DYNAMIC URBAN ISLANDS

Seasonal Landscape Strategies for Resilient Transformation

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DYNAMIC URBAN ISLANDS
SEASONAL LANDSCAPE STRATEGIES FOR RESILIENT TRANSFORMATION

ABSTRACT

This landscape architectural research investigates spatial transformation, seasonal dynamics, and resilience in islands. Islands are distinctive cases of urban development and ecology. In the Anthropocene, impacts of urbanization and climate change are accentuated, and many islands are increasingly exposed to external and internal hazards. Future design and planning strategies need to address the specificities of islands. In a broad overview, I conceptualize Dynamic Urban Islands as the interplay of islandness, forces of the Anthropocene, and potential resilience. This thesis elaborates the hypothesis that understanding seasonal phenomena and integrating them into landscape design can increase the resilience of urban islands. In the three case studies of Sylt (Germany), Malta (Malta), and Itaparica (Brazil), I apply Research through Design to address the following questions: How are spatial transformations linked with seasonal dynamics on islands? How can seasonal dynamics be employed in landscape design to build resilience on islands?

The results from the three islands uncover multiple seasonal-spatial dynamics such as tourism, bird migration, and periodical flooding. In projections, I test how the findings could contribute to biodiversity, flood-risk reduction, livelihood security, and coastal adaptation. I critically discuss these resilience-building efforts against the backdrop of island spatiality and resilience principles that I have identified for islands. The thesis demonstrates that addressing seasonality can be meaningful for developing time-sensitive design approaches and building resilience in islands. The results provide insights and strategies for design and planning, and for island studies. I position Research Through Design as transformative because it is integrative, application-oriented, and projective. Although the research has not integrated a transdisciplinary collaboration, I argue that it has produced system, target, and transformative knowledge about seasonal phenomena and building resilience in urbanizing islands.

Keywords: island urbanization, seasonality, resilience, urban landscapes, spatial transformation, Research through Design, Sylt, Malta, Itaparica

DYNAMIC URBAN ISLANDS
SEASONAL LANDSCAPE STRATEGIES FOR RESILIENT TRANSFORMATION

KURZFASSUNG

Die vorliegende landschaftsarchitektonische Forschung untersucht die räumliche Transformation, saisonalen Dynamiken und Resilienz von Inseln. Im Zeitalter des Anthropozäns spitzen sich die Auswirkungen von Urbanisierung und Klimawandel zu, und die Anfälligkeit vieler Inseln für sowohl interne als auch externe Risiken wächst. Inselräume sind prägnante Beispiele für singuläre Entwicklungen von Verstädterung und Ökologie. Zukunftsfähige Strategien für Entwurf und Planung müssen sich mit den spezifischen Wesenheiten von Inseln auseinandersetzen. In einem breiten Überblick konzipiere ich „*Dynamic Urban Islands*“ als das Ergebnis des Zusammenspiels von „Inselhaftigkeit“ (*islandness)* und den Kräften des Anthropozäns in Ausrichtung auf eine potentielle Resilienz. Die Dissertation erarbeitet die Hypothese, dass das Verstehen saisonaler Phänomene und deren entwerferische Integration die Resilienz urbaner Inseln gegenüber internen und externen Risiken erhöhen kann. Eine entwerfende Forschung anhand von drei Insel-Fallstudien – Sylt (Deutschland), Malta (Malta) und Itaparica (Brasilien) – untersucht folgende Fragen: Wie sind räumliche Transformationen mit saisonalen Phänomenen gekoppelt? Wie können saisonale Dynamiken beim Entwerfen miteinbezogen werden um Resilienz aufzubauen?

Die Fallstudien decken eine Vielfalt saisonal-räumlicher Dynamiken wie Tourismus, Vogelzug und periodische Überschwemmungen, auf. In konzeptionellen Entwürfen (*projections*) wird getestet, wie die Erkenntnisse zur entwerferischen Integration von Saisonalität zur u.a. Biodiversität und Existenzsicherung *(livelihood security*) auf Inseln beitragen oder das Überschwemmungsrisiko reduzieren können. Diese Ansätze werden vor dem Hintergrund von Resilienzprinzipien, die im Rahmen der Dissertation spezifisch für Inseln herausgearbeitet wurden, sowie den räumlichen Eingenarten von Inseln kritisch diskutiert. Die Dissertation zeigt, dass die Beschäftigung mit saisonalen Phänomenen einen sinnvollen Beitrag zur Entwicklung von landschaftsarchitektonischen Strategien und zur Erhöhung der Resilienz von Inseln leisten kann. Obwohl nicht explizit transdisziplinär aufgestellt, kann sich diese entwerfende Forschung (*Research through Design*) aufgrund ihrer integrativen, anwendungsorientierten und projektiven Eigenschaften im Kontext der transformativen Forschung positionieren. Diese Forschungsarbeit generiert System-, Ziel- und Transformationswissen über saisonale Phänomene und die Stärkung der Resilienz urbaner Inseln.

Stichwörter: Urbanisierung auf Inseln, Saisonalität, Resilienz, urbane Landschaften, räumliche Transformation, entwerfende Forschung (*Research through Design*), Sylt, Malta, Itaparica

DYNAMIC URBAN ISLANDS

I POSITIONING

Introduction

To clarify at the outset, I have adopted a spatially-based, pragmatic definition for the purposes of this landscape architectural research: This thesis studies islands as spatial entities, bodies of land completely surrounded by a sea-land interface and, in common sense, regarded as islands. Here, I introduce how this doctoral Research through Design came about and how it is structured.

Why islands?

Islands are isolated. Islands are disconnected. Islands have boundaries. Islands are peripheries. Islands are strategic. Islands are egocentric. Islands are independent. Islands are dependent. Islands have their own time. Islands are relaxed. Islands are harsh. Islands are vulnerable. Islands are introverted. Islands are resistant. Islands are slow. Islands are controllable. Islands are something else. Islands are different. Islands are dynamic.

I do not come from an island, but where I do come from is not far from it. Observing the frequent discussion of islander versus mainlander perspectives in island studies (e.g., Stratford 2003; Conkling 2007; Baldacchino 2008; Jackson 2008; Grydehøj 2017), it is appropriate to position myself. I will not write on and on about my grandparents' cottage on an archipelago, surreal day trips from busy cities to nature reserves and historic slave islands, and the strong islander identity of a close friend – factors that probably have intuitively affected my choice of theme. I felt drawn to conduct research near water. Close to islands and islanders, I am attached to the land-sea interface, which is maximized in islands. That is where personal experience blends with professional interest: Islands have prompted more questions than other landscapes I have explored – particularly about densification and mainland-island disparities. I grew to conceive of and sense islands as other kinds of places.

Imagining other realities, or projecting, is at the heart of landscape design. My initial research question – what happens when an island is fully built – arrived as I was leafing through an airline magazine that was trying to attract non-resident citizens to Malta. It showed a coastal city with not an inch of green – a rather unconscious yet obvious observation of a landscape architect. Soon after, aerial images of Mozambique Island, Santa Cruz del Islote, Malé, Bermuda, and the like caused awe and curiosity, waking my professional ambitions to deal with transforming landscapes in bounded spaces as I started discovering the world of dynamic urban islands.

Why seasonality?

Here, you get more questions than answers. That is why I wanted to Research through Design – but there is a story: Anything but dynamic, during strolls in the silent villages and empty beaches of Corse in December, the question arose: Whose season is the off-season? The idea that one could seasonally manage uses or functions in landscape in order to (re)generate ecosystems or to improve urban life developed into a research interest. Which urban and natural phenomena have seasonal-spatial dimensions? How do they materialize and transform urban landscapes? For example, food seasonality hardly exists in a supermarketized society – yet, food production has enormous spatial impacts, and, (for now) to a large extent, it depends on climate and involves seasonal labor. Tourism urbanizes many islands in odd ways – just look at Sal's deserts in Cabo Verde. Seasonality, or periodically recurring phenomena, relate to human practices and landscape changes differently than linear processes or random events do. From a design perspective, their certain predictability, and the speculation I had about the flexibility that seasons could provide, are interesting aspects. These ideas combined with the initial concern: If islands do not have space on land, or suitable grounds, where will the populations grow food, dump waste, build, bury bodies, accommodate tourists, jog, protect waterfronts from waves, demonstrate, and so on? And should we also ask *when*?

Why transformation towards resilience, and Research through Design?

Fluctuating around a theme for a PhD in designing urban landscapes, my intuition delivered a hypothesis about integrating seasonality into resilience-building on islands. Resilience appealed to me because it is more strategic and dynamic than sustainability, and island narratives exude the paradox of vulnerability versus resilience. When it comes to the framing of this thesis, the innovation is not in saying that the globally urbanizing planet is in the Anthropocene and needs new solutions with a broader understanding of the interaction between nature and humans. The innovation will be in transformative action in which designing urban landscapes can play a part by developing and testing practice-oriented approaches. Through carefully considered projections, this thesis makes a contribution to transformative research on island urbanization and resilience-building.

Limitations and contribution

The topic and approach demand trans-disciplinary knowledge. Transformative research, designing urban landscapes, and resilience-building underpin participatory processes, which were not part of this individual undertaking. I neither claim to be an expert at hydrology, biology, sociology, geospatial technology, civil engineering, economy, nor architecture, but have made efforts


Fig. 1.1 Anything but dynamic, during strolls in the silent villages and empty beaches of Corse in December, the question arose: Whose season is the off-season?

to incorporate knowledge from relevant fields. This PhD does not provide a complete history of the case-study islands, but instead, it looks to their future.

For the purpose of the Research thourgh Design, I have primarily investigated islands with a population above one thousand and under one million, and a land area of 2–2000 km^2, and have developed a design approach in three case studies. The chosen cases (Sylt, Malta, and Itaparica) open up a discussion beyond the mostly paradigmatic research about small island developing states. When it comes to originality, this thesis is likely to be the first doctoral project that combines the study of urban islands and resilience with seasonality in Research through Design. The case studies demonstrate that with the means of designing urban landscapes, seasonal phenomena can be integrated into resilience-building in islands in various ways. Despite the limitations, in this research, I have produced unique island-specific findings about urban development and seasonal-spatial relations as well as application-oriented insights for design, planning, and resilience-building in islands. These outcomes can be considered as system, target, and transformative knowledge, aspired by transformative science.

Structure

The thesis is composed of five parts: positioning, describing, practicing, projecting, and concluding. The first section establishes the theoretical framework and hypothesis of the thesis. The first chapter introduces the central concepts of the Anthropocene and urban landscapes, transformation, and resilience. Against this background, the practice-oriented approaches of resilience-building and designing urban landscapes, as well as the topic of island urbanization, are contextualized. The chapter closes by introducing the emerging

Table 1.1 Overview of the thesis structure. See table 2.1 for the research design (chapter 2.3).

I POSITIONING

Introduction

Chapter 1. Context, concepts and state of research

Chapter 2. Hypothesis and research design

II DESCRIBING: DYNAMIC URBAN ISLANDS

Chapter 3. Urban islands	Chapter 4. Resilient islands

III PRACTICING

Chapter 5. Two approaches

IV PROJECTING

Chapter 6. Investigating three islands

7. Case Sylt	8. Case Malta	9. Case Itaparica

IV CONCLUDING

Chapter 10. Seasonal landscape strategies for resilient transformation field of island studies, drawing attention to a research gap and opportunity concerning novel spatially sensitive approaches. Inspired to pursue resilience and explore temporal dynamics in islands, the second chapter delineates the thematic focus on seasonal phenomena and presents a seasonality hypothesis for the Research through Design.

With two chapters, the second section conceptualizes the thesis' headline, "Dynamic urban islands." Chapter three provides an overview of island studies and island concepts, moving on to observations about how islands have become urban. It describes urban-island processes and exceptional spatial characteristics, and it illustrates what happens when the dynamics of the Anthropocene meet islands. Chapter four covers aspects of resilience-building, pointing out key strategies, resources, and resilience principles for islands. It forms a basis for the Research through Design in case studies. The methodology is discussed in the third section, where I position Research through Design as transformative, and reveal unexpected common features of design processes and case selection.

In the fourth section, I answer the research questions and test the hypothesis in Sylt (Germany), Malta (Malta), and Itaparica (Brazil). Conceptual landscape designs, or projections, incorporate seasonal phenomena and translate resilience principles into spatial measures. Each case study includes a direct reflection. The procedure developed constitutes an essential part of the results. After the case studies, the concluding section of this thesis provides a critical discussion on the research outcomes and findings against the theoretical frame of the thesis. The thesis closes with an outlook on the contribution of the research to further applications.

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1. Context

The first chapter introduces the central concepts of the Anthropocene and urban landscapes, transformation, and resilience. Against this background, the practice-oriented approaches of resilience-building and designing urban landscapes, as well as the topic of island urbanization, are contextualized. The chapter closes by introducing the emerging field of island studies, drawing attention to a research gap and opportunity concerning novel spatially sensitive approaches.

1.1. The Anthropocene and designing urban landscapes

1.1.1 The Anthropocene

This doctoral research is grounded on the conception of a new geological epoch, the Anthropocene, that is, the geology of humankind (Crutzen 2002; Zalasiewicz et al. 2010). A scientific body of the International Subcommission on Stratigraphy called the Anthropocene Working Group wrote:
"The 'Anthropocene' is a term widely used since its coining by Paul Crutzen and Eugene Stoermer in 2000 to denote the present time interval, in which many geologically significant conditions and processes are profoundly altered by human activities. These include changes in: erosion and sediment transport associated with a variety of anthropogenic processes, including colonisation, agriculture, urbanisation and global warming. the chemical composition of the atmosphere, oceans and soils, with significant anthropogenic perturbations of the cycles of elements such as carbon, nitrogen, phosphorus and various metals. environmental conditions generated by these perturbations; these include global warming, ocean acidification and spreading oceanic 'dead zones.' the biosphere both on land and in the sea, as a result of habitat loss, predation, species invasions and the physical and chemical changes noted above. […] A proposal to formalise the 'Anthropocene' is being developed by the 'Anthropocene' Working Group for consideration by the International Commission on Stratigraphy, with a current target date of 2016." (Subcommission on Quaternary Stratigraphy 2017)

While citing this in 2018, the new geological epoch, which is proposed to terminate the Holocene, had not yet been formalized by the Subcommission of Quaternary Stratigraphy or the International Commission on Stratigraphy. However, the discussion about the Anthropocene is broad across scientific disciplines, and the term has been adopted by non-scientific sectors.

Besides alternative suggestions such as the industrial revolution, strong arguments now position the start of the Anthropocene at the "Great Acceleration" in socio-economic and Earth system trends, such as world population, nutrient flows, international tourism, and building of large dams in the latter half of the 20th century, to name but a few (Steffen et al. 2015; Zalasiewicz et al. 2015; Waters et al. 2016). Humans have always altered the environment, but the dimensions of the impacts on Earth systems since then are overwhelming (Zalasiewicz et al. 2010; WBGU 2011:31–65; Steffen et al. 2015; Waters et al. 2016). Many landscapes of the Anthropocene are vaster in dimension than the human-made rural-cultural landscapes of previous centuries: ore mines, holiday resorts, monocultures, infrastructures, and so on extending far beyond cities. They reach places remote from major urban nodes, such as oceanic islands where the impacts of the Anthropocene are evident in sea level rise, sedimentation of plastic, coral bleaching, and new hybrid species (Gomes 2013; Thomas 2013; Biermann et al. 2016). Besides spatial expansiveness and hybridity, the Anthropocene has brought about acceleration and intensification of temporal dynamics in both societies and Earth systems through technological innovation and environmental depletion (e.g., Leinfelder 2013; Wolkovich et al. 2014; Görg 2016). Humankind is the biggest destroyer and modifier, but also a transformer and co-creator of ecosystems, landscapes, and the Earth. This perspective is elemental for landscape architects because it provokes propositions and supports recent approaches.

Most global transformations of landscape result from the production and consumption of energy, food, services, and waste, including logistics and mobility, having their origins in urban life and concentrating in urban regions (Forman 2008; Elmqvist 2013; WBGU 2016). Planning practitioners, institutions, and scholars in sustainability and the Anthropocene discourse today share the vision that most if not all development, including contributions to sustainability, resilience and social-ecological issues, should and will be dominated by urban concentrations and urbanization processes (Pickett, Cadenasso, and McGrath 2013; United Nations 2015; WBGU 2016; UN-Habitat 2017a). To understand and address contemporary urban issues, the following conceptualizations of planetary urbanization and urban landscapes urge one to look beyond human settlements and outdated dualisms, because the city has become obsolete, and landscape is not its natural or rural counterpart (Giseke 2010; Brenner and Schmid 2011). Urbanization is perhaps the most remarkable characteristic of the Anthropocene (Biermann et al. 2016). As both a challenge and potential (WBGU 2011:64, 2016), it is the foundation of this thesis.

1.1.2 Planetary urbanization

"Today, the urban represents an increasingly worldwide condition …This situation of *planetary urbanisation* means, paradoxically, that even spaces that lie well beyond the traditional city cores and suburban peripheries – from transoceanic shipping routes, transcontinental highway and railway networks, and worldwide communications infrastructures to alpine and coastal tourist enclaves, 'nature' parks, off-shore financial centres, agroindustrial catchment zones, and erstwhile 'natural' spaces such as the world's oceans, deserts, jungles, mountain ranges, tundra and atmosphere – have become integral parts of the worldwide urban fabric." (Brenner and Schmid 2011:12)

Global diversity of urban phenomena in different cultures, economies, and geographical settings leads to a plurality of conceptions and definitions used by disciplines and institutions. "Urban" traditionally refers to everything that relates to cities, and landscape has been a concept for the opposite. As urban boundaries have become non-definable, the definition of "urban" in the context of spatial planning has been undergoing a reconceptualization in recent decades (e.g., Burns and Kahn 2005; Giseke 2010; Brenner and Schmid 2011). In this thesis, urbanization is generally understood in three ways: 1. increasing migration of people to and concentration of functions in cities or urban regions; 2. as a result, spatial growth of cities or urban regions, an increasing number of urban settlements, denser urban networks, and increasing population and functional densities; 3. the expansion of urban economies and lifestyles into areas considered non-urban (Braun 2010:529).

Referring to such dynamics, the notion of "urban" in this thesis is based on the conception of "planetary urbanization" by Neil Brenner and Christian Schmid (2011) and the "urban landscapes" of the research network Studio Urbane Landschaften[1] (Giseke 2010), explained further in this chapter. Brenner and Schmid have described worldwide socio-spatial transformations of "[a] global urban fabric" characterized by "mega scaled urban constellations," "the blurring and rearticulation of urban territories," "hinterlands" of industrial urbanization and associated global networks, and an extinction of the "wilderness" of oceans, mountains, rain forests, and deserts dramatically altered by consequences of urbanization (2011:11–12). This research (in chapter 3) explores islands, because most research has instead reviewed them as isolated and pristine (Hennessy and McCleary 2011; Grydehøj et al. 2015). Although development dynamics vary greatly across regions (Steffen et al. 2015), in this light, islands do not escape planetary urbanization. Chapter 3 describes these urban islands, and the thesis addresses a research gap in understanding island urbanization and their spatial development (Coccossis 1987; Grydehøj 2014; Fernandes and Pinho 2015).

1 An international research platform initiated at Leibniz Universität Hannover in 2005.

1.1.3 Urban landscapes and new approaches

Conceptions of a pervasive influence of humankind and urbanity, previously thematized by John Brinkehoff Jackson (1984) and William Cronon (1992), have been adopted by landscape designers and theorists. "In the century when the human population has become predominantly urban, all landscapes can be considered urban to the degree that they are managed to provide ecosystem services. While ecosystems in cities obviously have been radically changed for human purposes, agriculture, forestry, mining, and transportation landscapes are arguably equally urban, even when they appear to be countryside" (Nassauer 2013:80, referring to Cronon 1992). Such phenomena have encouraged landscape designers to update the concept of landscape, bringing forth new themes and approaches to developing open spaces.

The spatial understanding of this thesis is based on the concept of "urban landscapes," developed by and in Hille von Seggern and members of Studio Urbane Landschaften to describe and categorize contemporary landscapes. They entail "complex and multi-layered spatial interactions of built and unbuilt areas" (Giseke 2010:525, from German). The concept of urban landscapes thus addresses open spaces that not only are compact cities or countryside and natural landscape, but are also where new practices and forms of space, culture, and production emerge; created and developed by multiple stakeholders, they are characterized by cultural and social diversity (von Seggern, Werner, and Grosse-Bächle 2008:20; Giseke 2010:526–8; Prominski 2014b).

Dynamics and change, and countering a nature-human dualism, are central for the contemporary understanding of urban landscapes (Waldheim 2006; von Seggern and Werner 2008:55–7; Giseke 2010; Prominski 2011; Reed and Lister 2014).[2] Urban landscapes are a product of different processes that emerge in space under "different parallel dynamics of change and temporal cycles, they consist of different spatial images and are modified by different spatial forces and actors" (Giseke 2010:527). More complex than conventional, functionally designed open space, urban landscapes have something unfamiliar, or "*Unvertrautes*" (Idem:528–9). New design strategies and landscape-based spatial visions are needed to build long-term frames to handle the multi-layered dynamics and complex developments (von Seggern and Werner 2008:57; Giseke 2010:528; Prominski 2014b).

2 Adopted by European and North American scholars and practitioners who, to some extent, operate worldwide. It is reasonable to mention the regional context, because this research has made me question to which extent the conceptualization is suitable for describing and operating in the diversity of islands and landscapes of the so-called Global South. However, I use the theoretical framing with respect to the expanding planetary reach and global forms of urbanization.

Altogether, these conceptions underpin an internationally recognized need for new strategies and planning tools, and trans-disciplinary approaches to address the ubiquitous and incoherent urban condition while highlighting a site-specific understanding of the characteristics and dynamics of a place (Shannon 2004:38–42; Waldheim 2006; Giseke 2010; Brenner and Schmid 2011). Design approaches are needed in such larger scale projects that have traditionally been seen as planning tasks (Seggern and Werner 2008; von Haaren et al. 2014). Instead of spatial form, a fundamental change in recent decades has brought operationality, complex systems, interactions, flows, and natural processes to the foreground of urban and landscape studies (Graham and Marvin 2001; Corner 2006; Batty 2009; Reed and Lister 2014; Milligan 2015; Waldheim 2016). The hybrid discipline of landscape urbanism has been central for such orientation, but it is not the only school of thought promoting landscape as a medium to adapt to rapidly changing urban environments and investigate changing relationships and processes in design and planning (Shannon 2004; Corner 2006; Waldheim 2006; Nassauer 2013; Erixon Aalto 2017). Studies and statements about large-scale urban landscapes, urban metabolism, and productively performing landscapes represent a new wave of landscape architecture, comprised of works and propositions such as *The Landscape Urbanism Reader* by Charles Waldheim (2006); Undine Giseke's (ed.) *Urban Agriculture for Growing City Regions: Connecting Urban-Rural Spheres in Casablanca* (2015); Paul Roncken's concept 'landscape machines' (Roncken, Stremke, and Paulissen 2011); the proceedings of the International Architectural Biennale 'Urban By Nature' in Rotterdam 2014 (e.g. *Urban Metabolism* by Gemeente Rotterdam et al. 2014); and *Projective Ecologies*, edited by Chris Reed and Nina-Marie Lister (Reed and Lister 2014); among others. Although realized projects remain few, approaches that seek new understandings of ecology and human-nature relationships are gaining ground. Returning to the context of the Anthropocene, these are central themes. Is the new term necessary for describing what has already been known and pursued for decades?

1.1.4 The Anthropocene as a position

Environmental processes and large-scale problems associated with urbanization have gained the attention of ecology, development organizations, and landscape planning and design (Forman 2008; Reed and Lister 2014), independent from the frequent use of the term "Anthropocene." Yet, the term offers more than pointing out humanity's massive and fateful impact on the Earth: This thesis interprets the Anthropocene as a philosophical position that urges one to conceive humanity's (including designers') role and relations to nature in novel ways (Crutzen and Schwägerl 2011; Leinfelder 2013; Hight 2014; Jonas 2014; Prominski 2014a; Görg 2016; Latour 2018). For example, on a global scale, Ellis' team proceeds from traditional biome mappings to classifying "anthromes" or anthropogenic biomes (2010). To overcome "outdated" dualisms of city versus country, or culture versus nature, Martin Prominski has coined the concept "andscape" (2014a). Inspired by Japanese conceptions of unity of natural and cultural systems, his term suggests a productive conceptualization of an integrative practice in the Anthropocene (Ibid.). If diversity in regional contexts is taken into account, the Anthropocene can be a useful and important concept for understanding and reframing the development of social-ecological systems (Biermann et al. 2016). The Anthropocene underlines previously present premises for the role of landscape architecture: urban focus, larger dimensions, process-orientation, multi-disciplinarity, and advocating new perspectives on ecology.

Whether as a political, normative, or a more philosophical concept (Görg 2016; Latour 2018), in the pursuit of urban sustainability, the Anthropocene can ideally help to catalyze a paradigm shift that enables desired transformations. Wolfgang Jonas has stated that, in the Anthropocene, "[w]e are facing the paradoxical situation of ever greater manipulative power of design, science and technology, while at the same time a diminishing prognostic capacity and less control with regard to the social, economic, or ecological consequences" (2014:74). Planners and designers should intervene because they "shape practices" (Jonas 2014:76).

1.2. Approaching transformation

"*Transformative research aims at paradigmatic change and adopts a normative position.*" (Schneidewind et al. 2016:8)

1.2.1 Transformation

As in the subtitle, this thesis is concerned with landscape strategies for transformation on islands. According to dictionaries, "transformation" means a thorough or dramatic change in the appearance, medium, character, or function of, for instance, an object, organism, or system – the urban landscape in this case. It comes from the Latin *trans*, "across" and *formare*, "to mold, make up, or organize."

In this thesis, the term relates to two levels: Firstly, (urban) landscapes are constantly undergoing transformation, and landscape architects not only have always dealt with perpetual change, but also, increasingly, are often catalyzing it. Secondly, transformation is topical for the current scientific and political agenda: The Stockholm Resilience Center (2018) investigates transformative change implicit in maintaining and strengthening Earth's life-support systems and achieving the Sustainable Development Goals adopted by the UN General

Assembly in 2015 (Randers et al. 2018). The German Advisory Council on Global Change uses the term "Great Transformation," which conceptualizes an unavoidable, comprehensive systematic shift towards low-carbon societies as a response to today's crisis of natural life-support systems and global population growth (WBGU 2011). Here, transformation is a strong normative concept, because, in the face of unsustainable megatrends and lifestyles, "[a] change of course is […] an urgent imperative" (Idem:62).

For the purpose of this research, it is necessary to distinguish the concept of Great Transformation from spatial transformation(s). The latter are not one orchestrated process, but rather include the diverse developments that occur. However, I see both planned and uncontrolled spatial transformations as implicit in the Great Transformation, as contributor and consequence: On one hand, steering spatial transformations (e.g., land-use planning, urban development, bioengineering, designing productive landscapes, walkable cities, and blue-green infrastructure) can enhance sustainability. On the other hand, profound systemic changes will bear spatial consequences, that is, changing the dimensions, functions, structure, and appearance of city blocks, urban regions, nature conservation areas, open spaces, and infrastructures. Furthermore, the Great Transformation is an interesting concept, because it has led to promoting new kinds of research.

1.2.2 Transformative research

To aspire to the goals of the Great Transformation, an initiative of transformative research has emerged in German-speaking Europe to globally address environmental and social sustainability (WBGU 2011; Schneidewind et al. 2016; WBGU 2016). In order to direct social-ecological transformation processes and to handle complex issues such as climate change, urbanization, and planetary boundaries, communities worldwide need to plan and test new solutions. Researchers at Wuppertal Institute for Climate, Environment and Energy have defined transformative science as "a specific type of science that does not only observe and describe societal transformation processes, but rather [sic] initiates and catalyzes them" (Schneidewind et al. 2016:6). Besides research about transformation processes, a new type of research is necessary: "Transformative research supports transformation processes in practical terms through the development of solutions and technical as well as social innovations, including economic and social diffusion processes and the possibility of their acceleration, and demands, at least in part, a systemic perspective and inter- and cross-disciplinary methods, including stakeholder participation" (WBGU 2011:322; see also Wittmayer and Hölscher 2017). "Real-world labs" are examples of how transformative research intervenes in society, engaging its agents in "co-producing" knowledge (Schneidewind et al. 2016).

Transformative research is concerned with producing socially robust knowledge that supports change through concrete innovation and is application-oriented; it is trans-disciplinary and integrates different types of knowledge (WBGU 2011:23–4; Schneidewind et al. 2016). These include systems knowledge, target knowledge, and transformation knowledge (Wuppertal Institute for Climate 2017) – that is, knowledge about what is, visions about what should be, and practice-oriented knowledge about how to direct desired change. Considering these goals and characteristics, I propose that landscape architectural research can provide meaningful contributions to transformative research.

1.2.3 Landscape strategies for transformation

Designing is managing necessary and desirable change (Lynch 1972:1).[3] Recent theories have investigated the creation of new knowledge through design and planning practice (Prominski 2004; Seggern et al. 2008; Moore 2010; Jonas and Monacella 2012; Engels-Schwarzpaul and Peters 2013; Buchert 2014a; Schultz 2014; Verbeke 2015; Prominski 2016). The discussion is situated in a larger paradigm shift in science that challenges the traditional (Western) ideal of the sciences with the "Mode 2" sciences that are context-sensitive and application-oriented, and discourage hierarchical knowledge production by being trans-disciplinary and introducing a broader understanding of how to qualify research (Nowotny, Scott, and Gibbons 2001; Prominski 2004; Moore 2010; Doucet and Janssens 2011; von Seggern 2012; Engels-Schwarzpaul and Peters 2013). This doctoral thesis is bundled within this emancipation of the creative practices as scientifically qualified and valuable. In chapter 5, I suggest positioning Research through Design in the field of transformative research, because it is paradigm-shifting, integrative, and projective.

Designing is development-oriented (Seggern and Werner 2008:35). It "[tries] to project into the future, and thus to change things" (Verbeke 2015:79). Design approaches enrich technical approaches to socio-ecological problems (Janssens 2012:214; Corner 2014). By creating hypothetical futures and showing possible worlds, designers can investigate structural change and trigger novel mindsets (Janssens 2012:210–27). While this is not to conclude that all design is transformative in the sense of transformative research, landscape architects can facilitate ecological and societal transformation and challenge paradigms (Brown and Kjer 2007; Corner 2014; Jonas 2014; Prominski 2014a). Where and how?

International scholars and institutions (e.g., WBGU 2011, 2016; UN-Habitat 2017a) have highlighted that the ways of urbanization will define the direction of

3 Kevin Lynch was perhaps one of the first urbanists articulating powers of urban transformation: disaster, preservation, renewal, and revolution (1972:3–28).

worldwide transformation. Availability and uses of land for agriculture, forestry, and infrastructure are also central (WBGU 2011:317). Sustainability transitions can benefit from a relational understanding of space (Levin-Keitel et al. 2018), applied in designing urban landscapes: Through the medium of space, landscape architecture deals with the physical and non-physical dimensions of both regimes. Furthermore, landscape architects are familiar with the processual nature of ecological systems. Contemporary landscape design has embraced a shift in ecology from a concern for stability to favor open systems, adaptability, and dynamism (Hill 2005; Ahern 2011; Reed and Lister 2014). In this respect, a third conceptualization of transformation is essential: In resilience ecology, transformation is a response of an ecosystem to disturbances by developing a new system (Walker et al. 2004). Analogous strategies can be envisioned for urban regions and systems to achieve transformations (Folke 2006; Elmqvist 2013; Pickett et al. 2013; Stockholm Resilience Center 2018). Before introducing the urban island context, I discuss resilience. The term is frequently mentioned in the urban sustainability discourse as well as in island studies, and it is central to this research.

1.3. Social-ecological and urban resilience

"*…how to persist through continuous development in the face of change and innovate and transform to new more desirable configurations.*" (Folke 2006:260)

In the context of sustainable urban development, resilience has gained major visibility in research and policies. Since the millennium, urged by the attention to climate change, a wide range of literature in ecology and urbanism has been addressing resilience (Walker et al. 2004; Folke 2006; Walker and Salt 2006; Folke et al. 2010; Birkmann et al. 2012; Pickett et al. 2013; Garschagen 2014; Meerow, Newell, and Stults 2016; Sharifi et al. 2017; UN-Habitat 2017a). Trans-disciplinary consortiums such as Resilience Alliance and Stockholm Resilience Center have been founded, and academic initiatives include the emBRACE project, which has involved various European universities (Birkmann et al. 2012). As a concept or approach, resilience is included in Sustainable Development Goal 11 ("Make cities inclusive, safe, resilient, and sustainable") and five other key global agendas[4] of the United Nations (UN-Habitat 2017a:13). The international association ICLEI – Local Governments for Sustainability runs a Resilient City Agenda and hosts numerous programs, projects, and tools, including the Pacific Islands Climate Resilience Toolkit (ICLEI 2017). In 2016, UN-Habitat established the Urban Resilience Programme that incorporates their

4 Sendai Framework for Disaster Risk Reduction, the Addis Ababa Action Agenda, the Paris Agreement, the World Humanitarian Summit Commitments to Action, and the New Urban Agenda.

preceding City Resilience Profiling Programme (UN-Habitat 2017a:30–34). UN-Habitat has chaired the Medellin Collaboration on Urban Resilience since 2014, and founded the Urban Resilience Institute in Barcelona for research. Noticeable practice-oriented cross-regional initiatives include the 100 Resilient Cities program of The Rockefeller Foundation (2018) and the Future Proofing Cities project launched in the UK (Atkins 2012), whose networks consist of political organs, academic institutions, and design and engineering firms.

The majority of publications and resilience-building projects, particularly in the UN context, relate to disaster risk and climate-change adaptation – which is perhaps a research bias concerning small island developing states (SIDS), where both rapid-onset hazards and long-term impacts of climate change are central concerns. SIDS have gained high visibility in the global development agendas by, for example, hosting the UN Climate Change Conference's annual Conference of the Parties in Bonn in 2017, presided over by the Republic of Fiji (UNCCF 2017). Global Island Partnership introduced the Island Resilience Initiative (GLISPA 2018), and resilience appears in the SAMOA Pathway, an international action framework for sustainable development in SIDS (United Nations General Assembly 2014). The Global Facility for Disaster Reduction and Recovery hosts the Small Island States Resilience Initiative (GFDRR 2018).

The term "resilience" is generally regarded as positive, and its use seems inflationary in the same way that "sustainable development" is. Multiple meanings make resilience difficult to deploy in practice (Birkmann et al. 2012; Garschagen 2014; Meerow et al. 2016). To the extent that they are applicable, this thesis draws on some operational resilience approaches in chapter 4. The following subchapter introduces the concept development and positions the scope of this thesis.

1.3.1 Concept and operational framework

To address the resilience of urban islands, considered as interconnected human-environmental entities against the background of the Anthropocene, this thesis primarily draws from a social-ecological and urban resilience. The term "resilience" stems from ecology, introduced by C.S. Holling to understand ecological systems' dynamics (1973) as opposed to a stability paradigm. Revised by Walker and colleagues, "[r]esilience is the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks" (2004:5). Put more straightforwardly, resilience is the "capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop" (Stockholm Resilience Center 2015). Resilience, as both absorbing drastic disturbances such as natural hazards and adapting to long-term changes like climate change, is needed by society, the economy, and the environment if humanity wishes to keep existing. While sustainability concerns the resources and needs of current and forthcoming generations, resilience is about handling shocks, stresses, and future uncertainties (Sharifi et al. 2017). It can contribute to long-term sustainability of resource use and urban or environmental management (Walker and Salt 2006:37; Elmqvist 2013; Sharifi et al. 2017:15; UN-Habitat 2017a). Resilience can be either general (of a system) or specific (of a certain component of a certain disturbance), and resilience of subsystems (a forest, a city, an island) can contribute to resilience at the Earth systems scale (Folke et al. 2010).

Approaches to resilience have shifted from resistance or "engineering resilience" and maintaining functionality to emphasize linked social-ecological systems, transformability, and development (Carpenter et al. 2001; Folke 2006; Birkmann et al. 2012; Lister 2015; UN-Habitat 2017a). In the field of urban design and planning, Ahern (2011) captured the turn in his article title "From fail-safe to safe-to-fail." In response to a disturbance, recovery and coping refer to short-term responses that do not aim to alter a system; adaptation is a mid- or long-term process in the face of an emerging situation or anticipated stress (Garschagen 2014:111; Sharifi et al. 2017:7). Transformation is required of a social-ecological system when adaptation is not enough (Walker et al. 2004; Folke et al. 2010).[5] Concerning social-ecological systems, the concept of resilience thus "incorporates the idea of adaptation, transformability, learning and self-organization" (Folke 2006:259). Such a perspective is also called "evolutionary resilience" (Davoudi et al. 2012; Sharifi et al. 2017), and Davoudi and colleagues have pointed out its suitability for developing planning in the sense of exploring the unknown and preparing for transformation. With respect to the Anthropocene, social-ecological-resilience thinking is a useful "integrative and operational framework" for overcoming polarization of the urban and nature in planning and design (Erixon, Borgström, and Andersson 2013). Diversity, redundancy, and further principles of resilient systems are introduced in chapter 4.1.

Building on social-ecological resilience, the concept of urban resilience explicitly addresses cities or urban systems including infrastructures. Instead of providing one definition, a spectrum of approaches and actors has most recently been reviewed in UN-Habitat's "*Trends in Urban Resilience*" (2017a). UN-Habitat (2017a:xiii) itself adopts a social-ecological approach, underlining the dynamic and always contextual nature of (urban) resilience. With institutional

5 All three (coping, adaptation, and transformation) can contribute to resilience-building, although some differences occur in using the terms – whether they be a prerequisite or product of resilience. See also Birkmann (2013) and Sharifi and colleagues (2017:7), who have written that adaptation "can be either incremental or transformational." It is yet another discussion whether or not transformation can also be achieved incrementally. In fact, addressing resilience opens up a range of related concepts, such as vulnerability, adaptation (whose to what, and when), and exposure or susceptibility to risk or change (Birkmann 2013; Garschagen 2014).

partners, multi-national consultancies such as AECOM, Atkins, and ARUP address urban resilience (Atkins 2012; ARUP and The Rockefeller Foundation 2015). The approaches share a human-centered perspective, emphasizing the social and economic prosperity of cities in the face of uncertainty. To overcome inconsistencies, Meerow and colleagues have articulated that "[u]rban resilience refers to the ability of an urban system – and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales – to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity" (2016:39).

Resilience has been criticized as an incoherently defined concept that has gained a normative connotation as a desirable attribute (Birkmann et al. 2012; Garschagen 2014; Meerow et al. 2016). Yet, not all resilience is positive in itself: For example, persisting attitudes can hinder a shift to sustainable practices, or a degraded ecosystem can be resistant (Cumming et al. 2005; Walker and Salt 2006:37; Folke et al. 2010; Wu and Wu 2013:224; Meerow et al. 2016). Furthermore, the resilience interests of different systems or actors can conflict. Urbanization does not necessarily undermine resilience, because it can bring about economical assets and social capital that improve robustness and adaptation capacity (Lauer et al. 2013; Garschagen 2014:95). With experience in island studies and action research, Kelman (2016) has pointed out that academic and institutional rhetoric is distant from the everyday life of target communities. Experts acknowledge the complexity of operationalizing and measuring resilience (Carpenter et al. 2001; Cumming et al. 2005; Walker and Salt 2006; Birkmann et al. 2012; Garschagen 2014; Meerow et al. 2016).

Despite ambiguities, a wide array of efforts to develop the concept and to build and evaluate resilience is emerging (Birkmann et al. 2012; Meerow et al. 2016); operational approaches to urban resilience are underway (UN-Habitat 2017a), and studies show that spatial and urban planning and design can employ principles of social-ecological resilience (Ahern 2011; Albers and Deppisch 2013; Erixon et al. 2013; Lister 2015). Principles and procedures for building and measuring resilience in this thesis are reviewed in chapter 4.

1.3.2 Projecting resilient landscapes for urban islands

In this landscape architectural research through design, I address resilience, because it is more strategic than sustainability (Ahern 2011:3), and, in contrast to vulnerability, resilience implies a forward-looking approach (Birkmann 2013b:33; Erixon et al. 2013). Taking Folke as a point of departure, resilience is an approach to exploring non-linear dynamics and the interplay of coupled human-environmental systems across temporal and spatial scales (2006). As a resilience strategy, transformation of social-ecological systems involves innovation and requires shock and experimentation, and can be operationalized through an incremental, multi-scalar approach (Folke et al. 2010). Erixon-Aalto (2017:129) has pointed out that both design-based research approaches and resilience are "about transformation and embrace aspects of experimentation." Against this theoretical background, which encourages experimental applications, resilience has room for heuristic exploration and a projective approach, and is thus suitable for landscape architectural research through design.

Based on the concepts of social-ecological and urban resilience introduced, the key message for this thesis is a perspective of integration, adaptability, transformation, and process-orientation – echoed in contemporary landscape architecture (see 1.1.3). Lister has explained that "emerging [landscape architectural] approaches reference the language of resilience and adaptive management, and are associated with elasticity and flexibility, using hybrid engineering of constructed and ecological materials that adapt to dynamic conditions and natural forces" (2015:18). Resilient designs in particular materialize as blue-green infrastructure that combines public open space and storm-water management, or as floodable parks that work with natural dynamics.

As further explained in chapter 4, despite a paradigmatic focus on vulnerability (Bass and Dalal-Clayton 1995; Briguglio 1995; Lewis 2009; Philpot, Gray, and Stead 2015), islands are specific cases of resilience. Disaster-risk reduction in small island developing states is perhaps the most common theme of resilience research and policies concerning islands (Lauer et al. 2013; Barnett and Margetts 2013; Baldacchino and Kelman 2014; Philpot et al. 2015). For disciplines concerned with social-ecological and urban resilience, islands provide prime examples of close interconnections between human and natural systems, and adaptive capacities (Coccossis 1987; Bass and Dalal-Clayton 1995; Stratford 2003; Chapman 2011; Lauer et al. 2013; Vitousek and Chadwick 2013). Recent research thus emphasizes a broader consideration of island resilience as well as island contributions to producing new, future-oriented insights for resilience-building.

This thesis handles resilience as the capacity of urban islands and their subsystems to maintain, adapt, or transform towards a desired state or dynamic in the face of a disturbance or stress, while undergoing change. In landscape architectural projections, the case studies address the resilience of islands as social-ecological or urban systems to the overarching stresses of urban expansion and climate change. The particular focus on seasonal dimensions is elaborated in the following hypothesis (2.2). A defined system scale and time-frame – such as islands and seasonality - can help to operationalize and measure resilience-building efforts (Birkmann et al. 2012; Meerow et al. 2016). The potential impacts of the case study projections are discussed against the resilience principles and key lessons that I outline in Chapter 4.

Fig. 1.2 Urban expansion on a hilly terrain, a canalized stream valley, and land recovering from forest fires in Madeira. As prime examples of close interconnections between human and natural systems, islands can enrich the discussion of the Anthropocene, and provide topical insights for spatial strategies that handle resilience.

1.4. The emerging field of urban island studies

Although much of contemporary research into urbanization and sustainability calls attention to trans-disciplinarity, new research fields and niches are emerging. The discipline of "designing urban landscapes" is very niche-like due to the small number of practitioners and scholars (see for example 1.1.3), and yet, at the same time, it is a very trans-disciplinary-oriented field that integrates, for example, ecology, sociology, and urbanism. Borrowing knowledge and methodical approaches from other disciplines, I describe the individual work at hand as cross-disciplinary. It is especially inspired by the emerging field of urban island studies, which is a branch of inter- and multi-disciplinary island studies. Islands are also represented in and by international organs and networks such as the Alliance of Small Island States, Global Islands Network, International Small Islands Studies Association, and RETI-Network of Island Universities; researchers have founded *Island Studies Journal*, the journal *Shima*, and, most recently, the journal *Urban Island Studies* (Baldacchino 2007b:18; Grydehøj et al. 2015). Small island developing states (SIDS) are a specific global island community, recognized by the United Nations, and their urbanization is highly topical (UN-Habitat 2015; Mycoo and Donovan 2017).

The increasing attention to islands signals the expansion of global urbanization: islands distant from mainland centers become ever more accessible and desired – yet, in some cases, very exclusive – accommodating exotic dreams, global treasures, and vice. Offshoring weaves islands into networks of global finance and tourism (Baldacchino 2010; Urry 2014; Galaz et al. 2018; Ratter 2018), and, coupled with migration fluxes and climate-change dynamics, islands are "emblematic figures" of the Anthropocene (Pugh 2018). This study focuses on islands that go through spatial transformations due to urban expansion or intensification of goods and people networks, and changing lifestyles. These "dynamic urban islands", discussed in chapter 3, represent startling impacts of urbanization in the Anthropocene, as well as resilient characteristics in the face of climate change and other stresses.

Based on the previous conceptualization of urbanization, this thesis addresses geographical islands as a heterogeneous category of urban landscapes that faces comparable challenges due to said landscapes' exceptional spatiality. In continental cities, land and materials available for human purposes and needs have political boundaries, which, in most places, can be seamlessly crossed in space by many means of transport and can be hypothetically negotiated. Despite global connections, when it comes to islands, the alteration and crossing of the land-sea interface requires onerous effort and resources (Grydehøj 2015b). Island spatiality encourages urbanization, but islands have commonly not been considered urban (Grydehøj et al. 2015). Most planning has applied a mainland perspective, while most island studies haven't been concerned with urbanization (Bass and Dalal-Clayton 1995; Chapman 2011; Fernandes and Pinho 2015; Grydehøj et al. 2015). There has been a call for more spatially sensitized approaches to island development (Chapman 2011; Fernandes and Pinho 2015).

With respect to the broader theoretical framing of this thesis, Vitousek and Chadwick (2013:1) have noted that "islands provide a useful model for understanding how coupled human and natural systems experience the Anthropocene, and perhaps for how they can manage its impacts". Stemming from a Western dualistic worldview of human versus nature – to which scholars now seek alternatives – the Anthropocene has been criticized as a Eurocentric "one-worlder" idea (Morrison 2015; Escobar 2016; Latour 2018). Based on evidence further emerging from this research and supported by literature (Vitousek and Chadwick 2013; Pugh 2018), I argue that island perspectives could enrich the ideas of the Anthropocene. As islands are distinctive cases of urbanization and interdependent systems – and are often innovative – this research anticipates them providing novel insights regarding spatial transformation and urban resilience.

Summary

Since the mid-20th century, the influences of humankind on Earth systems have been so pervasive that Western scientists have proposed formalizing a new geological epoch called the Anthropocene. The Anthropocene is manifest in planetary urbanization that reaches even remote islands typically considered pristine and isolated. Urban island studies is an emerging field of research, and this thesis addresses a research gap concerning island urbanization and spatial development from the perspective of designing urban landscapes.

To tackle challenges such as climate change and hybrid spatial and ecological conditions, the Anthropocene holds premises for landscape architecture: urban focus, larger dimensions, process-orientation, multi-disciplinarity, and advocating new perspectives on ecology. Urban landscape is a concept and approach that aims at understanding rapidly changing and incoherent environments and developing multi-functional and productive open spaces. In this pursuit, the Anthropocene can provide a philosophical position that guides new understanding of relations between humans and nature, as well as spatial transformation. Islands, in turn, can diversify and contextualize perspectives and approaches in the Anthropocene.

In this thesis, the term "spatial transformation" refers to thorough changes that urban landscapes undergo, both unplanned and as a consequence of design. In a broader context, the normative concept of the "Great Transformation," by the German Advisory Council on Global Change, conceptualizes a comprehensive systematic shift towards low-carbon societies. To aspire towards that goal, a transformative science concerned with systems knowledge, target knowledge, and transformation knowledge is emerging. Transformative research is application-oriented and aims to catalyze change towards environmental and ecological sustainability. This research suggests positioning research through design in the field of transformative research, because it is paradigm-shifting, integrative, and projective. New design strategies and landscape-based spatial visions can build long-term frames to handle multilayered dynamics and complex development processes.

It is widely acknowledged that urbanization processes and urban nodes play a major role in transformation, and resilience is a central topic in the discourse. Resilience is particularly topical for islands whose vulnerability to human-made and natural hazards is proportionately high. Rather than a fixed goal or set of characteristics, this thesis deploys resilience, first of all, as a framework or approach that embraces change and dynamics, adaptation, and flexibility.

Islands represent deep interconnections between humans and nature, and are thus expected to provide excellent case studies and new insights about urban resilience and transformation.

Concepts: the Anthropocene; planetary urbanization; urban landscapes; spatial transformation; transformative research; resilience; urban islands

Research gaps: urbanization and spatial development in islands; contextualizing the Anthropocene; exploratory and visionary approaches to resilience-building in coupled human-environmental systems

2. Seasonality hypothesis and research design

Transformation always implies a temporal dimension. Temporal dynamics are pronounced in the deployment of this research. Building on the first chapter - inspired to pursue resilience and explore temporal dynamics in islands - this chapter establishes a hypothesis, research questions, and goals for this thesis that pursue a seasonal design approach in islands.

2.1. Framing seasonal dynamics

There is no landscape without time. There exist linear time, punctual events, evolution, periodic processes, and cycles – regular and irregular dynamics that are, to some extent, predictable or entirely unpredictable. Time can be measured in absolute units such as a calendar or in relative units such as heartbeats – measured as something other than experienced time (Lynch 1972; Wolkovich et al. 2014). Objects have their own time (Gamper and Hühn 2014), as very much seems to be the case for island experiences. The Anthropocene witnesses multilayered, interacting timescales (Leinfelder 2013; Christoph 2016), from geological processes to file transfers and plastic decomposition rates to extreme weather events; from long-term climate change to flights and political procedures. Landscapes accommodate temporal scales that humans cannot fathom; the complex and wide-ranging temporal dimensions of the Anthropocene make it difficult to operationalize significant actions that tackle acute environmental challenges (Görg 2016). Adam (1998) expressed a similar concern before the millennium, arguing for the importance of time-based analysis of socio-environmental issues. Wolkovich and colleagues have called for a "temporal ecology in the Anthropocene" that "link[s] spatial and temporal patterns and concepts to improve ecological theory and forecasting" (2014:11). Her team has pointed out how climate change and technological innovations have shifted the temporal dynamics of systems – for example, by accelerating ecological cycles and shifting seasons (Wolkovich et al. 2014). Temporalities of the Anthropocene are evident in island geography (Pugh 2018:98–9).

Deciphering the timescales of the Anthropocene would be a grandiose attempt for an individual doctoral thesis that is also applying findings to designs. This thesis does not encompass the topic of time in landscape architecture, which Noël van Dooren (2016) has approached, focusing on representations. Instead, out of an idea born on an off-season island trip, I address seasonality. Many coastal destinations and islands are particularly affected by seasonal cycles of, for example, mass tourism, which is a clear trait of the Anthropocene and whose impacts are heightened in island spatiality (chapter 3).

With seasonal phenomena, or seasonality, this thesis refers to practices and phenomena, events and periods that usually reoccur annually. Their repetitive rhythm and regularity (Palang and Sooväli et al. 2007:3) is, of course, subject to uncertainties of urban processes and climate change. Recent investigations in landscape research provide insightful starting points for exploring both temporal and spatial aspects of seasonality (Palang and Sooväli et al. 2007). The word comes from agriculture: the French *saison* originates from the Latin *satio*, meaning the "time of sowing," related to words meaning "seed" in many languages (Jones 2007:18–19). Temporally, "the term 'season' has come to have a wide variety of metaphorical usages concerned with the preiodization of time, particularly (but not exclusively) for periods of less than a year" (Jones 2007:19). Besides calendar and weather, periods and cycles can be defined by different human activities, some of which are noticeably seasonal, like agriculture and tourism. All aspects of seasonality are reflected in landscapes: climate, social seasons, economic-industrial cycles, accessibility, and so on (Jones 2007:20; Kizos 2007; Palang, and Sooväli et al. 2007).

Contemporary landscape architectural practice and education often takes seasonality as the annual climate variation in appearance of vegetation. Seasons are something to be observed, and "[p]urpose-built seasonal landscapes" (Purs 2013:103) enable skiing and sunbathing. Broader potentials of seasonal phenomena and their application as a particular design principle, as performing agency, or as a source of inspiration (for example, non-Western understandings) have not been widely considered or strategically explored[1] – perhaps due to the seeming banality of the topic (Palang and Sooväli et al. 2007:2). Urban designs and planning specialize in more rapid cycles, such as 24-hour or weekly patterns of public spaces and neighborhoods. Studies about seasonality on islands primarily relate to tourism and economy, or micro-organisms with little reference to spatial development (Andriotis 2005; Kizos 2007; Kench, Parnell, and Brander 2009; Ridderstaat and Nijkamp 2013). While temporal approaches such as Torsten Hägerstrand's time-geography have remained fairly unknown (Schwanen 2007), Lefebvre's *Rhythmanalysis* (2004) has been well promoted. However, investigating everyday paths of actors and the goods or modalities of social life in the city is not quite what this research aims at. Lawrence Halprin's ideas about cyclic design processes and translating choreographies and calendars into open space (1981) and Kevin Lynch's innovative book *What time is this place?* (1972) may provide the closest support for the focus of this thesis.

1 Some examples include the Kiruna project by 70°N Architects, which incorporates eight Sami seasons; Studio Vulkan's competition entry for Energieberg Hamburg, where the urban landscape changes according to the harvest of energy plants; Lola's 2010 competition entry for Marstallplatz in Hanover; the H+N+S study of water peaks in Emscher Park in 2002; and Diller Scofidio and Renfro's entry for Zaryadye Park in Moscow, which brings all the seasons to a site at once.

This doctoral thesis sets about to explore the spatial occurrence of seasonality in islands beyond climate (whether it be a monsoon or the "four seasons," i.e., the German *Jahreszeiten*), tourism, and agriculture. I postulate that seasons provide an additional "space" of opportunity in urbanizing islands, where physical space is limited and contested.

2.2. Seasonality hypothesis, research questions and goals

"*Seasons are something both to be exploited and to be escaped from*" (Palang, and Fry et al. 2007:169). In other words, one's season is another's off-season.

On islands, the accelerated temporal dynamics of the Anthropocene, such as urban expansion, climate change, and seasonal tourism, occur at extremes (see chapter 3). This thesis addresses the challenge of limited spatial and ecological resources in islands by approaching the less obvious yet inevitable question: "When?" with a focus on annual cycles and seasonal phenomena. By doing so, this research pursues learning from the particular spatial-temporal dynamics on islands and designing (with) them. As explained in chapter 4, most resilience building efforts on islands focus on natural disasters. While some thought has been given to managing short- and long-term resilience, for example, rapid-onset disasters or climate adaptation, seasonal phenomena and periodically recurring disturbances and stresses have garnered less attention.

Against this background, the main hypothesis is that **understanding seasonal phenomena and their spatial dimension can contribute to increasing resilience of urban islands.** The following questions are examined, and the suggested approach is tested in three island cases:
1) How are seasonal phenomena linked with spatial transformations on islands?
2) How can seasonal dynamics be employed in landscape design to build resilience on islands?
A differentiation of resilience-building goals is provided in chapter 4 and the case studies.

Beyond annual seasons, the investigation may incorporate further cycles, in a scale of monthly to decennial, in ecological processes, urban flows, and human spatial practices on islands, as well as events – for example, punctual holidays (like New Year's), periods (semesters), regular cycles (ferry schedules), and irregular cycles (cyclones). With this unique approach, I expect to discover or design urban landscapes or integrative "andscapes" (Prominski 2014a) that contribute to island resilience.

The primary intention is to enlarge the body of knowledge about seasonal phenomena on islands and their relationship to spatial transformation, and to discover ways to design (with) seasonality. Furthermore, the goal is to test and reflect whether the design approach can contribute to urban resilience. The goals are to:

- expand understanding of seasonal phenomena on urban islands (and landscapes)
- learn from island resourcefulness, interconnectedness, and conflicts
- find ways to build resilience through open spaces in case-study islands
- produce specific yet transferable insights about island urbanization, seasonal phenomena, and resilience-building for island studies and spatial planning and design.

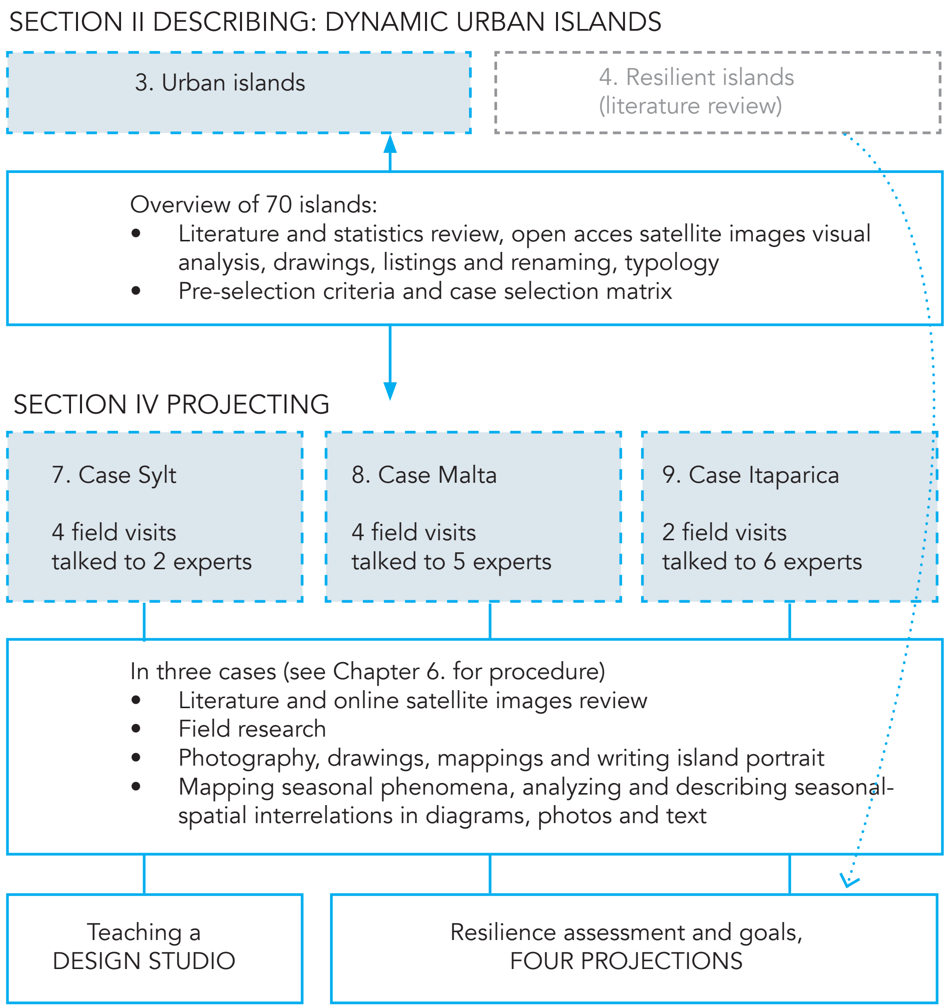
Despite island-specific projections, the research aims to develop a design approach that could be adapted to further circumstances, and applied in various scales, concepts, strategies, or built projects. While the scope of the study comprehends three cases, some ideas may be applied to building resilience and catalyzing transformation on other islands, and some outcomes can be useful for urban and landscape design in general.

2.3. Research design

To understand the topic, to test the hypothesis, and to produce practical and theoretical knowledge, I have applied case study research and Research through Design (see chapter 5). After a broader study on island urbanization and resilience (section II) that included a literature review as well as an investigation through drawing and reviewing satellite images, I opted to use three case studies in order to experiment with incorporating the aspect of seasonality into a design approach. For the manageability and purposes of the research of this thesis, I considered islands with a population above one thousand and under one million and a land area of 2–2000 km^2. Lake and river islands, apart from some outer river-delta islands, were not included. Adopting such a scope is far from saying that the islands within it are comparable or similar, or that the observations apply to all islands with those variables. The approach does not compare islands with each other or the effects of different climates to seasonal-spatial relationships.

Characteristic of a Research through Design, the investigation included exploratory components. Due to the novelty of the topic and originality of the intended approach, the course of action developed during the research process. In the carefully selected case islands of Sylt (Germany), Malta, and Itaparica (Brazil), I have used seasonality as a lens through which ideas can be invigorated and knowledge regarding spatial development on islands can be gained. The

Table. 2.1 Overview of the methodology: Combining Research through Design and Case Study.



island of Sylt was first investigated in teaching as a platform to test the approach. At that time, resilience was not an explicit goal of the design studio, and so the case differs slightly from the other two cases. Work in the two other case studies consisted of four key phases: preparation, field research, design, and reflection. I have analyzed the spatial dimensions of seasonal phenomena, as well as topical spatial problems and needs for resilience building. During and after field research periods, the insights were applied in conceptual landscape designs and spatial projections. I discuss their potential resilience-building impacts in each case. The Research through Design procedure and its limitations are described in chapter 6.

II DESCRIBING: DYNAMIC URBAN ISLANDS

Islands are isolated. Islands are introverted. Islands are independent. Islands are dependent. Islands are paradise. Islands are resistant. Islands are different. Islands have their own time. Islands are dynamic.

This section grounds the thesis' headline "Dynamic urban islands": In my conception, they are the sum of islandness, forces of the Anthropocene and resilience. The investigation regards islands as a category of urban landscapes, as spatial entities completely surrounded by a land-sea interface and that are generally perceived as islands.

Processes of urbanization in islands are conditioned by their specific spatial characteristics, and traits of the Anthropocene are heightened in island spatiality. As rapid developments emerge and conflicts culminate, there's a need for resilience-building and more spatially sensitive approaches on and for islands. At the same time, islands are resourceful and adaptive. Characterized by high proximity and interconnectedness of ecological, social, and economic systems that underlie their spatial transformation (Coccossis 1987; Chapman 2011), islands are exemplary for learning about urban landscapes and resilience-building.

Chapter 3 starts with an overview of island studies and island concepts, and then moves on to observations about how islands have become urban. As previously mentioned, the research considers islands with a population above one thousand and under one million and a land area of 2–2000 km^2. However, looking at exceptions like Greenland and Ebeye (the Marshall Islands) was highly topical with regard to the context of the Anthropocene. The second half of the chapter describes island process and introduces seasonal dynamics. I then highlight how spatial characteristics of islands make processes of urbanization occur in particular ways and illustrate intriguing findings from an overview of what happens when dynamics of the Anthropocene meet islands. Chapter 4 covers aspects of resilience in the context of island urbanization, building a basis for the projective approach in the case studies.

3. Urban islands

Islands are born from a multiplicity of processes – from ancient philosophical journeys and primary geological genesis to the most recent processes of the Anthropocene, or the geology of humankind (see 1.1.1). Peter Sloterdijk has expressed that, prior to the Modern Age, seas and gods made islands, but since Enlightenment, islands have been skillfully designed in literature and political utopias, which has shifted islands "from the register of the found to that of the made" (2016:293). Although he described "technological explicatory forms for island formation," which are worth studying beyond the scope of this thesis, his phrase is accurate in the context of the Anthropocene. Until recently, islands were discovered. If a banal comparison, today, humans are capable of building sizeable, material islands that not only function as utopias. Chapman has noted that "islandness deserves a particular attention which would assist in improving our ability to understand and shape organized complexities and spatialities in widely beneficial and sustainable ways" (2011:20). Although islands should not be simplified as miniatures, their manageability facilitates such study of close interactions among humans and nature (Chapman 2011; Kelman et al. 2011; Barnett and Margetts 2013; Vitousek and Chadwick 2013; Grydehøj and Kelman 2017).

3.1. Island studies, insularity, islandness

Island studies is a young inter- and multi-disciplinary research field (i.e., Baldacchino 2010:xxviii–xxx), as introduced in 1.4. Even before its emergence in recent decades, islands have held a special place in human fascination, evolutionary research, biogeography, and anthropology. For centuries, islands have born functions and associations such as places for defense, prisons, dreaming, ports, laboratories, and so on. Research of islands has been dominated by a mainlander gaze that tends to romanticize or steward islands as precious small objects or microcosms (Royle 2007; Baldacchino 2008; King 2009). Since the 1990s, islands have been strongly represented among international development agendas. Recent island studies have brought about an empowering paradigm shift in perspective – to avoid stereotypes, to study islands on their own terms, and to encourage research by, with, and for island(er)s (Baldacchino 2008; King 2009; Ratter 2018:208–9). Baldacchino (2008) underpinned that both insider and outsider (islander vs. mainlander) perspectives have limitations and advantages in investigating the hybrid, diverse, and undefinable nature of islands.

3.1.1 Island definitions

Definitions of or inquiries into what an island is have spread from institutional geographical-juridical definitions, such as distance from mainland to size and philosophy (Deleuze 2004; Hay 2006; Royle 2007; ESPON 2013; Royle 2014; Sloterdijk 2016; Ratter 2018). A multiplicity of terms exist for islands of different sizes, geographies, and so on in different cultures (Royle 2007:52), reflecting the diversity of local features and conceptions of islands (Ratter 2018:5). For mainlanders, islands represent symbolic landscapes and a fascinating "other" (Billig 2005:230). Islandness-mainlandness is a relative construct: Bigger islands are mainlands for even smaller ones (Baldacchino 2008). Bridges and tunnels change island geographies, but the latter remain invisible. The inconsistencies, heterogeneity, and (im)possibility of an island theory has been discussed (Baldacchino 2006; Hay 2006; Warrington and Milne 2007; King 2009; Ratter 2018). Some authors have questioned whether the theoretical dimension and metaphorical use of islands is so dominant that it ignores island realities (Hay 2006; Baldacchino 2008). Islands and archipelagos are popular metaphors in planning and design, too. I do not elaborate on the metaphorical use of island concepts in this research, but they have provided inspiration along the way. For the purpose of answering the research questions of this landscape architectural thesis, the pragmatic, spatially-based definition, given in the section introduction, is suitable. While the scope of islands studied in this research is broad and heterogeneous, this chapter presents certain attributes that islands share and that make them special.

3.1.2 Insularity and islandness

To describe islands and their particular circumstances, the partially intersecting (and not clearly distinguished) concepts of insularity and islandness have been used in literature. Ratter has explained insularity as the specific living situation of islanders, in contrast to mainlanders, that is conditioned by island geographies (Ratter 2018:14). In another description, "Insularity expresses 'objective' and measurable characteristics, including small areal size, small population (small market), isolation and remoteness, as well as unique natural and cultural environments. However, it also involves a distinctive 'experiential identity,' which is a non-measurable quality expressing the various symbols that islands are connected to" (ESPON 2013:8). Accounts of islandness involve the concepts of isolation, connectivity, boundaries, smallness, and paradox (Stratford 2003; Baldacchino 2005; Grydehøj 2014; Karampela, Kizos, and Spilanis 2014; Fernandes and Pinho 2015). These factors condition island development – for example, by engendering interconnectedness and contributing to vulnerability or resourcefulness (Coccossis 1987; Lewis 2009; Fernandes and Pinho 2015; Ratter 2018). For this landscape architectural thesis, the spatial dimensions and implications of islandness are particularly interesting, as further discussed in 3.5.

Islandness and insularity bear multiple, often ambiguous readings: All islands are insular but not remote (Briguglio 1995:1617), and Kizos and colleagues have emphasized that "[i]slandness is not only about 'boundedness' but 'connectedness'" (2014:295). Through globalization, the isolation of islands is becoming obliterated or desired, and island-status can be used to gain exceptional privileges in international negotiations (Baldacchino 2010; Urry 2014; Ratter 2018). Despite limitations – and sometimes exactly because of them – island spatiality has benefits that have rendered them favorable sites for settlements (Grydehøj 2015:1). Yet, because of small economies, resource scarcity, and proneness to the impacts of natural and human-made hazards, vulnerability is commonly attributed to islands (Briguglio 1995; Lewis 2009; Baldacchino and Kelman 2014; UN-Habitat 2015; Fernandes and Pinho 2015). At the same time, islands can portray themselves as resilient, robust, and resourceful, with attractive environments, innovative capacities, and adaptive structures (Stratford 2003; Baldacchino 2006; Jackson 2008; Campbell 2009:94; Kelman et al. 2011; Hofmann and Lübken 2015; Ratter 2018). Islands are thus described as ambiguous and paradoxical places, in physical and abstract ways (Stratford 2003; Baldacchino 2006:5; Hay 2006; Warrington and Milne 2007; Kizos 2005). Such characteristics have been highlighted in recent discussions in which the voices of islanders or the island perspective (as opposed to the traditional mainlander approach) have been increasingly present (Baldacchino 2007a, 2008; Jackson 2008; Hofmann and Lübken 2015; Ratter 2018).

3.2. Paradoxes and paradigm shift: How islands became urban in the Anthropocene

The introduction above on islandness arrived at two intriguing aspects: the paradoxical nature of islands and a paradigm shift in island studies. Islands are not peripheral and isolated objects, but agents in "complex and cross-cutting systems of regional and global interaction […]" (Baldacchino 2006:10). Here, I draw a connection to the Anthropocene: The emancipation of islands as well as new perceptions about them are driven by processes of globalization, climate change, urbanization, and other associated traits that have accelerated since the mid-20th century, such as tourism. In recent decades, islands have gained increasing attention and a new spatial presence almost independent of geographical location – in the media, in global development agendas, as tourist destinations, as eco-pioneers, and as political-economic engines. In particular, scholars have described the repercussions of globalization that are accentuated in island economies, societies, politics, and ecologies (Sheller 2003; Baldacchino 2010; Urry 2014; Ratter 2018). Islands are also iconic in climate change discussion (Kelman 2018), and, at the same time, the Pacific is currently the world's most rapidly urbanizing region (Mycoo and Donovan 2017:49). I interpret that this shift in perceptions and island paradoxes are highlighted in the Anthropocene. This materializes in the (at first sight) paradoxical idea of urban islands.

3.2.1 Overcoming remoteness, consuming resources

Despite (or because of) boundaries, centralized populations, and limited island resources and spaces, networking and trade via sea have always been obvious for islanders. The pre-colonial Swahili societies along the East African coast, which primarily inhabited islands, were urban merchants in the Indian Ocean (van Oers 2013); routes developed equally in the Pacific, Mediterranean, and North Atlantic (Vikings), but the communities remained quite regional (Depraetere and Dahl 2007:90). Global trade was established in the colonial era, but worldwide transport to and from islands remained costly and slow (Royle 2014; Ratter 2018). In the Anthropocene, or since the second half of the 20th century, expanded connectivity by air, sea, and telecommunications has relieved accessibility to and from islands, physically and digitally. The rapid increase in mobility via air perhaps has been and continues to be (IATA 2016; Bowen and Rodrigue 2017) the strongest impulse for accelerating island urbanization worldwide. Peripherality is a matter of viewpoint, and places regarded as remote can be very urban. This has been well illustrated by highly (sub-)urbanized and/or islands developed for tourism far from mainland centers, like Bermuda, Svalbard, Sal in Cabo Verde, and Santorini in Greece. On a geographical map, Santorini is the island farthest from Athens in the Aegean Sea, but its connectivity is far better than that of many other islands closer to Athens (Kizos et al. 2014:302). Niue is hyped as a "Wi-Fi nation." The symbol of island isolation, Saint Helena, inaugurated an international airport in 2017.

Remoteness is drastically being overcome, and despite physical boundaries, islands are not closed systems. With multiplied or further-reaching flows of finance, goods, nutrients, people, and even other species, island systems are increasingly characterized by openness (Coccossis 1987:85; Baldacchino 2006; Hay 2006; Hennessy and McCleary 2011; Fernandes and Pinho 2015:3; Graham et al. 2017). Such dynamics bring forth island urbanization. Islands can access and provide resources and services globally – but their carrying capacity and limited landscapes and seascapes are strained. In fact, extensive changes in many island societies and landscapes date back to a history that colonial exploitation brought along with it (Anderson 1977; Sheller 2003; Lewis 2009; Ratter 2018). During colonialism, in their smallness and hazard-prone circumstances, islands were not productive at a large scale, and transport was costly; colonial economies and later monocultures and resource extraction depleted whole islands (Royle 2014:40–7). What distinguishes the latter half of 20th century is a shift in many islands' economies from agriculture and natural resources to tourism and financial services, followed by an acceleration of urbanization and even overcrowding, increased imports, resource stress, environmental degradation, and impacts of climate change (Anderson 1977; Bass and Dalal-Clayton 1995).

In the face of such transformations, resilience and vulnerability are topical counter-narratives in island literature and political agendas (Hofmann and Lübken 2015; UN-Habitat 2015; Mycoo and Donovan 2017; Kelman 2018; Ratter 2018). Island ecologies and societies are highly vulnerable to external and internal impacts (Lewis 2009), yet they are often also capable of withstanding disturbances and adapting to changes (Stratford 2003). Island spatiality is ideal for sustainability rhetoric of the Anthropocene, but widespread marketing and production of eco-islands engages in greenwashing and dangerous contradictions (Grydehøj and Kelman 2016, 2017). Pacific atolls provide classic examples of small island developing states (SIDS) that have become international icons of climate change (Baldacchino and Kelman 2014), but research on the topic should not be limited to such cases (Hofmann and Lübken 2015:9). The implications and potentials of island vulnerability and resilience are highly relevant for planning and design in the context of island urbanization, and thus further discussed in chapter 4.2.

3.2.2 A paradoxical idea

The word combination "urban island" sounds like yet another paradox. In contrast to common notions, the isolated character of islands has often spurred development of a highly urban society within an island, if measured against the provision of multiple urban functions (Grydehøj et al. 2015:5). Today, counting out of the 30 countries whose population is over 90% urban, two thirds are islands (United Nations 2014).[2] Even in SIDS, the total urban population reached 38 million, or 59%, by 2015 (UN-Habitat 2015). Traditionally categorized as remote periphery, islands have represented anything but urban (Grydehøj et al. 2015). It is exactly that character that now attracts growing global tourism industries and mainland urbanite exodus: isolation, smallness, and island peculiarities are resources for islands (Jackson 2008:75–7) (Bertram and Poirine 2007:346). A paradisiac imagery still prevails as travel and financing industries promote island fascination. Island nature is both idealized and offshored (Baldacchino 2010; Hennessy and McCleary 2011; Hong 2017). Yet, distance is no longer a guarantee of pristine nature or indigenous cultures (e.g., Hennessy and McCleary 2011). Islands are marketed with images of indigenous people, but only the cosmopolitan super-rich can afford to travel to enjoy elitist solitude, while service staff is invisible and a shaman may wear an imported pair of Nikes. While certain islands represent climate change martyrs – or saints – their paradisiac settings

2 The percentage of reported urban population depends on the ways settlements and urbanity are categorized in each country, and criteria vary: for example, in Iceland, localities with 200 inhabitants or more are taken into account as urban, but in Malta, settlements with 2500 or more inhabitants hosted an estimated 95% of the population in 2015.

Island paradoxes	
remote, isolated, peripheral*	connected, accessible, central, internally extremely urban
closed system, self-sustainable	open, globally networked
colonialized, dependent	post-colonial, absolute
introverted, attached, socio-culturally resistant	migratory, cosmopolitan, adaptive, innovative
small economies, import and aid dependence	economic and political negotiation power
vulnerability (economic, social, and ecological)	resilience: resourcefulness, robustness, adaptation, and innovation
utopias, paradise, attractive and exotic places*	limited resources and opportunities, harsh and unattractive places
marketing of pristine nature and culture	long-term human influence, staged
simplicity, indigenous livelihoods, precariousness, poverty	luxury, exclusivity, jet-set life, romanticized authenticity
member of small island developing states (SIDS)	High-income (GNI) economy
extensive plantations for export	import dependency on food
vast unbuilt landscape, low population density	100% urban population
* depends on mainland/islander perspective	

Table 3.1 Island paradoxes. The table summarizes some typical ambiguities and surprising contradictions that typically occur within single islands or archipelagos.

might host concentrations of offshore illegalities (Baldacchino 2010; Urry 2014) and be involved in activities like, for example, land-use change in the Amazon (Galaz et al. 2018). In a weird symbiosis, one island or archipelago can accommodate places of excess consumption and bought ecological enclaves (Baldacchino 2010:185). Also controversially, an island can, at the same time, rank among countries with top gross national income (GNI) per capita and be a developing state. Such high-income island-states that are also recognized as small island developing states include, for example, Singapore, Bermuda, Barbados, the Bahamas, and the U.S. Virgin Islands.[3]

3 In contrast, for example, the autonomous island of Zanzibar is not included in SIDS because it is part of Tanzania.

3.2.3 Accentuated repercussions

To summarize, in economic, social, and environmental terms, islands are isolated but connected, vulnerable yet resilient, bounded yet open, marginal but significant, excessive and broke, desperate and paradisiac (see table 3.1). These co-existing realities and new perspectives of and towards islands are underpinned by accelerating processes of the Anthropocene. Despite a planetary influence, most ambiguous traits may be more strongly manifest in islands than elsewhere (Hay 2006; Pugh 2018), intensifying the "hybrid" essence of islands (Baldacchino 2008).[4] Moore (2015) recognized that the Anthropocene idea – not as a time period but concerning human-nature relations – is a "problem space" that frames island development in the Caribbean. However, it also engenders opportunities for islands, for example, through high-speed data connections and digital technologies (Pugh 2018:101–2). For landscape architecture, islands provide both challenges and opportunities to understand the presence of antinomies or the amalgamation of dualisms in a condensed context.

This overview of island paradoxes closes with the observation that an increasing number of scholars have described islandness in terms that connect to contemporary understanding and topics of urbanity (Grydehøj 2015a:2). One can observe that these characteristics and topical issues encompass openness and accessibility; global networks and flows of finance, goods, and people; complex systems and hybridity; resilience; and a capacity for innovation. Grydehøj has stated that the shift in conceptions has turned both cities and islands into processes (Ibid). Such a paradigm shift in thinking can aid understanding of the concept of urban islands that I am proposing. I argue that island urbanization is a flagship of the Anthropocene: Hardly anywhere else are new trajectories so apparent.

3.3. Defining urban islands

"*[I]sland spatiality per se encourages urbanization.*" (Grydehøj 2015:5)

This chapter provides a working definition of urban islands. The introduction has shown that there is no singular definition or consensus about what is an island and has adopted a pragmatic definition for this thesis. While island studies is a relatively new field of research, studying urban islands is an even more recent niche (Grydehøj 2014), and investigations into the emerging urban landscapes and seascapes and diverse situations on islands are merely taking off. As explained in chapter 1, this thesis investigates islands in the context of planetary

4 Hybridity is not defined more precisely but can be interpreted as a mixture of sometimes contrary attributes, representative in its own right.

urbanization and from the perspective of designing urban landscapes. To define urban islands, I thus consider both a conventional (Western) understanding of urbanity as built and population density, and a contemporary understanding of urbanity as dynamic systems, as the concentration of flows of people and goods, as lifestyles distanced from natural phenomena and nature-based livelihoods, and as a planetary condition. Urban lifestyles are no longer restricted to cities, and cities' infrastructures impact remote sites. This conceptualization stems from mainlander literature, but the forces engender new forms of spatial development and urbanized landscapes on islands.

Literature and statistics speak for a tendency of islands to support highly urbanized populations (Grydehøj et al. 2015). Due to their specific geographical (and social) characteristics, described later in this chapter, spatial development and urbanization on islands differ from mainland (Coccossis 1987; Fernandes and Pinho 2015). Nonetheless, most planning has viewed islands according to mainland perspectives or methods, and most island studies are not concerned with urbanization (Bass and Dalal-Clayton 1995; Chapman 2011; Fernandes and Pinho 2015:1; Grydehøj et al. 2015). "[L]little research has thus far been performed on how islandness affects urban development and how urban development affects islands, thereby emphasizing the need for additional study" (Grydehøj et al 2015:9). For example, Hong Kong and Singapore are renowned as metropolises rather than islands. Urbanization is also a notable trend in the typically small towns and villages of SIDS (UN-Habitat 2015:14). In the following, I exemplify urban islands and some of their typical phenomena.

3.3.1 The concept "urban island"

To start with, Grydehøj (2014), founder of Island Dynamics Network and the journal Urban Island Studies, has defined two categories of island cities and urban archipelagos:

1) Strongly urbanized small islands and archipelagos. These include, for example, Hong Kong, New York City, Abu Dhabi, Venice, Tromsø, Xiamen, Lagos, Malé, Malta, and so on. Some metropolises have started on islands and expanded to the mainland.

2) Major population centers located on largely rural islands or archipelagos, such as La Palma, Taipei, Havana, Reykjavik, and so on. In this case, the total population or density may be low and landscapes may not be considered urban zones, but they fulfil urban functions.

While these categories definitely make sense, this thesis extends from the commonly used concept of a city and refers to urban landscapes (see 1.1.3). Regarding whole islands as compressed entities of interconnected systems

(Coccossis 1987; Chapman 2011), and the plural forms of global urbanization, I employ the concept "urban island," which goes beyond island cities or cities on islands:

3) A whole island as an urban entity and as *an urban landscape.* Examples of this category can be found in both categories 1 and 2. However, it also includes islands where the city and country are more or less the same, islands with low built density but with highly urbanized populations and import-dependency, islands that represent the hinterland of close or distant urban nodes, and islands where infrastructures dominate even though human presence is only occasional.

The category includes islands such as Guernsey, St. Martin, Sylt, Bahrain, Capri, Okinawa, Barbados, Nauru, Batam, and so on. Even Iceland, whose population, despite the low density of 0.3 people/km^2, is 94% urban (United Nations 2014): The suggested definition extends focus from Reykjavik to the scale of the whole island, whose vast emptiness is consumed by urban ideals of wilderness tourism and produces energy for urban needs. In addition to Bermuda and St. Martin (the Dutch part), in the absence of high-rises, the populations in the non-dense islands of Anguilla, Nauru, and the Cayman Islands are reported to be 100% urban (UN DESA 2014). "[L]ocally-defined notions of spatiality" make Jersey an urban island, although half of the land area is agricultural (Johnson 2016:55). I regard the case study island of Sylt as entirely urbanized with the attendant socio-economic phenomena (tourism, transport, extreme gentrification, lifestyles), even though the permanent population and population density are small, the villages are compact, and the landscape has a rural-cultural-natural image: Seasonality makes the island part-time urban (see 3.4.2 and the case study, chapter 7). According to this definition, the Galápagos Islands, with their idealistically protected nature, (Hennessy and McCleary 2011) are an urban product: Despite exclusive prices and policies that intend to preserve the mecca of evolution, round 170,000 tourists visit the island annually, tying it to global networks and urban lifestyles, and the human impact paradoxically affects the main island's settlement, infrastructure, and nature conservation (Hennessy and McCleary 2011). Speaking about the global reach of urbanization, it is not surprising that, at first sight, the suggested category tends to color all islands urban. For clarification, this thesis estimates the urbanity of islands according to the following criteria.

3.3.2 Indicators of the urban island in this study

"Islands, especially small islands, are defined by their finite size. In other words, urbanization is determined according to the extent to which landscapes and seascapes are transformed through urban development" (Johnson 2016:58). To orient this study, the following statistics, as well as physical and non-physical aspects related to spatial transformation, are considered as indicators of urbanity, separately or together:

- Total population density > 500 people/km^2
- Population living in urban settlements or cities > 80%
- Prevailing urban land cover: built density, infrastructure (ports, airports, energy, communications) and artificial land cover, including urban sprawl and maintenance-intensive leisure developments such as golf -fields
- High connectedness via multiple modes and/or frequency of connections: marine, air, causeway/tunnel/bridge, telecommunications; a hub of cargo or migrating people
- Economy based on tourism, services, commerce, industry, and agriculture/fishing other than subsistence; high reliance on imported food, goods, and energy
- Notable offshoring destination of finance, leisure, and so on.

While the working definition of the urban island provides a starting point, I underpin that urbanization on islands may have to be considered along local parameters and understandings. They vary in different parts of the world, and mainland-based notions may not be appropriate for estimating an island's urbanity. For example, in the Philippines, areas with a minimum density of 500 people per square kilometer, and, in Seychelles, 1500 people per square kilometer, are considered urban. In many islands, a low population density or a relatively small built-up area can be misleading if geographical constraints, lifestyles, import-dependency, tourism peaks, and resource stress are taken into account. In contrast, despite top rankings in density statistics and overfull satellite images, the fishing communities on Ilet a Brouee in Haiti (MacGregor 2017), Santa Cruz del Islote in Colombia, and Fadiouth in Senegal are not necessarily urban. In the Pacific, growth is characterized by "myriad urban village types" (Mycoo and Donovan 2017:49).

Finally, urban is not a "status quo." Independent of population growth trends, humans living in capitalist systems are expected to continue consumption and production of food, energy, goods, materials, buildings, and waste. The metabolic processes have ecological and spatial dimensions. A higher standard of living may promote cleaner energies and environmental education, but it tends to foster urban land uses, larger vehicles, sprawl, boutiques, and tourism facilities, producing an increasing waste problem and environmental degradation. Rather than looking at islands that are urban per se, this thesis focuses particularly on cases where processes of urbanization[5] acutely bring about spatial transformations

5 Urbanization is defined in chapter 1.1.2 as: the increasing migration of people and the concentration of functions in cities or urban regions; the resulting spatial growth of cities or urban regions, the increasing number of urban settlements, and denser urban networks, increasing population and functional densities; and the expansion of urban economies and lifestyles into areas considered non-urban.

and challenges. Before elaborating on the concept "dynamic urban island," a few notes on the chosen indicators would be appropriate.

3.3.2.1 A note on densities and island statistics

Statistics for ranking islands and archipelagos based on population, area, economy, and administrational status are usually available on a national level. Considerably many islands that are overseas territories, subnational jurisdictions (Baldacchino 2010), or parts of archipelagos are not often represented. Both population and built density on islands range from uninhabited to the densest places of the world. I have selected the reference value of 500 people/km^2 as an indicator of considerable density because it corresponds with the densest continental European state, the Netherlands (World Bank 2014), excluding the micro-nations Monaco and Vatican City. The mainland example provides a clue for the academic context from which this research stems. However, island densities should not be compared to mainland cities, because island populations and areas are generally smaller, and island spatiality poses particular challenges (see 3.5). In terms of sustainability in the Pacific, Anderson considered island population densities exceeding 100 people/km^2 challenging (1977:18). A listed 100 % urban population may indicate lack of differentiated data.

3.4. Urban island dynamism

Dynamic: "1. (of a process or system) characterized by constant change, activity or progress. […] 2. (of a person) positive in attitude and full of energy and new ideas" (en.oxforddictionaries.com 2018).

Urban systems are dynamic. Ecosystems are dynamic. Climate is dynamic. Resilient systems are dynamic. Dynamism depicts something not stable but growing, and active. It is a trendy term in recent urbanism and landscape architecture. Yet, it is an old companion for designing landscapes – because of growth and decay, and because landscapes host and are the result of various processes in constant change at different velocities. A contemporary understanding of urbanity highlights dynamism as opposed to a traditional, formal understanding of cities and static boundaries. The urban is thus inherently dynamic, and, in light of planetary reach, almost all islands can be considered urban – that is, dynamic. To be everything but static is also the recent paradigm in island studies (Pugh 2018). All islands are dynamic, but not all of them are urban. "Urban" and "dynamic" are not on/off labels: Developments take different forms, more or less intense, rapid, slow, unplanned, or controlled.

As mentioned above, islands are traditionally not viewed as urban or dynamic, and spatial planning has been mainland-oriented. In this thesis, employing both the dynamic and urban as descriptive attributes of islands has a double purpose:

a) to emphasize a novel and topical perspective on islands, positioning them in the context of the Anthropocene, and b) to call attention to new planning and design approaches in and for islands. Dynamism is centrally related to the design approach of this thesis, which is concerned with seasonality (see hypothesis, chapter 2), and, as this chapter points out, it is characteristic of islands. In this research, "dynamic" refers to both spatial and temporal dimensions of urban island phenomena. In their complexity, dynamic urban islands provide a multifaceted research field where a discovery of a variety and intensification of urban and seasonal phenomena can be expected. The case studies further aim to understand what is special about spatial and temporal dynamics in islands.[6]

A dynamic urban island experiences spatial transformations as well as increasing resource consumption resulting from population growth and/or increasing wealth, urbanization of lifestyles and economy, and intensification of urban flows, such as connections and waste. In contrast, many (urban) islands have shrinking or temporary populations and are marginalized or unattractive in terms of basic services, business, or tourism. This may not be in direct relation with de-growth, as on Sylt (see the case study, chapter 7), where tourism continues to drive urban development. Dynamic urban islands undergo accelerated spatial transformations and temporary fluctuations. **In my conception, dynamic urban islands are the sum of islandness and processes of the Anthropocene** (see 3.6). **Furthermore, they (should) entail the potential and capacities to adapt to changes that internal and/or external forces bring about.** Here, I describe processes that shape urban island landscapes.

