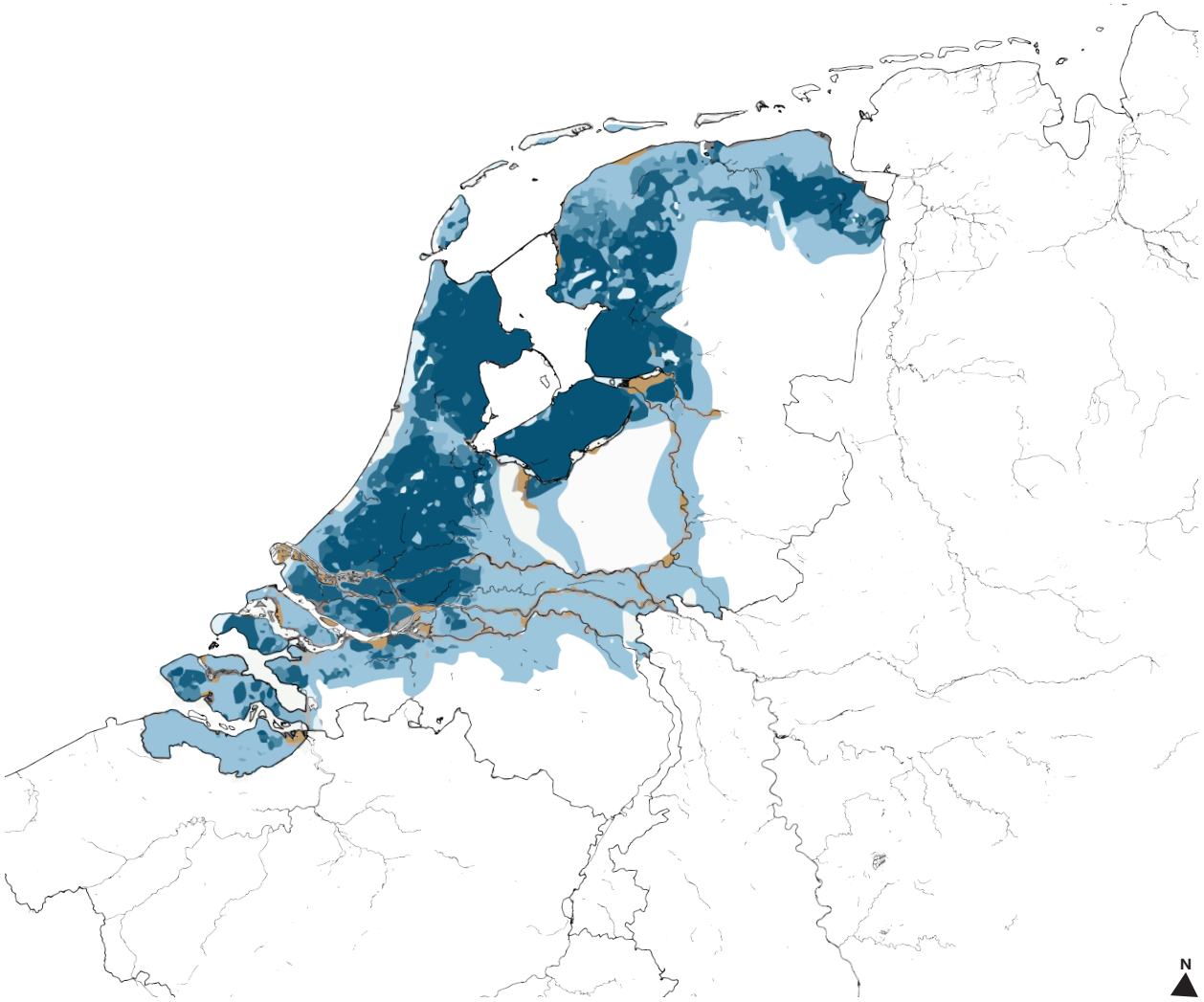
Envisioning retreat

Managed retreat as transformative adaptation

The Netherlands is sensitive to flooding which is why it has a long history of flood defence approaches which have over time created the Netherlands and its urban configurations.



flood sensitive regions of the Netherlands

below sea-level: 26%
above sea-level: 29%
area outiside dikes: 3%

At the moment the flood defence approach is in transition. During the nineties, after two cases of serious flooding of river landscapes of the Netherlands, a reconsideration of flood defence policy was required. Room for the River is a example of this new strategy that works with nature. It aims to create space for the flow and temporary storage of the river water. This demand for space means that it is no longer subservient to urban development, but often competing with it.

In 1995, high water levels and flood threat caused the evacuation of 250.000 people (RWS Beeldbank)

One of the ways in which this space for water is created within this programme, is by de-poldering. This is controlled inundation of a polder. The Noordwaard polder is an example of this. The depoldering caused displacement; The 75 farmer families, had the option to stay in the Noordwaard in newly constructed farms on mounds, or to be financially compensated to move elsewhere. In this case, the community's displacement reduced risk for a much larger population. More urbanised areas downstream. De-poldering and controlled flooding are expected to remain at the forefront of policy and societal discussions about flood management in the Netherlands.

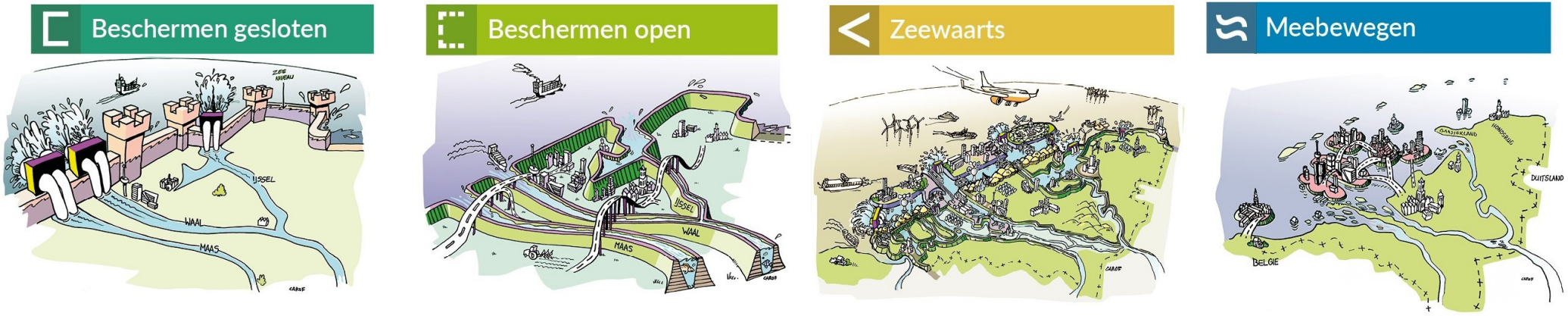
De Noordwaard(polder) with houses on dwelling mounds (ANP, 2020)

The question is what this means for the coast of the Netherlands. It faces a growing challenge as the uncertainty in predictions of SLR, as a result of climate change, becomes more evident.

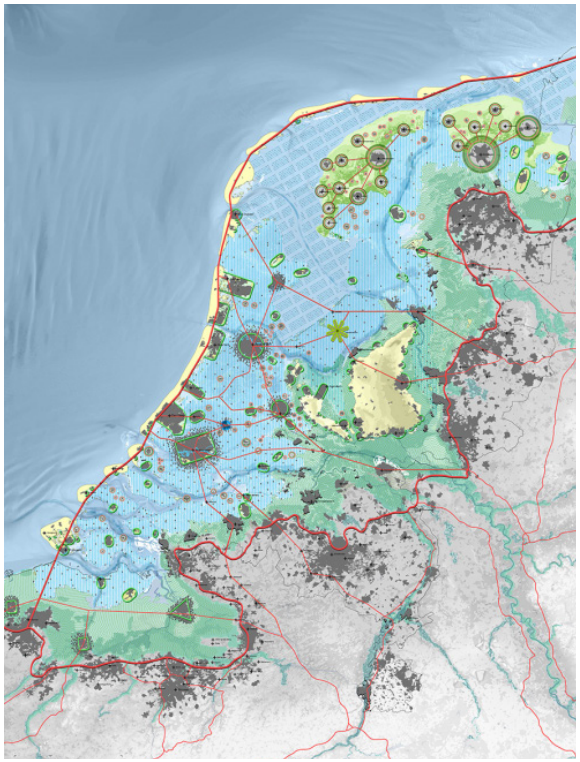
The Hague during storm ‘Dennis’ (Durieux, 2020)

In relation to the coastal region of the Netherlands, Deltares, commissioned by the Dutch Delta Programme, deals with the uncertainty in SLR predictions by laying out different scenarios: Protected Closed, Protected Open, Seaward, Move Along (Haasnoot et al., 2019).

Deltares
Enabling Delta Life

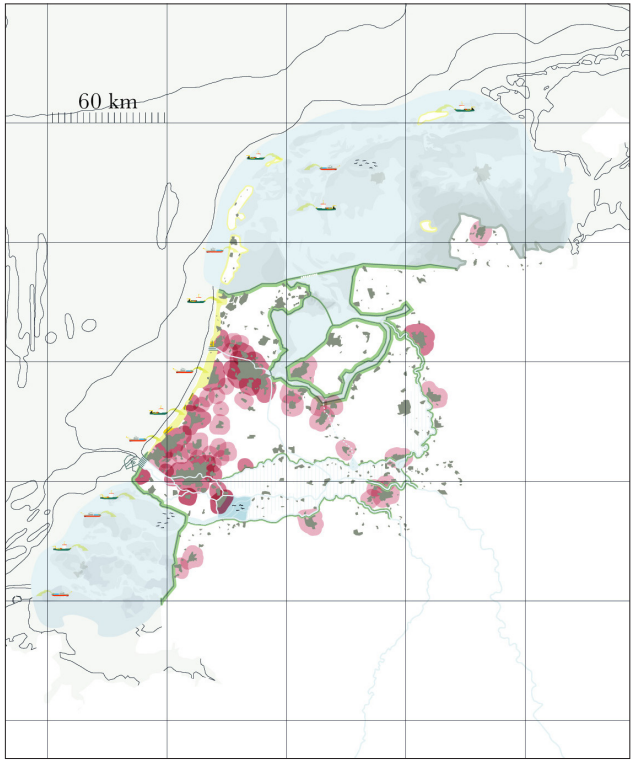


There are explorative studies on the future of the Dutch coastline which have put the scenarios of Deltares to practice. Most of them include returning parts of the country to the ocean. At this point, none of the studies on the future of the Dutch coastline incorporate this human aspect in abandoning parts of the country. However, when looking at the visionary images representing these studies, it does suggest a huge societal shift.



LOLA – Plan B: NL2200

WUR – A more natural future for the Netherlands in 2120



Geert van der Meulen – New Netherlands

In context of the development of a new adaptive flood defense strategy for the Netherlands, there is little attention for the human factor in abandoning parts of the country; **displacement.**

“ **Managed retreat** is the term widely used in the context of western delta regions and has a been used to describe **population relocation as an element of landward relocation of flood defence structures.** It has been defined as a deliberate intervention, requiring an implementing or enabling party like the government (Hino, Field, & Mach, 2017). ”

managed retreat

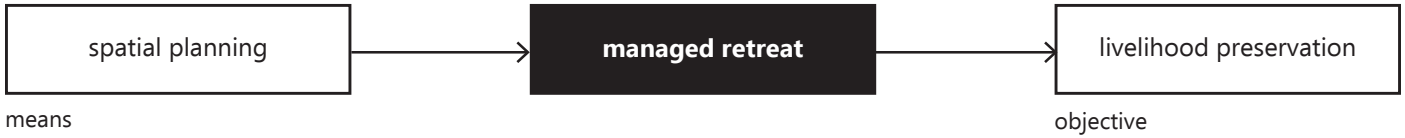
“ **Implementing managed retreat on the national scale** can be considered **transformative adaptation.** The large scale requires **transformation of our underlying norms** (Siders, 2019)**.** ”

managed retreat

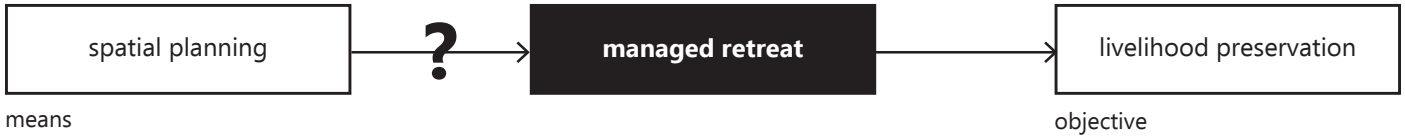
“ There are challenges to managed retreat, the main one being why managed retreat is considered to be controversial; the social and psychological difficulties in displacing people from their homes (Hino et al., 2017). **Preserving livelihoods can therefore be considered the main goal of a good implementation of managed retreat** (Wilmsen & Webber, 2015). ”

How can this be achieved for the national scale?

“ **Spatial planning** is concerned with identifying long- or medium-term objectives and strategies for regions. It involves the **distribution of spatial resources** and therefore has an important role within **social justice** (Klosterman, 1985). Dealing with **managed retreat of a national scale involves spatial planning** and may **contribute to livelihood preservation** (Hino et al., 2017) (Siders, 2019). ”



In short, the question is what the role of **spatial planning** can be in **sustaining livelihood** within future implementation of **transformative managed retreat**



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How can **spatial planning** contribute to **livelihood** in the context of **managed retreat** in the Netherlands?

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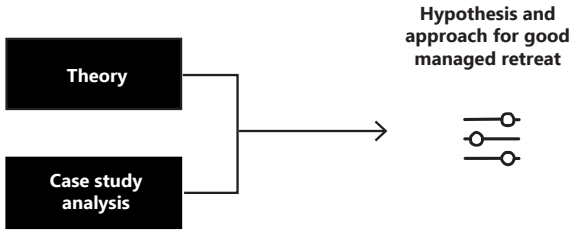

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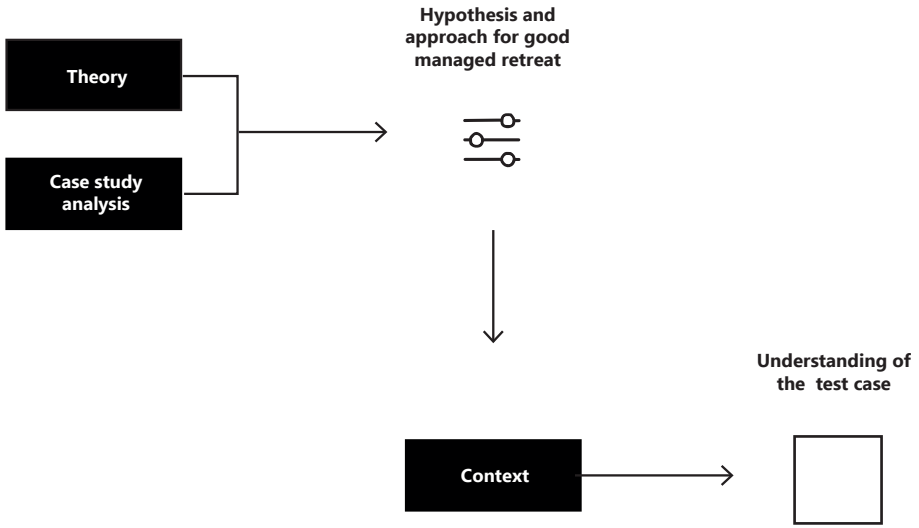

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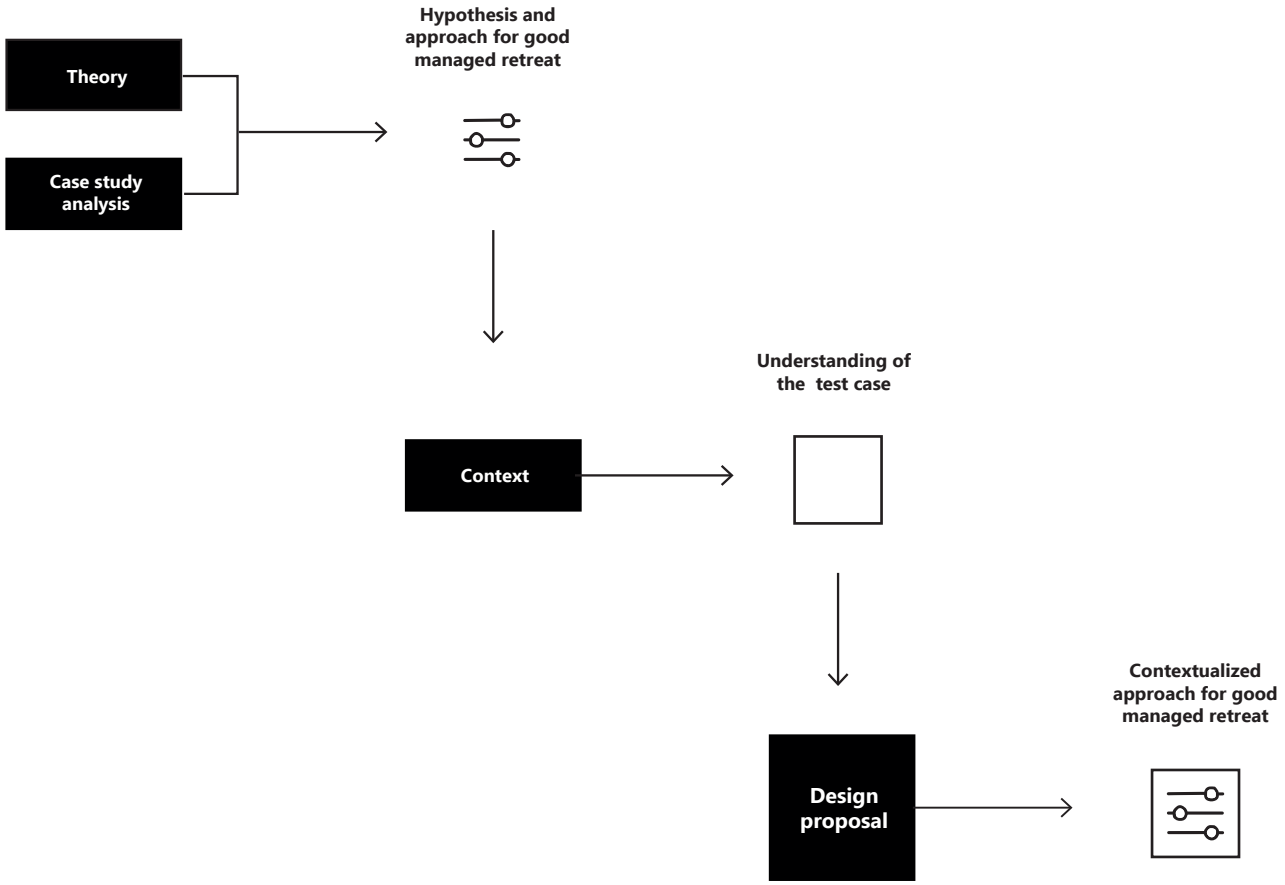

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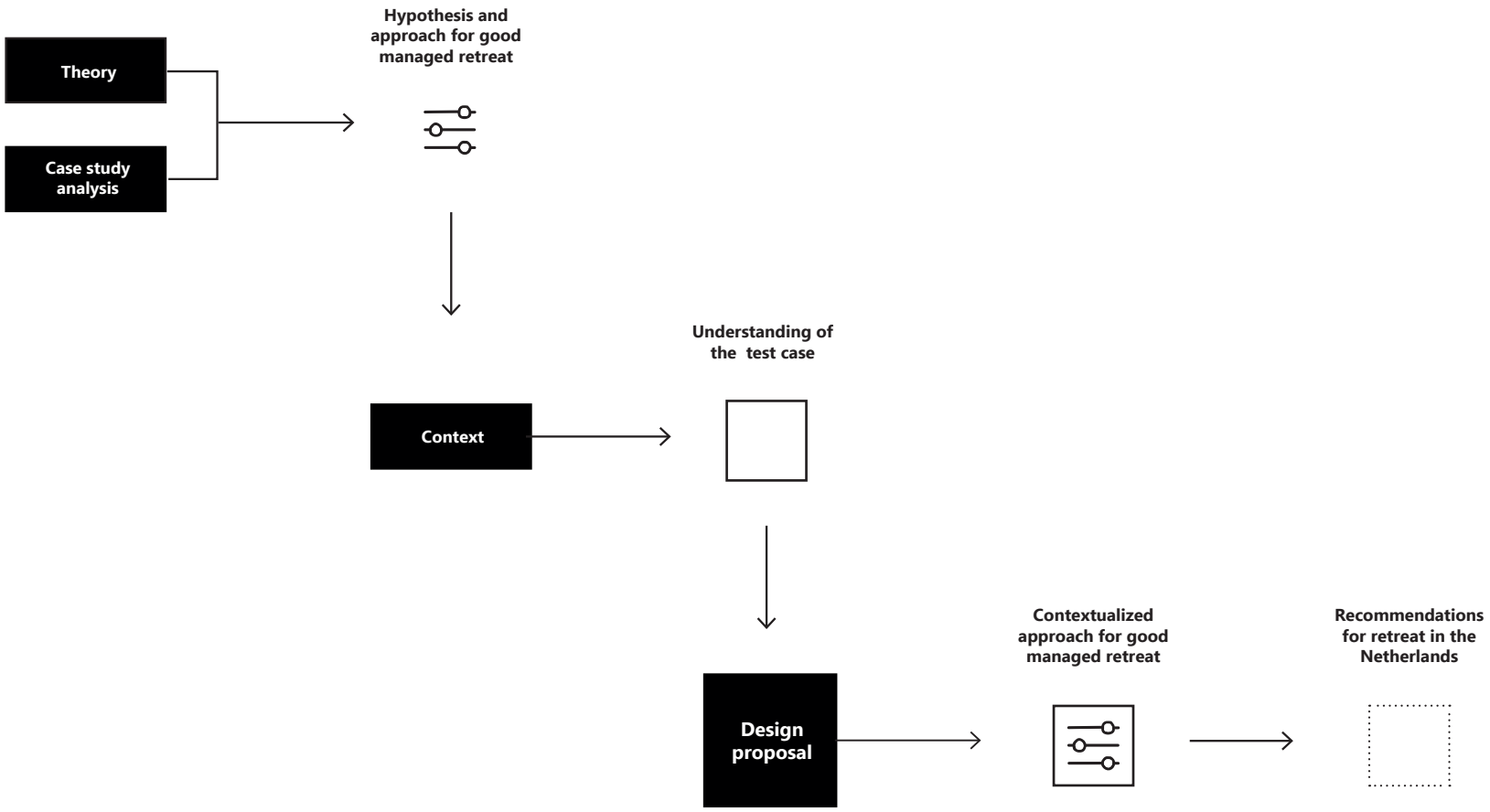
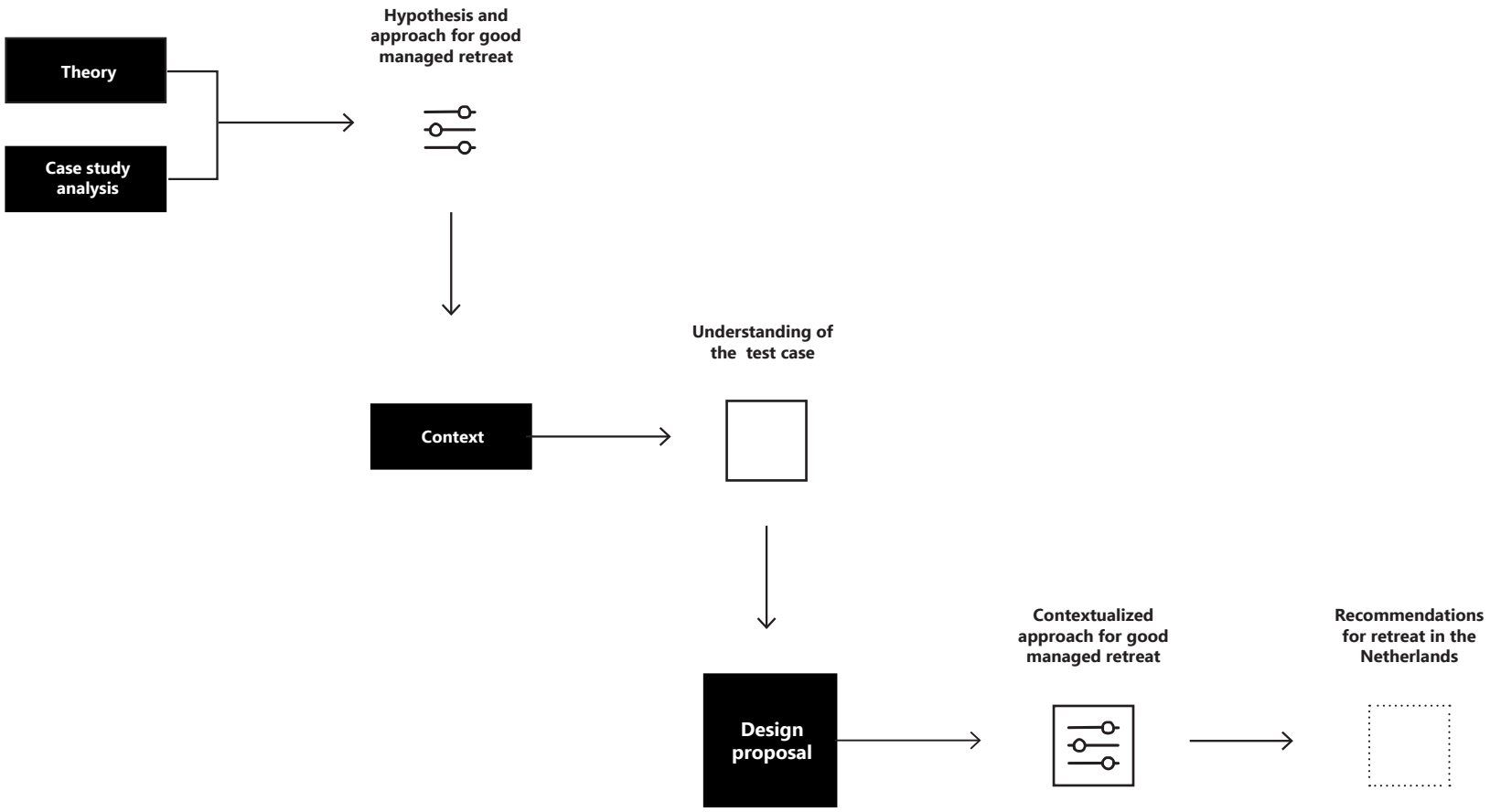


How can **spatial planning** contribute to **livelihood** in the context of **managed retreat** in the Netherlands?

