

Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences



Graduation Plan: Urbanism

Submit your Graduation Plan to the Board of Examiners (Examencommissie-BK@tudelft.nl), Mentors and Delegate of the Board of Examiners one week before P2 at the latest.

The graduation plan consists of at least the following data/segments:

Personal information		
Name	Frithasya Jeniardina Purba	
Student number	5991617	

Studio		
Name / Theme	Metropolitan Ecologies of Place	
Main mentor	Steffen Nijhuis	Landscape Architecture
Second mentor	Diego Sepulveda-Carmona	Spatial Planning and Strategy - Urbanism
Argumentation of choice of the studio	<p>Cities are growing, urban areas and settlements are perpetually expanding, while natural resources are continually being exploited to fulfill societal and political demand. Environmental degradation increases, causing the unstoppable loss of biodiversity and soaring our vulnerability towards climate change as a global threat.</p> <p>Within the MEP studio, I aim to explore the approach of addressing ecological issues in a transdisciplinary manner in relation to socioeconomic elements. Fitting on my topic, I want to put focus on regenerative approaches to respond to environmental damage caused by socioeconomic activities and further impacting back the societal and economic perspectives.</p>	

Graduation project	
Title of the graduation project	Reclaiming Mangroves of Balikpapan Bay: Designing Socio-Spatial Strategies Towards Regenerative Landscape
Goal	
Location:	Balikpapan Bay, Kalimantan, Indonesia
The posed problem:	<p>Wetlands are among the world's most vital ecosystems, covering only 6% of the earth's land surface yet supporting 40% of its plant and animal species (Nations, n.d.). Mangroves, as a wetland ecosystem, serve as natural defences against both coastal storms from offshore and erosion caused by sedimentation from the land. They provide critical habitats for diverse marine and terrestrial species, acting as nurseries and feeding grounds. Mangroves also play a vital role as the global blue carbon sinks, storing four times more carbon than terrestrial forests (Rani et al., 2023). For centuries, they have offered productive ecosystem services to humans, serving as economic resources for fishermen, popular tourism destinations, and sacred sites for indigenous communities. While both indigenous groups and modern societies view nature as a source of life, indigenous people have traditionally respected and protected it, whereas modern society often exploits it through urban expansion and infrastructure projects, placing less prioritisation on conservation.</p>

	<p>Indonesia is home to over 20% of the world's mangroves. However, prioritising economic growth has led the country to lose 6,500 hectares of mangrove forests annually (Bunting et al., 2018). The primary driver is land conversion to meet the socio-economic demands of urban expansion, industry, aquaculture and plantations, leading to widespread environmental degradation. Over the past five years, the Indonesian government's plan to build a new capital city on Borneo Island has further amplified the environmental impact, where it could have served as an opportunity to pioneer a more sustainable and socially inclusive urban development model.</p> <p>In Balikpapan Bay, which has been designated as one of the nature reserves within the new capital's development zone, water quality has deteriorated due to nearby industrial and urban activities. The degrading mangrove forests are losing their water filtration ability, resulting in biodiversity loss, including endangered species like the proboscis monkey and Irrawaddy dolphin (Baraputri, 2022). The coastal population loses houses from flood and abrasion, fishermen communities face threats to their livelihoods, and indigenous groups primarily lose their once-sacred lands. Ecologically, deforestation of the mangrove forests promotes carbon release into the atmosphere and exacerbates climate change. Further, it has reduced the region's ability to adapt to climate change, increasing vulnerability to coastal flooding and abrasion, risking infrastructure and leading to significant economic losses.</p> <p>This situation calls for urgent action to regenerate the mangrove forests of the Balikpapan Bay area, intending to foster a healthy ecosystem through landscape-based approaches that strengthen and support socioecological resilience in the face of climate change. Strategy exploration of taking ecological rehabilitation into urban planning and design will be addressed through the lens of regenerative development that integrates ecosystem-based adaptation and adaptive capacity. The project aims to develop a spatial landscape framework to restore the damaged environment, counterbalance the economic needs, and guide future urban developments.</p>
Research questions:	<p>Main research question: What landscape-based spatial strategies can be applied to the coastal ecosystems of mangroves in the Balikpapan Bay region to catalyse social-ecological resilience?</p> <p>Sub-Research Question 1: What conditions enable mangrove ecosystems to thrive, and how do these reflect the current state of the mangrove ecosystem in Balikpapan Bay?</p> <p>Sub-Research Question 2: How do the challenges of mangrove ecosystem degradation in Balikpapan Bay impact the various actors and stakeholders involved?</p> <p>Sub-Research Question 3: How can regenerative principles address the issues imposed in the Balikpapan Bay region?</p> <p>Sub-Research Question 4: What socio-spatial framework and strategies can be applied to the issues imposed in the Balikpapan Bay region?</p> <p>Sub-Research Question 5: How can these regenerative socio-spatial strategies be put into realisation?</p>
Design assignment in which these result:	