3.4.1 Changing within and reaching beyond

3.4.1.1 Interdependency and island substance (onshore)

Typical of development within islands is a high interconnectedness of social, economic, and ecological systems: Changing one changes the other (Coccossis 1987:85; Bass and Dalal-Clayton 1995). Scholars have emphasized the intensity of the interdependency and spatial conflicts or co-existence on islands due to their boundedness and limited resource base (Coccossis 1987; Fernandes and Pinho 2015; Grydehøj 2015b). For example, urban expansion happens at the cost of agricultural land and natural habitats, and inland development impacts the coast. The ever-changing relationships between land, water, and human activity play a central role in island dynamics (Grydehøj 2015b). Modified by geological processes, the substance of islands is "transient" (Hofmann and Lübken 2015:8). With reference to the geological dimension of the Anthropocene, technology, engineering, and weathering intervene noticeably in the material substance of islands.

6 Of course, the division is somewhat artificial, as all spatial processes have a temporal dimension. However, the spatial dimension of all temporal processes (or seasonal, in this case) is not so spatially palpable.

3.4.1.2 Offshoring

Most islands are part of global dynamics. Islands are particularly popular locations for offshore finance, wealth, and leisure, which brings them both startling benefits and illegalities (Baldacchino 2010; Urry 2014). More than half of offshore financial centers are islands or archipelagos (Wikipedia 2017).[7] Mainland-born desires and the global umbrella concept of offshoring produce urban-island landscapes and seascapes: Tax evasion, shipping, jet-set aeromobility, tourist fantasies, and other phenomena drive mighty industries towards islands, turning them into iconic tax havens, casinos, and paradisiac hideouts from Turks and Caicos to Macau (Baldacchino 2010; Urry 2014). With the proliferation of air transport and cruising, the middle class has gained their party and beach islands, too, such as Ibiza, Mallorca, New Providence, and many Mexican islands. Travel websites demonstrate that every season conquers new destinations. Migration is quintessential for small islands (Connell 2007; King 2009), and islanders migrate to mainland and back in different phases of their life (Baldacchino 2010:116). Australia offshores migrant camps to isolated Nauru (Royle 2014:44). Since colonial times, offshored production, resource extraction, and plantation monocultures have devoured wide proportions of the Caribbean islands, Mauritius, and even the Pacific (Anderson 1977:8; Bass and Dalal-Clayton 1995; Royle 2014:29–53), today witnessed in Batam and Karimun in Indonesia, in favor of neighboring Singapore. Urban atolls in the contemporary Marshall Islands are the product of launching the Anthropocene with nuclear tests in Bikini (Royle 2014:80–4). The expensive oil town Port-Gentil (Mandji, Gabon) is practically an island (Perry 2007). Developments of the Anthropocene have liberated mainlanders' eternal fascination, and many islands also actively attract development (Bass and Dalal-Clayton 1995; Baldacchino 2010).

3.4.1.3 Proximity to mainland (offshore)

I previously mentioned coastal metropolises that have originated on islands and expanded, such as Mumbai, or New York City. Proximity to mainland-born urban nodes encourages urbanization another way: "Islands near metropolitan regions generally experience changes more rapidly and on a scale greater than islands more remote from cities" (Jackson 2008:10). Bridging facilitates urban development, and satellite images show how islands close to coastal cities tend to be more built (and populated) than islands further away, with the exception of the crowded capital islands of some oceanic archipelagos. However, island geography might also hinder expansion of a metropolis, and island spatiality can restrict developments (see 3.5). Services and infrastructure on islands within mainland metropolitan influence might be peripheral, as in the cases of Itapairca and Zanzibar. Unattractive islands face emigration and abandonment (Connell 2007; Royle 2014:48). Although small and distant islands tend to be generally

7 The listing was compiled in 2016; the repercussions of the Panama Papers leaks are not reflected in this research.

rural in character (Fernandes and Pinho 2015:10), increased possibilities of migration or tourism and imports transform even distant archipelagic landscapes (Bass and Dalal-Clayton 1995). Total volumes may be small, but the worldwide reach of islands' export-import and migration dynamics is manifest in port-hubs such as Hong Kong, Nauru's refugee camps, natural icons like the Galápagos Islands, the way waste travels from Diego Garcia, and hotels erected in barren desert locations like Sal in Cabo Verde. The paradoxical development in Sal also demonstrates well a temporal dynamic of global urbanization on islands: seasonality.

3.4.2 Seasonal dynamic

Islands have their own time. "Rituals of passage" between islands or mainland and island contribute to the sensation of transferring to a different temporality (Jackson 2008:39). This research makes the point that seasonality (see hypothesis in chapter 2.2) represents a distinct feature of island dynamics.

Depending on climate and the seas, fishery and agriculture have traditionally been practiced in different seasons. On urbanizing islands, agricultural and marine livelihoods – together with a tacit knowledge about natural dynamics – have made way to the new seasonality of tourism, altered by effects of climate change and the global economy. Tourism is probably the most noticeable form of seasonality in islands, as well as the trait that has gained the most attention. While seasonality is typical of tourism everywhere, it is accentuated in islands (Andriotis 2005:208; Kizos 2007:146), together with its counterpart, the off-season (Kizos 2007). The spatial impacts of tourism (whether seasonal or not) from coastal overdevelopment, second-home-sprawl, and hotel clusters to waste problems and erosion are discussed in the extant literature (Anderson 1977; Ioannou 2002; Andriotis 2005; Kizos 2007; Gössling and Wall 2007; Hennessy and McCleary 2011; Pons and Rullan 2014) and is also illustrated in the case studies.

As a strategy for extending or creating new seasons for tourism (Andriotis 2005:208), events attract tourists beyond beach seasons. Festivalization is a phenomenon of the Anthropocene, and, as increasingly connected and special places, islands host a growing number of festivals: The popular high-school spring-break party holidays of US origin are now also launched in Europe in locations such as Pag in Croatia. The effect of short events in island landscapes (including appearance, function, and performance) can gain enormous dimensions on smaller islands. Events can have significant impacts in islands' bounded space, arrival points, and interdependent systems. In Ibiza and Mallorca, partying has become almost perpetual. Besides an array of urban and beach furniture, seasonal tourism results in permanent built structures and land uses.

In addition to settlements, particularly on tourist islands, seasonal fluctuation impacts population, connections, and resource demand (Kizos 2007; Fernandes and Pinho 2015:12). It affects occupation of spaces from congestion to absence. Off seasons are periods when physical settings are absent of people, businesses are closed, and programs and services are clearly diminished or cut off. The period often coincides with winter, or durations of adverse weather phenomena: In the Caribbean, hurricane season conditions tourism. Connections to and from islands are, in many places, dictated by seasonally available means and schedules. Off seasons affect islanders' lives and livelihood practices. Kizos has polarized (tourist) seasonality on the Aegean Islands as "Heaven in Summer, Hell in Winter" (Kizos 2007). The off season and winter are not only negative times. Traditionally, frozen seas and ice roads have facilitated connections between islands in northern climates (Palang and Sooväli et al. 2007:11). In contrast, on some islands, flash flooding or monsoon flooding disconnects or "re-islands" (adapting a term from Pigou-Dennis and Grydehøj 2014). However, it can be a blessing for agriculture and biodiversity, as the case studies demonstrate. Besides mobility, such temporary spatial changes have effects on the availability of (natural) resources.

Seasonality seems to dominate the dynamics of many islands, particularly in tourist locations, affecting connectivity, infrastructural demand, and spatial development. In my interpretation, **urbanity itself can increase and decrease seasonally, and such temporal dynamics render some islands part-time urban**, as conceptualized in the case of Sylt (see chapter 7). This research investigates the emerging urban landscapes and the spatial dimension of seasonality. In the Anthropocene, on one hand, increased connectivity and access to global resources and services eradicates the impacts of seasonality on islands. On the other hand, mass-tourism peaks and climate irregularities particularly challenge islanders' traditional practices. I postulate that seasonal dynamics engender conflicts and potentials in limited island spaces.

In the case studies, the spatial-temporal dynamics of urban islands are described and explored in more detail, in order to answer the research questions (see 2.2). I also observe how seasonal phenomena intertwine with linear processes like accelerating sea-level rise and shorter cycles like the tide. Looking at the dynamics from within the islands, geographical aspects such as smallness and coast-to-land ratio condition spatial transformation of islands. Island spatiality is thus a relevant concern for designing and planning. It follows that patterns and challenges of spatial development are described next.

3.5. Spatial characteristics of urban islands

Island spatiality makes islands special (Fernandes and Pinho 2015; Ratter 2018:10). It is conceptualized as smallness, boundedness, isolation, and fragmentation (Fernandes and Pinho 2015). Further inherent aspects include coastality, complex interconnections, hybridity, and the paradoxical nature of islands (i.e., Coccossis 1987; Stratford 2003; Hay 2006; Baldacchino 2008; Fernandes and Pinho 2015; Grydehøj 2015b). As a consequence, islands foster distinctive urban development. Like elsewhere, geo-biophysical factors, culture, and economy have directed spatial development on islands to idiosyncratic forms (Fernandes and Pinho 2015). Islandness does not determine development alone; rather, many aspects distinguish islands from mainland cities, or peripheral settlements like mountain villages (Fernandes and Pinho 2015). Grydehøj has pointed out that "certain kinds of islands have hosted certain kinds of cities in certain places," such as seats of power and trading posts (2015a:3). Even where bridges are built, islandness has steered urban development (Ibid). This chapter exemplifies spatial effects of islandness and island urbanization today, and island spatiality is further reflected in the three case studies.

3.5.1 Shaping unique biogeographies

Discontinuity, isolation and unique environments

To start with, spatial discontinuity has led to the development of unique island spaces and natural environments, including fragile ecosystems and ecological hotspots that contribute to global diversity (Briguglio 1995:1618; Helmus, Mahler, and Losos 2014; Fernandes and Pinho 2015:4–10; UN-Habitat 2015; Mycoo and Donovan 2017:25). Despite isolation, since colonial times and increasingly in the Anthropocene, human impacts on many oceanic island ecosystems have been ubiquitous, for example, in Mauritius, Zanzibar, the Caribbean, and the Pacific (Anderson 1977; Lewis 2009; Helmus et al. 2014:1618). Today, the role of geographic location in island biogeography is changing (Helmus et al. 2014). These developments are undermining the widespread advocacy of native island ecosystems – yet island ecosystems continue to be unique and valuable in regard to island smallness and high development pressure.

Land scarcity and interconnectedness

Smallness translates into land and resource scarcity, densification of settlements, and concentration of hazardous environments (Fernandes and Pinho 2015:8; Grydehøj 2015a). A low number of different ecosystems may be compensated by their internal diversity (Bass and Dalal-Clayton 1995; Fernandes and Pinho 2015:8). Limited land suitable for human-related uses notably steers urban development on islands, and they usually host little crop land or industry (Baldacchino 2010:168; Fernandes and Pinho 2015). Marine and terrestrial systems are closely linked (Coccossis 1987; Bass and Dalal-Clayton 1995).

The high spatial proximity and functional interdependence of spaces, places, resources, and systems is a significant outcome of smallness and boundedness: An accentuated interconnectedness of ecological, social, and economic systems distinguishes islands from other regions (Coccossis 1987:85; Bass and Dalal-Clayton 1995; Chapman 2011).

Sea-land interface

Islands have more coastline in relation to their land than any continental territories (Bass and Dalal-Clayton 1995; Fernandes and Pinho 2015:11). "Many small islands are entirely coastal entities" (Bass and Dalal-Clayton 1995). Coastality may well be the most essential ingredient of spatial development on islands (Fernandes and Pinho 2015:11). A coastline is not a mere drawn boundary (Baldacchino 2005), but a connection interface, and an ecologically, socially, and economically significant space that is constantly changing. Both conceptual islandness and concrete island spatiality seem to culminate at the land-sea interface (Bass and Dalal-Clayton 1995; Depraetere and Dahl 2007; Baldacchino 2010:115; Fernandes and Pinho 2015; Grydehøj 2015b).

3.5.2 Spatial forms of island urbanization

In general, land-use patterns on islands tend to be less rationally organized than on mainland (Fernandes and Pinho 2015:7). Small size and boundedness incubate "exceptional spatial competition" (Grydehøj 2015b:97), and urbanizing islands are prone to land-use conflicts (Fernandes and Pinho 2015:7). Regarding island spatiality, certain features are characteristic of urban form on islands:

Density

High densities are very likely on small islands (Bass and Dalal-Clayton 1995), and many islands face overcrowding (Fernandes and Pinho 2015:12). Some Asian islands, the islands of Banjul and Mozambique in Africa, Oceanic atoll capitals like the Maldives and the Marshall Islands – not to mention island districts of coastal archipelago cities (Mombasa, Abu Dhabi, Stockholm, New York City, Lagos, Venice, etc.) – reach extreme densities that outnumber continental cities. Among the nearly hundred islands listed and viewed for this study, smaller areas tend to accommodate the highest population densities. Density takes different forms: While extreme overcrowding in the old island town of Mozambique epitomizes the near extinction of open spaces and terrestrial ecosystems, compact verticalization on the Penang and Labuan islands rises beside green landscapes. Urbanization may coincide with a concentration of hazard-prone sites (Fernandes and Pinho 2015). An island might, to a large extent, be mountain, desert, or glacier, making settlements or agriculture nearly impossible (e.g., Greenland, Svalbard, São Vicente, O'Ahu, Madeira), and the population is crammed on a small portion of land. In flatter island topographies, a thorough expansion of built development is more probable. Smallness facilitates ubiquitous human influence, and results in the proximity of urban functions, natural habitats, and landscapes types – the case of Malta is an excellent example of this. On Jersey and Guernsey, there are no fallow patches. Aerial views of Bermuda and the case of New Providence in the Bahamas illustrate an even cover of built landscape that suggests a new reading of ecosystems and island landscape in the Anthropocene.

Urban primacy

Centralization, or urban primacy, is a typical form of island urbanization, highlighted in archipelagos: Advantageous physical locations may be few, and developmental pressure and investments concentrate in the main island or town (Fernandes and Pinho 2015:9, 12; UN-Habitat 2015:14). These are usually located in lower elevation coastal zones (Mycoo and Donovan 2017:18). Development gaps mark the residual areas of a larger island or archipelago (Fernandes and Pinho 2015:12). Cabo Verde and the Bahamas evidence core periphery development due to archipelagic fragmentation and/or biogeographical constraints. It can also be a conscious strategy, like Malta profiling Gozo as its green satellite (Baldacchino 2010). Urban concentration might spare natural habitats from fragmentation, although it does not guarantee healthy ecosystems.

Sprawl: fragmentation and "leisuring"

By fragmentation, in the concept of islandness, Fernandes and Pinho mean a spatial discontinuity of infrastructures within or between islands and mainland (2015:6). I also find the term useful for describing the consequences of urban sprawl and expansion of informal settlements on islands. Sprawl is a more recent trend on islands and is often related to seasonal occupation (Fernandes and Pinho 2015:10). In the absence of periphery, it perforates limited island landscapes, fosters "leisuring" (Bunce 2008) of island landscapes, and raises land and housing prices (Fernandes and Pinho 2015:12). The climax has perhaps been reached in Bermuda, but moreover, "the Caribbean in particular has become one great leisure region" (Bunce 2008:970). Accumulation of wealth is manifest in a sprawl of luxurious resorts from Anguilla to Bermuda, the Cayman Islands, St. Martin, the Maldives, Seychelles, Exuma, Mustique, St. Barts, and a number of private islands. Paradoxically, the large ecological footprint also produces ecological island reserves (Baldacchino 2010:185). In many European cases, protection of vulnerable environments has constrained densification and sprawl (Fernandes and Pinho 2015:7), as is the case on Sylt and Ile de Ré. In contrast, high levels of informal urbanism are typical in SIDS (Mycoo and Donovan 2017:18).

Places of connection and infrastructure

Smallness, remoteness, and spatial discontinuity affects provision of infrastructure, whose dimensions depends on island size and status: water treatment and energy-production facilities, dumps, roads, and, last but not least, vast parking and camping fields of tourism spots, such as beaches on Sylt. Historically, access to waterways has benefited development of trade nodes on many offshore islands (Grydehøj 2015a:4). In all islands, connection points are important and determine spatial development. On smaller islands, the positioning and presence of connection–access–departure landscapes, such as harbors and airports, and, in some cases, bridges and causeways, is more determinate than on mainland (Fernandes and Pinho 2015). Both physical structures and the ephemeral movement of people and goods are centralized. Airports devour large proportions of crop land, ecological habitats, and potential settlement sites. Like ports, they often necessitate land reclamation. As an icon of the Anthropocene, their footprint dominates even some remote (almost) uninhabited islands as a legacy of geopolitics and human presence in places such as on Midway Atoll in the middle of Pacific Ocean and San Felix far off the coast of Chile.

In continental post-industrialized cities and growing hubs, there is a tendency to relocate or build larger infrastructures outside the city. On small islands, different functions continue to coexist closely. Built to the other side of the island as the old central harbor could not expand, Malta Freeport is now a giant bordering a small town. The small island of Malta also hosts two former military airports converted for multiple new uses. Rarely do such spaces perform so multifunctionally on mainland, appropriated by islanders, as in the case of Kiribati, with people picnicking on the runway (Warne 2015). Depending on the island's shape, smallness, at best, enables short distances and ease of clustering, which reduces the need for extensive and inefficient infrastructures. Yet, many critical infrastructures need a coastal location, or a connection point if drawn overseas, like data cables.

Coastal development

Coastal urban occupation characterizes most islands (Fernandes and Pinho 2015:11). A small inland, suitable connectivity points, marine resources, increasing tourism, and its attendant preferences lead to coastal development and clashing interests (Ibid; Grydehøj 2015b; UN-Habitat 2015:15). Land reclamation is increasingly typical of island urbanization (Grydehøj 2015b). Historic coastal zones have expanded successively, but more recently, iconic developments, like in Dubai and Macau, have popped up (Ibid). Waterfronts and islandness are so desired that even Bahrain and Abu Dhabi, whose hinterland would supply space for sprawling settlements, opt for artificial islands (Idem:105). In the Maldives, sizeable developments like Hulhumale are perhaps the only resettlement option in the face of sea-level rise. Such development necessitates capital and political power, and Grydehøj observes a tendency of exclusive and iconic developments at the cost of public space and local social interaction (2015b:107–11).

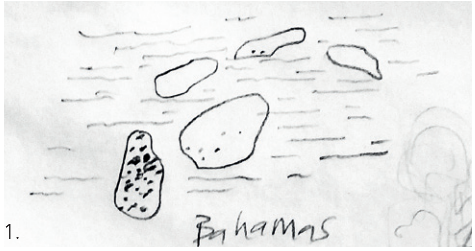
The coastal concentration of many (small) island populations, their jobs, and industrial, residential, and recreational uses often weaken or destroy naturally buffering and adaptive key ecosystems – coral reefs, mangrove forests, deltas,

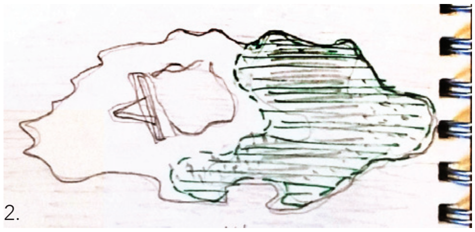
Fig. 3.1 Illustrating spatial characteristics of urban islands:

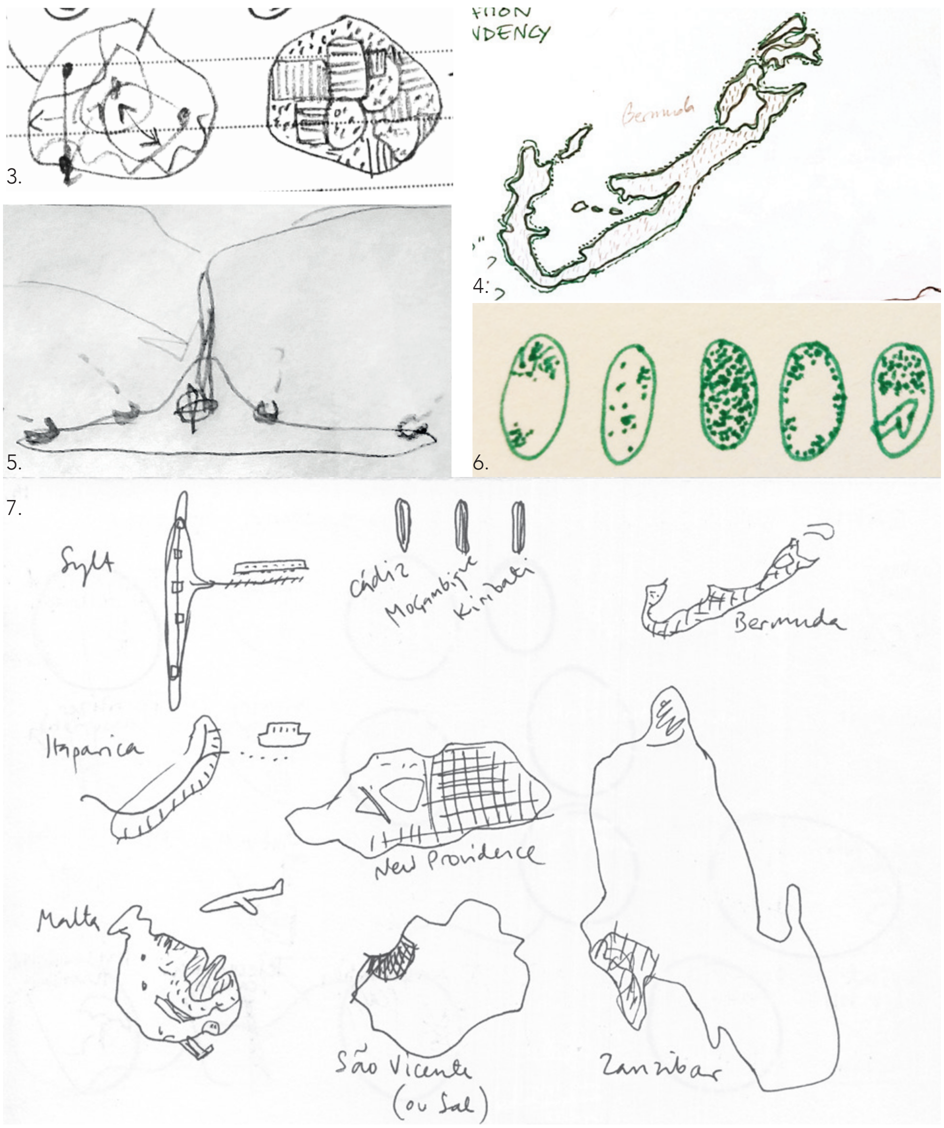
1. Densification and centralization
2. Cities' relative size compared to surroundings
3. Proximity and interlinked systems
4. Extensive coast-to-land ratio
5. Connection/access points steer urbanization patterns

Based on: Fernandes & Pinho 2015; Grydehøj 2014; Coccossis 1987; and open access satellite images

6. & 7. Studying urban form in potential case studies.







sea grass beds, coastal marshes, and sand plates – that protect settlements and infrastructure from coastal flooding and erosion (Bass and Dalal-Clayton 1995; Barnett and Margetts 2013a; Fernandes and Pinho 2015:11; Mycoo and Donovan 2017:25, 35). Built shorelines alter tidal currents and reinforce the effects of storm waves. The matter of securing island substance with engineered structures and sand nourishment is existential for some small islands. Baldacchino and Kelman have postulated that sea-level rise might revert coastal development scenarios, affecting land-use patterns and the value of islands' interiors (Baldacchino and Kelman 2014:9). I postulate that retreating glaciers might have a similar effect on islands in the Arctic. In any case, the prevalence and adaptation of port cities will be essential for islands (Mycoo and Donovan 2017:63).

3.5.3 Exceptional conditions

To summarize, spatial development on islands is distinctive. The small size and physical boundaries result in high ecosystem interconnections, concentration of hazard-prone sites, and closely linked marine and terrestrial systems (Coccossis 1987; Fernandes and Pinho 2015). Island urbanization produces conflicts over land and resources, and certain land-use patterns prevail: coastal development, densification, core-periphery disparities, and, more recently, sprawl (Coccossis 1987; Bass and Dalal-Clayton 1995; Fernandes and Pinho 2015; Grydehøj 2015a). Some problems are similar to continental and coastal urban areas, but island spatiality accentuates their effects (Coccossis 1987; Briguglio 1995:1618).

The spatial challenges deriving from smallness and boundedness include lack of hinterland, limited land suitable for human uses, overdevelopment, overcrowding (especially in SIDS, but also in Malta), and/or resource stress, particularly during tourism peaks (Fernandes and Pinho 2015). Expanding built development within physical boundaries implies fragmentation or loss of ecological habitats and open spaces (Ibid). Due to lack of alternatives, settlements occupy hazard-prone sites like hillsides and coastal areas (Ibid). Urbanization triggers escalating land prices, extreme gentrification (see the case of Sylt, chapter 7), and coastal privatization (Clark et al. 2007; Grydehøj 2015b:12). In island spatiality, almost all dynamics culminate at the sea-land interface (Bass and Dalal-Clayton 1995; Depraetere and Dahl 2007; Baldacchino 2010:115; Fernandes and Pinho 2015; Grydehøj 2015b). There, urban development often reduces the ecological performance against waves and winds. Studies have pointed out that, coupled with unique patterns of urban development, island spatiality contributes to vulnerabilities (Briguglio 1995; Fernandes and Pinho 2015; Mycoo and Donovan 2017) – that is, island populations' and ecosystems' exposure to hazards and lowered capacity to deal with them. However, side by side, island conditions have also generated resilience, as discussed in the chapter 4.2.

Rather than problematic per se, I have observed that effects of islandness create exceptional spaces where the repercussions of urbanization are ubiquitous and tangible. On islands, everything is local and present. Altogether, the particularities of islands mean that they have to resolve many spatial and environmental challenges in different ways compared to those on mainland. Spatial competition and interdependency puzzle island planning (Coccossis 1987) and design. I thus agree with Vitousek and Chadwick (2013) that islands are promising examples for learning about coupled human-nature relations in the Anthropocene – and they could provide lessons for designing integrative "andscapes" (Prominski 2014a). What happens when dynamics of the Anthropocene meet the exceptional spatiality of islands?

3.6. When the Anthropocene meets islandness

As formulated in 3.4, my conception of dynamic urban islands describes the product of islandness and forces of the Anthropocene – with the potential and capacities to adapt to changes that internal and external forces of urbanization bring about. The dimension of seasonal dynamics underlies these elements. In order to understand the research objects I have been dealing with, and to come up with a working definition of (dynamic) urban islands for this thesis, an inquiry about urban phenomena on islands was necessary. I wanted to include illustrations of typical seasonal dynamics in this worldwide overview, but temporal dynamics are not as immediately perceptible as spatial patterns. Seasonal phenomena have therefore been handled in the case studies.

This first part of my research has been driven by a curiosity to discover how island spatiality conditions trajectories of the Anthropocene – and vice versa. To investigate the spatial dimensions, I started with population densities and land uses, including Hong Kong Island and the like, which are obviously very urban. Pragmatically, I obtained listings on Wikipedia, institutional websites, island databases, and commonplace web-search engines, and discovered built density, land use, and landscapes in open-access satellite images, browsing coasts and oceans. Additionally, I relied on island literature, travel magazines, and tips from people I met. The following insights result from the process of discovery and definition that accompanied the writing of this chapter on dynamic urban islands. It was also part of the case selection. First and foremost, the overview has provided an irreplaceable thinking tool for this research process.

While island situations are diverse and changing, it was possible – and helpful – to recognize or to imagine recognizing recurring outcomes: a typological approach emerged, in the sense of studying and sorting recurrent traits of island urbanization and the Anthropocene. The diagram and sketches display typical phenomena that have caught my attention in the making of this thesis: accelerated processes of island formation, development of spatial patterns,

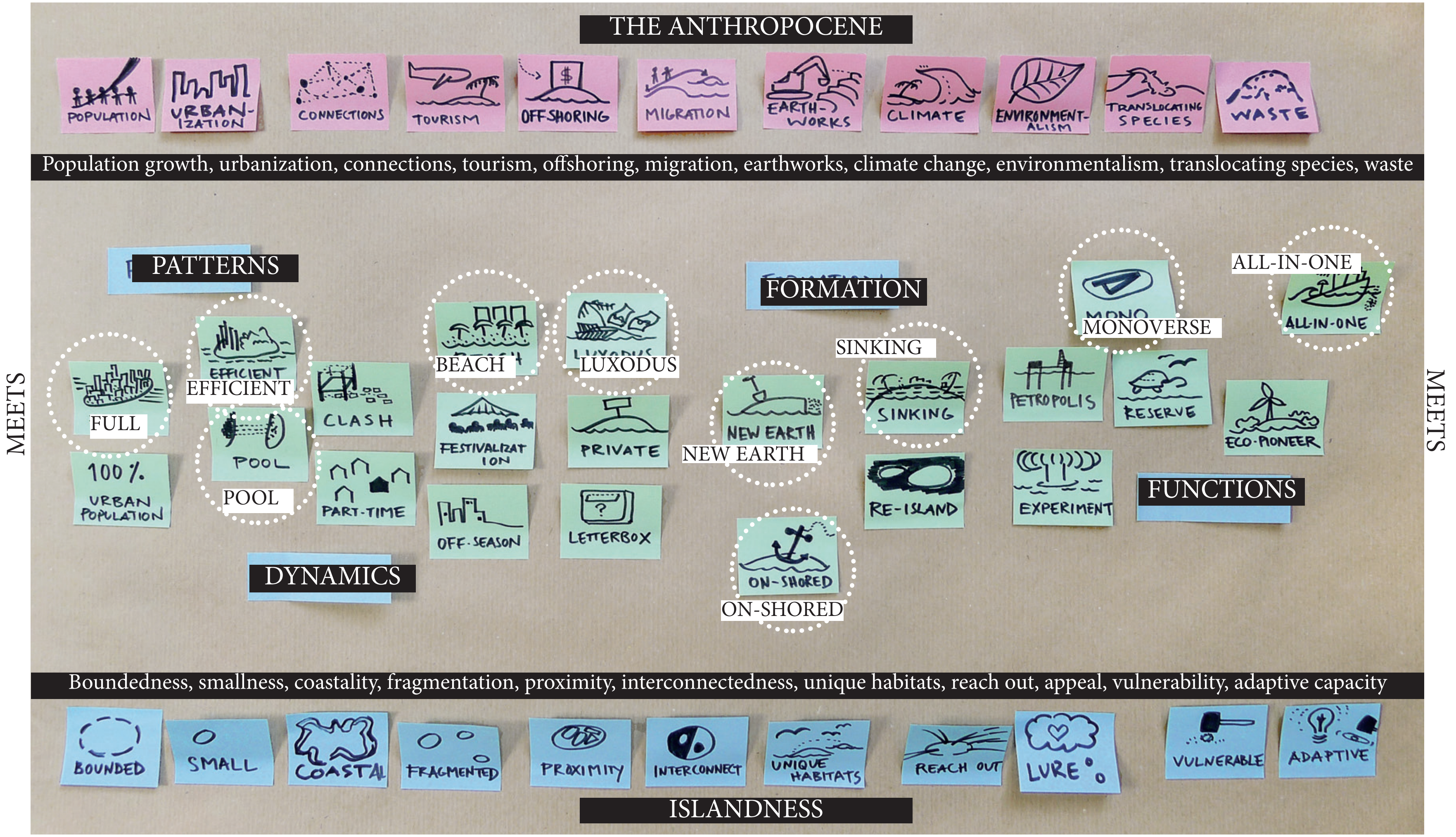
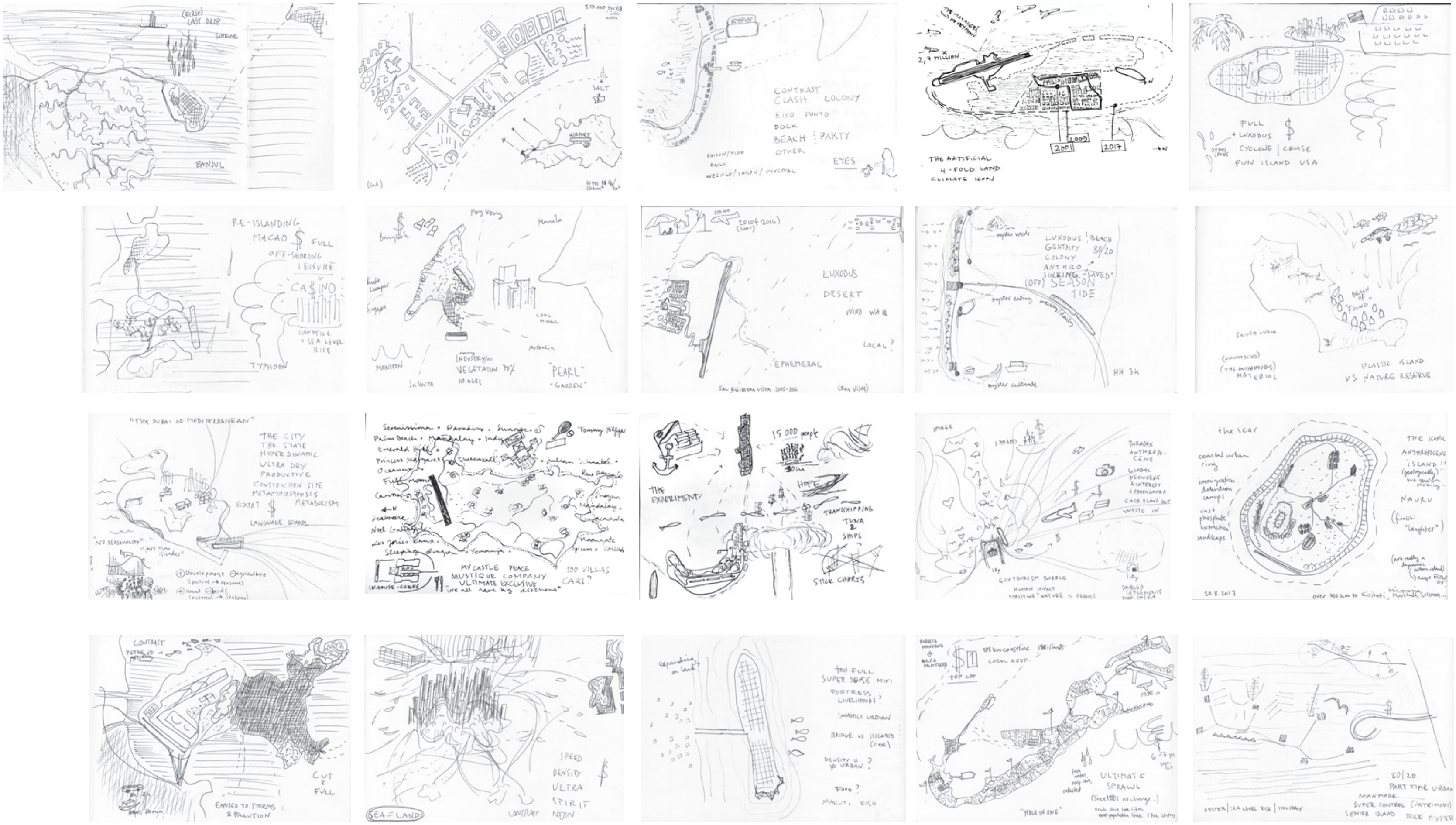


Fig. 3.3 Typical phenomena: What happens when forces of the Anthropocene (above) meet islandness (below)?
The post-it illustration reflects the non-fixed character of the study, enabling various ways of clustering.

Fig. 3.2 Studying dynamic urban islands: Twenty drawings of islands in the Anthropocene (based on open-access satellite images).



altered dynamics of occupation by humans, flora and artifacts, and emerging functions. However, the further one looks, the more one finds all forms between. In "emblematic" examples, multiple features coalesce and condense. Many of the phenomena observed occur on mainland, too, but this overview shows that islandness accentuates their materialization. Forces of the Anthropocene stretch and reshape island borders, manipulate islands' smallness to congest small island spaces, intervene in the manageability of systems, and highlight the paradoxical and hybrid nature of islands.

DESCRIBING URBAN ISLANDS IN THE ANTHROPOCENE

FULL: Malé, Bairiki, Singapore, Manhattan, Ebeye, Banjul, Venice, Cadiz, Atlantic City, Bermuda, Governador island, for example. The result of population growth and boundaries is mathematics: the smaller, the denser. Ebeye in the Marshall Islands started filling from relocation at the dawn of the Anthropocene (see 3.4.1.2). In oceanic archipelagos, extreme densities result from regional climate change migration. Overcrowding is not visible in satellite images: Mozambique Island has been fully built for centuries (but is it urban?). Some dense island cities expand onto the continent and/or reclaimed land (New York City, Lagos, Abidjan, Xiamen, Recife, Abu Dhabi, Banjul, Mumbai, etc. started on islands). Governador Island is full with an airport and favela; far off in the ocean, Bermuda has been filled with sprawl and golf fields.

THE EFFICENT: Hong Kong, Xiamen, Penang, and Santos, for example. Reaching similar population densities as the fully built ones, many coastal islands in Asia have verticalized and maintain a lush integral green area – usually a mountain or wetland that challenges building. They often have bridges to the mainland.

LUXODUS: St. Barts, the Cayman Islands, Turks and Caicos, St. Thomas, Mustique, the Maldives, Seychelles, Anguilla, Bora Bora, Sylt, and examples on internet sites like privateislandsonline.com. Tax havens in tropical seas are amply described in the literature (see 3.4.1.2). Their urban landscapes are shaped when an exodus of mainland wealth combines with the lure of an island paradise, often featuring close to 100% urban population and low built density; a sprawling rug of jet-set resorts and leisure opportunities – and natural landscape, depending on the island's size. Islands resemble gated communities: "The super rich can be offshore at St. Barts and spatially segregated from the merely rich" (Urry 2014:84). Sometimes produced by finance offshored on other islands (Baldacchino 2010:185), PRIVATE islands can eco-label exclusivity – such as Bawah (Indonesia) or Necker (the British Virgin Islands). The environmental footprint of the cosmopolitan travel and consumption patterns is paradoxical.

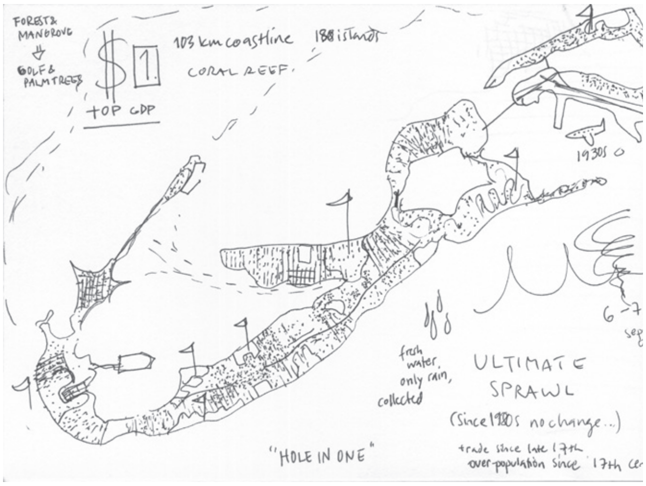


Fig. 3.4
Bermuda (FULL, LUXODUS)

Fig. 3.5
Hong Kong (THE EFFICIENT)

Fig 3.6
Mustique (LUXODUS)

BEACH: Ibiza, New Providence, Pag, Zanzibar, Atlantic City, Phuket, and Sal, for example. Mass tourism is the commonplace and crowded version of *luxodus*, with hotel clusters, replicated apartments, cruise ports, congested beaches, and clearer seasonality. Not only throughout the Mediterranean and the Caribbean, all-inclusive holidays and low-cost airlines expand to new, unspoiled destinations each season, and global trends insinuate a massive impact on islands. Their spaces homogenize with the almost modular dimensions of hotel chains and global shopping brands. Some islands specialize as PARTY and FESTIVAL destinations. Where urban dynamics meet subsistence tradition, a CLASH of building practices and lifestyles shape island landscapes, compressing the paradoxical realities of desire and marginalization. In Sal, the rationale of enough-sand-and-accessible-by-air produces absurd constellations.

POOL: Florianopolis, Itaparica, Zanzibar, Atlantic City, Capri, Ile de Ré, Rottnest, Phillip Island, and Smögen, for example. Within metropolitan regions, island lure and proximity produces uneven situations (see 3.4.1.3): Islands invite "amenity migration" (Jackson 2008), weekenders and second-homers, and, on the smallest islands, almost staged day trips. In Zanzibar, Itaparica, and Gozo, islands are controversially exploited for leisure yet marginalized from services and infrastructure. The paradox of paradise and impoverished hinterland emerges. Karimun is being hollowed out for building neighbors. With the temptation of connections and land reclamation, proximity to pulsating continental cities highlights mainland-island disparities in the Anthropocene.

ON-SHORE: Bikini Atoll, Ebeye, Nauru, Batam, the Cayman Islands, Comoros, Thilafushi, and Saipan, for example. The nuclear test in Bikini Atoll marked the start of the Anthropocene in islands. Islands are favored outposts for unwanted and illegal phenomena (Urry 2014). With enhanced technologies and mobility, from the island perspective, this means intentional or accidental on-shoring: migrants, alien species, sweatshops, and waste. While the discreet spatial impact of non-resident letterbox possessors can be found back in luxodus, the excess-consumption and environmental problems of the Anthropocene materialize in the waste geology of Thilafushi.

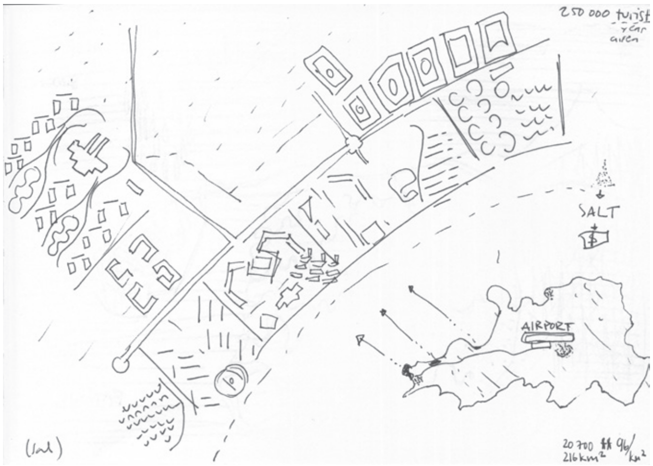


Fig. 3.7
Sal (BEACH)

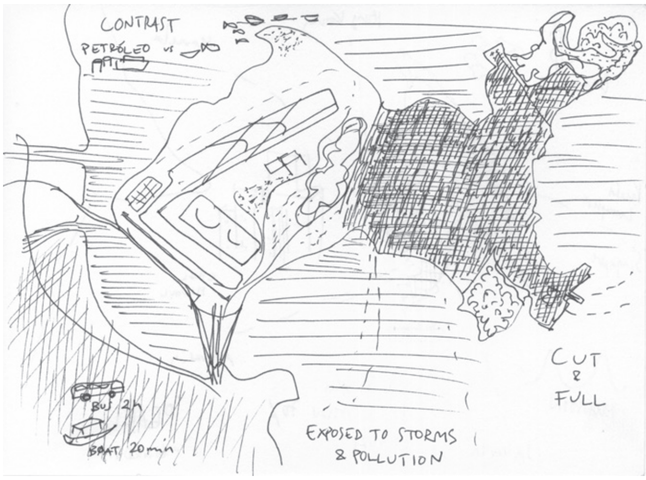


Fig. 3.8
Governador Island (POOL, FULL, MONOVERSE)

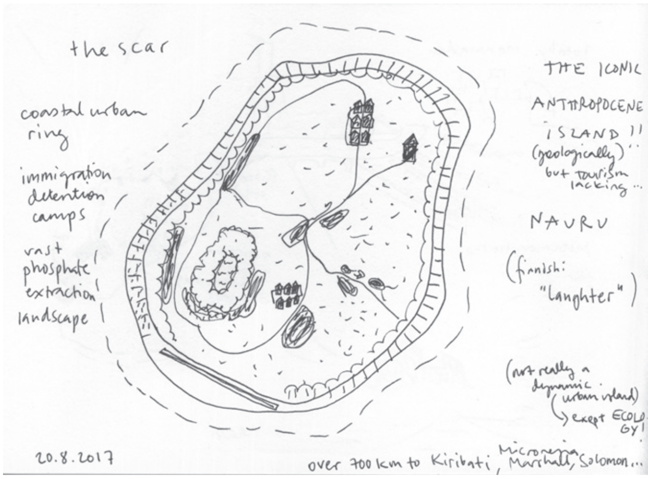


Fig. 3.9
Nauru (POOL, ON-SHORE)

SINKING: The Maldives, Kiribati, the Marshall Islands, Tonga, the Bahamas, and Greenland, for example. For many islands, climate change is the most striking phenomenon of the Anthropocene. Sea-level rise threatens low-lying small islands and coastally concentrated populations. Melting glaciers render Arctic islands iconic. "Climate icon" and "sinking" are neither politically nor geologically correct terms, but they describe the international hype about islands as flagships of climate change. Less conspicuously, islands and their parts, like Macau, Belize, Port-Gentil, Banjul, Sylt, and Batam, face possible situations of RE-ISLANDING. Due to humans' unwise constructions and sea-level rise, the impacts are dramatic.

NEW EARTH: Tala Island, Jumeirah Palm, Thilafushi, Hulhumalé, Fadiouth, the Cotai Strip, for example. Artificial islands are concrete products of the Anthropocene, usually districts of a larger urban center or archipelago. Venice is a very old example in this category, but in the Anthrpocene, summing up island smallness and fantasies, material excess, and human-made technology, the intriguing category of artificial islands entails waste disposal (in Thilafushi, Spectacle Island), "petropolises" off the coast of Brazil (Bahatia and Casper 2013), luxury housing (in Dubai, Bahrain), and climate responses (in Hulhumalé).

MONOVERSE: Kharg, Jurong, and San Felix, for example. When the scales of the Anthropocene meet the smallness of islands, a whole island might be dedicated to one purpose. After slave ports, pastures, and hospitals, the Anthropocene produces a diversity of mono-functional and mono-spatial islands: scientific tests, resource extraction, industry and port hubs, and airbases. In fragmented archipelagos, a division of functions is typical; a single purpose can also be the reverse effect of concentration in other islands, or when large structures push other elements out. ECOLOGICAL RESERVE is a single function assigned to many islands. Ironically, the most exclusive resorts with large ecological footprints may coexist with(in) protected areas (e.g., the Marquesas Islands, the Galápagos Islands), and global plastic lands on uninhabited islands (e.g., Santa Luzia, Henderson). Fully built small islands are a monoverse, too, while other islands with 100% URBAN POPULATION have divergent spatial patterns, from Nauru to Anguilla, Sao Vicente, and Bermuda.

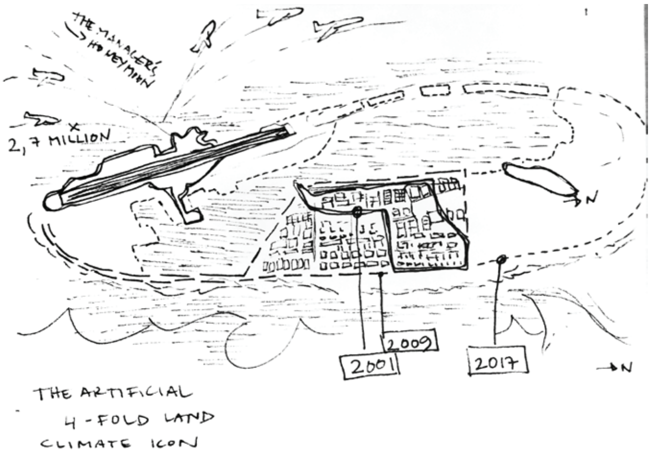


Fig. 3.10
Hulhumale (FULL, NEW EARTH)

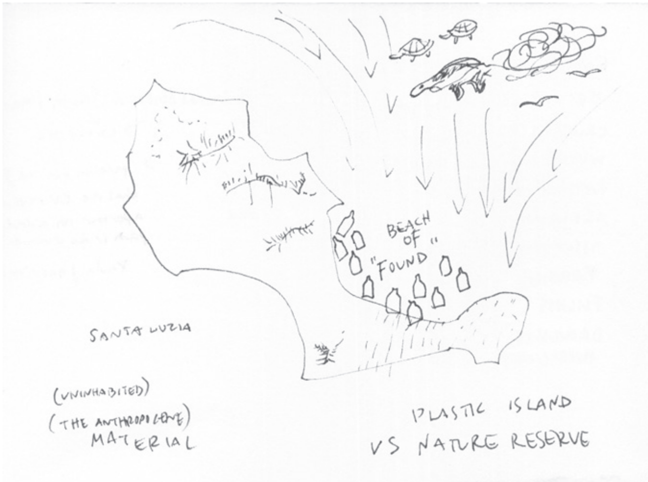


Fig. 3.11
Santa Luzia (MONOVERSE, ON-SHORE)

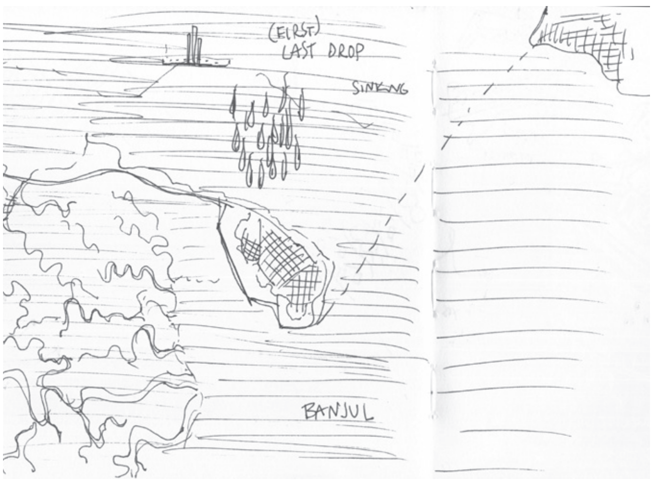
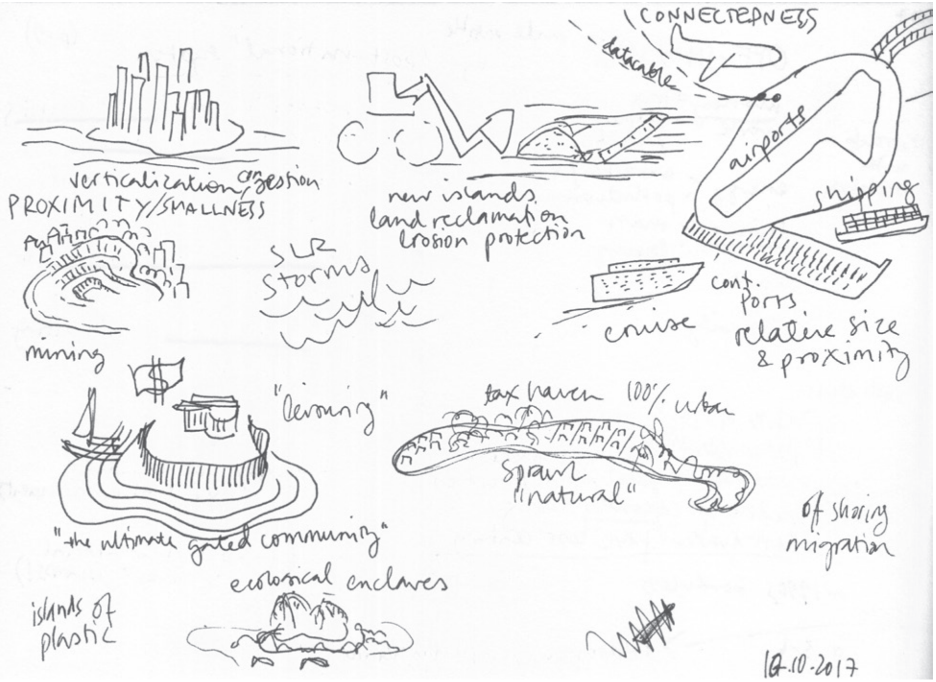


Fig. 3.12
Banjul (FULL, RE-ISLANDING)

ALL-IN-ONE (THE EMBLEMATIC): Bermuda, Kwajalein and Ebeye, Yeongjongdo, Nauru, Thilafushi, Sal, Isabela (the Galápagos Islands), and Macao. Reviewing the phenomena above, some very small islands stand out with a condensed assembly of traits of the Anthropocene. They communicate the accentuated, palpable encounters of islandness and the Anthropocene better than others. Ebeye is overwhelming as a fully built migration destination, offshoring center, and climate change icon. Bermuda is full of sprawl and golf courses, fed by imports. Macao is a full and vertical tax haven with an airport island and casino theme park that expands onto new earth, which might be re-islanded by sea-level rise.

THE PROSAIC: Malta, Zhoushan, Labuan, St. Martin, Roatan, and Norderney, for example. If not every urban island is emblematic, but the Anthropocene and islandness are planetary, there must be mundane island spaces. Interpreting identities and naming types is very subjective: The difference between all-in-one and a-little-bit-of-everything is a matter of storytelling. All these less spectacular forms and impacts of the Anthropocene on island dynamics escape categorization and yield surprises.

Fig. 3.16 Typical urban island developments in the Anthropocene.



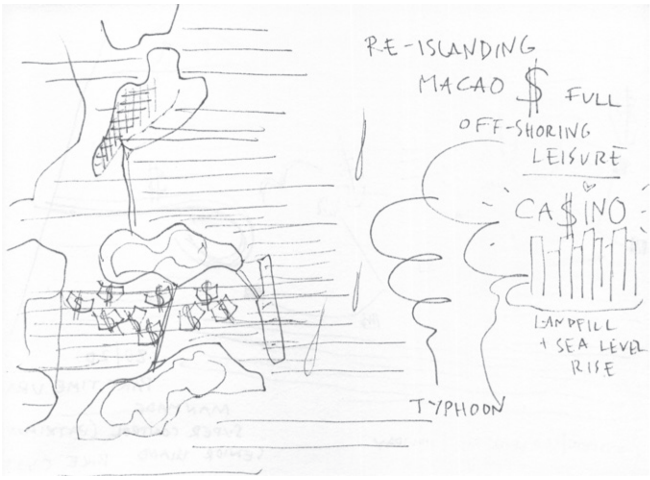


Fig. 3.13
Macao (ALL-IN-ONE: FULL, NEW EARTH, RE-ISLANDING, + THE CASINO)

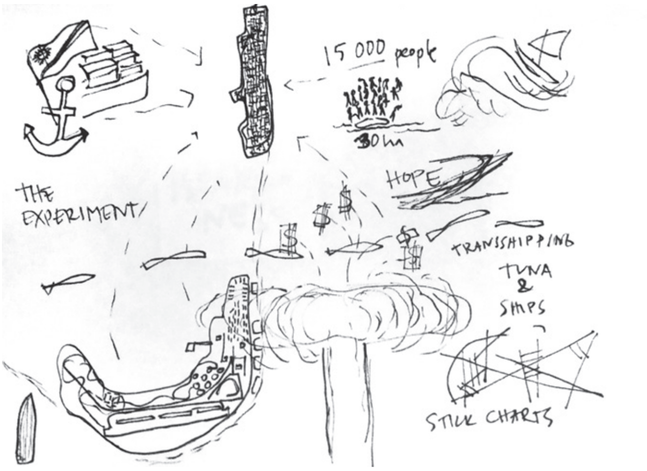


Fig. 3.14
Kwajalein & Ebeye (ALL-IN-ONE: FULL, MONOVERSE, ON-SHORE, SINKING + THE EXPERIMENT)

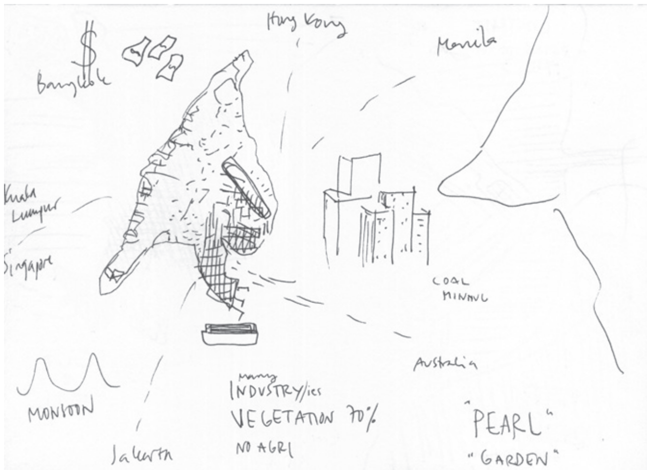


Fig. 3.15
Labuan (THE PROSAIC)

Summary

Island studies is a young, interdisciplinary field of research. Today, almost all islands are urban. They are not closed and isolated, but open and globally networked. The attributes "dynamic" and "urban" are, first of all, employed to emphasize a paradigm shift regarding island studies and planning. This study focuses on islands that face spatial transformations due to their urban growth and eco-spatial limitations, and globally intensifying networks and flows of goods and people. Besides local-global dynamics, island spaces experience internal dynamics. Later in this thesis, seasonal dynamics, particularly accentuated in islands, come to play a central role. For example, resulting from tourism, urbanization can be a part-time phenomenon with permanent infrastructures and recurring disturbances. In their complexity, urban islands provide a multifaceted research field where a discovery of a variety and intensification of urban and seasonal phenomena can be expected.

Spatial conditions (boundedness, land scarcity, coastality, and fragmentation), unique ecologies and socio-economic dynamics (global fascination, openness, interconnectedness) render islands distinctive cases of urbanization and urban landscapes. They produce land-use conflicts, and their urbanity and ecosystems are more interdependent than on mainland. Highlighted in island spatiality, urban development produces increasing density or fragmentation, compromising the number, quality, and functions of ecosystems and public open space. Altogether, the particularities of islands mean that they have to resolve many spatial and environmental challenges in a different way compared to those on mainland. The exceptional spatial developments on islands deserve special attention and design and planning approaches that address their dynamics, urbanization, and vulnerabilities, which are engendered by trajectories of the Anthropocene.

This first part of the research includes a typology that uncovers how island spatiality conditions trajectories of the Anthropocene – and vice versa. The chapter closes with the foresight that island(er)s may not only be in need of design and planning, but also actually exemplify adaptive capacity. Hence, the term "dynamic" gains another dimension: In my conception, dynamic urban islands are the sum of islandness and forces of the Anthropocene – with the potential and capacity to adapt to changes that internal and/or external forces of urbanization bring about. The intrinsic dimension of seasonal dynamics is handled in the case studies, but before that, it is necessary to examine resilience-building in the next chapter.

4. Resilient islands

The previous chapter closes with the vision that dynamic urban islands are the outcome of islandness, forces of the Anthropocene, and an entailed or aspired to resilience. Resilience, as explained in 1.3, is globally established in sustainability and urban-planning agendas as aspired-to strategies or capacities of system(s) to cope with hazards, keep functioning, and adapt to changes or transform. In island studies, both vulnerability and resilience are frequent topics, and the paradoxical nature of islands (see 3.2) is highlighted again: Small island developing states (SIDS) are at the center of global policies of climate change adaptation. Their vulnerability has gained an almost paradigmatic focus, but today, many scholars also underpin islands' resourcefulness and resilience (e.g., Conkling 2007; Campbell 2009; Lewis 2009; Lauer et al. 2013; Fernandes and Pinho 2015; Hofmann and Lübken 2015; Philpot et al. 2015; Kelman 2018; Ratter 2018:173–99). For disciplines concerned with eco-social and urban resilience, islands provide examples of close interconnections between human and natural systems, adaptive capacities, and transformation (Coccossis 1987; Bass and Dalal-Clayton 1995; Stratford 2003; Chapman 2011; Lauer et al. 2013; Vitousek and Chadwick 2013). In the face of urbanization, traditionally developed resilience is not enough or is declining, and a need for planning for resilience in islands is evident (Bass and Dalal-Clayton 1995; Campbell 2009; Lewis 2009; Lauer et al. 2013; Barnett and Margetts 2013:446).

In response, this thesis aims to integrate seasonal phenomena to resilience-building in landscape-architectural projections (see hypothesis, chapter 2). Described along the lines of the interdependence and connectedness of socio-ecological systems, cross-scale interactions, acceptance of change, and highlighting adaptive capacity, resilience is becoming mainstream in contemporary landscape architecture. But does landscape design automatically increase resilience? How can we pursue it strategically, and how can we evaluate the effects? Keeping the scope in mind, this chapter first puts islands aside and investigates means of building resilience. I then return to discuss resilience and resources in island contexts, and derive principles of resilience for the island case studies.

4.1. Operationalizing resilience

The introduction of social-ecological and urban resilience in chapter 1.3 indicates the difficulty of operationalizing and measuring resilience. General principles and approaches facilitate the employment of resilience and assessment of the island case studies in this thesis. Based on social-ecological resilience, the key means introduced here to build resilience in the field of landscape architecture encompass exploring, envisioning, and predicting alternative development trajectories, as well as scenario-building. The "adaptive cycles" and "panarchy" models (Gunderson and Holling 2002) that are frequently recommended (Carpenter et al. 2001; Walker and Salt 2006; Holdschlag et al. 2012; Wu and Wu 2013) have not been included due to their complexity and the interdisciplinary expertise required. Likewise, the study of cross-sectoral and multi-stakeholder procedures of (urban) resilience-profiling and disaster-risk reduction promoted by multinational institutions (e.g., UN-Habitat's City Resilience Profiling Tool and Resilience Action Plans; Urban Resilience Hub; and ICLEI's tools for building urban climate change resilience) is limited to the scope of islands, where ecosystem-based adaptation is a key tactic. Before focusing on islands, the chapter points out the general challenges of resilience-building efforts.

4.1.1 Multiple scales and relations: Of what to what, when, and where

Rooted in the socio-ecological resilience background, Stockholm Resilience Center summarizes seven principles for deploying resilience thinking (Biggs, Schlüter, and Schoon 2015): maintain diversity and redundancy, manage connectivity, manage slow variables and feedback, foster complex adaptive-systems thinking, encourage learning, broaden participation, and promote polycentric governance systems.

To apply principles in a specific context, first of all, the reason and goals of resilience-building should be clear (Birkmann et al. 2012; Meerow et al. 2016:46; Sharifi et al. 2017:7). The importance of addressing *whose* (what system) resilience *to what* (which disturbance or stress) is an essential starting point (Carpenter et al. 2001; Folke et al. 2010; Lauer et al. 2013; Biggs et al. 2015; Meerow et al. 2016). This implies identifying system components, their relationships,[8] and potential changes and disturbances (Cumming et al. 2005). Furthermore, the temporal and spatial dimensions of resilience (*where* and *when*) should be addressed explicitly (Carpenter et al. 2001; Meerow et al. 2016). Defining system scale and time-frame also helps to measure resilience-building efforts (Birkmann et al. 2012). However, a focus that is too specific may be counteractive to developing general resilience (Folke et al. 2010; Lauer et al. 2013) or lead to achieving short-term benefits while inducing longer-term harm (Carpenter et al. 2001; Walker and Salt 2006; Garschagen 2014:74). Lauer and colleagues (2013:48–9) exemplified resilience trade-offs with the coastal urbanization in Simbo: Improved access to medical services increased the resilience of people to diseases, but the new settlement location made them more vulnerable to tsunamis. To avoid or to understand such possible trade-offs, operationalizing resilience (and transformation) may thus succeed by taking into account multiple scales at once (Carpenter et al.

8 This is what landscape architects generally do because landscapes are complex! (See also Bava 2010:124)

2001; Walker and Salt 2006; Folke et al. 2010; Birkmann et al. 2012). Reducing negative resilience, vulnerability, constraints, and undesirable states or features, as well as increasing adaptive capacity, are further important aspects of building resilience (Ribot 2011; Birkmann 2013; Wu and Wu 2013; Meerow et al. 2016:44). Ideally, resilience goals as well as the understanding of socio-ecological systems are elaborated in multi-stakeholder workshops (e.g., Cumming et al. 2005).

The key message here is to be context-specific and precise, and to focus on goals and key elements (drivers of change and their indicators) while understanding the big picture. The questions why, who, what, when, and where serve for orientation.

4.1.2 Envisioning, scenario-building, and spatial design

Explorations, envisioning, and scenario-building are useful ways to apply resilience thinking and to test assumptions (Cumming et al. 2005; Folke 2006; Folke et al. 2010; Erixon et al. 2013). Such approaches are habitual for design. Lister has called for an "evidence-based approach that contributes to adaptive and ecologically responsive design in the face of complexity, uncertainty, and vulnerability" (2015:16). Erixon and colleagues have demonstrated the potential of "tentative designs" (2013). Experimenting at the interface of urbanism and disturbance ecology – and islands! – Barnett and Margetts (2013) developed landscape-dynamic-based bottom-up "disturbanism" as a basis for resilience.

Table 4.1 sums up resilience-building principles and strategies from the field of urban planning and design. While some aspects are quite lucid, connectivity or permeability and redundancy deserve an explanation: Connectivity, or landscape permeability, "defined as the number of barriers and degree of fragmentation within a landscape," allows continuity of ecological flows (of species and natural processes) and increases resilience by facilitating range shifts and the reorganization of communities (Anderson, Clark, and Olivero Sheldon 2012:2). It also encompasses mobility – that is, how a spatial structure facilitates the capacity of people (and, why not, of fauna and flora) to evacuate (Albers and Deppisch 2013:1602). Redundancy means a diversity of responses or availability of workarounds when multiple elements can deliver a similar function (Biggs et al. 2015). It is associated with diversity and resourcefulness (Cimellaro 2016:39), which usually means the (innovative) capacity of a community to use resources (Birkmann et al. 2012). This involves the amount and diversity of materials, equipment, and spaces at hand.

Resilience principles are interdependent: For example, landscape complexity, or topographical and habitat variation, entails a range of options and thus supports both the maintaining of functions (or species) and adaptive capacity (Anderson et al. 2012:3). Large-scale structures enhance diversity (Erixon et al.

2013). Resourcefulness can create redundancy, and vice versa. Understanding of the relationships and cross-scale interactions can be taken into account by designing all scales at once instead of a hierarchical planning process – however, in an urban context, it is meaningful to start with ecological principles and proceed to social needs (Erixon et al. 2013).

Concrete examples of resilience-building in urban landscapes include incorporating adaptability to new designs and structures, or the possibility of modifying an existing spatial configuration (Albers and Deppisch 2013). Redundancy can be embedded in polycentric (settlement) structures (Idem:1604), decentralized infrastructure (Sharifi et al. 2017), or ecological mosaics. Modularity of components can facilitate recovery and provide flexibility for re-arrangement (Ahern 2011; Albers and Deppisch 2013; Mehrotra and Vera 2015). Open spaces, soft infrastructure, and hybrid engineering play an important role in the provision of stabilizing and buffering capacities in the face of climate change disturbances and adaptation to them (Albers and Deppisch 2013:1605–06; Lister 2015). "[S] pecific land uses for only a limited period" (Albers and Deppisch 2013:1606) or "intertwining/combining functions, stacking or time-shifting" (Ahern 2011:4) help to achieve flexibility and multifunctionality. Such ideas resonate with the seasonality approach of this thesis.

Finally, Barnett and Margetts have underlined that "[t]he production of urban resilience requires us to work directly with urban landscape systems, on their own terms, using their own systemic potentialities" (2013:458). In this sense, the urbanism analysis of Kumbh Mela (Mehrotra and Vera 2015) as a very site-sensitive project provides interesting lessons about resilient urbanism: The unique elasticity – in building components, organization, and spatial plan – of the "ephemeral city" accommodates a flow of people and goods to the religious bathing event that transforms a flood plain into a city accommodating five million residents and 20 million visitors for 55 days every 12 years. Its reversibility is a particularly interesting principle with respect to seasonality. Kumbh Mela also represents the capacity to re-arrange and self-organize, which is a socio-ecological resilience component (Carpenter et al. 2001; Cumming et al. 2005; Folke 2006).

The key characteristics of resilience in the field of urban and landscape planning and design are summarized in table 4.1. The principles serve as overarching goals that can be translated into a spatial dimension, although they cannot be oversimplified. They are interlinked and form paths. Cross-scale interactions of systems are important – thus, multi-scalar and integrative (of social/ecological/technical systems) design processes support resilience-building (ResilientCity.org 2017; Ahern 2011; Erixon et al. 2013; Pickett et al. 2013). Resilience-building has to be context-specific. With creativity and critical thinking, indexes or toolkits (ARUP and The Rockefeller Foundation 2015) help to identify key topics, and

Table 4.1 Resilience principles for landscape and urban design/planning.

	Author	resilience principles and characteristics
GENERAL	Carpenter et al. 2001	the capacity to **self-organize**, **ADAPTIVE** capacity
	Walker and Salt 2006	**DIVERSITY**/complexity, **REDUNDANCY**, robustness, ability to recover (rather than speed), **modularity**
	Folke et al. 2010	Persistence, **ADAPTABILITY** and **transformability**
	Stockholm Resilience Center (Biggs et al. 2015)	Maintain **DIVERSITY** and **REDUNDANCY**, manage **CONNECTIVITY,** manage slow variables and feedbacks; foster complex **adaptive** systems thinking, encourage learning, broaden participation, and promote polycentric governance systems.
	UN-Habitat City Resilience Profiling Tool (2017b)	comprises resilience: persistent, **ADAPTABLE**, inclusive; enables resilience: integrated, reflexive, **transformative**
PLANNING & DESIGN-DISCOURSE	Ahern 2011, 2013	**DIVERSITY** (biological and social), multi-scale networks and **CONNECTIVITY**, **multifunctionality**, **REDUNDANCY**, and **modularization**, adaptive planning and design, "safe-to-fail" design experiments
	Albers and Deppisch 2012	planning foresight, **DIVERSITY**, **REDUNDANCY**, **FLEXIBILITY and ADAPTABILITY, modularity,** interdependency; stabilizing/buffering (capacity to resist or absorb), and **MOBILITY**
	Anderson et al. 2012	Landscape **COMPLEXITY**, landscape **PERMEABILITY**
	Barnett and Margetts 2013	**Self-organizing**, **ADAPTIVITY**, absorbing change, **integrative**, working directly with urban landscape systems, bottom-up design
	Erixon et al. 2013	**DIVERSITY**, legibility; handling multiple scales at once; **integrative** framework
	Pickett et al. 2013	spatial **HETEROGENEITY** and multi-scalar dynamic ecological and urban mosaics, **FLUX** of water in the urban realm, consciously designing **shifting** and **FLEXIBLE** systems and the engagement of social actors, as well as processes and agents of urban organization in design
	Wu and Wu 2013	designing patch dynamics, investing in natural capital, reducing negative resilience and developing **transformability**
	da Silva et al. 2012, and ARUP and the Rockefeller Foundation 2015	**FLEXIBLE**, inclusive, robust, reflective, **REDUNDANT**, integrated, **resourceful,** safe-to-fail, responsive
	Mehrotra and Vera 2015 (own interpretation)	**ADAPTATION**, robustness, **modularity** and **REDUNDANCY**, **FLEXIBILITY**, steered **HETEROGENEITY**, **self-organization**, identity, and **reversibility**. **Elasticity** in building components, organization, and spatial plan

site-specific actions can be derived from them. Resilient designs are proactive, adaptive, and provide transformative capacity (Ahern 2011; Albers and Deppisch 2013; Wu and Wu 2013; Pickett et al. 2013; Lister 2015).

4.1.3 Methodical challenges

Operationalizing theory to build and measure resilience is an intricate task (Walker and Salt 2006; Birkmann et al. 2012; Garschagen 2014; Meerow et al. 2016). First of all, systems are complex, and some resilience principles may be contradictory (Albers and Deppisch 2013:1602). Higher social resilience or ecological resilience does not directly contribute to an increase in socio-ecological resilience (Cumming 2011:9). Identifying stakeholders, defining goals, and considering lateral and cross-scale interactions of systems requires interdisciplinary expertise. Secondly, the dynamic implicit in resilience is challenging: When ecological systems and social contexts change, initial observations may not be appropriate (Carpenter et al. 2001:779). For example, climate change brings about increasing uncertainty. Much of the literature highlights assessment of existing systems, and being proactive is challenging (e.g., Kiribati, in UN-Habitat 2017a:115). During a design and planning process, an understanding of resilience is subject to evolution (Erixon et al. 2013).

When it comes to measuring resilience, it is pivotal to ask why resilience is assessed: Quantifiable indicators may not be meaningful in cases that are assessed for normative reasons (Birkmann et al. 2012:10–14). Resilience can only be measured against change (Cumming et al. 2005:978). However, that is the very challenge in "constantly re-shaped" systems (Birkmann et al. 2012:13). In design, it is important to resolve how much change is tolerated (Lister 2015:20). "[H]ow the communities actually change – which species will thrive and which ones won't – is dependent on a myriad of interactions, disturbances, starting conditions and arbitrary events. If the outcome is completely predictable, then there must be very few options or alternative paths available to the inhabitants which is a good definition of a vulnerable, non-resilient site" (Anderson 2012).

Although vulnerability may not be the opposite of resilience (see, e.g., Garschagen 2014), the quote above underlines that resilience-building efforts and their outcomes are complex and unpredictable. Designers and planners need to handle open-endedness and accept never having complete control (Erixon et al. 2013). Alternative designs or scenarios may complicate decision-making, because solutions may be resilient in different ways (Ibid). However, they can provide "[a] more multifaceted image of the landscape – as well as the possible future trajectories inscribed in it – [that] is essential in identifying win–win situations" (Idem:366).

The key lessons for resilience-building include: defining resilience of what to what, accepting complexity, being proactive, seeking to understand multi-scalar interdependencies, and accepting that complete control cannot be achieved through planning or design. As both systems and threats are constantly changing, any processes of building and assessing resilience ought to be continuous. Research through Design can integrate resilience thinking in an exploratory approach, trying out alternatives for resilience-building.

4.2. Island resilience

4.2.1 Special places: Vulnerable and resilient

One of the island paradoxes (see 3.2) is their simultaneous vulnerability and resilience. From tropical storms, tsunamis, and drought to oil spills, volcanic eruptions, and power outages, and so on, islands face internal and external hazards of natural and anthropogenic origin; globally viewed, they do not necessarily occur more frequently in islands than other regions (Lewis 2009:5; Hofmann and Lübken 2015). Yet, an "overwhelming proportional impact upon them, their inhabitants and their economies" distinguishes islands from other places (Lewis 2009:5). Island vulnerability to natural and human-made hazards is related to the smallness of their area, population, economy, and resources, to a concentration and exposure of people and infrastructure at the coastal interface, and to the appeal to be appropriated (Bass and Dalal-Clayton 1995; Briguglio 1995; Lewis 2009; Baldacchino and Kelman 2014; Fernandes and Pinho 2015; Mycoo and Donovan 2017).

In some islands, vulnerability originates from colonial oppression and monocultures (Anderson 1977:9; Bass and Dalal-Clayton 1995; Lewis 2009:8–10), histories of unsuitable models or locations for urbanization (not only in small island developing states!), and conflicts between inherited land and plantations (Barnett and Margetts 2013:446; Mycoo and Donovan 2017:25)[9] Stresses today include climate instabilities, uncontrolled settlement development, habitat fragmentation and loss, tourism and refugee landings, waste problems, and freshwater contamination and depletion (Lewis 2009; Fernandes and Pinho 2015; UN-Habitat 2015:27–8). Current urbanization trends engender vulnerabilities at an accelerating pace (Anderson 1977:9; Bass and Dalal-Clayton 1995; Lewis 2009:8–10; Barnett and Margetts 2013:446; UN-Habitat 2015; Mycoo and Donovan 2017).

9 Much of the vulnerability and resilience literature handles formerly colonialized islands in the so-called Global South, but for example, Greenland has been a colony, too.

Dealing with scarce resources and extreme weather events in their limited space, traditional eco-social practices and village patterns in many islands have been sustainable and resilient (Bass and Dalal-Clayton 1995; Campbell 2009; Lauer et al. 2013; Barnett and Margetts 2013; Hofmann and Lübken 2015). Barnett and Margetts (2013) have highlighted the self-organization capacity of Pacific island landscape systems in the face of disturbances. Instead of labeling islands either vulnerable or resilient, Philpot and colleagues have broadened the horizon by identifying a range of relationships between vulnerabilities and resiliencies (2015:43–4). Critical reviews of the (im)possibility of island sustainability stewarding global rhetoric and iconic eco-pioneering (Baldacchino and Kelman 2014; Grydehøj and Kelman 2017), and of the reduction of island resilience to a "celebration of indigeneity" (Pugh 2018:103) are justified. However, Mycoo and Donovan have highlighted that approaches and solutions implemented in small island developing states spearhead climate change adaptation (2017:153). As discussed in chapter 3 and here, not only is islandness a handicap, but islanders have also developed extraordinary strategies, unique resources, and disaster-management practices (Lewis 2009:10; Kelman et al. 2011; Fernandes and Pinho 2015). They are taken into account in this research – after a brief review of resilience-building approaches for[10] islands.

4.2.2 Disaster-risk reduction and ecosystem-based adaptation in islands

Among multinational development organizations, such as agencies and collaborations of the United Nations, the mainstream of resilience-building in small island developing states (SIDS) and, more recently, urban areas, centers on disaster-risk reduction (DRR), climate change adaptation (CCA), and their combinations. On an institutional level, for example, Global Island Partnership's Island Resilience Initiative addresses the resilient, sustainable, and equitable development of island communities (GLISPA 2018), and resilience appears in the SAMOA Pathway, an international action framework for sustainable development in SIDS (United Nations General Assembly 2014). The abundance of initiatives, partnerships, projects, and changing program names exceeds the scope of this research. Instead of a systemic inspection of the innumerable SIDS and urban resilience approaches,[11] I introduce landscape-related measures that could be helpful for the case studies of this thesis.

10 Here, rather "for" than "in" because the initiative or consulting often comes from multinational agencies.

11 For example, four of the ten cities participating at the City Resilience Profiling Programme are small cities on islands: Balangoda in Sri Lanka, Dagupan in the Philippines, Portmore in Jamaica, and Wellington in New Zealand. During the making of the thesis, their profiles were not published, but it would be interesting to see whether islandness plays a role.

In contrast to a prevalent institutional focus, the Blue Urban Agenda provides perhaps the first spatially concerned, action-oriented set of guidelines that frame "transformational adaptation" in the Caribbean and Pacific (Mycoo and Donovan 2017). The Small Island States Resilience Initiative (SISRI), supported by World Bank and the Global Facility for Disaster Reduction and Recovery, provides technical and operational support for practitioners (GFDRR 2016). Ecosystem-based adaptation (EbA) is the main umbrella of measures to increase climate resilience at the coastal interface of islands (Sovacool 2012; UNEP 2014; Mycoo and Donovan 2017). It stands for approaches that use "biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change. It includes the sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to the adverse effects of climate change" (CBD 2009).

Urban planning for islands should be risk-based and bottom-up (acknowledging traditional know-how, encouraging self-organization and responsibility), identifying unsuitable settlement locations and acknowledging informal settlements or actions, as well as landscape dynamics (Barnett and Margetts 2013; GFDRR 2016; Mycoo and Donovan 2017). The Blue Urban Agenda underpins three main strategies of climate change adaptation: protection, accommodation (e.g., raising homes), and planned retreat (Mycoo and Donovan 2017:71), exemplifying a review of case studies. For example, the town of Lami in Fiji (Idem:92–6) and the Maldives (Sovacool 2012) demonstrate combinations of measures that serve coastal protection: seawalls, sand replenishment, coral-reef propagation, and mangrove afforestation. Infrastructure protection and redundancy are important concerns in islands (e.g., Holdschlag et al. 2012; UNEP 2014), and resilient infrastructure, too, consists of mixed soft and hard elements (Sovacool 2012; Mycoo and Donovan 2017:193; SISRI 2017:8). Sovacool (2012) has recommended incorporating rainwater catchment areas, climate change proofing of drainage systems, and refurbishment of water storage tanks. The Blue Urban Agenda has advocated compact settlement forms with mixed uses and water-sensitive green infrastructure (Mycoo and Donovan 2017:193).

While foresight is necessary, overemphasizing long-term environmental development in the name of climate change tends to neglect more immediate aspects of island communities, education, health, and livelihoods (Baldacchino and Kelman 2014). This concerns spatial and landscape measures, because consecrating islanders' environments and resources can inhibit daily life (Ibid). Island communities and cultures ought to be prioritized by integrating local traditions and the know-how of livelihoods and environment; the economic diversification of the blue-green economy can contribute to resilient island systems (UNEP 2014:19–21).

As islands are very different, first of all, a consideration of different hazards (extreme, rapid events vs. slow-onset events) and profiles is important (UNEP 2014:29). None of the case studies in this thesis is a small island developing state, nor a "classical" vulnerable island in terms of the combination of low-elevation coastal settlements, economic hardship, and natural disasters. Although climate change is not the only impulse for resilience-building, lessons from the approaches presented can be adapted for their purposes. Landscape architectural designs often naturally incorporate ecosystem-based adaptation while being sensitive to spatial dynamics. Resilience-building needs to incorporate local strengths, and key resources that cannot be imported.

4.3. Resilience principles for urban islands

4.3.1 Key resources: Resilience cannot be imported

Before applying imported resilience-building strategies, I start by uncovering what is there – and what should stay there with regard to islands' resourcefulness. In a globalized world, self-reliance is not a norm: Like cities, islands benefit and be dependent from imports. However, to some extent, autonomy is important for survival and persistence in the face of disturbances, and for the capacity of islands to mitigate disasters and to adapt or transform. Resources like the very fascinating and unique islandness cannot be imported nor offshored from islands. In the context of urbanization and climate change, from the perspective of landscape design and urban development, I review key resources that are elemental for urban islands:

Territory, coastality, and **diversity of environments**
To start with, land, freshwater, and coasts are, environmentally speaking, the key resources of islands (Coccossis 1987:86). Loss of territory is a palpable concern for many small islands (UNEP 2014:41), as floating cities are yet to come. Territory and soil are needed, whether it be a matter of arable land or suitable ground for building and public open spaces. The latter may be critical in limited island spaces because they can adopt a multifunctional and adaptive role in building resilience of ecological and social systems. Spaces or elements that provide storm-water and flood-risk management, micro-climate regulation, and good air quality are needed locally, and so are environments that support livelihoods. Key ecosystems' functions cannot be imported, and their rarity cannot be relocated or substituted. Particularly in SIDS "biodiversity is essential for productivity, the functioning of ecosystems, and adaptability to climate change" (Mycoo and Donovan 2017:25). Coastal ecosystems are the most crucial in terms of erosion and flood protection, and marine livelihoods (Bass and Dalal-Clayton 1995; Fernandes and Pinho 2015; UN-Habitat 2015). The proportionately extensive sea-land interface and coastal landscape are multifaceted spatial and ecological

resources. If wisely managed, they provide a unique source of identity and diversity in social, ecological, and economic terms (PAP/RAC 2005; Fernandes and Pinho 2015; Mycoo and Donovan 2017). Heterogeneity of the (urban) landscape contributes to resourcefulness on site.

Basic amenities

Potable water, food, and energy can be imported, but their provision locally is important for resilience**.** On islands, freshwater resources are critical. Highly urbanized islands like the Bahamas, the Maldives, Singapore, Barbados, and Cape Verde have freshwater resources below the scarcity reference value (UN-OHRLLS 2015:27). Reverse-osmosis plants for desalinizing seawater are energy-intensive, such as in the case of Malta. High dependency on imported energy and food increase vulnerability. Agricultural practices traditionally form the closest interaction between ecosystems and societies (Vitousek and Chadwick 2013:1), contributing to the local understanding of natural dynamics.

Character, originality, identity, and engagement in urban landscape

I do not recapitulate the abundant landscape architectural theories on the topic here – but the concept of *Eigenart* (a German word for "character") has been coined by WBGU as every city's "own way" to facilitate sustainability transformations (2016:132): "*Eigenart* comprises all that is typical of every particular city. This can be described on the basis of its socio-spatial and constructed environment, its socio-cultural characteristics and urban practices" (WBGU 2016:142). Besides "specific uses of space and/or by urban practices […] it includes the population's right to create new urban space according to their needs" (Idem:143). In this thesis, *Eigenart* would refer to islandness, or rather, the specifics of each island that the case studies trace.

Flexibility and traditional knowledge

Island communities are often self-organizing and flexible social institutions, which allows them to react and operate promptly (Lauer et al. 2013:46–8, Ratter 2018:189). A local planning system with local ecological knowledge, traditional skills, and practices, including settlement patterns and infrastructure design (Lewis 2009:10; Lauer et al. 2013; Barnett and Margetts 2013:446; UNEP 2014), could support development of adaptive solutions and reactions, help build confidence, and facilitate change. Planning is related to governance, and, in this respect, the smallness and flexibility of island societies and systems may be assets. In principle, smallness supports manageability of land use, urban development, and the implementation of environmental policies and innovative solutions. In practice, cases like Malta (see 8.1.2) show that such causality is not straightforward.

These key resources, elements, and resourcefulness needed for resilience cannot be imported. The observations are exemplary and need adjustments according to each island and hazard context. What happens with the resources and how resilience develops partly depends on spatial processes within each island. Traditional resilience has often developed unintentionally, but in the face of urbanization, a need for planning is evident (Lewis 2009; Lauer et al. 2013; Baldacchino and Kelman 2014; UN-Habitat 2015), and islands deserve "more spatially sensitive approaches" (Chapman 2011:5). I postulate that, sensitized to island conditions and resources, new forms of urban landscapes can support islanders and their environment in recovering, adapting, and transforming.

4.3.2 Key principles for resilient islands

"*The production of urban resilience requires us to work directly with urban landscape systems, on their own terms, using their own systemic potentialities.*" (Barnett and Margetts 2013:458)

"*Given the impossibility of studying all aspects of any real-world system, some level of subjectivity in determining which system properties to study seems inevitable in any applied study of resilience.*" (Cumming et al. 2005:978)

Based on the readings presented in this chapter, the island case studies adopt resilience as a goal and an operative framework that guides design. The complex traits of island urbanization and resilience theory bring me to a straightforward starting point: On islands, everything is local and present. I envision that, in limited island landscapes, synergies such as combining infrastructure with leisure or treating waste as resource and spatial "recycling" or intensifying might be inevitable. I hypothesize that intensification can also happen through temporal strategies such as rotation of activities in a certain area, or seasonally adaptive infrastructure. Such measures may also contribute to flexibility in the longer term, enabling islands to reconfigure their spaces in the face of new forces and lack of hinterland. Referring to the scarcity of land, I wondered earlier where islanders might grow food, dump waste, bury bodies, or jog. Instead of asking where and how, should we ask when?

So far, in this research about dynamic urban islands, I have written little about seasonal dynamics (see 2 and 3.4). That is because seasonality is novel terrain in the context that this thesis proposes: In the case studies, this thesis centers on the spatial dimension of seasonal phenomena on islands, and their role as stressors or potentials with respect to resilience-building. In landscape architectural projections, I have tested the hypothesis that understanding seasonal phenomena can contribute to resilience in islands. The idea is to discover ways to build the resilience of islands against seasonal disturbance, with interventions in open spaces and/or urban landscapes. Disciplinary limitations are acknowledged in chapter 6.2.

To guide and evaluate the efforts of resilience-building in the case study projections of this thesis, a set of principles and case-specific goals and criteria or indicators are needed. Based on island spatiality and urbanization, and against the background of the resilience characteristics highlighted earlier in this chapter I postulate that the following resilience characteristics, paths, and measures are particularly critical, challenging, and meaningful for urban islands:

1. CONNECTIVITY: continuous green structures and open spaces, allowing ecological flows (species, hydrology, and organic matter) and recreational mobility, avoiding fragmentation typical of islands, and facilitating reorganization of flora and fauna. Potential weakness: also allowing harmful flows.
2. DIVERSITY: promoting large green structures and heterogeneous mosaics, increasing a range of options, avoiding single-use areas and structures. Potential weakness: diversifying land uses or habitat types at the cost of sufficient size in small, bounded island spatiality.
3. REDUNDANCY/RESOURCEFULNESS (closely linked with diversity): availability of resources and "workarounds," locally providing a range of options and resources for maintaining, restoring, and adapting key functions and flows, and thus contributing to the ability to rearrange, which, in turn, increases adaptive capacity. Difficulty: requires ecological modeling.
4. FLEXIBILITY: promoting multifunctionality, synergies and optimizing use of space with, for example, adaptive spatial structures and time-shifting. Potential weaknesses: too much open-endedness, loss of characteristics, and resistance.
5. REVERSIBILITY (part of flexibility but deserves a separate mention): may be a useful principle with respect to seasonal disturbances and limited island space.

Beyond resistance or coping with change, these principles contribute to adaptive capacity. They can be employed to maintain and restore (pre)existing functionality and systems, or incorporated to explore ideas and introduce completely new and desirable (ecological) connections and flows, spaces and habitats, functions, and species. This is a preparatory list that is not meant to provide a hierarchical order. It is also meaningful to remember that these general principles of resilience can also have negative influences or trade-offs. Therefore, a case-specific understanding of the situation, processes, and multi-scalar interconnections or paths is relevant. Relevant principles may vary according to specific characteristics of an island and its goals of resilience-building.