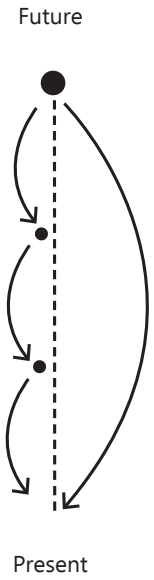


How can **spatial planning** contribute to **livelihood** in the context of **managed retreat** in the Netherlands?

Backcasting

scenario: what could be?

how to?



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In order to find appropriate cases it is important to establish what the nature of retreat in the Netherlands will be. This is why we indentify different contextual conditions for retreat.

managed retreat

Contextual conditions

scale

timeframe

status of disaster

The case studies are used to look at different approaches to managed retreat in relation to these contextual conditions. In order to assess the relevance of the cases, it is important to establish which contextual conditions are expected for managed retreat in the Netherlands.

Contextual conditions	Prospected
Scale	Large part of population
Timeframe	Large timeframe
Status of disaster	Pre-disaster (proactive approach)

The cases can be assessed on how livelihood is preserved throughout the process. This is enabled by a socially just compensation. There are two catergories; distributive and procedural justice. Distributive justice involves the physical compensation replaced residents receive, whereas procedural justice focusses on the participation of residents within the process.

livelihood preservation

objective

Socially just compensation mechanisms

Distributive justice

Procedural justice

The European cases will be covered more thorough, as their neo-liberal government structure makes them more representative for the Dutch context. The non-European cases provide information on the missing contextual conditions; the large scale and timeframe.

European cases

Noordwaard

Danube Catchment

Non-european cases

Sao Paulo

Mekong Delta

Contextual conditions	Prospected	Noordwaard	Danube Catchment	Sao Paulo	Mekong Delta
Scale 	Large part of population	Small part of population (<100)	Small part of population (+/-500)	Medium part of population (+/- 25000)	Large part of population (+/- 500.000)
Timeframe 	Large timeframe	Small timeframe (2000 - 2014)	Large timeframe (1972 - present)	Medium timeframe (1987 - 2007)	Medium timeframe (1996 - present)
Status of disaster 	Pre-disaster (proactive approach)	Pre-disaster (proactive approach)	Post-disaster (reactive approach)	Post-disaster (reactive approach)	Post-disaster (reactive approach)

Contextual conditions	Prospected	Noordwaard	Danube Catchment	Sao Paulo	Mekong Delta
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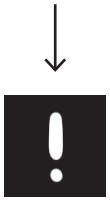
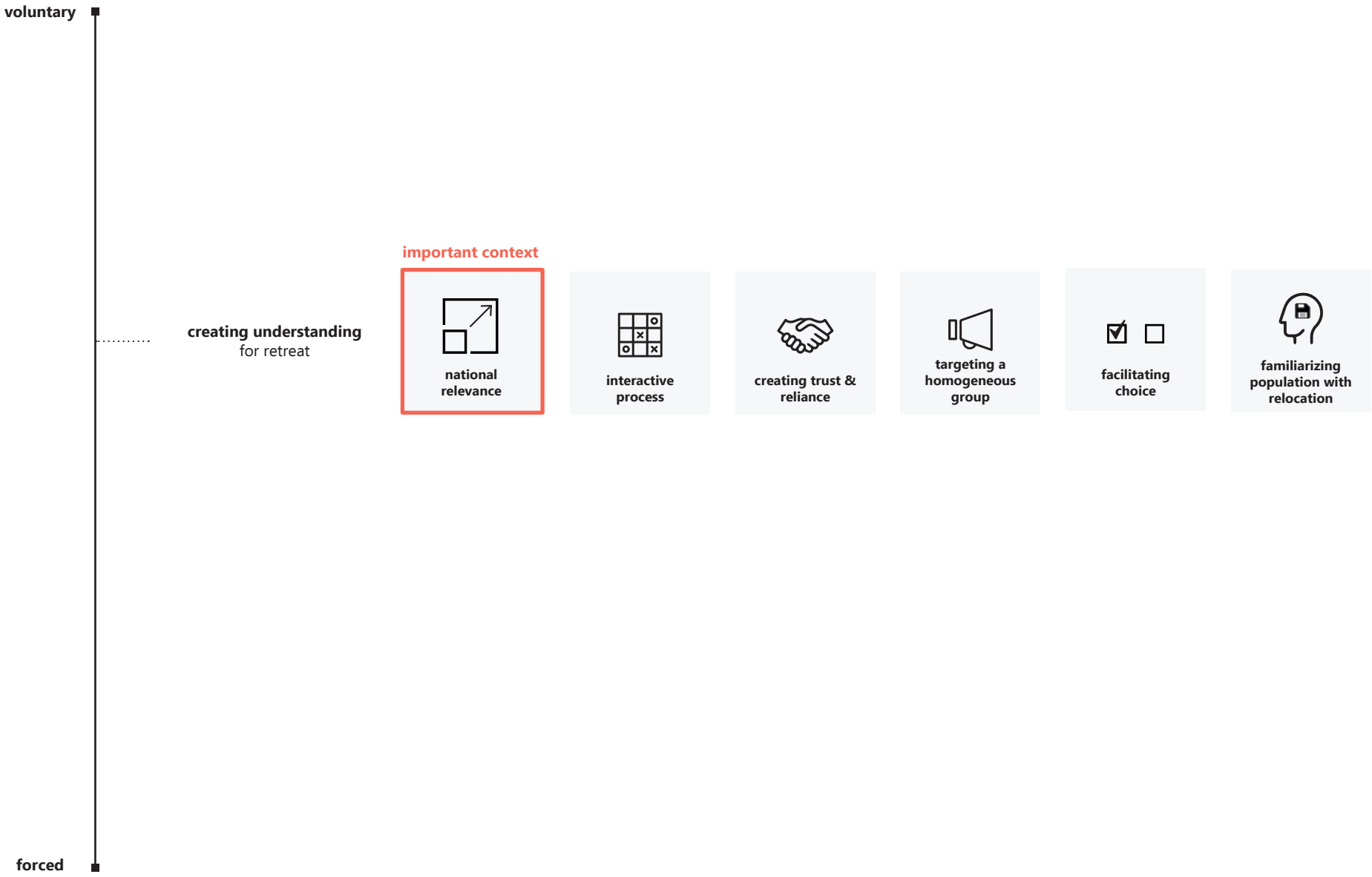


Retreat in the pre-disaster setting was made possible because only a small part of the population had to move in order to create a large benefit for society. The residents of the Noordwaard were made aware of the national relevance through an interactive design process which created understanding.

De Noordwaard(polder) with houses on dwelling mounds (ANP, 2020)


voluntary
creating understanding
for retreat
important context
national relevance
interactive process
creating trust & reliance
targeting a homogeneous group
facilitating choice
familiarizing population with relocation
forced

Contextual conditions	Prospected	Noordwaard	Danube Catchment	Sao Paulo	Mekong Delta
Scale	Large part of population	Small part of population (<100)	Small part of population (+/-500)	Medium part of population (+/- 25000)	Large part of population (+/- 500.000)
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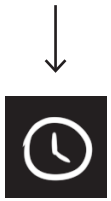


In 1972, after a fire in a farm, the major would not allow for rebuilding in the flood prone area. He offered compensation for the relocation in a safe area. After this, agricultural funds were available to all households that were just above the water level. Eventually this sparked a voluntary compensation scheme for all residents in the region. 500 households were relocated over the course of 50 years.

The eferding basin during spring tide

The Austrian relocation strategy evolved into using a voluntary compensation scheme. This is not a buyout program, but a funding scheme in which applicants accept the given rules. The goal in a voluntary compensation scheme is to make sure the population accepts it.

The timeframe of the policy window allowed people to reach the right biographical stage and it enabled social learning and network effects. On the other hand, it had a negative impact on people who stayed behind and could not oversee the move.

autonomous movers

influenced by biographical stage

using biographical stages

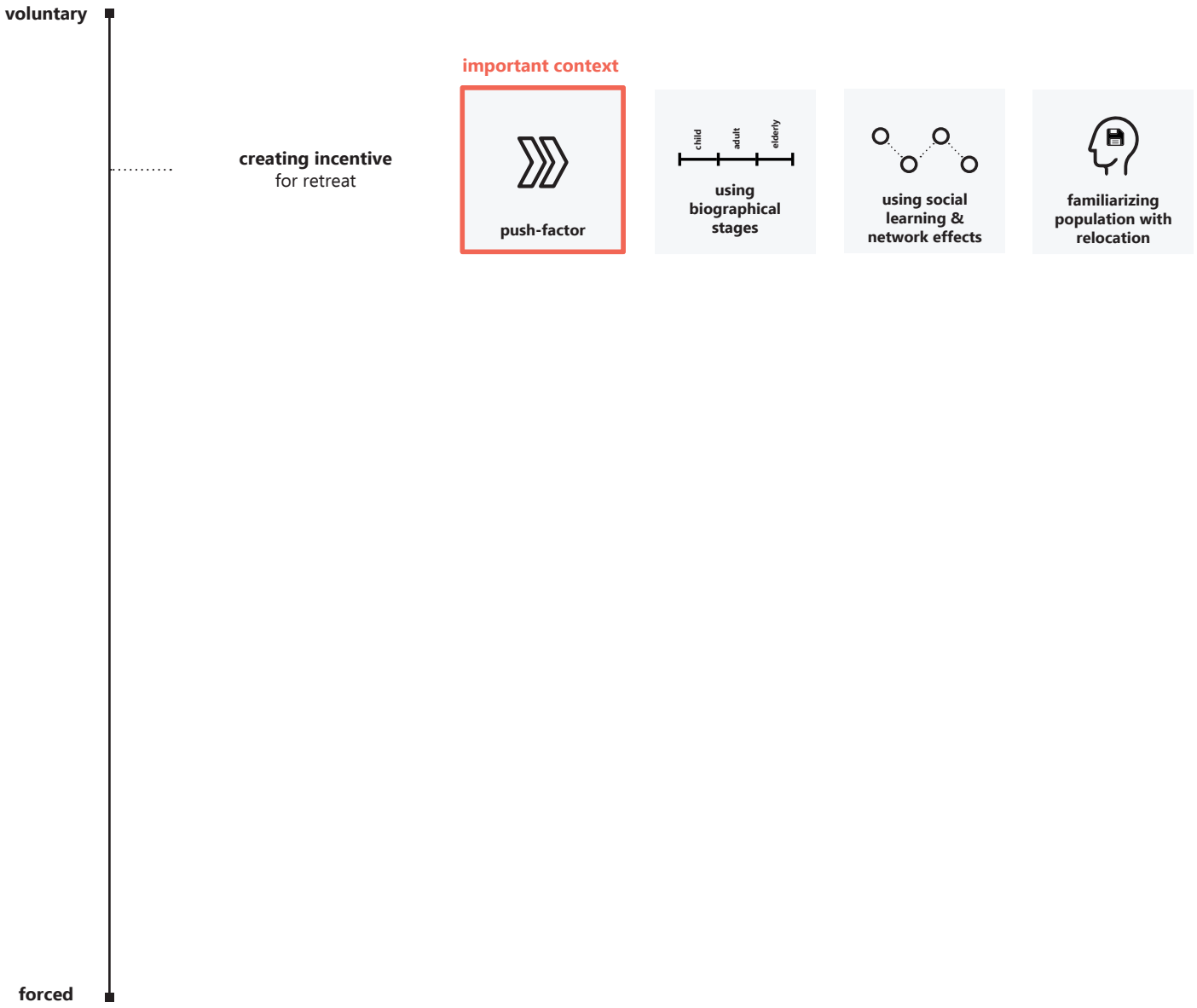
settled

influenced by social learning and network effects

using social learning & network effects

vulnerable

influenced by personal circumstances and biographical stage (elderly)


voluntary
creating incentive
for retreat
important context
push-factor
child
adult
elderly
using
biographical
stages
using social
learning &
network effects
familiarizing
population with
relocation
forced

Contextual conditions	Prospected	Noordwaard	Danube Catchment	Sao Paulo	Mekong Delta
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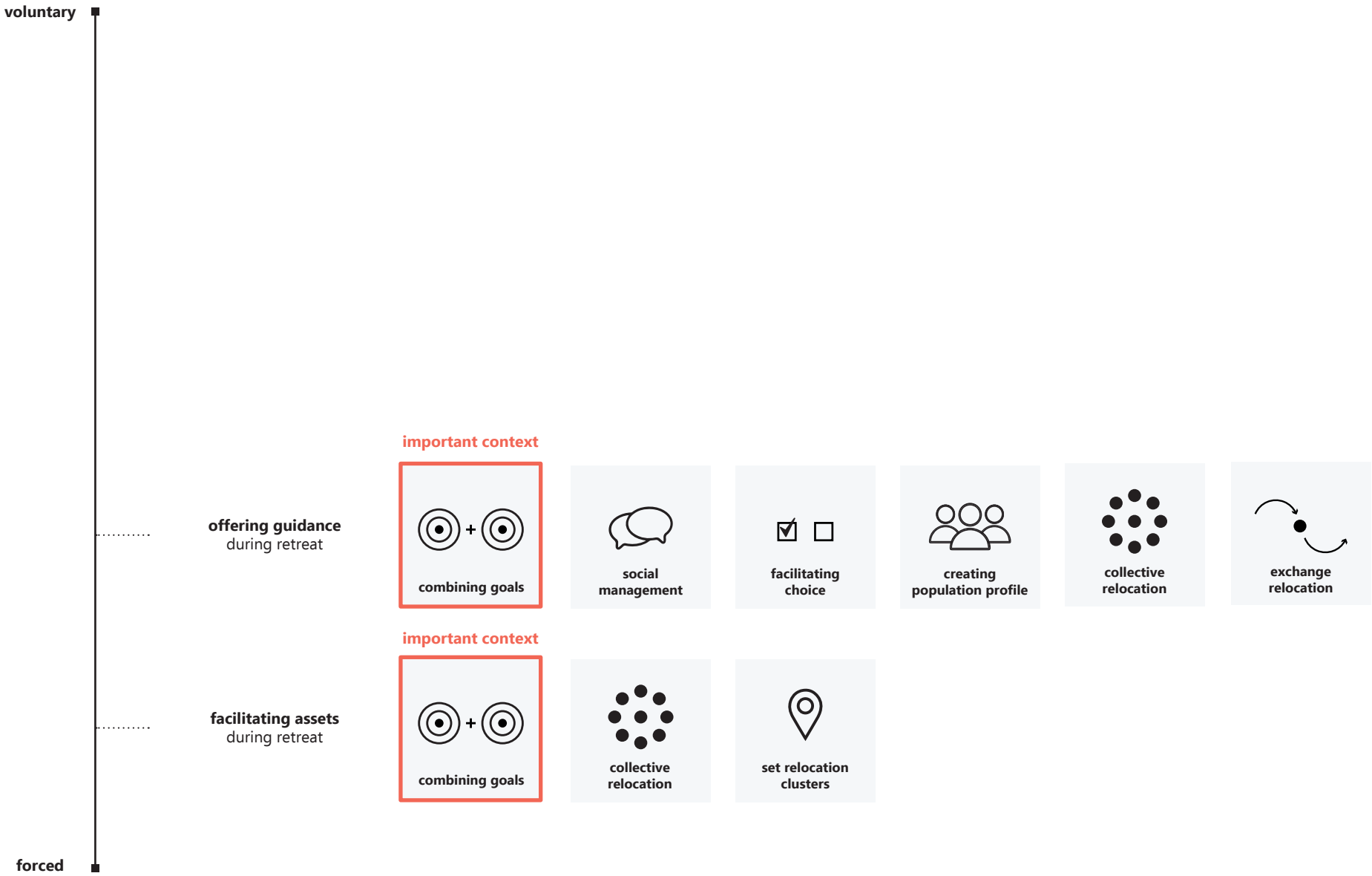
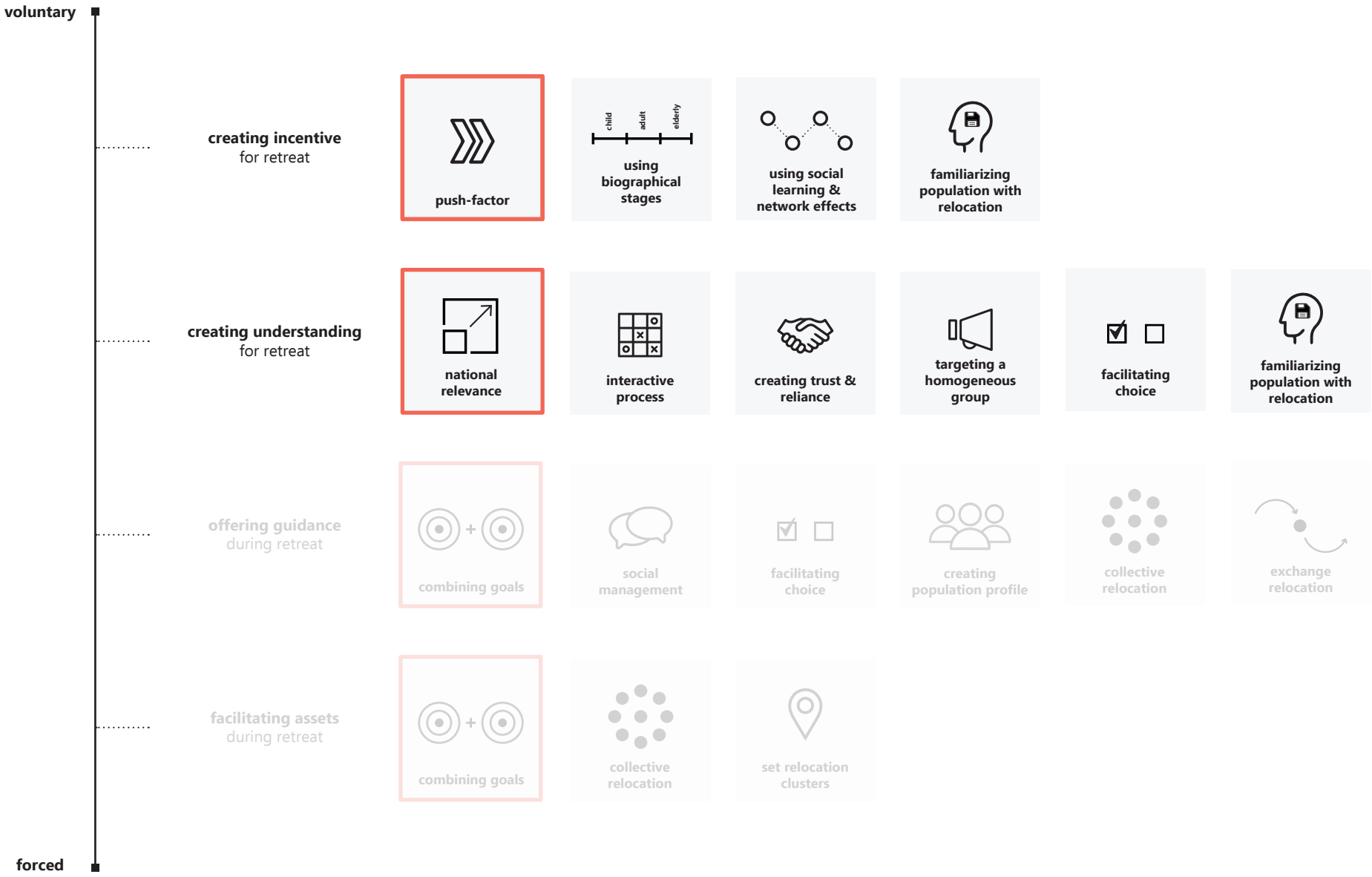
Both non-european cases tackled informal settlements where livelihoode was already under pressure. By combining flood-risk reduction with poverty reduction or redevelopment, livelihood improvement on higher ground became the shared goal. This allowed large scale retreat. Livelihood was preserved by keeping communities together through collective relocation and by creating designated relocation clusters.

