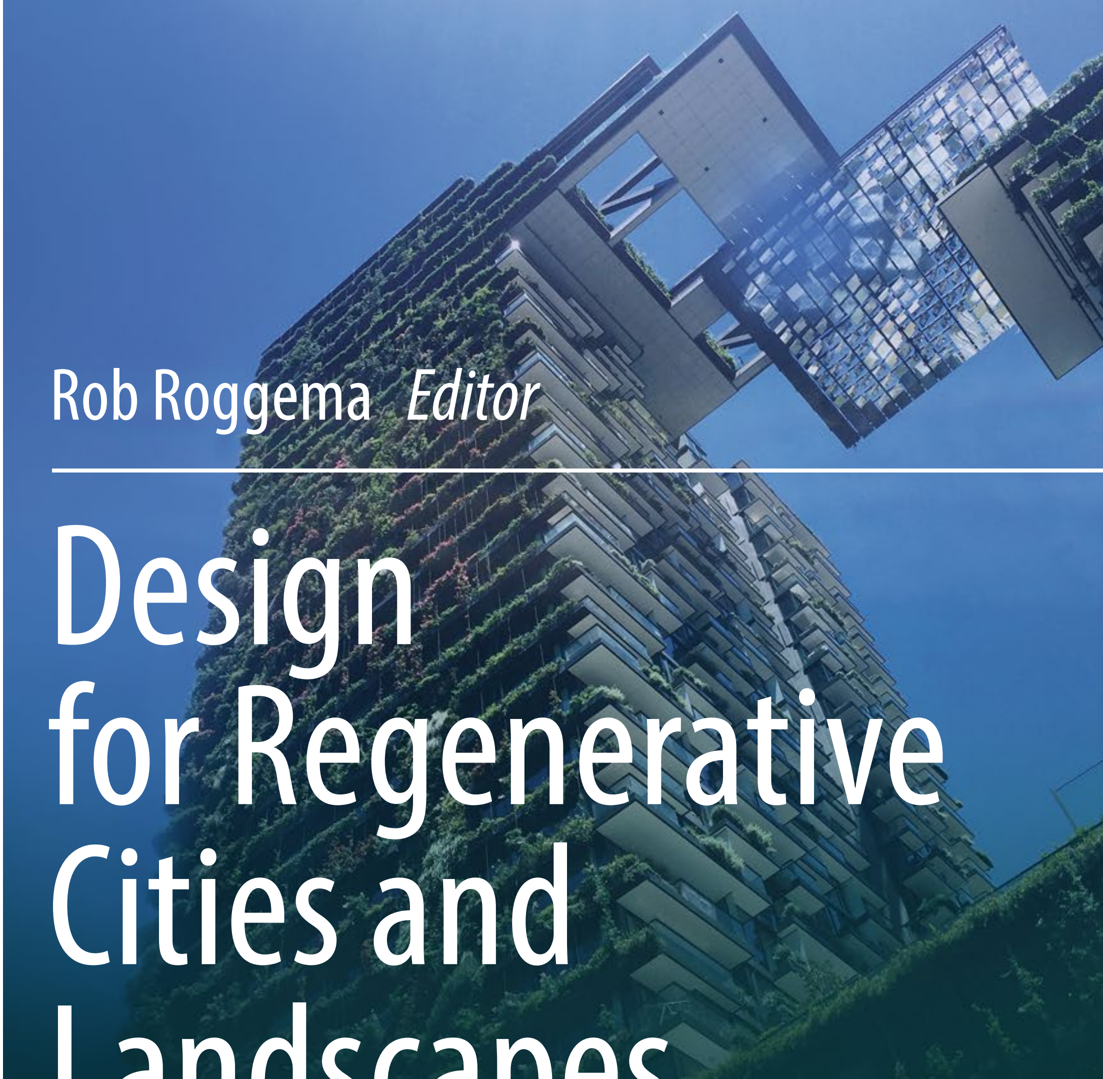

Contemporary Urban Design Thinking

Rob Roggema *Editor*

Design for Regenerative Cities and Landscapes

Rebalancing Human Impact and Natural Environment

Springer

Contemporary Urban Design Thinking

Series Editor
Rob Roggema, Cittaideale
Office for Adaptive Research by Design
Wageningen, The Netherlands

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Rob Roggema
Editor

Design for Regenerative Cities and Landscapes

Rebalancing Human Impact and Natural Environment

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Editor
Rob Roggema
Cittaideale
Wageningen, Gelderland, The Netherlands

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About the Contributors

Cinthia Buchheister is head of communications at Arup in Germany with a clear focus on sustainability. She has been accompanying research and project developments on green building envelopes for 7 years. Cinthia has a degree in business administration from the German Real Estate Academy at the University of Freiburg. Before joining Arup, she worked for international real estate investors and developers such as Hammerson and DeWAG.

Seán Cullen is Lecturer in Future Cities in the School of Natural and Built Environment at Queen's University Belfast (QUB). His research focuses on how architecture and design can tackle the challenges of climate change in a globalised, accelerated culture. In recent years, he has worked on a range of research projects that explore the application of design methodologies to imagine spatial interventions in landscapes and industries that require rapid climate action. These projects have included: the *Moveable-Nexus* (M-NEX), funded by Joint Programming Initiative (JPI) Urban Europe and Belmont Forum, which applied a design-led approach to the food-water-energy nexus in cities vulnerable to climate change; and, *Ideal Home*, funded by Innovate UK, which examines sustainable pathways, technologies and processes for poultry production while improving animal welfare. He teaches architectural design in the undergraduate and postgraduate programmes at QUB, running a masters studio unit, *Architettura Superleggera*, with Professor Greg Keeffe between 2019–2021. Previously, he has worked for Burckhardt+PartnerAG and Sult Design on a range of commercial and public design projects.

Considering almost all societal challenges come together in the same spatial context, the landscape, working together on creating enabling environments at different scales is at the heart of the focus and approach of **Bertram de Rooij**. As landscape architect and senior researcher, he connects common understanding, building bridges and envisioning inspiring and integrative futures; working together on vibrant and resilient landscapes; connecting, innovating and inspiring; creating common understanding; and building bridges and visualising envisioned futures. In almost 20 years as a landscape architect in consultancy, government and research, he has worked on a broad variety of assignments, from different angles but always linking strategy and implementation opportunities. Currently, he is fully involved in strategising food futures and resilient landscapes, on a conceptual level as well as grassroot. He is one of the co-authors of 'The Netherlands in 2120' – which is currently setting the scene in the Netherlands – and is annually guest lecturer in the courses 'Climate change governance' and 'Food systems in and urbanizing society'.

Chrisna du Plessis is associate professor, chair of the School for the Built Environment and head of the Department of Architecture, University of Pretoria, South Africa. With more than 20 years' experience in sustainable human settlement development, both as practitioner and as researcher, she has applied her focus on developing the principles and guiding frameworks for the practices of sustainable construction and human settlement development in a body of work that spanned the fields of housing, construction industry performance, urban/human settlement development and infrastructure design. Her current research concentrates on resilience and regenerative development, and together with Dr Dominique Hes, she published *Designing for Hope: Pathways to regenerative sustainability*, which outlines some of this thinking.

Marcus Foth is Professor of Urban Informatics in the QUT Design Lab, Faculty of Creative Industries, Education, and Social Justice, Queensland University of Technology, Brisbane, Australia. Marcus' research brings together people, place and technology. His current research foci include: urban media and geoprivacy, data care in smart cities, digital inclusion and participation, blockchain and food supply chains, and sustainability and more-than-human futures.

For two decades, Marcus has been at the helm of ubiquitous computing and human-computer interaction (HCI) research into interactive digital media, screen, mobile and smart city applications. This work has been adopted by industry and universities. The outputs of Marcus' research have received many awards. For example, the Rapid Analytics Interactive Scenario Explorer Toolkit received the 2021 National Award for Cutting Edge Research of the Planning Institute of Australia for significantly accelerating the calculation of value uplift in linear infrastructure projects such as rail networks.

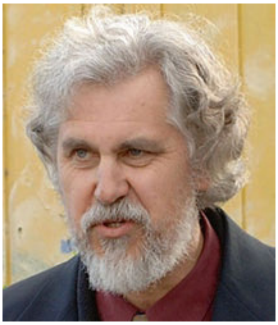
Marcus is a fellow of the Australian Computer Society (ACS), a distinguished member of the Association for Computing Machinery (ACM), and a member of the Australian Research Council's College of Experts.

Greg Hearn is a research professor in the School of Design at QUT. His research examines social, business and future workforce issues in the adoption of innovation. He is a lead researcher in the Advanced Robotics for Manufacturing Hub and a chief investigator in the ARC Training Centre for Collaborative Robotics in Advanced Manufacturing. He has worked in large R&D projects with private industry and public sector organisations over three decades, across many sectors including, aviation, defence, agriculture and manufacturing.

He is author and editor of over 20 major books and reports, including *Creative Graduate Pathways within and beyond the Creative Industries* (2017: Routledge); *Creative Work beyond the Creative Industries* (2014: Edward Elgar); *The Knowledge Economy Handbook* (2005 and 2012: Edward Elgar); *Knowledge Policy: Challenges for the 21st Century* (2008: Edward Elgar). Most recently, he edited *The Future of Creative Work:*

Creativity and Digital Disruption (2020: Edward Elgar), which examines the impact of digital disruption, robotics, and AI, on jobs in design, art and media, and the creation of high value products and services across all sectors of the economy.

Dominique Hes Dominique Hes is the Zero Carbon Buildings Lead in the City of Melbourne and chair of the board at Greenfleet. She has degrees in science and engineering, and a PhD in architecture. Her passion is finding ways to address the issues we are seeing all around us: loss of biodiversity, loss of habitat, changing climate and so forth. She works on the premise of hope, not air fairy 'wish the grass was greener' hope but grounded hope – an irresistible vision of a thriving future and ways to move towards it.

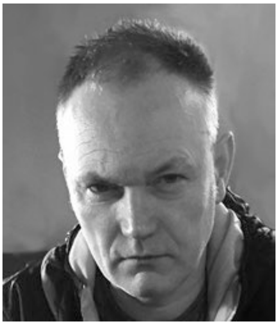


Colin Hocking Colin crosses the divide between scientific and social research, and he has been recognised with awards at both state and national level. His interests cover learning and change for sustainability, including professional development and community engagement for sustainability, evaluation of sustainability programmes, and research into management of native grasslands and control of weeds of national significance. Colin is currently coordinating a community-based project aimed at protecting an area in North-West Tasmania from coastal erosion, and is evaluator of the Light Up Timor project, in association with Rotary Australia and Renew Inc.

Nick Kamols (MPhil) is a passionate and highly motivated town planning scholar and practitioner currently completing his PhD studies in the QUT Design Lab, Faculty of Creative Industries, Education, and Social Justice, Queensland University of Technology, Brisbane, Australia. Before joining QUT, Nick has already gained expertise across local government, private practice and social enterprise.

Awarded the title of Queensland Young Planner of the Year for 2021, Nick uses his unique perspective to devise creative solutions to systemic planning problems. Nick has been bridging the gap between academia and planning practice through his Master of Philosophy and PhD, where Nick is studying and working to solve systemic workplace issues, such as how institutional cultures affect participatory planning, and institutional decision-making processes.

In addition to Nick's academic work, through PowerWells, the social enterprise Nick co-founded, Nick and his team are repurposing used lithium-ion batteries, paired with solar panels, to give renewable energy to off-grid communities in Indonesia. Nick and his team have already given renewable electricity to approximately 200 homes, and saved 7,000 battery cells from landfill – simultaneously inspiring other young planners to pursue entrepreneurial ventures.



Greg Keeffe is an academic and urban designer with over 30 years' experience in sustainability, energy use and its impact on the design of built form and urban space. He is Professor of Architecture and Urbanism, and head of the School of the Natural and Built Environment at Queens University, Belfast, UK, which is a large interdisciplinary school, concerned with investigating the complex problems of the Anthropocene. Previously, he held the Downing Chair of Sustainable Architecture at Leeds School of Architecture, UK.

Greg has extensive experience of working closely with architects, engineers and planners to develop exciting ways of re-invigorating the city through the application of innovative sustainable technologies, informing his work on the sustainable city as synergistic super-organism. In this way, he has sought to develop a series of theoretical hypotheses about our future existence on the planet, through a series of technological and spatial interventions. Most of his work comes out of a free-thinking open-ended discussion about how things could and should be.

Anne Kovachevich is an experienced sustainable buildings consultant who now leads the Arup Foresight and Innovation offering in Australasia. Anne's innovative approach to design and sustainability is internationally recognised with invited keynote presentations including the Singapore Government, the Green Building Council and NASA Langley.

Anne believes that foresight and innovation skills are integral to achieving sustainable outcomes and is passionate about applying these techniques for long-term positive outcomes. Anne's work has included smart cities strategic development working with Brisbane City Council to develop their Smart, Connected framework. Anne is currently developing the Smart Cities Readiness Cards with the Smart Cities Council of Australia and New Zealand. Sustainable food systems and net positive design are also key focus areas for Anne's work.

Passionate about sustainability for buildings, Anne has been on the Green Building Council technical advisory group for many years as well as being a Green Star assessor, a WELL building assessor and a NABERS assessor. Anne is currently assisting in the development of a strategy for Arup's alignment with the UN Sustainable Development Goals.

Chels Marshall A Gumbaynggirr woman and Knowledge Keeper, Chels is a leading Indigenous systems ecologist with extensive experience in marine ecology, cultural landscape management and regenerative design. She has over 27 years of professional experience in cultural ecology, environmental planning, design and land management within, government agencies, research institutes, Indigenous communities and consulting firms. Chels is currently the director for Flying Fish Blue, an Indigenous-owned company that specialises in socio-cultural and ecological assessment and advisory services. Chels works to embed Indigenous knowledge systems, principles and governance models into business and project planning for regenerative ecological, social, economic and spiritual outcomes.

Steffen Nijhuis is an internationally experienced academic, designer, project leader and author of award-winning publications. By training, he is a landscape architect and a gardener. His work focuses on landscape-based urbanism, sustainable urban landscape development, design with natural processes, designed heritage landscapes and gardens, and digital landscape architecture. He is research leader in the Department of Urbanism and Associate Professor of Landscape Architecture at Delft University of Technology, and an associate at OKRA Landscape Architects.

Nijhuis is an advisor to NGOs and governmental and regional authorities across the world and serves on the boards of the TU Delft Department of Urbanism, the Chabot Museum Rotterdam and the Dutch School of Landscape Architecture (DSL). He is also editor-in-chief of the Research in Urbanism Series (RiUS), and editor of *Bulletin KNOB* (Royal Netherlands Society for Architecture, Urban and Landscape Heritage) and the Springer Urban Studies Book Series.

Supervision of PhD, post-MSc and MSc graduation projects are core activities. Furthermore, he is visiting professor and guest lecturer at universities in Europe, Asia, the Middle East and North America. www.steffennijhuis.nl

Martin Pauli is an associate director and leads Arup's Foresight team in Europe. He built his experience working in innovation and foresight and management consulting. Over the past 8 years, Martin and his team have been working with public sector clients and blue-chip firms in the architecture, engineering and construction (AEC) industry with a particular focus on ESG, sustainable development and the circular economy.

Martin holds a number of internal roles and external appointments. He is an innovation advisor to the German Sustainable Building Council (Deutsche Gesellschaft für Nachhaltiges Bauen – DGNB) and a member of the DGNB Advisory Board for Circular Construction. At Arup, he leads the Sustainable Development Portfolio for Germany and spearheads a global design workstream with its partner, the Ellen MacArthur Foundation. Martin holds a master's degree in architecture from the Technical University of Berlin.

Gilbert Rochecouste Recognised as one of the world's most successful placemakers and community activator, Gilbert has worked with more than 1000 cities over the last 30 years to bring his flamboyant brand of placemaking to communities across the world. As the director and founder of Village Well, Australia's premier placemaking consultancy, he passionately believes in the capacity for people to create loveable places.

Rob Roggema is a landscape architect; Professor of Landscape Driven Design at InHolland University of Applied Sciences; founder of Cittaideale, office for adaptive design and planning; and visiting professor at Queens University Belfast. He is lead-author of the Architecture, Urban Design and Planning chapter of the third assessment report of the UCCRN. He held several professorship positions at VHL University (Professor of Design for Urban Agriculture 2014–2016), the University of Technology Sydney (Professor of Sustainable Urban Environments 2016–2018) and Hanze University Groningen (Professor of Spatial Transformations 2019–2021). Before 2010 he worked for the province of Groningen and municipalities such as Almere, Breda and Rotterdam on the design of ecological and sustainable cities and landscapes. Recently, he led the design of a Nature-Rich Netherlands, the climate adaptive design 2021 for the Groningen region, he initiated the FEW-nexus project 'the Moveable Nexus', and he designed the Edible Park in Ede, the Netherlands. Rob has facilitated over 40 design charrettes worldwide and has presented his work at conferences and symposia all around the world.

Remon Rooij Phd, MSc, is an associate professor at Delft University of Technology in the Faculty of Architecture and the Built Environment, Department of Urbanism, Section Spatial Planning and Strategy. Remon has supervised several students within the MSc urbanism and MSc landscape architecture graduation studio *Urban Ecology & Eco-cities*. His interests focus on strategic spatial planning in regional development and urban transformation.

Remon has a strong interdisciplinary background: a doctorate in spatial planning within the TRAIL Research School for Transport, Infrastructure and Logistics, and an MSc degree in urbanism and real estate, and construction management. Since 2018, Remon has been co-leading the faculty-wide initiative 'Research on Education Innovation' with a specific focus on design education, inter- and transdisciplinary education, academic skills for spatial designers, online and blended education, and educational leadership and curriculum renewal. Since 2020, he has been a member of the 4TU Centre for Engineering Education management team, as TU Delft educational co-leader.

Rudi Scheuermann is director and global leader of Building Envelope Design at Arup. As an architect and engineer, he has built up the building envelope design and numerous specialist disciplines, including building physics, fire protection, materials, lighting design and acoustics in Arup's German office. His focus is on a multidisciplinary design of sustainable and energy-efficient building envelopes. In recognition of his achievements, he was appointed Arup Fellow in 2014.

Rudi Scheuermann studied architecture at the University of Karlsruhe and later completed a research study in Bath, England, with a master's degree in architecture in membrane constructions. He has worked for architectural and engineering practices in Germany, the Netherlands, the UK and the USA.

Michael H. Shuman An economist, attorney, entrepreneur and a leading global visionary on community economics and loyalism, Michael is known for his fun, dynamic and practical approach towards making places and communities more resilient and self-reliant. Michael is the author of ten books that have helped develop many of the principles and practices of the New Local Story.

Nico Tillie is a landscape architect/botanist and specialises in synergetic urban landscape planning at TU Delft, where he leads the Urban Ecology & Ecocities Lab. He works on issues ranging from low carbon cities and climate adaptation to biodiversity.He is conference chair of the Ecocities World Summit 2022 and chairs the scientific Board of NL Greenlabel.

Troy Turner is a communications scholar and practitioner with more than 10 years of professional experience in industry and government. He graduated with a Bachelor of Communication from the University of Queensland (UQ) in 2011 and is currently completing a Master of Governance and Public Policy course in the Graduate Centre in Governance and International Affairs within UQ's School of Political Science and International Studies. His research foci include transport, urban planning and community engagement.

Jason Twill LEED Fellow With a career spanning over 22 years in climate change, education, sustainability and urban regeneration, Jason has been at the forefront of social, ecological and economic transformation. A globally recognised pioneer in regenerative development and design, Jason's work is advancing next generation solutions to reverse global warming and restore planetary health. His career experience includes managing award-winning urban regeneration projects throughout North America and Asia Pacific, serving on the world change advisory team for Paul G. Allen, heading sustainability and innovation for Lendlease Australia, and consulting multiple local and national governments on climate action and social equity strategies.

Currently based in Doha, Jason serves as director of the Qatar Foundation's World Cup Program, helping shape the national legacy of Qatar's hosting of the 2022 FIFA World Cup™.

A regular lecturer at multiple universities across the world, Jason previously served as a Runstad Fellow at the University of Washington and a Research Innovation Fellow at the University of Technology Sydney, where he led research into regenerative urbanism, housing affordability, and Indigenous knowledge systems.

Jason was designated a LEED Fellow by the United States Green Building Council in 2014. He is a co-founder of both the International Living Future Institute and the Green Sports Alliance.

Senne van't Hof During her studies Biology and Science Communication, it became more and more clear: she wanted to work for a non-profit organization which is restoring the earth and tackling the climate problem. Justdiggit was the perfect match. The simplistic approach and the involvement of the local communities within the projects were factors she felt connected with. Within Justdiggit she is responsible for translating the impact we make in the project areas to the 'broader public'. Communicating the (positive) effects of regreening degraded landscapes can help people to become inspired and activated to start regreening their own lands as well. This way we can scale up the regreening and make a real impact on the livelihoods of millions of people, the local ecosystems and the regional – and eventually the global – climate.

Louisa van den Brink is a recent graduate from TU Delft urbanism master's programme and also holds a bachelor's degree in landscape architecture. She is currently working as an urban designer at Witteveen + Bos. Louisa has a specific interest in semi-urban landscapes and focuses on the interface between landscape architecture and urban design. She pleads for a rediscovery of the relationship between city and countryside by rethinking current planning practices of the urban-rural boundary. In her graduation thesis, she compares the fringe landscapes of our cities with a membrane at macro scale, a distinctive landscape that acts as a spatial layer facilitating interaction between the urban and rural environment. Through research-by-design, she explores what this membrane landscape could look like and how it can add social and ecological value.

Thijs van der Zaan With a background in international land and water management, he feels a strong connection to sustainable use of land, especially in areas where pressure on resources is high and poverty plays a large role in overexploitation. Through his work at Justdiggit, Thijs aims to contribute to enabling people in marginal areas to use their resources more sustainably and be prepared for the impact of climate change on their livelihoods through the implementation of nature-based solutions. As a monitoring, evaluation and learning Officer, his role is to assess the impact of the programmes and evaluate on how they can improve in the future.

Tim van Hattum has broad experience as consultant, policy advisor, project manager and researcher in the field of integrated water management and climate change. He has led several (inter)national projects and public private partnerships focusing on innovative and nature-based climate solutions. Tim has a large (inter) national network in the business, government and research sector. He completed his MSc in environmental science in 1998 and started his career as a consultant for Witteveen+Bos consultancy. In 2003, he became policy advisor for a provincial authority and later a regional water authority. Since 2010, he has been working at Wageningen Environmental Research as senior project manager and researcher. Currently, he is leading the Green Climate Solutions Program at Wageningen Environmental Research that aims to contribute to climate action by providing tailor-made climate impact information and evidence base for nature-based solutions for mitigation and adaptation.

Chapter 1
Designing for Regeneration

Rob Roggema

Abstract In this chapter the foundations for an ecologically responsible future are discussed. The changes and transformations in the current era are so substantial that a fundamental rethink is needed in the way we develop our cities and landscapes. This is no longer possible through reaching political compromises, but requires radical thinking and solutions, which are capable of braking through the current paradigms. Where urban societies are net depleting their resources, we should aim to replete them. From taking form our environment we need to start giving back. This requires a shift from a predominantly mechanistic worldview, in which solutions are engineered and calculated, towards an organic one, which is based on understanding systemic change, complexity and self-organisation. Here, Man is seen as part of nature and his physical demands are as important is his mental ones. The urban society has to transform from generating stuff to regeneration the living conditions that will sustain life on the long run. The move towards ecological responsibility requires implies that man is part of nature, city is part of the landscape and both mind and stocks need to be replenished. Finally, design approaches enables ecological responsibility though grasping the complexities of systems and interactions, can ignite change through spatial interventions, and is able to be adaptive so the landscape remains changeable.

Keywords Regenerative design · ReciproCity · Resilience · Ecological responsibility

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1.1 Introduction

According to the Lancet, we ruin our planet by the diet we eat (Willett et al. 2019). According to the IPBES, half of our biodiversity is or will be lost (IPBES 2019). The IPCC states that our land use exaggerates climate change and degrades large areas across the world (IPCC 2019). The same IPCC reports that our oceans are rising dramatically, and they are also heating up, decreasing their role as carbon sink. And in the same report, the cryosphere increasingly lacks the resources to provide drinking water to billions of people (IPCC 2013). Finally, the Dutch nitrogen advice brings urban development to a stand-still (Adviescollege Stikstofproblematiek 2020).

The food system, nature, a safe living environment, the availability of water and energy and the ability to develop ourselves, all these aspects of the quality of life are at risk. For long humankind opted to establish a sustainable equilibrium (World Commission on Environment and Development 1987) which aims to safeguard the quality of life and resources for next generations at minimal the same level as we can access today. Soon it became clear that even if we were successful in achieving this, the system as a whole could suffer from external shocks and disruption, putting this equilibrium at stake. The response is to aim for resilience (Gunderson and Holling 2002), in order to keep the system functioning, or bringing it back to the same state as before the disruption. However, even a combination of providing the resources to future generations and being able to deal with shocks could deteriorate life on earth. Using the environment to an extent humankind does would imply we are net depleting the systems we are dependent upon. Beyond balancing the system, we have to regenerate the living conditions (Mang and Reed 2012a, b). In this context, man should be seen as part of these bigger systems, and not as a separate entity, controlling and engineering equilibria. Therefore, it is simply not sufficient to think in terms of regenerative cities (Girardet 2015), or focus regeneration on the built environment as such (Reith and Brajković 2021), but the surrounding, underlying and all-encompassing ecological landscape should be taken into account, and this landscape should be thought about first (Roggema 2021), before the urban. The city then will have to play a role in returning resources, qualities and spirituality to these ecological systems. Moreover, regeneration should not only be an engineering exercise balancing the quantitative pluses and minuses to a net positive sum it is also needed to design the future landscape within which these sums make sense. A design opens the way to unexpected solutions and imagination that can go far beyond the calculations themselves.

1.2 A Depletanary State

The current period in history seems to be deteriorative. Recent research shows that millennials will be the first generation who will have it (economically) worse than their parents (Janssen et al. 2018). Simultaneously, there is a wide consensus that humanity is influencing the global climate system, in such a way that a new geological era has been defined, the Anthropocene (Crutzen 2002). These current anthropogenic, human-centered societies focusing on the individual well-being, are characterized by ambition for power, masculinity, and dominance of the strongest (Wheatley 2017). Power is derived from strength, position, and the willingness and possibility to dominate others. Related to this are various characteristics that we can recognize easily in today's society, such as keeping up appearances: we like to make a good impression, want to be social, show an urge towards expansion, are jolly, and think that we base our decisions on common sense. Features of such deteriorating systems is described as follows:

> 'Increasing disorder is fueled by money replacing service as the core motivator. Hierarchical leaders focused on maintaining power at all costs, the disappearance of the future from decision making, the preservation of the status quo by the few elites who prosper from it. As things deteriorate relationships disintegrate into distrust, self-protection and opposition. Internal conflicts increase and no one even notices threats to the whole as they fight for their tiny piece of the pie. Leaders use fear to control and manipulate people and everyone moves into self-protection. Distractions, entertainments and entitlements become primary instruments of allaying peoples' fear and for controlling them.' (Wheatley 2017, pp. 54)

The belief in masculinity, power, and manufacturability has brought us a, on average, higher level of wealth, but also a severe lack of broadly shared welfare. Fundamental problems have arisen which seem difficult to solve, such as climate change, migration, monetary issues, the hardening of society, individualization, and a low level of trust in politicians. These problems also manifest themselves in the way we idealize and worship athletes, actors, and artists (Wheatley 2017). Humanity can feel that the end of an era is in progress, sees disaster creeping in and gives itself a few last little bits of happiness by diving into the private lives of celebrities and gossip magazines. You cannot get around *fake news*, and humanity loves it.

There is evidence galore that, despite successful interventions and policies, like shrinking the hole in the ozone layer and improving the water quality of the Rhine, real fundamental changes have had no or barely any effect (HIER climate bureau 2016; IPBES 2019; IPCC 2013; PBL 2009, 2018).

The current era displays many different signs that fit the deterioration phase. Climate change leads to record temperatures and droughts, floods and hurricanes at the same time. Earth will experience the highest number of and the worst hurricanes still to come. Global average sea levels have risen by about 8.1 cm between 1990–2018 (Lindsey 2018). During this period, hurricanes have already had a serious impact on our coasts and cities such as Katrina (New Orleans), or Sandy (New York) have shown (Fig. 1.1). The projections for the future vary, but the higher scenarios fluctuate between two meters (Lindsey 2018) and three meters or higher (Haasnoot et al. 2018) in 2100. If these projections are accurate, it means that in the past 30 years we have only seen 2–3% of the total sea level rise. In the next 80 years, another 192–292 cm increase can be expected.

Apart from their contribution to global warming, coal-fired power plants also significantly harm our health. The consequences to our health of coal-fired power plants and wince are significant: 30.000 asthma days for children, a reduction in

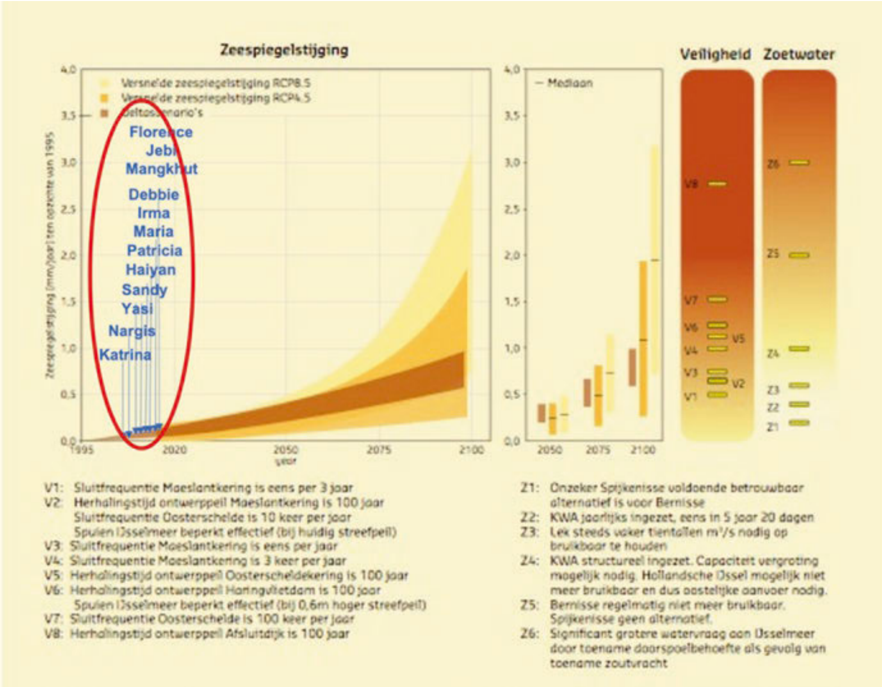

Fig. 1.1 Recent hurricanes positioned on the projections for sea level rise. (Adapted from Haasnoot et al. 2018)

workdays by 500.000, and 5.4 million euros in added health costs, caused by the activities of just one energy company (RWE in this case) in Europe alone (Fig. 1.2, Sandbag Climate Campaign 2018).

Adding to substandard air quality resulting from the way we generate energy, moving around in the air and space is also contributing. Despite air traffic has been moderated due to the COVID-pandemic, it is a clear sign of the way we treat the earth (and ourselves). Together with the satellite waste this is a nearly invisible impact, looming beyond our views (Fig. 1.3), potentially destructive to our lives and ecosystems.

Land use for food production also has significant effects (IPCC 2019). Since 1961, we have started using 800% more artificial fertilizer, two million people suffer from obesity, about one million children are malnourished or are underdeveloped in some way, the use of irrigation technology has increased by 100%, 30% of farm products go to waste, and there is less than 9% prehistoric forest left on the planet; the rest of the forest areas (22%) are used for production (Fig. 1.4).

In conclusion, besides the threat of floods and hurricanes, the impact of energy generation and air mobility, and the way we produce food, it is most likely that we find ourselves on a scorched earth, on which bushfires rage, drought reigns supreme, cities are flooded, and humanity will have less and less safe places to live. The only

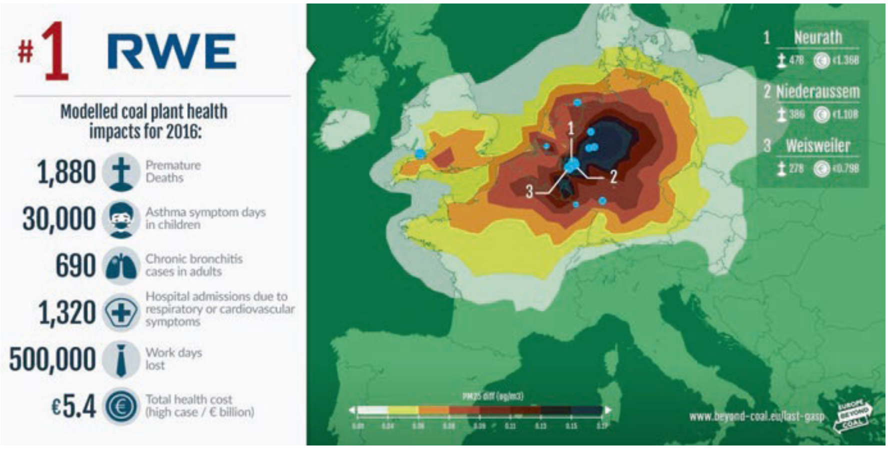

Fig. 1.2 Health impact of coal fired power plants in the Ruhrgebiet, Germany (Sandbag Climate Campaign 2018)

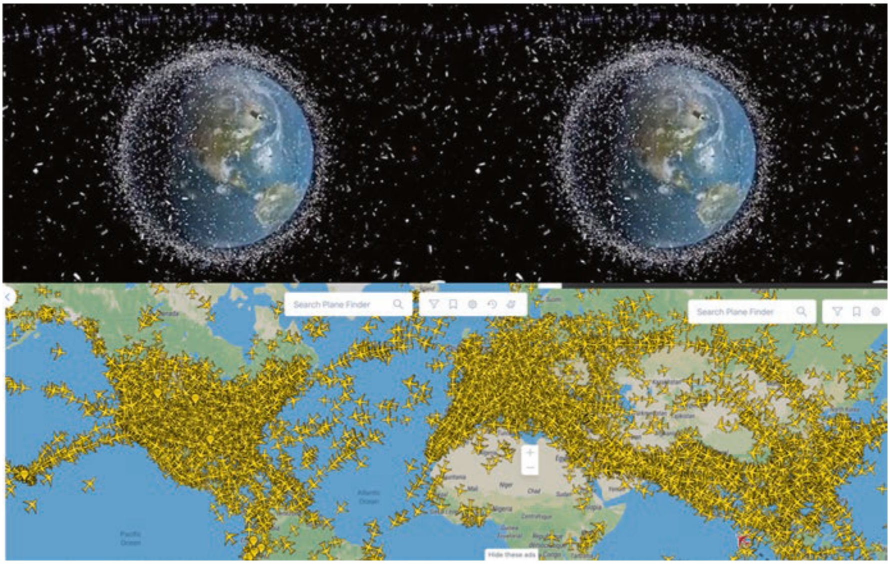

Fig. 1.3 Space waste around the Earth (ESA, https://www.esa.int/dut/ESA_in_your_country/The_Netherlands/Kunst_en_ruimtepuin_komen_samen_bij_Space_Waste_Lab/(print) and (below) air traffic, Saturday night 03-08-2019, 21:30 CET

habitable place will then apparently be located in North-Scotland (Lynas 2008) with most of the rest of the earth will be uninhabitable (Wallace-Wells 2019). Could it be that we have abused our planet for so long that she will eventually take revenge on us (Lovelock 2006)?

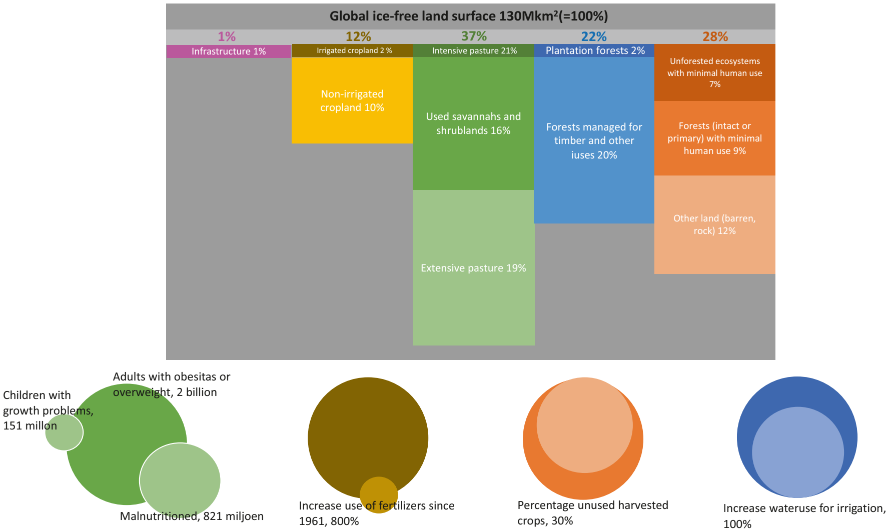

Fig. 1.4 Impact of food production on land use and health. (By author, based on IPCC 2019)

This said however, a period of deterioration is not uncommon. This happens to every system. For humanity, the time of existence of civilizations is about 250 years. The last cycle began at the end of the eighteenth century, so it is no less logical that we have now reached the end of another cycle (Glubb 1976; Tainter 1988). The 'resilience'-cycle shows that periods of decay and reconstruction follow each other naturally. The growth towards maturity is followed by decay and demise, after which growth starts again. The concept of panarchy (Gunderson and Holling 2002) connects separate resilience cycles in time and space. During the deterioration phase, guidance of this decay is the best choice, as fighting it is ineffective. What is left are the remains, the waste of the old system, and it takes a while before progress can take root again and grow. Luckily, nature has been designed to get rid of old remains and transform waste into something valuable. The route from an older system to the new one generally takes place by beginning with small steps and small, quick adaptive cycles at the lowest level of panarchy (Fig. 1.5). These are the niches (Geels 2005), which have the potential to develop into movements, revolutions, which can influence the regime at the middle level. This regime is in turn framed by longitudinal cultural memory which is stored at the highest level. Supportive and subservient leadership can help bring people together, in the same way nature does by making something beautiful out of the remains of the old system.

When 'togetherness' is created at the same time, in many different places, with many different people and communities, these initiative-rich networks become the '*bifurcation points*' (Poincaré 1902–1908), the moments in time that mark decisive changes and which can form a '*tipping point*' (Gladwell 2000), the moment when the system 'flips' to a new shape. By allowing new beautiful sustainable movements to be created, and through the creation of '*islands of common sense*' (Wheatley

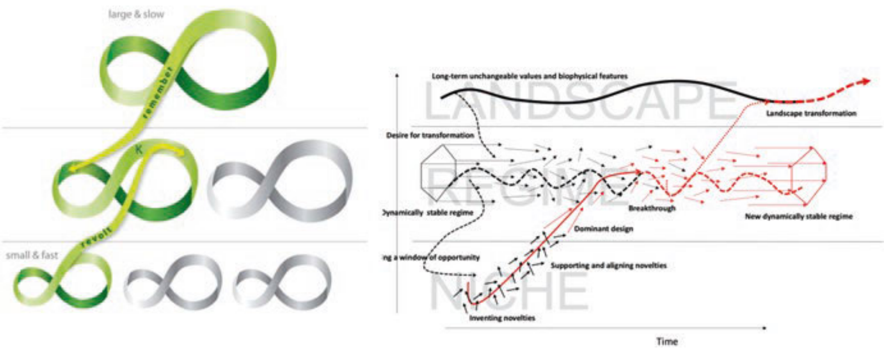

Fig. 1.5 The three levels of panarchy (Gunderson and Holling 2002) and the multi-level perspective (Roggema 2020, after: Geels 2005)

2017), people will be made capable of being aware of the situation our civilization finds itself in. Then, we can accept that we do not have to try to change the bigger system – because, thanks to itself, it will break down regardless – and instead aim for guidance of this process, in order for a possibility for new growth to be created.

1.3 Replete the Planet

Guiding the old depleting system towards a repleting system, requires leaving behind our former convictions. Instead of consuming and using everything around us for the human good, repletion can only happen when the city is no longer seen as a drain, but rather as a source. Closing cycles as the circular economy proposes is only the point of departure, not the end game. A city should operate as a living organism rather than a technologically driven system (Fig. 1.6), so that there may be hope that we can truly make our environment reciprocal (Hes and du Plessis 2015). This has become a necessity since in the last 170 years we have exhausted the earth's natural resources, causing water pollution, a decrease in biodiversity, and large-scale deforestation, and led to enormous amounts of waste. It implies enforcing a shift from aiming for 'sustainability' to becoming 'regenerative', aiming to give back more than we take (Mang and Haggard 2016; Mang and Reed 2012a, b; Roggema 2019; Wahl 2016).

What makes a regenerative development differ from a sustainable development or a restorative one? The first element is that ecosystems are not static making it impossible to return an ecosystem back to its original condition. Restoration is in a literal sense not possible with a non-static system, as it can only be in process; either a process of evolution, or de-evolution A regenerative development aims to re-align human activity with the evolution of ecosystems. This makes humans a partner in that evolution. Secondly, on one level regenerative development questions how to design activities such as agriculture, land development, and transportation so these

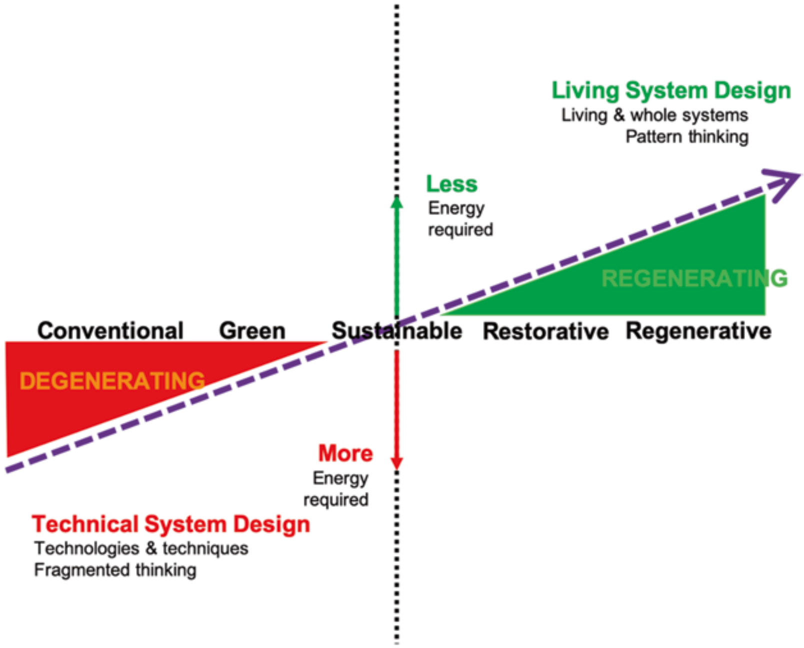

Fig. 1.6 From a technologically driven system to a living system. (After Mang and Reed 2012b)

can harmonize with and support local natural systems. The third element is a deeper question about the connection of the community to the underlying natural systems. The narrative of the community defines how it values itself and what it is valued for by the larger world. This awakens the members of the community so the will to engage with the design work in an organic and sustained way is unlocked (Murphy 2015). When we apply these principles to regenerative agriculture, it is a food system that improves the resources it uses, rather than destroying or depleting them. It is a holistic systems approach to agriculture that encourages continual on-farm innovation for environmental, social, economic and spiritual wellbeing (Rodale Institute 2014). So, regenerative design is creating a system where the output improves the health and resiliency of that system over time. This is achieved by positive feedback loops, where the production of each element has positive influences on the other elements of that system. Regenerative agriculture is not just about reducing harm – but seeks to improve the health of the land, waterways, the animals that live on it, and people that benefit from it. The sustainable production of resources must ultimately be blended in with sustaining healthy natural ecosystems.

Regenerative design can be seen as the paradigm that potentially realizes the most positive impact from an ecological worldview. Chrisna du Plessis describes the different design paradigms (Fig. 1.7) eloquently in Chap. 2 of this book, all of them to a more or lesser extent contributing to an ecologically responsible world. As we can see, even certain paradigms can have a degenerative effect on the

Fig. 1.7 Ecologically responsible design paradigms. (Du Plessis 2021; Chap. 2 of this book)

environment. Therefore, the importance of this work is unmatched, since it gives insight in some of the current practices, such as green design, being presented as being sustainable, but in reality have negative impacts.

Regenerative design has, according to Du Plessis, three main goals: it should bring new life, it should give back instead of taking out, and it should create connection (Du Plessis 2021; Chap. 2, this book). It also implies ways of thinking that are not (yet) common. In order to be able to face sudden, unprecedented changes and surprising events, a radical break with past practices may be required.

1.4 The Need for Radical Thinking

Adopted policies are often the result of a negotiated outcome and are therefore likely to be a compromise between several interests. A side effect of thus keeping the power balances in place is that fundamental problems are not sufficiently taken care of. When problems are big, complex and require a real break with past policies and action, the compromise is counterproductive. A halfhearted way to prevent an iceless Arctic will not lead to the return of the sea ise, a little bit of GHG emission reduction will not exterminate bushfires, nor stop the melting of glaciers. It will not stop sea level rise, flooding, droughts and failed harvests. Radical design propositions can help to respond to unexpected futures. This way sea level rise of 10 m does not have to be apocalyptic but can be treated as a new reality. Understanding such a future, which for the Netherlands would mean a radical different outlook requiring land use to adapt to unprecedented conditions. This can, however, be a prosperous, safe and attractive future (Fig. 1.8).

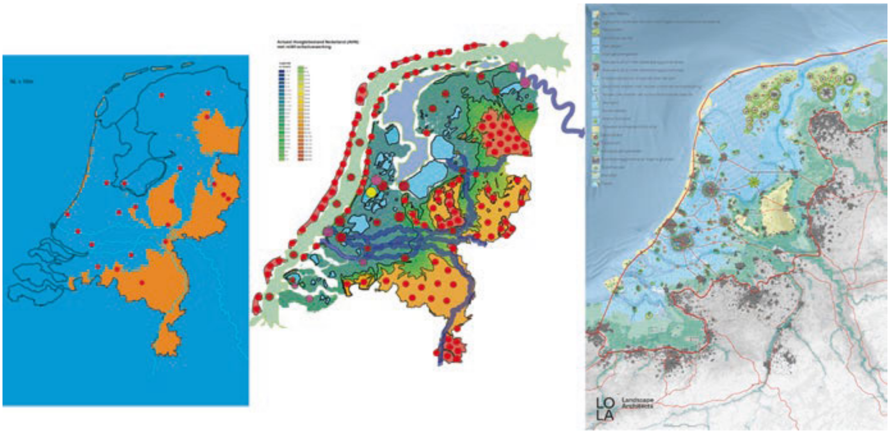

Fig. 1.8 The Netherlands at a sea level rise of 10 m (Roggema 2018a) and attractive design responses to such a future scenario (Roggema 2007; LOLA 2019)

In any scenario the future will thus be radically different than the world we now know. A part of this is also that we must leave old planning traditions behind and develop radically different visions. This will only be possible if we step outside of our comfort zone and start working counterintuitively and a boatload of creativity is necessary (Brugmans, and en Stikker, M. 2019). We won't achieve this with the old solutions but need to start designing the imaginable for unexpected future.

New planning and design perspectives aiming at regenerating the landscape are necessary, as these are capable of shaping responsive and resilient landscapes, that move with change. For instance, sea level rise then does no longer have to be dealt with by creating strong artificial coastal protection, such as dikes and closure dams, but a biodiverse, dynamic new coast may emerge as result of acupuncturistic design interventions, that start the process of a natural coastal development. For example, positioning a second row of Wadden Islands (Roggema et al. 2006) north of the existing ones (Fig. 1.9), enables sedimentation, creating more tranquil conditions in the Wadden and North Sea. Nature then is allowed to take over, and the process of shaping additional drying plates and sandbanks, so essential to the current valuable ecosystems, is accelerated. The size of the current Wadden Sea will double and as such form an extra layer of protection against storms.

In recent years, serious parts of the Great Barrier Reef have suffered substantial bleaching, the result of a warning Pacific and acidification the ocean. Here the question is whether protection of the current reef should be accompanied by offering a novel strategy to ignite the process of reef forming where temperatures and the ocean waters are most suitable for reef habitat. Assuming the ideal environment for (sub-)tropical reefs shifts to the south and is found in a few decades just off the coast of Sydney. The underwater design for the Sydney Barrier Reef (Roggema 2017) establishes firstly artificial bases of sunken recycled oil platforms where in second phase the natural growth of the reef will emerge (Fig. 1.9) which will grow quickly

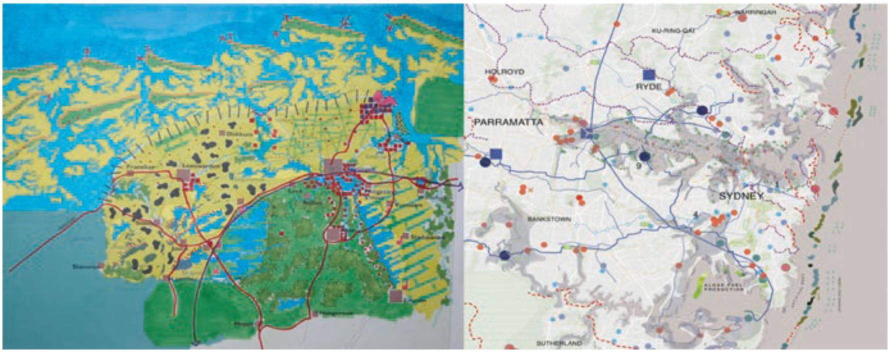

Fig. 1.9 A second row of Wadden Islands north of the Dutch coastline (Roggema et al. 2006) and the plan for a Sydney Barrier Reef (Roggema 2017)

by using small bits of cultivated coral (Page et al. 2018). Here also, nature takes over and forms its own ecology. When this reef is fully grown, it protects the coast from future cyclones, offers ideal surfing conditions and will be attractive to divers and tourists.

Yet another impact of sea level rise is the threat to the Hinterland. Where current decisions often emphasize keeping out the water by building strong and high dikes and dams, as sea levels rise further this gets increasingly risky. Not only is a higher dike more vulnerable of breaking, the impacts of a dike breech and subsequent flooding of the land are much bigger too. Moreover, a strict division between the sea and the land is decreasing biodiversity, separating ecosystems and minimizing the natural gradients. Influx of mud and creation of marshlands is, as a result, minimal. The compromise here has led to degradation of nature, safety, fertility of the soil, ground levels and, even though the water management is engineered to suit agricultural practices, the profitability of farming. A seemingly radical decision to give the sea (re)newed influence in the Hinterland could start a process of regeneration of the natural landscape. The plan for a Floodable Eemsdelta (Roggema 2015a) for example embraces the rising sea level. By making a hole in the dike instead of fortifying it, the water will be able to manifest itself in the landscape (Fig. 1.10). Because this will happen gradually, a possible disaster in the case of a dike breech is prevented, and the re-arrangement of the landscape can take place by allowing land-forming processes to occur as result of the natural forces of water, currents, wind, and sediment entering the landscape.

In the plan 'Moeder Zernike' (Roggema et al. 2021) the former geological system is taken as the point of departure for the design of a regenerative landscape (Fig. 1.10). The former Reitdiep valley is given the lead in forming land shapes and patterns by reconnecting the river with the sea. The process of saline sea water entering the land adds sediment, saline and brackish soils, hence bringing new opportunities for a safer way of living (as the ground levels are raised with additional mud), new economically viable forms of saline aquacultures, sea food, mussel and oyster banks and food forests, and ultimately the revaluing of the ecology of salt marshes, brook forests, reforming peat and estuarine landscape.

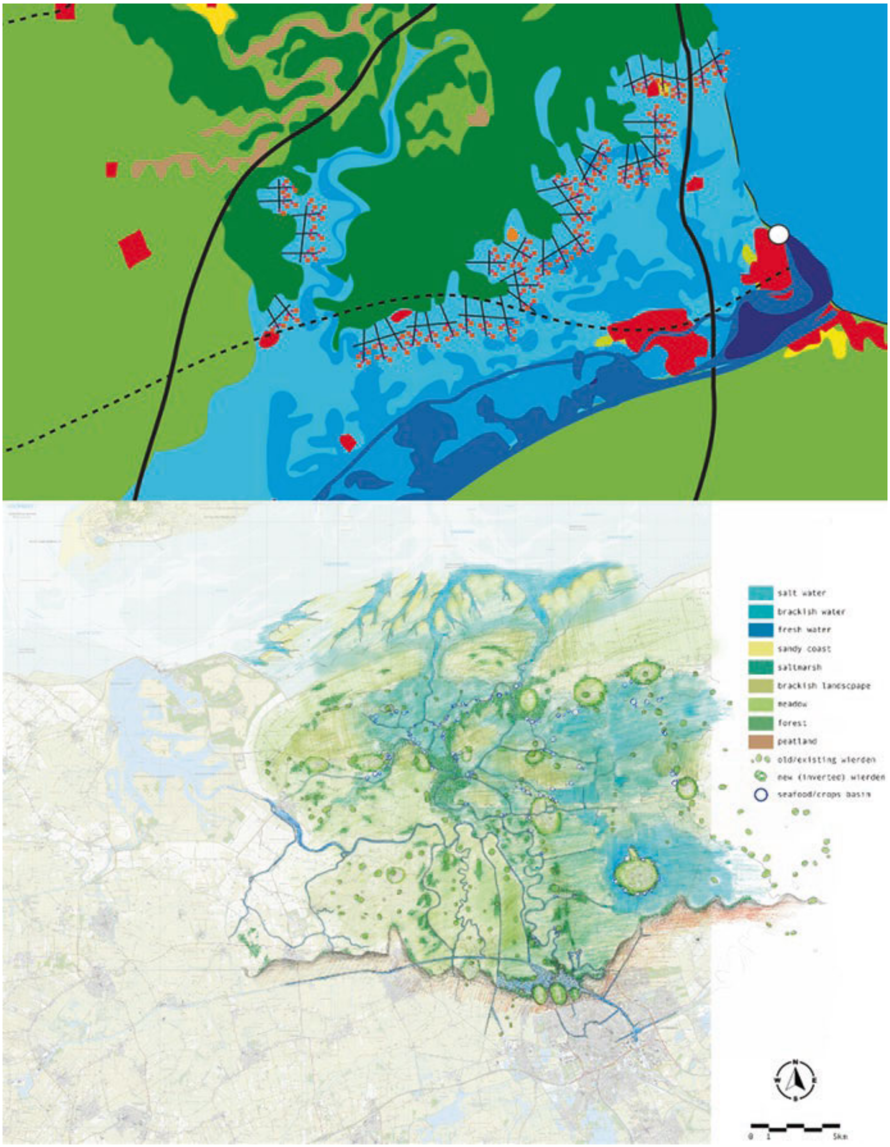

Fig. 1.10 Floodable landscape of the Eemsdelta (Roggema 2015a) and the Moeder Zernike plan (Roggema et al. 2021)

Where a disruptive, uncertain future leads to fear, the trust in the capacity of nature to regulate and survive all dynamics, even the unknown, gives certainty, without knowing the details of how the future looks like. This requires radicality in focus to design a sharp vision and is impossible without creativity and an unprecedented mindset. The tradition of the recent mechanical paradigm needs to be replaced by an organic view, moving along with the natural processes, just as eagles make use of thermal properties of the air to reach higher goals. These goals may be reached by seeing the whole picture with a sharp vision, work hard, take action and make connections.

1.5 Replenishing Our Minds

Trusting the strength and self-organising capacity of ecological systems also implies that the urban, predominantly humanly created world is no longer consumer of resources and stocks. Instead, the urban environment is embedded in the natural system, placing the human species as being a part of nature. Understanding and respecting the natural system has a long tradition. Traditional communities such as Indigenous Australian communities, but also Native American tribes in north America have long known that being a part of and living by the rules of nature is better than fighting it. They make use of the earth and arrange their lives, uses and surroundings in such a way that what is available is shared, and where humans are one with the natural world (Fig. 1.11) Stocks are returned to where they are resourced from, so the system as a whole can continue to exist (Marshall 2018). Humans can then also work together with animals, for example the orcas that brought fish to the indigenous Australians, because they knew that they would then get a portion themselves (Pascoe 2014). This coexistence stopped and mutual benefits ended when the first fleet showed up and killed an orca and they never returned.

To apply this wisdom, societies must create surpluses, so they are able to give back to the system to ascertain the long-term availability of raw materials. This is

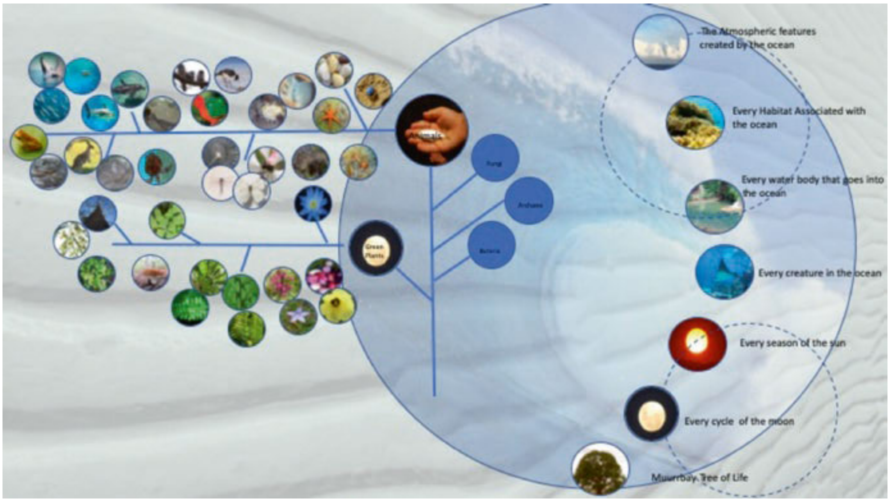

Fig. 1.11 Environmental kinship and totemic relations (Marshall 2018)

not only a technical operation of creating the physical means to recycle materials and flows but requires also creation of mental space and time that allows for the flexibility to share abundance of resources and make them available to others elsewhere or later. Mental flexibility enables the community to make these surpluses available to others, de facto repleting stocks. This implicitly views humans as being part of the whole ecosystem and not taking more from it than it can provide and replenish. Moreover, the land should not be exploited to the last square meter, but it should be given the time to recuperate and left unused for certain periods. This way parts of the landscape can be used interchangeably so its potentials can regenerate. The consequence is that people will live where the resources are at any given moment in time, and by being flexible their adaptive capacity is larger, moving to the best and safest places when potential disasters loom.

The mental space becomes increasingly confined, and people suffer from tight schedules and expectations about being productive. In these hectic times, the need for contemplation is growing (Hannema 2019) and creating additional space where people can spend time to think would meet these needs. In current urban development, the *horror vacui*, the fear of emptiness (when nature overgrows everything, according to Aristotle), still determines the way cities are planned: there is no space left for emptiness. It seems imperative to let a fundamental need for emptiness be a part of design plans and building policy (Hannema 2019). Therefore, we need to start thinking about time in a different way. Chronos has given us the understanding how to measure time so we could calculate our days, the invoices and records. But we have forgotten about Koiros, the Greek God of *the right moment* (Fig. 1.12). Without measurable time we have the mindscape to contemplate, wander around and having conversations. This does not bring us clear programs and amounts, but it does bring us new ideas, creativity, originality and consideration, through daydreaming, reflection, and coming to new realizations. Getting lost in unmeasurable time allows us to access freedom and creativity (Hermsen 2010). These spaces which contribute to human well-being, with views of nature, silence, space to go for walks, physical emptiness, stimuli-free spaces, mental emptiness and inward-focused time (Hermsen 2010) are often absent in the places where most people live. We need to start thinking of the city as a mindful place. What is the meaning of symbols, icons, spaces of emptiness for the wellbeing of residents? How can they influence their own environment and what is the future mentality of the place where they live?

To satisfy this need for mental space, physical spaces are required, where people are invited to contemplate. The winning entry in the 'Bubble – Tackling Loneliness' design competition (Walsh 2019) '*From Eliminating to Elevating: Tokyo loneliness Tree Hole Plan*' explicitly designs spaces for contemplation within a busy city life (Fig. 1.13, left). Similar thinking is the driving force for the Biennale 2011 entry 'Vacant Netherlands', in which RAAAF creates emptiness (Woertman 2011; Rietveld and Rietveld 2014) by removing more than is added. To visualize how much unused space is 'left over' and to suggest using this to a better end, for knowledge, arts, and innovation (Fig. 1.13, right), concrete mental space is created.

Fig. 1.12 Chronos (left) and Koiros (right)

Fig. 1.13 Winning submission 'From Eliminating to Elevating: Tokyo Loneliness Tree Hole Plan' (Cai and Cai 2019) and 'Vacant Netherlands', unused space in public domain, Venice Biennale 2011 (Rietveld and Rietveld 2014)

Especially when times seem to be uncertain, for instance resulting from the potential threat of severe climate change or the far-reaching impacts of a pandemic, surplus space, emptiness, will need to be designed to help people through difficult times and which only become useful when the need arises, for example during a flood (Roggema 2018b). Mind and body have the need to find physical (*la cite)* and mental (*la ville)* spaces (Sennett 2018). The creation of a sound balance between these two, forms one of the most essential tasks for the current generation of designers. Each of these two beings of the city need to cope with different future dynamics: a fast-developing city, a slow-motion city and a city dealing with sudden change (Roggema 2015b).

1.6 A ReciproCity

Uniting the physical aspects of 'Le Cité' with the mental ones of 'La Ville' the city becomes reciprocal. It is capable of regenerating both ecological and psychological systems. In this 'ReciproCity' biodiversity is generated, people are given more time to think and made healthy. This way the earth can recuperate, sources will be repleted and people will gain reflection. In the ReciproCity water comes out cleaner, more carbon is captured than emitted, leguminous plants convert Nitrogen in Protein, and where more urban food is grown than imported from far away. The city is reciprocal in a spatial way by returning more physical amounts of materials and stores, mentally by taking care of the entire (eco-)system, socially by developing common values together with others that create a sustainable, enjoyable environment at a local level, and ideologically by realizing that humanity has gotten caught up in a transition process, by accepting decay and adapting to the new era. In every (part of the) city and in every landscape this process is occurring at its own pace, some may be fast, others slow of sudden. For each of these the design for regeneration has to be adjusted (Fig. 1.14).

Six typologies together form the ReciproCity (Fig. 1.15):

- When cities develop fast, and pressure in building new homes and facilities is high high-tech regenerative solutions are an option. In the *Space to Build* typology vertical agriculture, solar technology and water treatment technologies can be applied inside the built environment to make sure resources are recycled, reused and returned to their environment. The Norra-Bunkeflostarnd in Malmö is a good example (Allanson et al. 2018).
- In the slow-motion city *Space for Repletion* must be created so the food-energy-water systems become the driver for urban development. Here the landscape is the main driving force and therefore taken first. The regional urban plan for Western Sydney is a good example in which the creeks, elevation and ecosystems are taken as the basis for an urban (agro-)forestry strategy (Roggema et al. forthcoming).
- When a landscape has to deal with sudden change, such as a potential flood, a long period of droughts or other climate related impacts, the design needs to be able to take up these sudden changes, and spatial claims. Therefore (urban) voids need to be incorporated in the spatial vision (Roggema 2018b), so *Redundant*

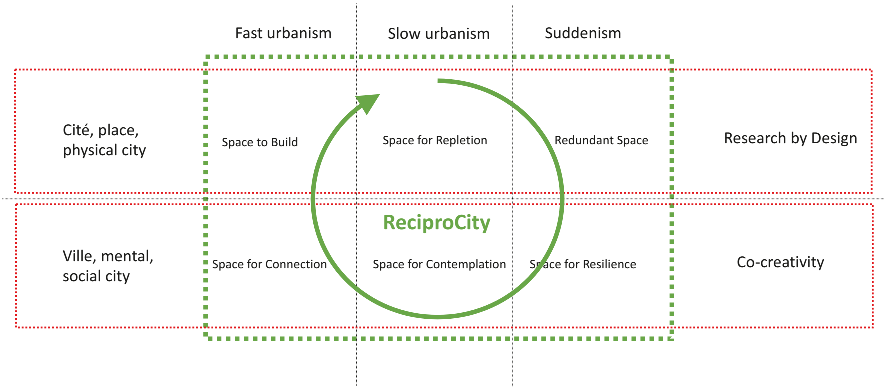

Fig. 1.14 Connecting physical and mental aspects in the ReciproCity (Roggema 2019)

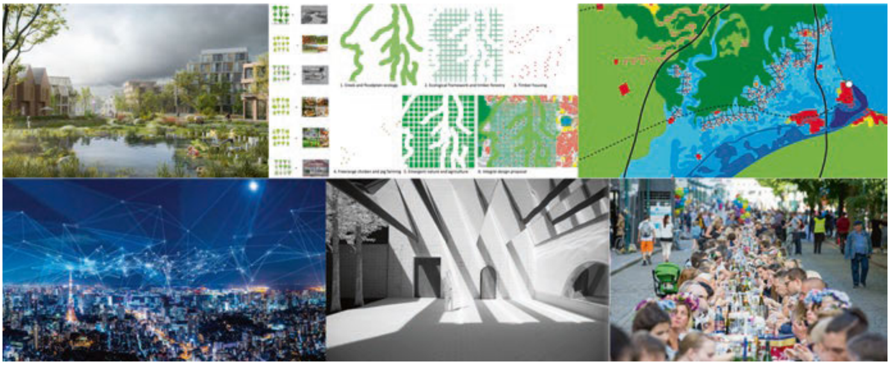

Fig. 1.15 Urban spaces for regeneration: Norra-Bunkeflostarnd, Malmö (Tredjenatur https://www.tredjenatur.dk/wp-content/uploads/2019/09/NORRA-BUNKEFLOSTARND_IMAGE_03-948x621.jpg), Western Sydney (Roggema et al. 2021), Floodable Eemsdelta (Roggema 2015a), Smart City (https://simplecore.intel.com/itpeernetwork/wp-content/uploads/sites/38/2019/12/Intel-HPC-Smart-Cities-768x437.jpg), City Monastry Rotterdam (Jurgen Ten Hoeve, https://www.ravb.nl/content/media/2017/09/02-de-Werkplaats-maquette-foto-530-breed.jpg) and Hoplr neighborhood cohesion (Clickx, https://www.clickx.be/wp-content/uploads/2020/01/header-2.jpg)

Space beholds the flexibility to adjust over time. This will give the landscape options for the future, as the plan for a Floodable Eemsdelta (Roggema 2015a) illustrates.

– To connect people and establish abundancy of interaction between people and with their urban environment, the principles of a smart city can be used to create *Space for Connection.*
– At the same time the environment needs to provide *Space for Contemplation*, so people can reset, reflect, and recover from the busy schedules in their lives. The Urban Monastery plan in Rotterdam illustrates how urban space can be transformed (ArchitectuurNL 2018).

– Finally, when disasters happen or tribulation occurs, sudden change overcomes people and the way they can respond depends on the *Space for Resilience* they experience. People find solace amongst each other so they can cope with the stressful situation. When people feel the mental space to help each other the disruptive situation can be dealt with. Strengthening social cohesion is important, such as happenings and gatherings in the public space (Geerts 2020).

1.7 Conclusion

In this chapter the main concepts regarding creating an ecological responsible future are discussed. The three concepts of sustainable development, resilience and regenerative design are aiming at the same, however, seem to have different ambitions. Where Sustainability can be reached by establishing an equilibrium through which future generation can have the same quality of life as the current, the resilience paradigm aims to achieve this even under serious change and shocks to the system, and the objective of regenerative design is to regenerate the living conditions of the entirety of the system, both human and ecological. A couple of observations are made:

– To regenerate the living conditions both resources and minds need to be replenished, more has to be given back than taken out of the system. This is what the ReciproCity entails to do.
– Regenerative design needs to move beyond the regenerative city as such. It is not enough to design a city that operates in a regenerative way, e.g. that it is able to regenerate the living conditions within the urban boundaries. The city as a system should also contribute to becomes the regeneration of the entire ecosystem and the landscape underneath and around it. The city is embedded in the landscape system, and urban development should therefore start with understanding and using the qualities, features, sensitivities and vulnerabilities of its forming systems (soil, water, air, ecology, etcetera).
– A regenerative future combines the physical aspects of the city and the mental side of it. For every pace the city develops, fast, slow or sudden, it deserves its own spatial typology for both the mental as well as the physical city. In this, the city gives space to building, repleting and redundancy, as well as connection, contemplation and resilience.
– Regeneration is a design task. Factual data can give the information if the regeneration is sufficient or not, but this is not satisfying since regeneration by its very nature is a systemic process towards a continuous changing improvement of the living conditions, which over time, will change due to changes in and interactions with the environment. Therefore, the complexity of the systems, transformations over time and interactions between people, the atmosphere, ecosystems and all that lives makes a mechanical approach doomed to fail. Instead, a design-led approach is capable of grasping complexities, ignites change through spatial interventions, and is able to be adaptive so the landscape remains changeable.

The future is full of challenges. By bringing together knowledge and design for a physical and social city, we can create a future which is both sustainable and reciprocal. The most important thing we can wish for as humans are those regenerative living conditions in which we can enjoy spending time with our loved ones. This environment must have the self-organising capacity to remain and replete, and offer relief and give time to think (even about nothing in particular), in times of desperation. The fact that in doing so, we also design an environment which can take sudden changes, and provides raw materials rather than producing waste, makes the task interesting, positive, and fundamentally important. The right moment has arrived, to speak with Koiros, to make the crucial difference towards a positive future.

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Chapter 2
The City Sustainable, Resilient, Regenerative – A Rose by Any Other Name?

Chrisna du Plessis

Abstract As humans struggle to come to terms with how to move forward in the confusing and frightening world of the Anthropocene, a number of new concepts and terms developed to describe different approaches to find meaning and identify appropriate actions and solutions. These approaches define different paradigms of what can broadly be described as ecologically responsible design. While each of these paradigms provide useful tools and strategies, they also evolve as their shortcomings and limitations become apparent. Unfortunately, as terms fall out of favour and fashion, there is a tendency to replace the old term with the newest buzzword, without critically engaging with the theory underpinning this new terminology. Thus, sustainability becomes resilience, which becomes regenerative, with little acknowledgement that these require different design paradigms with different goals, practices and rules.

This chapter explores the evolution of three different, yet connected paradigms of ecologically responsible design, to achieve a better understanding of what the difference is between the often-conflated concepts of sustainability, resilience, and regeneration. It goes beyond dictionary definitions to unpack the evolution of these interconnected paradigms as they run into their own limitations and become exposed to different worldviews. It then explores what each of these paradigms would mean for the design product, the design process and the designer as person.

Keywords Sustainable · Resilience · Regenerative · Design · Paradigm

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2.1 Introduction

William Shakespeare famously wrote that a rose by any other name would smell as sweet, meaning that while we may give different names to a thing, the essence and characteristics of that thing stays the same. This would appear to be the spirit in which many urban thinkers, commentators and actors approach the concepts of sustainability, resilience and regenerative design and development.

As the term 'sustainability' lost its lustre through overuse and misuse (Worster 1995), many working in this field were looking for a new term to describe a set of strategies for building a healthier relationship between cities and the ecosystems from which they draw resources. First resilience (Zolli 2012; Ferenbacher 2013) and then regenerative design (Stafford et al. 2018; Gibbons 2020) were hailed as the new sustainability, often with little changing except the name of the rose. For example, in 1996 Herbert Girardet proposed a short list of what sustainability would mean in an urban context (Girardet 1996). Sixteen years later, he repeated essentially the same list as the characteristics of a regenerative city (Girardet 2010). This list remains the core framework guidelines for designing a sustainable/ resilient/ regenerative city proposed by organisations such as the World Future Council and large private sector consultancies and repeated by opinionistas in blogs and media articles. The list usually includes references to the circular economy, water management, renewable energy and energy efficiency, walkable cities with public transport, local food security through urban agriculture, green roofs and walls, thermal efficiency and restoring local biodiversity through greening public space. So we see that while sustainability is increasingly being challenged as a driving concept, architectural and urban design practices proclaiming that they are departing from sustainability continue to use this list as a basis for what they now describe as regenerative design practices (for example, Babtiwale 2019; Holl 2020). Others, while seeming to understand the theoretical basis of regenerative design, when pressed to describe this in case studies, fall back on the same set of markers used for green design to identify and describe regenerative building projects (see Brown et al. 2018).

The problem with this renaming of the rose is that resilience and regenerative design are not new varieties of roses. They may share the same genus as sustainability, and therefore exhibit many of the same characteristics, but they are different species that evolved from a common ancestor in response to a changing environment and failures of the previous species in the evolutionary tree. They are, in fact, different design paradigms with different goals, practices and rules. The confusion often comes in when sustainability is used as a catch-all concept and development ideal, even amongst those who sees its flaws and limitations (e.g., regenerative sustainability). For the purposes of this chapter, the term *ecologically responsible design* will be used as the genus or overarching concept and *sustainability, resilience,* and *regenerative design* as different species (paradigms) within that genus. The term *ecologically responsible* refers to the main objective of all three paradigms: to find a way to ensure the health and well-being of the global social-ecological system (not just ecological systems). However, each of these paradigms interpret this objective differently. This chapter explores the evolution of the three concepts or main paradigms, before it unpacks the differences between the paradigms using as a framework the three lines of work proposed by Mang et al. (2016). These lines represent the design product, the design process, and the designer themself.

2.2 An Evolutionary Trajectory for Ecologically Responsible Paradigms

The notion of ecologically responsible design as following an evolutionary trajectory through a number of paradigms, each with several possible pathways, and finally shifting from one main worldview to another, is described in detail in Reed (2007) and Du Plessis (2012). All these pathways and variants stem from a root concern: the dysfunctional relationships within the global social-ecological system and how this is fuelling a range of social ills while threatening the long-term survival of the human species.