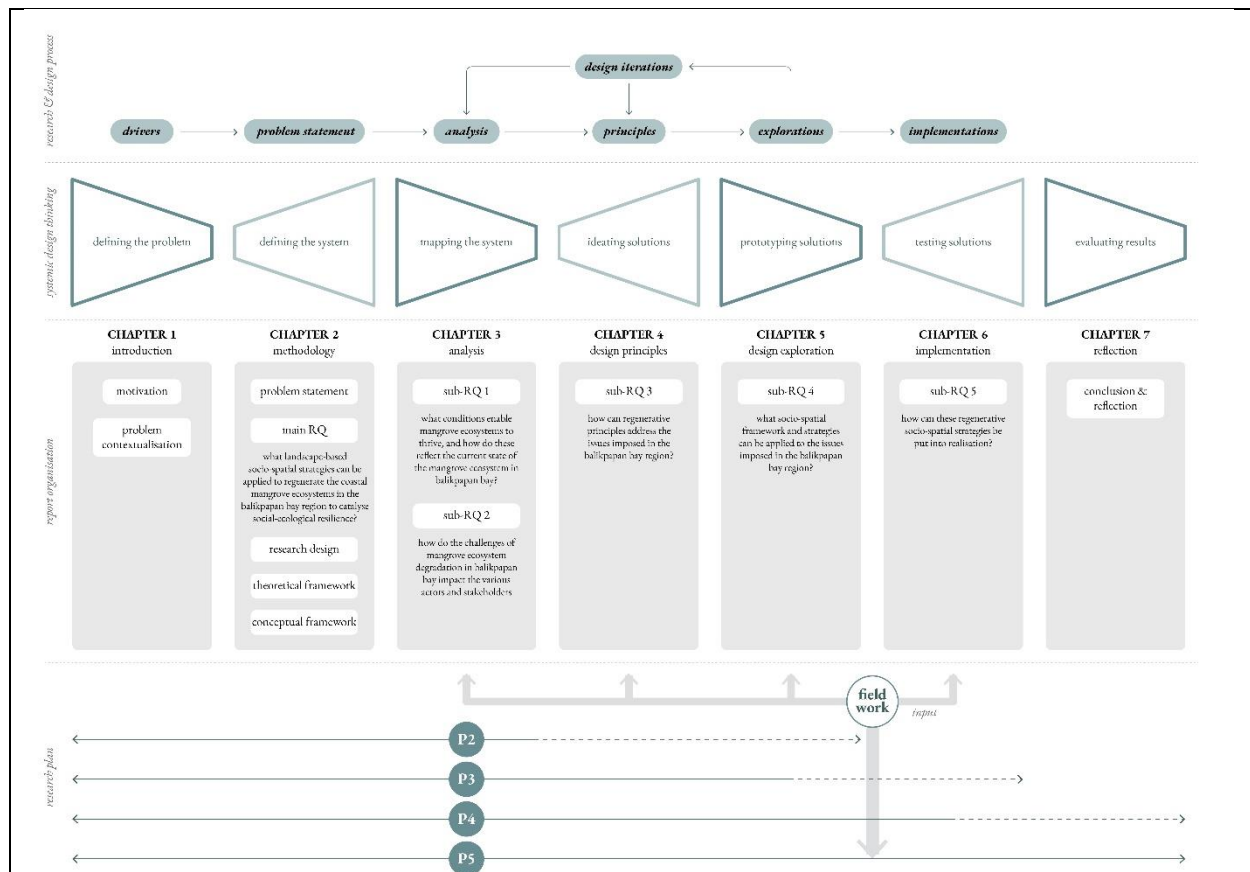


Figure 1. Research organisation diagram

The *research through design* process from Landscape-based Urbanism (Nijhuis, 2022) shapes the research framework. A similar scheme is introduced by Research Development and Design concept called *systemic design thinking* (Ospina, 2019; Roggema, 2022; Wandl, 2024). This research is organised by cross-referencing these two design process schemes. Additionally, until P2, the report will provide the research progress and will consist of Chapter 1 until 5, while Chapter 6 and 7 will be elaborated on in the later process.

