

An aerial photograph of a rural landscape. The scene is dominated by large, dark brown agricultural fields, likely plowed or in winter. A winding stream or small river flows through the center-right of the image, surrounded by a dense line of trees with yellow and orange autumn foliage. In the upper corners, there are small clusters of buildings, possibly farmhouses or small villages. The lighting is warm, suggesting late afternoon or early morning, with long shadows cast across the fields.

# Systems thinking

What can it give for landscape architecture?



# What are social-ecological systems?

‘Social-ecological systems’ (SES) is an emerging concept for understanding the intertwined nature of human and natural systems in this new, interconnected and interdependent way.

The SES concept developed in the early to mid-1990s through collaboration of scholars working in the interdisciplinary areas of ecological economics and common-pool resource systems (e.g. Berkes 1989; Ostrom 1990; Costanza 1991).

Berkes, F., ed. 1989. *Common Property Resources: Ecology of Community-based Sustainable Development*. London: Belhaven Press.

Ostrom, E. 1990. *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge: Cambridge University Press.

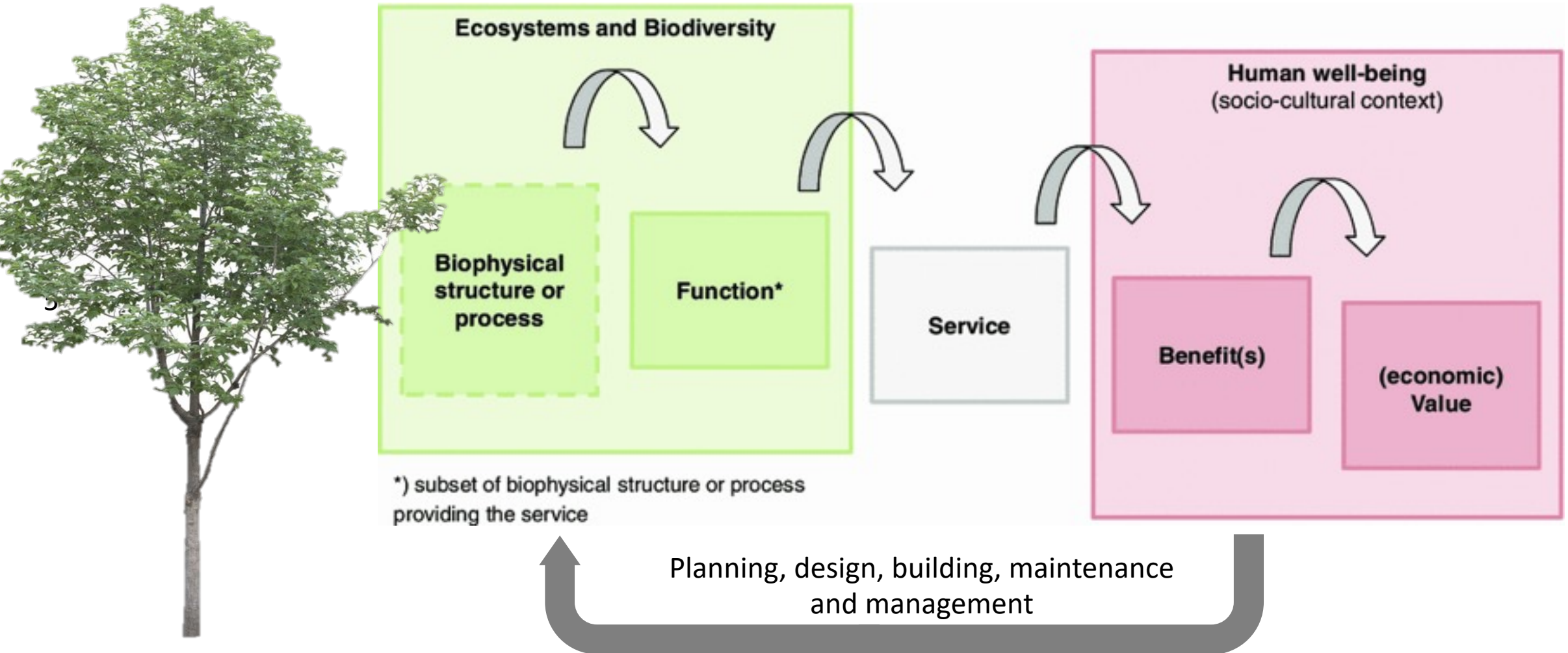
Costanza, R., ed. 1991. *Ecological Economics: The Science and Management of Sustainability*. New York: Columbia University Press.



- Although the Earth itself is a closed system, all systems on Earth are open systems.
  - All systems on Earth are also interdependent, or at least interact with each other. Since all systems on Earth influence other systems, they are in fact parts of one big Earth system.
  - However, since the entire Earth system is far too large and complex to be managed or understood, in practical action we must draw boundaries to the systems we are working with.
- > It is necessary to provide some boundary for systems in order to understand and operate with them. However, **this does not mean that the effects of a system end at the boundary of the system**, or that the responsibility of the designer and user of the system stops at the system boundary.



# Ecosystem services cascade model



# Characters of SES

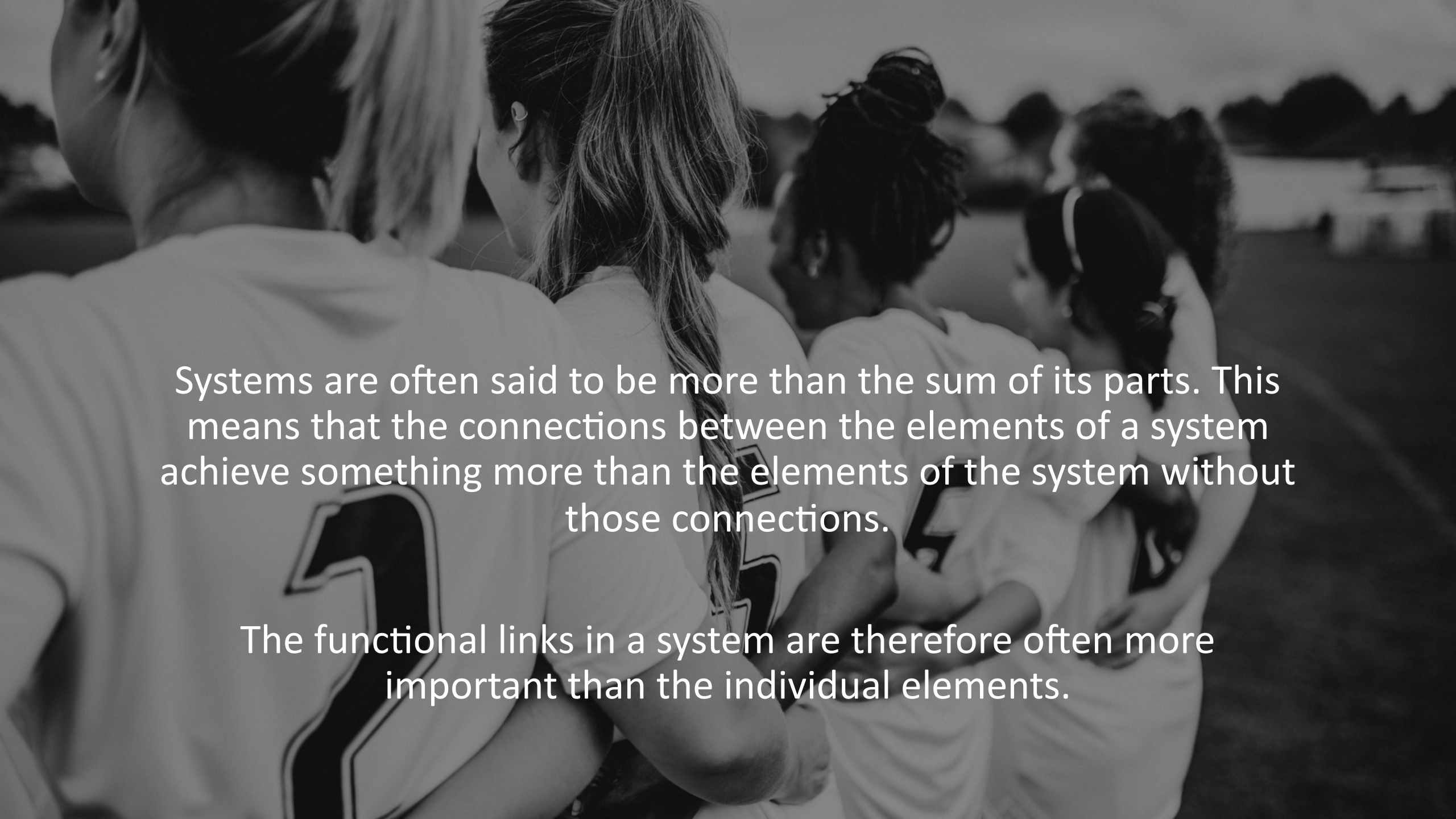
SES have adaptive capacities. The many interrelations in the system create feedback processes that enable an SES to continuously adjust and adapt to changing conditions, brought about either by the system itself or by external forces.

The dynamic interactions within the system are often non-linear, meaning that small changes can lead to large and surprising effects, or vice versa (Levin et al. 2013).

SES do not have clear boundaries and are context dependent.

Levin, S.A., T. Xepapadeas, A-S. Crépin, J. Norberg, A.D. Zeeuw, C. Folke, T. Hughes et al. 2013. 'Social-Ecological Systems as Complex Adaptive Systems: Modeling and Policy Implications.' *En- vironment and Development Economics* 18(2): 111–132. doi:10.1017/S1355770X12000460.