The three main paradigms of ecologically responsible design each have their own developmental pathway (Fig. 2.1) and can be studied in isolation. Sustainability grew from the realisation that a) the way we build our human habitats have an impact on the natural environment and on the health of the people living in these

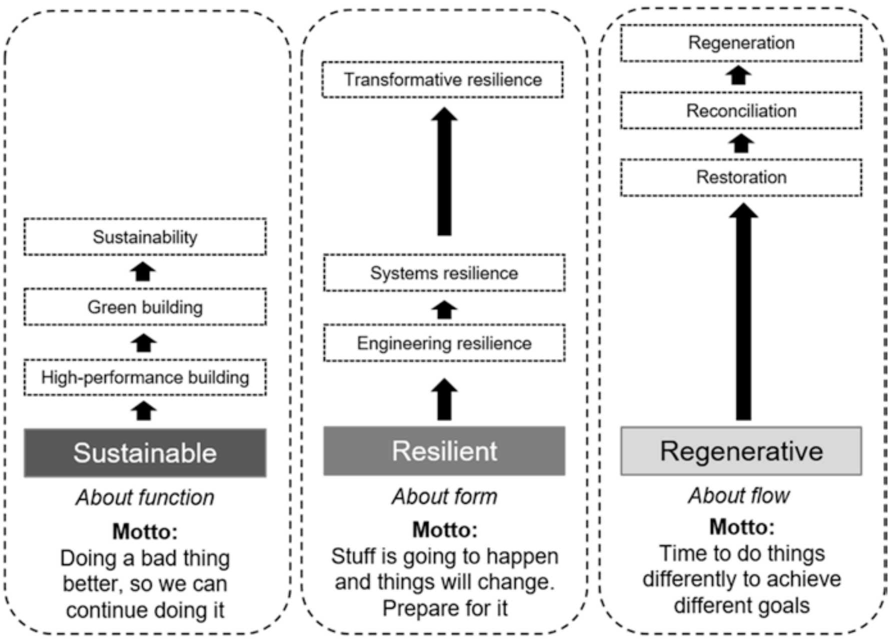

Fig. 2.1 Evolution of the three main paradigms in isolation

habitats; and b) that the resources we rely on to provide modern habitats are finite. The initial response was to improve the performance of buildings by making them more energy efficient, providing better air quality and more natural light, and in general improve their efficiency. However, it was soon realised that buildings and cities have much larger ecological footprints through the lifecycles of materials, energy sources and land use changes and that these systems should also be taken into consideration. To encourage the adoption of new measures and technologies, a series of measurement and management instruments were developed, and the green building industry became a major driver in improving the functioning of the dominant systems of production and consumption. Eventually, the penny dropped that this was about people and providing for needs, but they were largely left out of the equation. Sustainability also introduced the human component to what was measured and managed - procurement equity, labour-intensive practices where there is a surplus of labour, better working conditions, inclusive design, etc. However, it was still about doing a bad thing less bad (McDonough 2004) so that we can continue to do it.

Where sustainability is about trying to maintain current development pathways within a safe and just operating space (Raworth 2012), resilience is about preparing for perturbation and change. Rather than a goal to achieve, it is a characteristic of a system that determines the system's ability to absorb, adapt or transform in response to external perturbations or internal pressures, and it is a property that emerges from the system's structure. Its three main forms show a progression from engineering resilience which aims to build the resilience of infrastructure and mechanical systems to a specific disturbance by improving efficiency, constancy, and predictability, to systems resilience, and eventually transformative resilience. The latter two forms accept that social-ecological systems are complex, exist in states far from equilibrium at the edge between order and chaos, and are characterized by unpredictability. These systems experience cycles of change that include both slow, cumulative change and abrupt and disruptive changes and resilience in these systems arise from their qualities of persistence and adaptability. Design for resilience focus on changing the structure of the system so that its networks are more distributed and there is diversity and redundancy built into the components which make up the system. The next step in the evolution of resilience thinking was the realisation that resilience itself is neither good nor bad, but value neutral. In fact, long-term pressures like climate change, crime, corruption, rapid urbanisation and pervasive urban poverty (that includes a lack of quality education, basic services and safety) reflect the qualities of highly resilient yet perverse systems, which may require dismantling and reconfiguring – hence transformative resilience.

The regenerative paradigm arose from the realisation that it is not enough to have a net-zero impact (if that is even possible), but that if we want real change, we cannot continue propping up a dysfunctional way of living and being. To quote Buckminster Fuller: we need to design a new model to make the old model obsolete. The first step would be to reimagine the role of humans in the greater global ecosystem, to turn the human species from the villain in the story to a productive member of the community of life through restoring that which needs healing, reconciling the values and goals of humans and nature, and finally to create the conditions for new life, enabling the ongoing co-evolution and mutually beneficial integration of human and natural systems.

In his seminal 2007 paper, Bill Reed unpacked this journey as a trajectory of environmentally responsible design, starting with conventional practice and ending in regenerative practice, as described in Fig. 2.2.

For Reed, the paradigm shift happens when we move from a degenerative system with sustainability focused on fragmented, issue-based solutions, to a regenerative system which uses living systems approaches leading to increasing wholeness. This trajectory moves through the following 'stages': *conventional practice* following the law; *high performance design*, which improves efficiency and reduce negative impact; *green building*, which results in relative improvement working towards no harm; *sustainable,* which he sees as a neutral position with net-zero impact; and then moving above the line to *restorative* approaches which aims to restore healthy function in local natural systems; *reconciliatory design* which acknowledges that humans are part of nature; and finally, *regenerative design* which sees humans participating as co-creative members of nature and its co-evolutionary processes. Each of these stages can be considered a different paradigm, with different goals and

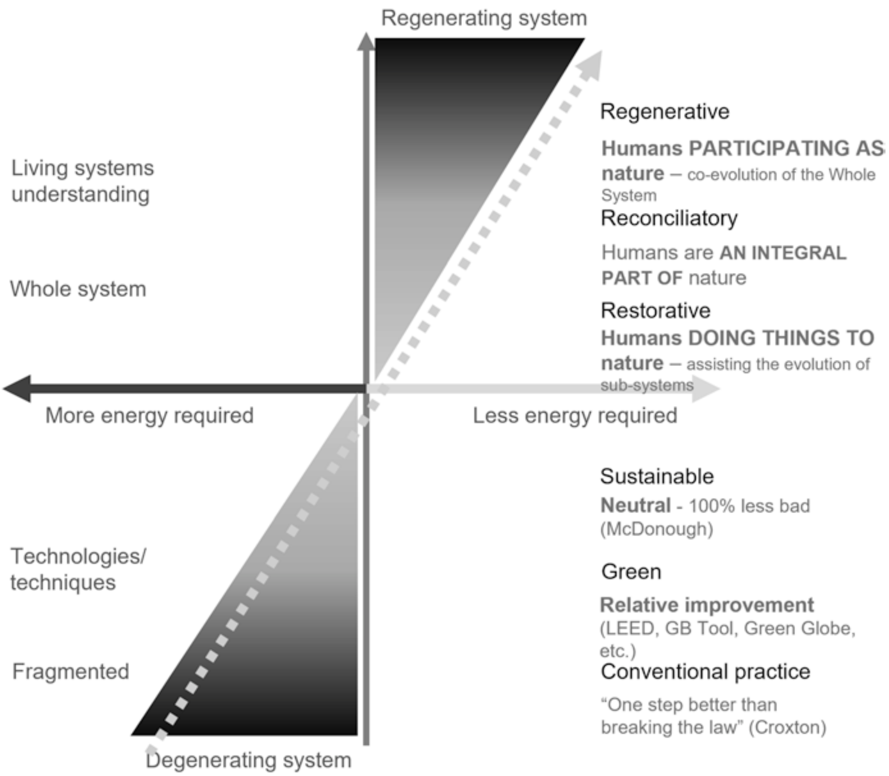

Fig. 2.2 Trajectory of environmentally responsible design. (Redrawn from Reed 2007)

methods, and represent branches of thought, more than a clear hierarchy or linear progression as they attempt to address flaws or shortcomings in existing paradigms.

Reed's initial trajectory diagram has seen several adaptations by other authors (e.g., Guzowski 2011; Wahl 2016). The original trajectory described a shift from degenerative approaches which focuses on efficiencies in aspects or parts of the socio-technological system and that uses more energy the lower the approach is in the hierarchy created by the trajectory, to approaches which follow a whole/living systems model and requires less energy as the trajectory moves into more regenerative approaches. One of the important contributions of this trajectory was the change from sustainability being seen as the end goal, to it simply becoming the neutral boundary between degenerative and regenerative pathways, with approaches such as green building serving as steppingstones towards sustainability. More than a decade after its first publication, it is perhaps time to update this trajectory to integrate a number of additional concepts which enriches the thinking and provide more clarity on the goals and approaches associated with each of these 'levels' of progression.

2.2.1 Working Above or Below the Line

The first of these concepts draws on the work of physicist David Bohm (2002). He proposed that the basis of all that exists is what he calls the holomovement, a vast and dynamic background whose basic movement is the folding and unfolding of the implicate order. As this implicate order unfolds, the explicate order of the four-dimensional world of objects in space and time manifests. Thus, the whole of all possible existence is enfolded within every aspect of itself, in much the same way that fragments of a hologram contain the image (or the information) of the whole hologram. Matter is that part of the implicate order which manifests (has been unfolded) in relatively stable form and appears as the explicate order of the four-dimensional world of objects in space and time. However, it may fold up and become non-manifest, unfold again to become manifest, and refold again. Our perception sees the explicate order as consisting of separate entities with their own agency and agendas, forgetting that this is a false individuation. These entities did not separate from the underlying holomovement, but are constantly being brought into being by the flows of energy in the holomovement, bringing forth the potential in the implicate order in a continuous flow of creation and destruction, of being and becoming.

This idea was taken further by Charles Krone (1992) to provide a framework for developmental processes which every living system must continually engage, known as the *Levels of Work*. In this framework, the two spheres are referred to as being either above the line or below the line, with the line being the threshold between the explicate and implicate orders. Falling below the line separating actual from potential, the first two levels of this framework operate in the explicate order (that which is already manifest). In this world we can operate and maintain/sustain systems. However, if we want a new model, we need to look at the potential that sits in the Implicate order (that which has not yet manifested). This is where we find ways of improving and regenerating systems. Krone calls this work of calling forth potential from the implicate order 'working above the line'. Krone's framework is a core concept in regenerative theory as proposed by Regenesis. Figure 2.3 describes this relationship between the implicate and explicate orders and the levels of work in each.

We can see the difference in below the line and above the line thinking in the language which shapes our thinking. Below the line, the world is seen as discrete elements that can be separated and aggregated; our relationship with nature is exploitative and controlling, with nature seen as merely a resource to provide for human needs. This attitude sees us as isolated from our environment and focused on our own survival in a world where we have to compete for scarce resources in a system we cannot influence or change. This leads us to become fearful and thus make decisions based on fear, which limits our imaginations and willingness to listen to others and see other possibilities.

Above the line work sees the world as consisting of interconnected and interdependent **living** systems, and our relationship with nature as one of collaboration, partnership and co-evolution in which we share the common goal of thriving (not just surviving). By working with nature and following her values it is possible to create abundance by enabling the development of potential within our systems as

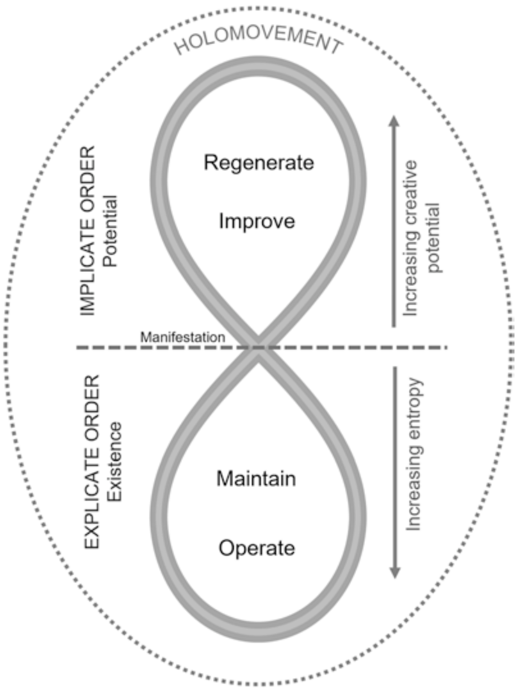

Fig. 2.3 Above and below the line levels of work

we rediscover and embrace the affinity we have with all the communities of life to which we belong.

It is important to understand though that it is necessary to engage all four levels of work, as "the capability to work at all four levels is characteristic of life and living processes and thus it is essential to sustainability" (Mang et al. 2016: XXXI). This notion of integrating seemingly opposing goals is central to understanding the progression of ecologically responsible design as an ideal.

2.2.2 An Integral View of Worldview and Paradigm Changes

The second idea is that this progression of thought about what sustainability entails also coincides with a shift in worldview from the fragmented approaches of a mechanistic worldview towards whole and living systems approaches found in an ecological worldview. Broadly speaking, a worldview is a story of how the world is perceived and experienced, what the world is, how it works and how humans should act in this world. As such, it is far more than a scientific explanation of the physical universe. Hammond-Tooke (1998:2) argues for a broadening of the term 'worldview' to "subsume all cognitive ways of conceptualising and classifying the world, including both secular and sacred ideas", and reminds the reader that it is possible to simultaneously hold multiple (even conflicting) worldviews (e.g., individual, organisational and societal worldviews).

However, worldviews themselves evolve. As Wilber (2000:58) explains:

> "Each worldview gives way to its successor because of certain inherent limitations in the earlier worldview. This generates a lot of chaos from which the system escapes by evolving to a more highly organized pattern which solves or defuses the earlier patterns. In turn, the new worldview will eventually come across its own recalcitrant problems and inherent limitations that cannot be solved at its current level, and thus trigger a new collapse into chaos and a new worldview which address these limitations".

Wilber (2000:5) further proposes that the essence of evolution is to include all that went before, and then transcend this to create a new form – to "incorporate and go beyond". Thus, any new worldview builds on the knowledge and insight accumulated through numerous preceding worldviews but adds its own insights to increase the scope and coherence of the picture being unveiled by the accumulated knowledge and wisdom revealed through all these worldviews. Paradigms flow from a specific worldview and are the "shared conceptual, theoretical, methodological, and instrumental commitments from its community of practice" (Kuhn 1996:42). Paradigms too evolve and are replaced. Van Breda (2008:127) noted though that while it is necessary to "suppress old paradigm concepts, ideas and representations" in order to produce the language of the new paradigm, such suppression does not mean "the complete demolition of old ideas… in a way that they become meaningless". Rather it means that they "have been restricted to a particular level of reality where they still exercise their original validity and truthfulness" (*ibid.*). So in the ecologically responsible design trajectory, the different paradigms are not discarded, but those elements which are useful at a particular level of reality are retained, which is why, for example, renewable energy remains a valid tool in any of the paradigms.

The main shift in worldview that drives the evolution of the trajectory is from the mechanistic to the ecological. However, this is a very simplistic differentiation of shifts currently happening. Black (2012) proposed a progression that builds on Hindu philosophy, introducing the concept of Seva, a Sanskrit term which translate as service. In his model the progression is from EGO, with man at the top of the pyramid ruling over everything else, to ECO, with humans as part of the community of life, to SEVA, with humans as standing in service to the community of life. Black describes Seva as "a role that can only be performed with a relationship of love and humility to all entities in the environment".

Lynam (2012) offers a "developmental map of the worldviews of sustainability", based on the constructive developmental theory framework developed by Suzanne Cook Greuter and its "action logics" (how adults tend to reason and behave). Similar frameworks were developed by Clare Graves, Don Beck and Christopher Cowan (Spiral Dynamics) and Ken Wilber (Integral Theory). What these have in common is that they describe stages of personal development that moves from egocentric to world centric and the progression through these stages are characterised by larger time frames, ability to include more perspectives, "widening circles of care, identity and responsibility and an awareness of and developing capacity to participate in increasingly complex systems" (ibid.).

Interestingly, Graves also identified below the line and above the line worldviews or values, proposing two tiers to the developmental spiral. The first tier describes the 'subsistence' levels of human development. These subsistence levels "have as their overall goal the establishment of individual survival and dignity" (Graves 1974:73). Currently the bulk of humanity and its societies spans across these levels, with progressively fewer individuals at higher levels. The second tier that comes into play "once an individual has become reasonably secure, both physically and psychologically… and free to experience the wonder and interdependence of all life" (ibid.) contains what Graves terms the 'being' levels. The levels in this tier take a globally integrated view focusing on the long-term future of the world system, acknowledging and integrating diversity and previous levels of development, and allowing an integral sense of a global community of life in which the fate of all of life is connected. It is also the level at which deeper mental and spiritual capacities are awakened, resulting in a "great step in development" (Beck and Cowan 1996:289).

2.2.3 Resilience Thinking

The last of the concepts to include is resilience – a school of thought that became prominent after a series of significant natural disasters (Hurricanes Katrina and Sandy, the Christmas Day tsunami, and a worldwide increase in large wildfires destroying urban infrastructure, old growth forests and agricultural production).

Whereas green building and UN-style sustainability is very much about improving living conditions while trying to minimise environmental negatives, but not fundamentally changing the economic goals of society, resilience thinking proceeds from the assumption that we are vulnerable to many predictable and unpredictable shocks and that things will change, whether we want them to or not.

From this point of view, the objective of ecologically responsible initiatives is not to resist or reverse change, but to accept that change is inevitable and manage the phase changes within systems in such a way that the system does not lose its fundamental identity and tip into another stability domain, or that such collapses do not cascade upwards into the larger system. This means managing the capacity of the system to "absorb disturbance while retaining essentially the same function and structure" (Walker and Salt 2006:1).

Current urban resilience initiatives mainly base their tools and methodologies on an engineering resilience interpretation of how best to manage change. Pendall et al. (2010:73) describes how much of current thinking about urban or regional resilience is still caught up in the equilibrium (or engineering) version of resilience that is focused on the ability of a city or region to bounce back to 'normal', i.e., to its functions and growth trajectory as it was before disaster struck. Even when disasters expose the flaws in the previous system, raising the question of whether the system should not instead be guided towards a 'new normal' (ibid.: 74), what this new normal should be is often determined by current social and institutional values, norms and rules that didn't change.

The second category of resilience, termed systems resilience by Martin-Breen and Anderies (2011), ecosystems resilience by Holling and Gunderson (2002) and ecological resilience by Davoudi (2012) refers to the magnitude of disturbance that a system can absorb without severely compromising its survival within a narrow range of permissible fluctuation. It focuses on maintaining critical system functions in the face of both sudden crises and slow pressures, but the way these functions are provided, as well as the system components and structures providing these functions can change (Anderies et al. 2004).

The understanding of resilience has subsequently been expanded to a more evolutionary model that acknowledges the ability of the system to adapt and transform to a new state of being while still maintaining previous functions (Kirmayer et al. 2009; Zolli and Healy 2012). This describes the third category of resilience identified by Martin-Breen and Anderies (2011) as the resilience found in complex adaptive systems such as ecosystems and social-ecological systems (e.g., cities), and it is differentiated from systems resilience by the quality of adaptability and its focus on system conditions that are far from equilibrium. The emphasis is on the opportunities created for "generating new ways of operating and new systemic relationships" (Martin-Breen and Anderies 2011:7) through "recombination of evolved structures and processes, renewal of the system and emergence of new trajectories" (Folke 2006). As such it can be described as transformative and regenerative resilience with main characteristics being adaptation and transformation.

Furthermore, the concept of resilience itself is only part of a larger theoretical framework of resilience thinking that provides a metaphorical lens through which to find the strengths and weaknesses of a city system in response to either a specific disturbance, as in disaster and crisis management (specific resilience), or to a press disturbance such as slow climate change, poverty, or ineffective service delivery (general resilience) (Walker and Salt 2012). Engineering resilience relies heavily on specific resilience, whereas systems resilience and transformative resilience focus on building general resilience.

When these concepts are included into a revised evolutionary trajectory, we get a better understanding of the distinctions between the different ecologically responsible paradigms.

2.3 A Revised Evolutionary Trajectory

This revised trajectory presents a synthesis of the stages of the three main paradigms and how these fit into the levels of work and different worldviews proposed. While Fig. 2.1 shows these paradigms as a direct progression, it is important to note that they represent different evolutionary branches of three main paradigms which evolved in parallel: sustainability, resilience and regenerative. As each of these paradigms evolved, they responded to different stimuli in the same environment, as well as each other. It is also important to consider that the evolutionary progression follows the principle of include and transcend (Wilber 2000) – thus solutions such as renewable energy and resource efficiency found in green design & development, or net zero emissions found in sustainability, become the building blocks available to the construction of new realities in regenerative design. However, they are not indicators or characteristics of regenerative design. A short description of each of these paradigms as described by the framework in Fig. 2.4 is provided next.

Fig. 2.4 Revised evolutionary trajectory of ecologically responsible design

2.3.1 *Below the Line Approaches*

According to Krone's framework (Krone 1992), below the line approaches focus on the operation and maintenance of existing systems and the main goals are to ensure the continued functioning of these systems and improve overall efficiency through efficiencies in component systems. These approaches are also still rooted in a mechanistic worldview which separates humans and nature as systems with different, often competing goals, and reduces complex problems by focusing on individual components of the problem and hoping that the aggregate solution of these would magically resolve the complex problem. Many of the below-the-line tools developed to operate and maintain existing systems while improving efficiency and reducing negative impacts are based on identifying different system components which are then individually monitored and addressed. The three pillars of sustainability (which with the addition of technology and culture became five pillars), the five capitals model, every single green rating or assessment system, and even more 'enlightened' models such as the Living Building Challenge – all of these functions in this way and all of these are focused on management through measurement which would enable regulation (and thus control).

2.3.1.1 Conventional High-performance Building

Worldview: Mechanistic, EGO*; Main paradigm:* Sustainability*; Sphere of existence:* Actual*; Level of work:* Operate.

Building regulations in many countries provided parameters for conventional buildings that laid the foundation for what became green building. These parameters include aspects such as natural and mechanical ventilation, air quality, daylight, inclusive design, and insulation - all which directly influence the operational qualities of a building. These aspects are considered by themselves in stand-alone regulations, a hallmark of the mechanistic worldview, and the main driving force behind their adoption is compliance and providing basic levels of human comfort, with little thought given to negative environmental impacts. High-performance building became the next level of conventional building – focused on improving performance and efficiency, but not challenging the conventional building paradigm.

2.3.1.2 Engineering Resilience

Worldview: Mechanistic, EGO*; Main paradigm:* Resilience*; Sphere of existence:* Actual*; Level of work:* Operate.

The focus of engineering resilience is on the persistence of system structure and function. Holling (1996) describes this as concentrating on maintaining stability near an equilibrium steady state by focusing on efficiency, control, constancy and predictability, which he sees as attributes that lie "at the core of desires for fail-safe design and optimal performance" (*ibid.*). This understanding of resilience is mainly relevant to mechanical assemblies and systems that can only function if their structures stay the same or return to their original form. Related to engineering resilience is what Davoudi (2012) refers to as bounce back or disaster management resilience, where the focus is on the capacity of techno-socio systems to rebound to the status quo after destruction. Engineering resilience tends to focus on specific vulnerabilities within the system and developing built environment solutions to these, such as measures to make buildings earthquake resistant.

2.3.1.3 Green Design & Development

Worldview: Mechanistic, EGO*; Main paradigm:* Sustainability*; Sphere of existence:* Actual*; Level of work:* Operate.

Green design & development is the next evolutionary step up from conventional and high-performance building and adopted many of the tools of this earlier paradigm such as performance criteria and assessment systems. The main driver behind green buildings and cities is to reduce negative environmental impacts and improve efficiencies in resource use. Where regulation and improved profit margins were the main instruments driving conventional and high-performance building, rating and assessment tools provided the main instruments driving Green building. However, this approach has been widely criticised. Kohler (2002), Birkeland (2005, 2007) and Schendler and Udall (2005) criticized indicator-based building assessment and rating systems as tending to reinforce existing building types and practices, while the reliance on aggregation methods for the assessment of different technological interventions does not easily lend itself to a systemic understanding of the site or the city, thus preventing solutions that build on synergies and symbiosis (Birkeland 2007). Another main critique of Green is its focus on the natural environment, and especially resource use, while ignoring the human aspects required for sustainable development. While later versions of rating systems such as Leadership in Energy and Environmental Design (LEED), Building Research Establishment Environmental Assessment Method (BREEAM), and Green Star, do begin to pay lip service to social considerations, this is still done in a reductionist, aggregate manner.

From this point forward, buildings should use renewable energy, be thermally and energy efficient, recycle wastewater, and make conscious material choices to reduce its ecological and carbon footprints. These are the low-hanging fruits of ecologically responsible design.

2.3.1.4 Systems Resilience

Worldview: Mechanistic, with some aspects of ecological, EGO shifting to ECO*; Main paradigm:* Resilience*; Sphere of existence:* Actual*; Level of work:* Maintain.

Used initially in ecology and ecosystem management, this view of resilience is more appropriate to living systems which respond to change and perturbation by adapting to and absorbing stress in order to keep functioning. Accordingly, resilience can then be defined as the ability of a system to move through periods of episodic change (prompted by an external disturbance or increased internal rigidity), adapting by shifting system states as required without crossing a threshold into a different stability regime (and thus losing functional identity). This is significantly different from engineering resilience, which requires that a system returns to the same state. Systems resilience also begins to question the goals of efficiency and improved performance in different elements of the system, suggesting that optimization of system behaviour is not an appropriate goal for the management of dynamic systems, as any optimization around a single objective only sets up conditions for the next systems failure (Holling and Gunderson 2002); and that "optimization (in the sense of maximizing efficiency through tight control) is a large part of the problem, not the solution" (Walker and Salt 2006:141). The main goal of systems resilience is to maintain the dynamic equilibrium of the system within a specific set of conditions (the stability regime). However, in contrast with engineering resilience, which requires that the form of the system returns to what it was before, systems resilience might adapt the form of the system to better suit new conditions, for example building levees to address increased flooding and sea level rise, or applying managed retreat strategies (Carey 2020).

2.3.1.5 Sustainability

Worldview: Mechanistic, with some aspects of ecological, EGO with some aspects of ECO*; Main paradigm:* Sustainability*; Sphere of existence:* Actual*; Level of work:* Maintain.

Sustainability is essentially about maintaining the health of the natural environment so that it can continue to provide for the well-being of humans. However, there are many different approaches and perspectives on how best to achieve this (see Cole 2012; Du Plessis 2012), each with its own flaws. However, the biggest drawback of the sustainability paradigm is the goal of maintaining a steady state equilibrium – moving from a current 'unsustainable' state in which the law of entropy sees ecosystems deteriorate further, while demands on these systems grow, to a future 'sustainable' state in which the supply and demand is somehow balanced out. This is the basis of the Natural Step, which proposes that development should take heed of four system conditions aligned to nature's cycles of production and processing/decomposition (Robert 1995). It can also be seen in the capitals model of sustainability, which holds that loss of natural capital can be compensated for by other forms of capital, so that the intergenerational transfer of capital remains the same (Solow 1992; Parkin 2005). The only debate in this model is between so-called 'weak' sustainability, which sees all five capitals (natural, manufactured, social, human and financial) as interchangeable (DFID 1999), and 'strong' sustainability, which holds that there are certain functions that the environment performs that are essential to the welfare and survival of the human species and which cannot be duplicated by humans. These ecological assets are called 'critical natural capital' and cannot be traded for any of the other forms of capital, as their depletion would endanger human survival (Sigma Project 2003). Another approach is presented by the Doughnut Economics model proposed by Kate Raworth (Raworth 2012) which situates sustainability as the safe and just space between the external limits of planetary boundaries (as determined by Rockström et al. 2009) and internal limits provided by human well-being needs as set out by the UN Sustainable Development Goals.

Both these approaches have evolved significantly from the earlier focus on resource efficiency and reducing environmental impacts found in Green building, but still do not question the fundamentals of a modernization project that prevents effective engagement with a complex, dynamic and living world, and continues to see the relationship between humans and their biophysical environment as adversarial and eventually mutually destructive if not tightly regulated. While it sees the need for a shift to ECO, it is still very much trapped in EGO. To overcome this, we need to shift to an understanding of the world in which humans are seen as an integral part of nature and partners in the processes of co-creation and co-evolution instead of being merely users or clients of various ecosystem services (Van der Ryn and Cowan 2007; Kibert 2008; Du Plessis 2012).

Furthermore, sustainability is often presented as the end goal of various ecological design initiatives. However, the focus on minimising negative impact to an eventual net zero or net neutral negative impact ignores the reality of a global system that is in dire need of repair, reform and transformation. The next question that should be asked is: how do we as designers have a positive impact and contribute to the continued wellbeing and evolution of the nested social-ecological systems in which we operate? This question leads us into the next level of work and the sphere of potential or the implicate order.

2.3.2 Above the Line Approaches

We can see the shift to working above the line in the evolution of our approaches to creating a right relationship with the world. With sustainability as the neutral pause creating the dividing line between degenerative and regenerative approaches, it is also the dividing line between approaches that aims to operate and maintain existing systems, with some improvement (doing less bad), and approaches that focus on allowing potential to flourish and systems to evolve and transform to a better state.

Moving above the line means shifting the focus to “increasing the value-adding capacity of human and natural systems” (Mang et al. 2016: XXIX). The emphasis is on unfolding the potential of the whole system through enabling and emergence, making full use of the ability of complex systems to self-organize and create new higher-order system configurations. The approaches in above-the-line work focus on repairing and reconnecting fractured systems, providing scaffolding for new system configurations, and evolving the global social-ecological system to something which is different, and hopefully better. The ultimate goal is the “reconnection of human aspirations and activities with the evolution of natural systems – essentially co-evolution” (Mang and Reed 2012: 26).

Above the line work is also fully informed by the ecological worldview which sees humans and nature as an integrated, interdependent and co-evolutionary living system. The ecological worldview takes a globally integrated view, acknowledging and integrating diversity and previous levels of development. It allows an integral sense of a global community of life in which the fate of all of life is connected, and in which humans have a responsibility for maintaining the well-being of the entire system. This requires also an evolution in the realm of mind towards an ever-increasing sense of global and transpersonal awareness and levels of human mental and social development that operate from such a holistic and globally integrated and interconnected point of departure and increasingly integrative value systems (Du Plessis 2009). Thus, the above-the-line approaches are not just about a change in the processes and products of design, but also in the mind of the designer themselves – new ways of being leading to new ways of doing.

2.3.2.1 Restoration

Worldview: Ecological, ECO*; Main paradigm:* Regenerative*; Sphere of existence:* Potential*; Level of work:* Improve.

Restorative development can be defined as "socio-economic revitalization based on the restoration of our natural and built environments" (Cunningham 2003:23). Some authors see it as restoring natural and cultural systems to their original form (Morseletto 2020), while others see it as restoring disrupted and damaged social and ecological systems to a healthy state by firstly restoring natural processes and functions through approaches such as the circular economy (France 2010) and rewilding (Brown et al. 2018), and secondly restoring the connections between humans and nature through the promotion of approaches such as biophilic design and permaculture. Instead of addressing problems in a piecemeal fashion, restoration as a paradigm focuses on reweaving the webs of life and community. There are many case studies of people restoring degraded landscapes to become healthy ecosystems, and they do this by intervening just enough to create the conditions for nature to regenerate by itself.

2.3.2.2 Reconciliation

Worldview: Ecological, ECO shifting to SEVA*; Main paradigm:* Regenerative*; Sphere of existence:* Potential*; Level of work:* Improve.

Up to this point, the different paradigms have all been about humans doing something to nature and approaches which either focus on reducing the harm done to nature or, as with restoration, repairing the harm already done. In the context of ecologically responsible design, reconciliation aims to put an end to seeing the relationship between humans and nature as adversarial. The term 'reconcile' can mean to restore harmony, to resolve differences and to bring opposing forces into agreement. The reconciliation paradigm's main goal is therefore to reconcile the needs of humans and the needs of nature, aligning values towards achieving the common goal of health and wellbeing for the greater good of the social-ecological system.

It also sees humans and nature as one system, accepting humans and their habitats as part of nature. The main departure point for this reconciliation is that humans are nature too, and if we are part of nature, we should follow the laws of nature, cooperate with nature, and learn from nature. Perhaps the biggest mind shift we need to make is to accept that we are no different than other ecological engineers (organisms that modify, maintain and/or create habitat) such as beavers. We too modify our environment, build nests and create habitats for others.

Once we have accepted that we are part of nature and we can help nature to regenerate, we understand how important it is to reconnect with nature. In ecological design there are three ways for us to reconnect with nature. The first is biophilic design, which helps us to connect psychologically to nature. The second is biomimicry – learning how nature operates and applying these principles to our design. Linked to biomimicry is the third way: the idea of bio-based technology, where we use nature's processes in designed ecologies integrated with technological systems to help us provide certain infrastructure services.

This is the approach of reconciliation ecology (Rosenzweig 2003), which proposes that since humans have played a fundamental role in shaping ecosystems for millennia, the way forward is to accept this relationship and develop ways to restore and increase biodiversity in human-dominated landscapes which reconciles the needs of humans and other species. It goes beyond the simple actions of letting lawns revert to meadows and growing green roofs, with other species learning to co-exist in the niches created for them in human-dominated habitats. It also requires, as Fisher (2016) has formulated it: "an ethic of modesty and restraint, the practice of living within the constraints of community and a willingness to attune human ambition, societal expectations and mores to what a balanced ecosystem permits". Thus, reconciliation requires that conflicting parties let go of old ways of being and seeing so that something better can be built around shared values of a common future.

2.3.2.3 Transformative Resilience

Worldview: Ecological, ECO*; Main paradigm:* Resilience*; Sphere of existence:* Potential*; Level of work:* Regenerate.

Transformative resilience thinking acknowledges the need to at times release potential through a collapse of part of the system, so that such potential can be used to reorganize the system, enabling it to adapt to new conditions and regenerate itself – bringing forth new life, new form and new functions. It requires acts of radical imagination which does not attempt to improve the world incrementally, but rather to break open the world as it is now, rearranging its networks and flows to enable the emergence of something not just new, but better than what was before. Transformative resilience steps forward from the quest of trying to control uncertainty through either building in fail-safes or providing options, instead it embraces change and uncertainty, letting go of things that no longer work or are no longer relevant.

Unlike previous resilience paradigms, it does not strive to keep a system within the same stability regime. In fact, in conditions where systems exhibit perverse resilience, it actively works towards shifting the system into a new stability regime that disrupts the systemic qualities which kept it trapped in an undesirable state, allowing for potential to be released and networks to be rearranged in new ways which allows new forms to evolve. Regenerative design and development take that gap and nurture it, enabling the system's evolution to higher and more complex levels of being.

2.3.2.4 Regenerative Design & Development

Worldview: Ecological, SEVA*; Main paradigm:* Regenerative*; Sphere of existence:* Potential*; Level of work:* Regenerate.

The term regeneration dates from thirteenth century Middle English and is based on the Latin *regenerātus:* to bring forth again. The important thing to note, is that it is specifically aims to not just restore systems to what was, but to a better or higher state. One of the big problems with the current institutional models of sustainable development, such as the Sustainable Development Goals, is that they are trying to improve the existing reality, instead of providing the model for a new reality. In many ways regenerative design and development is trying to build that new model of relationship with the earth and her inhabitants, including humans. The basic premise of regenerative thinking is that humans can be a force for good – we can choose to contribute to the creation of a thriving and abundant world.

The discourse of regenerative thinking is based on two main pillars: The first draws on transformative resilience to propose that the destruction and collapse of existing systems provide an opportunity for creating new systems, relationships, and values. A lot of the sustainability discourse is about the doom and gloom of environmental and/or societal suffering and collapse. Regenerative thinking says we should focus on the potential created by these disturbances in the system to see how we can restore health and build new ways of being. Secondly, regenerative thinking suggests that we should use living systems, their properties and their behaviours as the inspiration for the new model we are building. This draws on restoration and reconciliation approaches.

Regenerative design and development have three main goals. Firstly, it is to bring new life, whether to ecosystems or neighbourhoods, by creating the conditions for the emergence of new complex ecosystems which expand the urban biodiversity and thus the ecological base of the city. However, it can be argued that it is not just about building the ecological base, but also about more complex and diverse social and cultural systems. Secondly, it is about giving back more than one took out, not just in terms of material or resource flows, but also in support of increasing and empowering the many 'soft' aspects of our human systems through contributive practices which contributes to the well-being and healthy functioning of the social-ecological system - improving and enriching the various relationships and flows in which that social-ecological system forms a node. The last main purpose of regenerative design is to create connection. It not only reconnects humans with nature (as in the ecosystems both inside and outside of them), but also connects individuals to their communities, and communities of life to each other.

2.4 The Three Paradigms According to Three Lines of Work

Mang et al. (2016: XXXIII) propose that "in every design project there are three agents that powerfully influence its ability to bring about change". These agents are the design product, the design process and the designer and each of them has responsibility for a certain level of work. The design product's work focuses on what one is trying to create that will add value to the system. The design process' work is to build the capabilities of the client, the team and even the community to not only collaborate, but be able to see, think about and engage with the world in a new way. Finally, the work of the designer is to hold the project vision and undertake the personal growth necessary to become what is necessary for a successful project.

The following sections use this framework to further explore the differences and commonalities of the three main ecological design paradigms, and what these means for the designer.

2.4.1 Line of Work: The Design Product

In the sustainability paradigm, the design product is seen as an object (building or urban infrastructure) which support goals of resource efficiency and strive for net-zero impact. However, to achieve this the product is still considered as an aggregate of the performance of separate systems, as measured by the indicators of a rating or assessment system. The goal of net-zero impact, with buildings generating as much energy, and harvesting and cleaning as much water as they use and forming part of a circular economy, assumes a dynamic equilibrium or steady state model as representing sustainability.

In the resilience paradigm, the product is a systemic intervention which will improve the adaptive capacity of the system at whichever scale the designer is working. This entails identifying risk and vulnerability, developing scenarios for future conditions, and designing options and fail-safes into the system. Thus, the product can be a levee system to manage storm surges and sea level rise; it can be a neighbourhood scale combined heat and power system making use of hybrid renewable energy solutions in unused interstitial and left-over urban spaces; or it can be a community space which provides a cold refuge for vulnerable members of the community, using passive cooling systems.

In both the above paradigms, the lessons learnt and designs developed can be transferred to other, similar conditions, with minor tweaking. In the regenerative paradigm the design product is as much a creation of its designers as it is of that specific place – being generated from the potential and essence of that place and its various communities, and its most valuable contributions cannot be transferred to another place.

For in this paradigm, the design product is not merely a building or other design object, but what Buckminster Fuller called a trimtab or what Jaime Lerner would call a needle in an urban acupuncture pressure point. Design projects are seen as regenerative change agents that become value-generating members of the community (and not just creating return on investment for the client). A phrase often repeated by regenerative design practitioners is that "it's not about the building" (Hes and Du Plessis 2014). Regenesis (Mang et al. 2016) provides many examples of where the building design or development master plan became almost incidental to the value that was created. It is this value to the larger system that is the true product of regenerative design.

2.4.2 Line of Work: The Design Process

In the sustainability paradigm, the design process is multi-disciplinary, analytical and consultative, with different professions working from within their own fields of knowledge to solve the design problem under the leadership of the main author (architect, urban designer or planner). The structural engineer works on the structure, the façade engineer works on the façade, the mechanical engineer works on the HVAC systems, while the electrical engineer focus on the electrical layout, optimising the efficiency in each of these systems. Only in recent years have they begun to cooperate to find design solutions in the in-between spaces between the disciplines as the pressure to achieve ever-higher green building ratings increase.

In the resilience paradigm, the process becomes more interdisciplinary, with experts from different knowledge fields contributing to the goal of avoiding catastrophic shocks to the system (or at least reducing their impact) and adapting to changes already baked into the system. Here we can see ecosystem scientists collaborate with engineers to design green infrastructure to manage stormwater, preventing future flooding and recharging aquifers; or architects working with indigenous people, drawing on their traditional knowledge of managing temperatures in extreme climates to design new buildings which would protect their inhabitants against extreme heat conditions.

In the regenerative paradigm, the process is transdisciplinary, intuitive and co-creative, with the design process becoming a catalyst for far larger systemic interventions. The first step in this process is to understand the place within which the designer will be working: its organisms and living systems, as well as the larger systems and broader community within which the project is situated and to which the project should contribute. This changes who is called on to collaborate, with the community and the place itself becoming key partners in defining design solutions that would grow the potential of the place and enable the development of new systems (Hes and Du Plessis 2014). This process involves scientific experts as well as community members and aims to identify the 'essence' and 'potential' of a place (Mang and Reed 2012).

Furthermore, this process obliges both the practitioner and client to let go of the need to be in absolute control of the outcome. Often it is necessary to let go of a design, an idea, a concept, or a solution as it may not be in the long-term interest of the larger system; or letting go of a particular idea will enable a solution with a multiplier effect - addressing multiple opportunities and problems simultaneously.

However, the most important way that practice changes in regenerative design is that its ultimate goal is to inspire others to co-create the vision of what it is that needs to be created (not just the object of the building), and then holding that vision through all the trials and tribulations of a project and beyond. It is about planting a seed that would only reach its full potential much later and trusting that the conditions have been created that would allow that seed to grow and evolve.

2.4.3 Line of Work: The Designer

Reed (2007) argued that if we want to do things differently, we do not just need new processes, but also new purpose. But most importantly, we ourselves need to become different. We cannot expect significant transformation in ways of practice if we cannot also transform our own ways of being. As Mang et al. (2016:197) explains: "To be agents of transformation, designers must transform themselves. They must redesign their own thinking and ways of being". Each of the three paradigms requires a different set of transformations from the practitioner.

The sustainability paradigm requires that designers build new levels of technical competence, stepping outside of disciplinary comfort zones and become systems thinkers. They need to develop skills in negotiation and conflict resolution to reconcile the ideas and inputs of the many parties working independently on aspects of the project.

The resilience paradigm requires that designers become comfortable with complexity and learn to let go of certainty, building their own adaptive capacity. They also need to learn how to facilitate deep conversations and hold space for the fears and concerns of the different stakeholders while building common values. The designer thus becomes a mediator and facilitator of deep conversations and collaborative processes.

In the regenerative paradigm, the main role of the designer is to become a systems actualizer, that is to help the system become everything it is capable of becoming to fulfil its true potential. To become a systems actualizer, Mang et al. (2016) suggest the practitioner aims for three developmental objectives:

- Awaken caring: Help all stakeholders see the true potential of what can be released and their role in creating a common vision so that they care about the outcome of a project.

- Honour complexity: Develop the capacity to shift between foreground and background, big picture and detail, and see different viewpoints.
- Be a work in progress: This links back to becoming a reflective practitioner who is constantly both self-observing and self-remembering. Self-observing requires one to be aware of three things: your emotional state, how it is being created, and how your state influences your behaviour and environment. Self-remembering is about remembering who you want to be in a given situation – this can be your role (e.g., good cop, bad cop), as well as the kind of person you want to be.

The need for on-going inner work and personal development is one of the strong undercurrents running through the regenerative movement. Three key personal development practices a regenerative practitioner can use to help them work more confidently in this new way is to develop a regular reflective practice, to allow themselves to be vulnerable and open to different perspectives, and to not shirk from the heavy mental work required to effectively deal with information from so many disciplines and sources (Hes and Du Plessis 2014). It is important to understand that there are no easy recipes, checklist spreadsheets or ten-step plans, and most actions require skilful negotiation of vast amounts of data and many competing knowledge claims from which the practitioner has to extract nuanced meaning, without falling into the trap of reductionist thinking. The designer must do the hard work of really studying and contemplating the theoretical basis of the tools they use, moving engagement with the subject from knowledge to understanding and finally wisdom.

Finally, Mang et al. (2016: 217) propose that the role of the designer has evolved from being a mere problem solver, to becoming a resource for "reconnecting places and people to their inherent potential", helping communities to make sense and find meaning in their place so as to help their social-ecological system to not only heal, but evolve to its fullest potential.

	Design product	Design process	Designer
Sustainable paradigm	Object as aggregate of separate systems. Transferable to similar programmes and conditions	Multidisciplinary Analytical Consultative Led by a main author	Become a systems thinker Build new technical competencies Develop negotiation and conflict resolution skills
Resilience paradigm	Systemic intervention to improve adaptive capacity Transferable to similar conditions	Interdisciplinary Collaborative Joint problem-solving	Learn to become comfortable with complexity and uncertainty Build own adaptive capacity Develop mediation and facilitation skills
Regenerative paradigm	A trimtab/change agent that leads to larger systemic value Place-specific	Transdisciplinary Intuitive Co-creative Catalyst for larger systemic transformation Emergent	Become a systems actualizer Build personal reflective and transformative practices Develop capabilities for sense-making and meaning-making

2.5 Conclusions

This chapter explores the evolution of three different, yet connected paradigms of ecologically responsible design, to achieve a better understanding of what the difference is between the often-conflated concepts of sustainability, resilience, and regeneration. It goes beyond dictionary definitions to unpack the evolution of these interconnected paradigms as they run into their own limitations and become exposed to different worldviews. It expanded the evolutionary trajectory of ecologically responsible design originally proposed by Reed (2007) to include resilience, which was not included in the original framework, as well as provide links to several other concepts such as the worldviews of EGO, ECO and SEVA, and the differentiation between below the line levels of work, which operate in the manifest reality, and above the line levels of work which operate in the world of potential.

Each of these paradigms make a unique contribution to how a) we create meaning for designers in the confusing and frightening world of the Anthropocene; and b) envision approaches to firstly minimise the negative impacts of the currently dominant civilisation, secondly avoid or adapt to threats posed by the changing planetary conditions, and lastly help the global social-ecological system to recover, reintegrate and evolve to become something better. The important lesson is that the evolutionary lessons of each of the paradigms are not lost or turned irrelevant. Instead, while responding to different drivers, the approaches developed in each of these paradigms can support one another when answering to the overarching goal of regeneration. Perhaps the most difficult lesson for designers is that regenerative design and development does not necessarily look different on the surface. A regenerative building may still have solar panels and use reclaimed timber. Rather its key characteristic lies in that which is often invisible: the design process and way of thinking about a project as not solving a specific design problem but rather as a catalyst to developing potential and capability in the place and the community within which a project is situated.

What differentiates the regenerative approach from sustainability or resilience is that it is not just about adopting a new ‘ecological’ but still technocratic approach or asking more ‘ecological’ questions instead of mechanistic ones. Instead, it is first and foremost about a change of perspective about our place in the world and the reality of that world that goes against a deeply entrenched need for control and security and stability. But without this change there is every danger that the approaches of the above-the-line paradigms of ecologically responsible design will fall into the same trap as those of the below-the-line paradigms of sustainability and we will once more just be pouring old wine into new bottles.

It is tempting to think about what comes after regenerative – already the term itself is being co-opted and misused by those eager to identify ‘the next big thing’. In the world in which we are living, where academic careers hinge on being at the forefront of knowledge and a billion wannabee influencers are desperate for a new trend to establish them as thought leaders and get more ‘likes’, this is a natural impulse. But perhaps we need to stop and breathe a bit to truly assimilate this journey and the growth it requires, because we have not even managed to achieve sustainability yet. In pushing for the shiny new toy, we are skipping over the critical personal and cultural growth that is necessary to truly create a regenerative world. And this quest for ecologically responsible design turned out to be not a merely technological journey, but essentially a journey of human cognitive development. In the parlance of Spiral Dynamics, Regenerative is stepping into the second tier - a new dimension of thinking that requires a new way of being in the world; that requires of us to let go of our caterpillar selves to become the butterfly. And only the butterfly knows what comes next.

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Chapter 3
Using Indigenous Knowledge in Climate Resistance Strategies for Future Urban Environments

Chels Marshall and Jason Twill

Abstract Although Indigenous people have maintained and asserted that cultural obligations that include equity to landscapes and species is a custodial response to human place within the environment, it is only recently that research is increasingly demonstrating the practices and approaches used by Indigenous people for natural resource management is more effective than approaches created and used by post-colonisation economic and governance practices. Inherent responsibility is an ideology that has sustained and assisted many Indigenous people throughout the world during environmental changes. The impacts of colonisation, and the social and economic constructs that come with it, have been extremely destructive to Aboriginal people, the cultural landscape and associated cultural knowledge. In the process of colonisation, the disregard to Aboriginal knowledge including the attempted removal and muting of knowledge systems attached to landscapes, have seen the planet endure centuries of bad management, unsustainable practices, increasing species loss and social removal from nature connection.

Applying Indigenous knowledge systems as a foundation for regenerative urbanism presents an opportunity to redirect sustainability to one that prioritises life and the living systems of our planet, not the economy. Cultivating a regenerative mindset through Indigenous ways of knowing is a starting point to usher in a new paradigm and approach to regenerative city making.

Keywords Indigenous knowledge · Climate change · Indigenous knowledge systems · Regenerative design · Regenerative urbanism · Sustainability · Traditional ecological knowledge

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3.1 Introduction

We are at a critical point in human history where there is a pressing need for a new paradigm to drive humanity forward toward a safe, prosperous, and ecologically regenerative future. The 'green' or 'sustainability' paradigm to harmonize environmental, social, and economic progress, which has pervaded industry and government for the past three decades, has come under strong critique in recent years. Unfortunately, the reality is many organizations with the best intentions are falling significantly short of following the guidance of the International Standards Organization, the UN Global Compact, the World Business Council on Sustainable Development, and other respected frameworks for transitioning toward sustainable organizational behaviour and impacts.

It has been 34 years since the publication of *Our Common Future* and 28 years since the adoption of Agenda 21 at the Earth Summit in Rio de Janeiro, Brazil in 1992. Yet, ecological and social degradation continues to threaten livelihoods across the globe: climate change is driving more and more extreme weather events; inequality between the haves and the have-nots is greater than ever; languages across the world are disappearing at an alarming rate with approximately 90% of existing languages expected to be dead or unrecoverable by the end of the current century; biodiversity and ecosystem services are under such serious threat by human activity that geologists have named our current geologic era the Anthropocene; and right now we are in the midst of a global pandemic that is collapsing economies and taking lives the world over (Crutzen and Stoermer 2000). The modern sustainability movement has failed to commensurately address these challenges. A new approach is required if we hope to create a better future for life on our shared planet, Regenerative Development and Design (Mang and Reed 2012).

Regenerative Development and Design is a paradigm designed to transition humanity beyond sustainability. While sustainability focuses on 'sustaining' or "using resources today in a manner which does not prevent future generations from using those same resources," regenerative development goes beyond 'sustainable conditions' to restorative and regenerative outcomes that match the speed, scale and magnitude of the challenges we face (Caniglia 2018; Mang and Reed 2012).

As defined by Elizabeth Caniglia, Regenerative processes have three primary goals:

- Catalysing increased prosperity and health of human and natural environments through holistic design and meaningful community participation
- Fostering positive feedback loops where human and natural resources are utilised within the biological carrying capacity of our planet.
- Respect and deep consideration to local contexts, whether economic, cultural, or ecological, so that development is properly adapted to local ecosystems, cultural and economic circumstances

The aim of regenerative development is to create conditions conducive for life to thrive on our one Earth and to create equitable, healthy, and prosperous relationships between the technosphere (human economies) and the biosphere. Creating a regenerative future will require every level of society to adopt a new set of values and to reorganize in ways that facilitate collaboration, evolution, and innovation (Caniglia 2018).

3.2 Indigenous-led Regenerative Development

The core principles of Regenerative Development are inclusive of Indigenous ideologies and philosophies that date back many tens of thousands of years. The Western oriented 'sustainability' concept has not achieved its original intentions effectively. In the past 10 years the integration of Indigenous ideologies in sustainability has shown merit and benefit (see Armstrong et al. 2021). The inclusion of Aboriginal-led sustainability and viewpoints can produce an alternative to the detrimental path we are currently traveling down. Collaboration between Indigenous knowledge holders, Indigenous design practitioners, cultural ecologists, designers, planners, engineers, financers, policy makers and industry are generating new, co-produced and progressive mainstream strategies that are shaping an Indigenous-led regenerative development model for effective adaptation in how we think, live, and move in our home space and society (Marshall 2019a).

Many planners, designers and engineers understand the urgency in approaching a reduction of negative impact on the natural environment yet continue the same perpetual pattern of mindset and technology that exploits and damages nature, continuing a colonizing parasitic relationship with nature. A timely example is the responding to climate change by building the same hard infrastructures and promoting high-tech homogenous design. Without implementing soft systems that use biodiversity as a building block, designs remain inherently unsustainable (Watson and Davis 2020).

As unconventional as it may sound, Indigenous Knowledge Systems evolves from a very old viewpoint and frame of mind that together form an ideology and practice of land as a living entity with an obligatory symbiotic relationship of commensalism with the environment. It encompasses all living biotic and abiotic components, including the cultural integrity of the site/place. It asks, who is this place, what is its history, how has it been treated, has it already been given a name and meaning, what is this meaning and how can it be nurtured and cared for to sustain current and future life. This is somewhat uncommon place to start a development, but we are talking about new adaptive mindsets for predominately Western societies. No matter how you approach the analysis, the fundamental is that the world needs better land and resource management through transformative and effective cognition, design, and governance. This includes a regenerative planning paradigm that places the environment, ecological processes, culture, climate, and ecosystem needs as the primary nucleus of regenerative place and community outcomes. The development of an administration system based on Indigenous/Traditional Knowledge Systems (IKS/TEK) and Cultural Adaptive Management (CAM), and the return of obligatory symbiotic relationships of commensalism with environment is now warranted to inform regenerative urban planning, particularly in settler colonial states (Marshall 2020).

A key to understanding the role of Indigenous-led sustainability in society is understanding the evolving relationship of people to land, water and living systems. These interdependent systems and relationships, coupled with the administration system, provide a framework for holistic infrastructure design, land-related policies and land management practices that are adaptive and regenerative. Importantly, addressing Indigenous Knowledge of land and culture at the onset of a project leads to architectural design responses that are derived from place and have meaning in conceptualisation and function. Indeed, Indigenous-led regenerative planning paradigm places, culture, climate, and ecosystem needs at the nucleus of design parameters. It is a framework that is eco-centric in its nature and allows humans to take their place in the landscape as custodians and caretakers from the onset.

One way this is currently applied is through the utilisation of Aboriginal place names and language associated to place along with locational history. Using native place naming and language can provide a window into thousands of years of association and relationships (including past climatic shifts) to place and the meaning of the area. An example is the application of Traditional Knowledge to influence architecture at the Indigenous-led Larrakia Development Corporation Cultural Centre in Northern Territory Australia. Incorporating knowledge of seasonal shifts allowing design (architecture) to encompass and respond the seasonal variation of solar radiation, wind directions, rain, and water.

Traditional Knowledge Systems have been applied in the context of scientific research in natural resource management and single species management for the last few decades. The use of Traditional Ecological Knowledge Systems (TEKS) has the potential to extend further and into new realms of integrative design in the application of architecture, construction, planning, urban design, and local capacity building including climate change resilience and adaptations (building local knowledge and strengthening local governance and organization). This can be extremely value-additive to urban planning and development projects as most Indigenous adaption principles are embedded in local knowledge, sustainable livelihoods, and community-based innovation (Nakashima et al. 2012). These principles have value in both the components of initial design of the urban and rural landscape and in the design of community governance objectives, principles, and policies. The application of Traditional Ecological Knowledge is in line with the notions of different ways of knowing, thinking and being, producing solutions to the uncertainty of future challenges in climate change and planetary health.

3.3 The Legacy of Colonisation and Continuing Effects of Colonising

Western societies have a deep history embedded in cultures based on imperialism (Bowden 2014; Patnaik and Prabhat 2016). With this, there seems to be an obsession with conquering and colonising other people's landscapes and associated cultures. Western science, planning and governance are a construct of this society. The notion of sustainability is also a construct from this science. As mentioned earlier, there is criticism and explanation as to why sustainability derived from Western ideology is flawed (Howes, 3 April Howes 2017).

The Australian continent has sustained and nurtured Aboriginal people for many tens of thousands of years, a sustainability paradigm that had distinct law and social systems that controlled population to adequately facilitate resources (not only for humans but all living entities). This mindset facilitated a cultural landscape that in turn facilitated the innovation of social systems resulting in the first astrologers, chemists, horticulturists, artists, ecologists, navigators and more. Yet in one act of dominance an invasion not only brought about fragmentation of the existing law, economic order, culture, and system of governance that the distinct peoples of First Nations groups had been practicing for more than 200 generations, it was near annihilation, arising from a distinctly genocidal intent (Porter et al. 2017). This mindset of dominance and invasion has flowed through the whole genesis of Australia, particularly to the interaction with and use of natural resources, and planning systems. Planning is an important activity and structure of governance, shaping the contemporary ways we organize space and fulfil our relationships with place. At the same time, Indigenous structures of governance and relationships to place have been profoundly marginalized through the violence of colonization (Porter et al. 2017).

Indigenous practitioners attempting to integrate Traditional Ecological Practices and Indigenous ideology in planning methodologies face an ongoing barrier of misalignment with the embedded ideology of settler colonial frameworks in planning. Western urban planning paradigms are currently dominated by local economic growth drivers and market dynamics and only seek recognition, or at best, are required to find a fit 'in' for Indigenous acknowledgement and recognition, such as public art, as an add on or afterthought. In countries such as Canada, the USA and Australia, planning practice and education continues to reinforce a normative framework that privileges settler understandings of cities, place and space while artificially recognising Indigenous historical and contemporary presence, if recognizing it at all (Patrick and Barry 2016).

In Australia, Aboriginal people's role in planning has historically tended to be seen as 'stakeholders', 'interested parties' or people to 'consult', not as traditional custodians of the land and place going back millennia. Still, the perceived capacity and timeframes that allow collective Indigenous community input are based on the position and functional capability of the corporate or highly resourced government agency. No consideration is given to the fact that Aboriginal people remain persistently among the most marginalised and disadvantaged groups in the world (see Australian Government 2020).

Yet, it is perceived that if an Aboriginal group does not respond, then they must not be interested in the planning topic and indigenous ideology and participation is once again absent and discarded. Walker describes this as structural violence (Walker and Nejad 2017). Structural violence takes form in an unequal balance of power and resources, and the extent to which tools of colonial governance (e.g., laws, policy priorities, market dynamics, programs, civic processes) serve to structure persistent material and discursive marginalization among Indigenous peoples of the world. As Walker explains, this type of violence is often not disapproved of. In planning for new urban communities, it can go unchallenged. Moreover, it is typically supported through conventional political, cultural, economic, and social norms (Walker and Nejad 2017).

Porter highlights that a decolonising agenda needs to be set by Indigenous people and requires both de-centring and de-privileging the centrality of Westernism or Eurocentrism in the story and culture of place (Porter et al. 2017). Importantly, this includes re-education about the truthful account of this narrative and how the continued expansion and exploitation of Indigenous and Native lands occurs and the role that contemporary urban planning plays as a central mechanism in that continued structure of dispossession.

In many local context's issues such as design, sustainability, population growth, intensive agriculture for food production, climate change mitigation and planning for rapid urbanization, with simultaneously shrinking resources, poses pressing challenges on the notion of environmental sustainability and pressures on cultural landscapes. The intensifying and rapid responses required by governments to fix or consolidate areas already being damaged or under threat from climate induced environmental processes applies pressure on the ability for Indigenous people to participate in the production of planning documents and strategies. For many Indigenous people, focus on alleviating poverty, retaining, and reclaiming lands, furthering economic development, providing cultural education, and managing social issues within community remain as priority (Marshall 2019a, b). Western planning is a construct of this dominance of entrenched Western governance regimes. The notion of sustainability is also a construct from this western ideology.

If resilience is to be relevant to societies in which people have long-term relationship with land and resources, but have been disempowered by a dominant society, then a new tangent is required, and more culturally oriented methodologies and frameworks. There are always going to be complications when trying to apply Indigenous ideology and indigenous paradigms in a highly western and Eurocentric frameworks and governance. As Nursey Bray suggests in her paper, to develop culturally responsive climate governance for and with Indigenous peoples, the history of colonisation and ongoing dominance of entrenched Western governance regimes needs to be acknowledged and redressed to enable in contemporary environmental/climate change management (Nursey Bray et al. 2019).

It will also be critical to differentiate between policy decisions that support and empower Indigenous peoples by reinforcing their resilience, and those that may undermine their adaptive capacities. In other words, adaptation planning at local, national, and international levels may be fruitfully directed at creating a policy environment that facilitates the fullest expression of Indigenous adaptive capacity in the face of climate change (Ford and Pearce 2010; Ford et al. 2007; Nyong et al. 2007).

3.4 Indigenous Knowledge Systems Support Climate Change Resilience

Indigenous people have always made clear the intention of living regeneratively on the planet and have also been open to western science and people to learn the associated fundamentals of existence in a holistic worldview. Many Indigenous Knowledge practitioners have also shown willingness to provide guidance on how IKS is applied. Indigenous people have had the insight to the principles of regenerative systems for tens of thousands of years and we are witnessing an emergence of how Indigenous technologies, cultural paradigms and practices offer some of the best solutions to addressing the existential threats of climate change, biodiversity loss and ecosystem collapse (see Yunkaporta 2019).

For indigenous peoples, resilience is rooted in traditional knowledge, as our capacity to adapt to environmental change is based first and foremost on in-depth understanding of the land. As climate change increasingly impacts indigenous landscapes, communities are responding and adapting in unique ways. In a recent statement to the Conference of Parties to the UN Framework Convention on Climate Change, the International Indigenous Peoples Forum on Climate Change (IIPFCC) stated *"…[W]e reiterate the need for recognition of our traditional knowledge, which we have sustainably used and practiced for generations; and the need to integrate such knowledge in global, national and sub-national efforts. This knowledge is our vital contribution to climate change adaptation and mitigation."*

We currently exist in a dominant paradigm where we find rightness in short-term thinking, compromise in short-term gain and solutions in band-aid methodologies. As humans with the inability to accept and execute change in a closed technological society (Marcuse 1991), questions arise as to whether the resistance to let go of these privileged, comfortable positions is because everything else seems primitive, romantic, or too big of a change in socio-political engineering. Knowledges and systems that engage in sharing and true sustainability as a foundational construct would be a very compromising move for a society that prides itself on the industrialism of productivity imposed by the interests of capital and private profit (ibid.).

There is however an increasing awareness, indicated in the Convention on Biological Diversity (CBD) of the critical need for Indigenous Knowledge to achieve ecological, cultural, and social regeneration. Indigenous ways of knowing are holistic, acknowledging the 'interconnectedness of physical, mental, emotional and spiritual aspects of individuals with all living things and with Earth, the star world, and the universe' (Lavallee 2009). It is an ideology of how to really live regeneratively that encompasses every facet of existing. While top-down adaptation approaches still dominate in this space and in many instances have merit, community-based adaptation initiatives add further refinement (Collen et al. 2016). As Nursery Bray outlines they also differ from top-down models of environmental management in two key ways: firstly the developmental process encourages close involvement of local Aboriginal people, so they become participants (not just subjects); and secondly the integration of culturally appropriate knowledge into adaptation planning and design is facilitated (McNamara et al. 2013).

Anguelovski et al. highlight that when planning for climate change, we should strive to build cities and landscapes that are socially and ecologically healthy, and the interventions of planners and designers can help us adapt to uncertain future conditions. But with that, also being mindful about the language and narratives we celebrate, particularly where the cultural contexts are different from our own (Anguelovski et al. 2016). By facilitating an approach and process to design that has nature and cultural foundation as the base, which then incorporates mechanisms or platforms for a participatory approach allows the ecosystem needs to be embedded as the primary thread throughout design principles (Fig. 3.1). Allowing adaptation planning to identify specific local vulnerabilities and particular “special features” in local knowledge as a key resource. Then incorporating and facilitating observations of change at local levels and factoring into adaptation planning (Riedlinger and Berkes 2001).

3.5 Future Environment

Observations, reconstructions, and climate modelling provide a consistent picture of ongoing, long term climate change interacting with underlying natural variability. Associated changes in weather and climate extremes such as extreme heat, heavy rainfall and coastal inundation, fire weather and drought have intense and large-scale impacts on the health of ecosystems and wellbeing of our communities.

The CSIRO State of the Climate report 2020 (Commonwealth of Australia 2020) draws on the latest climate research, encompassing observations, analyses and projections to describe year-to-year variability and longer-term changes in Australia’s climate. Currently, Australia’s climate has warmed on average by 1.44 ± 0.24 °C since national records began in 1910, leading to an increase in the frequency of extreme heat events. Whilst rainfall and streamflow have generally increased across parts of northern Australia since the 1970s there is a consistent decrease in rainfall and stream flow in other parts of Australia.

Other observations in the Australian CSIRO 2020 report include:

– An increase in extreme fire weather, and in the length of the fire season, across large parts of the country since the 1950s, especially in southern Australia.

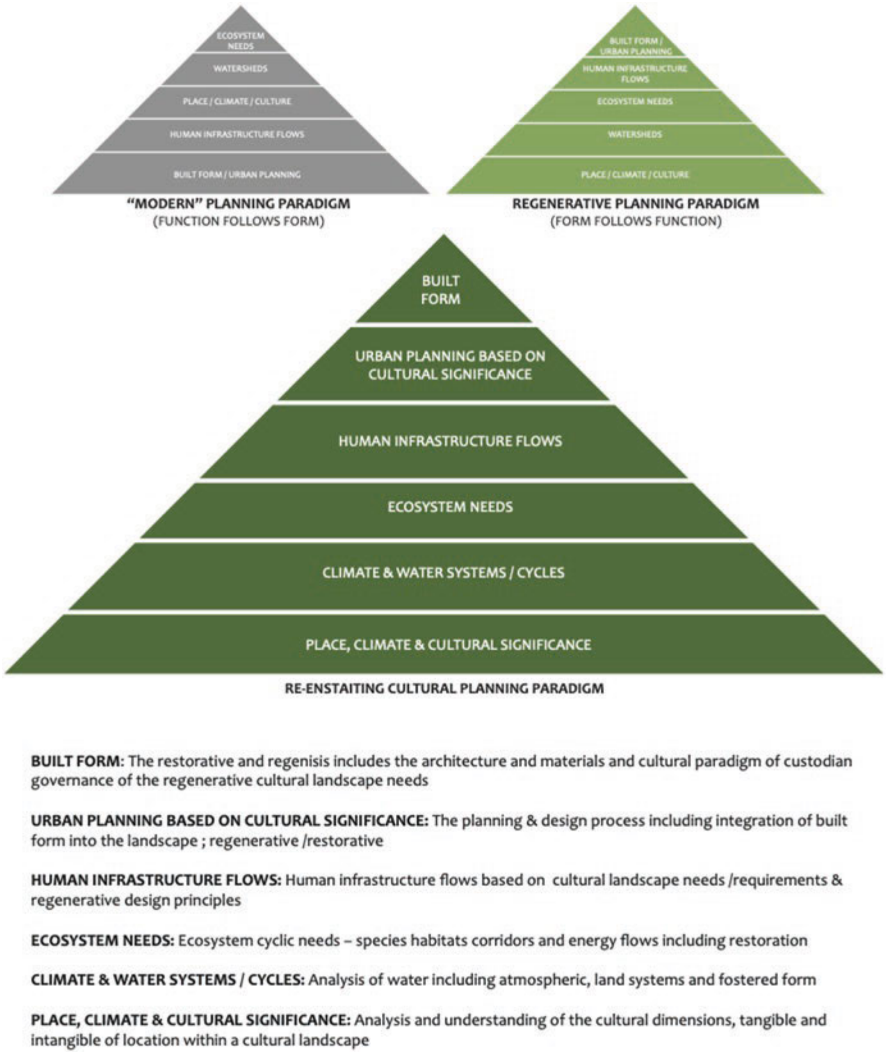

Fig. 3.1 Connecting planning paradigms

- A decrease in the number of tropical cyclones observed in the Australian region since 1982.
- The acidification of oceans around Australia, which have warmed by around 1 °C since 1910, contributing to longer and more frequent marine heatwaves.
- Sea level rises around Australia, with more frequent extremes, which are increasing the risk of inundation and damage to coastal infrastructure and communities.

Australia needs to plan for and adapt to the changing nature of climate risk now and in the decades ahead. Reducing global greenhouse gas emissions will lead to less warming and fewer impacts in the future but we are not at this stage yet. According to the Australian CSIRO 2020 report, Australia will experience ongoing changes to its climate the coming decades (10–20 years). Australia is projected to see continued increases in air temperatures, more heat extremes, and fewer cold extremes, and continued decrease in cool season rainfall across many regions of southern and eastern Australia, likely leading to more time in drought, yet more intense, short duration heavy rainfall events. Additional projections include (Commonwealth of Australia 2020):

– Consequential increase in the number of dangerous fire weather days and a longer fire season for southern and eastern Australia.
– Further sea level rise and continued warming and acidification of the oceans around Australia.
– Increased and longer-lasting marine heatwaves that will affect marine environments, such as kelp forests, and raise the likelihood of more frequent and severe bleaching events in coral reefs around Australia, including the Great Barrier and Ningaloo reefs.
– Fewer tropical cyclones, but a greater proportion projected to be of high intensity, with large variations from year to year.

With this, it is important to look essentially at how natural systems adapt or respond to these extreme events and how as humans we adapt or respond to these natural systems. One response would be to design and build places that allow resilience to form naturally by incorporating Indigenous ideology and suitable adaptation mechanisms or as Julia Watson explains ‘soft systems that use biodiversity as a building block’ (Watson and Davis 2020).

Climate change is happening now and will get worse in the immediate future, even if global efforts to reduce emissions prove effective, as we have passed the tipping point and the ramifications are here.

Extreme weather and climate-related events that result in vulnerabilities to such incidents as floods, droughts and storms will become more frequent and intense in many regions. This leads to many adverse impacts on ecosystems, economic sectors, and human health and well-being. Therefore, actions to adapt to the impacts of climate change are paramount and should be tailored to the specific circumstances in different parts of the planet and its bioregions.

Aboriginal people knew about change (this is highlighted in many landscape interpretations, associated language and song lines of creation explanations) –. Knowledge about climate-driven impacts and potential approaches for adapting to these changes have been embedded in Aboriginal cultural law and oral histories for a very long time (Marshall 2019a, b). The intimate knowledge Aboriginal people have of environmental systems focussed on familiarity with seasonal cycles and animal adaptations to habitat changes along with the larger changes in atmosphere and landscapes. Holistic thinking and nature derived ideology, formation of culture from environmental cues, integrating the environment as an equitable living system with flow on cultural practices and integration within culture is the intellectual example of symbiotic evolution. The variations of habitats in the landscape provided an array of different conditions and refuge for humans. This included the deliberate sculpturing and designing of these landscapes, the use of fire is one example utilised in Australia for this. The manufacturing of water ways and water storage was also used. Layering in these traditional practices into contemporary urban planning and governance can lead to profound and transformational approaches to twenty-first century city making.

The uncertainty of climate change, the ramifications of human colonisation practices, the future availability of finite resources, associated political turmoil and the threats of viruses and diseases, has placed thought of future existence of humans and our ways of life at the fore front of modern planning.

In any disruption, it has proven that plants and animals will either adapt, evolve, or die out. There is the belief that unless humans adapt and develop the capacity for resilience to these forecasted changes, these extreme events and decadal modifications will see the continual and eventual breakdown and of society and current living standards along with resources. Climate adaptation' as defined by the Intergovernmental Panel on Climate Change (IPCC) is an "adjustment in natural or human systems in response to actual or expected climate stimuli or their effects, which moderates harm of exploits beneficial opportunities" (IPCC 2007, 869).

The question for us now is how do we design a future on a changing landscape? Do we continue to colonise and extract resources to build and combat predicted changes evolving into another technological industrial revolution and exist in some form of artificial life systems? Do we continue to exclude Indigenous People's knowledge and knowledge systems from planning and governance? Or do we assess the logical adaptation mechanisms of old-world cultures that lived, thrived, and coexisted with intense environmental changes?

3.6 Adaptation and Adaptability (Physical or Behavioural)

Adaptation is the physical or behavioural characteristic of an organism that helps that organism to survive better in the surrounding environment. Living things are adapted to the habitat they live in. This is because they have special features that help them to survive. Forms of adaptation include migration, hibernation, dormancy, camouflage, and estivation. Migration can be defined as the phenomenon of movement of animals from one region to another for their survival. Other mechanisms of adaptation include, behaviour modification, camouflage, adapt to changed environment, Habitat, Inborn Behaviour (instinct), Mimicry or Predation (Jurmain 2014:332).

For humans, adaptations may be biological or cultural in nature. Biological adaptations vary in their length of time, anywhere from a few seconds for a reflex to a lifetime for developmental acclimatization or genetics. The biological changes that occur within an individual's lifetime are also referred to as functional adaptations. The other is behavioural or cultural adaption (Jurmain 2014:332).

The types of adaptations are often activated and dependent on the location, severity and duration of stressors in the environment. A stressor is anything that disrupts homeostasis which is the condition of balance or stability within a biological system (Jurmain 2014:332). Homeostasis is a self-regulating process where the organism tends to maintain stability while adjusting to conditions that are best for survival, if successful life continues, if unsuccessful the result is death or disaster of the organism (Britanicca 2020). Stressors are either abiotic or biotic. Cultural adaptations however can occur any time and can either alleviate the stressor instantly or over a series of time.

Humans have biological and neurological plasticity, or an ability to adapt biologically and mentally to our environment. An adaptation is any variation that can increase one's biological fitness in a specific environment; more simply it is the successful interaction of an individual and or population with its environment. This is where those old sayings come into play, "we are what we eat", "you look after country and it looks after you", and if degraded environments are what we continue to exist in then that essentially makes us degraded peoples.

3.7 Conclusion: Designing Habitats for Future Life

The recent devastating bush fires and flooding of much of the Australian landscape and the impact and stress on the environment, animals and people has prompted discussions on different ways of doing and thinking including a re -evaluation of how we plan, design, and build with and within these landscapes.