The case studies address the resilience of entire islands as social-ecological or urban systems to the overarching stresses of urban expansion and climate change. The strategic focus is on seasonal human-made and natural hazards and disturbances. The interventions handle open spaces, and systematic parts or processes connected to the whole. The questions of resilience of who to what/when/where and resilience principles are considered separately in each case, drawing on theory and the specificities of islandness. Particular goals and indicators of resilience-building are defined in each case study. The effects of the case study projections in potentially increasing resilience has been qualitatively evaluated by discussing the outcomes against the resilience principles and key lessons from this chapter. In my conception, DYNAMIC URBAN ISLANDS are the outcome of islandness + the Anthropocene + resilience. Seasonal dynamics are embedded in these three dimensions.

Summary

Resilience is the capacity of a system to deal with rapid and long-term change, including internal and external stresses, while maintaining its essential and characteristic functions, and developing or undergoing change. While critiques have pointed out the difficulties of operationalizing and measuring resilience, emerging projects and tools have also paved the way in the field of urban and landscape planning and design. Resilience is expressed in principles or characteristics that tend to be detached from spatial context and are sometimes in conflict. Therefore, defining the case-specific goals of resilience-building – of "what to what" – is essential. While careful assessment or the status quo lays the basis for any intervention, envisioning and scenarios are needed to operationalize resilience-building efforts. Such forward-looking and exploratory approaches are natural for design. Understanding and accepting the dynamic nature of systems and threats is necessary for working with resilience. In islands, resilience-building approaches center on disaster-risk reduction and climate change adaptation. In the socio-environmental sector, ecosystem-based adaptation measures at the coastal interface and in settlements are widely recommended.

Paradoxically, islands are, at the same time, described as vulnerable and resilient. While the vulnerability of islands is often attributed to their geography and import dependency, island societies are described as flexible and innovative. Considering their assets, compressed complexity, challenging spatiality, and traditional knowledge, islands provide potential to pioneer in resilience-building. Design and planning that is sensitized to the peculiarities of island spaces and islanders' livelihoods is needed. Resilience cannot be imported.

In landscape architectural projections, this thesis sets out to address the resilience of islands as socio-ecological or urban systems in the face of seasonal disturbances. It explores ways to translate them into (spatial) measures of resilience-building in the specific contexts of the case study islands. The case study projections have been evaluated against the following resilience principles, developed for dynamic urban islands: connectivity, diversity, redundancy/resourcefulness, flexibility, and reversibility, with specific emphasis defined in each case.

Dynamic urban islands are the constantly changing outcome of islandness + forces of the Anthropocene + resilience.

III PRACTICING

This section describes and contextualizes the methodical approaches of Research through Design and case study research. Along with the body text, I include reflective excerpts of their application in practice in this thesis. Besides introducing the chosen methodology, I make two points: Firstly, I argue that Research through Design can be positioned in the field of transformative research. Secondly, I demonstrate that methodological awareness about case selection – to which attention is usually paid in landscape architecture – is a knowledge-generating process that has commonalities with Research through Design.

5. Two approaches

"*Research is the curiosity-driven production of new knowledge. It is the process oriented toward the realm of possibilities that is to be explored, manipulated, controlled, given shape and form, and transformed. Research is inherently beset by uncertainties, since the results or outcomes are by definition unknown.*" (Nowotny 2010:xvii)

In this PhD thesis a combination of case study research and Research through Design has been chosen as the methodology in order to: 1) understand the topic (of spatial-temporal dynamics on urban islands), 2) test the hypothesis by exploring seasonality as an agent in design, and 3) produce both practical and theoretical new knowledge. Case studies are frequently used in landscape architectural education, research, and practice. Design is the central activity of the discipline in addressing problems and developing spatial or conceptual solutions, visions, and strategies. So far, there have been many case studies about designed projects, but conducting research in case studies through design has only been increasing recently (Verbeke 2015; Prominski 2016; Swaffield 2016). It is an essential way of developing methodology and scientific thinking in landscape architecture, and it helps to engage with other disciplines (von Seggern and Werner 2008; Lenzholzer, Duchhart, and Koh 2013; Weidinger 2015; Prominski 2016).

As research objects, urban landscapes and design processes – and the latter as a method – are complex by nature (Prominski 2004; von Seggern and Werner 2008; Giseke 2010; Lenzholzer et al. 2013; Jonas 2014; Reed and Lister 2014). Both case study research and Research through Design are highly appropriate for answering the research questions at hand and for developing a transferable method of designing urban landscapes. Scholars refer to the suitability of the methods in:

- understanding complexity in real situations
- gaining expertise and practical skills
- testing new ideas and concepts
- developing theory
- communicating insights
- serving interdisciplinary engagement

(Yin 1994:3; Francis 1999:10; Flyvbjerg 2004; George and Bennett 2005:19; von Seggern and Werner 2008:87; Lenzholzer et al. 2013)

In this doctoral thesis, the methods occur in parallel and intertwined. To start with, the motivation to conduct Research through Design influenced the research question formulation and case selection. The actual island-specific Research through Design took place after selecting the cases, but a design approach was also essentially part of the cross-case overview, which was the phase where the two methods particularly overlapped. This thesis has emerged as a non-linear process of applying a suitable method to answer the research questions and exploring suitable cases to develop design methodology. Design, or projecting in the selected cases, is the central process of forming new knowledge. In and around case studies, research for and about design – that is, in the form of literature research across disciplines, and analyses of existing designs – forms a contextual background and theoretical frame, provides valuable information and ideas, and helps to build links to theory and other disciplines. As a whole, I consider this thesis an example of Research through Design.

5.1. Research through Design in landscape architecture

"*In terms of research by design, the act of designing is the key process to develop understanding and knowledge.*" (Verbeke 2015:79)
"*The act of designing as a means to answering a research question*" (Prominski 2016:27).

Research through Design is a category of design research that has gained ground since the 1990s. In landscape architecture, it usually means acquiring or "creating" both theoretical and practical knowledge through the act of designing (von Seggern et al. 2008; Moore 2010; Jonas and Monacella 2012;

Jenner 2013; Verbeke 2015; Prominski 2016). For a discipline that looks for solutions to complex natural and urban issues, exploratory design processes are the central, most natural and comprehensive way to answer research questions (Lenzholzer et al. 2013; Reed and Lister 2014; Prominski 2016). Before discussing the characteristics of a design process and what qualifies design as research, I give a brief picture of some outcomes and forms it takes.

Typically, Research through Design in landscape architecture happens with the help of (and/or by producing) various analog and digital media, such as sketches, drawings, concepts, spatial plans, graphics, models, reports, guidelines, and even videos. Scales and topics vary from small objects or exhibitions to gardens, parks, cities, blue-green infrastructure, and regions – like any landscape architectural design that might be visionary and/or implemented. Many Research-through-Design projects or processes in landscape architecture focus on environmental and urban issues on a relatively large scale (e.g., Viljoen, Bohn, and Howe 2005; von Seggern et al. 2008; von Seggern 2012; Gemeente Rotterdam et al. 2014; Giseke 2015). Individual doctoral theses embed professional practice and/or teaching to grow a body of knowledge. They explore particular design tools and methods, such as playing, walking, narrating, landscape urbanism, and so on (Shannon 2004; Janssens 2012; Langner 2013; Schultz 2014; Kania-Feistkorn 2017; Schmidt 2018) to understand complex phenomena, develop methodology, and answer research questions. Beyond universities, trans-disciplinary design labs address environmental challenges by bringing stakeholders and experts into dialogue (Westley and McGowan 2014:294–5). These can be seen as analogous to "real-world labs" of transformative research (Schneidewind et al. 2016), where the expertise of design and planning disciplines in producing ideas and visualizing alternative scenarios is highlighted (Alcántara et al. 2018:286).

What distinguishes research from a design project is critical reflection on the process and outcomes within a theoretical framework and drawing transferable conclusions from specific cases (Prominski 2016). In order to go beyond a singular project or piece of art, a research project in creative disciplines – just like any other – qualifies scientifically by being a systematic inquiry, knowledge-directed, and transparent (Archer 1995). Further guidelines and critical texts address requirements of scientific practice in the arts and creative disciplines, and support qualification of design as research in the academic context (e.g., Borgdorff 2006; European Association for Architectural Education 2012; Verbeke 2015). According to Frascati Manual, acknowledged worldwide, (scientific) research and experimental development is qualified and measured according to the criteria of novelty, originality, uncertainty, systematic process, and transferability or reproducibility (OECD 2015:46–8).

In this thesis, the definition of Research through Design is based on the conception that "the act of designing is the key process to develop understanding and knowledge" (Verbeke 2015:79), and to applying "[t]he act of designing as a means to answering a research question" (Prominski 2016:27). There is no single format for Research through Design, and it is also generally called Research by Design. Lenzholzer and colleagues introduced the term "research through designing" to highlight the active employment of design (2013:121). Although definitions vary and are sometimes debated, in recent times, a great number of publications have considered design processes as a meaningful mode of research and knowledge generation (Prominski 2004; von Seggern et al. 2008; De Maeyer 2011; Jonas and Monacella 2012; Engels-Schwarzpaul and Peters 2013; Lenzholzer et al. 2013; Buchert 2014a; Weidinger 2015; Prominski 2016).

Here, being systematic and rigorous does not refer to a linear structure of a research process. A colleague insisted: "Why is it called Research through Design? Isn't it first research and then design?" To explain why design can be an integrated or inseparable part of the research, and not a posterior application of findings from an analysis, I look for answers in the non-linear and reflective nature of a design process.

5.1.1 Non-linear, reflective, self-critical, and application-oriented

Research through Design can, to some extent, be distinguished from research that informs design (research for design) or from research on carried-out design projects and processes (research into/about design) (Frayling 1993; Lenzholzer et al. 2013; Verbeke 2015). Johan Verbeke has insisted that a process should only be regarded as "research by design" (this thesis employs the term Research through Design) when design practice is the primary way of insight-seeking, realization, and knowledge creation – representing both the "actual methods and outcomes of the research itself" (2015:67, 81–2). Margitta Buchert's "reflexive design" (2014b) suggests a sequence of "research and design." While design or creative practice may take place only in some phases of research, Martin Prominski underscored that a design process in a research context usually integrates all three aspects (2016:28–9). He continued to argue that combinations of the categories are inevitable in order to position design as scientific research in a broader context, and to produce transferable results.

In this thesis, I consider research *for* design to be all the work to gather and analyze information about islands, seasonality, and theory. However, to carry out such steps, I have used design tools such as intuitive typologies, renaming, and selective/interpretative/abstract mapping for the cross-case overview, or quick diagram-sketches to organize thoughts. Moreover, the whole PhD can be considered as research *for* design because it hopefully can inform future designers and projects, including those in other locations (e.g., Prominski 2016:28–9). Here, research *about* design includes not only the reference projects I have studied from other designers, but also inspecting and reflecting my process. Thus, research about and for design as traits of design research can be part of Research through Design. At times, the modes are difficult to discern, because, even during analyses, the projective goal is present in mind. Aside from objective information, I selectively and serendipitously look for applicable information, ideas, and the purposeful employment possibilities of my method.

Research about and for design proceed in parallel with design, because a design process is non-linear (von Seggern et al. 2008) and reflective (Schön 1983; Buchert 2014b). Donald Schön (1983) described "reflection in action" employed in a design process, which simultaneously uses both sketching and conversation to communicate and to investigate alternative solutions. The act of drawing "talks back" to the designer, and, going in cycles, a task is reframed and reworked, and the designer evaluates design decisions and their consequences, potentials, and problems (Idem:101). This iterative "web of moves" proceeds by balancing creative freedom and given imperatives (Idem:99, 101). An openness to being distracted, what Braae and colleagues called practicing "intentional serendipity" (Idem:194), can alter the course of Research through Design. Altogether, these elements – non-linearity, reflection, openness, and the iterative – play a central role in the process of gaining insights and being innovative. Thus, it is not simply first research and then design.

In academic circumstances, I have witnessed a public view considering design as a creative and hence subjective practice. The scientific viability raises critical questions, mainly from other disciplines, but also from designer peers: "That subjectivity is a problem. How can you credibly reflect on [read: objectively analyze] your own creative work?" Here, building on Bourdieu's reflexivity – being conscious of how oneself as a researcher influences undertakings – Buchert has called attention to a "self-critical way of thinking in design practice" that can qualify scientific knowledge production (2014b:34). Schön's analysis of a designer's reflective practice (1983: 95–97) demonstrates "normative design domains" that are rationally and pragmatically used to "evaluate [spatial or design] problems, consequences, and implications" even if the spoken and drawn language includes "feelingful or associative terms," and the result is not merely functional but something that the designer "likes." This exemplifies how a design process is in part subjective, yet critically self-reflective and aware of the implications of each decision. In this thesis, I transparently reflect the design process and outcomes (see 6.2 and projections in case studies). However, to my colleague, I wanted to say, "That subjectivity WAS a problem…," shifting attention to currently topical qualities in science.

Research through Design calls traditional scientific norms into question (e.g., Prominski 2004; von Seggern et al. 2008; Engels-Schwarzpaul and Peters 2013; Weidinger 2015). However, academic agreement as to what knowledge is has been challenged to expand to include different conceptions and types, such as tacit knowledge (Polanyi 1967), practical experience and reflection in action (Schön 1983), and creating or designing knowledge (e.g., Prominski 2004; von Seggern et al. 2008; Janssens 2012; Weidinger 2015). The emancipation of creative disciplines takes place in the context of a paradigm shift in science, conceptualized in Gibbons and colleagues' (1994) model of Mode 1 and Mode 2 knowledge production. Prominski positioned design in Mode 2 sciences, because both are contextual, temporal, and application-oriented (2004:106–7). The quality of design is not measured in accumulation of generalizable truths, but in usability and providing the best possible solution for a certain context (Wolfgang Jonas in Prominski 2004:105–6). Besides meeting the "general criteria of originality, significance, and rigour" in their Criteria and Characteristics for Quality, the European Association for Architectural Education underpins relevance for practice, and reckons that architectural research "explores emotional, intuitive and/or artistic aspects of the domain" (2012). In these conceptions, subjectivity does not erode the qualification of the knowledge gained in the process. In fact, I make the interpretation that the critique signalizes the difficulties of trans-disciplinary communication (Nowotny 2006), an emerging issue in the context of sustainability transformations. This incentivizes shifting focus to the integrative and projective qualities of Research through Design.

5.1.2 Integrative assets

"*The specific quality of the activity of design lies in the conscious combination of analytical, intuitive and emotional faculties […] in order to grasp complex relationships and consequently to formulate possible solutions.*" (von Seggern and Werner 2008:37–9)

"*[Design] can integrate the knowledge gained in the process projectively.*" (Buchert 2014b:42)

Both space (urban landscape, see 1.1.3) as a medium and the process of design are integrative. Schön's "reflection in action" describes how an expert integrates rational and subjective threads, practice and theory (1983). Furthermore, incorporating different modes of discovery, perception, projection, and types of knowledge is central for design (von Seggern and Werner 2008; Janssens 2012; Braae et al. 2013; Buchert 2014a; Corner 2014; Schultz 2014; Verbeke 2015). Landscapes consist of more than physical attributes. Thus, subjective engagement and intuition allow sensing, experiencing, understanding, interpreting, and making apparent intangible aspects and abstract qualities of space, such as atmosphere, dynamics, and cultural meanings (von Seggern and

Werner 2008:39; Braae et al. 2013; Schultz 2014). Design processes also often explore across disciplines, such as ecology, sociology, urbanism, hydrology, geology, fine arts, and so on, and involve multiple actors to be informed and inspired. Besides being transdisciplinary (Doucet and Janssens 2011), the task of designing urban landscapes incorporates both implicit and explicit knowledge (Schultz 2014:284), and projectivity as a poetic mode of knowledge-building (Janssens 2012:218).

Design deals constantly with complexity – unpredictability, processes, and relativity – and a specific context (Prominski 2004:23–5, 116). Therefore, to develop expertise, a (design) practitioner requires more than theory and analytical rationality (Flyvbjerg 2004:120). The subjective, implicit knowledge, embracing uncertainty and heuristics, are essential to discovery, creativity, and the projective capacity of design, and any research (see Flyvbjerg 2004; Polanyi 1967). James Corner advocated that a fusion of subjectivity, art, imagination, and poetry can renovate instrumentalized problem-solving – and create not only alternative forms of landscape, but also meaningful "relationships between people, places and earth" (2014).

Whether investigated or produced, landscapes integrate physical and abstract qualities, functions, topography, users, and meanings. Design integrates modes of discovery, types of knowledge, disciplines, theory, and practice – and the subjective and the rational. Research through Design integrates:

- Practice & theory
- Analytical & interpretative & projective/visionary modes
- Types of knowledge (explicit and implicit) & experience, uncertainty, and heuristics
- Subjective & objective; rational-technical & intuition
- Modes of inquiry & perception
- Multiple disciplines & stakeholders: knowledge, methods, teams
- Space/landscape as a medium integrates physical & abstract qualities (forms, functions, meanings, actors, etc.)

(von Seggern and Werner 2008:39; Moore 2010; Doucet and Janssens 2011; Braae et al. 2013; Lenzholzer et al. 2013; Corner 2014; Prominski 2014b; Schultz 2014)

An integrative and transdisciplinary approach is necessary for understanding urban landscapes, and particularly for the forward-looking nature of design: It is the integrative capacity that allows for "creating knowledge" (von Seggern and Werner 2008:39). The subjective-objective debate loses weight, because the ability of research to address topical environmental and societal issues gains more relevance. Integrative capacity, intuition, and the experimental nature and uniqueness of each design process, as well as the openness of both process and results, are key qualities in producing applicable new knowledge about urban landscapes. They also enable questioning of existing models and forms. The following chapter highlights this transformative potential of designing urban landscapes and suggests embedding Research through Design in transformative research.

5.2. Research through Design as transformative research

"*Transformative research aims at paradigmatic change and adopts a normative position. It is oriented towards a more sustainable society and wants to contribute actively to the transformation processes needed to achieve this goal.*" (Schneidewind et al. 2016:8)

"[*W*]*ith the advent of an ecological Anthropocene, design becomes the nexus of mediation between the social, the subjective and the ontological. … For authorising design through scientistic metaphor or mandate, design becomes perhaps the central practice and way of thinking about our ecological condition and of intervening within it.*" (Hight 2014:101)

Design is "oriented towards development" (von Seggern and Werner 2008:35). It "[tries] to project into the future, and thus to change things" (Verbeke 2015:79). The driver for this thesis is the expected capacity of Research through Design to produce integrated and solution-oriented knowledge for complex challenges such as urban resilience. Here, I return to the word "transformation," which means a thorough or dramatic change in the appearance, medium, character, or function of an object, organism, or system. It comes from the Latin *trans* ("across") and *formare* ("to mold, make up, or organize"). Hence, first of all, landscape architecture is transformative in the literal sense of shaping and re-using existing spaces, places, and landscapes and their processes (Braae 2015). Secondly, based on the qualities presented in this chapter, I delineate Research through Design as transformative research (see chapter 1.2).

Braae positioned transformation as a form of design practice and theory, of changing something into something else – in contrast to conservative restoration or an obsession with novelty (Braae 2015:278–81). Design can also produce objects, materials, functions, concepts, spaces, and systems that challenge customary practices (Buchert 2014b:46; Corner 2014; Hight 2014). For Corner (2014), both ecological and creative processes represent effective transformative powers for landscape architecture to employ. Many approaches and projects, from Landscape Urbanism (Waldheim 2006, 2016) to Water Atlas Hamburg (Studio Urbane Landschaften 2008), illustrate the transformative potential of designing urban landscapes (see also 1.1.3). Projecting beyond perceived reality and the imaginary, designers can show possible worlds and hypothetical futures (Janssens 2012:210–18).

Transformative research supports change through concrete innovation and is application-oriented (WBGU 2011:23–4; Schneidewind et al. 2016). The goal of transformative science is to catalyze societal change processes and advance sustainability (Schneidewind et al. 2016:6–7). Building on a reflexive modernity and Mode 2 sciences, transformative research is trans-disciplinary and integrates different types of knowledge (Idem:4–6). In doing so, it adopts an approach common to design: "From an epistemological point of view, transformative research can be related to the tradition of pragmatism, where the strict separation of knowledge and experience disappears" (Schneidewind et al. 2016:8, based on John Dewey). Moreover, "[t]ransformative research and research programmes should be reflexive and adapt flexibly to problem situations" (WBGU 2016:30). This reminds one of designers' typical working mode in context-specific and non-linear processes explained in 5.1.1. Transformation is pursued through the participation of science in society, in "real-world labs" (Schneidewind et al. 2016), and Transformation Labs (Pereira 2017).

I argue that landscape architectural research can provide meaningful contributions to transformative research. As previously demonstrated, subjectivity and poetics incorporated in design can purposefully enrich a plain rational-analytical problem-solving approach: They expand observations and diversify the means of knowledge production. A projective mode of research can catalyze transformation by stimulating reflection and novel ways of conceiving futures (Janssens 2012:223). By integrating different modes of inquiry and projection, as well as types of knowledge, designing urban landscapes challenges existing scientific practices and theories. It often aspires to change beyond sustainable spatial solutions: Contemporary landscape architecture seeks ways to encourage meaningful engagement with nature and awareness of humans about natural dynamics (Janssens 2012:214–15; Corner 2014; Hight 2014:100–1; Prominski 2014a; Reed and Lister 2014). Christopher Hight emphasized the integrative and transformative role of design disciplines in the Anthropocene "to coalesce heterogeneous and often contradictory social, cultural and natural factors into coherent expressions … and finally, the affect of the design in altering, constructing or reconfiguring both the social subject and the environment around it" (2014:100). In such pursuits, the combination of heuristics, intuition, serendipity, and a poetic mode of thinking and making helps to achieve outcomes that objective reasoning and technical problem-solving alone cannot accomplish.

Designers increasingly often assume the role of mediators between expert teams and users, and as facilitators of participatory process. This enables a transfer of different types knowledge between academia and society, and a development of new models of creative cooperation, for example, in design labs (Westley and McGowan 2014; Alcántara et al. 2018). Embedded in a research context, a design process can produce specific and transferable new knowledge that contributes to transformative science. By suggesting new forms of urban landscapes that encourage engagement, design has potential to foster changes in urban ecological systems and societal attitudes towards more sustainable futures. This echoes the aspirations of the emerging transformative science to produce systems knowledge, target knowledge, and transformation knowledge – that is, knowledge about what is, visions about what should be, and practice-oriented knowledge about how to direct desired change. In this pursuit, the processes and means of knowledge production in Research through Design can be highly useful. I suggest positioning Research through Design in the field of transformative research, because it is paradigm-shifting, integrative, and projective.

5.3. Case study research

Previously, this chapter highlighted the call for conducting Research through Design in case studies, and the joint advantages of both methods are summarized in the introduction. This chapter introduces the case study as a research method and focuses on the selection, which often seems to be ignored in landscape architecture (Swaffield 2016:105). Transparency reveals unexpected similarities between case-study selection and non-linear design processes.

Most landscape-architecture education comes about in case-study format by lecturing about or examining projects and by executing design tasks. Mark Francis has stated that "case studies are a way to build a body of criticism and critical theory and to disseminate the effectiveness of landscape architecture outside the profession" (1999:9; see also Swaffield 2016). According to geographer Bent Flyvbjerg, case study research in a real-world context is an appropriate method for understanding a complex issue, and developing expertise or practical skills (2004). Moreover, case studies are useful not only for hypothesis generating but also for testing them (Flyvbjerg 2004; George and Bennett 2005; Gerring 2006). Swaffield mentioned the suitability of case studies integrated with Research through Design (2016:114). Strategic selection of purposeful cases and reflection in a broader context is essential for meaningfulness and scientific validity (Flyvbjerg 2004; Gerring 2006; Swaffield 2016).

Political scientist John Gerring defined a case study as "an intensive study of a single unit for the purpose of understanding a larger class of (similar) units" (Gerring 2004:342). In social science, George and Bennett defined a case as "an instance of a class of events … that the investigator chooses to study with the aim of developing theory" (2005:17–18). For landscape architecture, Francis suggested the following: "A case study is a well-documented and systematic examination of the process, decision-making and outcomes of a project, which is undertaken for the purpose of informing future practice, policy, theory, and/or education" (1999:16). The case study in itself is not a method that says how to proceed within a case: That depends on the research field and purpose.

In my Research through Design, case studies are intensive, exploratory studies of urban islands for the purpose of understanding their seasonal-spatial dynamics and developing a transferable design approach. The latter is, at the same time, the means and the outcome of the case studies (see 5.1). In this thesis, three case studies test the seasonality hypothesis (see 2) by design. I have used an in-depth case study to produce a spectrum of ideas and develop the design approach in a specific, real context that could also concretely benefit from the results.

5.4. Case selection for Research through Design

In order to test a seasonality-driven design approach for resilience-building in islands, a purposeful set of cases had to be found for the Research through Design. For the depth of the design task and a range of results, I decided to work on three cases. While islands are distinct cases of both urbanization and seasonality (see chapter 3), the common advice to choose cases based on the research questions left space for much speculation. Typically, I could have relied on a designer's instinct (the expert's intuition) about optimal cases combined with pragmatic considerations, but I worried about overlooking something crucial. In landscape architecture, guidelines have developed about how to consistently conduct a case study (Francis 1999, 2001:21), but little attention is usually paid to articulating the precedent choice. Swaffield (2016) has called for a more systematic way of using case studies in landscape architectural research to strengthen their knowledge claims. Thus, in the following, I elaborate on case selection. To a large extent, the cited literature stems from sciences that use case studies to study causal mechanisms (if A, then B) and for comparison. While all methodological principles cannot be translated into Research though Design, awareness of selection techniques helps to prepare research and develop scientific thinking.

To identify relevant cases for the research, case choice is usually based on selection criteria and an analysis across potential cases. Implicit in the selection process, a cross-case analysis helps understanding of how the case is positioned in relation to other cases (Gerring 2006:88–90). Here, availability of data and pre-knowledge about key variables are crucial (Idem:90–1). In my research, it has become evident that case selection and case analysis are "indistinct and overlapping" steps (Idem:150). Selection within the vast miscellaneous category of urbanizing islands became a fruitful process for gaining inspiration and knowledge for the research at hand.

5.4.1 Case types

Different cases serve different purposes (Flyvbjerg 2004; Gerring 2006). In contrast to the prevailing "opportunist" case choices in landscape architectural research (Swaffield 2016), alternative case selection techniques can be informative and increase validity. Flyvbjerg (2004) and Gerring (2006) explained different types of cases. The terms refer to the type of cases in relation to a larger population of cases. For an exploratory research mode that tests a hypothesis,[12] Gerring recommended typical cases that represent a broader set of cases, or deviant cases, because they suggest unexpected findings that contribute to progress and new theory (Gerring 2006:91–6, 105–7). Flyvbjerg highlighted the high informative potential of extreme and unusual cases, as they can be very problematic or innovative (Flyvbjerg 2004:127–30). A critical or crucial case can confirm or falsify expectations (Flyvbjerg 2004:127–30; Gerring 2006:116). The identification of case types is complicated in the early stage: One case may represent multiple types. Besides available data for cross-case analysis, case identification and choice often demands experience or pre-knowledge, as well as intuition (Flyvbjerg 2004; Gerring 2006). These are not methodological factors (Gerring 2006).

Aside from purpose, the representativeness of cases is usually at stake: "In order to be a case of something broader than itself, the chosen case must be representative (in some respects) of a larger population," but there is no purely unique case (Gerring 2006:145). Extreme and deviant cases are exploratory, and, by definition, not representative; depending on the sample, even typicality does not ensure representativeness (Gerring 2006:97, 104–5). While the representativeness or transferability of a low number of cases might be questionable (George and Bennett 2005:31), Flyvbjerg has claimed that "few cases chosen for their validity" are more likely to offer deeper or broader insights, and even a single case can lead to scientific innovation (2004:125, 127). I thus postulate that this might not be a central concern for Research through Design. Although purposefully selected cases help to achieve research goals (Swaffield 2016), these traits lead to the question of how much case types and the selection process matters in this type of research: Some islands have common characteristics and problems, but each design is expected to be unique, while the design approach can be applicable beyond islands. Could I rely on my interest, intuition, and pragmatic reasons to select the best cases?

12 In the political sciences, usually the hypothesis is about causal reference, and not directly applicable for design approaches.

To sort my island discoveries, almost unconsciously, a strategy widely used in design emerged: a typological overview, which I used only instrumentally as far as it was helpful (see 3.6). Swaffield has pointed out the benefits of typology for identifying purposeful cases and a set of contrasting situations (2016:109). In case study research, the typology approach can be translated into a "diverse-case" method (Gerring 2006: 98–101) or "maximum variation cases" (Flyvbjerg 2004). A set of diverse cases increases representativeness and is useful for observing various circumstances (Flyvbjerg 2004:128; Gerring 2006:100). Finally, it is usual to apply different case-selection strategies simultaneously (Flyvbjerg 2004:131; Gerring 2006:148). While I present the criteria and the chosen cases in chapter 6.1, I summarize my case process below for methodical reflection.

5.4.2 Parallels of case selection and a design process

"*So you have to make up reasons, but it won't be the real reasons.*" (Hubert Dreyfus interviewed in Flyvbjerg 2004:130)

In order to select three cases, I started creating my own database, which, during the process, grew to 92 islands (see Appendix A). First, I formulated exclusion criteria and exercised a most-similar cases approach. It seemed neutrally scientific, and simple for navigating the complex themes, but resulted in arbitrary, unsuitable, or logistically and financially impracticable sets of three islands. To my surprise, asking for advice, I discovered that not only designers follow intuition – which I soon address below. A loose typology (see 3.6) was a useful tool to move forward with the case selection. In my integrative case-selection overview, I had gained different types of knowledge: I could sort islands according to features and phenomena – and, moreover, recognize a feeling about cases that could be more promising than others. I had a diverse picture about urban islands, and my idea of designing-with-seasonality had advanced. After learning about case techniques, I reconsidered the purpose of Research through Design. Balancing between rational-analytical and intuitive-pragmatic, I adopted a threefold, mixed strategy: Besides diverse types, I listed my intuitively favorite urban islands and delisted useful or paradigmatic cases that did not interest me. As a third component, I imagined preliminary design approaches that handle temporal cycles. Based on these three approaches, I considered thirteen islands, and delisted some due to practicability considerations. Having gathered and interpreted information from various sources, I was able to develop a heuristic consideration of relevant variables and formulated a selection matrix (see 6.1).

The uncertainty and openness of the cross-case overview bore fruit: I had gained implicit and explicit knowledge and experience in the process. I also started understanding the main reasons for difficulties in the case selection, mainly, lack of suitable data to evaluate possible cases due to the novelty and originality of the approach. As Swaffield pointed out, case choice "is not a routine matter but an integral part of the creative and critical process of developing a productive and insightful research project" (2016:116).

This description of a case selection process reveals two interesting aspects in regard to design disciplines. First of all, the process is **non-linear and iterative.** Recognizing case type(s) might be difficult at first, and the accumulated knowledge and hypothesis-testing changes them (Flyvbjerg 2004:129–31; Gerring 2006:148). Revising a cross-case analysis is normal (Gerring 2006:149). "[T]he perfect case study design is usually apparent only ex post facto" (Idem:149). I particularly noticed this while developing an ambitious set of selection criteria during pre-research about islands worldwide. The intended criteria were instead becoming a definition of what I considered an urban island and which characteristics would be interesting for designing urban landscapes. These remarks illustrate a similarity to a design process wherein one switches between analyzing, hypothesizing, and projecting (see 5.2.1). Even background research (e.g., in the form of a case-selection process) involves projective agency, and vice versa. Secondly, I argue that, in Research through Design, **intuition and other so-called biases** can be methodological factors.

The role of intuition connects case selection to design. Polanyi (1967) and Flyvberg (2004) have claimed that tacit knowledge and intuition are central at the outset of all scientific research. Undoubtedly, one also has an intuition about suitable cases, but this is usually just not revealed (Flyvbjerg 2004; Gerring 2006). Flyvbjerg concluded that, in case choice, "intuitive decisions are accountable in the sense of being sensible to other practitioners or often explicable if not immediately sensible" (2004:131). In creative fields, intuition is a natural component. This should not be confused with an arbitrary or pragmatic choice as described by Swaffield (2016:106–7): Even in landscape architecture, one should be observant and conscious about the limitations of an "opportunist" case choice that may not have sufficient grounds for knowledge claims (Ibid). Then, intuitively, one may end up selecting cases that one knows (Gerring 2006). This can cause a tendency to find what one is looking for, to verify a hypothesis (George and Bennett 2005:24; Gerring 2006:132). Moreover, studying the most successful or well-known "paradigmatic" cases, for which more information is available and/or whose status has gained more attention is a bias (Gerring 2006:150) However, Flyvbjerg has claimed that case studies rather tend to falsify expectations (Flyvbjerg 2004:135). Familiarity is useful for recognizing case types and "allows much stronger research designs" (George and Bennett 2005:24). Gerring stated that "neither pragmatic/logistical utility nor theoretical prominence qualifies as a *methodological* factor in case selection" (2006:150).

Curiously, for design disciplines, the mostly unexpressed logic of case choice seems to work contrarily to what is underlined as good practices in other sciences. Designers trust self-selection and, at times, bravely employ "pitfalls" and

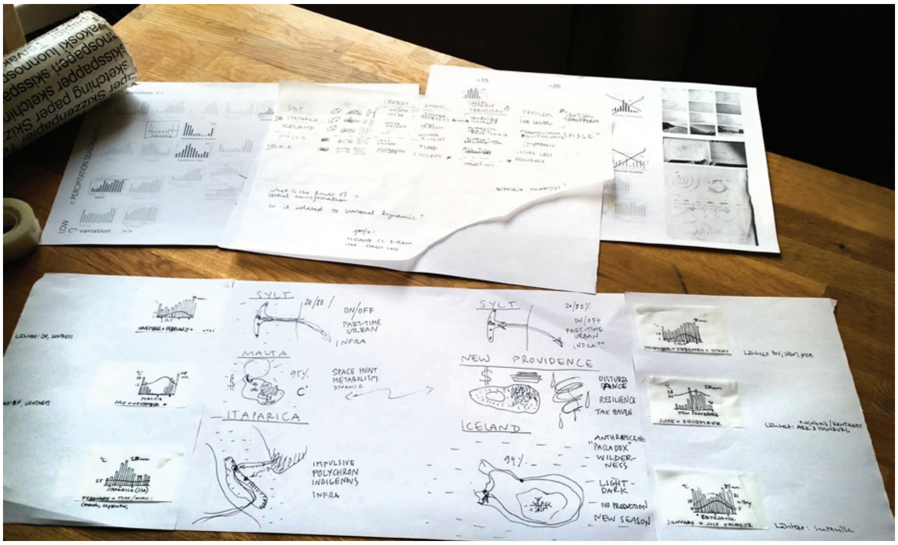


Fig. 5.1 The iterative case-selection process in this thesis resembled a design process and contributed to knowledge generation about urbanizing islands.

Fig. 5.2 Mapping potential case studies.

"biases" such as intuition, knowing a place, financial-logistical considerations, and ignoring representativeness and case types. As designers are not primarily trained as data collectors, familiarity with, for example, language and geo-biography facilitates engagement. However, in Research through Design, the scientific validity of results can be independent of objective case choice and representativity.

To conclude, in contrast to Gerring (2006:150), I argue that, in the case selection for landscape architectural research, the pragmatics and intuition of the experienced and curious are "*methodological* factors". If some cases feel more promising compared to others, there is no reason in a Research- through-Design project to undervalue the choice. While case techniques from other fields provide useful advice, I postulate that a seemingly biased process can produce valid results. It can become a fruitful discovery where transparent reflection contributes to gaining knowledge.

Summary

Focusing on the field of landscape architecture this chapter first described Research through/by Design(ing) and its positioning in the trans-disciplinary agenda of transformative research. Research through Design is a method that searches to answer research questions and create new knowledge through design processes. I underpin the integrative, solution-oriented, trans-disciplinary, projective and reflexive (as basis for change and critique) nature of Research through Design. The exploratory method challenges paradigms of science and knowledge production by combining subjective/objective modes of inquiry. Designing urban landscapes often adopts a normative position about changing practices towards sustainability, and deconstructing societal dichotomies of and nature/culture. In this path, subjective approaches, implicit knowledge, and heuristics are essential for discovery and the projective capacity of design. Thus, they can be embraced in Research through Design while also complying with a scientifically valid process. With these assets and attitudes Research through Design can produce society- and application-oriented robust knowledge. In conclusion, I argue that designing urban landscapes and Research through Design are inherently transformative, and suggest to embed them to the agenda of transformative research.

Research through Design can fulfil the commonly accepted criteria of research: reflection in a larger context, using appropriate methods to answer a research question, being original, transparent, systematic, and advancing and transferring knowledge. Research through Design / designing urban landscapes is by nature non-linear, integrative (rational and intuitive; types of knowledge), reflective and reflexive, projective and trans-disciplinary. It is both analytical and visionary. It produces theoretical and practical knowledge – or integrated, applicable, solution-oriented knowledge – and both specific insights as well as transferable knowledge. It challenges paradigms and can produce innovation that contributes to transforming society. Thus it is inherently transformative on multiple levels.

Case studies are a common form of landscape architectural research, practice and teaching. It is an excellent format for Research through Design to develop expertise and create knowledge. Since there is little guidance on choosing case studies for landscape architectural research, I looked for orientation in other fields of science. Case selection is essential because different cases serve different purposes and choice affects the representativeness, transferability or informative potential of cases. The selection process is non-linear and affected by biases, intuition and pragmatic aspects. In design disciplines case choice seems to be based exactly on what many disciplines describes as pitfalls. I suggest that these biases, generally considered as not methodical issues, are methodical for landscape architecture.

Both Case Study Research and Research through Design are highly appropriate for answering the research questions of this thesis and for developing transferable approaches of designing urban landscapes. In this type of research, limitations of representativity need to be acknowledged, but the context of transformative research highlights the context-specific nature of knowledge-production and outcomes. Even with a small number of cases, the method combination of Case Study Research and Research through Design can be used to understand complexity in real situations, gain expertise and practical skills, for testing new ideas and concepts, to communicate insights, and to develop theory.

The following section presents the three island cases studies in which answers to the research questions were pursued by employing design. It starts with the case choice and a process-description of how the Research through Design was conducted.

IV PROJECTING

In this section, I investigate three island cases to answer the research questions and test the hypothesis that **understanding seasonal phenomena and their spatial dimensions can contribute to increasing the resilience of urban islands** (see 2). Drawing from the previous background on islands and resilience, I apply and develop a design approach for resilience-building in islands. Besides specific knowledge about the chosen islands, the case studies aim to produce transferable knowledge about island urbanization, seasonal phenomena, and resilience-building in islands, as well as potential applications for designing urban landscapes in general. I first explain the case choice. Preceding the actual cases, I present the procedure that I developed (6.2), which is also part of the original research results.

6. Investigating three islands

6.1. Selection criteria and case choice

There was no instantly available synthesis of urban and seasonal phenomena on islands worldwide to facilitate an overview of potential cases. With pre-selection criteria according to size, population density, and urban proportion statistics, and observation of land use from satellite images, I created a worldwide listing of about 70 urban islands, which I complemented, bringing the number up to 92 during the research. It includes conspicuous exceptions, such as Long Island and Svalbard, and recommendations from experts, friends, and magazines (see Appendix A). I filtered 26 island candidates with the following pre-selection and exclusion criteria:

- Population density over 500/km^2 or urban population over 85%
- Land area 2–1,500km^2 (urban islands are typically small and I considered the manageability for the design purpose)
- Population under one million (island populations are typically small and I considered the manageability for the design purpose)
- Not in the Pacific Ocean, the Caribbean Sea, North America, or Asia (because of their dominance in island research)

6.1.1 Selection matrix

During the case selection process, I analyzed maps and satellite views, statistics, and literature research; listed and typified islands; developed a definition; and iteratively switched between these practices. I had come across various types of islands, their spatiality and urban phenomena. This was less so when it came to seasonality, apart from climate, tourism, and bird migration. A "mixed" selection strategy (see 5.4.2) and practicability considerations resulted in a final list of thirteen islands. They are positioned in a matrix (table 6.1) of four variables based on the research questions and insights from the cross-case overview: spatiality and land use, climate, connectivity (to urban centers), and socio-economic or planning context.

1. Spatiality / urban land use: The first variable addresses the original research interest concerning urban expansion and land scarcity on islands (see 3.5). While diverse urban morphologies and mixed forms of land use occur on islands, based on a visual survey of aerial images, the category includes the three types principally identified as problematic for further development:

A) Densely or full built; almost no open space left
B) Urban sprawl and fragmented open spaces
C) Compact settlement(s) constrained by regulations or geography

The second and third variables are relevant for the hypothesis that understanding seasonal phenomena and their spatial dimensions can contribute to increasing the resilience of urban islands (see 2.2):

2. Climate variation: Clear seasonal variations in climate obviously influence seasonality. In contrast, I considered a case that experiences little climate variation throughout the year, which can draw attention to undiscovered forms of seasonality, independent of climate. There is no straightforward distinction between seasonal and non-seasonal climates, but based on a climate-graph overview, this rough division serves this research:

A) Climates with over 10° C variation in average temperature or a dramatic change in precipitation.
B) Climates with less than 5° C variation in average temperature and an even distribution of precipitation throughout the year. Islands that face tropical storm periods are rated higher in variation than others in seemingly similar climates.

3. Connectivity: Proximity to mainland urban centers is considered a significant factor that influences island urbanization and temporal dynamics. Although this concern is not only about geographical distances, intense mainland-island relations expectedly produce different seasonalities, urban dynamics, and more frequent flows of people and goods than do more independent and, to some extent, isolated or distant oceanic islands, where, for example, daily commuting is not possible. The cases are sorted into two values based on a rough estimation:

SELECTION CRITERIA:	1. SPATIALITY / URBAN LAND USE			2. CLIMATE VARIATION		3. CONNECTIVITY		4. SOCIO-ECONOMIC / PLANNING CONTEXT	
ISLANDS	Dense/full	Fragmented	Constrained	High	Low	Oceanic	Coastal	EU / high	SIDS / low
00. Sylt (Germany)			x	x			x	x	
01. Malé (& Thilafushi, The Maldives)	x				x	x			x
02. Banjul island (Gambia)	x			x			x		x
03. Malta (main island)	x	x		x		x		x	
04. Ischia (Italy)		x		x			x	x	
05. New Providence (The Bahamas)	x				x	x			x
06. Santa Catarina (Florianópolis, Brazil)		x		x			x		x
07. Unguja (Zanzibar)		x		x			x		x
08. Itaparica (Brazil)		x			x		x		x
09. São Vicente (& Sal, Cabo Verde)			x	x		x			x
10. Iceland			x	x		x		x	
11. Mozambique Island	x			x			x		x
12. Yeongdo (South Corea)	x			x			x	x	
13. St Martin & Sint Maarten		x			x	x		x	

Table 6.1 Case-selection matrix.

A) Oceanic islands with no fixed links (apart from possible underwater cables) and further than two hours from mainland cities via regular waterway traffic.
B) Offshore islands within two hours to/from mainland centers via regular water transport or a bridge or tunnel.

4. Socio-economic/planning context: The fourth variable has been added to pursue insights from a radically different context than that of Europe, and to contribute to knowledge production for where planning and implementation resources are inadequate. This aims to be not a neo-colonialist approach but one of learning.

A) Islands in Europe and the United States, including overseas dependencies.
B) Small island developing states (SIDS) or comparable circumstances in the so-called Global South.

6.1.2 Chosen cases

The set of three cases covers different values of each variable. In addition to Sylt, which I included as the pre-test of the approach, I selected two islands.

Case 1: Sylt is the most urbanized island in Germany. Exemplifying the category of "luxodus" I coined in (3.6), its urban development is steered by extreme gentrification related to the island's status as a desired holiday destination for the affluent. The island has a four-season climate and is connected to primary German cities via air and a rail causeway through the provincial hinterland. Strict land-use regulations constrain the expansion of built areas.

Case 2: Malta's main island is the most radically urbanizing island in Europe. Close to the category of "full," it is Europe's most densely populated and built island. A proliferation of global and local urban dynamics have combined with an acute lack of space and seasonal overcrowding in this state, which is the size of an urban region. In the polarized wet/dry Mediterranean climate, under thorough impacts of urbanization, Malta has become a very barren island.

Case 3 Itaparica in Brazil has been chosen as an example outside Europe, with little seasonal variation in climate. As a "pool" in metropolitan periphery, its distinct urban dynamics are characterized by island-mainland flows of goods and people. As a consequence, Itaparica is fragmented by real estate speculation and informal urbanization. In the face of more urgent socio-environmental issues, the island seems to be dormant about climate change.

6.2. Developing a design approach in case studies

"*To design means to draw up a hypothesis of possible answers to a question*" (von Seggern and Werner 2008:35).

To test the hypothesis and answer the second research question in the chosen cases, each case includes one or several conceptual landscape designs, or projections. I now explain the Research through Design procedure, which starts with an interpretative island portrait and a seasonal-spatial analysis that answers the first research question, and I provide remarks on limitations and reading certain results.

6.2.1 A non-linear procedure

During the preparatory phase of the thesis, the German island Sylt was investigated in teaching as a platform to test the approach. At that time, resilience was not an explicit goal, and so the case slightly differs from the other two cases.

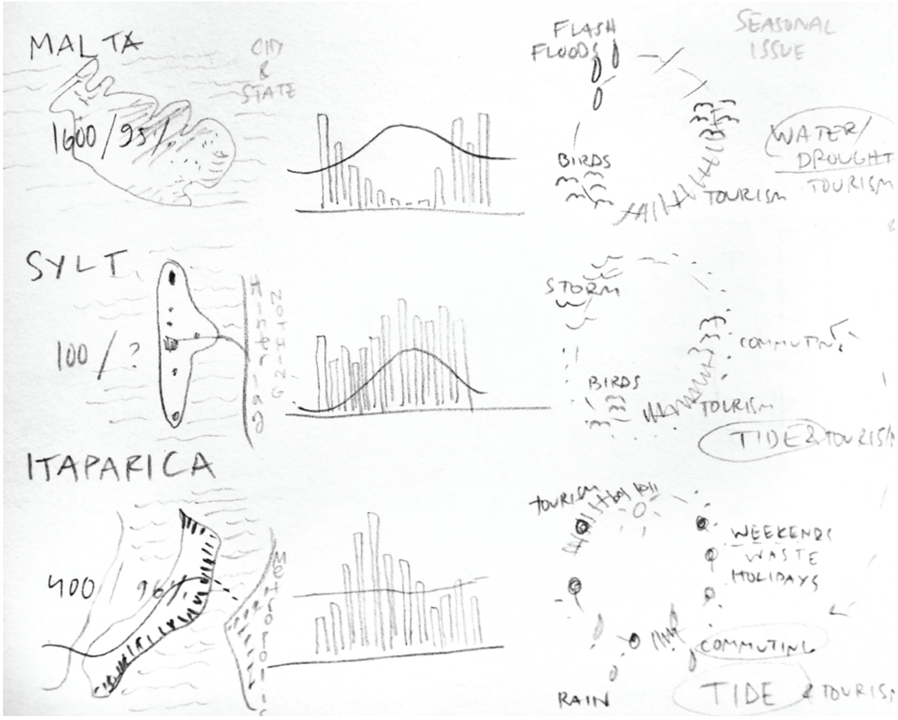


Fig. 6.1 An early overview of the selected cases: Tracing urban patterns, climate, and seasonal cycles on Sylt, Malta, and Itaparica.

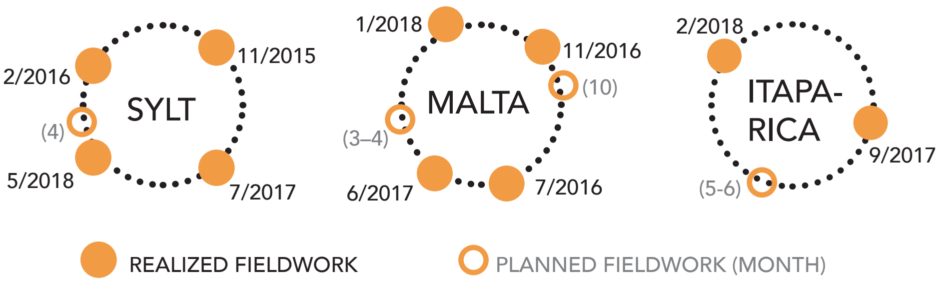
Work in the two other case studies consisted of four key phases: preparation, field research, design, and reflection. They overlap because design is a non-linear process (see 5.1.1). Analyzing, drawing, writing, reflecting, and projecting were worked apace, supplementing each other in the process of developing questions, answers, argumentation, and evaluation. The case design processes can be described as "pragmatic," typically applied to answer "how" questions: an integrative mix of approaches where the choice and order of methods is guided by the research questions (Lenzholzer et al. 2013:124–6). The strength of this strategy is the accumulation of different types of information that together form new, unique, and contextual knowledge (Lenzholzer et al. 2013:125–6).

Visual studies and illustrations compose a significant part of the research in a) the analytical sense of gaining knowledge or understanding a phenomenon, b) the productive sense of testing a hypothesis and projecting and developing ideas, concepts, and spatial visions (designing), and c) communicating the research. Insights gained throughout the process have also complemented other chapters. The iterative knowledge-creation process in the case studies is summed up below:

FIELD RESEARCH, DESIGNING AND PROJECTING, REFLECTION:
0. Planning fieldwork: anchoring promising points of visit in time and space
1. Exploring and documenting different landscapes and settlements according to expected seasonal discoveries, yet allowing serendipity
2. Portraying the island, discovering its specificities and topical problems with regard to island spatiality
3. Identifying and mapping spaces of seasonal phenomena and practices and asking whether, and to what extent, they formed the sea/landscape
4. Figuring out which transformations take place: on-off seasonal dynamic or essential longer-term change: comparing maps, newspapers, and literature, asking experts, using common sense and expert intuition
5. Investigating whether A) transformation is triggered by seasonal dynamics or B) seasonal dynamics are affected (e.g., decreasing) by spatial transformation
6. Verifying observations in exchange with experts
7. Identifying conflicts (spatial-temporal and temporal-temporal) and possible synergies or points of manipulation
8. Identifying resilience-deficit and its relation to seasonal dynamics
9. Outlining resilience-building goals and (a) design brief(s)
10. Seeking ways to apply resilience principles and making spatial projections that target the goals
11. Evaluating outcomes of projections and their potential effects; reflecting and iteratively going through the steps

6.2.1.1 Preparation and fieldwork
The case studies began with content-related and practical preparation that preceded field research: collecting data from literature and online sources; establishing contacts with experts, academia, and planning authorities; analysis “from far” of acquired cartography and images; and creating a field research schedule and itinerary. The timing of field research is crucial when the research “objects” are temporal processes. I used the strategy of selecting certain points in time for field research, which I call “anchoring,” adapted from Hautala (2017). I visited each island two to four times strategically in different seasons for one to three weeks (figure 6.2).

Fieldwork is an integral part of conducting Research through Design. In order to produce viable analyses and projections, site visits are highly important for gaining understanding about urban landscapes on a local scale and from perspectives that are not possible via satellite images. Field research enabled the identification of the islands’ specific sea- and landscapes, and the spatial dimensions of seasonal phenomena. Furthermore, it helped to develop a personal interpretation of and critical perspective on the case at hand. While being mindful of the importance of serendipity (Braae, Diedrich, and Lee 2013), that is, openness to unexpected findings, an adaptive fieldwork procedure served systematic inquiry. I documented the findings in photography, drawings, and notes in order to decipher the dimensions and interconnections of spatial



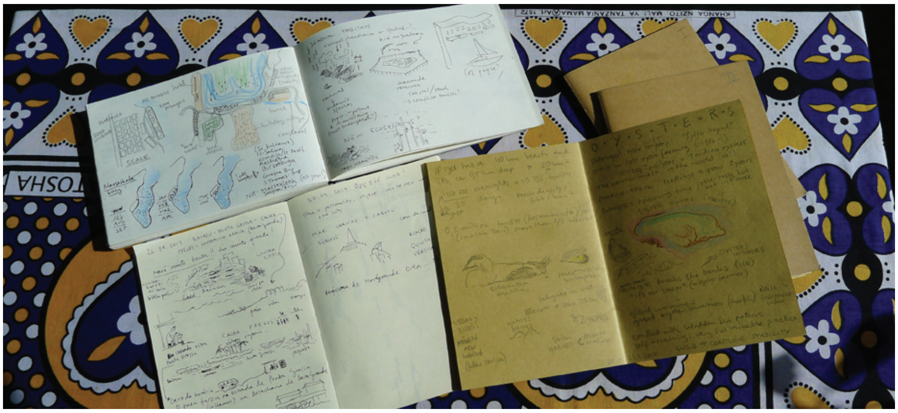


Fig. 6.2 Planning fieldwork in the case studies: "Anchoring" visits in different months, according to expected seasonal phenomena (top).
Fig. 6.3: Visual studies and illustrations compose a significant part of the research.

development and seasonality. I met local actors (e.g., planners, professors, and fishermen) and gathered sources not available online, in order to discover local knowledge about seasonality and ecosystems and to gain understanding of actual problems regarding spatial development.

6.2.1.2 Design process: Projections

During and after the field research, I applied the insights in conceptual landscape designs – that is, spatial projections that integrate seasonal phenomena to resilience-building. Drawing from the knowledge gained by answering the first research question (How are seasonal phenomena and spatial transformation linked?) and the identified resilience deficits, the projections serve to test the hypothesis that "seasonal phenomena can contribute to designing urban landscapes to increase resilience in islands." They explore answers to the question "How can seasonal dynamics be integrated into designing urban landscapes to build resilience?" More or less consciously, the projections are nurtured by the specific features of islandness and transformative potentials recognized in the case (see 6.2.3). The emphasis is on the design approach and process of translating resilience-building into spatial measures in landscapes, and exploring ideas of incorporating seasonality into design: solving conflicts, looking for synergies and desired paths, and asking the question "What if?"

The projections do not (cl)aim to provide accuracy or detailed spatial solutions, but to generate discussion and to open up new perspectives. For this reason, they ignore some real-life limitations, such as planning documents, budgets, and land ownership. In many places, they rely on heuristic, or practitioner intuition, common sense, estimates, and interpretation of information accumulated during the research. Nevertheless, they address topical problems and concrete spaces, trying to adopt reasonable directions, but sometimes exaggerating and often imagining.[1] I have taken such liberty, because transformation is about shifting mindsets and practices: It requires creative thinking outside of the box, and reframing (Held 2018; Latour 2018). This aspiration connects with the Anthropocene and transformation as a wider framing of the research (chapter 1). With these purposes in mind, the potential outcomes of each projection are evaluated against resilience principles and island spatiality.

To test the hypothesis and to answer the second research question, the following steps are included, but the first phase in particular was non-linear in itself:

ASSESSING HAZARDS AND RISK, AND SETTING GOALS AND PRIORITIES
1. Listing and mapping hazards
2. Identifying and mapping settlements and ecosystems at risk; listing key functions to be secured, enhanced, or introduced; listing current positive and negative resiliences (for limitations see 6.2.2.2)
3. Projectively reflecting and sketching where which resilience principles are needed. This is, at the same time, an analysis and a design sketch, and one of the steps that enables a multi-scalar review.
4. Outlining a design brief: defining resilience goals, the resilience of what to what, where, and why and listing case-specific key resilience principles (also see chapter 4.3) and selecting projection focus

DESIGNING/PROJECTING
5. Thinking of anticipated or desired situations for the context of projections, for sub-systems and alternatives
6. With resilience goals and the specific space in mind, finding ways to address or employ seasonality in spatial interventions

EVALUATION
7. Evaluating how the projections contribute to resilience: which principles are supported by which spatial measures or possibilities
8. Describing possible conflicts or shortcomings of the proposed interventions
9. Reflecting the projections with respect to island spatiality
10. Resuming an answer to the second research question and, based on the hypothesis, reflecting the transformative potential of the approach

1 According to Sloterdijk (2016:16), exaggeration is a method of clarifying context; Janssen underlined that both realistic design approaches and critical-utopian projectivity are needed to search for future alternatives (2012:209–210).

6.2.2 Challenges and limitations

Such a broad undertaking for an individual doctoral thesis, without a trans-disciplinary team, involves disciplinary and methodical challenges and limitations. First of all, the background work of gathering and organizing data from various sources for the case overview and three cases may have shortcomings. The practical challenges of fieldwork included those of getting around (mainly transport, but also security concerns on Itaparica), making contacts, postponed meetings, adverse weather conditions, obtaining maps, and explaining the research intention in order to have useful discussions. As a (young) woman, sometimes I was not taken seriously. When it came to answering the research questions, a particular concern was the complexity of the topic of resilience and seasonality: where to start and how to organize thoughts when everything seems interconnected. Although interviews and participatory workshops were not methodically planned as part of the case studies, I discussed the viability of some observations related to the first research question and ideas addressing the second research question with scholars and locals. Each case is unique, and the solutions may not be implementable or transferable one-to-one. However, I expect to have developed a design approach that can be employed in various contexts. In the following I highlight a few crucial issues.

6.2.2.1 A note on mapping seasonality and relations

Research about a temporal process is challenging. How can I be sure whether what I see during limited field periods is a *seasonal* phenomenon? In the field, the main (scientific) challenge for assessing the observations was uncertainty of whether it was appropriate timing or atypical weather for a season. To avoid pitfalls, I complemented observations with literature, newspapers, web searches, satellite images, using common sense, and talking with people to confirm a detected seasonal phenomenon, and, further on, its spatial occurrence. The lists of phenomena in the case studies may not be comprehensive. This also applies to the seasonality mappings that, in some places, rely on best guesses, although careful considerations. Finally, seasonal phenomena may shift spatially in the course of time, for example, with settlement changes, or loss and emergence of habitats. Climatic seasons or religious holidays shift temporally. Due to the inseparable nature of the spatial and temporal, some ambiguities emerge in the seasonal-spatial diagram tool that I developed: Should (seasonal) flooding, ghost towns, or the presence of boats and beach equipment be listed under seasonal phenomena or spatial transformations? I revisit this point in the conclusions. While I consider the mappings and diagrams reliable, they should not be taken as facts. The mapped variety of seasonalities in the urban island landscape serves to exemplify the intentions of this research.

6.2.2.2 A note on risk maps and building resilience in projections

A basis for operationalizing resilience in this thesis is provided in chapter 4. There are limitations in adopting the concept, employing it in practice, and evaluating the results in an individual doctoral thesis. Considering islands as entities shaped by intertwined human and natural interactions, this work acknowledges but cannot investigate in equal depth the essential roles of social actors and networks, learning and knowledge transfer, governance, critical infrastructure, and finance in resilience-building. Multi-stakeholder workshops, ecological modeling, and complex-adaptive-systems simulations have not been applied, and the intention is not to calculate resilience indexes. For the purposes of this research, a general understanding of phenomena and their multi-scalar interactions is more important than systemic, quantified data collection for a resilience assessment of the present-day situation. I presume that the synthesizing capacity of landscape architecture and its modes for addressing ecological, social, and infrastructural issues in visions of land uses and open spaces are assets in building socio-ecological and/or urban resilience.

The resilience deficit analysis navigates an abundance of traits. Like seasonality maps, the risk maps are elaborated with the help of a range of sources, but sometimes also by trusting experience and a general understanding of landscapes. I have aimed to make legible visualizations without overgeneralizing, to be anticipatory by including expected disturbance or spatial development – but this was particularly challenging. Although the maps depict one situation, exposed and vulnerable areas change, for example, when settlements occupy new areas.

In the process of building and assessing resilience, the principles identified in 4.3 have played a central role. The same principles and goals that guide the projections have been used to qualitatively evaluate the resilience-building contributions. Ideally, in an ongoing real-life process, the designs could then be adjusted. The projections in the case studies do not instruct one to "do it like this and your island will be resilient." A critical reflection on the resilience-building efforts is included in the end of each projection.

6.2.3 On transformative potential

With reference to the thesis subtitle "Seasonal landscape strategies for resilient transformation," and to the theoretical input (see 1.2 and 5.2), transformative potential is one of the key elements in the case studies. It is an impulse for designing: a key component or series of components in a landscape that can contribute to thorough and/or systemic change in function and spatial appearance, towards resilience. The cases trace transformative potential according to three aspects: spatial resources, seasonal phenomena, and the approach as a whole.

First of all, before imposing the predefined hypothesis about seasonality, freeing myself for a moment from the control of research questions, an open question was posed: Where do I see transformative potential? From a design perspective, this translates as "What intrigues, and where could meaningful, strategic, or systemic spatial interventions take place?" This question was answered with practitioner's intuition, which combines experience and expertise with a subjective, rational-analytical and forward-looking approach (see 5.1.2). The question has no single answer, and each engaged person might answer it differently. Even if the factors discovered do not fit the research focus later on, they reveal something about the island and stimulate idea generation. More importantly, together with listing actual acute problems, they serve to critically reflect the validity of focusing on seasonality, and encourage recognition of new relations.

Secondly, I go beyond illustrating relations of the seasonal-spatial phenomena of the island by extending the first research question to "How *can* they be linked?" Studying the material produced with curiosity, and posing manipulative questions, insights about strategic intervention points and paths have arisen.

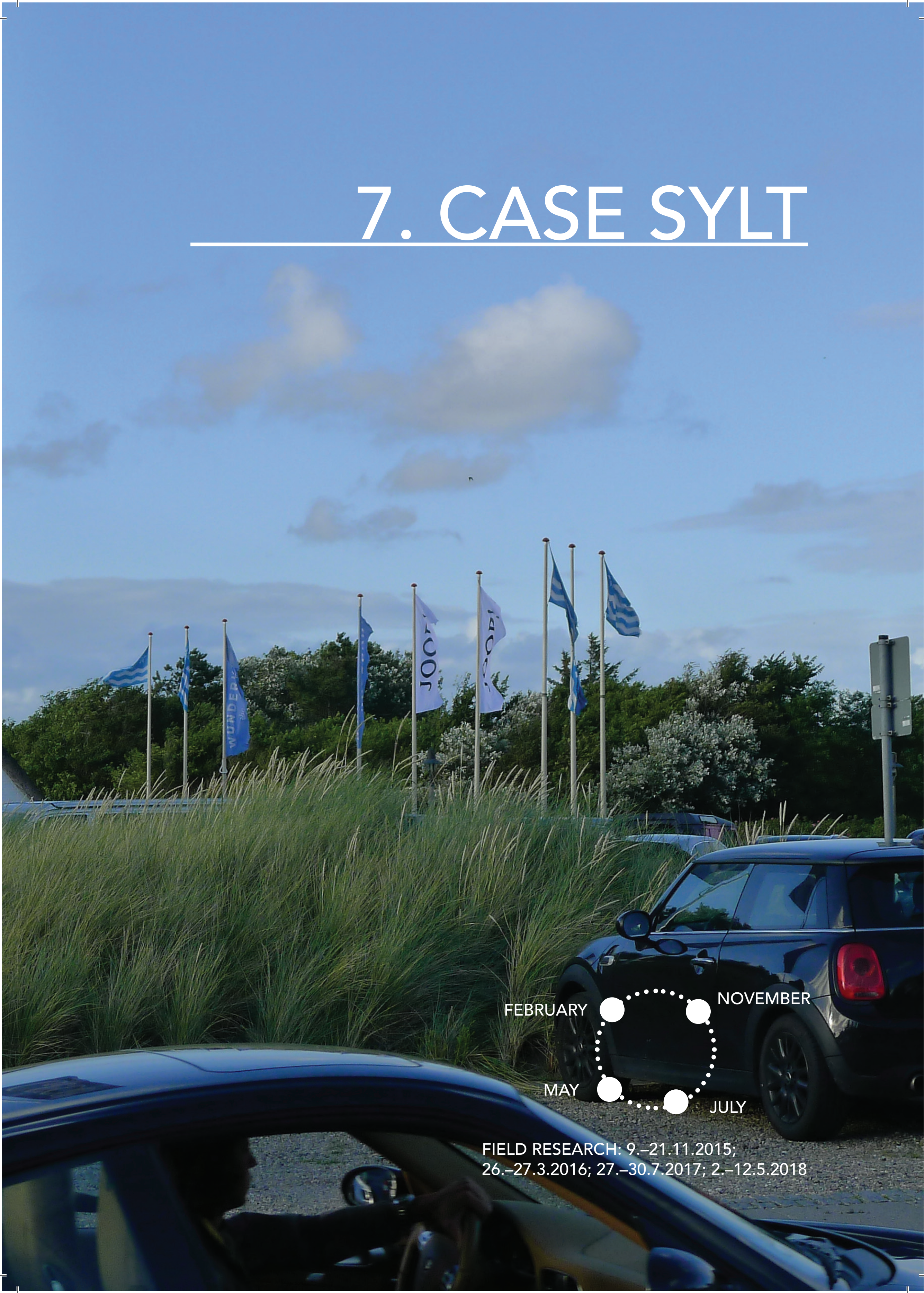
Thirdly, the transformative potentials identified in the previous steps flow into the projections. This may not happen in a one-plus-one-is-two manner, yet, during the process and in its outcomes, new insights about catalyzing transformation are expected to emerge. Finally, the transformative potential of the projections and the seasonal approach is reflected against the backdrop of island spatiality and resilience.

6.2.4 Case structure

The three cases are organized in a similar structure, but some differences emerged in the process and from the selected means of illustration, considering that the procedure evolved and was consolidated over the course of time. The first case, Sylt, differs from the other two, because it was conducted as a preliminary master design studio to approach the topic, which, in that phase, was still taking shape and for which resilience was not an explicit goal. The second case, Malta, was initiated prior to Itaparica, thus the third case of Itaparica has profited from previous progress. In each case study, an island portrait precedes answers to the two research questions. It is an interpretation of the dynamic urban island, portraying and reflecting spatial characteristics and (current) dynamics against the theoretical background about islandness and island spatiality presented in chapter 3. Secondly, the case studies set out to test the seasonality hypothesis and answer the research questions about the spatial dimensions of seasonal phenomena (Q1) and integrating seasonality into enhancement of resilience (Q2) – applying the previously described procedure. Each case study closes with a critical reflection of integrating seasonality and the expected transformative potential.


Gallery
MICHAELMEYER
GUCCI

7. CASE SYLT



FIELD RESEARCH: 9.–21.11.2015;
26.–27.3.2016; 27.–30.7.2017; 2.–12.5.2018

S Y L T

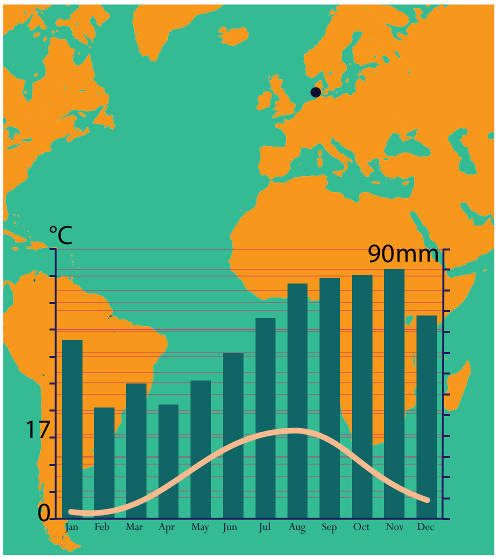
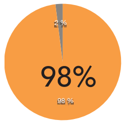
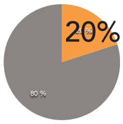


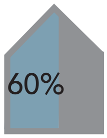
Illustration Karin Eremia, climate diagram based on https://www.urlaubsziele.com/bilder/klima/staedte/229/



urbanized population



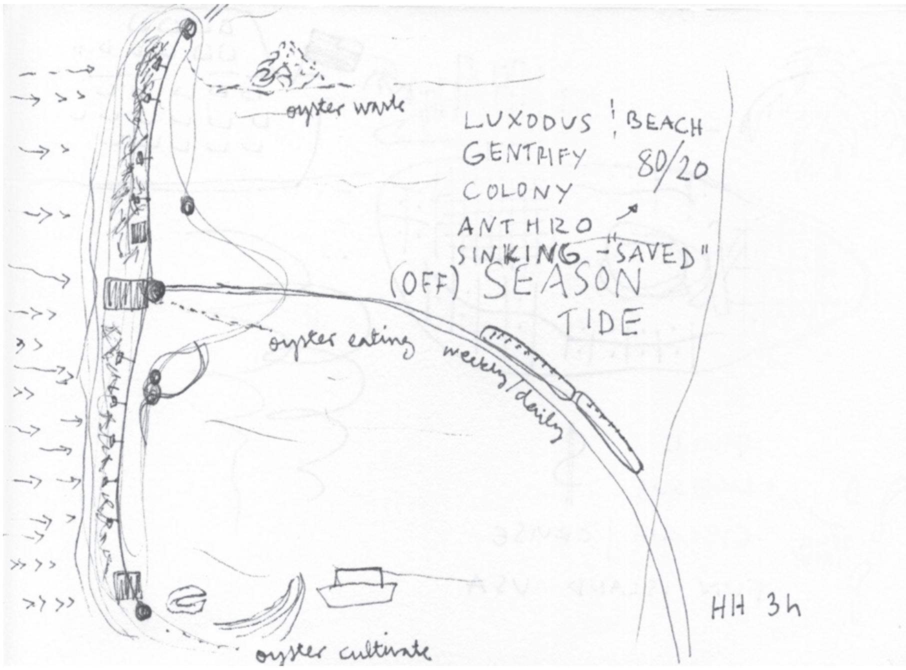
urbanized (built-up) land

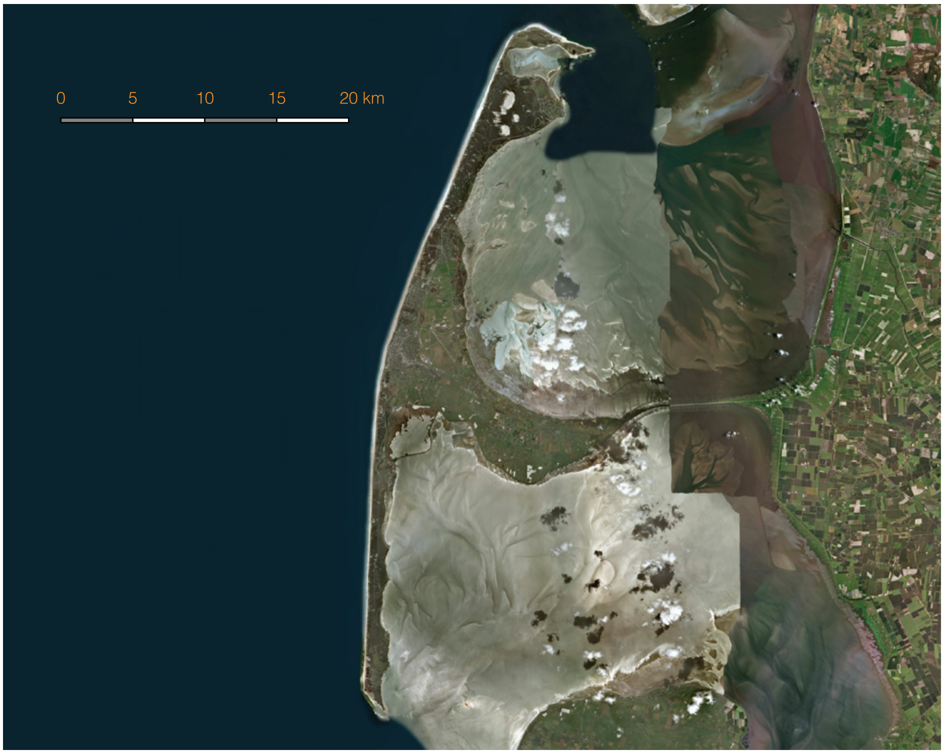


second homes
(no official data)

18 163
residents
(2017)

600 000
visitors
per year





Map data © 2019 Microsoft Corporation Earthstar Geographics SIO (Bing Aerial via QGIS)

Status:
The German island of Sylt consists of several small municipalities. Unofficially, it is a provincial satellite, 187 km from the metropolitan city of Hamburg – or by plane, two hours from Zurich.

population[1]	18,163 (2017)
land area	99 km^2
population density	183/km^2
urban population[2]	98 %
urbanized land area[3]	20 %

Urban dynamics:
gentrification, shrinking local population, increasing seasonal urbanization (tourism and second homes)

Key ecosystems:
The Wadden sea, dunes, salt marshes

1 https://www.statistik-nord.de/fileadmin/Dokumente/Statistische_Berichte/bevoelkerung/A_I_2_S/A_I_2_vj_173_Zensus_SH.pdf
2 unofficial estimate based on lifestyles
3 ca. 80 % of the island area is designated for nature conservation and landscape preservation, or still used for agriculture

7. Sylt

In how many towns of 20,000 inhabitants and only one forty-kilometer-long road do you find a Porsche dealership, Hermès, Gucci, and Prada? Sylt is an iconic island off the German coast. For decades, spatial transformation there has been driven by tourism, which adapts to the maritime climate with four distinct seasons. As the most urbanized island in Germany, Sylt became the preliminary exploration for this dissertation. The case study is, for the most part, based on a design studio that I conducted. In this case chapter, the first section is a snapshot of the urban landscape dynamics, interpreted in consideration of the concepts of islandness and island spatiality (see chapter 3). The second section presents findings from the design studio. I then further investigate seasonal phenomena to answer the research question about seasonal and spatial relations. Unlike in the other two cases (Malta and Itaparica), the case of Sylt does not include a resilience assessment nor target resilience building. The reflections pave the way for the two other case studies.

7.1. Islandness and specificity

7.1.1 Portraying a dynamic urban island

Luxodus
With a declining population but also luxury brands and sky-rocketing real estate prices, the German island of Sylt is surrounded by the rising and stormy North Sea. Forty kilometers of beach attract an increasing number of around 600,000 visitors per year (Sylt Tourismus-Service 2017:6). Prices, style, menus, cars, and real estate brochures communicate exclusivity. Sylt is "luxodus" (see 3.6) – a luxurious exodus from the mainland. Yet, the northern landscape and climate are far from tropical paradise, and the mainland is easy to reach. Sylt is connected by ferry (from Denmark), by plane (even from Switzerland), and, most commonly, by car *on* a train: A causeway imports and exports visitors, food, goods, and 3,000 commuters plus seasonal workers (Seemann 2015). Two transatlantic data cables land on Sylt as well (TeleGeography 2018).

Cars and sand
Sylt is a car island. A linear road through the slender island is dotted with immense parking lots between dunes. Step out and walk through the dunes to find the sea, and stop at the edge for a selfie. Pay 4 euros in environmental taxes per day to enter the beach). That is cheap: For up to 7.5 million euros, a million cubic meters of sand is replenished on the waterfronts annually (Holdschlag et al. 2012:55–6; Henningsen 2016). Engineered tripods, asphalt, quays, groynes, and multifunctional dikes secure the shoreline. Sylt is a barrier island that protects not

only itself, but also mainland Germany. An orderly pattern of sticks and marram grass structure the coast, aiming to fix the dunes that build up and wander when the sand is mobilized by wind and waves (Reise 2015a). Preservation fights against the shifting is the nature of the island. Sand keeps blowing onto the asphalt.

70/30 and Syltifying

Dunes, mudflats, sea, and reed comprise the image of Sylt. Amidst of UNESCO nominated Wadden Sea biosphere reserve, seventy percent of the island surface is dedicated as protected natural and cultural landscape (Seemann 2015). Within the remaining thirty percent, settlements are compact, and new building sites append contrasting scales at their edges. Transport infrastructure and time-sharing complexes are disproportionately large compared to settlements and the island's land area, but sprawl is constrained. Overdemand results in inverted verticalization as millionaires dig deep into the dunes (e.g., Manager Magazin 2017). Sylt is Germany's highest ranking real estate location, and one square meter of a villa can exceed 20,000 euros (Engel and Völkers 2018), four times the average of top continental cities (Statista 2018). Human habitat on Sylt is an odd constellation: Neighbors may change weekly, if there are any. Extreme gentrification, or "Syltifying," (*Syltifizierung* in German), makes islanders take off to mainland (Dahlkamp 2010; Kostka 2013; Wyputta 2015) and upgrades traditionally homogeneous villages with a bourgeoise atmosphere that simulates authenticity. The status island celebrates with champagne and eating local mussels and oysters. Materials, money, data, and people arrive from international origins, contributing to the clichés of Sylt. The economy, built environment, and lifestyles make the provincial island urban.

Tracing islandness and the Anthropocene

Discreet excess and superlatives have become normal on Sylt. Island images do not include the profane sight of the 1980s hotel heritage, the tourist harbor stalls in List, the few rental blocks, or the grocery retailers that are supplied with goods and workers from the mainland. In contrast to the underlying natural forces and urban dynamics, visiting Sylt involves a routine choreography of where to eat, ride, and contemplate. When almost 70% of the land is dedicated to ageing dunes (Reise 2018), the landscape feels staged and settled. Despite some eclectic corners, the island landscape lacks diversity, youth, and surprise. Sylt is apparently pinned in its **branding** and regulations.

Islandness means **extreme exposure** to sea, climate, and human fascination. Sylt is a contrast to the embanked German coast, monocultures, and cities. Due to its shape, Sylt is almost entirely identified by the **coastal interface**, and, on top of the dune hill, both shores are visible (plus even the mainland). Stabilizing the island substance along the lengthy land-sea interface, and digging into dunes, humans have been constructing a new geology that requires mighty resources and efforts. In a very physical way, the massive engineering and protected

Portraying a dynamic urban island: SYLT



Fig. 7.1–7.9 Luxury brands and sky-rocketing real-estate prices; festivalization and the profane sight of 1980s hotel heritage (above). Overdemand and regulations result in inverted verticalization as millionaires dig underground (top right). Dunes, mudflats, the sea, and reeds are the image of Sylt. An orderly pattern of sticks and marram grass keep the dunes together as preservation against the perpetual shifting is the nature of the island (below). Heavier measures are also in place (right).




LAN
SER
HOF
Böcker


BMS

landscapes reflect Sylt's manifestation of the Anthropocene. Yet, like an umbilical cord, the causeway fastens the island to the continent, as if leashing a proliferated island metamorphosis.

7.1.2 Topical spatial problems, trends, and hazards

Storm floods and tides are the primary sources of disturbance on Sylt. Statistically, their frequency might have (temporarily) decreased (Klatt 2012:76), but winds and waves can annually erode 1–4 meters of sand from the island's west coast (LKN.SH 2018). The famous sand replenishments have made Sylt a flagship of climate change adaptation in Germany. For now, the fight against the sea seems to have been solved – but experts have postulated its insufficiency in the long run (Holdschlag et al. 2012:98; Reise 2017). The German economy is growing, but what if a crisis cuts resources, tourist flows, or fuel? Climate futures are unpredictable but have been envisioned in many publications (Daschkeit and Schottes 2002; Klatt 2012; Reise 2015b). Even with coastal erosion under control, possible cliff collapses, the slowly shifting material substance of the dune island, and land-use regulations, combined with the building pressures, challenge urban development on Sylt.

Daschkeit and Schottes (2002:4) have forecast that, with sea level rise, the Wadden Sea ecosystem will change as it becomes deeper – but species are likely to adapt; sediment flows will increase, and, with more frequent flooding, salt marshes will keep growing in height, although waves will erode their edges. The maintenance intensity of the urban landscapes on Sylt is as concerning as the economic dependence on the conserved landscape image. The dunes are important to biodiversity on a regional scale because low-nutrient habitats are extinct on the mainland. However, spreading seeds from gardens alter their vegetation (Reise 2018).

While the island is gripped by many environmental problems, land use conflicts and the extreme gentrification linked to them are societal challenges. Problems include unaffordable housing, car-dependency, and maintenance services for the declining permanent population. Public open space is not an investment due to other attractions and weathering. Demographic change is unlikely to reduce human pressure on the landscape. The islands water self-sufficiency may be at a tipping point, although a predicted increase in precipitation may reduce the threat of water scarcity (Reise 2018). Contamination from the airport or, for example, the laundries of the hospitality business, as well as salinization and overconsumption of the limited volume of freshwater lenses, are potential hazards, and there is no pipeline from the mainland (Nieß 2017). Furthermore, import dependency on food entails a disaster risk and increased ecological footprint.

7.1.3. Transformative potential I: Elements and resources

In light of the first analysis, Sylt seems to be very much under control, planned, routine, trimmed, and even sedated. This allures one to envision disturbances. What if the rules were lost? Or, in contrast, what about thinking of the island utopias of complete manageability, and imposing even tighter restrictions concerning access, building, sharing, self-sustainability, emissions, and consumption? Thirdly, I call attention to the underrepresented aspects of Sylt and their role in transformation: rental blocks, youth, public open spaces, roads, parking lots, and production beyond hospitality services.

When it comes to landscape processes as a potential resource, as Reise (2015b, 2017) has envisioned, the natural dynamics of the dunes and the Wadden Sea flatlands are an adaptive system to learn from. Dealing with the shifting dunes and reversible building measures could provide new solutions for urban island transformation. The repetitive series of beach entrances through the dune belt could offer moments of surprise. Developing their own interpretations, the following student projections address various starting points for spatial transformation on Sylt.

7.2. Island Times

Inselzeiten, or "Island Times," was a M. Sc. design studio held at the Institute of Open Space Planning and Design, Faculty of Architecture and Landscape Sciences, Leibniz Universität Hannover during the winter semester of 2015–2016. Conceptualized and taught by Vilja Larjosto and Börries von Detten, under the supervision of Professor Martin Prominski, the project worked as a platform for elaborating the topic and approach of this dissertation.

The studio set out to investigate urban dynamics and temporal patterns on islands. The goal was to explore time-based landscape architectural strategies that strengthen socio-environmentally sustainable development and the experienced identities of islands. Firstly, with a worldwide overview, the studio looked into a spectrum of spatial transformations and urban landscapes on islands. Secondly, the analysis of spatial- temporal relations were deepened on the German Frisian Islands, while developing techniques to visualize temporal phenomena and their spatial dimensions. The creative research inspired large-scale approaches for the island of Sylt. Addressing temporal cycles of tourism, settlements, and natural dynamics, the resulting designs propose contributions to eco-social resilience and island identity. The central questions throughout the course were:

Analytical

- How do urban dynamics materialize/appear on islands?
- Which annually recurring patterns can be identified? Where do they take place?
- What are the qualities of an "off-season"?

Projective

- Which strategic measures could affect the spatial-temporal organization of an island?
- Which conflicts and potentials do seasonal phenomena create with regard to the (built) landscape and ecosystems of an island? How can large-scale landscape design contribute?
- How can the specific temporality of an island and the individual experience of time be regarded in design?
- Which landscape architectural strategies and tools can convey temporal phenomena in spatial form?

Answers to these questions were explored in a Research-through-Design process, and the tasks were discussed in weekly sessions. The course was attended by 15 landscape architecture students, working in small teams. Intense field research and a design workshop took place on Sylt in November.

7.2.1 Preparation: Urban islands and temporal dynamics

7.2.1.1. Conceptualizing urban islands

The first half of the design studio discovered urban islands and temporal phenomena with designerly means. In the first exercise, a series of 45 island portraits were prepared to illustrate global connections and dominant forms of urbanization. They crystallized islands in conceptual titles such as "*Urlaubssturm*" or Holiday Storm (Long Beach Island) and "*Die ausgemolkene Kuh*" or The Milked-out Cow (Nauru). Each team sorted islands in different ways: according to spatial character, social phenomena, economy, or human impact. All portraits were then clustered for an interactive rating that pinpointed urbanization.

The following findings emerged: Both history and isolation, in the sense of distance or having few connections, play a role in island urbanization. Proximity to mainland is considered influential, but an airport also raises the urban status of an island. A tendency towards the coexistence of broad global networks and diverse land uses and functions was observed. Besides tourism, gentrification was identified as a typical urban phenomenon on islands.

Three variables for measuring urbanization were determined:
(Y) Urban land cover: Degree of settlements and built land including infrastructure and land use for human practices such as industrial agriculture
(X) Connectedness: Multiple modes of transport, frequency of connections, travel time to/from major centers
(Z) Complexity: Multifunctionality or diversity of land uses, economic activities, society, and spatial character

Finally, the portraits were re-positioned according to these indicators [Fig. 7.10]. Among the sample, Xiamen, Hong Kong, and Södermalm (within Stockholm) were rated most urban. Islands like Nauru and the Magdalene Islands – altogether extremely different – occupied the other end of the spectrum.[2] This did not result in the simplification that the higher an island rates in sum, the more urban it is. Bikini Atoll and Easter Island provoked discussion as curiosities of the Anthropocene. Considering that the exercise required broad research in a limited amount of time, the analyses partly rely on impressions. The purpose was not to determine whether, for example, the Maldives were urban, but to generate an overview and reflections about island urbanization.

7.2.1.2 Developing a method: Time on the Frisian Islands
To sharpen the methodical focus, the second preparatory task was exclusively concerned with the "*Eigenzeiten*" (individual times) and rhythms of the German Frisian Islands. The exercise was experimental and yielded a range of discoveries and graphic representations highly sensitive to the particular temporal dynamics and landscapes on the sibling islands: from tide cycles and irregular yet frequent floods to lighthouse flashes; from bird migration to ferry schedules; from freshwater lenses to settlement dynamics; from mail delivery to the waste management cycle; from micro-organisms that nourish dune vegetation to whole islands shifting over centuries. The interconnections between different temporal scales stood out. The exercise produced a set of 45 island sheets that revealed the challenge of capturing change in two-dimensional representations. They also exhibit various visual possibilities. The images range from hand sketches to computed diagrams and collages. In regard to the questions of this doctoral thesis and graphic representation, the most insightful results are illustrated here[3]:

Juxtaposing: Parallel peaks, Christian Tautz [Fig. 7.12]
This illustration depicts the elemental hydrological process of a freshwater lens on Langeoog Island, and juxtaposes two seasonal phenomena: Diagrams at the low end call attention to the annual cycle of water production and depletion during

2 I had pre-selected a sample of 30 islands I considered urban, or whose urbanity I wanted to discuss, and each student chose one additional island. No urban theory was given to frame the exercise in advance.
3 Not the original titles; I have given the English titles in the context of this dissertation to conceptualize the purpose of the illustrations.

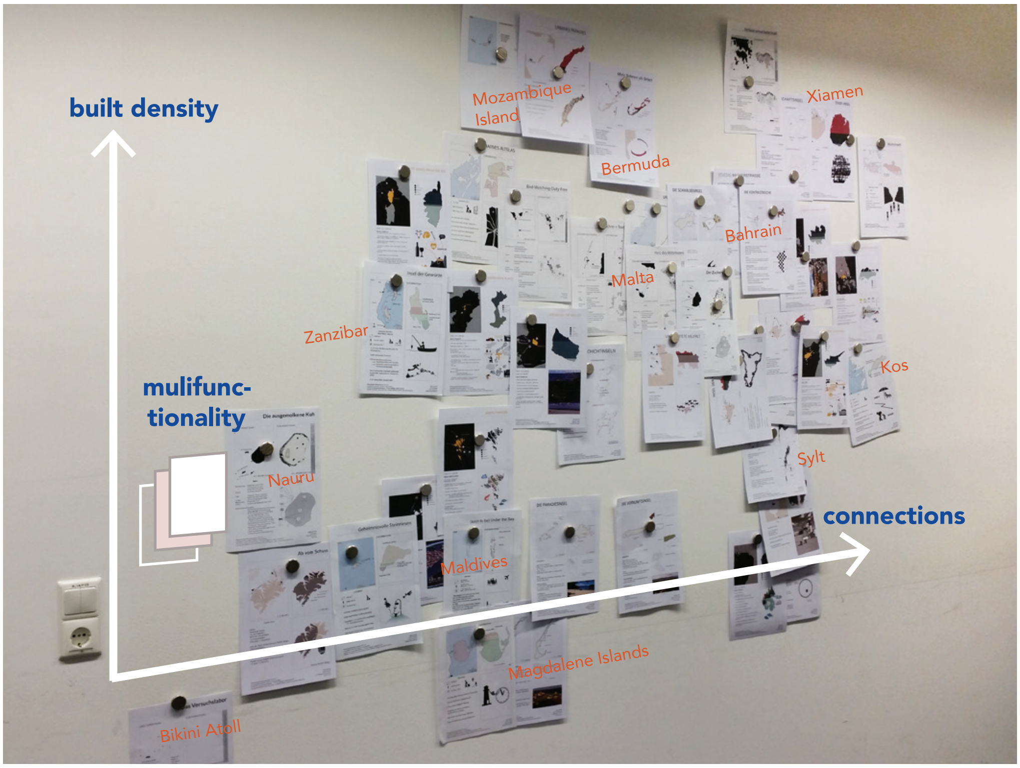


Fig. 7.10 Conceptualizing urban islands.