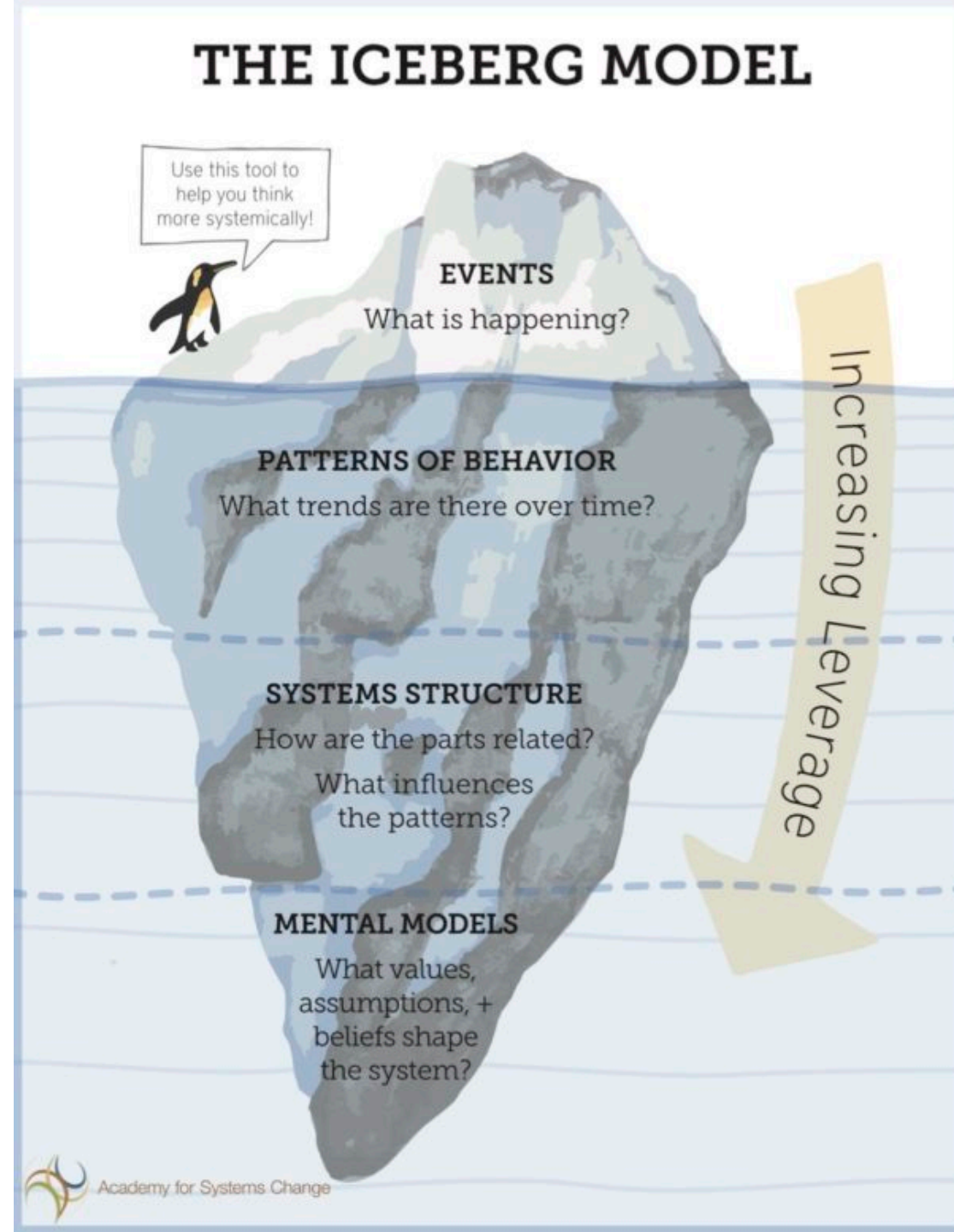


Systems are often said to be more than the sum of its parts. This means that the connections between the elements of a system achieve something more than the elements of the system without those connections.

The functional links in a system are therefore often more important than the individual elements.

# Leverage point

- Leverage points are places within a complex system where a small shift in one thing can produce big changes in everything.
- Leverage points are points of power.
- They are, therefore, of immense interest to anyone seeking to affect change within our interconnected ecological, social and economic systems.





# What new SES approach brings?

People and nature are **interdependent and coevolving**, through multiple interactions or feedbacks.

Human behaviour and individual and social identities are increasingly understood as relationally constructed and coevolving with the biophysical context.

Interactions between human well-being or inequality and ecosystems are increasingly recognised as **dynamic**.

The application of SES research to policy and practice requires collaborations between researchers and practitioners holding multiple types of knowledge, an approach known as **transdisciplinarity** (Mauser et al. 2013; Roux et al. 2017).

Mauser, W., G. Klepper, M. Rice, Bettina, S. Schmalzbauer, H. Hackmann, R. Leemans, and H. Moore. 2013. 'Transdisciplinary Global Change Research: The Co-creation of Knowledge for Sustainability.' *Current Opinion in Environmental Sustainability* 5(3–4): 420–431. doi:10.1016/j.cosust.2013.07.001.

Roux, D.J., J.L. Nel, G. Cundill, and P.O. Farrell. 2017. 'Transdisciplinary Research for Systemic Change: Who to Learn with, What to Learn about and How to Learn.' *Sustainability Science* 12(5): 711–726. doi:10.1007/s11625-017-0446-0.

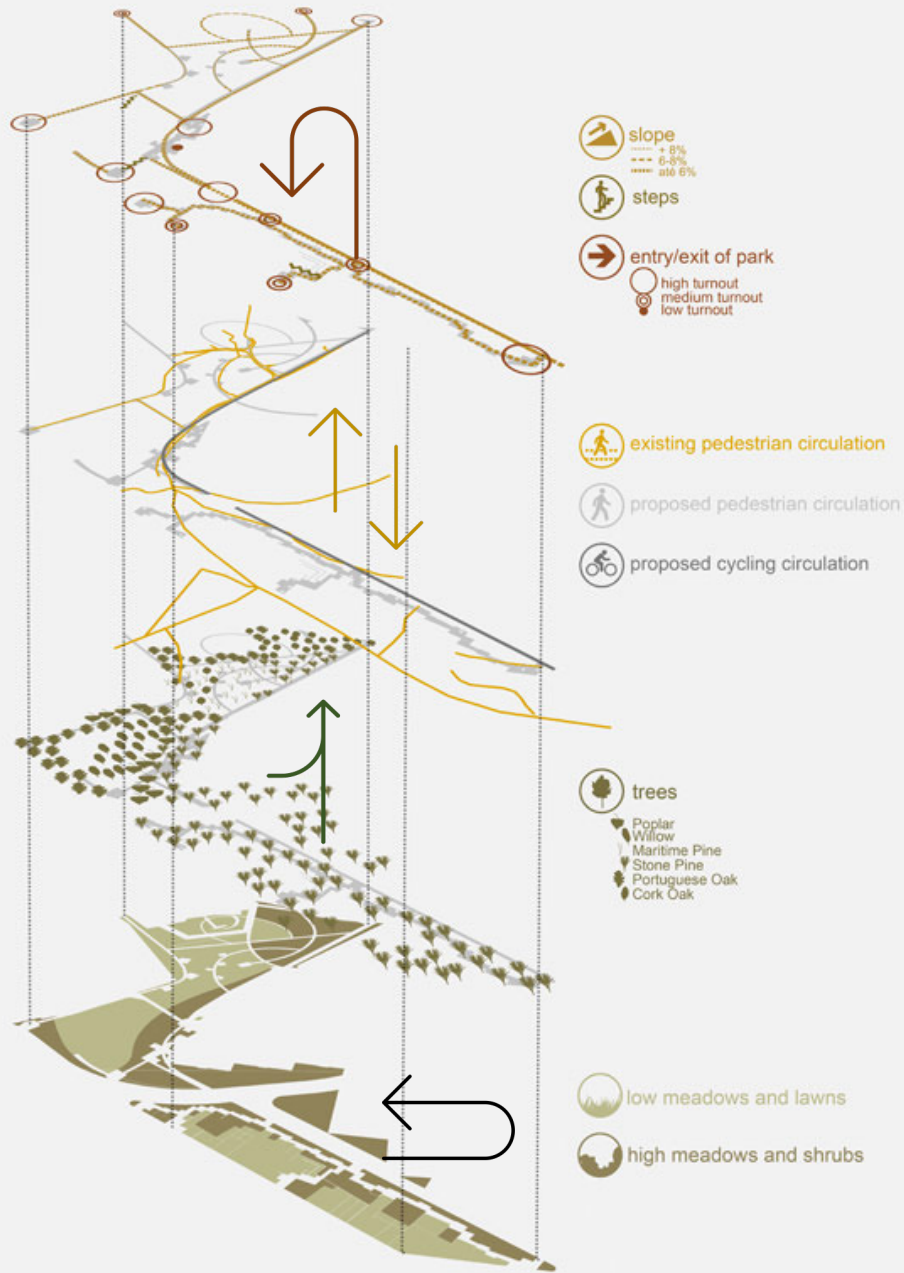
# How to do planning in SES?

- With the help of system analysis, the impact of planning decisions on the system can be understood (by analysing the impacted elements and their impact and feedback loops within the system).
- Understanding the system helps to find leverage points -> Effective actions can be identified.
- Planning activities can be seen as part of the system too.
- Planning is more about steering the system in the desired direction than defining a certain static target state. Processes matter more than final objects.



# Assignment 4: system analysis

- The next step of the planning process is to create a system diagram.
- The aim is to understand the local social ecological system or at least parts of it: how humans and nature interact? Which feedback loops are beneficial and which are harmful?
- Think about representation of the site: it can be suggestive or exact (map or aerial photo).
- Think about representation of the system element: humans, natural elements, how they are located and related to each other.
- Try to draw a diagram presenting the flows (materials, energy, people, information...), impacts, feedback loops that happen on the site. Think about directions, quantities and spatial dimensions.