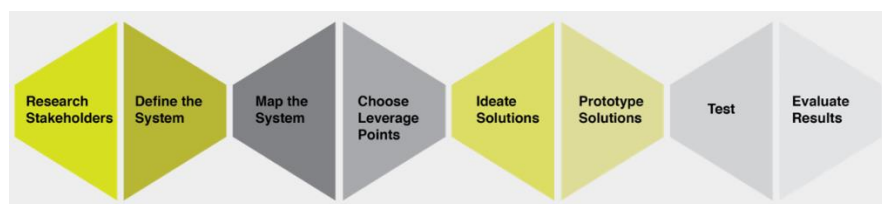


Figure 2. Design process of systemic design thinking (Ospina, 2019; Wandl, 2024)

The P2 report will cover the introduction, methodology, analysis, and initial design processes proposal including design principles and explorations (Chapter 1 – Chapter 5). After P2, fieldwork will commence in which the result from data collection is planned to enrich the analysis and provide the co-creation aspect for the design processes until implementation plans. P3 progress is planned to cover the initial implementation plans, while P4 and P5 presentations will cover the entire research process elements.

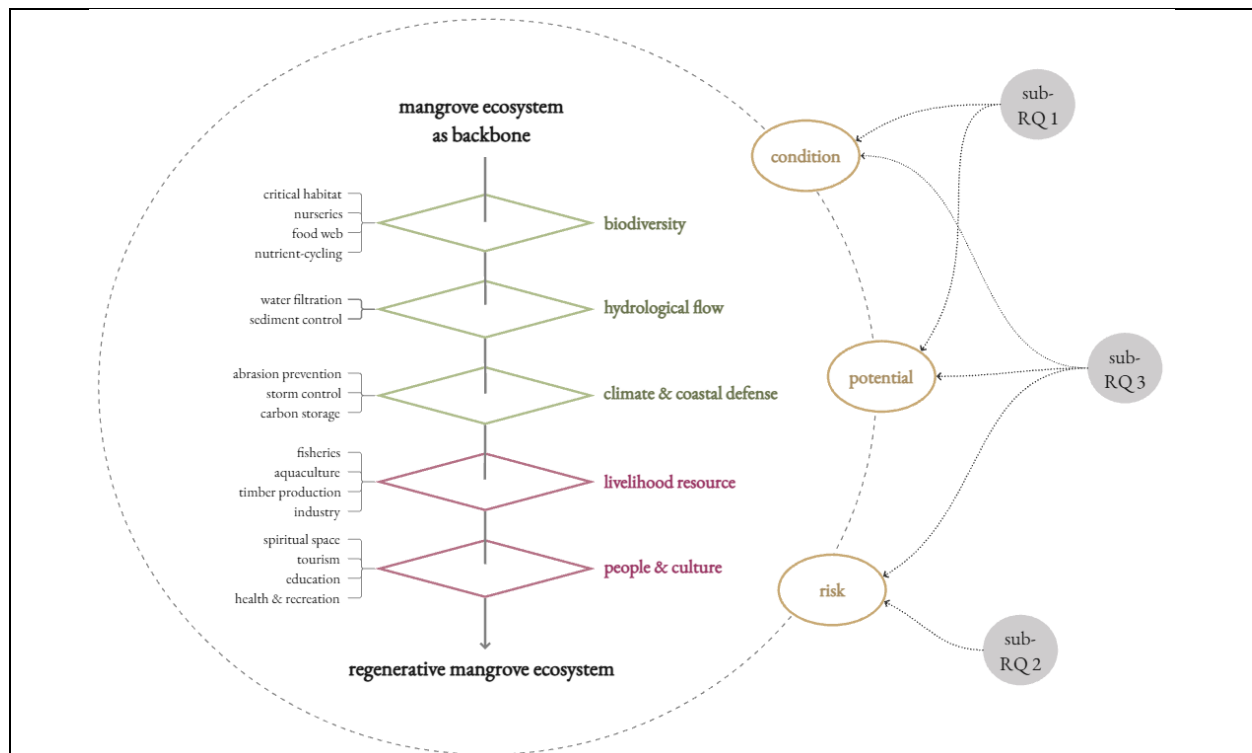


Figure 3. Analytical framework

Landscape-based Urbanism (Nijhuis, 2024) introduced the “layers approach” to understanding the complex and dynamic networks of different sub-systems, including the natural context, human interventions, and culture, organisation, and politics. According to the Ecosystem-based Adaptation concept (IUCN, 2017), the approach utilises biodiversity and ecosystem services to reduce vulnerability and increase resilience when facing climate change. The layers in this framework are formulated as the “layers” context of the issue and the unravelling of the mangrove ecosystem’s biodiversity and ecosystem services. The analytical framework consists of the elements that will provide the base for analysis, and how the aspects support answering the research questions.