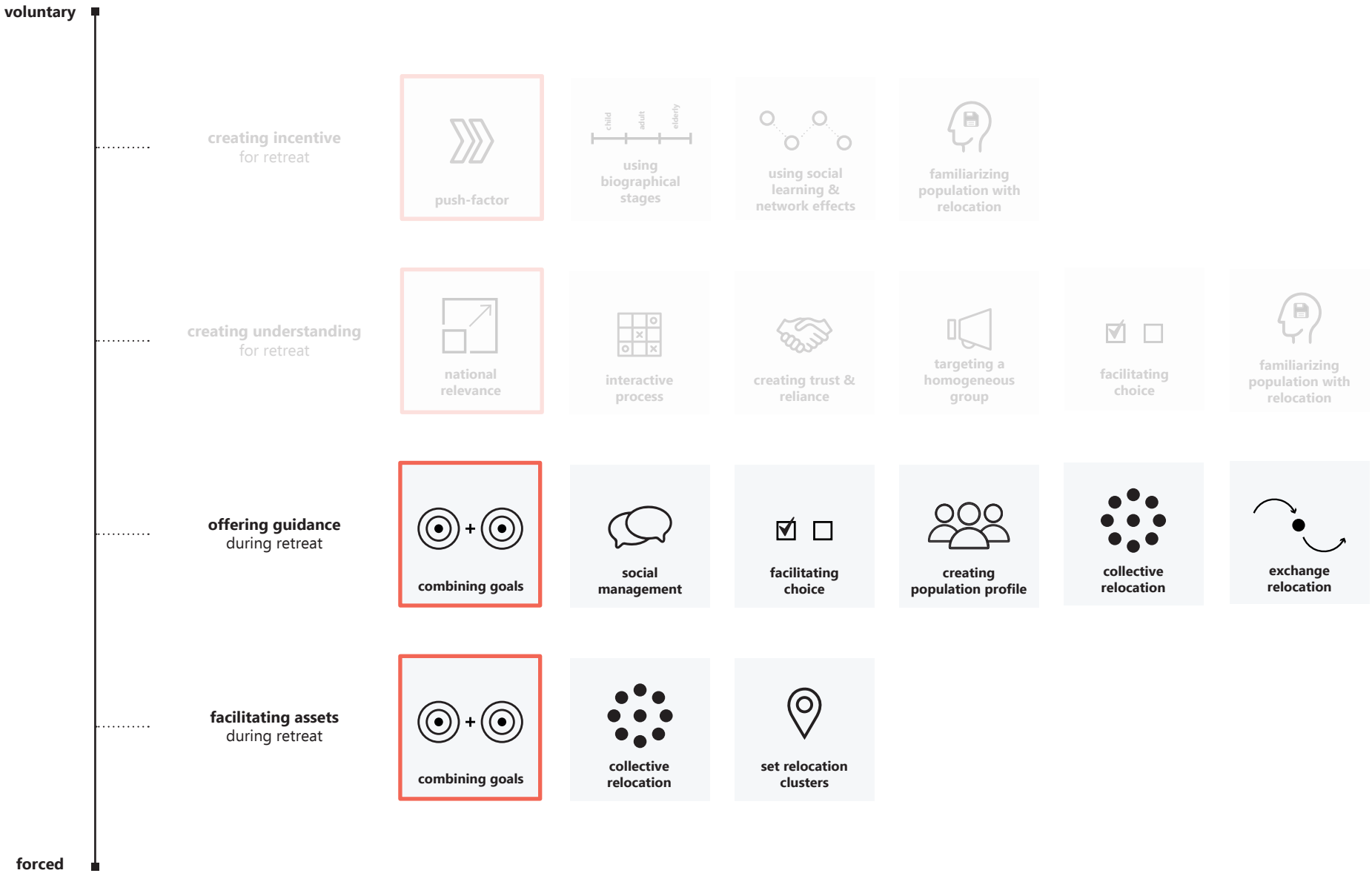
Informal settlements in Sao Paulo and the Mekong Delta


voluntary
offering guidance
during retreat
important context
combining goals
social management
facilitating choice
creating population profile
collective relocation
exchange relocation
facilitating assets
during retreat
important context
combining goals
collective relocation
set relocation clusters
forced

The voluntary compensation schemes where the implementer involvement puts the focus on creating incentive and understanding for retreat is a more realistic for the Netherlands, and is aided by the large timeframe that is available.

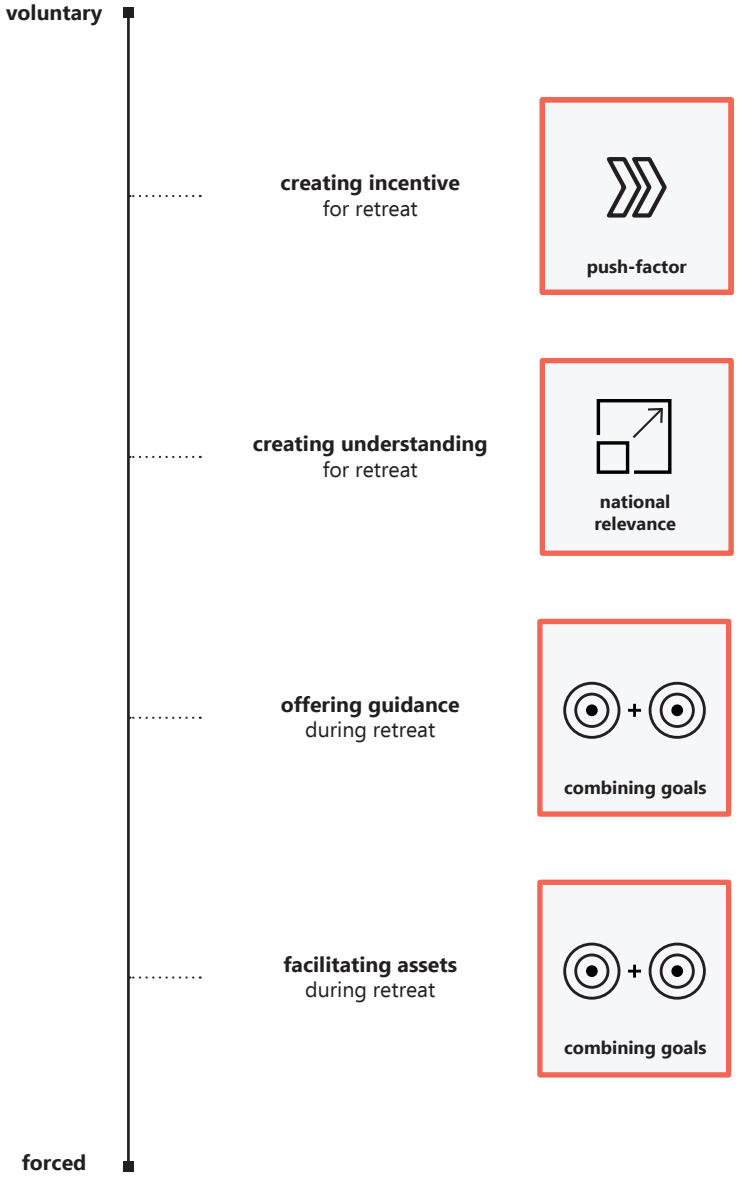


The instruments of the non-European cases are crucial in dealing with the vulnerable groups, as there is more implementer involvement.



Case study analysis
Conclusions

The context greatly influences the success of the retreat strategy. The push-factor was crucial in creating incentive and ensure the voluntariness. The combination of goals allowed large scale retreat and ensured livelihood improvement for the vulnerable. In a pre-disaster setting, existing trends might be able to offer the same effect.



Hypothesis for good managed retreat

In the **absence of threat as a push-factor**, **trends that are prevalent in the sending region might have a similar role in creating incentive to move.** In addition, these **trends can offer a combination of goals to increase the support for retreat** and maintain voluntariness.

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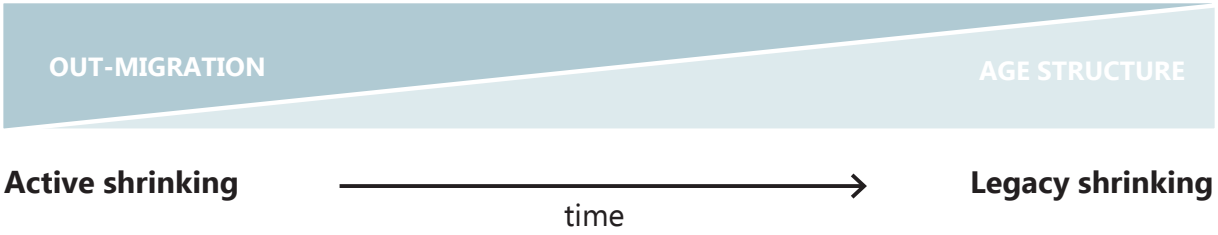
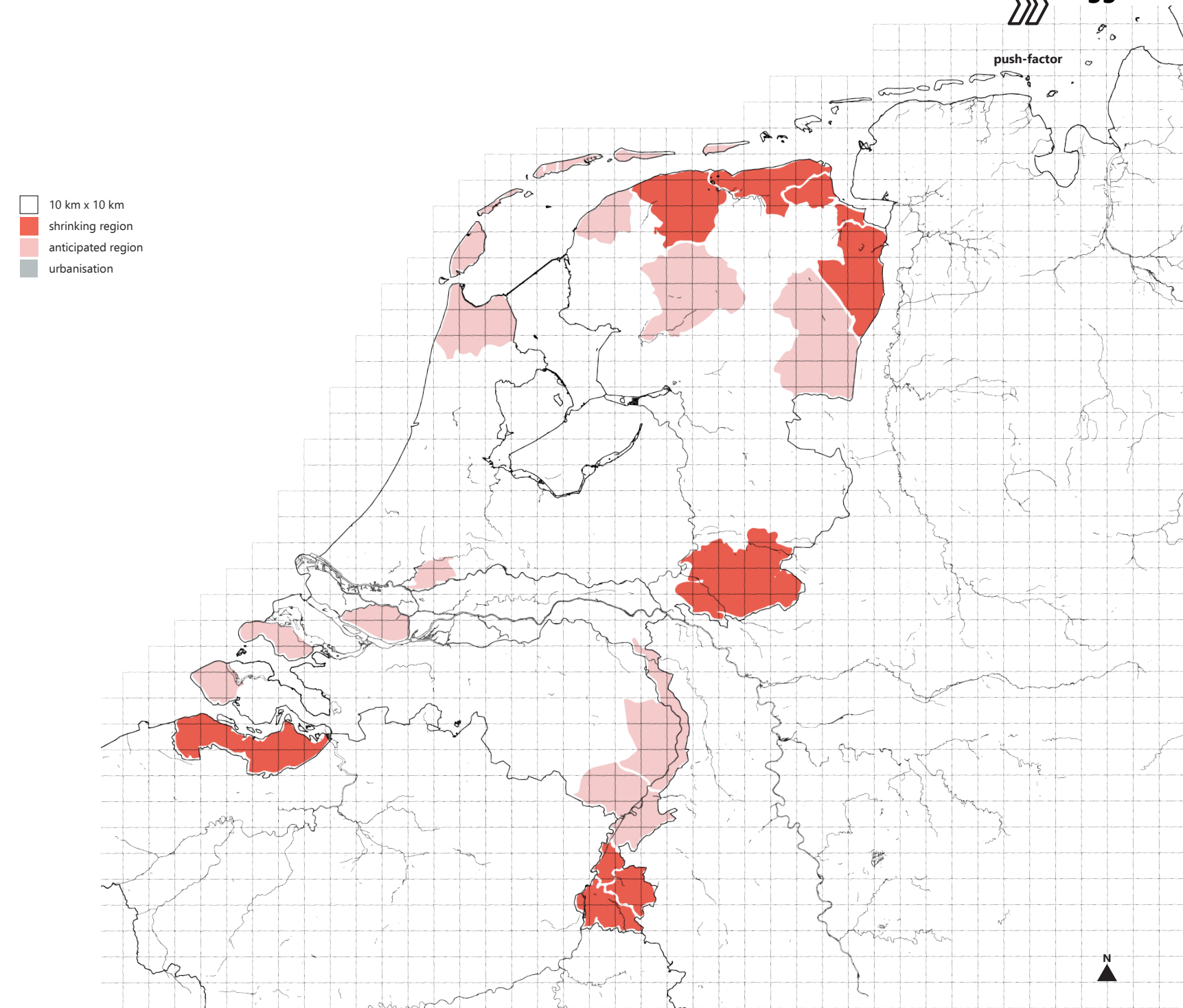
The most obvious trend is demographic decline. Decline is a push-factor in itself, but is also a symptom of other push-factors. These push-factors cause the out-migration of youth, so-called active shrinkage. Subsequently, legacy shrinkage is caused by the distorted age structures, like aging and dejuvenation, as a result of the out-migration in the past. The process creates a negative feedback loop (Copus, 2019).



Test-case
Building on trends

Identified regions of demographic decline and regions where decline is anticipated (Ministerie van Algemene Zaken, 2021)



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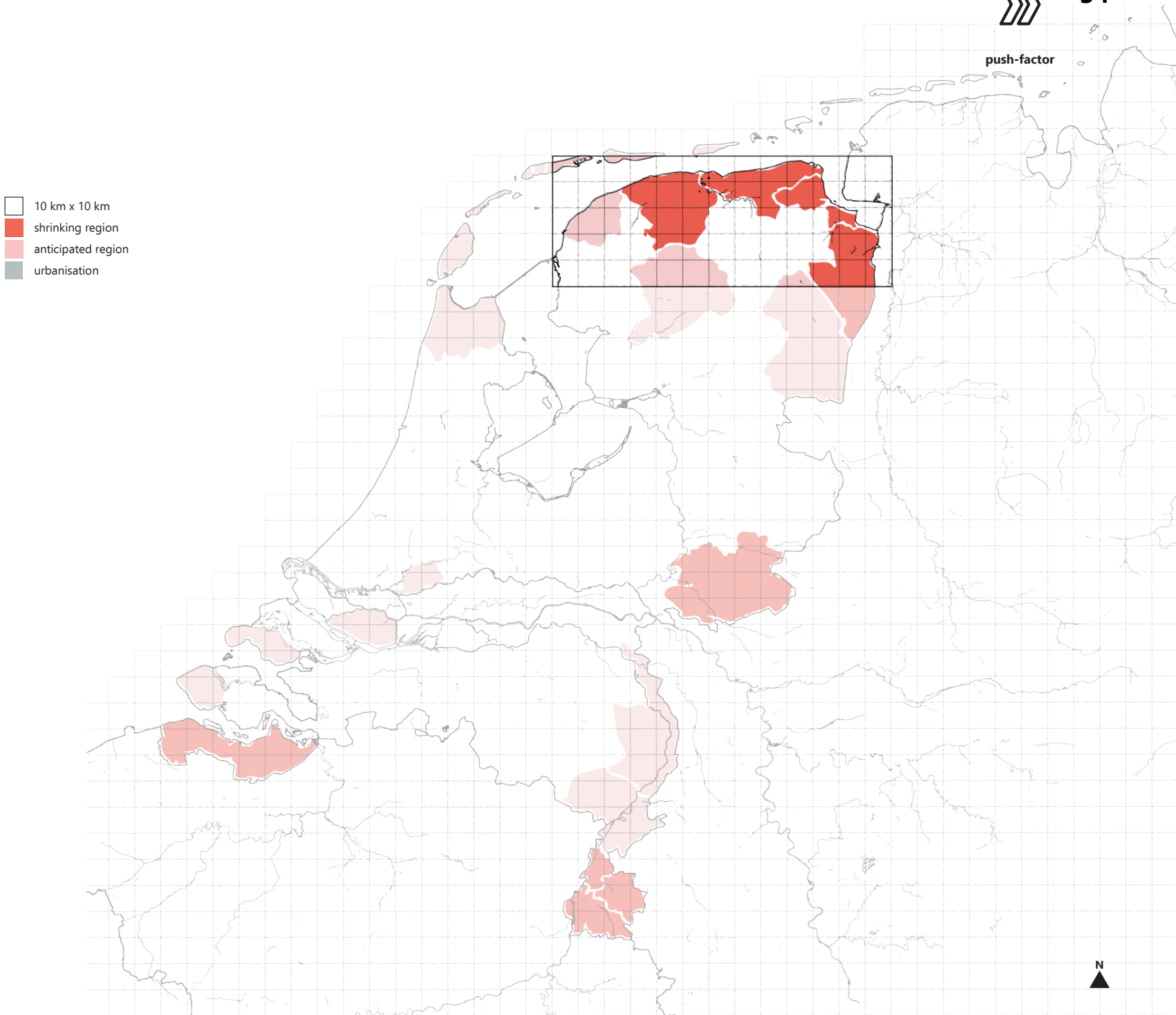
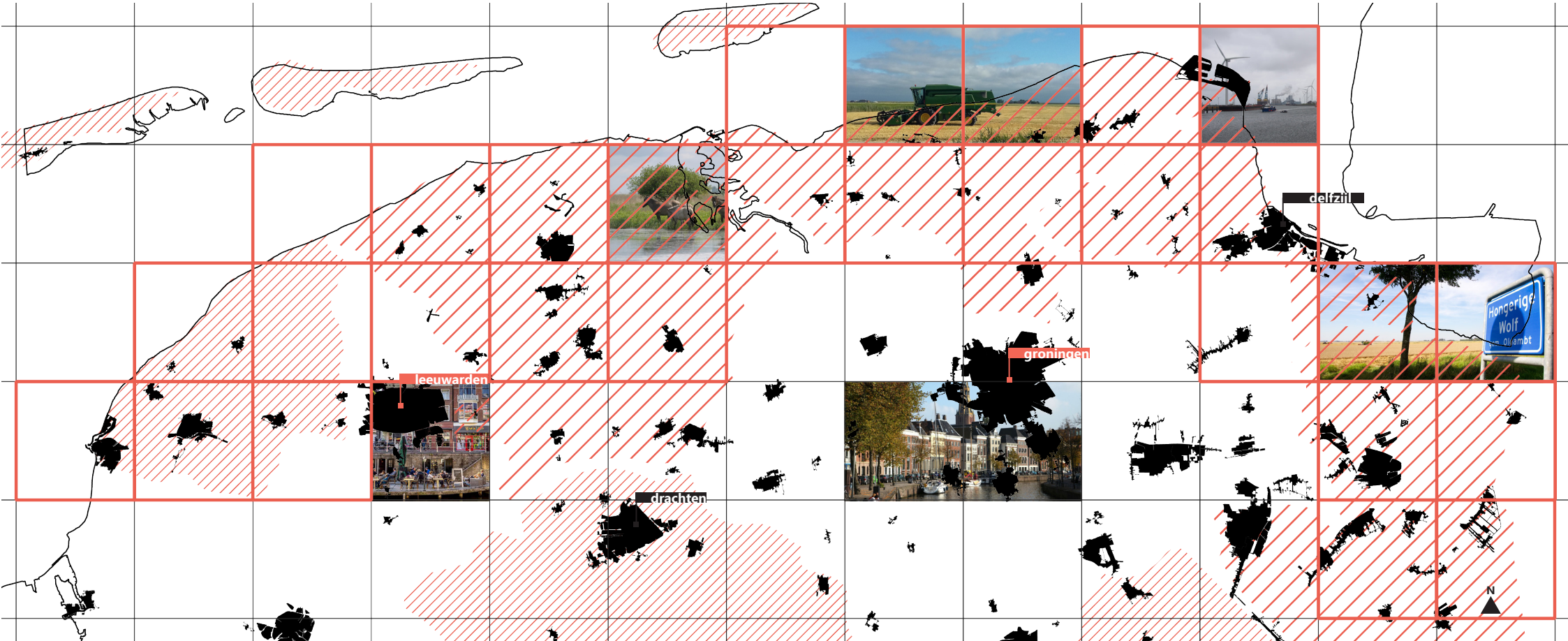
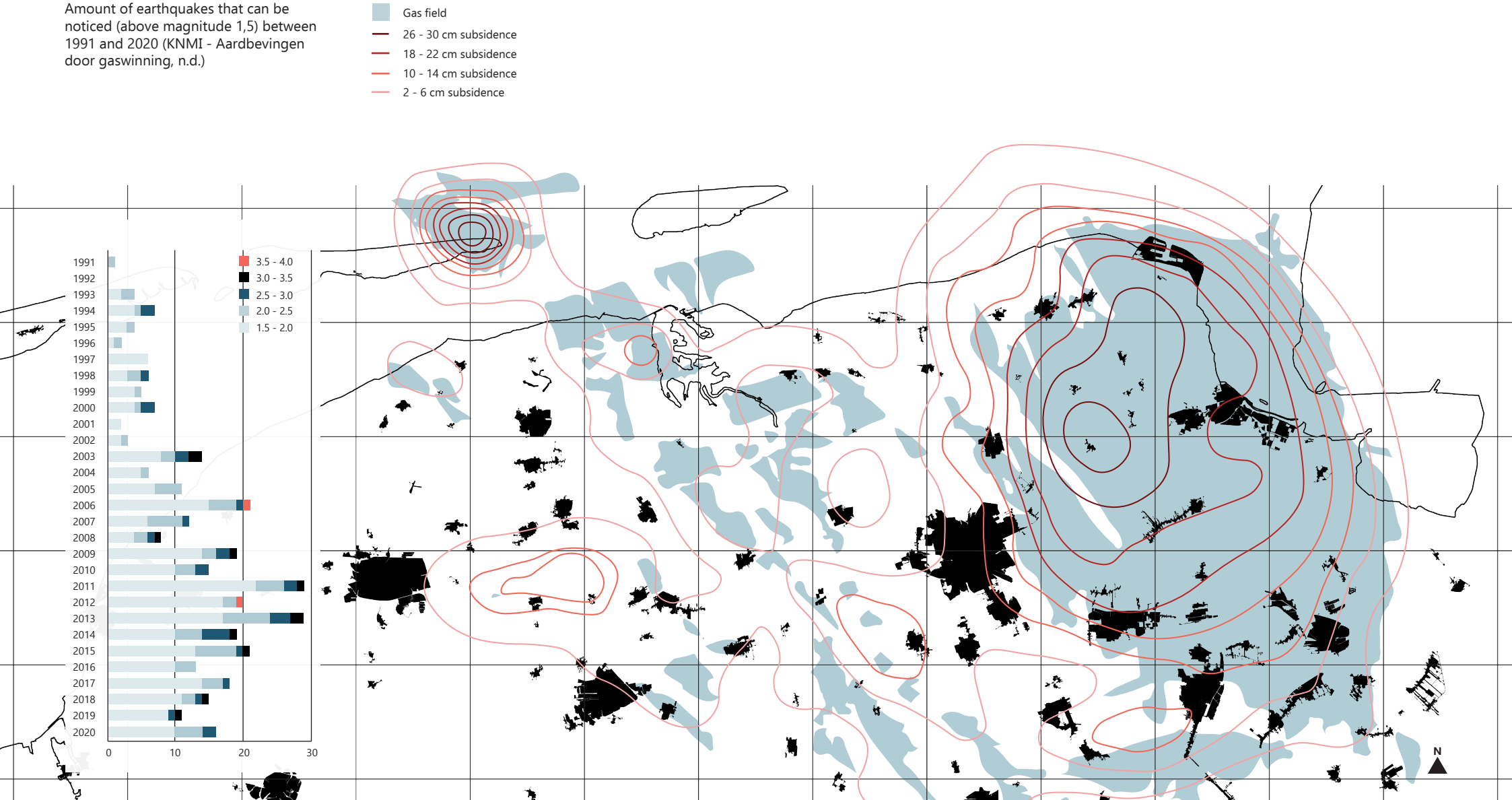


The northern provinces with marked regions of demograpic decline and density as illsutrated by landscape characteristics.

- places
- shrinking region
- anticipated region
- established coastal shrinking region



Amount of earthquakes that can be noticed (above magnitude 1,5) between 1991 and 2020 (KNMI - Aardbevingen door gaswinning, n.d.)