- Create a diagram (or more if needed)
- Aspire simple, still informative outcome
- Try to present essential elements of the site at the current state: a synthesis of the local social and ecological features presented in relation to a site or a place
- The diagram can include temporal dimension too
- You can later on use the material to present the change in the system that your plan will deliver
- You can add texts and additional illustrations if needed
- DL 27.2. at 12.00

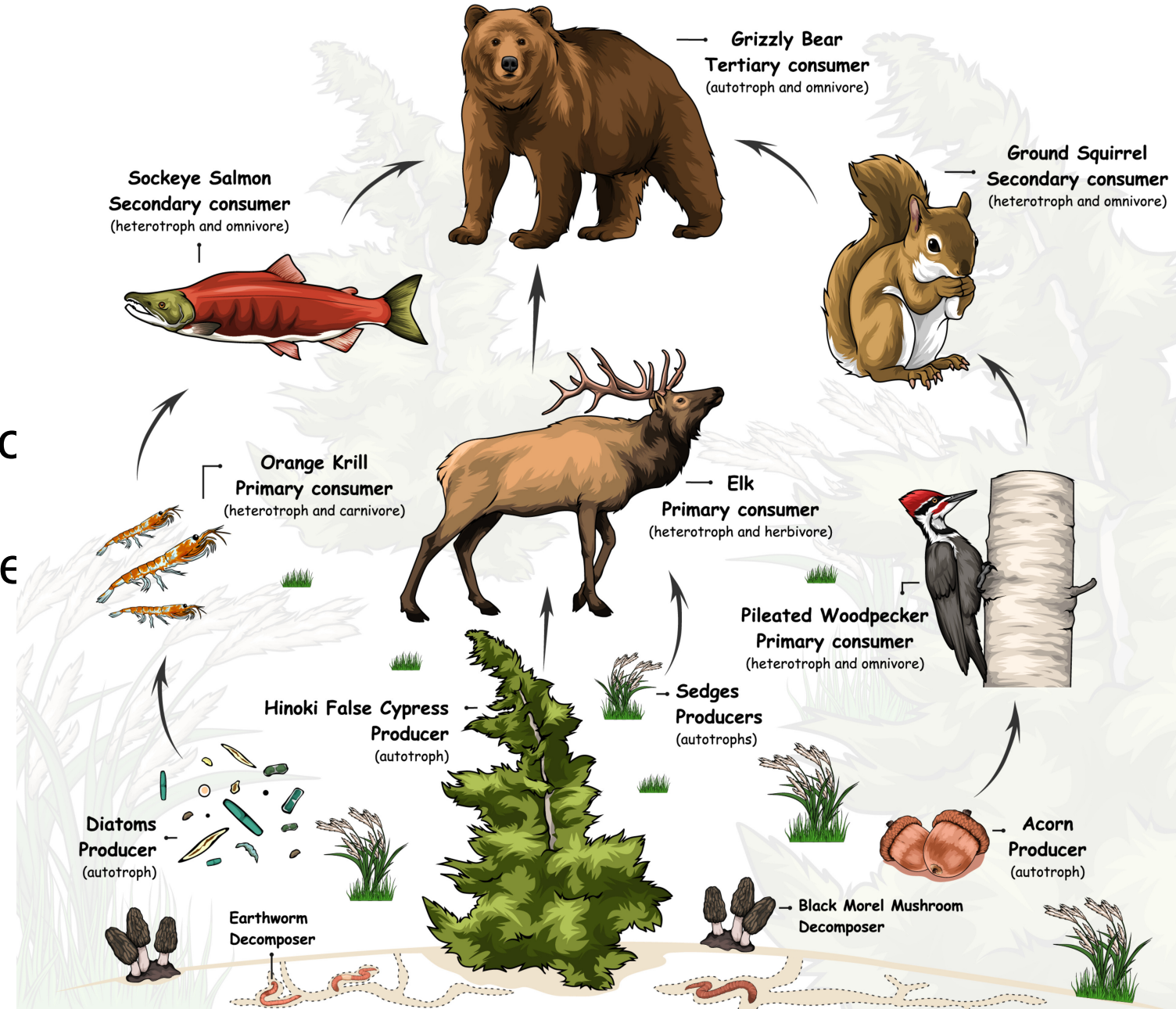


# Grizzly Food Chain

How to start?

**System elements:** Which elements compose the system?

Exactly what is considered to be elements of a system depends on the system under consideration and the scale of the analysis.





**Interconnections between elements:** Functional interconnections between elements of a system refer to the impact of elements on other elements and thus on the system as a whole.

In physical systems, they can be simply the movement of matter.

In many systems the most important interactions take place through the transfer of information.





**Modularity:** Larger systems and networks often have a modular structure, i.e. a system consists of groups of closely interconnected elements (modules).

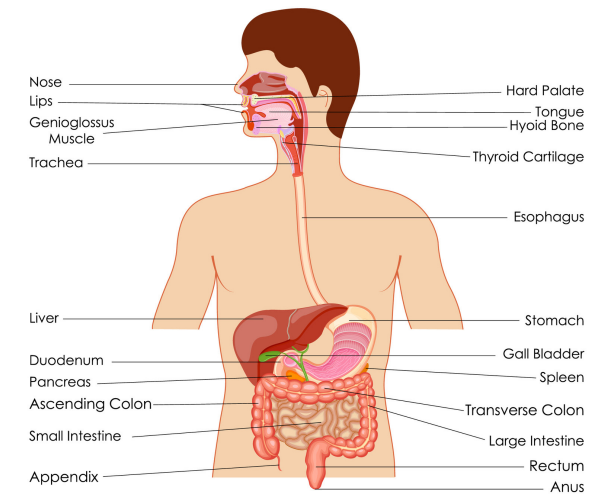
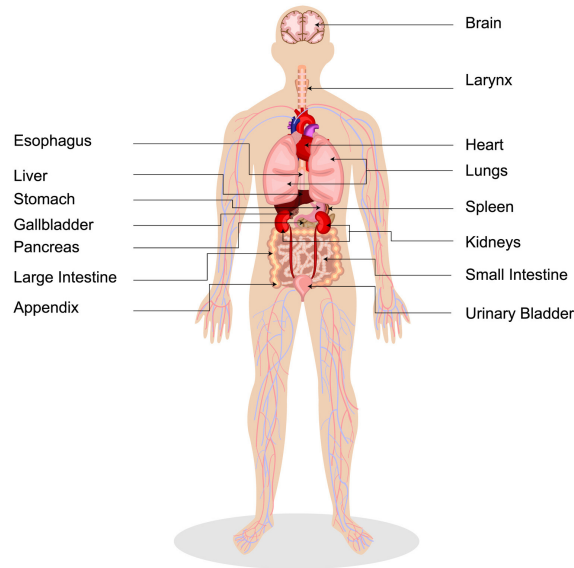
There are also links between groups, of course, but these are not as strong as the links between elements within groups.

Modular structure can make the system more resilient.