Through the research through design framework, following the analysis as a way to understand the urban and landscape complex system, the design processes can start. In this project the processes including generating design principles and creating design prototypes or design elaborations. The detailed method will be explained in the *method description* section below.

Process

Method description

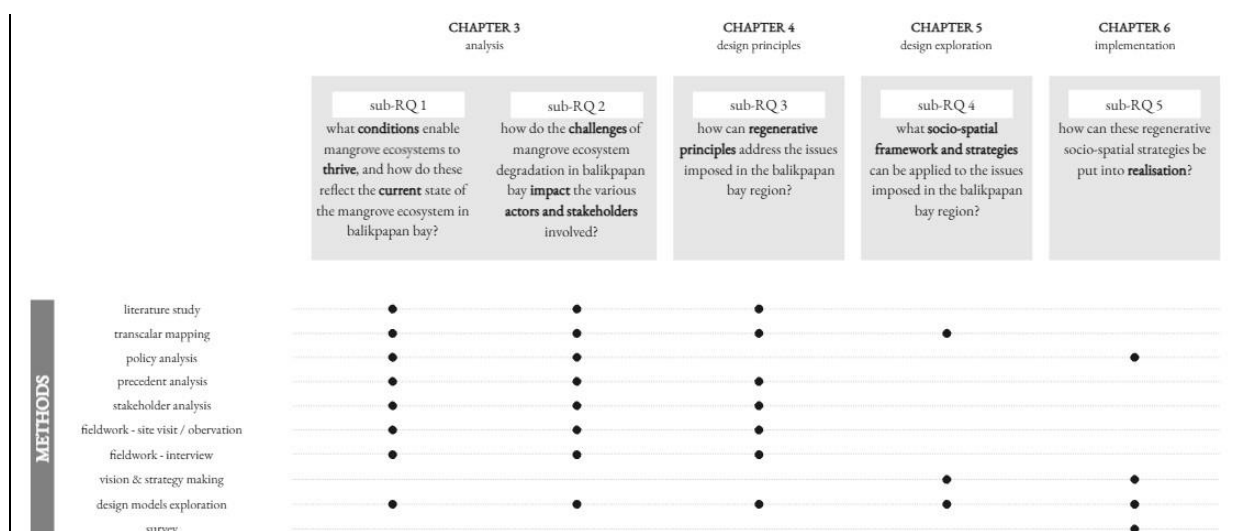


Figure 4. Research methods

The methodology helps put order and organisation in the research. In this project, sets of methods facilitate the process of answering the research questions systemically. This research will examine the interrelationships between human, nature, and their synergies, through the context of the conditions, potentials, and risks; and use the results to build design assignments.

To initially build the research, a **literature study** is vital to set the ground for understanding the issues and the drivers, to put focus based on the context studied, and to support the knowledge-gain for taking the next steps. As a part of the literature study, **precedent analysis** allows the author to reflect on the ideas excerpted from the study and examine what had been applied, how it worked out, and what can be learned from it. **Policy analysis** includes a desk study to acknowledge both limitations and potentials for the project. After generating the results, as part of the implementation process, policy analysis becomes the strategy to reflect on the existing regulations to propose new sets of policies in the project context.