M. Sc. Design Studio Island Times

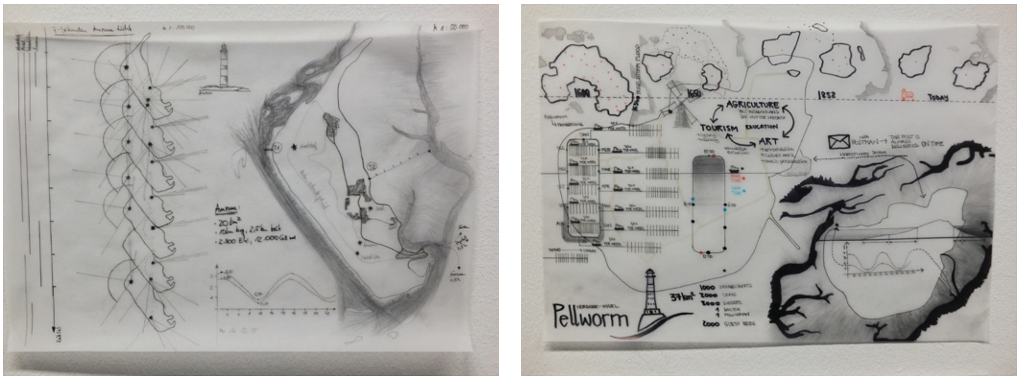


Fig. 7.11 Mapping time on the Frisian Islands – Lighthouse pulses and the tidal influence on the ferry schedule. Lukas Merkel, Klavdija Peperko, and Nadja Gothe.

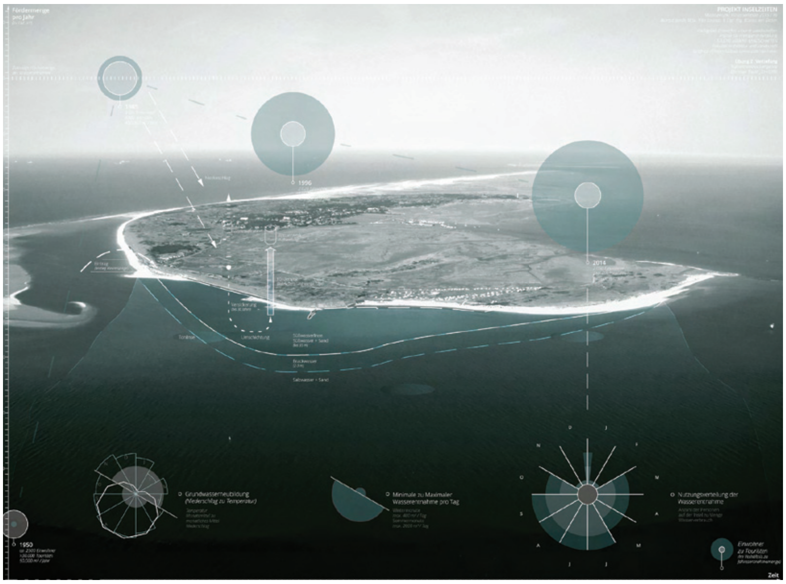


Fig 7.12 Juxtaposing: Parallel peaks. Christian Tautz.

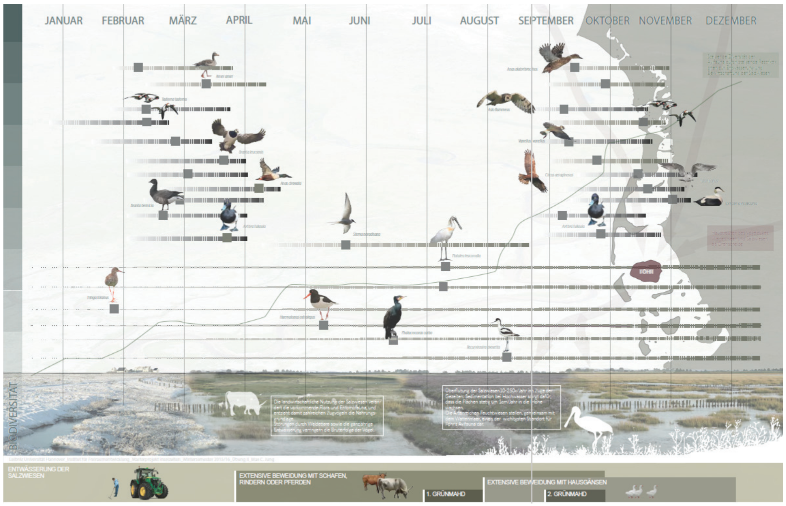


Fig. 7.13 Juxtaposing: Seasonal biodiversity. Maximilian Jung.

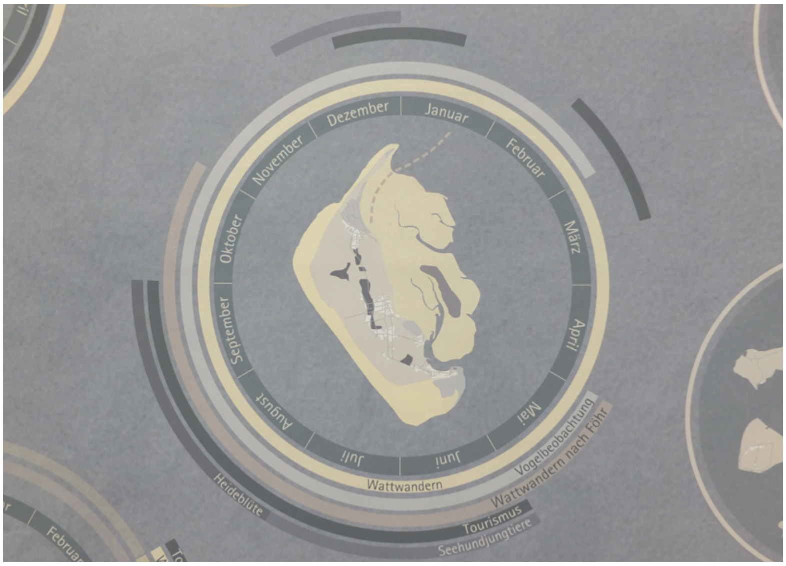


Fig. 7.14 Landing rhythms. Patrick Brink.

tourism peaks. The background image of the island locates the observation in real life, rendering an invisible problem more haptic. The composition is too complex as such. Yet, the format holds excellent potential to inform stakeholders in a more comprehensive and appealing way than statistics and tables.

Juxtaposing: Seasonal biodiversity, Maximilian Jung [Fig. 7.13]
This image illustrates seasonal variations in the biodiversity of salt marshes on Föhr. It places bird migration and breeding periods side by side with the human impacts of an annual agricultural cycle. This enables reflections about the relation of potentially conflicting land uses. The tool can be developed to investigate the spatial dynamics and interrelationships of fauna and other actors over time, approaching an "andscape" perspective (Prominski 2014a).

Landing rhythms, Patrick Brink [Fig. 7.14]
Here, the seasonal and weekly rhythms of islands are illustrated in circles and indicated on a map. The result shows both spatial and temporal overlapping and gaps. The technique helps to understand the spatial dimension of (potential) conflicts and synergies. Besides analysis, it could be developed or even programmed for planning concrete interventions and strategic management.

7.2.2 Encountering Sylt: Field research

During the design studio, field research on Sylt took place in November, in preparation of design approaches for a whole urban island. Over three days, the island was explored individually and in small teams that planned their itinerary around thematic expectations. Impressions from islanders were obtained during appointments with the head of the planning unit, Martin Seemann, marine-biologist Professor Karsten Reise, and in individual short interviews on site. The excursion called attention to various topics: weather; the wind's impact on landscape types; experienced time (impressions of fast and slow places and moments); the landscapes and pulses of arrivals/departures; a sublime atmosphere; identity and authenticity; the paradox of wandering and preserved dunes; contrasts (built vs. open, human vs. nature, the east-west split); the off-season; and social dynamics in settlements.

Thematic maps were elaborated in parts that comprise the whole island of Sylt. Fieldwork sketches surrounded the assembly, forming a mapping–collage rich in information and impressions (Fig. 7.15). The sketch-like presentation was open for rearrangements during the iterative design process. Discussions and personal engagement with the island prompted the following topics as main problems with regard to designing an urban landscape on Sylt:

Fig. 7.15 Students working on a mapping-collage during and after fieldwork on Sylt.

- A lack of identity of the built environment and open spaces, seeing the island as a whole
- The neglected quality of open spaces
- Human-versus-nature dynamics: implications, interventions, and coping strategies in a harsh environment
- The off-season: emptiness and social constellations in settlements – also as a positive aspect

7.2.3 Designing: Landscape strategies for an urban island

After the field research, teams developed temporal landscape strategies for Sylt. Building on the first exercises and design references, new analytical and projective tools emerged or were adapted from existing approaches. These employ temporal factors more often as tools than as concrete spatial solutions. I summarize the following approaches that contribute to understanding spatio-temporal relationships and to integrating seasonal phenomena into design:

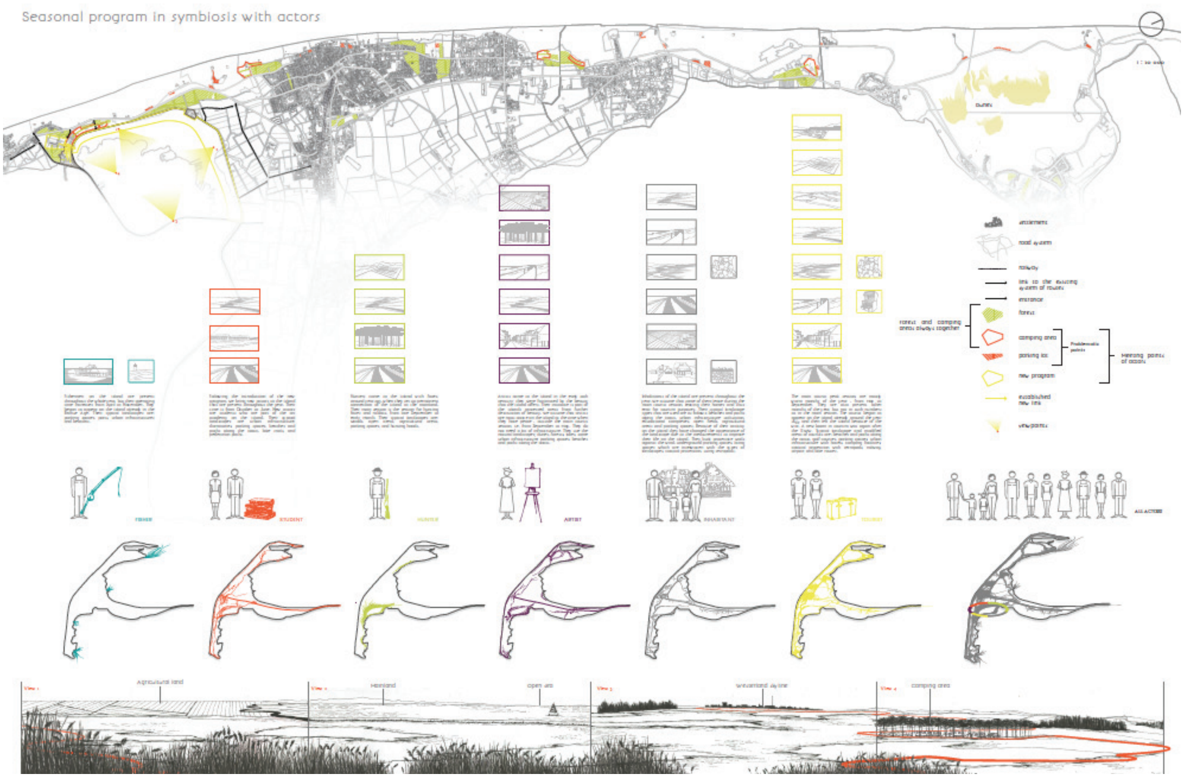
Seasonal players (analytical & projective): "Seasonal program in symbiosis with actors" by Nadja Gothe, Klavdija Peperko [Fig. 7.16]
"Each actor has a different main season on the island, as well as their characteristic types of landscape uses." This work interprets the off-season as an absence of activities and human interaction in many parts of the island. It defines typical Syltian actors and their relationship to landscape: for example, tourist, student, hunter, artist, or fisherman. Some of the personages are fictional. To find out how, where, and when these typical or influential players (could have) affected the island, their spatial use over time was mapped, and the actors were combined with landscape types. Integrated into landscape analysis, the tool enables one to see hot spots and empty zones – for example, no spot in the off-season was as frequented as the ubiquitous parking lots. I postulate that employing this tool can help to address (potential) conflicts and synergies, anticipate landscape changes, and strategically direct human impact on specific areas. This could be done on a seasonal basis or in other temporal scales. Fauna, industries and enterprises, and natural forces can also be considered as actors alongside humans.

Engagement program (projective): "Multi-figure" by Siyu Lin, Tian Guangyu [Fig. 7.17]
This work aspires for more interaction and sustainable relationships between humans and animals. It investigates annual rhythms and spatial occurrences of animal species, and it diversifies tourism within the metaphorical frame of a museum. By zoning Sylt according to programmed galleries and activity spaces, the plan suggests new forms of encounter with, for example, oysters, birds, and cows, while concretely participating in improving their habitats. Besides natural habitats, it takes into account farming and aquaculture – and nothing stops one from including the city habitats of urbanized species. Seasonal patterns form an operational basis for long-term development. Considering that both tourism and specific, fragile habitats are typical island issues, strategically encouraged appreciation-through-seasonal-engagement can enhance island resilience.

Temporal urbanities (analytical & projective): "Oh My *Gosch*!" by Patrick Brink, Jan Fröhlich, Lukas Merkel /[Fig. 7.18]
This approach employs temporal character and uses to distinguish urban landscapes on Sylt: permanent (dense settlements), temporary (event spots), and a suggested hybrid category for developing seasonal aspects. The latter is currently manifest as a specific but neglected type of seasonal urban landscape with parking spaces, golf courses, and camping areas scattered around Sylt. Toolkits of spatial measures have been designed and applied with respect to the three categories. This strategy makes use of the innovative concept of part-time urbanity, which emerged from the project. The method shows how the identity of open spaces can be interpreted and improved according to temporal dynamics, and can even develop new forms of temporal urbanity.

Allowing adaptation (projective): "Sandhunger Sylt" by Lydia Koch, Christina Pach, Ann Katrin Schönmann [Fig. 7.19]
A radical approach embraces the future by gradually or partially deconstructing the engineered coastal protection and reactivating wandering dunes. While the designs catalyze unpredictable long-term processes, they take seasonal phenomena into account in the timing of procedures. Three spatial measures deal with consequences. At a small scale, a returning visitor can read the effects of sea level rise and dune movement over time from fixed landmarks. At a larger scale, islanding and resettlement keep Sylt habitable while adapting to a dynamic environment. These highly speculative approaches are open to uncertainties and explore adaptive and anticipatory strategies.

Fig. 7.16 Seasonal players.




Phase 1
+ verstärken die Wichtigkeit von der anderen Faktoren
+ verbessert die Lebensraum
+ vervollständigen die Verbindung system
+ bauen die "OPEN AIR MUSEUM"
Phase 2
+ finden die neue Verbindung von humannishce Aktivität und Natur
+ schaffen neue Aktivität in "OPEN AIR MUSEUM"
Phase 3
+ zukünftige Aspekt z.B. Bedrohung von Anstieg der Meeresniveau

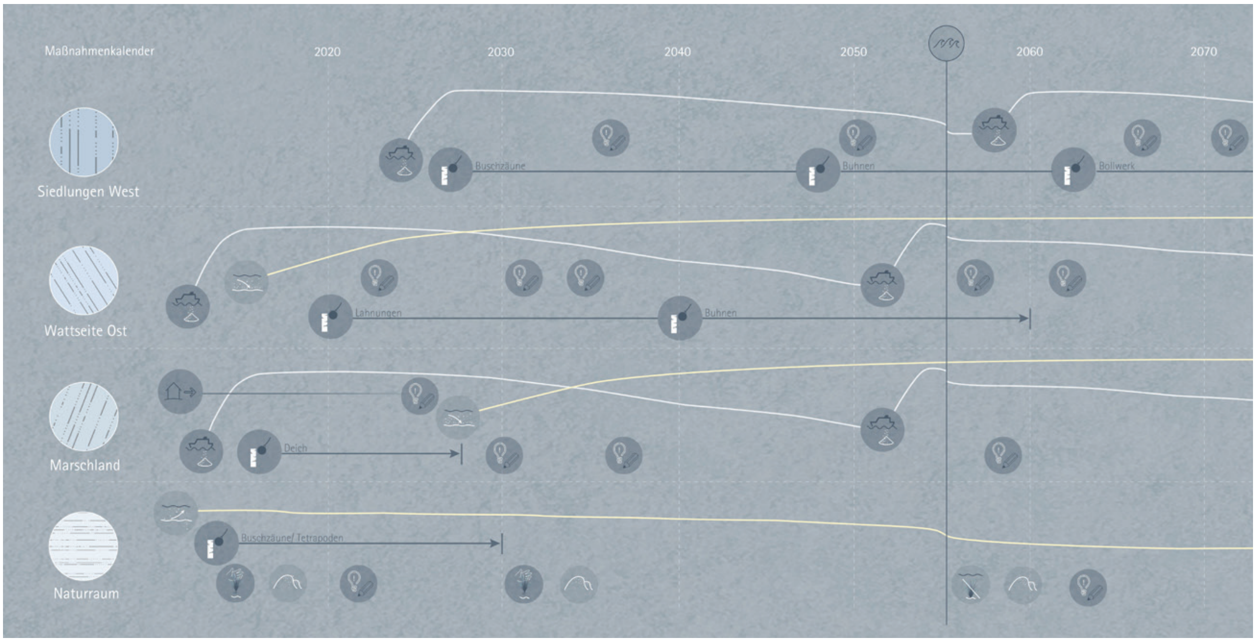

Maßnahmenkalender
2020
2030
2040
2050
2060
2070
Siedlungen West
Buschzäune
Buhnen
Bollwerk
Wattseite Ost
Lahnungen
Buhnen
Marschland
Deich
Naturraum
Buschzäune/ Tetrapoden

Fig 7.17 Multi-figure (left).
Fig. 7.18 Oh My *Gosch!*

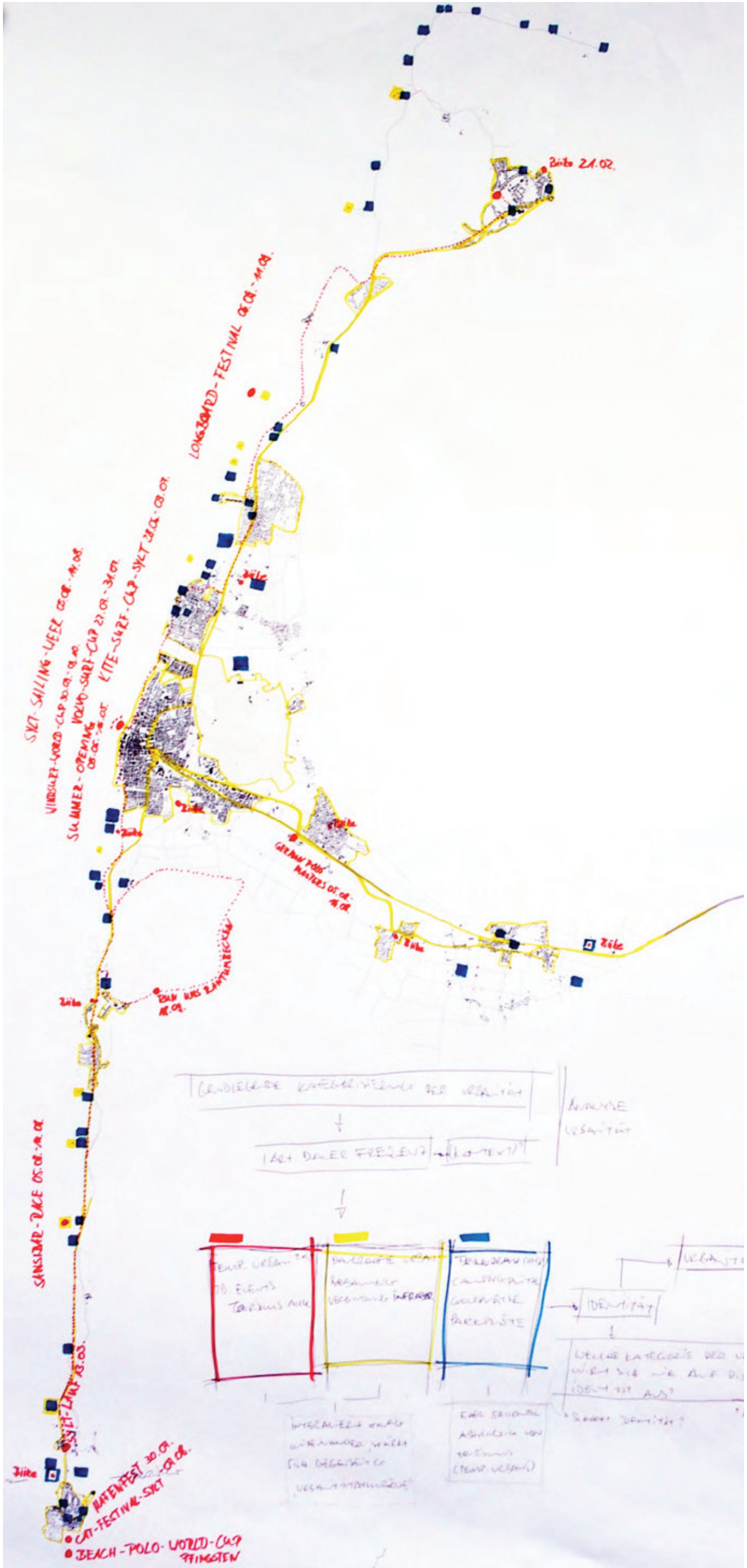
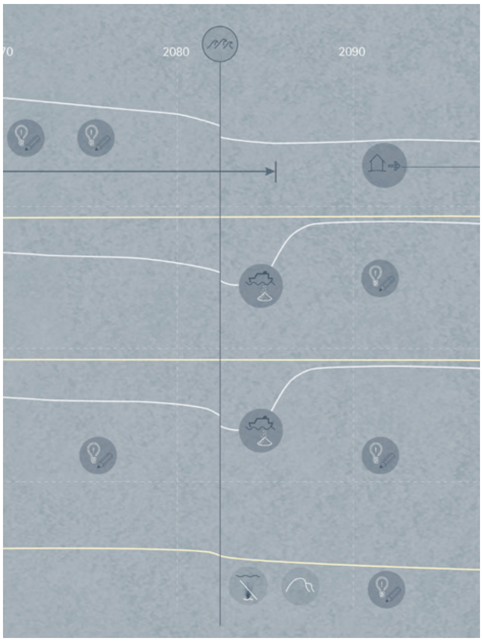


Fig. 7.19 Allowing Adaptation.



7.3. How are seasonal phenomena linked with spatial transformation?

The design studio thematized many seasonal phenomena on Sylt, but not to the extent I had expected. In order to answer the first research question, this subchapter completes the Research through Design with my own further investigations on Sylt: From seafood snack bars to empty camping fields, seasonal phenomena leave permanent traces in the island's urban landscape.

7.3.1 Seasonal phenomena and their spatial dimensions

Tourism

From May to October, tourists and second-home owners come to Sylt. Visitor numbers have steadily risen, almost doubling in a few years, and, during the peak in July-August, the island gets crowded, with over 600,000 hotel nights each month (Sylt Tourismus-Service 2017). About 100,000 people are on the island per day, five-fold of the permanent population. Most guests stay in private accommodation, among them are 10,000 privately owned second homes (Seemann 2015). While the winter is the off-season, New Year's accommodation has to be booked two years in advance. Festivalization completes the annual pulse of tourism. The event calendar spans from the traditional *Biikebrennen* bonfires in February to the Wind Surf World Cup in October. Sylt also hosts the "prestigious" annual Beach Polo World Cup, sponsored by a Swiss private banking group (Julius Bär 2018).

Gentrification is described in 7.1.1. Each villa has a name sign with a contact for reservations to enjoy suites, yacuzzis, and video-surveilled gardens. Tourism affects settlements and architecture, arrival landscapes, infrastructure, commercial offers, and social life. The high number of privately rented-out apartments is not directly visible. Summer peaks are manifest in the crowds and bustle, lines of cars, 120,000 cyclists, and outdoor event furniture. A former train track has been converted into bike routes, and, on converted agricultural land and dunes, the 90km^2 island features four golf courses.

Infrastructure on Sylt is dimensioned for visitor arrivals and ten-fold peaks of water consumption and waste production (Seemann 2015). In summer, five-kilometer traffic jams congest the heart of the main town, Westerland. Due to growing tourism, freshwater extraction is likely to expand from the island middle to further wells in List (Nieß 2017; Reise 2018). Increasing water storage capacity is required (Nieß 2017) because consumption peak is the inverse of the annual cycle of freshwater lenses (see dune slacks, below).

The off-season

The off-season appears as ghost towns, kiosk shutters, and empty parking lots. From November to March, two or three houses might be inhabited in a village of twenty. Empty camping fields have a particularly bemusing atmosphere, with their platforms and infrastructure anticipating next visitors. Dune bridges for beaches stand idle. Rough weather and busy hospitality businesses necessitate frequent maintenance work, mostly in early spring, autumn, and winter (Seemann 2015).

Storm tides and beach nourishment

Seasonal yet unpredictable storm tides typically occur in winter. Their dramatic erosive impacts are described in 7.1.2. In response, perhaps the most impressive seasonal undertaking is the massive sand replenishments on Sylt's western beaches between April and October (Holdschlag et al. 2012:55–6; Henningsen 2016); further protection measures are described in 7.1.1. The sand comes from the bottom of the North Sea, as sea-going dredgers pass in the horizon. Warning signs keep bathers out of the replenishment zone, while a huge pipe spouts tons of water-sand mixture onshore. "New" sand shines pale against the red cliff, and caterpillar tracks signal an accomplished task. Sand soon drifts south with the waves, landing in the neighboring row of islands (Reise 2015a).

Bird migration and breeding

Sylt's dune and salt marsh landscapes in the middle of the Wadden Sea are a haven for birds. April to May and September to October are peak seasons, with massive flocks of migratory species (Günther 2006). Roosting and breeding birds are part of Sylt's seasonality, and established preservation areas cover large areas of the island. Human intervention in many parts is seasonally disrupted, but the massive dikes in List and Rantum are excellent structures for bird-watching. Some species profit from urbanization: Seagulls opportunistically follow the abundant catering of snacks during the tourist season (Die Welt 2016). Oystercatchers have learned to expand their territory from mud flats to golf courses during the breeding season (Klatt 2012:21).

Oyster and mussel farming

There are hardly any fishermen left on Sylt. Vessels and equipment for oyster and mussel farming concentrate in two port settlements at the island's extreme points to the north and south: Starting in March or April, the oyster farming season involves a daily practice on the mudflat near List's land-sea interface, before moving away from storm floods and the ice to an indoor hall (e.g., Kasbohm 2014). The farm's dimensions are very small, but it produces a million "Sylter Royals" annually. Shells pile up in backyards and flower pots. In late summer, the mussel harvest season begins a choreography of vessels in front of Hörnum. After winter, boats, nets, and breeding tubes float idle in the port. Seafood restaurants and kiosks exist all over Sylt, including the famous Gosch!, which can be found in innumerable German towns. Cold chain enables year-round consumption (Kasbohm 2014), and, over the causeway, mussels are exported to the Netherlands (shz.de 2016).

Dune slacks

From winter to spring, small ponds form between dunes where ground water is exposed. A natterjack toad concert accompanies late spring – so one can hear the dune slacks from afar at night. Sea level rise elevates water lenses' surface, making dune slacks appear wetter, but in summer, most of them dry due to the high uptake of water from the freshwater lens of the island (Reise 2018).

Hunting

In November, orange security coats can be spotted on a dike south of Westerland. There are some 150 hunters on Sylt (Nieß 2015). Fox hunting is allowed throughout the year and takes place two or three times a year, for example, around a tiny forest. Wild rabbits plague the island environment, but can only be hunted from October until the end of the year (pbo 2014). Hunters plead control of species on the island.

Reed harvest

Thatched roofs are one of Sylt's branding symbols. According to "Sylt's last reed farmer" (Sylt Marketing GmbH 2011; cra 2017), harvest takes place in winter, from November to February or March, when the crop is dry and salt marshes are accessible: not necessary frozen, but the birds are gone. Reed marshes on the eastern coast are mostly under protection as bird habitat. With shrinking wetlands, their appearance on the island has declined, but cutting invigorates plant renewal. The only harvested field is a small parcel at the eastern tip of Sylt, where trains meet the island: A mere 12 hectares suffice for about three roofs. The life cycle of a thatched roof is about 40 years. The demand is so high that most thatched roofs are imported, and the harvester predicts obsolescence of the local practice.

7.3.2 Synthesis

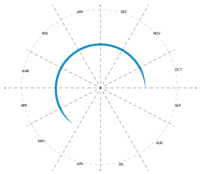
The mapping (Fig. 7.20–22) indicates a concentration of the listed seasonal phenomena close to the **coastal interface**, which also accords with Sylt's shape. Temporally, many phenomena accumulate in August and September. The nordic climate, tourism-driven gentrification, and storm tides are major drivers of spatial transformation on Sylt. Through the presence or absence of elements and uses, seasonality articulates the urban landscape and social dynamics: villas, holiday resorts, camping fields, arrival points, tourism facilities, golf courses, marinas, parking lots, birdsong, scenic landscapes, human productive practices and recreating, and storm mitigation. Climate defines patterns of ecosystems, agriculture, aquaculture, and beach life. Swimming crowds and caravans appear and disappear annually, but tourism and agriculture also have long-term impacts and indirect effects on spatial transformation. Settlement character and "leisuring" (Bunce 2008) are particularly visible consequences of tourism that, through gentrification, also affect atmospheres and uses of spaces.

Seasonal-spatial relations are multi-layered and reciprocal: Spatial transformation influences seasonality, too. Land rise through sedimentation affects reed growth and harvest locations. Decline in agriculture and strict preservation (or golf course!) have enlarged bird roosting and breeding areas. Spatial changes have benefitted one seasonal phenomenon at the cost of another. Landscape preservation is partly an indirect consequence and an attractor of tourism, and it intervenes in production: Regulations in the National Park and Biosphere Reserve inhibit expansion of oyster farming, even if demand is there (Kasbohm 2014). Spatial (and societal) transformation has almost obliterated some seasonal phenomena, like agriculture.

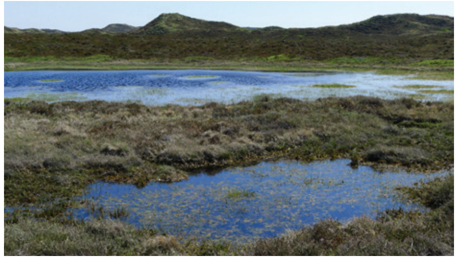
Effects can also be observed between seasonal phenomena. On Sylt, seasons do not only alternate on and off in sequence, but they attract each other, overlap, and clash: Sand replenishments take place in the swimming season, and, like tourists, bird populations peak in late summer, coinciding with the beginning of mussel season. The off-season, first and foremost, derives from tourism and winter – its negative or positive connotations depend on the angle. Birds and mussels attract tourists, but recreation, reed harvest, oyster farming, and fishing are limited due to seasonal (and long-term) habitat protection. These conflicts and synergies have spatial dimensions.

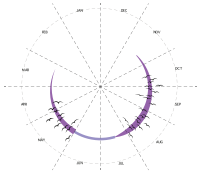
It is important to notice that shorter cycles initiate and accelerate elemental, longer-term spatial processes, too: The tide is elemental on Sylt, constantly altering the shoreline, the timing of human activities (transport, mud-flat tours), and the behavior of waders. Daily high tide gradually accumulates sediment in salt marshes, resulting in a rise by 1–2cm per year and vegetation changes (pbo 2016). Coastal micro-organisms nourish dune vegetation in biannual impulses, helping its establishment (Reise 2015a). However, frequent but irregular seasonal storm floods can interrupt the processes.

To summarize, spatial transformations on Sylt evolve, to a large extent, from tourism and climate, and, to a lesser extent, from practices like farming and fishing. Most of the seasonal phenomena affect the appearance and infrastructural, social, economic, or ecological performance and functions of the urban landscape. Analyses of sedimentation and settlement dynamics show that seasonal and cyclic phenomena not only switch on and off, but also catalyze linear processes, accumulative change in space. The diagram 7.26 illustrates relations of seasonal and spatial phenomena. Understanding all interconnections would require a long-term investigation and more data, for example, on holiday-house locations.

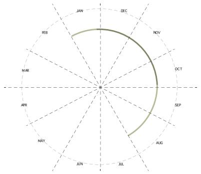


Dune slack

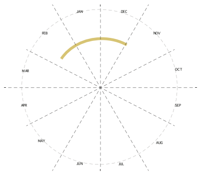




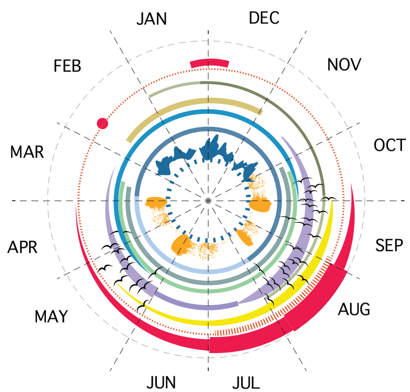
Bird migration

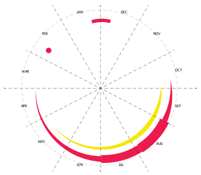


Hunting



Reed harvest




Tourism and beach

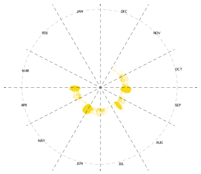
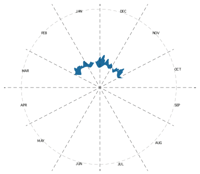
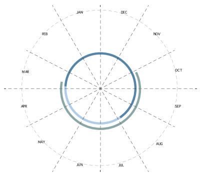
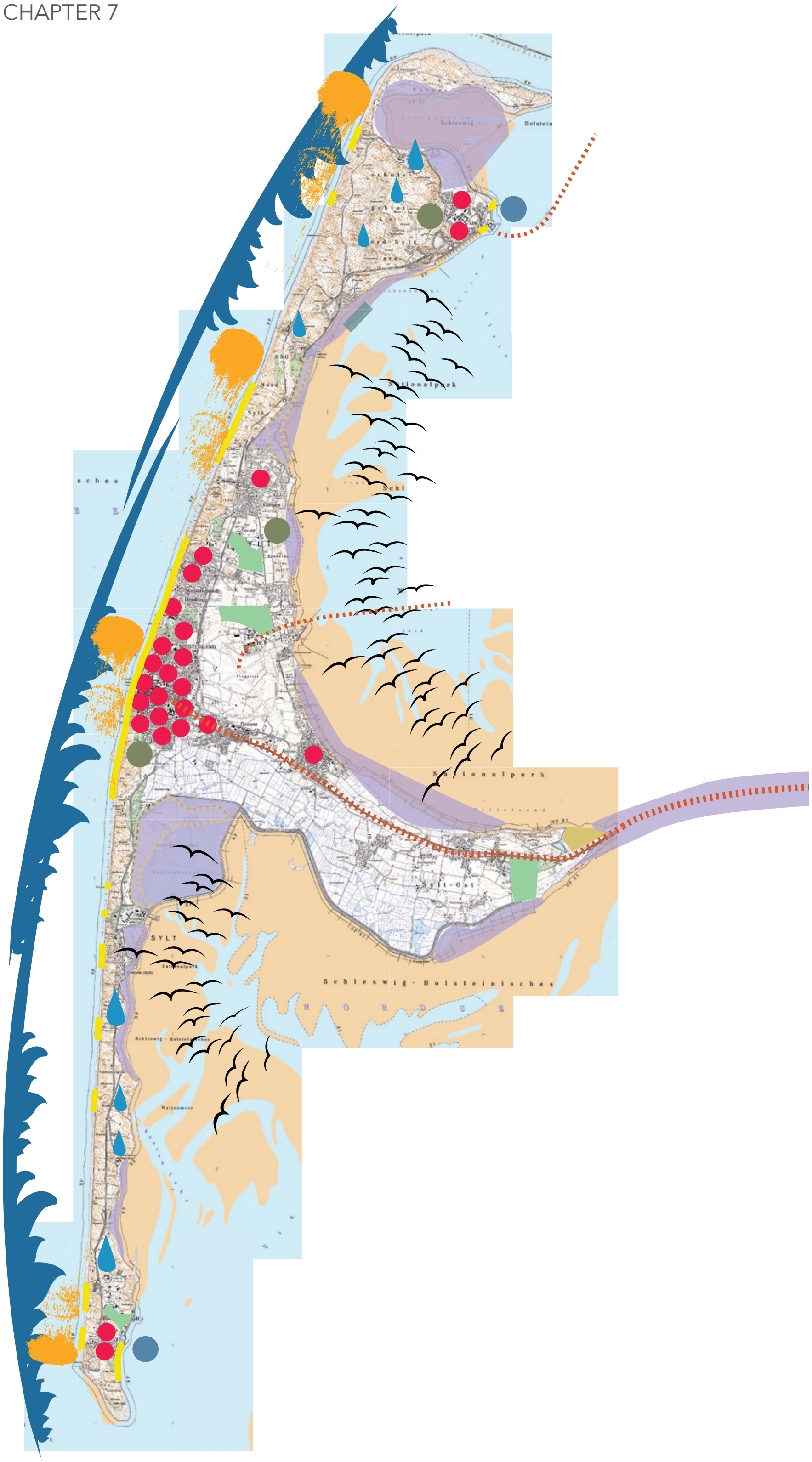

Sand replenishement

Storm tide


Fig. 7.20 Q1: How are seasonal phenomena linked with spatial transformation? (I)


Oyster & mussel farming



Nationalpark
SYLT
Sylt-Ost
Schleswig-Holsteinisches

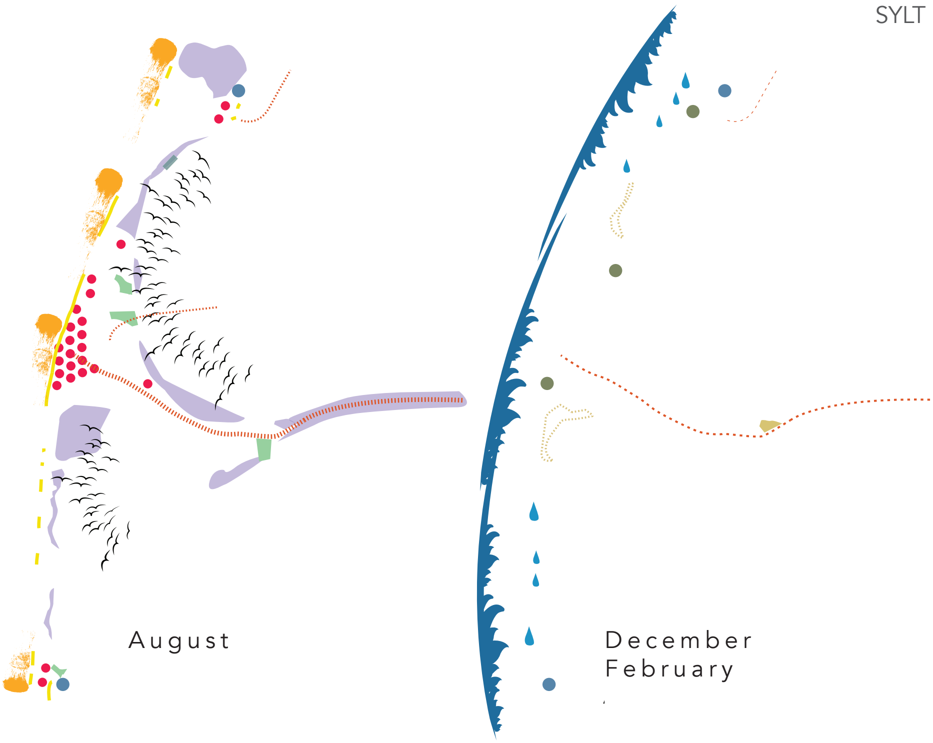


Fig. 7.21-22 Q1: How are seasonal phenomena linked with spatial transformation? (II)

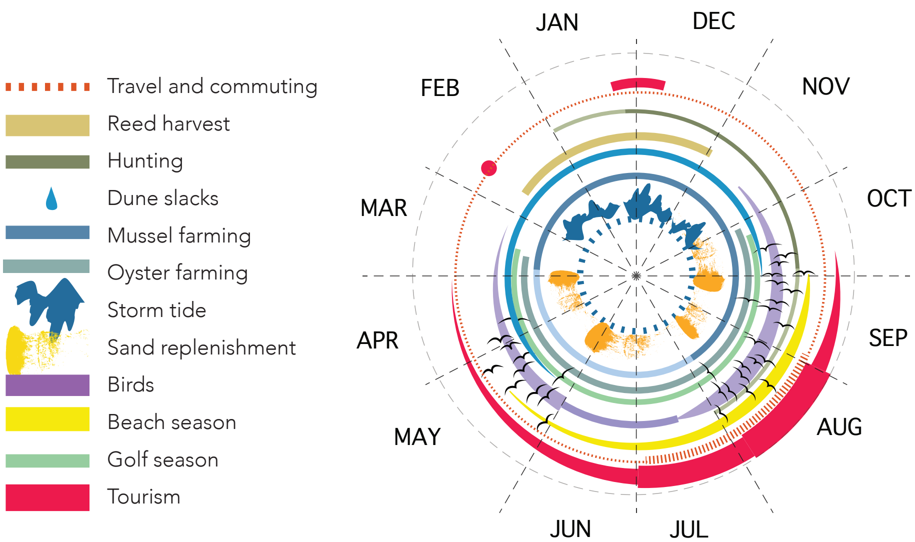
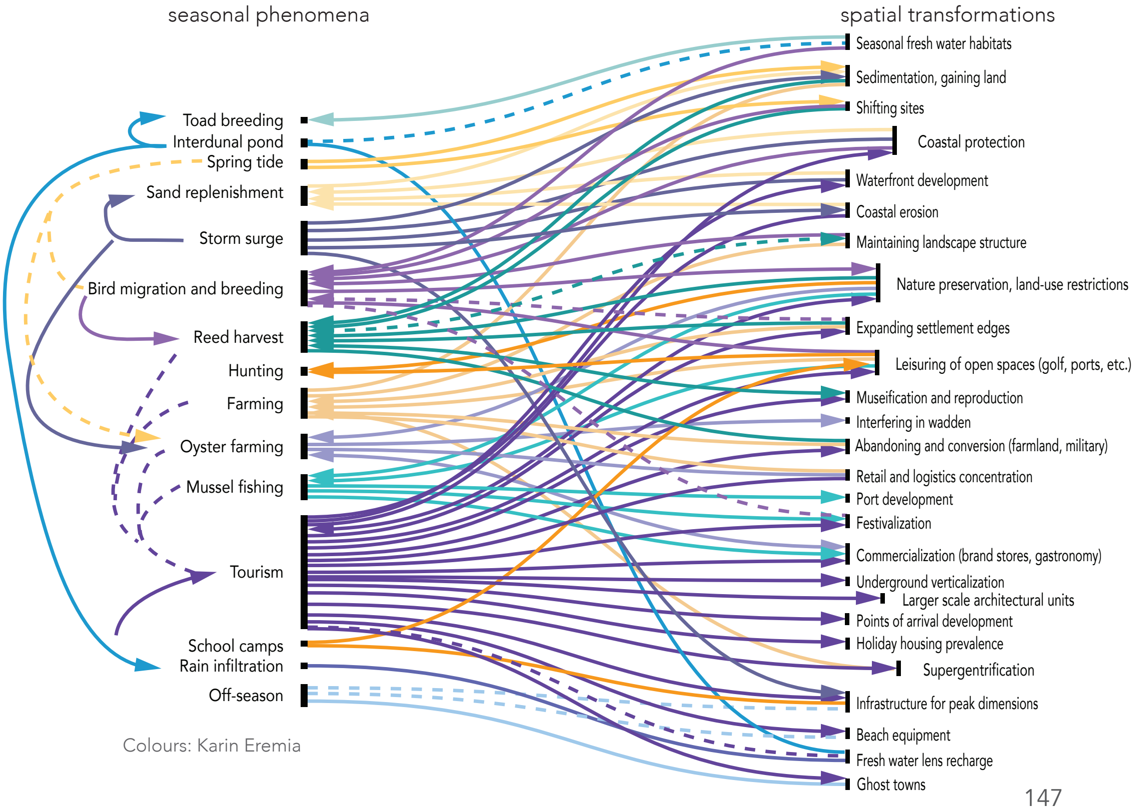


Fig. 7.23–24 Large-scale developments on settlement edges (above), festivalization (below), and leisuring (next spread) are spatial consequences of seasonal tourism.

Map data © Google, 2016 GeoBasis-DE/BKG

Fig. 7.25 Contrasting scales of new visitor-oriented developments at village edges.

Fig. 7.26 The seasonal-spatial diagram: Abstracting relations.



Colours: Karin Eremia

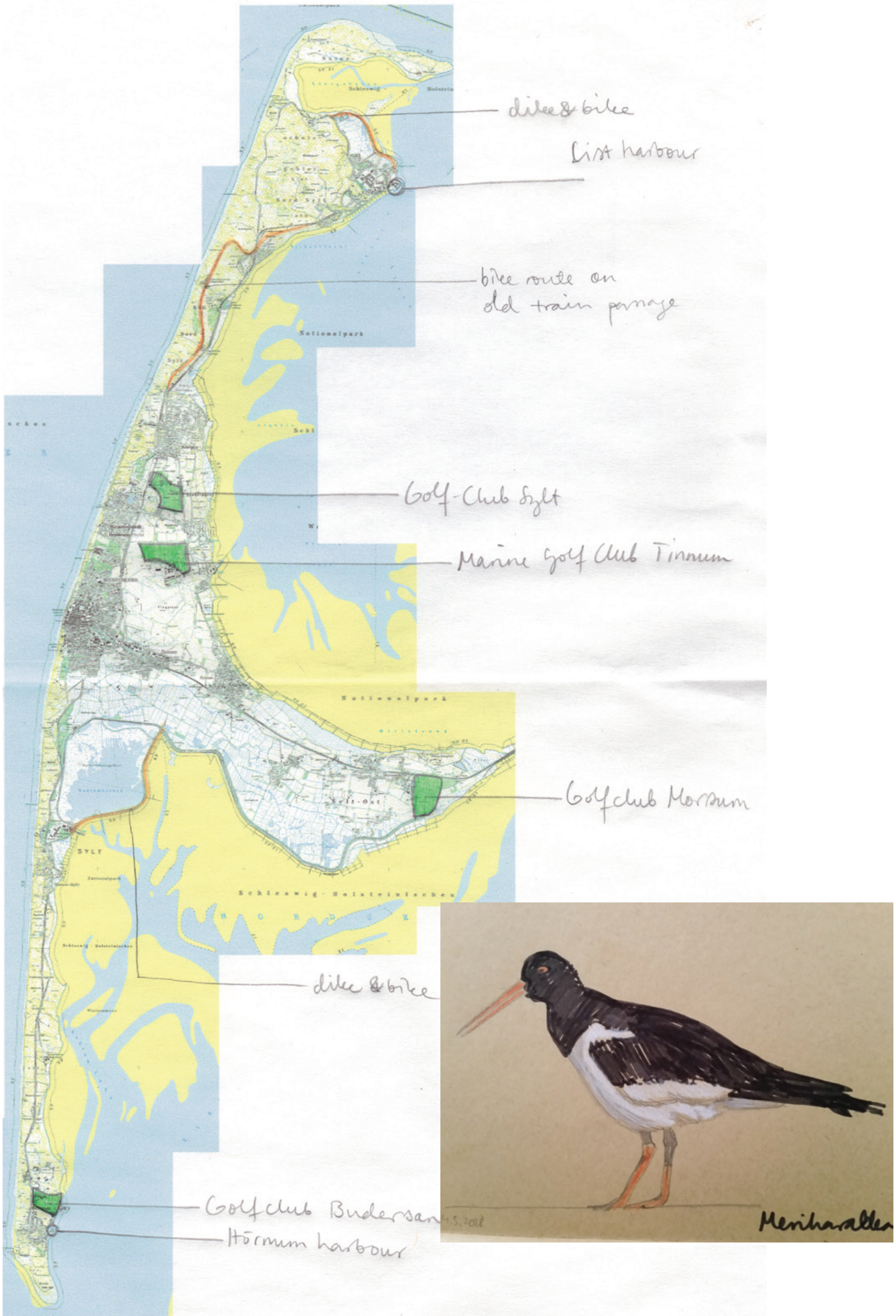
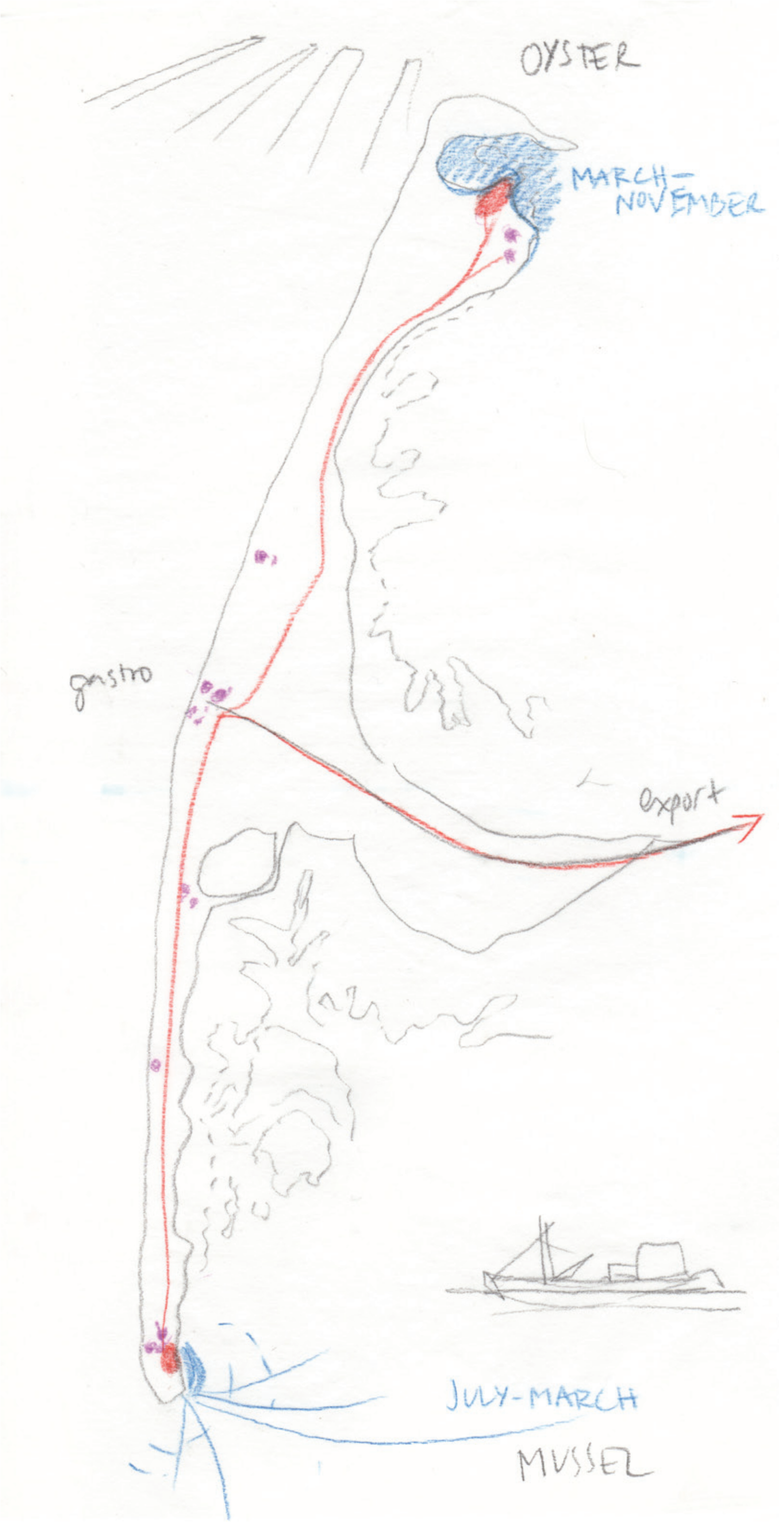

dike & bike
List harbour
bike route on old train passage
Golf-Club Sylt
Marine Golf Club Tinnum
Golfclub Morsum
dike & bike
Golfclub Budersand
Hörnum harbour

Fig. 7.27 Bicycle routes on dikes are part of Sylt's leisure landscape.

Fig. 7.28–29 Four golf courses on a small island occupy a proportionately large land area on converted agricultural land and dunes. They have created a novel habitat for oyster catchers.



OYSTER
MARCH–
NOVEMBER
gastro
export
JULY-MARCH
MUSSEL

Fig. 7.30–33 Oyster and mussel farming entails ports, production facilities, culinary establishments, and logistics of connecting to the mainland.

Map data © Google, 2016 GeoBasis-DE/BKG

Fig. 7.34–7.35 The off-season is characterized by empty parking lots and camping fields, closed businesses, and empty houses. The island's linear main road is dotted with immense parking lots between dunes.

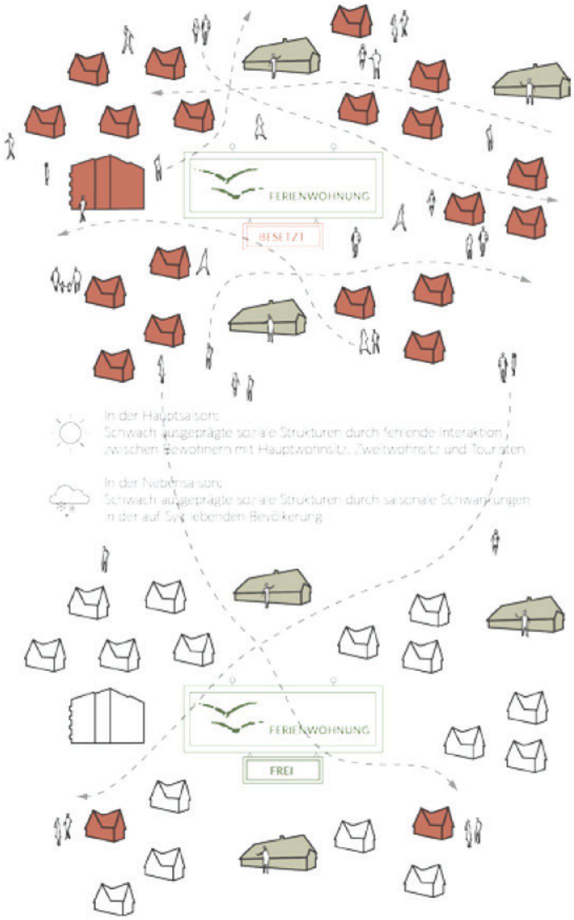


Fig. 7.36 Illustrating the odd settlement dynamics on Sylt. Sebastian Beutel, Maximilan C. Jung, Christian Tautz. M.Sc Design Studio Island Times 2015–2016.

7.3.3 Transformative potential II: Manipulating

Thinking of these dimensions, and the trends of increasing tourism and storm-tide intensity, or decreasing food and production, I conclude the section with some ideas of how to integrate seasonal phenomena with desired transformations. Shifting sites and mobile accommodation may make sense for adaptation in the dynamic landscape and regulated spatial resources (see 7.2.2). Which role do, or could, empty camping fields and parking lots play?

Adaptation could also involve mollusks: While the Billion Oyster Project (2013) has promoted the reestablishment of oyster banks to New York Harbor for filtering polluted water and buffering wave impacts, Reise (2018) is skeptical about their robustness to storms on Sylt. However, "oyssel reefs" could be more resilient to biotic disturbances and climatic warming, thus increasing the adaptive capacity of the Wadden Sea (Reise et al. 2017). However, introduced to Scandinavia, the Pacific oyster is a resilient invasive species. Whether or not it is harmful (Kasbohm 2014; Reise et al. 2017), it has caused a crisis that is not far at all, in Denmark, from threatening the natural oyster and mussel populations, which are very important for the Wadden Sea ecosystem (Dolmer et al. 2014). Accidental overproduction of seafood and potential raw material could be a positive problem – but does it compensate for the ecological loss? Could the production, consumption, and ecological dimensions of oyster farming, mussel fishing, and reed farming and construction be integrated into a seasonal design that encourages resilient development through tourism engagement? I wonder whether spatial transformation has removed some form of seasonality that would be useful today for making the island more resilient to the impacts of climate change and urban peaks, or more self-sustainable in terms of imported resource consumption.

In the spring, birds and natterjack toads and wind called my attention to acoustic landscapes and orientation. Closing my eyes in List, based on the species, I could *hear* where a given habitat was: the coastal flats, the tiny grove in the middle of the village, the villa gardens. Old dunes were quiet, apart from sheep and a school camping site. To complement the popular mudflat walking tours, Sylt could develop seasonal landscapes based on sensory experiences.

Finally, the off-season suggests some wiggle room if its meaning is extended from the absence of tourism to other phenomena. As there are various seasons, there are also various off-seasons. I suggest studying plural off-seasons as a new perspective on development, asking: Whose season is the off-season?

7.4. First landings

This chapter summarizes how the case study contributed to developing the thesis approach, and answering the research questions of the thesis. I reflect the findings of the master design studio and my own further inquiries. As a preliminary case study, Sylt is, at the same time, research *for* design – to establish a conceptual framework and methods for the other case studies – and Research *through* Design. The case study has produced insights about island urbanization, specific knowledge about the relationship of seasonal and spatial dynamics on Sylt, and transferable landscape-design approaches that incorporate temporal dynamics on islands. I provide general insights and critical remarks regarding the topic and approach, followed by results and recommendations for further research.

7.4.1 General outcomes and challenges

7.4.1.1 Defining urban islands

The first exercise of Inselzeiten produced a heuristic combination of indicators to assess island urbanization: land use, connectedness, and complexity (see 7.2.1). The assortment emphasizes the multiple facets of island urbanization and reveals the paradoxical nature of islands: Located in the extreme periphery and/or having vast natural-cultural landscapes, an island may be rapidly accessible from mainland centers, thrive as a service and tourism economy, and sustain a high material standard of living, fed by intense global flows of people and goods. Sylt ranks in the middle, with its natural image yet also intense interactions with urban Germany and global data. In contrast to spatial definitions, Inselzeiten highlights the temporal dimension of urbanity on Sylt: It is a part-time urban island.

7.4.1.2 Approaching temporal dynamics

The wide range of graphic presentation experiments of the second exercise places temporal data in the spatial context, creating images of changing landscapes over seasons. Attempts to visualize the temporal dimensions led to a better understanding about island-specific dynamics, and to insights about potential planning issues and intervention points. Thus, the project shows new ways to survey and integrate temporal dynamics into design. Altogether, in the first phase, the acts of experimenting – with types, concepts, and visualizations; developing one's own tools; and rearranging island portraits – facilitate comparison, recognition of relationships, and repetition. They thus provide answers to the research questions and contribute to idea generation. What has not quite been utilized to the extent that I expected, is a clear emphasis on cycles and seasons.

A more precise fieldwork strategy could have rendered more targeted outcomes in Inselzeiten. Although the projective task subconsciously guides interpretation of what one experiences, at the beginning, one might not find what one is looking for, because one does not necessarily know what it is. A narrowly programmed search for what one needs to find can turn out to be affirmative. Freedom to explore facilitates a more critical approach, and openness to being distracted provides unexpected encounters. The time to discover Sylt during the design studio was very short – and I later on completed the observations about seasonality in different months on Sylt.

7.4.1.3 The challenging dimension of seasonality

The experience from the design studio demonstrates that seasonality is a challenging topic for a spatial discipline. Among the various temporal scales that were handled, seasonal discoveries and tools were perhaps the least represented. Many students addressed some other time scale, ranging from micro-organisms' development and daily rhythms to long-term geological processes. Evidently, cycles coexist with linear time, and seasonality should be considered in connection with other processes (see 7.3.2). Seasonal dynamics are linked with and catalyze longer-term transformation. As I was developing the approach – not only for the purpose of the seasonal-spatial diagram (fig. 7.26) but also in the sense of thinking of transformative impacts – I pondered how to distinguish seasonal phenomena from spatial transformation: When and how does an on/off furnishing turn into a longer-term, profound change?

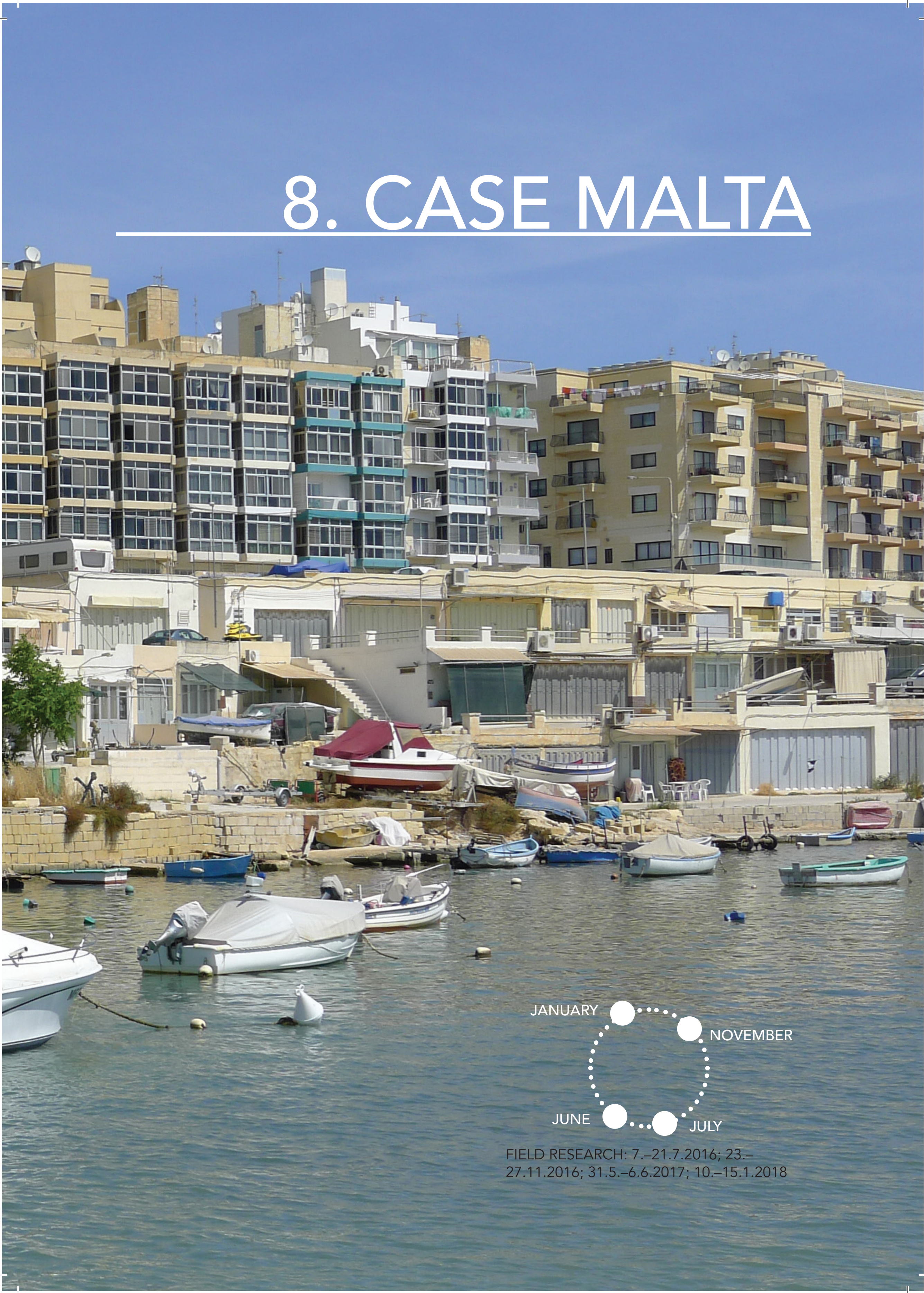
7.4.2 Integrating seasonal dynamics into designing urban landscapes

The practical examples of and reflections on transformative potential demonstrates that seasonality can be integrated into design urban landscapes. Both analytical and projective design approaches emerged in the course of the design studio. Many works from Inselzeiten combined temporal approaches with other tools in the design process. The following measures and approaches demonstrate particular potential for working with seasonal dynamics (for details, see 7.2.1.2 and 7.2.3.): landing rhythms; juxtaposing parallel peaks as well as juxtaposing seasonal biodiversity; the seasonal players; temporal urbanities; programming engagement; and the landmarks designed as part of allowing adaptation. Additionally, the following tools address the land-sea interface and catalyze adaptive processes by questioning humans' relation to natural dynamics in the Anthropocene: allowing shift, and resettlement. These ideas are applicable for building resilience, although, at this stage, they do not incorporate seasonality but rather long temporal scales. Altogether, the approaches presented are focused, yet flexible for further development and adjustments, which enhances transferability to other locations.

Finally, based on my exploratory research on a number of seasonal phenomena on Sylt, the case study and methodical reflections raised further questions. I delineate three other design foci in regard to island seasonality: blue-green infrastructure, productive landscapes, and the off-season.

- Would it make sense to design seasonally adaptive blue-green infrastructure? Besides climate and bio-geography, this would require studying and mapping the seasonal variations of the natural/urban metabolism of an island – a project in itself.
- What is the potential of reinforcing productive landscape cycles in island development? Considering its ecological footprint, luxury tourism is usually extremely non-sustainable. To some extent, it is desirable to increase the self-sufficiency of an island.
- Lastly, Sylt calls attention to the spatial qualities and dimensions of plural off-seasons: What happens in the off-seasons of different phenomena?

8. CASE MALTA



FIELD RESEARCH: 7.–21.7.2016; 23.–27.11.2016; 31.5.–6.6.2017; 10.–15.1.2018

M A L T A

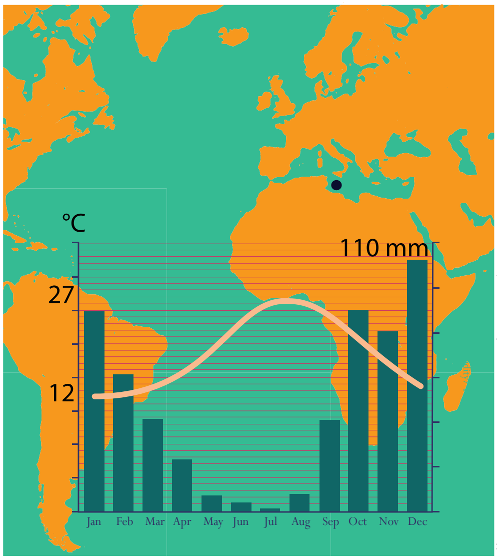
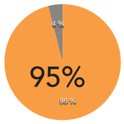
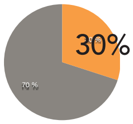


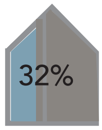
Illustration Karin Eremia, climate diagram
based on: http://www.malta.climatemps.com/



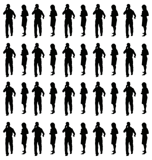
urbanized population



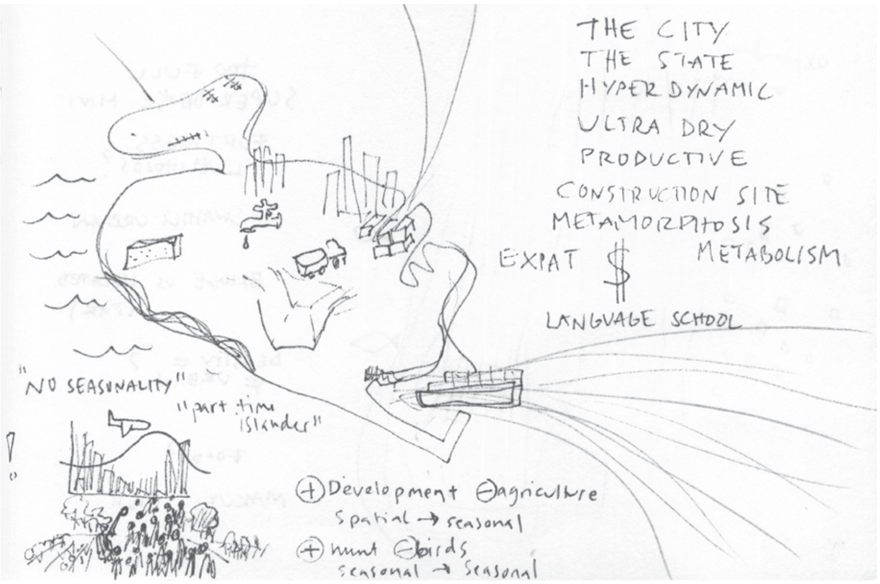
urbanized (artificial) land



vacant and seasonally
used housing (2011)



403 995 residents
2,2 million visitors 2017



Status: The main island of an archipelago state

Map data © 2019 Microsoft Corporation Earthstar Geographics SIO (Bing Aerial via QGIS)

population[1]	403,995 in 2015
land area	246 km²
population density	1642/km²
urban population[2]	95 % in 2014
urbanized land area[3]	30 %

Urban dynamics: demographic growth, speculative construction boom
Vacant and seasonally used housing 32 %[4]

Key ecosystems: seasonal freshwater habitats, transitional wetlands, *Posidonia oceanica* (seagrass) meadows, sclerophyllus forest, macchia, and garrigue

1 NSO 2016b: 3 (434,403 total in 2015, of which 93 % live on the main island)
2 United Nations 2014
3 European Environment Agency 2017 (artificial land cover)
4 NSO 2014

8. Malta

Images of Valletta – panoramas of only buildings and the sea, with no green spaces – originally raised the question about what happens with landscape when an island is fully built. Malta is the most densely populated state in Europe.[4] This case study handles the highly urbanized main island, and a distinction is made when referring to the whole archipelago. A closer look has revealed that half of the island's surface is agricultural land (European Environment Agency 2017), yet, 95% of Maltese people live in cities or towns (United Nations 2014), and ongoing urbanization is exceptionally intense. The Mediterranean climate is polarized with unpredictable winter precipitation and extremely dry summers that bring about language students and flocks of tourists. With respect to resilience, Malta's global ranking as a country with a low disaster-risk profile (INFORM 2018) is deceptive (see, e.g., Kelman 2018; Main et al. 2018). From geological modifications to fluxes of people and emissions, Malta represents many exponential traits of the Anthropocene. The spatial dynamics and challenges point to an insight-provoking island case of resilience-building and seasonal phenomena.

The first part of this case study is an interpretation of the dynamic urban island with respect to spatial transformation, and is reflected against concepts of islandness and island spatiality (chapter 3). The second and third parts use a more specific lens to answer the research questions about seasonal phenomena and resilience-building.

8.1. Islandness and specificity

8.1.1 Portraying a dynamic urban island

Malta is a group of three islands and a small state in the middle of the Mediterranean Sea. Situated between Africa and Europe, ferries, airplanes, shipping lanes, and data cables weave the island into global networks of travel, communication, finance, and cargo. Malta's main island of the same name is the biggest and densest in the archipelago.

Ultra-dynamic expansion

The major current societal and spatial transformation in Malta is urbanization. A startling real estate market and construction boom are epitomized by the density of construction cranes. An endless balcony facade of holiday apartments makes up a considerable part of the island's waterfront settlements (fig. 8.1). They sit on a rugged coastline, in a sequence of bays, accompanied by docks, huge

4 After city-states and territories of Monaco, Gibraltar, and Vatican City.

cruise ships, and infrastructural facilities that accommodate the most accessible waterfronts. Townhouses double their stories, and a spreading conurbation has engulfed villages. Planning has controlled sprawl, but urban expansion and verticalization dominate spatial development (SPED 2015). Approved building permits and useful floor area have catapulted in recent years (NSO 2016b:80). Artificial land covered 30% and agricultural areas 51% of the archipelago in 2012, and the main island is the most urbanized (European Environment Agency 2017).

Ultra-dynamic flows

In 2017, Malta hit a record of over 2.2 million tourists (Malta Tourism Authority 2018), and international companies have been bringing in a considerable expat population (Martin 2018) to the (former) tax haven. Malta produces medicine, toys, and fireworks; it repairs ships and attracts film-crews and investment-based citizenship. The island is an important transshipment hub and has one of the busiest ports in Europe (Malta Freeport 2010). Imports are necessary to supply almost everything, from basic needs to excess consumerism, from fossil fuels (MEPA 2012b:27; Conrad and Cassar 2014:6734) to even the world's most productive tuna aquaculture (Borg 2018).[5] The processes are run with a physical infrastructure of power stations, ports, and desalination and waste treatment plants. Handling metabolic issues internally poses spatial challenges for a small island city-state. The large proportions of infrastructure and industries are clearly distinguishable in aerial views. Land scarcity prompts optimization: Two former military airports and a landfill have been converted for leisure and production (fig. 8.9–10), and a Dubai-ish SmartCity rises in the place of an industrial estate. However, startling rates of vacant properties (NSO 2014a) and the simultaneous real estate boom form a paradoxical situation in Malta.

An abandoned mosaic

For its size and density, Malta can be considered an urban region, but scale is relative: Islanders speak of cities and the countryside. Neat furrows start from town edges, and farmlands form an extensive small-scale mosaic. Large machines are absent, and terraced fields contribute to a picturesque countryside. Potatoes, eggplants, strawberries, and capers are sold from farmers' vans in towns. Urbanization encourages abandonment of agricultural practice and lands, yet, in certain valleys, intensifying horticulture and greenhouses alter the landscape (SPED 2015:15). The rural idyll camouflages environmental problems (see 8.1.2).

5 Frozen fish is imported to feed the tuna.

Portraying a dynamic urban island: MALTA

Fig. 8.1–7 An endless balcony facade of holiday apartments at the waterfront: The construction boom is epitomized by the density of construction cranes. Malta Freeport is an important trans-shipment hub and one of the busiest ports in Europe. Sandy beaches are rare. In Malta, one almost always sees inert waste, a quarry, the land fill, or cranes. Yet, one can also always see the sea or sense its proximity from the light of the open sky and horizon, sense that the land ends.

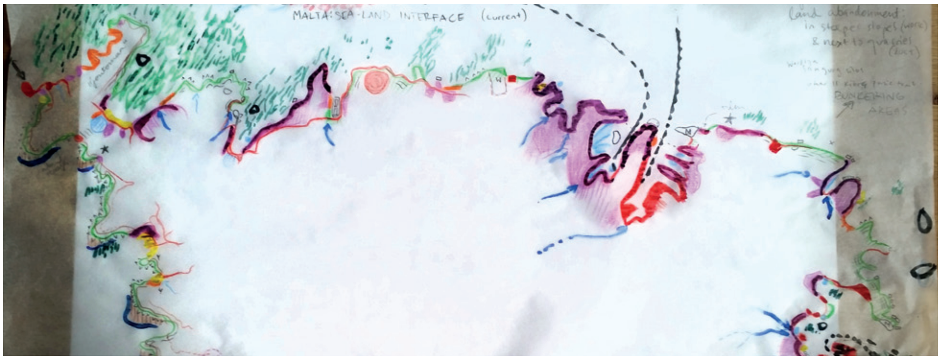


Fig. 8.8 Drafting Malta's rugged coastline: A series of urbanized bays.

Disturbed and ephemeral

Malta is barren: Woodlands are absent, and soils are thin and rocky. In western Malta's raw-wind and green-shrub landscape, one can still sense detachment from the city. Malta is not blessed with kilometers of breath-taking beaches, but cliffs that rise up to 250 meters have spared long coastal stretches from built development. Human presence is marked by bird traps, archaeological sites, quarries, and car trips. Geological formations provide cinematic scenery for Hollywood and hikers. In Gnejna Bay, an elderly islander wonders how tourists find these distant, hidden places. Even the isolated village of Bahrija is flanked with construction cranes, and accounts of livelihood and ecological sabotage (Deidun 2003). "Disturbed ground" is as typical as garigue or steppe with shrubs and grasses (ERA 2018b; Lanfranco 2018). There is hardly an untouched natural spot in Malta, but the number of protected areas has increased (MEPA 2012b:42). In fact, the island has great biodiversity (IUCN 2018). Marine ecosystems are among the richest, including *Posidonia oceanica* meadows that also mitigate coastal erosion (PAP/RAC 2005:11). In the event of sufficient rain, temporary streams, ponds, and puddles in Malta's valleys and ravines provide indispensable habitats (see 8.2.1). There are no permanent surface waters apart from very few small watercourses, but the whole limestone island is a group of stressed aquifers (see 8.1.2).

Made of limestone

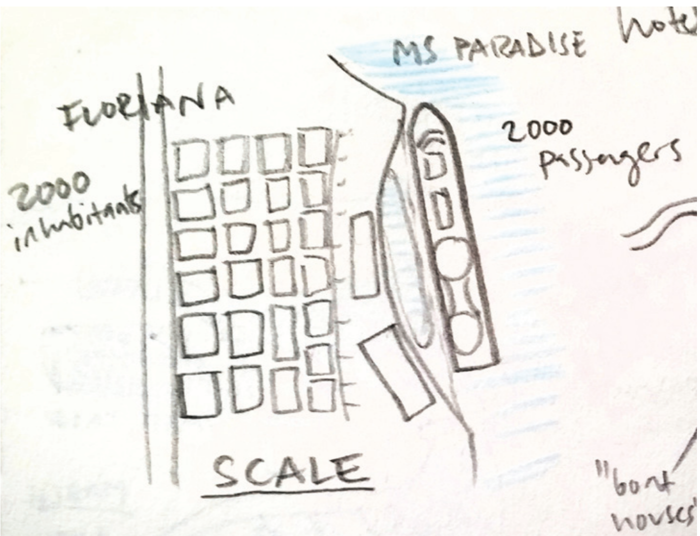
Malta is literally made of limestone in different forms, from the super-dense towns to the cliffs. The island substance has been cut and re-shaped by humans in acceleration since the 1960s. Although building materials are also shipped, Maltese are (or used to be) masters of cutting and assembling, rearranging and modifying the island: gaping limestone quarries; rubble walls and country shacks structuring farmlands; salt pans carved on the rocky coast; homes, hotels, and fortresses. The ubiquitous elements range from minuscule to monumental. In Malta, the Anthropocene (see chapter 2) is embodied in the tangible relation of the geology of humankind and urbanization. The solid materiality contrasts ecological ephemerality, exponential visitor fluxes, and a risky geomorphology that is anything else but static (see 8.3.1).

Fig. 8.9–10 Land scarcity prompts optimization (above): Two former military airports and a landfill have been converted, among other activities, for production and leisure.
Fig. 8.11–12 Recreation outside of towns is limited because agricultural lands (even if not cultivated) are private (below). At sunset in the summer, people gather at the urban bays (bottom).

Tracing islandness: a disillusioning entity

With regard to islandness and island spatiality, Malta particularly displays the aspects of **smallness** (if compared with mainland cities) and **proximity**. Landscape elements are very **detailed** in scale: towns, streets, tiny stores, beaches, coastal marshes, forests, and agricultural holdings. That **contrasts** quarries, recently built supermarkets and retail centers, hotel clusters, a former dump, and logistics hubs (e.g., the airport, the cargo port) – and cruise ships (fig. 8.13–14). Due to the size and shape of the

Fig. 8.13–14 Tracing islandness – comparing scales: An aerial view of a cruise ship with 2000 passengers docked next to the town of Floriana, with 2000 inhabitants. Fig. 8.15 Malta is made of limestone that is transformed from quarries to towns (left).



island, all elements are in immediate vicinity to one another, and the topography renders them visible from many locations. Fields start from townhouse walls, and a cargo port rubs against a beach town; a market takes place in front of a power plant, and bird reserves neighbor hotel clusters. There are no buffering spaces, despite the paradoxically high number of unoccupied farmland and properties. In Malta, the distribution of land uses is not functionally coherent or rational, but the island is an intriguing heterogeneous entity, seasoned with underuse and overuse.

My aesthetic impression of the landscape is a disillusioning outcome of pragmatism and barrenness. One almost always sees inert waste, a quarry, the land fill, or cranes. Yet, one can also always see the sea or sense its proximity from the light of the open sky and horizon – one can sense that the land ends. Coastal concentration is evident, but overdevelopment and the inaccessible cliffs direct (built) development inwards, fragmenting key ecosystems and open spaces. Due to the lack of virgin land, the importance of spatial recycling, multifunctionality, and innovation are highlighted. The island dynamic is characterized by discernible transformation: urban expansion, verticalization, abandonment, visitor fluxes, ephemerality, and conversion.

8.1.2 Topical spatial problems, and trends

With respect to urban landscapes, the acute problems in Malta result from spatial limits and manifold effects of demographic, economic, and urban growth. The political dimension goes beyond the scope of this research. Malta seems to have know-how on strategic levels, a strong economy, EU funding, generally

accessible technologies, and the manageable size of a small island, but measures of sustainable spatial development have not kept up with harmful impacts.

8.1.2.1 Land scarcity, environmental degradation, and resource depletion

The biggest problem in Malta is the (ir)rational and extensive use of land (Schembri 1993:37; Conrad and Cassar 2014). It causes extreme competition and affects ecosystem integrity and functions (Conrad and Cassar 2014:6742). Environmental degradation includes habitat fragmentation and loss, pollution, soil degradation, aquifer depletion, abandonment of agricultural land, coastal (over)development, and land-use conflicts (MEPA 2012b; SPED 2015). From the densely built northeast and coastal settlements and their expanding fringes, these problems expand to the whole island. In agriculture, pesticides are widely used, and (illegal) wells and nitrate leakage threaten ground water[6] (MEPA 2012b:32; SPED 2015:15). These problems concentrate in the northwestern parts of the island. Municipal and construction waste production is high (MEPA 2012b:37; Conrad and Cassar 2014:6741–2; Eurostat 2018b), space for inert waste is running out, and it is often illegally dumped (MEPA 2004:135; Camilleri 2018). The coastal interface is under particularly high pressure from both land- and marine-based interests and impacts. Experts point out that "[l]and-based activities are the main sources of coastal and marine pollution" (SPED 2015:16). Besides other threats, invasive alien species mar the island's rare native species (ERA 2016).

Both soil and freshwater are extremely scarce and vulnerable resources in Malta. Malta's Water Exploitation Index (EU) and freshwater availability per capita (UN) clearly indicate high water stress and insufficient capacity to ensure basic needs (SEWCU and ERA 2015:108, 114). Freshwater scarcity and aquifer depletion result from population growth, tourism peaks, increasing demand for agricultural use, soil impermeabilization through land uses, high evapotranspiration rates, and irregular precipitation (Gatt and Farrugia 2012; Mangion 2013; SEWCU and ERA 2015:110, 114–22). Further threats to ground water include salt intrusion, contamination from agricultural and urban activities, and increased demand for agricultural use (SEWCU and ERA 2015:110, 114–22). Malta converts seawater into potable in reverse osmosis plants that depend on imported energy to produce half of the water consumed (PAP/RAC2005:38; Gatt and Farrugia 2012; European Environment Agency 2018). Paradoxically, against the water scarcity, the extreme consequence of soil sealing is flash flooding on main roads that are built on stream beds. Outside towns, valleys are used for illegal waste disposal, which affects water flows. Enhanced storm-water runoff carries pollutants, and flooding can cause sewage overflows (MEPA and MRA 2011:47). Land-use pressure results in a high degree of soil sealing and loss of soil (MEPA 2012a:47). Due

6 However, the major consuming sectors that are officially billed are private households and services! (MEPA 2012).

to urbanization, agricultural (mal)practice, and industrial development, the thin and rocky soils of Malta are afflicted by desertification, erosion, contamination, decline of organic matter, and salinization (MEPA 2012a:47). Dust from quarries lands on settlements and agricultural lands and ecological habitats (Conrad 2017).

Demographic growth, a construction boom, and a car-dependent lifestyle (MEPA 2012b:13; SPED 2015:13) – coupled with tourism – result in urban congestion. Lack of recreational areas and open green spaces within and around settlements reinforces heat waves and indirectly relates to health problems such as obesity (Conrad 2017). Recreation in the countryside is limited to a few parks and spots because agricultural lands are private (fig. 8.11). Shooting ranges and off-roading are considered problematic (MEPA 2004:155).

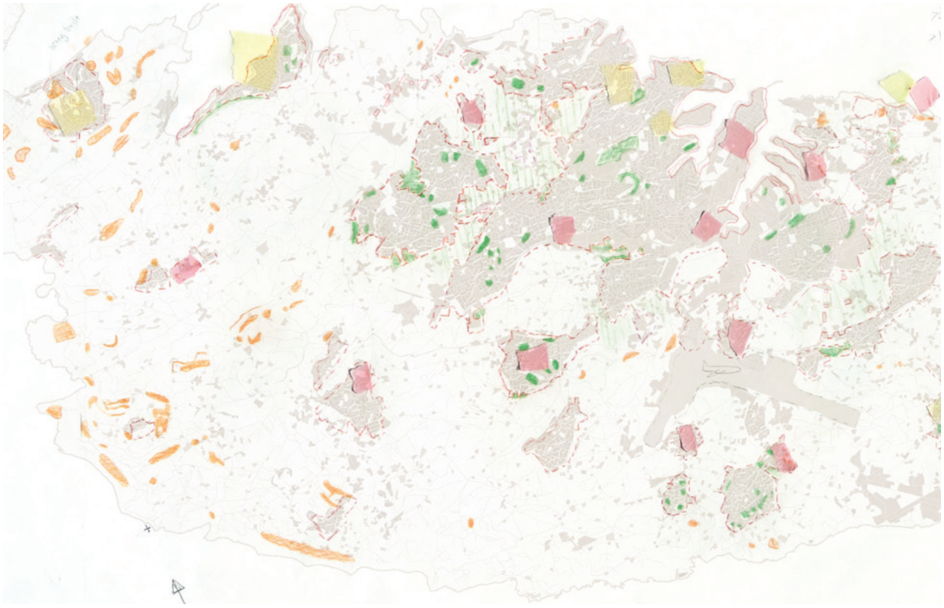
8.1.2.2 Urbanization and climate change prospects

The growing population of Maltese archipelago is expected to be about 463,200 by 2040 (NSO 2016a:30). Malta stands out, with the highest increase in population per 1,000 people in Europe (Eurostat 2018a) and is frequently cited as one of the fastest growing economies in Europe (e.g., Ministry for Finance 2018). Scarcity of land and environmental degradation continue to be serious problems unless they can be decoupled from economic and population growth (Conrad and Cassar 2014). Highly dependent on imported food and fossil energy, Malta has a considerable ecological footprint, and its energy and transport sectors are considerable contributors to greenhouse gas emissions, which increased overall by 54.4% from 1990 to 2012 (SPED 2015:13).

The national Climate Change Committee for Adaptation has stated that "Malta is expected to be moderately impacted by climate change when compared to the overall global situation, with the main impacts being drought, deterioration of freshwater resources, increased risk and intensity of flooding, soil and coastal erosion, desertification, changes in sea level, and progressive loss of biodiversity and resilience of natural ecosystems" (2010:42). An increase in both mean temperature (by 1.1°C) and record-high temperatures has been observed since the 1980s (Galdies 2011:25–9). Coupled with predictions of less wind and less cloud cover (CCCA 2010:3), heat waves are expected to magnify. Besides densely built towns, they will strain cultivation and key ecosystems. Rainfall patterns have high spatial and temporal variability over the Maltese Islands, but between 1951 and 2010, there was no trend in the total annual precipitation or strong rain events (Galdies 2011:31–2). However, the extensive human impact and current urban development in Malta intensify flash floods, extreme flows of storm water, and erosion as a consequence of water runoff. Estimates concerning sea level around Malta are ambiguous, and the CCCA report projects a rise of 0.45–0.15 cm per year (2010:4) – that would be 12–36 cm by 2100. In global comparison,

Fig. 8.16 Small patches of farmland remain enclosed within expanding urban settlements.

Fig. 8.17 "Placeholders": Transformative potential scattered around the island in settlements with over 20 % vacant (pink) or 13 % seasonally used properties (yellow), and abandoned agricultural lands (orange).



such estimates may not seem dramatic, as Malta also profits from a hilly territory. Nonetheless, the coastal prevalence of infrastructure, settlements, economic assets, and rare ecosystems make coastal and marine zones vulnerable to rising sea levels, storm surges, increased temperatures (marine ecosystems' biodiversity and wave buffering), and erosion (SPED 2015:16).