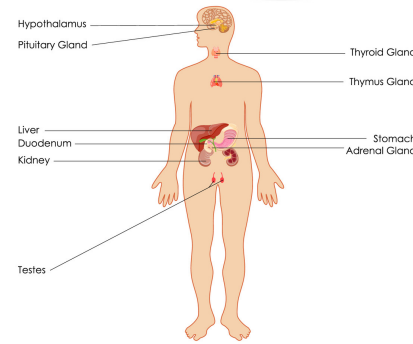




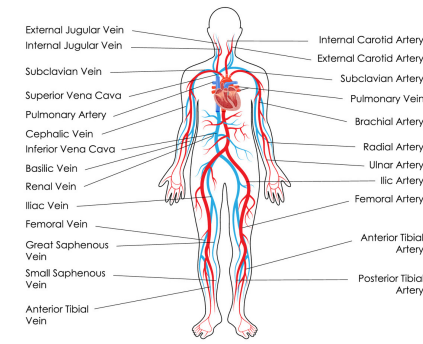
# HUMAN BODY SYSTEMS



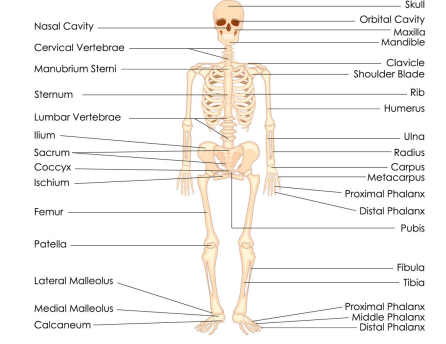
## DIGESTIVE SYSTEM



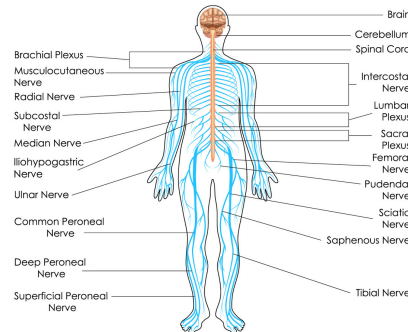
## ENDOCRINE SYSTEM



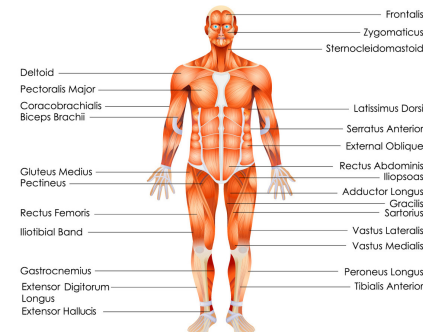
## CIRCULATORY SYSTEM



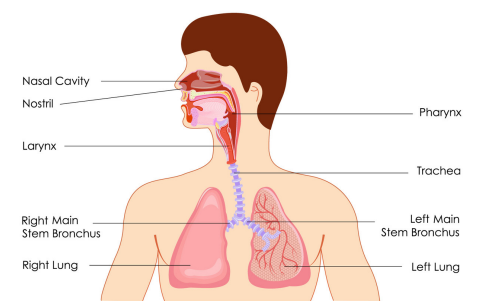
## HUMAN SKELETON



## NERVOUS SYSTEM



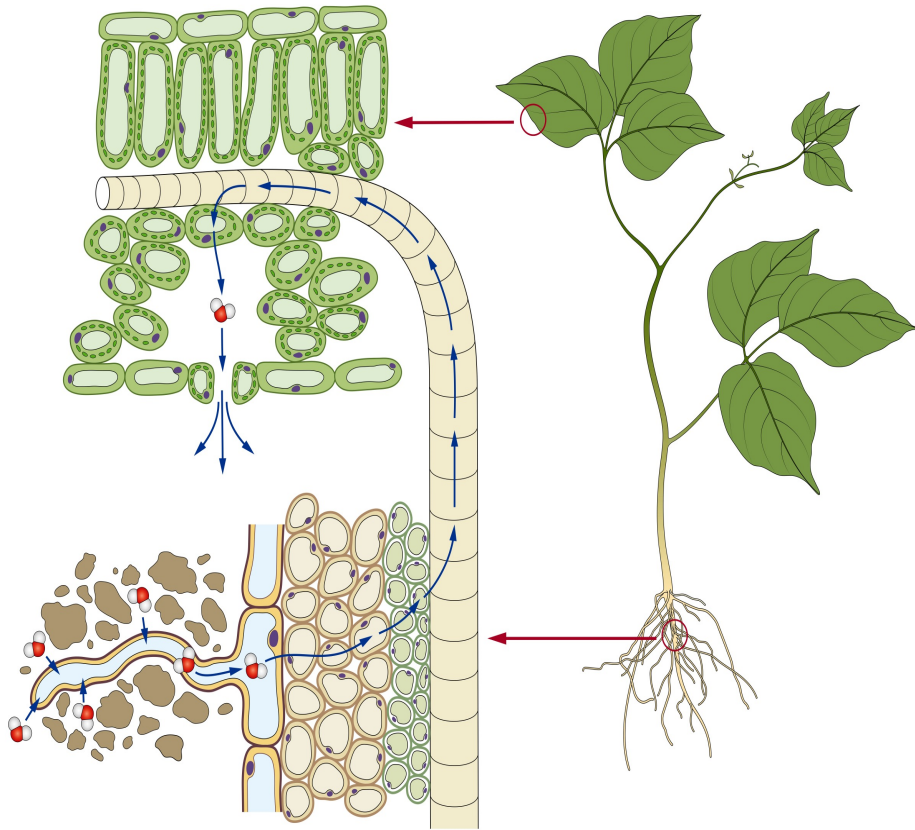
## MUSCULAR SYSTEM



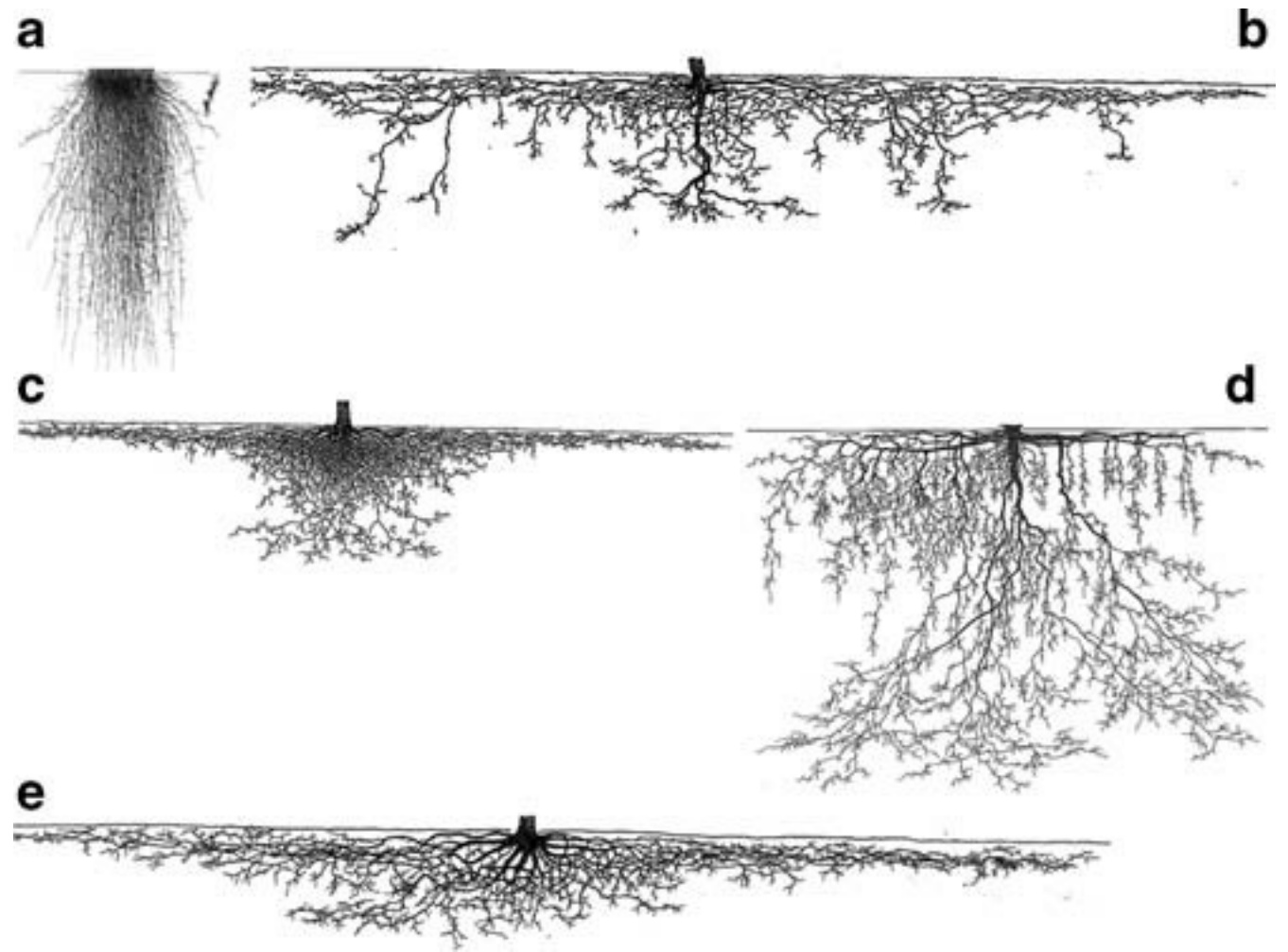
## RESPIRATORY SYSTEM

**Hierarchy:** Large systems are typically not only modular but also hierarchical, i.e. they consist of nested systems.

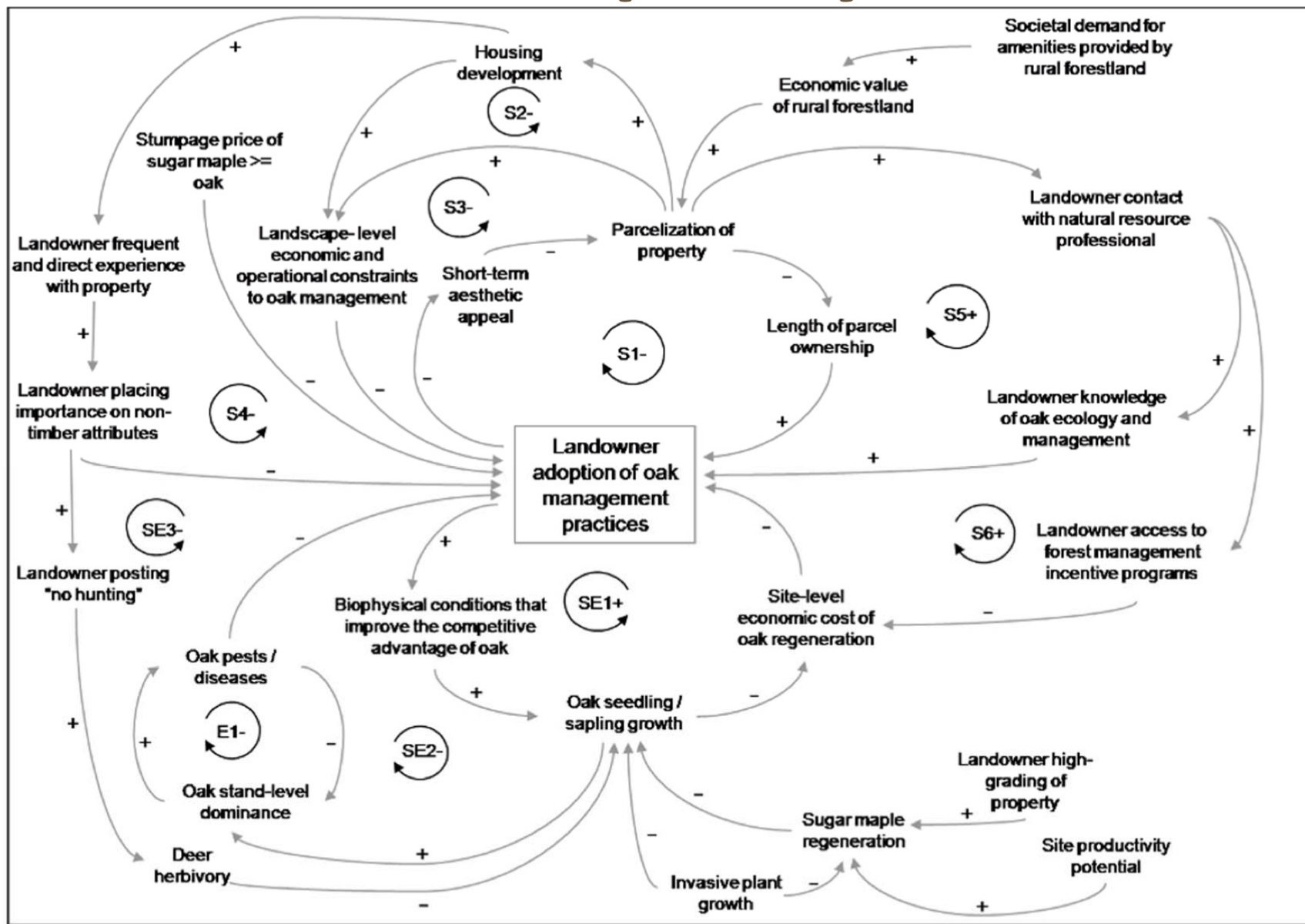
# Some examples



WATER SYSTEM IN A PLANT



FIVE BASIC TYPE OF ROOT SYSTEMS



Source: Knoot, T. G., L. A. Schulte, J. C. Tyndall, and B. J. Palik 2010. The state of the system and steps toward resilience of disturbance-dependent oak forests. *Ecology and Society* 15(4): 5. [online] URL: <http://www.ecologyandsociety.org/vol15/iss4/art5/>