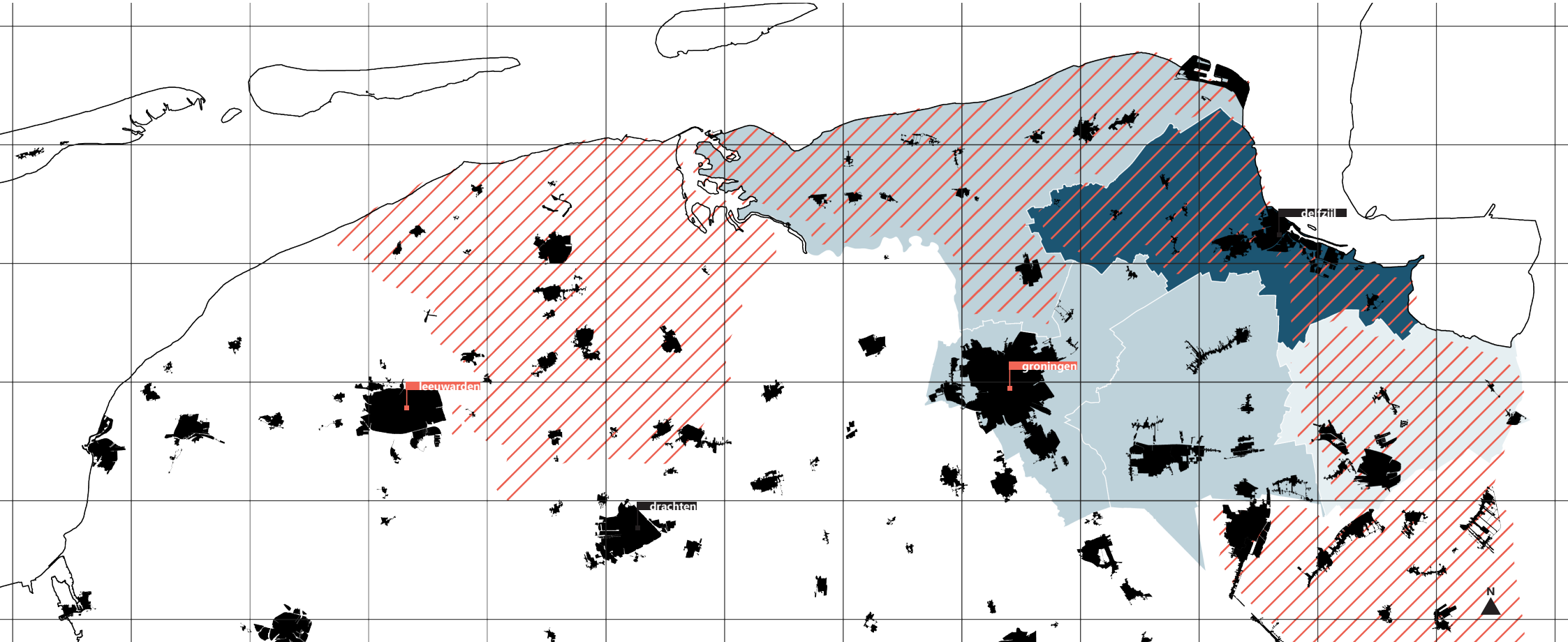
Combination of roll-out regions

roll-out region reinforcement plan:
concentration of reinforcement interventions

- high
- medium
- low

roll-out region: plan of action demographic decline

+



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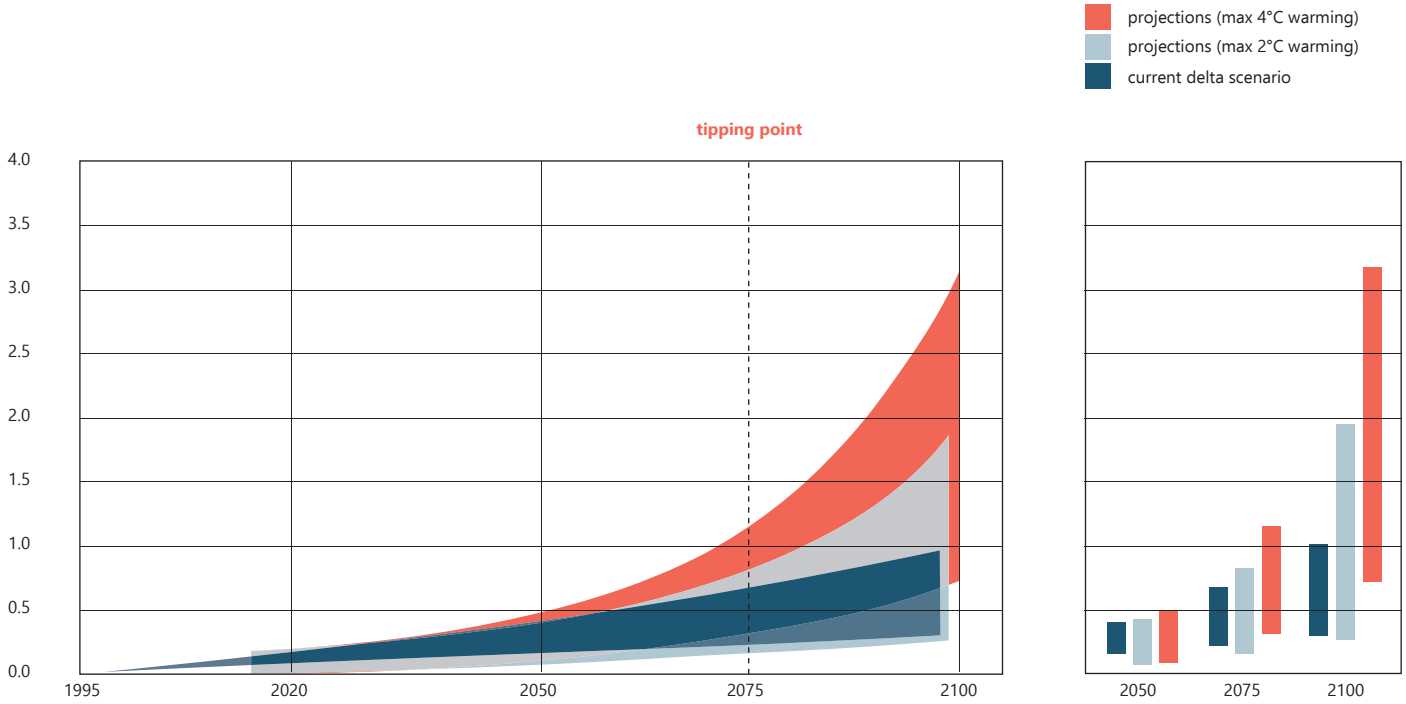
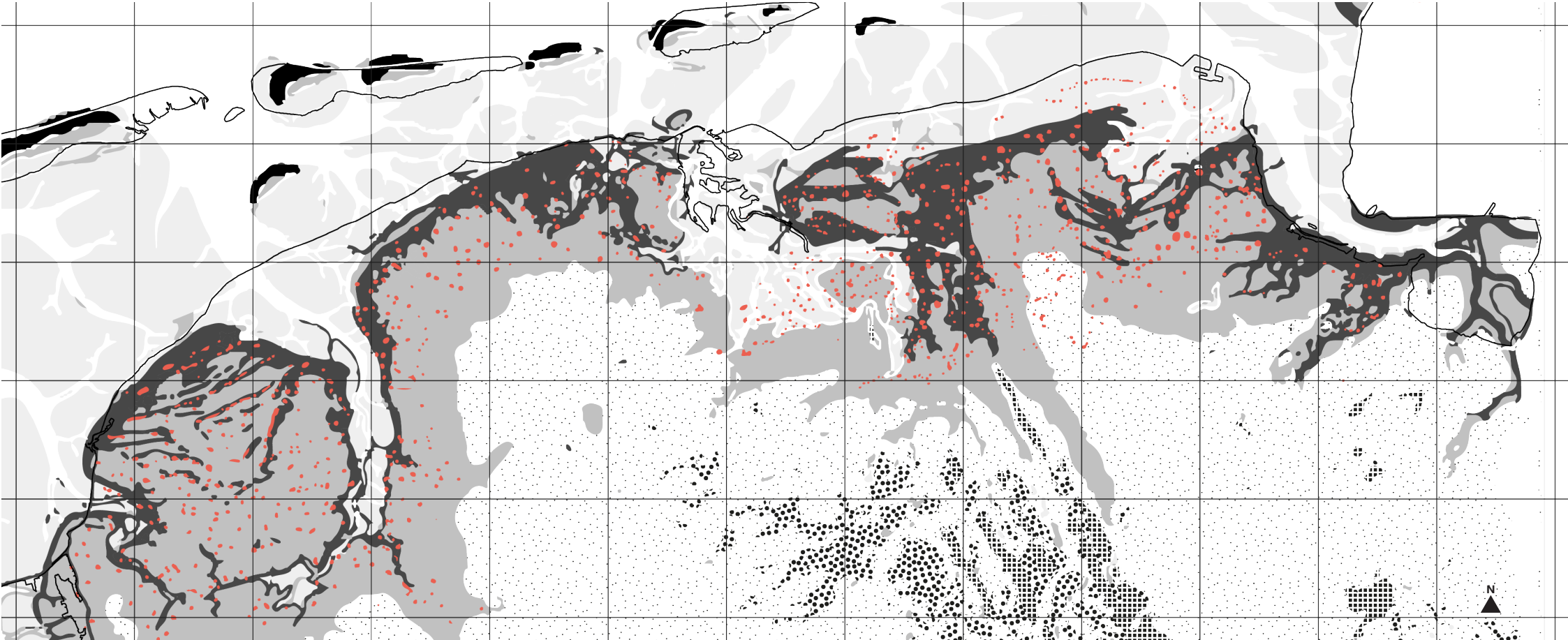
In order to move towards the strategy design, a scenario for retreat is needed that guides the design. The degree of retreat is determined by just how fast sea levels rise, which is why a SLR scenario is created to guide the strategy design.



Possible SLR for the 21st century according to the current delta scenario and the projections of accelerated SLR as a result of disintegration of the WAIS (Haasnoot et al., 2018)

Before there were dikes for protection the northern coastal region was a dynamic landscape. In 800 AC the coast was moving seawards eventhough sea-levels were rising. This was caused by the surplus of sediment.

- sand dunes
- salt marsh embankments
- salt marshes
- mudflats
- historical dwelling mounds (elevated grounds)



Sand banks remained dry during high tide, which caused salt marshes to form. On the edges of these salt marshes sediment accumulated more easily creating sandy ridges with a height of a few decimetres developed along the coastline: the salt marsh embankments.

Young salt marshes (Ivo Vrancken)

Elevated landforms called mounds originated on these embankments. With the rising sea-level and the subsequent sedimentation and man-made elevations, clusters of mounds would over time merge together, creating village mounds. Nowadays these mounds still exist, although they have lost their function.

Wierden-landscape, salt marsh embankments at the foot of a village mound (Geert Hendrik Streurman, Veenkoloniaal Museum, Veendam)

Towards 2075

Due to the demographic decline trend, the northern coast is identified as a possible region for coastal retreat as a solution to extreme SLR. This means that as long as it is uncertain to what extent sea-levels will rise, preparations are made to allow easy implementation of retreat if necessary. During these preperations, retreat and (re) development goals are combined in order to increase support for retreat in relation to the uncertain pre-disaster setting.

After 2075

In 2075 the tipping point is reached. In face of the exponential rise (also after 2100) the government decides to change the flood defence paradigm and create a landscape that is alive, moving with the water and growing over time. Dikes are no longer reinforced. Rather, the landscape behind the dikes is able to retain the water, creating a natural buffer which allows sedimentation to take place. This marks the start of the large scale retreat strategy from the northern coastal region towards the High East.

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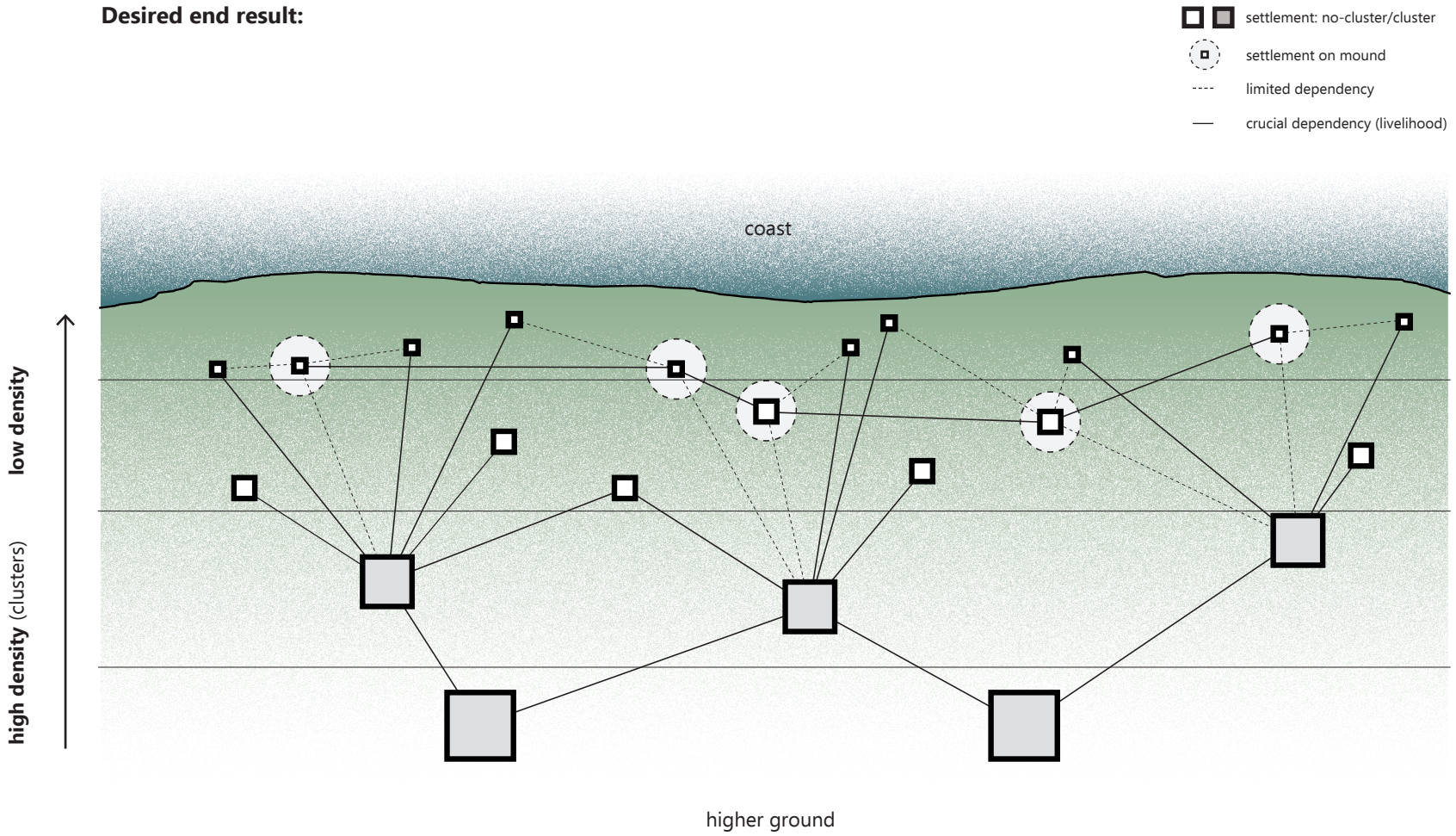
When a region is experiencing demographic decline, the support for amenities deminishes, which results in impoverishment of the region and ultimately loss of livelihood. However, a village can survive without presence of amenities, provided that regional amenities are of high quality and easily accessible. In other words, the distribution of amenities needs a regional strategy; Centralisation.

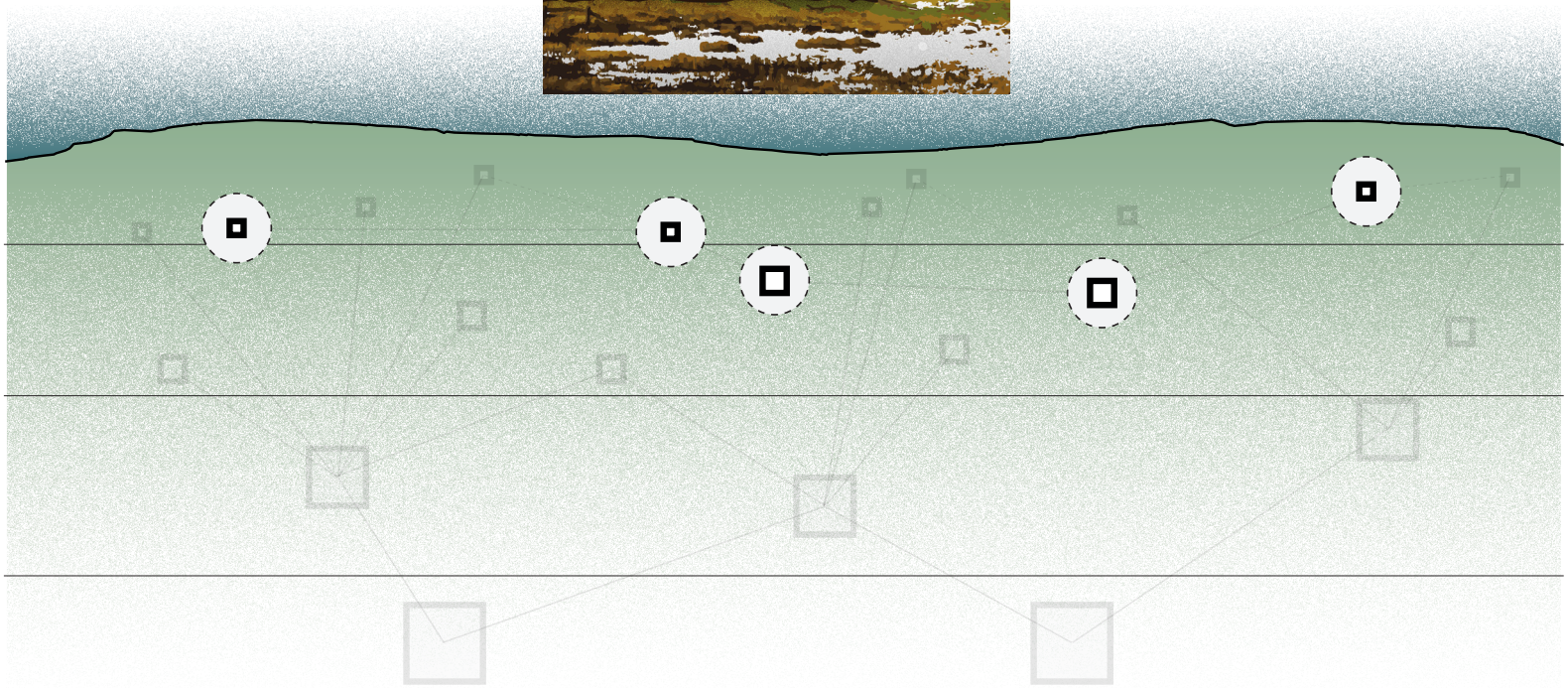
Creating this resiliency can be useful for future implementation of retreat. By rearranging the size of clusters in relation to their proximity to the sea, retreat can be implemented while sustaining livelihood in the sending region. At the same time, smaller scale relocation can be used to create this regional configuration and be an instrument in sustaining livelihood once regions become too sparsly populated.

Desired end result:

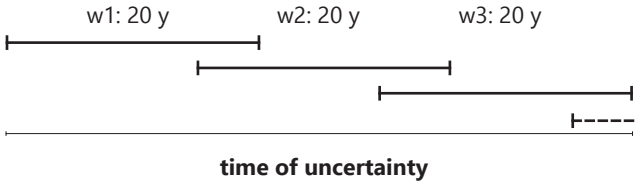


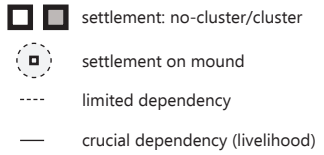
This centralisations strategy should also incorporate the potential of the historical dwelling mounds. Settlement on mounds higher than 3 meters are assigned a different role within the strategy. In contrast to supporting decline in villages close to the coast, dwelling mounds in the coastal region should become resilient settlements that can sustain themselves (and eachother) once retreat is implemented.

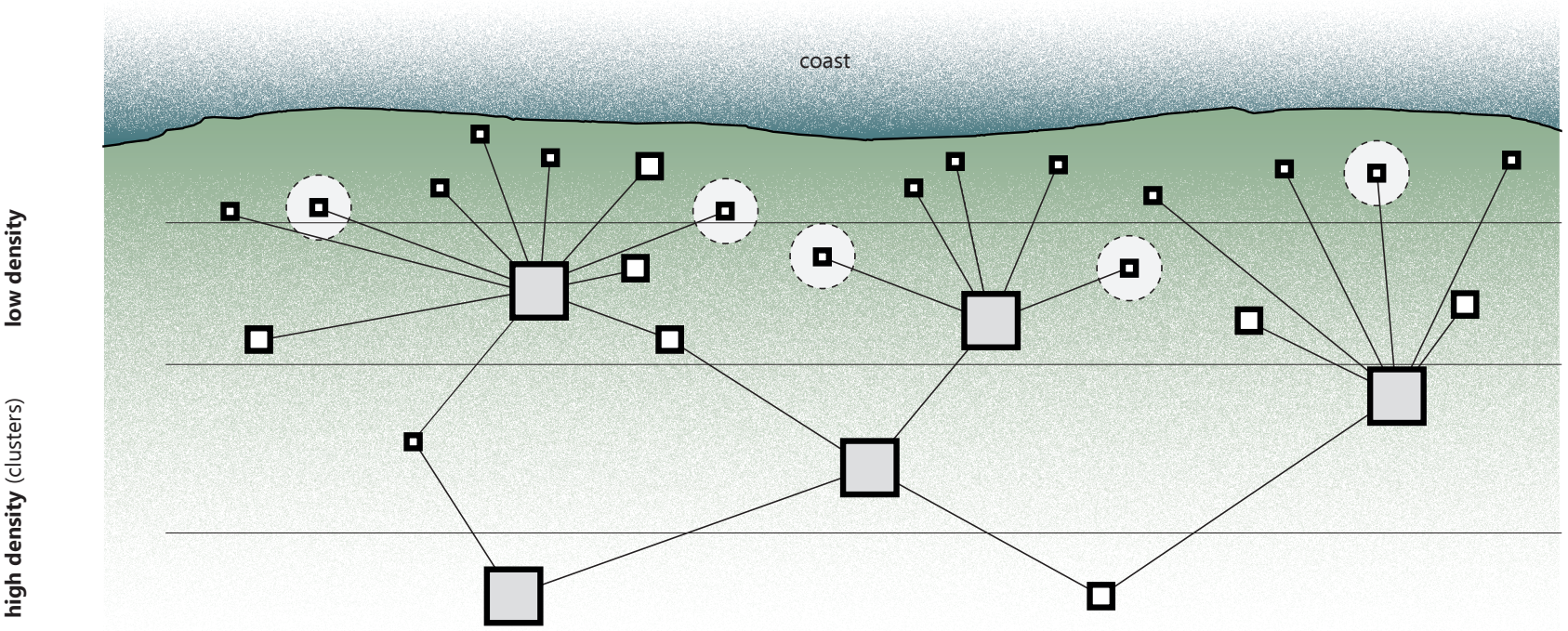
Desired end result:



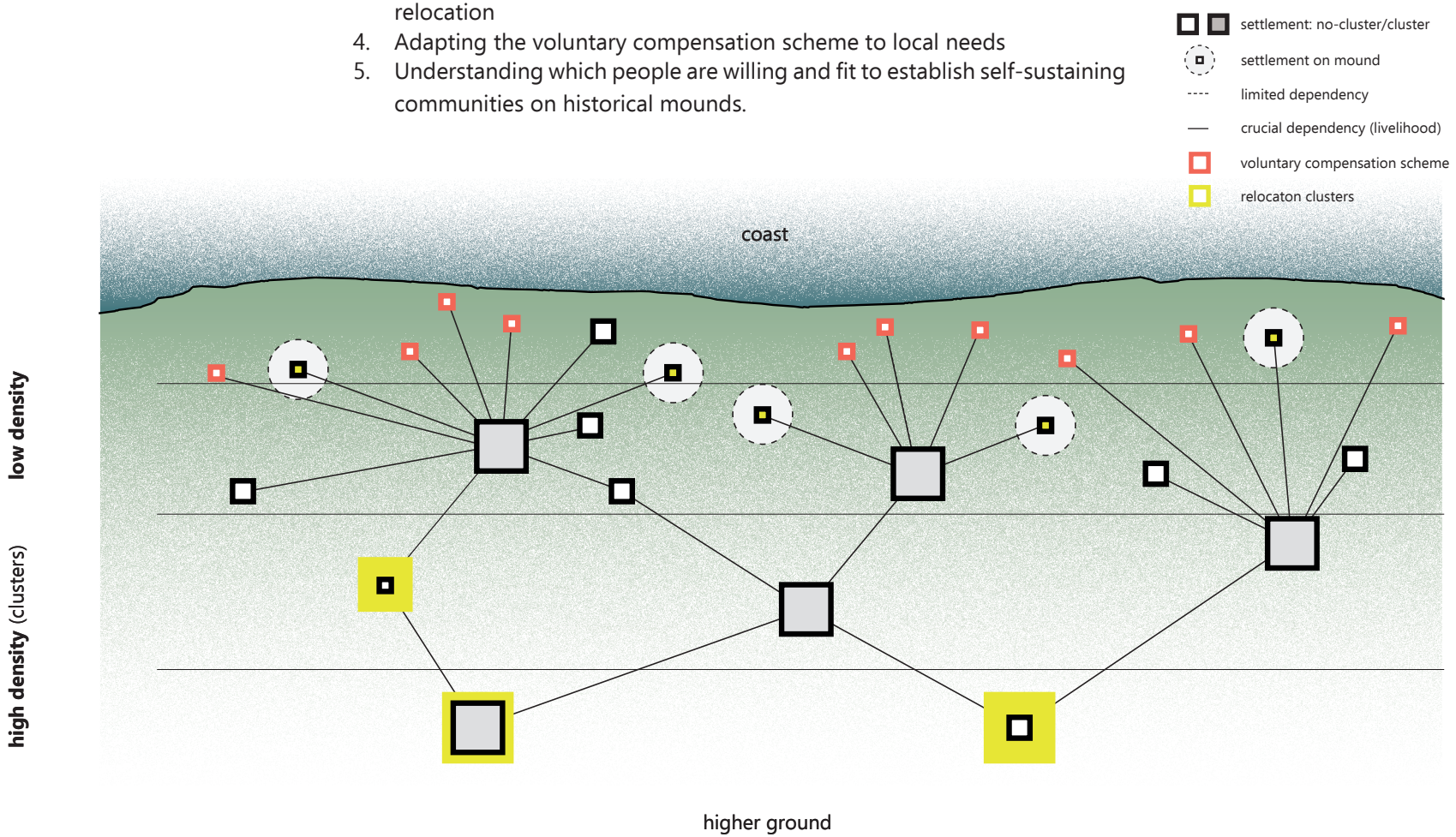
In order to reach this hierarchy, a regional centralisation strategy is proposed. In face of the uncertainty, the centralisation strategy is rolled out in consecutive waves of 20 years until the tipping point is reached. Each wave has specific goals:



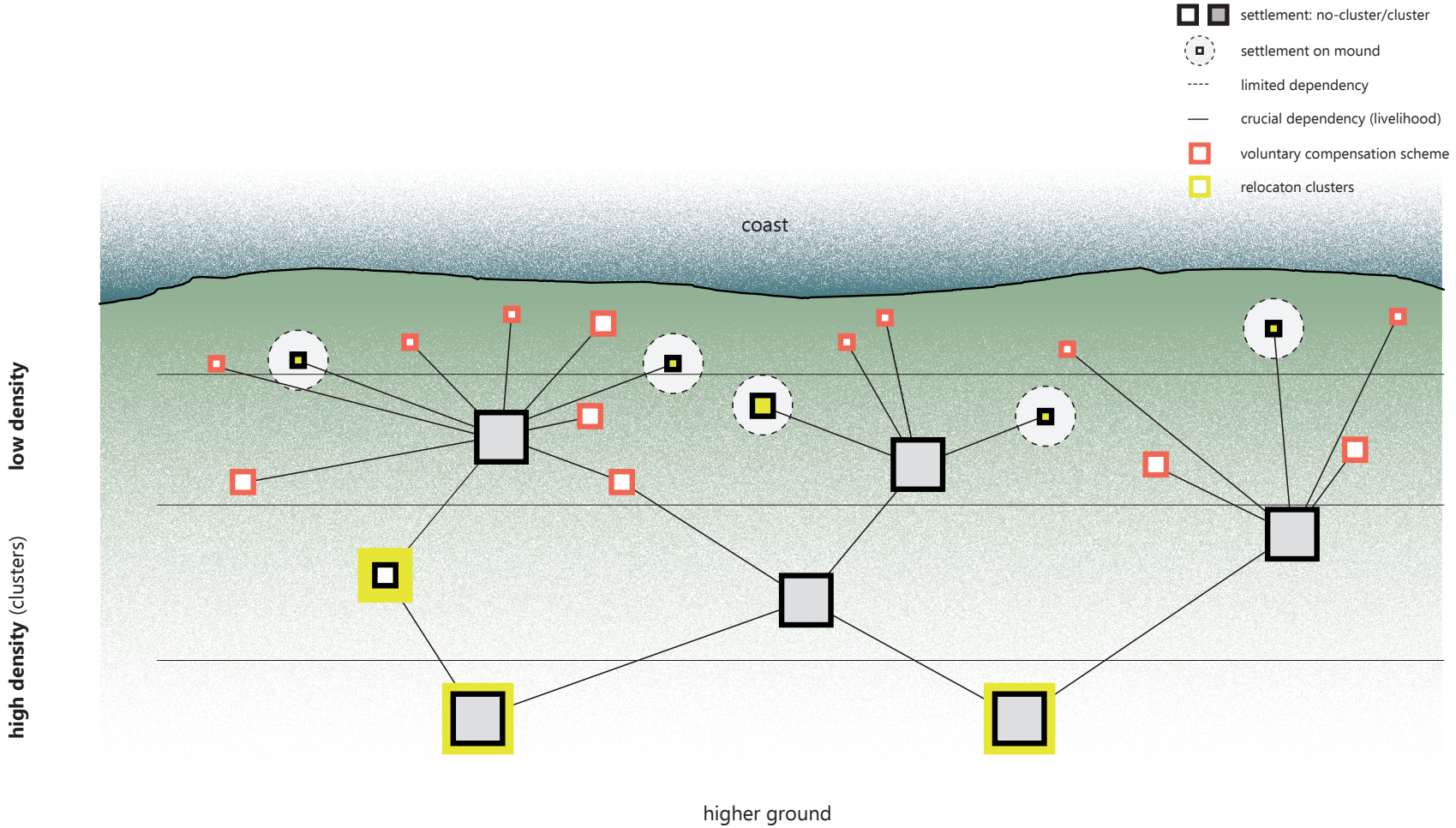




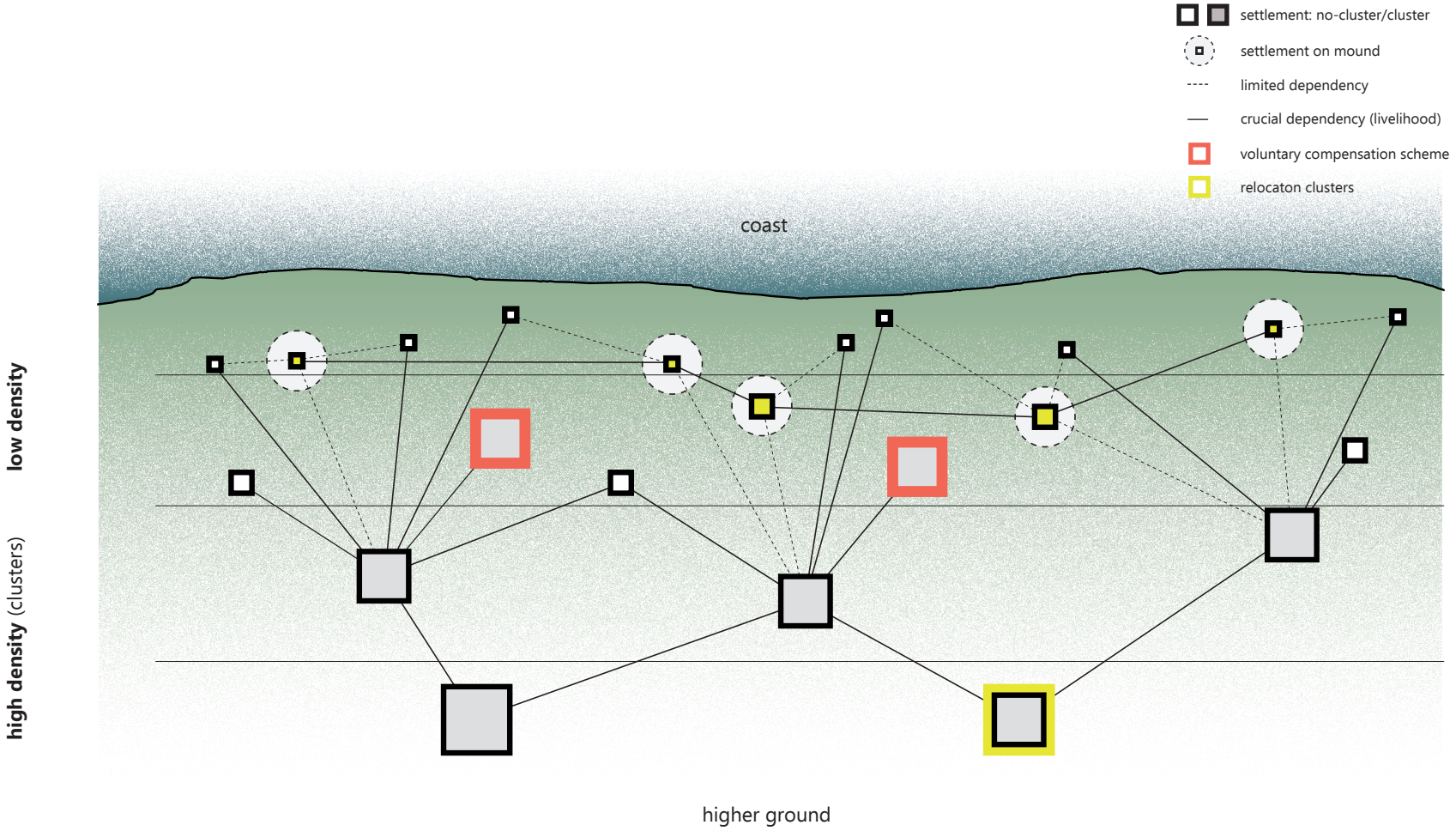
1. Decreasing the impact of demographic decline on the vulnerable groups along the coast (villages with distorted age structures)
2. Relieve unmarketable property owners (as a result of the gas extraction crisis).
3. Familiarizing the community with a voluntary compensation scheme for relocation
4. Adapting the voluntary compensation scheme to local needs
5. Understanding which people are willing and fit to establish self-sustaining communities on historical mounds.



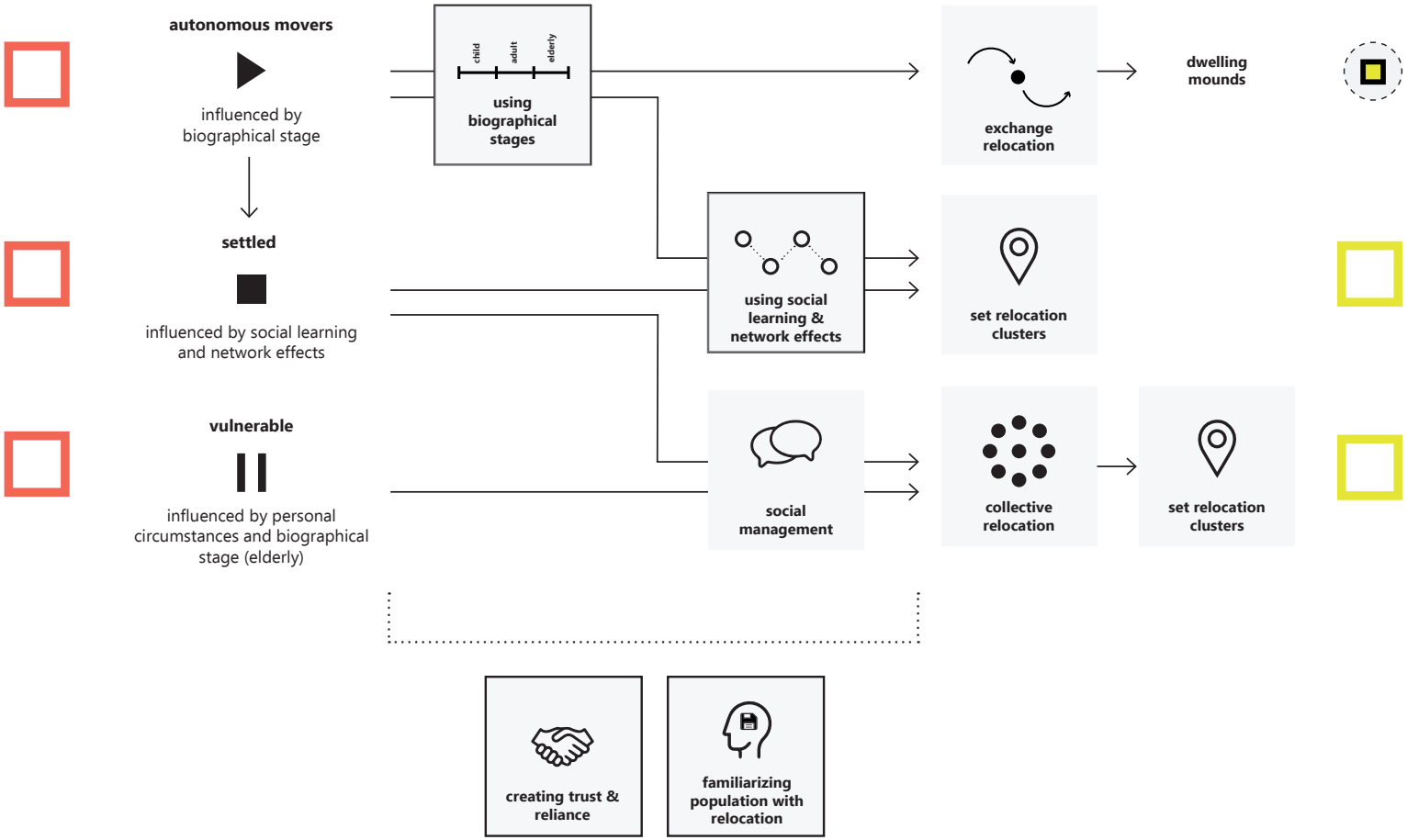
1. Controlled decline along the coast
2. Maintaining the size of the supporting clusters
3. Increasing independence of self-sustaining communities on historical mounds.



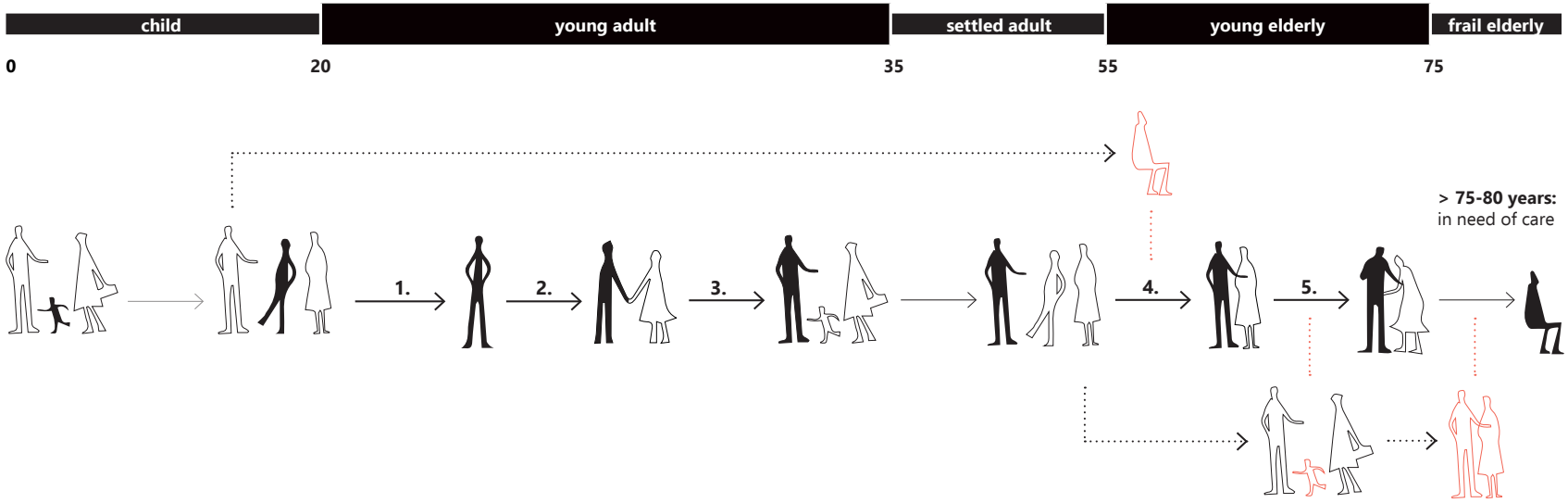
1. Decreasing size of clusters that are no longer needed to support the surrounding region
2. Increasing independence of self-sustaining communities on historical mounds that can support the surrounding region



These are the instruments used in order to reach this resilient configuratoin. In order for the population to accept a voluntary compensation scheme there is a strong reliance on biographical stages, social learning and network effects. Using these processes as instruments requires a deeper understanding of how biographical stages influence motivation to move.



The young adults are the easiest to motivate, whereas the young elderly are the most crucial to motivate. What is also clear, is that there is a strong relation between these biographical stages, caused by family ties.



Refining instruments
Pull-factors

using biographical stages

set relocation clusters

By creating pull-factors in the relocation clusters that relate to the young adults and the young elderly, incentive to accept relocation can be increased.

young adults

Moving out

\+ Available housing
\+ Available education
\+ Job opportunities

Moving in together

\+ Available housing
\+ Job opportunities

Settling down

\+ Available housing
\+ Neighbourhood appropriate for young children
\+ Job opportunities

young elderly

Empty nesters

\+ Available housing
\+ Job opportunities (difficult)
\+ Closeness to parents (care)

Retirement

\+ Health (future proof)
\+ Closeness to (grand)children

multigenerational communities

senior communities

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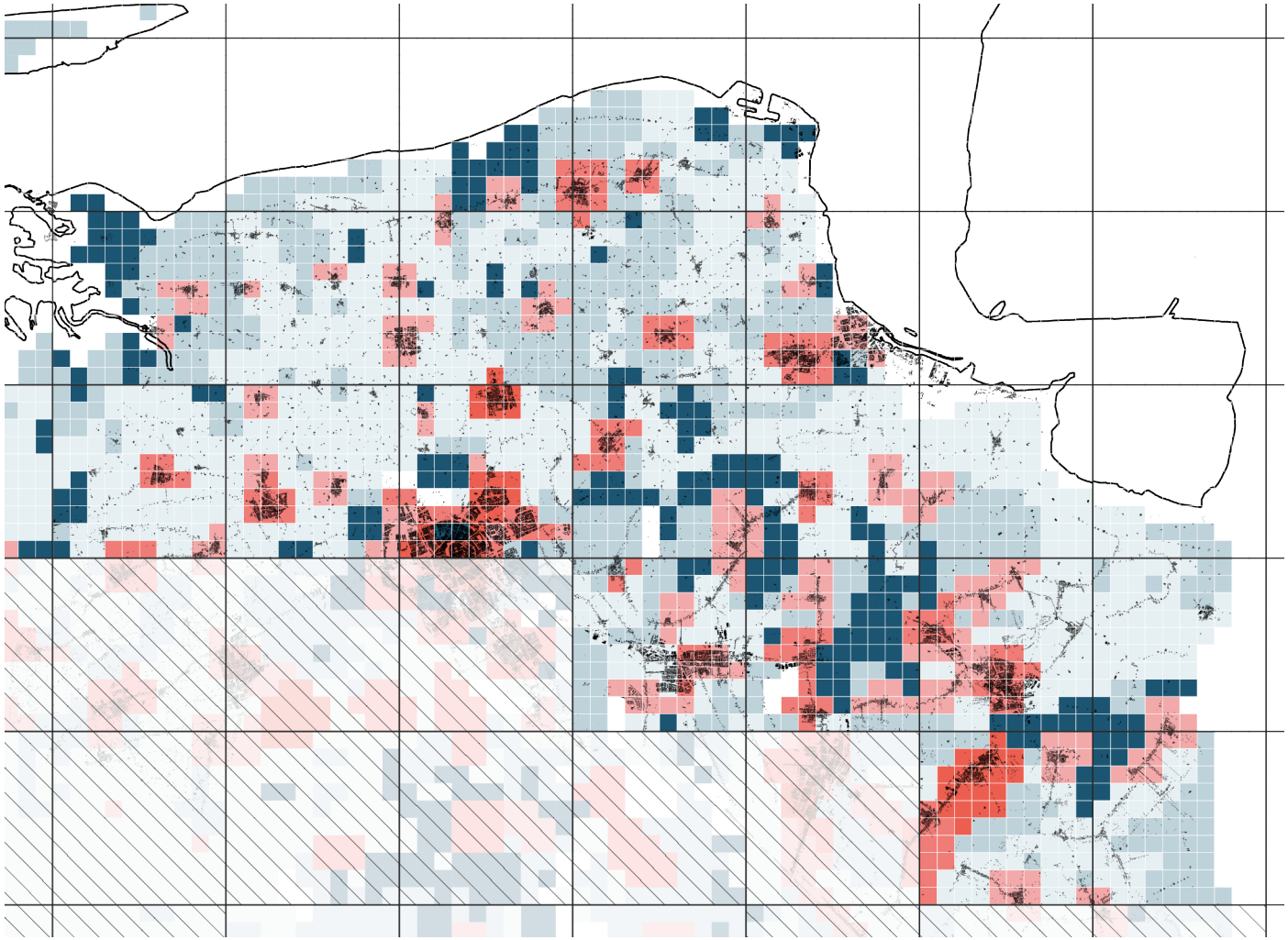
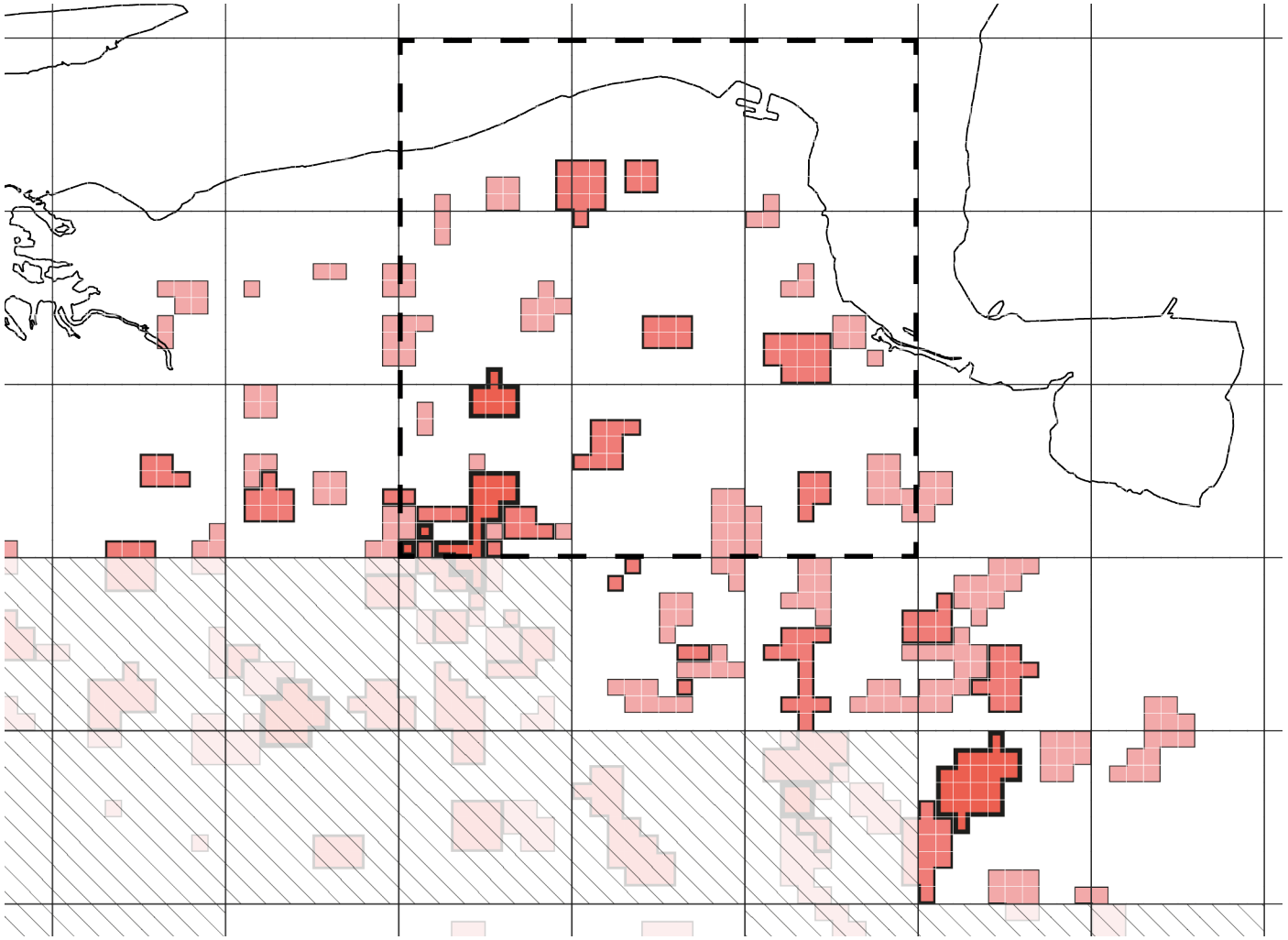
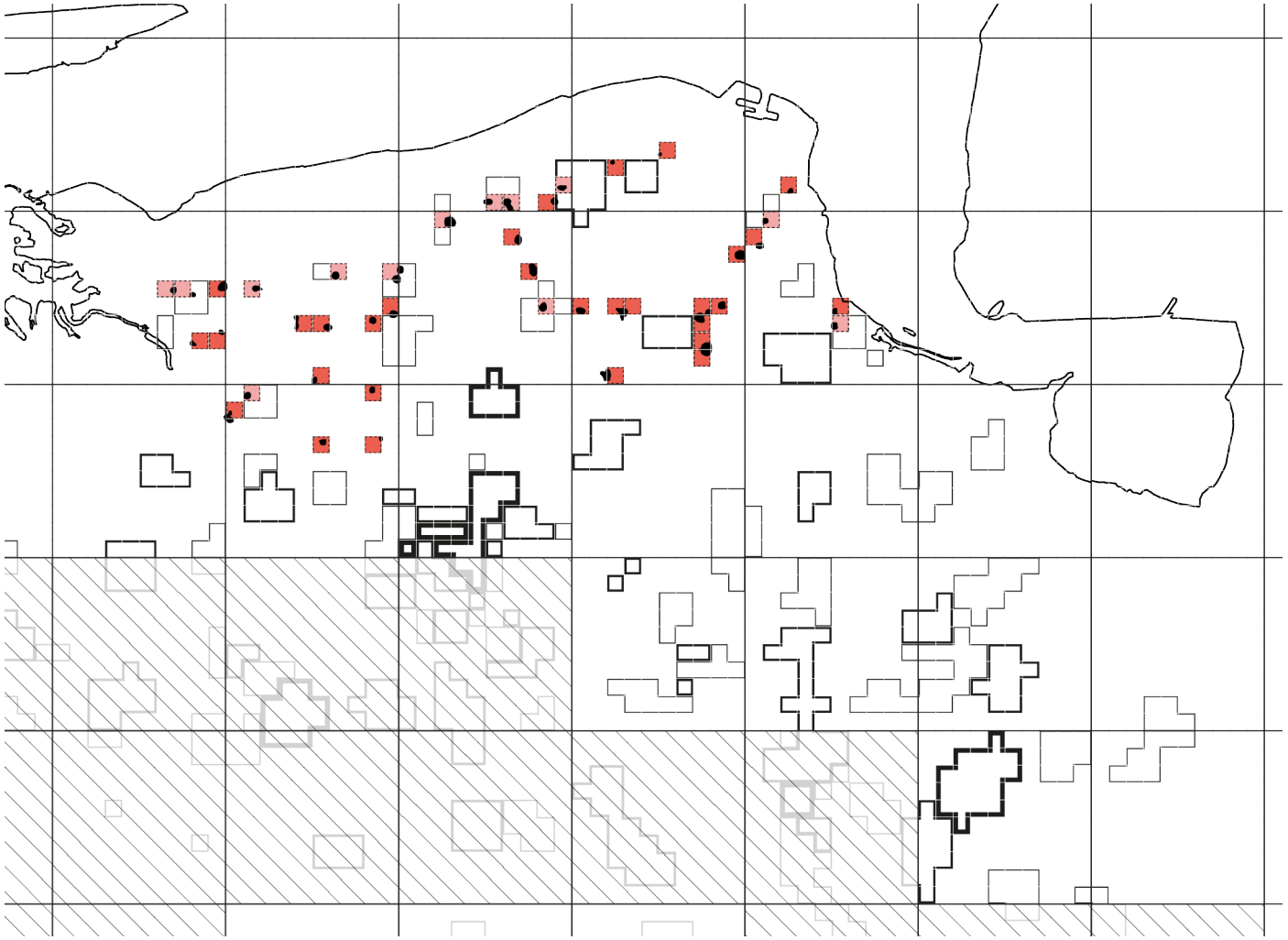