Evolving human mindset and preparation to Anthropogenic climate change includes the need to become resilient and adaptable. Mitigation is a form of resilience. In the approach to mitigating climate change, we must reduce or prevent the emissions and colonising behaviours linked to human activities. This means designing future urban landscapes with resilient building material, design, and architecture. Finding sustainability in self generating energy and water systems and living within the means of the landscape. Many will acknowledge that the intent of mitigation as a form of resilience has missed its window of opportunity and this time has lapsed, however mitigation in restoration of the environment and inserting new functionality i.e., micro habitats, micro heat sinks, microclimates etc., micro food generation, circular systems is still a viable form to direct adaptation and resilience. Human induced climate change is the unpredictable factor in intensifying and amplifying pressure and negative change within social, economic, and political tensions. There is a dark truth of planning for "climate resilience." Decisions about which areas will be protected are not only about whose safety will be guaranteed; they also involve transnational concerns like reassuring global investors and preserving manufacturing supply chains (Yarina 2018).

We need a new vision for the future, for the world, and for Australia. We've spent too long artificially separating ourselves from the natural world, pushing living systems to the fringes of our population centres and marginalizing habitat and species wellbeing. The cost of these behaviours has been a legacy of destruction and mass extinction that now clearly sets us within the 'Anthropocene age.' Simultaneously, we are experiencing a crisis of 'home' – a fundamental disconnect from place and local history due to western ideologies and technological systems that tell us that we are separate from nature, superior and special.

It is both a personal and a cultural crisis and is at the heart of our ecological crisis. In the future communities of a well and truly "sun burnt country", we are boldly re-claiming the more mature view that humanity is an important part of an interconnected system and that we ourselves are nature – not separate and superior, but integral and interrelated. This vision is based on the founding principle that only life regenerates; things do not. Life requires diversity and diversity is resilience. For the future urban environments to reach its full potential, it must celebrate its unique place and the biodiversity within it. Humanity's habitat must support and enrich the wider ecosystem to be truly sustainable.

The objective of using Indigenous knowledge in climate resistance strategies for future urban environments is to apply and show how the urban landscapes can become a global flagship where science, national values and Aboriginal wisdom all come together to drive the ideology behind design, construction, and operation of a vibrant, functioning community. To envision a place at the heart of the community that responds, without compromise, to the challenges and opportunities of the twenty-first Century, regenerating natural systems and generating new social, natural, and financial capital to create a future where people can lead increasingly happy and healthy lives on our cultural landscape. This is the indicator of change, if we have no natural environment or functioning ecosystems around us there is no gauge to environmental change.

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Chapter 4
Lake District 2.0: Mutability and Low-Density Landscapes in an Accelerated Culture

Sean Cullen and Greg Keefe

Abstract Design must challenge prevailing, traditional methods for engaging with place that is often static, linear and didactic. In this chapter, the use of latent and inherently mutable features of low-density landscapes will be endorsed to unlock regenerative futures through design. Elements in landscapes are continually susceptible to change – even the ones long perceived as inert – in large part because of our global, accelerated culture and the effects of human activity on climate. The rate of change is quickening and remoulding how we interact and use our cities, landscapes and resources. While design cannot stall or stop these dynamics, it can deflect them on a desirable trajectory that places climatic and ecological principles at its core. As such, design must view and engage with place through six propositional frameworks: (1) everything is now urban; (2) landscapes are all about processes, the answer is not an aesthetic one; (3) things go round in circles; (4) time is speeding up; (5) the rural condition is not natural; and, (6) the site must be seen as a body, or whole, rather than a collection of parts. Lake District 2.0 tests and visualises how these propositions can bring transformative change to the understanding of mobility, infrastructure, heritage, culture and economy. The approach is predicated on design viewing mutability as a driver for regenerating systems that are light-touch and resilient to the unforeseen factors that places must endure in years, decades and centuries to come.

Keywords Mutability · Low-density landscapes · Accelerated culture · Lake District

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4.1 Introduction

Vivid and tangible examples of the pressures faced by low-density landscapes have been made evident by the Covid-19 pandemic. Even though low-density landscapes are often seen as pastoral landscapes that are slow to change and adapt, they operate and function like complex global, urban territories. Online retail or supermarket orders can be delivered to your home, surrounded by farmland with grazing sheep, booked from the comfort of your home office, connected via highspeed fibre optic cables. However, oftentimes, these territories are in tension as they try to balance the natural environment with the effects of globalisation. The forces pushing and pulling are most explicit in landscapes that tread a finely balanced line between the global and the local, the natural and the anthropogenic. Using the Lake District as an example of such a territory that tries to mediate these forces, its future is questioned and designed. How does it ensure a sustainable economy reliant of travellers from all over the world? How does it balance and meet the needs of visitors and residents against the identity it has crafted for itself as a natural landscape, one so vividly portrayed by the Romantic poets?

The Lake District negotiates between culture, heritage, tourism, climate change and land use while it attempts to be all things to all people at all times. Even though it only has a population density of 18.4 persons per km^2, it attracts millions of visitors each year. The National Park experiences major fluctuations in density, demand on resources and economic intensity over the course of a year (ONS 2013; Cumbria Tourism 2018). Compounding these pressures is the World Heritage Status bestowed on the Lake District in 2015 as a cultural landscape of importance. Owed to poets and writers, like Wordsworth (1835), Potter (1902–30) and Wainwright (1955–65), as well as the traditional farming practices, the Lakes now must negotiate a way of dealing with tourism and the economy while addressing major climate issues (Nabholtz 1964; Squire 1993; The Lake District National Park Partnership 2016a). The Lakes experience floods, degradation of natural farmland and have a heritage of mining activities that is due to be exacerbated because of the stalling effects of policy (maintaining world heritage status) and heritage (ensuring tourists still visit for the poetry and beauty of the landscape). However, we argue that rather than attempting to petrify the Lakes, mutability of climate, culture, heritage and policy should be embraced in order to deflect these pressures towards sustainable, regenerative and ecological futures.

In this chapter the outputs of research and design projects for the Lake District from students of architecture at Queen's University Belfast are examined. They exemplify attitudes and practices that set new trajectories of possible futures for the Lakes that are light-touch and regenerative. By embracing mutability, the static ideas of place are challenged in order to unlock synergies and circularity in contentious contexts. A methodology is offered by which complexities in these regions are visualized, mutable features of these territories are discussed and the emergent themes of interest for designing low-density landscapes are defined.

The possibilities for low density landscapes, rendered visible by the studio design propositions, imagines future ways of living and engaging with place that is global, but also local, and sustainable, yet adaptable – Lake District 2.0.

4.2 Landscapes of the Anthropocene

Our global, accelerated culture is present in all landscapes. No matter how romantic the idea of the Lake District countryside, the presence of contemporary services, infrastructures, industries and policies are evident. It is a landscape with a significant ecological footprint that experiences significant fluxes and flows of occupation based on seasons. It has a resident population of 40,000 while approximately 19 million overnight visitors go to the Lakes each year (Lake District National Park 2021). To keep it operating requires the arrival of resources via global systems - much like any major city. Similarly, the resources of the Lake District are vital to other places beyond its boundary, notably Thirlmere dam, which provides 11% of the water demand for the North East of England (The Lake District National Park Partnership 2016b). All the while, the veneer attempts to convey the rural, traditional and romantic landscape of Wordsworth and Ruskin, projecting to the world an image of English heritage and culture connected to nature. The maintenance of this façade requires greater efforts, necessitating further environmental destruction.

Six principles by which low-density landscapes should operate are set out here. They are framed to view these landscapes not as natural and aesthetic, rather constructed and ones of contestation, urban at their core and extremely susceptible to climate change.

Proposition 1
Everything is now urban: the Anthropocene is an urban condition, everywhere, no matter how remote, has some element of the man-made about it. Nuclear fallout from atomic testing is now used as a glacial dating tool in Antarctica: sea level rise in the Maldives is a product of U.K. industrialization.

Proposition 2
It's all about the process: stop looking with your eyes: the answer is not an aesthetic one. Landscapes are a network of flows, not a selfie opportunity.

Proposition 3
Time is speeding up: not only has the internet accelerated culture, but the glacial time of eons have also changed. Suddenly the change in the geological record is measured in seasons rather than millennia. Nature will have to adapt more quickly.

Proposition 4
The rural condition is not natural: it's as man-made as the factory. Feeding the nine billion will need a new agriculture.

Proposition 5
Things go around in circles: a closed material cycle is needed, one that is ecological. However, a circular monetary system that keeps money in the region will also be required.

Proposition 6
The site must be seen as a body, a whole, rather than this collection of parts, and if the site is a body, then it must be subject to the evolutionary forces of the biotic. These mutable forces of evolution are intended to create a new way of designing the world.

The propositions for Lake District 2.0 exemplify radical visions for how controversial and contested landscapes that have very traditional ideas of place must respond to globalisation and climate change. They are designed to invoke a response that challenges or reaffirms an ethical and moral position. It asks you to sit at the edge and find the boundaries of possible solutions.

4.3 Mapping Controversies

The starting point engaged with concerns inherent in the Lakes and visualise how contentious issues are perceived. To do this, the methodology of mapping controversies is used, a way of visualising prominent and highly debated issues faced by a given place. A controversy is a heated public debate of public importance because it affects a large number of people (Cambridge Dictionary 2021). It is also a method rigorously applied in architecture pedagogy by Yaneva (2012). Here these problems and concerns of a place are visualised in order to engage with the diverse ways it is seen, from differing perspectives. For example, a shop owner may find the volume of traffic moving through a town in the Lakes during the summer months as good for business while someone who lives on the high street sees it as noisy, polluting and a nuisance. The attempt to understand very complex landscapes necessitates ways of extracting relevant details in information rich contexts.

By visualising the natural geography, cultural connections and industrial activities which have shaped and transformed the region over time, the method of exposing controversies allows for the definition of a design challenge or brief. The purpose of this methodology is to remove the designer from the solution area to focus solely on depicting the problem. The mantra is: representing the problem is different from representing the solution. By removing the designer from the solution space, tangential and interconnected issues can become embedded and layered without narrowing the scope. Therefore, the process is one of divergent narratives, but convergent information. Central to this mapping process is defining a way of seeing and representing a territory. What is the theoretical underpinning of the lens through which one views this area? What is the method of visualization one adopts? What architects, urbanists and theorists one leans on to further explore these themes?

The mapping focused on fourteen geographically defined areas of 2 × 2 km each. These zones were selected because of their inherent controversies known and aware among a wider public audience. However, this challenged the viewer to look closer and deeper at the problem, the kernel of which might lie in a different space or place entirely. This also required the mapping to go beyond the visible, tangible or obvious elements traditionally mapped by the urban designer or (landscape)architect. It challenged the map maker to see beyond the spatial and geographic of natural and built landscape so as to consider cultural, economic and climatic features of these territories. Each designer mapped two different zones, meaning each zone was mapped twice, by different authors. The process aimed to express alternative perspectives and controversies latent in the landscape and for the interests or viewpoints of the authors to become apparent. As a research method, this tested whether a solution explicitly emerges from the defined problem or whether it arrives at the same challenge and research question for a place.

The maps also consider the anthropogenic impacts on our landscapes, climate, towns and villages. Much of what has taken place since the industrial revolution has been linear in nature and extractive of the natural environment for the benefit and consumption in more distant places. The controversy mapping method unpacks ideas of historical resource extraction that supplied local industries in Staveley (Fig. 4.1), the carbon sequestration potential of forests in Grizedale (Fig. 4.2), vehicle traffic variations over a year in Ambleside (Fig. 4.3), tourism and ecology (Fig. 4.4) and flooding defences and infrastructure at Newby Bridge (Fig. 4.5). The outputs were complete before visiting the sites, a process which forced the mapper to be objective and remove emotive experience of the site. However, once the author travelled to the sites, the maps were reflected upon. Notable was how some of the maps produced explicit directions of travel for design challenges while others were tangential or subtle.

4.4 Mutability and Regenerative Features of Low-Density Landscapes

Low-density landscapes that are defined by their heritage and natural beauty can often be portrayed as static, petrified territories. Tourism advertisements and brochures oftentimes define it this way in order to appeal to the sentimental and historically oriented visitors who yearn for the rural and picturesque. However, the future of these regions requires a contemporary reading of climate, landscape and sustainability. Culture, people and climate, long considered sacrosanct and unchangeable, must regenerate their purpose, meaning, identity and form. To become regenerative, ecological and sustainable in operation, these places must embrace mutability of heritage, industry, mobility, tourism, policy, climate change and ecology.

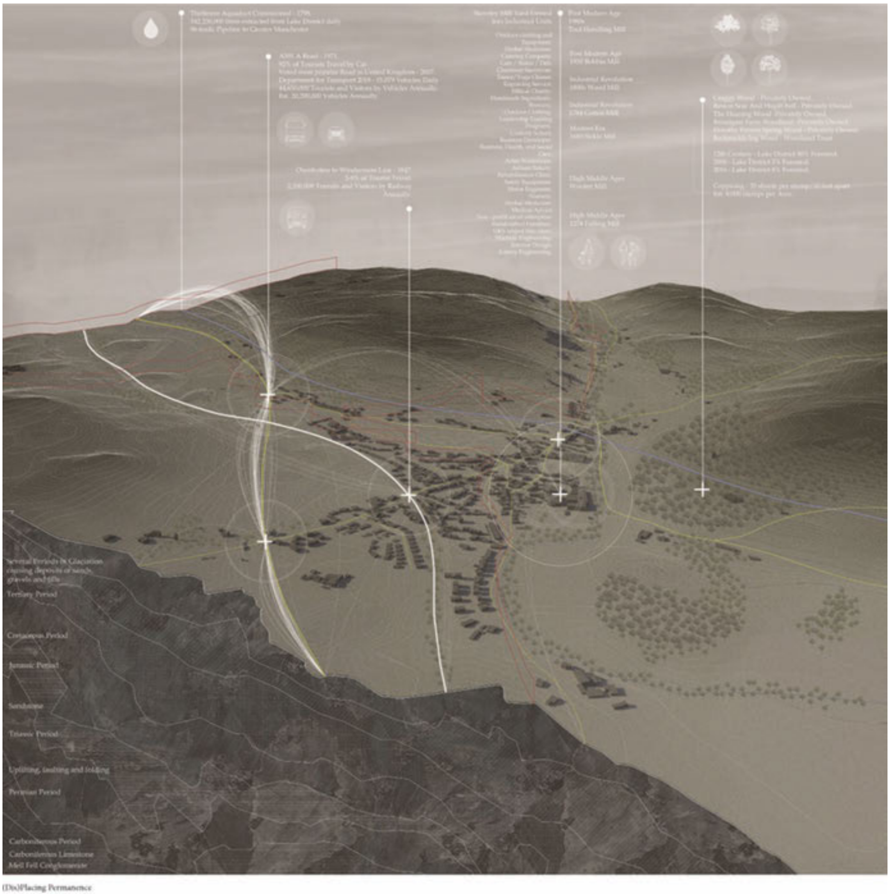

Fig. 4.1 Staveley – (Dis)placing Permanence. (Jason Crawford © Architeturra Superleggera, Queen's University Belfast)

4.4.1 Culture

Low-density territories, like the Lake District, are latent with new cultural attitudes to landscape, production, heritage and industry. Ideals and attitudes shift over time and are informed by the historical context to embody or disassociate oneself from the past. Our view of the rural condition is not prioritised by the distribution of services and opportunity to new places, such as the rolling out of fibre or the support of mass tourism for economic prosperity. Rather the archaic view of the rural is characterised by visual and aesthetic consumption of landscape and culture.

Freezing a cultural attitude to a landscape can be problematic. The Lake District offers an interesting example of such an issue where damaging farming practices continue solely for the purpose of retaining World Heritage Status. Three-quarters

Fig. 4.2 Grizedale – Environmental vs. Economic potential of Grizedale. (Christopher Connolly © Architeturra Superleggera, Queen's University Belfast)

of Sites of Special Scientific Interest (SSS) are in "unfavourable conditions" for biodiversity (The Lake District Partnership 2016c, p. 535). While the devastation on the landscape continues, the productive and profitable value of the land is limited. It is not to say it must be eradicated. Instead, it needs new avenues of use and adaptation that employ ideas of circularity and economic value. Retaining the culture, heritage and practices for the sake of it will no longer be enough, especially as young people migrate to intense urban centres in search of economic opportunity. Access to opportunities and services is critical to the long-term sustainability of these regions. This is often viewed as opening up global operations and retail opportunities to visitors and residents. The jarring tension between the conservation and preservation of built heritage is evidenced by the arrival of global, multinational brands in towns

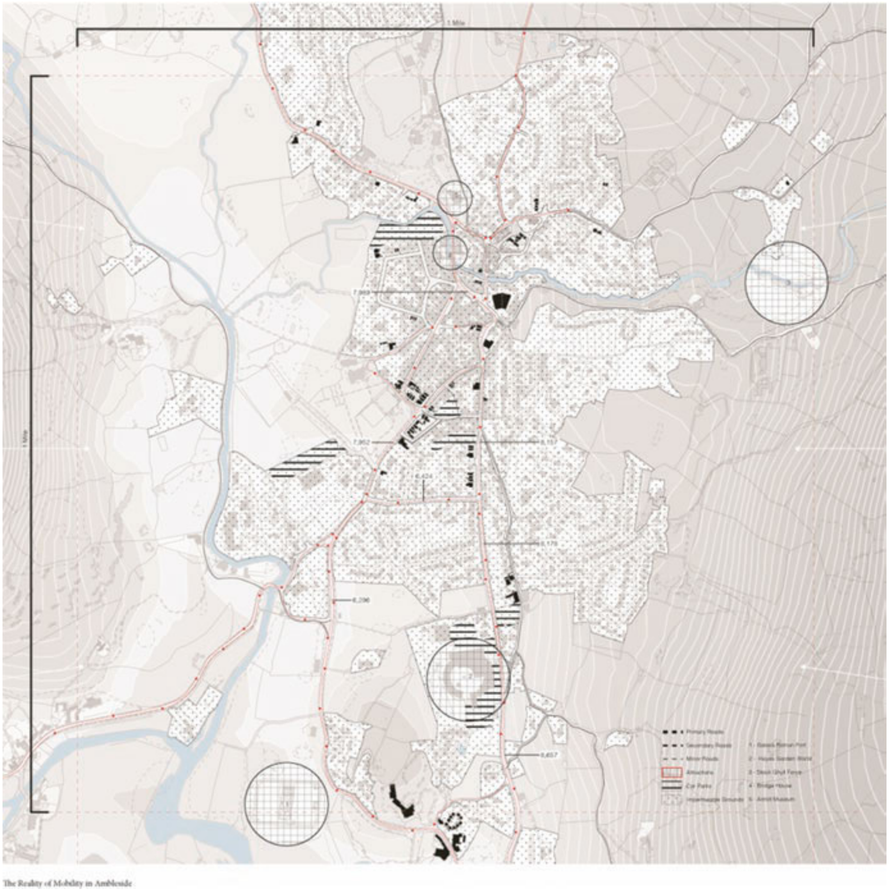

Fig. 4.3 Ambleside – The reality of mobility in Ambleside. (Riane Samir © Architeturra Superleggera, Queen's University Belfast)

like Ambleside (Fig. 4.6). Questions of authenticity and value creation for the residents emerge.

Unlocking the mutability of heritage and industry requires low-density landscapes to be viewed as systems and processes. Therefore, future ideas of healthcare delivery and economic activity require radical reshaping that are distributed and equitable. In some cases, new attitudes to location-based activities and old forms of operation must be rethought to unlock transient, mobile opportunities. By doing so, effective and efficient services to regions can be provided.

Similarly, the utilisation and staging of curated heritage and culture can act as key anchor points for directing change. The arrival of the experience economy raises questions of authenticity. Contemporary tourists and visitors to the Lake

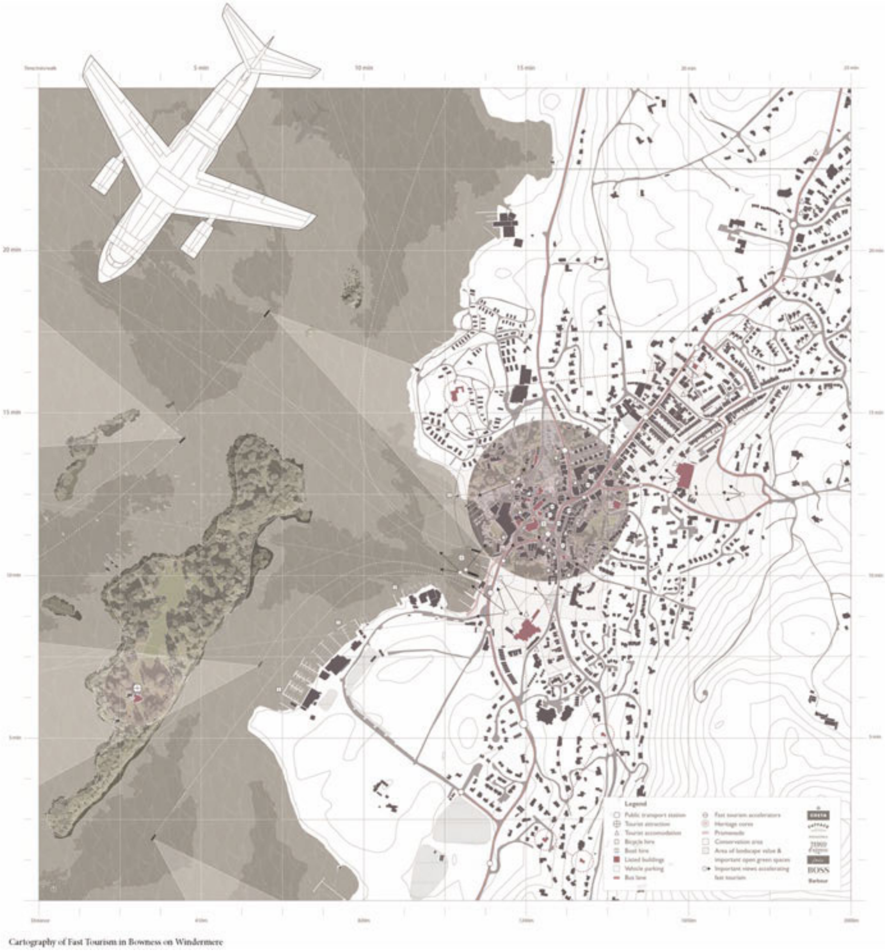

Fig. 4.4 Bowness-on-Windermere – Cartography of tourism. (Leonard Chipawa © Architeturra Superleggera, Queen's University Belfast)

District want to create lasting memories and experiences of a holiday, bringing with it new and significant challenges for the region. What does the ideal tourist look like? How can you get them to spend money in the region and support the local economy? How can you make their experience memorable and valuable? What do they do while they are there? These questions can be asked of many major tourist destinations. Without being archaic or sentimental, the mutability of culture and heritage must become unique, empowering and caring to the landscape and environment.

Fig. 4.5 Newby Bridge – A dynamic flooding system and connective node. (Jessica Scott © Architeturra Superleggera, Queen's University Belfast)

4.4.2 People

The Anthropocene, accelerated by the pandemic, is challenging the way we live, occupy and use low-density landscapes. Four notable areas of change are services, mobility, policy, and tourism. They are different in nature but require new paradigms in the way they are conceived to allow mutability that can be effective and of value. Similarly, sustainable and ecological principles must be firmly embedded at their centre. Currently, the way we travel, conduct tourism, implement policies and deliver vital services and utilities is not only expensive but detrimental to our environment.

Of interest here is how design practice can reshape the way we live in the rural condition. Lake District 2.0 embodies ideas for adapting landscape, infrastructure and policy, but the key outcome is to affect how we inhabit our homes and towns,

Fig. 4.6 Homeostatic preservation, production and consumption of Ambleside. (Jason Crawford © Architeturra Superleggera, Queen's University Belfast)

and how we imagine and use our infrastructure. Can we leverage the rise of the sharing economy instead? Can slow and close engagement with people and place become the new norm? Can we craft flexible, nuanced and time-based policy?

The biggest challenges facing tourism, services and mobility is one of volume, independence and time. While distances between places in these terrains is minimal as the crow flies, often natural geography – lakes and fells – create time intensive jounreys. Mobility requires smarter forms of delivery that looks at the lifecycle impact and capable of catering for the fluxes and flows of need on a daily and annual basis. Similarly, how to best manage peoples time in a society that values speed and ease of service. For example, parents often have to spend hours each day driving children to and from school, activities, events and home. Providing capabilities to connect communities and social networks is vital for people's health and wellbeing.

Seasonality and the fluctuation of volume is a major challenge for tourism. How can one justify infrastructure for the maximum volume when its peak is only a few weeks in a year and when total overnight visitor numbers will increase to 22 million by 2040? In 2015, 83% of all visitors travelled to the Lake District by car while 10 million used cars as their primary mode of transport while there. In order to maintain these totals by 2040, the percentage of people travelling by car in the Lake would need to decrease to 64% (Smarter Travel 2018). Compounding this difficulty is how alternatives can deal with individual choice and distribution where directness and speed is valued. The time taken to get from one location to another is often prolonged without private mobility. In low-density landscapes, the provision of effective and direct public transport is limited and expensive. The time it takes to travel to areas of interest in the National Park using public transport is significantly great than the the time and distance travelled by private vehicle (Fig. 4.7). How can tourist numbers and associated distribution of wealth be shared evenly throughout the Lakes? And is it fair to do so? Similarly, what does the ideal tourist look like? The average expenditure of the typical visitor is small – in 2018, 19.35 million visitors spent £1.48 million (Lake District National Park 2021). Currently, the consumption of nature is exploitative, offering little value to local services and businesses. Lake District 2.0 rethinks models of operation and delivery of value for visitors and residents alike.

Policy is often seen as the primary driver of development and mutability. However, questions remain about who shapes it and to what end. Similarly, is policy nuanced enough to cover a large, low-density region that faces different economic, societal and environmental challenges across its various locations? As such, the formation of a more strategic policy framework requires the capturing of the complexity of issues at hand. How is heritage dealt with? How to craft new industry? How does the global and local interface? The formulation of strategic policy can radically shape our built environments and it is a realm where, often, not enough design thinking is applied.

4.4.3 Climate

Often considered as constant, the mutability of our climate is becoming ever more apparent due to climate change. Extreme weather events with lasting economic and psychological effects are occurring with increasing frequency. They are also costly. The 2015–2016 winter floods in the U.K. cost the economy an estimated £1.6 billion (Environment Agency 2018). To create resilient and climate-proof regions, the adaptability of landscape, architecture and the urban context must become embedded in the design. The mitigation and adaptation of landscape and the built environment to an evolving climate can ensure effective action is taken on everyone's behalf. Lake District 2.0 views carbon sequestration, flooding and reparations as key regenerative features of landscape.

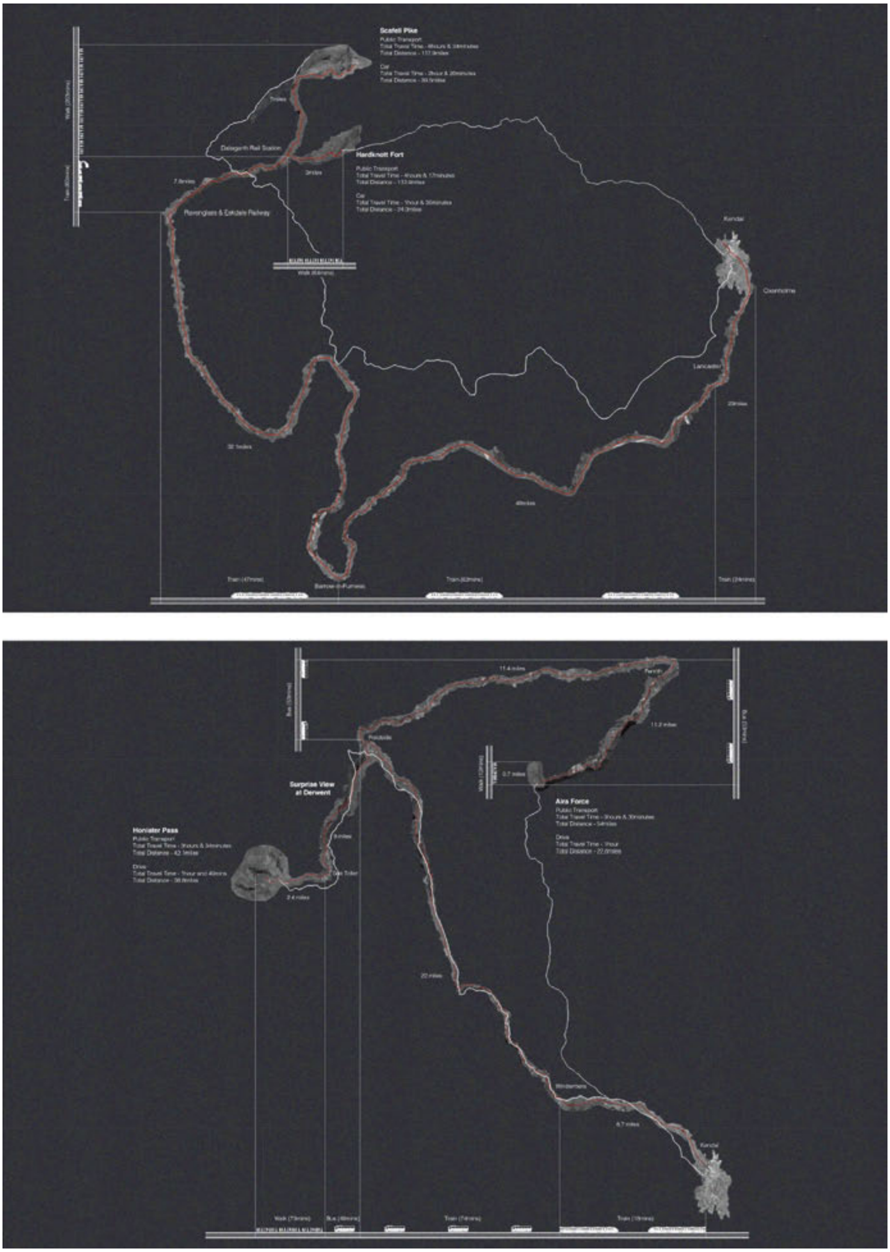

Fig. 4.7 Public transport and access. (Riane Samir © Architeturra Superleggera, Queen's University Belfast)

The natural landscape is a carbon sink. However, as urban, infrastructural and agricultural development takes place, the change in land use reduces the potential for carbon sequestration. Capturing carbon is vital to offsetting the negative effects of other activities, be that travelling by car to the Lake District for your holiday or eating lamb for dinner while in Ambleside. Forests, bogs and pastures all capture carbon but require careful management, expansion and preservation in the future. However, one of the main challenges of increasing the area for sequestering carbon is the economic value it has compared to other activities or functions. The tension between land value and income potential, compared to what it offers to the environment, is out of balance. Therefore, a new way of approaching ideas of carbon capture and financing it are required for mutability in the right direction.

In recent years, the effects of flooding on the landscapes and towns of the U.K. have become ever more obvious and publicized. The reaction of government and communities is to deliver significant infrastructural investment and interventions on river systems in order to hold back, manage and monitor flood water (Fig. 4.8). Despite these efforts, they prove fruitless or even compound the problem, as seen in the devastating Cumbrian floods of 2009 (Miller et al. 2013). Attitudes to dealing with major flooding requires forms of adaptation and mitigation that embody resilience beyond the lifetime of an individual – and far beyond any government. The event horizon for the effects of climate change on our landscape transcend hundreds and thousands of years and, therefore, the respect and prioritisation of water's potency must be acknowledged. Lake District 2.0 looks at how landscape and architecture can offer solutions to the major challenges of flooding and how the education of visitors and residents about flooding can unlock new ways of occupying these territories.

Any activity that is undertaken pays a cost to the earth. This is most evident in the contamination and pollution discarded of onto land and in the air, primarily from industrial production. This is even in the Lake District. Regeneration of our ecology, biology and environment must be at the centre of how we treat our evolving low-density landscapes. Ensuring an understanding of the impacts of interventions is one thing, but to actively engage with the challenges of improving and enhancing these features is even more difficult. Therefore, natural ways of dealing with regenerating the soils and rewilding in low-density landscapes is a central pillar for embracing mutability of climate. They require vision and distant event horizons. The process of healing the damage and destruction sowed is a necessity and one that should be enacted upon immediately.

4.5 The Lake District 2.0

4.5.1 Crafting Policy, Building Future Heritage

The built environment is continually adapting to context, be that technological, societal or economic. In the Lake District, much of the built fabric is considered heritage. Heritage refers to valuable practices, cultures and buildings that have

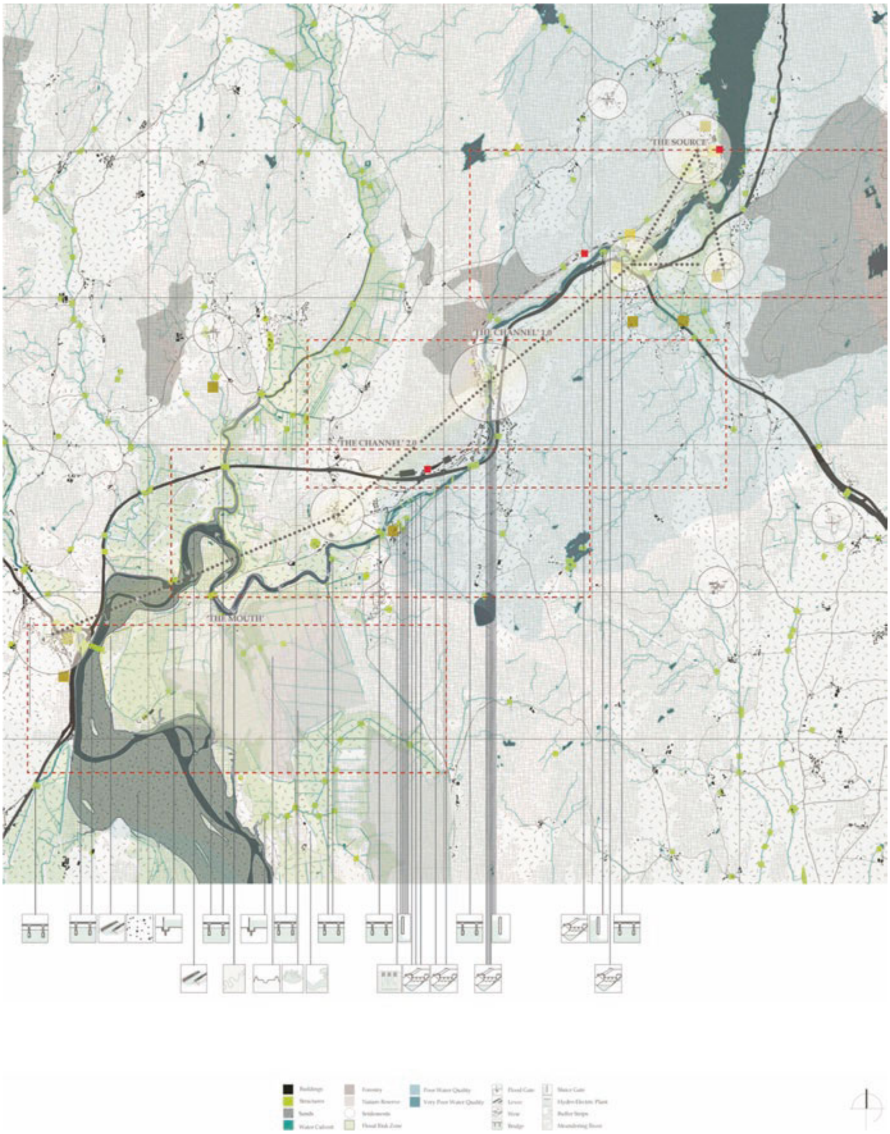

Fig. 4.8 Before the flood – a critique of interventions on the River Leven. (Jessica Scott © Architeturra Superleggera, Queen's University Belfast)

importance beyond the material or physical form or output. In the context of low-density landscapes – where human intervention on a landscape is arguably more evident – heritage is a charged topic because of the varying social, economic and environmental perspectives people have of it. While industrial in its practices, the Lakes utilises the idea of heritage to make it attractive to visitors. However, Lake District 2.0 questions how static or fluid is the idea of heritage? How is it perceived by visitors and residents? What role does policy play in shaping heritage?

Sustainable and ecological ideas of heritage in architecture and urban planning are complex. The use of localised materials ensures lower embodied carbon in construction; how long these materials last and their efficient application for new ways of living requires consideration. The conflict between heritage in form versus heritage in material must also be negotiated. That is, if it looks the same as contemporary heritage, but made of new materials, is that agreeable? Or if it is of the same materials but of radical form, is that agreeable? Policy and collective conversation affect these views and shapes our built heritage in a significant way.

In the Lake District, policy moves slowly compared to the actions, habits, desires and needs of residents and visitors. A more nuanced idea of how heritage is understood provides new synergies between different regions of the Lakes that have different economies, histories, infrastructures and connections with communities and industries beyond the National Park boundary. As such, policy is seen as a tool for unpacking and repacking materials, typologies and economies to and from places. Lake District 2.0 creates a stepped, transformative policy-scape that does not treat the whole of the national park in the same way. As towns and villages require specific ways of regeneration, it requires policy that is micro but affects the built environment, economy and culture of the Lake District, in the long term, at a macro scale.

Therefore, crafting a new, effective means of policy is proposed in order to challenge our views and use of built heritage (Fig. 4.9). Lake District 2.0 celebrates existing built heritage of value while allowing for a policy-scape that is flexible enough to adopt new technologies, principles and materials of construction. Crafting projective and future oriented ideas ensures generations to follow are not starved of current notions and ideas of occupying territories. Mutability is therefore seen as a necessity; otherwise, the prevalence of staged and performed heritage reduce knowledge building and value creation.

Explored through policy are both a permeable and transitory approach to the issues surrounding people, place and function within the National Park. The accumulation of localised materials and the integration of a three-tiered policy-scape through the creation of the *Deep*, *Medial* and *Outer* Lake District, seeks to use policy as a controlled method through the slow adaptation and forming of new heritage (Fig. 4.10). The policy framework provides either stringent or lenient methods through the removal and unpacking of artificial form and function or the creation and packing of emerging biomaterials and future heritage into the *Deep* Lake District. The cascading policy-scape enables authentic ideas of heritage to flourish in *Deep* Lake District – the honeypot – while the outer Lake District engages with global forms of industry and resource supply. The *Ecotone* – a transitory zone between the tiered policy-scapes – is the blended, productive zone that allows materials, industries and people to adapt and assemble for the coming policy strata. Each scale of policy has differing notions of materials use, speed of change and industrial activity.

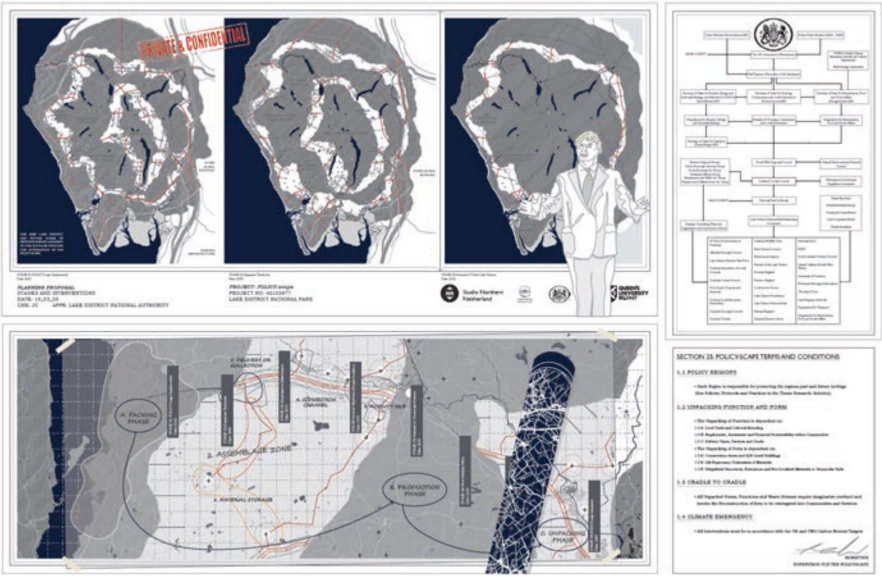

Fig. 4.9 Planning towards a United Policy-scape. (Jason Crawford © Architeturra Superleggera, Queen's University Belfast)

4.5.2 *Critical Infrastructure, Mobility and Circularity*

Each year the flow of people into and out of the Lake District National Park varies greatly between the summer and winter months. As large number of visitors arrive through very few gateways main roads and rail infrastructure in the region becomes congested. During the summer, cars clog the street of towns and villages. For example, in 2017, 15,901 motor vehicles (a daily average of total yearly traffic counts) travel through Windermere on the A591 (Fig. 4.3) (Road Traffic Stats 2017). However, as discussed, addressing the issues of mobility in a low-density landscape is challenging because of the peaks and troughs of use in addition to the directness of private mobility versus public transport. Equally it is hard to justify large-scale public investment in public transport in such a distributed and sparsely populated area. Banning the car proves problematic in other ways. The primary gateways at the periphery, like Kendal and Carlisle, would likely become large car parks (Fig. 4.11). These nodes would become pinch points as visitors arrive and cause significant strain on regional infrastructure and services. Therefore, the reimagining of mobility in the Lake District 2.0 must be predicated on a different thesis.

Cars allow flexibility in where and for how long you might visit, encouraging further distribution of people. Rather than seeing the car as a product of consumption, Lake District 2.0 sees it as a product of service that couples the movement of people with the distribution of utilities. A colony of autonomous vehicles is seen as a connective tissue that allows people to travel, independently or collectively, at a

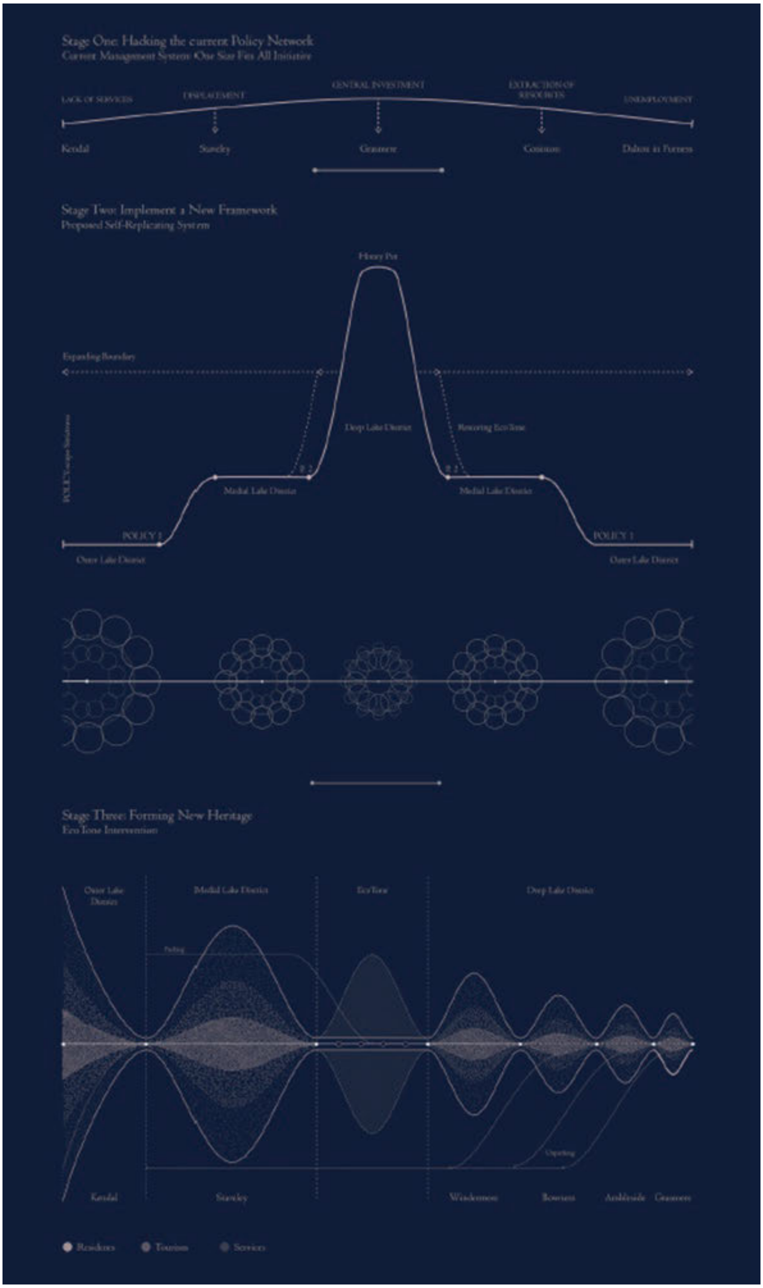

Fig. 4.10 A case for the policy-scape. (Jason Crawford © Architeturra Superleggera, Queen's University Belfast)

Fig. 4.11 The Car-free Lake District. (Riane Samir © Architeturra Superleggera, Queen's University Belfast)

time of their choosing and to whatever destination. By removing ownership of cars, there are no longer masses of stationary vehicles in towns and villages. Instead, the fleet is continually moving people, energy, water and waste. Allowing the vehicle to take on the responsibility of moving utilities, it questions how to deal with the legacy and materiality of twentieth century infrastructure in the landscape and how the vehicle engages with the house in order to deliver them.

The aesthetic language of the Lake District in understood as natural but continually present are infrastructural interventions for utilities and commodities (Fig. 4.12). As autonomous vehicles begin to do the work of much of this infrastructure, what happens to these materials becomes an interesting question. Huge amounts of copper, steel and timber simply provide electricity to homes and businesses. Lake District 2.0 is circular in nature and utilises these products in new ways to adapt existing homes and heritage for new ways of living with the environment (Fig. 4.13). A light-weight skin encloses the home and is made of the redundant twentieth century infrastructure removed from the landscape. The primary structure is made from recycled electricity poles. The tensegrity prisms are created from timber that has been salvaged from the landscape. The cables are created using disused telecommunication cables. The circularity of materials is central to the adaptation of heritage. Inside the home, the occupant can enjoy unaltered heritage without the need for any further modifications to allow for comfort. Vernacular construction techniques such as dry-stone walls, timber joist ceilings and single glazed window can remain untouched and celebrated. All-weather play spaces and vertical, indoor growing allows for year-round food production that the family can consume. The vehicle connects into the skin, delivering the food, water and energy needed for the next 24 hours, leaving with the children to be dropped at school. Contained within the skin are a number of systems that will improve the performance of the home. Rainwater harvesting and sprinkler system to provide water to high-tech vertical garden. Photovoltaics with a converter and inductive charging pad to power the autonomous vehicle and home. An HVAC system regulates temperature, circulates air and inflates the ETFE skin. A robotic arm automates the process of removing and attaching commodities to the vehicle such as greywater, food and electricity.

The landscape will become totally free from visible utility infrastructure, adding value to the world heritage status the Lake District is supposed to reflect. People will regain control of the streets. It will appear as pristine and perhaps untouched. In reality, the landscape will remain a highly technological system. The supply of commodities and resources requires the location of nodes between the global and local scales. Larger autonomous vehicles move larger quantities of resources in and out of the Lake District between primary and secondary nodes – from Kendal to Bowness-on-Windermere, for example. From here, the small fleet takes resources to houses, operating non-stop. The only resting time is when vehicles need to recharge, collect or drop-off their commodities. The masterplan envisages distribution and resupply centres to be spread throughout the landscape to ensure food, water, energy and waste can be collected, distributed and processed effectively using existing road networks as the connective tissue.

Fig. 4.12 Lakes infrastructure. (Greg Keeffe © Architeturra Superleggera, Queen's University Belfast)

4.5.3 Undoing Infrastructure, Repairing Landscape

As our climate changes, more extreme weather events are likely to occur, requiring inherent adaptability for our landscapes, buildings and infrastructures. By 2050, the U.K. is likely to have wetter winters and drier summers (UKCP18 2018). In recent years, major flooding events have drawn national attention, particularly in the Lake District in 2008 and 2015. While significant efforts have been made to attenuate, divert and channel the water courses of the Lake District, flooding has still occurred. If these events are likely to continue and get worse, are there other ways of dealing with them? If so, how will it affect the way in which residents and tourists live? The importance of water to the region is clear but new paradigms for engaging with bodies of water are needed. Lake District 2.0 re-imagines the ways in which visitors and residents become familiar and experience flooding events that educates, while making communities and ecology more resilient.

A critique of the defensive infrastructure along the River Leven offers an interesting example of artefacts from a traditional flood defence approach (Fig. 4.8).

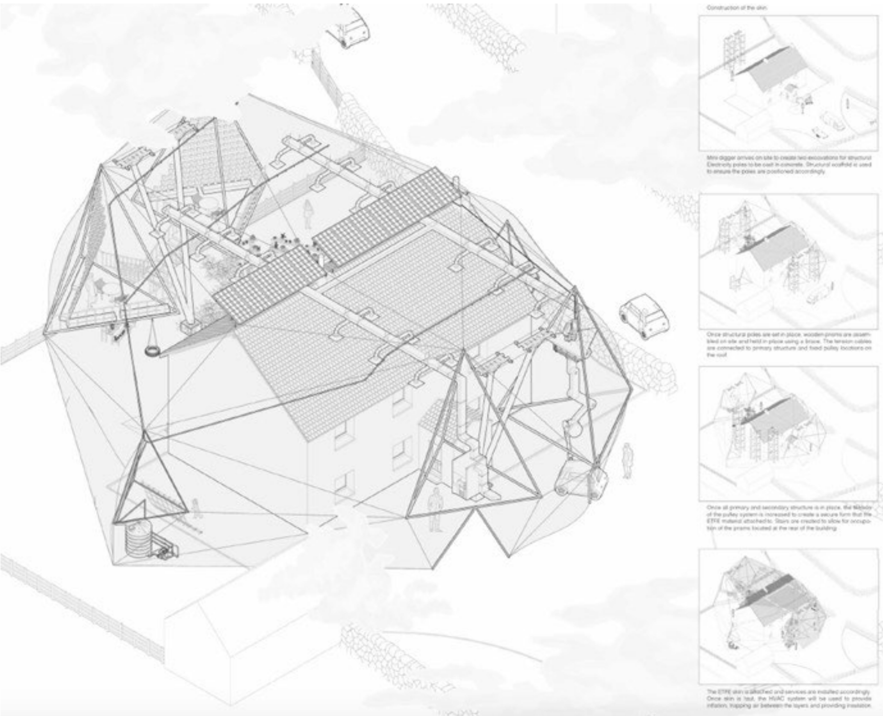

Fig. 4.13 Adapting Heritage for autonomous, distributed utilities and for new lifestyles. (Riane Samir © Architeturra Superleggera, Queen's University Belfast)

Their role is to prevent major flooding events but in recent years these have even failed to do so (Huq and Stubbings 2015). The long-term role of these infrastructures in Lake District 2.0 advocates flood risk management through natural and ecosystem characteristics. Embracing the flood enables the landscape and ecology to respond naturally to the flows of the river over time and along the course of the river. The removal of non-effective flood defence infrastructure sees the one-year floor and the 10-year flood levels inundate farmland and infrastructures, altering the relationship between river mouth, estuary and land (Fig. 4.14). It allows for a robust and flexible systems approach that can adapt to climate change while reducing major infrastructure capital expenditure.

Furthermore, this enables a new form of tourism to take place in flooded landscapes. Tourists and visitors can now engage with the experience of a flood (Fig. 4.15). These opportunities are educational (learn about flooding and climate change), escapist (stay in an Airbnb that floods every now and again), entertainment (kayak the new river course) and aesthetic (enjoy the scenery of the new river mouth). Each of these realms of the experience economy offer new economic and cultural forms of engagement with climate change and landscape (Pine and Gilmore 1998). The result is a new form of slow tourism and creates a close engagement with

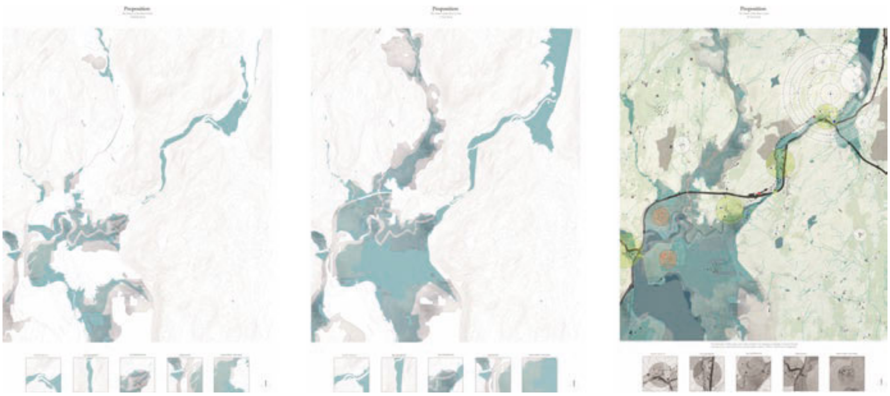

Fig. 4.14 1 month flood (left), 1-year flood (centre), 10-year flood (right). (Jessica Scott © Architeturra Superleggera, Queen's University Belfast)

the landscape. A deeper and more meaningful experience of the Lake District is important to foster, compared to the speedy and shallow visitor experience that fetishizes aesthetic. The reparation on natural water flows in the landscape is about softening the extremes of weather patterns on the built environment and providing an authentic experience of it to visitors. Forcefully controlling water flow and managing flood levels gives residents and visitors a sense of control over the natural world that is often misplaced. With more extreme events likely to take place, is it right that we continue to raise these infrastructures and fight back, or should we embrace and enjoy the environmental fluctuations?

The reparation of landscapes in the Lake District also extend to peat bogs to the south of the National Park. 70% of the bogs in the Lake District require some form of restoration because of draining, farming and forestry damage (Cumbria Wildlife Trust 2020). Yet, in their natural state, bogs can sequester and store significant quantities of carbon (Leifeld and Menchetti 2018). Growing these habitats and soils takes a very long time, far longer than it takes to destroy them. Long-term planning and expansion of these areas is required to off-set global CO_2 emissions. The incentives for reparation are limited however and requires a new economic model that leverages complementary programmes of use. Lake District 2.0 looks at how we can pay for the effective management of peatlands while also allowing for their expansion so greater volumes of carbon can be sequestered. To do so, bunds of data storage systems allow for peat soils to be flooded again and provide a balancing of the water table across the bog (Fig. 4.16). As natural vessels for preserving material elements, like bog butter, bogs are appropriate for the preservation of contemporary information. Data is embedded in a landscape that is difficult to access and takes a long time to restore, thereby producing an active bund system that pays for the recovery of the landscape at the same time. The modular bund system allows the bogland to expand over time, sequestering larger quantities of carbon in the process. Similarly, it increases the storage capacity of the data centres which act as long-term economic and cultural archives to the digital information of the twenty-first century.

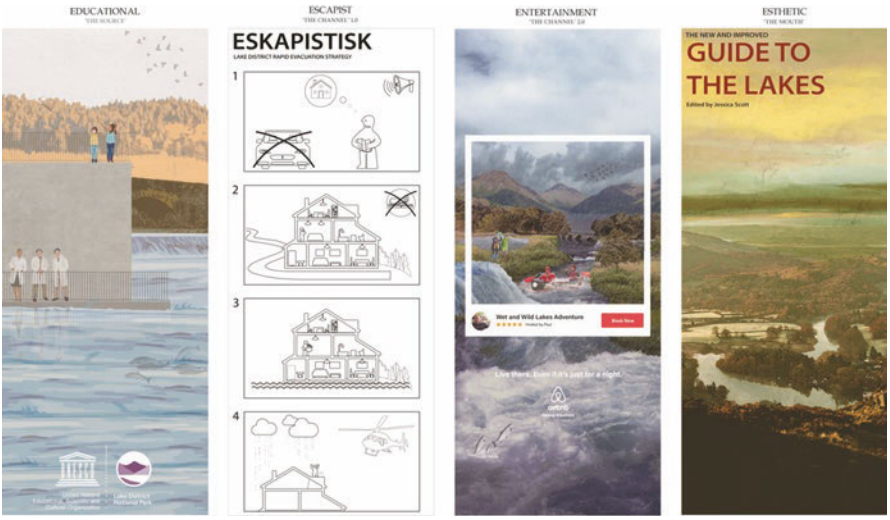

Fig. 4.15 Experience the flood – the four realms of an experience. (Jessica Scott © Architecturra Superleggera, Queen's University Belfast)

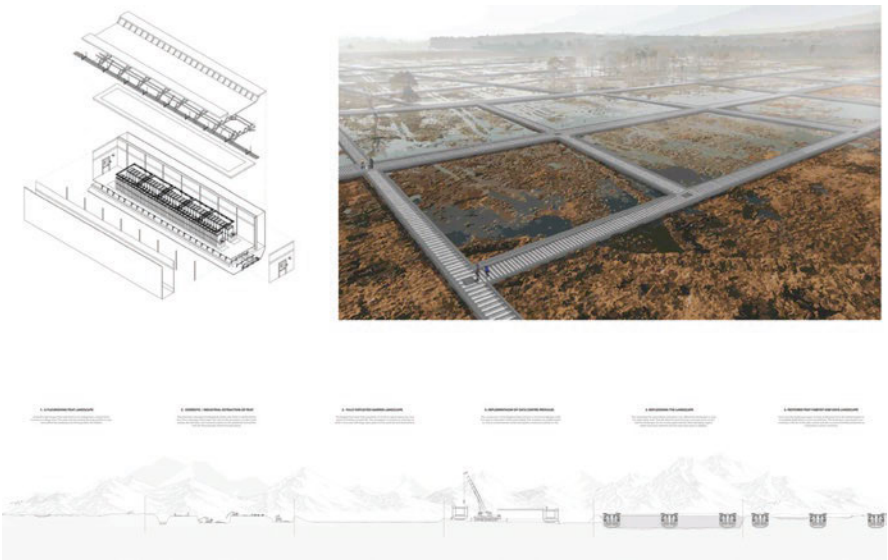

Fig. 4.16 Bogland Data Bank – peat reformation in the Lake District. (Chris Connolly © Architeturra Superleggera, Queen's University Belfast)

4.6 Conclusion

Mutability of climate, technology, culture and economies is changing the way in which we live and operate in low-density landscapes. Lake District 2.0 leverages the latent trajectories of change in order to imagine regenerative, circular and synergetic systems that provide new relationships and ways of engaging with ecology, landscape and the built environment. The tendency to see the rural condition as slow, static or rigid no longer applies. The speed at which transformation is taking place in these contexts is significant. Even the features long perceived as slow, like climate, are accelerating. The Lake District provides an explicit and evocative example, but these tendencies can be seen elsewhere, from the Highlands of Scotland to the polders of Groningen. The answer for design is not to petrify or fortify these landscapes, economies, cultures and technologies. Mutability must be absorbed to allow for flexibility and regeneration that can be moulded by future unknowns. Therefore, the visions of Lake District 2.0 offer insights of light-touch and flexible approaches that are of a time and intended to be adapted, removed and altered in the future. They represent viewpoints that are neither nostalgic nor linear. It places the concept of mutability and environment at its core – one that necessitates Anthropogenic change. From large scale ecological systems to small scale cultural shifts, the low-density landscapes of the future are cyborgs that value speed and lightness.

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Chapter 5
Regenerating a Country by Design: New Nature-Rich Netherlands

Rob Roggema

Abstract The plan for a nature-rich Netherland presents a vision how a country could be redesigned in a regenerative way. The plan to transform at least 50% of its area in nature connects and solves a series of problems. It enhances the reestablishment of biodiversity at a national level, it causes the resilience to deal with unexpected climate impacts, it captures carbon to mitigate climate change, it opens the way to transition the food system into a regionally based nature inclusive food supply, and it provides the natural environment for additional housing to solve the housing scarcity in the Netherlands.

By integrating the solutions all these problems are solved at the same time, one solution brings the benefit to another and vice versa. The design for the Netherlands is based in its historic landscape forming systems, as a condition for future resilient landscape forming. This way the water system forms the basis for the design, guiding the regrowth of peat and giving room to free-flowing rivers and streams, connected to additional typologies of landscape based mixed forests. The existing agricultural land is bought-up on a voluntary basis, with a serious premium of 40% above current market price for farmland, which makes it possible for farmers to stop or transition their farm to nature-driven farming methods. The finds fort his generous offer are made possible by the development of new housing on 4% of the bought farmland. This landscape make-over is to be centrally governed as to organize the planning, the land-use change and the financial arrangements in a fair way for everyone.

Keywords Biodiversity · Nature-based planning · Nature-inclusive farming · Housing · Climate change

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5.1 Introduction

To deal with global problems, such as accelerating climate change (IPCC 2021; Wunderling et al. 2021; Carrington 2021), biodiversity loss (IPBES 2019) – and the strong connection between these two (Pörtner et al. 2021), and goes beyond planting trees only (Einhorn 2021) – and the food supply, an integrated approach is essential to create a better, more sustainable, and more beautiful country, regional landscapes, livelihoods, and communities. To create a regenerative country, the map of the Netherlands should therefore be redrawn. This is a major task (Studiegroep invulling klimaatopgave Green Deal 2021). The often-separated policies, measures, and accounts for individual problems, have led to an impasse in solving major urgent problems. So is growth of biodiversity counteracted by paralysis in climate action and is the impact of agricultural emissions not reduced due to estimated economic value of the sector. This disintegrated approach inevitably comes at high costs, both ecological, social, and economically. A novel, integrated view on these key problems could create more room for nature, food supply, housing and living in a dense country such as the Netherlands. Connecting the crises of climate and carbon emissions, biodiversity loss, water droughts and floods, and nitrogen can bring solutions to the fore that seemed to be impossible before. On the new map of the Netherlands this multiplicity becomes visible. Starting with the foundations of the soil and water system, land use can be integrated leading to lessening the pressure on the land, implying there are more benefits for all.

The need for a fundamental rethink is a direct result of our own actions: climate has changed, biodiversity has been lost. Continuously raising the coastal protection will, in the end, not suffice to safeguard us against rising sea levels. Soils are exhausted and endanger the food supply. Further intensification of agricultural use and environmental pollution lead to increased ecological damage. With a little bit of drama one can say that we have put life, our lives, at stake.

In this chapter a vision is presented how a regenerative, biodiverse, and prosperous land can be envisioned at minimal costs. After briefly touching on the major problems of our time, the geological embeddedness of the core characteristics of the Netherlands (Sect. 5.2) is taken as the point of departure for the vision. This then is guiding the future and the way the country can transform towards a regenerative environment, finding its key points of departure (Sect. 5.3) in the natural water system and declaring an order of decision-making: nature first, then food, then housing. Such a vision can only be realized if the business case and the responsibilities are clear. This is described in Sect. 5.4.

Key choices in the fields of ecology, food and housing are needed and need to be integrated to one whole. Endlessly raising seawalls cannot protect the land against the impacts of sea level rise. Exhausted soils put the food supply at risk and continuing intensification and pollution leads to huge biodiversity loss. Human life is at stake.

5.2 Problems

For decades the signals and warnings of science have been ignored. Responses to serious threats have been too small and too slow. Wandering the path of graduality, crossing endless fields of ryegrass, the edge of the abyss is nearby. Looking backwards bygone tipping-points become clear. Only fast action could regain control to establish a better future.

Apart from climate change and biodiversity loss, there are many other reasons to redesign the Netherlands. Hundreds of thousands of people search for an affordable home, a number that will only increase in the future. Many farmers lead economically marginal lives, looking for more certainty. Without a new perspective the Dutch food supply is at risk.

A shocking image appears:

1. 68% of biodiversity is lost since the 1970s (WWF 2020). Nitrogen emissions from agriculture, housing and traffic threatens vital forms of life, nature, and human health.
2. Climate goals are not met without capturing a vast amount of carbon.
3. Housing demand is out of balance. The Netherlands is a prosperous country but access to the housing market for low-income people and starters is extremely difficult.

The urgency is large and is felt in multiple aspects determining human life. This requires setting priorities and making clear choices to regenerate the country and make it more resilient. A fundamental transformation is needed not to treat problems in a sectoral and mechanical but in a holistic and organic way. A rising sea level is responded to by strengthening sea walls, an increasing pressure on the housing market is met by building more dwellings and when pollution such as nitrogen is preventing developments this is solved by putting in place stricter regulations. Treating every single problem with its own solution requires investments in every isolated sector, culminating in overall higher costs.

5.3 First Responses: Large-Scale Planning for the Longer Term

Currently the attention to the relationship between nature and (the impact of) agriculture gains attention. In the Netherlands, a range of visions have been presented recently. These visions differ in their approaches, though have similar objectives, e.g. to bring back the balance in the use of the landscape so biodiversity can increase and resilience improves. Implicitly all these plans pledge for limitations, in one way or another, within the agricultural system to:

– Reduce emissions, being it nitrogen, carbon (Crippa et al. 2021), phosphates, pollution of ground- and surface water, or emissions impacting the atmosphere,
– Realize biodiversity objectives, as current flanking policies, such as agricultural nature management tend to fail (Boonstra et al. 2021; Sanders et al. 2020)
– Reduce the 'visual pollution' of the landscape.

Inevitably, spatial, ecological, and environmental quality must therefore be connected, a finding that resonates since the 1970s (Langenhoff 1975).

Many actual problems are seen as being so fundamental they require a break with planning traditions of the (recent) past. Rethinking how the country is planned considers therefore elements such as the use of a systemic view on transforming land-use (Abbenbroek and Nijhof 2020), the integration and mix of different uses (Hooimeijer et al. 2001) and preferably using a research by design methodology (NVTL, BNA, BNSP 2019). This search for a new planning paradigm starts with taking the local foundations of soil, ecological and water systems (ABDTOPConsult 2021; Baptist et al.; 2019; Hamers et al. 2021; Huitzing et al. 2021; Kamphuis et al. 1996) as the point of departure for future planning, secondly it searches to optimally combine uses and separating out those that do not belong together, and finally linking these to the regional spatial identity (ABDTOPConsult 2021). The plan for NL2120 takes the natural system as the basis for land use, makes use of the water systems in the best possible way, creates nature-inclusivity across society, and applies adaptive spatial planning principles (Baptist et al. 2019).

The type of agriculture is a crucial factor in the way the country realizes its ambitions to become more biodiverse, resilient and climate sensitive. In the Netherlands, agriculture is mistakenly seen as an economic powerhouse. Primary production contributes 1.4% to the BBP, and including secondary industries profiting from agriculture only 4.1% of the National BBP can be related to the agricultural sector (Oudman 2021a). A smaller agricultural sector is no threat to nature and landscape, but the opposite is true: large scale and intensive forms of producing food has disastrous impacts on the landscape, nature, and ultimately human health (Lamers 2007). Too many linear habits in the current production system stand in the way to achieve a viable circular agriculture (Sijmons and Thoral 2020). Moreover, the impact of the Dutch agriculture on ecosystems in other continents cannot be overestimated (De Vries and Smit 2021).

Unexpectedly, the productivity of the agricultural sector is relatively low, and more labor is needed to grow local and sustainable food (Mesters 2021; Smit 2018). Cost benefit analysis shows that reducing size and impact of the agricultural sector (especially intensive husbandry) is economically beneficial (Van den Bossche et al. 2020), and has a range of additional benefits, such as less emissions and more capture of carbon (Atlas Natuurlijk Kapitaal n.d.), more nature, less food waste, and it brings the renaturing of peat areas within reach (Urgenda 2021). A landscape without meat (Stroeken 2021) could be spatially beautiful, and offers farmers new perspectives for a smooth transition, provided downsizing is shaped as a gradual process (Datema 2021) in which the farm is the core entity making the transition possible through collaboration, clear objectives and area arrangements (Ros 2021). Even most Dutch political parties are in favor of a modest or even substantial decrease of the number of animals in intensive production systems (Boezeman et al. 2021a). This would also partly solve the problems associated with deposition of nitrogen from agricultural practice (Van Geest et al. 2021; Boezeman et al. 2021b; Van den Burg et al. 2021), which negatively impacts biodiversity, the opportunities for housing development (Remkes et al. 2020). Revitalization moves too slow to stop further loss of natural values Brandsma and Havermans 2021; Havermans and Brandsma 2021; Bobbink 2021). An offensive and swift strategy to tackle these serious problems is needed which most likely changes the way land is used and the need to spatially plan the country in a very different way (Erisman et al. 2021; Haan et al. 2021). Therefore, voices become louder to design a fundamental new system to grow food in the country (Van Dinther and Smit 2021; De Belaige 2021).

Re-rooting the Dutch food system (De Boer et al. 2020) emphasizes a more localized agro-ecosystem obtaining its resources from the socio-economic network where it is embedded (Deijl 2021). The scale of this local system makes it possible for agriculture to become regenerative (LaSalle and Hepperly 2008), delivering a healthy soil (Aardpeer 2021; Berg 2021), growing food for humans instead animals without the use of pesticides and herbicides. When the practice of growing crops is more diverse and robust, by applying strip-, mosaic or intercropping (Sukkel et al. 2019; Regiodeal natuurinclusieve landbouw 2021) and agroforestry (Van Druenen 2019; Agrobosbouw 2021), higher yields can be achieved as nutrients are more efficiently used and plagues and diseases are reduced. These systems ideally are linked to settlements of human concentration, cities, and towns, to establish a regional cycle for nutrients to people and the reciprocal flow of nutrients back to farmland. Regenerative agriculture close to urban settlements also has social benefits for community building, raising awareness, and generates food democracies for collective prosumers of food, and moreover, could create greener urban environments, which is beneficial for climate adaptation or mitigating the urban heat island effect. Traditional grassland is transformed in wetlands, peat, or forests (Van Dinther 2021a) to capture carbon, extensively grazed by lightweight cattle producing high quality meat and milk (LifeIsMore n.d.), which most probably is more expensive.

Such a transformative vision requires a major reorganization of the Dutch countryside, separating intensities of agricultural production, based on the fertility of the soil and landscape qualities, and decreasing the intensity of agricultural production in general (Bakker 2020; Bakker et al. 2021; Van Houweling 2021). Logically, this cannot be achieved without a strong, more centrally organized governance than is the current practice. Therefore, a range of pledges can be noted, such as the (re) installation of a Minister of Spatial Affairs who needs to connect themes such as food, nature, water, and housing, through a holistic and centrally directed overall vision (ABDTOPConsult 2021; De Lugt et al. 2021; Huitzing et al. 2021; Veerman et al. 2021).

5.4 Connecting Traditions

No matter how the Netherlands is rooted in its cultural polder patterns, it has a tradition of adapting the land to changing conditions. Dutch heritage reflects a series of large-scale interventions to stay in the swampy delta, all embedded in the geophysical context that grew over thousands of years (Bazelmans et al. 2012). Sea walls and polders were realised top protect the country against floods. Wastelands were reclaimed to prevent hunger, and bare hands planted trees when sand dust started to cover the land. Dutch cultural heritage is based on facing problems, act with courage and do whatever is needed to create a safer future. Now is the time to follow these footsteps, designing a country that can deal with uncertainty and future risks. A new nature-rich Netherlands takes nature, and the natural systems, as the framework to regenerate the country, using the resilience nature offers and use these principles to develop a country able to face future change. Within these boundaries that are provided by nature, the food supply is fitted in and within that landscape the design of where and how housing and living is positioned.

A healthy future can only be envisioned by understanding the past (Baas and Raap 2017; Haartsen 2010), because no matter how the country was redesigned and made to fit the underlying natural forces that shaped the Netherlands may be restrained but has not vanished. The geological structures provide the guide to future transformations (Van den Brink 2021) and could reset natural qualities at the local level (Den Boer 2021). Using art and historical artefacts (Winkel 2021) that refer to the past is hence a strong signal to the community.

The Netherlands is the result of a continuous reciprocity between sand and water, and land and sea. Out of this dynamic the coast emerges, shaping extension, terra forming, peat growth, water discharge and a range of ecologies (Fig. 5.1). This also resulted in vast areas with fertile soils where advanced agriculture was practiced and higher sandy grounds with small scale occupation, and settlements along the coast and rivers, where dams and waterworks kept control. Over the years, the Dutch made their land to what it is today: neatly arranged dikes, dams, city walls and polders managed the water in a way nature seems to be subdued.

Around 800, the Netherlands consisted of elevated sandy landscapes in the eastern parts, flat and wet peatlands where sand transitions into the sea-clay areas in the northern and western parts (Fig. 5.2). Rivers and smaller streams connect these areas by discharging water roughly from the southeast to the west, where all water eventually flows into the North Sea. This created a huge delta, with a natural richness of islands, salt marshes and gullies. The so-called komgronden, consisting of heavy clay soils, the natural levees existing in the river landscape and large parts of the coastal zone fertile clay sedimented due to the never-ending in- and outflux of the sea. People lived safely at elevated parts of the landscape, protected by small earthen walls or on raised hills, the mounds.