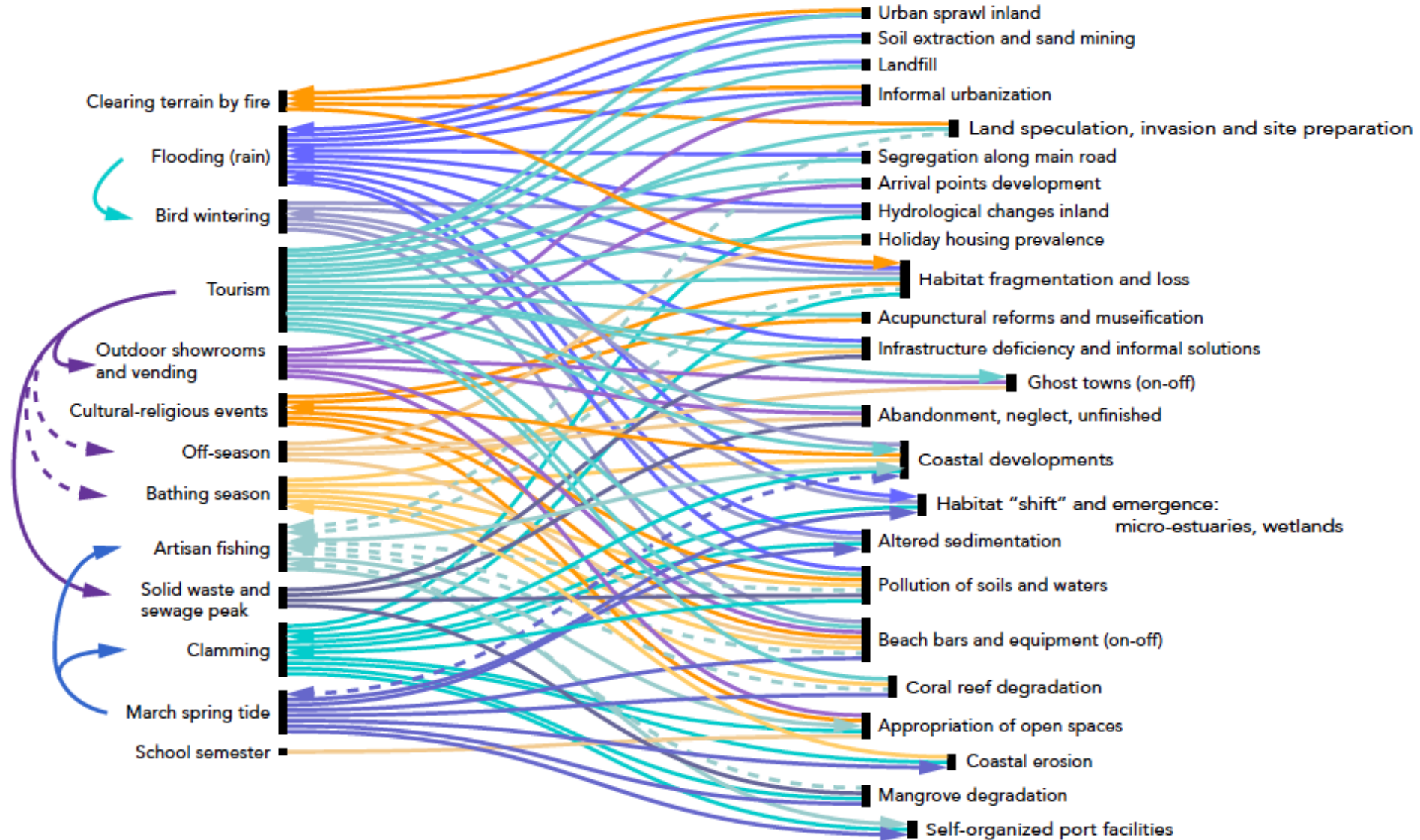
An aerial photograph of a rural landscape during autumn. The scene is dominated by large, dark brown agricultural fields, some of which are divided into smaller plots by thin lines. A winding river with a light blue-green hue flows through the center-right of the image, bordered by dense trees with golden-yellow foliage. In the upper corners, there are small clusters of buildings, likely farmsteads or small villages. The lighting is warm and directional, casting long, dark shadows across the fields, which emphasizes the texture and contours of the land.

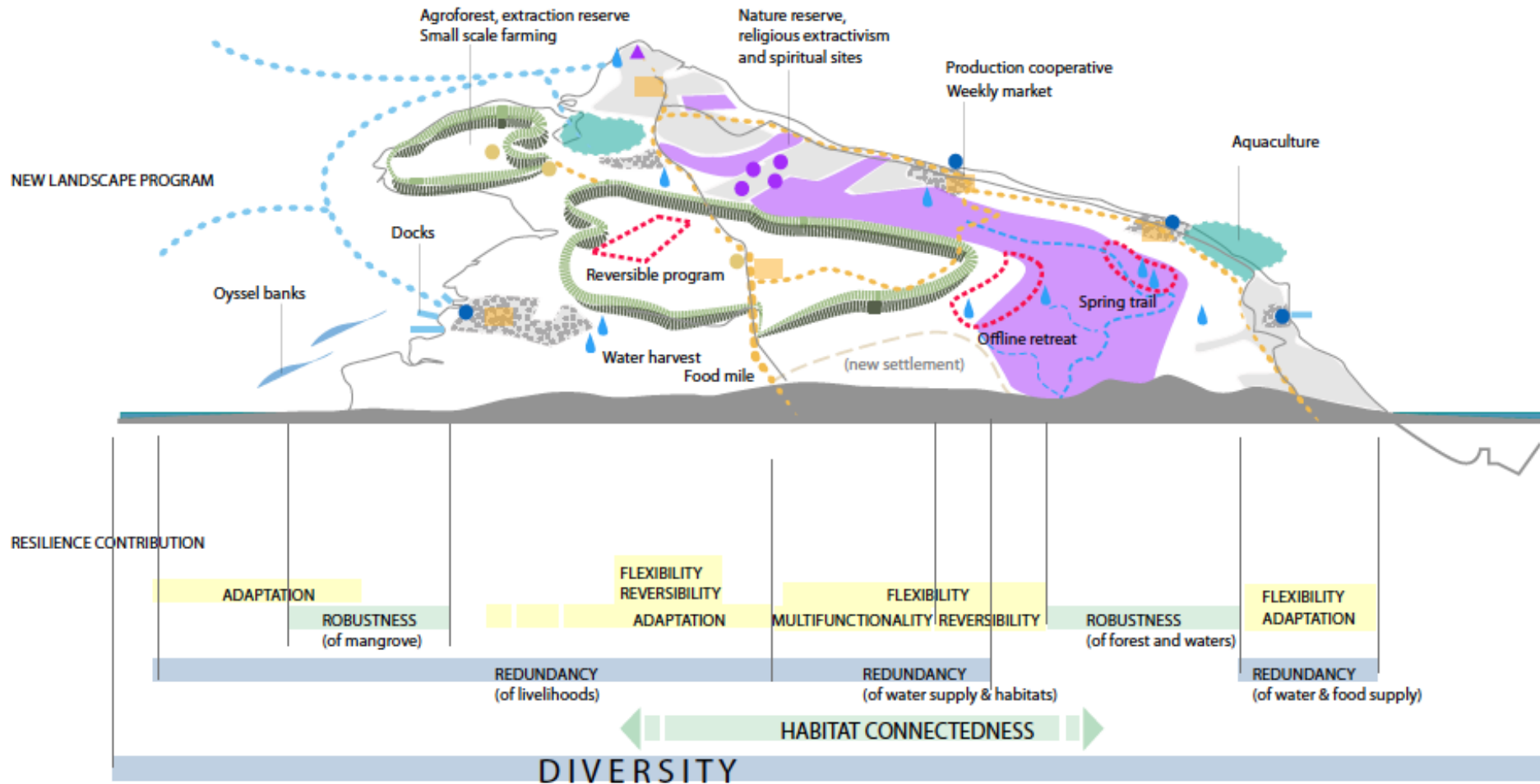
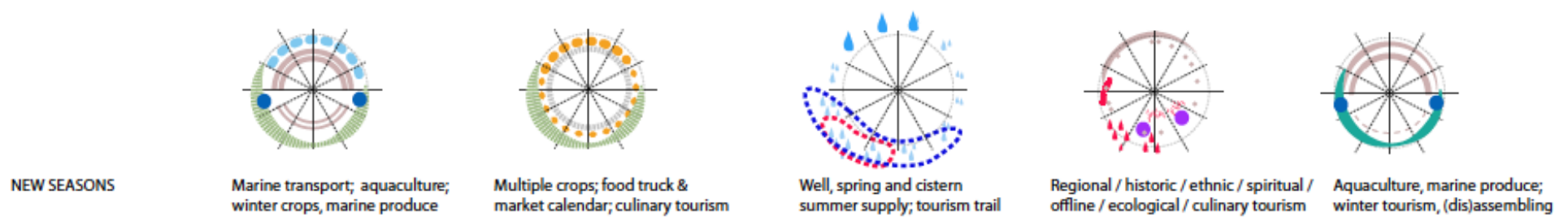
As landscape architects you need to be able to connect a system with a place / site / landscape / local dimensions.