The **survey** method, as a part of the co-creation strategy, will be conducted to complement the implementation process, with the target sample population being the local communities around the project's location. The target audiences will be decided through **stakeholder analysis**, which is vital to answering the research question about impacted actors and stakeholders.

Based on the "layers approach" from Landscape-based Urbanism (Nijhuis, 2024), unpacking the landscape in layers helps to grasp the systems and subsystems and their relationships. These layers are adapted into maps to facilitate visual thinking and communication through **transcalar mapping** to support the analysis and design processes. As a part of the Research through Design process, **vision and strategy formation** entails creating a long-term regional vision based on the knowledge of the human-nature systems by addressing the identified challenges and potentials to envision a desirable future (Nijhuis, 2022). Following the vision, **design models exploration** formulates the adaptation of the strategies into applicable design solutions in local context. It is a powerful research method with which complex spatial challenges can be approached integrally (Nijhuis, 2022) to work across scales.

Fieldwork is an essential part of this research as a means to collect primary data through site visit, observation, and interview, and provides foundation or justification for the collected secondary data. Observation during site visits give understanding of the area through experiences, and can be investigated with sensory experiences, space and scale, system and network, and culture and society observations (Rocco, 2023). The fieldwork trip will be conducted in February 2025 to Kalimantan,

Indonesia. Author will visit Balikpapan Bay and the surrounding area, including Balikpapan city, Samarinda city, Panajam city, and several nature reserve areas and native communities' villages.

Literature and general practical references

Main literatures for the theoretical framework:

- Landscape-based Urbanism

Nijhuis, S. (2022). Landscape-Based Urbanism: Cultivating Urban Landscapes Through Design. In R. Roggema (Ed.), *Design for Regenerative Cities and Landscapes* (pp. 249–277). Springer International Publishing. https://doi.org/10.1007/978-3-030-97023-9_11

Nijhuis, S. (2024). *Landscape Logic*. JAP SAM BOOKS.

- Regenerative Development and Design

Roggema, R. (Ed.). (2022). *Design for Regenerative Cities and Landscapes: Rebalancing Human Impact and Natural Environment*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-97023-9>

Mang, P., & Reed, B. (2012). Designing from place: A regenerative framework and methodology. *Building Research & Information*, 40(1), 23–38. <https://doi.org/10.1080/09613218.2012.621341>

- Ecosystem-based Adaptation

Colls, A., Ash, N., & Ikkala, N. (2009). *Ecosystem-based adaptation: A natural response to climate change*. IUCN.

- Social-ecological Resilience

Wilkinson, C. (2012). Social-ecological resilience: Insights and issues for planning theory. *Planning Theory*, 11(2), 148–169. <https://doi.org/10.1177/1473095211426274>

Literature lists for supporting concepts, mangrove projects, and others:

- Systemic design thinking

Ospina, D. (2019). Beyond Design Thinking: The Systemic Design Thinking Framework. *Medium*. <https://conductal.medium.com/beyond-design-thinking-the-systemic-design-thinking-framework-8d4952271222>

- Research by design

Roggema, R. (2016). Research by Design: Proposition for a Methodological Approach. *Urban Science*, 1(1), 2. <https://doi.org/10.3390/urbansci1010002>

- Mangrove

Saenger, P. (2002). *Mangrove Ecology, Silviculture and Conservation*. Springer Netherlands. <https://doi.org/10.1007/978-94-015-9962-7>

MacKinnon, K. (Ed.). (1997). *The ecology of Kalimantan*. Oxford Univ. Press.

Spalding, M., Kainuma, M., & Collins, L. (2010). *World Atlas of Mangroves*. Washington, DC: Earthscan.

Ellison, A. M., Felson, A. J., & Friess, D. A. (2020). Mangrove Rehabilitation and Restoration as Experimental Adaptive Management. *Frontiers in Marine Science*, 7, 327. <https://doi.org/10.3389/fmars.2020.00327>

Warsidi, & Endayani, S. (2017). Komposisi Vegetasi Mangrove di Teluk Balikpapan Provinsi Kalimantan Timur. *Jurnal AGRIFOR*, XVI(1). <https://doi.org/10.31293/AF.V16I1.2598>

Muhammad Hijri Haydar. (2023). *Jenis-jenis Tumbuhan Mangrove di Teluk Balikpapan dan Delta Mahakam, Kalimantan Timur* [Bachelor's Thesis]. Universitas Gadjah Mada.