8.1.3 Transformative potential I: Elements and resources

First of all, considering the spatial dimensions, quarry after-use is highly topical in Malta. Island spatiality urges one to consider the proportionate vastness of quarries and their proximity to settlements, agricultural lands, and key ecosystems. Their contrasting solid materiality and sublime dimensions are special. Mineral production from quarries has been decreasing (NSO 2016b:80), and these hollowed out spaces are a considerable potential resource for spatial innovation.

Secondly, the scattered abundance of abandoned agricultural fields bears systemic potential for spatial interventions (or unplanned development). Together with single patches locked within expanding settlement fringes, I call them "placeholders." This also includes the higher-than-average (17.7%) number of empty or occasionally used properties in many settlements (NSO 2014a). Transformation potential could be found within the densest urban concentrations as well, because that is where it is both dynamic and uncomfortable. These development pockets – of the absence or congestion of human life – contain little ecological diversity or processes. Yet, a large number of small-scale agricultural holdings (NSO 2014b) speaks for self-organization with significant dimensions. This can be good or bad: Private ownership hinders planning and uses of open spaces (see 8.1.2), and resistant attitudes can undermine development. However, farmers could also represent a critical pioneering mass. What happens on their land is relevant.

The concrete canals in urban valleys are a recurring urban space in Malta, with potential for multifunctionality and biodiversity. They are hardly used for anything, if not as parking space or a pedestrian corridor to the supermarket. Built for the case of extreme flooding, their single function has priority (Gatt 2018) – unless flood risk is reduced by other means. This leads to the observation that the dry river valleys – *wied*, plural *widien* – are a cross-cutting spatial system over the whole island, linked to the urgent topic of freshwater.

Unlike most development in Malta, the features thematized here intersect at a fringe zone between the northeastern conurbation and the rural west (fig. 8.18–19). Some of them point at seasonal dynamics, which are explored and discussed in the following.

Fig. 8.19 Studying the spatial characteristics of the main island of Malta. A zone of proximity of different elements and functions dovetailing. The two further drawings portray the coastline and verticalization boom.

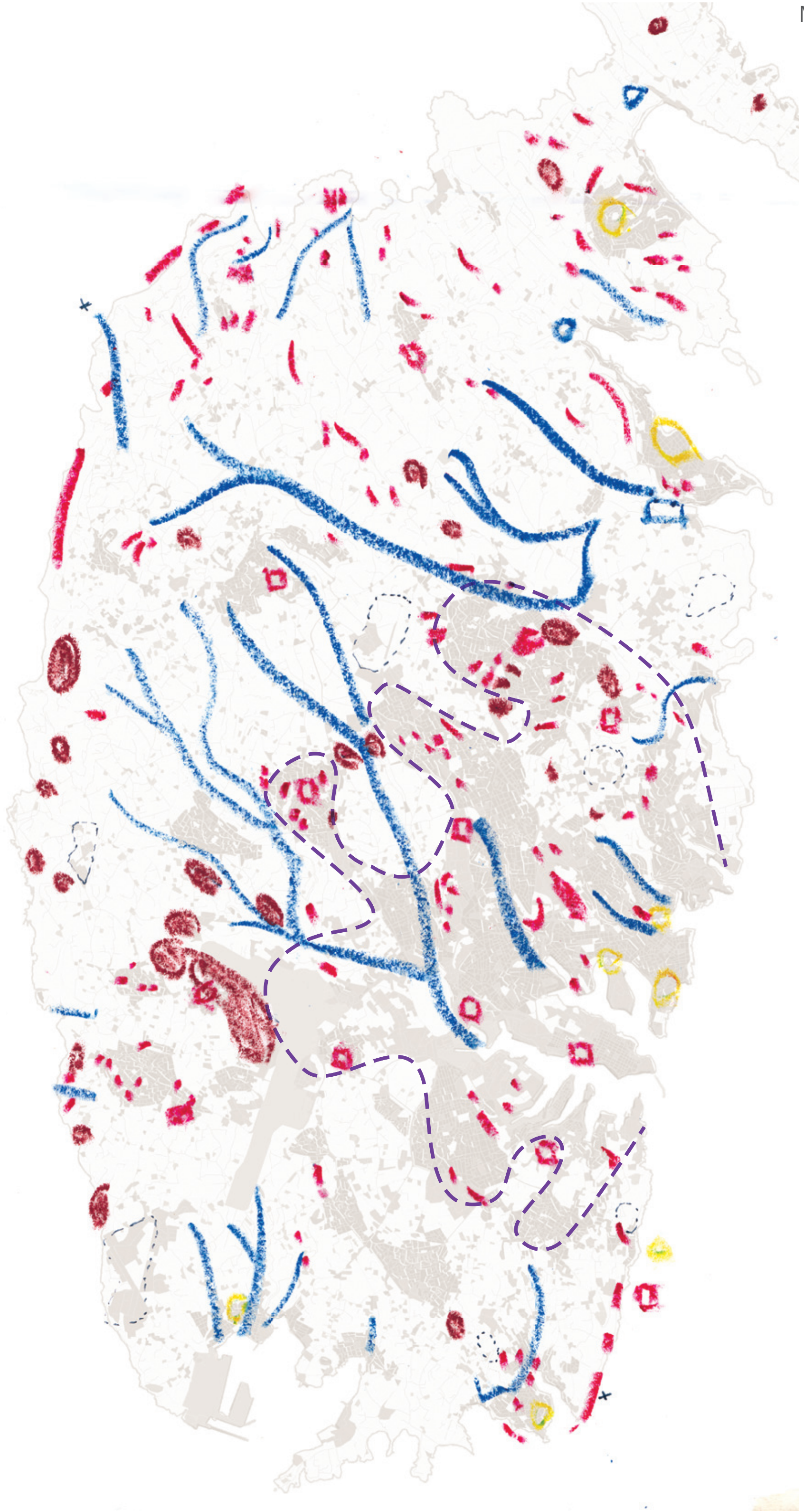


Fig. 8.18 Transformative potentials on Malta: Dry river valleys, quarries, and "placeholders". Overlaying the features demonstrates a spatial concentration at the fringes of the core urban areas (see also below).

8.2. How are seasonal phenomena linked with spatial transformation?

8.2.1 Seasonal phenomena and their spatial dimensions

The following seasonal phenomena and practices have been discovered in Malta: tourism, flash floods, and ephemeral freshwater habitats, bird migration and hunting, farming and salt production. Village feasts, fishing, and recreational patterns have seasonal influences, too. While absolute droughts occur almost every July (Main et al. 2018:845), in winter, the whole landscape in Malta is greener.

Tourism

"Between 2001 and 2015, Malta recorded an increase of 55.6 per cent in inbound tourists" (NSO 2016b:85). In 2017, over 2.2 million tourists visited Malta (Malta Tourism Authority 2018). The seasonality of tourism is declining, but two thirds of tourists arrive from April to September, and there is a clear peak in August (Ministry of Tourism 2015:17–18; Malta Tourism Authority 2018). The daily number of tourists in August was around 60,000 on average, between 2002 and 2011 (MEPA 2012b:15).

Tourism concentrates in the capital and northern coasts of Malta, and seasonality is most noticeable in northwestern settlements (Ministry of Tourism 2015:10). The number of seasonally occupied housing can reach 20–45% (NSO 2014a), but locals point out that there are no ghost towns (Zammit 2017). Accommodations grow vertically and laterally, contributing to congestion in already dense areas and to a decrease of agricultural land and natural habitats. Historical sites, caves, and activities like diving and sailing attract tourists beyond purpose-built settlements and beaches. The seasonally accentuated footprint of tourists expands to natural resources and infrastructures: The mean daily consumption of water by tourists is two to three times that of locals and peaks in summer months (MEPA and MRA 2011:111; Mangion 2013:69–71). Beaches and hiking areas are exposed to erosion (and micro-plastics from shoes). Waste production and pollution from transport increases. 97.9% of tourists arrive by airplane, and, at over 300 cruises per year, cruise-line calls are on the rise (Malta Tourism Authority 2018). Malta International Airport takes up a proportionately large territory, and massive ships circulate the historical port, pumping visitor flows towards the old town's refurbished waterfront.

Flash floods, aquifer recharge, and seasonal habitats

Maltese aquifers are only replenished by rain and percolation, mostly during winter. In the event of sufficient rain, valleys gather ephemeral streams, ponds, and puddles. Between October and January, flash floods are typical in sealed urban river beds or canals that lead to bay outlets (see also 8.3.1). Temporary streams and pools provide seasonal freshwater habitats for a diversity of fauna and flora. This includes valuable endemic species like the endangered freshwater crab *Potamon fluviatile ssp. Lanfrancoiz*, which actually requires a permanent water source (ERA 2018a), the painted frog *Discoglossus pictus pictus*, and the seasonal aquatic plant Maltese Waterwort, *Elatine gussonei*; this also includes invasive species like the giant reed, *Arundo donax* (SEWCU and ERA 2015:102, 131–4). The reed's expansion was formerly limited due to its extraction for blinds, fishing equipment, and other purposes (Portelli 2015). In addition, coastal wetlands "are maintained by seasonal fluctuations in precipitation, run-off, evaporation and seepage […] During the dry season the water becomes progressively more brackish until it becomes hyper saline and finally disappears completely, leaving the marsh dry until the following wet season" (PAP/RAC 2005:10). Transitional water bodies at the coastal interface have been heavily modified by humans for centuries (SEWCU and ERA 2015:7), and holiday settlements and fishing harbors have often grown at their side.

Bird migration and hunting and trapping

The seasonally changing habitats of transitional waters are optimal for birds. The Maltese islands provide invaluable stopover habitats in the European-African flyways: In spring and autumn, over 170 migratory bird species from at least 48 countries are regularly observed (Birdlife Malta 2018). The spring migration is from mid-March to May, and the autumn peak is in mid-September (Birdlife Malta 2016, 2017). Through initiatives of environmental organizations, bird migration has triggered designation and landscaping of conservation areas. Besides the cliffs and Malta's few woodland patches, these include tiny reserves and the airport sanctuary. In some places, afforestation is executed by hunters (Baldacchino 2016). Hunting and trapping of birds is a widespread tradition. Besides designated seasons and the species quota in spring and autumn, illegalities threaten protected species (Birdlife Malta 2018; CABS 2018). Clearings for clap nets can be recognized in aerial views, dotting cliffs and the countryside, and many sites are in active use (CABS 2015).

Farming

Although agricultural production in the Mediterranean climate is year-round, the rainy season is important, and winter is the main season for crops, ploughing, and sowing (Vassallomalta.com 2016); hand work with small machines is a common sight in the fields. Despite the decline, agriculture is the largest land-use type in the Maltese archipelago (Conrad and Cassar 2014:6733). Two thirds are, on average, one-hectare parcels of different owners, mostly part-time farmers (NSO 2014b). Agriculture has shaped the island almost everywhere, and the seasonally changing appearance of fields is an essential characteristic of the landscape.

Fishing

Fishing in Malta is seasonal (Briguglio et al. 2002:15): There are different seasons for different catch and respective techniques (Vassallomalta.com 2017). Despite tradition and an eye-catching collection of boats in the bays, fishing is only a part-time livelihood for many of the slightly over 300 fishermen in Malta (Baldacchino 2016; Borg 2017). Commercial or subsistence fishing concentrates in the southeastern region (PAP/RAC 2005:12). In the (former) fishing ports of all the coastal settlements, landing sites still exist, even in tourist settlements. The Sunday fish market at Marsaxlokk Port is a tourist attraction with all kinds of goods, and selfie-taking visitors are more numerous than the handful of fishermen they spot clearing nets. The waterfront promenade is flanked with seafood restaurants. Today, recreational fisheries are more common. For example, squid fishing takes place from the shore in winter months; the "hot spots" are located in the northern bays (maltabookers.com 2018). In many parts of the island, just meters from the sea, small linear groups of former fishermen's boat houses have been converted for summer use.

Salt production

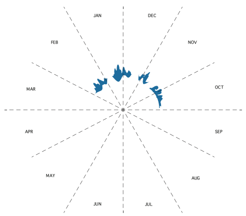
Salt extraction from seawater through salt pans has left extensive, very peculiar marks scattered around the rocky coasts of Malta. Apart from one site in the town of Marsaskala and one on Gozo island, it is an abandoned activity. Salt production's seasonal cycle traditionally started in March with scrubbing the pans that seawater would enter. Salt was harvested from July to September, when evaporation rates are the highest. "With respect to salt production the main concern is related to lack of adequate protection and the identification of suitable alternative use […] They are also important resting grounds for waders in transit to and from Europe" (PAP/RAC 2005:65). Small salt pans are carved into the rock in different shapes and depths for evaporation. The historical Salini in St. Paul's Bay is a larger-scale construction of pools, recently rehabilitated and designated as a bird sanctuary.

Village feasts

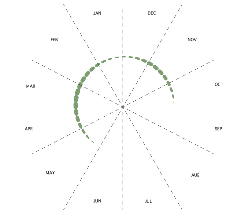
Summer is the prevalent season for numerous village feasts dedicated to their patron saints. Within decorated settlements, a "festive atmosphere" emerges in the "transformed streetscapes" (MEPA 2004:156), where people gather and parade. Feasts are not spatial transformations in the sense of permanent nor thorough change. However, the "spectacular and characteristic displays" are an essential part of Maltese culture (Ibid). They seasonally change the appearance, atmosphere, and function of public spaces. Fireworks, masts, and lights are often visible from afar in the landscape. They are not far from villages, small firework factories are dotted across the islands (Ibid).

Bathing, hiking and car trips

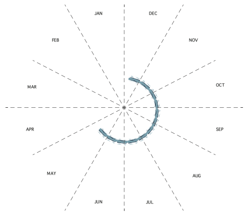
A seasonal pattern can be observed in recreational uses of open spaces. From mid-April to mid-November, the few beaches and accessible locations at the rocky waterfronts are used for swimming. In peak months, beaches are used in shifts: Maltese gather to barbecue in the late afternoon, when sun-bathing tourists take off (PAP/RAC 2005:22). *Posidonia oceanic* (Neptune seagrass) banquettes that accumulate ashore in winter are removed from tourist beaches, exposing sand to erosion (Idem:64). Former boathouses and informal clusters of seaside residences equipped for summer occupy many waterfronts. In the cooler months, local families seek parks and other suitable areas inland for recreation (Conrad 2017). Car trips to the formerly less visited areas are popular (MEPA 2004:158). As a consequence of hiking, soil erosion is particularly present in shrublands and on the almost extinct dunes and beaches that make up only 2 percent of the Maltese coastline (PAP/RAC 2005:10).



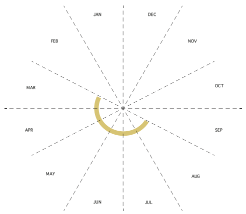
Flash flood and fw habitats



Recreation inland

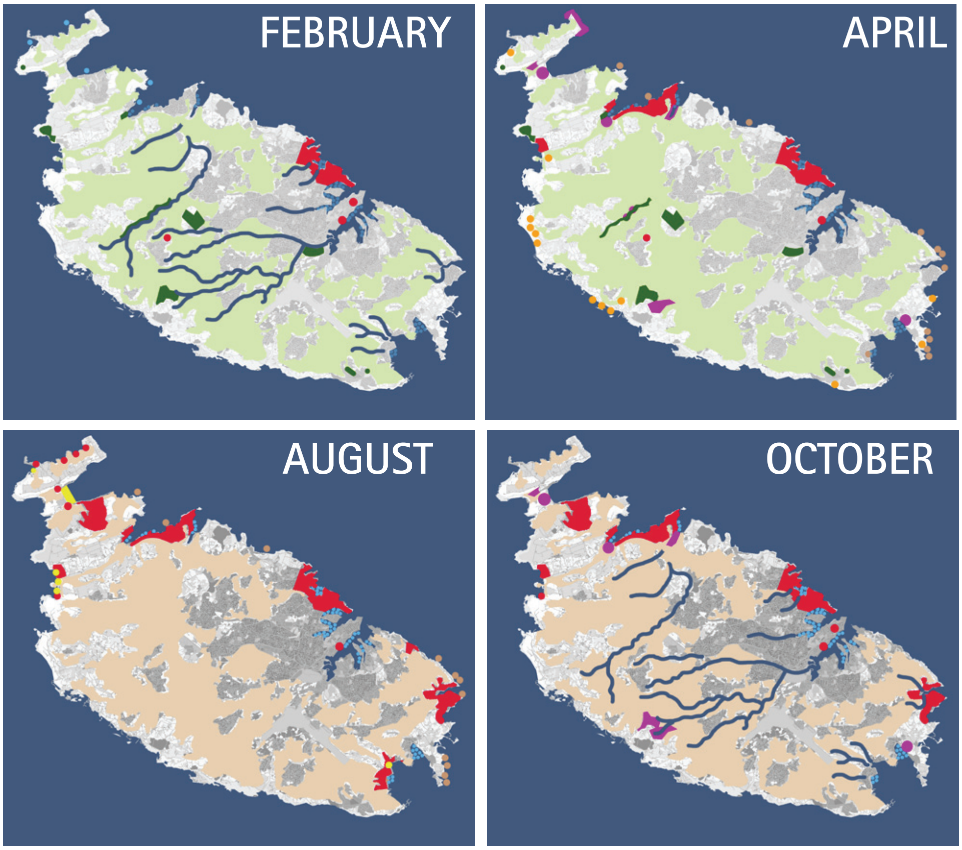


Fishing

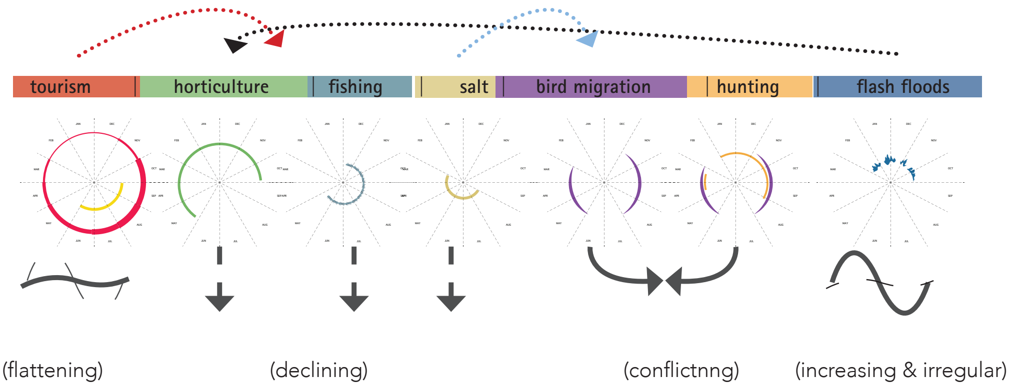


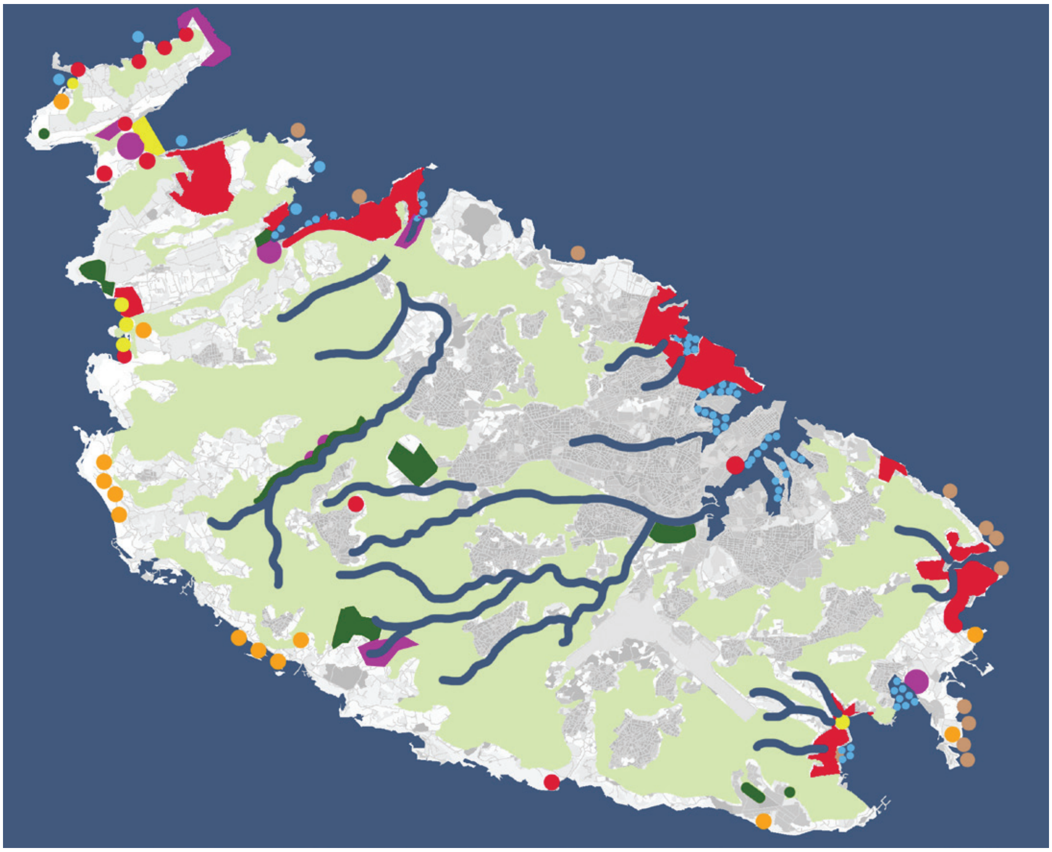
Salt harvest

Fig. 8.20 Q1: How are seasonal phenomena linked with spatial transformation? (I)

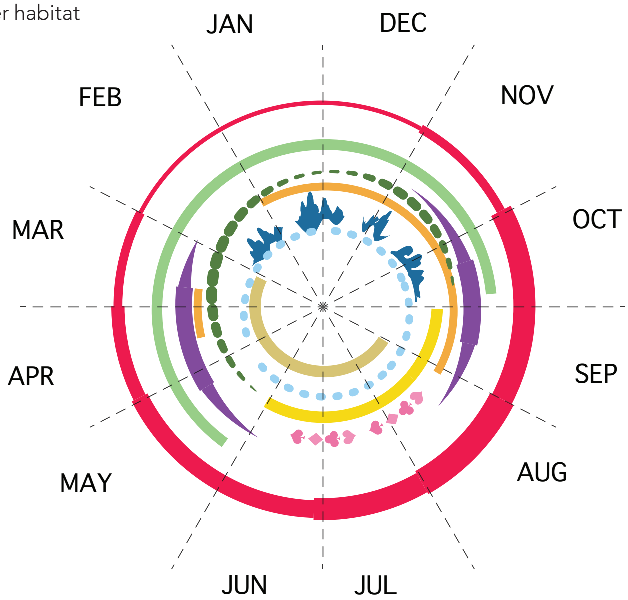


8.21–24 Q1: How are seasonal phenomena linked with spatial transformation? (II)





- Horticulture
- Recreation inland
- Hunting
- Flash flooding & freshwater habitat
- Fishing
- Bird migration
- Salt harvest
- Beach season
- Village feasts
- Tourism



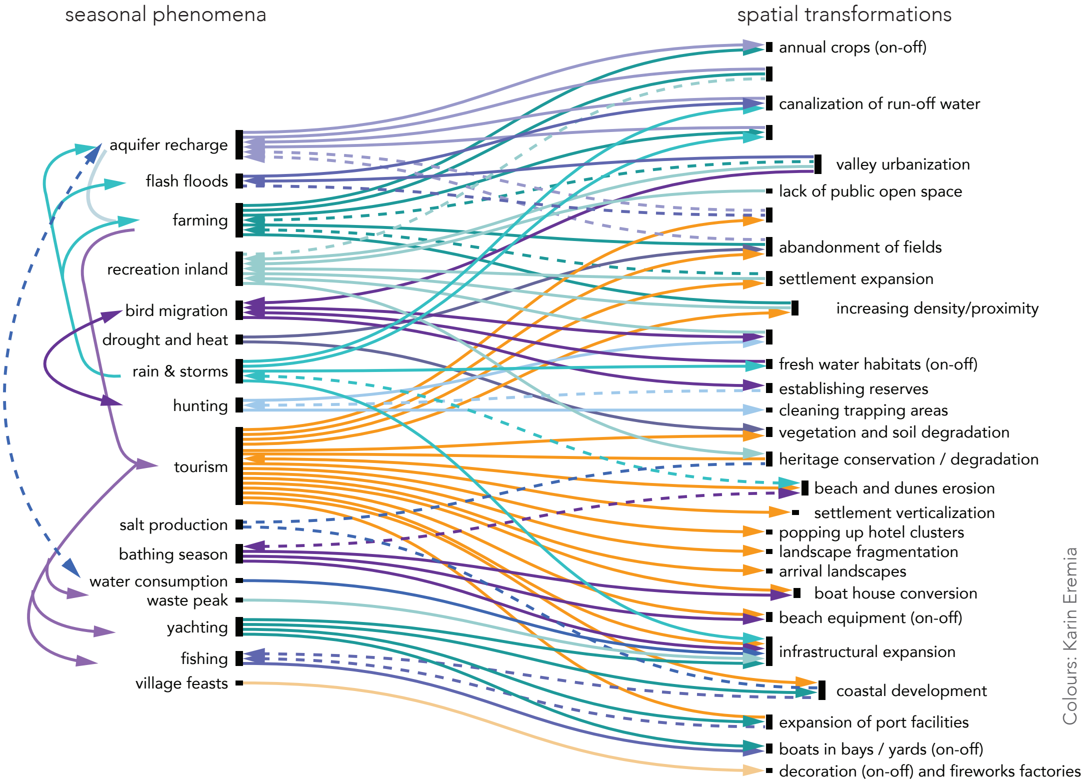


Fig. 8.25 The seasonal-spatial diagram: Abstracting relations of seasonal phenomena and spatial transformation.

8.2.2 Synthesis

The interrelations of seasonal phenomena in Malta are complex (fig 8.25). Tourism seems to be the most influential phenomenon in terms of spatial development and the other seasonal phenomena that it attracts, impedes, or replaces. Some **relations are ambiguous**: The tourist economy has diminished the importance of fishing, but restaurants keep up demand. Construction and demolition in tourist areas are banned during summer months.

The **seasonality of rain is linked to almost all island systems**, from ecological habitats and aquifer recharge to farming and urban flooding. Small dams and sealed canals have been built in response. Development of land uses and infrastructure will have effects on water runoff, erosion, and the temporary riverbed habitats. Concrete surfaces and the reduced presence of water contributes to heat waves in summer, which might, in turn, stimulate people's seasonal escape from the towns. For agriculture, "rainfall is the most important climatic element in that its spatial and temporal distributions have a decisive effect" (Vassallomalta.com 2016). Irregular and heavy rainfall, drought, and flooding strain soils and crops.

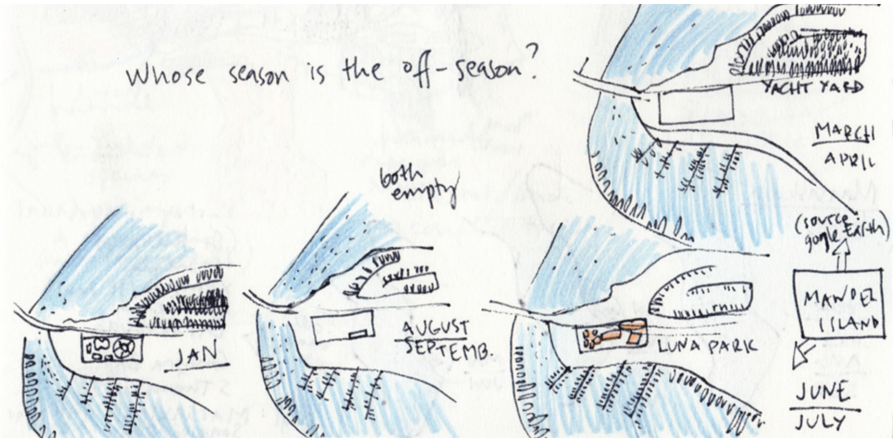


Fig. 8.26 A detail: The seasonal choreography of boats and a circus, Manoel Island.

Fig. 8.27 The Sunday fish market at Marsaxlokk Port is a tourist attraction with all kinds of goods, and selfie-taking visitors are more numerous than the handful of fishermen they spot clearing nets.

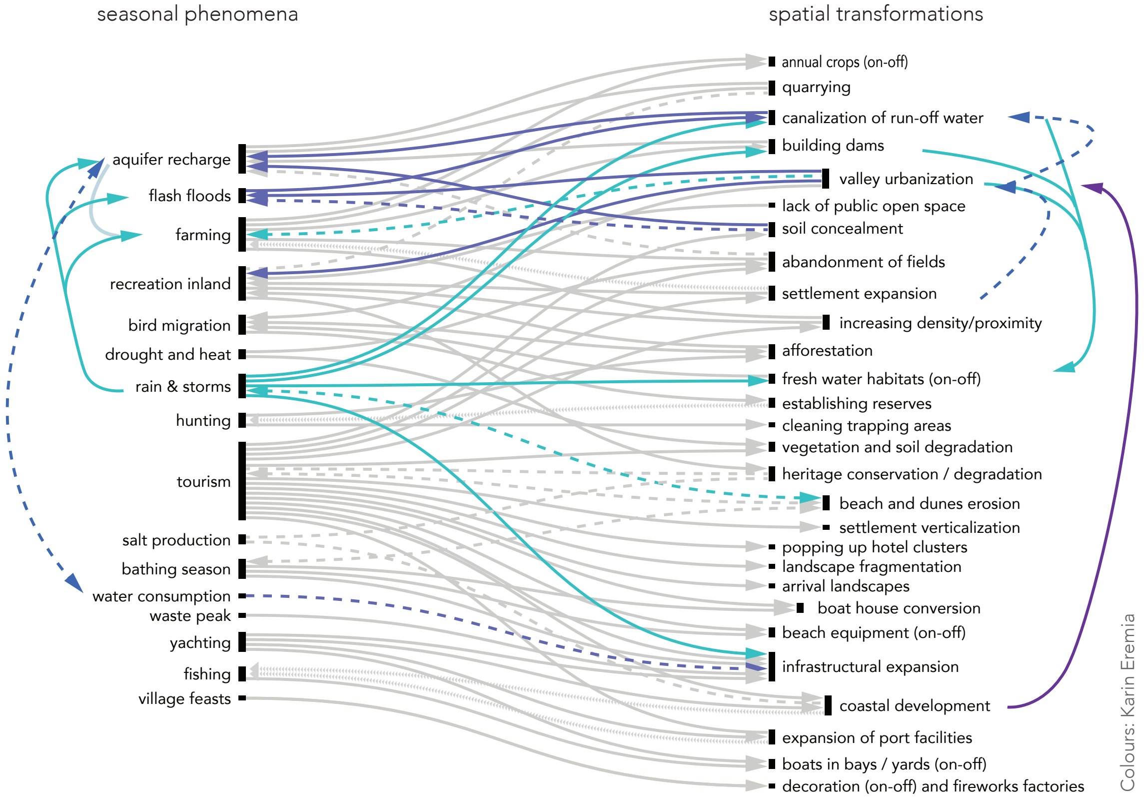


Fig. 8.28 The seasonal-spatial diagram: Highlighting water.

Coastal urbanization and tourist development engender seasonal-spatial conflicts regarding land use, facilities, occupation, and congestion. The seasonal phenomena described **concentrate in coastal areas**, with the exception of omnipresent agricultural surfaces and temporary streams in valleys. The declining seasonality of tourism and increasing recreational pressure inland results in shorter times for regeneration of vegetation. However, the most salient conflict embedded in seasonal phenomena is the relation of bird migration and hunting.

When it comes to trends, the seasonality of tourism and agriculture is declining or disappearing. Salt production and fishing seem to be relics. With expansion of retail and industrial units and settlements, fragments of farmland are left abandoned, and seasonal variation in the landscape diminishes. Birds' and water's natural cycles are disturbed. Although winter is considered the prime season for flash floods in Malta, dramatic events in southern France and Mallorca occurred in the summer of 2018. In Malta the catchment area is much smaller.

Fig. 8.29 How are seasonal phenomena linked with spatial transformation? The concrete canal (in Qormi) as part of the dry river-valley system and the seasonal hydrological cycle in Malta – a spatial problem and transformative potential.

Besides seasonality, spatial dynamics in Malta reflect the state's diversified economy, population growth, and urbanization: In different island spaces, temporal dynamics of occupation are first and foremost characterized by 24-hour day, week, and weekend pulses, in purposefully built places or anywhere suitable. Geological time is present in the island's materiality, intersecting with seasonality: from quarries to salt pans and from villages to hiking landscapes.

8.2.3 Transformative potential II: Manipulating

After the exploration of seasonality in Malta, I continue from the recognition in 8.1.3 that abandoned fields and urban concrete canals of the dry stream valleys provide transformative potential. In addition, the following observations and questions have emerged:

In my conception, the issues of freshwater, of which there is either too much or too little, depending on season, is particularly problematic and thus prominent. This keeps attention on the (potential) role of the dry river-valley system in connecting spaces of different seasonal phenomena (habitats, aquifer recharge,

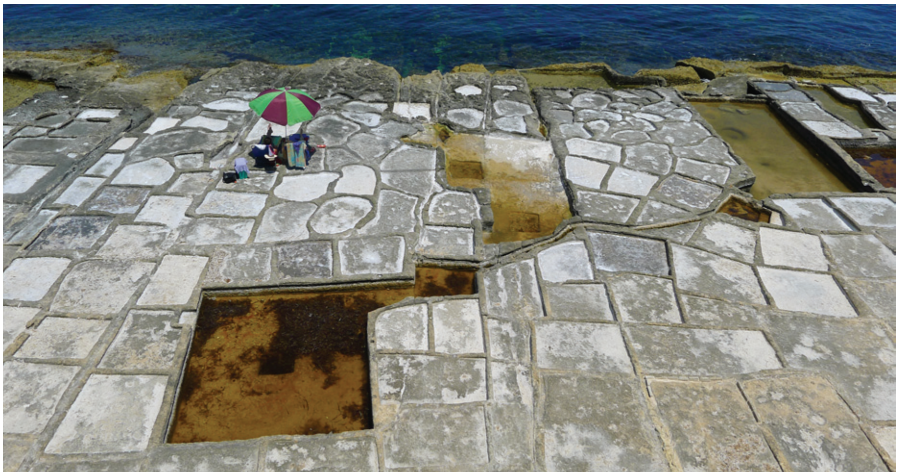
Fig. 8.30 The critical issues related to freshwater draw attention to the (potential) role of the dry river-valley system in connecting spaces of different seasonal phenomena: habitats, aquifer recharge, agriculture, flash flooding, and winter recreation.
Fig. 8.31 Are the stone-carved salt production sites only historical, or do they have ecological or economic potential in building resilience (right)?

agriculture, flash flooding, and winter recreation). Why not, in an island that cuts itself into so many places, make more room for flooding by cutting into stone, not just in the quarry zone, but also in the agricultural spaces and settlements? Can rain or water be made? Here, I recall landscape-based projects that combat desertification, such as Rajendra Singh's interventions in India (Singh 2017), SMAQ architects' Casablanca Rainmaker (Team SMAQ 2011), and the majestic tree belt implemented across the Sahel region (UNCCD 2016).

Without concrete reference, the integration of seasons in the zoning of coastal lands has been mentioned (PAP/RAC:62). Are the stone-carved salt production sites only historical, or do they have ecological or economic potential in building resilience? Could there be a salt spa? Tourism has potential for developing seasonal niches (e.g., agritourism) that are less stressful for the island environment. A conceptual idea borrowed from fashion could be applied: Programming open spaces for "next season" while "disposing of" the previous ones by leaving them to regenerate, or for recycling as second-hand, could become a new semi-self-organized model for spatial development.

Thinking of turning conflict into synergy, the clearings for bird trapping are recurring sites. The problem is that they are on private land and are often illegal – and thus inaccessible or hidden. Could they be used as Sunday picnic grounds to avoid spreading erosion in the sensitive landscape? Can one, instead of birds, trap water?

Finally, is seasonality a quality in the age of global urbanization? Could reinforcing seasonal phenomena bring new social and ecological qualities to the Maltese urban landscape? What if all agricultural fields were left fallow? Could landscape interventions engender new seasons? Which seasons would turn up if the imports and fossil fuels were to not function? Would tourists come?



8.3. How can seasonal dynamics be integrated into designing urban landscapes to build resilience?

Building on the preceding investigation of seasonal phenomena in Malta, this third step tests the hypothesis that **understanding seasonal phenomena can contribute to resilience-building in islands,** and pursues answers to the second research question. After identifying a resilience deficit and outlining a design brief, the seasonal approach is applied in a test projection. The outcomes are evaluated with respect to resilience principles and islandness. Finally, transformative potential is discussed with regard to the seasonality hypothesis.

8.3.1 Identifying resilience deficit and outlining a design brief

As discussed in chapter 4, resilience-building begins with differentiating resilience "of what to what" and why. The partly overlapping procedure consists of identifying hazards, risk, and defining priorities of resilience-building (procedure and limitations see 6.2). Resilience deficit is not an official term, but expanding from identifying hazards and mapping risk, I postulate where what kind of resilience could be needed. Malta's disaster-risk rate is ranked as very low (for example INFORM 2018), but global rankings communicate a false notion of safety (Main et al. 2018): A lack of historical data is misleading, and the islands' limited land area; its high and increasing density; a large, fluctuating, non-native population; and the expanding urban fabric may render impacts of small events disproportionately high.

8.3.1.1 Hazards

In a recent investigation, Main and colleagues (2018) diagnosed the following sudden hazards: Earthquakes at Sicilian faults can vibrate in Malta and cause tsunamis. Statistically calculated, magnitude six earthquakes that hit Malta can reoccur every 40 years, and the interval of magnitude seven events is 92 years. Other geological hazards include cliff collapse, slope failure, landslides, mudflows, rock-mass movement, and clay displacement – sporadic and local, or larger mass movement. While storm surges and high-magnitude storms such as medicanes or Mediterranean cyclones may be augmented with climate change (Romera et al. 2017), frequent flash floods and droughts are currently the biggest hazards of climatic origin. Volcanic ash from an eruption of Etna can paralyze air transport in Malta. Interruptions in food and electricity imports (also for desalinization plants) are topical hazards. Through dependency on imported foods, Malta is vulnerable to water crisis in other parts of the world (Scicluna 2015). I assume that marine pollution and industrial accidents might occur in the vicinity of settlements and key ecosystems. Bush fires could devastate Malta's woodlands and shrubs.

Further relevant hazards for this research include slow-onset events and stresses discussed in 8.1.2.: groundwater depletion, loss of biodiversity, desertification, sea level rise, and urban expansion. Seasonal disturbances include heat waves, flash floods, storms, and bird hunting (see 8.2.1). Tourism causes erosion, water consumption, waste-production peaks, overcrowding, and damage to sea-grass meadows.

8.3.1.2 Mapping human settlement and (other) ecological habitat risk

Exposed locations (based on Main et al. 2018, unless otherwise cited): Malta's urbanized, low-lying coasts, with buildings, expanding infrastructures, and boats, are exposed to storms and tsunami waves. The geomorphology of Malta tilts towards the urbanized northern coast, concentrating flood risk in the densest settlements and key traffic arteries. Coastal and marine ecosystems are exposed to increased sea temperatures and erosion (SPED 2015:16). The southern cliff coast between Fomm ir-Riħ and Għar Lapsi is "very exposed" to waves (SEWCU and ERA 2015:38), but there are no settlements – only one of the desalinization plants. Settlements on blue clay slopes or outcrops and green sand areas are the most susceptible to earthquakes and geological hazards. Expanding occupation of Xemxija, Mistra, Paradise Bay, and Għajn Tuffieha increase earthquake and landslide risk. Overall, there is an unknown risk of slope failures or collapses. They can be triggered by loads, a lowered water table, or removal of vegetation; urban expansion also increases risk.

The maps highlight 1) the most vulnerable settlements (fig. 8.32) and 2) key ecosystems that are almost extinct or mostly degraded, which, in addition to biodiversity, contribute to climate change adaptation or disaster mitigation (fig. 8.33). The high seasonally fluctuating and non-native population has even less of an idea of risk than locals. Coastal and marine ecosystems control erosion by, for example, wave buffering. The layers include:

Settlement risk: settlements on blue clay and green sand; coastal settlements and key infrastructure below 5m; settlements at flood risk; the densest settlements in locations sheltered from wind, which are at risk to heat waves; tourist settlements (more than 20% seasonally occupied property); immigrant reception and detention centers.

Ecosystems, habitats, and resources at risk: Beaches and dunes; freshwater ecosystems and degraded valleys; transitional wetlands; woodlands (all) and maquis outside of designated areas; Neptune seagrass beds in bays exposed to human activities; an aquifer in the area of the most intensive agricultural over-extraction and contamination; soil at high risk according to a multicriteria assessment by MEPA (2012a).

Fig. 8.32 RESILIENCE DEFICIT: Mapping settlement risk

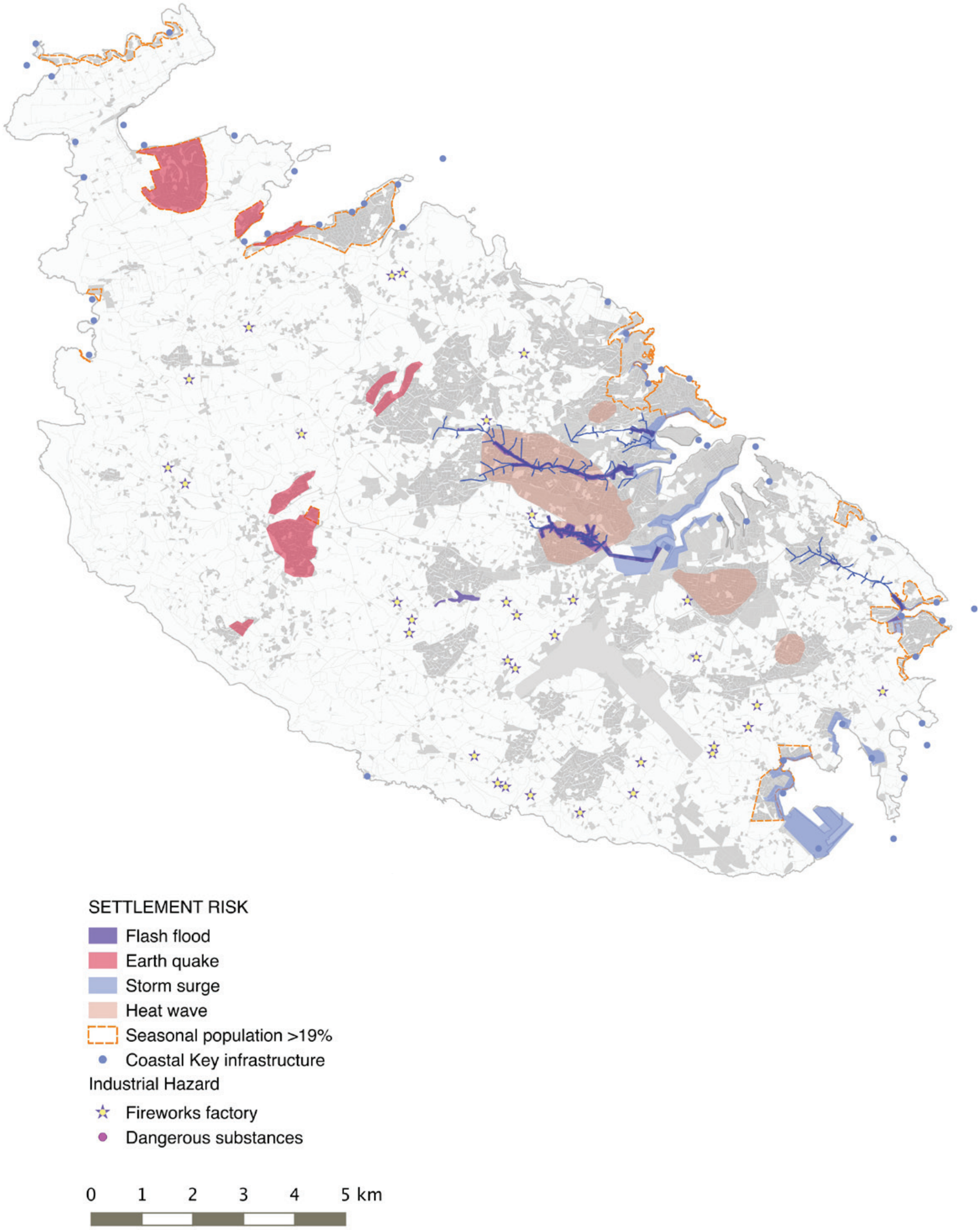


Fig 8.33 RESILIENCE DEFICIT: Mapping ecological risk

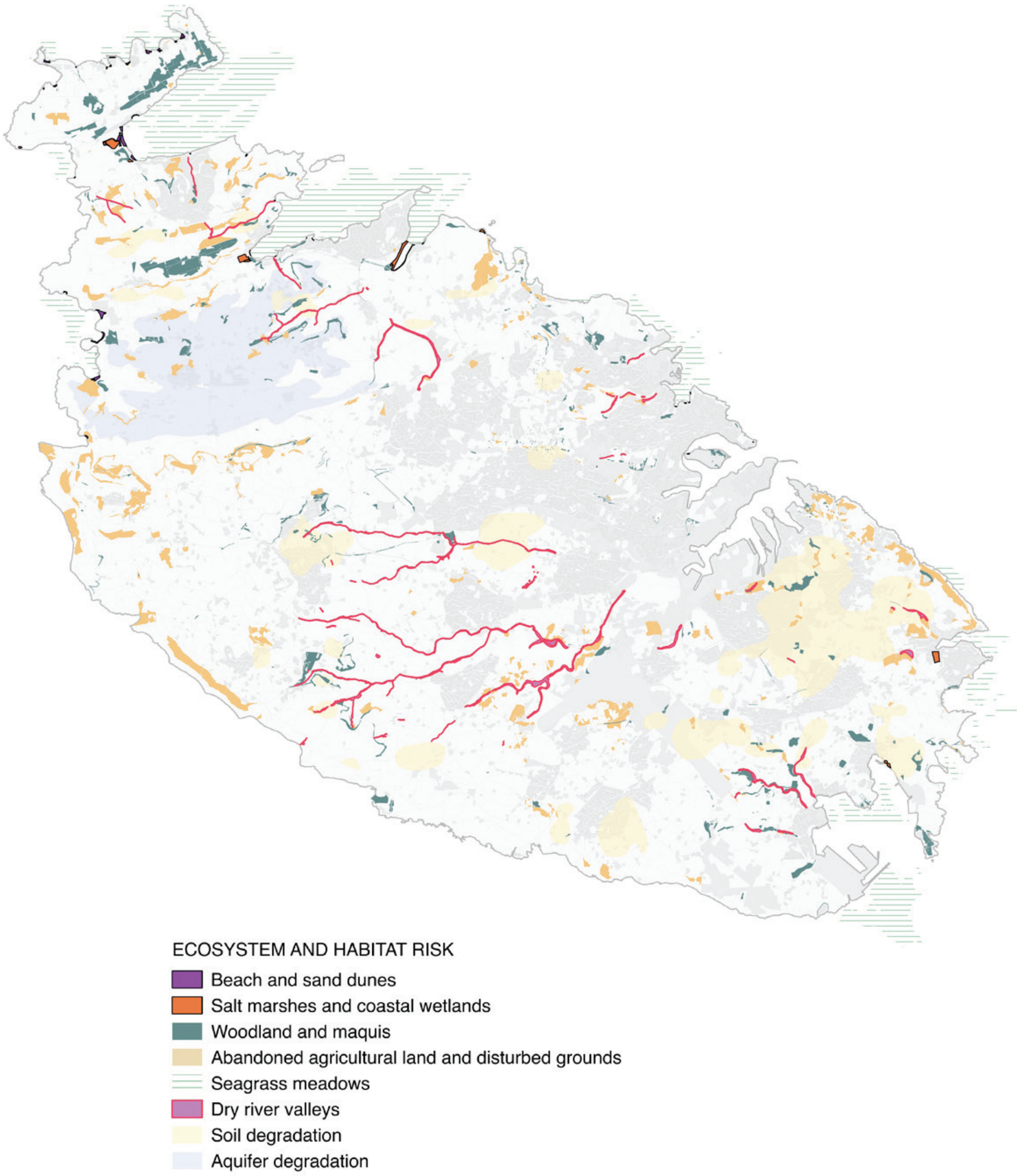
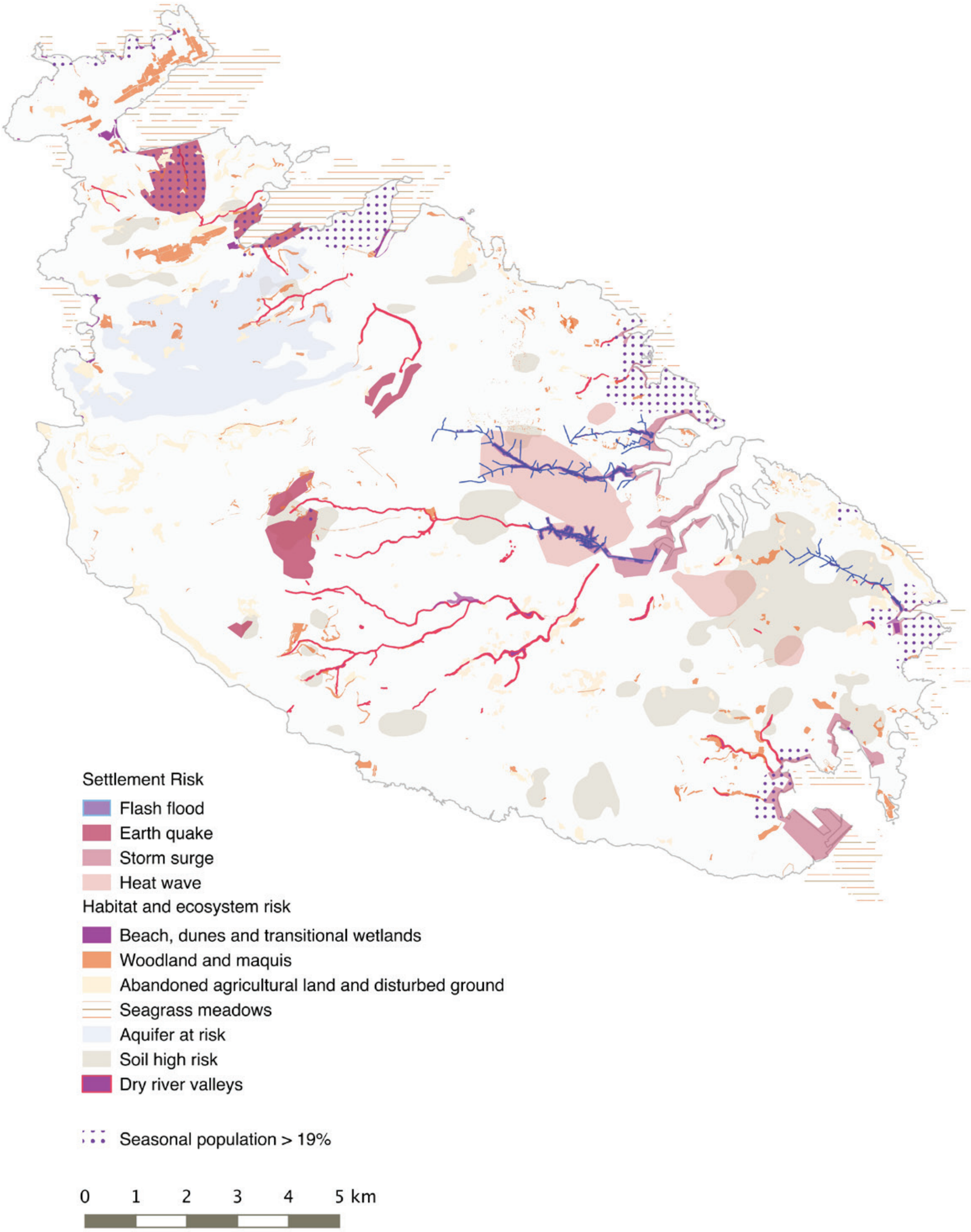


Fig 8.34 RESILIENCE DEFICIT: Mapping risk – Synthesis



Limitations: Apart from seasonally occupied housing (NSO 2014a) and refugee detention and reception centers (Global Detention Project 2017), the social dimension of vulnerability (the proportion of immigrant, elderly, or low-income residents) and risk according to building types is not differentiated. Water scarcity and dependency on imported food and energy are not mapped. City-dwellers may be more vulnerable in terms of food security and water scarcity than farmers who may have wells. However, the latter are afflicted by climate, hydrology, and soil hazards, particularly in the northwest (Vassallomalta.com 2016). Practically the whole island is an aquifer, more or less under stress, but all aquifer contamination and exploitation sources could not be mapped.

8.3.1.3 Synthesis (fig. 8.34)

The risk maps indicate in which parts of the island resilience-building is needed. A typical **proximity of hazard-prone sites** on a small island is evident. In terms of frequency, I estimate settlement risk to be most severe in urbanized bays that can simultaneously experience storm surge and flash flooding. In coastal settlements, risk increases seasonally because of the concentration of tourist population. **Risk varies spatially throughout the year**. The risky geomorphology (not mapped) adds a layer of uncertainty whose interactions with humans is, in light of current knowledge, difficult to anticipate (Main et al. 2018). Urban expansion and climate change (see 8.1.2) are expected to increase disaster risk in Malta. The map clearly demonstrates how small the fragmented terrestrial key habitats are. In terms of rare habitats, both **seasonality and stress concentrate in the western parts of the island** – that may be because the other parts are completely built. The scattered layer of abandoned fields and disturbed grounds are considered areas of low ecological resilience and as having transformative potential (see 8.1.3). The dry river valleys form a series of corridors that connect both habitats and settlements at risk – and furthermore, they coincide with the seasonal mappings (see 8.2).

8.3.1.4 Current resiliencies

Agriculture in Malta has a tradition of adaptation (CCCA 2010:47). The sector can represent both negative and positive resilience (see 8.1.3). Economic resilience and political resilience seem to be present, but my impression of the latter is negative: Despite the manageable size of the island, sustainable paths have not been adopted. Malta's maritime zone provides economic and ecological resources: fishing, bunkering, aquaculture, and yacht marinas (SPED 2015:16). The hilly topography and prevailing rocky coasts are less susceptible to erosion and sea level rise than softer, loose sediments would be. The temporary stream and transitional wetland habitats are highly adaptive and probably resilient to slow change like climate change, but they are prone to external pressures and extinction. Vegetation that survives in scarce soils might also adapt to urban conditions. Although Malta is characterized by a challenging fragmentation, heterogeneous landscape can be considered a resilience quality.

8.3.1.5 Outlining goals and priorities for resilience-building

The CCCA report outlines priorities for climate change adaptation in Malta: Coastal areas are of key economic and infrastructural importance. The sector of infrastructure and building needs spatial and material innovation, and "for tourism and industry, [climate change] adaptation will require changes in period of operation [and] relocation of activities […] A key objective in an adaptation strategy should be that of preserving and strengthening the resilience of ecosystems and wherever possible reducing other pressures that could reduce their capacity to adapt to and counter the effects of climate change" (2010:47–9). Protection of biological diversity, soil, and water, as well as increasing ecological connectivity, are seen as necessary measures.

In the face of multiple hazards and stresses, a focus on the hypothesis (see 2) of this research helps to prioritize: The purpose of discovering how seasonal phenomena can be integrated into building resilience is understood here beyond disaster-risk reduction. First of all, considering the dynamics of urbanization in Malta's bounded spatiality, the fundamental eco-social resilience principle of biodiversity is particularly challenging. Thus, **the primary underlying goal for this case study is maintaining or increasing biodiversity.** It has an intrinsic value as a resilience principle that also provides important functions and benefits for the human population. The rarest habitats are temporary or experience periodically accentuated stress. Secondly, **water security** (see 8.1.2) is the most alarming resource issue in Malta. It is also linked to seasonal phenomena and other hazards. To include the aspect of disaster-risk reduction, I point out a **coupled hazard** situation in the densest settlements. The resilience-building projections should thus address the following goals:

1. **Connectivity and redundancy of ecological habitats:** In the extremely fragmented Maltese landscape, these two resilience characteristics can be the key means for maintaining biodiversity. Based on the mappings, it is important to increase (reintroduce) habitats in the urbanized eastern parts of Malta. Priority: endangered habitats and ecosystems that contribute to settlement security (see risk map).

2. **Water security:** Malta experiences water scarcity and depends on imported energy for its supply, while storm-water infrastructure discharges into the sea. Priority: reduction of storm-water runoff and enhanced percolation; valley stream beds and groundwater protection zone; water-sensitive design.

3. **Settlement security againsts the combined event of flash flooding and storm surge:** This coupled hazard is the biggest disaster risks for Maltese settlements that incorporates a seasonal dimension. Unexpected summer flash floods might reach a peak tourist population in the urban bays. Priority: permanently occupied settlements.

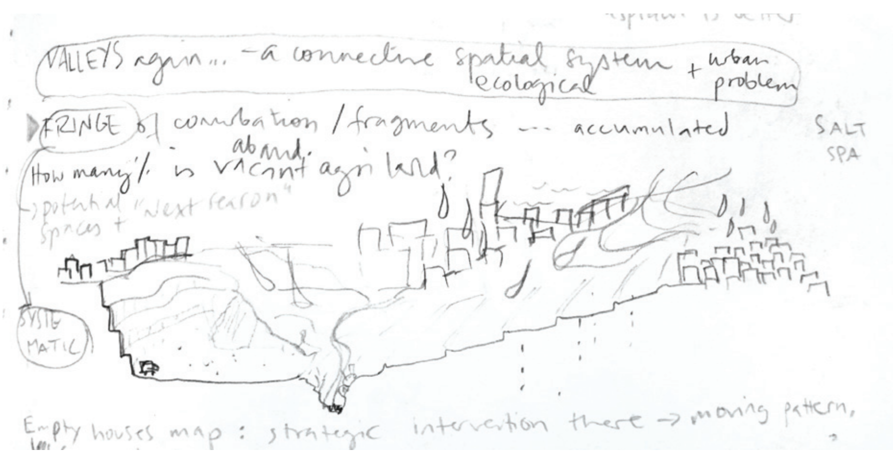


Fig. 8.35 Studying a valley.

The dry river valleys represent the spatial system that brings these aspects together. They link different island systems (urban settlements, agriculture, key ecosystems), sources of hazards (agriculture, industry, settlement expansion in unsuitable locations), and elements at risk (freshwater habitats, agriculture, aquifers, flood-prone settlements). The valleys thus enable a study of multiple scales and connectivity. Furthermore, the valleys incorporate seasonal dynamics from temporary habitats to urban flash floods. Actually, flash floods are perhaps addressed by the most advanced disaster-risk management policies and measures in Malta (Main et al. 2018:848). The National Flood Relief Project implemented eleven kilometers of tunnels and one soakaway reservoir (MTIP 2017). However, from an integrative landscape architectural perspective, the engineering resilience of the implemented canals and tunnels does not resonate with water-sensitive urbanism (see 4.2.2). Their efficiency in leading water out of the island neglects (fresh)water scarcity in Malta. An inventory of valleys, including proposed "remedial" measures,[7] was published in 1998 by Haslam and Borg, and a Master's thesis discusses water management (Caruana 2017). In my conception, there is a need to develop landscape-based solutions that

address the sources of the problem in the wider landscape, which requires an understanding of the interacting elements of the valley system, and

seek complementary solutions that integrate seasonal phenomena and contribute to a healthier hydrological cycle – and thus water security, biodiversity, and flood-risk reduction on the island.

7 For flood-risk reduction and hydrological improvements, as well as heritage conservation and recreational trails.

8.3.2 Projection: "This is not a normal river"

STARTING POINTS:

This projection regards Maltese valleys as a cross-cutting system that simultaneously needs resilience-building and provides potential for landscape architectural interventions. I start by identifying landscape types along the valley, alias subsystems, and what kind of resilience is needed where, based on the trends and hazards presented in this chapter. I then propose a set of adaptable and transferable measures for one river, targeting the resilience-building goals (8.1.3.4).

System components: Resilience of who to what, and desirable states

Widien (Maltese for "valleys") connect and intersect quintessential natural habitats, cultural landscapes, industrial areas, and settlements (fig. 8.36–39). Dry valleys have been used as roads since historic times and, today, are also used for dumping waste (Haslam and Borg 1998). The (seasonal) watercourse is often banked with walls or canalized. Flash floods are the most distinct disturbance, where valley outlets are built up for arterial roads and city blocks. Sealed squares replace transitional wetlands, and not enough sediment is transported from the altered streams to protect beaches from erosion. On the other end, rare seasonal habitats and endemic species such as the Maltese freshwater crab remain (see 8.2.1). In most parts, terraced fields spread over valleys, disrupted by quarries. The subsystems and valley profiles are illustrated on the first spread of the projection. Drawing on the information accumulated during the case study, the first projective map (fig. 8.40) reflects the different components along the valleys and proposes where what kind of resilience is needed. As a whole, in the face of urbanization dynamics and climate change, the valleys need adaptive capacity in the form of flexibility or multifunctionality, and resourcefulness and connectivity.

Settlements need resilience to flash floods. An enhanced capacity to absorb flooding, multifunctional spaces, increased biodiversity, and a better microclimate are needed in the urbanized valleys. Buffering and absorbing is pivotal in the lowest areas, where storm surge from the sea poses a risk. Designs need to take early warning and evacuation into account.

Freshwater habitats need to sustain resilience to irregular rain and drought periods. Formerly, the changes between winter and summer water flows were slower and smaller (Haslam and Borg 1998:167). Few permanent water sources are left, and robustness is needed against decline and pollution. Thus, freshwater habitats need sufficient clean water, which means improving retention and avoiding fast surface runoff and evaporation. The invasive giant reed *Arundo donax* needs to be managed. A larger size of freshwater habitats and reduction of stressors at the edges may help their continuity over time and ability to recover from unusually long droughts. Redundancy, that is, alternative habitats, is needed.

Salt marshes naturally adapt to irregular seasons and sea level rise, but they need adaptation to drought, and robustness to built expansion and contamination. Maintaining or increasing the size of transitional wetlands and securing regular access to both fresh- and saltwater is vital.

Beaches need resilience to erosion, ideally being supplemented with sediment from (temporary) streams and protected from waves by seagrass meadows.

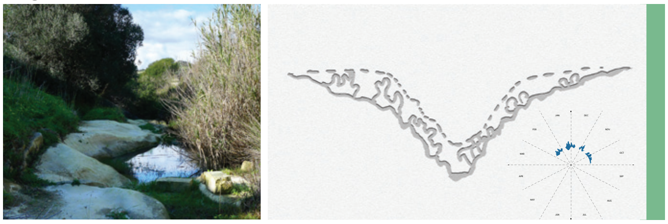
Farmlands need resilience to drought, heat, erosion, and desertification. An improved water retention capacity and avoidance of too-rapid surface runoff and evaporation are desired, as well as increased biodiversity, soil health, and less infiltration of nutrients to the aquifer. The climate adaptation capacity of rural valleys is tied to water management.

Aquifers need resilience to depletion (seasonal overuse), contamination, and salinization. Their robustness can be improved with enhanced percolation of water while controlling over-extraction and leakage of contaminants.

Quarries are a specific system part whose role in resilience-building needs to be investigated.

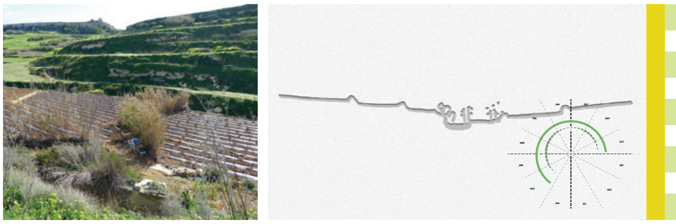
The role of seasonality in the valleys:
Apart from variations in precipitation and surface waters that range from puddle habitats to flash floods, different parts of the valley system accommodate migratory birds, hunting, hiking and recreation in winter, and horticulture. In summer evenings, local crowds have been doubled by tourists at the urban bay squares that have replaced river mouths and are at elevated risk to flash flooding.

Fig. 8.36 STREAM BED and VALLEY PROFILE

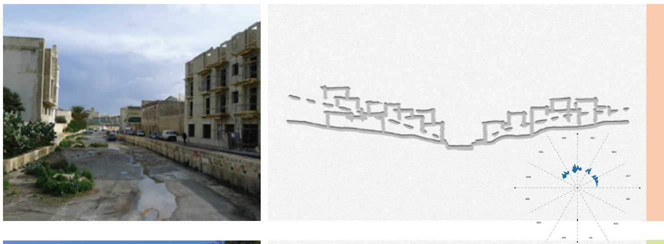


FRESH WATER HABITATS
with shrub- and woodland on limestone slopes, ephemeral water "pockets" also on the walls; close-to-natural stream bed. Temporary streams and puddles, usually dry in summer.

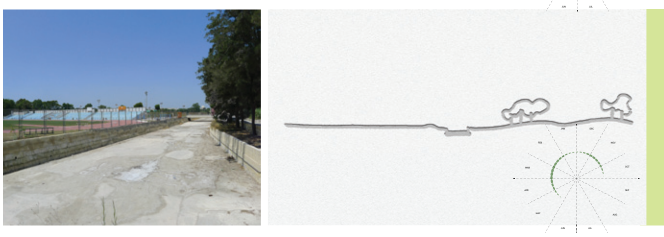
LIMESTONE QUARRIES
alter the valley profile. On the valley side or upstream, they intercept water flow to stream beds. Quarrying causes dust, noise, vibration, and pollution, but it is a declining activity.



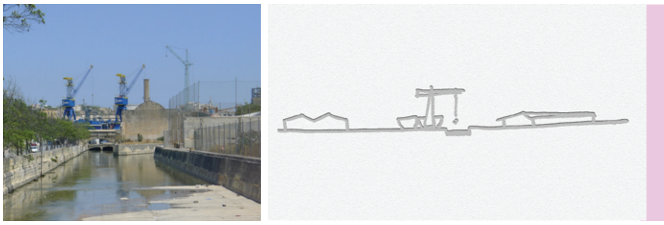
FARMLAND
with partly natural stream beds, valley roads, walls, wells, impoundments, pipes, sediment runoff, nutrients and pesticides leakage. Privacy, hunting, and lack of facilities limit recreation.



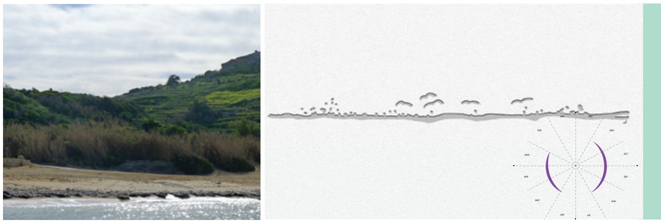
TOWN
Within settlements, valleys are usually built up, and stream beds are asphalted, paved or canalized, and used as roads or for parking.



RECREATIONAL
The former marsh of Marsa has been converted to a golf course and horse racetrack. The stream has been canalized.



INDUSTRIAL AREA / PORT
with mixed uses, and a paved, disturbed, or canalized stream bed; leachate from industry, garages, car repair shops, and scrap yards.



TRANSITIONAL WETLANDS
and BEACH DUNES
are remnants of natural stream outlets where sediment accumulates. In urban bays they are replaced by plazas, or used in the beach season.

Fig. 8.37 DRY RIVER VALLEYS : SPATIAL ELEMENTS

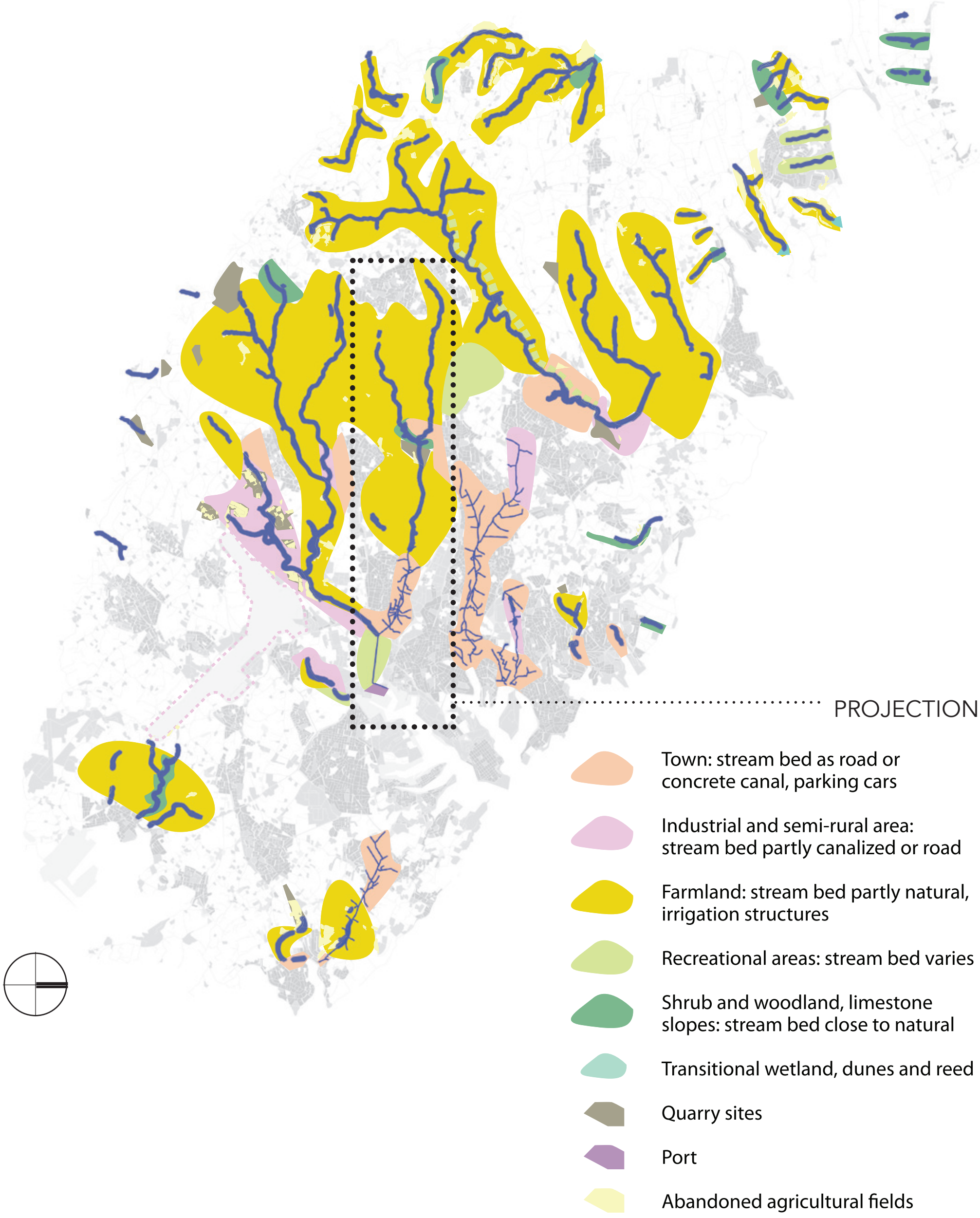


Fig 8.38 RIVER MOUTHS and STREAM OUTLETS IN URBAN AREAS

INDUSTRIAL HARBOR

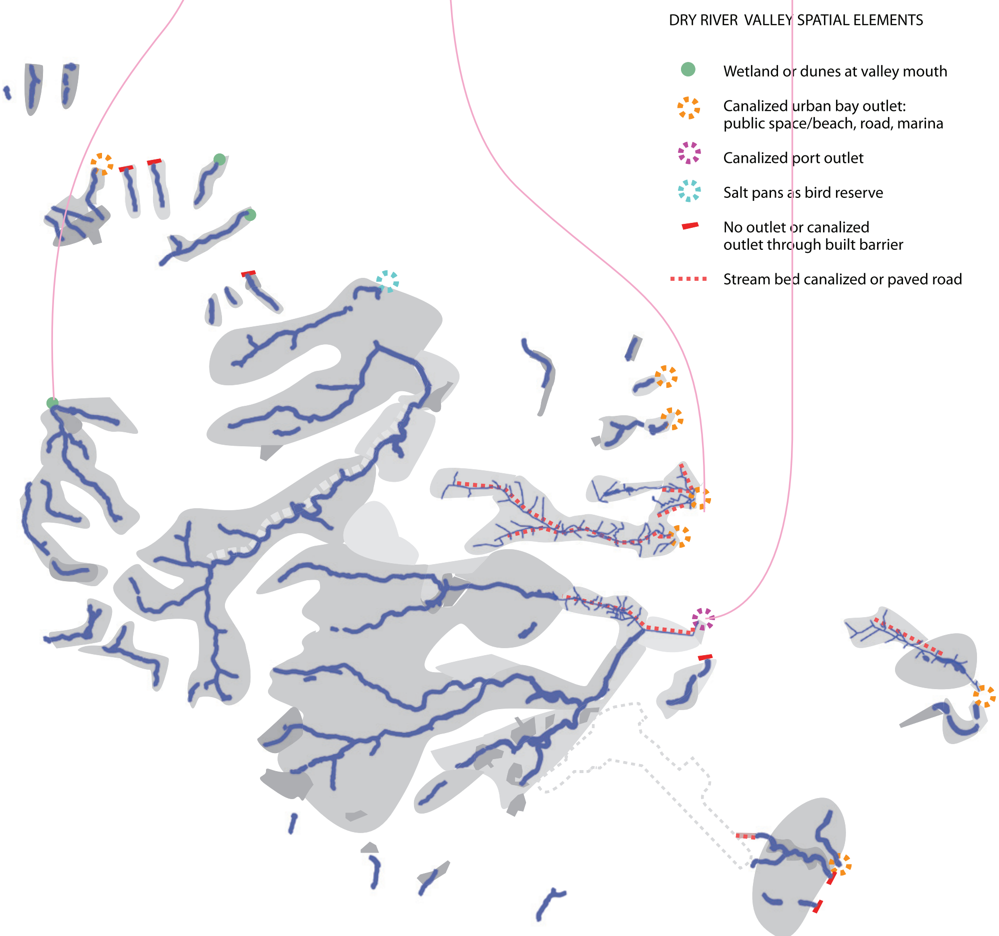
OPEN SPACE / MARINA

SALINA RESERVE

BOAT HOUSES / ROAD

Fig 8.39 RIVER MOUTHS and STREAM OUTLETS IN URBAN AREAS

Map data © Google, 2018, Imagery Date 6/15/2017 (left) / Map data © Google, 2018, Imagery Date 6/15/2017 (middle). / Map data © Google, 2018, Imagery Date 3/9/2017 (right).



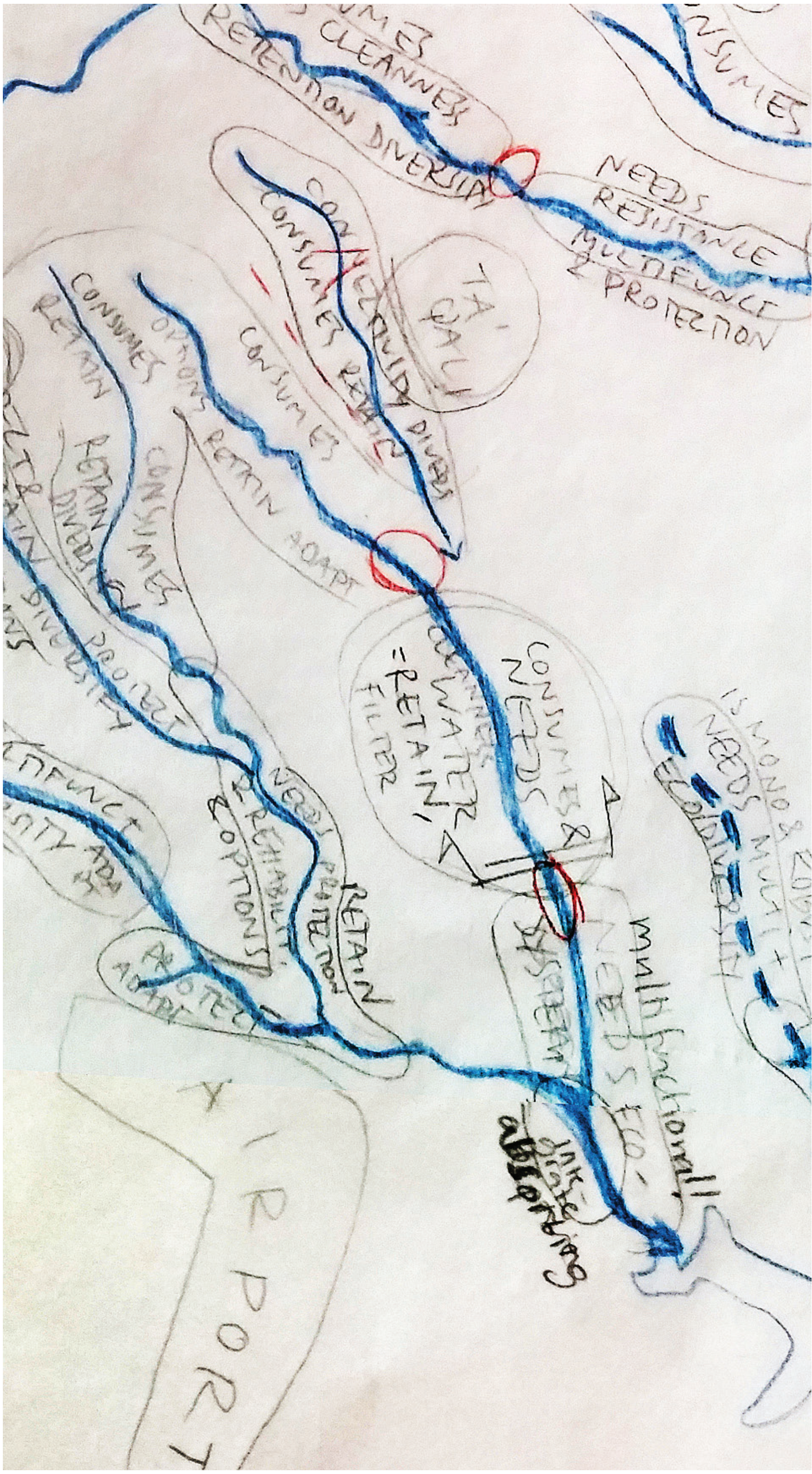
MEDIUM / HOW

-> Retaining water – Extending the season
-> Mixing systems and coupling uses – Managed shifts and accumulation
-> Decentralizing (water and habitats)
-> New habitats
-> Light structures and adaptive public spaces

To develop measures for resilience-building, I zoom in on the is-Sewda, which was described as the "worst-polluted" valley in 1998 (Haslam and Borg:297). Twenty years later, during fieldwork for this thesis, the valley did not seem very healthy. The design presents over twenty resilience-building measures from small structures to the whole valley (fig 8.43–44). Many seasonal phenomena are integrated, and their dimensions are conceptualized in four strategies that support resilience-building (fig 8.45).

Water management features range from conventional, tested solutions (such as dams and swales) to experimental proposals and combinations, extended for multiple purposes (gulp, placeholder reserve, and catch-and-release). Parts of the interventions are dynamic (meander), reversible or (re)moveable, and replaceable. Repeated maintenance and participation comprise a strategic part of non-physical resilience-building. "Rainworks," realized with a biodegradable superhydrophobic coating (Rainworks 2018), are invisible when dry and appear only when there is rain. They last a short time, but can be re-created in or for regular events to anchor awareness. Such early-warning weather consciousness artworks can take various forms. Besides single elements, some interventions address multifunctional open-space entities (a water square, wetland park, or quarry), and others address the whole valley as a continuum. For example, together, the interventions form a network of "minimum dynamic reserves" (Leroux et al. 2007; Greco and Larsen 2014:20) for native fauna and flora to secure continuity after disturbance (Greco and Larsen 2014:20). The proposed function of quarries is to absorb what would elsewhere be a disturbance (flood or erosive impact of climbing in ravines), and, at the same time, to provide a haven: a protected bird habitat and efficient aquifer recharge.

Certain rules apply according to the location in the valley sequence and profile: Filtering of urban and farmland runoff is necessary before entering the ground water or stream bed. For mid-stream natural habitats, no interception of surface-water flow from upstream is allowed. Agricultural land upstream of the city needs to maximize the capture of pluvial water and minimize evaporation and runoff. Downstream settlements need to feature decentralized, redundant water-harvest and infiltration solutions, and absorbing double impacts from the river and sea at urban bays.


RETENTION DIVERSITY
NEEDS
RESISTANCE
MULTIFUNCT
& PROTECTION
TA' QALI
CONSUMES
RETAIN
ADAPT
CONSUMES & NEEDS
= RETAIN, FILTER
NEEDS REHABILITY & OPTIONS
RETAIN
NEEDS ECO-SYSTEM
multifunctional!!
NEEDS MULTI + ECODIVERSITY
AIRPORT

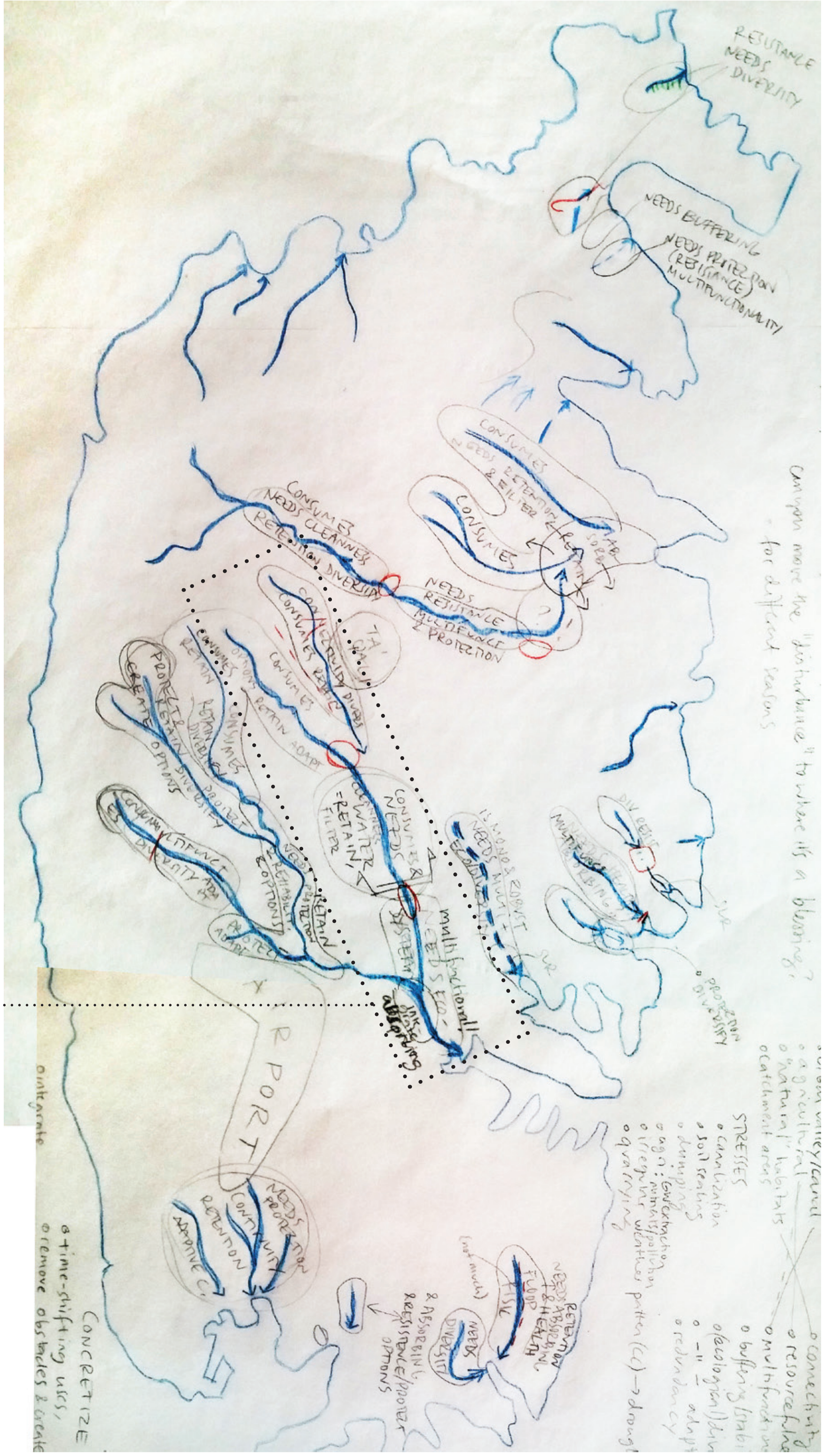


Fig. 8.40 PROJECTING SEASONAL WATERWAYS: WHERE IS WHAT KIND of RESILIENCE NEEDED?