## Seasonal phenomena

## Spatial transformation



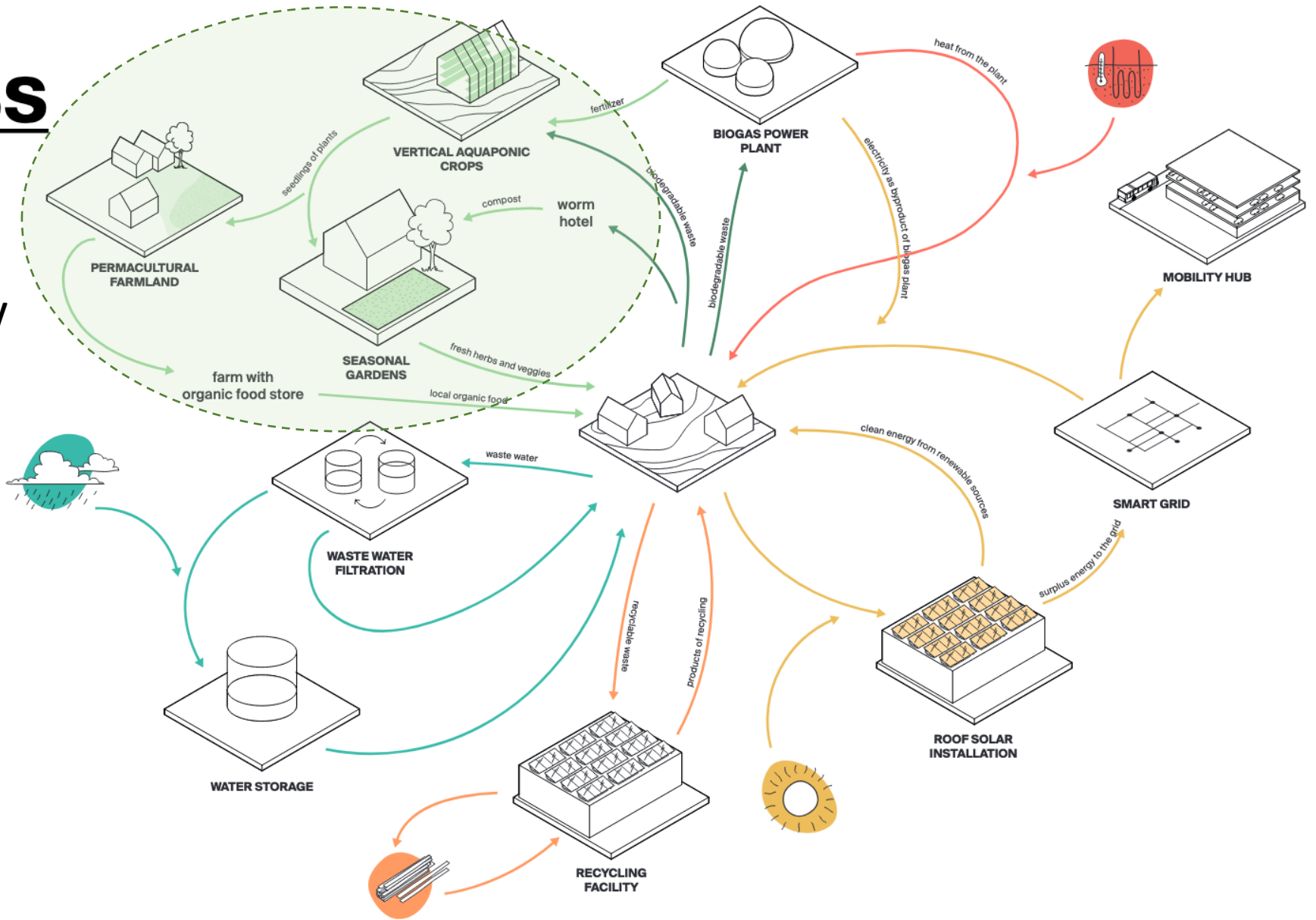


Vilja Larjosto (2019): Dynamic Urban Islands. Seasonal Landscape Strategies for Resilient Transformation.