Best Practice Guidelines for Mangrove Restoration. (n.d.). The Mangrove Alliance. Retrieved December 18, 2024, from <https://www.mangrovealliance.org/best-practice-guidelines-for-mangrove-restoration/>

Reflection

1. What is the relation between your graduation (project) topic, the studio topic (if applicable), your master track (A,U,BT,LA,MBE), and your master programme (MSc AUBS)?

My graduation project is about mangrove ecosystem regeneration that largely put focus on landscape—with support from my first mentor, Prof. Nijhuis—however as I delve deeper into the topic, I grasped the understanding that natural landscape is inevitably connected with human. It is indeed a topic that fit the Metropolitan Ecologies of Place graduation studio. Later in the theoretical study, it is becoming my main takeaways from the studies: the concept of human-nature relation as a complex and dynamic system. The declining mangrove ecosystem, which caused massive biodiversity loss in Balikpapan Bay was mainly happening due to human activities, including urban expansion and industrial activities. It is even becoming closely linked to my master's track—Urbanism—from the context of the development of Indonesia's new capital city, Nusantara, that currently intensifies the environmental degradation. The landscape-based approach intends to address socio-ecological issues to, eventually, create strategies that aims to reduce impact of climate change and help people, especially the vulnerable groups, adapt to it. Sustainable development, as one of the over-arching topics, is closely related to the MSc AUBS program as one of the foundations of the whole program. This project is also aligned with the Global LDE (Leiden-Delft-Erasmus) project to Nusantara capital.

2. What is the relevance of your graduation work in the larger social, professional and scientific framework.

My graduation project touches upon the relevance of social, professional, and scientific fields. The main issue is ecological, in which the solutions require technical knowledge acquired scientifically with data-based research. In the scientific fields, there are already a lot of projects and papers about mangrove restoration projects; but not with specific site of Balikpapan Bay and topics of integrated socio-ecological approach with pressure from the new capital city development. The societal relevance works closely to the topic; as 50% of mangrove restoration project fails due to lack of monitoring and long-term management measure, this project puts focus on the involvement of people and communities as stewardship. Concerns are also put on indigenous people as one of the most vulnerable groups impacted by socioeconomic development; co-creation with these groups is one of the main methods in this project. It adds the societal value as some parts of mangrove forest in Balikpapan Bay are sacred to the indigenous people. As the project emphasises involvement of people in ecological restoration, collaboration is one of the main plans that will be commenced with various stakeholders. It requires support not only from local people, but also government and local authorities as essential elements especially in Indonesian projects; also different environmental NGOs who put focus on mangroves and wetlands.

Sources:

- Baraputri, V. (2022, September 7). *IKN dan Teluk Balikpapan: Pesut pesisir 'tinggal kenangan' jika tidak diperhatikan nasibnya*. BBC News Indonesia. <https://www.bbc.com/indonesia/indonesia-62722490>
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- Nations, U. (n.d.). *World Wetlands Day*. United Nations; United Nations. Retrieved October 12, 2024, from <https://www.un.org/en/observances/world-wetlands-day>
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- Ospina, D. (2019). Beyond Design Thinking: The Systemic Design Thinking Framework. *Medium*. <https://conductal.medium.com/beyond-design-thinking-the-systemic-design-thinking-framework-8d4952271222>
- Rani, V., Schwing, P. T., Jayachandran, P. R., Preethy, C. M., Sreelekshmi, S., Joseph, P., & Bijoy Nandan, S. (2023). Carbon stocks and sequestration rate in mangroves and its major influencing factors from highly urbanised port city, southern India. *Journal of Environmental Management*, 335, 117542. <https://doi.org/10.1016/j.jenvman.2023.117542>
- Rocco, R. (2023). *Methodology—Observation Techniques* [Course lecture AR2U088 Research and Design Methodology for Urbanism, TU Delft Faculty of Architecture & the Built Environment].
- Roggema, R. (Ed.). (2022). *Design for Regenerative Cities and Landscapes: Rebalancing Human Impact and Natural Environment*. Springer International Publishing. <https://doi.org/10.1007/978-3-030-97023-9>
- Wandl, A. (2024, September 16). *Designing with Flows -Systemic Design* [Lecture for AR3U105 Graduation Orientation].