After millennia of fighting against the water, raising seawalls, pumping land dry into polder systems, significant parts of the sea were turned into land (Fig. 5.3). The land is now under control by (and for) humans. The sea is kept behind dunes and

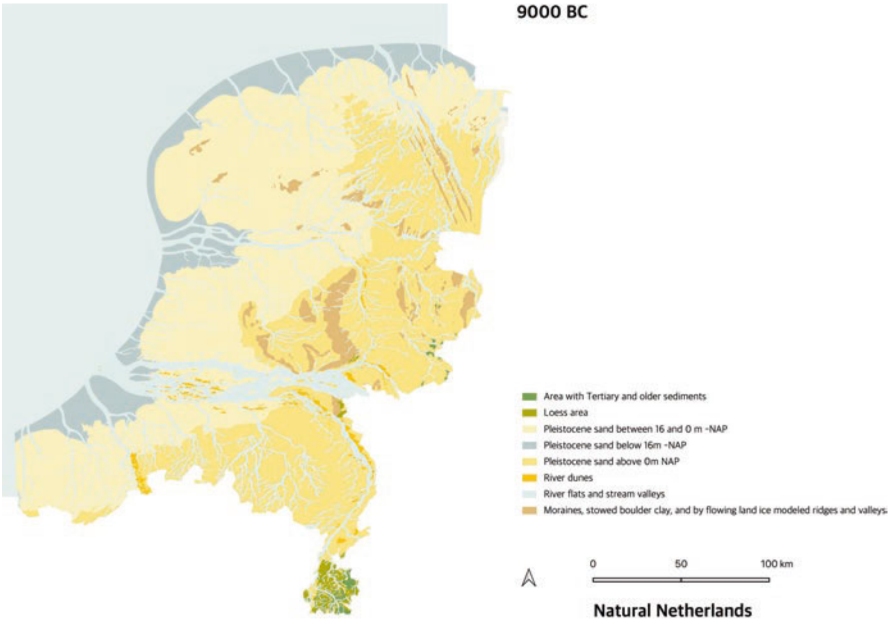

Fig. 5.1 The Netherlands in 9000 BC

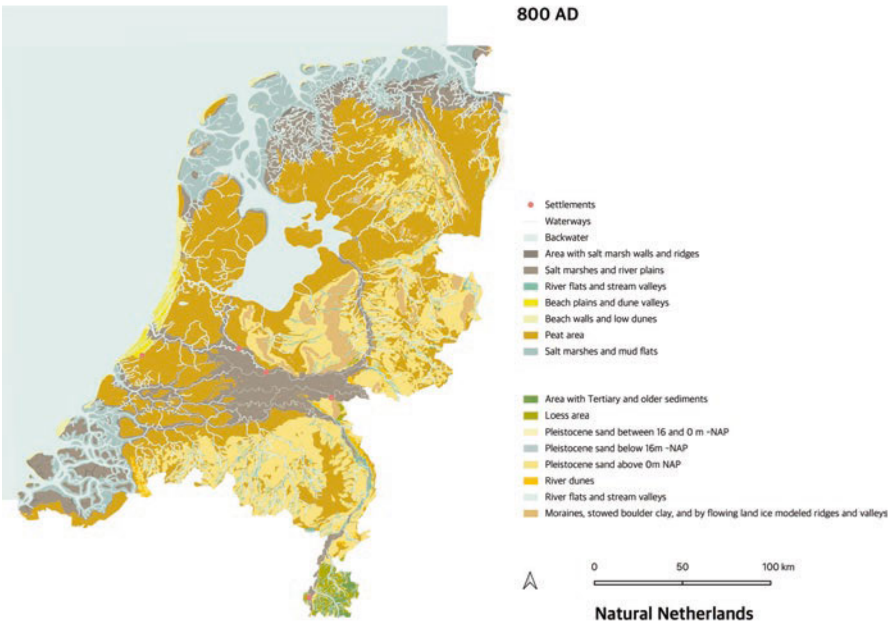

Fig. 5.2 The Netherlands in the year 800

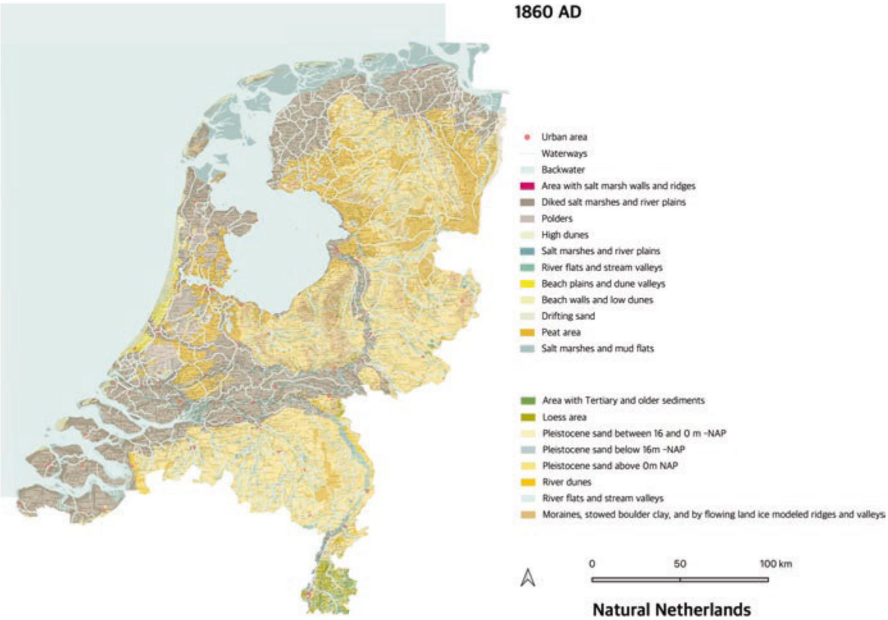

Fig. 5.3 The Netherlands around 1860

dams, and the polders offer abundant space for growing food. Until the late 1800s man succeeded in manufacturing this landscape with simple and historic tools. Fertile soils were abundant and wild nature mainly consisted of waste- and peatlands. Much of the original forests were cut to construct houses, ships, and tools.

Currently, approximately 17 million people live in cities, towns, and villages, occupying around 19% of the area. 66% is in use as agriculture (Fig. 5.4), of which half is grassland and the other half consists of cropping fields, greenhouses, and stables, where millions of animals are kept (CBS 2015). Two-thirds of productive land provides animal feed, which is processed by cows, pigs, and chicken to become meat for the export and manure which is spread over the land again. The soil is degraded because of applying intensive agricultural technologies, extracting all nutrients, and changing the soil structure forever. The only way out is to use even more fertilisers and pesticides, and to lower the groundwater levels. On top of this, many farmers earn a marginal income and would, without subsidies and ancillary income, hardly survive. Only 15% of the land is nature (CBS 2015), of which the majority consists of old industrial forests, growing slowly and suffering from prolonged droughts.

In a new Netherlands stream will flow freely through the landscape, peat will regrow, and forests are extended and be more diverse. The most fertile grounds are used to grow food, while the poorer and vulnerable grounds are saved and regenerated. Houses will be built in a climate-positive way in rich variety, from highly intense urban to low-density in green and nature. This implies a large-scale

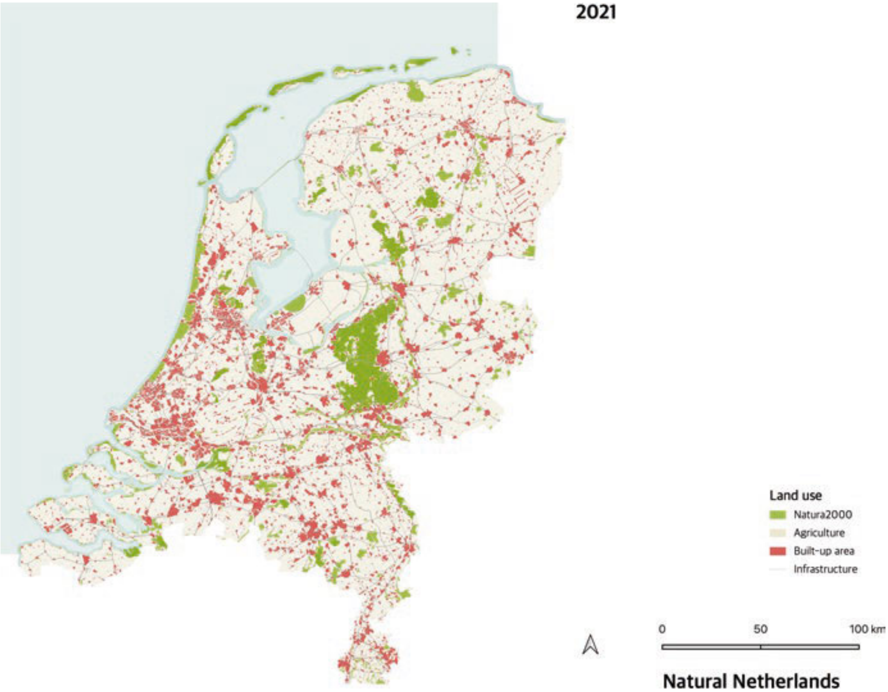

Fig. 5.4 The Netherlands in 2021

transformation. Nature is at the basis of this transformation, guided by the flows of the water. The genesis of the land is formed by these flows as the geological maps illustrate and can be traced back by overlaying historic and current waterways (Fig. 5.5). This enduring systemic feature shows the way towards the future when used as the guiding principle for choices in land use.

The aim is to plan the country in a sustainable, regenerative way. The first step in doing so is to embed future change within the boundaries and resilience of the natural systems of water and landscape (FMF 2021; Roggema 2021; Roggema et al. 2021). Renaturing or rewilding (Jepson 2016; Cockburn 2021; DeWeerdt 2020; Langkjær-Bain 2020) large parts of the land can capture and mitigate much more carbon and nitrogen. Naturally, this also helps reinforcing (lost) biodiversity (Hagendoorn et al. 2021; IPO en Ministerie van LNV 2020a) and because of the expansion of space for nature, the capturing, storing and stagnating water can be fully integrated and spacious. This way, the landscape provides conditions for a healthier and moister soil and allowing large-scale regrowing peat. Within this nature-rich landscape high quality food is grown and attractive sustainable houses can be built, a place where everyone can live, eat, and exercise a healthier life. This turns current practice on its head: nature is no longer cursed within the functional frames of agriculture and housing but offers the (safe) operating space within which food is grown and people live. As nature is the solution for a range of problems

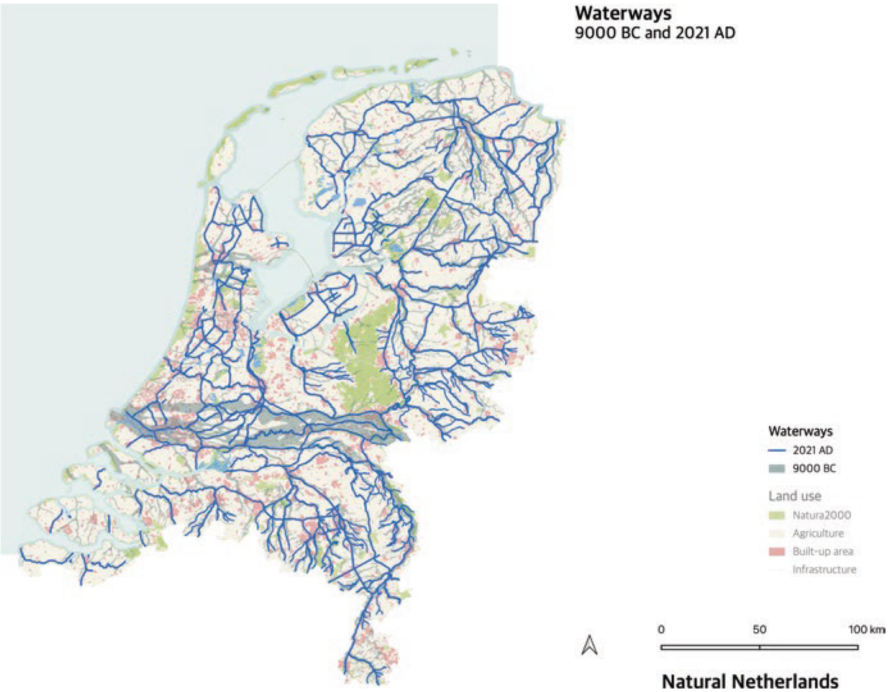

Fig. 5.5 Waterways in 9000 BC and 2021

(Fiers 2021), it all starts with nature. A greater biodiversity better regulates the climate so changes can be kept within limits, which on its turn offers better chances for nature to stay alive. It therefore is a matter of self-interest for humans to undertake action and increase the amount of nature.

Putting nature first implies imaginarily rebuilding of the country. Realising approximately 50% of the land as nature needs to start with keeping current nature reserves (the Natura 2000 areas, and the nationally planned Nature Network) and realise the once planned main ecological structure in the Netherlands (which got abandoned and was never fully executed) in retrospect (Fig. 5.6), and from there transform an additional amount of land into nature (Havermans 2021), for instance by creating robust connections (Alterra 2001). Extending nature hence building with it instead of against it will provide the resilience and the space to increase the safety and fertility of the land. To increase the chance of surviving, climate change must be kept within limits hence carbon shall be captured, and biodiversity-loss be reversed, so resilience is increased. This integrated nature-based system is capable to both respond to climate impacts and at the same time helps to limit climate change (Stafford et al. 2021). This raises the adaptive capacity to for instance protect the country against all the water coming from rivers, the sea, and the air. In this sense, taking nature as the point of departure it is a well-understood form of human egoism. The view on a stronger, resilient, and resistant land requires clear choices

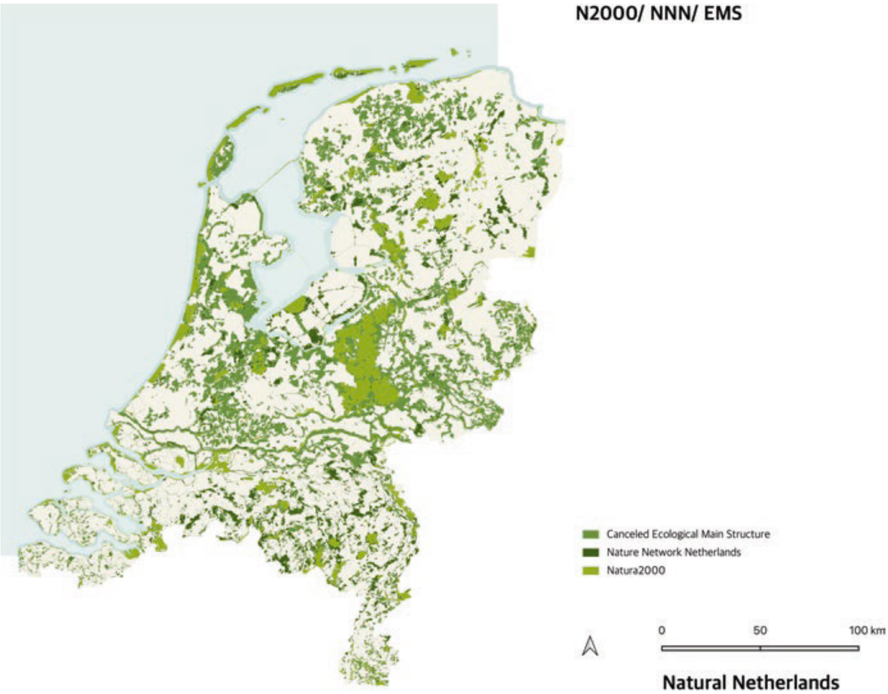

Fig. 5.6 Nature in the Netherlands: Natura 2000, the Nature Network Netherlands (NNN) and parts of the ‘never realised’ Ecological Main Structure

for nature, the food system and how and where we live. Moreover, this connects to the broadly felt sentiment amongst the Dutch population (Vogelbescherming Nederland 2020).

5.5 Business Case

At first sight, such a fundamental transition requires substantial investments. In line with the urgency for change and limit financial risks the National Bank of the Netherlands pledges for serious climate investments (Dijk et al. 2021), to realise climate objectives private investments are highly needed (Fingas 2021; McDonald 2021). New business cases are developed and make the transition of current agricultural grounds to finance nature (Taskforce financiering landschap Nederland 2008) and urban green spaces, allowing for development of housing within reach (Paardekooper Overman et al. 2021). However, combining problems and connect solutions means that revenues in one sector can be made beneficial for a problem in another, the bonus of approaching problems holistically (Natuurrijk Nederland 2020). A budget-neutral transformation of the Netherlands, solving the housing problem, the climate and nitrogen crisis and the biodiversity loss at once, is within reach if new housing can be developed on mere 4% (or 1.2 million hectares) of the agricultural area that is planned to be turned into nature (Table 5.1). With the pressing problems at our doorstep, this is the moment rusty habits can turn fluid and elude a jump forward.

To transform 1.2 million hectares of agricultural land to forest and nature demands the willingness of landowners, and they will only be willing to move along if the financial compensation is generous. Because all are at the cause of the climate crisis, it is no more than reasonable to offer farmers an ungrudging arrangement should they be willing to transform their land. The estimated costs for a large-scale transformation are approximately 99 billion euro (Table 5.2). This can be covered by the relatively small transition of agricultural land into housing development, managed by the (national) government, which buys the land from the farmers and landowners, turns it into nature and housing developments and sells the lands with the added value due to housing development.

The buyout of farmers can only be successful if the price is attractive and generous. Therefore, the price paid to farmers is the current local market price with a premium of 40%. For an averagely priced hectare of 65,000 euro the former will be offered 91,000 euro, this is the premium price (Table 5.2). For instance, a cattle famer with 50 hectares of land will receive the market value (50 × 65,000) of 4.55 million euros and the premium of 40%, 1.3 million euros. This buyout offers the farmer to pay his debts of mortgage and pension allowance, and the opportunity to transform his business in, for instance, nature or forestry.

Table 5.1 Proposed transformation in land-use in the Nature-rich Netherlands plan

Current land use in the Netherlands (source: CBS 2015)

	Hectares	%	Value/ha (euro)	Total value (billion Eur)
Total area of the Netherlands	3,367,098	100%		
Built-up/semi built-up	410,844	12.2%	2,600,000	1068
Recreation	105,418	3.1%		
Traffic/infrastructure	115,563	3.4%		
Agriculture	2,236,317	66.4%	65,000	145
Forest and nature	948,056	14.8%	15,000	7

Proposed land use according to Nature-rich Netherlands

	Change to current	Hectares	%	Value/ha (euro)	Total value (billion Eur)
Total area of the Netherlands	0	3,367,098	100%		
Built-up/semi built-up	50,000	460,844	13.7%	2,600,000	1198
Recreation	0	105,418	3.1%		
Traffic/infrastructure	0	115,563	3.4%		
Agriculture	−1,235,000	1,001,317	29.7%	65,000	65
Forest and nature	1,185,000	1,683,956	50.0%	15,000	25

Table 5.2 Estimated costs of the transformation

Costs for compensation	
Total hectares to be turned into nature	1,235,000
Average price per hectare (EUR)	65,000
Percentage above market value, when bought out	40%
Price per hectare (buyout) (max EUR)	140% of 65,000: 91,000
60% of premium price, subsidy to landowners (EUR)	60% × 91,000: 54,600
50% of premium price, subsidy to farmers (EUR)	50% × 91,000: 45,500
Max costs if 100% is bought out, the premium price (billion EUR)	112
Max costs if 100% is subsidised to landowners (billion EUR)	67
Max costs if 100% is subsidised to farmers (billion EUR)	56
Costs of realising nature (EUR per hectare)	12,500
Total costs of realising nature (billion EUR)	15
Total maximum costs (billion EUR)	112 + 15: 127
Total minimum costs (billion EUR)	56 + 15: 71
Total costs, average (billion EUR)	99

If the farmer doesn't want to sell his land, he can receive a subsidy (50% of the premium price) if he chooses to transition to nature-inclusive circular agriculture. In turn he will give a small part of his land to the government for developing housing. The amount of land he must transfer depends on the amount of subsidy divided by the average price of building grounds (2,600,000 euro). For instance, a famer who wants to change to a nature-inclusive cropping receives 2275 million Euro (50% of 91,000 Euro × 50 hectares) subsidy. He will then need to transfer 2275,000/2,600,000 = 0,875 hectare to the government. The remaining area of 49,125 hectares he keeps and will practice nature-inclusive cropping.

The total costs to transform 1.2 million hectares of agricultural land to nature and/or nature-inclusive agriculture will cost between 112 and 56 billion Euro (Table 5.2). The costs of realising nature on these grounds will additionally be 15 billion Euro. The average (a 50/50 divide between buy-out and subsidy) will cost 99 billion Euro. This can be financed by turning 4% of the bought or subsidised land in housing area. This is only 50,000 hectare or 1.5% of the total area of the Netherlands. The value gain of these hectares from 65,000 to 2.6 million Euro per hectare (minus 400,000 Euro for site preparation) can easily cover the costs of the transition: 2,135,000 Euro × 50,000 hectares = 106.75 billion Euro (Table 5.3). Even if the average value of housing land drops a little this will be sufficient to pay for transitioning 50% of the Netherlands to nature (Table 5.3).

There will be additional revenues not covered in the business case, such as taxes on housing development and forestry-industries. Health and environmental benefits resulting from the transitioning of agricultural land to nature is estimated at 5 billion Euro per annum. This high-level calculation illustrates the potential and viability of the vision can be realistic. However, it requires local and regional finetuning and tailor-made propositions for individuals and/or groups of farmers and landowners.

Table 5.3 Expected revenues and net result

Potential revenues	
4% of area developed as housing (hectares)	50,000
Average value of development land (EUR per hectare)	2,600,000
Average cost of site preparation (EUR per hectare)	400,000
Total revenue (billion EUR)	106.75
Net revenue with average costs (billion EUR)	7.75

5.6 Key Choices for Nature, Food, and Housing

As mentioned above, the fundamental transition of the Netherlands will start by putting nature at the core of the change, therefore the first choices are proposed to establish nature in a major part of the country up till 50% of the total land area. Given this context choices are made to fit an adjusted food supply system in, within which the choices for additional housing are subsequently made.

5.6.1 Nature

To increase the amount of nature from the smallest ecologies such as insects (Natuurmonumenten 2021) and bees (Pinto-Rodrigues 2021) to entire eco-landscape systems, several key choices will have to be made. Water has always been essential to shaping the Netherlands, but in recent decades human influence has minimized the natural thriving force of the water. When water is given the space to freely shape the landscape again, nature will emerge along rivers and streams, and in regenreated peat areas (Fig. 5.7).

Space for Water Courses

Embracing the water as a harmonious counterpart of human life implies allowing it in the environment. Water then forms and transforms the landscape. Instead of treating water as a machinery, controlling it, and discharging it away from people, the power of the water in forming a resilient and biodiverse system is cherished so it strengthens the capacity of the landscape to cope with unforeseen shocks and risks. The coast for instance can become much more resilient when water is given the space inland to regulate higher sea levels, cope with larger amounts and allow to enter unprecedented places to where its influence reaches, and to establish responsive natural gradients.

The variety in long dry spells interluded by heavy rainfall events is exaggerating. For the Dutch countryside this means the traditional conditions for agriculture, being a constant groundwater level, and swift discharge of surplus rainwater, can no longer be guaranteed. As a matter of fact, this system is counterproductive for long-term resilience of the landscape, as it causes soil subsidence and peat oxidation.

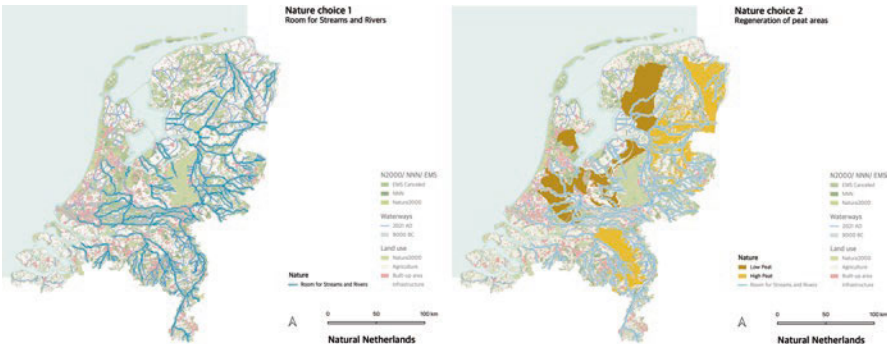

Fig. 5.7 Choices for nature: space for rivers and streams, and regeneration of peat areas

Water shortages at one side impact nature, cattle, people, and crops, on the other side floods cause risks for harvests, livelihoods, and survival of nature. The choice here is to increase the capacity of watersheds to store and keep water in the system. When rivers and stream are re-meandered water is slowed down, becomes available in drier periods, and will not harm cities and farms. The nature in these riverbeds will hold more water as it uses it to grow and to establish a biodiverse natural system.

Regenerating Peat Landscapes

Large parts of the Netherlands have long been peat- and raised bogs. These landscapes were able to regulate the water saturation of the land. Nowadays these areas have been reclaimed and the water is managed out of it. However, given the current water problems, loss of biodiversity and carbon emissions, regenerating a stagnant water landscape could regain the growth of peat and hold large amounts of water when designed like sponges (Baldwin 2021). Raising the water level supports the regeneration of the peat landscapes, whilst capturing large amounts of carbon and increasing biodiversity (Innovatieprogramma veen n.d.). These landscapes are unsuitable for traditional cattle but can be maintained through extensive grazing, however their cultural values can be restored (Historic England 2021) and can play a role in improving mental wellbeing (Maund et al. 2019).

Enriching a Varied Forest Landscape

High-lying landscapes with sandy soils are increasingly suffering from droughts. The types of forest in these landscapes were planted for production and industrial use, mainly consisting of fast-growing coniferous species. Currently these forests are old and full-grown, which means they need quite some water to survive, which is more and more difficult given the drop in groundwater levels, and decreasingly capture carbon (Schelhaas et al. 2017). Therefore, transforming these forests into mixed or deciduous forests alternating with open grassy lands with heather, shrub, and flower- and herb fields, where water can infiltrate (De Niet et al. 2021). When older forest patches are replanted by young, carbon capturing trees (Hoffman 2009) compensating for nitrogen deposition (Siepman 2018a, b; Schuttenhelm 2021a, b), the water balance is reset, the biodiversity is increased, and the worn-out sandy landscape is brought back to live.

Apart from replanting existing forests, a doubling of the forest area is projected (Stichting Probos n.d.; Vermeulen et al. 2019 IPO en Ministerie van LNV 2020b). These new forests are both useful for growing timber, to add nature and biodiversity, and to create new space for people to wander, exercise or cycle. To certain extent forests offer space for living (Spijkerman et al. 2021) and new types of food growth, such as food-forests, agroforestry (Van Dinther 2021b), and free-range cattle. Each landscape type requires a specific forest type. Forest is planted (Fig. 5.8):

– Connected to existing forests, reforestation, and enriching nature values
– In the 'non-realised ecological main structure'
– Where people do not appreciate the current landscape, in the northeast of Groningen, northern North-Holland, parts of the Flevoland polders and Zeeland
– Along newly grown peat areas (BIJ12 n.d.): 'rabat'- and 'broek'forests (Poels et al. 2000), such as alder breeches in the Randstad, the western part of the Gelderland Valley, southwest of Friesland, and the former Peat Colonies (Burdis et al. 2021; Bureau Peter de Ruyter 2020).
– At the inside edges of the dunes to provide cooling and prevent dehydration of the land
– In the floodplains of rivers and streams (Poels et al. 2000) with riparian forests and alder breeches
– Near people, close to urban areas, where forests offer recreation space.

The Randstad is the most dense and urbanised area in the country. Here an addition of urban forests as garlands (Fig. 5.9) could skirt the current urban settlements, offering a green and healthy alternative for the stressful and unhealthy lives of many urban dwellers (Enthoven et al. 2018; Enthoven and Groot n.d.). These urban garlands are a park-like zone full of diverse nature, consisting of forests, water-rich polders, food-forests, and new urban nurseries, where people can recreate and grow their own food. The new nature is rich and cleanses the air for a healthier urban environment.

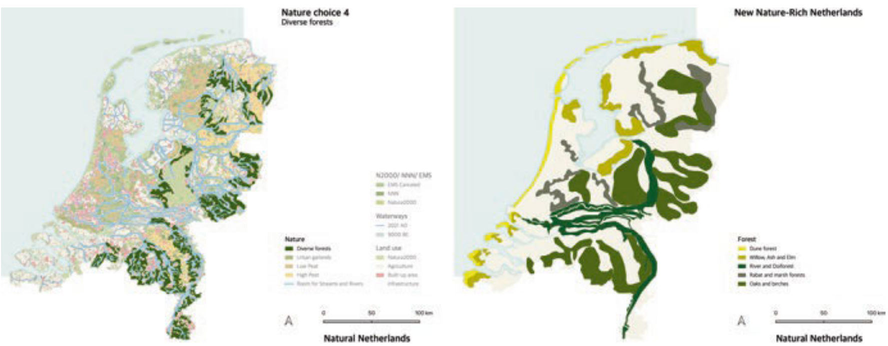

Fig. 5.8 Reforestation of the Netherlands: replanting higher sandy forests and adding a typology of new forests

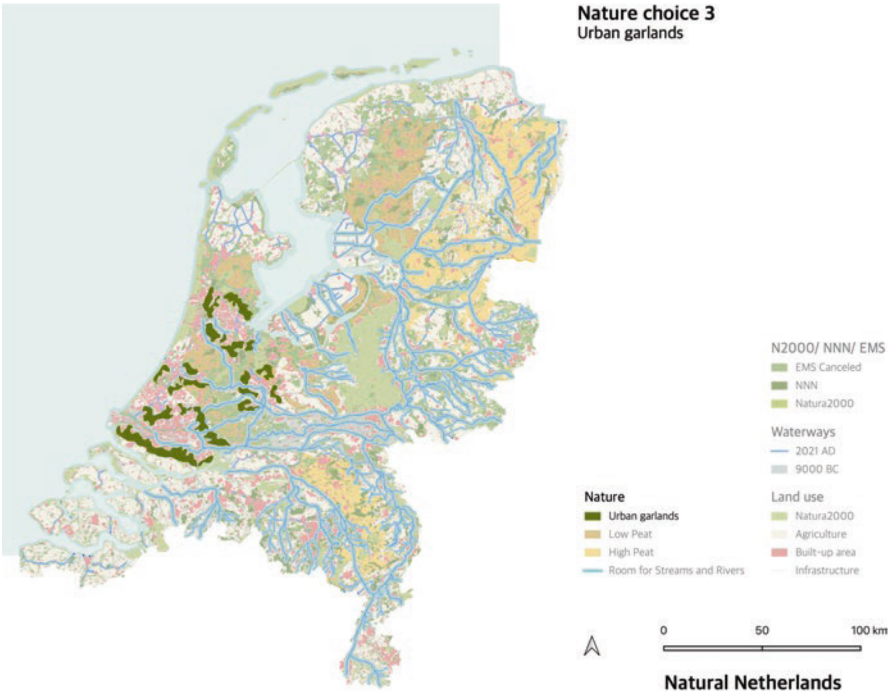

Fig. 5.9 Urban garlands

5.6.2 Food

A food supply that fits the ambition to regenerate the country with nature should emphasise the quality of the food rather than the export quantity. A food system that contributes to biodiversity will look different from the current monocultures and leads to a more (bio)diverse landscape (Pascoe 2021). The distinction between where nature belongs and where agriculture is no longer valid and will be replaced by a system in which more space is available for raising well-treated animals, and crops that are grown for human consumption rather than as feedstock and grassland to dump liquid manure. The farm gets reintegrated with its natural environment: nature-inclusive farming (IPO, Natuurmonumenten, Staatsbosbeheer, LandschappenNL 2021; Provincie Gelderland 2021; RVO n.d., De Nieuwsbode 2021).

The most fertile grounds are used to grow most of the food. Strip- and mosaic cropping in clay soil areas, fruit crops in the large riverscapes, and saline crops along the coast (Fig. 5.10). Strip and mosaic cropping essentially grows different crops in strips and patches next to each other. The rigorous diversity of crops makes the soil more resilient and able to regenerate which, on the longer term could raise productivity, feasibility, biodiversity, and landscape quality. The fertile clay soils along the large rivers are very suited for fruit cropping. The crops will benefit from extensive chicken farming, adding their manure to the fruit trees, whilst living better lives and deliver better meat and eggs.

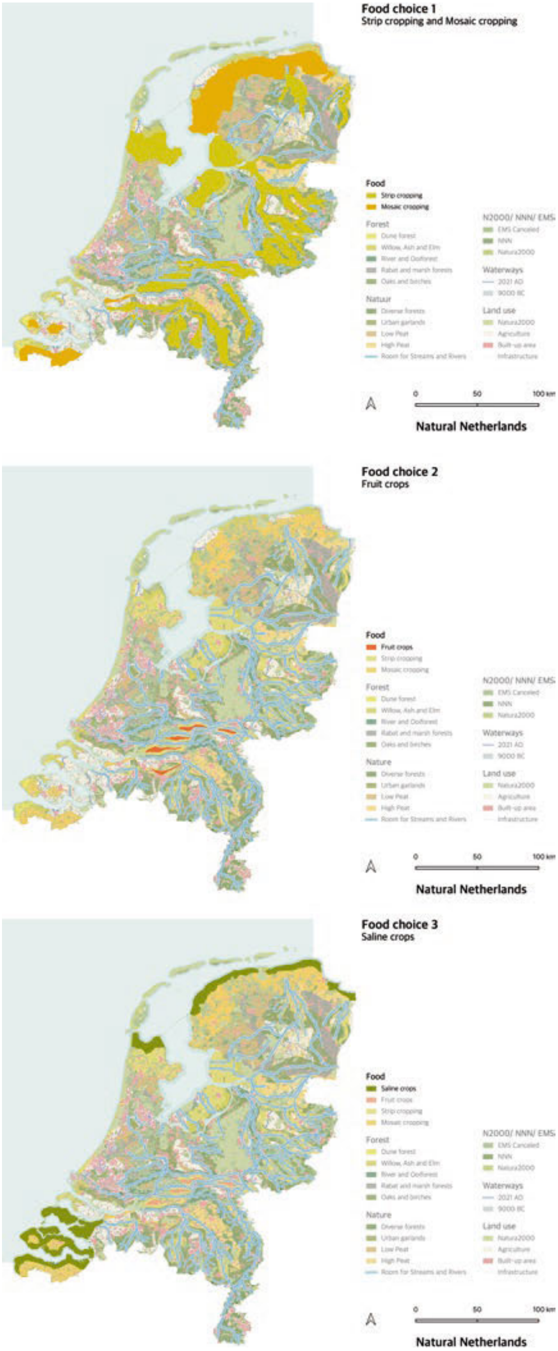

Fig. 5.10 Strip- and mosaic cropping, fruit crops, and saline crops

The coastal zones will salinize due to increasing sea levels which makes it increasingly impossible to grow traditional crops here. Salt-tolerant varieties of traditional crops such as potatoes or carrots and crops specifically suited for saline conditions, such as samphire or sea kale are the future in these areas.

The less fertile grounds can be made productive in a more extensive way, using forests for free range cattle, or create space for extensive grazing cattle along streams and rivers (Fig. 5.11).

In newly developed forest areas forestry can be combined with extensive cattle farming. The chickens, pigs and cows can wander around freely and undisturbed, searching for food and in return contribute their manure to the mineral balance of the soil. This extensive way of keeping animals is economically feasible because the meet is of higher quality hence is more expensive while the costs for the farmer (lower maintenance and less expensive feedstock) are lower.

The space created in the floodplains is suitable for extensive grazing. The quality of the food for the cattle adds manure in balance with the soil hence varied and flowery pastures emerge which, on their turn, form quality food for the animals. The quality of the milk is better, and revenues rise because of the lower costs and higher profits.

Some components of the food system have come loose of the soil and local context. These fully controlled environments are industries rather than farms. These intensive food fabrics, pig- and 'glassports' are concentrated where logistics can be optimized and the environmental impact limited, such as the greenhouses in the Westland area, or bundled pig farming near Eindhoven Airport.

5.6.3 Housing

New nature and a novel food system create specific local conditions for attractive living. The shortage of affordable sustainable housing in the Netherlands is approximately 1 million (De Geus 2021), until 2050 and can be accommodated by offering a range of appealing green environments (Stuiver and Vredeveld 2021). These newly created environments detract the focus on building within existing cities

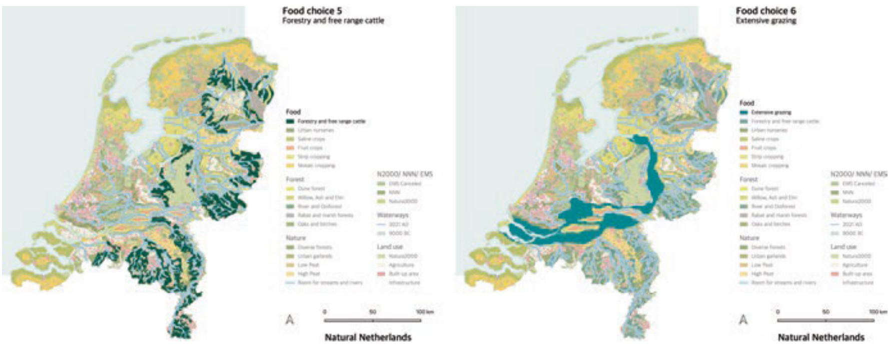

Fig. 5.11 Free range cattle in forests and extansive grazing along streams

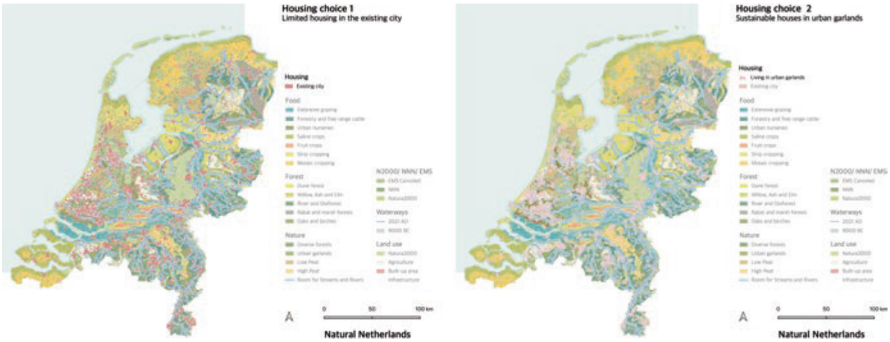

Fig. 5.12 Limited housing in existing cities and low-density sustainable housing in urban garlands

towards a mix of places in urban, peri-urban, and rural landscapes. Most people seeking a place to live do not favour a small urban setting, which generally is also the more expensive option. Currently though, this seems the only option, if at all (Kip and De Wilde 2021).

A limited amount of new housing is added in current urban centres (Fig. 5.12), for young urban professionals who seek such a lively inner-city environment. Additional housing can also improve the quality of the traditionally problematic neighbourhoods by adding affordable quality housing supportive of people with low incomes. Building large new neighbourhoods close to the bigger cities in the Randstad is not planned because these lowest lying areas are subsiding and are at risk of flooding when sea level is rising. Here water requires more space not less, and a natural watery environment is preferred to create safety and a green healthy environment for the urban dwellers.

Within the urban garlands, and in a balanced mix with nature, water conservation and the growth of food, incidental housing can be developed (Fig. 5.12). New housing concepts, in harmony with nature and off grid, build with timber, straw, loam and hemp could contribute to biodiversity and circularity. These tiny houses do not require infrastructure and mobility can be kept to a minimum: the distance to the city is bikeable.

The higher landscapes of the south and east are relatively safe for sea level rise. However, these areas are at risk of sudden intense rainfall and should be designed with this in mind: creating spaces for large amounts of water, storage basins which provide enough water to the growth of food and nature conservation in longer dry periods. These neighbourhoods are regenerative as they return more resources (infiltration of water, added biodiversity, capturing carbon and nitrogen, a large enough support to keep viable amenities such as shops schools and sports clubs, and improve human health) to the surroundings than they extract. The largest contribution these new neighbourhoods, between 10,000 and 15,000 inhabitants large, can bring to midsized towns that suffer from decline (Fig. 5.13). There are many of these in the eastern and southern parts of the Netherlands; Sittard, Weert, Venray, Oss, Boxmeer, Elst, Doetinchem, Deventer, Almelo, Meppel, Hoogeveen, Assen, Hoogezand, to name a few. The recent trend to structurally work from home and travel only when needed makes these locations attractive for many people, provided these are connected through fast public transport, such as regional fast trains and light rail systems. Moreover, the projected sites are interesting from an investment point of view as most of this land is relatively cheap and not yet obtained by project developers, or real estate companies. The construction costs in landscapes with these sandy soils are much lower than in the wet and swampy Randstad, where building new towns is highly controversial (Hendriks 2021; Weijts 2021; Beijer and Leeflang 2021), the affordability of the housing is therefore better and surrounded by green and (new) nature the environment meets the desires of many people. In 30-odd of these mid-sized towns a total of 300,000 to 450,000 houses can be developed.

In addition to these regenerative neighbourhoods the new forests in these areas offer another opportunity to integrate living with nature. The park-like landscapes form the backdrop for new collective estates (Fig. 5.13), in which several families and households can live together (Erfdelen n.d.; Kollebergboeren n.d.; Van Dinther 2021c). These estates are built in circular and self-sufficiently. By building these estates where streams well up they can capture rainwater, reuse, and recycle this and let it infiltrate in the soil. This way, the estates contribute to mitigating the drying out of the land.

In the floodplains space for nature and the growth of food is prime, but in small amounts these areas are suitable for spectacular living with the dynamics of the water, on poles or floating. These houses are connected to nature, follow the water levels, and are built sustainably (Table 5.4).

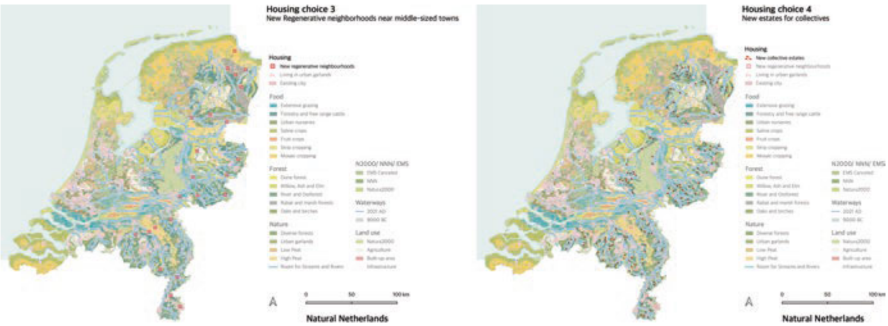

Fig. 5.13 Regenerative neighbourhoods and new collectives in the higher parts of the country

Table 5.4 Estimated number of houses in different landscape environments

Housing typology	Number of houses estimated
Within existing cities	250,000
In urban garlands	75,000
Regenerative neighbourhoods	450,000
New collective estates	175,000
Floating/on poles	50,000
Total	1,000,000

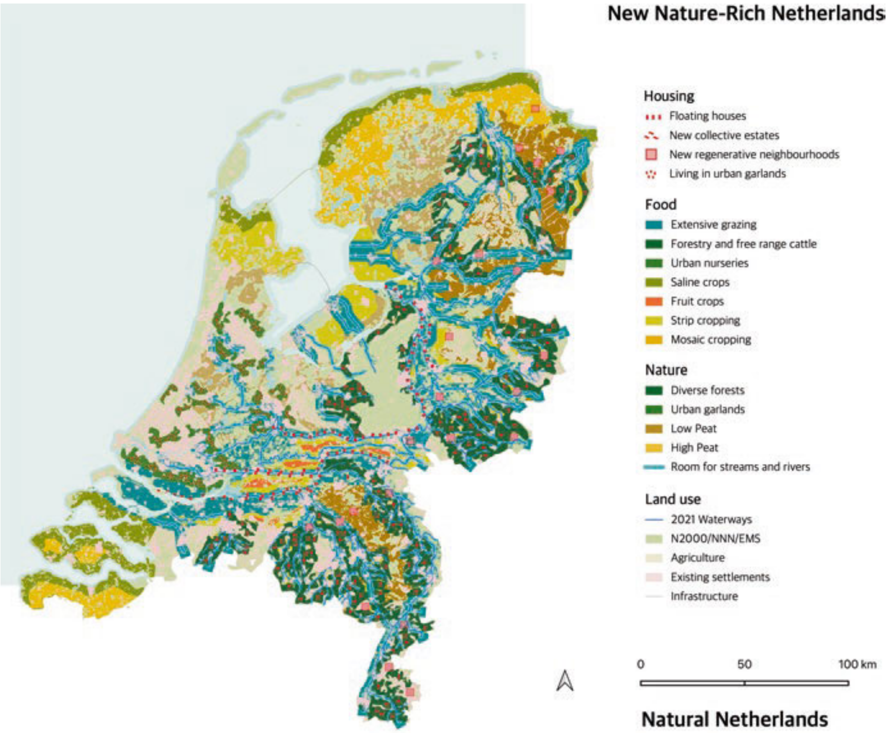

Fig. 5.14 A new Nature-rich Netherlands

The choices for nature, food system and the way people live within these contexts are connected and integrated to form one whole, strengthening each other, and enhancing synergies. The housing problem is solved by providing a solution to marginalised agriculture, which due to this solves its nitrogen emission problem by increasing the amount of nature, which collectively captures carbon, mitigates climate change, and provides health and resilience to its inhabitants. This balanced proposition can be afforded at national scale making a small profit, but not at the expense of the state government or taxpayer. A new Nature-rich Netherlands is an attractive image (Fig. 5.14) but requires coherent and collaborative action to execute.

5.7 Implementation

The large scale of the plan for a new Nature-rich country requires coordinated execution and the will and urgency to act aligned. In general, this is not easy. However, the claim future generation lie on the current people in charge of future policies is pressing. Groups such as Youth for Climate (Jonge Klimaatbeweging 2021; NOS 2020), The Urgenda arrest (NJCM 2019), the many questions asked to politicians what they have done to 'save the planet' become more and more manifest. The question how future generations will judge if current generations did enough, knowing the climate and biodiversity crises, to safeguard the quality of life for future generations of people and nature alike? Or will future generations have to conclude the current people in power did not undertake any action in a time the financial resources were abundant, and, for instance interest rates are close to zero or negative? Why, will they ask, was there inaction, why have former generations not stopped climate change and biodiversity loss? Will they be right in blaming the current generation?

There is a large common feeling time is closing in and the urgency to act is there. However, it also seems that within the common ambition individual differences are enlarged and people who all want to realise more nature confront each other. Instead, the communalities should be highlighted and magnified to start moving towards a regenerative country with an abundance of nature that provides the resilience to deal with shocks and awes. Some argue that the only way to safeguarding biodiversity and creating a climate resilient society is through legal action (AELA 2021) or giving nature juridical rights (Schouten 2021). Some find proof in the fact that despite being declared world heritage, natura 2000 and being part of the essential European nature conservancies, the Waddensea area is still subject to economic exploitation rather than putting natural qualities at the basis of every decision (Oudman 2021b). However, other non-legal pathways might prove more efficient. Several aspects can help to guide this movement.

Central Control, Decentralised Implementation

A fundamental transformation of spatial land use in the Netherlands requires a certain level of central control, preferably directed from one Ministry to integrally care for spatial planning, housing, climate, biodiversity, and the environment. It is therefore responsible for guidance on both design and the execution of the vision.

Central arrangements are needed because of the character of the vision. It cannot be predicted which of the farmers want to be bought out and where they live. It wouldn't make sense if the additional housing is bound to this coincidental area, as the demand could be somewhere else. This then requires a form of central planning, and the exchange of land so housing locations can be allocated where the demand is at a certain moment. For the government the implication is it must plan centrally but also implement the vision in a decentralised way. The central governance focuses on coordinating the planning of a new nature-rich Netherlands, and the realisation of the new nature according to the guiding principles, making an inventory who is interested to become part of the transition, coordinating land exchange, implements the buy-out and subsidy arrangements, and coordinates the issuance of building land, and the attached requirements regarding the typology, sustainability, and viability of the newly built homes.

The advantages of a centrally organized governance lie in fact that a coherent vision can be executed how the country looks like, according clearly defined guiding principles. The implementation however will for a large part be the responsibility of regional alliances and consortia of provinces, municipalities, industries, landowners, and citizens (Fiers 2020). This makes the new nature owned by everyone.

Design a National Map with Guiding Principles
The process of designing the new map of the Netherlands, directed by the national government, forms the spatial framework for regional elaborations. However, these are bound to the transformative principles defined at the national level, such as what an acceptable way of building houses in new nature, in which way (financial) exchange of bought-up land can be transformed to building houses in other regions and how a swift change of land-use can be established. The new national map and accompanying guiding principles are the basis for practical regional and local implementation.

Start with Government-Owned Land
Approximately one third of the land in the Netherlands is owned by government, national, regional, local and by waterboards. The government can take the collective responsibility for the collective future and use the land it owns for the realization of nature, new circular ad nature-inclusive agriculture and housing at crucial locations. One of the options is to declare land a common good, owned by all people (Soudagar 2021; Maarhuis 2020). The other possibility is the government itself starts the change using the grounds it owns. This way the government can take the initiative to tackle the biodiversity, climate, food, and housing crises at once. To show this to all entrepreneurs and creatives in the country, they will all feel such a large-scale transition is possible, desired, and supported so it makes sense to commit and contribute to the overall ambition.

5.8 Conclusion

The plan for a nature-rich Netherlands illustrates the need for holistic approaches to the problems that humankind faces. The impact of a single problem can often be solved by investing, but when several problems are considered simultaneously the revenues from solving one problem could be used to tackle the others. So can the housing problem be treated by allowing building in new nature while the profits can be used to create that new nature.

The vision for the Netherlands takes the historical landscape context as the point of departure, as the systems that formed the land are still the driving forces that make interventions logical and easier to implement. Water plays a crucial role and is essential for guiding the type of nature to merge in different landscape typologies. The plan for a nature-rich Netherlands proposes to increase the space for water and nature up to totally 50% of the countries area. Within that spatial framework the food system is integrated, contributing to the natural qualities, and increasing biodiversity. Only while respecting the nature and food systems new regenerative and sustainable houses are made possible on approximately 1.5% of the countries land. This nested planning of uses guarantees the dependency of human activities within the natural boundaries.

Moreover, the vision shows that such a holistic approach can almost quadruple biodiversity from 14% to 50%, may establish a circular, regional and nature-inclusive food supply that is economically beneficial for farmers, and is able to develop housing environments in the middle of nature and suited to the desires of many people seeking a place to live. When the agriculture is regenerative, and the building materials locally sourced and retrieved from nature, the regenerative capacity of forests and nature can be used to deal with the largest crises humankind faces: biodiversity loss and climate change.

The business case requires the development of housing on 4% of the bought-up farmland (eg. 1.5% of the entire country), to break even. In turn, half of the country becomes a nature-rich environment, supporting the health and wellbeing of all inhabitants, providing clean air and water, capturing carbon, and solving nitrogen problems. Because this is such a firm transition, central governance is needed to guide the process of planning, the permission required for land-use change and establishing land-exchange and financial arrangements.

The power of the vision is large, and meets the urgency currently felt in society. The first and most useful step is for the (central) government to lead by example and take the initiative to transform its own lands to nature, forests, nature-inclusive farming, and a small portion of housing.

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Chapter 6
Design for Regeneration – A Nature-Based Future Perspective on Cities

Bertram de Rooij and Tim van Hattum

Abstract In a rapidly urbanizing world climate change and biodiversity loss are amongst the biggest risks for societies across the globe. In its annual global risks report the World Economic Forum defines these topics as the risks with the largest likelihood and impact for the global economy. A call for action is widely acknowledged, but the way forward and action perspectives are not always clear. These major topics are often placed at the same level compared to other emerging issues and transitions. Current planning practice shows a wide palette of actions, action-oriented programming and rethinking urban and rural design from different angles and perspectives: circular, smart, adaptive, nature inclusive or resilient. Unfortunately, this seldom ends up in a coherent planning strategy and integrated design for a circular, smart, adaptive, nature inclusive and resilient city. This is not unique to the urban tissue but is also common practice in rural areas. Additionally, urban and rural strategies are also still heavily disconnected, although clear relationships and interdependencies across social, economic and natural systems are eminent. Above all, the revaluation of green and blue in both urban and rural areas is moderately moving forward. But a radical rethinking, intertwining the natural basis in all our actions and perspectives as a solid fundament for a sustainable, resilient and prosperous future, is often missing. Do we see and understand the complete picture? Do we embrace diversity and complexity? And do we really envision an enabling future which combines a long-term perspective with dedicated short-term actions? How do we create a long-term vision for the future in the context of a short-term decision-making practice? Besides reducing negative impacts, a positive impact and future quality in the broadest sense should be enhanced.

In 2019, Wageningen University & Research published a future perspective entitled 'A nature-based perspective for the Netherlands in 2120', which soon got embraced throughout society, from high level policy makers, across sectors and most importantly also at the local level. In contrast to many other (sectoral)

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perspectives, it brought together all transitions and spatial challenges in one perspective with a clear message: No doom or gloom, but dream and green. In this vision nature-based solutions play a prominent role in dealing with climate and biodiversity challenges. An opportunistic total view as an invitation, puts the importance of the natural basis and its opportunities at the very forefront. This interlinks urban and rural challenges via the natural basis that doesn't stop at a formalized border and puts system(s) and design thinking upfront, to the next level. In this chapter we will dive more specifically in the perspective, but most of all bring the urge forward to rethink the meaning of the natural basis in urban challenges, beyond green blue veining. Last but not least, it is linked to clear design and system approaches towards common understanding, action perspectives and design practice.

Keywords Future · Nature-based solutions · Integrated design · Systems thinking · Transitions · Adaptation · Vision · Resilient cities

6.1 Introduction

Entering the decade of transitions, as some call the 2020s, the future perspective 'A nature-based future for the Netherlands in 2120' was published (Baptist et al. 2019). Soon it was widely taken up by national media and took a leap forward throughout society. The perspective envisions the Netherlands in the long term, taking biodiversity and climate change as key drivers and enablers but bringing it together in the full swing. This full perspective also places urban challenges and opportunities in a systemic view and urges to rethink the meaning of the natural basis in urban challenges.

In this chapter we will dive into the urban challenges and the way the vision for the Netherlands in 2120 provides inspiration to shift approaches and action perspectives from a framework that puts the natural system at the core again. Although not intentionally designed as an example for regenerative design, it shows the power of regenerative design and the role it can play to connect transformative pathways towards radical change.

The World Economic Forum highlights climate change and loss of biodiversity as the largest risk for the global economy in the next decades in their Global Risk Report (WEF 2021). The IPCC Special Report on the impacts of global warming concluded, that there is a very high risk that under current emissions trajectories and current national pledges global warming will exceed 1.5 °C above pre-industrial levels. In a 1.5 °C warmer world, climate change and climate change responses will affect people in countries at all levels of development. These risks are not evenly distributed across the globe and cities are extremely vulnerable for the impact of climate change. Coastal cities and urbanized deltas will be hardest hit, which will face rising seas, salinization of groundwater, extreme rainfall as well as droughts (IPCC 2018). This will have major impact on the urban context. Climate adaptation is key. The cost of adapting to climate change could hit $500 billion per year by 2050 (UNEP 2021).

Coastal cities will have to deal with increased risk for coastal flooding due to sea level rise. Increasing extreme weather events will impact cities by increased risks for flooding, droughts and heat waves. Current sewer systems are not designed for increased heavy rainfall or torrential rains and, combined with increased soils sealing, the risk for floods is already impacting many cities around the world. A two hour rain event in the city of Copenhagen caused one billion euro of damage in the city and put climate adaptation on top of the political agenda (Ziersen et al. 2017)). Climate change will not only increase the risk for floods. Another challenge is the increased risk for long periods of droughts. This will lead to serious water shortages for urban water supply. In 2018 the city of Cape Town almost reached day zero, the day that no water was available for over 4.1 million urban dwellers (City of Cape Town 2018). Cape town is dependent on one major reservoir that, due to 3 years of low rainfall, almost reached the bottom with only 10% of the capacity left when it luckily started raining again in spring 2018 (Pascale et al. 2020). These water-related problems are already challenging many cities around the world and climate change and increasing demand for water is putting these issues higher on the agenda of urban planners. Recent studies show that half a billion people already face severe water scarcity all year round (Mekonnen and Hoekstra 2016). One in four cities is already water stressed (McDonald and Shemie 2014). These cities and their hinterlands lack insufficient clean freshwater resources for sustainable water supply due to increased competition for water and alarming depletion and pollution of freshwater resources. Climate change and population growth will further increase the risk for water shortage in cities worldwide.

All these water-related challenges ask for a systemic approach and a paradigm shift in urban design and planning, including urban water management. Cities around the world need to rethink the way they deal with water and redesign cities towards water smart cities.

Urban heat is another climate related urban challenge. In many cities green space is transformed into concrete squares, building blocks and parking lanes. All the hard surfaces result in up to eight degrees Celsius warmer spaces than in the surrounding rural areas (Ward et al. 2016; Kleerekoper et al. 2012). Increased heat waves and air pollution will create serious health risks for the urban population that is growing fast. Europe experienced a hot and dry summer in 2003 that resulted in large number of heat-related death reported in France, Germany and Italy. Peer-reviewed analysis places the European death toll at more than 70,000 (Robine et al. 2008). The 2003 heat wave created awareness for the increasing risk and impact of climate related heat waves in cities.

Climate change and the speed of urbanization puts large pressure on the liveability of cities. Most cities around the world are developing fast with negative impact on human health and the environment. Currently, only 2% of the land surface is urban infrastructure. This is expected to increase towards 10% in 2050 (Angel et al. 2011; Seto et al. 2012; IRP 2018; Chen et al. 2020).

All these challenges require a new approach for urban development. The urgency for climate action in cities is the driver for a regenerative approach for redesigning cities. Incremental change is proven to be ineffective. Large scale implementation of nature-based solutions, water-smart technologies, retrofitting of buildings and developing climate positive and nature inclusive buildings and mobility is the only way forward. There is a strong need for a long-term perspective on urban development.

6.2 Designing a Nature-Based Future for the Netherlands in 2120

The Netherlands is an urbanized delta facing many challenges both in the urban and rural realm. As such, urban challenges cannot and may not be seen solemnly from an urban context but should be positioned in the full spatial spectrum.

The Netherlands has a rich tradition in planning and design. For over a century the country relied on a coordinated and clear planning strategy at three governmental levels and spatial scales. The last decades a trend towards decentralization of responsibilities for the spatial domain and increased focus on sectoral planning emerged (Claassens et al. 2020; Balz and Zonneveld 2018; van Straalen et al. 2016). Although many of the big challenges have been put on the agenda, a clear direction and coordination is lacking. Numerous plans and actions have been developed and undertaken at different levels, but clearly miss a shared perspective on how this all comes together. Moreover, a sectoral approach does not reveal or disclose potential synergies and frictions. A long-term planning strategy is needed to face the challenges of the twenty-first century.

The 2120-vision for the future of The Netherlands was well received by society and high-level policy makers, across sectors and most importantly also at the local level. From all sides it is acknowledged that this kind of long-term visions, as a general direction, has been lacking as a point on the horizon.

In contrast to many other (sectoral) perspectives, it brought together many transitions and challenges in one perspective with a clear message. Nature-based solutions (NBS) play a prominent role in dealing with climate and biodiversity challenges (EEA 2021, Seddon et al. 2020). An opportunistic overall view is set out as an invitation and puts the importance of the natural basis and its opportunities at the very forefront. This interlinks urban and rural challenges via the natural basis that doesn't stop at a administrative borders and puts system(s) and design thinking upfront. In this vision NBS play a prominent role in dealing with climate and biodiversity challenges, but also form a strong reliable fundament for society and economy (GCEC 2016; Nesshöver et al. 2017).

6.2.1 Bringing Theory in Practice

To design a future perspective for the Netherlands in 2120 is highly ambitious. It aims to take nearly all major challenges into account and to simultaneously bring the different systems and their spatial appearances in line. Therefore, it is necessary to understand the full complexity and interactions of these systems, without getting lost and stuck in this complexity. At the beginning of the process, a flexible, creative approach was foreseen, combining sufficient knowledge about the most recent insights and actions across systems and regions from multiple knowledge fields with spatial, regional design capacity. Although much has been written on systems thinking, interdisciplinary approaches and design, actual practice shows the difficulty of bringing this to an appealing, understandable, and communicable, though substantiated result.

A broad and multidisciplinary group of experts were brought together. Everyone was well-informed on the actual policy and practice in their field of expertise, but also about the different relevant aspects of the natural, societal or economic system. This initial step sets the scene as an invitation to further discuss the long-term spatial challenges for The Netherlands. Even at this early stage, for all involved experienced this as an adventure to commonly search and investigate. It soon became clear such a process demands an open, iterative design process. Finally, the importance of building strong narratives and a solid communication style was placed at the very heart of the project. This valued not only the outcome and impact of the project, but also was highly supportive in the internal communication and discussions as the 'languages' of the different expert fields differs strongly. In the initial approach well-considered decisions were made to put nature-based thinking at the very heart to build strategic narratives and a valued vision.

6.2.2 Nature Based at the Very Heart

The vision builds on the 'wedding cake'-model (Fig. 6.1) presented by the Stockholm Resilience Institute (Stockholm Resilience Institute 2016), which arranges and ranks the Sustainable Development Goals. This model clearly shows the importance of the biosphere as the natural foundation for society and economy on the one hand and emphasizing its crucial interactions on the other hand. The wedding cake model highlights the importance of enhancing biodiversity, the availability of water and climate action as boundary conditions for all other sustainable development goals. It shows that nature should be at the core of future development, with full view on the interaction and interplay with the economic system and society. Although this provides a clear framework, the major challenge is to make this conceptual framework more concrete, recognizable, and imaginable. Therefore, it deserves to be elaborated in local circumstances and urgencies.

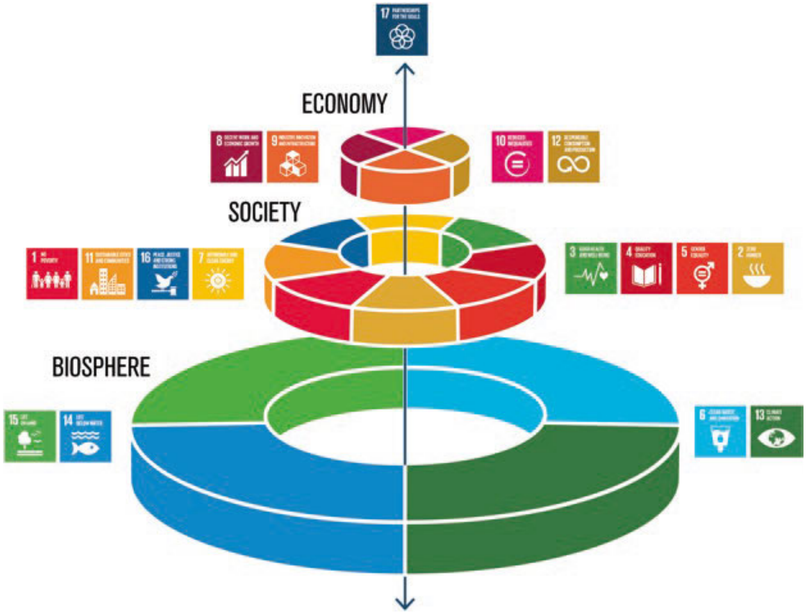

Fig. 6.1 Wedding cake model. (Stockholm Resilience Institute 2016)

NBS offer an important opportunity to bridge the gap between climate and biodiversity challenges and the sustainable development goals. However, large scale implementation of this concept is still lacking. Despite the concept of NBS is emerging and embraced more and more, it still demands for a clear definition, understanding and, above all, good, concrete examples. Although different definitions exist (Nesshöver et al. 2017), the definition from the EU Research and Innovation policy agenda is most suitable to characterize the way nature-based solutions are interpreted in the perspective of the Netherlands in 2120: *"…solutions that are inspired and supported by nature, which are cost-effective, simultaneously provide environmental, social and economic benefits and help build resilience. Such solutions bring more and more diverse, nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions*" (Faivre et al. 2017; European Commission 2016). To achieve these systemic interventions full understanding of these features and processes, as well the urgencies and challenges is needed. This requires a multi-scale approach and thinking beyond boundaries. Although this approach implies a full systemic understanding (of all systems involved) and the scientific underpinning of NBS is still to be investigated fully, appears to be fragmented and insufficient (Nesshöver et al. 2017), the proof of the pudding is in the doing and moving forward. By bringing NBS at the heart of a generic and adaptive vision, based on current insights and addressing the needs to know, it will also provide an agenda for further knowledge development, evidence-base and action research.

6.2.3 Strategic Narratives

Knowledge and (story)telling can be linked by strategic narratives. In recent decades many narratives on climate change and other societal and environmental challenges, have been negatively framed: they put emphasis on everything that is at risk and at stake. Most climate related narratives showcased the future we don't want or are afraid of. At the same time, clear alternative action perspectives as an alternative to bend this to the positive are lacking or limited to a single viewpoint or a narrow base (Lodder et al. 2014). To put society in the action perspective visualization of the future is needed.

In the EU Placard project which aimed at bringing the disaster risk reduction community and climate adaptation community closer together, the importance of the development of strategic narratives was further elaborated and provided worthful insights (Coninx et al. 2020a, b). Although these communities seem already somewhat in line with each other, practice shows there is a need to share knowledge and enhance collaboration. Besides levelling playing fields, improving knowledge management, and strengthening coordination and capacity, the value of strategic narratives was identified as a potentially promising approach. The lessons learned how to develop strategic narratives and make them important were used from the start in the development of the perspective for the Netherlands in 2120: "Well-constructed strategic narratives can help to overcome that deadlock by creating a momentum for joint action" (Coninx et al. 2018, 2020a, b). Constructing a strategic narrative of hope deals with language, taking into account different perspectives, angles and most importantly various motives, but most of all presents a positive message. A message that not only calls for action, but also paves the way for true action and change.

6.2.4 Imagination over Knowledge

To quote Einstein: "imagination is more important than knowledge". As scientists this may sound strange, but in the project, it soon became clear that a lot of sufficient knowledge and insights about the different systems, challenges and opportunities from different angles and viewpoints is readily available. However, all these insights do not come together, nor does it lead to a coherent, positive action perspective – not in an integrated way but even not sectoral. Therefore, the biggest challenge is not to deepen knowledge, but to bring it together and make clear, strategic choices. The natural foundation – or as Mang calls it the ecological and ecosystem perspective – provide a common "language" or set of frameworks that facilitates integrative approaches. In the same way Mang illuminates the importance of more comprehensive goals affecting multiple fields to stimulate more integrative and interdisciplinary approaches (Mang and Reed 2012). In summary, a common understanding of the natural system, the regional characteristics, and the opportunities it provides in a shared, positive perspective where multiple fields come together, will enhance the uptake of a true transformative pathway (Skilbeck et al. 2016). A variant of a scenario study was intentionally not chosen because many scenario studies already exist, and these generally keep a wide variety of choices open. Therefore, the choice was made to present one perspective, based on clear choices and intrinsic core values. Choices and core values that are often hidden in political and societal debates but are crucial to get to the next level: a full joint perspective with coherent actions and action perspective appealing and addressing to all. Due to the urgency of the problems, the time of experiments, incremental actions and limited uptake to a real systemic change is over. Reality has taken over. As the societal and political responses to the presented vision illustrate, to present this single vision worked out very well and was well received, almost as a flurry of illumination.

6.2.5 Methodology

The common search was divided in five clear steps: outlining the playing field and key assumptions, unravelling the natural foundation and regional differences together (Fig. 6.2), building coherent spatial strategies and translating this into a strong visualization and strategic narrative. Each of these steps will be explained and provide valuable insights derived from the process and choices made.

Fig. 6.2 Discovering the natural basis together. (Wageningen University & Research/Tim van Hattum)

1. *Outline of the playing field*

Normally, spatial planning has a strong focus on land territory. Recently, spatial planning focusing on sea territories emerges. Nevertheless, most of the time transitions are not only considered separately, but do also not consider the entire territory, land and water. In the context of the Netherlands in 2120 the playing field is set differently. By emphasizing both land and water, strategic choices were placed in a different light. For instance, the sea territory provides many opportunities both for food and energy that could alleviate the competition claims and felt pressure on land. Not just to 'throw it over the fence', but as a positive stimulus for the natural system at sea.

2. *Unravelling the natural foundation and regional differences*

The characteristics of the soil, water systems and the natural ecosystem are taken as the foundation to design the future of the Netherlands. The most fertile soils are most suitable for plant-based, regenerative agriculture. Peat lands are transformed into wetlands. Sandy soils located at higher elevation in the landscape are most suitable for reforestation and regenerative nature-inclusive agriculture. Future urbanization is projected as nature-inclusive and nature-based and located on the higher parts of the Netherlands in order to anticipate future sea level rise.

3. *Understanding complexity to build coherent spatial strategies*

In this step the group, consisting of completely different academic origins brought together their expertise and insights on the identified challenges each from their different angle. Complexity and interactions are defined at multiple scales, which on their turn again interact. From different angles, whether water, energy, or food, this led to a full perspective on the complexity, the interdependencies and potential feedback loops. But most importantly, every field of expertise is challenged to define it in the spatial context hence to make it location specific and potentially confronting with other insights. This led to a shared spatial strategy.

4. *Visualization*

Out of a sequence of design sessions a new map of the Netherlands in 2120 emerged. This nature-based future is presented as a new map, which was based on the different aspects of the natural basis. The aim is to visualize a greener, more sustainable future, at the same time addressing regional differences. The image should be imaginable without being fixed. The graphical style should compromise between used geodata and a designerly sketch.

5. *Narrative*

Together with the developing of the map a storyline about why, how, and what explains the narrative behind the Netherlands 2120. Formulating the narrative is time consuming and was undertaken as a team effort. Fundamental discussions took place, bringing forward the most confronting questions. Is the story balanced, well argued, concrete enough and still open? Is it understandable and appealing to the audience?

The vision for the Netherlands 2120 is the starting point for developing different transition pathways (Reinhardt et al. 2021; de Rooij et al. 2021; PBL 2021; ABDTOPConsult 2021; RLI 2020; Groot 2020; Ministry of the Interior and Kingdom Relations 2020) to align the different challenges. This is different from current practice in which individual pathways are often formulated in isolation eg. without a comprehensive long-term vision. “Vision without action is merely a dream, action without vision just passes the time’, to quote Joel A. Barker (1990). The overall vision is key but needs to kindle a follow up process towards concrete and flexible action perspectives for different regions, sectors, and stakeholders, so change can really be achieved. This follow-up process needs to embrace the combination of design and science and interlink NBS with a solid framework integrating ecology, economy, and society from different entry points at different scales. Nevertheless, the feedback loops from overall view to the tangible outcomes and back need to be always activated.

6.3 A Greener Future for the Netherlands in 2120

The Netherlands faces major challenges: the energy transition, the transition towards a sustainable agriculture, restoring biodiversity, increasing urbanization and climate adaptation. All these challenges have consequences for spatial planning. It is inevitable that, in one hundred years, the Netherlands looks very different. Major changes are inevitable be able to cope with rising sea levels, periods of extreme weather, an increasing demand for food production and a need to reduce greenhouse gas emissions. These challenges require a new narrative for the Netherlands.

The Netherlands has always been able to adapt effectively to climate changes, but the rapid increase in greenhouse gas emissions and global warming due to human activity are unprecedented. Sea level rise, an increase in extreme weather events and rising temperatures threaten the economy and wellbeing in the country. The vision for the Netherlands of 2120 (Fig. 6.3) specifies opportunities for the economy, biodiversity, and livability. In this new narrative for the Netherlands nature and natural processes are placed in the lead. The story is built on the themes of water management, energy, agriculture, circular economy, urbanization and biodiversity. By comprehensively approaching and analyzing developments in these areas, an environmentally positive, nature-inclusive solution can be achieved (Fig. 6.4).

6.3.1 Five Guiding Principles

For designing a nature-based perspective on the spatial future of the Netherlands five guiding principles are used:

Fig. 6.3 The Netherlands in 2120. (Wageningen University & Research 2019)

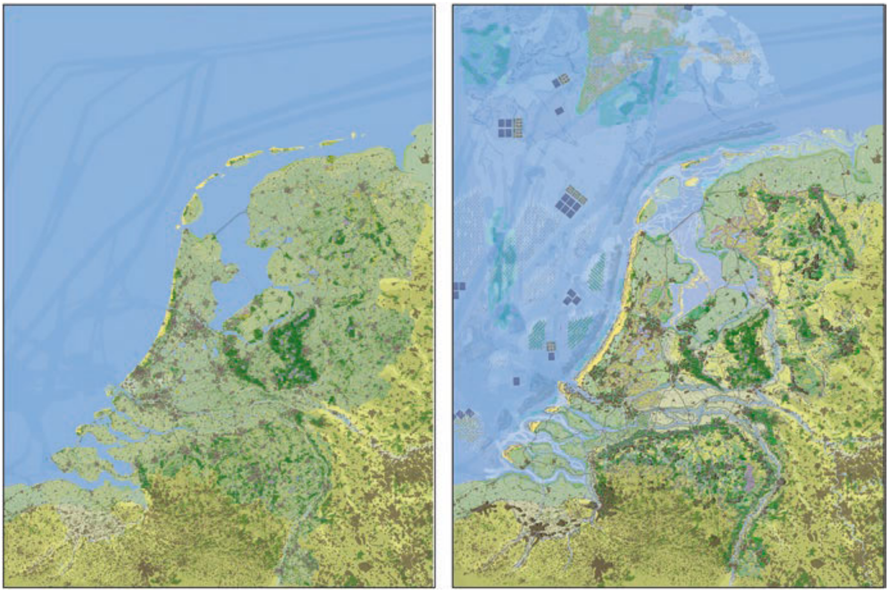

Fig. 6.4 A transformed Netherlands from 2020 towards 2120 highlighting the natural foundation. (Wageningen University & Research 2019)

1. The natural system is the point of departure

   The type of soil, the differences in elevation and the water systems in the Netherlands determine the future of spatial planning and development. The natural system is used to identify the solutions to realize a climate-proof and biologically diverse country.
2. Optimal use of water

   To enhance biodiversity and quality of the natural environment and to use every drop of water optimally, the water management system places maximal water retention first, followed by water storage and utilization before wastewater is disposed.
3. Nature-inclusive society

   Nature is considered when choices are made regarding the energy system, agriculture, circular economy, the quality of life, urbanization, and water management. The consequences human actions have for nature, the stricter protection of existing nature and stronger focus on natural processes, possibly in combination with technological solutions are central to the vision. New nature emerges by making optimal use of human benefits (ecosystem services) and working on ecological connections that help flora and fauna to shift their distribution.
4. Circular economy

   A more natural future for the Netherlands assumes that in 100 years the country will not only be climate neutral, but even climate positive, which means that more greenhouse gasses are captured than emitted. This requires a transition towards a circular economy centered on sustainability, with a focus on services and a highly evolved, circular agricultural sector on land and at sea in the form of aquaculture.