> 3000 households - cluster
1000 - 3000 households - cluster
400 - 1000 households - cluster
100 - 400 households
30 - 100 households - collective relocation
< 30 households


clusters (> 400 households)
> 3000
1000 - 3000
400 - 1000

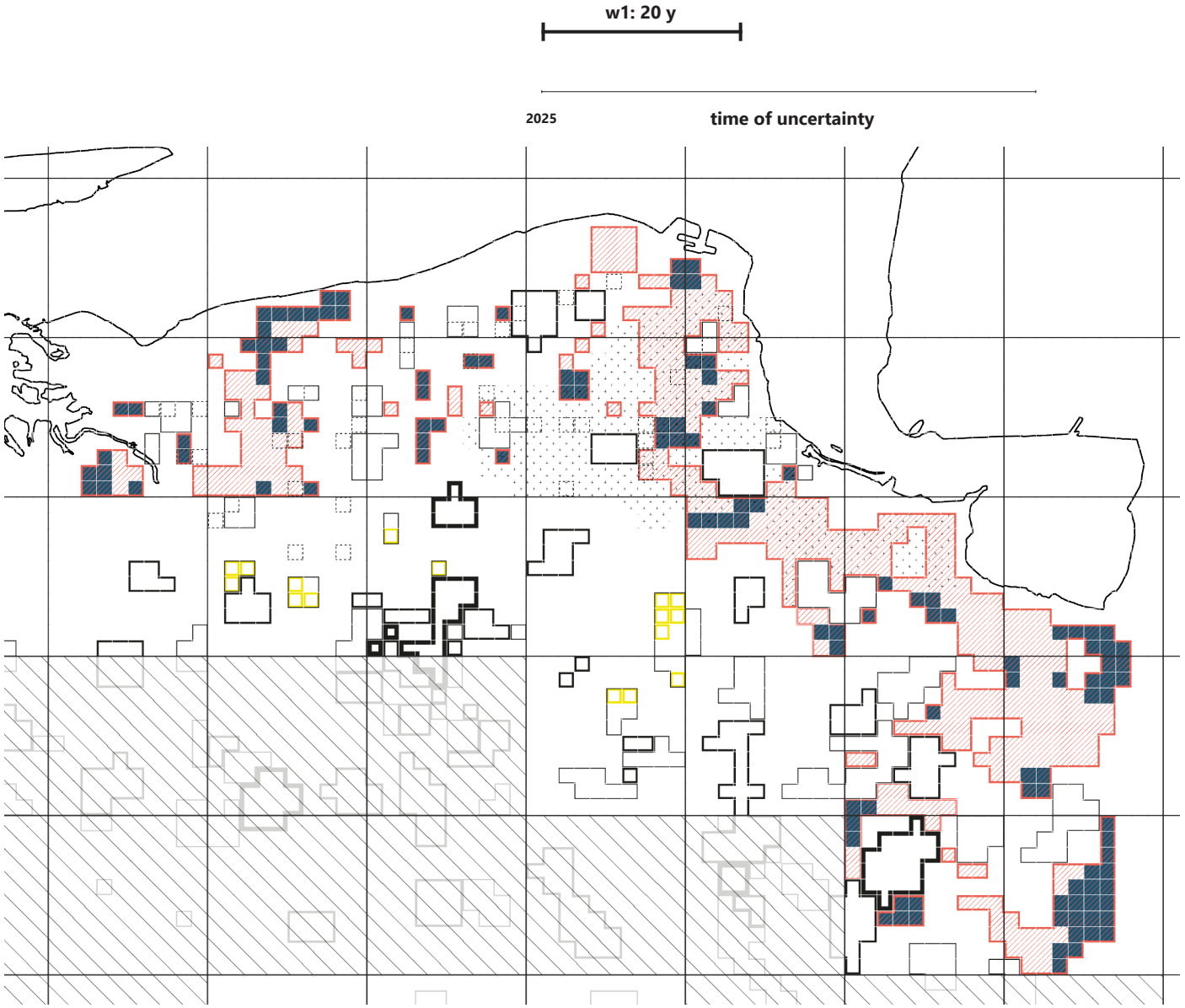

clusters (> 400 households)
> 3000
1000 - 3000
400 - 1000
mounds > 3 m
mounds within clusters
mounds outside of clusters

Strategy proposal
Waves of retreat - Wave 1

Roll-out region > voluntary compensation scheme:
Region where livelihood is under pressure:
Shrinking region outside of clusters as defined by the national plan for population decline where there is a high concentration of (future) vulnerable groups.

Roll-out region > exchange relocation:
Dwelling mounds higher than 3 meters outside of clusters

Roll-out region > collective relocation:
Region where households density is between 30 and 100 households per km²



clusters (> 400 households)
- > 3000
- 1000 - 3000
- 400 - 1000

roll out area voluntary compensation scheme
- roll out area exchange relocation (mounds)
- option of collective relocation (social management) (30-100 households per km²)

highest concentration damaged (unmarketable) housing

potential area relocation clusters (400-1000 households per km²)

Strategy proposal
Waves of retreat - Wave 1

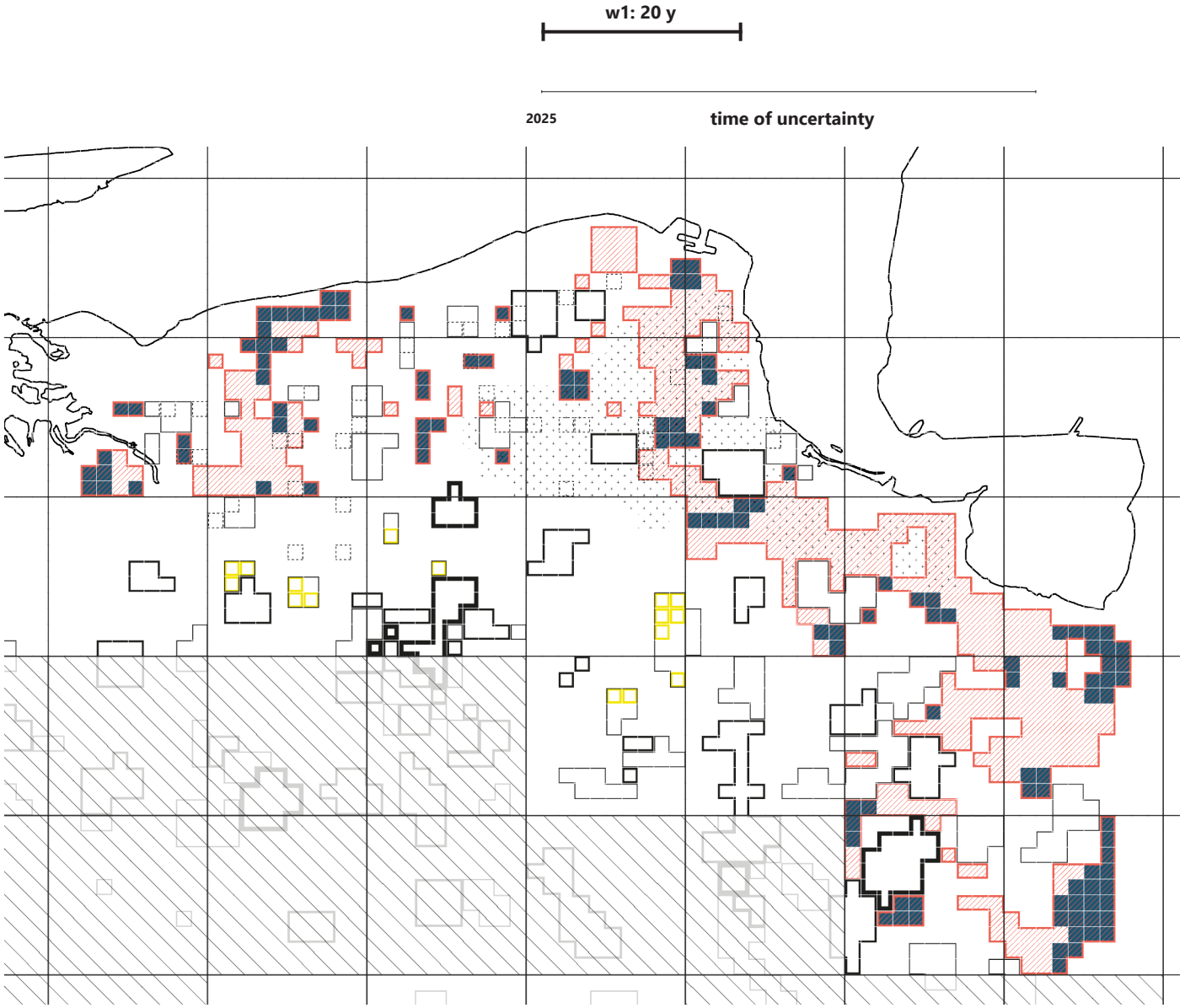
Biographical stage of focus:
Young elderly

Additional target group:
Citizens with unmarketable housing due to damage caused by earthquakes

Moment of opportunity:
Empty nesters / Retirement

Pull-factors:
- Future proof housing (senior living communities > close to amenities)
- Job opportunities for young elderly

When accepting scheme choice of relocating:
1. Cluster region: relocation clusters
2. Exchange relocation (possibility to apply for a position on the mounds)

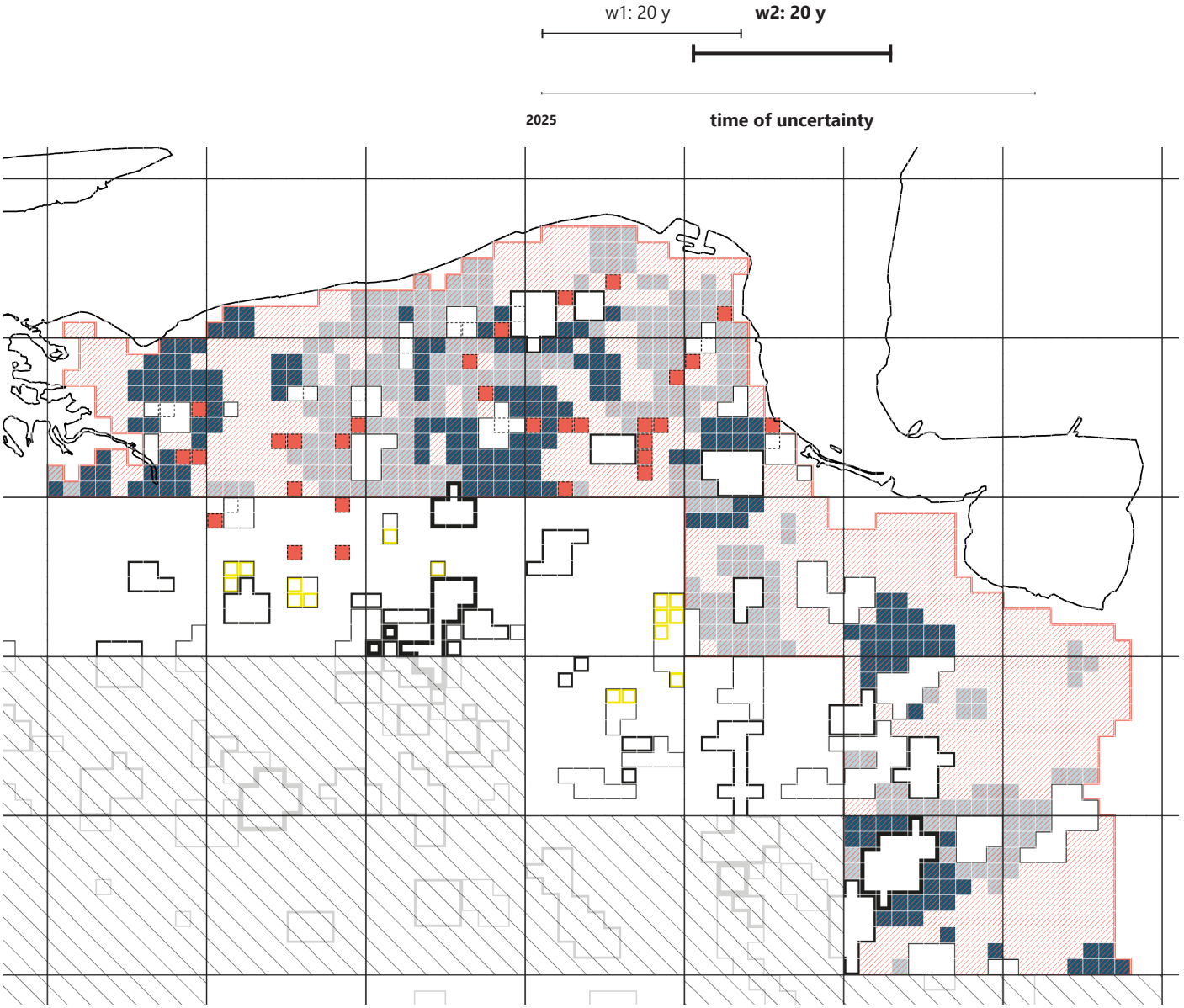


Strategy proposal
Waves of retreat - Wave 2

Roll-out region > voluntary compensation scheme:
Region where livelihood is under pressure:
Shrinking region outside of clusters as defined by the national plan for population decline where there is a high concentration of (future) vulnerable groups.

Roll-out region > exchange relocation:
Dwelling mounds higher than 3 meters outside of clusters

Roll-out region > collective relocation:
Region where households density is between 30 and 100 households per km²



clusters (> 400 households) with higher ground
- > 3000
- 1000 - 3000
- 400 - 1000

location target group wave 2

roll out area voluntary compensation scheme
- roll out area exchange relocation (mounds)
- option of collective relocation (social management) (30-100 households per km²)

potential area relocation clusters (400-1000 households per km²)

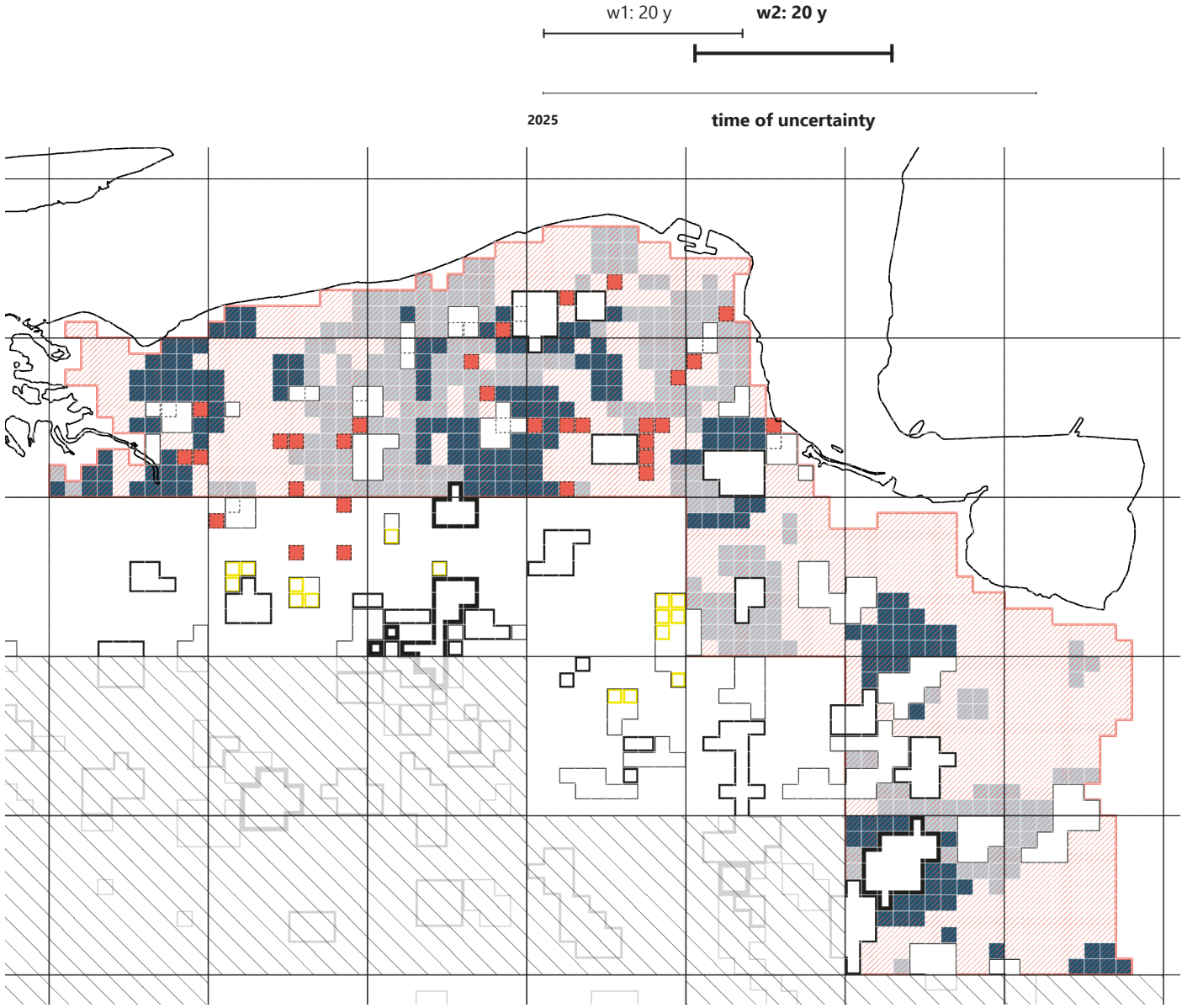
Strategy proposal
Waves of retreat - Wave 2

Biographical stage of focus:
Young adults and young elderly > possible autonomous movers

Moment of opportunity:
Moving out / settling down / empty nesters

Pull-factors:
- Good settling environment (housing/work/school)
- Future proof housing (senior living communities > close to amenities)
- Closer to (grand)children (multigenerational living communities)

When accepting scheme choice of relocating:
1. Cluster region: relocation clusters
2. High East: relocation clusters
3. Exchange relocation (possibility to apply for a position on the mounds)



Strategy proposal
Waves of retreat - Wave 3

Roll-out region > voluntary compensation scheme:

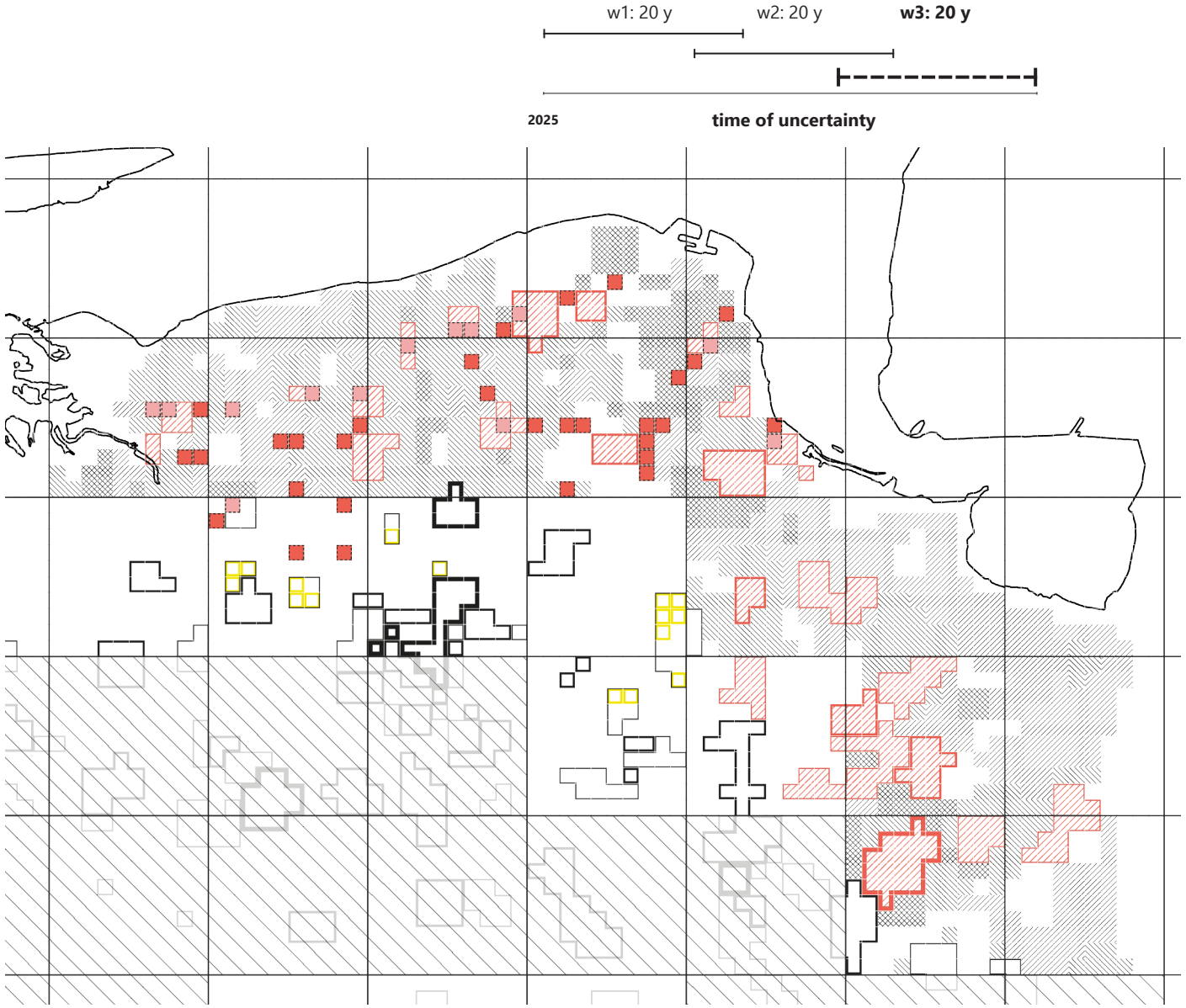
Non-supporting clusters:

Depending on the developments in wave 1 and 2, outer clusters might have lost their an important share of their supporting function due to decline of the hinterland.