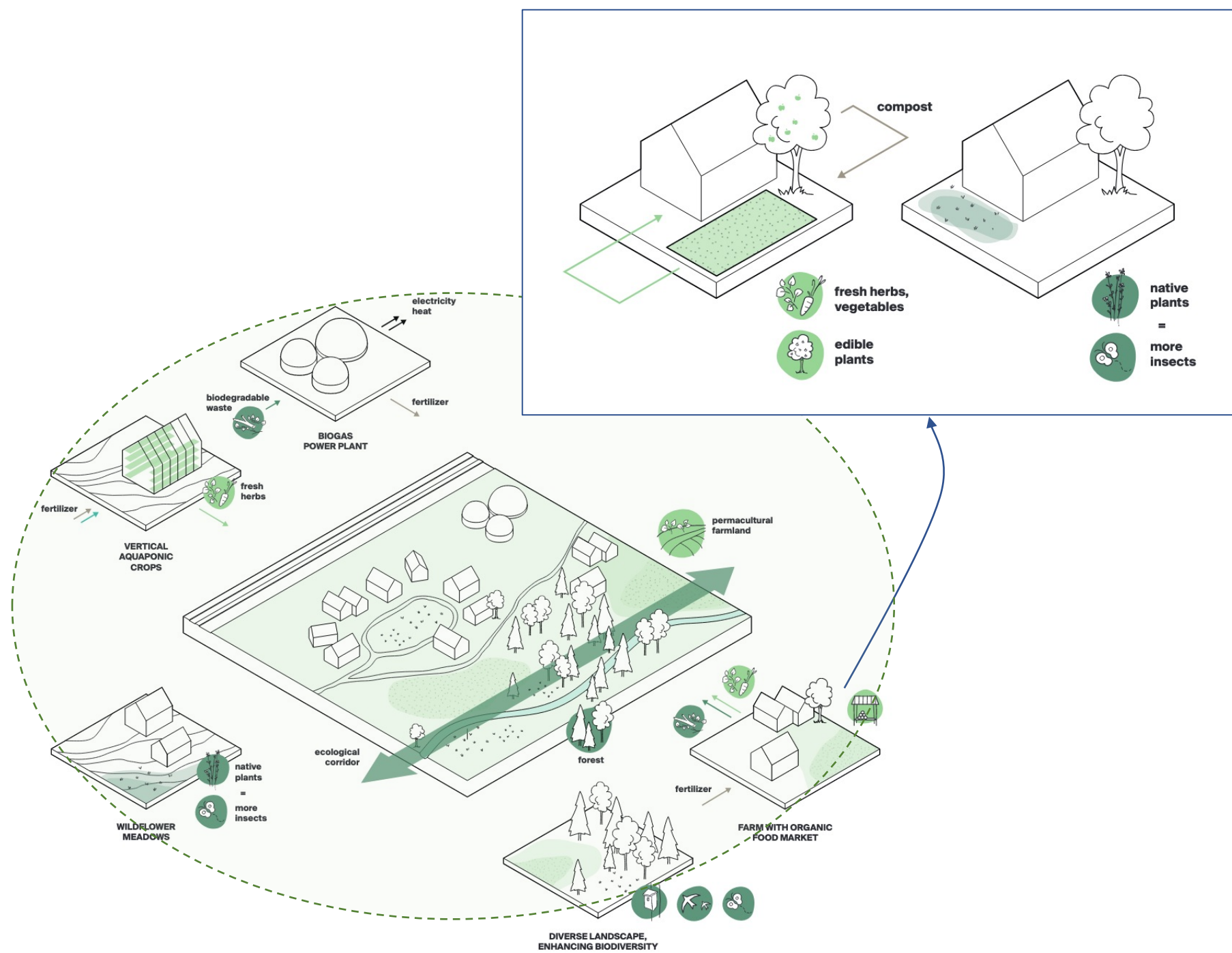


# System In Progress

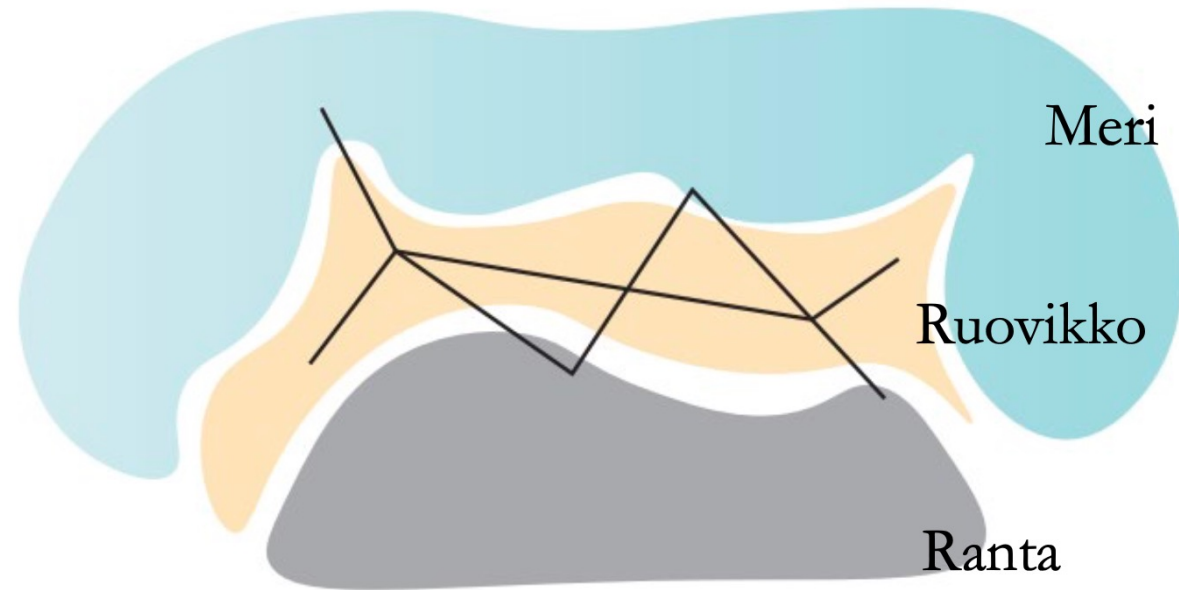
Food & biodiversity



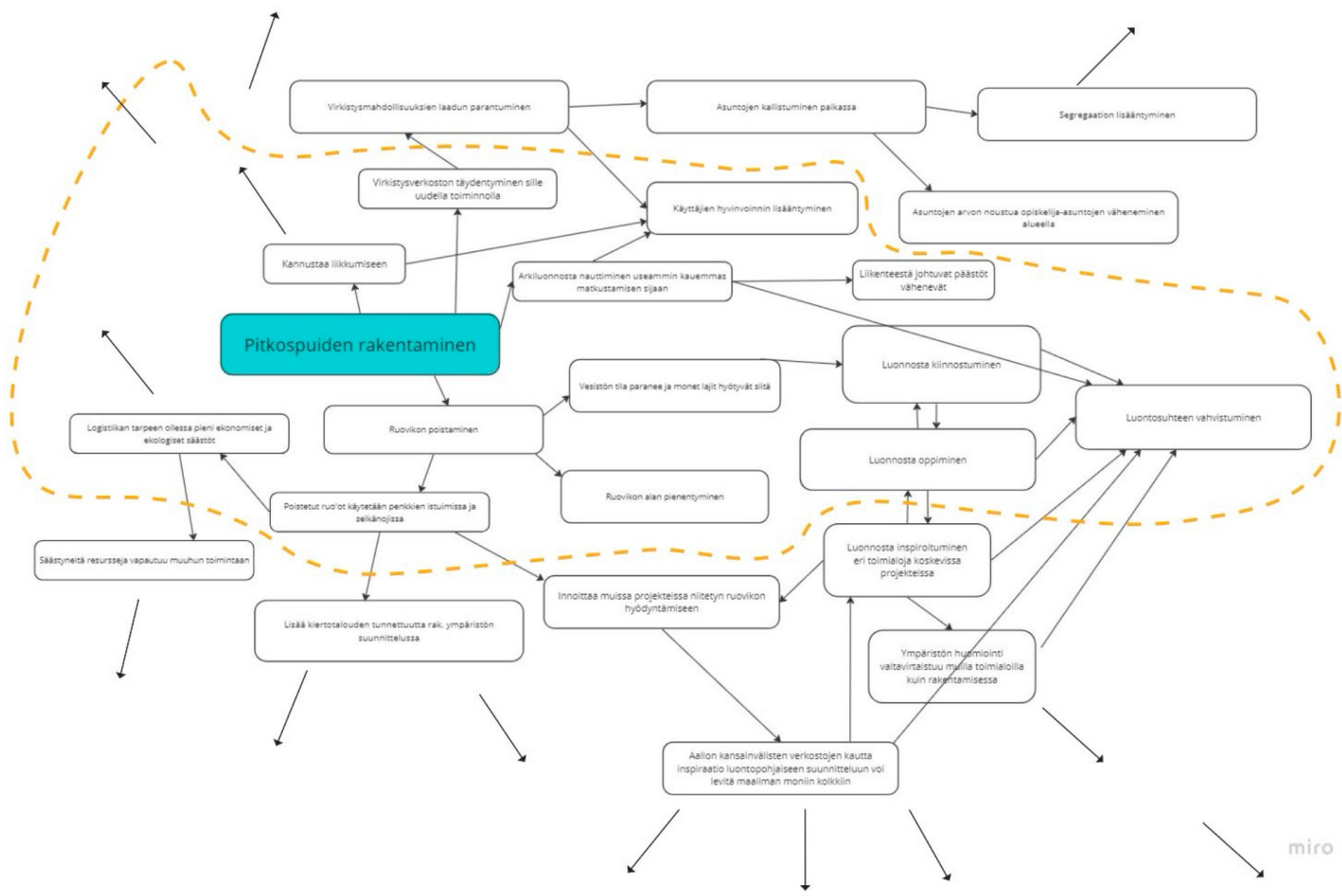
# 04 Food & Biodiversity



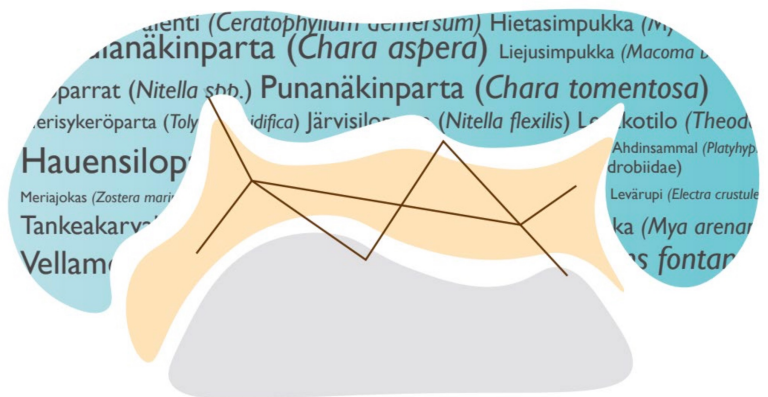
# Yksinkertaistettu konseptikuva



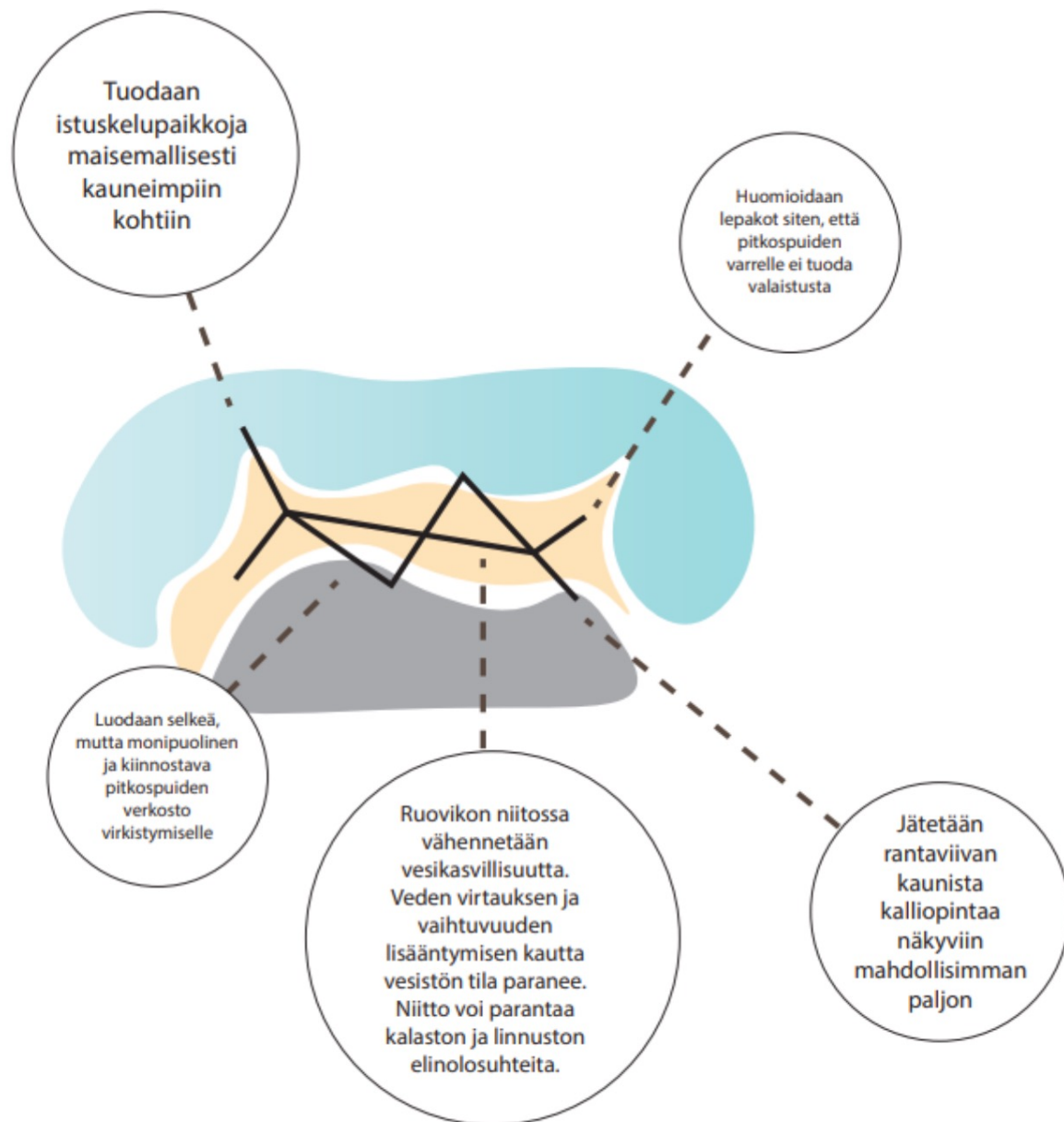




Lajikartassa fonttien tyylitellyllä (erilaiset fontit, fonttiväri, fonttikoko) viestitään katsojalle hierarkioita  
Esimerkiksi tärkeysjärjestystä, tietolahteita



Aino Nissinen (2023): Tyyni, systeeminen tarkastelu



**Millainen tilanne paikassa on ennen virkistysreittiä, millainen sen rakentamisen jälkeen? Mitä voidaan siis olettaa muuttuvan systeemitasolla?**

## Nykytila, tavoite ja matka

Kestävyysmurroksen ajattelun ja edistämisen kannalta hyödyllinen tieto lähestyy järjestelmiä ja muutosta kolmesta tulokulmasta:

### A. Järjestelmiä koskeva tieto (system knowledge)

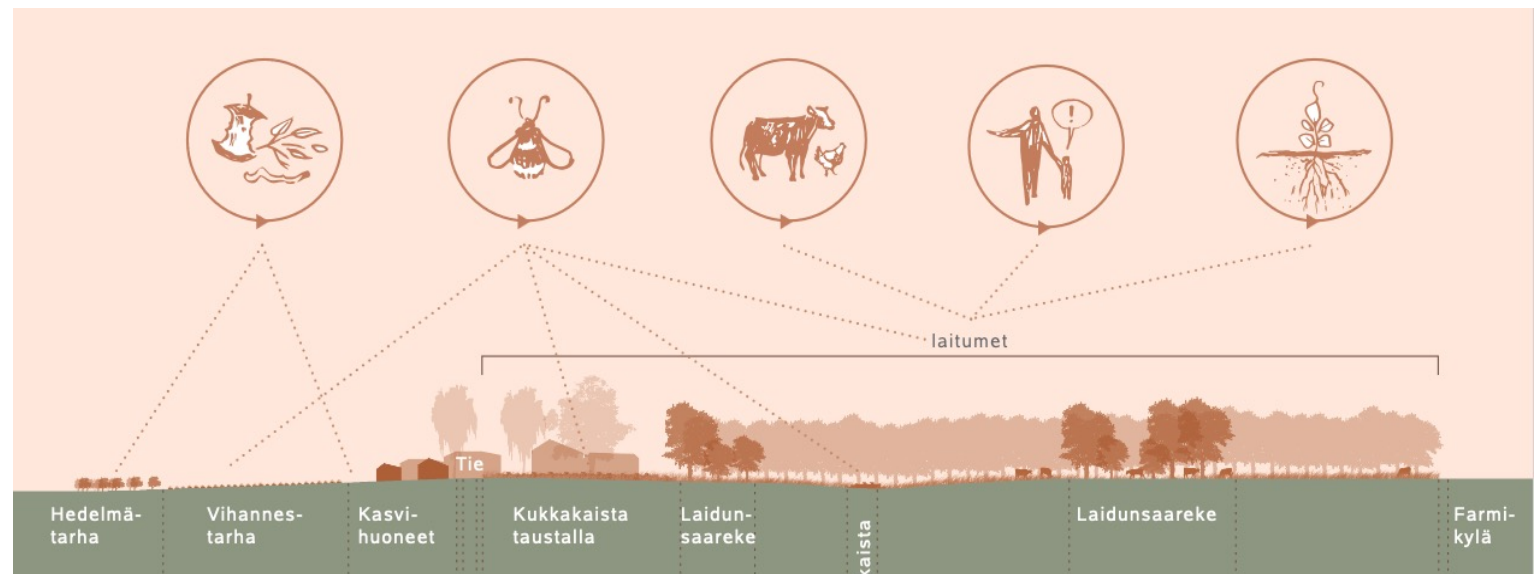
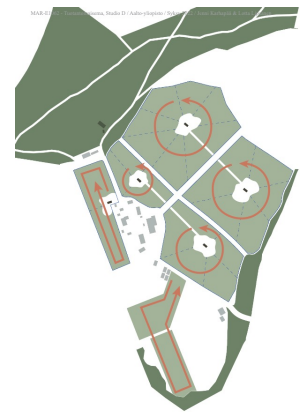
- Miten asiat ovat nykyään?
- Miksi nykytilanne on sellainen kuin se on?