5. Adaptive spatial planning

   The required adaptations to the effects of climate change, the energy transition, further urbanization and increasing mobility led to major changes in the environment and biodiversity. To ensure a safe, livable, prosperous, and sustainable future, the Netherlands must adapt intelligently to nature and make optimal use of natural processes in spatial planning. Examples of solutions include the 'Building with Nature' approach to flood risk management.

By revaluation of the natural basis the regional differences come to the forefront. In the Netherlands in 2120 each region has a place-based set of challenges and opportunities, but also the functional relations between regions have been fully put into effect. Cherishing diversity, without getting seduced to lose the importance of the full view. These basic principles and the regional differences (Fig. 6.5) also have their effect on the urban perspective in the Netherlands in 2120.

6.3.2 The Urban Perspective

The Netherlands can be seen as one large metropole. Urban tissue and rural areas are always close and often interwoven. Nevertheless, urban, and rural strategies are seldom linked, and regional differences and place-based design are seldom at the heart of interventions in urban actions.

In the perspective for the Netherlands in 2120 existing urban areas are improved and connected to their direct surroundings. Here, a new urban strategy for future housing is foreseen, taking climate change and living conditions fully into account.

To increase resilience and livability of urban areas large scale implementation of NBS such as parks, green corridors, trees, and open water is required. The future design of cities is no longer dominated from a civil engineering perspective. The nature-based perspective will put the natural system and natural processes upfront in designing resilient and attractive cities to live and work.

NBS can be classified into no-tech, low-tech, and high-tech green, thereby supporting urban designers to better utilize the ability of these green elements to effectively manage water flows in different urban settings. Here, "no tech" green is considered traditional urban green, handling (rain) water like nature would. "Low-tech" green (e.g., extensive Sedum roofs) are suitable for dense urban settings with limited demand for water management and ecosystem services. More developed "high-tech" green solutions have vegetation performing even beyond natural capacities, offering full water management control options and enable city planners, architects, and landscape designers to enhance urban resilience and circularity without claiming valuable urban space (Snep et al. 2020).

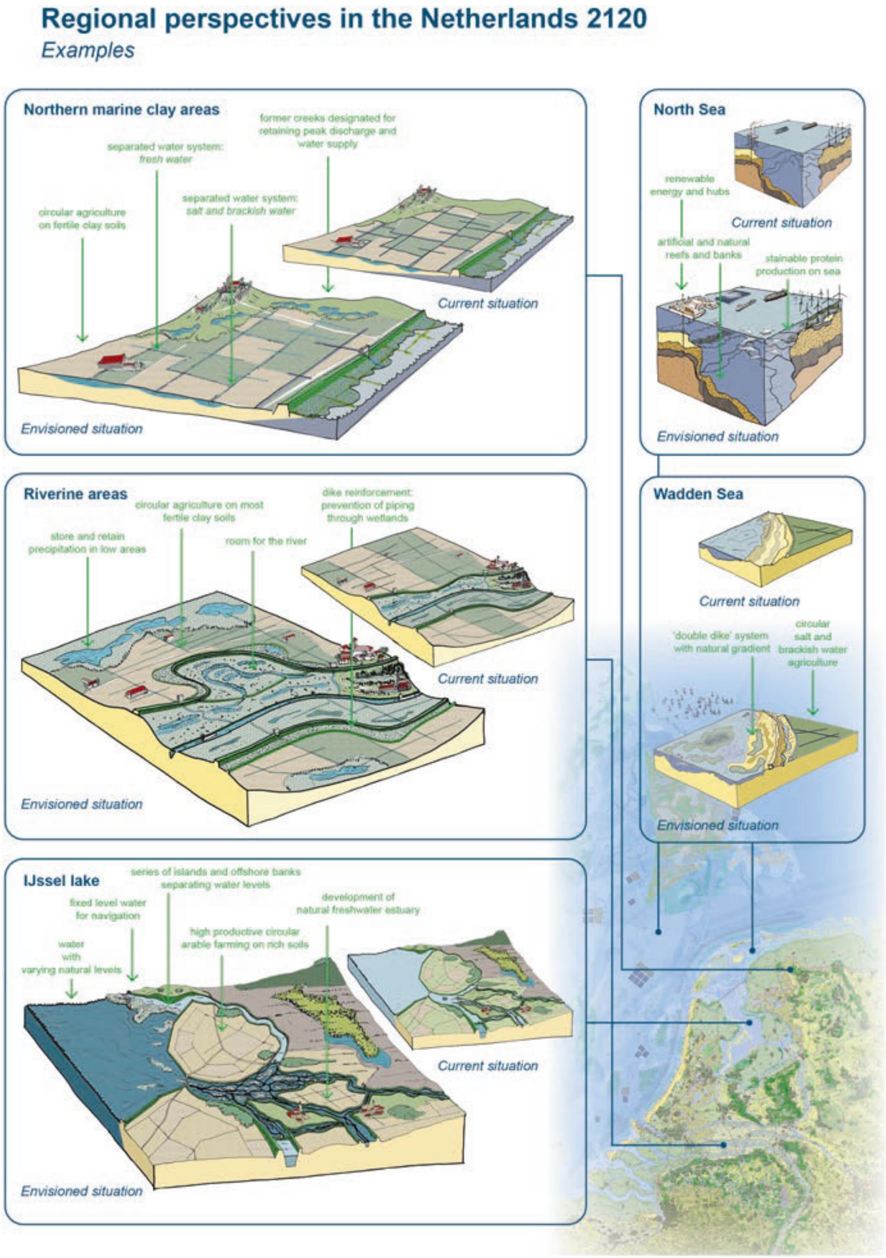

Fig. 6.5 Regional systemic perspectives. (Wageningen University & Research 2019)

The vision for The Netherlands 2120 visualizes how cities transform from grey and civil engineering dominated design into green and more organic cities. Peri-urban areas will provide low-tech NBS such as green belts of trees, wetlands or nature-inclusive agriculture and connect urban areas with their surroundings. Green corridors of climate resilient tree species through cities provide cool routes to walk and cycle while connecting the city center with urban districts. Large parts of cities become car free areas providing lots of space for urban green that helps to reduce urban heat and increase its sponge capacity. In more densely urbanized areas low-tech such open water will play an important role to improve urban wellbeing and resilient water management by daylighting rivers at large scale. High tech NBS such as smart blue-green roofs and walls, underground water storage and re-use systems contribute to circular water systems. Cities become climate positive. Buildings will become energy positive and nature inclusive. Timber construction will be dominant with lots of green in and around cities.

New economic centers are no longer developed in the western part of the Netherlands only. To anticipate future sea level rise urban growth is slowly moved towards the higher elevated sandy soils in the eastern and southern part of the country. These new urban and economic areas will be nature-inclusive from the initial design (Fig. 6.6). Nevertheless, the Randstad remains a focal point for economic and societal development. This is due to the importance of the region as a port and as center of governance, expertise, and logistics.

Rethinking the urban perspective deals with rethinking its boundaries (regional approach or city region approach), rethinking systems thinking and design approaches and re-rooting the urban tissue.

Rethinking the boundaries places the urban area in its context embedded in its natural foundation. In this regard, the city-region food system (CRFS) approach (Fig. 6.7) developed by FAO and RUAF is emerging as an important spatial approach (de Rooij et al. 2020). These approaches bring the food system back into spatial planning, but also clearly link the rural surroundings with the urban tissue, each containing their specific challenges, but also with their common challenges, dependencies, and shared opportunities (Fig. 6.8). These kinds of approaches are valuable for all systems. Additionally, this landscape-based approach is also worth mentioning for different other relevant themes, for instance in concepts like water smart cities in which urban perspectives are also linked to the broader context (Fig. 6.9) (van Hattum et al. 2016).

However, in practice rural and urban systems are often decoupled. As such, the focus is on one immediate problem located in one specific place, while the solution might be found in the broader perspective. For instance, trying to solve urban soil subsidence in peat areas by constantly acting on the direct hinder often fails because a strategic solution is more sustainable though different water management in the adjacent rural areas and water system. As such, the urban perspective shall be placed in a regional perspective, as systems do not stop at administrative boundaries.

Many current interventions in urban areas also show a sectoral, thematic, incremental, and often technical or ‘semi-natural’ approach, similar to the way problems in rural areas are enacted. As such, linkages between systems and related

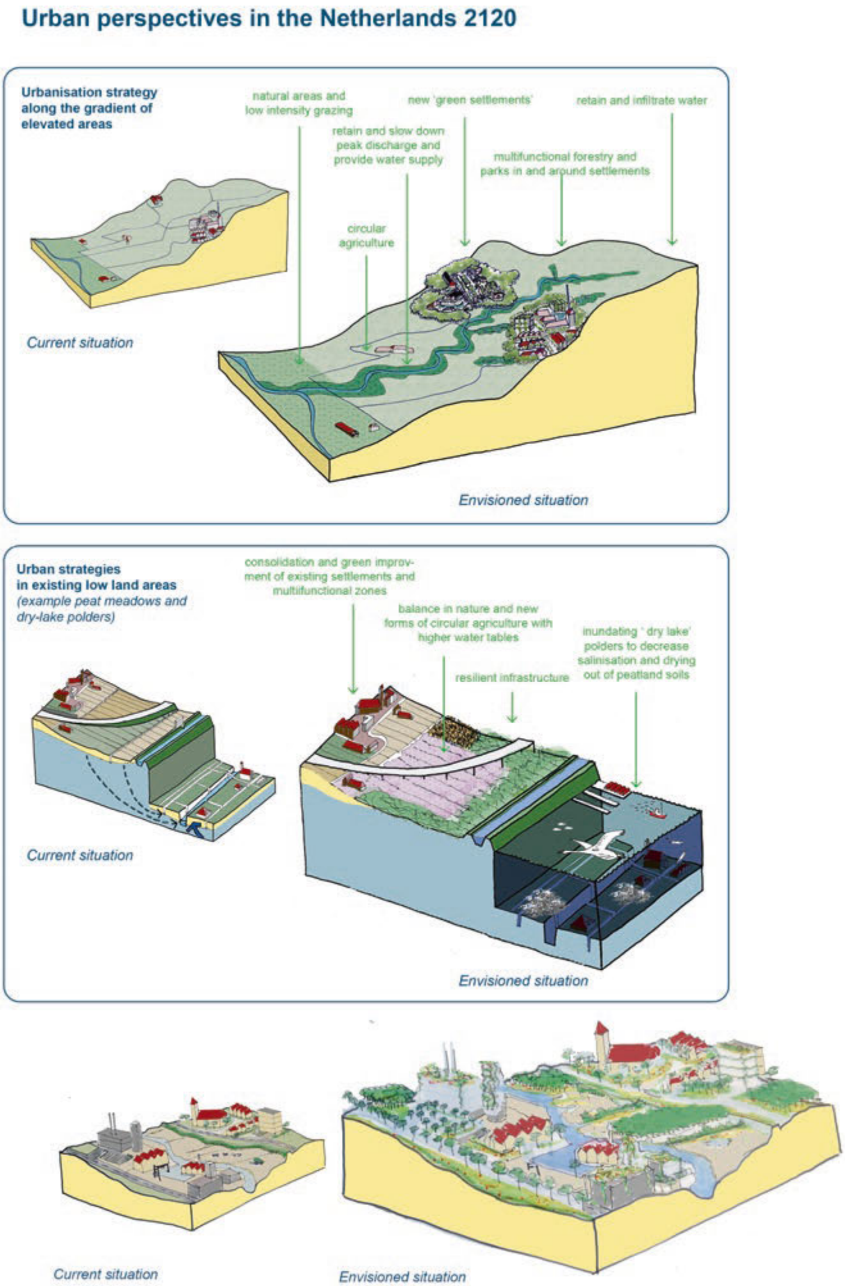

Fig. 6.6 New urbanization principles in the Netherlands 2120. (Wageningen University & Research 2019)

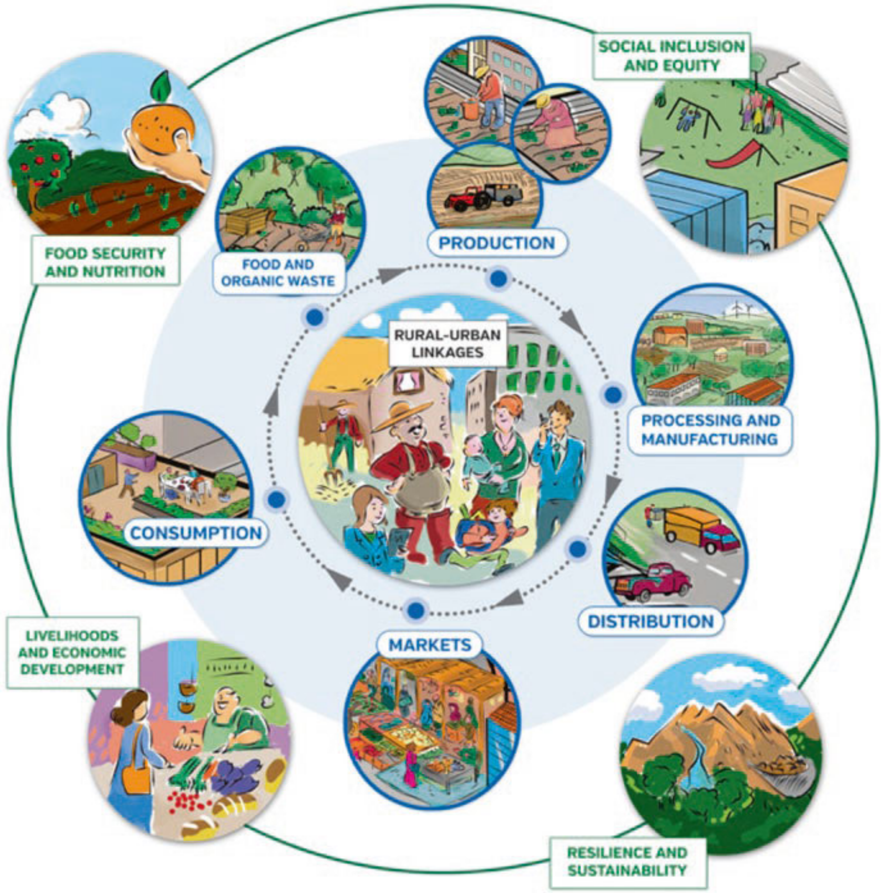

Fig. 6.7 City region food systems. (FAO/RUAF 2016)

opportunities are overlooked, leading to forms of 'green washing' and scattered green initiatives.

The concepts of landscape-based adaptation (Visser et al. 2019) and urban landscape adaptation, together with full systemic understanding of urban systems and the systemic linkages with the rural surroundings and systems provides a design framework that could bring the diversity in green open spaces and the green blue infrastructure to the next level. Landscape-based adaptation brings the natural basis back in urban areas. In 'Redesigning systems thinking' (Fig. 6.10), Sevaldson offers an interesting framework to better link design and system thinking, and design and system practice (Sevaldson 2017). In this context, it would be good to talk about systems thinking, in plural. This framework also provides a good link between action and reflection, and action research and design research.

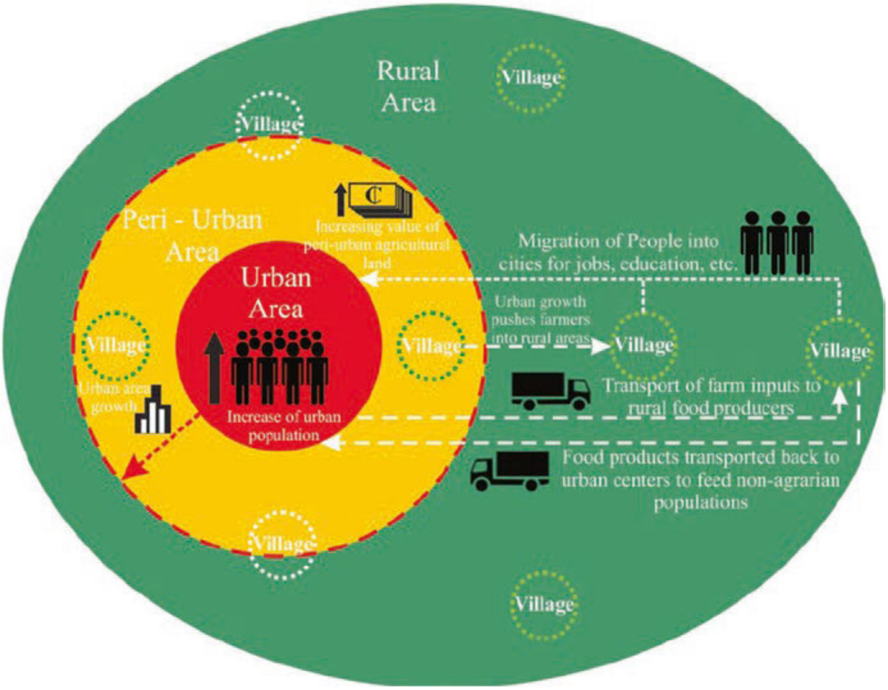

Fig. 6.8 Urban-Rural interrelationships with the food system. (Kuusaana and Eledi 2014)

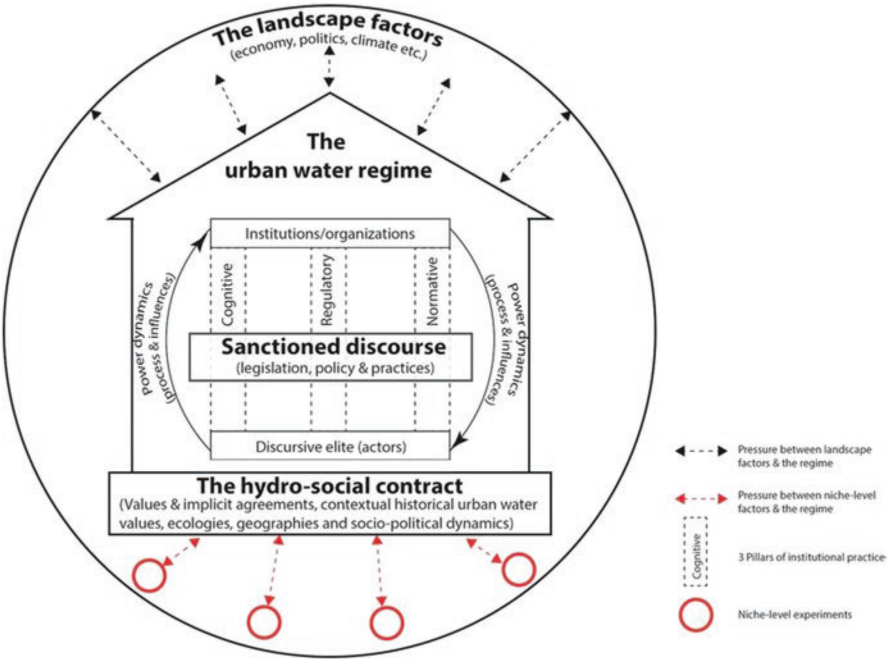

Fig. 6.9 Illustration of the Multi-Level Perspective on transition of large socio-technical systems for the case of urban water systems. (Mguni et al. 2015)

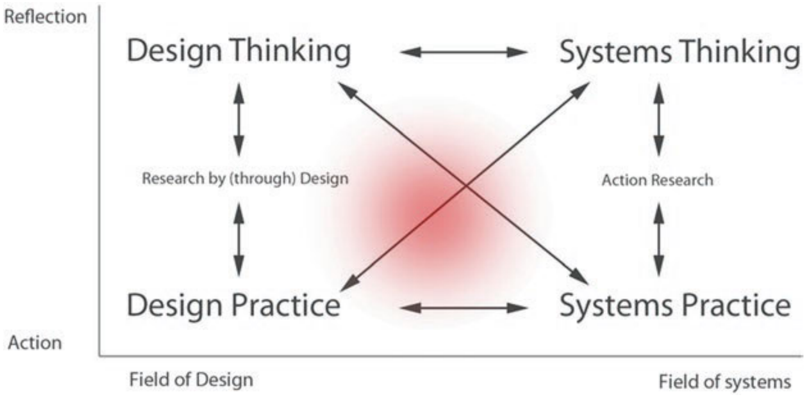

Fig. 6.10 Redesigning systems thinking. (Sevaldson 2017)

Current practice shows the limitations in demarcation of the natural systems in urban tissue. Green and blue infrastructure and green, open areas are still an adjusted variable, focusing on optimizing instead of rethinking and revaluation. Although much has been published about the benefits of a structural, qualitative, and quantitative green infrastructure in terms of societal and economic benefits, real systemic change is still absent. A systemic change to keep our urban areas livable and inclusive, economically thriving and effective is not a plea for greener per se, as this is only effective when the quality and functionality in the broader system(s) is granted.

Despite the potential NBS have in urban areas, the deployment and uptake remain limited. The Adaptative Cities Through integrated NBS (ACT on NBS) project aims to bring this thinking to the next level. However, to date there is little research undertaken on what causes this lacking use, and what factors hinder successful implementation (Boeschoten 2019). One assumption is that currently the focus is still on the different measures and techniques and an overall perspective is missing. An overall perspective that inspires, tells the full story, and brings it all together and makes it clear to all potential stakeholders in an appealing picture of the future.

6.3.3 The Key in Transition Pathways Is Vision

The Netherlands in 2120 started as an experiment to find out if an all including perspective on how the Netherlands would look like if NBS, climate adaptation and biodiversity is taken as the point of departure? Although discussions followed if the development of scenarios would be advantageous, the choice was made to really set standards high and aim for one overall perspective. Looking back, this was an excellent choice, because it clearly took stand, had a strong message, and kept sufficient room for interpretation. As such, it appeals much more than could be expected beforehand. This illustrates the importance of presenting a vision, and the way it is carefully constructed, as an important step in setting out transition pathways to actual change. Change as in transition or perhaps a more radical, transformative way.

In many domains the concept of ‘transition pathways’ or ‘transformative pathways’ (TWI2050 2018)) are explored, aiming to facilitate (radical) structural changes in systems (Elzen et al. 2019). A distinction can be made between incremental change, transition, and transformation (Roggema et al. 2012). The current perception is that incremental change and transition seem the best way forward as changes go gradually and it is believed as such they would better be accepted and in the end lead to a better uptake. However, this can be challenged as, in the end, these pathways are limited to optimizing the current state and solving problems, instead of structural choices. Structural choices that are needed because the major challenges do require. In 2012, Roggema already concluded that to face climate change requires fundamental change and as such a fundamental change in spatial layout -but putting it in perspective also societal and economically – and a transformative pathway is the best suitable (Roggema et al. 2012). Nonetheless, it is interesting to see these three pathways in line or next to each other. Perhaps there is nothing wrong with an incremental approach, but it should clearly link to a transformative perspective and action research should link to the systemic perspective and vice versa. Undoubtedly, all will have the same starting point and that’s not just the present situation with all its problems and challenges.

Developing such action perspectives and transition pathways all rely on a solid basis that consists of a well-understood common vision that connects. As mentioned before, one should carefully construct this vision along a coherent storyline and a flexible and open narrative, as transformative visions easily could lead to opposition if it doesn’t express the actual implications in the personal sphere and motives correctly and if it’s too distant and detached. It is a delicate process, but once well-constructed and appealing, shared long-term future landscape visions are a powerful boundary concept and a crucial source of inspiration for a coherent design approach, action perspectives and pathways (Van Rooij et al. 2021).

The role, place and the completeness of the vision also plays a crucial role. Although integrality is key, completeness could narrow the vision’s impact and outreach. Much research is available on transition and transformative pathways and sometimes the role and place of the vision is set differently. Some approaches start with setting the urgencies, scenarios, and in-depth analysis (Dijkshoorn-Dekker 2018), while others emphasize the ‘normative’ visions -an initial outline as a desired future as end state as starting point (Fig. 6.11). Scenario analysis (or explorative future scenarios) are used to test and adapt the normative vision (Hebinck et al. 2018). As mentioned before, Hölscher states in a recent article: “*Visions are not meant to be static, but rather give an open-ended desirable state allowing improvement through revisiting, reflecting or even reframing them*” (Hölscher et al. 2020).

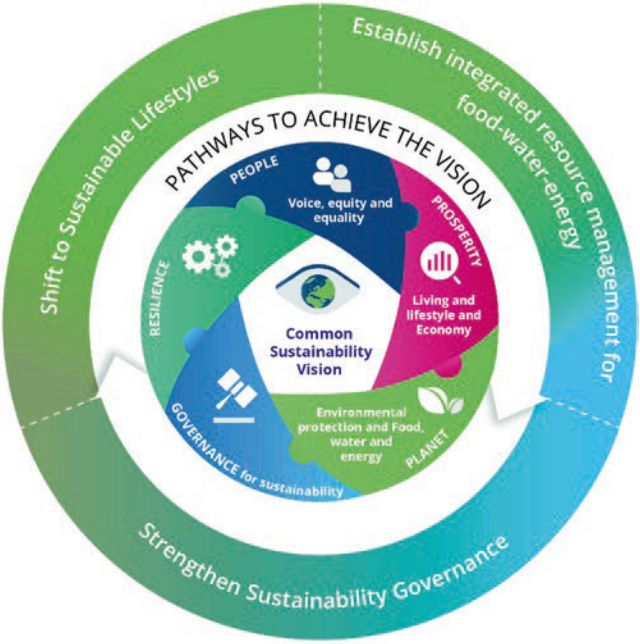

Fig. 6.11 Different views on pathways and the place of vision. (Hölscher et al. 2020; Dijkshoorn-Dekker 2018)

6.3.4 Regenerative by Nature

The Netherlands 2120 has shown the power of vision and visualization and the importance of providing a positive long-term vision and strategy to the future. Although the starting point of the Netherlands 2120 was to put forward the benefits of a nature-based perspective in a broader sense, when looking back, the perspective seems a good example of the next step in sustainability: from sustainable, restorative to regenerative.

In the explorative study of the Rethinking Sustainable Towards a Regenerative Economy of the COST Action RESTORE (Brown et al. 2018), much of the basic elements of the perspective the Netherlands 2120 seem in line with the recommendations and elements of and towards regenerative sustainability and design. The difference between sustainability, restorative and regenerative is clearly defined: from a balance point to a healthy state to finally enabling social and ecological systems to maintain a healthy state and evolve. Regenerative approaches and thinking are all about "*creating conditions where an ecologically sound environment, a just, healthy society and a vibrant economy can flourish equally*". Within the context of rapidly changing conditions the need for fundamental and systemic change is no longer a luxury, even so, it is not a burden but an enormous opportunity. This clearly links to the basic principles and starting point of the Netherlands 2120 perspective.

The key elements and 'triggers' Brown recommend, to make the paradigm shift and enhance true actions (Brown et al. 2018), also sound familiar: language, inspiration, place, reconnecting nature, regenerative economy and finally new design methods and approaches, based on systems thinking and oriented towards positive outcomes in the broadest sense, also including social and human aspects. Gibbons resonates, but in another terminology "*a key difference is the thinking underlying, with regenerative sustainability based on a holistic worldview and paradigm necessary for systemic transformation*" and "*it offers holistic approaches based on thriving living systems function, addressing root causes … and is inherently more inspiring and motivational*" (Gibbons 2020).

The point of departure in the design approach is to understand place, reconnect nature and build a regenerative societal and economic perspective at the same time, but most of all to make strategic use of positive narratives and language that build common understanding, inspires, and motivates. Narratives and languages that connect between sectors, but also between politics, professionals, and society. Narratives that provide a direction but are inviting to connect.

Such an open and inspirational approach paves the way for more in-depth studies and design strategies at the different levels. It seems important to cherish complexity and interdependencies, but to prevent these elements may confuse the message or hinder action perspectives.

When discovering regenerative development and design one could be dazzled by its complexity and broadness. Of course, regenerative development and design deals with the complexity and variety of process, flows and systems, but -without reducing its complexity towards easy simplification- should make this accessible and understandable to all. It is key to ease this in the process towards a guiding vision and transformative pathways that build towards this overall vision. The understanding and future functioning of the system should not be lost in sight. This is key to achieve the best thinkable future and is a basic condition for the full uptake of NBS.

The Netherlands 2120 provides an overarching view on the entire country at three different levels: the Netherlands as part of the Rhine-Meuse-Schelde Delta, the Netherlands as a complete system connecting sea and land and finally the different regions that interact within that system -and are systems on their own again. Regenerative development and design fully incorporate a multiscale approach and the component of time. As Gibbons calls "*regenerative design can develop the necessary capabilities for regeneration over time and across scale*", after she notes that system thinking currently limits to a one focal scale.

Looking back at the design approach and connecting science and design, Gibbons has some interesting recommendations regarding regenerative development and design. In the same article '*Regenerative -the new Sustainability?*' she notes the importance of developing adaptive design, bridging disciplines, science and practice and discovering the proper processes and related methods. But most of all she urges for visionary leaders at all scales, who understand and implement systems thinking and develop other leaders. These leaders should be across sectors and society and at all scales and should be connected by a joined vision.

6.4 The Way Forward

Visualizing the future supports acceleration of biodiversity and climate action. It is essential to not drown in complexity but understand it and position it in the (design) process. Moreover, the power of an enabling, appealing, and realistic vision in which all can find his or her place and role towards change is conditional for success.

Understanding and taking the natural basis and natural systems as the foundations on which, our society and economy is grounded and connect all necessary transitions in a common vision has high potential. Unravelling how systems can be better linked and based on this natural basis brings in new opportunities, sustains and creates diversity. Diversity is essential to create resilience, as nature shows. The natural basis acts as a common thread throughout an appealing narrative that is not the answer to all problems and issues, but can show common opportunities, where challenges meet and create joint and diverse action perspectives that are linked via the common vision. A vision is a start and should be carefully created. This doesn't mean it has to be complete, but it must be flexible in the way the narrative and ground principles can be translated into strategies and measures. As such, thorough knowledge of its systems is crucial, but it is not essential to have all the insights and in-depth knowledge at first. It is hardly impossible to understand all. This also raises the question how to prepare such a vision. Many believe co-creation is at the very heart, but the risk of losing the strength is real as it could become a politicized vision with comprises. On the other hand, it is important to keep it understandable, although it deals with complexity, also the keep the key message and main direction strong. Lessons learned about creating good narratives, for instance from Stories to Action (Coninx et al. 2018), and incorporating different motives will value the role and place a vision will take towards real transition and transformation.

A normative integral and systemic vision is key in transition or transformative pathways. Once the vision is solid (enough), widely accepted and embraced the pathways can be set out together with stakeholders. Once the vision is embraced stakeholders are eager to jointly undertake next steps. Then the key question is how to keep control and overview between diverting strategies and pathways and how to create a feedback loop to the central vision. In these pathways the constant connections between system(s) understanding and design thinking and action and experiment should also be put in place from the start. This requires new forms of governance and tailored design approaches and skills, together with excellent knowledge management.

The main recommendation is to design a long-term systemic perspective, which is nature-based, positive and linking the different systems and sectors, showing opportunities and shared values at different levels. This vision should be plausible and imaginable. Starting with an overall vision for a region or country and based on the main principles for specific areas. Not defined by administrative boundaries but based on the natural systems boundaries. Once these perspectives are constructed and embraced, actual common grounds will be set. This requires a joined effort of governments, the design sector and knowledge partners, but most of all a different set of skills and basic approach in governing, designing, and bringing knowledge to practice and vice versa. An open attitude and a constant learning process. Dealing with the major challenges and urgent transitions, asks for flexibility and direction at the same time and enabling and inspirational policy and management. This calls for a better understanding of social tipping dynamics and most of all insights and uptake of various perceptions, motives and interests of all actors involved, and calls for further collaborative interdisciplinary research (Otto et al. 2020). The spatial component makes it appealing, imaginable, and operational.

The current Covid19-pandemic shows society can shift radically if there is a common urgency and felt need. It also shows the current systems are under pressure and sensitive -especially urban, but most of all, it shows the importance of a good perspective to the future to have solid grounds for actions. A hopeful perspective that benefits all.

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Chapter 7
In-Between Nature: Reconsidering Design Practices for Territories In-Between from a Social-Ecological Perspective

Louisa van den Brink, Remon Rooij, and Nico Tillie

Abstract During past decades, Territories in-Between (TiB) have gained increased attention among researchers in the field of urban planning and design. TiB are often considered to be underused, lack spatial quality and are under mounting pressure of urban densification. However, the rich diversity of land uses and abundance of semi-open spaces in the TiB provide unique habitats and social-ecological potentials, different from exclusively urban or rural landscapes. Therefore, urban planners and designers should reconsider conventional planning and design approaches towards these kinds of territories. The objective of this paper is to present a holistic planning and design approach towards TiB which acknowledges and strengthens its unique social-ecological potentials on local and regional scales. The new spatial planning concept that was developed through a 'research-by-design' process is called: *The Recovering Membrane*. This concept was developed for the city of Rotterdam. The Recovering Membrane is defined as a spatial layer of interaction between two distinctive living environments – urban and rural – and various human and non-human actors in them. The research puts forward that design for the TiB should consider the urban fringe as a distinctive kind of TiB with unique social-ecological potentials. Moreover, spatial design should strengthen existing spatial qualities of the TiB, to protect its pressured, yet highly valuable, characteristics. Additionally, local nature-based interventions can provide an important tool for placemaking in the TiB, especially when integrated with long-term and large-scale area transformations.

Keywords Territories in-between · Urban fringe · Landscape ecology · Placemaking · Nature-based solutions

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7.1 Introduction

Ever since the emergence of their disciplines landscape architects and urban designers have been concerned with the distinction between their fields of interest, respectively the rural and urban landscapes. However, because of ongoing urbanisation and sustainability challenges the academic disciplines of urban design and landscape architecture are becoming increasingly intertwined with one another. Moreover, ongoing urban growth and densification in the Netherlands is pressuring semi-open spaces in between cities and rural land (Nabielek et al. 2014). Consequently, the distinction between the urban and rural landscape diffuses (Frijters et al. 2004; Zonneveld 2007). To understand the challenges that these semi-urban landscapes are facing researchers are looking for a more nuanced conceptualisation of the prevalent urban-rural dichotomy in spatial planning and design practice. One of the first and most ground-breaking theories that tries to conceptualise and centralise these semi-urban landscapes is Alexander Wandl's research on territories in-between (TiB) (Wandl 2020). The concept of TiB is used as an umbrella term to describe dispersed urban settlements which cannot merely be defined as urban or rural but are somewhere in-between.

7.2 Problem Field and Research Question

It is expected that the number of households in the Netherlands will further increase for several decades. This trend is the result of decreasing average household size and ongoing immigration (PBL 2011). To meet the housing demand about one million houses have been estimated to be built until 2040. The need is especially high in the larger cities in the Randstad region (Verdaas 2017). The main strategy to allocate these new houses is to transform and densify within the existing urban tissue. Brownfields, infrastructure corridors, old industrial districts, and semi-open spaces along the fringe of the city are key locations for urban redevelopment and new housing projects (Gemeente Rotterdam 2019). These are the typical locations that can be identified as Territories-in-Between (Wandl 2020). The abundance of unbuilt grey and green spaces in the TiB provides great potential for ecological development and the provisioning of ecosystem services (Wandl et al. 2012; Wandl 2020). Although the TiB have gained increased attention among researchers, limited attention is given to TiB in planning practices. As a result of this, its potential for the provisioning of ecosystem services is often not recognized (Wandl 2020). Moreover, the TiB are often considered to be underused and lack spatial quality. This wide underestimation of the existing qualities and potentials of TiB among spatial planners and designers is one of the core reasons for the one-dimensional urbanisation processes in the TiB. The densification process in the TiB increases the pressure on urban green spaces and requires urban designers to think of more holistic design strategies that ensure the liveability of both human and non-human species in the TiB. This brings us to the research question that will be answered in this paper: What kind of holistic planning and design approach strengthens the ecological and social potentials of Territories-in-Between, while also taking into account urbanisation needs?

7.3 Methodology

The research question is answered through a research-by-design process which is supported by findings from a literature study and spatial analysis of TiB in the Rotterdam region. The city of Rotterdam and its surrounding landscapes were chosen as a case area for the Urban Ecology graduation studio but were in particular relevant for the TiB design experiment, because of Rotterdam's diffuse urban-rural boundary, the great abundance of in-between territories and the great urbanisation pressure on these areas. The research by design process ran parallel to the literature study and spatial analysis. Therefore, the findings of the design process motivate the choice for specific literature domains and theories. This approach was especially helpful because of the limited available literature on territories in-between. In other words, the design process helped shaping the theoretical framework of the research. The following section discusses the spatial characteristics and current planning practices in the TiB with use of the findings of the spatial analysis and literature review. Thereafter, the main findings from the literature review are outlined and synthesised into concrete design recommendations for the in-between territories. Finally, the results and insights of the design experiment are presented for the case of the city of Rotterdam. The last section summarizes the main findings and presents design and policy recommendations for professionals in the field of urban planning and design.

7.4 Territories In-Between

In academic literature many concepts have been introduced to describe dispersed urban settlements such as peri-urban, urban sprawl, suburban and more (Wandl 2020). However, these concepts do not sufficiently cover the complexity and diversity of dispersed urbanization patterns. Moreover, Wandl argues that TiB have a distinct character and functioning that cannot be described by a simple urban to rural gradient; based on the dichotomy of urban and rural that most of these concepts rely on (Wandl et al. 2014). Therefore, he introduced the concept of territory in-between as an umbrella term to describe the significant spatial and functional characteristics of these landscapes. The TiB can be characterized by three prevalent spatial features which distinct the TiB from rural and urban areas: the intermingling of built and unbuilt spaces, the strong functional mix, and the significant presence of infrastructures in the landscape (Wandl et al. 2014).

7.4.1 Social-Ecological Potentials

The semi-open structure and diversity of land uses in the TiB provides habitats for general as well as endangered species. Species which are more often associated with urban landscapes, but also species which are more associated with the rural landscape. For example, oyster catchers on flat roofed logistic or commercial buildings, common linnet and European goldfinch at brown fields, or the green woodpecker and beech marten at graveyards. Therefore, TiB provide a unique combination and diversity of habitats that differ from merely urban and rural landscapes (Fig. 7.1). Consequently, unique interactions between species takes place that are not seen anywhere else. Additionally, typical land uses like sports fields, allotment gardens and graveyards also provide crucial spaces for people to interact with the natural environment and relieve stress, which contributes significantly to people's well-being (Haines-Young and Potschin 2010). This 'active' interaction between people and their environment is also crucial for building up people's sense of place. Sense of place is an important cultural ecosystem service. This concept is further elaborated in Sect. 7.3.

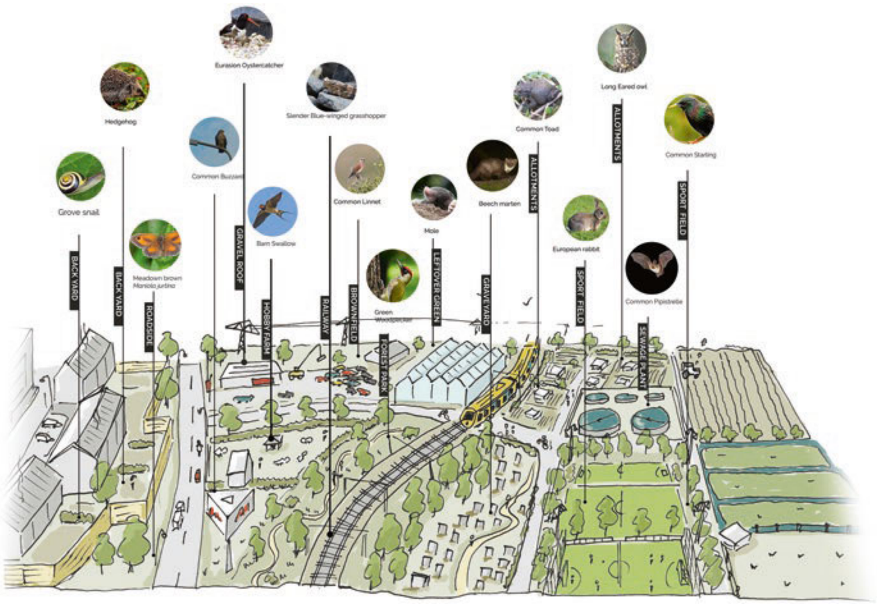

Fig. 7.1 Habitats and species of territories in-between (Van den Brink 2021)

7.4.2 Current Planning Practices

In academic literature a consensus exists that dispersed urban settlements are being neglected in spatial planning and policy making. This is even described as one of the key characteristics of the TiB (Wandl 2020; Frijters et al. 2004). Several socio-economic trends and planning policies are fundamental in the emergence of territories in-between in the Netherlands. First, there is the renowned spatial planning tradition of the Netherlands starting from the 1960's, when the first National Policy Document on Spatial Planning was issued (*Eerste Nota Ruimtelijke Ordening*) by the national government (Zonneveld 2005). These national reports outline the spatial planning strategies that need to be implemented by provinces and local governments. The goal of all national spatial planning policies so far has been to control suburbanization and preserve the rural landscape (Healey 2006; Zonneveld 2005). This idea was explained with the use of Dutch concepts like *compacte stad* (compact city), *gebundelde deconcentratie* (bundled deconcentration) and *stadsgewest* (city-region) which were used to give direction to urban growth (Frijters et al. 2004; Zonneveld 2005). However, in the last National Spatial Strategy it is argued that national spatial planning policies so far have failed to succeed their main goal of preserving the rural landscape (Bontje 2003; Zonneveld 2007). Moreover, they speak of *verrommeling* (cluttering) and spatial degradation of the landscape (Van Ool 2006; Veeneklaas et al. 2006). The prevalent lack of significant landscape features, and the presence of footloose industries and businesses are reasons why many people identify these landscapes as in-authentic and placeless (Arefi 1999; Wandl 2020). The current densification process taking place in most Dutch cities pushes large scale land uses, such as industrial facilities and sport facilities, towards the urban outskirts. These land-uses are often re-located along infrastructural routes or at the urban fringe of the city. Moreover, it is expected that the strong emphasis of the national government on economic development in combination with globalization and digitalization trends will put further pressure on the urban fringe of the city (Nabielek et al. 2014; Zonneveld 2005). Consequently, the TiB will only become a more fundamental part of the Dutch landscape (Van Ool 2006). Until 2006 when the last National Spatial Strategy (*Nota Ruimte*) was issued by the Ministry of Spatial Planning (MVROM) the national government took the lead in Dutch spatial planning (VROM 2005). In 2010, however the ministry of VROM was abolished as part of decentralization liberalization measures (Balz and Zonneveld 2018). Since then, urban development and sustaining spatial quality of the Dutch landscape was no longer a primary task of the national government. The national government concentrated its attention to spatial economic and infrastructural developments (Zonneveld 2005). Hence, sustaining the spatial quality within the TiB seems to be an issue of conflict between regional and local planning. A new planning approach for the TiB should therefore provide coherence between developments at the regional and local scale.

7.4.3 The Particular Case of Rotterdam

The greater Rotterdam area is particularly suitable for this kind of study, because of its diffuse urban-rural boundary, the great abundance of in-between territories and the great urbanisation pressure on these areas. Although earlier studies and plans have addressed the densification of Rotterdam's inner-city area (Tillie 2018; Tillie et al. 2018), Rotterdam now aims to build 50,000 new houses until 2040 of which most will be located in existing territories in-between (Gemeente Rotterdam 2019). As a result of the ongoing densification in these territories, the functions and services that they provide are under increasing pressure. This particularly includes allotment gardens, sport complexes and small commercial and industrial districts. This is a worrying development, especially because the demand for allotments and outdoor sport facilities has grown significantly during the covid-19 crisis. Spatial data mapping was used as a tool to get a qualitative understanding of the spatial distribution of Rotterdam's TiB and its spatial characteristics in different places, i.e., what typifies Rotterdam's TiB and what makes areas stand out? By overlapping different spatial characteristics of the TiB in a shadow map (Fig. 7.2), it is argued that certain places possess higher degrees of in-betweenness compared to others. The map is composed of four layers:

1. Functional land uses typical to the TiB (industry, sport/recreational land uses and commercial and logistic areas).
2. Large infrastructure corridors.

Fig. 7.2 Shadow map of Rotterdam's territories in-between (Van den Brink 2021)

3. Urban fringes within 200 m of built area of city limits.
4. Degree of protection by environmental policies such as Natura 2000 and Nature Network Netherlands (NNN).

This map is a first step towards qualitative mapping of TiB. Further improvement is expected to be made with more detailed spatial data analysis on open spaces (Open Space Ratio) and function mix (Mix-use Index) in the area (Pont and Haupt 2007; Van den Hoek 2008). It can be seen that Rotterdam's harbour district, the large green house areas in Westland and the major infrastructure corridors make up a significant amount of the total TIB within the city's surroundings.

7.5 Theoretical Framework

This section discusses the main scientific theories that have been of support and inspiration for the design research: edge-boundary theory, landscape heterogeneity, and theory on sense-of-place.

7.5.1 Edge-Boundary Theory

This theory is part of Richard Forman's Patch-Corridor-Matrix model (1995). This model is a fundamental research and design model used in the field of landscape ecology (Forman 1995). The model describes the arrangement of different spatial landscape elements that together make up the greater landscape structure: the landscape mosaic. According to Forman, the landscape mosaic is composed of three universal types of spatial elements: patches, corridors, and the matrix. The patch-corridor-matrix model can be applied in both anthropogenic and natural environments and at different scales. This makes the model a very effective research- and design tool for spatial planners and designers. Moreover, the model provides a way to compare dissimilar looking landscapes on a landscape structural level (Forman 1995). The design of patch edges and boundaries deserves specific attention because their characteristics are of great influence on species migration and human - wildlife interactions. The edge is described as the outer portion of a patch where the environment differs significantly from the interior of the patch. The change of behaviour of species near or in habitat edges is called the edge effect (Forman 1995). Territories in-between located at the urban fringes of cities can be considered the spatial edge between the urban and rural landscape with its distinctive edge effects. Because of the continuing expansion of human development into natural environments, spatial edges will increasingly form a critical point of interaction between human-made and natural habitats (Dramstad et al. 1996). Figure 7.3 shows the relationship between the spatial morphology of the edge and its related edge effects. Urban-rural boundaries which have a high structural diversity, are irregularly shaped and

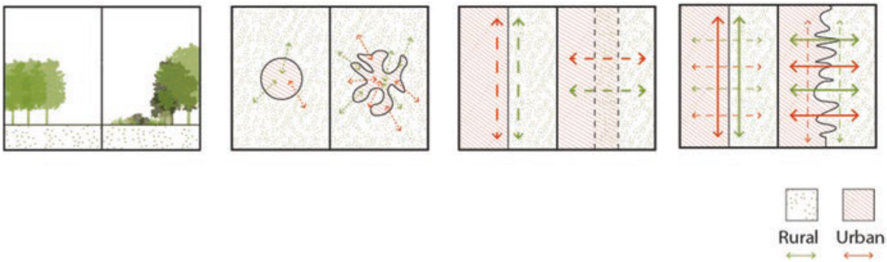

Fig. 7.3 Conceptual representation of design principles for patch edges and boundaries. (Adapted from: Dramstad et al., 1996)

provide a smooth gradient between urban and rural landscapes, which are essential for species richness, movement, and human-wildlife interactions. In other words, landscape architects and urban designers can re-shape spatial boundaries and influence the ecological functioning of the landscape at macro scale.

7.5.2 *Landscape Heterogeneity*

On a macro level, the mosaic of patches in the landscape can be described by its degree of spatial heterogeneity. The greater the diversity of patches and the greater the spatial mix of them within a specific area, the greater the landscape heterogeneity. Landscape heterogeneity is a fundamental aspect of landscape ecology that aims to relate spatial patterns to processes (Fahrig et al. 2011). Landscape heterogeneity is driven by two aspects: on the one hand the diversity of habitat types (compositional heterogeneity) and on the other hand the size, number, and spatial arrangement of these habitats (configurational heterogeneity). Theoretically speaking, increased compositional heterogeneity leads to more biodiversity because of greater habitat diversity within the territory. Additionally, a greater diversity of land cover types provides complementary resources, such as food, places of refuge and nesting places for different time periods in an organism's life cycle. Greater configurational heterogeneity can also increase biodiversity because of increased connectivity and interspecies interaction (Fahrig et al. 2011). The relationship between landscape heterogeneity and biodiversity is depicted in Fig. 7.4. Even though, landscape heterogeneity studies have mainly focused on natural, semi-natural and rural landscapes, the assumption is made that landscape heterogeneity principles can also be applied on more anthropogenic and semi-urban landscapes creating similar results. This theory on landscape heterogeneity is especially relevant for the TiB because of their multifunctional nature and rich diversity in spatial structure at macro level. Figure 7.5 is a good example of an aerial view of a highly heterogeneous in-between territory along the south border of the city of Rotterdam.

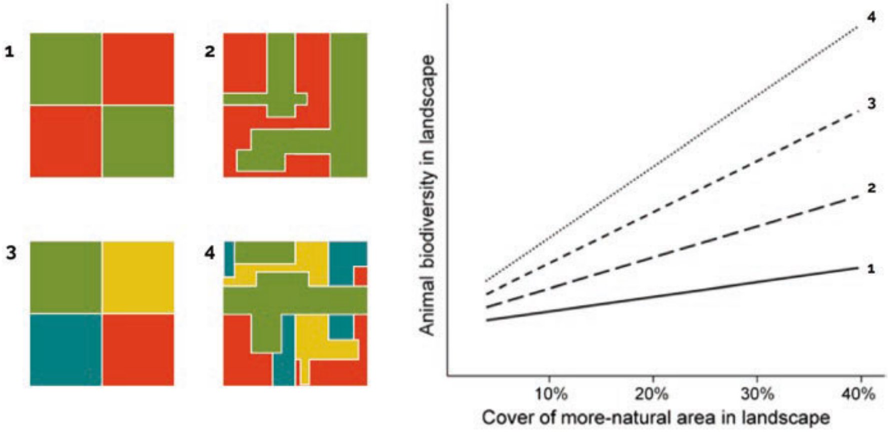

Fig. 7.4 (Left) Conceptual representation of landscape heterogeneity patterns. (Right) Correlation between heterogeneity patterns and biodiversity. (Adapted from: Fahrig et al., 2011 fig. 3&4 pag 104–105)

Fig. 7.5 Aerial picture of heterogeneous spatial structure of TiB at the south border of Rotterdam. (Retrieved from google earth)

7.5.3 *Sense of Place*

Sense of place can be described as the relationship between people, their imagination, and the physical environment. The concept is rooted in both objective influences of the environment such as landscape design, form, and sensory perceptions (smell, sound, climate etc.) and on the other hand subjective experiences such as memories, emotion, and culture. Therefore, sense of place is a complex concept about the emotional attachment of people to their living environment because of their interaction with the landscape (Shamai 1991; Bush et al. 2020). Consequently, facilitating human-nature interaction is essential for the creation of sense of place. According to Canter, a place is created by three main elements: form, function, and meaning (Canter 1977; cited in Ghani et al. 2018) These elements also describe the type of relationships between humans and the environment, respectively, cognitive, behavioural, and emotional. It is argued that good physical form and good function lead to good emotional response (meaning) which results in enhanced sense of place experience. The emotional dimension is therefore a result of the other two dimensions; the behavioural and the cognitive. (Ghani et al. 2018). The heterogeneous spatial structure and the abundance of green open spaces in the TiB provides great potential for people to strengthen their relationship with the natural environment and participate in various kinds of stewardship activities such as restoration, cleaning, and maintenance activities. Actions of stewardship can change people's meanings and attachments over certain places and therefore contribute to people's sense of place (Masterson et al. 2017). Greater sense of place experience among locals positively influences people's willingness for stewardship activities and can therefore positively influence the ecological quality and performance of the landscape. In turn, greater ecological quality generally provides greater sense of place experience through the provisioning of cultural ecosystem services.

7.5.4 Theory Synthesis

The main theory domains that support the design research are the fields of Ecology and Sense of place. Within ecology specific attention is paid to theory on landscape ecology in relation to biodiversity, i.e. how landscape patterns influence species richness. The two theory domains are connected with one another through an integrated design approach called 'nature-based placemaking'. The aim of this approach is to transform spaces into places by integrating not only the needs of the local community in the design process, but also the needs of local nature. It looks at nature as primary tool for placemaking. This approach relies on a positive feedback mechanism through ecosystem services and stewardship (Fig. 7.6).

7.6 Design Research

This section presents the results of the design experiment. This design consists of four main elements:

1. A regional planning concept and vision.

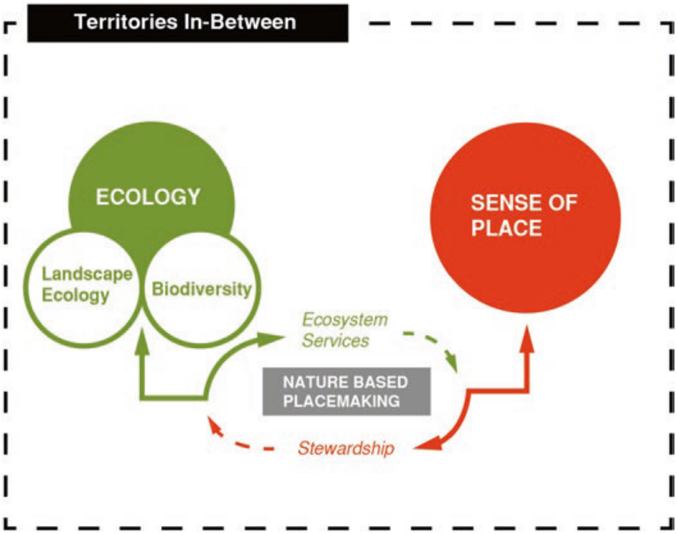

Fig. 7.6 Overview of key concepts and research approach (Van den Brink 2021)

2. A proposed staged development process.
3. A governing body at sub-regional scale.
4. Transferability study to other regions.

7.6.1 Regional Planning Concept and Vision

Through a research-by-design process, supported by the findings from the literature review and spatial analysis, a new planning approach for the TiB is developed. This new planning concept is named: 'The Recovering Membrane' and was applied and tested through design research for the case of Rotterdam. The recovering membrane is defined as a spatial layer of interaction between two distinctive living environments –urban and rural- and various human and non-human actors in them (Figs. 7.7 and 7.8). The membrane aims to bridge the urban-rural divide, enhance biodiversity and sense of place in the in-between territories at the urban fringes of the city. The membrane makes space for the pressured land uses in the territories in-between and strengthens the heterogeneous nature and multifunctionality of the urban fringes of the city. By doing so, the membrane can be considered as a unique kind of landscape with distinctive ecological and recreational qualities which are different from merely urban and rural environments. Moreover, the membrane provides a combination of services that are essential to the city resident's well-being.

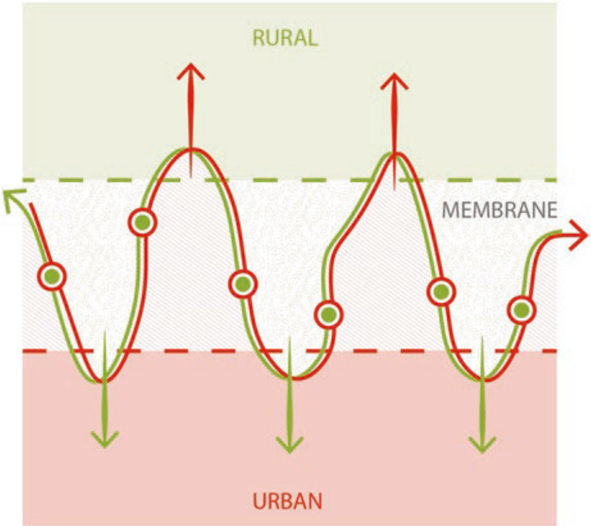

Fig. 7.7 Illustration of membrane concept (Van den Brink 2021)

Fig. 7.8 Drawing of recovering membrane for the region of Rotterdam (Van den Brink 2021)

7.6.2 Staged Development Process

The second component of the spatial planning strategy is the staged development process. The spatial transformation of the in-between territory into a membrane landscape can be organised into three development stages at: short, medium, and long time. This kind of staged development process allows for a more gradual transformation process. A process which provides coherence between small- and large-scale developments, which creates support among the local community and better respects the existing qualities of landscapes. The paragraphs below discuss the main objectives for each stage in combination with a design impression for a particular case at Hoek van Holland (Fig. 7.9).

Fig. 7.9 Street view of current situation at design location, Kulkweg Hoek van Holland (Van den Brink 2021)

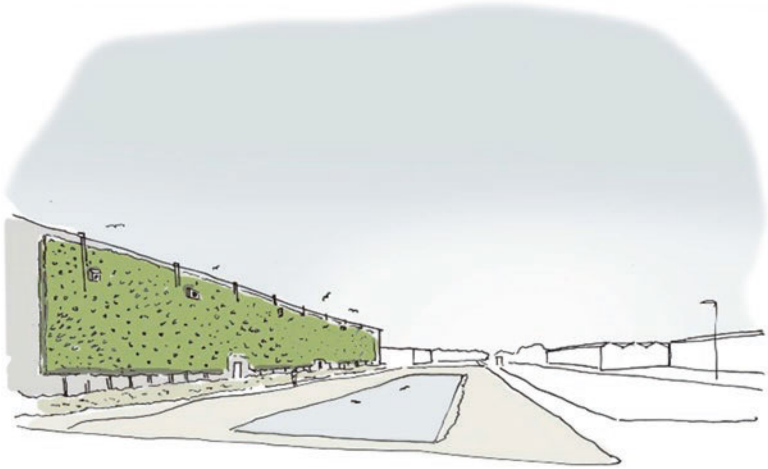

Fig. 7.10 Stage 1: Impression of design proposal (Van den Brink 2021)

Stage 1 (short term, < 5 years): Engagement and activation of the local community through a nature-based placemaking process. The aim of this stage is to improve the spatial quality within the membrane landscape through low cost and short-term interventions in co-creation with the local community. Figure 7.10 is an impression of relatively simple short-term nature-based intervention. The figure shows a green wall with bird nesting boxes mounted on the outside wall of a storage warehouse.

Fig. 7.11 Stage 2: Impression of design proposal (Van den Brink 2021)

Stage 2 (mid-term 5–20 years): Connectivity and integration of the territory in-between within its surroundings through social-ecological corridors. The primary aim of this stage is to improve the social accessibility and ecological connectivity of the landscape to its surroundings. This is especially important for the recreational quality of the membrane landscape that is often very fragmented by large infrastructures. Figure 7.11 shows how the green facade can become of greater ecological value when connected to an ecological corridor along the waterway and street.

Stage 3 (long term, > 20 years) Re-distribution of clustered land-uses to strengthen the heterogeneous nature of TiB. This stage is of specific importance as greater landscape heterogeneity does not only cause greater ecosystem resilience and biodiversity but can also positively contribute to people's sense of place experience, as has been discussed in Sect. 7.3. Figure 7.12 is an impression of the final situation where some of the greenhouses and large warehouses have made space for a greater diversity of land uses such as a day-care farm, sportsfield and extensive housing developments. This re-distribution of land-uses will further increase the ecological and recreational quality of this landscape.

7.6.3 Governing the Membrane

Existing institutions and partnerships for spatial development at sub-regional level do not sufficiently address the issue of spatial quality of the TiB at the urban fringes of the cities. They seem to be primarily interested in economic development. Therefore, there is an urgency for a distinct governance body that is primarily

Fig. 7.12 Stage 3: Impression of design proposal (Van den Brink 2021)

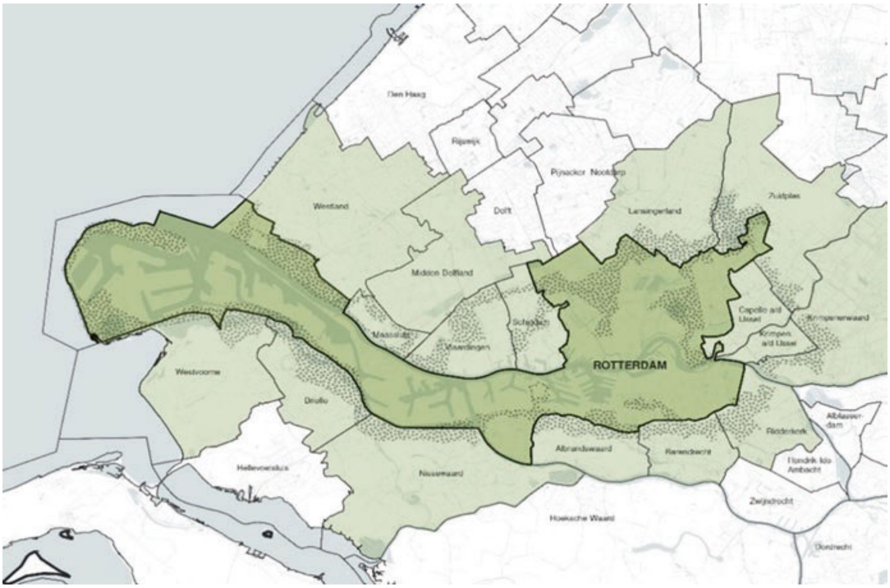

Fig. 7.13 Map of all municipalities in which the membrane landscape is located (Van den Brink 2021)

focused on improving spatial quality at sub-regional level for the territories in-between at this scale. To put this issue on the public agenda and achieve the spatial objectives of the membrane, a new governing body is proposed: The Membrane Management Group (MMG). The aim of such a new governing body is to facilitate coordination and cooperation between all municipalities connected to the membrane and ensure spatial quality and coherence of the membrane at sub-regional scale (Fig. 7.13). Interests of local municipalities are represented and together they plan and monitor regional spatial developments in the membrane and ensure consistency between regional- and local-scale projects. By doing so the issue of lack of spatial quality in the TiB is addressed in an integrated way at multiple scales.

7.6.4 Transferability of the Membrane

Even though the design approach was developed through a design experiment for the case of Rotterdam the main concept of the membrane is most likely transferable to other urbanised regions and cities. Figures 7.14 and 7.15 show the first step of transferability of the membrane concept to other urban regions. The concept can provide urban planners and policy makers with input for urban growth scenarios. A proposed strategy for the monocentric region of Paris is to improve accessibility of the membrane and increase the total membrane surface, in relation to interior urban area, by increasing curvilinearity of the urban border of Paris (Fig. 7.14). A different strategy is proposed for the polycentric region of the Randstad. For the Randstad region the strategy should be focused on protection of the interior (rural) environment, because of the high degree of spatial fragmentation of rural area, resulting from polycentric urban development. In this case a macro membrane landscape for the entire region can act as a buffer for the interior rural landscape, while also connecting different membranes at city level (Fig. 7.15). Therefore, the membrane concept can offer various insights and development scenarios depending on existing spatial conditions at regional scale.

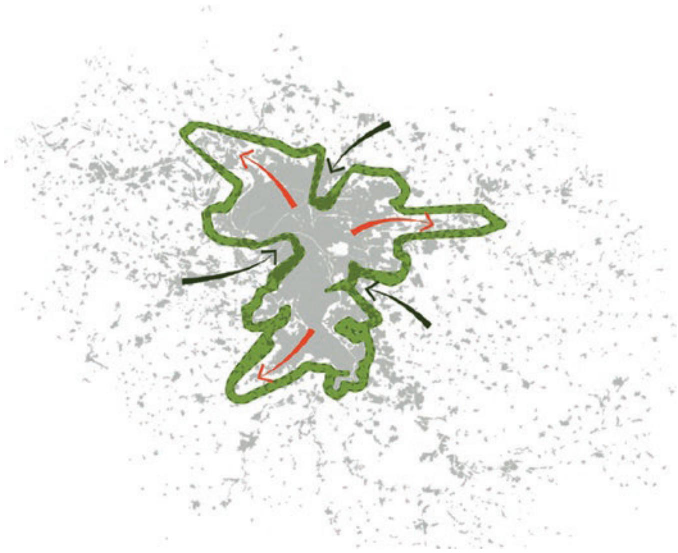

Fig. 7.14 Membrane proposal for urbanised region of Paris. Shape of membrane can operate as guide for urban development, indicated with arrows (van den Brink 2021)

Fig. 7.15 Membrane proposal for greater Randstad region (Van den Brink 2021)

7.7 Link with Regenerative Urbanism

Regenerative urbanism understands cities as living systems that maintain a mutually symbiotic relationship with their surrounding peri-urban and rural territories. This Is achieved by not just minimizing the city‘s environmental Impact, but by actively Improving and regenerating the productive capacity of the ecosystems from which It depends (Girardet et al. 2013). This understanding of the regenerative city stresses the need for an Integrated design approach that looks beyond the urban structures of the city. Hence, It also considers lands surrounding the city. In the past the land-use around our cities was closely related to the demands of that particular city, for example old fishing villages like Marken and Urk In the Netherlands, but also typical villages on higher sand grounds that relied on their surrounding communal lands for their resources. Nowadays, these productive lands are not anymore located around the urban fringes of our cities, but find themselves scattered across the globe. Consequently, the rural lands that surround our cities are often socially and economically disconnected from our cities. Therefore, a shift towards a more local economy Is needed In order to recover the symbiotic relationship between our cities and their surrounding landscapes. This Implies that a shift is needed inside and outside the city. This requires spatial adaptations beyond the urban borders of our cities.

The membrane landscape as it is being proposed In this research provides a first step towards this ambition. The design driven research has tried to Investigate what this landscape looks like, especially concerning its social and ecological potentials. With the Introduction of the membrane landscape we deliberately make space for this Interaction between our cities and the surrounding landscape on social, ecological and economic level. Even though the economic aspect has not been much elaborated In the design research, it is an essential aspect In the shift towards the regenerative city. Local industries, food production and production of building materials can become an integrated part of the city‘s membrane landscape. Therefore, the concept of the membrane landscape can be a promising addition towards to the existing body of knowledge on regenerative urban design.

7.8 Conclusions

In this paper it was argued that there is a need for a new holistic planning approach towards TiB which acknowledges the social and ecological potentials of these landscapes. A literature review, spatial analysis of TiB for the case of Rotterdam, and a research-by-design process were conducted to create the newly introduced planning approach. The approach can be described with four key recommendations for practitioners and policy makers in the field of spatial planning and design:

1. Consider the urban fringe of the city as a unique kind of in-between landscape (membrane), because of its ability to bridge the urban-rural divide.
2. Acknowledge and strengthen existing qualities and potentials of the TiB, such as spatial heterogeneity.
3. Address issues of spatial quality in the TiB through an integration of different spatial (regional and local) and temporal scales (short- and long-term) with use of a new sub-regional governing body (MMG) which is primarily concerned with spatial quality in these landscapes.
4. Provide spatial interventions that maximise human-nature interactions and increase stewardship and sense of place within the TiB. To do so, nature-based interventions should be used as a primary tool for placemaking within the TiB.

By considering the In-between territories as an integral part of a larger ecological system, the concept of the membrane landscape maximizes Its unique potentials for human exploration and wildlife interactions. Additionally, the membrane landscape can provide various kinds of resources for the city and provide a place of transition towards a more localised economy. Therefore, It reconnects the city to Its surroundings and vice versa, on social, ecological and economic level. Finally, the design driven research explores what this membrane landscape could look like and how these territories can evolve towards achieving this ambition.

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Chapter 8
Regeneration of Degraded Land with Nature-Based Solutions

Thijs van der Zaan and Senne van 't Hof

Abstract More than ever, humankind is out of balance with nature. The Earth is warming, leading to water and food scarcity, poverty, loss of biodiversity and climate refugees. Nature-based solutions (NBS) can help to reverse these events. Research estimates that NBS can contribute up to 37% of the carbon emission intake required to keep global warming below two degrees Celsius. Besides sequestering CO_2 out of the air, applying NBS also improves the livelihoods of both humans and animals. Globally, more than two billion hectares of land can be regenerated – an area twice the size of Europe. The mission of Justdiggit is to apply NBS to reverse land degradation and empower local communities. The focus is on Sub-Saharan Africa as this region is highly vulnerable to the threats of climate change, natural resource degradation and poverty, and has a high reliance on subsistence agriculture. Justdiggit aims to make dry land green again by inspiring and activating farmers in Africa to start regreening. This has a positive impact on climate change, nature, and people. They restore degraded land by combining traditional farming techniques with technology whilst using media and communication in order to reach the hearts and minds of people. Together with its partners and media network, Justdiggit aims to ignite a "Regreen Revolution": a grassroots movement that jointly restores land in order to regreen the landscape and cool down the planet.

Keywords Nature-based solutions · Landscape restoration · Africa · Regreen revolution · Justdiggit

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8.1 Introduction

8.1.1 The Problem

More than ever, we are out of balance with nature. We are in a global climate crisis: our planet is warming while the human population is growing. The carbon dioxide (CO_2) emissions caused by human activities have increased over the years at an alarming fast rate (Fig. 8.1). The consequence: the atmospheric CO_2 concentration is higher than ever (Lindsey 2020). This accumulation of CO_2 leads to significant changes in the climate, including global warming (Cox 2000). Warming of the Earth can have severe consequences. It leads to increased rainfall in some areas, while other areas lack rain and become drier. Glaciers are melting and sea levels are rising (Hughes 2000).

Warming of the Earth is not the only consequence of a growing population. An increasing number of people demands more food, water, and commodities, putting even more stress on ecosystems (Song 2018). This higher demand leads to overexploitation of many ecosystems, which are unable to restore themselves and fully recuperate. The decline in healthy ecosystems also means a decline in ecosystem services, such as food and water. This results in people starting to use lands, which are highly susceptible for land degradation, leading to even more degraded land (FAO 1994). It puts these systems in a perpetual circle with negative feedbacks (Fig. 8.2).

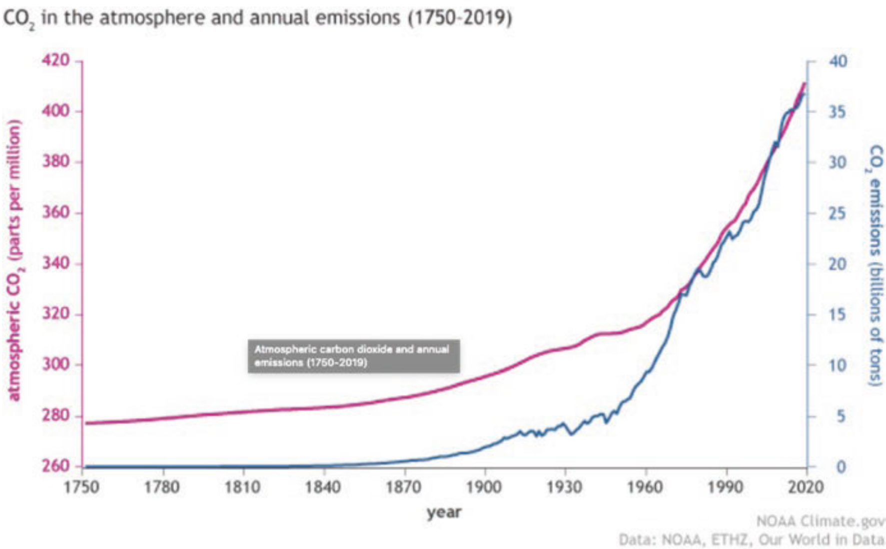

Fig. 8.1 Overview of the amount of CO_2 emissions by humans (blue line) since the start of the Industrial Revolution in 1750 along with the amount of atmospheric carbon dioxide (raspberry line) (Lindsey 2020)

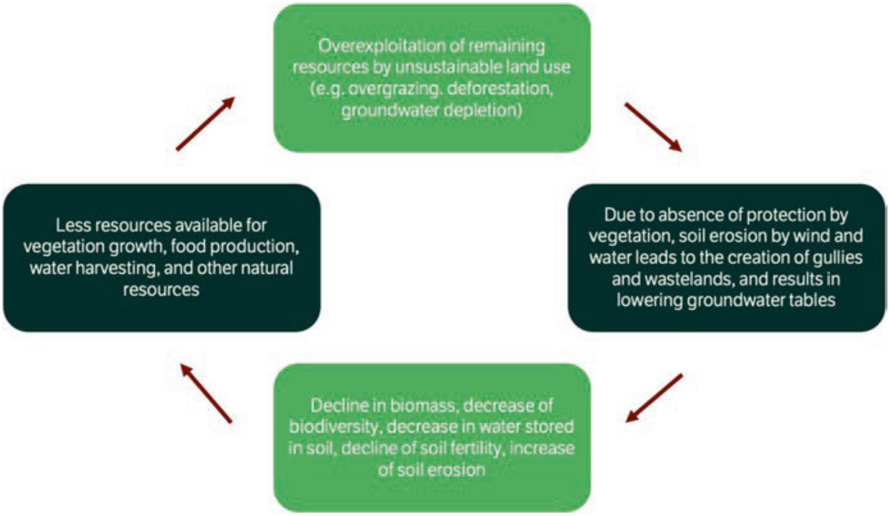

Fig. 8.2 A simplified representation of the negative feedback loop that leads to land degradation

It is estimated that every year, the world loses 12 million hectares of productive land (Hans Günter 2009). This degradation of the land negatively affects food security and livelihoods of billions of people (Nkonya E. M. 2016). It leads to a decline in soil fertility, increased erosion, and a decrease in bio-productivity (Enfors 2007). Especially within vulnerable areas, such as Sub-Saharan Africa, the consequences of the changing climate and land degradation are felt daily. In Africa alone, 3.9 million hectares of forests are lost each year (FAO 2020), and 65% of land is affected by degradation (FAO 2018). Particularly people who greatly depend on the land as a source of income and their livelihoods, such as small holder farmers, are highly affected by the negative side effects of land degradation (Nkonya E. P. 2008).

8.1.2 The Solution

NBS can help to bring back nature on a large scale, regenerating degraded landscapes. NBS include a wide variety of ecosystem-related methods to cope with societal challenges (Cohen-Shacham 2016), such as climate change and land degradation.

Worldwide, over two billion hectares of degraded forests and land can be restored (Besseau 2018), an area twice the size of Europe. One of the continents with the most regeneration potential is Africa (Fig. 8.3). Restoring degraded land in this continent gives the opportunity to protect and bring back biodiversity to some of the world's most special ecosystems.