While these clusters are in decline throughout wave 3, its amenities (in reduced size) are relocated on self-sustaining mounds in the area.

Roll-out region > exchange relocation:

Dwelling mounds higher than 3 meters



clusters (> 400 households) with higher ground
- > 3000
- 1000 - 3000
- 400 - 1000

higher ground outside of clusters

roll out area voluntary compensation scheme wave 3

roll out exchange relocation

population most affected by wave 1

population most affected by wave 2

potential area relocation clusters (400-1000 households per km²)

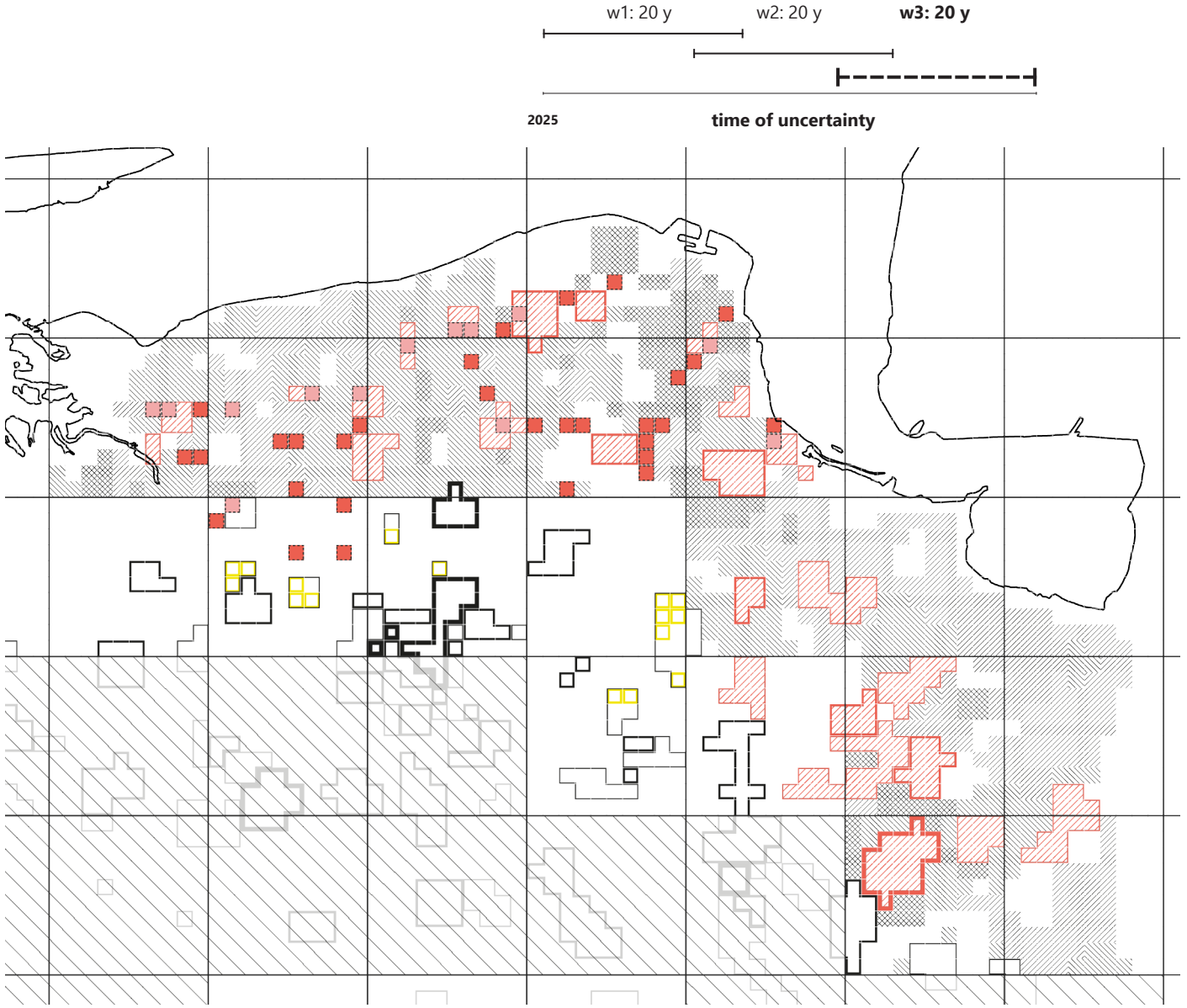
Strategy proposal
Waves of retreat - Wave 3

Pull-factors:

- Good settling environment (housing/work/school)
- Future proof housing (senior living communities > close to amenities)
- Closer to (grand)children (multigenerational living communities)

When accepting scheme choice of relocating:

1. Cluster region: relocation clusters
2. High East: relocation clusters
3. Exchange relocation (possibility to apply for a position on the mounds)



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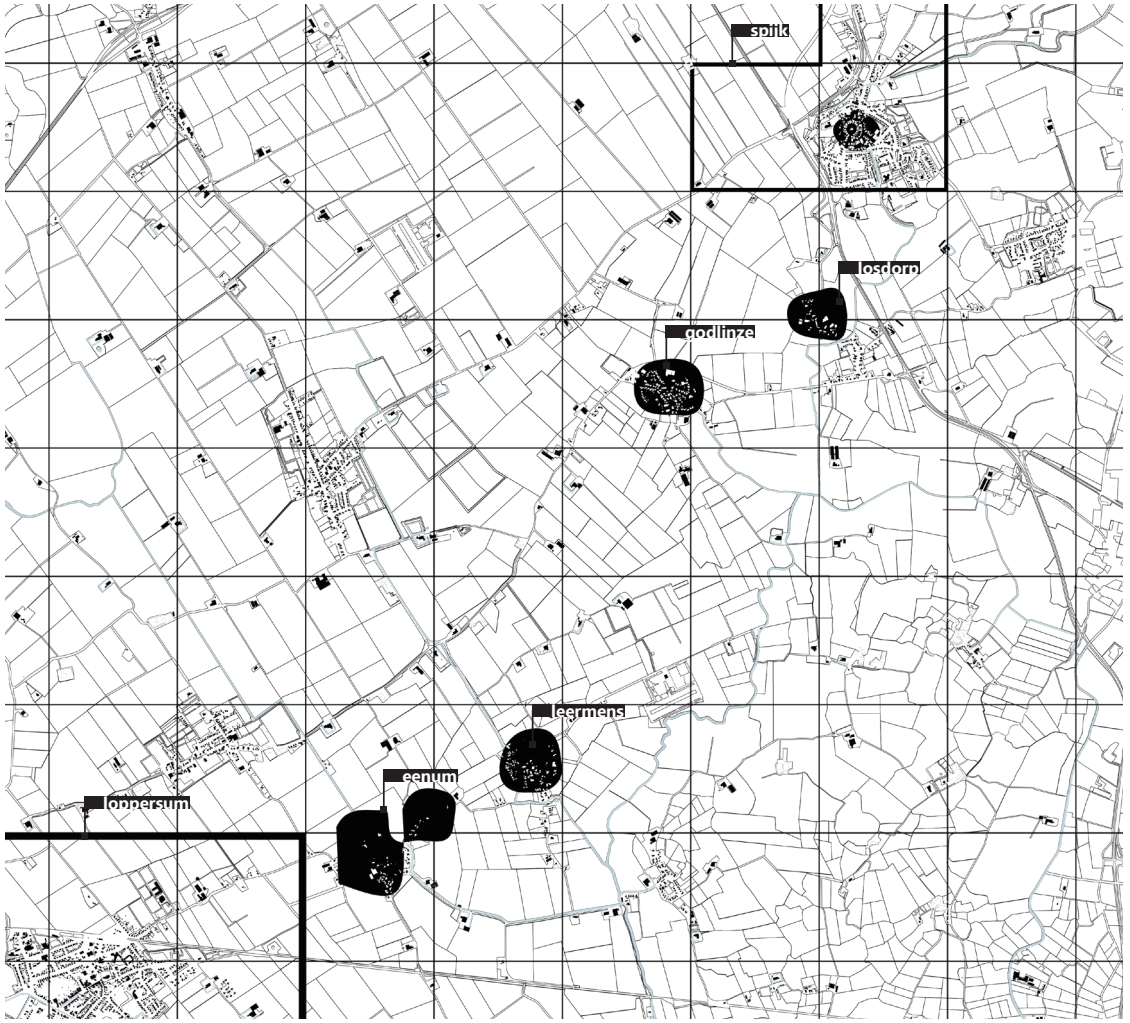
■ **Local design**

Conclusion & Reflection

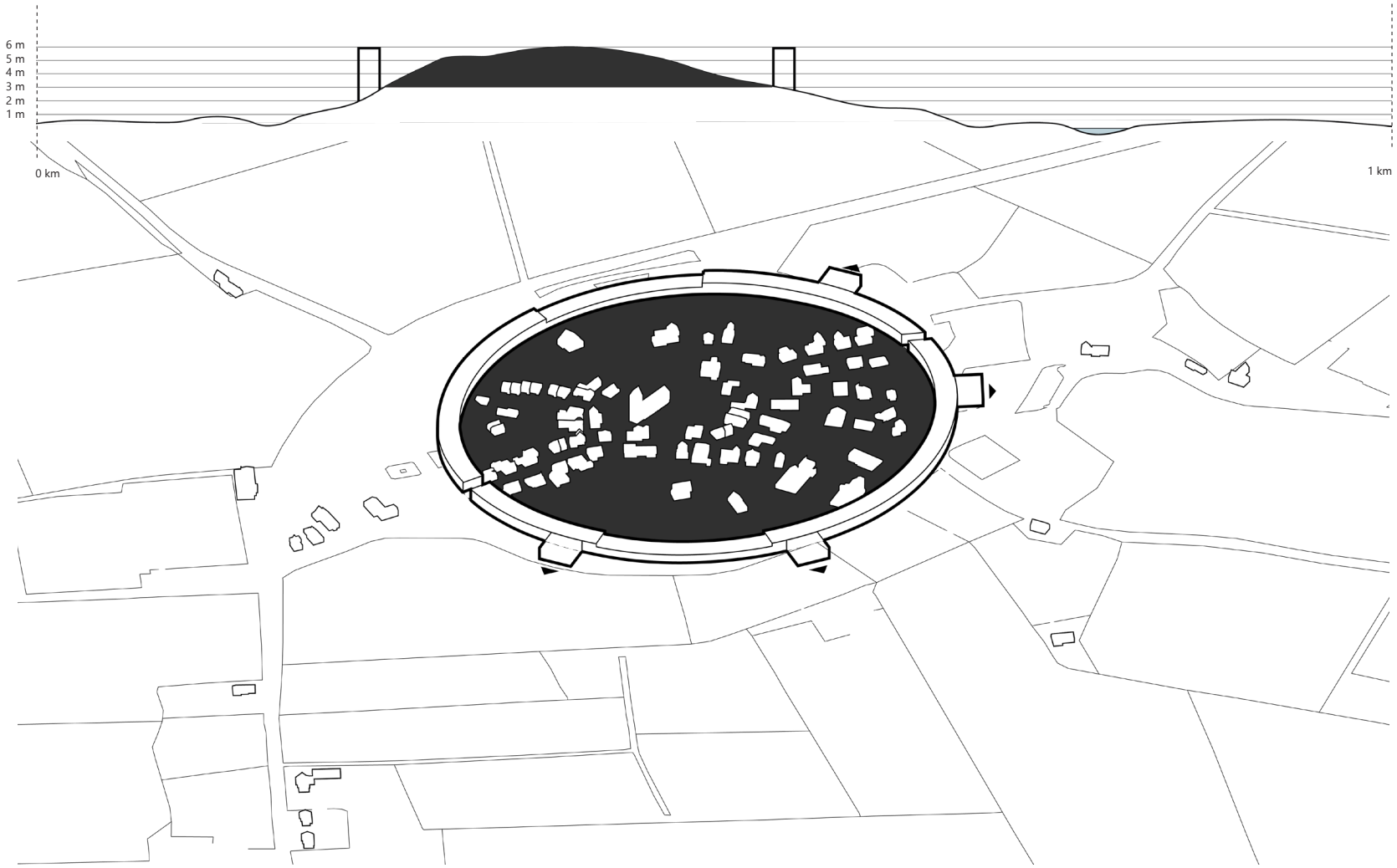
The local design illustrates the implementation of the strategy on the more tangible scale. It will focus on the system of self-sustaining mounds. It will zoom in on one in particular; Godlinze.



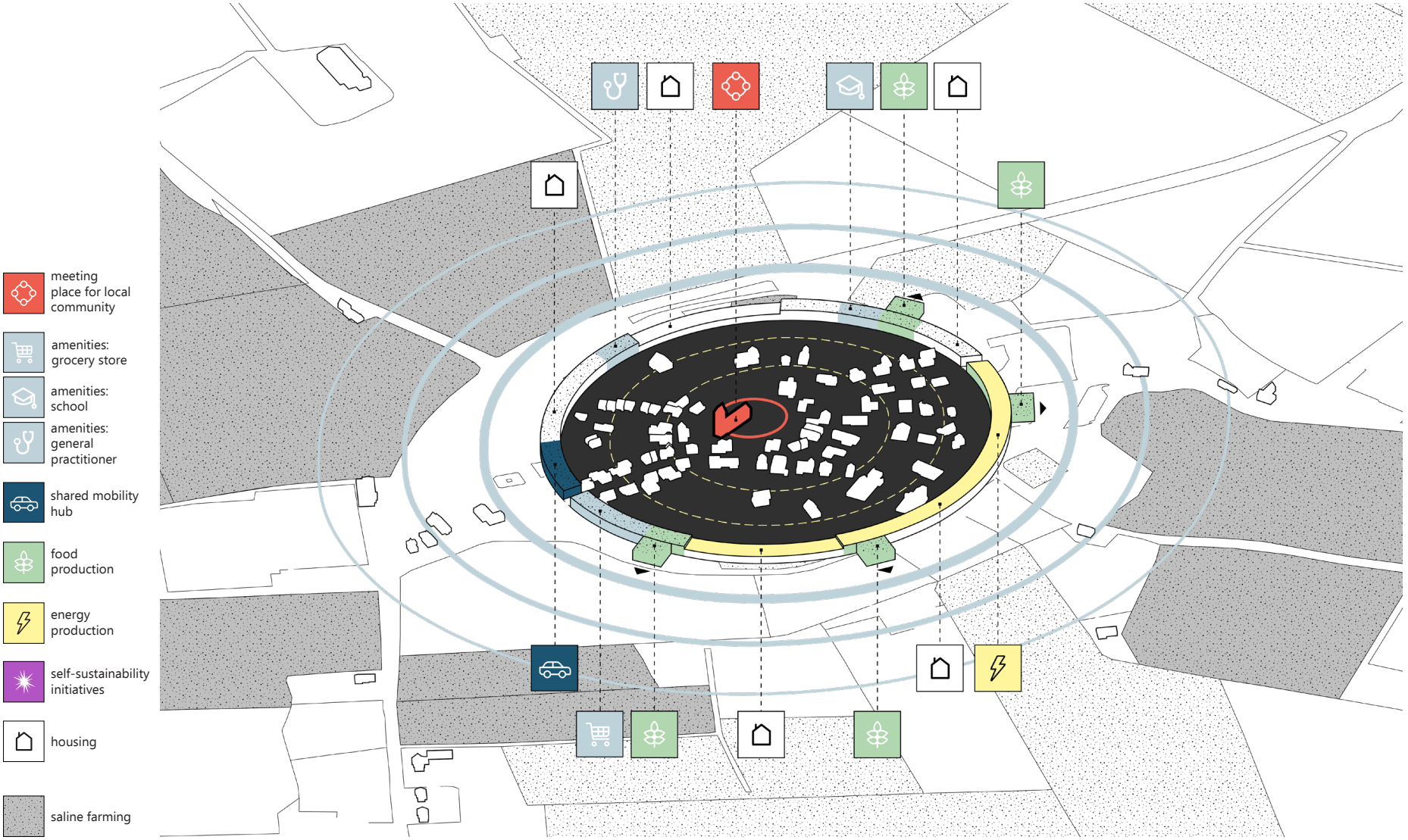
Godlinze is a dorpswierde, or village mound. It has a population of 240, with more than halve being over the age of 45. Godlinze has experienced dejuvenation, resulting in the closing of its primary school. Except from two churches, a community centre, a football club and a family restaurant, there are no amenities on Godlinze.

Godlinze (Aerophoto Eelde, 2016)

Goal 1: protection
The modern dwelling mound consists of a structure that defines the edges of the village and can provide protection while sea-levels keep rising.

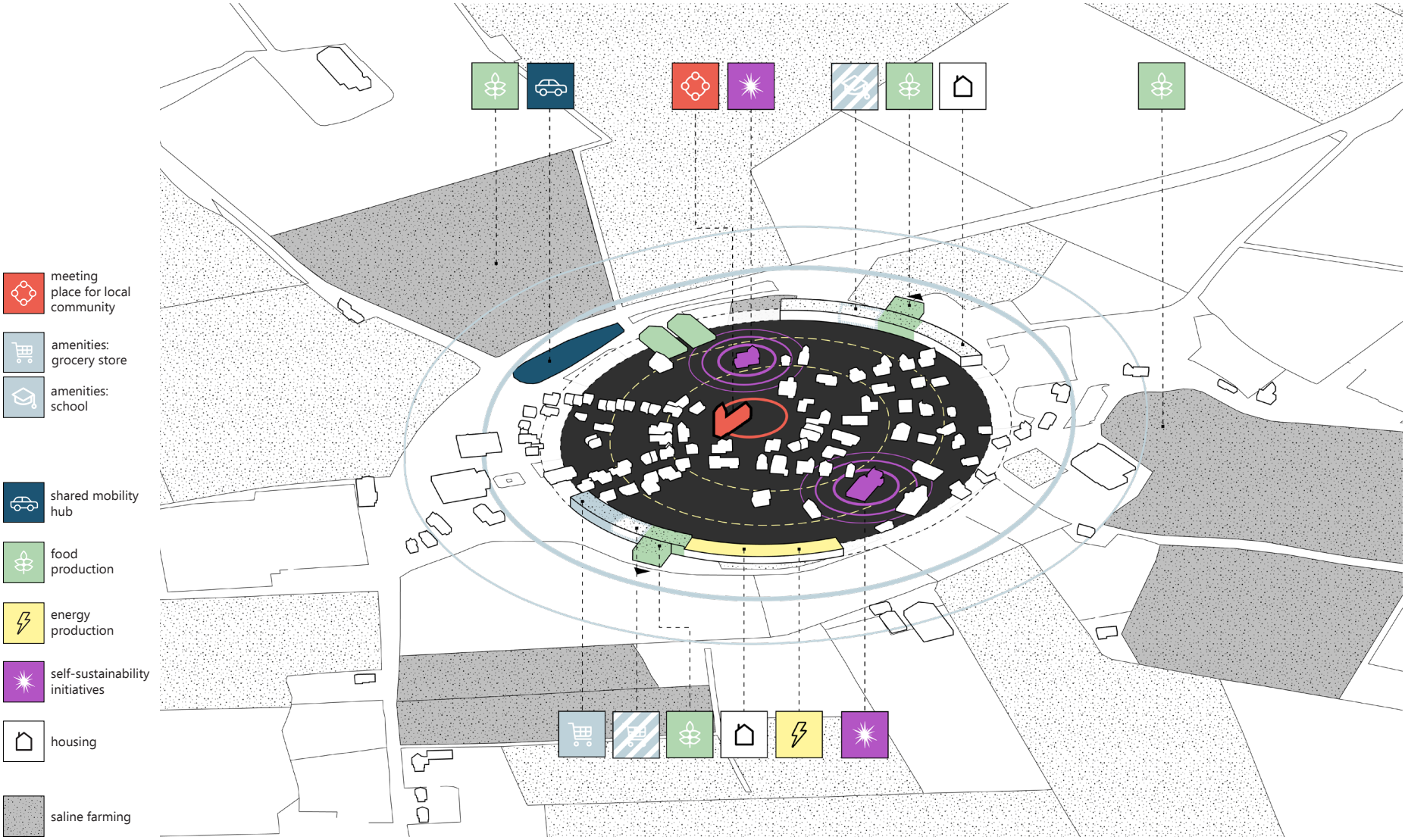


Goal 2: self-sustainable and supporting
The structure is not a dike, but a functional ring consisting of housing and amenities, while also providing space for the production of electricity and food.