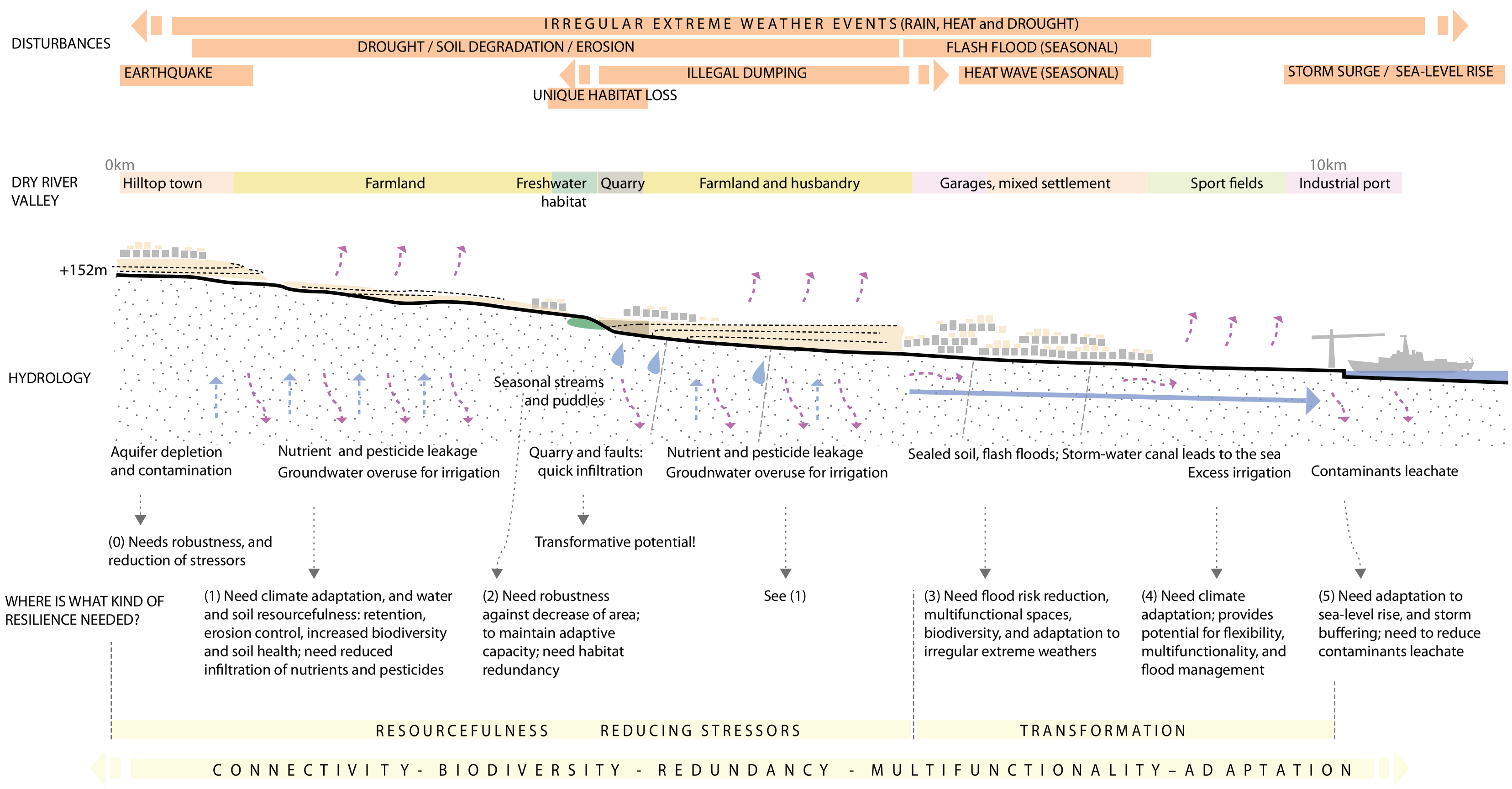
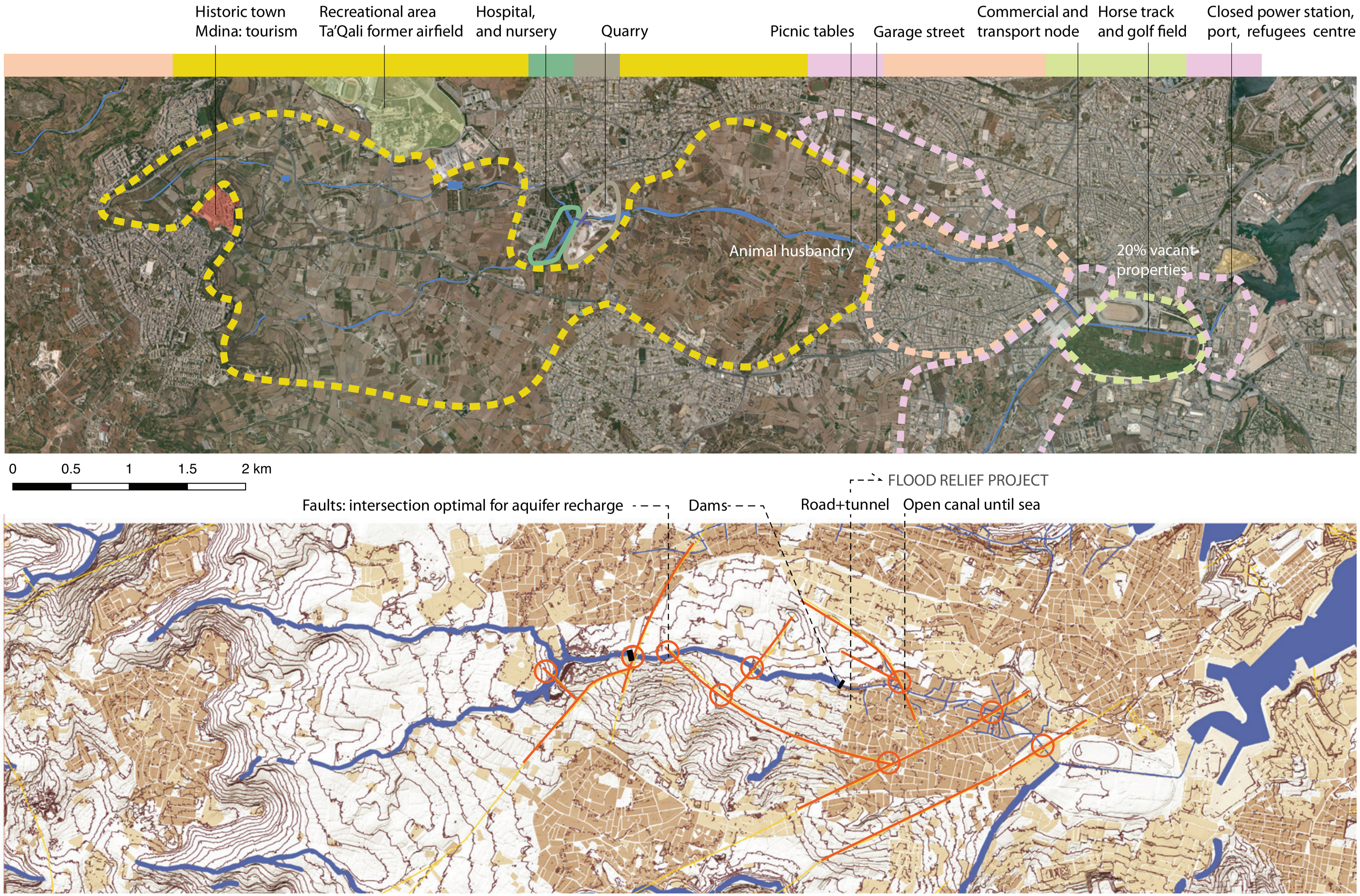


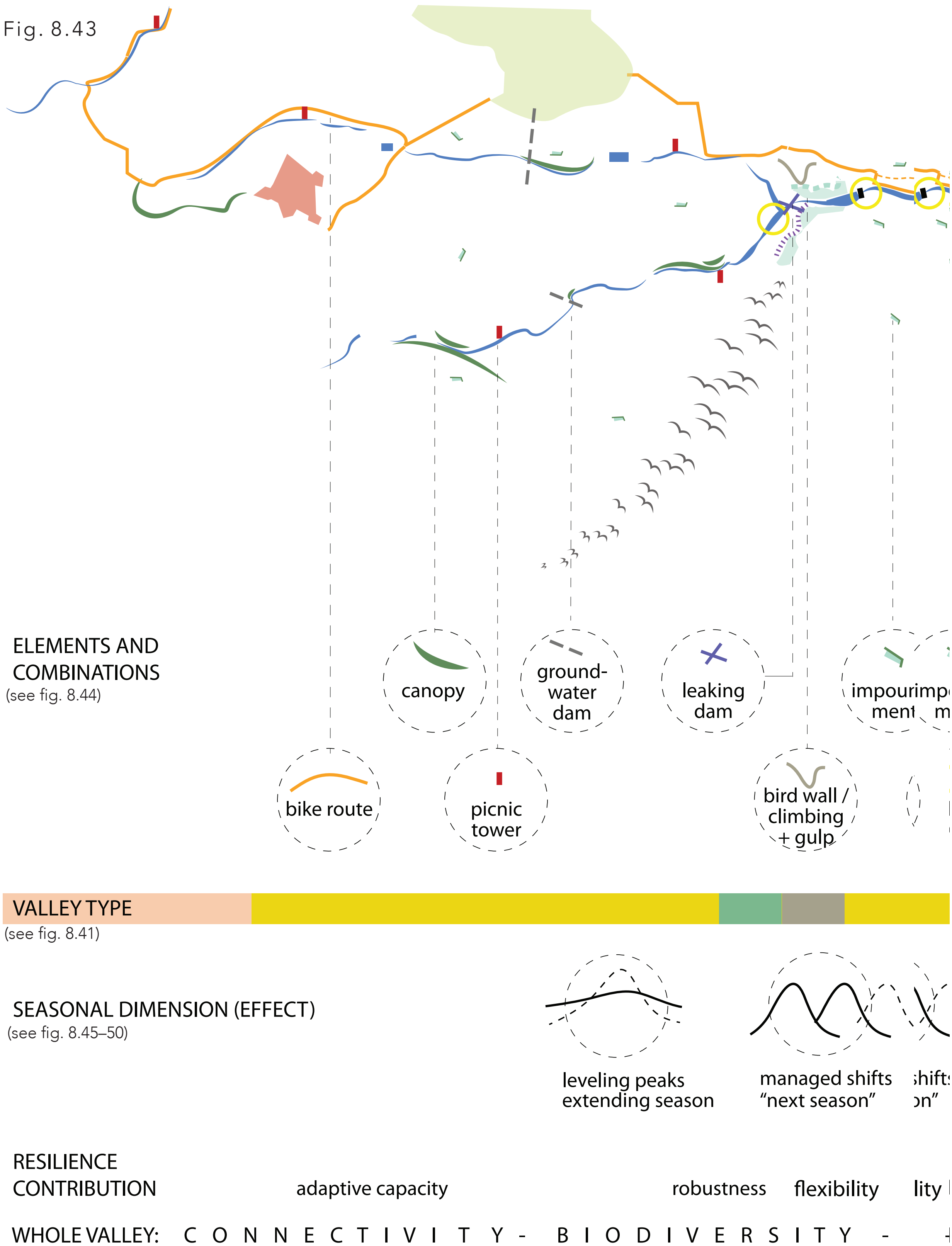
Fig 8.42 ZOOMING IN a VALLEY: HAZARDS, SUBSYSTEMS, HYDROLOGY and RESILIENCE NEEDED

Fig. 8.41 PROJECTING SEASONAL WATERWAYS: ZOOMING IN a VALLEY : LAND USES AND HYDROLOGY

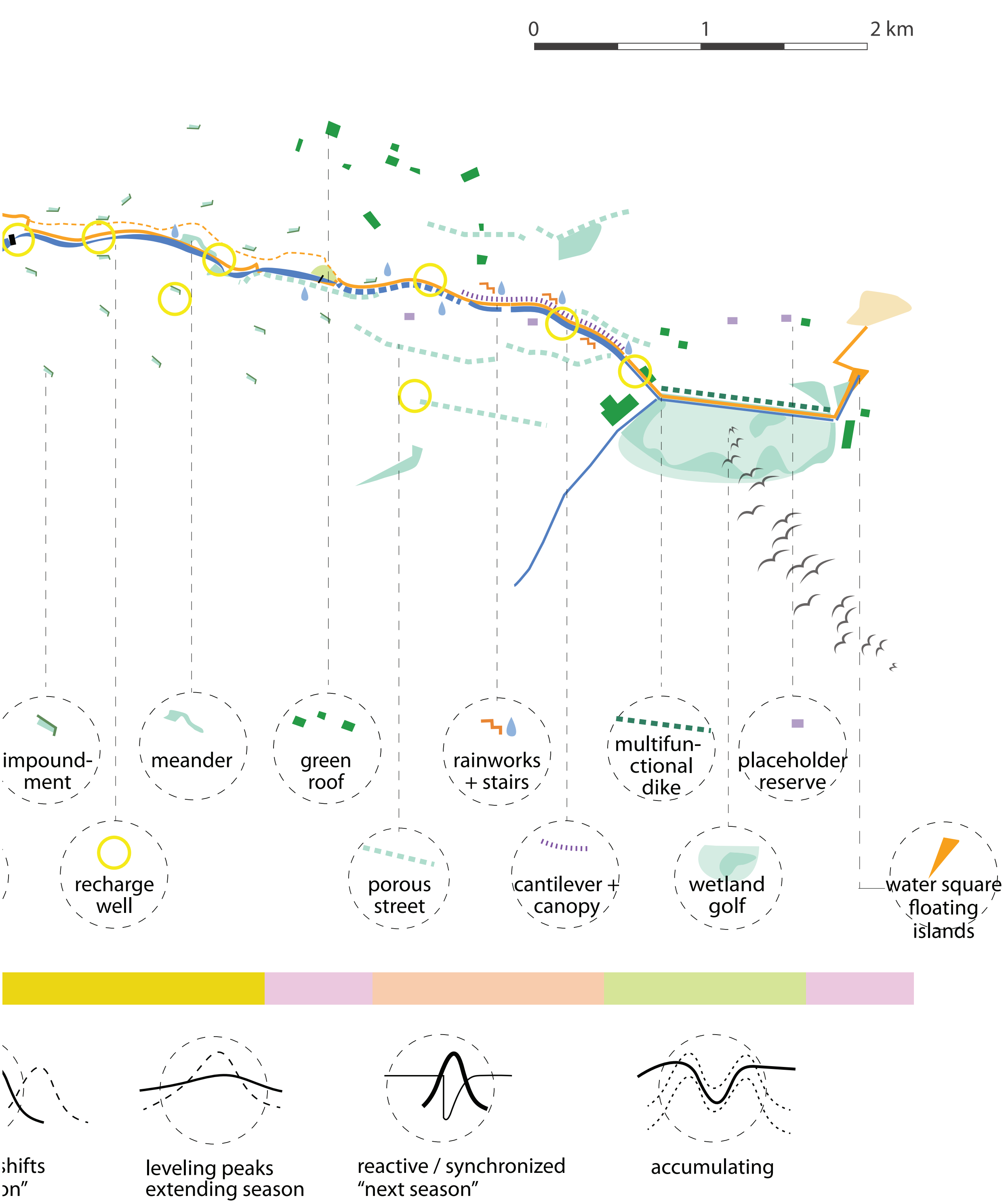


Map data © 2018 Microsoft Corporation @ 2018
DigitalGlobe © CNES (2018) Distribution Airbus DS

Fig. 8.43



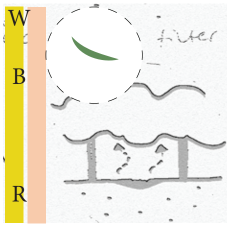
ELEMENTS AND COMBINATIONS
(see fig. 8.44)
canopy
groundwater dam
leaking dam
impourimp ment
bike route
picnic tower
bird wall / climbing + gulp
VALLEY TYPE
(see fig. 8.41)
SEASONAL DIMENSION (EFFECT)
(see fig. 8.45–50)
leveling peaks extending season
managed shifts “next season”
RESILIENCE CONTRIBUTION
adaptive capacity
robustness
flexibility
WHOLE VALLEY: C O N N E C T I V I T Y - B I O D I V E R S I T Y -



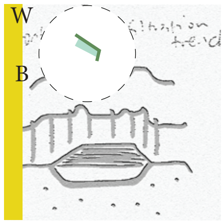
lity adaptive capacity reversibility and mobility absorbing and buffering

- R E D U N D A N C Y - M U L T I F U N C T I O N A L I T Y

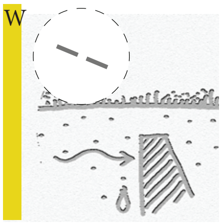
Fig. 8.44 A TOOLBOX of INTERVENTIONS



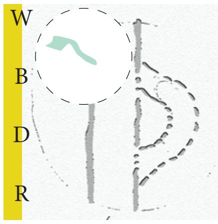
CANOPY over stream bed: Shading (crop) tree belts, reed covers, or pergola (urban area) reduce evaporation, moderate heatwaves, and improve public spaces.



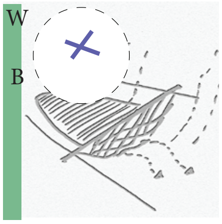
IMPOUNDMENT WITH CANOPY: decentralized, small reservoirs for irrigation and rainmaking. The canopy reduces evaporation. Coupled with a freshwater habitat and caper stripes for erosion control.



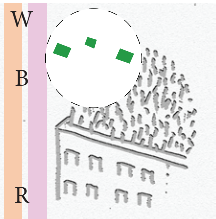
GROUNDWATER DAM underground contributes to water balance in rural areas upstream from fresh water habitats.



MEANDER or backwaters adapt rural areas to peaking water volumes, providing habitats and/or an irrigation and recreation possibilities. Reduces flooding downstream.

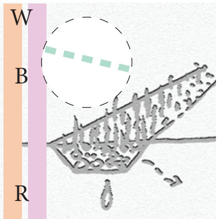


LEAKING DAM slows down water runoff, leveling peak flows and mitigating drought in freshwater habitats. A reversible construction.



GREEN ROOFS retain storm water, increase biodiversity and reduce heat waves. Particularly useful as large surfaces on industrial/commercial properties.

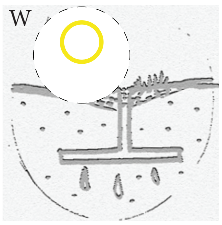
GULP: Midstream quarries are flood interceptors, absorbing runoff before settlements. Harmful substances are filtered before percolation.



POROUS STREETS take various forms, from broken surfaces to soakaways, and planted infiltration swales. In concrete canals and between fields they provide habitats/corridors. Caper stripes control erosion and evaporation.

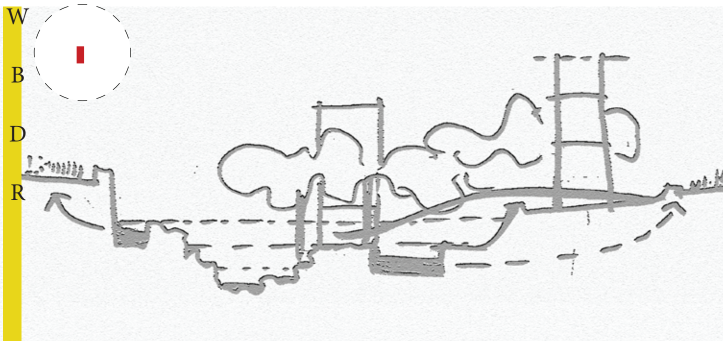
ALONG the WHOLE VALLEY

BIKE ROUTE incorporated into the canal and valley roads connects from public bays to inland recreational areas. Alternative routes for flooding season.



RECHARGE WELL at intersections of the valley bed and faults intensify percolation to the aquifer. They can be designed to be "invisible" or combined with other functions.

AN ISLAND HIGHLIGHT

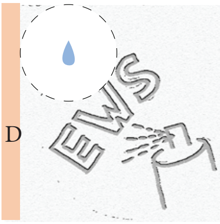


PICNIC TOWER is a multifunctional unit for rural areas where lack of public space constrains recreation. Elevation facilitates birdwatching. The structure can be combined with water management (canopy, recharge well, meander, etc.) and it provides evacuation from flash floods. It can accommodate seasonal uses like a kiosk or storage.

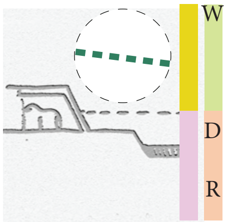
TARGETING GOALS: **W**ater management / **B**iodiversity / **D**isaster risk reduction / **R**ecreation

dynamic features

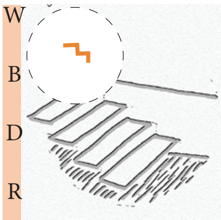
RAINWORKS is a land-art type early-warning system or real-life risk map in concrete canals that can sensitize people to flood risk and the importance of rain and freshwater.



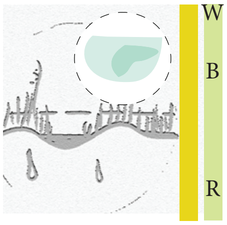
MULTIFUNCTIONAL DIKE at the edge of a wetland protects from flooding while accommodating horse stables or other spaces, plus a green roof.



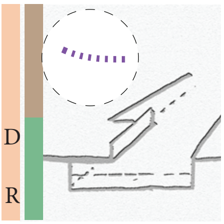
STAIRS enable access to the concrete canal, and evacuation from it in the case of a surging flash flood. Designed to minimize the obstacle to increased stormwater flow.



WETLAND (GOLF) PARK absorbs flooding instead of directing fresh water to the sea. Recreation is combined with seasonal habitats.

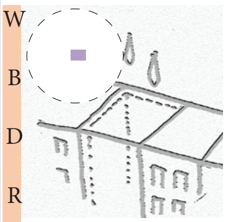


CANTILEVER on the side of an urban canal or valley wall, for pedestrians, also serves in moderate rain or to evacuate. Combined with pergola (canopy), the route is comfortable in summer.

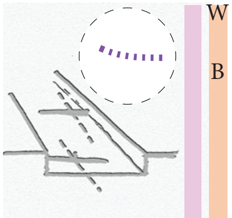


WATER SQUARE and FLOATING ISLANDS is adaptive, multifunctional, water-sensitive (re)development of sealed public spaces at urban bays.

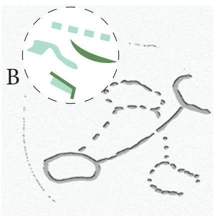
PLACEHOLDER RESERVE takes advantage of the high rate of vacant urban properties, construction sites and abandoned agricultural parcels for harvesting, storing or retaining rainwater.



CATCH and RELEASE is a flexible groyne that retains sediment for growing micro-habitats in canals but gives way to flash floods, releasing material downstream.



MINIMUM DYNAMIC RESERVE: The interventions create a redundancy of connected (freshwater) habitat islands along the whole valley to facilitate recolonization after disturbance.



GIANT SHAPESHIFTER: Giant reed is a key (invasive) plant to be seasonally controlled. It provides a variety of traditional and novel uses, from shades to phytoremediation.

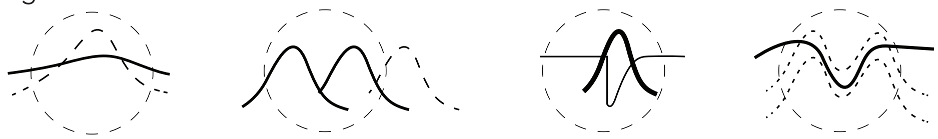
A SEASONALITY HIGHLIGHT

BIRD WALL/CLIMBING are proposed alternating uses for closed quarries. Cut walls and rubble heaps provide an artificial cliff habitat for migratory birds. To spare natural valley parts from erosion, quarries serve for seasonally limited climbing and off-road bike sites.

Fig. 8.48

This space provides multifunctionality and flexibility: Minimal interventions insinuate potential for uses, while functionality during flash flooding is provided.

Fig. 8.45 SEASONAL DIMENSIONS of BUILDING RESILIENCE



LEVELLING PEAKS, EXTENDING SEASON: Water-retaining interventions help freshwater habitats and rural areas to adapt to increasing climate irregularities of extreme rain events and drought periods. Near/in towns, interventions target water runoff to mitigate flash floods.

MANAGED SHIFTS & NEXT SEASON: In quarries, the climbing season introduced is limited to outside of the bird migratory season. In quarries and canals, each (human) season can introduce a new temporary use, analogous to fashion.

REACTIVE/SYNCHRONIZED: In town, minimal interventions encourage people to use the concrete canals, but the structures have a double function for evacuation when early warnings (e.g., rainworks) signal flash-flood risk. Use of the space is reactive, synchronized by the impulse of a disturbance, but the interventions aim for anticipatory reactions and learning.

ACCUMULATING: Besides golf players from fall to spring, the designed wetland park attracts migratory birds and freshwater wetland species, and it absorbs flooding volumes from the upstream settlement. Diversity accumulates outside of summer. A new habitat corridor can be built towards the sea, compensating for diminishing salt marshes on the island. Water level regulates accessibility for humans. Contribution to climate adaptation, biodiversity, flood-risk reduction, and recreation.

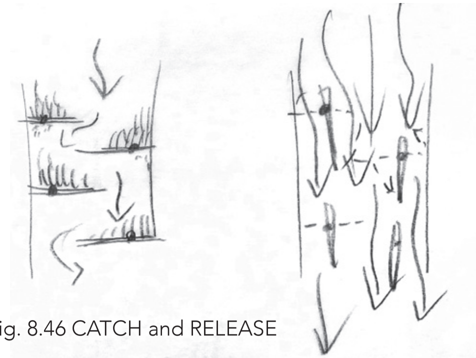


Fig. 8.46 CATCH and RELEASE

Fig. 8.47 The strategy of ACCUMULATING could be used in the Marsa sports park that has been built on a former marsh.

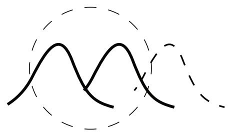
Fig. 8.50

LEAKING DAM improves the seasonal fresh-water habitat's adaptation to dry periods.

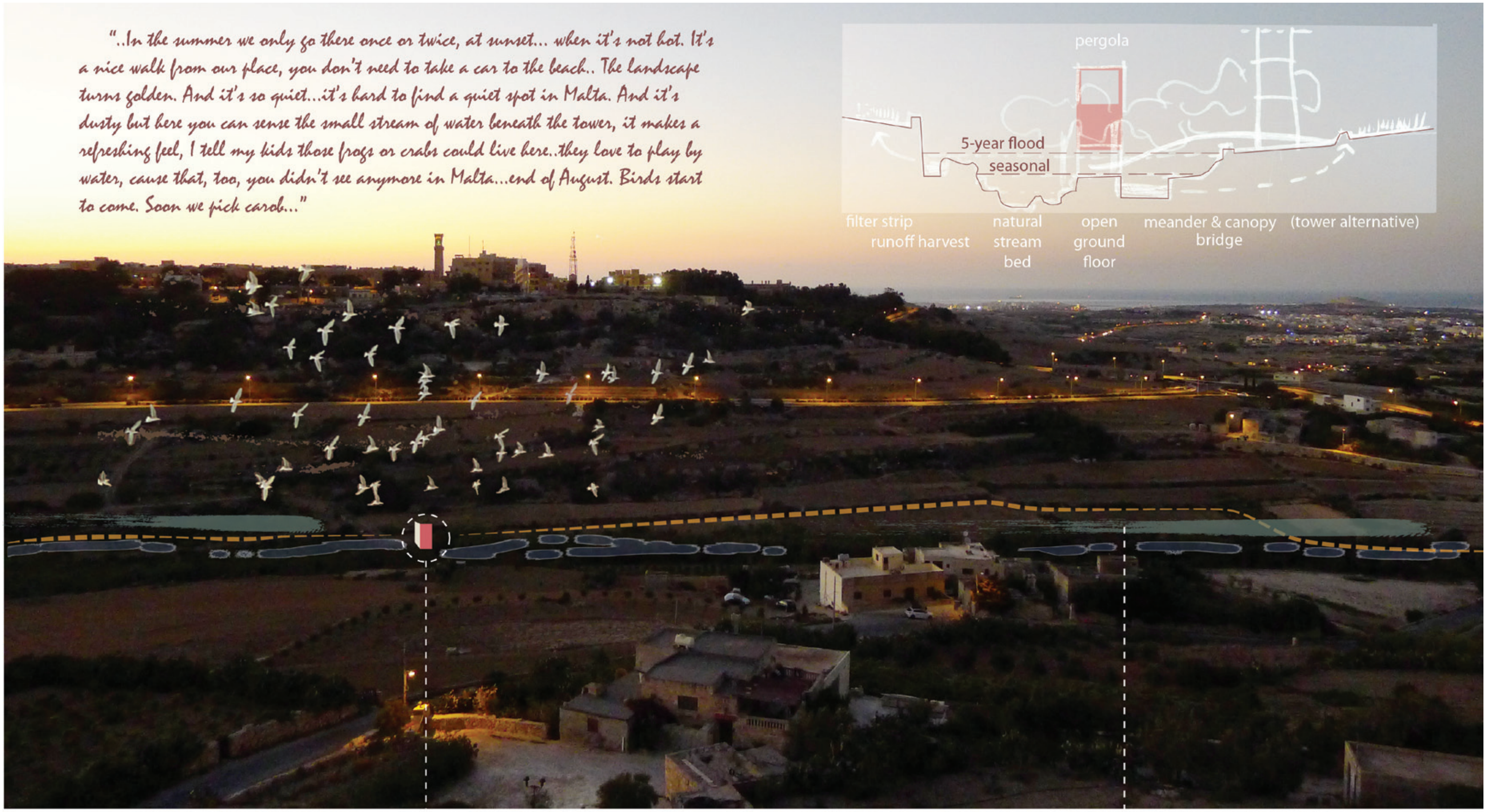
GULP: Cloudbursts form an ephemeral lake before percolating to recharge the aquifer. Biofiltering removes harmful substances, and sealed pockets provide damp micro-habitats.

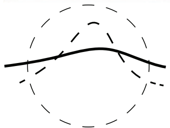
BIRD WALL: Human-made cliff provides a new seasonal sanctuary for migratory birds.

CLIMBING, prohibited in many sensitive natural areas, is an off-season activity.



The quarry on the valley side contributes to biodiversity by providing novel habitats and reducing pressure on natural sites elsewhere. It enhances the water security of the island and provides a flexible space that can be adapted seasonally to different uses.





PICNIC TOWER, MEANDER
LEAKING DAM

Multifunctional, light Interventions along the seasonal river course increase biodiversity and adaptive capacity of the rural areas to water scarcity and climate irregularities. The multifunctional tower creates a seasonally modifiable public space in the green, with evacuation in case of flooding.

CANOPY of native trees over the stream bed reduces evaporation, shades the BIKE ROUTE, and provides SEASONAL CROPS like **carob, a cocoa substitute harvested in September.**

Fig. 8.49

8.3.2.1 Evaluation

Contribution to resilience:
REDUNDANCY of habitats, flood mitigation, irrigation, aquifer recharge, and urban storm water infrastructure
ADAPTIVE and TRANSFORMATIVE CAPACITY of stream beds to different amounts of water and vegetation; of valleys to different functions over time; and of species and habitats to fragmentation or climate change (through connectivity and the creation of new habitats)
CONTINUITY of habitats in time and space, addressed with the model of minimum dynamic reserves
BIODIVERSITY of the island and the valleys, supported and improved through the above mentioned redundancy and continuity of habitats
CONNECTIVITY and MULTIFUNCTIONALITY of valleys as continuous landscape elements that enable and support spatial continuity of ecological and recreational functions and flows.
ADAPTABILITY and REVERSIBILITY of structures and light measures

Besides water management and biodiversity, the interventions address different aspects of DISASTER-RISK REDUCTION, particularly flood mitigation, early-warning (or sensitizing), and evacuation. Some interventions curb heat waves. Stabilizing the ground water surface can also mitigate geological hazards, such as karstic collapses (Main et al. 2018). Structures like stairs, cantilevers, and the bike route and picnic tower invite people to assume and familiarize themselves with their environments, while, at the same time, enabling mobility to evacuate. Furthermore, the proposal is integrative and takes into account MULTIPLE SCALES, considering how interventions upstream affect downstream. The toolkit is a flexible strategy, as the measures can be applied in multiple sites and circumstances by selecting suitable measures and/or developing new ones.[8]

Problems, conflicts, and resilience trade-offs
Besides spatial interventions, non-structural measures are needed, from maintenance (removal of debris from the riverbed) to environmental awareness, political decisions, and participatory processes. The projection entails conflicts of interest between farmers and nature conservationists, the quarry industry and other uses. In Malta, it can be difficult to reverse a policy mindset that favors engineering resilience. In physical space, the following trade-offs arise: There is a concrete canal that is devoid of biological diversity in its efficiency for flood management, but, in that form, it might actually be more flexible for purposes

8 The effects of the interventions could be quantitatively indicated by for example: extended surface area, volume and period of water surfaces; maintaining or growth of endemic populations and number of migratory birds; development of vegetation patterns and land uses; elevation of ground water surface and reduction of contaminants; increase in non-permeable surface-area and wetlands; reduction of recorded flash floods and (economic) damage.

other than a furnished public space or a re-naturalized watercourse. Despite careful consideration, the proposed structures may dangerously obstruct flash flooding or be torn with the flow. Attracting recreational use to valleys might compromise the peace of fauna and cause erosion. Retaining water raises the question of which valley parts it is viable in if the consequence is reduced water downstream. Excess water might change temporary freshwater habitats to a different state: Some flora may be lost, while species like the Maltese freshwater crab could profit. Despite the toolkit approach, I underline that each valley is a specific context. The unique situations and the valley sequence need to be taken into account to define suitable measures. Implementation requires a comprehensive inventory of valley profiles and existing structures (dams, canals, etc.), ecological and hydrological modeling,[9] and integrative management.

Reflecting islandness

Unlike typical island resilience-building, which concentrates on the coastal interface and sea level rise, the focus on valleys underpins the closely interconnected systems in Malta. Many of the proposed elements are not novel, but their application in the island's dry river-valley context is new and site-specific. Most landscape architectural flood-mitigation projects have much more space available. In Malta's crucial areas, the stream bed cannot be expanded without relocating housing or industry. Therefore, the projection promotes decentralized, small-scale water management. Through light, modifiable elements and combinations, the projection advocates flexibility and multifunctionality as a solution for limited spatiality.

The topic of finding and creating novel habitats in urban and rural areas contrasts with conservatory island approaches. A densely urbanized island like Malta cannot afford to be conservative about habitats. With minimum dynamic reserves (Leroux et al. 2007), I propose spread and redundancy instead of protection. The idea (and fact)[10] that endemic species can adapt to built environments is necessary and productive for an island that faces a proliferated construction boom. Malta has potential to proliferate the way nature conservation takes shape in the Anthropocene.

9 For example, minimum-dynamic area-modeling for key endemic species, and simulations of flood risk and ground-water extraction/replenishment situations.

10 For example, the Maltese wall lizard, leopard snake, and cat snake are found in private urban gardens and industrial areas (ERA 2016a). I caught a glimpse of a crab that had found its way into a storm-water gully.

8.3.3 Reflection (Transformative potential III)

How can seasonal phenomena be integrated into designing urban landscapes to enhance resilience of islands? / Understanding seasonal phenomena can contribute to resilience-building in islands.

8.3.3.1 The seasonality hypothesis and integrating seasonal phenomena into designing resilience

The case study confirms the hypothesis that understanding seasonal phenomena can contribute to resilience-building in islands: In the first place, the pursuit of understanding seasonal phenomena led to the identification of two critical aspects, flash floods and freshwater habitats. This, in turn, resulted in the recognition of whole valleys as systems that require resilience-building. Although water scarcity or flash floods would have been obvious topics without a study of seasonality, handling them in Malta implies seasonal cycles. Moreover, seasonal mappings increase knowledge of who is at risk, where, and when. Understanding the seasonality embedded in the valleys' interlinked ecological systems, human practices, and aquifer recharge has significantly contributed to the projection.

The Research through Design produced a series of spatial measures that target resilience goals, are informed by seasonality, react to seasonal dynamics, enable new seasonal uses, and manage seasonal stressors. By integrating seasonality into the pursuit of water security, biodiversity, and disaster-risk reduction, both island-specific outcomes (e.g., a picnic tower) and universal elements (e.g., infiltration swales) emerged. Resilience principles have been employed at the scale of the whole valley and in its different parts, underpinning redundancy. In Malta, multifunctionality is pivotal due to lack of space, and seasonality has proven to be particularly useful for creating multifunctional spaces by shifting or accumulating seasonal uses. Seasonality is conceptualized in four measures that support resilience-building: 1) levelling peaks, extending season; 2) managed shifts and next season; 3) reactive/synchronized; 4) accumulating (fig. 8.45). They target certain parts of the valley while the principles are transferable.

Moreover, seasonality becomes a means to promote a highly urbanized population's encounters with natural dynamics. Although recreation is not directly a resilience-building goal, some interventions invite seasonal uses to monofunctional spaces. They signal seasonal risk and contribute to aesthetic experience of seasons through engagement, for example, with early-warning artworks or a carob[11] harvest. The projection finds poetic and material ways to sensitize people to water scarcity, disaster risk, and climate change.

11 A native superfood that is used as a cocoa substitute.

8.3.3.2 On seasonality and transformative potential

The recognition of the transformative potential of the approach itself was established during an iterative process. Going back to the island portrait and field research, my first concern was that, in Malta, seasonality pales in the presence of more urgent spatial problems. Salt production and bird migration may not provide means to deal with urban expansion or earthquakes. However, the projection shows that water-related seasonal phenomena are highly meaningful for transformation towards resilience in Malta. The approach is not restricted to seasonality, but also succeeds in combining other transformative potentials (see 8.1.3), like quarries and "placeholders." The increasing unpredictability is challenging when climate change intervenes with what has been considered regular seasonality. Design proposals cannot take the seasonal occurrence (or absence) of flash floods or drought for granted. Therefore, safe-to-fail solutions and landscapes of "preparedness" are necessary; but mindsets and practices of preparedness are also needed.

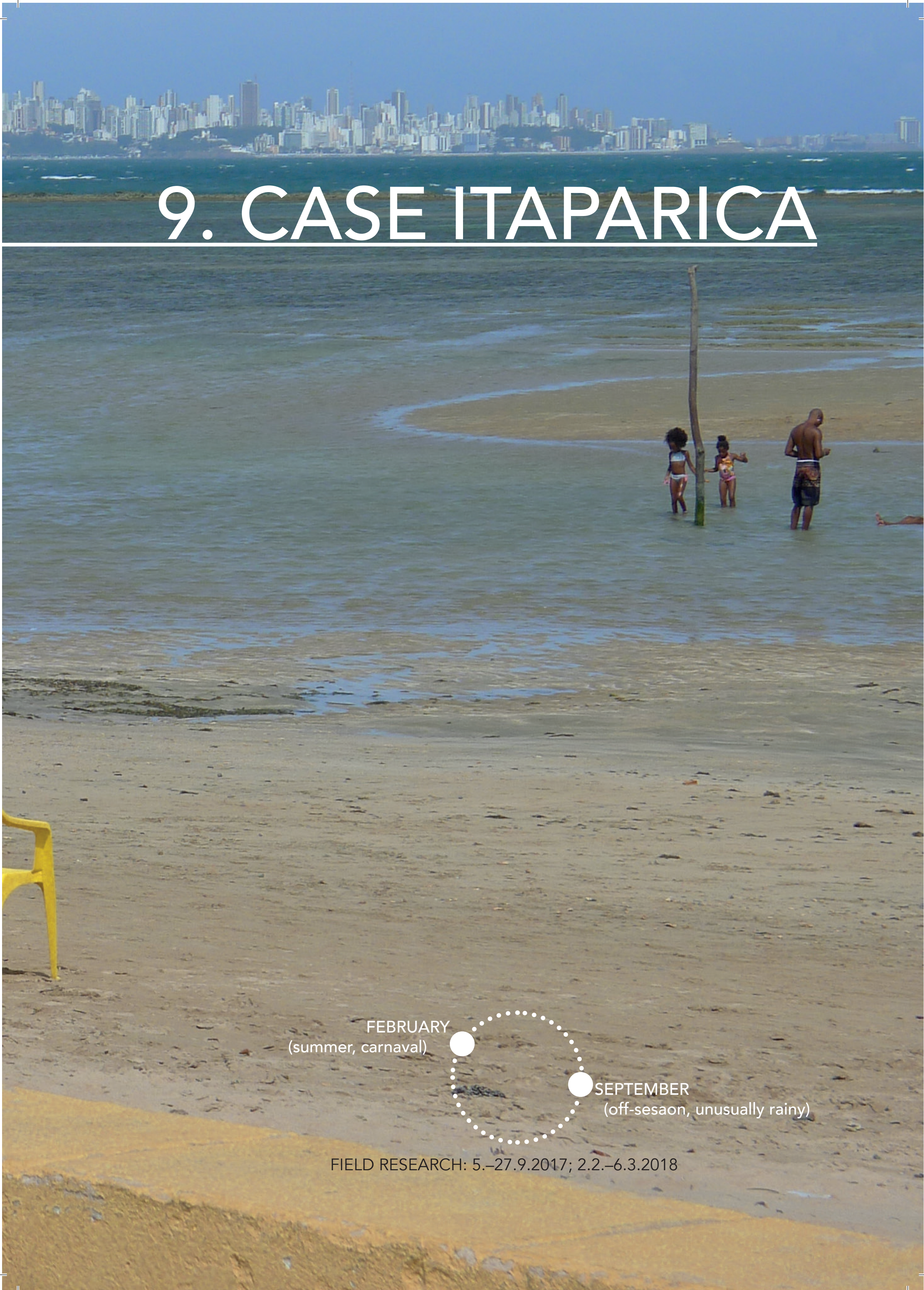
Transferability is part of transformative potential. Within Malta, the tools developed can be employed in the wider valley system. I further postulate that many measures are transferable to other Mediterranean and arid islands, for example, the Canary Islands or Cabo Verde. With respect to transformation, one of the biggest qualities of the projection is the consideration of novel habitats. Independent of seasonality, it can be a meaningful subject in other urban landscapes.

The added value of seasonality lies in the way it enriches the projection: Different from a conventional disaster- (or flood-) management approach, the projection always attempts to envisage two frequently, more or less regularly occurring situations, rather than a regular permanent spatial solution that accommodates a once in a 5- or 10-year exception. The approach engenders ideas about elements that have double purposes or that are reversible. Secondly, it brings out local specificities for creating landscape experiences beyond technical solutions. Such specificities, of course, do not need to be (only) seasonal, but it has been the emphasis in this research. Thirdly, the approach has launched a cross-sectoral, integrative modus operandi that is essential for transformation towards resilience. To conclude, taking seasonal phenomena into account has proven useful in four ways:

1. It led to identification of important issues and priorities for resilience-building.
2. It helped to understand seasonal exposure and changing risk (where, when, and who).
3. It generated a multi-sectoral overview that has revealed synergies and conflicts.
4. It enriched the spectrum of solutions for resilience-building.


SKOL
SKOL

9. CASE ITAPARICA



FIELD RESEARCH: 5.–27.9.2017; 2.2.–6.3.2018

ITAPARICA

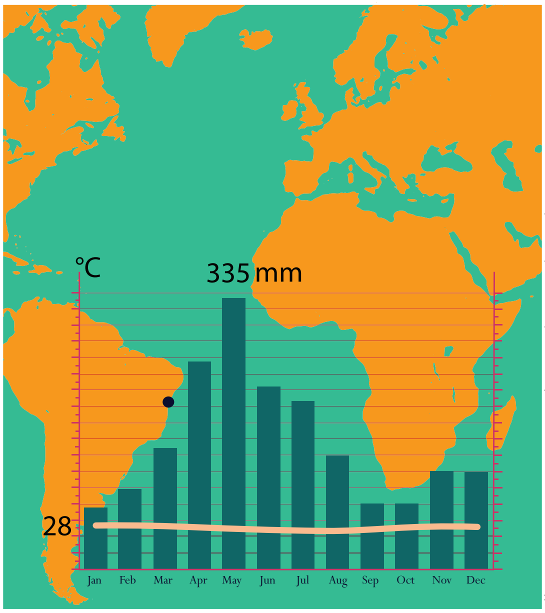
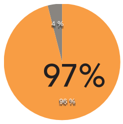
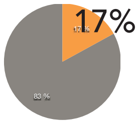


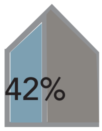
Illustration Karin Eremia, climate diagram based on:
https://es.climate-data.org/america-del-sur/brasil/bahia/vera-cruz-43377/



urbanized population



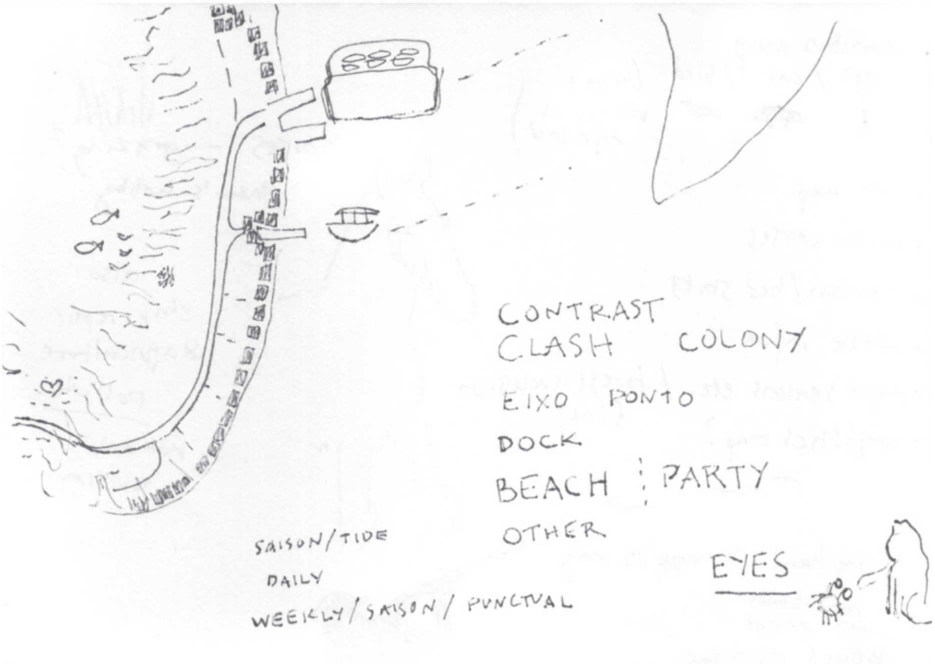
urbanized (built-up) land



occasionally used housing (2010)

2017: 66,506 residents

+130 000 fluctuating population



Status:
Part of the metropolitan region of Salvador, in Brazil, the island comprises two municipalities (Itaparica and Vera Cruz)

population[1]	58,292 in 2010 / estimate for 2017: 66,506
land area	246 km^2
population density	270/km^2
urban population[2]	96,9 % in 2010 (Itaparica: 100%, Vera Cruz 93,82%)
urbanized land area[3]	17 % -> population density in urbanized area 1590/km2

Urban dynamics: seasonal urbanization (second homes), informality
Occasionally used housing is at 35 % in Itaparica and 48 % in Vera Cruz, precarious housing is at 38,3 % and 49,23 %; a total of 71 % of households had a maximum income level of two minimum salaries in 2010.[4]

Key ecosystems:
mangrove, coral reef, beach, *restinga* (dunes, beach vegetation, coastal shrubs and forest, swales), Atlantic rain forest, inland marshes and wetlands, natural springs and ubiquitous network of brooks, and estuaries

1 IBGE 2017a, 2017b
2 SEDUR 2014, 24
3 SEDUR 2014, 219
4 SEDUR 2017, 16

9. Itaparica

Opposite of metropolitan skyscrapers, Itaparica Island in Brazil is a prominent case to study seasonal phenomena and spatial transformation: The major force for change is urbanization rooted in the seasonal dynamic of tourism and second-home owners. Despite a low built density, almost no land is considered statistically rural, and the population of the island's two municipalities Vera Cruz and Itaparica is 96.9% urbanized (SEDUR 2014:24). In this text, the name Itaparica primarily refers to the whole island, and reference to the municipality with the same name is mentioned separately when appropriate. The humid tropical climate, with little annual variation in temperature, was one of the case-selection criteria – expected to reveal seasons that are not climate-dependent. With respect to resilience, Itaparica Island is not a typically researched, globally iconic disaster island (see, e.g., Kelman 2018). Unspectacular yet rich in contrast, the island might open up new perspectives to island resilience and the Anthropocene.

The first part of this case study is an interpretation of the dynamic urban island with respect to spatial transformation, and reflected against concepts of islandness and island spatiality (see chapter 3). The second and third parts take a more specific lens to answer the research questions about seasonal phenomena and resilience-building.

9.1. Islandness and specificity

9.1.1 Portraying a dynamic urban island

Itaparica is an island at the edge of metropolitan Salvador, part of the biologically, physically, and culturally diverse Recôncavo region and Baía de Todos os Santos – the Bay of All Saints, or Kirimuré by its indigenous name. The island is characterized by noticeable contrasts, as the forces of an uneven metropolization encounter traditional island life.

Resorts and the self-built
A transformation from colonial plantations to an elite summer destination started in the late 1930s. Insertion into the metropolitan periphery accelerated in the 1970s with the establishment of a car ferry connection to Salvador city and, on the opposite side, a bridge to the continent (Santos Neta and Santos 2012). Today, 17% of Itaparica's land area is urbanized (SEDUR 2014:219); this is practically the whole **coastal strip** facing Salvador, between a main road and a 45km beach. It is dominated by walled resorts and holiday homes around old village cores. The latter consist of both permanent and seasonal self-built housing, beach bars, and small public squares. There is no middle ground. The two opposing

settlement configurations form the normalcy on Itaparica. During the summer and on holiday weekends throughout the year, second-home owners and Brazilian tourists crowd the beach zone. In the winter, ferries and boats continue to transport commuters and goods, but a ghost-town atmosphere takes over.

Decay and boom

Despite a vibrant beach season, many people describe the island as being in a state of stagnation and decay. I understand that Salvadorians attribute this to the exodus of the elite, and locals to the state of municipal development. Yet, segregated by the main road, an expanse of informal settlements towards the inland, and anticipatory clearings for large allotments, tell another story. Proximity to the growing mainland metropolis, which is running out of land, increases urbanization prospects for Itaparica: Plans for a 12km bridge are underway (Instituto Polis, Oficina, and Demacamp 2014). As the littoral has become full, an inward sprawl combined with irregular mineral extraction is reinforcing landscape fragmentation. At the edges of the village of Baiacu, half-finished buildings and fenced lots expand onto tidal salt flats that used to limit settlements, earmarking a territory of uncertainty.

Resulting from this dynamic, construction material retail is one of the most noticeable forms of commerce on the island. Piles of gravel, blocks, roof tiles, and swimming-pool frames flank the sides of the main road, used by companies as a show room and storage. Vertical surfaces are not visible in satellite images, but cuts in the bright orange terra often provide a backdrop for newly built houses, or occur somewhere in the landscape. It requires intentional observation to spot these recurring signs of mineral extraction and to comprehend their ubiquity and rapid expansion in the altered topography and vegetation. New roads in the making penetrate straight into the hills.

What is labeled subnormal or precarious in official documents is often described as simplicity by islanders, with a less negative connotation.[12] This usually refers to traditional small villages, where many islanders support their families with fishing and clamming. Urban statistics camouflage the importance of these livelihoods and the islander identity of many natives (the mixed population of mainly African, indigenous, and Portuguese origins) who are highly dependent on the island's coastal biodiversity. This draws attention to tidal dynamics.

12 Biased perspectives, appropriate terminology, and strategies are widely discussed in planning and design research about informal urbanism (see, e.g., Werthmann and Bridger 2015; Gilbert 2007; Roy 2011).

The *maré* – A tidal space

Until recently, all settlements have been located on the **coast**, and economic and social activities have concentrated there. The lengthy shape of Itaparica emphasizes large proportions and **proximity of two contrasting sea-land interfaces** on the opposite sides of the island: In the east, the beach and coral reef facing the city host visitor crowds and remaining fishermen and women. In the west, a mangrove estuary enveloping a few villages has a completely different atmosphere. For locals, *maré* (the Portuguese word for "tide") is not only the variation of low and high water levels, but also a space both in a physical and abstract sense – a tidal territory at the sea-land interface that does not exist in conventional maps. It is lived and modified by artisan fishermen and clammers who are familiar with mud, mangrove tree sounds, sand, shells, coral reefs, and currents. Shaping specific ecosystems, livelihoods, and identity, the tidal dynamic is immediate and pervasive. The *maré* space also accommodates visitors and their activities. The distinct coasts with their indispensable ecosystems, and the subsistence versus beach cultures, culminate at the points of the island in Cacha Pregos and Itaparica town.

Artisan fishing and clamming practices organize village spaces, including ports, small shipyards, huts for equipment, fishing colony houses, and modest market stalls. Private porches, front steps, and tiny furnished squares are spots for repairing nets, cleaning fish and clams, and socializing. Shells are a common sight as road fillings and wall decoration, or are just discarded. **The *maré* is the coastal essence of Itaparica.** Brief encounters during fieldwork conveyed that tacit and embodied knowledge about its qualities and behavior blends with beliefs and legends (see also Ribeiro 1979; Santos Alves 2015). Although artisan practices modernize and lifestyles urbanize, a rich Afro-Brazilian cultural tradition associated with natural resources is apparent in the communities – ranging from fishing and culinary practices to religious heritage and dances – and frequently cited (Lima 1999; Rossoni, Pinheiro Araujo, and Meirelles Correia 2012; Instituto Polis et al. 2014; SEDUR 2014; Instituto Polis, Oficina, and Demacamp 2015a, b). Is this, then, an island of the Anthropocene?

The Anthropocene materializes on the beach

The rising sea level is slowly making its way into islanders' consciousness due to accelerated coastal erosion: The familiar *maré* is "growing." Yet, there is no McDonald's on Itaparica, and the only large, all-inclusive hotel complexes are the international Club Med and national SESC. A tiny private airport is frequented in summer, but mobile and Internet connections are unsatisfactory. Beach waste brought by waves from the capital or left behind is of a specific global kind, consisting of five items: plastic bottles, cups, straws, flip flops, and coconut husks cut for drinking. It reminds one of Facebook postings of polluted tropical oceans. Having observed beach cleaning, I assume layers of waste below the sandy surface to be sediments of humankind. Although global dynamics are much more modest than in the Caribbean, Itaparica has entered the contradictory, insular "problem space" of the Anthropocene (Moore 2015), accentuated at the sea-land interface.

Tracing islandness: The paradox

Coastality has dominated spatial development on Itaparica. Today, the repercussions also draw attention to the **fragmenting** island middle. In total, Itaparica's landscape is composed of **ambiguous** layers, one shaped by natives and the tidal dynamic, and another by seasonal relaxation for urbanites. Newcomers construct another layer, superimposed on remnants of colonial plantations. Described as **stagnating**, yet undergoing **dynamics**, Itaparica hosts **enclosed resorts** and **self-built expansion**. These contrasts are connected through the underlying diverse topography that ranges from coral reefs and mangroves, the Atlantic Forest and valuable freshwater wetlands, to pastures and clearings. As a result, the landscape character of Itaparica is not handsome real estates in lavish nature, but, in many places, unsettling and neglected.

The island holds parallel worlds (**marginalized and paradise**) and tempi (**the metropolis and the island**). Life is simultaneously characterized by a dependence on and adaptation to metropolitan dynamics, and the pervasive tidal rhythm that interferes with the urban, affecting boat connections and beach occupation. Itaparica features both geographical **boundedness and connectivity**, **isolation and attachment**. Locals color precariousness with hopeful nuances. Itaparica exemplifies the typical island paradox of being **colonialized and self-organized** at the same time.

9.1.2 Topical spatial problems, hazards, and trends

9.1.2.1 Environmental degradation

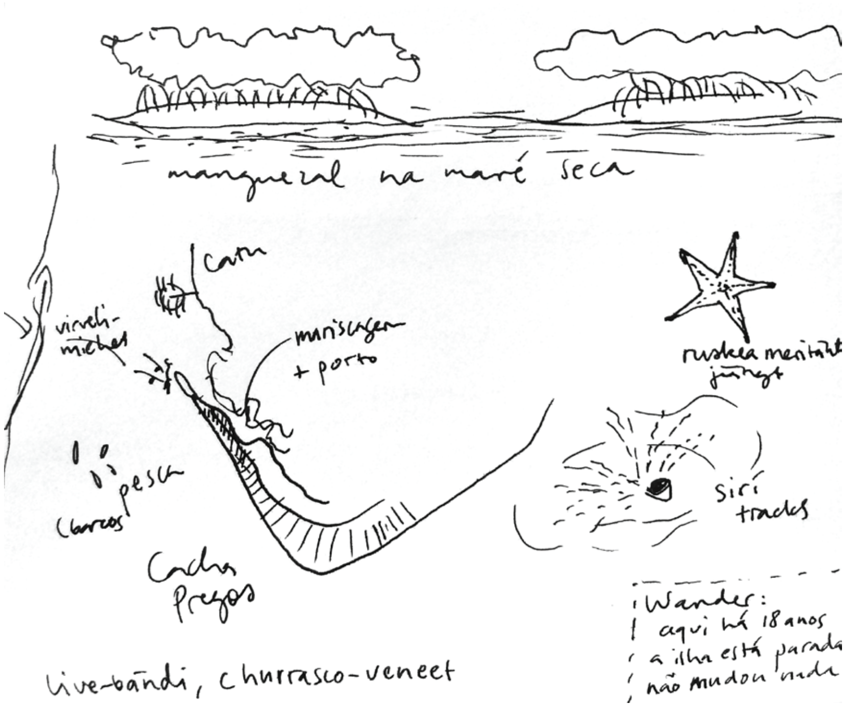
Settlement fabric on Itaparica has been evolving so fast that planning and monitoring cannot keep up. The two municipalities of Itaparica Island have elevated levels (over 50% and 75% in 2010) of "inadequate habitation" and precarious housing (40–50%) (Instituto Polis et al. 2014:16; SEDUR 2014:241). Coupled with socio-economic challenges – that stem from a colonial history and the island's status as metropolitan periphery – environmental degradation is a major problem. In 2010, in the Itaparica municipality, around 50% of households had inadequate sewerage solutions, and in Vera Cruz, the number was almost 75% (SEDUR 2014:292). Lack of infrastructure and services has led to self-built solutions, and a lot of sewage goes directly into the environment. Mangrove forests might be quite robust, but other wetlands, streams, and coral reefs in the east are highly sensitive, and ubiquitous surface waters facilitate the spread of contaminants (see map). Waste heaps up in and around settlements. Urban expansion and land speculation – deforestation, invasions, clearing brush by burning, and extraction of sand and soil – cause a high habitat fragmentation index (SEIA 2018). Occupied up to 53% with solid constructions (Instituto Polis

Portraying a dynamic urban island: ITAPARICA

Fig. 9.1–7 Between holiday homes, walled alleys lead directly from the main road to the beach, making up an odd settlement pattern. Almost every house has a "to let" or "for sale" sign. Piles of gravel, blocks, roof tiles, and swimming pools dot sides of the main road, used by companies as a show room and storage. Walls shining orange terra backdrop newly built houses, or occur somewhere. New roads in the making penetrate straight into the hills.

Fig. 9.8 The coastal strip is dominated by holiday housing.
Fig. 9.9 At the edges of fishing villages like Baiacu and Cacha Pregos, half-finished buildings and fenced lots expand to mangrove forests or tidal salt flats that used to limit settlements, earmarking a territory of uncertainty.

Fig. 9.10 *Maré* - The tidal territory at the sea-land interface does not exist in conventional maps. It is lived and modified by artisan fishermen and clammers who are familiar with mud, mangrove tree sounds, sand, shells, coral reefs, and currents. It also provides the space and rhythm for arrivals/departures and beach uses.




+40cm
+65cm
+10cm
"normal" tide (sea level)

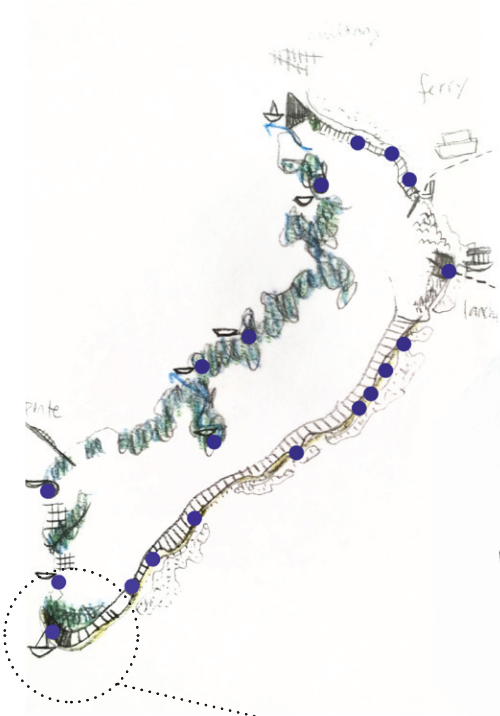
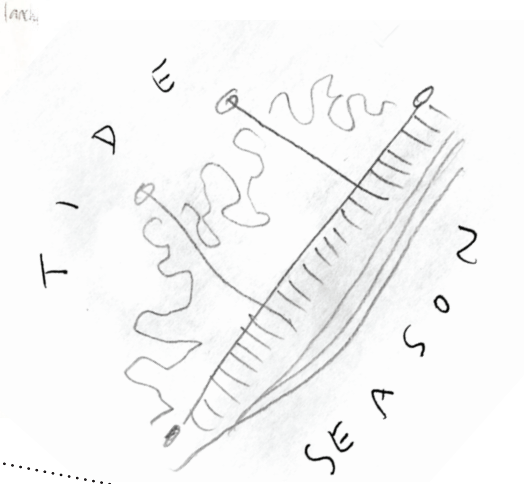
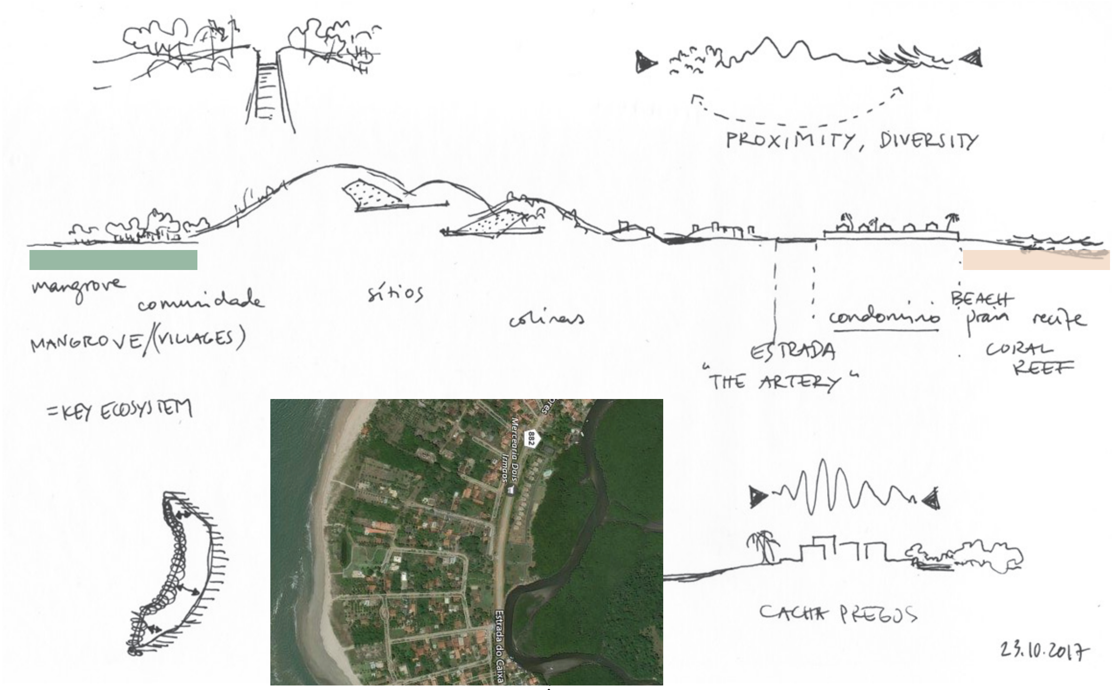


Fig. 9.11–9.15 Studying proximity of two different sea-land interfaces: mangrove in the wast coast, and beaches and a coral reef on the east coast. The distinct facets meet at the points of the island in Cacha Pregos and Itaparica town (right). They have a different temporal character, one side dominated by the tide, and on the other side layered with seasonal dynamics (below).





Map data © 2017 Microsoft

et al. 2014:12), beaches are the most degraded environments, followed by central floodplains, susceptible to contamination and altered hydrology (SEDUR 2015:13). The key coastal *restinga* ecosystem – that consists of dune formations and plant communities in sandy and salty conditions with high biological value and natural function in mitigating erosion – is almost extinct. Despite locals' knowledge, extraction of marine resources is not performed on a sustainable basis (Magalhães, Costa Neto, and Schiavetti 2011), and overfishing has impoverished parts of the coral reef.

9.1.2.2 Human security and public space

For humans, environmental problems entail health risks and degradation of livelihood opportunities. Seasonal flooding (see 9.2.1) is the biggest recurring (natural) disturbance in Itaparica's settlements. Many islanders suffer from frequent water shortages (SEDUR 2014:284; Instituto Polis et al. 2015a, b). Household water that is unsuitable for drinking unless filtered is supplied from the continent and regulated in the high season. Sub-surface waters are abundant, but in many places contaminated by sewage leakage (Santana Pereira 2009).

Lack of recreational spaces was frequently cited in the participatory workshops of a recent planning process (Instituto Polis et al. 2015a, b). These consist of bars, tiny furnished squares, football fields (often wasteland, tidal flats, or clearings in mangroves), and the beach. Their facilities and distribution are inadequate. In the port of Cacha Pregos, residents have built a series of tiny, lovingly named seating groups. Condominiums provide gardens, playgrounds, and pools for visitors, but beach alternatives, such as ecological trails, are nonexistent. High incidents or fear of violence and crime partly explain the absence of activities such as camping and nature trails. Safety concerns (Instituto Polis et al. 2014:11, 2015a, b) affect housing, urban design, and use of open spaces.

9.1.2.3 Urbanization and climate change prospects

Population growth by 2010 had slowed down to 1% in the municipality of Itaparica and 2.6% in Vera Cruz (SEDUR 2014:25). However, the prospects of a new bridge predict a 400% rise in population within two decades (Idem:186) – an extreme amount of pressure on the island systems. An intermunicipal urban plan (Plano Urbano Integral) from 2017 associates the bridge with economic growth (SEDUR 2017). Its rhetoric and zoning highlight biological, cultural, and landscape patrimony, but built development is not allocated. With these envisioned developments, I suspect less seasonal fluctuation and more weekend visitors and commuting throughout the year. The plan does not mention climate change factors.

Based on the IPCC's estimates by 2100, experts predict a 52–98cm mean sea level rise for neighboring Maré Island (Santos et al. 2015). That will directly impact coastal livelihoods, settlements, and the coral reef, which is a particularly sensitive ecosystem. Consolidation of the beach zone with hard constructions makes the island more vulnerable to waves and coastal erosion. Locals account for signs of "the sea taking back what belongs to it," and a major change in beach shape, causing property damage, has taken place in Cacha Pregos (fig. 9.16). This might be part of long-term sedimentation cycles occurring in the delta (Bittencourt et al. 2001), but holiday housing that had replaced a buffering dune and lagoon system was damaged by tidal flooding in September 2018.

Fig. 9.16 The aerial image sequence shows a transforming coast in Cacha Pregos, under the influence of delta currents and built development.

By the end of the 21st century, along the coast of Bahia state, a 1.5°-3.5° C temperature rise and a general tendency of reduction of annual rainfall by 30% are expected (Tanajura, Genz, and Araújo 2010; PBMC 2013:24, 2016:78). The Brazilian Panel on Climate Change (PBMC 2016:61, 76–9) predicts an increase in high temperatures and extreme rain events, and inter-annual irregularities are predicted in the Salvador area. Summers are expected to have more dry periods, but an increase in autumn rainfall is predicted until 2041, before reduction towards the end of the century. While storm surges have become more frequent, there is no clear trend in wind intensity. In September 2017, the impacts of the Atlantic hurricane season were felt even on Itaparica as unusually strong winds and abundant rainfall. Coupled with urban development, an increasing population may be exposed to these future hazards. They might turn into disasters unless adequate anticipatory and adaptive measures are taken.

9.1.3 Transformative potential I: Elements and resources

On Itaparica, the unfinished and unplanned character of settlements and open spaces provides transformative potential in a concrete sense: Installing or renewing infrastructure is easier in the unpaved roads than retrofitting an asphalt city with solid conventional structures. This socio-physical quality can facilitate incremental and hybrid solutions.

People who are capable of producing their settlements and adapting (to) their environment (through traditional knowledge about natural dynamics, self-built ports, adapting public space) may hold a key position in change. Self-organization can be a considerable transformative capacity – or a resistant force. Poverty should not be romanticized, but learning from "simplicity" can engender insights into dealing with scarce island resources.

The main road is a significant space. Its seemingly unplanned, incomplete sides provide a linear space of possibility for a diversity of functions. Passing through the island as an artery, it concentrates the fluxes of people and vehicles, and feeds village centers, beach-house alleys, and the few connections to the opposite coast. The roadsides are used for both formal and informal commerce and services, socializing, collective transport, and even religious offerings. The road itself manipulates landscape: It determines a line of social segregation and spatial division; it forms a barrier that impedes ecological flows, including water drainage from the inland towards the beach.

The diverse vegetation is seen as an asset for livelihood development and nature-based solutions – for example, in the form of cash crops, sewage treatment, and erosion control. As an odd layer taken over by holiday homes or forest, dirt road grids are probably remains of colonial plantation structures. The recurring patches may provide transformative potential for dealing with history or testing new uses. In the coastal plain, the repeating walled allotments hold plenty of underused, private open space with low ecological significance, empty most of the year. This observation connects to the core of the thesis: seasonal phenomena and their role in spatial transformation and resilience-building.

9.2. How are seasonal phenomena linked with spatial transformation?

9.2.1 Seasonal phenomena and their spatial dimensions

To answer the first research question, the following seasonal phenomena and practices were discovered on Itaparica: tourism, the off-season, the March spring tide, flooding (the rainy season), bird migration and wintering, fishing and clam harvest, fires to clear terrain, and appropriation of public open space for commercial, recreational, and cultural uses, such as hangouts, vending, and cultural or religious manifestations. Despite the tropical climate, residents of the region speak of spring, summer, autumn, and winter, which is characterized by increased rainfall and rougher sea between April and August, the "off-season."

Tourism

As described in 9.1.1, seasonal beach tourism, which follows the holiday calendar and summer weather, is the major driver of spatial transformation on Itaparica. Occasional use applies to 35% of domiciles on Itaparica and 48% in the Vera Cruz municipality (PUI 2015:17), dominating walled allotments on the beach plain. This has resulted in an odd settlement pattern of metaphorically islanded allotments and alleys that, between walls, lead directly from the main road to the beach. Almost every house has a "To let" or "For sale" sign. Summer brings people and beach furniture. During the carnival, cars with booming sound systems occupy villages and beaches (fig. 9.17–18). South of Tairu, the main road itself turns into a dance and bar zone impossible for cars to pass. The ferry port in Bom Despacho gathers a traffic jam (which starts in Salvador), and the port in Mar Grande bustles with passengers, vendors, and vans.

Waste and water consumption peaks

The fluctuating crowd triples the amount of solid waste collected (Vera Cruz 2018), and, as the collection process is not perfect, lots of waste ends up directly in the environment. Supposedly, there is also a peak in sewage production. These problems exist without tourism (see 9.1.2), but seasonal peaks contribute to long-term pollution and contamination of settlements, waters, and soils, and accumulation of waste on the island. The peak particularly affects urban estuaries, beaches, and the coral reef. There is also a corresponding peak in water consumption. It contributes to distribution breaks (another factor highlighting social inequality), but local subsurface waters are not depleted, because water is supplied from a continental river. Locals have developed workarounds to seasonal water shortages, such as using natural springs and building wells (Santana Pereira 2009), as well as filling cisterns and barrels when the household water supply works.

The off-season

The clear summer season ends abruptly after carnival, and the off-season, from March to November, takes over the built-up coastal zone. Although holidays and feasts punctuate the rest of the year, a distinction between the summer and off-season is evident. The absence of holidaymakers, sunbathers, dogs, and disruptive pop-music, among empty houses and closed stores, stalls, and restaurants, give settlements the air of ghost towns. One of the initial creative questions of this thesis is "Whose season is the off-season?" While for some islanders, it means less income, many seem to appreciate it as pleasant time. It is the season of wetland habitats, uninterrupted tap water, and school uniforms.

The March spring tide

Summer also closes with a natural dynamic: In March, the spring tide is particularly high. The Portuguese term *maré de março* frequently comes up in traditional songs. As it often coincides with strong winds and the start of the rainy season, it can cause flooding and erosion – mainly along the eastern coast. Because holiday settlements have eradicated almost all of the naturally buffering *restinga* ecosystem, occupying Itaparica's beaches with walls and bars, a counterproductive cycle of damage and fortification measures has been initiated in many places. With sea level rise, the impacts of the spring tide are expected to escalate, ephemerally almost isolating the towns in the southernmost and northernmost areas of the island. Spring tides also reach a high level in September (the actual spring in Brazil), but weather conditions are usually milder. In 2018, unusual tidal flooding destroyed beach homes in Cacha Pregos.

Seasonal habitats: Birds, crabs, and wetlands

On the west coast, hypersaline tidal flats adjacent to the mangrove forest (*apicum*) are associated with seasonal changes: The March spring tide bringing salt and evaporation in the dry season contribute to their formation (Albuquerque et al. 2014). This is the habitat of the endangered Cardisoma guanhumi crab, known in English as the blue land crab, which "walks about" during the mating and egg-laying period from January to May (Firmo et al. 2012). Before the recent prohibition of their catch (Vasconselos 2018), Firmo and colleagues showed that its reproductive cycle and consequent closure periods (that is, harvest is prohibited during breeding) used to affect crab harvesters' activities. Pollution of estuaries and settlement expansion threaten their habitat.

Seasonal guests include birds: In summer, a wintering roseate tern population – a threatened species that migrates from North America – flocks around mangroves and sand banks of Cacha Pregos (Lima 2006:140–3). Ruby-topaz hummingbirds follow the flowering of the *ingá* tree (in coastal forests, not necessarily on Itaparica) (Idem:200). In the rainy season, swamps and marshes enlarge, and pluvial flood plains emerge. Water bodies in the swales of the original *restinga* ecosystem provide seasonal habitats for birds and reptiles. For example, in the north of Bahia – and, I assume, on Itaparica because it is located in the region – wetland birds such as the snail kite, the common gallinule, and the rare white-necked heron are present during rainy-season flooding (Lima 2006). Frogs, insects, and even small fish appear within settlements.

Directly or indirectly, these seasonal habitats are affected by tourism, which, through settlement patterns, mineral extraction, and waste and sewage peaks, has contributed to pollution and has altered land cover and sedimentation processes. In the coming decades, heat and drought periods (see 9.1.2) might decrease inland wetlands. However, similar to Sylt (Reise 2018), sea level rise might "lift" the freshwater lens, thus still keeping wetlands moist.

Rain and flooding

Coastal occupation and the sprawling urbanization towards the island interior have turned the natural hydrological cycle into a seasonal urban hazard. During the rainy season from March to September, low-lying areas are frequently affected by flooding – in particular, the expanding informal settlements along the main road. Aside from making access difficult – even "islanding" some communities on the opposite coast when roads are flooded – flooding can damage property and increases ecological and health risks. It can spread contaminants from settlements with insufficient sewerage infrastructure, and provides a breeding environment for harmful insects. The root causes of flooding essentially include building in unsuitable locations (including small landfills and waste heaps that alter hydrology) and fragmentation of existing waterbodies and uphill forests. Coastal occupation has reduced infiltration and stream outlets towards the beach and sea, and the main road works like a dam. The current urbanization pattern insinuates further occupation of flood-prone areas, and more intense rain events are predicted. This might also induce landslides in precarious hill settlements, where roads already show heavy signs of erosion after rain.

Fires to clear terrain

In the dry months, smoke among the hills is a common sight. First and foremost, it originates from the practice of clearing vegetation by fire for new lots, but also from burning uncollected waste that would start to smell in the heat. This illegal but unmonitored small-scale phenomenon might become hazardous as landscapes become more flammable with the predicted drought and heat periods (see 9.1.3).

Fishing and clam harvest

Artisan fishing and clamming practices on Itaparica are, to some extent, seasonal, depending on variation in fauna, weather, demand, and periods of closure. Activities decline during winter but are carried out throughout the year, sometimes dependent on and always informed by tidal dynamics. On the east coast, fishermen (and women) and clam harvesters share the beach and settlements with tourists and second-home owners. Exposed to wind and storms from the open sea, their practice is more seasonal than in the calm waters of the western villages (Lima 1999:157).

Appropriation of public space: Socializing, commerce, culture, and religion

Seasonal phenomena also occur as periodic appropriation of public open space for informal uses and temporary structures. In summer, hawkers stroll amidst the beach crowd and vendors use the main road as a show room. Benefiting from peak demand, fishermen and clammers have vending spots in villages. Youth gather on squares during school semesters. From time to time, Afro-Brazilian religious feasts and cultural events take place outdoors. These seasonal pulses do not transform the physical space completely, but they are a motivation for landscape design and transformation: These phenomena point out the importance and scarcity of public open spaces, and recreational or environmental-educational opportunities. They also demonstrate creativity and capacity for spatial appropriation and adaptation.

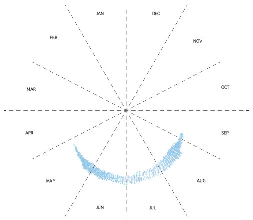
Fig. 9.17-18 During carnival, cars with sound systems are parked in villages and on the beaches.

9.2.2 Synthesis

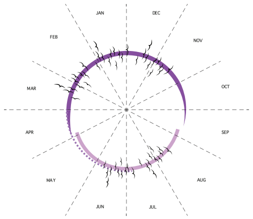
The seasonal findings on Itaparica may seem quite obvious or typical: beach tourism and ghost towns, flooding (when construction is in the wrong place), seasonal habitats for migratory birds, a calendar of festivals. What is new then? The analysis shows how the seasonal-spatial phenomena discovered are always interlinked on Itaparica, producing complex chains and paths (fig. 9.22) – or, actually, one major chain (which is open). In island circumstances, **proximity and interconnections** of seasonal-spatial organization is highlighted (fig. 9.21): Low-lying wetlands north of the main road, originally the swales of the *restinga* dune system, experience an intensified seasonal hydrological cycle due to the settlement patterns that originate from development south of the road. In the interconnected dynamics described above, three seasonal-spatial **conflicts** are highlighted with respect to resilience: Tourists' coastal occupation aggravates beach erosion and drives locals to flood-prone areas; beach life disturbs birds (besides causing urban expansion that more permanently alters and destroys habitats), as the tourism peak coincides with birds' wintering season; flooding introduces a typical human versus nature conflict. The relation of fishing and clam harvest to tourism, which occupies spaces and increases the demand of seafood but at the same time offers other jobs, remains **complex**.

Against expectations, on Itaparica, the **timing** of most seasonal phenomena and practices – identified in this investigation – depends on climate, meteorological and astronomical phenomena, global timing, and the calendar. Climate change factors add uncertainty and irregularity to their cycle. **Spatially**, seasonal phenomena concentrate in the beach zone along the east coast. In the form of the beach population, fauna cycles, and the spring tide, seasonality occurs in the *maré* space. As an essential characteristic of island life, the *tidal* may be more significant and permanent than the *seasonal* on Itaparica – especially in the western sea-land interface – but these temporalities and spatialities coexist.

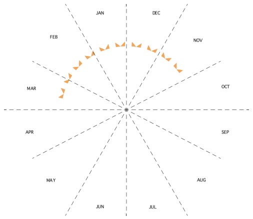
Fig. 9.19 Q1: How are seasonal phenomena linked with spatial transformation? (I)



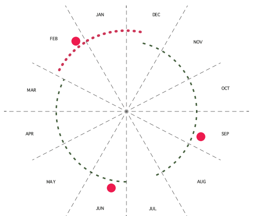
Flooding



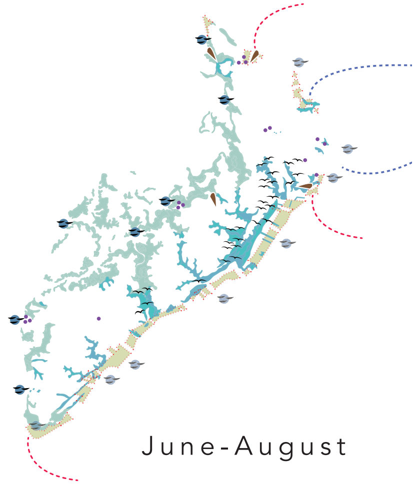
Bird migration

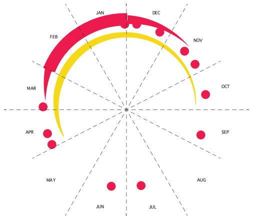


Fires for clearing terrain



Assuming open spaces

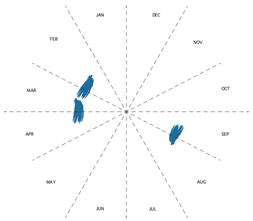




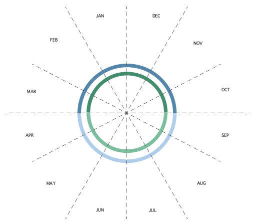
Beach tourism



The off-season



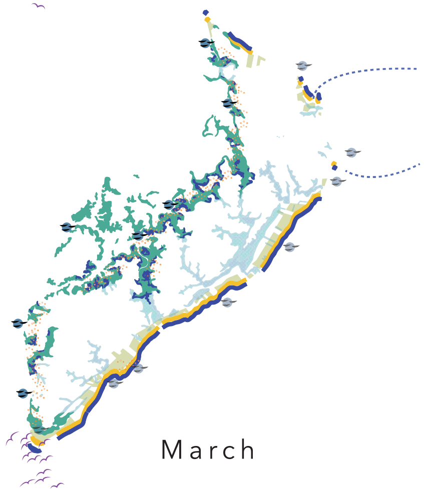
March spring tide

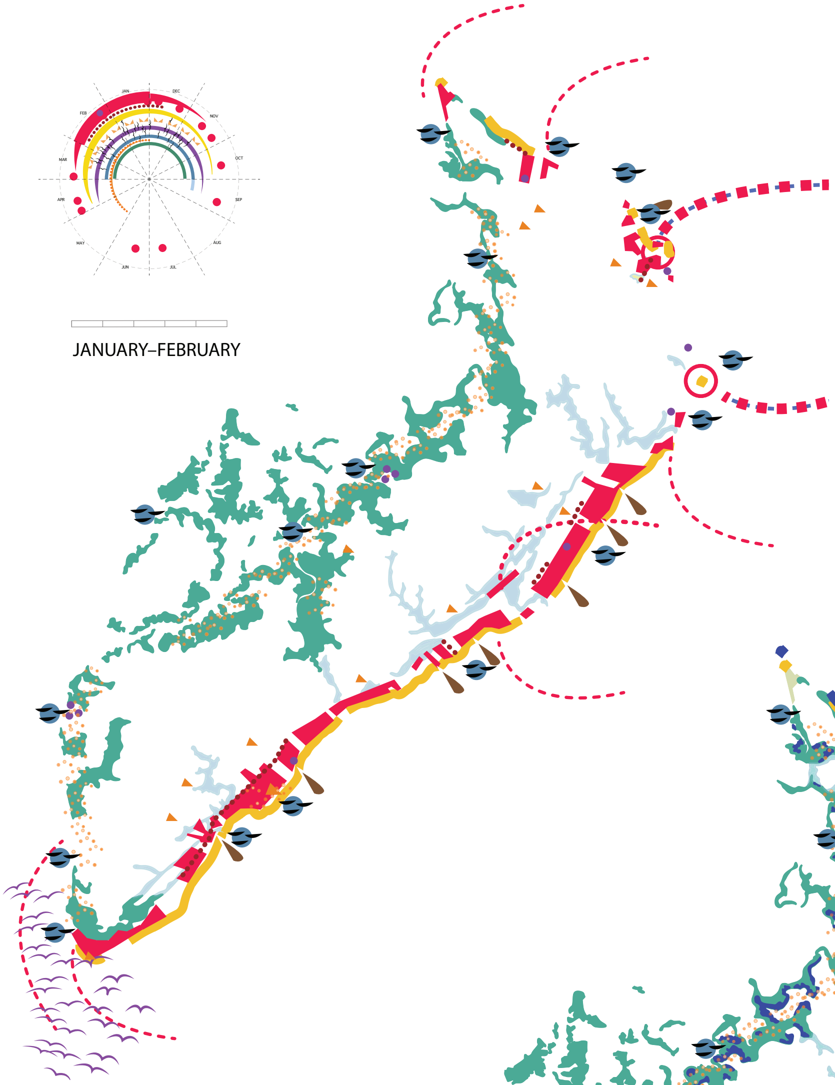



Fishing and clam harvest

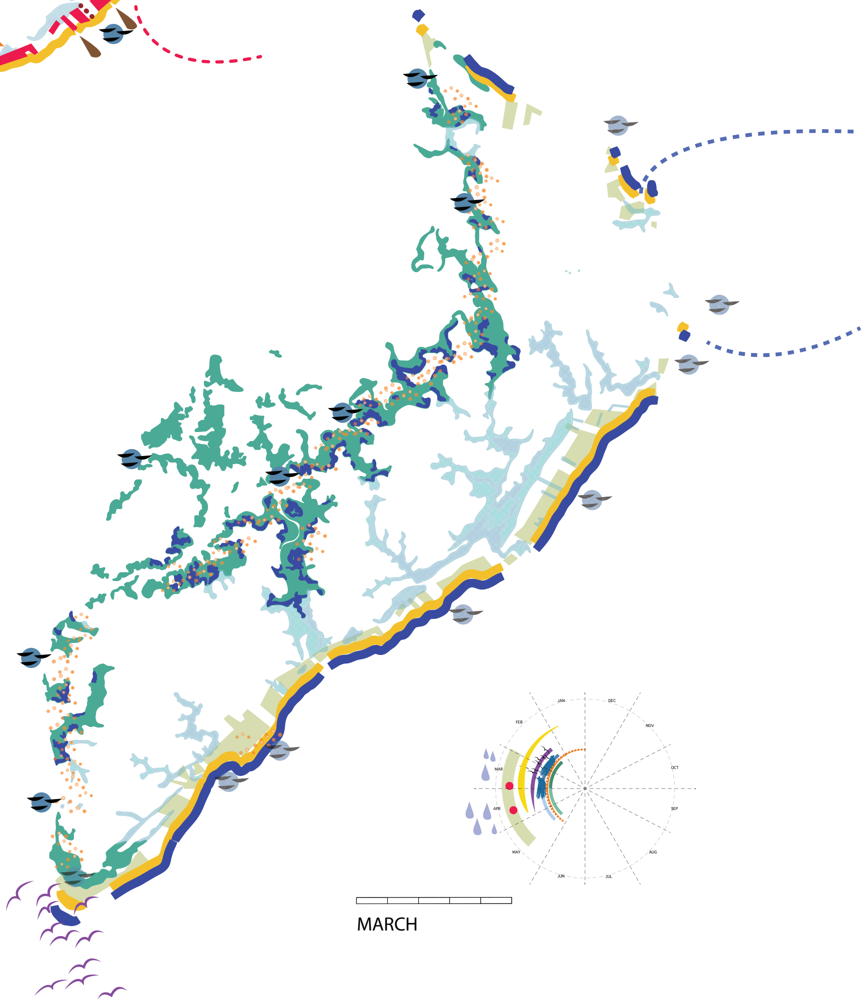


December
-February


March

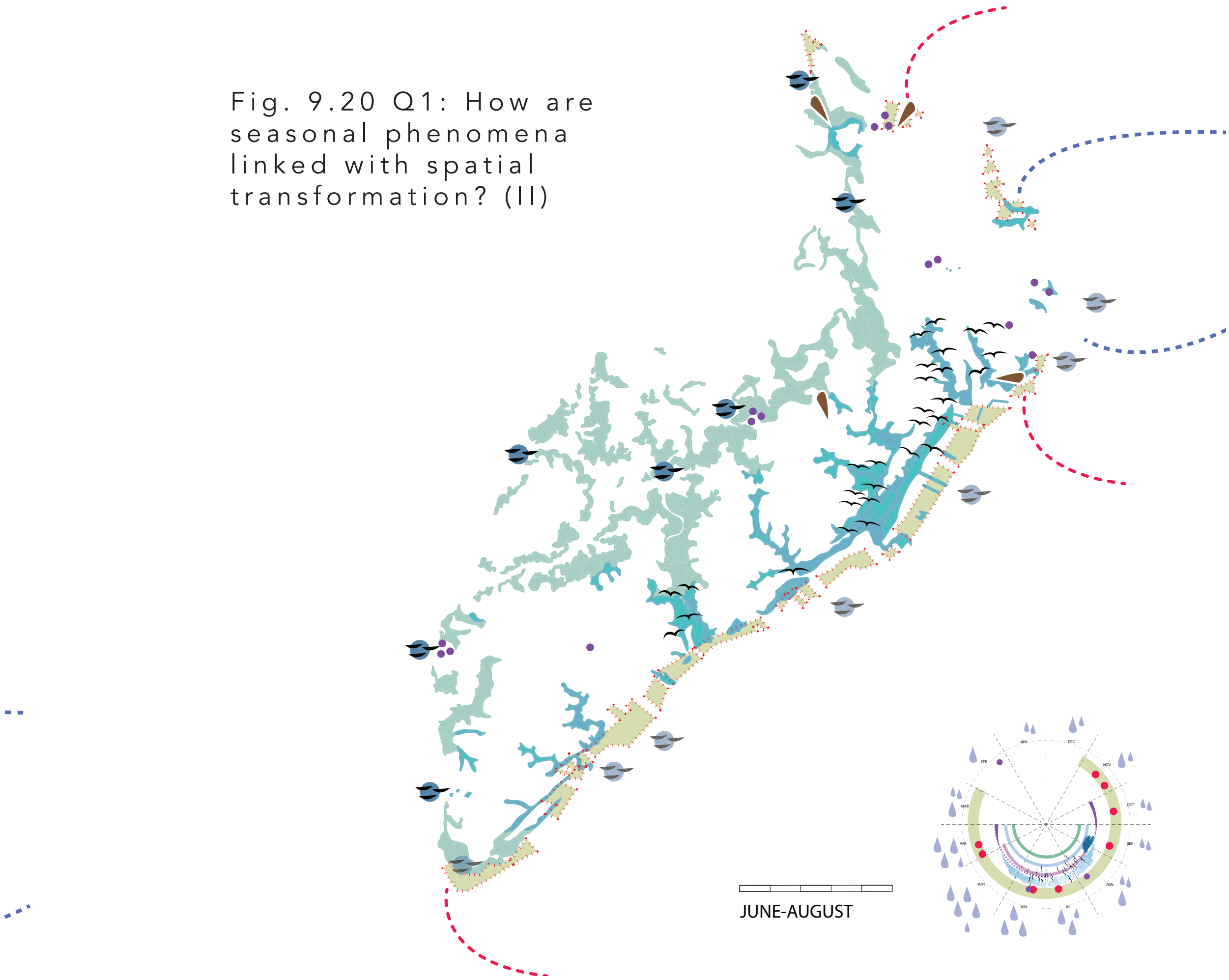


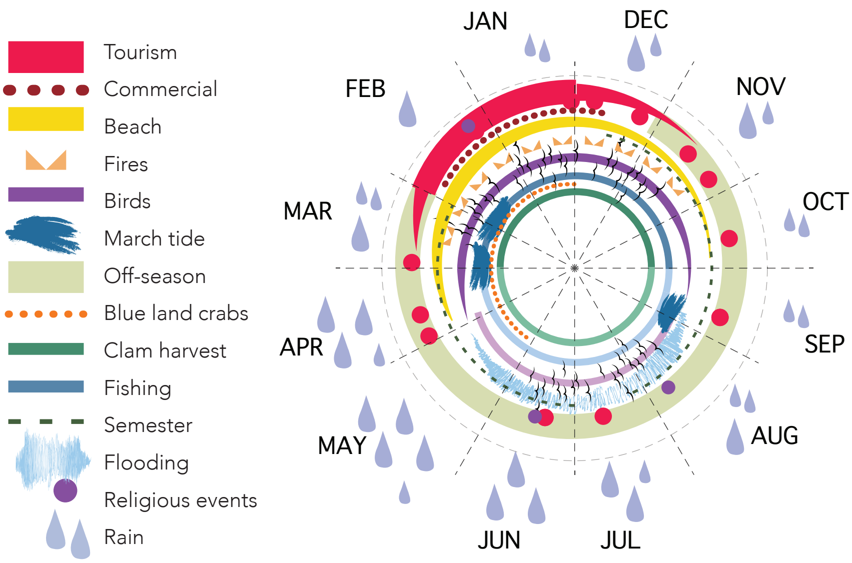
JANUARY–FEBRUARY



MARCH

Fig. 9.20 Q1: How are seasonal phenomena linked with spatial transformation? (II)





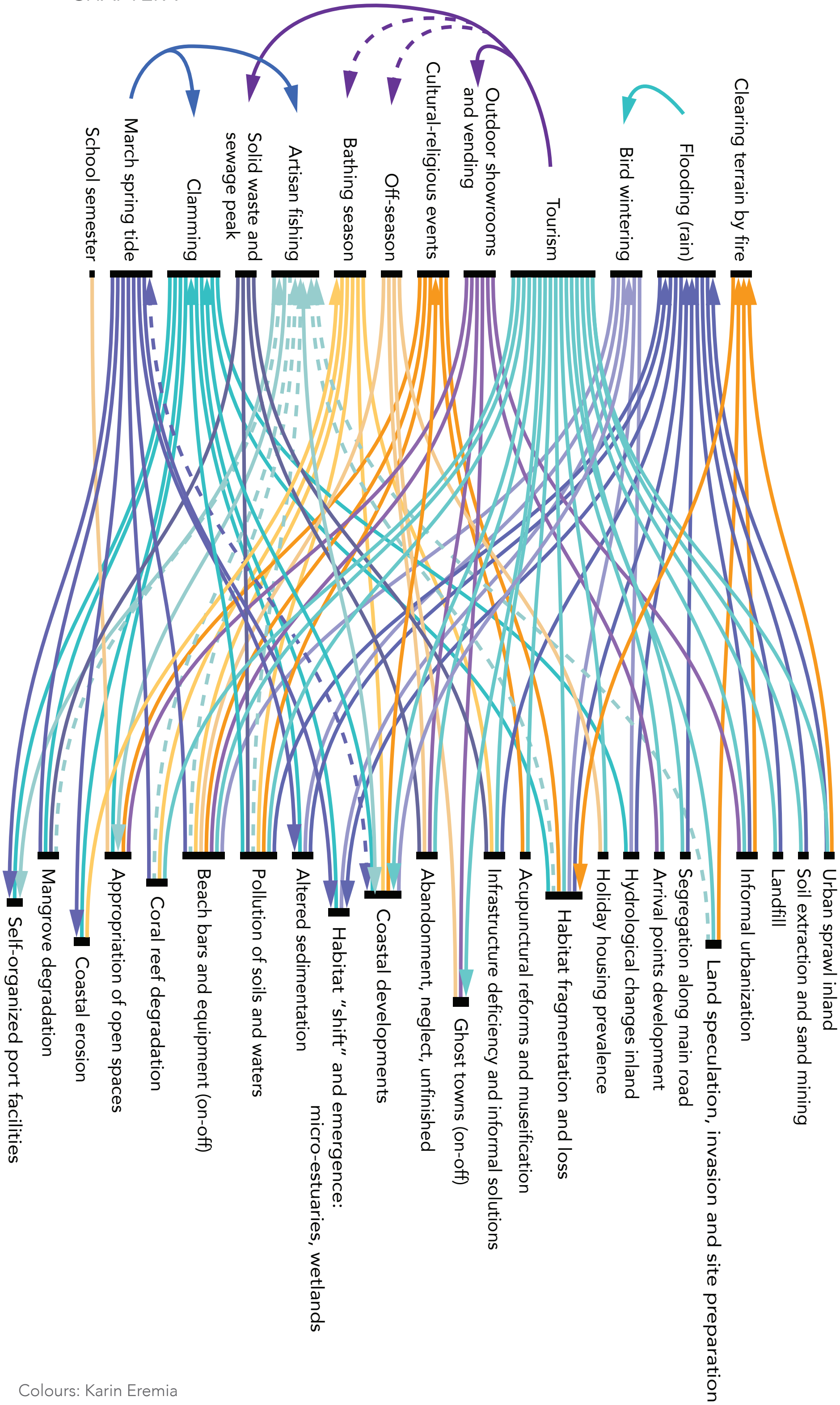


Fig. 9.22 The seasonal-spatial diagram: Abstracting relations of seasonal phenomena and spatial transformation.