Bringing back nature in degraded areas not only positively impacts biodiversity and the livelihoods of local communities, it also positively impacts the climate.

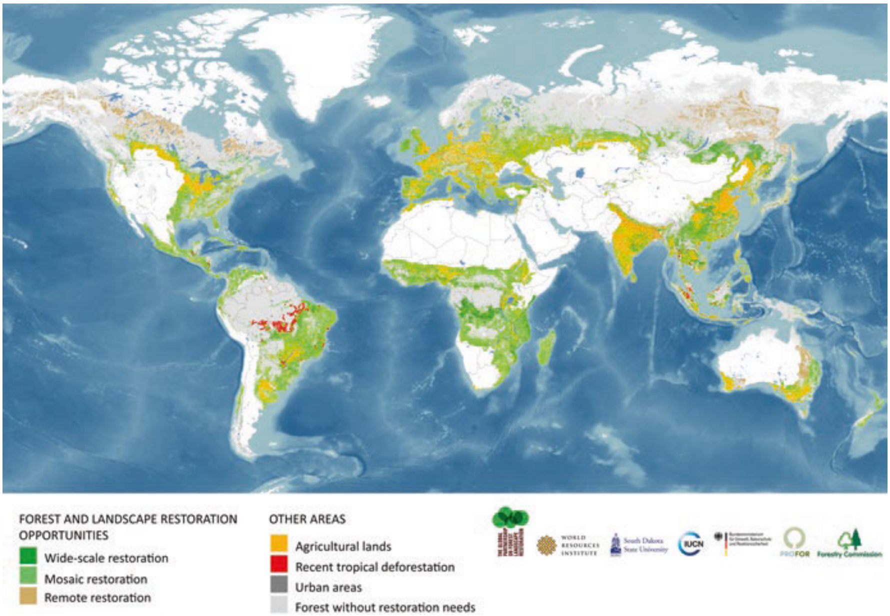

Fig. 8.3 Forest and landscape restoration potential worldwide (Institute 2014)

Research estimates that NBS could contribute up to 37% of the carbon emission intake required to keep global warming below two degrees Celsius (Bronson W. Griscom 2017). Regenerating degraded landscapes by restoring vegetation can play a big role in bringing down rising global temperatures. Plants and trees are the air conditioning of our planet: they remove carbon from the air and cool the surrounding area.

8.2 Justdiggit

Non-profit organization Justdiggit has the mission to cool down the Earth by regreening degraded landscapes in Sub-Sharan Africa on a large scale, together with millions of farmers and pastoralists. By combining landscape restoration techniques with the power of media and communication, data, and mobile technology, they aim to inspire, unite, and empower an entire generation and grow a landscape restoration movement.

To regreen Sub-Saharan Africa on a large scale, they focus on three core activities:

1. Implementing regreening programs in Sub-Saharan Africa
2. Scale-up these programs through the power of communication and technology
3. Realizing international awareness campaigns

8.2.1 Objective

Justdiggit runs regreening projects in Kenya and Tanzania and supports projects of partner NGOs in Uganda, Ethiopia, Togo and Madagascar. Their mission is to regenerate millions of hectares degraded land throughout Africa by implementing NBS. Through empowering millions of farmers and local communities to bring back green on their own lands, they aim to restore ecosystems on a large scale, positively benefitting nature, biodiversity, humans, and the climate.

8.3 Methodology

The core activity of Justdiggit is implementing regreening programs in Sub-Saharan Africa. Their projects help to improve the livelihoods of local communities, and positively impacts biodiversity and nature. At the same time, these programs function as a laboratory, where new ideas and innovations are tested and evaluated. As regreening is not a one-size-fits-all solution, Justdiggit uses various landscape restoration techniques. The techniques used within the projects are chosen in close collaboration with their local partners and the local communities, who know the areas best.

8.3.1 Rainwater Harvesting

Though many people think otherwise, in many African countries it does rain, even in dry areas. However, due to degradation of the land, this rainwater no longer infiltrates in the soil. This causes the water to wash away towards lower areas, taking the upper layer of fertile soil with it, a process called erosion. The consequences are increased flooding and further depletion of the already degraded lands. With help of rainwater harvesting techniques this vicious circle can be broken. Several techniques are available to harvest water on different scales (IFAD 2011). Depending on the local conditions (gradient, soil type, amount of rainfall, etc.) and culture (farmers or pastoralists) the most suitable technique for a specific area can be selected.

An example of such a rainwater harvesting technique is the water bunds: semi-circular holes which are dug to open the hard top layer of the soil. The bunds slow down and capture rainwater running downhills, preventing erosion of fertile soil (Taylor 2007). By capturing the water, it has more time to enter the soil. The water balance in the soil restores, increasing the water availability for the seeds still present in the soil. These seeds now get the chance to sprout, which means the landscape regreens. Sometimes the regreening process is given a little push by sowing extra (grass) seeds within the bunds. This way the degraded area restores even better. Within half a year a dry and degraded area, turns green again (Fig. 8.4).

Fig. 8.4 The regreening process of water bunds. After six months a dry and degraded area has become green again with help of the water bunds. Even in the dry season the returned vegetation remains (Justdiggit 2017–2018)

In March 2022, Justdiggit already dug over 200,000 of those water bunds in their projects in Kenya and Tanzania.

The bunds are dug by the local Maasai communities, giving them ownership over the project. Moreover, they get paid for the work, leading to socio-economic benefits for the communities.

8.3.2 Farmer Manager Natural Regeneration

Another intervention that helps to increase soil moisture and thus can lead to regeneration of degraded areas is the Farmer Managed Natural Regeneration (FMNR) technique. This technique helps to bring back trees which were cut down in the past and supports young, natural occurring sprouts to grow big (Rinaudo 2007). The

Fig. 8.5 Stump of a felled tree with little shoots growing out of it (Justdiggit 2018b)

technique showed already promising results in Niger (Haglund 2011), Ghana (Weston 2015) and other African countries.

The FMNR technique consists of four different steps:

1. Selection of the tree stump which will be helped to grow back.
2. Pruning the tree stumps. The roots of these felled trees are often still alive, causing little shoots to grow from the stumps (Fig. 8.5). As there are many, none of them gets enough energy to grow big. With help of FMNR most of these shoots are pruned, keeping only two or three shoots getting enough energy to grow big.
3. Marking the trees which are under FMNR so that everyone in de surrounding also knows that this tree is protected.
4. Protection of the regrown trees, but also of natural occurring sprouts as they are a tasty snack for livestock and wildlife.

With the process of selecting, pruning, marking, and protecting the felled trees get the chance to grow back into real trees again.

8.3.2.1 Kisiki Hai in Tanzania

There used to be many trees within the Tanzanian Dodoma Region. Most of them have been cut down in the past to be used as firewood, timber, for charcoal production or to make room for agriculture as farmers used to believe that a good land is a clear land. With the FMNR technique, or - as Justdiggit likes to call it -Kisiki Hai (‘living stump in Swahili), these trees can be regenerated. Together with their partner LEAD Foundation, Justdiggit teaches farmers in this region how to apply this technique on their own land.

Fig. 8.6 Champion Farmers learning how to apply the Kisiki Hai technique (Justdiggit 2018c)

By training 1179 facilitators (so called Champion Farmers), of which 44% is female, Justdiggit can reach out to farmers in 324 villages in the Dodoma region. These facilitators train their fellow farmers on how to regenerate trees on their own farmlands (Fig. 8.6). This way, thousands of farmers are activated to regreen their own land, bringing back millions of trees in the Dodoma region resulting in an increase in drought resilience, food production and household income. The Champion Farmers are also trained in rainwater harvesting practices, helping them to regreen the land even further.

8.3.3 Grass Seed Banks

Grass seed banks are small parts of communal land that are used for the production of grasses and grass seeds. The grasses that grow on the grass seed banks are protected from grazing livestock and wildlife by a so-called living fence of local shrubs. They form an oasis of green in the barren surroundings (Fig. 8.7). The grass seed banks are managed and maintained by Maasai women groups in Kenya. Once the grasses are fully grown, they produce grass seeds which are sold by the women on local markets or to other regreening projects.

Fig. 8.7 Grass seed bank of the Justdiggit project in the Kuku Group Ranch, Kenya (Justdiggit 2019d)

Selling the grasses and the grass seeds harvested from the grass seed banks generates a source of income for the women who are managing the grass seed banks. This income serves as an alternative livelihood, making the women more independent. It can help the women to pay for school fees, health care and support their family. When other people in the community see the successes of the grass seed banks, it provides the women a higher status within their community.

The grasses grown in the grass seed banks attract insects and small animals. Their return stimulates the recovery of the ecosystem and enables vegetation in the surrounding to start to grow as well. Moreover, the grass seeds which are sold to other landscape restoration projects, will add to the regreening of other areas. They are, for example, used in the water bunds projects of Justdiggit.

8.3.4 Other Regreening Techniques

Digging bunds, bringing back trees with Kisiki Hai and growing grasses in the grass seed banks, are not the only techniques Justdiggit uses to regenerate dry areas. Olopololi plots and woodland enclosures are used to prevent overgrazing of grass- and woodland, whilst Fanya Juu & Fanya Chini and stone lines are used to capture rainwater that is running downhills.

Fig. 8.8 Drone shot of the Fanya Juu and Fanya Chini techniques applied on farmland in Dodoma, Tanzania (Justdiggit 2019b)

8.3.4.1 Fanya Juu and Fanya Chini

Fanya Juu and Fanya Chini are rainwater harvesting techniques. Farmers dig trenches in alignment with the contours of their farmland to prevent erosion and to capture the valuable rainwater within their land (Fig. 8.8). Fanya Chini means 'throw it downwards' in Swahili. It prevents the rain falling outside the farm from entering the farm, inhibiting erosion of fertile soil. Fanya Juu means 'throw it upwards', and prevents the rain falling within the farm to flood away, increasing the water availability for the crops on the land. In the end it helps to make the farmland greener.

8.3.4.2 Olopololi Plots

One of the main causes of land degradation is overgrazing. Grazing management is thus of great importance. By preventing livestock from grazing in the most vulnerable areas, these areas have time to recover. In their projects, Justdiggit spreads the knowledge about the advantages and techniques of livestock and grazing management in various ways, always involving the Maasai communities. This way the aim is to make the overgrazed and degraded areas green again.

Fig. 8.9 White pole marking an olopololi plot in the Olgulului-Ololarashi Group Ranch, Kenya (Justdiggit 2020b)

An olopololi plot is a traditional Maasai grazing management technique, which became out of practice. The olopololi plots are marked areas of communal land, in which grazing is only allowed during specific periods, such as at the end of the dry season when there are fewer other places to graze or only for certain animals such as calves (Fig. 8.9).

Together with their local partners, Justdiggit brought this traditional technique back into practice. They use landmarks and awareness campaigns, to inform local communities in which area grazing rules apply. Grazing committees, consisting of community members, are assigned to supervise the sustainable management of the grasslands. They closely monitor the plots, so that the grass has time to grow back.

8.3.4.3 Stone Lines

Stone lines are used to capture rainwater and to prevent soil erosion (Fig. 8.10). They are often used in project areas where many stones are available. Stones break the erosive force of water and increase the infiltration of water in the soil. Organic material and seeds are captured behind the stones, giving the seeds time to sprout, regreening the area.

Fig. 8.10 Stone line located within the project are within the Kuku Group Ranch, Kenya (Justdiggit 2019e)

8.4 Results

Regenerating degraded landscapes has a range of positive benefits on nature, climate, biodiversity, and humans.

8.4.1 Environmental Benefits

With help of vegetation, ecosystems can be restored. This results in different benefits for the environment.

8.4.1.1 Increased Soil Moisture and Soil Quality

By capturing rainwater with help of the water bunds or by regenerating trees (rain) water infiltrates in the soil, leading to an increase of soil moisture, which remains in there for a longer period. This results in a longer growing season hence more vegetation (Taylor 2007). This increase in vegetation also means an increase of organic matter in the soil, which in turn holds moisture and contains nutrients and carbon.

The organic matter also attracts micro-organisms, which helps the soil to become a healthy living soil. Besides increasing the quality of the soil, vegetation also helps to retain the upper layer of ground during intense rainfall, preventing the erosion of fertile soil (Taylor 2007).

8.4.1.2 More Local Precipitation

Next to increasing soil moisture, vegetation also increases air humidity. Through transpiration, plants release moisture into the air (Kravčík 2007). These higher humidity levels of the air have been found to raise the likelihood of precipitation. A 10% raise in relative humidity can lead to two-to-three times the amount of precipitation (Fan 2007; Khain 2009). This increased local rainfall is the result of two factors:

1. The increase of evapotranspiration leads to more cloud formation.
2. Vegetation makes the surface rougher, which leads to compaction of clouds. This then leads to an increase in rainfall, as compact clouds rain out more (Pielke Sr 2007).

This increase in rainfall also positively affects the availability of water in the soil, which leads to an increased growth of vegetation, forming a positive feedback loop (Fig. 8.11). Some studies even show that in areas with vegetation present rainfall is increased as much as 30%, compared to non-vegetated areas (Los 2006). This enhanced rainfall generation especially occurs in the ends of the rainy season, extending the rainy season (Assessment. 2015).

Fig. 8.11 Vegetation helps to increase the water availability in the soil by promoting water to enter the soil and reducing evaporation through their shade (Justdiggit 2020a)

This paradigm about the expected vegetation-atmosphere feedback is still subject to scientific debate. There are researches which reject the hypothesis that local rainfall comes primarily from local evaporation (Angelini 2011).

8.4.1.3 Cooling Effect of Vegetation

Vegetation has a cooling effect on the climate. Plant and trees can be seen as the air-conditioning of our planet, as it helps to cool down the Earth in various ways and on multiple scales, from the micro-climate to the regional and even the global climate.

The impact of vegetation on the micro-climate is illustrated in Fig. 8.12. The heat picture shows a decrease in temperature inside the bund where the vegetation is present of up to 30 degrees Celsius compared to the area outside the bund. This cooling effect is caused by two different processes: the vegetation creates shade, which helps to cool down the soil (Pielke Sr 2007; Reij 2013; EGA 2016). Additionally, plants release moisture through a process called transpiration, which cools down the air surrounding the vegetation (Kravčík 2007). This process can be compared with human transpiration, which also has a cooling effect for the body.

The effects of bringing back vegetation in degraded areas does not only affect the local climate, but also influences the regional climate. The atmospheric response due to landscape change influences vegetation and soil processes at a large distance from where the regeneration of the degraded land has taken place. This faraway effect is called teleconnection (Glantz 1991). An example of this mechanism is the clouds that are formed at a certain location not only cause rain at the location where they were formed, but often also cause rainfall in adjacent regions.

By capturing large amounts of CO_2 from the air, vegetation also helps to cool down the global climate. Plants and trees store the CO_2 in the form of carbon via a process called photosynthesis, which helps them to grow. Since CO_2 is one of the most abundant greenhouse gasses, this sequestration of CO_2 from the atmosphere can help to reduce the greenhouse effect and subsequently global warming (NASA 2016). This cooling effect of vegetation can be felt worldwide.

8.4.2 Biodiversity

Biodiversity is key for a healthy ecosystem. By restoring degraded areas, the living environment for many different animal and plant species is improved, increasing the biodiversity (Benayas 2009). With more water and food availability, an increase in plant, insect, bird and wildlife species can be spotted in the regenerated areas (Fig. 8.13).

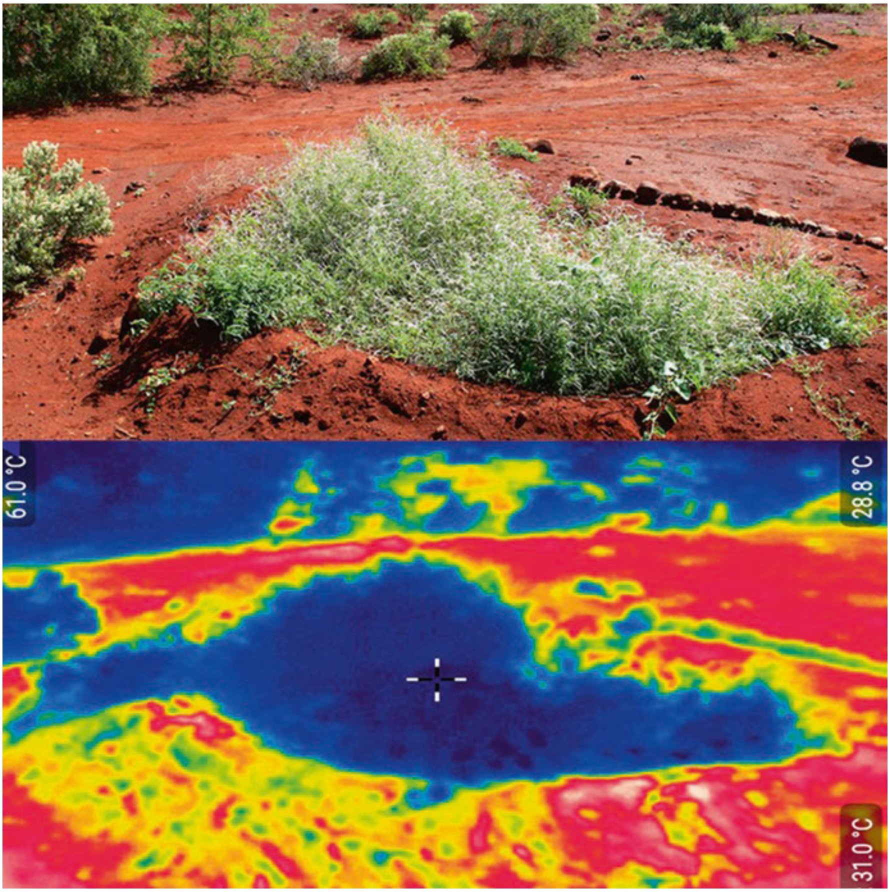

Fig. 8.12 Cooling effect of vegetation on the micro-climate. Upper picture: bund with vegetation in a barren surrounding. Bottom picture: heat picture showing the cooling effect of the vegetation inside the bund. The difference between inside and outside the bund is up to 30 degrees Celsius (Justdiggit 2016)

8.4.3 Socio-Economic Benefits

Bringing back vegetation also has a positive effect on local communities and their livelihoods (Taylor 2007; IUCN 2016).

The regreening projects of Justdiggit are managed by their local partners and communities on the ground. In Kenya, the community members involved in the project get paid for the work they do, increasing their income. This extra income can be used to pay school fees, hospital bills and extra food. In Tanzania, Justdiggit encourages farmers to regreen their own farmlands. By doing so, they improve the soil quality and water availability on their land, which can have a positive effect on

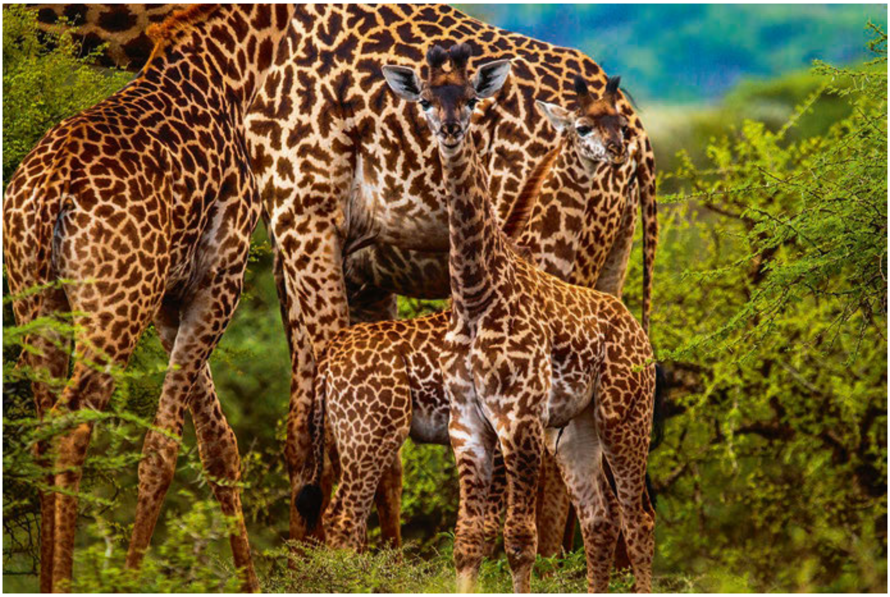

Fig. 8.13 Giraffes seen close to the Justdiggit project in the Kuku Group Ranch, Kenya (Justdiggit 2019c)

their crop yields. This gives their income a boost. Improving the income of the people involved strengthens their commitment to – and ownership of – the projects.

To promote gender equality within the project areas, women’s empowerment is an important factor. In Kenya for example, Maasai women groups completely manage and maintain the grass seed banks (Fig. 8.14). In their project in Tanzania, Justdiggit ensures gender equality among the Kisiki Hai Champions. Of these champions, 44% is women.

The green brought back in the degraded landscapes does not only provide increased food and water availability for wildlife, but it also means that more food is available for the livestock of the Maasai pastoralists. They depend heavily on cattle as source of food and income. Grazing management rules in the newly regreened areas help to prevent overgrazing. This way, the regenerated pasture lands stay healthy while providing food and water for livestock.

8.5 Scaling-up Regreening

Over the past years, the programs of Justdiggit have proven that it is possible to regreen degraded landscapes in Sub-Saharan Africa quickly and efficiently. However, to make a global impact it is important to start regreening on a larger scale. That is why these programs are scaled-up through the power of

Fig. 8.14 Women group managing one of the grass seed banks (Justdiggit 2020c)

communication and technology and by developing international awareness campaigns to promote NBS.

By inspiring and mobilizing millions of subsistence farmers and pastoralists in Sub-Saharan Africa, and millions of others all around the world, Justdiggit aims to build a regreening movement, scaling up their regreening efforts.

8.5.1 Inspire, Empower, Activate and Celebrate

In 2019 the rural population in Africa was estimated at 656 million people (Bank 2019). Almost 350 million people living in these rural areas, can potentially benefit from regeneration of the land with help of sustainable land management practices such as pursued by Justdiggit (D. Garrity 2012). These people are mainly farmers and pastoralists, who highly depend on their land as a source of food, water, and income. By inspiring, empowering and activating these farmers and pastoralists to regreen their own land, Justdiggit has the opportunity to scale up their regreening efforts throughout Sub-Saharan Africa at minimal costs.

8.5.1.1 Inspire

The first step to activate farmers and pastoralists to start regreening and regenerating their own land is to inspire them. A message is only accepteded if the person receiving it is already receptive to accept and act on that message. If a person has a low receptiveness, he or she will not accept any related messaging and thereby will not undertake any action (Eric V. Larson 2009).

8.5.1.2 Empower

Empowerment is key in the process of activating farmers and pastoralists to regreen their own land. By giving them tools, which teaches them how to apply landscape restoration techniques on their own land, Justdiggit actively empowers farmers and pastoralists to get started.

8.5.1.3 Activate

Once inspired and empowered, the farmers and pastoralists are ready to start the regreening practices and join the regreening movement.

8.5.1.4 Celebrate

Finally, the farmers and pastoralists showcase their achievements to the wider world together with Justdiggit, celebrating their achievements. This way they can reach and inspire an even larger audience to stimulate them starting their own regreening.

8.5.2 Building a Grassroot Movement

To inspire and activate people anywhere in Sub-Saharan Africa to regreen their land, Justdiggit uses the power of media and communication. By doing so, they can reach people on a massive scale, both in terms of numbers and area, and thrive the regreening of the ground without setting foot on it. They use data, mobile technology and new media to inspire and limitlessly spread the knowledge about regreening techniques across the continent, hence building a regreening movement.

8.5.3 Media

By creating positive online and offline awareness campaigns about the solutions to deal with the changing climate and with dry and infertile land, Justdiggit aims to inspire and activate farmers and pastoralists throughout Africa. They use different media outlets in order to reach people everywhere in Africa, from cities to the most remote rural areas. Not only in Africa Justdiggit aims to inspire and activate people to join their Regreening Revolution. With their global positive awareness campaigns, they also aim to show the rest of the world the effectiveness of NBS in the fight to reverse climate change. The campaigns are specifically developed for each country or landscape. In Kenya they show the digging techniques, while in Tanzania they promote the Kisiki Hai technique of restoring trees. In European and global campaigns, they break down the science into a more easy-to-digest language: regreening = cooling down the planet.

Their awareness campaigns are broadcast across different media channels, from television and radio to online. This visibility extends not only into homes, but also in cinemas and on digital screens and billboards everywhere (Fig. 8.15).

Justdiggit works together with media partners who support the work on a global level by developing campaigns and give them the exposure needed. These partners effectively donated millions in terms of media value, which gave Justdiggit the possibility to reach millions of people in both Africa and Europe.

Fig. 8.15 Billboard in Tanzania (Justdiggit 2019a)

8.5.3.1 Technology

In 2019, 45% (477 million people) of the Sub-Sharan Africa population was subscribed to mobile services (GSMA 2020). It is expected that this will increase to 50% (614 million people) of the population in 2025. This increased access to mobile services allows Justdiggit to use modern technology as a communication tool to inspire and activate farmers and pastoralists to start regreening. An example is their Regreening App, developed in close collaboration with KaiOS. KaiOS is an operating system for smart feature phones which requires little memory, but still offers a rich user experience through access to apps like Google Assistant, WhatsApp, YouTube, Facebook and Google maps. The Regreening App is developed to give farmers and pastoralists tips and tricks about regreening, so that they can easily start regreening themselves. By doing so, Justdiggit manages to connect ancient regreening techniques with modern smart technology. With affordable KaiOS enabled devices it is possible to connect farmers in rural Africa to the internet for the first time.

8.5.3.2 Case Study: Building a Movement in Tanzania

The potential of scaling with help of media and communication can be clearly seen in one of Justdiggit's on the ground projects. Within their project in Dodoma, Tanzania, they have applied different strategies to reach thousands of farmers in the region to inspire and activate them to bring back trees on their own land. An example is their movie roadshow, a video-caravan going from village to village (Fig. 8.16). This roadshow is a whole day event, filled with theatre, music, dance, and performances all about Kisiki Hai. When the evening falls, a large movie-theatre screen is set up, which shows an inspiring movie about Kisiki Hai that is filmed entirely in the Dodoma region. Up to date 324 villages in the Dodoma region have been visited, reaching over 200,000 farmers with their regreening message.

To spread the regreening movement even further, Justdiggit has also set up various approaches to reach and inspire farmers, without physically visiting them. This way they are also able to inspire farmers outside the Dodoma region. Together with partners LEAD Foundation, Dodoma FM and Farm Radio International, a special Kiski Hai radio program is developed. The goal of the show is to inform, inspire and activate farmers to start practicing Kisiki Hai on their own land, in a fun and entertaining way. In February 2021 already 300,000 people listened to the show. Besides a radio show, Justdiggit also has set up a Kisiki Hai SMS service. Farmers can subscribe for this service, which will send them a text message every week with tips and tricks on how to practice Kisiki Hai. Figure 8.17 shows the different ways of contactless regreening implemented in the program.

With help of all these different approaches activating farmers to bring back trees on their own land, Justdiggit managed to regenerate over six million trees (February 2021) since the start of the program in 2018.

Fig. 8.16 The movie roadshow in one of the villages within the Dodoma project area, Tanzania (Justdiggit 2018a)

Fig. 8.17 Different methods of contactless regreening implemented in the program in Dodoma, Tanzania. Upper left: Kisiki Hai radio show; upper middle: billboards showing the Tanzanian campaign; upper right: SMS service providing farmers with tips and tricks; bottom left: social media channels to spread the regreening message online; bottom middle: murals (painted posters of walls of houses) explaining the Kisiki Hai technique; bottom right: posters and flyers handed to the farmers, explaining the Kisiki Hai technique (Justdiggit 2021)

8.5.4 The Decade on Ecosystem Restoration

To make an even bigger impact, Justdiggit works together with different initiatives that have the same goal: restoring the planet to reverse climate change and improve biodiversity and livelihoods of millions of people. One of these initiatives is The Decade on Ecosystem Restoration. This decade, running from 2021 trough to 2030, has been declared by the United Nations Environment Programme (UNEP) and is all about restoring ecosystems around the world. The upcoming ten years are crucial in the fight to climate change and degradation of our planet. By restoring ecosystems worldwide, climate change can be restored. This is why the UN has giving the restoration of ecosystems a decade (UNEP 2021). Humans are fully dependent on Earth's ecosystems and the services that the provide (Assessment, Milennium Ecosystem 2005). Ecosystems are not only for humans of great importance, but all life on Earth depends on ecosystems. By preventing, halting, and reversing ecosystem degradation, poverty can be put to an end, climate change can be reversed, and mass extinction can be prevented (UNEP 2021).

By regreening and regenerating landscapes in Africa, Justdiggit has a unique NBS for restoring ecosystems. That's why they've partnered up with the UN Environment Program and joined their mission in restoring degraded ecosystems.

8.6 Conclusion

The Earth is warming, which leads to some severe side effects. Regreening degraded landscapes with help of NBS can help to reverse these events. Research has estimated that nature-based solutions can contribute up to 37% of the carbon emission intake required to keep global warming below two degrees Celsius. Justdiggit regenerates degraded landscapes in one of the areas where it is most needed: Sub-Saharan Africa.

With help of ancient regreening techniques such as rainwater harvesting and FMNR, Justdiggit have brought back vegetation in heavily degraded areas. With their on the ground regreening projects, Justdiggit has shown that regreening degraded landscapes has a range of benefits for the environment. Bringing back vegetation increases the moisture and quality of the soil, leads to more local precipitation and cools down the environment. It also leads to an increase in biodiversity. Moreover, their projects have shown to positively impact the livelihoods of the local communities due to increase crop yields, healthier pastureland, and the empowerment of women.

Justdiggit not only shows that degraded areas can be regreened quickly and effectively, but they also show that these regreening efforts can be scaled up by using the power of media and communication, data, and mobile technology. This way millions of farmers and pastoralists throughout Africa can be inspired and mobilized to start regreening their own land.

Justdiggit works together with a large network of partners, which support them in their mission to regreen degraded landscapes in Sub-Saharan Africa. They show that when working together, the Earth can be regreened and cooled down.

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Chapter 9
The New Local Lens: A Framework for Local Place Regeneration and Economic Diversification

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Abstract The events of 2020 have challenged the vitality and viability of our local places, main streets, shopping malls, community meeting places. The Covid-19 virus revealed how fragile these places were, how much we relied on them and how our approach to them needs to enable greater agility, adaptability and resilience. A new approach to local place and economic development is urgently needed.

To address this challenge, a new framework is proposed, one with three overarching principles. It starts with *place*, understanding what is unique and vital about a community and how to nurture it. This is followed by *regeneration*, or regenerative development, an approach which explicitly looks at how to actively contribute to the aspects of a place that bring it to life. The last of the foundational principles is the concept of *connectivity*, which recommends building relationships between elements in a place, its people, its businesses and its ecosystems.

Supporting these three are seven sub-principles. These provide the methods and concepts to support the development of what we call "the New Local," a plan and a strategy to drive recovery from the impact of the Covid-19 virus while ensuring greater ability to respond to future stresses. These principles are: *diversification, ownership, reinvestment, innovation, equity, democracy,* and *culture*. The potency of this model it the interrelated and integrated nature of all the principles, it does not privilege economy, or nature, or place, but shows how they are all needed to create a resilient, adaptive local place.

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This chapter outlines each of the principles, applies them in a case study, and shows how they can inform the redesign of a community's physical space and economy. The principles come from the combined experience of 80 years of practice in local economic development, placemaking and regenerative development.

Keywords Placemaking · Local economic development · Regenerative development · Resilience · Adaptability · Community · Covid-19

9.1 Introduction

The year 2020 challenged every part of our lives – where, how and when we work, where we shop, and where we meet. The Covid-19 virus and the consequent shutdowns exposed the fragility of these places, and also revealed their importance. We are all now rethinking our sense of community and rediscovering with fresh eyes much of what we once took for granted. In that context, we believe it is urgent to develop a new approach to economic development, one rooted in protecting and nurturing the places that are so critical for our daily lives and ongoing wellbeing. We call this the New Local.

In this chapter we describe the New Local and the principles that underpin it. Three principles lie at its core:

- The first principle is *place*, to understand what is unique and vital about a community and how to nurture it.
- Next is *connectivity*, the need to connect action to multiple principles at the same time (and not just to one goal like economic growth, for example), and to connect with local innovation all over the world.
- The third overarching principle, *regeneration*, expresses the idea that we need to grow intelligently within our resource constraints. We must learn to grow in ways that do not require greater throughputs of energy or materials, that is ways that do not deplete the ecological systems we depend on. Growing instead through better technology, more efficiency, beauty, empathy, and intelligence offers the best chance to create economic, social, and environmental abundance, together.

Supporting these three overarching principles are seven other principles that provide specific methods to underpin the New Local: *diversification, ownership, reinvestment, innovation, equity, democracy,* and *culture*. The ten principles are interconnected, and interrelated, they cannot be worked on in silos. Working on all ten at once means they are elevated together thus supporting the whole, for example innovation can only happen in a way that supports regeneration and equity.

Embracing these principles can help a community generate plans and strategies that keep residents safe, and at the same time builds recovery socially, ecologically, and economically. Taken together, these principles provide the design guidelines of the future, and create the plans and strategies to ensure our greater ability to respond to future stresses, including the challenges of climate change and biodiversity loss.

This chapter outlines each of the principles and provides an illustrative case study from the City of Newcastle, which used the New Local strategy to rethink its municipal policies and practices. The chapter also introduces how these principles can inform the design of physical space. This thinking comes from the authors' combined experience of 80 years in the fields of local economic development, placemaking, and regenerative development. Although developed in response to the pandemic, we believe both the principles and the practices recommended can enable communities to prepare for many other kinds of future challenges.

9.2 The New Local Lens

9.2.1 The Need

The New Local's values are of a given place, connecting all stakeholders in that place, and deepening their connection with that place, with one another, and with the world.

Regenerative development defined as: "the process of cultivating the capacity and capability in people, communities, and other natural systems to renew, sustain, and thrive" (Plaut et al. 2016, p. 2). It supports the New Local by helping a community create a vision for a vibrant, vital place. It provides people with the agency to move through change and crisis (Hernandez-Santin et al. 2020). It is rooted in the relationships that can be built among all the stakeholders of a community, human and non-human, ecological and social (Hes et al. 2020). It is about enhancing connectivity and attachment, in essence creating a care, or love, of place.

The need for a regenerative approach to place was highlighted by the 2020 pandemic, as the vitality and viability of our local places, main streets, shopping malls, and community meeting places was challenged. The Covid-19 virus showed how fragile these places are, and at the same time how important they are to our daily ways of living, and our sense of identity and community. This regenerative approach is presented here as a framework for the New Local. It is an approach for revitalising and strengthening places, through a focus that begins at the local level, an approach that builds greater agility, adaptability and resilience. It is an approach that integrates both research and experience, in ways that best to energise and coordinate community renewal, using complementary research and experience to re-localise economic activity, finance and governance.

9.2.2 What Is Placemaking

The concept of placemaking is critical to the New Local. Placemaking is a continuous process of shaping spaces to create meaningful experiences (in, of, and for) people (Wyckoff 2014). Harvey (2003) writes that physical space in a city should go beyond the individual, it should be a collective exercise that reshapes space as part of the community and the surrounding social and ecological systems.

While regenerative development creates the meta narrative, placemaking constitutes the hands-on work to make it real by co-creating strategies to act on the narrative in a specific geographical location.

9.2.3 How the New Local Was Created

When catastrophe strikes and our survival is challenged, we also are invited to take stock of what we loved about the past ways of being, to reflect on what was not working, and to develop ways to build on the positives and reduce the negatives. This is how the New Local was born. Michael Shuman, a U.S. based advocate of economic localization, was scheduled to visit Australia in the middle of 2020, as he had in recent years, to work with Gilbert Rochecouste, founder of the Village Well in Melbourne, to strengthen various Australian communities with new ideas on placemaking and local investment.

In parallel with this planning, Gilbert and the Village Well team also were in discussion with Colin Hocking regarding ways to strengthen the focus on sustainability and regeneration within the framework of Placemaking. Several internal documents were prepared, drawing on efforts to enhance sustainability and move towards regeneration at the local level. These ideas included:

> the new place making will be about how we deeply engage with, and devolve power back to communities and mobilise key leaders in catalysing key tipping points for a new story for their towns in streets and neighbourhoods … bringing together the social, environmental and economic, and look at the need to integrate these … AND … how we deeply engage with, and devolve power back to communities and mobilise key leaders in catalysing … a new story for their towns in streets and neighbourhoods …. (Summary of personal communication between Gilbert Rochecoste and Colin Hocking, February 2020)

By early April 2020 we were already starting to discuss the effects of actions to control Covid-19 in directing people back to their local communities, in a multiplicity of ways, across social reconnection, engagement with local businesses and economic activity, and appreciation of local natural places. Thus, when the suggestion was made of developing some sort of on-line forum, to continue working within the travel restrictions of Covid-19, we decided to offer an online course combining Michael and Gilbert's perspectives and offering it to an audience beyond Australia. In parallel with, and interweaving with, the proposal for an on-line forum that addressed local economics, social foundations and environment together, was the idea of exploring how this could be made more interactive, drawing initially on Colin's prior experience of blended-mode learning (VanDerLinden 2014), in a previous University context (for a description of blended mode learning combining on-line and face-to-face settings, see Latrobe 2021).

The first step in this process was for Gilbert and Michael each to nominate five principles that underpinned the ideas that they wanted to bring to on-line teaching and learning, focusing on the now identified theme of The New Local. The commitment to blended-mode learning prompted discussions around how these principles related to each other, as well as how they should be introduced, what emphasis would be placed on bringing key concepts and information to the on-line learning process, and what key issues for discussion were to be proposed, for the interactive part of the on-line program.

An additional step taken in this process was to plan for front-loading some of the key concepts and information, in the form of short videos, able to be accessed by participants prior to the on-line sessions. This would be followed, at the start of each of the synchronous on-line sessions, with a discussion between Gilbert and Michael about how they were grappling with understanding these concepts, and how best to implement them.

As these ideas developed, it was recognised that the principles, initially envisaged as stand-alone items, were inter-related, and that some of these principles were foundational to all of the principles being developed/proposed. This led to the emergence of the New Local Lens. As the work progressed on developing the concept and ideas of each of the principles, the team connected with Dominique Hes to check in with regenerative development concepts. Dominique also contributed ways in which the New Local principles could translate into designed spaces.

9.2.4 The New Local Lens Introduced

As the ten principles evolved and changed through our on-line discussions, three clear principles emerged: A Sense of Place, Connectivity and Sustainability/Regeneration – sometimes referred to as 'Planet'. A shift emerged in how these three principles were expressed in relation to the other seven principles, around the concept of locating all the other principles within Sustainability/Regeneration. In part, this comes from the concept expressed 25 years ago in the first Australian State of the Environment report (Lowe 1996), of changing from the notion of seeing Social, Economic and Environmental dimensions as overlapping (the Venn Diagram) to the notion that the Economic is contained within the broader Social, which in turn is contained with the Environmental (Fig. 9.1). In other words, there is no social or economic without a functioning environment.

Further discussion identified the notion of Place being central to the overarching concept of The New Local – that is, the characteristics of each local Place were fundamental to understanding how each of the principles could be enacted in each local and regional context. The principle of connectivity was originally conceived as connectivity between businesses and enterprises, but it was soon realised that, particularly in the context of Covid-19, the interconnections between the social and economic were going to be important in addressing the change in circumstances of peoples' lives. In addition, there was the recognition that both the social and economic are also intimately connected to their environmental foundations.

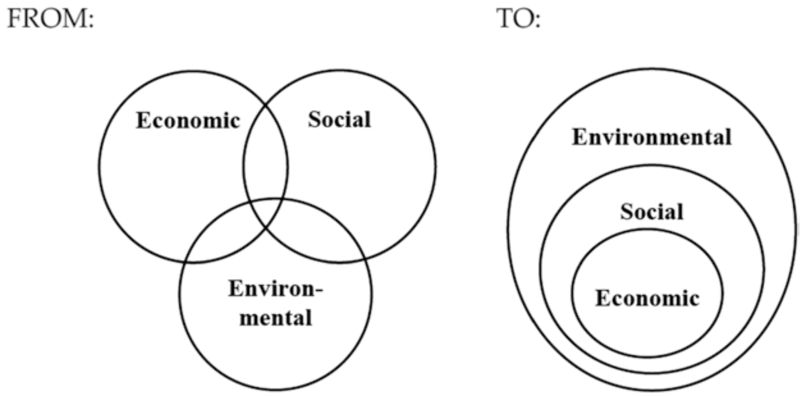

Fig. 9.1 From Venn diagram that result in trade-offs, to embedded, connected, integral, nested (Lowe 1996)

Out of all of this, the New Local Lens was born (Fig. 9.2). With the need for a 'local' focus, the principle of 'Place' was located at the at the centre. 'Connectivity' was located as a band that recognised that the local needed to be linked to both the global (Planetary) and, at the same time, that connectivity needed to be enhanced between the elements (a systems approach). This was all embedded in, and connected to the principle of Regeneration/Planet, as this is the foundation within which all actions and activities would take place. And it involved a shift from just 'sustaining' to also 'regenerating', aiming to give back more than we are taking out (Mang and Haggard 2016; Mang and Reed 2012; Wahl 2016).

9.2.5 The New Local in Practice

The City of Newcastle, Australia started a journey of implementing the New Local at the end of 2020. They were inspired by an introductory webinar on the New Local, and they felt that their new economic local plan needed a new narrative to inspire the community and all stakeholders to have agency of the plan and its potential. At the time of writing this chapter, the authors have had several interactions developing the New Local at Newcastle through (Fig. 9.2):

- Workshops with a wide variety of Council departments participating
- Presentation of workshop outcomes and recommendations to Council staff
- Presentation to Councillors, Deputy Lord Mayor and key business/industry leaders for input
- Delivery of a New Local festival with community and business engagement to integrate the New Local principles

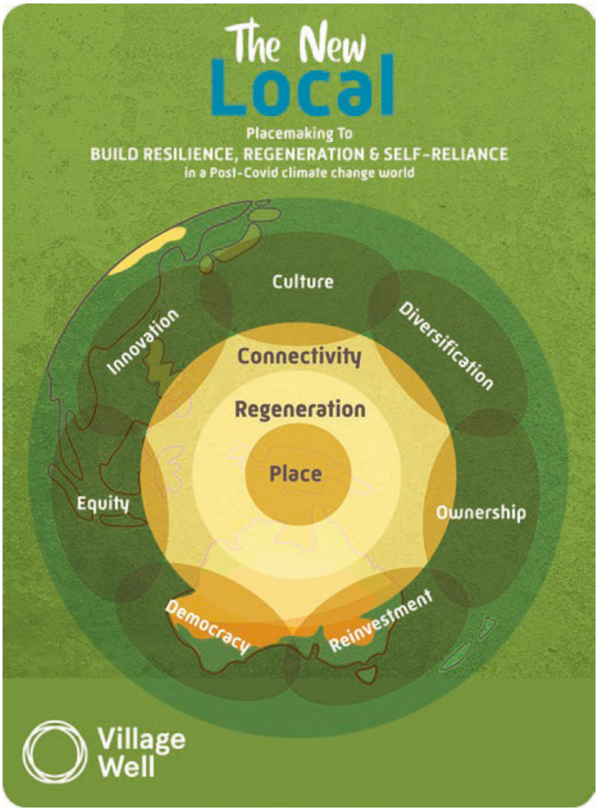

Fig. 9.2 The New Local concept. (Source: Authors)

This helped the Council to create a more integrated lens, looking at how to stimulate both place initiatives and local economic stimulus. In this chapter we will briefly use this case study to illustrate how each principle informed their strategy.

9.3 The Principles of the Lens

The next section of this chapter outlines each of the principles of the lens, presenting their purpose, origin and describing ways that the New Local approach can help communities investigate and plan for each interconnected opportunity, as revealed by applying the lens.

Image 9.1 The City of Newcastle Mural artist: Fintan Magee (under the Big Picture Fest); Image: Wiltliving Photography. (Source: City of Newcastle Economic Development Strategy, p. 26)

9.3.1 Place

Place and placemaking are central to creating resilience (Hes and Hernandez-Santin 2020; Hernandez-Santin et al. 2020). Everything starts from place—who we are, what our identity is (Bush et al. 2020; Davis 2016), what makes us special. 'Our' place, both its essence and vision, reflects authentically who we are and what we want to be. It includes both the human and non-human, both the software and hardware.

The concept of software and hardware is a good way to express 'place' in more detail. The 'hardware' is evident in the designed artefacts of place, the buildings, benches, the roads, and footpaths, the drains, and city squares, the trees, ground-cover and wildlife, and the water features. The software, in turn, comprises the operating systems of the place, the regulations, the community groups, the festivals, the goodwill, the volunteers, the meetings, the skills of facilitation, and holding a community safe through processes of decision making, design and change.

The local place has always been important but becomes even more so as we come to terms with the challenges of international events such as Covid-19. Highlighting the economic, environmental, and social challenges that need to be addressed in developing the post-crisis support for communities. Placemaking is the art of creating meaningful, inclusive, and connected places that people have. It is the process of creating a great place. The ecological aspects of place and how it contributes to wellbeing and connection can be understood through the theory of Biophilia (Kellert and Wilson 1993).

In Biophilia, a key underpinning concept in regenerative development, there are two critical aspects that need to be considered. The first is the 'Organic or Naturalistic' dimension. This is expressed by shapes in the built environment that directly or symbolically reflect the human affiliation to natural systems, it is the parks, the trees, the flowers, the structures and so forth. The second is the 'place-based' dimension that relates to "*the culture and ecology of a locality or geographic area"* (Kellert 2005, p. 6), elements that are not quantifiable and are rooted in environmental, social and cultural dimensions that, when interconnected, produce what is often called the 'sense of place' (Ibid).

That is, if a place weaves together the social, economic and ecological aspects, if it provides places for engagement, retreat, safety, connection, resilience, and so forth, the result is a community with deep attachment and connection to the place. This is a critical contribution to the New Local – the understanding of the importance of place in resilience, in the need for people to feel recognition, belongingness and sense of community, all of which contribute to place attachment. This in turn provides a "*remedy against feelings of alienation and estrangement*" (Aravot 2010).

For Newcastle, place helped inform their new Economic Development Strategy – it was about a place-based approach to its villages, precincts and main streets. Each of these require a distinct place-based solution around amenity, initiatives, transport, activation and opportunities to engage. The intent is that the New Local approach for each specific geographical spot will be community owned, understood and delivered (Fig. 9.3 one of the New Local workshops).

This all informs the physical design of the public spaces of Newcastle, for example by providing spaces for people to sit and talk without needing to pay money for coffee, ensuring transport is an enabler of connection not a barrier, and so forth. This ensures that the hardware enables the software to be developed collaboratively with the community, as they think about their New Local, and how to be active participants of their place (see Fig. 9.4 places, main purpose and connections informing physical design).

9.3.2 Connectivity

Everything is connected, which means we must think holistically, across boundaries and across principles. We must embrace two kinds of connectivity. One is that we live in a "Glocal" world (Robertson 1992, 1995); and the other is that we appreciate the connections among all ten of our principles and never let one "silo" impede our attention to achieving the larger goals.

The first type of connectivity requires that we remain curious, aware, and engaged with other communities worldwide, to learn what is working in business and policy.

Fig. 9.3 Community and Business Workshop developing the New Local, Newcastle May 2021. (Source: Authors)

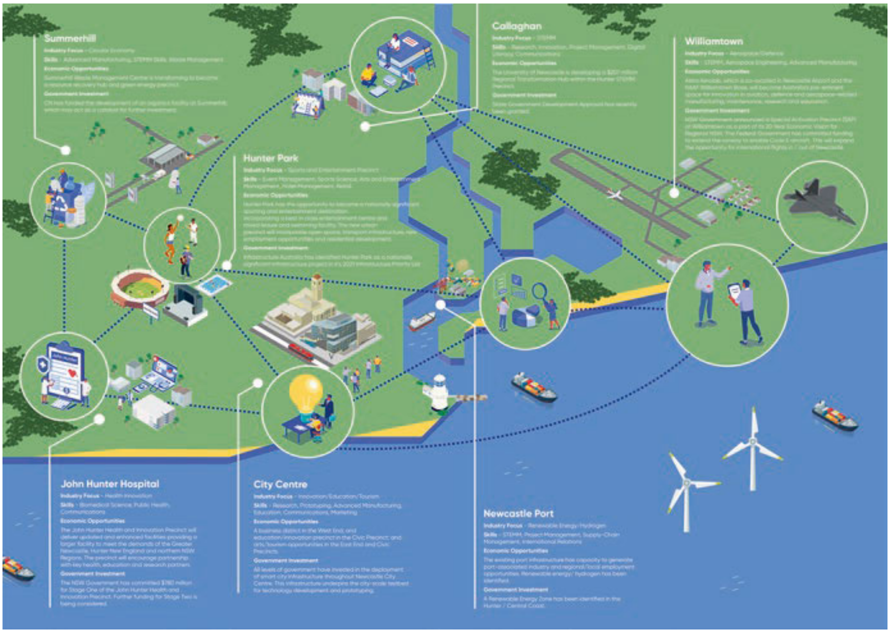

Fig. 9.4 The unique places of Newcastle May 2021. (Source: EDS report by CoN)

Every locality exists in a web of other localities and every place can learn from other places.

Shuman's own entry into the field of community development came about from his earliest experiences with connectivity. After receiving his law degree, he co-founded the Center for Innovative Diplomacy (CID), which for more than a decade helped mobilize U.S. cities to engage in foreign policy. CID recorded, amplified, and catalysed the efforts of thousands of U.S. mayors and city council members during the 1980s and 1990s to change national policy with respect to nuclear arms control, military intervention in Latin America, and apartheid in South Africa. It also organized U.S. and Canadian cities to enter a Stratospheric Protection Accord, which laid the foundation for the Montreal Protocol, which in turn curtailed emissions of CFCs and halons to protect the earth's ozone layer. The lesson was that localities working together could, like the Lilliputians tying down Gulliver address some of the world's toughest problems.

The old local was about isolationism and going it alone. The New Local is about a different kind of globalization. It means communities working together worldwide to spread the know-how, technologies, and business models for greater self-reliance. In 2010, Shuman and his colleagues undertook a study of 24 *Community Food Enterprises* from around the world for the Gates and Kellogg Foundations. One of the most surprising findings was that almost every business had productive, give-and-take relationships with counterparts elsewhere in the world. For example, the White Dog Cafe in Philadelphia, which was one of the central organizers of the local economy movement, had a "sister restaurant" relationship with Cabbages & Condoms in Thailand, which was the leading promoter of AIDs education and reproductive rights in that country.

As communities seek to implement the New Local, one of their primary tasks is to import, not unnecessary goods and services that they should be producing for themselves, but ideas and innovations. Equally important is exporting success stories to other communities. Every innovation that one community makes in, say, food self-reliance through hydroponic greenhouses and aquaponic fish production, should be shared freely with other communities. As more and more communities become increasingly self-reliant, all kinds of otherwise insoluble global problems like climate disruptions, capital flights, or resource-driven wars, become more manageable.

The other meaning of connectivity is to be mindful of the relationship of each principle to the other nine. If our concept of innovation is simply an incubator that exacerbates local inequality, then it is a poor economic-development choice. Most mainstream economic development policies prioritize jobs and corporate expansion, with little appreciation for the impacts on sustainability, resilience, or place.

With connectivity in mind, a community might insist that its economic development agenda be attentive to the social standards of companies. For example, more than 3500 companies worldwide have embraced the rigorous standards of "B Corporations," which measure performance with respect to governance, the community, the environment, customers, and other stakeholders. A few communities have started to award certain economic benefits, such as tax breaks or public procurement preferences, to high performers. Redefining success from "more jobs" to "more jobs in socially responsible businesses" can greatly improve a community's quality of life.

For Newcastle, in applying the New Local principles to their strategic documents, it was about understanding economic leakage and supply chains, and creating sector-specific partnerships to minimise economic leakage by refocusing economic development on small, locally owned, leak-plugging businesses. Newcastle has since issued a tender with universities and local partners to identify the leakages and cost-effective opportunities for investing in new or explained local businesses.

9.3.3 Regeneration

Regeneration is where we put back more into our ecological and social fabric than we take out. It goes beyond just being sustainable, and looks at the whole system. It asks: how can we make this system stronger and more resilient? It understands that everything is interconnected and therefore what is important is to strengthen and support the relationships people have to the built environment, the natural environment, and with each other.

The goal of regeneration is to increase the ecological fabric, while also increasing social and cultural cohesion, to enhance local life supporting systems. Regeneration empowers local enterprises to be part of their place, and feel pride in contributing to it. This involves supporting them to think about what they can do to improve the local environment, including how to reduce waste and water use, how to minimize greenhouse gas emissions, and at the same time support the community, etc.

Regenerative development, the engine underlying the outcome of regeneration, as defined earlier it is about developing local capacity to enable adaption and place specific evolution. Simplified this means (adapted from Hernandez-Santin et al. 2020):

1. Understand the flows through the place that bring it to life and create a healthy, nourished living system. Flows are the various resources (water, energy, money, people, buildings, ecology, etc.), including 'intangibles' such as, culture, beauty, history and social cohesion.
2. Design place-based solutions that create multiple, mutual benefits between these flows by focusing on the opportunities for creating relationships.
3. Review, reflect, revisit, communicate, connect, share and empower to build the capacity to adapt to change.

Though in its infancy in application, Regenerative Development is informed by systems thinking (Meadows 2008), ecological thinking (du Plessis and Brandon 2015) and indigenous thinking (McClelland 2019; Wahl 2016; Mang and Haggard 2016). Critically, regeneration requires us to work within a system to enable the potential of the system to emerge, to co-evolve the aspects of the system, so that it can constructively adapt to change and evolve towards increasing states of health and abundance.

Therefore, for a community to integrate regenerative thinking into their New Local strategy, they need to think through what brings this place to life; what does it look like when it is thriving, humming with energy, and feeling energetic? With the answers to these questions then the intention of regeneration is to actively design in the hardware and software to support these things to occur.

For the City of Newcastle (CoN), the start of the journey towards developing the New Local within a regenerative frame was to develop a: "*compelling twenty-first century economic development vision and roadmap that puts people and planet first, unleashes creative entrepreneurship and becomes an enabler, facilitator and partner of social innovation and positive change*." (The New Local Newcastle: Engagement Summary and Recommendations Report 2020, p. 3). Regeneration helped Newcastle to develop a way to increase the diversity of the city's businesses, creating more small-to medium-sized locally based companies and collaboratives. It helped to develop businesses that can respond to local needs, for local stakeholders. The intent was to help entrepreneurs identify "*local-market opportunities for SME expansion, facilitating collaborative SME networks, spreading best practices for social performance, developing a pipeline of promising start-ups, and stimulating "buy local" programs*" (ibid, pp. 5, 6). That is, to build local potential.

Spatially when designers are working with the New Local, it involves both the ways to adapt spaces to support the placemaking, and ways to re-localises, specifically looking at how to connect people to place and each other, supporting and strengthening the connectivity aspects discussed above. Regenerative development is also a process of integrating ecological capacity (see Fig. 9.5), for example designing in green spaces, water bodies, references to local history (pre and post-colonial), geology and landscapes, that also then are included as part of the design response.

9.3.4 Diversification

A new vision of economic development should strive to increase a community's self-reliance. The old vision, rooted in David Ricardo's theory of comparative advantage, encouraged communities to find a small number of "world class" exports, and import the rest of the goods and services it required. The new vision sees the value of diversification, partially because it contributes to a stronger economy and partially because it strengthens community resilience. The more we buy and sell to one another in our own communities, the more income, wealth, and jobs we can create. The more self-reliant we are, the more prepared we can be for unexpected global events, whether wars, pandemics, capital flights, or supply chain disruptions. Emergence from Covid-19 offers a prime opportunity to rebuild communities with a high level of self-reliance and local diversity. While perfect self-reliance is impossible and counterproductive, there's little doubt that every

Fig. 9.5 Museum Place Park, Newcastle. (Source: Hunter and Central Coast Development Corporation)

community can increase its level of self-reliance, especially in basic goods like food, water, housing, health care, finance, and other services. Two examples underscore the virtues of diversification.

1. Thirty years ago, Güssing was a dying rural community of 4000 in Austria. Its old industries of logging and farming had been demolished by global competition (Tirone 2007). Many of today's economic developers would have given up and encouraged the residents to move elsewhere. But the mayor of Güssing decided that the key to prosperity was to plug energy "leaks." He built a small district heating system, fuelled with local wood. The local money saved by importing less energy was then reinvested in expanding the district heating system and in new energy businesses. By 2007, 50 new firms had opened and created 1000 new jobs. And most remarkably, the town estimates that this economic expansion actually will result in a reduction of its carbon footprint by 90%.
2. A second example is Zingerman's Community of Businesses in Ann Arbor, Michigan. Since its first business, a delicatessen, opened in 1980, Zingermans has since grown into a community of a dozen businesses, each independent but linked through overlapping partnerships that collectively employ 750 people and achieve annual sales of over $65 million. Over that period the proprietors conscientiously built a food cluster from scratch. They carefully assessed the items going into the deli – bread, coffee, cheeses – and developed profitable opportunities for creating a bakery, a coffee roaster, and a creamery. They looked at the products being sold at the deli – fabulous coffee cakes and high-quality meats –

and built new, value-adding businesses with these products, including a mail-order company and a restaurant called the Roadhouse. A smart community will nudge as many of its businesses as possible to follow this kind of growth strategy.

These examples cast doubt on economic developers' singular focus on identifying and expanding existing "world class" clusters. A better approach is to create new clusters based, initially at least, on local demand. Locally owned clusters often then naturally expand into regional and global markets.

As Jane Jacobs (1969) argued, an economic strategy promoting import-substituting businesses turns out to be the best way to develop exports. Suppose North Dakota wished to replace imports of electricity with local wind-electricity generators. Once it built windmills, it would be self-reliant on electricity but dependent on outside supplies of windmills. If it set up its own windmill industry, it would then become dependent on outside supplies of machine parts and metal. This process of substitution never ends, but it does leave North Dakota with several new industries – in electricity, windmills, machine parts, and metal fabrication – that are poised to meet local needs but also export markets. This example shows that, instead of putting all of a community's enterprise eggs in one export-oriented basket that leaves the local economy vulnerable to fluctuating global markets, import substitution develops myriad small businesses, grounded (initially at least) in diversified local markets, many of which then become exporters.

For Newcastle, embracing this principle now means creating a cluster of creative industries and developing a culture of creative entrepreneurship. One initiative is revitalizing parts of the city centre by offering low rent and subsidised tenancies, and setting up co-learning networks. Drawing from models in nature, Newcastle is nurturing niches of innovation. These evolving spaces for quiet work, collaborative work, online work, research, training, ideation, building prototypes, and so forth are increasing the local diversity of products, employment and adaptiveness. Figure 9.6 below shows input into spatial and activity planning at one of the CoN's networking events.

9.3.5 Ownership

While mainstream economic development values all jobs equally, irrespective of the type of business providing them, the New Local favours a laser-like focus on businesses that are locally owned. One reason is that a locally owned business spends more in the local economy and thereby imparts a more profound "multiplier effect" than a nonlocal business. Over the past 20 years, there have been more than two dozen studies comparing the impacts of local versus similar non-local businesses and showing that the local business generates two-to-four times the jobs, wages, taxes, and other economic-development impacts (Shuman 2015).

Other studies have found that communities with a higher density of locally owned businesses have stronger economic performance. In a 2010 study in the

Fig. 9.6 Collaborative approach. (Source: CoN)

Harvard Business Review, the authors wrote, "Our research shows that regional economic growth is highly correlated with the presence of many small, entrepreneurial employers—not a few big ones" (Glaeser and Kerr 2010, p. 26). Another study published soon after in the *Economic Development Quarterly*, similarly found: "Economic growth models that control for other relevant factors reveal a positive relationship between density of locally owned firms and per capita income growth, but only for small (10–99 employees) firms, whereas the density of large (more than 500 workers) firms not owned locally has a negative effect." (Fleming and Goetz 2011, pp. 277–281) This is also the finding of a 2013 paper published by the Federal Reserve in Atlanta, which analysed counties across the United States, and found statistically significant "evidence that local entrepreneurship matters for local economic performance . . . [T]he percent of employment provided by resident, or locally-owned, business establishments has a significant positive effect on county income and employment growth and a significant and negative effect on poverty…." (Rupesingha 2013, p. 22). In other words, strengthening local businesses is a key to reducing poverty and promoting social justice.

Local ownership of business also stabilizes an economy. A community with one big factory, run by outsiders, is extremely vulnerable to decisions made in boardrooms outside the locality. As many single industry locales have learned – especially those producing resource-dependent products like fish, paper, wood, oil, or coal – if a global corporation takes over the industry and decides it can get a slightly higher return by moving the plant elsewhere (e.g., Mexico or Vietnam), the community can collapse overnight. A community with a diversity of local businesses, in contrast, is better able to adapt to inevitable changes in the national and global economy. While a global factory owner will move from place to place, looking for the highest rate of return, a local factory owner may be happy to stay if it is generating even just a small but positive rate of return.

Greater economic stability of communities filled with local businesses means greater employee loyalty and less mobility (Tolbert 2014). In 1946, two noted U.S. social scientists, C. Wright Mills and Melville Ulmer, explored this question by comparing communities dominated by a couple of large manufacturers versus those communities characterized by large numbers of small businesses. They found that small-business communities "provided for their residents a considerably more balanced economic life than did big business cities" and that "the general level of civic welfare was appreciably higher" (Lyson 2001, p. 3). Thomas Lyson, a professor of rural sociology at Cornell, updated this study in 2001 by looking at 226 manufacturing-dependent counties in the United States. His conclusion was that these communities are "vulnerable to greater inequality, lower levels of welfare, and increased rates of social disruption than localities here the economy is more diversified" (Ibid.).

The rootedness inherent in local ownership contributes to quality of life. There is evidence that counties characterized by a greater density of local businesses have less crime and better public health (Stroope et al. 2014). The authors who made this finding surmise that the social connections and greater wealth of these communities contribute to more effective collective decision-making (Blanchard et al. 2012). Recent research on food systems has shown that local business communities, by embracing local food that's fresher and less processed, have lower rates of obesity and Type II diabetes (Bloom et al. 2018).

Finally, local ownership of business helped a community with placemaking. With local ownership, businesses can embody the unique DNA of local culture, foods, ecology, architecture, history, music, and art. It also convinces the best and brightest to stick around. Richard Florida argues that the "creative class" is drawn to local business communities that celebrate civic culture (Florida 2002). So are tourists, who are especially attracted to restaurants, shops, and museums that are unique signatures of a community.

It is worth underscoring that local ownership can come in many legal forms. Most small businesses, whether sole proprietorships, partnerships, or corporations, are locally owned. So are almost all cooperatives, mutuals, and public enterprises. Not-for-profits are not owned by anyone but are usually locally controlled. The only businesses that are clearly not locally owned are publicly traded corporations, which is what makes the next principle so important.

The City of Newcastle sought to embrace the New Local principles of ownership and diversification through several new policies. Using REMPLAN,[1] it analysed dollar leakages in its supply chains and purchasing patterns, to identify opportunities for cost-effective import substitution. This process began redirecting City investments, away from a small number of large companies to programs employing existing residents across a large number of small businesses.

[1] REMPLAN is a tool that enables complex region specific economic and demographic data to be analysed and presented to create insights that support local decision making and investment.

9.3.6 Reinvestment

A central contradiction in most developed countries is that the vast majority of businesses are locally owned, and yet citizens place almost all their lifetime savings into the small part of the economy occupied by global companies. This ensures a disconnect between the power of investment and the sought-for impacts of economic development. The New Local seeks to resolve this contradiction and provide communities with tools for localizing their investment dollars.

One innovative tool to relocalize investment is crowdfunding, which has greatly brought down the legal and transaction costs of small businesses obtaining investment from grassroots investors. Investment crowdfunding was legalized in the United States in 2016, and since then more than 1000,000 Americans have placed a billion dollars into small, mostly local businesses. The average raise by a business through an online "portal" is about $300,000, and the average investment about $800. The most successful entrepreneurs have been female and non-white, precisely those groups most marginalized by the current investment system. In Canada, local investment has been boosted by the recent development of neighbourhood pension funds in Nova Scotia, investment cooperatives in Alberta and British Columbia, and local investment tax credits in New Brunswick.

Changing the law is not enough. Smart economic developers also must focus on changing behaviour. This requires a concerted effort to make more local businesses "investment ready" through technical assistance, mentorship, incubators, fab labs, maker spaces, and co-working hubs. It further requires mobilizing local investors through education, investment clubs, simpatic investment advisors, and tax incentives. Communities also can facilitate relations between local businesses and investors through local investment networks (both physical and online), local investment funds, local stock markets, and local self-direction of pension investments. In fact, the entire financial infrastructure of countries needs to be reassembled at the local level.

Local reinvestment is a logical imperative for expanded local ownership – but not just of business. Local reinvestment prioritizes residents owning their own homes, their shopping malls, their downtowns, their solar and wind utilities, and even their community waste management system. We are already seeing the tools of reinvestment diversify to accommodate local needs. More cities are figuring out how to issue municipal bonds to expand their portfolio of civic projects, and more developers are using structures like community land trusts and community investment trusts to facilitate locally owned affordable housing. Local reinvestment also can help pull the most struggling households out of poverty by refinancing their high-interest credit-card and payday-loan debts.

Like all investments, local investments carry risks. The portfolio of a local investor is vulnerable to a sudden downturn in the regional business cycle. Some of these risks can be lowered through the superior knowledge a local investor can acquire by knowing the business or program in question and by asking hard questions of the managers and workers. But ultimately, the principle of reinvestment needs to be

Fig. 9.7 Lak and the team at Goldenfields where they grow heirloom tomatoes, cucumbers and beans, supplying to Your Food Collective. (Source: Your Food Collective)

integrated with the principle of connectivity. Creating a fund of local funds, that holds small pieces of hundreds of thousands of community funds, might allow a community to invest locally and still hedge its risk globally.

In Newcastle, the intent of the New Local festival is to give confidence in the local entrepreneurs and investors to reinvest in their local places and economies. Council is in the process of creating a package of incentives and support structures to create the confidence of that reinvestment. An example was at the New Local event a local group called 'Your Food Collective' (Fig. 9.7) presented a locally sourced food delivery service, supporting local farmers and producers.

9.3.7 Innovation

Economic development today says it is about promoting innovation, but in fact most of its resources are focused on the attraction and retention of nonlocal businesses. This amounts to, not the creation of new businesses, but the theft of businesses from one community by another. The New Local, in contrast, explicitly repudiates these practices and focuses instead on the start-up and expansion of locally owned businesses. This means a deep commitment to entrepreneurship and to retraining local workers to meet emerging workforce needs.

Another departure of the New Local from traditional economic development is how it defines innovation, that is grounded and informed by the other nine principles. Today, most economic developers mean creating high-growth businesses, what they call "the next Microsoft" or "the next Apple," by nurturing the "best and the brightest," typically those with the highest levels of educational attainment. They forget that Microsoft and Apple, in fact, were both started by college dropouts. Mindful of the principles of equity and democracy, the New Local seeks to stimulate and support innovation everywhere in the community: from recent immigrants, from high school students, from retirees, from people with disabilities. In many communities, such people on the margins constitute the majority of the population. How can any form of economic development worthy of the name reasonably proceed without these people?

An example of a New Local approach to innovation is Fundacion Paraguaya, a non-profit foundation that, since 1985, has been providing microlending and sustainable training to Paraguay's farmers and other agricultural workers, with some of the funding focused specifically on women and young people. Fundacion Paraguaya's Financially Self-Sufficient Organic Farm School offers a solid high school education focusing on strong agricultural practices, business skills, and entrepreneurship. The first of these schools was set up in Cerrito, 46 km from Asuncion, Paraguay's capital. Every student gets experience working in 16 different food enterprises on campus, everything from managing a restaurant to running a diary. These are real businesses, the revenues of which cover the entire cost of the high school. Coming out of high school is a new generation of innovative, local food entrepreneurs that will increase the levels of food self-reliance in communities across the country.

A community committed to the New Local conception of innovation might create peer-support groups for entrepreneurs in every sector of the economy. Special efforts would be made to include entrepreneurs who have the least resources and whose businesses are in the poorest neighbourhoods. For example, there might be a group of computer service start-ups, supported by the leaders of local software companies and computer manufacturers. Supporting these entrepreneurs might be a loan fund underwritten by local investors. The role of economic development is then to ensure that every person in the community with a great business idea – especially a young person – is able to find the capital, people, space, and partnerships needed to succeed.

To apply this to the Newcastle example, there is a need to encourage everyone to have confidence to come forward with their ideas, to link small businesses together, and provide the opportunities for business and educational institutions to think together (Fig. 9.8). And to support all of those with new ideas, to develop them further. Initially they will start this process through the New Local festival, and the incentives package which is in development at the writing of this chapter.

Fig. 9.8 Newcastle New Local Festival – Community and Business workshop. (Source: Authors)

9.3.8 Equity

Social equity can broadly be defined as the more equal distribution of public resources and goods (McCormick 2017); it is about all citizens being given equal opportunity and access to basic needs, such as fresh food, safe and affordable housing, open space, and other amenities, as well as services, such as healthcare, education and transport. Being able to access these basic needs readily and locally, irrespective of race, class and other dimensions of social identity, can indicate a high level of social equity and can be one way of measuring a community's health, inclusivity and liveability (Parker 2015). Where and how communities live can affect social equity – both within cities and between cities and regional, rural areas – bringing to the fore the role of place in social equity. Recent major challenges, such as climate change and the Covid-19 pandemic, have revealed some of the systemic inequalities and institutionalised policies and practices that disproportionately burden, disempower and further reduce social equity for some groups (Fensham 2020). In light of this, it is more important than ever to facilitate a holistic approach to place planning, one that considers the needs of all citizens and communities, to create more locally resilient, equitable and liveable places in future.

Equity is the foundation of a harmonious, inclusive, fair, and kind society. Fair and equitable access to education, health and affordable housing is the catalyst for an inclusive society. I (Gilbert Rochecouste – Co-author) am a product of this. Without access to free health and university I would not be here considering myself a placemaker and writing this article in Melbourne Australia.

For a local community to embrace equity they must critically analyse whether their economy is leaving no one behind, irrespective of race, gender, ethnicity, age or sexual orientation. This means looking out for blind spots in any of their economic, social and cultural development strategies. Entrepreneurship and workforce development programs should focus, at least in part, or to a substantial degree, on those who most need inclusion. Embracing social interventions like cooperatives, community land trusts, access to affordable education, food, housing, and health can be critical to improving equity.

There are two spatial examples of how this principle has been applied in practice. The first is an example of the New Local approach to equity is Murundaka Co-Housing Community, based in Heidelberg Heights, Melbourne, Australia (Murundaka Cohousing 2021). Murundaka is a housing rental co-operative, the name is a Wurundjeri word meaning 'a place to stay; to live'. Murundaka is a member of the Common Equity Housing program, an all-rental and long-term social housing program. All residents have secure, long-term, affordable, cooperative housing in a collaborative community, with a focus also on reducing their ecological footprint through the physical design of the buildings, while maximising social opportunities through the design of shared spaces.

The second example of equity is the Community Kitchens Pilot Project in Frankston, Victoria. The aim of the project was to bring local communities together and improve physical and mental health through learning about healthy food, and how to prepare it. The project fostered community ownership and ongoing participation. The project promotes equity through its focus on isolated families, Indigenous families and communities, families with a child or parent with a disability, and culturally and linguistically diverse families. A key aspect of the project's success is its flexible model, as each Community Kitchen operates in its own unique way to meet the needs, issues and preferences for different groups of people, by designing the kitchen spatially and procedurally, to meet their specific needs. Additionally, partnering with community groups and organisations has limited the need for external funding which bolsters the sustainability and resilience of the overall project. Community Kitchens are a flexible model to achieve food security in vulnerable population groups, and have proven to be successful in a variety of contexts.

In Newcastle the concepts that have been considered include access for all to high quality amenities, and to free events, and by providing enabling support, such as free high quality wifi, meeting spaces, quality public seating, parks, playgrounds, affordable local food, markets, etc. – in essence, enhancing the ability to meet, connect and contribute. Spatially this means designing highly accessible spaces – spaces that provide niches for all community activities. Examples of this include places that enable Indigenous teaching and connecting to Country, bush food areas, and places to learn about the wisdom of Aboriginal and Torres Strait Islanders. There was also thinking around ways to provide places for all age groups, from creches, to places to play cards or chess.

9.3.9 Democracy

The old version of democracy is a top-down approach where the experts and people in power make decisions directly affecting our wellbeing and livelihoods. The new democracy principle encompasses a bottom-up approach (power with, not power over) where empowered citizens directly participate in the decisions affecting their lives, communities, and local ecologies. The old top-down process, where experts and people in power make decisions, fails to recognise the wider perspectives, wisdom, relationships, and assets already embedded within a place and its people. A new approach to resilience and economic development has a foundation of authentic engagement at its core, supported by powerful tools for community involvement and governance. Mobilising and connecting with the community ensures that decisions and actions take place at the right scale, speed and depth, to create positive and meaningful change. From participatory and deliberative democracy through to citizen led processes that put power directly in the hands of the people; 'the wisdom lies in the community' is a new, effective approach for creating the new local.

Local democracy thrives upon three key pillars: citizenship, equal rights and justice, with representation and accountability, and citizen initiative and participation. These are about recognising the skills, experience and assets embedded in a place, and its community, and ensuring every voice is heard.

Democracy as a principle, can also be employed to achieve equity and diversity through ensuring representation of marginalised and diverse people. Transparency and accountability are also two key aspects of democracy, and these include the need for easily accessible information, clear communication, as well as regular reporting on goals, processes and outcomes. This ensures citizens are informed.