### B. Tavoitteita koskeva tieto (target knowledge)

- Millainen olisi tavoiteltava tulevaisuuden tila?
- Miten järjestelmät ja prosessit toimivat tavoiteltavassa tulevaisuudessa?

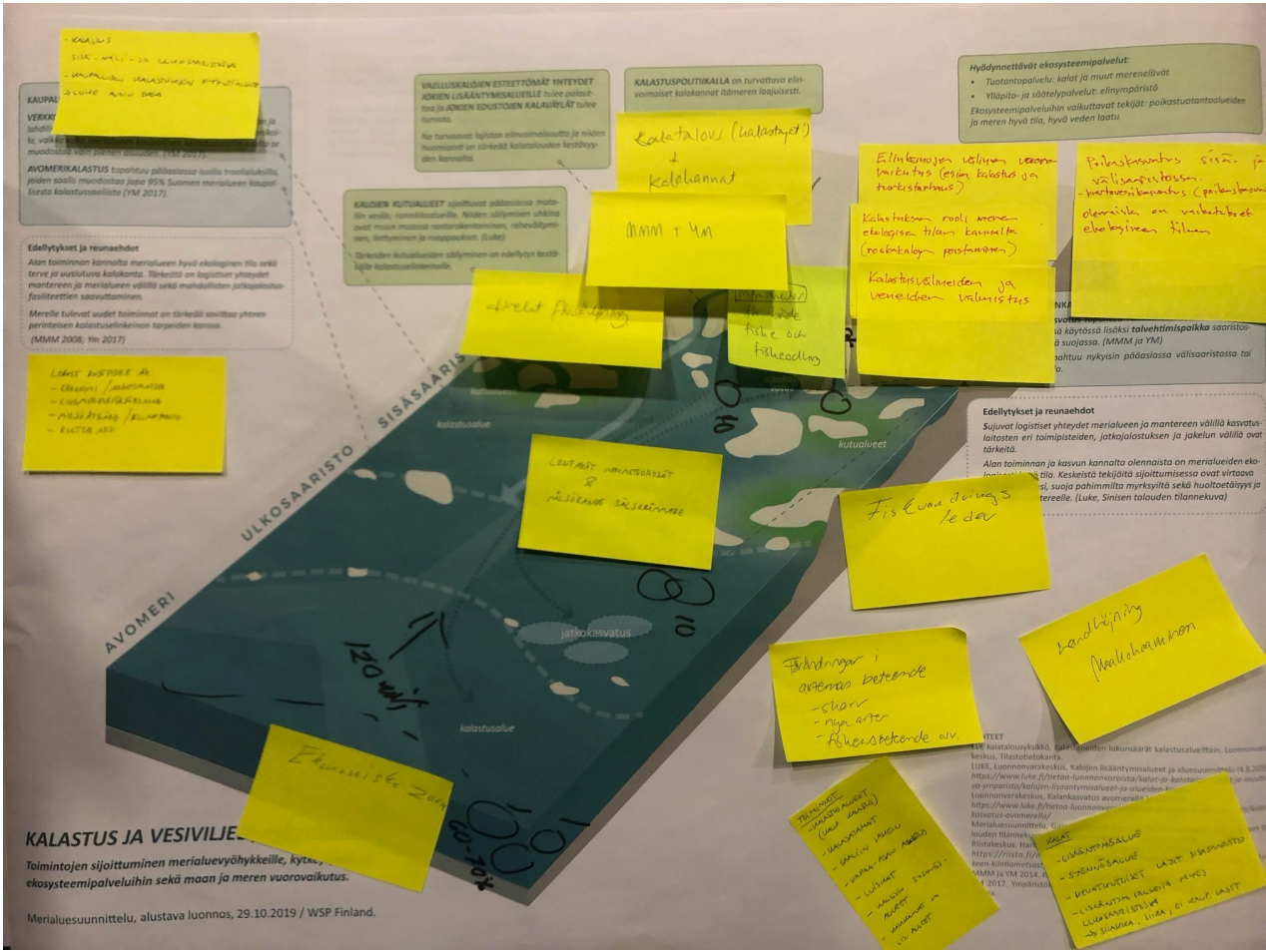
### C. Muutosta koskeva tieto (transformation knowledge)

- Miten nykytilasta päästään kohti tavoiteltavaa tulevaisuuden tilaa?



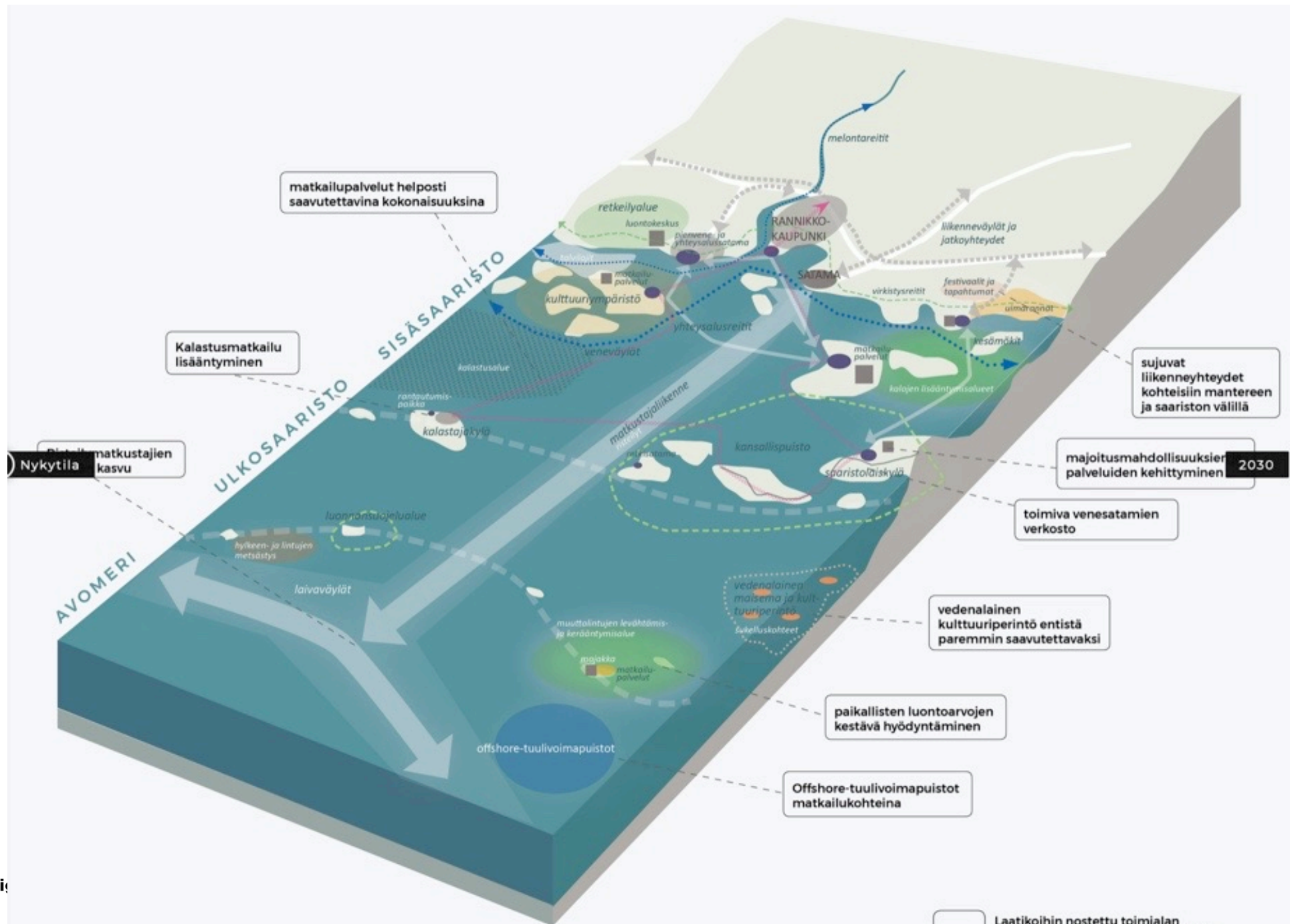
Jenni Kahrapää & Lotta Lipsanen (2022): Kierrossa, uudistava viljelytoiminta





MSP process, vision phase (2019)





Nykytila matkustajien kasvu

matkailupalvelut helposti saavutettavina kokonaisuuksina

Kalastusmatkailu lisääntyminen

sujuvat liikenneyhteydet kohteisiin mantereeseen ja saariston välillä

majoitusmahdollisuuksien palveluiden kehittyminen 2030

toimiva venesatamien verkosto

vedenalainen kulttuuriperintö entistä paremmin saavutettavaksi

paikallisten luontoarvojen kestävä hyödyntäminen

Offshore-tuulivoimapaistot matkailukohteina

Laatikoihin nostettu toimialan keskeisiä kehityssuuntia merialueilla