Colours: Karin Eremia

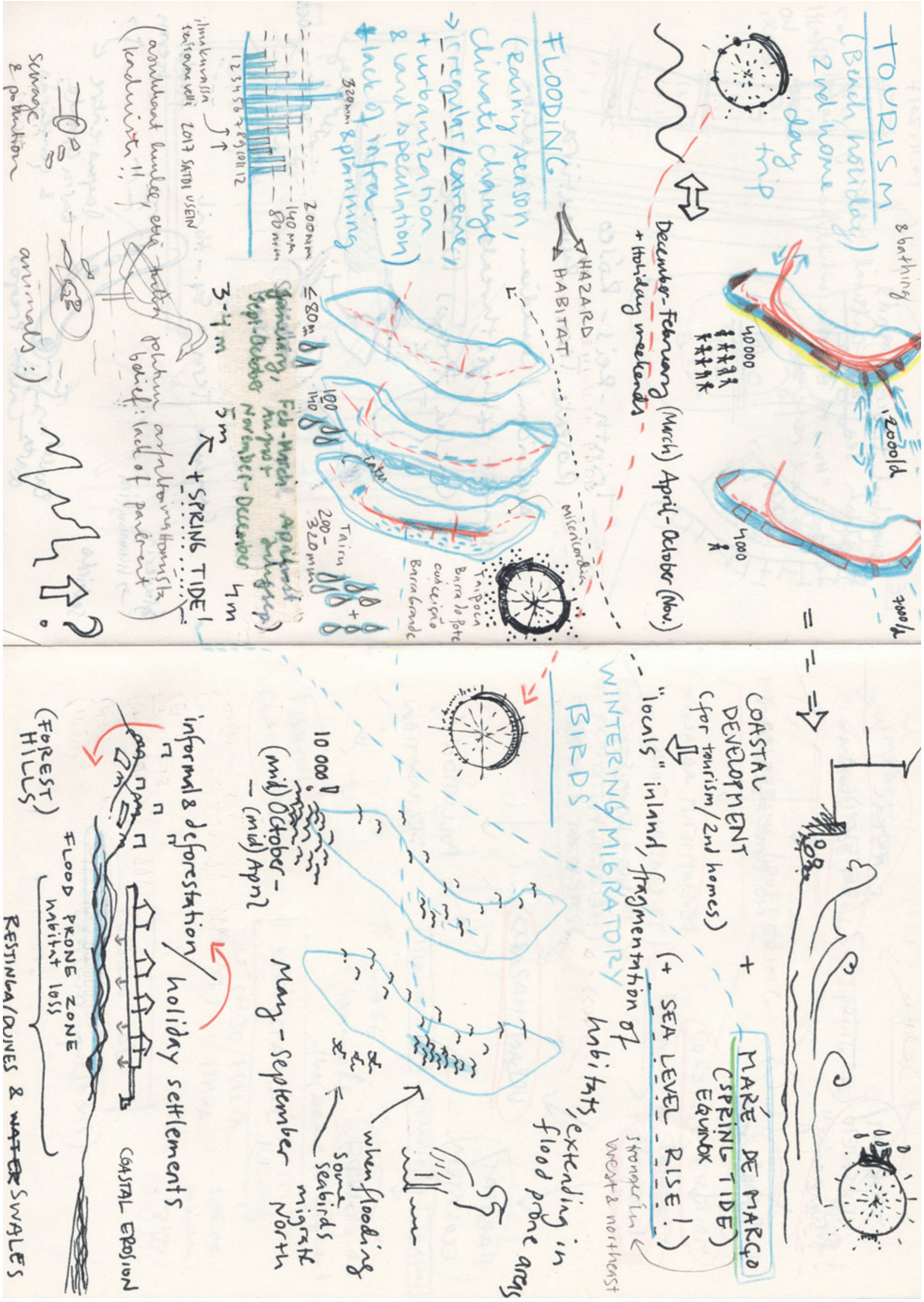


Fig. 9.21 Studying how seasonal phenomena are linked with spatial transformation on Itaparica Island. The lower righthand corner illustrates how the seasonally driven coastal occupation pattern influences inland urbanization, altogether intensifying the seasonal flood risk.

9.2.3 Transformative potential II: Manipulating

Drawing from the conflicts and synergies, as well as the relations illustrated in the seasonal-spatial diagram (fig. 9.22), strategic connections and points of intervention in terms of seasonal phenomena can be recognized. Beyond identifying connections, the case raises several questions or “hunches” about topics that indicate potential or demands for spatial-seasonal development: As a natural dynamic, flooding supports biodiversity and hydrological balance. Can it be treated as a blessing and redirected or managed to support biodiversity while avoiding damage and health risk in settlements? When settlements occupy wetland, puddles and ponds emerging in their streets invite frogs, insects, and small fish – creating novel, temporary urban habitats. Can they become appreciated mini-zoos? What potential does the low occupancy of housing provide? Is the sewage and waste peak useful for anything?

Concerning design approaches, the following questions are relevant for all cases: What locations and which seasons can be manipulated by temporal intervention? Could synchronization of ends or beginnings be used for new insights (similar to Lynch 1972)? Where can spatial solutions mitigate (uncontrollably occurring) climatic disturbances? For Itaparica, these questions engender partly naive remarks, which can turn into useful insights for design: Rain and tide just occur, thus spaces should adapt to them. Birds and tourists depend on the availability of suitable habitats – that is, come when you design for them. Diversifying tourist activities and targeting international tourism could be used to alter temporal patterns, for example, to extend the season, to smooth peaks, and to create new seasons. Urban landscapes could be strategically tailored to support tourism management. The off-season may remain, but can it be actively planned, and is it good?

Furthermore, what is the ecological role of migratory birds, and what if they do not come? Can the endangered blue land crab urbanize as it has in Florida, or attract ecotourism during mating and egg-laying season? What would be its "landscape machine" (Roncken, Stremke and Paulissen 2011) role in the coastal plain? What is the (potential) role of seasonally gathering social groups such as school children or teenagers, along with their interests in relation to spatial transformation? What kinds of demand and interaction potential do they generate with respect to urban landscapes on the island?

Sufficient data could not be collected about the seasonal and spatial dimensions of the traditional extraction of plants and plant-based materials for boats, fishing equipment, household items like brushes, musical instruments, culinary, medical uses, handicrafts, and Afro-Brazilian religious practices. This topic emerged during field research, but the locals were not necessarily willing to discuss the sites of extraction. Communities still have traditional knowledge about natural materials' occurrence and management (Instituto Polis et al. 2015b, a). For example, the native licuri palm provides material for a broom-maker in Barra Grande, and, according to him, its extraction encourages the plant's renewal to secure the availability of suitable material. Extraction thus provides beneficial maintenance while avoiding exploitation. Environmental authorities limit small-scale extraction, but at the same time, vast clearings for holiday resorts are overlooked. Although illegal extraction is problematic, there is a lot of potential for renewable resources on the island. Assuming that there are seasons for different plants and activities, uncovering of extraction practices and areas may provide seasonal-spatial synergies.

Fig. 9.23–24 Seasonally occupied walled condominiums and second homes dominate the beach zone, where the off-seasona could provide spatial resources for resilience-building.

9.3. How can seasonal dynamics be integrated into designing urban landscapes to build resilience?

Building on the previous investigation of seasonal phenomena on Itaparica Island, this chapter tests the hypothesis that **understanding seasonal phenomena can contribute to resilience-building in islands,** and pursues answers to the second research question. First, this section takes a differentiated look at resilience deficit on Itaparica Island, and then applies a seasonal approach in test projections that address the identified issues. The outcomes are evaluated with respect to resilience principles and islandness. Transformative potential is discussed with the seasonality hypothesis, raising and reflecting critical questions about the approach.

9.3.1 Identifying resilience deficit and outlining the design brief

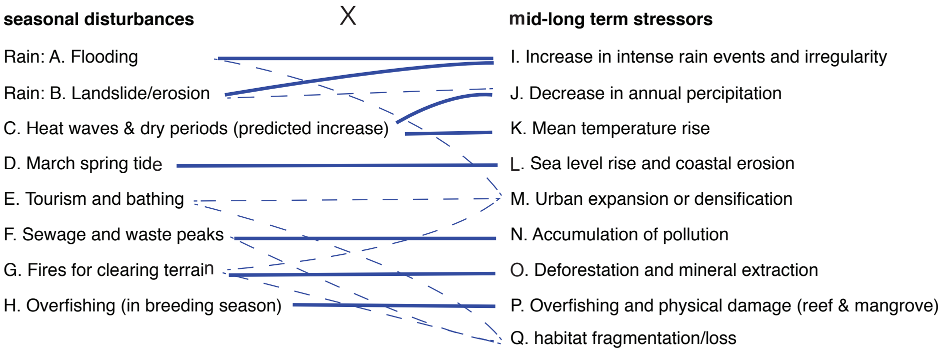
As discussed in chapter 4, resilience-building starts with differentiating resilience "of what to what" and why. The partly overlapping procedure is structured here under analyzing resilience deficit and defining priorities of resilience-building (procedure and limitations see 6.2). The resilience-deficit analysis consists of identifying hazards and mapping spaces that are exposed to them – highlighting the most vulnerable settlements and ecosystems that, at the same time, contribute to climate change adaptation and community resilience. It includes a further mapping that postulates where what kind of resilience is needed.

Based on the problems and threats identified earlier (see 9.1.3), the analysis of the **hazards** facing Itaparica resulted in observations about the coupled impacts of seasonal disturbances and the ongoing or expected mid- to long-term stressors listed in table 9.1. In addition, marine hazards, such as an oil spill in All Saints' Bay, coral bleaching, and severe storms, as well as food and water shortages are considered potential disasters. Itaparica is heavily dependent on imported food and formally relies on an external water supply. A regional drought or transport crisis could result in food shortage. Criminal violence is perhaps currently the most severe disturbance to human security (Instituto Polis et al. 2014:11, 2015a, b), but it goes beyond the scope of this thesis. Itaparica is susceptible to moderate long-term stresses and periodic disturbances, but in global comparison, I estimate disaster risk to be relatively small. The mapping of systems and places at risk consists of two layers: ecosystems and settlements.

9.3.1.1 Mapping ecosystems and habitats at risk

On Itaparica, **biodiversity, ecosystem health, and habitat integrity** are considered a priority, because losses of human life and displacement of people are unlikely in the hazards. Beyond ecological value, ecosystems are important for settlement security and livelihoods, mitigating disasters, and adapting to climate change. Their degree of vulnerability is estimated based on their rarity in island scale, their

Table 9.1 Seasonal disturbances coupled with long-term stressors on Itaparica Island.



exposure and susceptibility to stressors or shock, and the speculated capacity to develop under or recover from stress (table 9.2). Furthermore, their importance for biodiversity and role in resilience-building is taken into account. Thinking of the current and anticipated dynamics of seasonal disturbances, urbanization, and climate change, the mapping (fig. 9.25) thus indicates ecosystems, or their parts that urgently need and are needed for resilience-building. In the map, their proximity to urban(izing) areas and a concentration along the east coast are evident.

9.3.1.2 Mapping settlement risk

The second map indicates **settlements** at risk (fig. 9.26). It considers areas that have over 50% permanent housing or a number of over 80 permanently inhabited households,[13] and the estimated vulnerability based on lowest income, category of subnormal or precarious housing type, and infrastructure (maps in SEDUR 2014). The data are from 2010, and, when applicable, more recent Google Earth satellite images have been used for speculative analysis about urban expansion and morphology. Considering current and anticipated dynamics of seasonal disturbances, urbanization, and climate change, the map thus indicates where the population is most at risk in the face of the following hazards: periodic flooding and sea level rise (highest intensity), heat waves, and landslides (moderate intensity). It also indicates critical infrastructure at risk (ports, an airport, and two waste-water treatment plants that are also hazardous in themselves). **Exposure** of people to hazards varies seasonally: Flooding and storm tide primarily affect permanent residents, and holiday weekend crowds are only occasionally exposed, opting to stay away based on bad weather predictions. Heat waves affect both holiday population and locals in the densest settlements. In some situations, inexperienced tourists might be more **vulnerable** than locals who are familiar with the area and have experience of coping and adaptation.

13 The source map shows occasional housing in percentage and permanent households in total numbers. Depending on the timing of disturbance, some of them might be working and not at home. Many practice livelihoods outdoors at the sea-land interface or work and spend time on the settlements' porches and squares. Additionally, a high percentage of children under 10 years of age is considered a vulnerability, but there is no map of elderly or disabled people. Obviously, economic and demographic factors change over time.

KEY ECOSYSTEMS, HABITATS AND ENVIRONMENTAL RESOURCES THAT NEED RESILIENCE-BUILDING AND ARE NEEDED FOR BUILDING RESILIENCE (map see fig. 9.25)			
Ecosystem / habitat / resource	Priority	Hazards	Role beyond biodiversity
Restinga (last fragments)	Highest	Loss through urbanization, fire	Last fragments, SLR buffering model
Beach	High	Pollution, sea-level rise, and coastal erosion (x March tide), loss	Biodiversity, livelihoods, and SLR buffering, economy
Coral reef	High	Sea-level rise, mean temperature rise, mechanical damage (beach life), nutrient peaks from land, overfishing, oil spill, coral bleaching	Biodiversity, livelihoods, and SLR buffering
Rivers and estuaries (polluted, in/around settlements or other sources of pollution and urban expansion)	High	Pollution, loss	Biodiversity, hydrological regulation, health risk
Seasonal flood plains	Moderate	Loss through urbanization, heat waves x mean temperature rise, drought	Hydrological regulation
Inland wetlands (associated with settlement and urban expansion)	Moderate	Loss through urbanization and heat waves x mean temperature rise, drought	Hydrological regulation
Hypersaline salt flats (susceptible to urban expansion)	Moderate	Loss and pollution through urbanization	Habitat of endangered crab, protection of mangroves, livelihoods, SLR buffering
Mangrove (in settlement fringes)	Moderate	Habitat loss through urbanization	Livelihoods, SLR buffering
Natural springs (in/around settlements, susceptible to urban expansion)	Moderate	Contamination, depletion	Hydrological regulation, supports redundancy of water supply and resourcefulness of people

Table 9.2 Key ecosystems, habitats, and natural resources that need resilience-building and are needed for building resilience (see map on next spread).

SETTLEMENTS AT RISK (map see fig. 9.26)			
Settlement profile	Risk	Hazards	Priority reasons
Settlements in floodplain (permanent, precarious)	Highest	Periodic flooding (rainy season), climate change: extreme rain	Perhaps the most severe periodical disaster on the island (mobility limitations and economic damage)
Beach settlements (permanent)	Highest	Sea-level rise and coastal erosion (x March tide), storm surge	Perhaps the most severe long-term external stress (displacement, livelihoods)
Beach settlements (seasonally occupied)	High-Moderate	Sea level rise and coastal erosion (x March tide), storm surge	The beach is public and constructions worsen the overall situation, e.g., wave impact, stress on livelihoods
Settlements in mangrove (permanent, low-income)	High-Moderate	Sea level rise and coastal erosion (x March tide), storm surge	Anticipated expansion and importance of protecting mangrove
Settlements in steep slopes, (permanent, precarious, adjacent to deforested areas)	Moderate	Landslide and erosion (x extreme weather events)	Anticipated combined effects of urban expansion/verticalization and climate change (extreme weather events)
Densest settlements	Moderate	Heat waves x mean temperature rise	Increased exposure in peak season
Port infrastructure, airport	Moderate	Sea-level rise and coastal erosion (x March tide), storm surge, flooding	Critical infrastructure
Sewage treatment plants	Moderate	Sea-level rise, flooding, storm surge	Critical infrastructure, health risk
Settlements in floodplain; mixed, summer residencies, middle and high income	Moderate -low	Periodic flooding (rainy season), climate change: extreme rain	Anticipated densification increases risk

Table 9.3 Settlements at risk (see map on next spread).

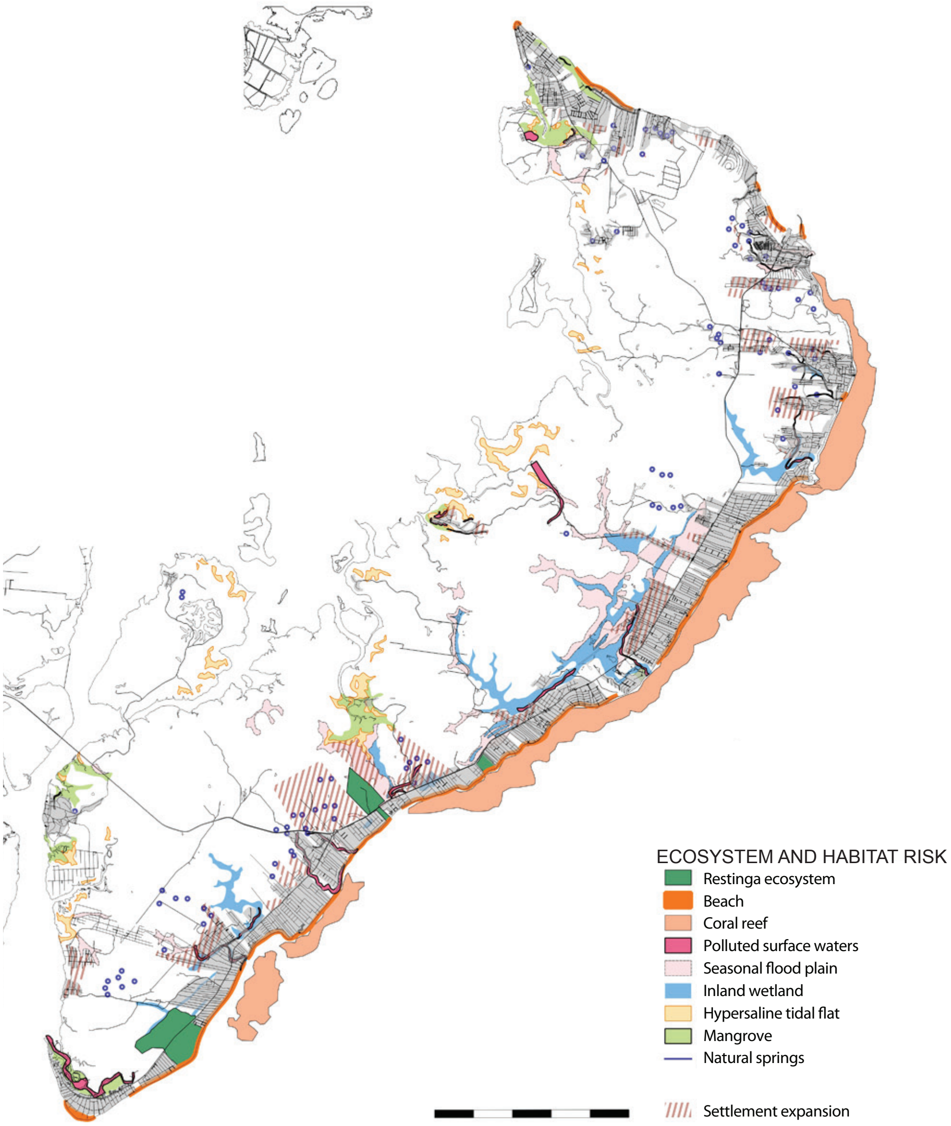


Fig. 9.25 ITAPARICA: ECOSYSTEMS and HABITATS RISK

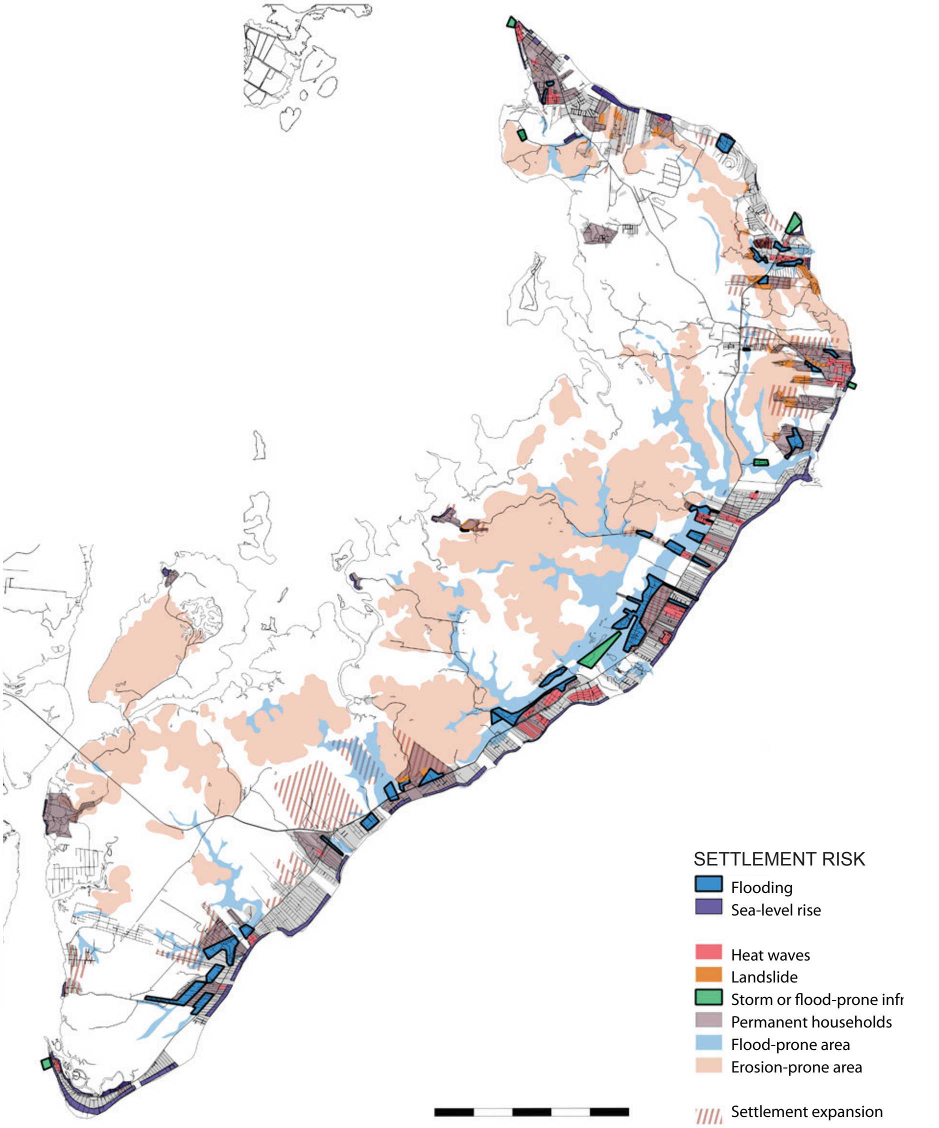


Fig. 9.26 ITAPARICA: SETTLEMENT RISK

9.3.1.3 Synthesis

Overlaying these two maps, a synthesis demonstrates that hot spots of risk concentrate in and around settlements along the east coast (fig. 9.27). Additional layers present **disturbed and intensive-maintenance landscapes** whose ecological resilience is decreased due to deforestation and earthworks (pastures, real estate speculation, mineral extraction) or low biodiversity and dependence on irrigation (agriculture, resort gardens), and areas of **urban expansion**. The permanent population's food and water security are not explicit in the mappings, but import-dependency is critical in islands (see 5.2). While Itaparica is easily supplied from the mainland, islandness causes a peripheral situation. The mappings show one situation, and, depending on the team and focus, the assessment might be different.

Current **resilience assets** and resources on Itaparica most importantly include the capacity for the self-organization of settlements, livelihoods, and water security, as well as the freshwater resources and total biodiversity of the island. A rich and integrated ecological mosaic of Atlantic Forest, the integrity of the mangrove forests, and the abundance and health of marine habitats provide both biodiversity and livelihood opportunity – particularly in the western parts of the island. Resilience is about **scales**: The *restinga* ecosystem in itself is resilient to coastal erosion and sea level rise – yet, on the island, it is almost extinct and perhaps the most threatened. Mangrove forests, to some extent, are threatened around settlements – and on a worldwide scale – but on the island, they still form a proportionately large, connected, and robust ecosystem.

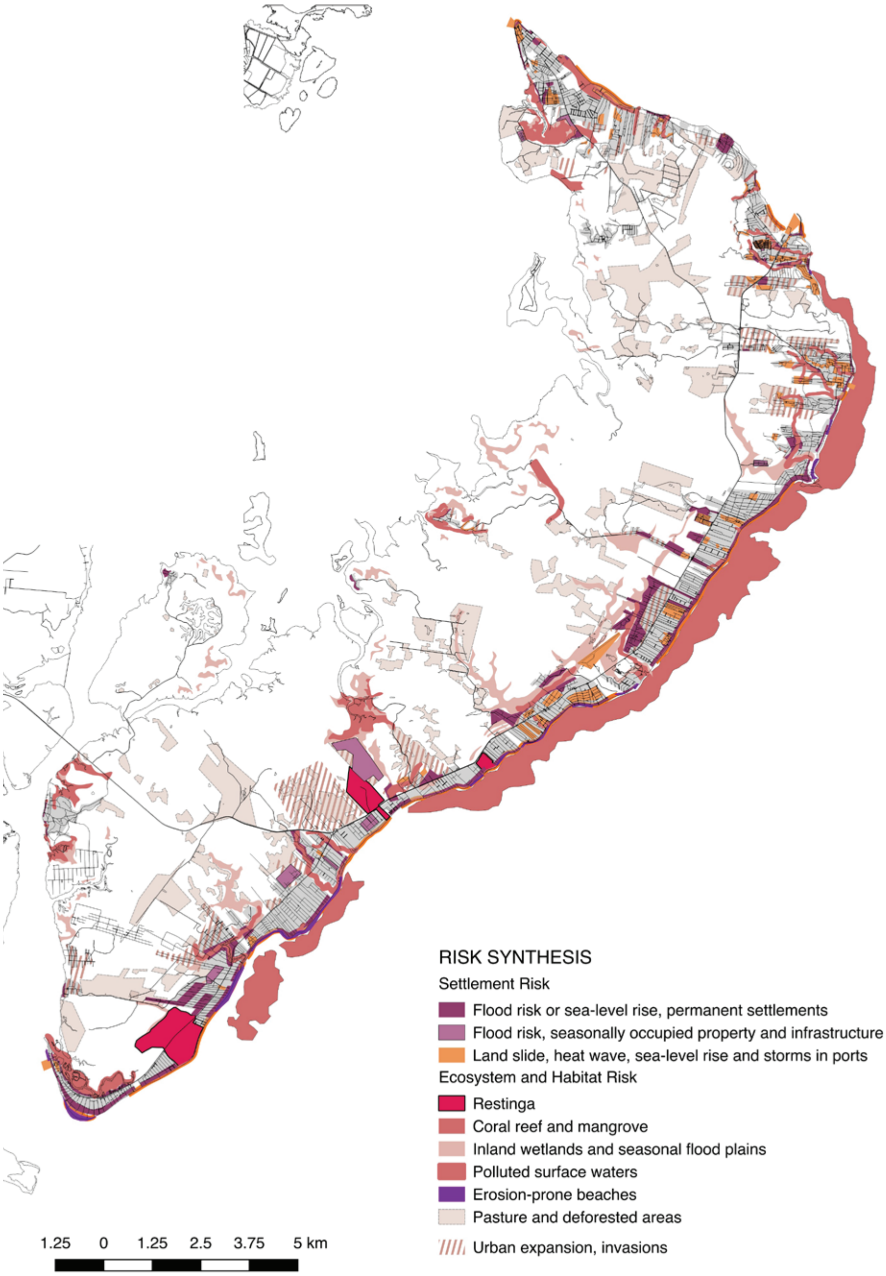


Fig. 9.27 ITAPARICA: RISK SYNTHESIS

9.3.1.4 Outlining a design brief for resilience-building

During this investigation, **goals and priorities of resilience-building** have been defined. On a strategic level, they are in line with Priority 3 of the Sendai Framework, "Investing in disaster-risk reduction for resilience" (UNISDR 2015). In light of this analysis, it is not very likely on Itaparica that hazards will become disasters wherein lives will be in danger or people will become homeless. While keeping in mind that environmental development or degradation is closely linked with human actions, the research presumes that, in Itaparica, situations "whereby the normal functioning of a social system has been severely interrupted by the levels of loss, damage and impact suffered" (Birkmann et al. 2013:196) can be avoided by prioritizing ecosystems. The projections are based on the following frame:

1. Maintaining or increasing biodiversity. Diversity is a resilience principle and value in itself. On Itaparica, the ecosystems, habitats, and vegetation forms support livelihoods, climate change adaptation, and cultural values. Their interdependency is underpinned by small island spatiality. Itaparica represents a unique concentration of Atlantic Forest ecosystems that are important locally and rare on a regional and global scale. Within the Bahia state, the island is specified as an area of extremely high priority for biodiversity conservation (SEIA 2018). Although ecosystem integrity and diversity have been prioritized, livelihood concerns need to be reckoned with (Baldacchino and Kelman 2014). Priority: endangered ecosystems (see mapping) that contribute to goals 2 and 3.

2. Settlement security and adaptive capacity. It is unlikely that lives are in immediate danger from anticipated disturbances, but mobility problems, economic damage, and health risk prejudice particularly precarious, permanent settlements. The needs of the local population are considered over those of tourists and second-home owners. Violence and crime are not addressed here. Priority: permanently inhabited precarious settlements prone to flooding and sea level rise, or hot spots of multiple hazards, and expanding settlements (see mapping).

3. Livelihood resilience (dependent on biodiversity). This goal strives for socio-economic improvement for the island's most vulnerable population, and prevention of depletion of environmental resources (e.g., overfishing). Regarding Itaparica's low economic performance and the dependency of the population on social benefits, and their cuts, in the current political-economic situation of Brazil, the resilience of livelihoods is central. It contributes to both goals 1 and 2. Priority: marine livelihoods, subsistence agriculture, and diversification of opportunities.

Within this frame, the following resilience-building projections focus on aspects that (might) couple with seasonal phenomena. Depending on each situation and scale, the order of the interlinked goals and priorities may change. Based on the assessment, the concrete intervention points of resilience-building should include flood management (coupled with biodiversity conservation), adaptation to sea level rise, livelihood diversification, and joint management of environmental resources (including food and water security). The reality in 10, 50, or 100 years might be very different than expected, and goals should be respectively revised. Minding the purposes of this research, space has been given for a somewhat free discovery of seasonal ideas in order to generate novel insights for resilience-building.

Before arriving at the specific focus, I cast a wholistic look at the island, as an eco-social entity or urban landscape: The resilience deficit assessment concludes with **a step towards design** – a heuristic mapping based on the accumulated data, knowledge, and information, against the background of resilience principles, that roughly envisions **what kind of resilience could be needed where (fig. 9.28–29).** The west-east section – which, in principle, has a similar profile through almost the entire island from north to south – studies both concrete and conceptual points of resilience deficit and respective opportunities. It demonstrates interlinked systems and multiple scales of resilience-building.

9.3.2 Projections

In the following, I explore how seasonal phenomena can be integrated to address the resilience-building goals on Itpaparica. As prominent topics for the island, the three projections cover coastal adaptation, livelihoods, and flooding, including a number of aspects from tourism to birds. Based on fieldwork and analyses from the institutional planning process (SEDUR 2014; Instituto Polis et al. 2015b, a; SEDUR 2015), they address the local population's needs and environmental problems – and the sometimes conflicting benefits of natural systems, fauna, and flora. They also draw on the aspects of islandness and spatial dynamics discovered in the case study so far, and the design-oriented questions raised in transformative potential II (see 9.2.3). Some ideas question the intrinsic anthropocentrism of resilience-building and seek to prioritize other aspects. Against the background of the Anthropocene, instead of separation, win-win situations have been pursued, but conflicts of interest have emerged. The imagined linear time horizon spans 50–100 years, but anticipating future hazards, development dynamics, and changing risk on Itaparica, or anywhere, is prone to uncertainty. Each projection is discussed with regard to resilience, island spatiality, and the seasonal approach. At the end of this chapter, a summarizing reflection on the findings is presented.

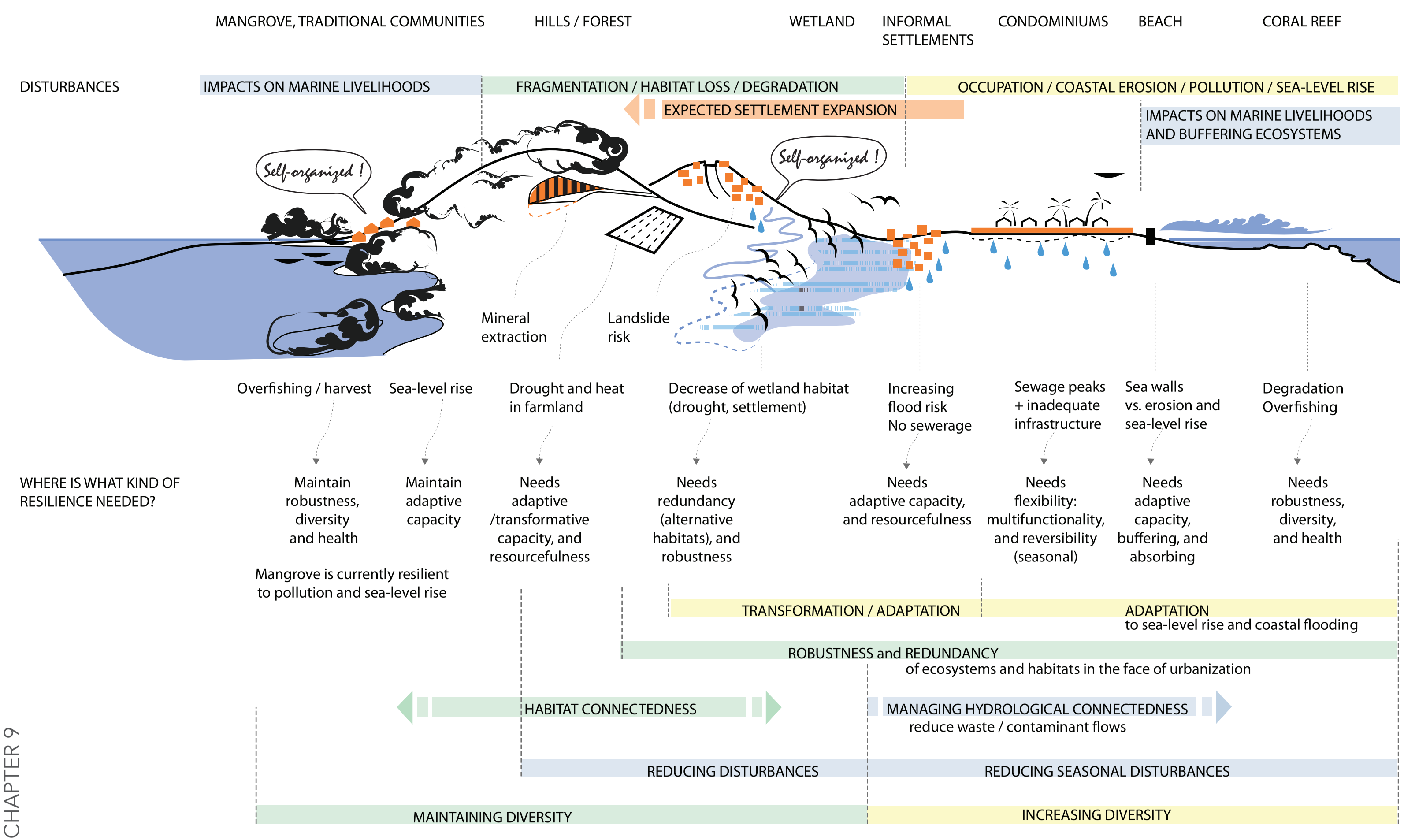


Fig. 9.29 RESILIENCE DEFICIT: The principle west-east section illustrates concrete and conceptual aspects of resilience deficit, helping to recognize interlinked systems and multiple scales of resilience-building.

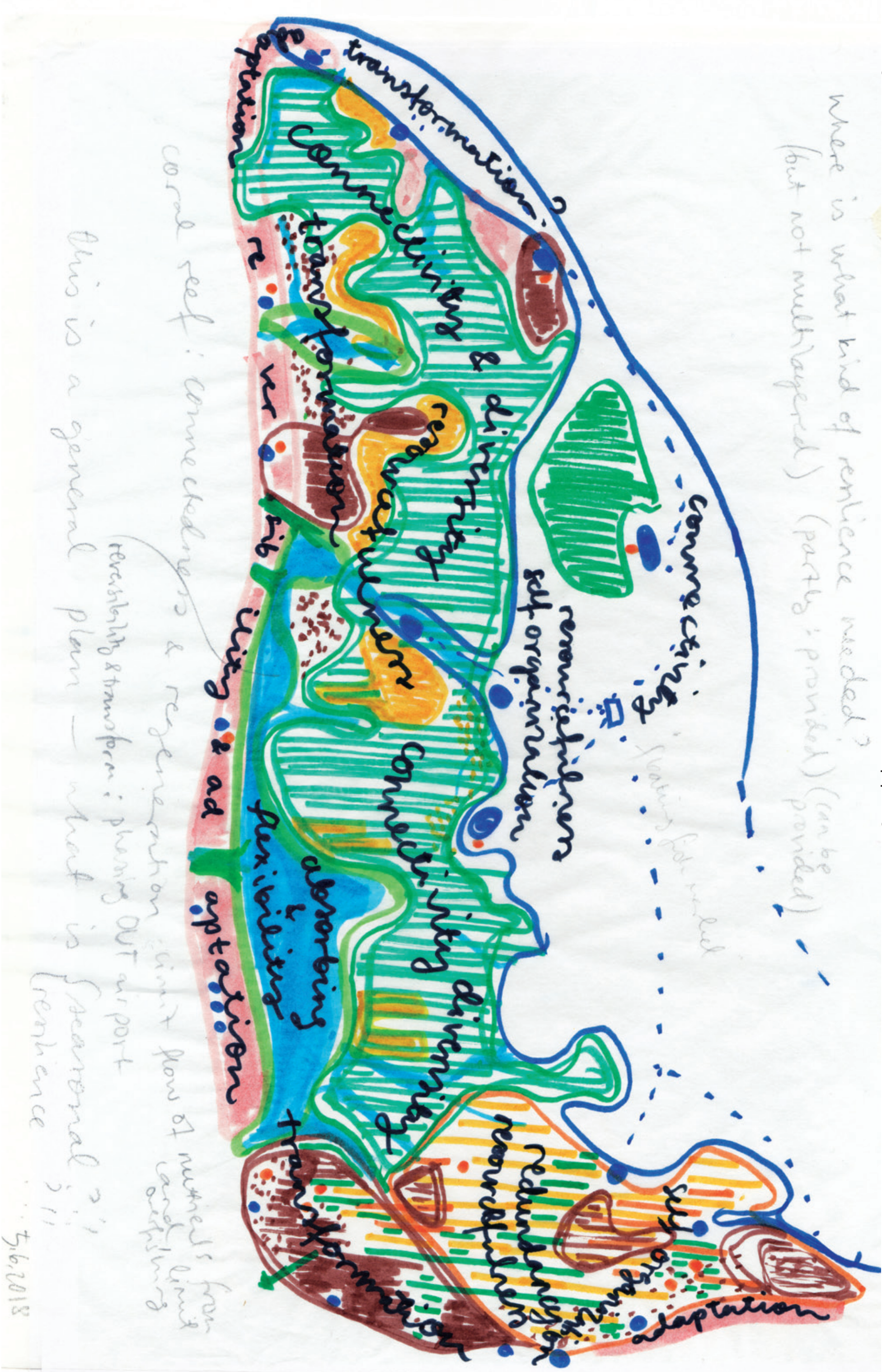


Fig. 9.28 INTERPRETING RESILIENCE DEFICIT on ITAPARICA: Mapping where what kind of resilience is needed.

9.3.2.1 Calibrating a basis: 1176 TOWERS and THREE ISLANDS

Before projections, I roughly sketched how much island land area would be needed to accommodate the 400% population growth within 20 years, assumed to take place in the case of a new bridge between Salvador and Itaparica (SEDUR 2014:186). In the first place, I did it out of curiosity to understand the spatial implications of the radical scenario – and to decide if and how I would take it into consideration in the projections. With 264,000 people, the population density of the island would increase to 1,300/km^2. Over-simplified drafts for the predicted population show that repetition of the current building and occupation patterns would require "**total sprawl**" over the island's whole land area. Alternatively, the erection of "**1,176 towers**" of twenty stories would suffice, calculated with a living area of 40m^2 per person, and a 20x20m building footprint. These would take up a surprisingly small land area in and around the existing centralities. The island's area would indeed be sufficient to host another Salvador. A mixed landscape-based model could keep built-up zones below 50% of the island's land area.

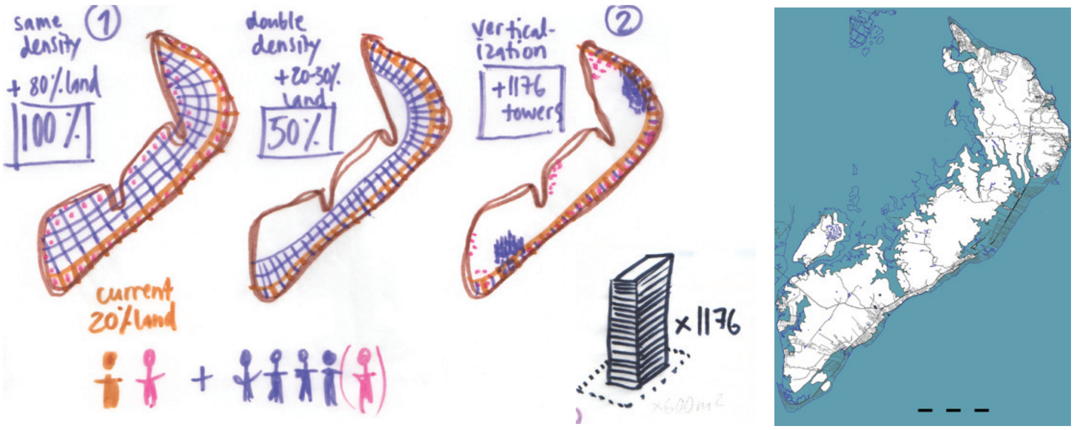


Fig. 9.30 Calibrating a basis: Studying how much – or little – land is needed for a 400% urban growth and illustrating how a five-meter sea-level rise would divide Itaparica into three islands.

The spatial dimension of seasonality could be steered through landscape design and housing: If all second homes and tourism were in the towers, seasonality would concentrate instead of sprawl. New types (floating, on stilts) spare land and adapt to sea and wetland dynamics. Secondly, I was curious about the implications of sea level rise. An extreme up to 5m above the current level (only likely in parts during storm surges, see 9.2.1) would divide Itaparica into **three islands** that would condition a new logic of spatial development. These exaggerated (but, who knows, possible) spatial speculations about urbanization and sea level cover a shortcoming in the masterplan (SEDUR 2017), and have prompted anticipatory thinking for resilience-building.

9.3.3 Projection 1: "Impulses" – Seasonality in coastal adaptation

Goals: This projection addresses all three resilience-building goals, because settlements, key ecosystems, and livelihoods concentrate at the coastal interface. Based on the literature (see, e.g., 4.2.2) and analysis of the coastal interface, the best adaptation measures for Itaparica would be re-establishment of a dune and swale belt of the *restinga* ecosystem, perhaps a planned retreat, and ensuring resilience of the coral reef, so that the east coast would buffer wave impact and the island could grow with sea level (Anthony et al. 2014; Martins 2018). This projection envisions how seasonal phenomena can contribute to these longer-term adaptation strategies.

Trends: Increasing coastal occupation, erosion, and coral-reef degradation, sea level will rise by 0.52–0.98m by 2100 (see 9.1.2 and 9.2.1). Peak tides in March and September may become more powerful and reach deeper inland.

Of what to what?
Beaches (as part of the *restinga* ecosystem), coral reefs, and settlements on the east coast of Itaparica are prone to the coupled impacts of coastal erosion, sea level rise, storm surge, and seasonal peaks of spring tide and waste. Not only do these ecosystems bear biological value, but their well-being also contributes to coastal protection. Besides fishing and clamming, the east coast accommodates seasonal uses from swimming to religious ceremonies, and ecological phenomena such as crab breeding. Coral reefs need resilience to increasing temperature, acidification, eutrophication, turbidity, bomb fishing, and invasive species (Anthony et al. 2014; Martins 2018). In order to buffer waves and protect the island, they need to grow, and beaches need to gain sediment and vegetation. The general resilience of the island as a material and cultural entity is at stake in the face of coastal erosion and sea level rise.

MEDIUM / HOW
-> Reducing seasonal disturbances
-> Introducing seasonal phenomena and reversibility
-> Raising awareness seasonally

To improve the adaptive capacity of the coastal interface and the state of ecosystems, this projection intervenes in the extensive zone occupied for seasonally used housing. Ranging from relocation to the adaptation on site of buildings and terrain, most of the measures are not seasonal per se. Seasonal, reversible forms of accommodation are proposed in some parts, where occupation can be regulated in 1–5 year rotations. Also, when building forms on the beach is adapted, temporal patterns of use are altered (e.g., the ground floor for people vs. tidal flooding). Stretches of shoreline occupation close to inland wetlands give way to re-establishment of *restinga* ecosystem and brooks.

Other projections (later in this chapter) handle livelihoods, tourism diversification, and improved sanitation and estuary restoration to reduce seasonally concentrating coastal stresses. Further disturbances could be addressed through regulation: On the beach, plastics can be prohibited and seasonal waste management enhanced. Sunscreens that are harmful to corals could also be prohibited, as well as walking in immersed areas and anchoring yachts, which mechanically damage the reef.

To introduce cyclic impulses of adaptation and to raise awareness, a coral nursery and artificial-reef building engage tourists and locals in seasonal participatory events: coral propagating, waste collection, and planting *restinga* vegetation. The perigean spring tides in March provide an opportunity for testing structures and measures to withstand or absorb waves and to deal with coastal erosion. It is also an opportunity to establish a land-art early-warning system or an on-site risk map that sensitizes people to the reality of rising sea level – allowing it to enter certain parts of the coastline or marking the highest levels in front of permanent or mixed settlements.

Finally, I propose a test area for re-introducing the endangered blue land crabs among east-coast settlements. They live just above the high-tide level in hypersaline tidal flats and estuaries where they excavate burrows, create mounds, and aerate soils, limiting but also facilitating coastal forest growth (Stewart Lindquist 2009). Crab bioturbation may enhance estuary restoration. Their seasonal cycles (see 9.2.1) can become an attraction that affects human presence and raises awareness. In Florida and the Caribbean, the species has adapted to urban habitats so well that it is considered a disturbance. While capture is newly prohibited by law (Vasconselos 2018), allowing traditional harvesting could manage a potentially problematic population on Itaparica.

Contribution to resilience

ADAPTATION, FLEXIBILITY, and REVERSIBILITY of coastal (seasonal) settlements and open spaces (tidal installations)

ADAPTIVE AND TRANSFORMATIVE CAPACITY of coastal ecosystems (beach and coral reef), habitats, and species (the blue land crab)

LEARNING through engagement and aesthetics: spring tide, reef workshops, crabs

DIVERSITY and REDUNDANCY of coastal habitats[14]

14 Success of the proposed interventions could be measured by: reduction of solid waste and contaminants on the beach and coral reef; reduced coastline retreat; enlarged *restinga*; stable or increased coral propagation rate and reef area; increased number of key terrestrial and marine flora/fauna and population sizes; reduced physical and economic damage to buildings and infrastructure; monitoring environmental attitudes and climate change awareness.

Problems and conflicts

Seasonal human population is not prioritized in the resilience-building goals outlined in 9.3.1. It may thus seem contradictory to suggest measures that address their property instead of the local settlements. However, tourists and second-home owners are more flexible to change locations than permanent low-income residents – who would assumedly benefit most from the interventions in terms of a more adaptive coast and livelihoods. Second-home and hotel owners are more likely to have resources for (imposed) self-financed structural measures. While their extensive presence is a major stress at the coastal interface, the fact that tourism brings economic benefits to the island is primarily based on the beach location. The projected strategies may be viable in comparison to annual beach nourishment that may be too expensive.

Camping as a reversible tourism option cannot be considered on Itaparica without security measures (that reproduce current segregation) or a societal transformation. Blue land crabs can cause confrontations in settlements, and their holes might worsen erosion. Therefore, they could be useful in the phase between removal of housing and re-establishment of vegetation. Regulations for coral protection might not work without sanctions: Although the reef is a conservation area, bomb fishing, for example, still occurs. It is uncertain whether tidal artworks and seasonal events engage people in the long run or gain transformative meaning. The flip side of seasonal measures may be operational and financial discontinuity.

Reflecting islandness

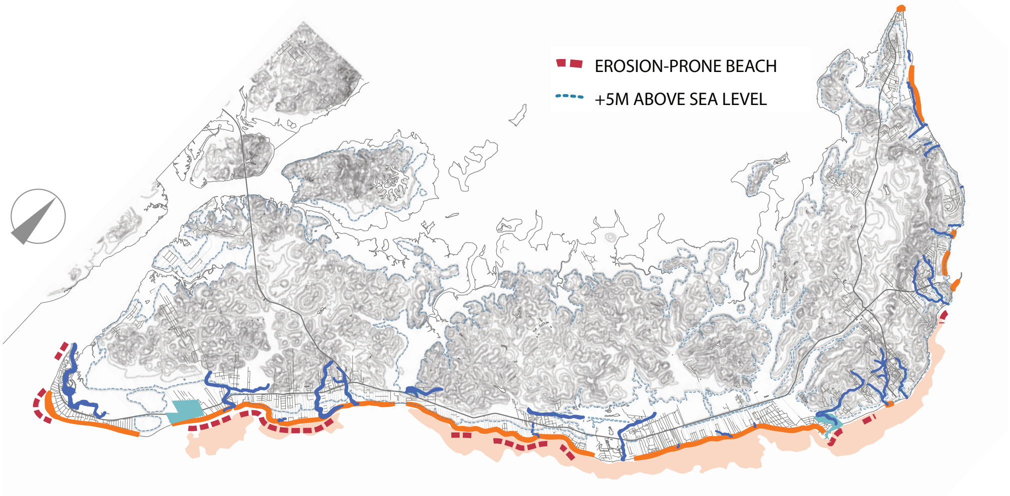
From an islandness perspective, adaptation of and at the sea-land interface is substantial and existential for Itaparica in social, economic, and biogeological terms. The projection integrates natural and human interactions and tensions that shape island boundaries.

About the hypothesis and integrating seasonality

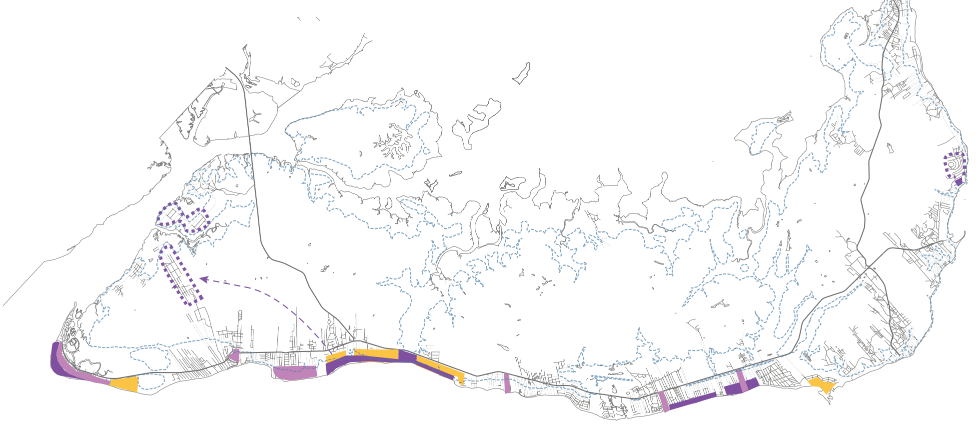
Seasonality contributes to longer-term linear procedures of coastal adaptation in three ways: Firstly, the projection targets stressors that have a seasonal origin. Guided by recommendations (see 4.2), the projection applies a mix of planned retreat and adaptation concerning second homes. One option proposed is to transform permanent physical structures of seasonal use to more seasonally adaptive and reversible forms of occupation. A mix of protective and adaptive measures could address permanent residences rather than relocation. Seasonality thus plays a role in setting priorities. Beyond reducing seasonal disturbances and introducing seasonality, the projection prompts a conceptual idea of inverting seasonal disturbances to beneficial impulses: from pollution to nutrient capture, or using flooding for sediment transportation. Seasonal natural phenomena, such as the crabs and the perigean spring tides, are integrated into the landscape design for resilience-building, not only to shape the sea-land interface, but also through the aspect of experimentation and learning.

9.3.3 PROJECTION I: "IMPULSES" – Fig. 9.31

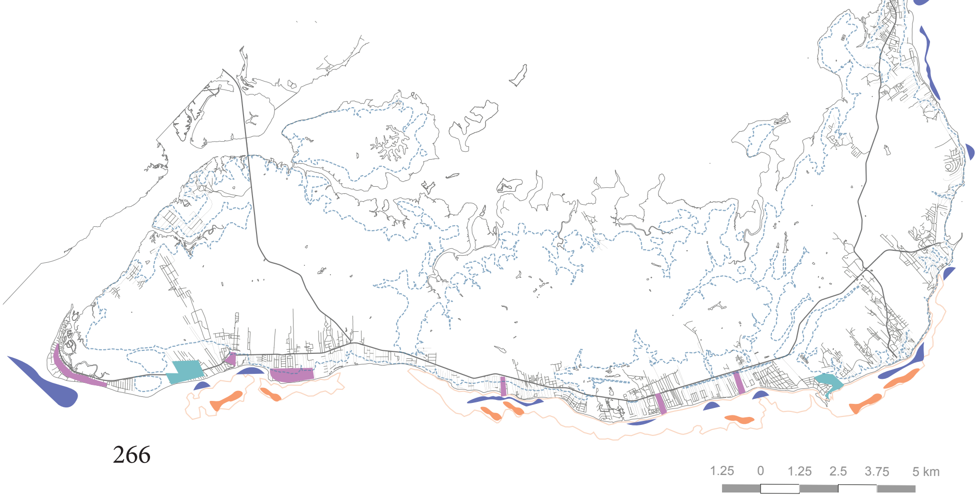
ECOSYSTEM-BASED ADAPTATION

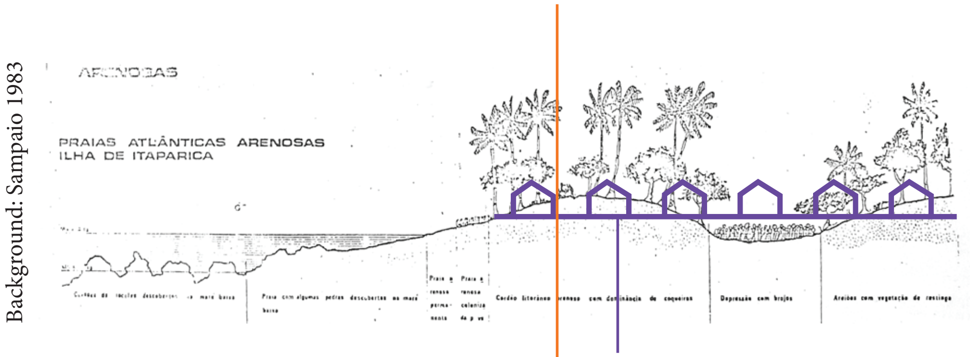


MANAGED RETREAT and ACCOMMODATION of SECOND HOMES



SEASONAL INTERVENTIONS





A typical holiday settlement

Deoccupation 60 m from high tide (existing regulation, monitoring with sea-level rise)

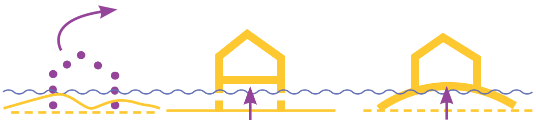
- CORAL-REEF RESTORATION and PROPAGATION
- BEACH RESTORATION and DEOCCUPATION 60m from mean high tide
- DUNE SWALES and ESTUARIES RESTORATION
- "LAND CRABBING" – INTRODUCING BLUE LAND

MANAGED RETREAT:

- NO PERMISSION TO RECONSTRUCT
- RELOCATING SUMMER RESORTS

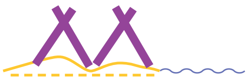
ADAPTATION ON SITE:

- ELEVATING SUMMER HOUSES or TERRAIN
- CONVERSION TO REVERSIBLE FORMS



Retreat from beach, or accommodation of housing to tidal peaks (March and September high-tide levels are approximately 1 meter above mean high-tide, expected sea-level rise 52–98 cm by 2100)

- SEASONAL CORAL PROPAGATING EVENT
- MARCH SPRING TIDE: TESTING SAFE -TO-FAIL SOLUTIONS AND SIGNALIZING SEA LEVELS
- "LAND CRABBING" – BLUE LAND CRABS' CYCLE
- TEMPORARY ACCOMMODATION (e.g., CAMPING)

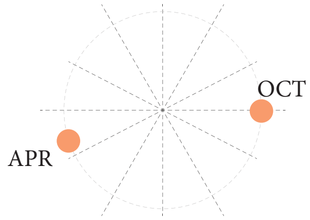


November–February, June (triannual rotation of sites)

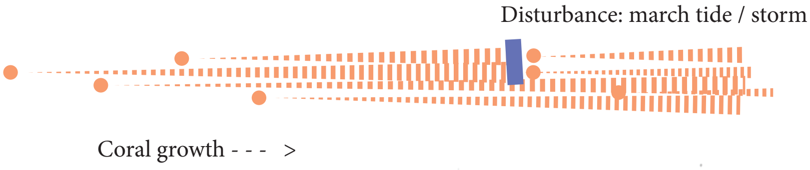
March / September

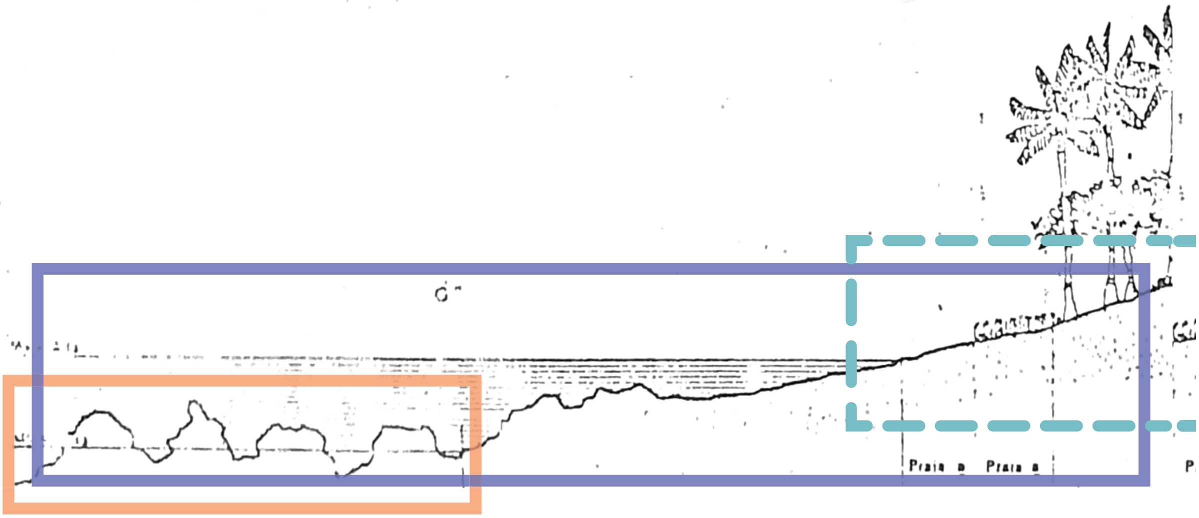
Fig. 9.32 SEASONAL INTERVENTIONS

SEASONAL CORAL PROPAGATION EVENT

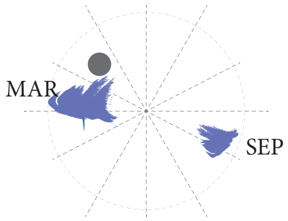


Reef restoration contributes to adaptation of the island to coastal erosion and sea-level rise. It increases biodiversity and supports marine livelihoods. Seasonal events engage people with resilience-building and are a means to diversify tourism. The timing relates to post-erosive periods – after the tourist season and the March tide, and again in October after winter.

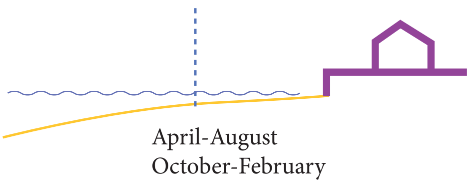




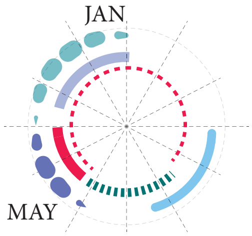
MARCH TIDE INSTALLATIONS



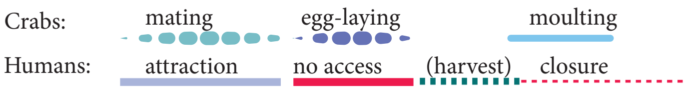
A window for learning and adapting at the sea-land interface of permanent settlements: 1. experimenting safe-to-fail solutions to dissipate wave energy; installation prior to February–March; 2. communicating sea-level rise and coastal risk through seasonal or permanent art installations.

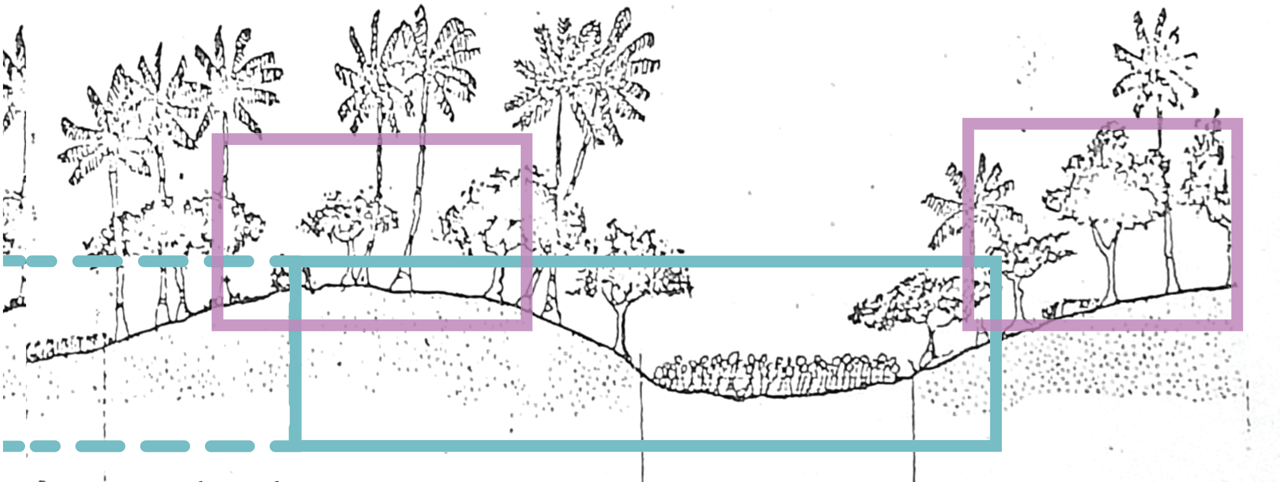


LAND CRABBING



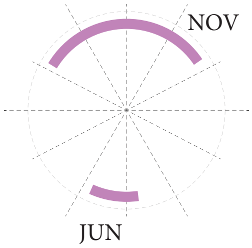
Introducing blue land crabs to estuaries on the built-up east coast increases biodiversity, and bioturbation enhances estuary restoration. The seasonal cycle programs human uses: from January to March, mating or "walking about" as attraction; in April–May, their egg-laying period as restriction. They can be harvested in June–July before molting.



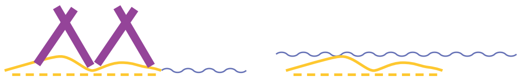


Background: Sampaio 1983

REVERSIBLE ACCOMMODATION



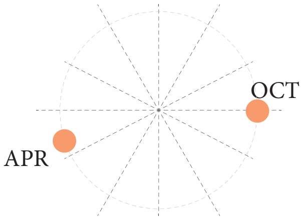
Camping or other temporary forms reduce exposure of structures to seasonal storms and helps to restore the buffering capacity of the beach plain to mitigate erosion and adapt to sea-level rise. Optionally, triannual rotation of sites allows development of vegetation.



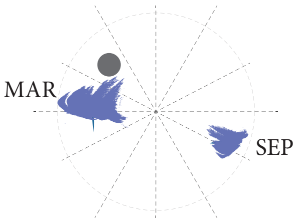
November–February, June   March / September

Fig. 9.33 SEASONAL INTERVENTIONS

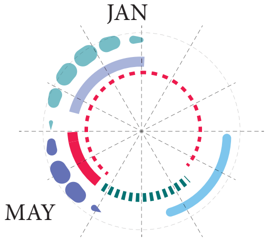
SEASONAL CORAL PROPAGATION EVENT



MARCH TIDE INSTALLATIONS



LAND CRABBING



REVERSIBLE ACCOMMODATION

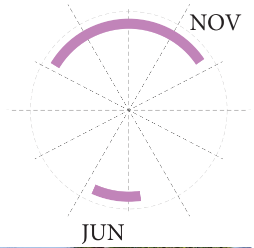
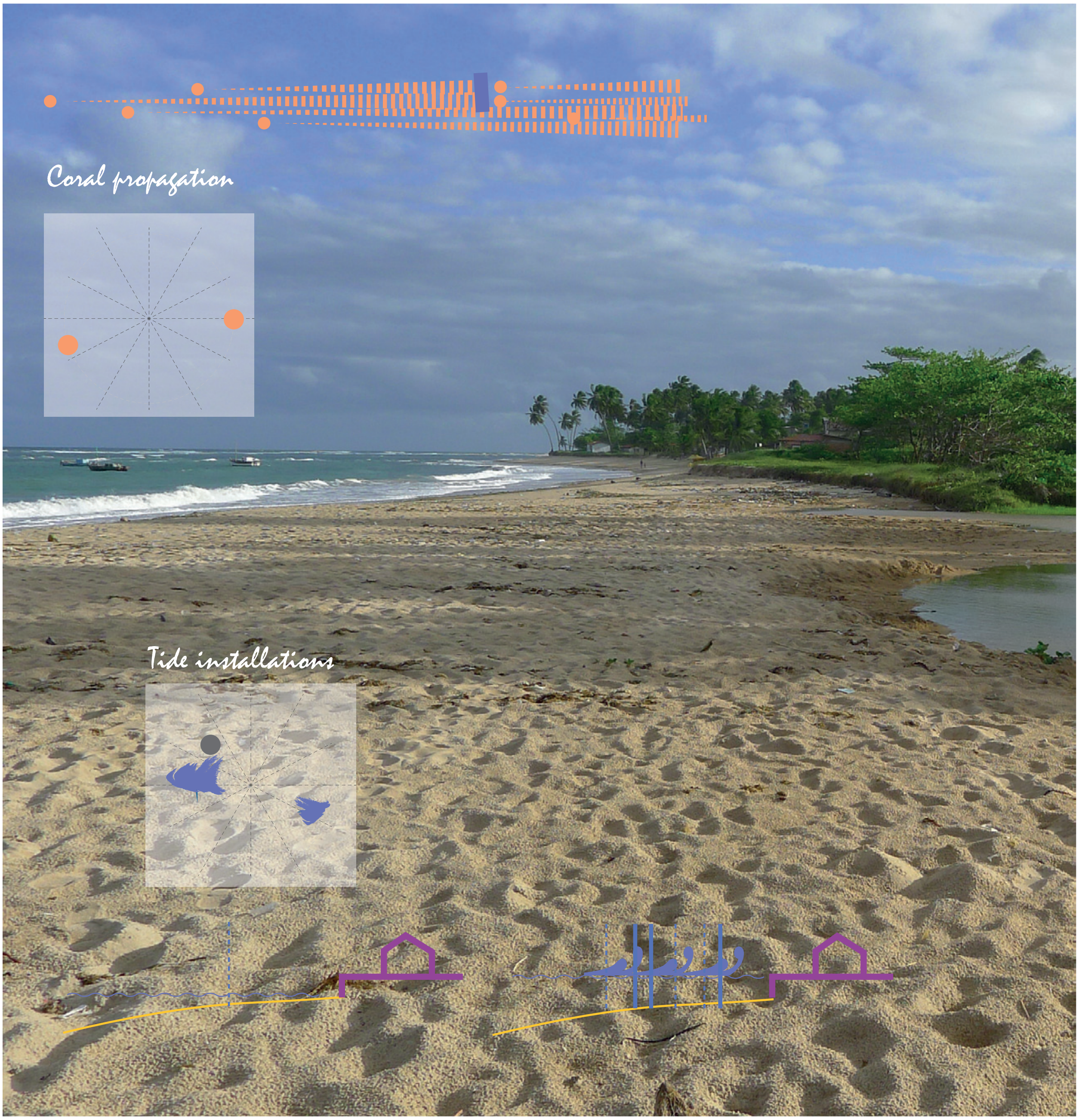
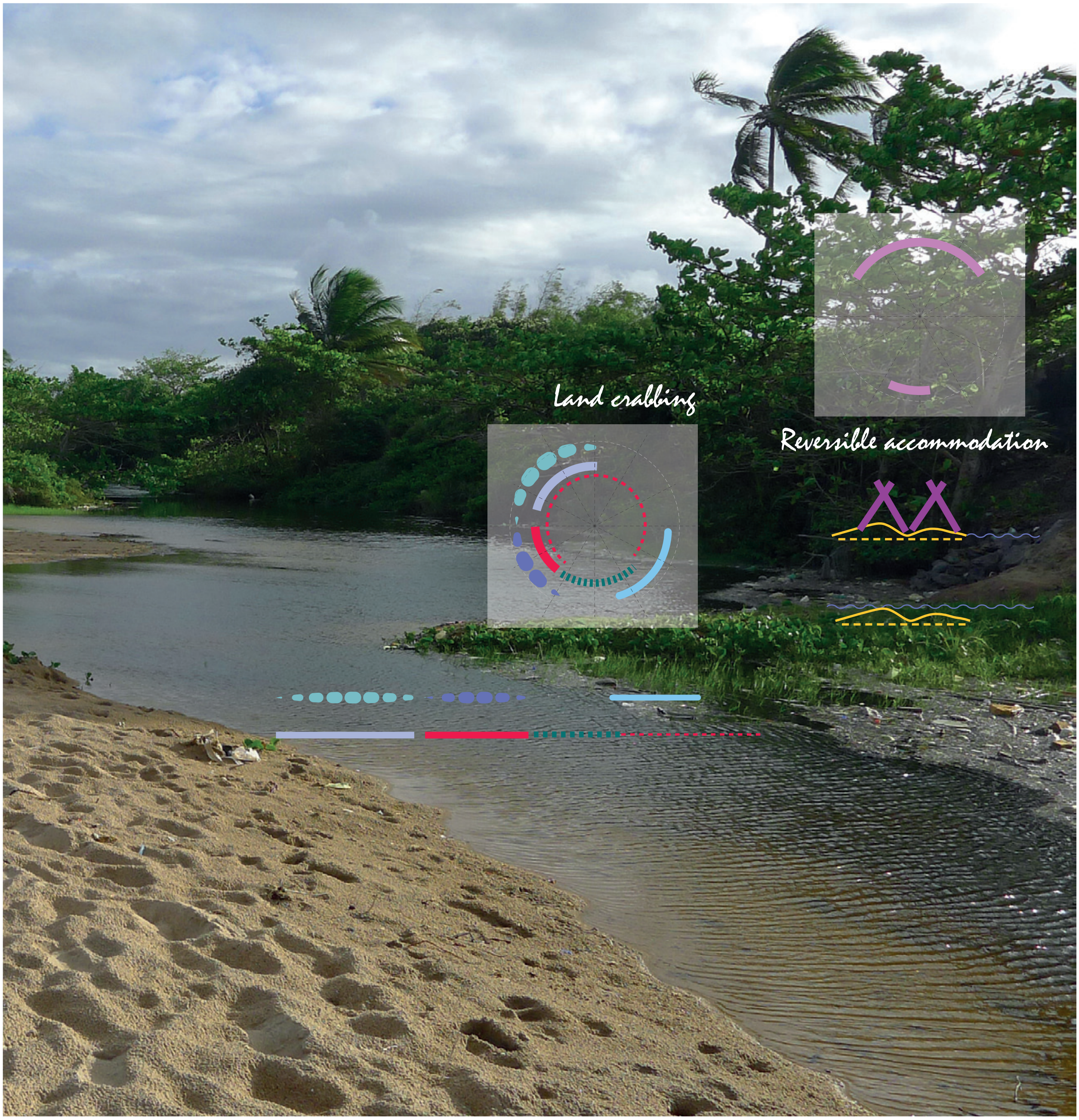


Fig. 9.34



In terms of the hypothesis – that understanding seasonal phenomena can contribute to resilience – the suggested installations and events would shift the exercise of understanding to citizens. This raises an insightful question: Who should understand? (At the outset, this research primarily thought of designers' and planners' know-how.) Instead of permanently intended fail-safe constructions, seasonality facilitates



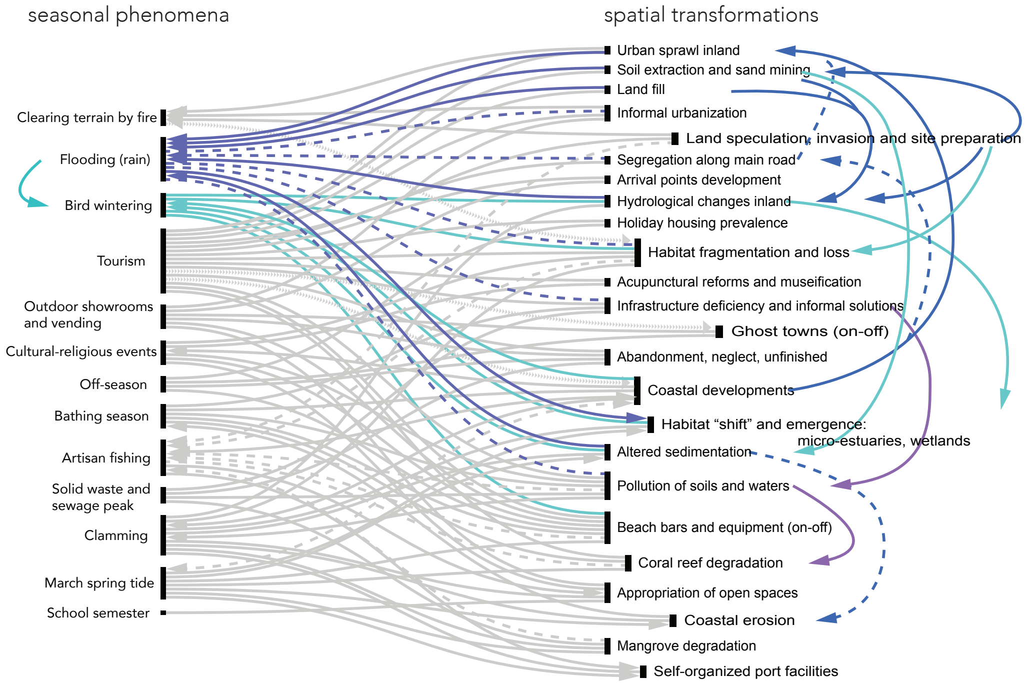
reversibility. I regard seasonality as enabling flexibility, annual adjustments or changes, learning, and a safe-to-fail mindset. In contemporary conceptions (see 1.3), that is essential for resilience-building, while participation is elementary in transformation (see 1.2). Altogether, the strategies in this projection are transferable, and I postulate that they could catalyze transformation.

9.3.4 Projection 2: "Flood with Birds" – From urban risk to biodiversity

Goals: This projection jointly addresses settlement security and biodiversity. The starting point is the seasonal accumulation of water in Itaparica's central area. Flooding is currently the most frequent natural hazard in settlements, posing hardship on permanent residents in precarious housing. However, it is also vital for wetland and freshwater habitats. The projection aims to reduce flood risk while harnessing ecological potential.

Trends: Increasing seasonal instability and extreme rain events are predicted, while total precipitation will decrease and dry and heat periods will extend (see 9.1.2). In the long run, wetland ecosystems, seasonal flooding, and associated habitats might thus decrease – unless sea level rise "pushes" the freshwater lens up so that wetlands stay wet (vs the case of Sylt). Even if urbanization remains at current levels, population growth and the settlement pattern trigger further occupation of flood-prone zones and adjacent hills. This, in turn, hampers hydrological regulation. Together with climate change, settlement flood-risk intensifies: More people become exposed, and there is less room for heavier rain.

Fig. 9.35 The seasonal-spatial diagram: Highlights flooding.



Resilience of who to what?

The projection handles the central stretch of Itaparica, from inland wetlands to the beach. Between March and September, flooding afflicts **precarious settlements** erected in an unsuitable area inland (see 9.2.1). Human lives are not in danger, but access difficulty, property damage, and health risk increase. The rainy season is a natural dynamic that provides important habitats for birds, like herons, and reptiles (see 9.2.1). From a human point of view, disturbance of everyday life and health risk outnumber the positive aspects. The wetlands might be capable of adapting to climate change, pollution, and fragmentation, but a chain of hazards can accumulate into disaster: Coupled with perigean spring tides and storms in March and September, flooding might escalate to a storm surge on the coast. Outside of the main tourism season, the exposure of the inexperienced fluctuating population remains low, but properties may be damaged.

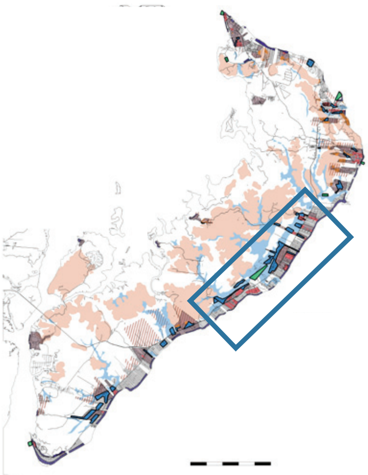


Fig. 9.36-37 Illustrating the spatial dimension of seasonal flooding in central Itaparica.

Map data © Google, 2018 DigitalGlobe and 2018 CNES / Airbus, Imagery Date 3/1/2016.
Map data © Google, 2018 CNES / Airbus, Imagery Date 8/23/2013.

MEDIUM / HOW
-> Allowing flooding, moving the flood: From disturbance to blessing
-> Temporally manipulating the flooding season through spatial intervention
-> Blue-green infrastructure
-> New seasonal uses

First of all, a consideration of both sides of the coin can lead to conceptual ideas such as “moving” the flood from where it is a disturbance to where it is a blessing: Can it be steered from settlements to increase valuable ecosystems? Approaching the flooding season temporally, I considered whether it should be lengthened or shortened, for example, through earthworks or conventional infrastructure – and where and how? Should it be controlled (where and when?) or just allowed, providing elements like stepping stones or temporary plank bridges and removing belongings from ground level during the season?

The exploration has resulted in two spatial proposals that provide nature-based flood and storm-water management, integrated public open space, and enhanced (seasonal) habitat potentials. Ideas for livelihoods and sanitation are outlined. The projection takes into account transformative potentials recognized in the course of the case study: the sparse settlement pattern and “unfinished” character or lack of conventional infrastructure, and seasonal vacancy of coastal allotments. Ideally, the suggested interventions would reduce settlement flood risk through improved storm-water management and sanitation. Simultaneously, they would increase biodiversity and provide a variety of recreational possibilities in open spaces. I have included the reflection of potential resilience contributions and problems in each proposal, and have then jointly handled islandness and seasonality.

9.3.4.1 “The lake / move the flood” – Disturbance for transformation

Based on the idea of moving the flood presented above, this proposal stretches the wetland season. It aims to mitigate flooding in settlements by redirecting storm water to a widened wetland or lake in the island interior. The proposal makes use of the barrier-effect of the main road, yet suggests bold intervention with the topography: cutting terrain, building small dikes, and incorporating nature-based sewerage. It creates an integral habitat and extends the migratory birds’ season. This large swampy body would impede construction on unsuitable land and fragmentation of the wetland floodplain. With shorter fringes, shrinking in dry periods would be less dramatic. New livelihoods such as aquaculture could be developed with the community. Seasonal extractivism could contribute to wetland management.

Problem/conflict: Implementation requires major earthworks, and these partly ruin the natural riparian zones. The ecosystem’s internal diversity might decrease

Fig. 9.38 "The lake / move the flood."

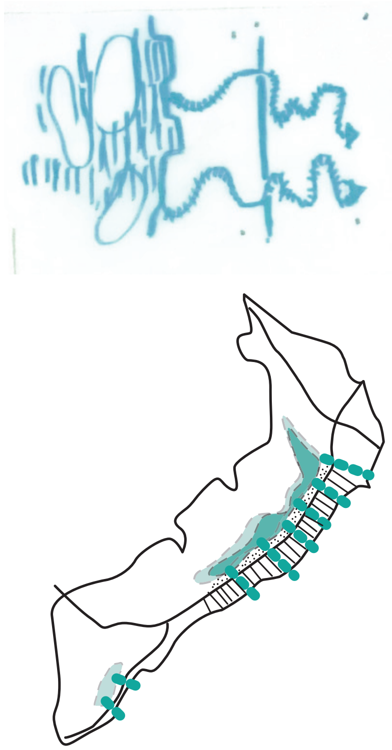


Fig 9.39 "The corridors."

if it is transformed from a small swale-ridge pattern to one homogeneous body with less fringes. However, diversity can be enhanced by thoughtful design. The proposal would also require high capital – however, sand from the earthworks on the site is needed in construction and could be used on the island to temporarily relieve (illegal) mineral extraction.

Contribution to resilience:
CONNECTIVITY and ROBUSTNESS: A larger, integral ecosystem with connected waterbodies is less vulnerable to fragmentation and loss.
FLEXIBILITY/ADAPTIVE CAPACITY: Multifunctional spaces enable different uses in different seasons, and space for flooding is provided at the lake edges.

BIODIVERSITY: Conserving inland wetlands supports diversity on island scale, and may indirectly contribute to the recruitment capacity of the coral reef by retaining nutrients and sediments.
SELF-ORGANIZATION and RESOURCEFULNESS: Incorporating new livelihoods (and options for an independent water supply in summer).

9.3.4.2. "The corridors" – Return to adaptation

This proposal is based on the original island topography and hydrological conditions. It partly embanks settlement edges against wetlands – drawing a boundary for settlement expansion – and provides relief from seasonal flooding by reintroducing "outlets": brooks that have degraded and given way to settlements in the coastal zone. Space is found in the low-density holiday allotments, which are mainly vacant during the rainy season. Micro-climate improves as vegetation and surface water reduce heat stress. New public open space along the brooks provides recreational possibilities. These ecological corridors reconnect inland wetlands and coastal ecosystems. Seasonally adaptive, decentralized gray water and sewage treatment can be integrated. In Brazil, there are also examples of retrofitted "condominial infrastructure" (Melo 2005). In the wetlands, dunes and swales can be restored while accommodating different functions – such as ecological trails – depending on season and hydrological circumstances. A larger multifunctional water-sensitive park could serve the whole island. Integrating co-designed livelihoods could benefit locals.

Problems, conflicts, and trade-offs

Providing public space on private properties can be problematic. The solution does not necessarily add value to the more needy settlements, but it upgrades the affluent property zone, perhaps contributing to gentrification. Although connectivity is a resilience principle, the enhanced water and ecological flows might increase the flux of contaminants from settlements to the beach and coral reef, which is vulnerable to eutrophication. Planning thus requires integration of coastal protection. The proposal requires municipal coordination for land works and technical knowledge, even if works are conducted "by hand," and moderation of dialogue between locals and second-home owners. Maintenance or monitoring of the created open spaces, infrastructure, and ecological flows from wetlands to the seashore is necessary.

Contribution to resilience
REDUNDANCY: decentralized drainage of storm water, including a few different solutions and a back-up system; multiple habitat and corridor options for brook/river/estuary species
FLEXIBILITY/ADAPTIVE CAPACITY: new multifunctional spaces for enabling different uses in different seasons and absorbing flooding
CONNECTIVITY: re-establishing surface-water corridors and re-connecting ecological habitats; linked recreational spaces
BIODIVERSITY: a revitalized brook/stream ecosystem in the coastal plain and within the settlements; healthier micro-estuaries and inland wetlands

The proposal integrates RISK REDUCTION in the coastal zone in case of an extreme rain event that coincides with a storm surge and holiday peak.