Another key aspect of local democracy are citizen-led initiatives – putting the power in the hands of the people. This can include creation of community managed assets, and assets co-management with community. An example of this type of democracy is the community boards initiative established by Thames Coromandel Council in New Zealand (Thames Coromandel District Council 2021). The community boards act as advocates for the interests of its communities, and are represented by a delegate, each with specific responsibilities.

A critical component of local democracy is authentic engagement. If implemented well, this allows individuals and communities to be part of the decision making and implementation processes, that can increase meaning for, and involvement by communities, and can transform barriers to give a renewed sense of hope and possibility. At the heart of authentic engagement are good facilitation and governance skills, self-awareness, and a willingness to support, challenge and inspire people and communities. As the world becomes increasingly complex, authentic engagement will become central to creating meaningful, sustainable and resilient outcomes. Engagement tools and methods include open space technology (Workshop Bank 2021), where participants create and manage their own agenda, kitchen table conversations, listening posts, consultation events and online surveys.

Measures of local democracy include assessing the extent to which there is community participation, evidence of local actions that are led by the local community, measures of equity and diversity, and systems of accountability and transparency.

The quiet heroes of Philadelphia, USA, are the volunteer block captains who unite neighbourhoods and liaise between residents and government Garcia-Barrio (2014). Block captains organise various events to beautify their block, including clean up days, and the provision of support and information. They are a focal point for identifying at-risk residents. In the face of the Covid-19 pandemic, block captains were responsible for ensuring food and security for their neighbours.

Another example of local democracy is Transition Town Banyule in Melbourne, Australia. Transition Town is a global movement of grassroots community projects that aim to improve self-sufficiency of communities and building resilient, re-localised and thriving places. Transition Town Banyule have initiated projects such as co-housing, nature-strip development lobby groups and transition streets, as well as conducting transforming power workshops, and community planning and visioning sessions.

For spatial design, the critical aspect to consider is how to facilitate decision making, discussion and consensus making. Spaces can be hierarchical or democratic, leading to greater unwritten permission to contribute. That is how the community is invited in, spatially, to decision-making that can support engagement, rather than alienate segments of society (see for example Holden and Iveson 2003).

In Newcastle, democracy is part of the New Local, through potentially using participatory budgeting for local investment.

9.3.10 Culture

Culture is about the rituals, customs, ideas and connections between and from groups of people. Culture encompasses community arts, experiences, tangible assets and values. It is not simply static art, but instead is an all-encompassing view of human activity, dynamic and constantly evolving. Culture comprises the glue that makes us human.

Community values and cultural assets enhance our sense of place and local identity when communities are empowered to express themselves creatively and innovatively. Art and culture have the power to unify, engage, educate, create new, shared experiences, and give voice to diversity within communities. Culture is about preserving ancient rituals as well as expressing new ideas – this is particularly important in a post-Covid world, as our values begin to shift and change. There is potential for a new participatory era to emerge, one that showcases different voices, encourages risk taking and celebrates creativity.

As a society, we are always seeking cultural accord. This is happening within constantly changing contexts, in which various cultures inter-mix and merge with one another as the world becomes increasingly globalised. As we experience increased varieties of people and places, and absorb different cultural traditions and practices, we are increasingly searching for meaning, identity and belonging (McClelland 2019). This is where cultural placemaking becomes integral. Cultural placemaking means creating the interface between people-based cultural software, the hardware of the built environment, and the people who experience it.

For the New Local, it means building a culture of placemaking that includes and integrates democracy, innovation, regeneration, diversification, ownership and connectivity. It is about creating the culture of place within which the other eight New Local principles can be realised.

Developing culture as a New Local principle means identifying the extent to which a community is enabling diverse groups to flourish and become a part of the culture, and then enhancing this. It means examining how and where culture is expressed in a community, including whether there is a strong arts presence. It also includes analysing the Indigenous presence in a community, and the extent to which First Nations people are acknowledged and celebrated.

One of the key resources here is cultural mapping, a method for gathering and recording tangible and intangible cultural assets, a way of highlighting the community's strengths, resources and opportunities (MAPC 2021). Tangible assets can include arts and heritage resources, including public art, cultural facilities and industries, artists networks, cultural events and cultural organisations. Intangible assets can include the stories, traditions, relationships and general atmosphere that contribute to the community's identity and sense of place (MAPC 2021). An example of a successful case study if cultural asset mapping is Project Willowbrook in Los Angeles, USA (National Endowment for the Arts 2021). Willowbrook is an area of poverty, cultural division and violence that is undergoing a major urban transformation, stimulated by the development of a key hospital. As part of this process, the Los Angeles County Arts Commission undertook a process of cultural asset mapping to deepen their understanding of Willowbrook's creative pulse and distinct identity. The process highlighted the capacity for art to be a vehicle for change, and catalysed support for many art and cultural projects.

Another example of a New Local approach to culture is the arts, cultural and educational hub in Melbourne, Australia known as Abbotsford Convent. Over two decades ago, the Convent was threatened by sell-off and conversion to up-market townhouses by a conservation government (Abbotsford Convent 2021). Yet, as a result of concerted community action, today its grounds and historic buildings are occupied by artisans, community and cultural events and host to a range of distinct and culturally diverse events including performances and markets. The Abbotsford Convent is a unique success story of a social and cultural enterprise built through a partnership between the community, the philanthropic sector, corporate sector and three levels of progressive government.

Newcastle has an active and engaged arts industry with well supported festivals and events, including their signature New Annual Festival. The New Local investigates methods to increase diversity and inclusion across these and all areas of local economic and social opportunities. The New Local challenges the council to enable a culture of 'yes' to support ideas, innovation and place leadership when ideas come in from all sectors of the community. At the New Local Festival, all cultures can participate and are felt to be supported to shine.

9.4 Designing the New Local Lens, Accelerating Regeneration

As has been touched on in all of the principles, there is a definite spatial design aspect that results from the New Local. This chapter has been mostly about how to support the community that lives within a place to be part of their own recovery, economically and socially. Yet, to enable many of the resulting recommendations, this means creating the spaces where they can be enacted. To a large extent, it involves how the principles are designed into the city, in the creation of the parks, the public spaces, the meeting place, the innovation niches, the sidewalks, the markets, the industrial precincts; in short, the enabling infrastructure is where the strategy becomes real.

As discussed briefly this includes designing in green spaces that include the integration of nature, as this is a critical aspect of the designed environment that contributes to the wellbeing of its citizens (biophilia). Well-designed spaces that include nature that people can engage with and connect to, is central to adding to the sense of belonging and attachment that, in turn, is central to enabling the development of local agency to implement the New Local.

9.5 Conclusions

What is presented here is an approach to integrating key aspects of place, a narrative of abundance, deep connection and contribution, and the role that a local economic approach can bring. This lens and its principles are prompts for each community to look at its own capacities, and develop its own approaches, in ways that guide both the social and physical infrastructure, and at the same time enables people to connect and thrive in place.

What has been interesting as we have been implementing the New Local is how interrelated all of the principles are. This is the lenses potency, its key contribution. For example, the design of a collaborative innovation precinct to support local supply chain capacity-building touches on principles such as reinvestment, ownership, innovation and connectivity. This interrelated aspect of the New Local is very much part of the ecological worldview for which regenerative development is a functional process. Holding the complexity of this interrelatedness is one of the key aspects that will need to be consciously managed when implementing and developing the New Local. That is, teams developing the New Local need to ensure that they do not privilege or silo specific principles.

While the New Local is in its infancy, and the City of Newcastle is the first local government to implement, it has really taken the principles to heart, and worked with the community to create a vision through the festival for their own New Local. The next steps will be towards the integration of the ecological plans, and for the New Local to inform how these impact planning and investment in any proposed parks, paths, precincts, public spaces and so forth. As in any ecological process, this is the start of the process. The joy will be in the journey of developing a plan that responds to local challenges and potential. The aim is to support local agency in growing local capacity, vitality and increase resilience and adaptability, in moving towards realising the potential of the place and its people.

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Chapter 10
Brisbane 2032: The Promise of the First Climate-positive Olympics for Regenerative Cities

Marcus Foth, Nicholas Kamols, Troy Turner, Anne Kovachevich, and Greg Hearn

Abstract In light of climate change and multiple ecological crises we are facing, sustainability driven urbanism is needed more than ever. While regenerative design has been around for over a decade, the notion of regenerative cities has seen a recent spike in interest as both governments and industry push to adopt circular economy principles. In this chapter, we examine the case of the city of Brisbane winning the bid to host the 2032 Summer Olympics, which are the world's first games required to not just be carbon-neutral but climate-positive. After establishing some contextual background around the history of urban regeneration strategies and the more recent focus on circular economies in cities, we juxtapose the bid's sustainability aspirations of becoming net positive with the realities of urban economic growth and the need to upgrade existing and build new sporting venues. We use punctuated equilibrium theory to ask if the city's once-in-a-lifetime opportunity to host the Olympics can be the urgently needed catalyst for a radical shift away from ongoing systemic issues underlying urban regeneration and towards embracing genuinely sustainable and regenerative city design.

Keywords Olympic games · Regenerative design · Circular economies · Punctuated equilibrium theory · Urban regeneration · Urban design · Regenerative cities

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10.1 Introduction

Design for urban regeneration continues to be a topic that at the same time excites and divides scholars, policy makers, urban designers, planners and citizens alike. For example, in 1991, the Australian federal government prominently embarked on an urban regeneration program called "Building Better Cities" between 1991 and 1996 (Neilson 2008). With support from State, Territory and local governments, the federal Labor government under Prime Minister Bob Hawke led this "nation-building" program aiming:

> to promote improvements in the efficiency, equity and sustainability of Australian cities and to increase their capacity to meet the following objectives: economic growth and micro-economic reform; improved social justice; institutional reform; ecologically sustainable development; and improved urban environments and more liveable cities. (Neilson 2008, p. 83)

Fast forward to today, and what is remarkable is how these aims hold up surprisingly well even after three decades of continuous urban renewal and nation-building activities (Ruming, 2018). While there are several different models of urban regeneration across the globe – and what happens in Australia is different from other parts of the world – a planetary perspective on urbanisation finds many high level parallels. In general, many urban regeneration strategies are seeking to address the same objectives as if nothing has changed. Is this a testament to the robustness of the program's original vision withstanding the test of time? Or is this evidence that this and more recent urban regeneration attempts, have so far largely failed in bringing about an inclusive, sustainable and just built environment? If it is the latter, what is so difficult in translating good intentions into good outcomes?This chapter is concerned with this consistent failure to deliver on the ambition. We present a critical argument that juxtaposes two parallel urban developments relevant to regenerative design: (i) regenerative cities through the advancement of circular economies, and; (ii) the case of the 'climate-positive' Brisbane 2032 Olympic Games. We believe that a critical reflection that ponders why conventional design strategies and approaches for regenerative cities have not been able to deliver on their ambitions is timely and urgent, especially in light of three larger, present-day sets of challenges:

(a) In *social* terms, population pressures calling for urban renewal are not only about population growth, but also demographic changes such as an ageing population, different needs and attitudes of both older and younger generations, new nomadic work practices, and a desire to combine career aspirations with lifestyle benefits in regional centres (Foth et al. 2020; Guaralda et al. 2020).
(b) In *economic* terms, the COVID-19 pandemic has made the cracks in the system more visible as well as allowed people to pause and think about whether a new way is possible. The severe damage caused by the neoliberal capitalist framework over the last three decades has amplified louder and louder calls for alternatives not just to be ideated around but to actually be implemented (Liaros 2019; Monbiot 2016; Moore 2017; Yigitcanlar et al. 2019a).

(c) In *environmental* terms, the realities of climate change, biodiversity loss, species extinction, and environmental decline require urgent action. While the predominant, technocratic concepts of the 'smart city' built on urban science (Batty 2013) continue to celebrate efficiency gains, we need to recognise that efficiencies and optimisation per se will not save us and the planet – a more radical and profound shift is needed (Mattern 2021; Paulos et al. 2008; Yigitcanlar et al. 2019a, 2019b).

In response to these three sets of challenges, this chapter contributes a critical review of the regenerative design and circular economy literature, and contrasts some of the policy and strategy rhetoric with regards to regenerative design aspirations in Brisbane's 'climate-positive' Olympic Games 2032 bid (Fig. 10.1) with the realities of what would be required to have genuinely regenerative urban design.

The chapter is structured as follows: In the next section, we set the scene and provide context by looking at four systemic issues with urban regeneration. Section 10.3 then introduces the notion of the circular economy and its relationship with regenerative cities. Reflecting on the gradual way the circular economy is being developed and deployed, we employ punctuated equilibrium theory (Cairney 2019) in Section 10.4 to juxtapose the incremental (and selective) approach to rolling out circular economies in cities on the one hand with the "once-in-a-lifetime" opportunity that winning the 2032 Olympics presents the City of Brisbane on the

Fig. 10.1 Aerial photo of the Gabba Stadium with the Brisbane CBD in the background (existing venue to be upgraded; athletics / ceremonies; capacity: 50,000). (© International Olympic Committee 2021, republished with permission. Source: Palaszczuk and Hinchliffe 2021)

other hand. Aiming to make a case for a radical break from accepted notions of regenerative design for cities, we conclude our argument by proposing a more-than-human perspective that decentres the human in the regenerative design for cities and landscapes (Forlano 2016; Loh et al. 2020). This perspective dissolves the urban–rural dichotomy and reconciles the built environment with the natural environment using a post-anthropocentric viewpoint (Yigitcanlar et al. 2019a).

10.2 Systemic Issues with Urban Regeneration

Before delving into the main argument, let us first establish some background context and develop the rationale for our argument.

The quest for urban regeneration is a global imperative, because there is an urgent need for humanity to avert a planetary ecocide due to climate change, biodiversity loss, pollution, and resource consumption pressures. While cities only make up 2% of the Earth's terrestrial surface, the UN Environment Programme[1] states that they, "consume over 75% of natural resources. Presently over half of the world's population resides in cities with up to 80 percent projected for 2050. Significantly, the majority of this growth will take place in secondary cities of the developing world. The conditions for urban inhabitants, in terms of employment, environment, health, education and overall quality of life are dependent in both the short and longer term on how cities draw on and manage the natural resources available to them." This establishes the significance of urban regeneration strategies beyond their local or national motivations – doing urban regeneration right is a global obligation (Loh et al. 2020).

Notwithstanding the tangible outputs that many urban regeneration programs often deliver in the form of better housing stock, new or renovated buildings that are more modern, safe and energy efficient, and the flow-on effects to the economy and labour market, there are systemic problems. We briefly discuss four of them: (i) gentrification; (ii) neoliberalism; (iii) fragmentation, and; (iv) technologically-driven perpetuity of the renewal process.

First, a persistent challenge for urban regeneration programs is finding ways to produce good, desirable outcomes without worsening neighbourhood gentrification. Urban regeneration programs often seek to remedy the so-called "doughnut effect," that is, the hollowing-out of inner-city areas as a result of geographic shifts in economic patterns and industrial activity (Hollander et al. 2009). However, the increased appeal and attractiveness that results often leads to higher demand and a spike in property prices and rents that locals may no longer afford. Leccis (2019) observes that even the most ambitious regeneration programs can further propel and drive gentrification with undesirable consequences such as the displacement of

[1] unep.org/explore-topics/resource-efficiency/what-we-do/cities/resource-efficiency-green-economy

established resident communities rooted in place. Lees (2012) observes how gentrification has travelled from the Global North to the Global South, confirming that this phenomenon is a global occurrence.

Second, the negative consequences and undesirable by-products of urban regeneration are often attributed to neoliberal politics – not just in Australia, but in many other countries led by neoliberal governments (Smith 2002). While urban renewal has a much longer history dating back to post WWII recovery efforts under the banner of 'reconstruction,' it was only in the 1980s under Ronald Reagan in the US and Margaret Thatcher in the UK that neoliberalism started to impact on the way urban renewal programs were conceived and deployed (Harvey 2012). Using the slogan of 'nation-building,' urban regeneration has continued ever since largely fueled by the same political motives (Monbiot 2016). For example, highlighting the bipartisan nature of the neoliberal turn, Weaver (2016) investigated national urban policy and local city politics in the US and UK to show how urban policy makers became persuaded by neoliberal ideas. As a result, urban regeneration programs became dominated over the past three decades by pro-market thinking. While this benefits the construction industry, it largely comes at the expense of creating genuinely desirable outcomes for ordinary citizens.

The adoption of neoliberal policies that guided urban renewal programs further exacerbated problems stemming from a dominant focus on securing, maintaining and growing corporate and political power and influence rather than a genuine concern for citizens and the planet. Examples include tokenism and so-called 'engagement theatre' – the co-optation of participatory design approaches to pretend the community is being consulted (Foth et al. 2018; Mattern 2020; Monno and Khakee 2012; Teli et al. 2020), corruption (Murray and Frijters 2016, 2017), and pork barrelling. Burton (2017) argues:

> It might also be seen as a continuation of an Australian tradition of taking an ad hoc approach to federal urban policy making in which the politics of the pork barrel are preferred to anything more systematic and evidence based. Thus, an opportunity has been missed for the Commonwealth government to provide a more coherent and consistent urban policy framework within which metropolitan and regional planning might flourish. (Burton 2017, p. 10)

Burton's statement offers a segue into the third systemic issue, which is about the fragmentation of both governments horizontally and governance vertically (Healey 2006; Tewdwr-Jones and Allmendinger 2006). In Australia, aspects of urban regeneration are divided across three levels of government: local, state and federal – with often little coordination due to political gameplay and miscommunication. Additionally, the issue of fragmentation is often further exacerbated horizontally by departmental "silos" as well as the overall lack of holistic governance and leadership that ought to be characterised by lateral thinking skills across domains and disciplinary boundaries and a vision that is longer-term than the election cycle. For urban regeneration programs and design approaches to be rethought and reformed in order to produce outcomes for mutual benefit as well as sustainable and inclusive habitats, collaborations and partnerships (rather than neoliberal pro-market competition) are vital (Foth and Adkins 2006; Foth and Brynskov 2016).The fourth symptomatic issue is about cities, and especially smart cities, having adopted a technocratic and technology solutionism approach (Hollands 2008, 2014; Mann et al. 2020; Mattern 2021; Morozov 2013) and embraced the 'perpetual beta' (Fredericks et al. 2019). This describes a never-ending push for change and disruption while the yardstick measuring real progress and outcomes gets continuously extended to be always out of reach. Constantly finding new signs of neglect, the geographic focus of renewal similarly keeps changing from the inner-city, to suburban and peri-urban areas, the 'creative fringe,' and the regions (Bilandzic et al. 2018; Collis et al. 2013; Mengi et al. 2020). Additionally, the latest renewal trend du jour also keeps changing: from brownfield, greenfield, transit-oriented developments (Pojani and Stead 2014), to knowledge precincts (Esmaeilpoorarabi et al. 2018), and creative industries driven renewal (Gentle and McGuirk 2018; Westbury 2015). Even a long-term proponent of neoliberal urban renewal strategies such as Florida had to finally admit how such policies intensify not just gentrification, but also housing unaffordability, community segregation, and social inequality (Florida 2017). Still, the next frontier for urban renewal is yet to be found. And, the current COVID-19 crisis offers ample space for scholars and commentators to imagine how urban regeneration can produce the post-pandemic city (Allam and Jones 2020; Batty 2020; Foth et al. 2021). Many of the emerging visions are for cities that are regenerative, circular, and can respond to cities' fragility by building local social, economic and environmental resilience, ensuring individuals can access basic necessities even within a lockdown (Blay-Palmer et al. 2020; Foth et al. 2021; Hespanhol 2017; Loker and Francis 2020; Roggema 2016).

These four issues do not represent an exhaustive list, and other issues are worthy of further exploration, yet go beyond the limitations of this chapter. For example, both geographic and socio-cultural contexts are crucial yet often disregarded in urban regeneration projects. This includes understanding and responding to the local climate rather than employing rigid cookie-cutter models. Recent discourse in Australia on regenerative design has also started to learn from Indigenous notions of caring for country and ecological stewardship (Graham and Maloney 2019; Vásquez-Fernández and Ahenakew pii tai poo taa 2020; Yunkaporta 2019). From a sustainable design perspective, such lessons are crucial not only to avoid creating inefficient or uncomfortable places but also – from a systemic perspective – to protect place identity (genius loci) so cities do not all feel the same globally (Norberg-Schulz 1980).

10.3 Regenerative Cities and Circular Economies

Many contemporary economic policies consider social and environmental matters, though rarely outside of their economic effects. General sustainability principles such as high-level themes of resource efficiency are common, as is the pursuit of balancing benefits versus harms through offsets. However, there is an increasing recognition that we must go beyond simply minimising negative impacts (Giampietro and Mayumi 2018; Loh et al. 2020; Roggema 2020; Zehner 2012). This is often pursued through some application of circular economy principles, which commonly focus on incorporating waste residuals from production or consumption back into production systems. The terminology, aims, objectives, measures and results are convoluted, but all are characterised by simultaneously promoting economic development, nature conservation, and social equity (Nikolaou et al. 2021; Stefanakis and Nikolaou 2021; Svensson et al. 2018).

The broad spectrum of what is included, lack of consistency regarding what is important – including an overemphasis on recycling – and tokenistic cooptations of meanings, undermines and dilutes the central concepts of working towards sustainable resource practices (Kirchherr et al. 2017; Linder et al. 2017). Circular economy proponents suggest significant changes for people and the planet, but overall there is a lack of exploring the possible, probable and preferable futures throughout the built environment (Hearn et al. 2014; Lazarevic and Valve 2017; Rodríguez et al. 2020). However, the core tenets of sustainability remain strong, and alternative terms dilute the messaging further. Terms that call for going 'beyond' sustainability, presuppose a 'weak' definition of sustainability as there is no real 'beyond' the continual reform of social, institutional and physical constructs (Birkeland 2020). Therefore it is appropriate to consider these factions and alternative terms through the lens of their contribution to the United Nations Brundtland Commission (1987) definition of sustainability of "meeting the needs of the present without compromising the ability of future generations to meet their own needs." However, for practical considerations, in this chapter we focus on pursuing sustainability through the lens of restorative / regenerative design and positive development, and examining circularity within these processes.

- **Regenerative Design** – "A system of technologies and strategies based on an understanding of the inner working of ecosystems that generates designs to regenerate rather than deplete underlying life support systems and resources within socioecological wholes." (Mang and Reed 2012, p. 8856)
- **Positive Development** – "would meet established ecologically sustainable development (ESD) criteria – but also reverse the impacts of current systems of development, increase the ecological base and public estate, and improve human life quality; that is, enhance the ecology and equity." (Birkeland 2012)

When examining approaches to sustainability, it is useful to consider the delineation between the anthropogenic 'technological sustainability' that focuses on technological and engineering processes, and the bio-centric 'ecological sustainability' that focuses on essential and natural functions of ecosystems (Orr 1992). It is commonly theorised that technological advancements will bring sweeping reform across the three objectives outlined by the Ellen MacArthur Foundation as being central to shifting towards a more circular economy. These are: (a) design out waste and pollution; (b) keep products and materials in use, and; (c) regenerate natural systems. However, the complexities of these issues pose challenges across temporal and spatial scales. The incorporation of spatial–temporal drivers and dynamics across resource supply and demand is difficult but promising. Regarding scale, the formulation of policy relies heavily on macro-drivers and top-down approaches. Though this often does not sufficiently incorporate the intricacies of factors such as localised climate and geography in implementing broad directives at a smaller scale (Leck et al. 2015; Shannak et al. 2018; Yan and Roggema 2019). Further to investigating these scales, it is useful to consider the ways circular economy principles present at the micro, meso and macro levels.

Within the micro-level, there is a clear delineation of market factors – supply and demand. The supply side is largely focused on business models that modify classical linear operations and productions through creating and exploiting material loops, and focusing on the full lifecycle of products (Geissdoerfer et al. 2020; Nikolaou et al. 2021). The demand side is concerned with the behaviour of consumers. This includes willingness to pay a premium, perception of quality, the right to repair, and likelihood of contributing to the ongoing circularity beyond the point of purchase (Bedford et al. 2021; Nikolaou et al. 2021).

The meso-level is concerned with the cooperation and collaboration of parties – particularly companies exchanging waste materials. This incorporates the established practices of industrial ecology where symbiotic clusters of parties benefit from one another, traditionally by using what other parties in the cluster produce. However there is an increased scope to also incorporate other parties' waste materials and energy into systems of production (Nikolaou et al. 2021).

The macro-level is largely policy-based, with top-down directives and incentive structures intended to facilitate societal shifts. These promote the inclusion of sustainable practices, and allow for shifts away from traditional business as usual. Leadership at this level enables the coordination of complex systems that is integral to large-scale adoption of sustainable and circular practices. This scale includes inter-institutional collaborations on large-scale public projects where the inclusion of sustainable practices has a large impact through the project, and also influencing practices outside the scope of individual institutions and projects (Mhatre et al. 2021; Nikolaou et al. 2021).

Our critical review has identified that consideration of concepts of circularity and regeneration within the built environment are largely confined to either the micro or macro scale. To the extent that scaling is considered, the meso-scale is largely overlooked, as are non-technical constraints such as governance and policy. It is commonly presupposed that the effectiveness of solutions at the micro-level would be retained or improved if they were to be scaled up to the macro scale. Further, there is a tendency to calculate the effectiveness of a fully mature and implemented solution at the macro level, without proper consideration of the process of getting to that stage. Therefore it is considered there is merit in investigating the gap between scaling technological solutions as they relate to the built environment, including those regarding circular economies and regenerative design, through the meso level.

Additionally, what is common across all three levels of circular economy principles as applied to the goal of designing and developing regenerative cities is the absence of any desire to radically shift away from the aforementioned underlying systemic issues with urban regeneration. The predominant notions of especially industry-led initiatives to foster circular economies still risk proliferating gentrification; they usually do not question the traditional economic growth paradigm embedded in a neoliberal market ideology; they do not resolve or overcome fragmentation, and; they not only continue but intensify technological solutionism (Bedford et al. 2021; Hulme 2014; Morozov 2013).

What can bring about the radical shift we need?

10.4 Will Brisbane's 2032 Olympics Punctuate the Equilibrium?

In the previous section we established that regenerative cities based on circular economy principles – while showing many ambitious qualities – largely fail to tackle the systemic issues urban regeneration projects often suffer from. As well, their incremental rollout appears to be strategically careful not to disrupt vested interests, the capitalist growth paradigm, or the neoliberal political landscape. More and more scholars and commentators argue that a more radical transformation is required if we want to heed the advice and stark warning in the IPCC Sixth Assessment Report 2021 (Alexander and Gleeson 2018; Escobar 2018; Ludlam 2021; Roggema et al. 2012). In this section, we use punctuated equilibrium theory (Cairney 2019) to examine Brisbane's successful bid for the 2032 Summer Olympic Games and its aspiration for them to be 'climate-positive,' that is, offsetting more carbon emissions than they produce (Stevenson and Kleyn 2021). This section is guided by the question, will Brisbane's 2032 Olympics punctuate the equilibrium and bring about a more radical shift towards circular economies and regenerative cities? We first briefly explain punctuated equilibrium theory, and then provide some background to the Olympic Agenda 2020, which reformed the bidding process by placing more emphasis on sustainability and maximising use of existing venues. We then juxtapose marketing statements such as Brisbane's challenge to host the first Olympics that the IOC requires to be climate-positive, with the traditional aspirations of urban development and economic growth.

10.4.1 Punctuated Equilibrium Theory

According to punctuated equilibrium theory, institutions exist on the historical timeline relatively unchanged or with small incremental changes (equilibrium) until a period of dramatic change is caused (punctuation or 'critical juncture'), after which relative stability resumes (Cairney 2019). Formal rules, compliance procedures, and standard operating procedures that shape behaviour and decisions are referred to as institutions within this theory (Steinmo et al. 1992). Critical to punctuated equilibrium theory are the concepts of historical contingency and path dependence. Historical contingency describes how events and decisions made in the past contribute to institutions and their decisions in the present. Connectedly, path dependence refers to the tendency for an institution or decision to produce increasing returns, making it increasingly difficult or costly to depart from the set path (Cairney 2019).

10.4.2 The Olympic Agenda 2020

The Modern Olympic and Paralympic Games are among the largest and most complex recurring international events. The international cooperation necessary for this, and the impact of the events across temporal and spatial scales, positions the International Olympic Committee (IOC) as being influential in the discourse of global sustainability. The negative environmental impacts of the 1992 Albertville, France Winter Olympic Games, are recognised as bringing about a shift towards increased consideration of environmental matters in the planning and delivery of the Games (O'Hara 2015). The 2014 Sochi, Russia Winter Olympics was largely hosted inside the UNESCO World Heritage Sochi National Park, which necessitated amending legislation to allow large events and the clearing of rare vegetation in the park (Müller 2014). The preparation of the games garnered international criticism, including for: Illegal dumping of construction waste and discharge of toxic fluids that contaminated local drinking water, works that significantly increased the risks of spring floods by altering the local hydrological regimen, and; disruption of migratory bird patterns (Müller 2015; O'Hara 2015). Further, the bid that secured the Games stated that they would be hosted in a sustainable, inclusive and environmentally responsible manner, which included carbon neutrality, zero-waste, and extensive environmental impact assessments. Additional studies also looked into social impacts of other Olympics Games, for example, Rowe (2012) critically examined the Sydney 2000 and Beijing 2008 Games from a human rights perspective. While the London 2012 Games aimed for transparent reporting around sustainability and had ambitions to regenerate urban areas, Dolan et al. (2019, p. 13) analysed wellbeing data but were "unable to claim any strong evidence of legacy effects on the hosting city."

Post-game evaluations back then contributed to the IOC realising that there was a need to be more ambitious and clear about goals and set up tools and protocols that are able to articulate and measure the Games' environmental and social sustainability outcomes, impact and legacy effects. As a result, the IOC unanimously adopted The Olympic Agenda 2020[2] in December 2014. It focuses on sustainability, credibility, and youth, across the IOC's three spheres of responsibility, that is, as (i) an organisation; (ii) owner of the Olympic Games, and; (iii) leader of the Olympic Movement (MacAloon 2016). Of the forty recommendations that were adopted, three are about revising the bidding process by placing sustainability at the core of

[2] olympics.com/ioc/olympic-agenda-2020

any bid and encouraging the use of existing venues as well as relaxing some venue requirements.

Additional pressures from stakeholders, as well as societal shifts regarding Environmental and Social Governance (ESG), have led the IOC to increasingly require host cities to incorporate sustainability into all aspects of the games. The IOC has recognised the negative aspects of hosting the games, and has shifted to necessitate that host cities take a much more sustainable approach than in the past. This includes requiring Paris 2024 and LA 2028 to be climate-neutral and Brisbane 2032 to be climate-positive. It also incorporates sustainable design principles, an emphasis on new construction being aligned with the host cities' needs beyond the games, and encouraging the use of existing and temporary structures where appropriate (Ross and Orr 2021).

In early 2021, the IOC (2021b) released a Closing Report of the Olympic Agenda 2020. This measured the impact of what the 2014 document set out to achieve and includes:

- The IOC as an organisation is carbon-neutral, intends to be climate-positive by the end of 2024, and the whole of the Olympic Games from 2030 onwards are to be climate positive, and;
- All upcoming Games have committed to carbon neutrality. Further, Tokyo 2020 showcased zero-carbon technologies, Beijing 2022 will use renewable energy to power all Olympic venues, and Paris 2024 is set to have a 55% smaller carbon footprint than previous Games.

10.4.3 Brisbane's 2032 Olympics

Australia has hosted the Modern Summer Olympics twice – Melbourne in 1956, and Sydney in 2000 (Rowe 2012) – and on 21 July 2021 has been awarded the rights to host the 2032 Summer Olympic Games in Brisbane. Brisbane was long considered the frontrunner in the bidding process, and considered to not have faced substantial competition by other potential hosts (Hart 2021). The award is seen as a once-in-a-lifetime opportunity for Brisbane to leverage the Games to further sustainable development, including regenerative design, positive development, and circular economy principles. Further, the Games are touted as an opportunity to consider long-term planning for sustainability, with a significant driver of change and a ten-year milestone.

Three key documents spell out the commitment for the Brisbane 2032 Olympics to be 'climate-positive' and to deliver sustainability outcomes as a legacy of hosting the Games: (i) the Value Proposition Assessment (Queensland Government 2019); (ii) the IOC Future Host Commission Questionnaire Response Final Submission (Brisbane 2032 Consortium 2021), and; (iii) the KPMG summary report of the economic, social and environment impacts of hosting the 2032 Olympic and Paralympic Games (KPMG 2021).

Even in the lead-up to the bid, the Queensland Government's Value Proposition Assessment suggested the following aspirations in §1.6.3 Environment and Sustainability:

> Harnessing the Olympic Games sustainability platform could drive Queensland's sustainability agenda. Stimulating new standards and innovation, the Games could provide a focal point for strategies that bring together expertise, industry and the community to address climate change and waste. These initiatives would provide a benchmark for Queensland and Australia, supporting long-term objectives. (Queensland Government 2019, p. 13)

The bid's May 2021 final submission further underlined Brisbane's commitment, "to partner with the IOC to develop climate positive Games and to engage with past and future hosts to continue and benefit from their developments" (Brisbane 2032 Consortium 2021, p. 8). In June 2021, the Queensland Government released a report prepared by KPMG (2021) who undertook a preliminary analysis of the economic, social and environmental impacts of hosting the Games. The report suggests that Brisbane 2032 intends to minimise and mitigate environmental impacts through:

- Repurposing and upgrading existing infrastructure, including using recycled materials and lower carbon options where feasible;
- Guiding behavioural change towards public favouring climate friendly policies and practices;
- Reducing waste and pollution, including promoting reuse and recycling, and;
- Planning transport to utilise lower-carbon options and minimise congestion.

However, the report also contains assessments using conventional neoliberal growth indicators suggesting that the 2032 Games will deliver AU$8.1 billion in benefits to Queensland including an AU$4.6 billion economic boost to tourism and trade and AU$3.5 billion in social improvements such as health, volunteering and community benefits (KPMG 2021). Will it be possible to reconcile conventional economic and sustainability assessment frameworks with the goal of hosting the world's very first climate-positive Olympics? Corroborating Birkeland's (2020) positive development paradigm mentioned earlier, Dr. Cle-Anne Gabriel argues that:

> it was about more than just 'doing no harm.' It's about contributing to creating something good, regenerating our environment." (cited in Stevenson and Kleyn 2021)

Climate Council's Prof. Will Steffen comments that Brisbane:

> has the chance – given that high profile – to set the example for how major complex activities like bringing together the world around sport, how those can be held in a way that's at least carbon neutral and, in Brisbane's case, climate positive. I think it's sending a really strong message to the world that we can achieve what we need to achieve in terms of getting climate change under control. (Steffen cited in Stevenson and Kleyn 2021)

While 84% of the venues (examples shown in Figs. 10.1, 10.2, 10.3, 10.4 and 10.5) needed for the Games already exist (Brisbane 2032 Consortium 2021, p. 12), this figure is lower than for the Paris Olympics 2024 (95%) and the LA Olympics 2028 (100%). Furthermore, for the remaining venues the Brisbane 2032 Consortium claims that "all new vertical infrastructure projects or significant upgrades will target 6 star (world leadership) Green Star for Buildings ratings from the Green

Fig. 10.2 The Gabba (existing venue to be upgraded; athletics / ceremonies; capacity: 50,000). (© International Olympic Committee 2021, republished with permission. Source: Palaszczuk and Hinchliffe 2021)

Fig. 10.3 Brisbane Arena (new venue; aquatics; capacity: 15,000). (© International Olympic Committee 2021, republished with permission. Source: IOC 2021a, p. 27)

Fig. 10.4 Brisbane Indoor Sports Centre (new venue; basketball; capacity: 12,000). (© International Olympic Committee 2021, republished with permission. Source: Brisbane 2032 Consortium 2021, p. 95)

Fig. 10.5 Chandler Indoor Sports Centre (new venue; gymnastics; capacity: 10,000). (© International Olympic Committee 2021, republished with permission. Source: Brisbane 2032 Consortium 2021, p. 94))

Building Council of Australia, where relevant" (p. 62). However, the non-committal wording could lead to this target being pushed aside. Moreover, there are unresolved issues with regards to performance assessment frameworks for the built environment, which have been criticised for being too focused just on energy or just on optimising efficiencies rather than net reductions (Loh et al. 2020). As well, the reliance on carbon offsets is also problematic as there is strong evidence of their weaknesses indicating that we need to aim for net reductions and net positive development (Birkeland 2020).

10.5 Conclusions

So will Brisbane's 2032 Olympics punctuate the equilibrium and bring about the required radical shift towards circular economies and regenerative cities? Our assessment juxtaposed the high level rhetoric used in the bid documents with the realities of the host consortium wanting to deliver economic development and growth using conventional growth mentalities. It suggests the Games will maintain rather than punctuate the equilibrium.

While this could become a missed opportunity, it is not too late considering the 10 year horizon. The Brisbane 2032 Olympics have been subject to positive agenda setting by their key institutional players, tweaking the approach to target augmented outcomes. For instance, these games will incorporate many vehicle-free venues, increase the host city's mass transit capacity, minimise land-take for new stadia, and spread the event across the South East Queensland region minimising the intensity of the resource hogging that traditionally occurs with this scale of event. The games do not exist in a vacuum and are responding to the imminent climate change threat, as well as the dwindling traditional economic viability potential their scale once provided.

Crucially though, as this Chapter has demonstrated, the Games and its host state and nation are attempting to answer these challenges largely from a playbook of existing norms and institutions. Much like Henry Ford's excellent musing that if he had asked his market what they wanted when he went about revolutionising the car, "they would have asked for faster horses" (nevermind we cannot prove Mr. Ford said that) (Vlaskovits 2011); with the 2032 Games – our review suggests – we could just be getting a faster horse.

The efforts of the International Olympic Committee to create climate-neutral and then climate-positive Games do not constitute a punctuation in the equilibrium. There is no fundamental shift in the broader institutional paradigm, only more of the same consumerist and economic growth-driven thinking that is reproduced by the institutions, rules and norms in which the policy actors delivering it must function. For instance, more public transport is a good outcome that can contribute to the legacy capability of the host city to move its own population sustainably post its hosting duties. But the lens that gives this outcome its positive label is an economic one, which sees the need for the host city's population growth and increased economic activity as gospel. Put another way, why is moving more people good? Because the city has to grow – and that mantra is not being questioned.

The inertia of existing paradigms and institutions is a powerful force that can either uphold or quickly redefine norms and rules that shape institutions and policy actors' decisions and, therefore, the real-world outcomes they are able to achieve. This inertia can send an institution on a collision course with another that dramatically alters, or punctuates, the contextual paradigm: climate change. Brisbane 2032, however, provides us with repackaged Games within its existing paradigm, not a new paradigm altogether.

So if the Olympic Games are unlikely to cause the necessary puncture of the equilibrium – or put an end to the prevalent climate complacency – what will? In an op-ed published in November 2021 after the failure of the Cop26 climate conference in Glasgow, Monbiot (2021) suggests a proposition quite similar to the punctuated equilibrium theory used here arguing that by mobilising just 25% of people (Centola et al. 2018), we can flip social attitudes towards the climate. Referring to recent research by Sharpe and Lenton (2021) offering "plausible grounds for hope," Monbiot (2021) argues:

> Sudden shifts in energy systems have happened before. The paper points out that the transition in the US from horse-drawn carriages to cars running on fossil fuels took just over a decade. The diffusion of new technologies tends to be self-accelerating, as greater efficiencies, economies of scale and industrial synergies reinforce each other. The authors' hope is that, when the penetration of clean machines approaches a critical threshold, and the infrastructure required to deploy them becomes dominant, positive feedbacks will rapidly drive fossil fuels to extinction.

Having made a case for the urgent need to radically transform old notions of regenerative design for cities, we conclude here by recommending a more-than-human perspective that decentres the human in the regenerative design for cities and landscapes (Clarke et al. 2019; Forlano 2016; Foth and Caldwell 2018; Loh et al. 2020). A more-than-human design approach to regenerative cities, which fosters stronger connections to place and nature, does not break with current aspirations but enhances and expands them. Solid foundations have been laid for Brisbane to reconnect to its identity, meet climate positive targets, create climate responsive venues and transport that promotes health and wellbeing in order to celebrate subtropical living. However, we argue there is an opportunity to switch gears and use the Games to take Brisbane one step further. Guided by a more-than-human design approach to regenerative cities, Brisbane could champion net positive development (Birkeland 2020) without just relying on carbon offsets and at the same time aiming to start dissolving the urban–rural dichotomy and reconciling the built environment with the natural environment using a post-anthropocentric viewpoint (Yigitcanlar et al. 2019a).As anxiety in the face of the planetary ecocide is rampant and time is running out, Monbiot's optimism is well received. Regenerative design can be a crucial ally to prove his optimism is right well before 2032.

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Chapter 11
Landscape-Based Urbanism: Cultivating Urban Landscapes Through Design

Steffen Nijhuis

Abstract Sustainable urbanisation requires planning and design strategies and principles that take the (natural) landscape as the basis for working with natural processes for the benefit of socially and ecologically inclusive and thriving urban landscapes. Such an approach takes the landscape first and considers the biosphere the context for social and economic development. In this chapter, the concept of landscape-based urbanism is introduced, taking the physical landscape structure, and associated natural processes as a foundation to generate favourable conditions for future development and to guide and shape spatial transformation. Therefore, this approach offers a multiscale and integrative model for urban development and transformation, the preservation of biodiversity, water resource management, improved leisure facilities, community building, stronger cultural identity and economic development while taking the landscape as the basis. Landscape-based urbanism identifies and guides urban development towards the most advantageous places, functions, scales and inter-relationships through the development of robust landscape structures. Design explorations utilise knowledge of the natural and social context and are used as a systematic search for possible solutions to a spatial problem. At the same time, the design explorations make clear which landscape structures and elements, for example from an ecological or cultural-historical point of view, should be preserved.

Keywords Landscape approach · Adaptive planning and design · Landscape-based regional design · Nature-based solutions · Sustainable urban planning · Ecological design

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11.1 Introduction

Guiding spatial developments in the urban landscape is just like gardening: if you do nothing, the garden will be overgrown and pests and bugs will take over, ending in chaos and decay. On the other hand, the gardener cannot, or should not, completely control everything because it leaves no space for spontaneous development and makes the garden vulnerable to unforeseen circumstances. Gardening is about cultivating the grounds, setting up conditions in such as a way that it will thrive. In this cultivation process the gardener allows dynamic processes to take place to provide sufficient diversity and resilience for renewal. At the same time, it provides sufficient structure to function in a coherent, fruitful way and bring aesthetic pleasure. This chapter does not deal with gardening literally. Here, gardening is used as a metaphor to cultivate the urban landscape throughout the scales, in such a way that it will flourish (Fig. 11.1). Such 'gardening' is all about creating the spatial conditions for ecological, social, and economic development. It provides ways to deal with uncertainty, finding ways to safeguard resources and cope with vulnerabilities. It is about creating strong, adaptive structures, while allowing flexibility, dynamic and change. This requires envisioning – putting a dot on the horizon as a long-term perspective–guiding short-term projects in the here and now.

Especially in times of immense societal challenges related to climate change, biodiversity loss, water management and urbanisation, spatial strategies and design

Fig. 11.1 Cultivating the garden in such a way that it will thrive. Woodcut of a gardener, c. 1550, Germany. (Image: The Granger Collection / Alamy Stock Photo)

solutions that strengthen resilience assist systems in coping with vulnerabilities and enhance their capacity to face natural and human-made threats. This suggests more innovative and integral forms of planning and design that lead to more sustainable and liveable urban landscapes. In this chapter, landscape-based urbanism is put forward as a multi-scale planning and design approach for developing resiliency and adaptive capacity by creating flexible, strong socially and ecologically inclusive landscape structures, connecting long-term perspectives with short-term interventions using research through design as wayfinding in a transdisciplinary process.

The first section addresses the importance of landscape as the basis for spatial development. Next, the development of landscape-based approaches is briefly outlined to arrive at landscape-based urbanism as an interdisciplinary regional design approach that takes the landscape first. The chapter subsequently elaborates how this approach translates into understanding the landscape as a living system and how this knowledge is employed for strategy formation and design explorations.

11.2 Landscape First

The natural landscape is essential for human existence and a good quality of life (IPBES 2019). The natural landscape contains a wide variety of ecosystems and is the prerequisite of biodiversity – the diversity within species, between species and of ecosystems. It also provides vital contributions to human existence and human well-being providing food, fresh water and ecosystem services and goods (Alcamo et al. 2003; Kumar et al. 2010). One could say the natural landscape provides the main conditions for human existence. Landscape, however, refers to an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors (Zonneveld 1995; Council of Europe 2000). This definition stresses the interaction of humans with their environment and merges the concepts of nature and culture – landscape is in that sense a cultural construct. In that context, it is interesting to note that bio-reserves like the Amazon (South America), the Białowieża Forest (Poland and Belarus), the Prairies of California (United States), or the t'Ename Forest (Belgium), because of their high biodiversity, are often referred to as pristine examples of nature or 'wilderness', but are as much cultural landscapes and the product of a symbiosis between people and their natural environment (e.g. Mann 2006; Anderson 2005; Marris 2013; Tack et al. 2021). The point is that for centuries people have lived in balance with nature, creating cultural landscapes with enhanced habitat heterogeneity and developing circular production systems with a multitude of domestic and wild species (Berkes 2018; IPBES 2019) (Figs. 11.2 and 11.3). They learned that mismanaging nature and exhausting the land will lead to the destruction of vital resources. Environmental history points out that whole societies collapsed by damaging their environments. Deforestation and habitat deconstruction, soil problems (erosion, salinization, and soil fertility loss), water management problems, overhunting, overfishing, effects of introduced species, et cetera were the main reasons that, for instance, the prehistoric Polynesian

Fig. 11.2 The Mulberry-dike and fish-pond system near Huzhou (Zhejiang Province) and in the Pearl River Delta near Foshan (Guangdong Province) in South China is a more than 2500-year-old form of agri-aquaculture and includes cultivation of mulberry-dike trees, silk rearing, fish cultivation and is based on a very complex irrigation and drainage system. It is one of the most sustainable agricultural landscapes of the world: mulberry is planted on the dikes and is fertilized with nutrient rich mud and water from the pond, the leaves of the trees are forage for silkworms (silk production), the bark is used for paper and the silkworm excrement is food for the fish in the ponds (Ruddle and Zhong 1988). (Photo: Guo Wei, Beijing Forestry University)

culture on Easter Island, the formerly flourishing Native American Maya civilization, and the medieval Viking colony on Greenland disappeared (Diamond 2005).

However, other societies around the globe also show that people understood the logic of the natural landscape and persisted. By trial and error, a wide diversity of developed practices actively and positively contributed to wild and domestic diversity and landscapes through accompanying natural processes with anthropocentric assets (e.g. knowledge, practices and technology). Indigenous people applied principles and indicators, such as health of the land, caring for the land and reciprocal responsibility, ultimately leading to rich synergies of natural-cultural qualities (Berkes 2018; IPBES 2019). This traditional ecological knowledge is a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, concerning the relationships of living beings (incl. humans) with one another and with their environment (Berkes 2018). Traditional ecological knowledge is a rich source of land-use (or 'gardening') practices that enhance biodiversity and proves that people can be agents of landscape renewal processes that allow for both cultural and biological diversity to flourish. Historical urban landscapes also showcase a sensitivity towards the natural context, particularly to water (e.g. Cronon 1991; Tvedt and Oestigaard 2014). Most cities of today are surrounded by a (engineered) waterscape that is still mirroring, though to different degrees, the character of how hydrological cycles manifest

Fig. 11.3 Wildflower super bloom on the Carrizo Plains of south-eastern San Luis Obispo County, California (US). Over thousands of years, California native people took care of this land and played a major role in the maintenance and enhancement of biological diversity and landscape heterogeneity by employing resource management techniques such as burning, irrigating, pruning, and coppicing, weeding and sowing seeds of wildflowers and grass (Anderson 2005). (Photo: Duncan Selby / Alamy Stock Photo)

themselves locally in the landscape (Tvedt 2016). Spatial differences in precipitation and evaporation patterns fundamentally define the character of cities and the sense of place.

In present times, often referred to as the Anthropocene (Crutzen 2006), people have a substantial negative impact on the planet. Surrounded by the built environment – and a static, mechanical, disembodied view of the world formulated by Descartes, Newton and other thinkers of Age of Enlightenment which has dominated our thinking – it has become difficult for people to relate to the environment (Berkes 2018). This alienation from nature has contributed to the environmental problems of the contemporary world. Under the pretext of technological and scientific advances, people alter and exhaust the natural landscape to an unparalleled degree across all spatial scales. This results in serious negative impacts on climate change and the decline of biodiversity at a rate faster than at any time in human history (IPPC 2013; IBPES 2019). Moreover, if no attention is paid to the landscape's carrying capacity, the risk of damage and capital destruction will increase dramatically (Planbureau voor de Leefomgeving 2021). Therefore, in 2015, the 2030 Agenda for Sustainable Development was launched which provides a globally shared blueprint for sustainable development articulated in seventeen Sustainable Development Goals (SDGs) (UN 2015). These SDGs acknowledge that ending

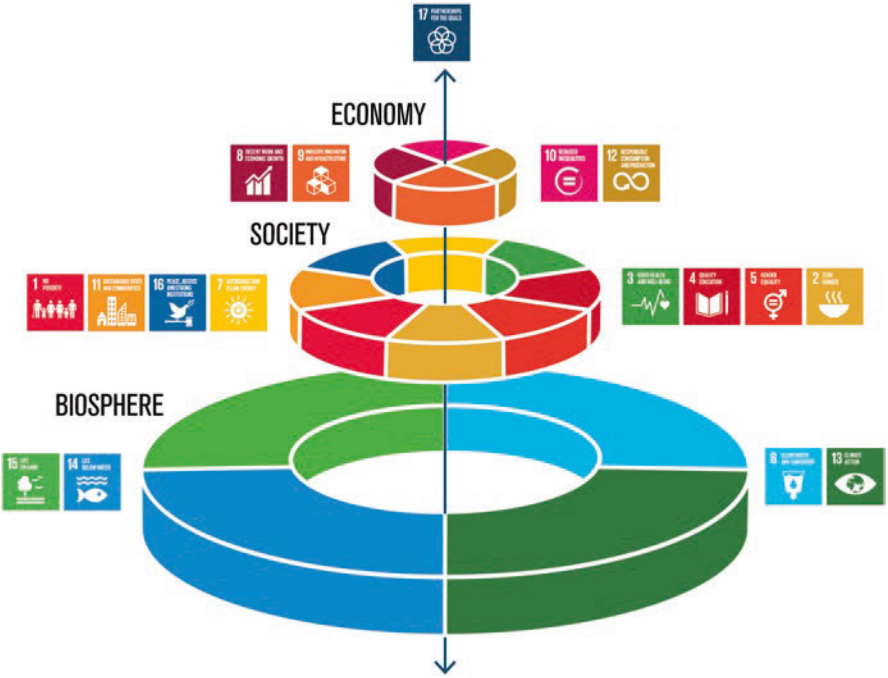

Fig. 11.4 Landscape as context for social and economic development. (Source: Stockholm Resiliency Centre)

poverty and other deprivations must go hand in hand with strategies for the development of sustainable cities and communities, for improving health and education, reducing inequality and spurring economic growth – all while tackling climate change and working to preserve our oceans and forests (UN 2015). To put these SDGs to work in the realm of sustainable urban development, it is necessary to develop and apply planning and design strategies and principles that take the (natural) landscape as the basis to work with natural processes for the benefit of socially and ecologically inclusive and thriving urban landscapes. Such an approach takes the *landscape first* (cf. LAF 2017; Roggema 2020a, 2021) and considers the biosphere the context for social and economic development (Fig. 11.4).

11.3 Towards a Landscape-Based Approach to Urbanism

Urbanism is an interdisciplinary field that combines knowledge from landscape architecture, urban planning, and design for future-oriented action on and thinking about the development of urban landscapes, responding to the needs of society by mobilising its knowledge and skills towards the creation of more sustainable living environments (Nijhuis et al. 2017). Even though sustainability is at the core, the landscape is still often not taken as the basis for future spatial developments. This is hard to understand because the landscape is the carrier of a multitude of values and services. It is the basis for spatial-aesthetic values like beauty and orientation in space and time. The landscape offers structure, ecological coherence, and variation simultaneously, but it is also flexible and multifunctional. The landscape as natural infrastructure saves billions of dollars a year in response to the climate crisis and is about 50% cheaper than standard infrastructure (IISD and UN-IDO 2021). For example, natural landscape infrastructure helps to reduce the energy demand and can be utilised for energy production; it is a critical factor for water retention and fresh water supply; and it provides a powerful means for flood protection and coastal safety from the perspective of climate resiliency. Next to this more functional benefit, the landscape as natural infrastructure provides many additional values and services. According to the Millennium Ecosystem Assessment (MEA) (Alcamo et al. 2003; MEA 2005), the natural landscape contains and provides for many (ecosystem) services. Supporting services such as soil formation, nutrient cycling, and spatial structure, but also cultural services, such as spiritual, aesthetic, mental and physical health. It also, in terms of provisioning, supplies food, fresh water and wood – it further regulates water cycles, (micro) climate, floods, air quality, temperature, etcetera. Human well-being relies critically on these services provided by nature and landscape (Alcamo et al. 2003), which play a crucial and valuable role in biodiversity, human health, nutrition, habitation and in the health and functioning of our economies (Kumar et al. 2010). In a landscape-based approach, the basic principle is thus to recognise these valuable services in design, planning and decision-making and to take care and use the natural structures and processes that carry out work or offer protection in their natural form.

In the past decades there have been serious attempts to raise awareness of the value of nature and landscape in urbanism. Seminal works include 'Design with Nature' (McHarg 1969), 'The Granite Garden' (Spirn 1984) and 'City Form and Natural Process' (Hough 1984). These publications stress the importance of understanding the natural setting of cities – water, geology, plants and animal life – as a prerequisite to create better, more liveable urban environments. Based on this notion, a wide range of concepts and approaches to shape the relationship between humans and the natural environment have been developed. Examples include: 'Biophilia' (Wilson 1986), 'Eco-cities' (Register 1987), 'Green Urbanism' (Beatley 2000), 'Landscape Urbanism' (Waldheim 2002), and 'Nature Driven Urbanism' (Roggema 2020b). The concepts and approaches as outlined in these publications provide powerful pointers to use nature and landscape as the main driver and shaping force in urbanism.

To make the concepts and approaches for landscape inclusive urbanism operational, an area-specific spatial strategy is needed that takes understanding of the landscape and its social-ecological processes as the basis for spatial development. This requires *thinking big* in terms of scale – from region to locality – and ideas – bold plans that take the landscape as the basis for any development. This can only be done by employing a *design perspective* that *utilises knowledge* of the natural and urban systems to shape a vision and make it tangible through design explorations augmented with *enabling geo-information technologies*, such as Geographic Information Systems (GIS). *Crossing disciplinary boundaries* by collaboration and co-creation in transdisciplinary ways is also needed to think together to come up with integral solutions and to implement ideas.

Landscape-based regional design is such a future-oriented strategy that aims to enhance spatial development by applying bioregional planning and design principles that view the urban landscape as a social-ecological inclusive, dynamic, and complex system (Nijhuis 2019). Such a landscape approach builds on ideas developed and implemented by Charles Eliot (1893), Warren Manning (1913), Pieter Verhagen et al. (1920), Patrick Abercrombie et al. (1922), Fritz Schumacher (1923), Ian McHarg et al. (1962) (Fig. 11.5), Vrijlandt and Kerkstra (1976) and Philip Lewis (1996). Most of these urban planners and landscape architects advocated a 'vertical approach' in which the variation in the elevation, soil and water system is considered when siting and designing changes and adding new functions. Jan Bijhouwer (1898–1974), the first professor of landscape architecture in the Netherlands was also an important pioneer of this approach, partly due to his expertise in plant

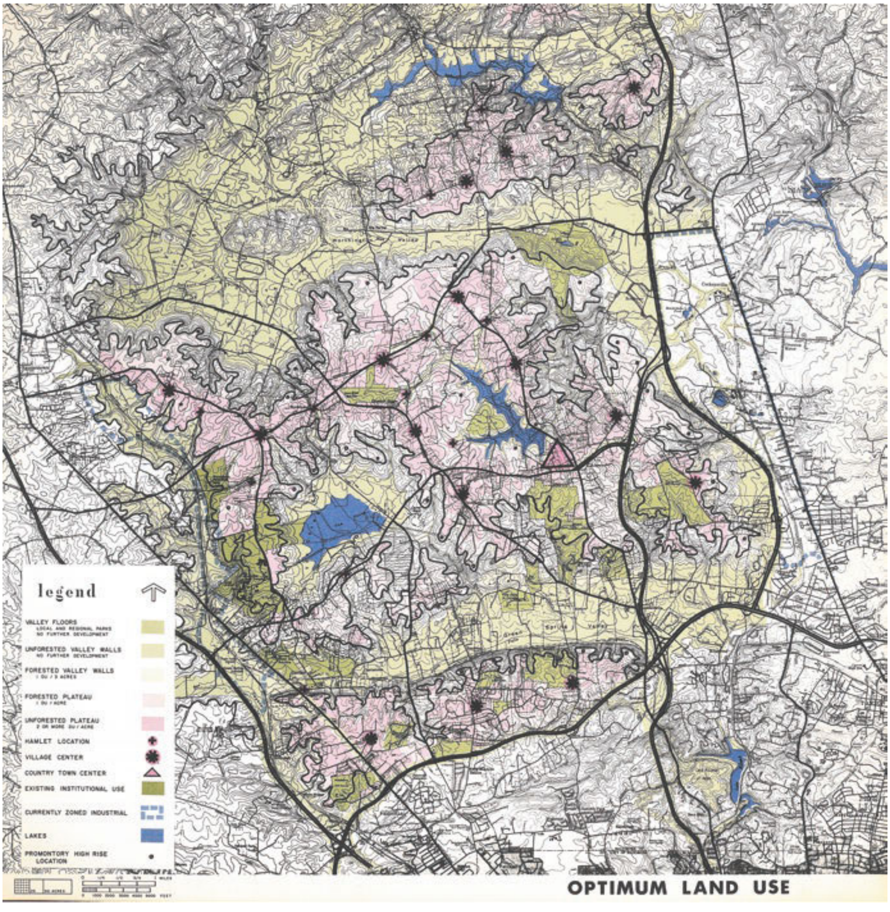

Fig. 11.5 Plan for the Valleys, an early example of landscape-based regional design (McHarg et al. 1962)

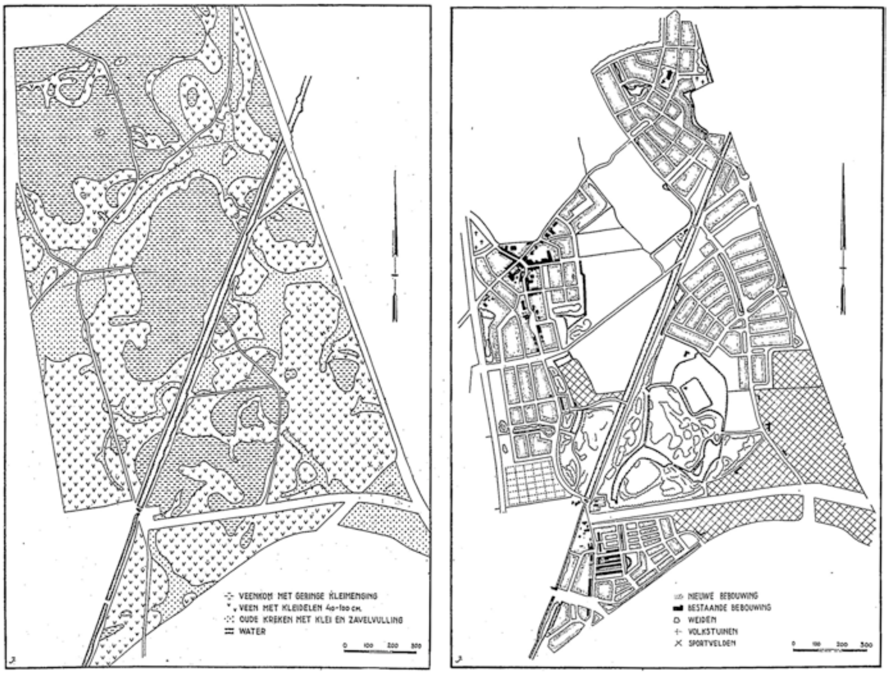

Fig. 11.6 Soil map (left) and urban and landscape design (right) for Kethel and surroundings. (Bijhouwer 1947)

geography focusing on the natural distribution of plants in relation to the soil (Bijhouwer 1926). In 1947, he commissioned a soil survey which he used as the basis for the design of a new town, called Kethel (near Rotterdam, the Netherlands), with surrounding parks and recreation facilities (Bijhouwer 1947) (Fig. 11.6). The possibilities of the soil and hydrology are reflected in the design. He also observed that the variation and recognisability of the landscapes as we perceive them is largely a reflection of the variation in the physical substrate (Bijhouwer 1971). It is urgent to follow this landscape logic again in new spatial developments related to urban development, climate, nature, water management and agriculture. The natural sub-soil sets conditions for the use of space, and this follows the structure of elevation, soil, and water, instead of the other way around. The natural landscape offers opportunities and constraints to human use and consequently should inform human interventions and modifications.

11.4 Landscape-Based Urbanism

Landscape-based urbanism is a form of regional design that applies principles from landscape architecture, urban design and planning, landscape ecology and geography to spatially oriented research, design, and planning. It also utilises knowledge from systems thinking and complexity theory to promote a more comprehensive regional planning and design form that addresses the complex web of relationships making up the urban landscape (Nijhuis and Jauslin 2015). In landscape-based urbanism, the physical landscape structure and associated natural processes are taken as a foundation to generate favourable conditions for future development and to guide and shape spatial transformations. Therefore, this approach offers a model for urban development and transformation, the preservation of biodiversity, water resource management, improved leisure facilities, community building, stronger cultural identity, and economic development (cf. Neuman 2000) while taking the landscape as the basis.

Landscape-based urbanism identifies and guides urban development towards the most advantageous places, functions, scales, and inter-relationships through the development of robust landscape structures. These resilient and adaptive spatial frameworks ensure the coherent development of the region (long-term strategy) and, at the same time, create conditions and flexibility for local projects (short-term intervention). Research through design is an essential means to explore the possibilities of and contextualise adaptive design principles, such as nature-based solutions, water sensitive design, social-ecological inclusive design, or design with heritage. This implies landscape-based urbanism operates at different scales, from regional to local, and accommodating both general or more specific measures. In this process, the utilisation of knowledge of physical, biological, and cultural aspects of the landscape is inevitable. Enabling digital technologies, such as Geographic Information Systems (GIS), is a powerful tool in landscape-based urbanism for pre-processing, modelling, analysing, and representing data to gain new insights and augment the design process with tremendous calculating and visualisation capacities.

Balancing the relationship between experts, citizens and authorities is also necessary to make landscape-based urbanism work. This calls for a process that is not limited to the domain of landscape architects but that also actively involves other knowledge domains, such as urban planners and designers, data scientists, environmental technology, and urban studies. It also affects people, administrators, the business community, and other stakeholders. The idea is that through meaningful participation of all stakeholders in envisioning, design and policy decisions, the resilience and adaptive capacity of urban landscapes will be increased, not only in physical terms but certainly also in socio-economic terms (Ahern 2011). Resilience is defined as the ability of a system to respond to change or disruption without altering its primary state (Walker and Salt 2006). Adaptive capacity is the degree to which certain uses, processes or structures can be adapted to changing conditions brought about by, for example, social, economic, or ecological processes. Adaptations as such may be spontaneous or planned and may be carried out in response or anticipation of such changes (Folke 2016). This implies a shared understanding of how the landscape system functions. But it also indicates a future-oriented, proactive approach in which the interaction between citizens, businesses, experts and the government is central.

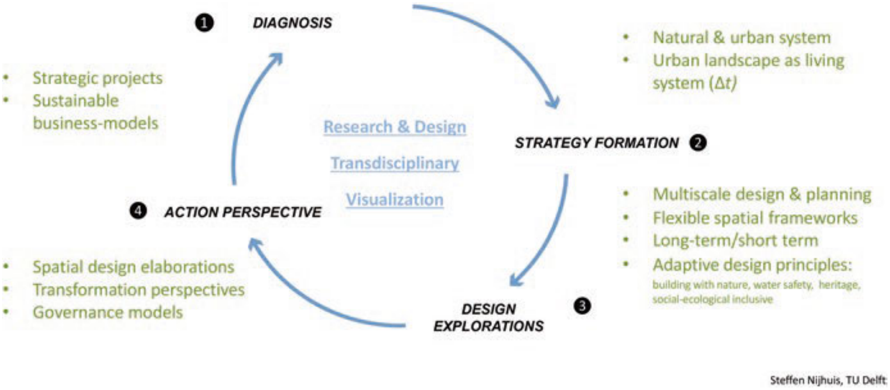

Fig. 11.7 Landscape-based urbanism as a process. Practically the design process entails four key phases: (1) diagnosis, (2) strategy making, (3) design explorations and (4) action perspective. This process is supported by a combination of research and design, meaningful stakeholder involvement and imagination (Steffen Nijhuis, TU Delft)

In landscape-based urbanism, content is thus linked to a process of promoting social-ecological inclusiveness, diversity, and flexibility (Fig. 11.7). Through landscape-based urbanism, we can create conditions, as it were, for change and guide transformations through the development of robust landscape structures that connect spatial scales while at the same time offering space for individual interpretation at the local level. Spatial quality is the leading factor in finding a new balance between experience, use and future values. In addition, multi-functionality, accessibility, heritage and biodiversity are some of the ecological, economic, social and cultural interests that need to be addressed. In this way, specialised knowledge and local expertise can contribute to an integrated approach of sectoral activities and lead to coordinated, sustainable results that benefit everyone.

To summarise, landscape-based urbanism:

– Takes the regional landscape structure and associated processes as the foundation to guide and shape spatial developments and transformation;
– Learns from landscape history and vernacular practice and makes use of the accumulation of indigenous and local knowledge (or traditional ecological knowledge);
– Employs knowledge-based spatial design as an integrative, multi-scale and transdisciplinary approach and exploits the power of enabling digital technologies;
– Develops resilient and adaptive spatial frameworks: robust landscape structures for the coherent development of the region (long-term strategy) and at the same time setting the scene for local projects (short-term intervention);
– Creates and regenerates living systems in which (bio)diversity, cultural history, and multi-functionality lead to sociologically and ecologically inclusive and water sensitive urban landscapes.

11.5 Understanding the Landscape as a Living System

Understanding the landscape is the foundation for landscape-based urbanism. But how to understand the landscape? As mentioned earlier, the landscape is the result of the action and interaction of natural and/or human factors. The landscape is therefore a physical and social construct that changes constantly by natural and human forces. Sometimes the changes are far-reaching, sometimes less so. Some changes, such as the consequences of geological processes or climate change, take a long time to become visible. But change can also occur swiftly, as when a new housing development is built in a former agricultural area, or ecological succession transforms an open field into a forest. Therefore, landscape can be conceived as a living system, which is to say a complex and dynamic network of subsystems that are constantly changing in response to natural processes, social demands, and technical possibilities. As such, the landscape is an interface between nature and society which manifests itself in a material space made up of both structures and processes.

To understand the coherence and heterogeneity of landscape in space and time, it is important to study the chorological (horizontal) and topological (vertical) relationships (Zonneveld 1995; Antrop and van Eetvelde 2019). A practical and widely used method entails analysing the landscape in layers and organising them according to the level of influence and dynamics of change (Braudel 1966).

11.5.1 Layers Approach

Unpacking the landscape in layers is a way of grasping the different systems and subsystems and their relationships (based on Nijhuis 2020). This dissection into layers should not be seen as a static or hierarchical arrangement. Rather, it is about discrete layers that influence one another to a greater or lesser degree, and that influence may also change over time. There are many types of layer-based analysis, such as the triplex model in which a distinction is drawn between the abiotic (relief, water, soil), biotic (flora and fauna) and anthropogenic (human activity) layers (Vrijlandt and Kerkstra 1976). Another well-known layer model divides the landscape into substratum, networks, and urbanization (De Hoog et al. 1988). Although useful in their application, neither model explicitly addresses the social and cultural aspects. Alternative layer-based approaches stress that the concept of the relation between the physical environment (hardware), human activity (software) and cultural, institutional, and conceptual ideas (orgware) is essential to understanding the landscape and its genesis (Braudel 1966; Dobrov 1979; Tvedt and Oestigaard 2014). In this perspective, the following layer-based analysis seeks to understand the landscape as a dynamic interaction between human beings and nature (Nijhuis 2020).

- *The natural context (layer 1):* The natural context is made up of relief, water, soil, geological substructure, and climate, together with the corresponding ecosystems. This layer should be seen as an exogenic, physical factor, with specific features that are also subject to change, such as geological and geomorphological processes like plate tectonics, erosion and sedimentation by wind and water. Natural succession, as when open grassland turns into a forest or into a semi-open park landscape because of natural grazing, is a concrete example of this process. The natural context should not be regarded as a discrete factor, but as a central and inextricable component of the system that in large part determines how the landscape can be used. The dynamics of this basic condition are characterized by a slow, often almost imperceptible process of change, repetition, and natural cycles (Figs. 11.8 and 11.9).

Fig. 11.8 Fragment of a tracing of the natural landscape around Versailles (France) in which relations between topography, hydrology and geology are studied. Note the black cross in the lower right corner, which is the Grand Canal of Versailles Palace (Source: Mazas and Freytet 1992)

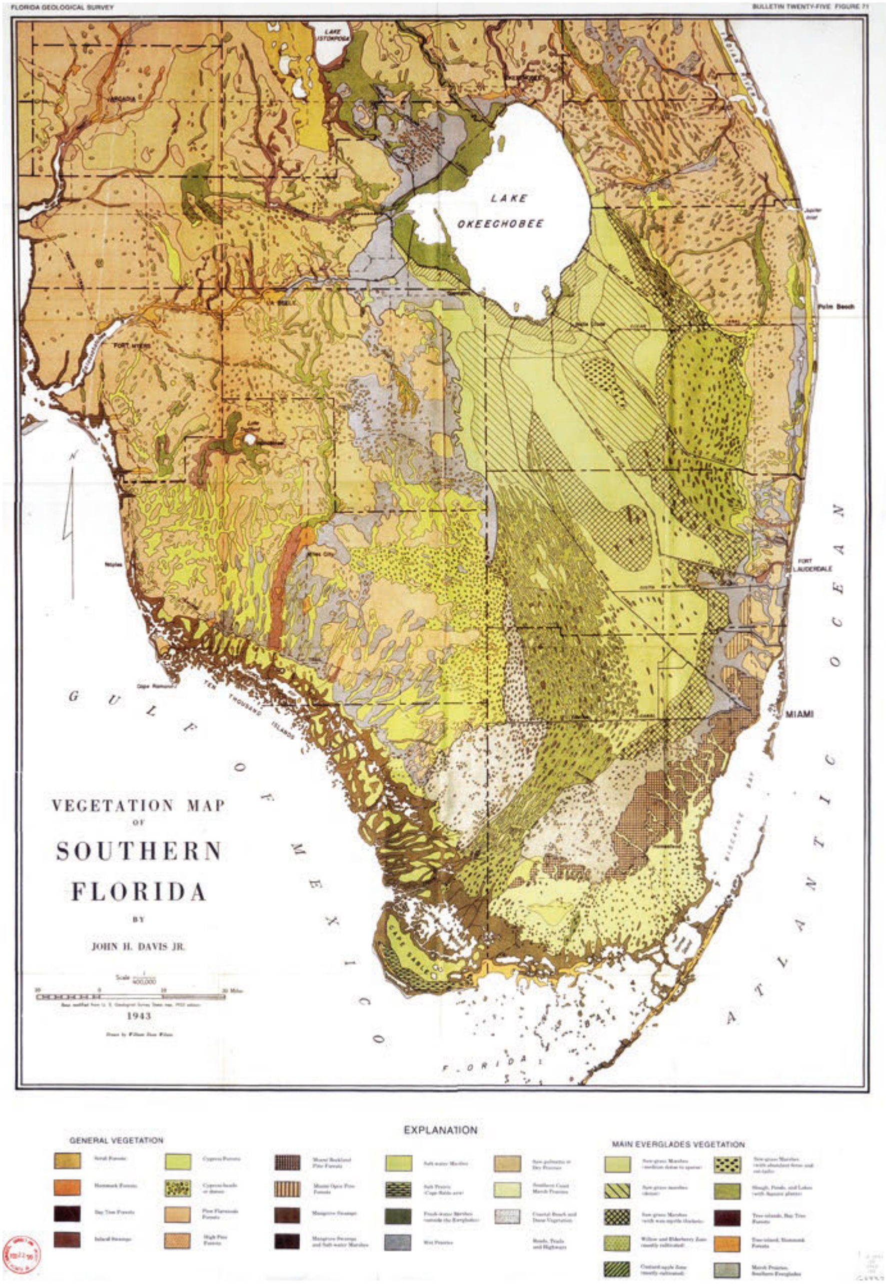

Fig. 11.9 Vegetation map of Southern Florida, 1943. Vegetation maps are critical for understanding biodiversity patterns through space and time as an expression of the interaction between biotic and abiotic factors (Image courtesy: The University of Florida, George A. Smathers Libraries)

- *Human modifications and interventions (layer 2):* Human activity is part and parcel of the use of the natural context for living, working and recreation. Human beings appropriate the natural environment through activities such as road building, land reclamation, diking and canalization of watercourses, the construction of towns and villages, drainage, and irrigation, which manifest as, among other things, different subdivision patterns and water infrastructure. Throughout history, that appropriation process has led to a succession of sometimes drastic changes in the landscape. The dynamics of this layer are related in the long term to social, economic, and cultural history.
- *Culture, organisation, and politics (layer 3):* This layer comprises the cultural, spiritual, and religious conceptions of the natural context and our engagement with it, including the state of science and technology, organisational forms, political movements, design concepts and aesthetic ideals. Water, for example, has different meanings in different cultures, which can find expression in landscape architectural treatments in parks and gardens. The reclamation of the peatlands in the western Netherlands, for example, was in part motivated by geopolitical and economic considerations. Another example is land reclamation for food production, housing, recreation, and nature development in the IJsselmeer area. The dynamics of this layer relate to the relative short term, linked to people and politics.