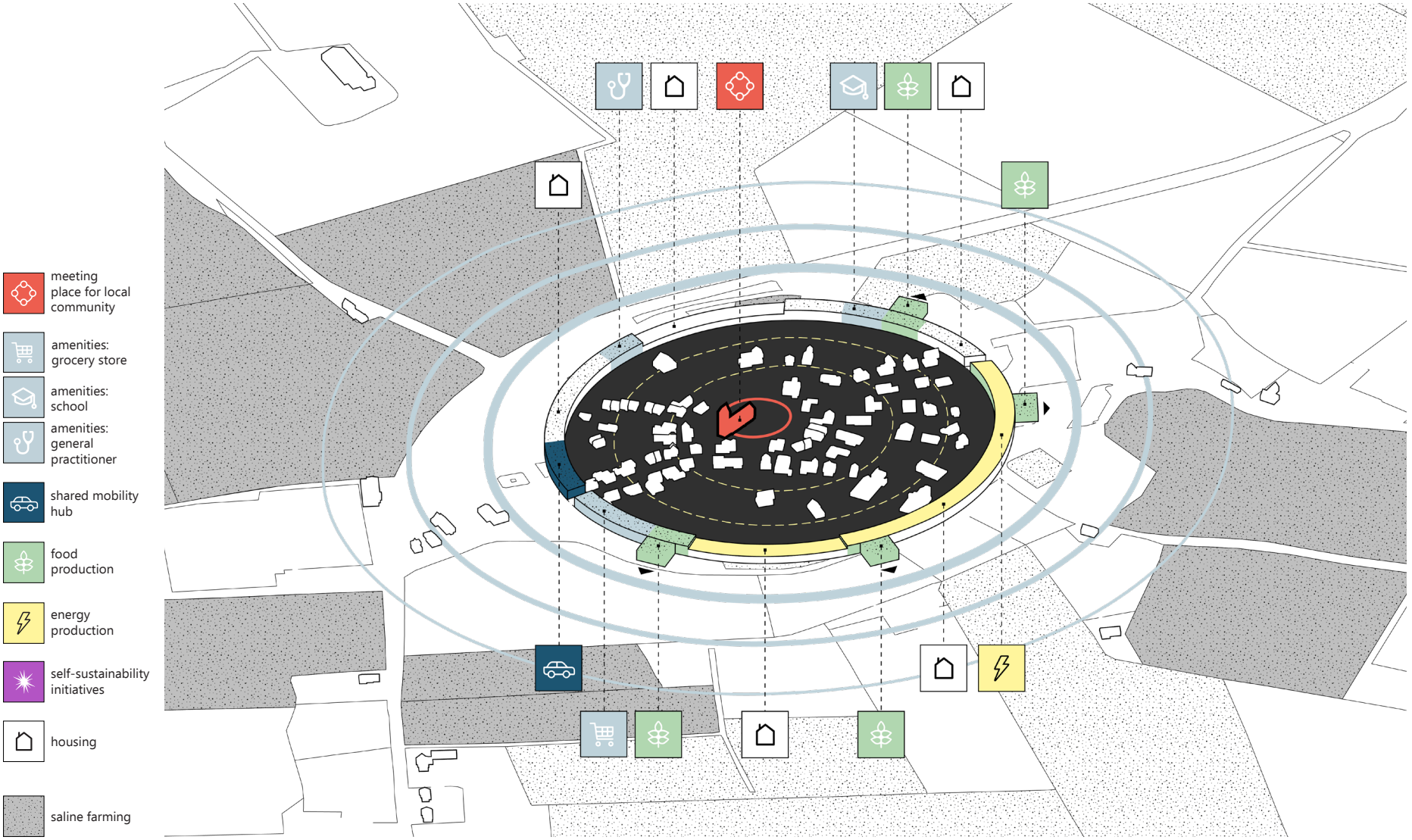



meeting place for local community
amenities: grocery store
amenities: school
amenities: general practitioner
shared mobility hub
food production
energy production
self-sustainability initiatives
housing
saline farming

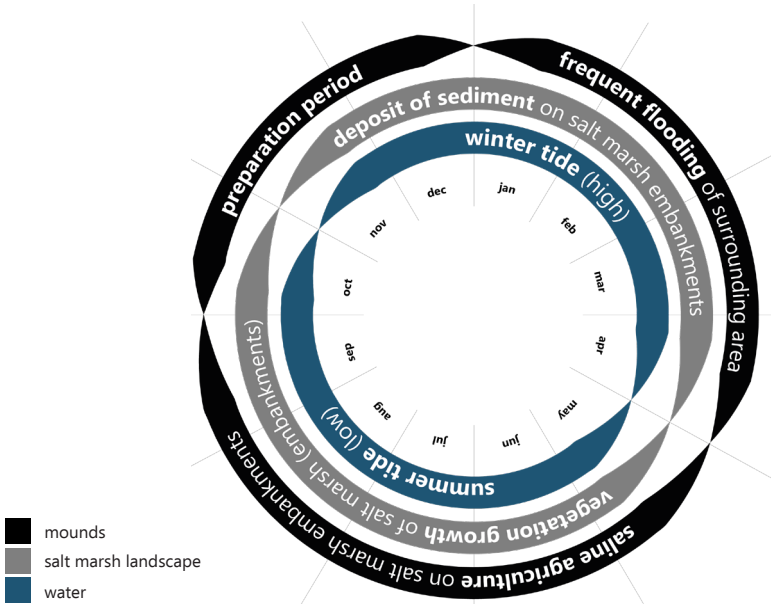

meeting place for local community
food production
self-sustainability initiatives
saline farming


meeting place for local community
amenities: grocery store
amenities: school
shared mobility hub
food production
energy production
self-sustainability initiatives
housing
saline farming

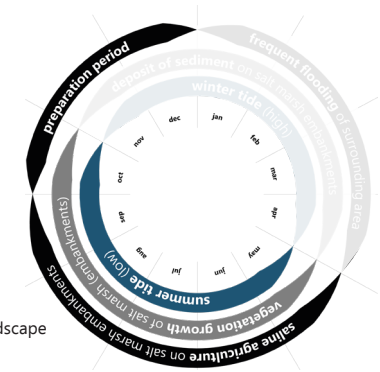
Local design
After 2075



From 2075, the community on the mound should be able to deal with the dynamic landscape.



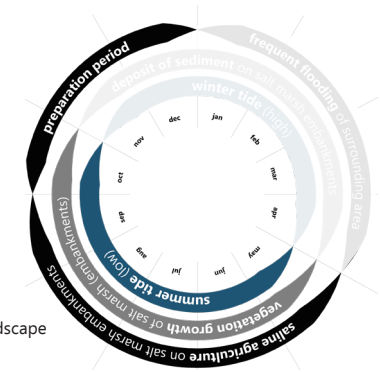
Local design
2150 - summer



mounds
salt marsh landscape
water

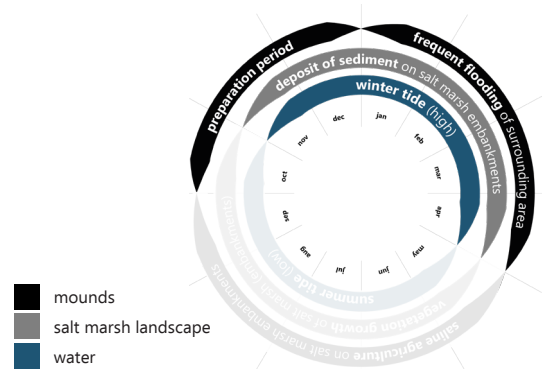
regular tide

Local design
2150 - summer



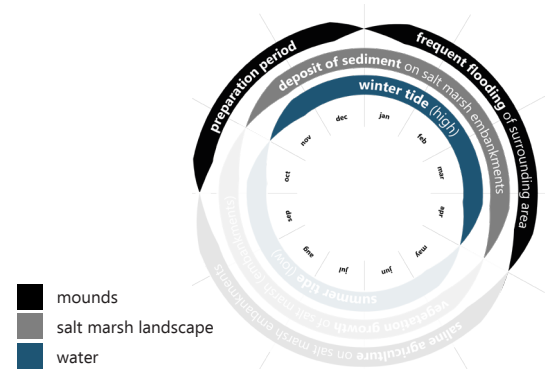
mounds
salt marsh landscape
water

spring tide



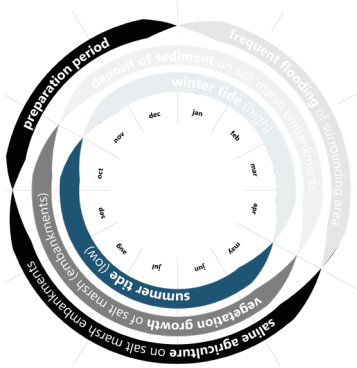
mounds
salt marsh landscape
water

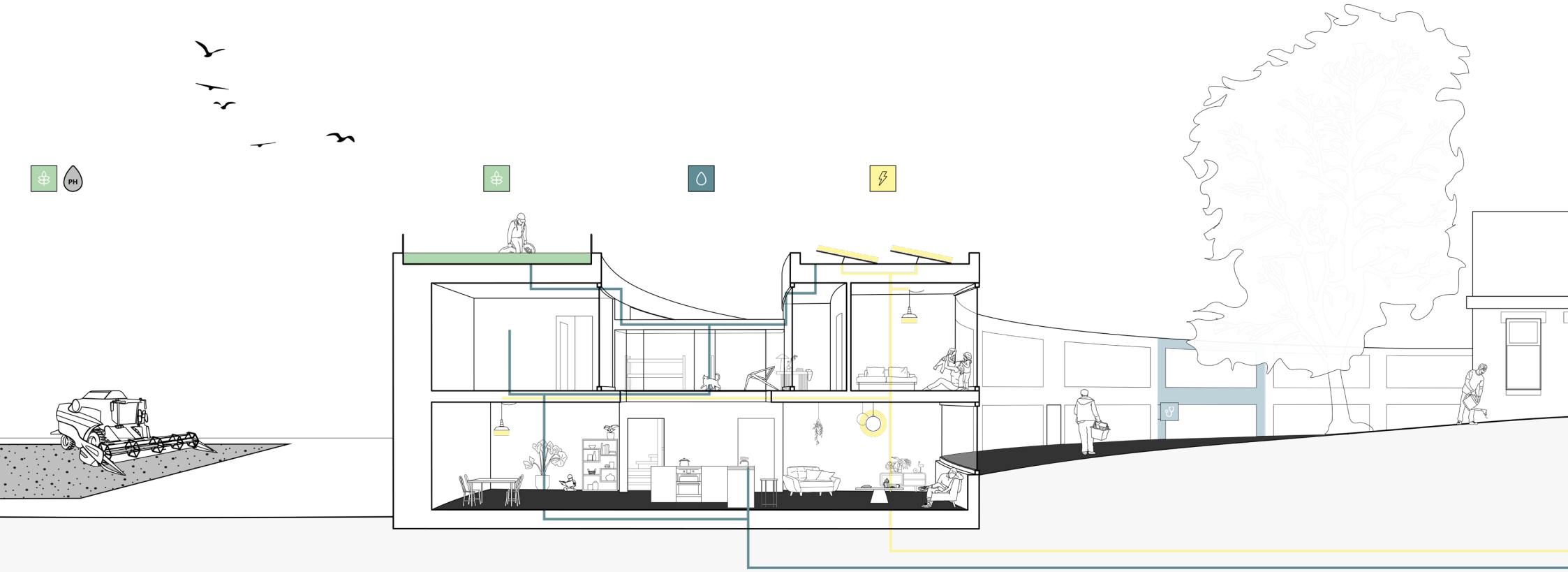
regular tide

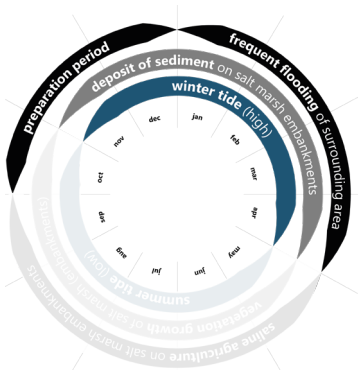


mounds
salt marsh landscape
water

spring tide


preparation period
frequent flooding of surrounding area
deposit of sediment on salt marsh embankments
winter tide (high)
summer tide (low)
vegetation growth of salt marsh embankments
saline agriculture on salt marsh embankments
jan
feb
mar
apr
may
jun
jul
aug
sep
oct
nov
dec


PH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summer tide (low)
vegetation growth of salt marsh embankments
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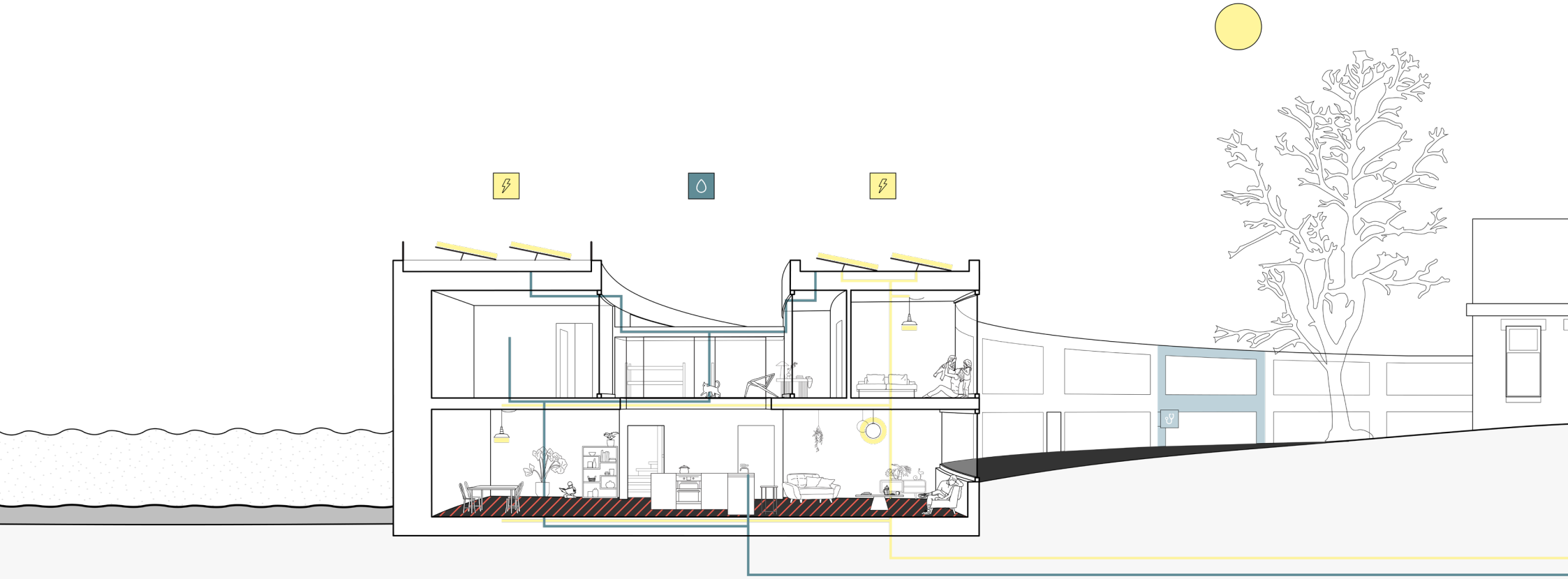

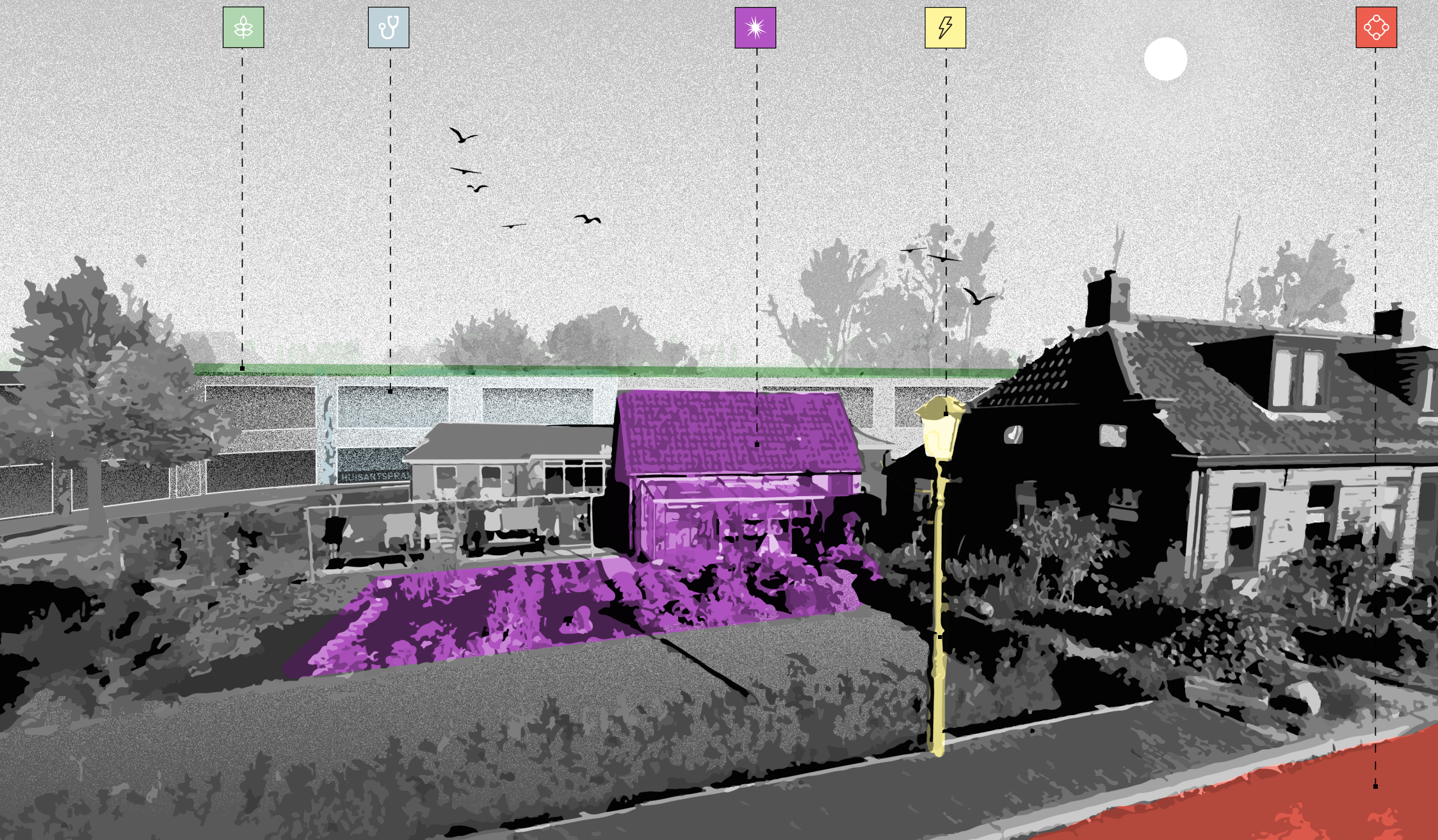

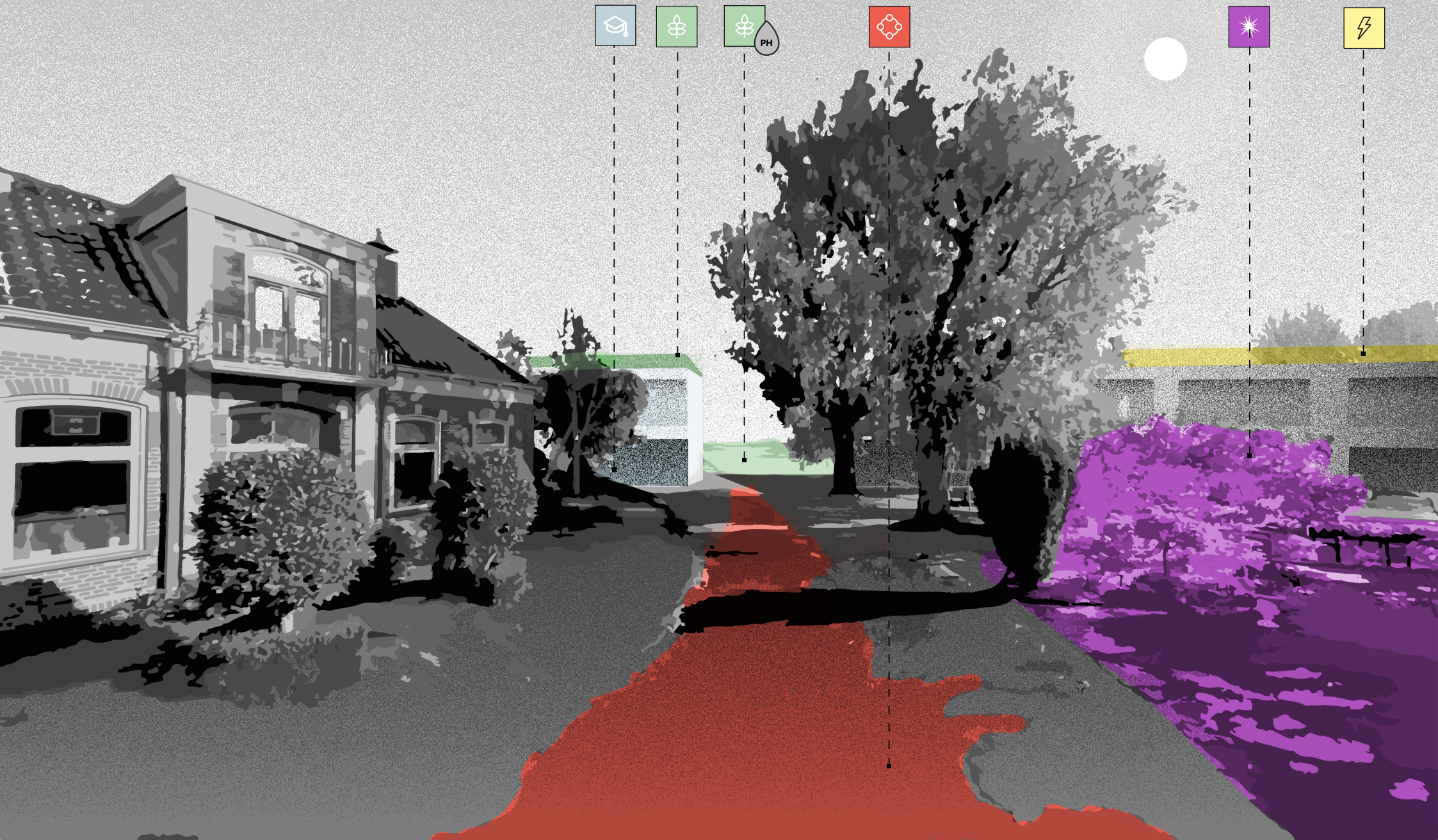
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■ **Conclusion & Reflection**

How can **spatial planning** contribute to **livelihood** in the context of **managed retreat** in **the Netherlands?**

The spatial strategy presented in this thesis was built on the notion that within pre-disaster retreat at the transformative scale, spatial planning can contribute to livelihood preservation by combining goals.

- **In the sending region...**
  regional development based on existing trends should focus on creating a **resilient regional configuration** that can ensure quality of life during the implementation of retreat in the future.

- **In the receiving region...**
  the goal is to create the **pull factors** that relate to the sending population. In the first wave, the focus should be on the vulnerable groups, as they are less likely to be able to cope with demographic decline as a result of the implementation of retreat.

Rijksoverheid

The national government has to..

- be **proactive** in dealing with the uncertainty of climate change **in order to limit the impact at a later stage**. They need to **take extreme SLR into account** and have to make **regional priorities** in order to **stimulate settling of the population in areas above sea-level**. They have to do so by making use of the amount of time that is available and by **embedding retreat in existing national and regional spatial plans.**

- look into a fit **compensation scheme that deals with climate change adaptation specifics**. The scheme has to focus on **creating understanding for the adaptation** measures, and ultimately on **creating incentive to move**. Using the large timeframe the scheme should allow an element of choice (timing), create familiarization, and built trust and reliance between parties.

Deltares
Enabling Delta Life

Deltares (research institute) has to..

- conduct research on the future of flood defence in the Netherlands that **incorporates the human impact of retreat**; **particularly which measures can be taken now to reduce the impact in the future**. By researching cases of retreat and monitoring the implementation of retreat measures in the Netherlands, Deltares can expand its role as a government advisor.

Local government has to...

- to function as the link between national policy and local impact and therefore plays a crucial role in creating tailor-made strategies for socially just retreat on the local level. They do not only have an executive role in relation to social management, but should also monitor the impact of the implementation.

Vulnerable groups ⏸

- Specific attention should be paid to the **vulnerable members of the population**, as this group is less self-reliant and is therefore **more likely to be impacted negatively** by a voluntary compensation scheme. By focussing on **existing community structures** (e.g. villages) and extensive **locally implemented social management**, these groups can be guided through the process, and make a considered choice.

Autonomous movers ▶

- **Autonomous movers** are easily motivated and **important for a succesful retreat strategy**. Providing the right **pull-factors** (e.g. relying on biographic stage) might be enough to start a migration flow.

Settled ■

- **The settled** are reluctant to move due te place attachment but may be **influenced by social learning and network effects.** By implementing a voluntary compensation scheme in regions with large homogeneous groups (e.g. biographic stages), this process is more likely to occur.

As the extent to which the climate is changing becomes more clear, the effect it will have on the livelihoods of the Dutch population will increase. The research can add to the discussion on how the long-term perspective of spatial planning can mitigate the impact of adaptation measures on the population.

> “ **Tackling the climate crisis requires a global transition that must be implemented locally. How do you ensure that you involve people locally in a global crisis?** (Vlaanderen, 2021) ”

For further research, the recommendation is to look into a more significant role of the receiving region in the story of retreat in which the goal would be to create a spatial strategy focussed on voluntary migration which would make large scale implementation of a compensation scheme avoidable.

A regular summer day in 2150...

A regular summer day in 2150...