9.3.4.3 Islandness and seasonality in both proposals

Reflecting islandness
The "lake" dedicates a wide area to securing a key ecosystem and supporting island biodiversity. However, by turning a central area into a "no-go" zone, it may intensify the occupation of adjacent hills, and the development pressure and land-use conflicts at the coastal interface. This, in turn, might pollute the wetland and undermine resilience of the island to sea level rise and storms. Is this kind of flood management worth compromising coastal key ecosystems?

The "corridors" proposal appreciates island spatiality by diversifying within settlements, and promoting proximity and efficient, integrative use of space. The interconnectedness of systems provokes the question: How do the new "outlets" affect the beach and coral reef (transporting pollution, sediment, or nutrients)? They probably do not transport enough sediment to replenish an eroded beach, but the re-established estuaries provide nature-based adaptation to sea level rise.

9.3.4 PROJECTION II: FLOOD WITH BIRDS – Fig 9.40

Fig. 9.41

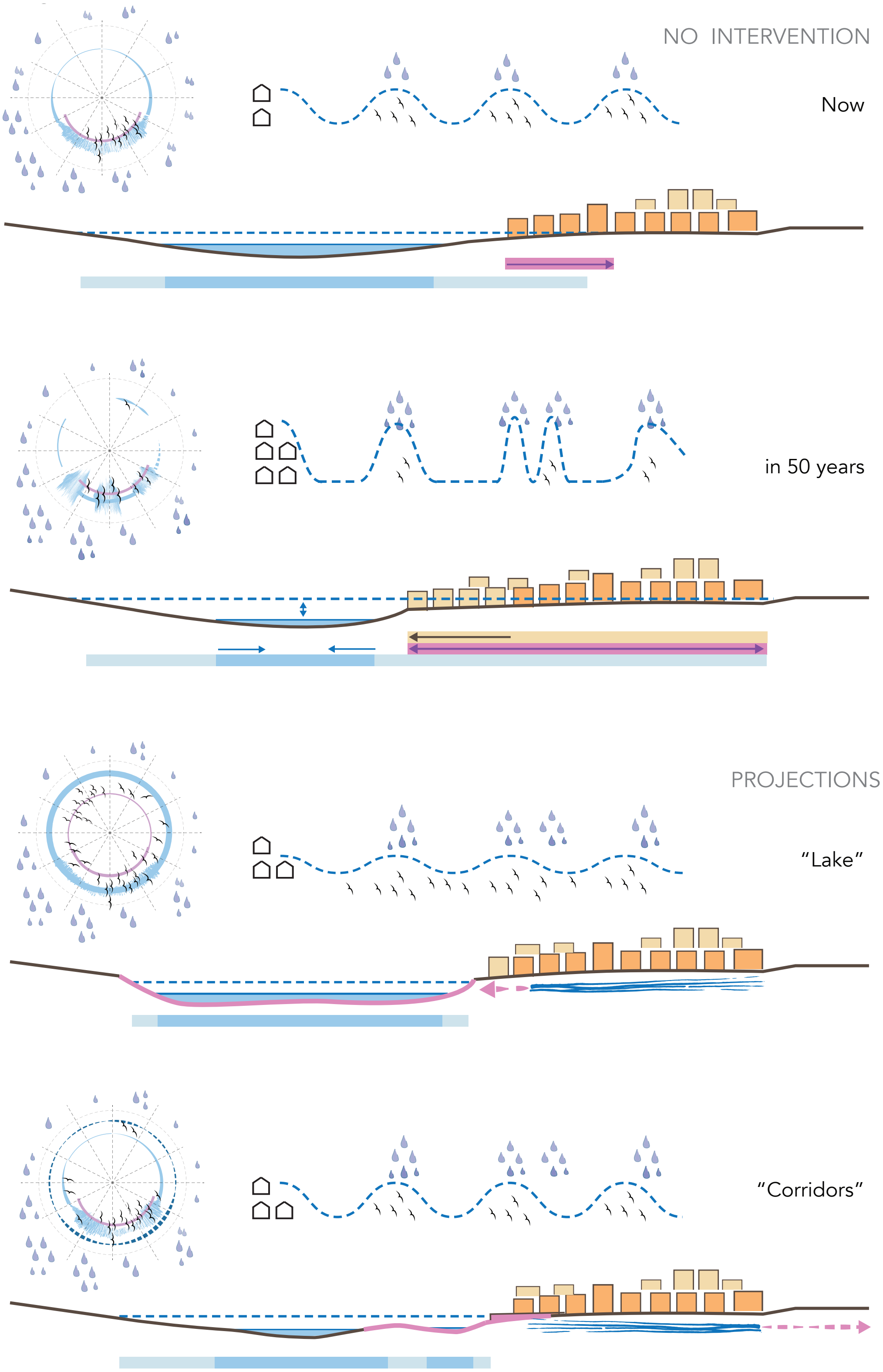
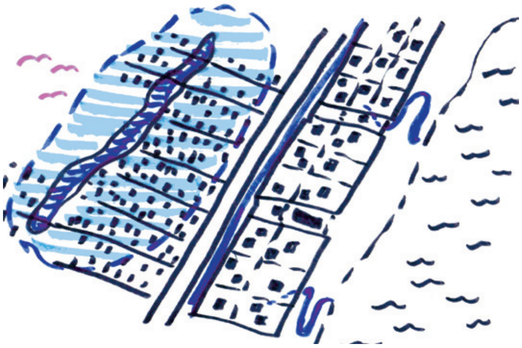
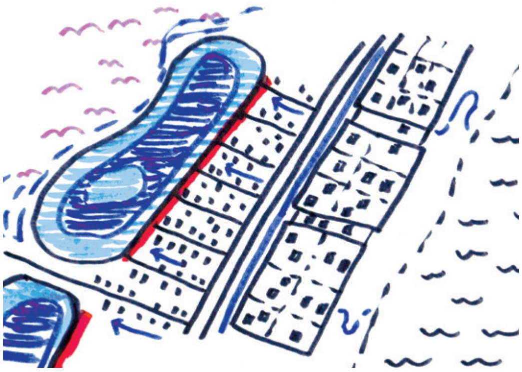

NO INTERVENTION
Now
in 50 years
PROJECTIONS
"Lake"
"Corridors"

Fig. 9.42–45

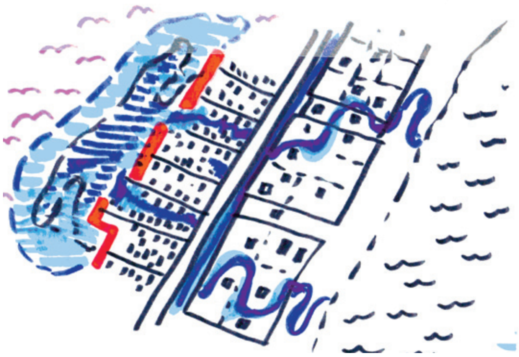
CURRENTLY
seasonal flooding occurs in settlements that occupy wetland edges. The main road blocks water flows, and coastal development has replaced streams and the estuaries at the beach are degraded.



IN 50 YEARS
settlement expansion, wetland shrinkage and more intense rain events are expected, increasing the flood-prone settlement area and flood risk.



THE LAKE PROPOSAL
mitigates flooding in settlements by redirecting storm water to a widened wetland or lake in the island interior. It stretches the wetland season.



THE CORRIDORS PROPOSAL
reduces flood risk by reintroducing brooks and revitalizing estuaries within seasonally occupied coastal settlements.

About testing the seasonality hypothesis and integrating seasonality The ideas in this projection take seasonal change as a medium for blue-green infrastructure. Instead of conventional drainage and sewerage, literature on climate-change adaptation in islands promotes blue-green solutions (see 4.2.2). Contemporary landscape architecture provides exemplary designs. The novelty here is adapting to island spatiality, and the particular incorporation of seasonality. Regarding the humans' disaster season as a biological advantage, the projection explores win-win situations that enhance both settlement security and ecological diversity.

Based on such starting points, and on the idea of temporal manipulation, the spatial interventions foster diversity, adaptation, multifunctionality, and connectedness.[15] The latter is best exemplified in the "corridors" (1) that connect the segregated spatial realms on both sides of the road through synergies of two already connected phenomena (birds and flooding) and the off-season area. Vacancy of coastal allotments provides space to handle the natural dynamic. This consideration may be important for risk reduction if extreme rain coincides with a storm surge and a holiday weekend. The proposed "lake" (2) is less sensitive to seasonal fluctuations. Development of on-site measures would provide transferability, incrementally advancing with settlement and adapting to topography. In both projections, seasonally adaptive or reversible structures could be experimented with for accommodation, recreational, and production facilities. The solutions drafted are based on seasonal dynamics and are safe-to-fail in the face of extreme rain events and climate uncertainty. In both projections, the earthworks and landscaping adapt to flooding, but their physical forms are not very anticipatory with respect to urban development. Neither proposal details how to intervene directly within the flood-prone settlements – but some initial ideas have been cast in 9.2.3.

With regard to transformation, I conclude the projection with another hypothesis: A seasonally recurring disturbance that is not disastrous might encourage self-organization and learning among communities, thus contributing to their adaptation and incremental transformation. However, in contrast, it also might only encourage a coping mechanism to get over each individual event without preparedness for extreme situations and longer-term change. The projections thus remind one of a principal question: Is (allowing) disturbance necessary for transformation? The question raised in the coastal projection repeats: *Who* should understand seasonality in order to increase resilience?

15 The success could be concretely measured by the total area of inland wetlands (not decreased); bird species/population monitoring (not decreased); number, duration, and economic damage of flooding events in settlements (to be monitored, should decrease); monitoring contaminants and key species, and so on.

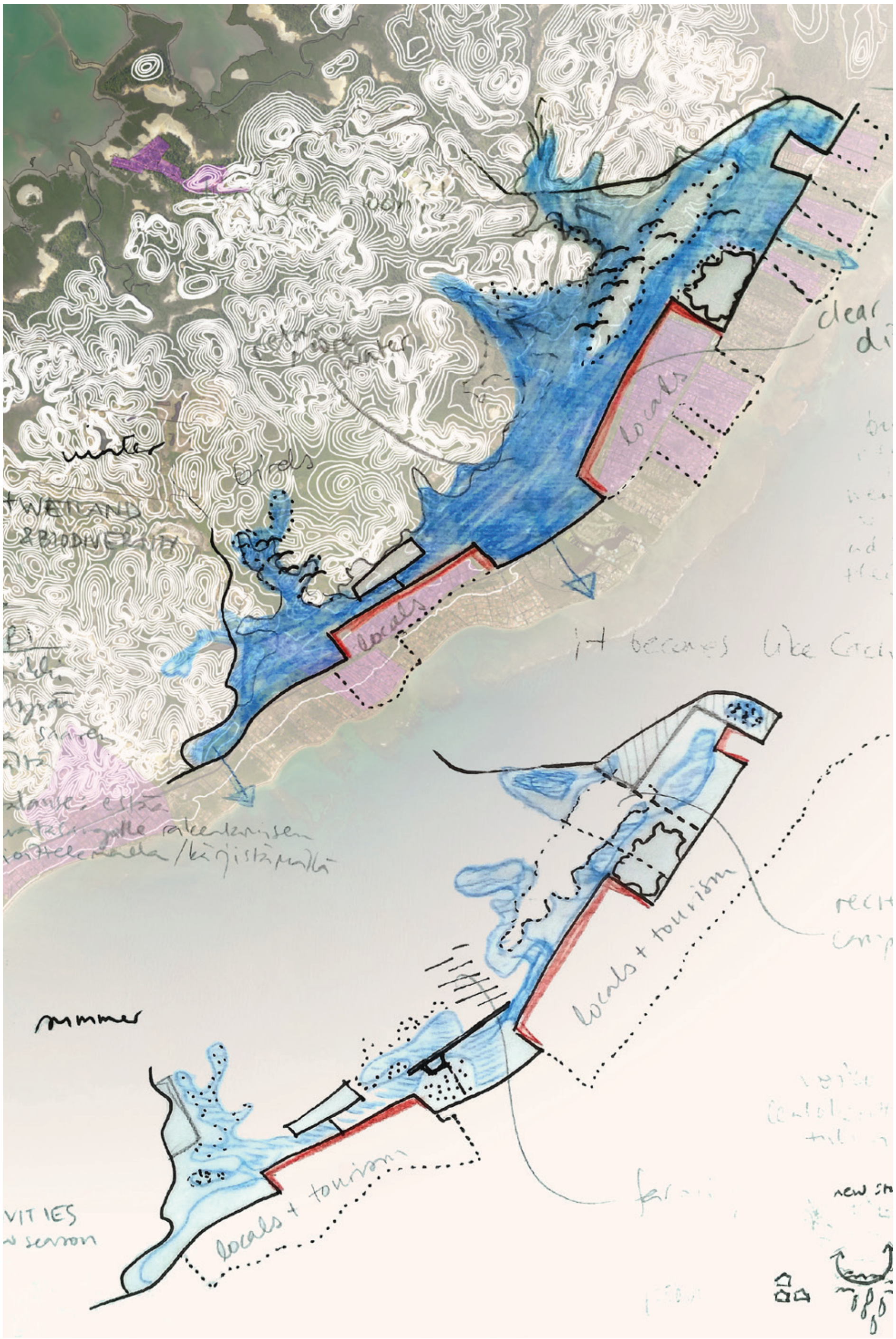


Fig. 9.46 Drafting seasonally adaptive blue-green infrastructure for flood-risk reduction, recreation, habitat preservation, and livelihood development.

9.3.5 Projection 3: "New Seasons" – Livelihoods and tourism diversification

Goals: This projection addresses the interconnected goals of livelihood security and maintaining biodiversity on Itaparica. Primarily, it aims to diversify livelihoods, coupled with a move from the unsustainable beach-tourism model towards environmentally and culturally sensitive forms. The projection handles Afro-Brazilian heritage as both at risk of eroding and as a resilience asset (e.g., traditional knowledge, sense of community).

Trends: With climate change, weather extremes and rising sea levels are expected to affect livelihoods and key ecosystems (see 9.1.2 and 9.3.1). Urbanization, tourism, and pollution are expected to remain at current levels. The projection could accommodate the 400% growth scenario, but in the first place, it provides a way of building eco-social resilience independent of the bridge that planners associate with prosperity (Instituto Polis et al. 2014).

Resilience of who…?

This projection centers on local communities. Indirectly, the resilience of key ecosystems is addressed, acknowledging their importance for livelihoods, settlement security, tradition, and tourism.

… to what? Livelihood limitations.

A high dependency on the limited scope of (marine) livelihoods, limited season of alternative income (tourism), and low access to jobs causes income insecurity in the face of coastal development, contamination, coral bleaching, or oil spill. Cutting the fishermen's periodic insurance and disruptions to fishing and clamming, or to commercializing seafood beyond the island, can result in loss of subsistence. Alternative income sources and healthy coastal ecosystems are needed.

Fig. 9.47 The Afro-Brazilian cultural heritage offers potential for community-based tourism. A memorial for historic female protagonists of resistance (left page).
Fig. 9.48 Drafting how, or where, to uncover existing traditional practices and sites and connect them to seasonal programming.

… to what? Water and food shortage.
Secondly, most food is imported, and, formally, the island relies on an external water supply. Local population suffers seasonally from frequent household water shortages and low quality in addition to high prices for food (Instituto Polis et al. 2015a) (also see 9.1.2 and 9.1.3.3). Locals have counted on natural springs and subsistence agriculture, which face multiple threats, from contamination to extreme weather. To mitigate disaster, more autonomous and redundant food and water supplies are needed.

… **to what?** Material shortage and marginalization.

Beyond basic needs, livelihoods and cultural tradition partially rely on local plant-based materials for tools, instruments, medicine, and so on. Restrictive legislation, environmental degradation, and urban expansion cause shortfalls. Privatization of open spaces marginalizes cultural manifestations. Integrative management and biodiversity are needed.

… **to what?** Impacts of beach tourism.

Tourism is heavily concentrated on the beach during summer months (see 9.2.1), and almost no other offers exist. Tourism is a source of income, but congestion, noise, and waste peaks stress coastal ecosystems and locals. The off-season brings disadvantages, but many islanders perceive it as a pleasurable, peaceful time. Diversity is needed.

MEDIUM / HOW:

-> “Diluting or dispersing” peaks, extending the season
-> “Seasonal programming”
-> Spaces for local supply & commercialization of produce
-> Preserving springs
-> Integrating heritage

To diversify livelihood and tourism opportunities hand in hand, this projection draws from the rich cultural tradition and nature-based livelihoods of Itaparica Island. They are, in many ways, related to seasonal dynamics (see 9.2). The spatial-temporal program integrates cultural heritage sites and immaterial legends, fishing practices, nature reserves, springs and existing fountains, horticulture, Candomblé temples and their associated green areas,[16] and further identified potentials. Besides subsistence, they provide an opportunity to develop tourism in a manner that is less harmful to key habitats and benefits permanent residents. Islanders could provide distinguished services and introduce new niches. The concerns and wishes of local communities, documented in (secondary source) planning reports from participatory workshops (Instituto Polis et al. 2015a, b), orient the projection.

A flexible spatial frame accommodates envisioned program(s) and practices in the northern part of Itaparica, where existing resources provide a good starting point. Suggesting extraction reserves (a Brazilian environmental conservation unit), agroforest, and leaving current forests for extraction and rituals, the design focuses rather on rediscovering and connecting than intervening. Abandoned

16 In the Afro-Brazilian religion Candomblé, natural elements like the sea, rivers, stones, trees, and topography have spiritual significance and affect the location of temples. Plants are central for rituals, medicine, and decoration. Whenever possible, they are extracted from the adjacent forest, but in urban situations, they are often bought or exchanged – thus, in Salvador, there is market potential.

Fig. 9.49–51 Traditional local cuisine and handicrafts are essential for livelihoods and use resources extracted from the island. Water security can be improved by learning from locals' self-organization and preserving natural springs. Fountains and springs are also culturally important sites.

colonial farm structures and forgotten sites of indigenous and Afro-Brazilian heritage are integrated in the spatial program. Natural springs are considered decentralized water sources. Innovative technologies can make up a key strategy to include the increasing segment of newcomers and local youth. The proposal seeks to encourage islanders and visitors to assume and create space in a sustainable way.

I propose farming to concentrate on crops that yield and/or require work in March–April and August–September, synchronized with perigean spring tides, storms, and closure periods of fishing and clamming. To connect producers along a 10km agroforest strip and invite consumers to the island interior, the main road (identified in 9.1.3 as a semi-readymade multifunctional space) transforms into a “food mile” with open-air market space and cooperative facilities for commercializing local products ranging from seafood and fruit to palm oil and cassava meal. Marine connections re-establish cultural-historical routes to facilitate commercialization and commuting – they can adjust to seasonal flows. The interventions facilitate circulation of products. Besides the existing algae soap factory, aquaculture and other new income sources can be introduced. Bioengineering and food production are combined: “Oyssel” beds (Reise et al. 2017) buffer waves and grow with sea level rise, and agroecological practices prevent erosion in hills. A consultative process in local communities and with the municipality and private sector is needed to develop suitable livelihoods and to elaborate a “seasonal livelihood program” (WFP 2013).

The seasonal flux of national tourists depends on the holiday calendar, but international niches can help to extend or to create seasons, for example: spiritual retreats, bird and crab watching, participation in traditional production, and children’s tourism (e.g., treasure hunts or indigenous camping), located inland and during the off-season.

Contribution to resilience:
REDUNDANCY (alternatives to earn income if one fails) and DIVERSITY (many different jobs or activities but not necessarily at the same time) of livelihoods, of mobility with new marine connections, of water supply (springs), and of fresh produce (not only imported) all contribute to RESOURCEFULNESS as having one’s own resources and learning to use them in different situations.
FLEXIBILITY: multifunctional spaces, time-shifting and altering seasonal uses and livelihoods, incremental or reversible structures; marine mobility (private and shared boats) that adapts to seasonal needs more flexibly than road infrastructure
HETEROGENEITY/DIVERSITY: landscape and habitat mosaic of different patches, agroforestry, small-scale farming and intercropping (temporal and spatial)
SELF-ORGANIZATION: encouraging communities to assume public spaces, to practice extractives and new livelihoods, to preserve and share traditional knowledge; enhancing independent water supply and mobility

The projection creates opportunities to move from single-source income towards a redundancy of subsistence while cherishing heritage and protecting biodiversity. Diversified livelihoods and enhanced food security relieve stress on marine resources and coastal ecosystems. Attracting tourism beyond beaches can contribute to the same outcome, if total numbers stay moderate and appropriate sanitation infrastructure and waste management are realized. In line with the Priority 3 of the Sendai Framework, the projection strengthens the protection of livelihoods and productive assets, and sustainable management of environmental resources (UNISDR 2015). I argue that a landscape dimension with corresponding temporary or reversible landscapes is a useful contribution to the implementation of seasonal livelihood programming (WFP 2013).[17]

Problems, conflicts, and trade-offs

Island tourism can hardly be environmentally sustainable as long as it has an increasing footprint (Baldacchino and Kelman 2014). Delineating to what extent human intervention is beneficial to ecosystems or "natural" dynamics is challenging. Monitoring and managing plant and material extraction is tricky: Who is allowed and who is not; how much is ok? Traditional community-based governance does not necessarily guarantee equal access for everyone to the resources (Pinto da Silva 2004). The proposed use of springs is uncertain, because urban expansion, contamination, and irrigation imply changes on hydrology and water quality. Many interventions depend on capacity-building and tourism management. To date, a lack of community initiative and municipal resources has been an obstacle (Instituto Polis et al. 2015a, b), but development in Matarandiba, the island's pilot community, shows great success (Gitel 2018).

Reflecting islandness

This projection draws attention from coastal activities to the island interior. It raises the question of whether a spatially and temporally concentrated peak is better than a dispersed, wider, and longer impact: Reducing stress at the coastal interface may affect central island areas. The projection underlines resourcefulness and autonomy in islands. It creates multifunctional, productive landscapes because there is no space for large mono-structures or rural hinterland. Furthermore, it appreciates marine connections and adopts the seasonality of livelihoods as characteristic of island time on Itaparica: for islanders, it seems natural to have partial seasonal, temporary, and part-time sources of income – thus, on Itaparica, new seasonal responses might be just as viable as (and more flexible than) permanent jobs.

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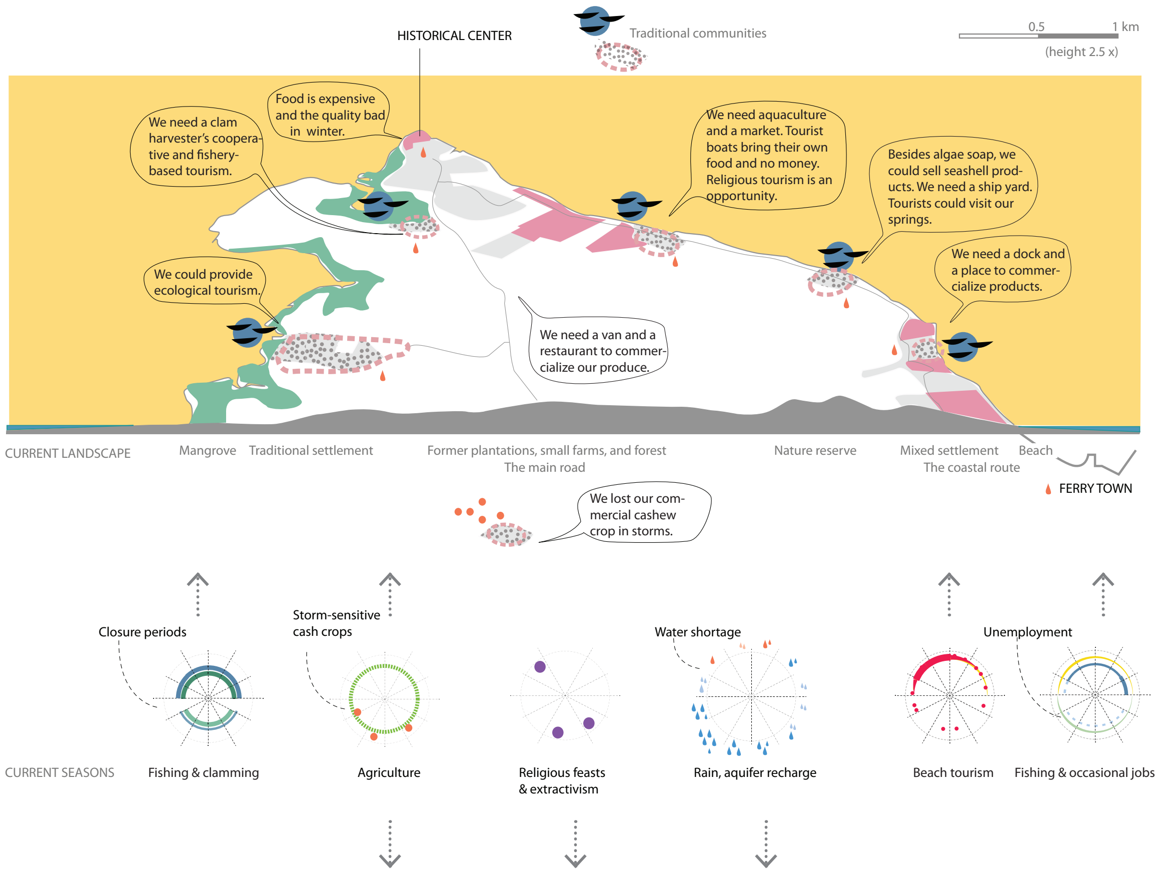
17 The concrete effects could primarily be measured through social and economic indicators (income, adopted livelihoods, tourism statistics, etc.). Landscape indicators for success could be based on monitoring land-cover change; quality and quantity of spring water; adoption of multiple crops and other agroecological practices; size, integrity, and reduction of pollution in coastal ecosystems; reversibility or adaptability of built structures; uses of open spaces; and so on.


SSA
BA

Fig. 9.52 In traditional communities, most livelihoods are based on marine resources, and religious practices are embedded. The fruit of *dendé* (above) is a resource for traditional palm-oil production. Both livelihoods and tourism concentrate at the coastal interface.

Fig. 9.53 COMMUNITIES and the COASTAL CONCENTRATION of SEASONALITY



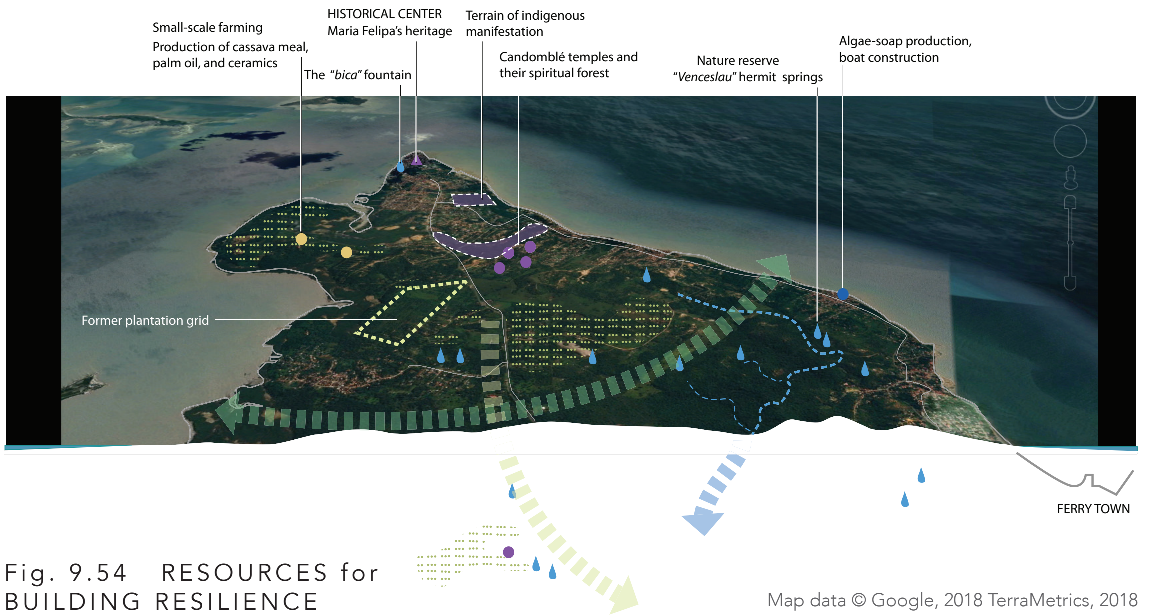
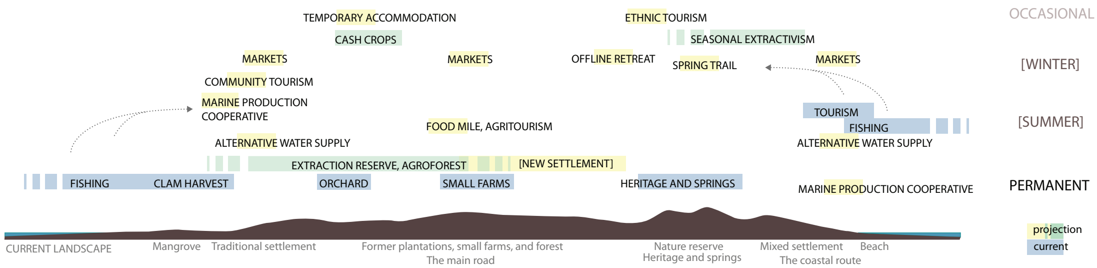


Fig. 9.54 RESOURCES for BUILDING RESILIENCE

Map data © Google, 2018 TerraMetrics, 2018 DigitalGlobe, and 2018 CNES / Airbus.



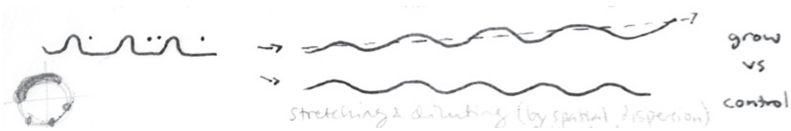


Fig. 9.55–56 STRATEGY: TOWARDS THE MIDDLE
DISPERSING TOURISM and LIVELIHOODS SPATIALLY and TEMPORALLY

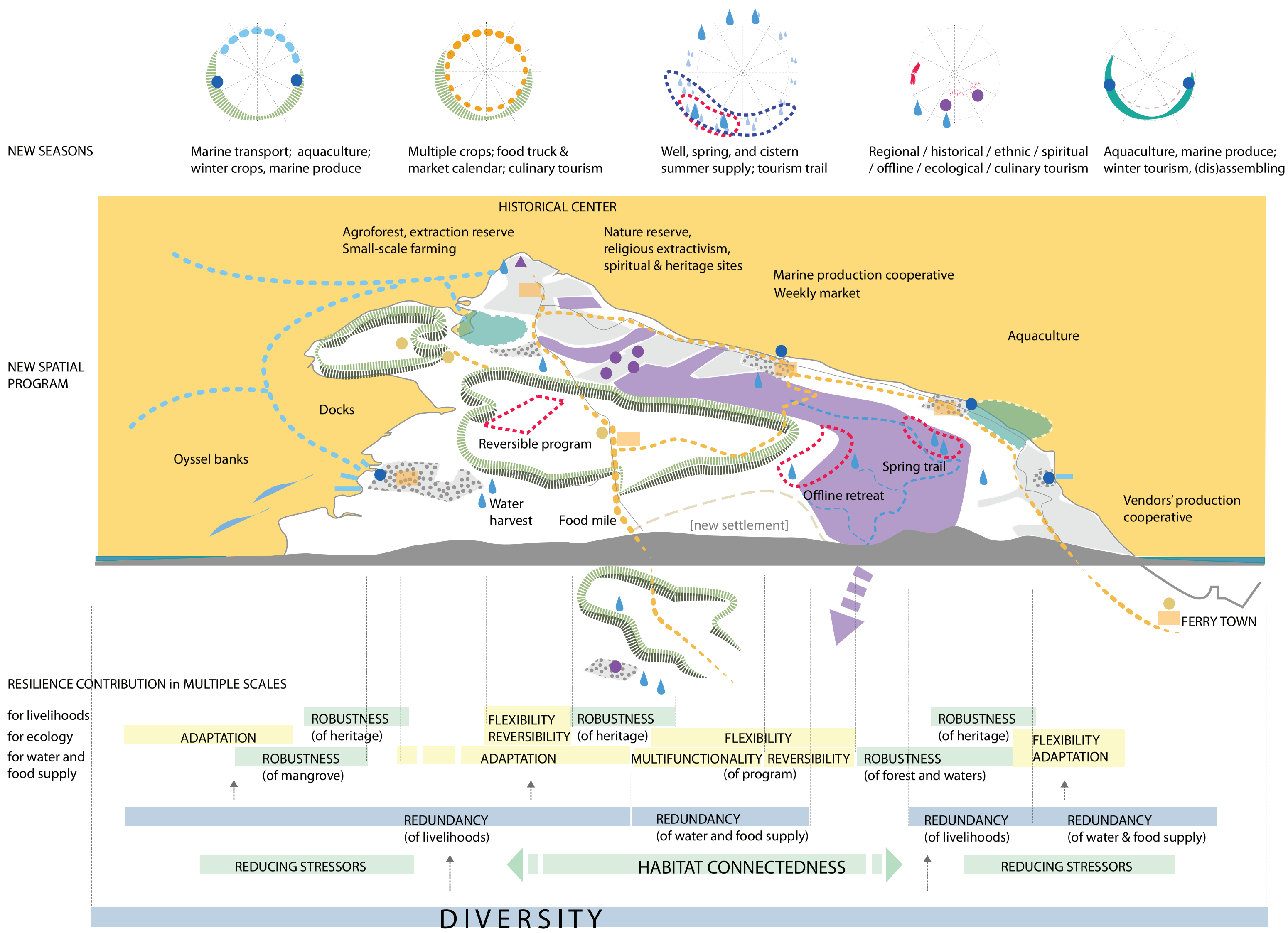

NEW SEASONS
Marine transport; aquaculture; winter crops, marine produce
Multiple crops; food truck & market calendar; culinary tourism
Well, spring, and cistern summer supply; tourism trail
Regional / historical / ethnic / spiritual / offline / ecological / culinary tourism
Aquaculture, marine produce; winter tourism, (dis)assembling
NEW SPATIAL PROGRAM
HISTORICAL CENTER
Agroforest, extraction reserve
Small-scale farming
Nature reserve, religious extractivism, spiritual & heritage sites
Marine production cooperative
Weekly market
Aquaculture
Docks
Oyssel banks
Reversible program
Water harvest
Food mile
[new settlement]
Offline retreat
Spring trail
Vendors' production cooperative
FERRY TOWN
RESILIENCE CONTRIBUTION in MULTIPLE SCALES
for livelihoods
for ecology
for water and food supply
ADAPTATION
ROBUSTNESS (of heritage)
ROBUSTNESS (of mangrove)
FLEXIBILITY
REVERSIBILITY
ROBUSTNESS (of heritage)
ADAPTATION
FLEXIBILITY
MULTIFUNCTIONALITY
REVERSIBILITY
(of program)
ROBUSTNESS (of heritage)
ROBUSTNESS (of forest and waters)
FLEXIBILITY
ADAPTATION
REDUNDANCY (of livelihoods)
REDUNDANCY (of water and food supply)
REDUNDANCY (of livelihoods)
REDUNDANCY (of water & food supply)
REDUCING STRESSORS
HABITAT CONNECTEDNESS
REDUCING STRESSORS
DIVERSITY

Fig. 9.57-58 DIVERSIFICATION of SEASONAL LIVELIHOODS and TOURISM HAND-IN-HAND

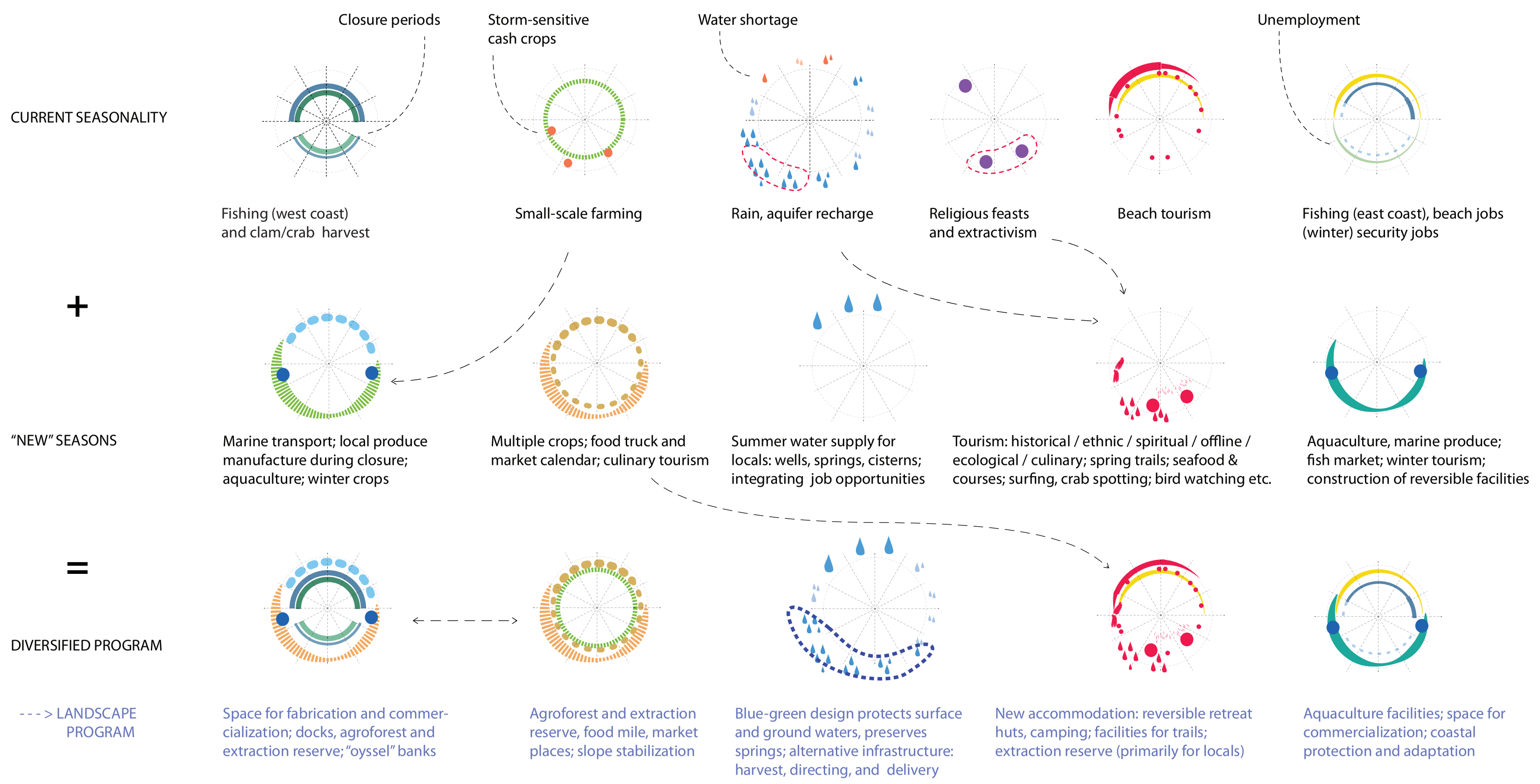
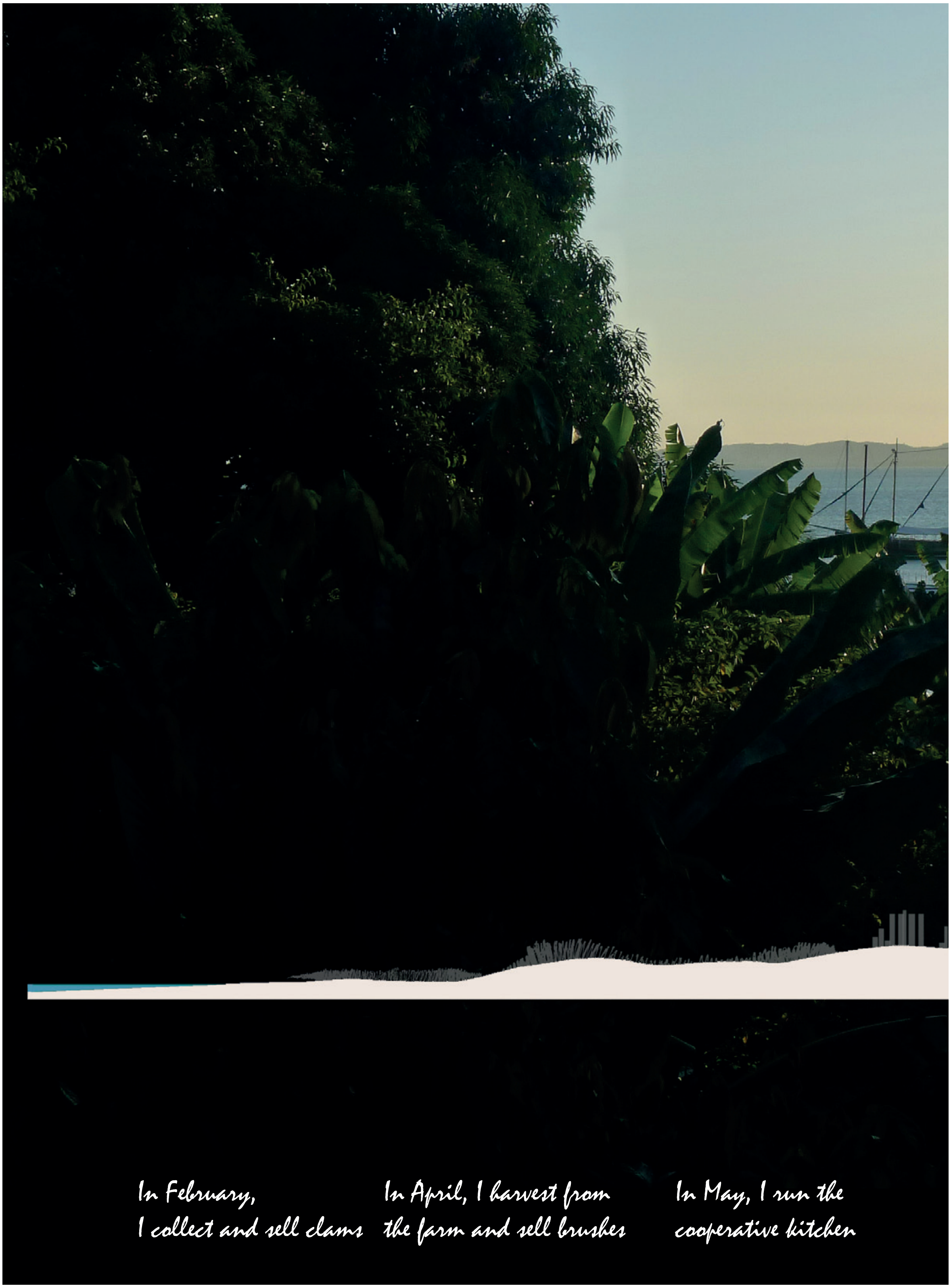
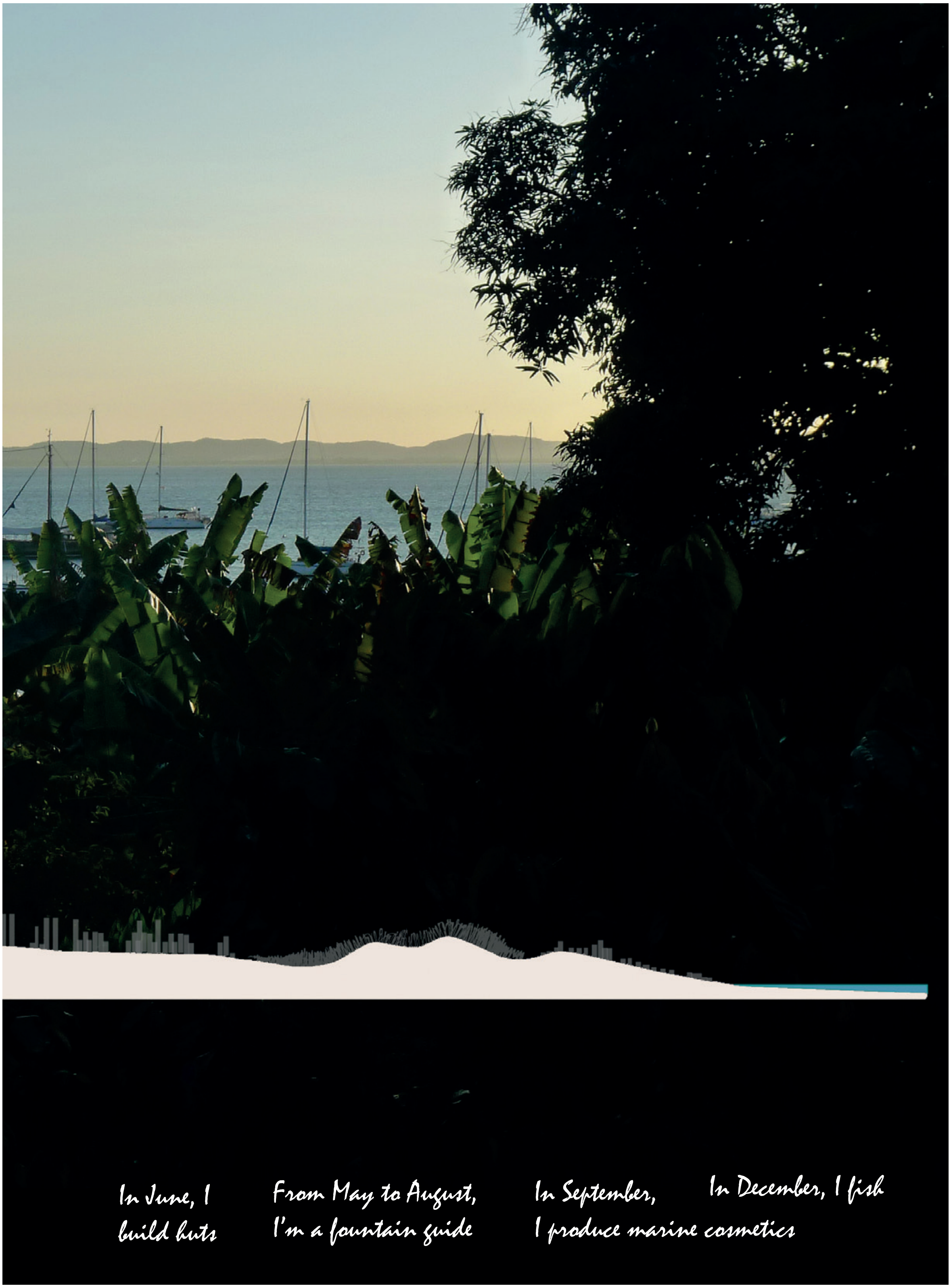


Fig 9.59 Extending seasonal programming from the coast towards the inland.




In June, I build huts
From May to August, I'm a fountain guide
In September, I produce marine cosmetics
In December, I fish

Conclusion about the hypothesis and integrating seasonality

This projection integrates teseasonality of tourism, livelihoods, and cultural practices into a landscape design that supports resilient livelihoods and ecosystems. I postulate that, in the case of Itaparica, I would have come up with a similar topic even *without* seasonal focus. However, conceptually looking at the temporal-spatial variations of livelihoods and tourism (expanding, dispersing) and emphasizing synchrony are novel tools (inspired by Lynch 1972). The starting point for decreasing disturbance and creating synergies is the manipulation of seasons. On this basis, the projection develops a locally sensitive spatial program that prompts new seasons – and perhaps decreases the overall seasonality.

When it comes to the hypothesis – that a better understanding of seasonal phenomena can contribute to resilience in islands – an even more detailed knowledge about the seasonality of extractivism, crops, cultural manifestations, tourism statistics, and their relations to space could provide a solid basis for achieving the resilience-building. These aspects help to organize complex interconnections and guide the landscape design. The projection has also prompted the insight that seasonal jobs might be fine instead of a formal conventional idea of permanent employment. The seasonal focus has provided the essential content for this projection, which demonstrates the potential to achieve a number of resilience goals. The strategy is applicable in other parts of the island.

9.3.6 Reflection (Transformative potential III)

Each projection has included a critical reflection with respect to island spatiality, resilience contributions, and the role of seasonality. To close the case, I have discussed the transformative potential of the approach, that is, the contribution of the case study to transformation towards resilience in islands.

9.3.6.1 Translating resilience into spatial measures in islands

The spatial interventions with a seasonal focus contribute to various resilience principles in each projection. Even if disaster risk is considered low on Itaparica, the interventions are in line with the Priority 3 of the Sendai Framework, "Investing in disaster-risk reduction for resilience" (UNISDR 2015). I have applied a twofold approach: on one hand, affecting drivers of disturbance and reducing stress (e.g., removing seasonal homes), and, on the other hand, addressing the resilience capacities of a system (e.g., flood absorption capacity, livelihood options). The mainland approaches to building resilience – blue-green infrastructure, other ecosystem-based adaptation measures, and seasonal livelihood programming – are sensitive here to the specific island context and seasons.

The projections shed light on resilience trade-offs on Itaparica: While tourism causes environmental stress, it contributes to the resilience of the local population through income opportunities. Flooding is a disturbance in settlements but necessary for biodiversity. Nature conservation is central to resilience-building but might conflict with the needs and interests of the local population for livelihoods, housing, and tourism. This is a typical dilemma in small island developing states (Baldacchino and Kelman 2014; Kelman 2018). In response, the projections bring forth viable new synergies and achieve multiple goals of resilience-building. This owes to the integrative approach of designing urban landscapes, and the focus on seasonality that enabled a cross-sectoral understanding of interlinked phenomena. To operationalizing any strategies, a more differentiated understanding of socio-spatial constellations in the settlements, in terms of permanent versus seasonal, old residents versus newcomers, and so on, and their resilience practices is necessary. The major challenge is the uncertainty of future dynamics. I claim that, in this case study, it is best handled with the idea of using seasons as an opportunistic time-space for experimentation.

9.3.6.2 On seasonality and transformative potential

The projections integrate seasonal phenomena in various ways. One takes the seasonal disturbance of flooding as a starting point, while others address current resilience deficits and explore how and which seasonal phenomena can contribute to the situation (livelihoods and coastal adaptation). Seasonality has thus provided a lens that has contributed to idea-generation in terms of discovering "new" phenomena and establishing new connections: For example, without a seasonal focus, I might not have come to think of the blue land crabs or temporally vacant lots. These findings (see also 9.2.3) have enriched the outcomes.

Throughout the projective process, I questioned whether I addressed the "right" hazards when there was no disaster, and whether the chosen seasonal phenomena were relevant and proposed interventions necessary: Seasonal disturbances seem less risky than unexpected, major one-time hazards. In the livelihood and flood projections, another critical question emerged about the usefulness of the approach: I speculated that I would have come up with a similar focus and interventions even without the seasonal lens – and I postulate that so would have many other designers/planners. I observed that the design processes tended to slide out of the scope of seasonality. I do not believe that seasonality (alone) provides the best insights to address the serious threat of coastal erosion on Itaparica. This point highlights the complexity of the topic, and the relevance of looking at phenomena connected in multiple temporal and spatial scales.

To find out what the added value of seasonality is for increasing resilience, the approach combines an idealistic curiosity for experimenting with seasonal phenomena with the urgency of climate change adaptation and disaster-risk reduction. In Janssen's conception, both "affirmative" design with existing paradigms and critical-utopian "projectivity [...] beyond perceived reality" are needed to develop the living environment (2012:209–10; see also 5.2). I postulate that it is exactly when the island is not used to powerful hazards and does not expect them that they may turn into disasters. In response, I have highlighted my proposition above about the seasons as a rehearsal: In the projections, seasons are a recurring space of options. They provide a temporal pocket (space) of experimentation and reversibility. Whether livelihoods, flooding, new public spaces, or the tidal dynamic, in one season, one could test safe-to-fail elements and adapt them in the next season. With regard to resilience, seasonal dynamics thus entail the option of reverting and changing direction. This is an important insight for transformation that would not have come about without the focus on seasonality.

Through the seasonal-based interventions, transformation is not expected to be immediately groundbreaking. Most projections do not introduce totally novel systems. However, they change spatial processes on the island, identify niches, and bring forward different levels of transformation: The coastal projection transforms vast zones of seasonal occupation. The flood projection introduces multiple new functions while reshaping the seasonal wetland system. By incorporating new (and old) practices, seasonal livelihood development works incrementally with social change and might thus have the most durable impact on increasing resilience. At different scales, all projections incentivize a shift towards redundancy. Seasonality also provides entry points to learning and participation, which are aspects emphasized in social-ecological resilience and transformative research (chapter 1).

To conclude on the transformative potential of integrating seasonal phenomena into resilience-building:

- It led to discovery of niches and new connections in the urban island landscape.
- It contributed to multiple resilience principles and to Sendai Framework Priority 3, and it demonstrated an application opportunity for seasonal livelihood programming.
- It showed potential to catalyze incremental change on different spatial scales.
- It led to the insight of seasons as a space for experimentation and learning.

I finish with new research questions and hypotheses that I consider crucial or insightful for research through design and transformation: Can (natural) seasons be appraised as a quality that connects people to their environment and natural dynamics? Livelihood and tourism diversification is adaptation and builds resilience, but is it a transformative strategy? Based on seasonal flooding, income shortages, and storms on Itaparica, I postulate that a recurring disturbance that is not disastrous might encourage self-organization and learning in communities, thus contributing to their adaptation. However, on the other hand, it also might only reproduce a coping mechanism to get over each individual event without preparedness for bigger change or extreme situations. Is disturbance required for transformation?

V. CONCLUDING

10. Seasonal landscape strategies for resilient transformation

Departing from the need to develop new design and planning approaches to island urbanization and resilience, this thesis has explored seasonal phenomena on Sylt (Germany), Malta (Malta), and Itaparica (Brazil). The first section contextualizes the research topic alongside the concept of the Anthropocene and transformative research (chapter 1). I have elaborated the hypothesis that **understanding seasonal phenomena and integrating them into designing urban landscapes can contribute to resilience-building in islands** (chapter 2). The second section has established the thesis headline "Dynamic Urban Islands": I have illustrated specific dynamics of the Anthropocene in island spatiality (chapter 3) and outlined key strategies, resources, and resilience principles for islands (chapter 4). To conduct practice-oriented research, I have introduced Research through Design and case study, underpinning the role of case choice in landscape architecture and the transformative characteristics of Research through Design (chapter 5). Drawing from this background research, the fourth section has tested the hypothesis by developing a design approach in case studies (chapters 6–10).

The thesis presents unique island-specific findings and application-oriented insights for design and planning, and resilience-building in islands. This concluding chapter elaborates on the contributions. The first subchapter proceeds from the more theoretical overview to the two research questions, presenting results from the case studies. Their systemic comparison is not relevant because of the cumulatively developed approach, but I highlight central insights from reviewing the three islands together. The second subchapter critically discusses the approach developed and its transformative potential. A final outlook reflects transferability of the research and raises topics and questions for further research.

10.1. Results: Integrating seasonal phenomena into building resilience in islands

10.1.1 Discovering dynamic urban islands

10.1.1.1 Flagships of the Anthropocene

The first findings illustrate processes and spatial characteristics of small urbanizing islands. I conceptualized Dynamic Urban Islands as the outcome of islandness, forces of the Anthropocene, and resilience. I made the point that island urbanization is a flagship of the Anthropocene, because hardly anywhere else are the traits of planetary dynamics so tangible. Of course, not all islands witness such developments differentiated in chapter 3 and by Larjosto (2018). In this thesis, Itaparica called into question the "one-worlder" idea of the Anthropocene (Escobar 2016), because the associated spatial phenomena or planetary signs are not striking. Nonetheless, my investigation shows how the island has entered the insular "problem space" of the Anthropocene (Moore 2015), characterized by contradictions of sustainability rhetoric versus spatial development. These points suggest that island studies may enrich the Eurocentric debate and ideas about the Anthropocene.

10.1.1.2 Density is not urban, urban is not density

Having looked at small islands in their entirety as urban landscapes, as urban entities, I did not aspire to (re)define urbanity but rather to renew the way of looking at islands. The further I investigated urban islands and thought about the working definition, the more I came to question some of the initial indicators, such as density (chapter 3.3), chosen to orient the study. For example, starting from the extremes, I would not claim as urban the ultra-dense fishing communities of Ilet a Brouee in Haiti (MacGregor 2017), Santa Cruz del Islote in Colombia, or Fadiouth in Senegal. There, islandness, rather than urbanization, produces density. The opposite is sparsely inhabited islands (like Iceland or Sal in Cabo Verde) with populations and tourism highly reliant on global urban dynamics. When it comes to the case studies, Malta is quite obviously urban, whether measured in population and built density or import dependency and global networks. The high proportion of protected landscapes on Sylt and, in particular, the practiced livelihoods in Itaparica provide nuances to the discussion on urbanity. Although I have illustrated some typical spatial forms of island urbanization (chapter 3), I argue that they should be considered along local parameters and understandings rather than being compared with mainland. For example, the tidal space of *maré* (see Ch. 9.1) is a very island-specific notion of space. A consideration of the attributes of coastality, boundedness, smallness, and the consequent fragmentation, proxmity, density, and interconnectedness of island systems has informed the case studies.

10.1.2 Spatial dimensions of seasonality on islands

Q1 How are seasonal phenomena linked with spatial transformation on islands?

10.1.2.1 Discovered seasonal phenomena and nested timescales

As expected, the three case studies show a spectrum of seasonal phenomena. In each island, I discovered over ten seasonalities with spatial impacts. Tourism and the beach season as well as a respective off-season exist in all of the islands studied; so do migratory birds, cultural/religious events, and different forms of fishing and seafood harvest. Groundwater recharge and temporary wetland habitats are part of each island's seasonal landscape. Common seasonal disturbances or stresses include storm tides, flooding, and heat waves. In addition, island-specific phenomena, from salt production to setting fires, relate to climate, geography, culture, and socio-economic context. Many seasonal phenomena affect each other: Some forms intensify, attract, or exclude one another. For example, tourism increases demand for seafood, and hunting menaces bird migration (in Malta). I assume that all of the phenomena listed can occur on other islands and mainland, and I return to this point when discussing transferability (10.2.5). What draws attention in the island spaces studied is their volumes, combinations, and spatial concentration.

Although the focus was on seasonality, a central observation concerns the **nested timescales** and coupled impacts of seasonal phenomena with shorter cycles, such as tide, and with long-term stressors or development, such as coastal erosion. Tidal processes are essential for Sylt and Itaparica. In the case of Itaparica, I illustrate how seasonal disturbances accumulate into long-term stressors or with extreme events. From beach umbrellas and vendors to habitat degradation, seasonal phenomena produce both **short-term on/off effects and long-term changes** at the sea-land interface and inland. This raises the question discussed later on, as to which extent changes count as spatial transformation.

10.1.2.2 Spatial dimensions of seasonality

The cases demonstrate that **urban landscapes are shaped in multiple ways by seasonal phenomena:** villas, holiday resorts, camping places, arrival points, tourism facilities, parking fields, bird reserves and soundscapes, scenic landscapes, humans in productive practices and recreating, and storm mitigation. **Spaces also have an impact on the occurrence of seasonal phenomena**, starting with the presence of suitable environments and habitats for swimming, migratory birds, and so on. For example, at Sylt's coastal interface, sedimentation affects reed growth and harvest locations. In Malta and Itaparica, urban development has led to flooding.

In all three islands, **seasonal phenomena concentrate at the sea-land interface.** More variation towards the inland occurs in Malta and Itaparica, while Sylt's narrow shape is entirely coastal. In Itaparica, the coastal concentration of tourism clearly affects spatial transformation and other seasonal phenomena inland. This connects with the observation that (beach) **tourism** – including related phenomena, from swimming and yachting to water consumption and waste peaks – is **the most influential seasonality** that drives spatial transformation in the islands studied. It is particularly palpable in different forms of built development: urban expansion, densification, coastal occupation, verticalization, and extreme gentrification. Besides habitat loss, degradation, and fragmentation, tourist settlements indirectly affect local building patterns, livelihoods or recreation, and hydrology.

The illustrations further make evident that **hydrological processes** and water in the landscape are central for the study of seasonal-spatial relations in islands: annual precipitation patterns, their irregularity, groundwater recharge and uptake peaks, seasonal surface waters and wetland habitats, seasonal contaminants, sedimentation, flood risk, and water scarcity. Ranging from blessings to minor stressors and major disturbances on the islands, many of these aspects are handled in the case studies. Two projections (Malta's valley, see 8.3.2 and Itaparica's flooding, see 9.3.3) address these ubiquitous issues specifically.

10.1.2.4 Transformative potential in seasonal-spatial relations

Besides identifying transformative potential in recurring or critical key elements and resources in the islands' urban landscapes (e.g., the quotidian spaces of Sylt, quarries in Malta, or the sides of the main road on Itaparica), I have traced transformative potential in the seasonal discoveries. I identified key seasonal phenomena or related spaces and intervention opportunities (e.g., oyster farming on Sylt, Malta's dry river valleys, and seasonally vacant lots on Itaparica). I distinguished between **two kinds of seasonalities**: those that can be **manipulated** (e.g., tourism) and those that just **occur** (e.g., rain). The following questions were relevant for all cases: Where and which seasons can be manipulated by temporal intervention? Where can spatial solutions mitigate climatic (occurring) disturbances? Can landscape interventions engender new seasons in the first place, and perhaps ones that contribute to resilience-building? These ideas build a bridge to the design approach. They can be strategically employed in designing urban landscapes, and many of them are substantial for the projections.

10.1.3 Seasonal strategies

Q2 How can seasonal phenomena be integrated into designing urban landscapes to increase resilience in islands?

In a series of projections, I set out to test the hypothesis that understanding seasonal phenomena and integrating them into designing urban landscapes can contribute to resilience-building in islands, and I answer the second research question. The analysis of seasonal-spatial relations and the transformative potentials discovered in the first phase have provided insights about central points of intervention. To orient and evaluate the projections, I identified key resilience principles for islands (chapter 4.3.2): CONNECTIVITY, DIVERSITY, REDUNDANCY/RESOURCEFULNESS (closely linked with diversity), FLEXIBILITY (including multi-functionality and adaptive elements), and REVERSIBILITY. The latter is part of flexibility but deserves a separate mention with respect to seasonality. Specific goals, such as coastal protection, increasing biodiversity, and livelihood security, have been adjusted for each projection. The main result of this research is not only the interventions illustrated in the projections, but also their reflection and the approach developed.

10.1.3.1 Projections

The design approach evolved in a sequence through the case studies. While resilience was not yet an explicit goal in the design studio for Sylt, both analytical and projective student design approaches that incorporate seasonality emerged (7.2.3). They include: a combined mapping and a seasonal diagram; a juxtaposition of parallel peaks (for example, tourism and water consumption); a juxtaposition of the seasonal biodiversity of different land-uses with that of natural dynamics in the salt marsh; an analysis of the spatial patterns of different people, which could also be used projectively; an urban-design strategy based on different layers of time; another strategy programming the island as an interactive outdoor museum that seasonally engages people with key habitats and activities; and coastal landmarks that demonstrate sea level rise for recurring visitors.

In the case of Malta, I elaborated one broad-range projection, “This Is Not a Normal River,” to operate in the dry valley system that integrates multiple seasonal phenomena and landscape types. I produced a toolbox of twenty interventions that contribute to flood-risk reduction, climate adaptation, mitigation of water scarcity, and biodiversity, particularly emphasizing redundancy. They are partly site- and situation-specific, and partly transferable.

On Itaparica, I differentiated thematic foci and strategies in three projections: “Impulses” explores the contribution of seasonal phenomena to long-term eco-system-based coastal adaptation through four interventions. “Flood with Birds” employs seasonally adaptive blue-green infrastructure to reduce urban flood risk while securing a habitat for migratory birds. “New Seasons” builds on programming livelihood and tourism diversification.

10.1.3.2 Key result: Approach and interventions

In the cases of Itaparica and Malta, I first projectively sketched where which resilience principles or measures would be needed. This "resilience-deficit" draft in the form of a plan and section has been, at the same time, an analysis and a design sketch that enables a multi-scalar review. In different projections, I have applied a two-way approach to resilience-building: 1) **reducing or (re) moving a disturbance:** directly addressing seasonal disturbances and stressors, or 2) **developing a system:** addressing the resilience capacities of a system (such as the integral area of a habitat or the flood-absorptive capacity of open space in settled areas) and finding related seasonal phenomena that can be manipulated. Furthermore, **reframing** – for example, thinking about how to make disturbance beneficial, or envisioning novel habitats where they are least expected – was also central for the design process. I thought of anticipated or desired situations for the context of a projection, considering spatial sub-systems, synergies, and alternatives. With resilience goals and the specific space in mind, I then sought and drafted ways to address or employ seasonality in spatial interventions.

The projections demonstrate that, with the means of designing urban landscapes, seasonal phenomena can be integrated into resilience-building in various ways. To spotlight the temporal aspect, the projections develop **different conceptual ways of manipulating seasons**:

- **Extending, dispersing, or diluting** phenomena spatially and temporally (tourism season and seasonal wetland in Itaparica)
- **Leveling peaks** (of water flows with blue-green infrastructure in Malta)
- **Accumulating** multiple seasonal phenomena in one space (converting a recreational park in Malta into a wetland that attracts birds and absorbs flooding)
- **Shifting** uses temporally (a climbing area versus bird reserve in Malta, camping versus tide in Itaparica)
- **Triggering and synchronizing** change of uses or elements in reaction to a seasonal disturbance (structural elements that for example enable access to and evacuation from the canal, and that give way to or indicate flooding in Malta)
- **(Re)moving** periodic disturbances to where they are not a risk (flooding on both Itaparica and Malta)
- **Introducing** new seasons by enabling new uses or function (livelihoods and recreation).

In principle, the projections include three kinds of landscape architectural interventions:

- **Permanent structures** (with multiple possible uses)
- **Elements that adapt seasonally** (partly or entirely reversible)
- **Seasonal events or programming** (uses, ecology, livelihoods)

Three projections handle seasonal resilience trade-offs: Some seasonal phenomena are simultaneously a stress and an opportunity. This is obvious in the case of tourism, which, from an ecological point of view, is mainly harmful, even though its economic importance may be substantial. Periodic flooding not only is a hazard, but also enhances biodiversity or aquifer recharge. Furthermore, I show an application possibility for the Seasonal Livelihood Programming (WFP 2013) that the World Food Programme promotes as a resilience-building strategy, and integrate seasonality with ecosystem-based adaptation. Taking into account the interlinked nature of resilience principles and socio-ecological systems, **all projections accomplish multiple resilience goals.** I expected such an outcome from the integrative approach of designing urban landscapes.

The iterative procedure I developed to answer both the analytical and projective research questions in the island case studies incorporated the following key steps (see also 6.2):

1. Anchoring promising points of visit in time and space according to expected seasonal discoveries (fieldwork preparation).

2. Identifying and mapping seasonal phenomena and practices, and figuring out whether a) spatial transformation is triggered by seasonal dynamics or b) seasonal dynamics are affected by spatial transformation.

3. Identifying conflicts (spatial-temporal and temporal-temporal) and possible synergies or points of manipulation.

4. Identifying resilience-deficit in island scale: listing hazards and mapping risk with focus on seasonal aspects; projectively drafting where which resilience principles are needed.

5. Outlining a design brief: defining resilience goals, resilience of what to what, where, and why, and selecting projection focus.

6. Projecting desirable situations and finding ways to apply resilience principles and address or employ seasonality in spatial interventions and/or through programming of uses.

7. Evaluating how the proposed interventions contribute to resilience, describing possible conflicts or shortcomings, and reflecting the projections with respect to island spatiality and the seasonality hypothesis.

10.2. Discussion: Seasonal landscape strategies for resilient transformation

10.2.1 Contribution to island resilience

Through the choice of cases and the approach, I am contributing to research on island resilience with examples beyond the mostly paradigmatic focus on small island developing states (SIDS) (Kelman 2018). Based on my theoretical background research and spatial investigations, I am advancing the study of island resilience by identifying key resources and principles for resilience-building in islands (chapter 4.3) and showing examples of their application, as well as of ecosystem-based adaptation measures. Part of the projections contribute to Sendai Framework Priority 3, "Investing in disaster-risk reduction for resilience" (UNISDR 2015). In addition to the innovative perspective of seasonality, part of the projections expand focus from the coastal impacts of climate change towards internal stresses and the interiors of island spaces. These aspects are currently highly topical for island studies that deal with resilience (Hofmann and Lübken 2015; Pugh 2018; Ratter 2018).

10.2.2 Methodological reflection: Seasonality as a novel aspect in designing

The validity of the results is related to the case choice. In chapter 5.4.2, I argue that factors that are generally considered biases in case selection (intuition, familiarity, and logistical or pragmatic considerations) are methodologically beneficial for landscape architectural Research through Design. One may ask if the low number and seemingly biased choice of cases could undermine the validity or transferability of the results. However, a low number of cases enables deeper understanding (Flyvbjerg 2004). As the results show, the cases have also successfully served the proposition of testing an idea in different conditions in order to produce a spectrum of results and to develop a transferable approach.

10.2.2.1 Studying a temporal phenomenon

As part of the results, I developed the iterative procedure listed above (10.1.3.2) and detailed in chapter 6.2. The key point – unusual yet applicable in other design processes – is the explicit and consistent incorporation of a particular temporal dimension. Based on general considerations and a landscape architectural perspective, I underline four methodical points about studying seasonality. First of all, **timing** of field work is important: Departing to unfamiliar territories, there is an insecurity about whether it is the right time or right weather to observe seasonal phenomena – whether an observed phenomenon is typical of that season, or just a coincidence or anomaly. Secondly, **duration** of field research and of the whole research project is central for estimating and monitoring seasonal patterns. As the time frame and personnel of an individual doctoral research project is limited, the analysis of spatial-seasonal relations mainly relies on the practitioner's intuition and common sense. While statistics were available about tourism on Sylt and Malta, configuring spatial dimensions is time-consuming. What seasonalities are to be found and to what extent their spatial dimensions can be traced obviously depend on the research team and availability of a broad spectrum of data.

Thirdly, it is challenging to **illustrate** temporal-spatial dynamics in two-dimensional drawings. Van Dooren (2016) elaborated on the topic in his thesis on representing time in landscape architecture. In this research, visual studies have contributed to insights and the development of the approach in a) the analytical sense of gaining knowledge or understanding a phenomenon, b) the productive sense of testing a hypothesis and projecting and developing ideas, concepts, and spatial visions (designing), and c) communicating the research. The illustrations in this thesis show some innovative starting points for handling seasonal-spatial relations. For example, I developed a mapping combined with a calendar circle, and an abstract diagram where lines represent the complex interactions between seasonal phenomena and spatial transformations, as well as seasonal-seasonal and spatial-spatial interrelations. In the design process, this combination helped to develop both spatially concrete and more abstracted insights about points of intervention, conflicts, and desired paths. Island sections worked well for illustrating the overall system as well as highlighting critical components and relations, and, hence, identifying needs for resilience-building and allocating resilience principles at multiple spatial scales. The illustrations were, and can be, useful for both analytical and projective purposes. However, in this research (and with potential for further development), they only capture one moment in time.

A fourth temporal aspect that relates not only to seasonality and timing of research but also to resilience-building in general is **uncertainty**. The dynamic nature and uncertainty of predictions, hazard, exposure, and system development posed difficulties for defining goals, prioritizing and determining concrete measures and interventions, and positioning and shaping physical elements.

10.2.2.2 Critical discussion

At the outset, I highlighted the critical background that, instead of mainland approaches, there is an evident need to find solutions that are more sensitive to island spatiality (Coccossis 1987; Bass and Dalal-Clayton 1995; Chapman 2011; Fernandes and Pinho 2015). Many of the measures and ideas I have applied in the projections – such as ecosystem-based adaptation, blue-green infrastructure, seasonal livelihood programming – have proven useful for other islands and often for mainland, as in contemporary landscape architecture, climate adaptation, and water management (Sovacool 2012; WFP 2013; Lister 2015; Mycoo and Donovan 2017; Singh 2017). This supports the feasibility of the projections. The innovative contribution of this study is in the new contextualization and application that takes into consideration islandness and seasonal phenomena. The designs are sensitive to the specific features I have discovered in the island spaces, and the focus on seasonality has enriched the designs, as I further elaborate. Handling whole islands as entities was important to recognize interconnected spaces and processes. This also drew attention to the islands' interiors and inland–coast relations. I did not systematically recognize situations where the mainland-born strategies would not be recommendable. However, what distinguishes island situations, such as Malta's, is the lack of space for blue-green infrastructure like wetlands.

Ideally, the projections would have been elaborated in a multi-disciplinary, participatory process that included the seasonal-spatial analysis, and assessment of resilience and defining of goals. For example, data on seasonal housing, ecological modeling, interviews, and hazard simulations would facilitate designing interventions, building synergies, and understanding seasonal dimensions of (disaster) risk. In the first place, statistical accuracy of source data or of the illustrations produced is not critical for developing ideas for this new design approach. A systemic verification of observations or returning to ask experts about their views on the interventions were not part of the process. The Research through Design has served the purpose of testing the hypothesis and answering the research questions, and has entailed the potential to engender discussions. Aware but free from real-world constraints, the projections operate between facts and a **heuristic, exploratory mode of research**. In Janssen's conception, both "affirmative" design with existing paradigms and critical-utopian "projectivity [...] beyond perceived reality" are needed to develop the living environment (Janssens 2012:209–10). Taking her claim further, I postulate that such a combination, carried out in this thesis, facilitates transformation.

I argue that the Research through Design conducted makes a contribution to transformative science (see 1.2 and 6.): It produces **system knowledge** about island spaces, about multiple scales and key resources for resilience-building in islands, about seasonal-spatial relations in the case studies; **target knowledge** about resilience principles for islands, as well as resilience goals and priorities for the case studies of Malta and Itaparica, and landscape visions for all three islands; and **transformation knowledge** about how seasonal phenomena and practices can be integrated into building resilience in the case studies.

10.2.3 The relevance of seasonality

Here, I review the contribution of the seasonal approach to my research. Many times, I have critically asked myself whether or not I would have arrived at the same projection ideas without the seasonal focus – and, if not, in that sense, would seasonality have just been something unnecessary. These thoughts stemmed from the feeling that I was not addressing the most critical hazards, which might be a disadvantage if resilience-building were solely needed for disaster-risk reduction. However, as the approach matured, I could see a number of central contributions in the case studies. Indeed, I doubt whether I could have falsified the hypothesis (arriving at the conclusion that seasonality could not contribute to resilience). Summarizing the evaluation and reflection from Malta and Itaparica, **the following outcomes of the projections confirm the original hypothesis and furthermore demonstrate the transformative potential of the approach:**

First of all, understanding and integrating seasonality into a design approach led to discovering important foci and related phenomena, as well as niches and new connections in the urban island landscape: For example, without a seasonal focus, I might not have come to think of crabs or temporally vacant buildings and lots. The focus on seasonality not only generated a multi-sectoral overview that has revealed synergies and conflicts, but also contributed to understanding who is at risk where and when. The projections contribute to broadly accepted resilience guidelines, as shown in 10.1.3. Incorporating seasonality into projections enhanced spatial qualities with, for example, multiple or new functions, and desired resilience characteristics. Testing the approach led to the insight of seasons being a space for developing safe-to-fail mindsets and practices for experimentation and learning. These are important aspects for operationalizing socio-ecological resilience and catalyzing transformation. One potential weakness therein is that seasonal interventions with intervals of passivity might not encourage continuity and maturing (Allen 2018) of resilient practices. However, I postulate that the proposed interventions can catalyze incremental change in different spatial scales. As I expected, **seasonality provided a lens that contributed to idea-generation and operationalization.** With the benefits and limitations described above, **I consider seasonality a promising, complementary approach to resilience-building** in islands. I later discuss transferability to mainland contexts.

10.2.4 Transformative potential

As the subtitle of this thesis implies, the research presented involves transformation. Transformative research seeks societally relevant, integrative, context-specific, and application-oriented contributions to deep societal change. It is transdisciplinary and participatory, and aims to produce system, target, and transformation knowledge in order to catalyze change. I position Research through Design as transformative, because it incorporates analogous characteristics (chapter 5.2). Against this background, I see the contribution of my research as having transformative potential – as something that may or may not be realized. The projections in this thesis have not been implemented but provide substance for discourse by showing alternative futures and strategies.

Transformative impacts can only be measured after the fact. I have evaluated the potential effect of the projections against resilience goals and principles and by speculating longevity or depth of change. While I argue that the projections could catalyze change towards resilience, the question arose as to *how* transformative they are. Could the proposed interventions promote thorough, systemic change in landscape or society? I have mentioned that not all design is transformative, for example, renewing outdoor furniture of a square in a way that does not enable new practices or ecological processes. However, as contemporary landscape design already incorporates transformative characteristics, and for example, eco-social innovations, the question of what distinguishes regular design from transformative design remains to be discussed. Projecting engendered the meta-level speculation as to whether (allowing) disturbance or disaster is a prerequisite of transformation, like some texts from the field of social-ecological resilience have suggested (Folke et al. 2010; Birkmann et al. 2013), or whether incremental change can reach sufficient dimensions – which, for example, WBGU (2016:6) has regarded as inadequate for the Great Transformation. In social-ecological systems, transformation in a subsystem can contribute to resilience at a wider scale (Folke et al. 2010). Presupposing seasonality as a reoccurrence, my Research through Design proposes interventions in a framing that speaks for incremental change. Irregularity of climate seasonality and a discontinuity of activities are factors of uncertainty. Further research could also elaborate under which conditions the transformative potential could be implemented.

Although the transdisciplinary mode of research is only theoretically present, I conclude that the approach in this thesis demonstrates transformative potential because it is societally relevant, solution-oriented, integrative, and projective, and it provides applicable, transferable knowledge for functional change, that is, transformation towards resilience.

10.2.5 Perspectives

10.2.5.1 Transferability to design and planning

To conclude, I consider the transferability of the results, particularly the projective resilience-building approach that incorporates seasonality. I have shown above that, in the selected cases, integrating seasonal phenomena can make contributions to resilience-building in many ways. The diversity of the chosen cases increases the possibility of discovering something transferable (Gerring 2006:98–101). For other islands, the interventions might be very different, but based on the discussion, I postulate that the approach can be meaningful. Furthermore, seasonal phenomena obviously are not limited to islands. They occur on mainland – and so do many challenges of urbanization and climate change. The seasonality perspective and approach should thus not be read as only transferable to other islands, on the one hand. On the other hand, theories highlight that islands are not similar (Baldacchino 2005; Depraetere and

Dahl 2007; Fernandes and Pinho 2015) and that designs are unique because they are contextual (Prominski 2004), which calls into question the whole idea of transferability. I argue that the ways presented to incorporate seasonal phenomena are **focused and site-specific, yet flexible** for further development and adjustments, which enhances transferability to other locations.

When adapted to real-world design and planning, one practicability concern may be the lengthy process of understanding seasonal-spatial relations, complex interconnections of systems, and their association with resilience. In this pursuit, the availability of spatial data and expert know-how about making use of multiple sources are important factors. Transdisciplinary collaboration and participatory processes are elemental to identifying problems and co-creating solutions in pilot projects.

Seasonal phenomena might not be the most significant temporal dynamic everywhere in social-ecological functioning or disturbances, but their meaningfulness can be evaluated in resilience-building processes. It is essential to conduct proper risk assessments and review multiple timescales to understand the coupled impacts of periodical disturbances and long-term stressors or one-time major hazards. In design or planning, seasonality can be a complementary focus. Adopting the approach of this thesis and adapting it to unique locations can engender valuable insights about resilience-building in urban islands and beyond.

10.2.5.2 Further research on the seasonal dimension of resilience

Drawing on the findings, I consider **seasonal patterns of exposure and vulnerability** very important, as visitors and tourist peaks multiply populations in hazard-prone locations, and they might not be aware of nor prepared for disasters. With regard to global trends, this may be of major relevance for operationalizing resilience: Despite the declining seasonality of some of the phenomena described, international tourism is expected to drastically increase in the coming years (UNWTO 2017). Population and urbanization trends in the Caribbean and Pacific islands are dramatic (Mycoo and Donovan 2017), and the powerful impacts of climate change – including irregularity of seasonal patterns – are not limited to small island developing states (Hoegh-Guldberg et al. 2018). Furthermore, investigations into seasonal variation of resilience trade-offs (a single phenomenon as benefit versus stress throughout a cycle) can be insightful. Developing indicators for measuring the impacts of resilience-building or transformation is a field for further research in general.

Finally, further development of and experimentation with **means of illustration** – such as the seasonal-spatial diagram or the multi-scalar resilience-deficit section presented – could be central for advancing the approach presented. Mappings and diagrams complemented with video and experimental combinations of analogue techniques, photography, geospatial data, and digital modeling can improve understanding of temporal-spatial relations, engender insights, and help to find ways of handling prospective scenarios and uncertain dynamics.

10.2.5.3 Further research on operating in island spatiality in the Anthropocene

In this thesis, I have conceptualized Dynamic Urban Islands as the outcome of islandness, forces of the Anthropocene, and resilience. These three aspects are undergoing change, and ongoing research and procedures are necessary for maintaining, renewing, and building resilience. Island spatiality has been highlighted with excellent potential for studying new relationships between humans and nature in the Anthropocene (Vitousek and Chadwick 2013; Larjosto 2018; Pugh 2018). I suggest that islands can provide key insights for further investigation into novel urban habitats (whether seasonal or not) and flexible, time-layered open spaces that contribute to biodiversity in limited, fragmented, and densifying spaces. Two central lessons for design and planning have emerged from this research on islands: **handling nested temporal and spatial scales, and treating whole islands as entities** including their interiors. I recommend further research on what needs to be adjusted when mainland approaches to resilience-building and urban or landscape design are used in island spaces. Here, concepts of islandness and island spatiality (e.g., Fernandes and Pinho 2015; see also Larjosto 2018) and developing them in further studies could be meaningful.

10.3. Outlook

An optimistic curiosity to handle transformations in bounded island spaces sparked this exploratory study. Besides *where* and *how*, the question *when* proved to be insightful for developing landscape strategies. Seasonality can be a fathomable timescale between long-term processes and ephemeral phenomena. Yet, visiting an island, it sometimes remained unclear whether I was experiencing a season or an irregularity, a coincidence or permanence. By uncovering seasonal phenomena in islands, spatial insights, poetic ideas, and experimental manipulations emerged. During this exploration, seasonality grew from a seemingly banal topic to a highly meaningful dimension for resilience and designing urban landscapes in islands.

It is uncertain how seasonality transforms in the face of climate change or the social trends of the Anthropocene. Irregularities may shift the relevance of the findings presented, but I do not believe that seasonal phenomena will completely disappear from the world of islands. Neither do islands disappear with sea-level rise. As this thesis shows, islands also offer multiple other aspects to think ahead about. Remaining optimistic, I propose inspiration for future island studies and design approaches.

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Appendix A

A list of urban islands and possible case studies compiled during the research.

	Island	Population	Area km2	Density	% urban	Other reasons and notes
1	Abu Dhabi	1500000	70	21429	(100)	Island city relation to mainland, built archipelago in the desert
2	Anguilla	15000	91	165	100	Luxury, tax haven, super fragmented land use
3	Anjouan (Ndzuwani, The Comoros)	340000	424	802		Not really urban despite density: an ylang ylang plantation
4	Antigua	80161	281	285		Super sprawled
5	Arrousa	4950	7	707		
6	Aruba	109000	140	779		
7	Atlantic City	40000	53	755		
8	Bahrain	1470000	765	1922		New islands
9	Banjul island	34800	12	2900		Erosion + sea level rise -> sinking
10	Barbados	280000	440	636		
11	Batam	1153000	715	1613		Industrial production
12	Bermuda	67500	54	1250		
13	Bonaire	18900	294	64	100	
14	Cadiz	124000	2	62000		
15	Capri	13000	10	1300		
16	Cheung Chau	22750	2,5	9100		
17	Chongming	615000	1411	436		Shanghai's reach?
18	Curacao	155000	444	349	100	
19	Diego Garcia	4239	27	157	(100)	Military base and reserve: imports everything, exports waste
20	Ebeye (Marshall Islands)	15000	0,36	41667		
21	Governador	215000	36	5972		
22	Gran Canaria	830000	1560	532		
23	Grand Cayman	52600	197	267	100	Growth rate, tax haven, very high standard of living
24	Grand Turk (TCI)	3720	18	207	92 (TCI)	
25	Guam	165000	544	303	94,5	US military bases 29%land area, Super rich tourism, army suburbs
26	Guernsey	65850	64	1029		
27	Helgoland	1356	1,7	798		
28	Hong Kong Island	1300000	80	16250		
29	Hulhumale (Maldives)	30000	2	15000		
30	Ibiza	117000	572	205		The iconic party island
31	Iceland	332529	103000	3	94	Limited ground (glaciers), the Anthropocene
32	Ile de Re	34000	85	400		Seasonal population 130000

	Island	Population	Area km2	Density	% urban	Other reasons and notes
33	Ischia	62000	46	1348		
34	Itaparica	55000	146	377	96 (sedur 2014)	Seasonal population from Salvador
35	Jersey	99000	118	839		
36	Karimun	272985	115	2374		Extensive granite and sand extraction to Singapore
37	Kinmen	128000	153	837		
38	Kotlin	43000	16	2688		
39	Labuan	100000	91	1099		
40	Liuqiu	12675	7	1811		
41	Long island	7000000	3600	1944		
42	Macau	83000	21	3952		
43	Madeira	270000	800	338		Tourism and risk profile
44	Mahe (Seychelles)	80000	155	516		
45	Majuro (Marshall Islands)	30000	9,7	3093		
46	Malé	153000	6	25500		
47	Maldives	349000	298	1171		As an archipelagic collection
48	Mallorca	846000	3624	233		The mass tourism island
49	Malta	409000	246	1663		
50	Manhattan	1600000	60	26667		
51	Margarita Island (Venezuela)	436000	1020	427		sprawl (but no international airport)
52	Mauritius	1263000	2000	632		
53	Mayotte	213000	374	570		
54	Mocambique Island	55000	2	27500		
55	Nauru	11000	21	524		
56	New Providence	250000	207	1208		
57	Oahu (Honolulu)	976000	1550	630		
58	Okinawa	1400000	1206	1161		
59	Pag	8400	284	30		“the new Ibiza”, only rocks
60	Pamandzi (Mayotte)	9900	4,3	2302		Mayotte’s airport island
61	Paqueta	4000	1,7	2353		
62	Penang	860000	305	2820		
63	Penghu	70200	64	1097		
64	Phuket	386605	543	712		Highest population growth rate in Thailand; +6 million passengers
65	Pingtan	400000	371	1078		
66	Port Gentil (Mandji)	136462	200	682	(100)	Practically an island; sinking, the most expensive city in the world
67	Proscida	10500	4,2	2500		

	Island	Population	Area km2	Density	% urban	Other reasons and notes
68	Providenciales (TCI)	24000	98	245	92 (TCI total)	Hollywood stars, land use, salt, Canadian tourism
69	Roatán	44657	83	538		Sprawl, ferry, tourism, golf, road network
70	Saint Pierre (et Miquelon)	5456	26	210	92	Canada vs aid economy
71	Saipan (Northern Mariana)	48220	115	419	89 (Northern Mariana)	Exports (ex-sweatshops) & tourism
72	Sal	35000	216	162	65 (Cabo Verde)	Mass tourism resorts on the desert
73	San Andres	67900	26	2612		
74	Sant Croix	50600	215	235	95 (US Virgin Islands)	Land use! Large oil refinery to be closed
75	Santa Catarina	420000	675	622		
76	Santorini	15550	90	173		Furthest from Athens but highest connectivity, tourism, big airport
77	Sao Luis	1380000	1410	979		
78	Sao Vicente	79400	227	350	97 (pt wikipedia) 92 (UN)	
79	Sata Cruz del Islote	1250	0,2	6250		
80	Singapore	5400000	719	7510		
81	Smögen	1440	2	720		
82	St Barthelemy	9000	21	429		Super exclusive
83	St Martin & Sint Maarten	78000	87	897		
84	St Thomas (US Virgin Islands)	50000	80	625	95 (US Virgin Islands)	Super sprawled and luxurious
85	Sylt	21000	99	212		Ultimate gentrification, seasonality
86	Thilafushi (Maldives)	1000	0,7	1429		
87	Tromsöya	33000	22	1500		
88	Unguja (Zanzibar)	897000	1464	613		Rapid touristic expansion
89	Venice	260897	415	629	(100)	Tourism & resilience: Iconic reference
90	Xiamen	1410000	132	10682		
91	Yeongdo	140000	14	10000		
92	Zhoushan	502000	502	1000		