The landscape is thus a relational structure that connects and influences scales and spatial, ecological, functional, and social entities. As such, the landscape is not just a holistic system, but also a scale continuum that we can only understand by looking at different spatial scales and their relationships.

11.5.2 Landscape as Long-term Structure

Key to the landscape as living system is the notion of the *longue durée*, the landscape as a long-term structure that changes over time in the process of 'sequent occupance' (Sauer 1925; Whittlesey 1929). Time is thus an essential factor in understanding landscapes. Over time landscape underwent transformations resulting from selections based on possibilities and evaluation. Some structures, patterns and forms were preserved; others continue to develop or are replaced by new ones, resulting in a rich historical and typological variation (Bobic 1990). Spatial transformation or series of transformations usually balance more permanent landscape structures and others more prone to rapid change. The more permanent ones tend to be resistant to change and, over time, become more robust (and even inert). Those asynchronous transformations turn the landscape into a layered whole in which physical traces of time can reinforce or contradict one another. These phases provide a window on a range of chronologies, events and meanings that connect the traditional and the contemporary, the tangible and the intangible. In that respect, the landscape is so rich in meaning that it can be 'read' as a biography, as a palimpsest that illustrates the key activities that have contributed to the formation of that landscape (Samuels 1979; Corboz 1983). Knowledge of these historical traces is one of the starting points for new transformations of the landscape: the addition of new ‘layers’. The evolution of the landscape is inherent in the ‘erasure’ and the ‘writing’ of history. As we see it now, the landscape results from a gradual process of selection in which some elements remain and others change or are replaced.

By analysing the stratification of the urban landscape and its development over time on several scale levels and relating them to each other, it becomes clear which landscape structure – and the related landscape patterns and elements – determine the character of the landscape. The landscape structure is the physical basis formed by the coherent, supporting parts, without which the landscape cannot function (Vroom 2010).

Maps and mapping play a decisive role in studying landscapes and their development over time (Nijhuis and Pouderoijen 2014). They are used as a means to identify the landscape structures, patterns and the related natural and cultural processes – but also to understand the related design challenges and opportunities. For example, an urban settlement entirely located in the lowlands requires a different design strategy than one that originated on higher grounds and partially extends into the lowlands. To determine these and other characteristics, visual representations like maps, but also sections and three-dimensional drawings, as well as infographics and scale models are natural tools for visual thinking and visual communication (Nijhuis 2013). Visual thinking is a way of generating information by creating, inspecting and interpreting a visualisation of the previously non-visible (seeing the unseen), while visual communication refers to the effective distribution of information in visual form (DiBiase 1990, cf. Zube et al. 1987). Maps as a product and the process of mapping are both important means for visual thinking and visual communication to understand landscapes. Maps help us to reflect upon emerging insights, appraise the landscape in its totality and observe the relationships between the parts and the whole (MacEachren 1995).

11.6 Strategy Formation and Design Explorations

Based on a proper shared understanding of how the natural and urban system functions, the challenges and potentials that need to be addressed the process of strategy formation and design explorations can start (Fig. 11.10). Strategy formation is about making plans that direct or guide courses of action on the long term into the future (Mintzberg 1994). One could say it is about outlining a path to get from here to there. Often, these outlines are broadly defined while details are allowed to emerge with them, providing flexibility. Strategy formation is in this regard a planning procedure to help guide design explorations and making plans (cf. Mintzberg 1994). Landscape and urban design devise courses of action aimed at changing existing situations into preferred ones (cf. Simon 1969). Design aims towards invention, that is, finding spatial solutions and ‘making them possible’. Spatial design as such

Fig. 11.10 The process of strategy formation and design explorations while utilising knowledge of the natural and urban landscape (Steffen Nijhuis, TU Delft)

translates abstract strategic notions into physical structures and lay-outs addressing several scale-levels. Spatial design is a synthesising activity and is about putting things together rather than taking them apart; integration rather than reduction; it is about relations between things and not the things alone (Meyer 1997; Sijmons 2012). In this respect, design explorations are used as a vehicle to make spatial problems visual, to generate solutions, explore possibilities and to express cultural values by means of spatial form. But how do strategizing and design explorations relate to each other?

11.6.1 Envisioning, Design Models, Backcasting, Adaptive Design Principles

Strategy formation in landscape-based urbanism entails creating a long-term regional vision or perspective that utilises knowledge of the natural and urban systems to address the identified challenges and potentials. Usually, a regional design is used to envision a desirable future expressing what the urban landscape should or can look like. The regional design provides strength and direction and gives meaning to what stakeholders want to achieve together. It provides a sense of focus and belonging when a vision is shared. Long-term perspectives also should address ways to deal with uncertainty, as we cannot gaze into a crystal ball to see the future. A common way to get a grip on uncertainty in spatial planning and design is scenario study (Veeneklaas and van den Berg 1994; Schoonenboom 1994; Lindgren and Bandhold 2009). Scenario study combines realism, prediction and imagination to identify robust developments and the ‘no regret measures’ (Dammers et al. 2013). So, in scenario study the emphasis is not so much on the differences (expressing the uncertainty), but on the commonalities (most likely to happen); the structures, locations and developments that pop up in every scenario.

Based on this understanding, the long-term regional vision can be shaped and spatialized by employing certain adaptive regional design models. A regional design model is a conceptual spatial scheme or plan by which a vision or objective is converted into a spatial arrangement that expresses the desired spatial structure of an area. The design model is an expression of a mental construct that is legible and open to interpretation. In the practice of landscape-based urbanism, three types of adaptive regional design models can be recognised that aim to guide spatial developments throughout the scales: area, framework, and corridor models (Nijhuis 2019) (Fig. 11.11).

– Area design models provide for a landscape mosaic in which zones for long-term, sustainable conditions for ‘low dynamic functions’ (network) are created as well as expanses of land in which ‘high dynamic functions’ may flourish (mosaic) on the short term. Examples include Plan Stork (the Netherlands) and Masdar City (Abu Dhabi, United Arab Emirates).

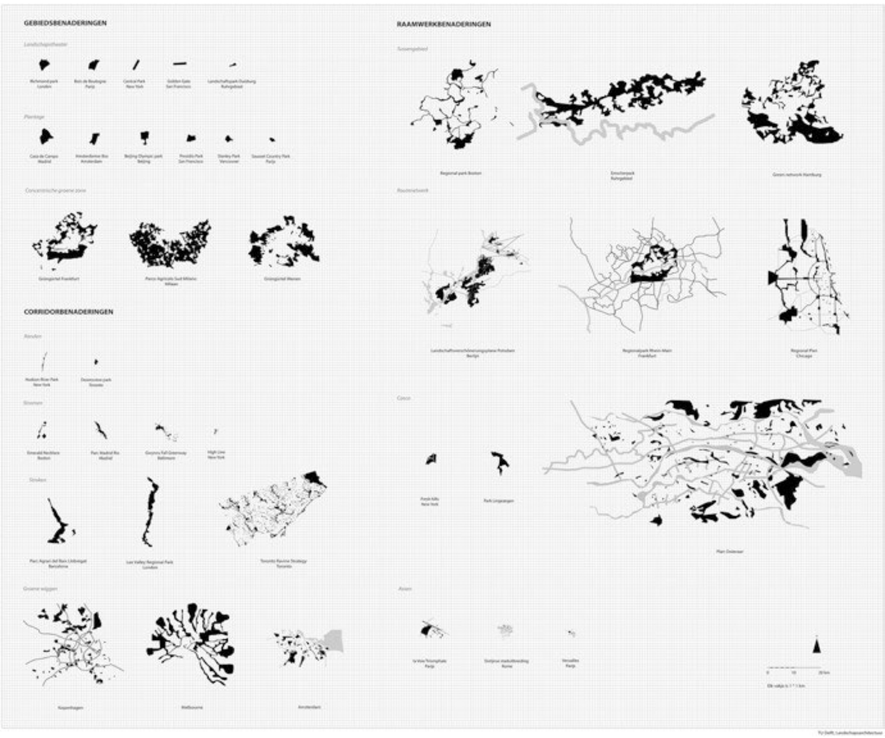

Fig. 11.11 Examples of landscape-based regional designs that follow area, framework and corridor design models (Steffen Nijhuis and Mei Liu, TU Delft)

– Framework design models focus on the development of long-term and coherent landscape networks of landscape structures to support spatial development, safeguard resources and spatial coherence and create conditions for local developments. Usually, this approach focusses on open-space planning (the inverse of the existing urban tissue). Examples include the Boston Metropolitan Park System (US), the Emscher Park (Ruhr area, Germany).
– Corridor design models provide for or develop supporting landscape structures as armatures for urban and rural development that direct, facilitate and create conditions for urban development and stimulate social and ecological interaction. Examples include Rio Madrid (Spain) and the High Line (US). In the daily practice the regional design models are employed in an interchangeable and complementary manner and are thus not exclusive.

Regardless the chosen adaptive design model, in the process of envisioning regional design is aimed at adapting the model to the spatial context through (regional) design. Here, the design process is focussed on the spatial translation of the vision that is geared towards the development and protection of coherent and robust 'strong' landscape structures, such as river corridors, metropolitan park networks, while employing associated natural processes to guide and shape spatial transformations on the long term (Figs. 11.12, 11.13 and 11.14). In a constantly changing environment, the landscape structure is a strong basis for, on the one hand, safeguarding the 'carriers' of the area. On the other hand, creating conditions for developments aimed at bringing about cohesion and adding spatial qualities when adapting to new developments or tackling challenges.

When the long-term regional vision in the form of a regional design is established, the next question is 'what do we need to do today to reach this vision and how can we adapt to changing circumstances?' This question can be answered by a process of backwards reasoning – called backcasting. Backcasting allows planners and designers to determine design strategies and principles and to consider what is realistic, but not necessarily what is realistic today (Robèrt et al. 2012). The focus is on the long-term regional vision, not just the current situation, charting the best possible way in the right direction (Robèrt et al. 2012). Adaptive design principles are powerful means in this regard. A design principle refers to a basic idea or rule that explains or controls how something happens or works. Examples of adaptive design principles (Lenzholzer 2015; Prominski et al. 2017; Sim 2019; Stafford et al. 2021; World Bank 2021) include but are not limited to sustainable water management, public space design and nature-based solutions (Fig. 11.15). These principles represent generalised design knowledge that is detached from a certain context and is applicable to other contexts (Nijhuis and Bobbink 2012). It offers, as it were, a 'toolbox', providing an overview of available design principles with essentials and leaving out particularities (Steenbergen et al. 2008). In that regard, principles are adaptive as they need to be contextualised as well so they can be adjusted given changing circumstances, while maintaining the focus on the overall objective. So, adaptive design principles can be adjusted according to the context and needs. To summarise: the long-term vison in the form of the regional design and the related

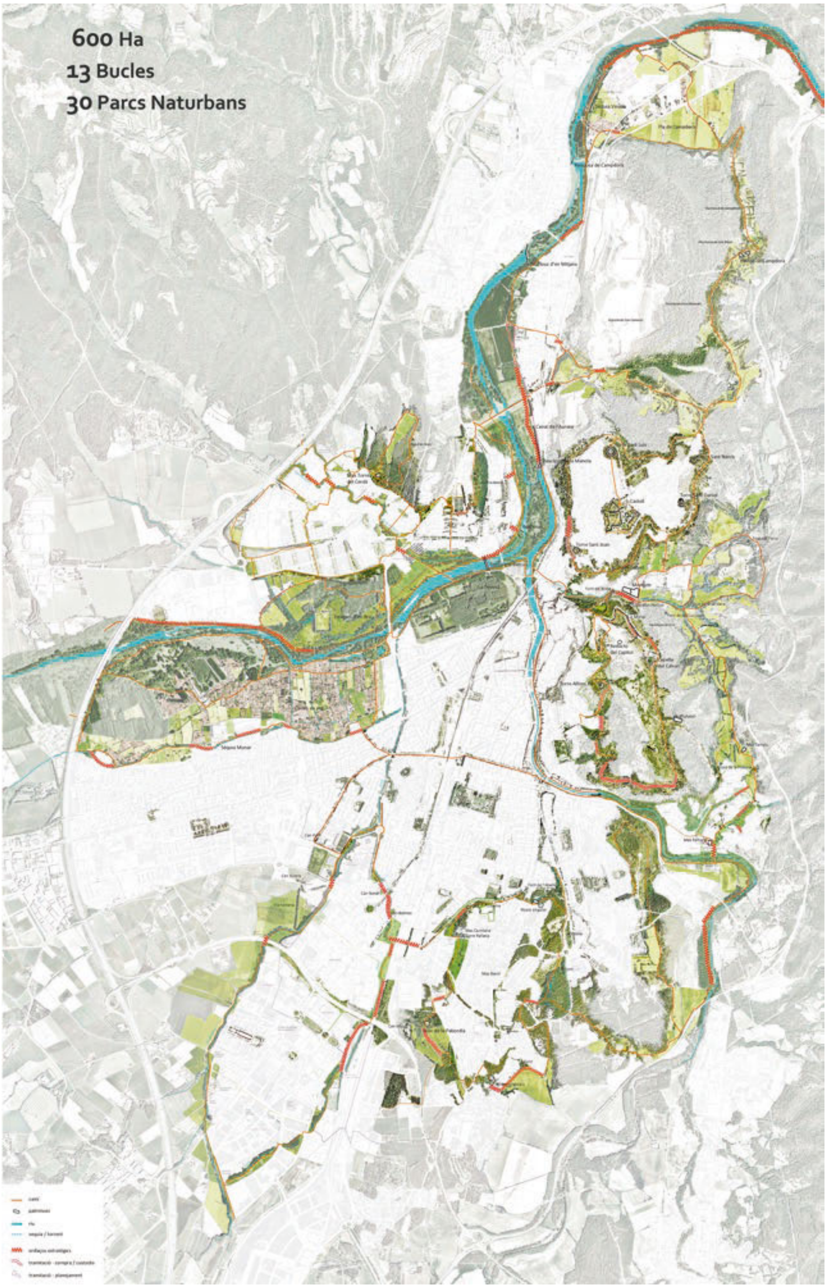

Fig. 11.12 The Girona Green-Blue Park System (Girona's Shores 2019) by EMF Landscape Architecture is an example of a long-term vision translated in a contextual landscape-based regional design which is conceived as a framework for spatial development. The framework constitutes of green, water and recreative networks connecting the city of Girona (Spain) with its surrounding territory and guides urban developments. The landscape framework also incorporates parks, gardens, cultural-historical elements, forests and agricultural land. The plan builds on local projects and initiatives. (Image courtesy: EMF, Estudi Martí Franch)

Fig. 11.13 Bird's-eye view of the landscape-based regional design for the Girona Green-Blue Park System. (Image courtesy: EMF, Estudi Martí Franch)

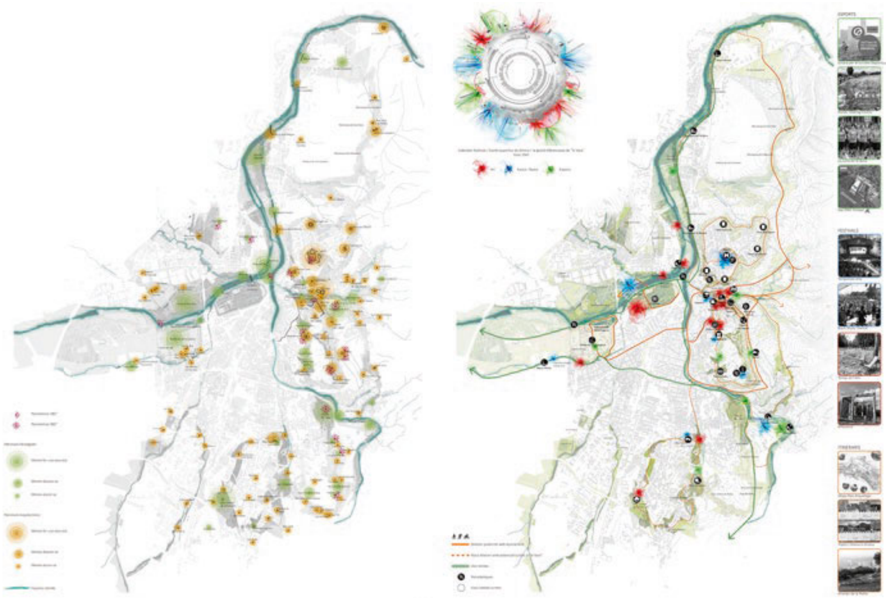

Fig. 11.14 The green-blue network (left) and the recreative network (right) that are part of the Girona's Park System. (Image courtesy: EMF, Estudi Martí Franch)

adaptive principles does not provide a blueprint for the future but guides a more or less open-ended design process in which strategic projects and design explorations play a key role in the achievement of sustainable urban landscapes.

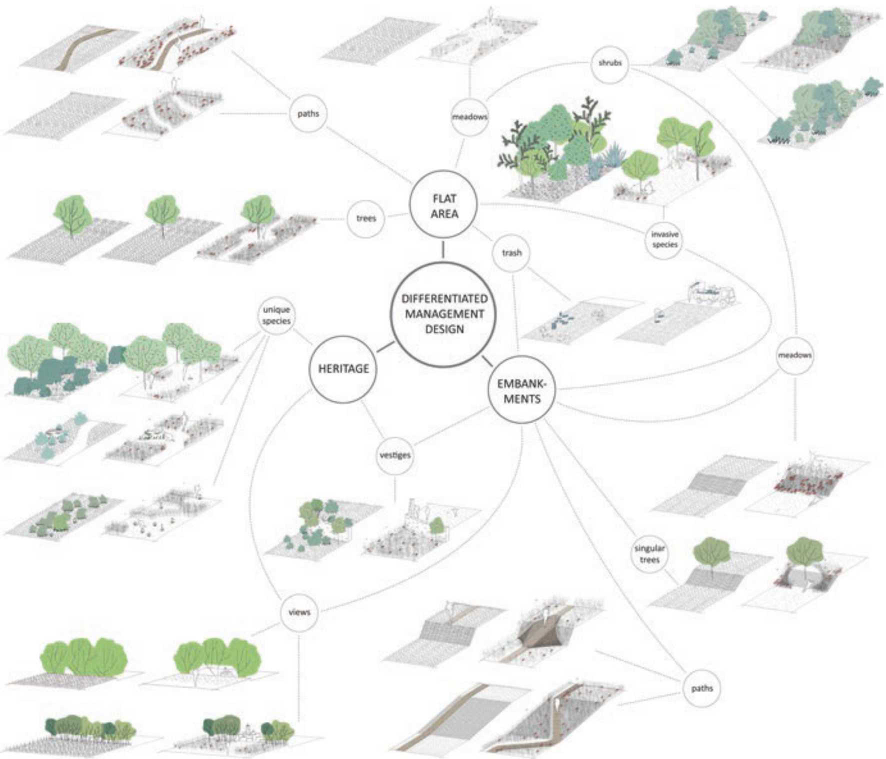

Fig. 11.15 Set of adaptive design principles employing natural processes and elements for working with flat areas, embankments and heritage in Girona's Park system. (Image courtesy: EMF, Estudi Martí Franch)

11.6.2 Strategic Pilot Projects: The Role of Design and Action Perspective

In strategy formation, the identification of strategic pilot projects is crucial to realise the ambitions as formulated and mapped in the long-term regional design. In this perspective, a pilot project is an initial and relatively small-scale implementation to prove the viability of the approach, principle, or idea, which can be a construction project, an urban or landscape development project or a research project. The regional design usually entails many potential projects varying in scale and focus but are needed to translate ambitions into reality. The pilot projects can be defined based on local 'bottom up' initiatives, usually building on existing initiatives and networks, such as a neighbourhood park, community gardens, a housing project or as 'top down' projects that transcend the locality and need regional coordination, such as river regeneration projects and green-blue infrastructure. What the pilot projects have in common is that they contribute to the realisation of the long-term perspective by short term actions and implementation. The purpose is to think together, contextualise the adaptive design principles through design and implement the ideas in practice (Figs. 11.16, 11.17 and 11.18). Through the pilot project

Fig. 11.16 Design of a stretch of the Ter River. This is a crucial pilot project for the Girona's Park system and aims to bring the neighbourhoods at both sides of the river perceptively and mentally closer by opening of transversal views to the river and between the banks. The project also includes the recovery of two river beaches by making use of fluvial sedimentation, the recovery of a wide strip of ecological valuable grassland, and the elimination of exotic invasive flora. A compensatory balance is sought between increased social ownership and environmental restoration measures. (Image courtesy EMF, Estudi Martí Franch)

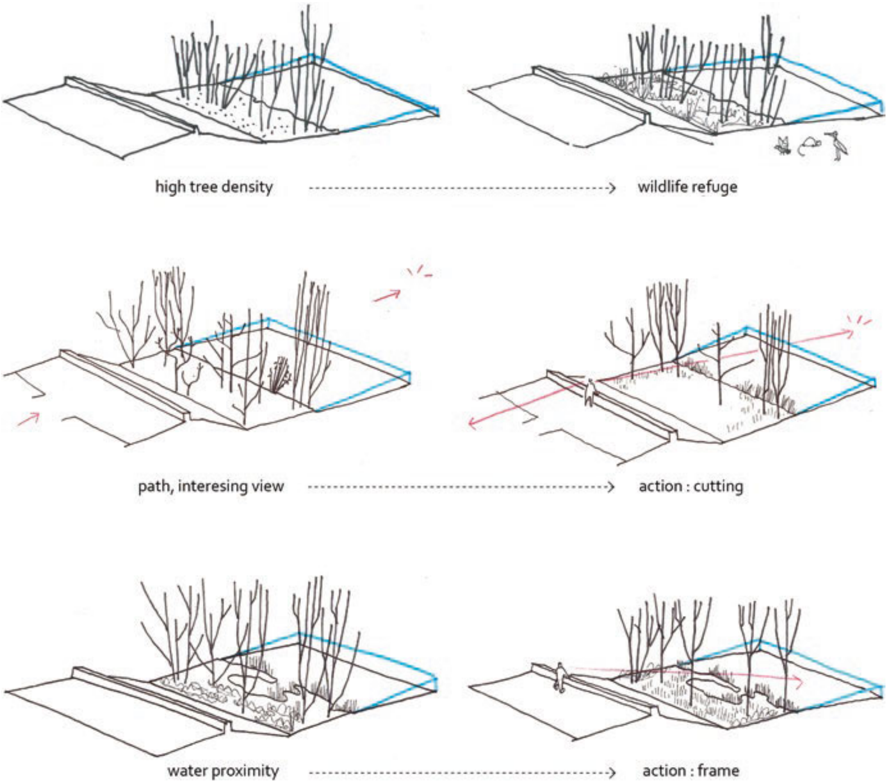

Fig. 11.17 Design principles for the banks of the Ter River. (Image courtesy: EMF, Estudi Martí Franch)

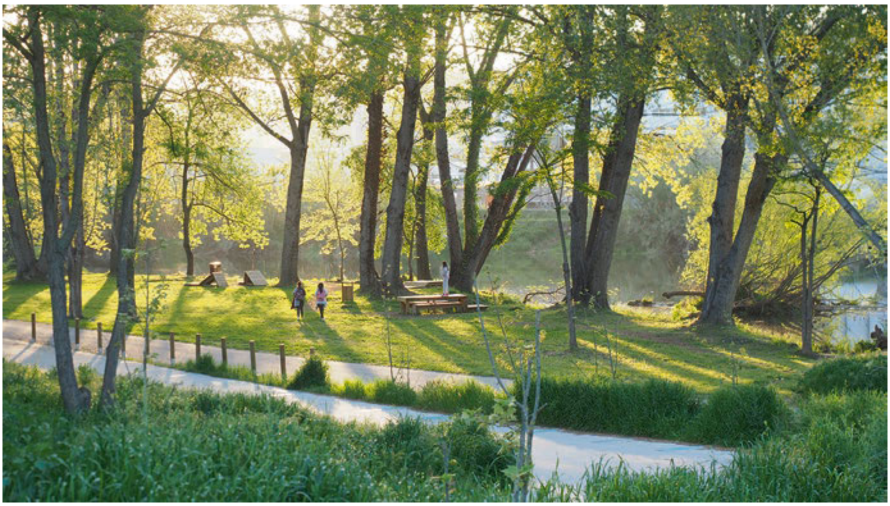

Fig. 11.18 Situation after the design intervention. (Image courtesy: EMF, Estudi Martí Franch)

designers, policy makers, citizens, academia, and industry are, as it were, united in a 'Community of Practice' (or 'Living Lab') to experiment, co-create and test in a real-life environment, delimited by geographical and institutional boundaries (Maas et al. 2017; Schliwa and McCormick 2017). Experimenting together in a responsible way, monitoring, and learning from mistakes, creates an informal space in which innovation is key and everyone is equal (Ahern 2011). This fits well with the social and political conditions needed to arrive at solutions on a policy and practical level. The strategic nature of the pilot projects is expressed by the fact that it should contribute to the realisation of the bigger ambitions in tangible ways, but also in intangible ways by building alliances of stakeholders, to develop governance models that guide and facilitate implementation and leverage innovative business models that are needed for a realistic action perspective.

What is the role of design in such an approach? As emphasised by the earlier definition, it is that design is regarded as a process or action that is geared towards exploring and producing. In this process, knowledge from other disciplines, such as ecology, urban planning, cultural history, and water management, is spatially translated and integrated. Designing, therefore, plays a role as a thinking-technical tool with which one thinks and acts in a structured way to generate ideas and explore possible solutions. This method is called 'research through design' (Nijhuis and De Vries 2019). In research through design, goal-oriented searching is central in a process where thinking and producing go hand in hand. Mechanisms of research and design are combined with imagination, creativity, and innovation (Nijhuis and De Vries 2019). During this process, a conscious or unconscious synthesis takes place that in some way precipitates into a visual form, by drawing, mapping, or modelling with analogue or digital media.

Design explorations are therefore a powerful research method with which complex spatial challenges can be approached integrally and creatively. A structured design process will be used in which important aspects are clearly revealed and the tasks are further translated and concretised in spatial terms. The adaptive design principles as formulated in the strategy formation phase are adapted and applied in the local context. Through these design experiments knowledge is acquired by studying the effects of actively and systematically varying design solutions in a specific context. Spatial design as such helps to identify challenges and potentials of the urban landscape and to suggest possible solutions. This is done by making matters explicit with drawings and sketching the context in which they can be realised. In this sense, the design explorations can also help to identify how stakeholders think about future developments at different scales. By visualising ideas and programmes of requirements and positioning them in the space, one can identify possibilities and limitations and formulate questions that require further investigation. Design results provide a context for conversations and observations about the importance of landscape structures and elements and allow for the discussion of solutions and measures with their spatial qualities. In the context of landscape-based urbanism, design explorations are used as a systematic search for possible solutions to a spatial problem. At the same time the design exploration makes clear which landscape structures and elements, for example from an ecological of cultural-historical point of view, should be preserved too.

11.7 Conclusion

Landscape-based urbanism is about cultivating the region in such a way that it will thrive. It is like gardening at the regional scale – a permanent search for the balance between intervening and letting happen, between the tamed and the wild, the desirable and the uncontrollable, the artificial and the natural. In the process of gardening, one works with the material at hand, but also manages, intervenes, and adds new elements to achieve an attractive result. Here, traditional ecological knowledge and local knowledge are an inevitable source of knowledge for management and design. In literal and figurative terms, it provides valuable knowledge about when and what to let grow, or how to cut down, prune, plant, or seed. Or how to create or change spatial conditions in which the region as a garden can thrive, while building on natural and social processes relevant for the context one is working in. Clear structures provide direction and at the same time allow for flexibility and spontaneity. Analogously, landscape-based urbanism finds and directs urban developments and transformations through creating strong landscape structures. As such, regional design is not about creating blue-print plans, but about producing roadmaps to realise and regenerate living ecological and social-economic systems that lead to a more sustainable and inclusive future urban landscape. The physical landscape structure and accompanying natural processes are used to create favourable circumstances for future development and to direct and influence spatial developments in a positive way at multiple scale-levels. Every scale-level has its own structures and influences the scale above and below, like a fractal. Top down and bottom-up initiatives and projects – short-term interventions – substantiate coherent development of the region – long-term strategy. In these projects, knowledge-based spatial design is employed as an integrative, multi-scale and transdisciplinary way to move forward in which thinking together, co-creation and implementation are at the core.

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Chapter 12
Urban Green Benefits

Rudi Scheuermann, Martin Pauli, and Cinthia Buchheister

Abstract Can infrastructural green improve the climate in cities? In a global study and for the very first time, the planning and consulting firm Arup has made it measurable to what extent green building envelopes can reduce the upheating in cities, filter fine dust and increase people's well-being. The study explains the significant role green buildings can play in reducing "urban stress" and giving people more access to nature.

Keywords Green building envelope · Green facades · Green infrastructure · Sustainability · Urban ecosystem

12.1 Introduction

In ever denser cities the space for green infrastructure, such as parks, green recreational areas, and trees in street canyons, is being depleted. What is often considered and belittled as expensive green architectural decoration is, however, an important element in our built environment and should not be underestimated. Besides the many health and well-being aspects resulting in significant stress relief for human beings, there are several effects which have a serious influence on the micro-climate in our built environment and the sustainability of building operation.

Our buildings hold enormous, so far largely untapped potential for green spaces. We consequently need to activate their envelopes to allow for green infrastructure to deliver its beneficial contributions. If we consider buildings to be generally cubic, their façades and roof areas offer about five times the area of their footprint. And if

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we then activate some 20% of the building envelopes to be green building envelopes, we could give back 100% of the building's footprint for infrastructural green. Our intention is thus in line with the requirements of cities such as Singapore, where 100% of a building's footprint must be given back to the city as green spaces on façades and roofs.

12.2 Making the Benefits of Green Building Envelopes Measurable

As part of a global research study (Arup 2016), Arup has investigated the impact of green building envelopes (Fig. 12.1) on our urban ecosystem, which is subject to drastic changes regarding available space, mobility, food, water, and the general way people live in cities. The frequently discussed benefits of green building envelopes with a view to their potential to mitigate urban noise, air pollution and heat are quantified. For the following five cities: Berlin, London, Hong Kong, Melbourne, and Los Angeles.

Not surprisingly, morphology as well as geographical and climatic context have a significant impact on noise, pollution, and heat. By working with various digital tools, the positive contribution of green building envelopes to our urban ecosystems can be demonstrated. The benefits of green building envelopes are measurable

Fig. 12.1 Green building envelopes (© Eddie Jacobs)

through simulations regarding heat, noise, and pollution in relation to the required investments for greening building envelopes.

With the support of Prof. Dr. Dr. Christian Ulrichs at the Department of Urban Ecophysiology at the Humboldt University in Berlin, Germany, measured data on the performance of plants are included into complex Computer Fluid Dynamic (CFD) Models. Based on three-dimensional models of the five global cities, a simulation of potential positive effects of green building envelopes has been possible.

The aim is to understand the impacts of urban morphology aspects, in particular the height to width ratio of streets and their correlation with positive effects due to green envelopes. The study demonstrated that green façades possibly lead to local reductions in concentrations of particulate matter, typically between 10% and 20%. Moreover, green façades can reduce sound levels from emergent and traffic noise sources by up to 10 dB(A). Green façades are most effective in reducing the Urban Heat Island (UHI) in cities with a height-to-width (H/W) ratio greater than two – very dense urban city centers like Hong Kong or Melbourne fall into this category – peak temperature reductions of up to 10 °C having been modelled.

However, the most important finding is that green urban infrastructure, no matter where it is applied or how large an area it might cover, there is always a positive resonance of people who appreciate the visual quality and all associated benefits having a positive impact on the quality of their daily lives.

12.3 Air Pollution

The political initiatives to date have concentrated on the reduction of emissions at source, i.e., from vehicle exhausts, but these have failed to reduce concentrations in large urban areas sufficiently to below standards set nationally and by the World Health Organization. As a result, further measures are required to reduce concentrations of particulate matter in cities. The use of green building envelope is an approach that offers the potential to provide significant mitigation, as the leaf surfaces of the plants intercept and remove particles from the atmosphere. The main mechanism of particle filtration in plants is the deposition of particles on the surfaces of leaves. This is a complex phenomenon that is not yet thoroughly understood, because it depends on many factors related to the particle matters, the properties of the plants, the pollution distribution in the urban context, and the structure of the wind field.

The study has used computational fluid dynamic (CFD) modelling to determine the effectiveness of green facades to reduce pollutant concentrations. It has examined how the different street and building configurations in those five global cities, i.e., Berlin, London, Melbourne, Hong Kong, and Los Angeles, affect the air flow at street level and over a green façade, and then predicted the level of removal for particulate matter from the atmosphere. CFD simulations were undertaken for a reference wind of four m/s from the west. The simulations are based on a simplified street canyon configuration, with west wind over the buildings. Additionally, two pollutant sources were included in the model: a) pollution drifted by the urban wind which could be considered as the background pollution, and b) pollution from car exhausts. The local impacts of air pollutant releases vary widely according to the local meteorological conditions.

Wind speed is an important factor in diluting pollutant releases, and wind direction is crucial for determining which location pollutant emissions may impact. In urban configurations, the wind speed inside street canyons depends on the aspect ratio of the streets and their relative orientation to the prevailing wind direction. While the particles size and shape and the meteorological parameters are generally dictated by the context, the plant species selection and the plant configuration within the urban context are factors that should be seriously considered during the urban design process. From the filtration capacity point of view, one of the most interesting characteristics that should be considered during the selection of the plant is the density of leaves, otherwise known as the leaf area index.

The biggest advantage of green façades is their capacity to reduce air pollution within the street canyons without increasing pollutant concentrations at pedestrian level. This is because green façades represent large green areas that do not interfere in the wind structures created in the street canyons and are aligned with main flows that carry the pollutants. Green façades can result in local reductions of concentrations of particulate matter, typically between 10% and 20%. The reductions are localized within the street canyon, and overall reductions of the air volume in the city will be much lower. However, green envelopes do provide an opportunity to improve air quality in selected areas.

Melbourne has a high urban density. The typical street canyon has an average aspect ratio of H/W = 2.5. The wind inside the street canyon forms a vortex that does not penetrate the whole depth of the street, leaving the part near the ground unaffected. Pollutants from traffic sources are concentrated at the bottom of the street canyon in the leeward side and ascend through the leeward façades. Pollutants above the roof level are brought into the street canyon by air passing down the windward façade (Fig. 12.2).

The case of Berlin is like that of London. The urban configuration has a typical street canyon aspect factor of H/W = 1.2. The air forms a single recirculation vortex

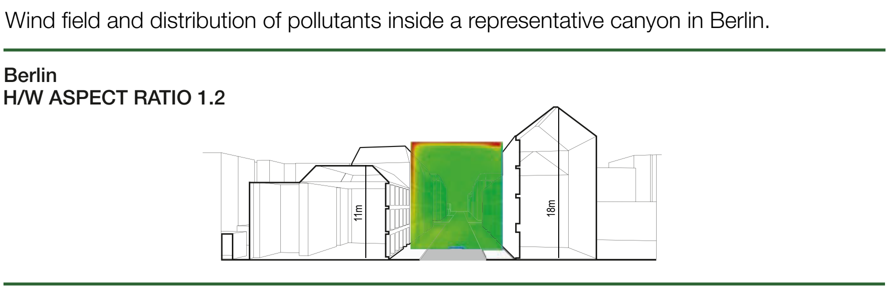

Fig. 12.2 Wind field and distribution of pollutants inside a representative canyon in Berlin

inside the street canyon, going down through the windward façade and up through the leeward. The pollutants perform identically to those in London.

12.4 Acoustic Noise

Street canyons are typically made up of hard and dense materials such as concrete, brick, asphalt and glass that reflect sound and increase the overall noise level on the street (Thompson, 2015). While green façades cannot effectively mitigate direct sound, they can absorb sound that would otherwise be reflected between building façades or bend round their corners, reducing the overall level of noise. Green façades have the potential to reduce both ambient noise, i.e., the background sound of a city made up of many noise sources, and noise from individual sources such as motorcycles, sirens and construction equipment that exceed the ambient level. Irregular sounds such as these can be disturbing when they significantly exceed ambient noise levels as they are very difficult to ignore (Van Renterghem and Botterdooren, 2015). The acoustical benefits of green façades go beyond measurable reductions in noise level. They can create a psychological perception of quietness that complements physical reductions of sound energy. They can also introduce and unmask sounds of nature, creating a more pleasing soundscape. A survey of 105 people living in apartments facing a noisy ring road in Ghent, Belgium, found that residents with a view of vegetation were five times less likely to report annoyance due to noise than residents without any greenery in their view (Fastl, 2004). In lab studies, the colour green alone has been shown to reduce perceptions of loudness compared to other colours (Tilley et al., 2014).

To gain an initial understanding of how green façades reduce noise in different cities, two independent computer modelling studies were carried out: the first isolating the acoustical effect of individual urban variables and the second predicting their combined effect on typical urban layouts in Berlin, London, Hong Kong, Melbourne, and Los Angeles. In a first modelling study, the impact of different architectural and urban variables on a green façade's effectiveness at reducing street-level noise using the acoustic computer simulation programme CATT were investigated. The purpose of the study was twofold: firstly, to determine the general range of sound level reductions likely to be achievable with the installation of green façades, and secondly, to assess the relative significance of the individual variables. Computer modelling studies were conducted on a range of different streetscape and building configurations to evaluate the effect of building and block depth, height, length, and road width on urban noise (See Figs. 12.3, 12.4 and 12.5). Point sources (single noise events) and line sources (continuous streams of traffic) were studied in each configuration. For the base condition, a 300-m-long street canyon was modelled, representing the typical block structure of Wan Chai, a densely populated neighbourhood in Hong Kong with narrow streets and tall buildings.

Two scenarios were tested, the first representing a typical street canyon with hard, sound-reflecting façades, and the second a street canyon treated with green

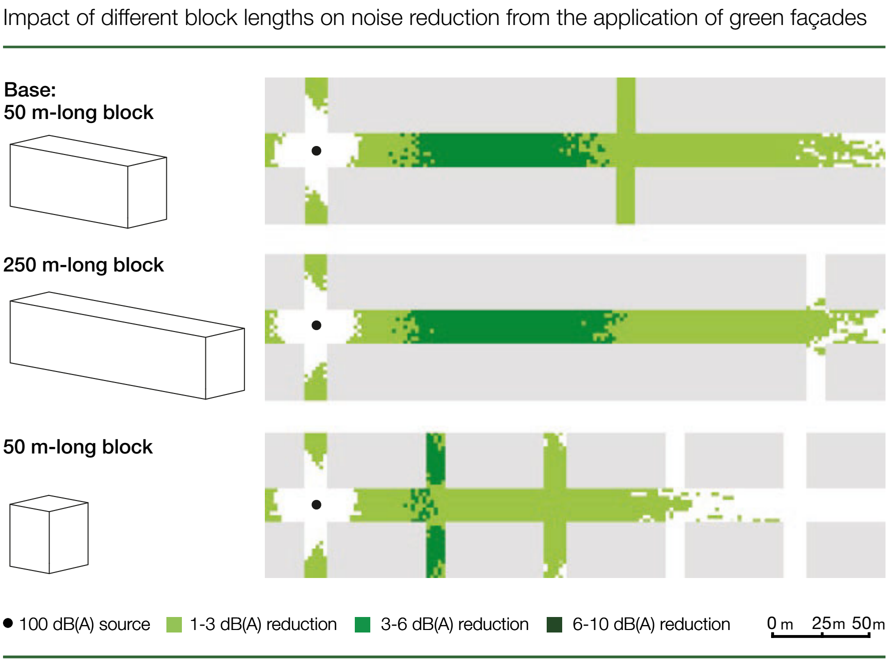

Fig. 12.3 Impact of different block lenghts

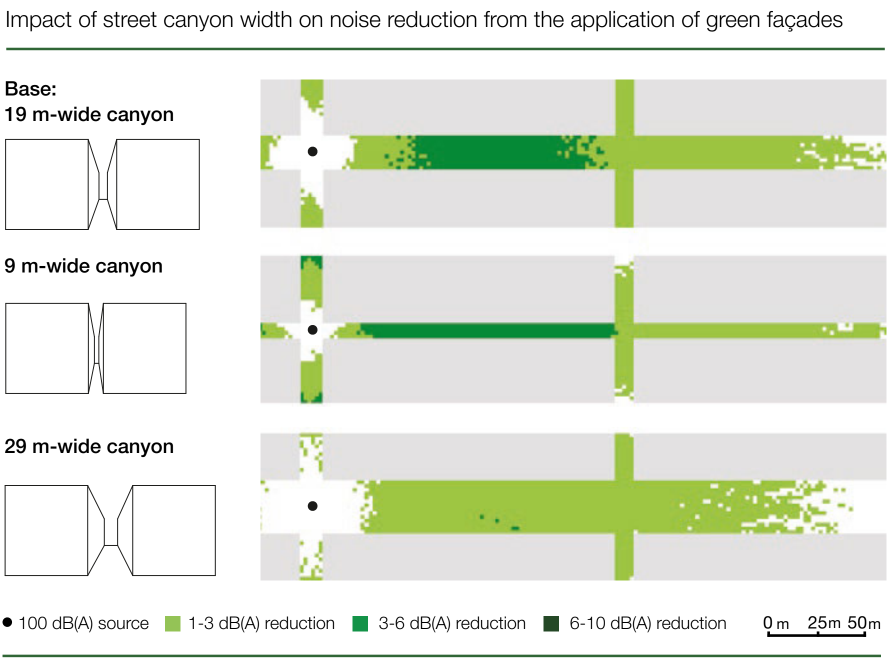

Fig. 12.4 Impact of street canyon width

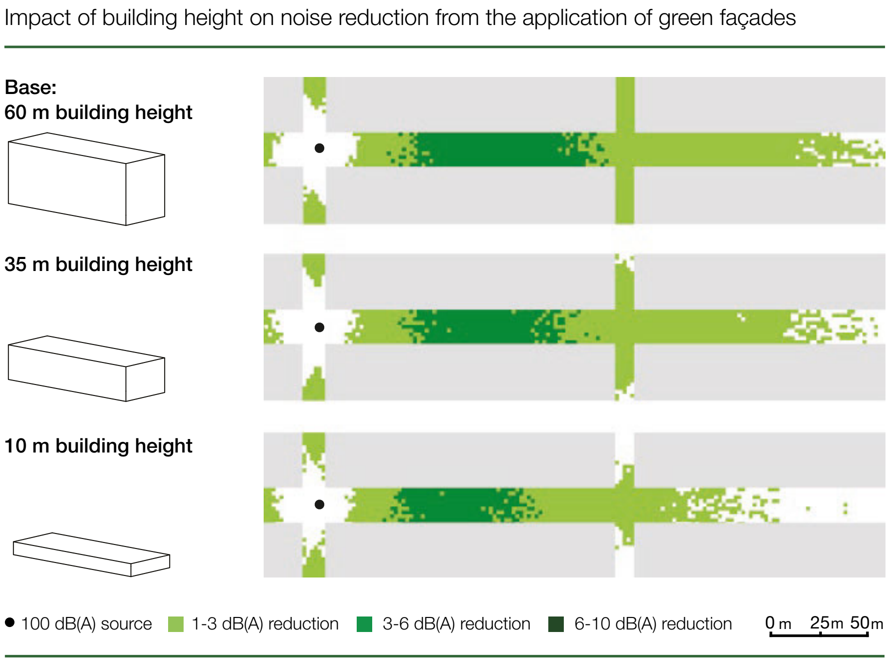

Fig. 12.5 Impact of building height

façade modules with sound-absorbing properties. For each of these scenarios, three block lengths were tested: basis, long and short block (Fig. 12.3). The base condition resulted in sound level reductions of 3–6 dB (A) starting about a third of the way down the first block and continuing almost to the end of that block. The long block condition resulted in a similar pattern, with a slightly longer area of 3–6 dB (A) reductions. In the short block condition, 3–6 dB(A) reductions were limited to a small area at the end of the first block and around the intersection into the cross street.

Moreover, three street canyon widths were tested, one 10 m narrower than the base Hong Kong condition and one 10 m wider (Fig. 12.4). The narrower condition resulted in 3–6 dB (A) reductions starting somewhat closer to the source than in the base condition and continuing until the very end of the first block. In the wider condition, no reductions greater than 3 dB (A) were observed.

Overall, the results of this test show that street width can have a moderate impact on emergent source noise reduction, with narrower streets resulting in greater reductions spread over larger areas.

Additionally, two façade geometries were tested, the base condition flat and the second condition featuring three 3-m-deep balconies at 10 m vertical intervals up the façade (Fig. 12.6).

Significantly greater levels of sound reduction were observed in the balcony condition, with reductions of 3–6 dB (A) extending round the corner of the first

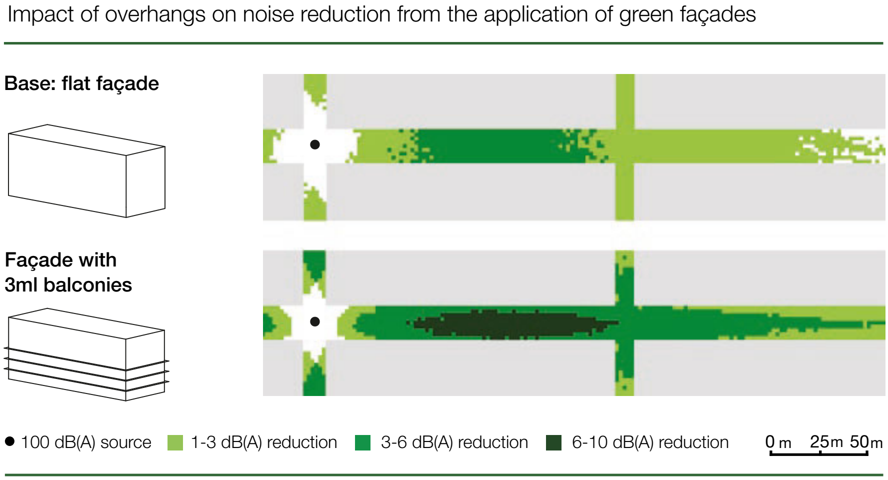

Fig. 12.6 Impact of overhangs

intersection and partway down the second block, and reductions of 6–10 dB (A) covering a large area of the first block. The results indicate that in a street with balconies or other overhangs, applying a green façade will have a much more noticeable acoustical impact than in a street with relatively flat façades. This is likely because horizontal façade elements trap more sound energy at street level than those of a flat, vertical façade.

Finally, three green façade coverage patterns were tested. In the base condition, the entire façade was covered in green façade modules. In the second condition, only the bottom 10 m of the façade was covered. In the third condition, the top of the façade was covered, excluding the bottom 10 m (Fig. 12.7).

The first two conditions resulted in an almost identical coverage pattern, while the third condition showed no sound level reductions exceeding one dB (A). The results suggest that to efficiently reduce noise levels, a green façade must cover the base of a building but need not necessarily cover the upper levels. This finding is only valid, however, for sources and receivers at street level. For sources and/or receivers located above street level, sound reflections from the upper façades of buildings in the street canyon will contribute to the overall sound level.

If priority is given to reducing noise reduction for building occupants rather than streetlevel occupants, or if elevated noise sources such as aircraft dominate the soundscape, a greater green façade coverage area will likely be needed to provide noise attenuation. Green façades can reduce sound levels from emergent and traffic noise sources by up to 10 dB (A). They do not significantly improve noise level reduction close to a noise source but show greater improvements with increasing distance from the source up to the point where ambient noise begins to dominate.

Green façades are unlikely to have a noticeable acoustical impact when a neighbourhood's sound environment is dominated by distributed sound sources. In general, they are likely to have a greater acoustical impact during the night, when

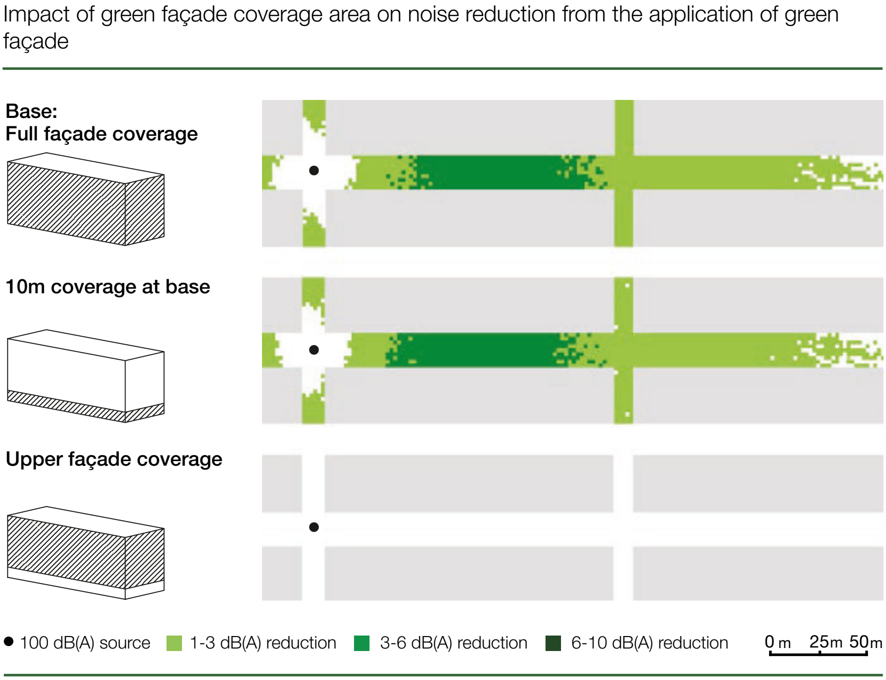

Fig. 12.7 Impact of green façade coverage area

ambient noise levels are lower, and the soundscape is dominated by emergent sound sources.

12.5 Urban Heat Island

The Urban Heat Island (UHI) effect describes an urban area whose temperature is considerably warmer than the surrounding suburbs and rural regions. Metropolitan hardscapes are the primary cause of this effect: concrete sidewalks, asphalt roadways, steel and glass façades, and other solid surfaces which radiate rather than absorb heat. This increased heat takes a toll on urban spaces, buildings, and the community, and may result in increased peak energy demands, amplified air pollution levels, poor water quality, higher cooling costs, modified wind and precipitation patterns, heat-related illnesses and an increase in mortality rates. The United States Environmental Protection Agency advises that an urban area with a population exceeding five million people may be one to three degrees Celcius hotter in the daytime and up to 12 °C warmer in the evening than surrounding areas Heat Island Effect (EPA 2015). Each decade since 1900, New York City's temperature has increased at a mean rate of 0.16 °C a rate that is expected to speed up in coming years. The New York Panel on Climate Change predicts that the average temperature in NYC will increase by 2.3–3.2 °C by 2050 (Cho 2015) at which point residents will experience a tripling of heat waves.

Innovative methods to document and calculate rising temperatures in cities continue to emerge. One such example is the work recently completed at Monash University in Melbourne, where researchers are utilizing drone technologies to map the urban forms contributing to UHI (RP, 2005). This detailed examination will provide the basis for future designers and builders to gain thorough knowledge of the causes of UHI and drive them to develop innovative solutions. Nature is the best and most recognised method of remediation. Plants absorb the sun's energy, provide shade and perform evapotranspiration – evaporation from the leafy parts of the plant (American Planning Association, 2007) - resulting in lower urban temperatures, cooler surfaces and cleaner air. Increasing the quantity and quality of vegetation, parks and open green spaces within a city can therefore reduce urban temperatures.

In the study (Arup, 2016) the climatic impact of green building envelopes for buildings and cities has been examined to quantify a potential mitigation of the Urban Heat Island effect. For both cases a CFD modelling approach was chosen, and the results have been compared with recent studies found in the literature. To assess the reduction in building energy consumption, a typical office building for each city was modelled within its typical surrounding. Office occupancy, equipment, lighting and building constructions are based on the California standard.

It is understood that building construction and schedules vary between different cities and countries. However, for the benefit of relative comparison and as a first pass, it was decided to keep the modelling inputs the same for all locations. To calculate the effect that vertical green façades would have on an urban scale would require a relative comparison for a city with and without green façades. The effect of the green façades would most likely be perceived in a reduction in air temperature over the urban landscape, typically referred to as the Urban Heat Island (UHI) effect. There is a variety of cityassociated parameters like the grid, solar radiation, canyon height-to-width ratio, thermal mass and the percentage of green space that influence the effect independent of green envelopes. Some of the main trends that were identified suggest that:

1. Green façades increase benefits for pedestrian circulation. They effectively remove 50% of the solar radiation (typical reflected shortwave + longwave radiation).
2. Green façades are most effective in reducing UHI in cities with a H/W ratio greater than two. Very dense urban city centres would fall into this category (e.g., Hong Kong, Melbourne, Madrid etc.). Reductions in peak air temperatures of the order of 10 °C were predicted.
3. Mean reductions in UHI are much less than peak reductions. For most areas the mean reduction is a fraction of a degree compared to the peak. This is in line with UHI observations that tend to be extreme during heat waves.

4. For cities that are already green, such as Berlin, green façades are of limited benefit compared to cities that have more concrete and are denser (e.g., London, Madrid, Hong Kong).
5. Cities with wide streets and lowrise buildings (Los Angeles) would benefit from more greenery at street level since those areas trap most of the solar gains.
6. Green façades have the biggest impact on reducing building energy consumption in cities where the H/W ratio of the street canyons is less than one and even more so in sunny climates.

Several studies claim that energy reductions of 20% - 50% are possible with green façades. The study presented in this article was not able to align with those results. According to the research results for most typical office buildings a reduction in mean and peak energy consumption of 2% - 8% can be achieved. The reduced effects are likely due to the facts that:

1. Building walls are well insulated and solar gains are less critical.
2. Most of the environmental cooling demand enters through the windows.
3. Since that was left unchanged, the cooling reductions are minimal.
4. Internal loads tend to dominate cooling demand for most office buildings with a decent construction.

The amount of energy reduction can be categorised by climate and building topology. A reduction of eight percent was predicted for a low-rise office building in Los Angeles, whereas denser European or Asian cities only saw reductions of tow to three percent in annual and peak cooling energy.

Countries like Singapore have shown that, with limited space and a fast-growing population, green infrastructure both horizontal and vertical is essential to attracting and retaining talent. The Sustainable Growth Strategy for Singapore sets a target of realizing 0.8 ha of green space for every 1000 persons and aims to increase greenery in high-rise buildings to 50 ha by 2030.

12.6 The Need for a Green Infrastructure Network

Apart from benefits in terms of well-being, placemaking and aesthetic enhancement, there is now significant scientific evidence to show that green infrastructure also brings improvements in air quality, reduction of the Urban Heat Island effect, noise reduction, stormwater attenuation and urban biodiversity. There is also the potential for energy production and urban agriculture helping to reduce transport waste.

To be able to realize these benefits require a distributed and managed green infrastructure network on both a city and a neighbourhood scale. This can help to reduce the load on traditional infrastructure systems. One size does *not* fit all; the potential green envelope interventions are numerous, often bringing with them multiple benefits in each case.

Current green façade systems are highly innovative and technological. They are applied all over the world, however, only in very small contexts. This is mainly due to high prices and the effort required for maintenance. It is therefore necessary to significantly reduce the complexity of green envelope systems. Low-tech systems require a more reasonable upfront investment and would be self-sustaining over the course of the year. They need to allow maximum design flexibility so that architects and designers can adapt them to specific design requirements. Often, irrigation systems for green building envelopes are criticised for their water consumption, which is critical in certain parts of the world. It is therefore recommended to focus on the use of grey water. Nearly all the buildings around the world 'produce' enough grey water to irrigate the green building envelope. Using grey water helps to reduce the amount of water that is discharged into public sewage systems. The amounts of grey water produced by average buildings should generally be sufficient, even in rather dry environments, if they are combined with plants that are suitable for the individual climatic and geographical context, and efficiently benefit from the specific grey water quality.

12.7 Achieving Carbon Neutrality by 2050

If the aim of achieving carbon-neutral cities by 2050 is serious, then this ambition must be translated into legal requirements as the basis for planning and building permit regulations. All possible opportunities must be used to reduce the carbon footprint of cities, and urban greening, extended by the great potential of green building envelopes, is an important contribution that cannot be ignored.

Green infrastructure can be activated not only in newly built constructions, but also in the existing urban fabric. A special way of retrofitting existing urban environments is the Pocket Habitat system, which was developed more than 15 years ago (https://www.arup.com/projects/pocket-habitat). It is a simple plant bag system that replaces pebbles on black roofs (Fig. 12.8). Filled with a volcanic substrate and pre-seeded, these can be positioned on black roofs. Pocket Habitats can be exposed to the elements and create a green roof in a very short time without weighing more than the alternative pebbles.

In every city there are a certain number of building sites that could easily be greened. The Vertical Meadow is an innovative and cost-effective living wall system for temporary applications such as construction site scaffolding and hoardings (https://www.verticalmeadow.com/). Plants and flowers can be grown from seed in-situ on a temporary mat that is easily fixed. Within two or three weeks the first shoots start to appear, before growing into a verdant vertical meadow - turning any unsightly hoarding or scaffolding into something remarkable (Fig. 12.9).

With increasing densities in cities minimal environmental qualities that keep the population healthy need to be ensured. A high proportion of green infrastructure in cities will provide a cooler urban environment with cleaner air quality and reduced noise levels, and much lower stress levels. Investors, developers, owners, and

Fig. 12.8 Pocket Habitats (© Arup)

Fig. 12.9 Vertical Meadow (© Arup)

tenants, but also public authorities, planners and designers are called upon to do their bit, because every plant counts on the way to a carbon-neutral city by 2050.

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Chapter 13
Overtaking Hindsight

Rob Roggema

Abstract It is urgent to adjust the way current urgent problems are approached. Instead of reacting to scientific findings, or even worse, only reacting after a disaster happens, we need to adjust our mindset towards anticipation and pro-activity. This implies to develop our minds in parallel: We need to be aware of what happens here and now and AT THE SAME TIME, to be able to grasp the bigger picture. These more abstract patterns that are emerging must be related to the concrete changes occurring and the urgent actions needed.

This between switching abstractions requires a novel way of thinking, and people that can link the two. People are needed that have the capability of simultaneously looking from the balcony and be on the dance floor. To see the unprecedented and uncertain future and then knowing what to do in the form of tangible pattern adjustments that can be implemented directly to move the entire system and the future towards a long-lasting, regenerative equilibrium and stay within our planetary boundaries (Rockström et al., Ecology and Society. 14(2): 2009; Steffen et al., Science 13;347(6223): 2015).

It also means that we can no longer only respond to change in hindsight, but instead we must take a future that looks extreme and may be highly unlikely, as the point of departure for visioning, planning, and construction.

Current change shows that extreme climate events are happening, therefore it is urgent we respond to the climate emergency we see occurring and prepare for what already happens. Current politics, policies, and negotiations, often work the other way around: they often react to what has been experienced after the occurrence. This ignorant responding is unintentional as smart people see the necessity to reverse these policy processes. However, unwillingly, when debate starts, it seems impossible to make the shift of mind.

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13.1 Introduction

It is summer 2021. IPCC presents their latest findings from a conglomerate of scientists from around the world (IPCC 2021). The message: we are pretty sure climate will change dramatically, and humans are an important cause of this nearing catastrophe. In following up this worrying report, national governments and institutions interpreted it and presented their local implications. The Dutch Planning Agency for the Living Environment (PBL) for instance concludes in its analysis of current, raised ambitions of the Dutch government, that although there is progress, the ambitions for 2030 are not yet within shooting distance. The Dutch Meteorological Institute (KNMI) describes how the climate in the Netherlands changes rapidly (KNMI 2021), which is remarkable as this is for the first time ever. And the Council of State, the Dutch advisory body on legislation and highest general administrative court, states in its consideration on the climate brief 2021 that the climate goals are getting out of sight and additional measures are needed urgently (Raad van State 2021). All these respected institutions claim the situation is urgent, the government is not acting enough, or not quickly enough. This brought the Guardian to make headlines with: 'The climate disaster is here' (Milman et al. 2021).

So, what could a doom scenario look like? For instance, when temperatures rise with more than two degrees, but get to three, four degrees, maybe even higher than that, what would the implications be? The places on earth where we have a productive landscape become limited, large areas will suffer from heat, drought, and fire, while in other places the risk of flooding increases, due to heavy rainfall, or storm surges and hurricanes (Lynas 2007). This is not a pleasant foresight, which many people already feel, and to which they will react. Underprivileged people will start searching for a safe place where they have access to sufficient food, and most likely they will start moving over the globe to where they think opportunities to survive are best. Potentially, this could trigger migration flows and even conflicts or war. In reaction wealthier countries or people might resist this and start protecting their privileged positions by closing borders and try to keep out people that are desperate. It might feed political movements and sensitivities. A cascade of events could lead to huge detoriation and unrest.

Let's go back in time 15 years. In the early years of this century scientists already pointed out that in the future we could be confronted with more impactful change then people could believe nor take seriously. At the opening of the International Polar Year the chair, David Carson, spoke about a possible sea level rise of several meters (Carlson 2006). Others, such as James Hansen and colleagues also presented findings pointing at an accelerated sea level rise by the end of the century, when positive feedback processes would continue to occur, and the albedo effect adds to further accelerating of melting processes (Hansen 2007; Hansen et al. 2007, 2008;

Rahmstorf et al. 2007). The question is, being aware of this research, how shall we respond? If international research presents us the risk of a possible and impactful change, a sea level rising by several meters, we could deny or become utterly inventive. If we pretend there is no problem, like an ostrich putting his head in the sand, we will be confronted with the problem that will turn even larger, eventually. Or we approach the problem like the inventor of the vacuum cleaner. In those days people were used to sweeping dust onto a look. When electricity became available, at first, they kept on trying to blow the dust waste onto it. However, the brilliance of reversing this process, by sucking dust into the cleaning machine, changed the practice of cleaning for good. This change of perspective is needed when novel become apparent (Roggema et al. 2007). However, these alternative voices are not always welcomed, certainly not by the vested institutions, accusing these thinkers of creating panic.

It is widely recognized that humankind currently lives in an era of climate emergency (Lynas 2020), and moreover, this is seen as an intertwined climate-biodiversity urgency (IPBES and IPCC 2021). Sustainability, which aims to provide a similar quality of life for next generations as current ones, resilience, which aims to prepare urban, social, and ecological systems in a way they can bounce back after a shock or disruptive change, or even a regenerative development, which aims to replenish resources and provide systems with more generative capabilities than they formerly had, might not be enough to deal with these extreme futures. A new paradigm not only emerges, but it should also further grow. Beyond regeneration, allowing for a step change towards a future that is unpredictable, prepares society, ecosystems, and life in general with the anticipative capacity to reshape in a way that can accommodate extremes as a new normality. Not simply assuming extreme change and plan for it but understand the systemic characteristics of the environment to build redundancy to offer the space for unprecedented demands.

13.2 Preparing for What Already Happens

The question here is whether we can (start) preparing for a change that is already amongst us? Or are we too late, and should we adjust landscapes and cities to repair the mistakes already made? It seems impossible to prepare for something that is already happening, therefore the way forward is to take current reality as the point of departure of our actions, then envision a future that can undergo further, more extreme scenarios. The current reality is visible in many developments that seem to be novel but becoming mainstream at a fast rate.

Here we have two options. Conduct scientific research and analyze the individual patterns of climatic change, or we take *unverified predictions* of the future of the whole system as the lead for our thinking. Though this may lead to problems regarding academic prove, extremities of climate models and predictions offer us also the redundancy we can use for implementing in planning our landscapes and cities. Because if we assume the future will be at the higher ends of the predictions, they may be unlikely, but when planning with extra margins a less extreme reality will easily fit within the plans, no matter what the exact future might bring. Moreover, recent history has shown that models and predictions often are reached faster and follow the highest edges of expectations. Prove can never be given beforehand, and therefore we should prepare for the proven change that can only be given in the future.

The future reality in retrospect could imply weather conditions such as:

– Torrential rain that lasts for weeks, causing urban flooding that keeps inhabitants bound ton their homes for a prolonged period. Questions about how to stay healthy, have access to sufficient fresh food, and how to deal with household waste and sewage, maybe unlikely, but could put pressure on the urban system. The energy supply is in danger and connectivity may be lost. Moreover, wet conditions and raised water levels urges people to live on the first or second floor, with all damage of their haven.
– A drought lasting for half a year, impacting the drinking water supply, and freshwater availability for crops and nature. Large areas may suffer from scarcity of water, desertification impacts bigger areas, agricultural loss of productivity, impacting the amounts of food available. Nature is damaged and groundwater levels drop, so the long-term implications can be serious, for instance loss of species, marginalization of biodiversity and loss of resilience of ecosystems. Water traffic may be no longer possible due to lower water levels in revies and canals, and salt intrusion from the sea will affect groundwater quality inland, without the option to let freshwater flow through the agricultural land systems.
– A heatwave lasts for a couple of weeks, which will threaten the lives of vulnerable people, the elderly and people dealing with illnesses. The demand for cooling increases, use of energy is on the rise, people must live in shades or inside controlled climates. Infrastructure can be damaged, for instance bridges or railways could melt of break, causing distribution problems of goods and services and loss of accessibility of neighborhoods and cities.
– A bushfire going on for weeks, burning natural reserves, threatening urban areas, and impacting air quality so people with asthma and other respiratory diseases may die of seriously suffer. Bushfires could close of urban precincts, making travel difficult, and blocking flee routes. Moreover, the fires may break down communication towers, leading to disturbed mobile networks and impossibilities to use digital cards to pay for services or goods.
– Sea level rise continuing for decades at accelerated rates and may reach 2-4 meter by the end of the century. This increases the risk of flooding, and coastal protection by defenses, dams, dikes, and other constructs becomes increasingly difficult to the point that they can no longer protect the population. Additionally, the risen sea levels in combination with soil subsidence exaggerate salinity of the soil, impacting the food system, and drinking water resources.

This unproven future reality is rapidly becoming a current reality. Again, the question being if regeneration is possible at all, of do we need to create a new system that generates the conditions for future generations to survive. This would imply far-reaching changes and a very different look at the way we live and shape our society. The choice we still have is to start anticipating now and integrate redundancy in our cities and landscapes, or wait for the prove that this doomed future has become reality and being too late to react? Off course there is no sound scientific underpinning for this apocalyptic future, but would we rather wait until there is or act in advance and being prepared for a more modest and less dramatic future?

13.3 A New Attitude

To experiment this thinking a new attitude is required. A way of looking and mental mode in which we see the bigger picture, seeing the patterns, even if science has not yet confirmed them. Therefore, we should make use of visionary minds that can see this bigger whole, envision a future that deals with unexpected large-scale change, even before it is there, before it can be proven, or measured. Bringing these minds in the position to start precautionary planning for the future, which takes a seemingly extreme scenario as the point of departure. If it turns out the future is not that extreme, we end up at the safe side anyway. No matter the expectations may be uncertain, we can use this set of extremities to start planning what is a no regret landscape anyway. Indeed, everyone would agree it is a good idea to increase the space for nature, multiply biodiversity to allow the landscape to regenerate. Not because we, as humans plan the regeneration, but we allow the space for nature to generate conditions we need as an interconnected system, by itself. Therefore, the biggest uncertainties shall be taken as the point of departure for planning and design. These can then create the frame within which concrete actionable interventions can be implemented and large-scale projects, such as redynamizing coastal zones, transforming countries to consist for 50% of nature, create abundant space for water, largely extend green areas in cities and let nature determine the size, types and amounts of food housing and economy.

This new attitude needs to be able to connect the view from the ‘balcony’ with the one from the ‘dance floor’, simultaneously seeing the large patterns of the systemic change and the impact it has or should have on the individual elements and vice versa. This allows us to let the bigger picture determine what concrete actions shall be taken responding and influencing what will happen on the ground. This as opposed to what we currently often practice: running like blind chicken actioning ‘urgent matter’ while the bigger picture is out of sight, mal understood, and not used or considered.

The predominant way of thinking the Enlightenment has brought us does not provide us with the tools to sustain the ecosystem we are all part of. The complexity of this reality cannot be understood by standards and simplifications. This brings serious risks. By attaching ourselves to rules and mathematics we become increasingly vulnerable in the face of changing rules, or when our calculations are no longer correct.

13.4 The Last Dance

The documentary 'The Last Dance' about Michael Jordan and Chicago Bulls friends offers a special view on the reasons why MJ was exceptional. He was able to simultaneously see the patterns of the game from above, both of his own team as the opponent, and to undertake the specific actions which could help the 'Bulls system' win the game. This continuous switching between seeing the bigger picture and performing effectively, is a unique capability. The same is required in our current times. It is no longer enough to add up individual siloed solutions, focus on regulating society or manage work in individual modules that are not related to each other.

To reach higher levels of adaptability of our living environment the patterns of the complex system should be looked at from above, like MJ did, to win the game. Just as the patterns of the game must be seen from above, our complex landscape and urban system is continuously adjusting itself to change and surprise. When we come too close to the far end of complexity chaos emerges. But when we create too much simplification and order the system will come to a grinding halt. Both could be witnessed over the recent period. The most important reason for this might be that we lost track of the integrated qualities of coherent systems, no longer 'seeing the patterns from above'. While thinking about our individualistic self we have withdrawn ourselves to a part of the whole where we maximized our individual profits. But this has driven us directly into the arms of chaos.

We need to start thinking holistically and allow for more reflectivity regarding the problems, surprises, uncertainties and changes we will have to face. This is the only chance to escape the funnel of order and regularity, where Chronos reigns and time is measurable and accountable. Conversely, Koiros, the god of the right moment, contemplation and coincidence, offers us reflective practice on the bigger picture, which could help raise the level of adaptivity (Fig. 13.1).

We need to start dancing the new dance of complex adaptive system thinking to guide our society, our economy, the way we manage our organizations and how we design our cities. The resilience cycle contains growth and decline, after which the system can reorganize itself. In that sense it is nothing new. A period of farewell to the measurable orderly world is nothing to be afraid of. We are at the brink of this period of disruptive chaotic conditions. Transformation to a new set of values is occurring, after a long period of being focused on the short term with predominantly economic gains guiding our decisions. We are slowly but definitely moving towards being part of a bigger system, being dependent on others, and they on us. Finding the balance in long term sustainability, beyond allowing next generations to only having the same opportunities as we do, but becoming a richer relational society that incorporates bigger change as a new normality (Fig. 13.2).

Growth towards larger adaptivity will replace the short-term orientation and will create more room for self-initiative, self-organization, and resilience to allow for redesigning the city as a respirating system, breathing an and out, and to prevent hyperventilation after keeping our breath for too long. In urban environments this

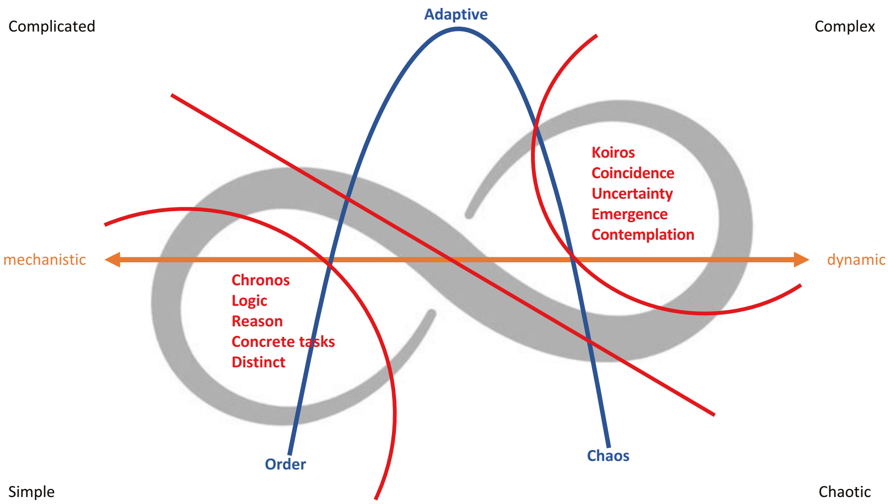

Fig. 13.1 Schematic linkages of adaptability, complexity and resilience

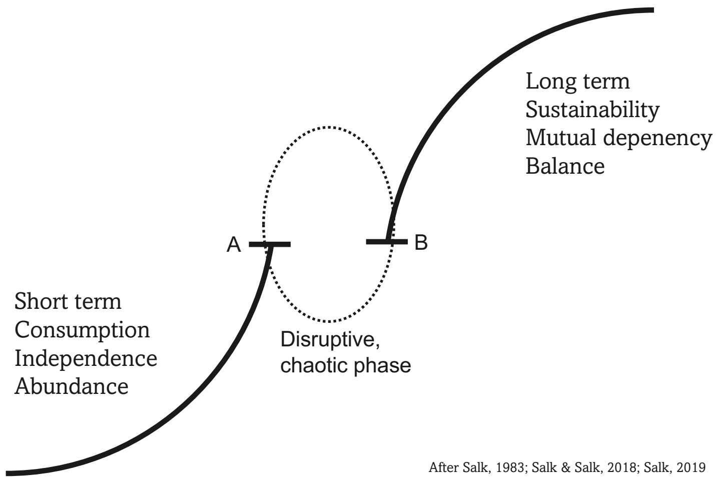

Fig. 13.2 Transition towards a new balanced system

implies literally and metaphorically more space to become available to undergo, create and realize adjustments. This new dance has just started, and we can design a respirating city if we keep looking for the connections between concrete actions and the bigger picture. In this type of city new pandemics will get less chance of disrupting our societies like it did in recent months, climate change can be tackled, and biodiversity can naturally be enhanced.

13.5 It Is Time to Dance!

Nature is the best MJ we can think of. Nature can see the bigger picture. By nature! And nature is capable of taking concrete actions to increase resilience, to regenerate, to let life succeed, and to continue living.

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