Counteracting desertification and abandonment in the rural Spanish landscape

revealing potentialities of regeneration through a local sensitive adaptive strategy

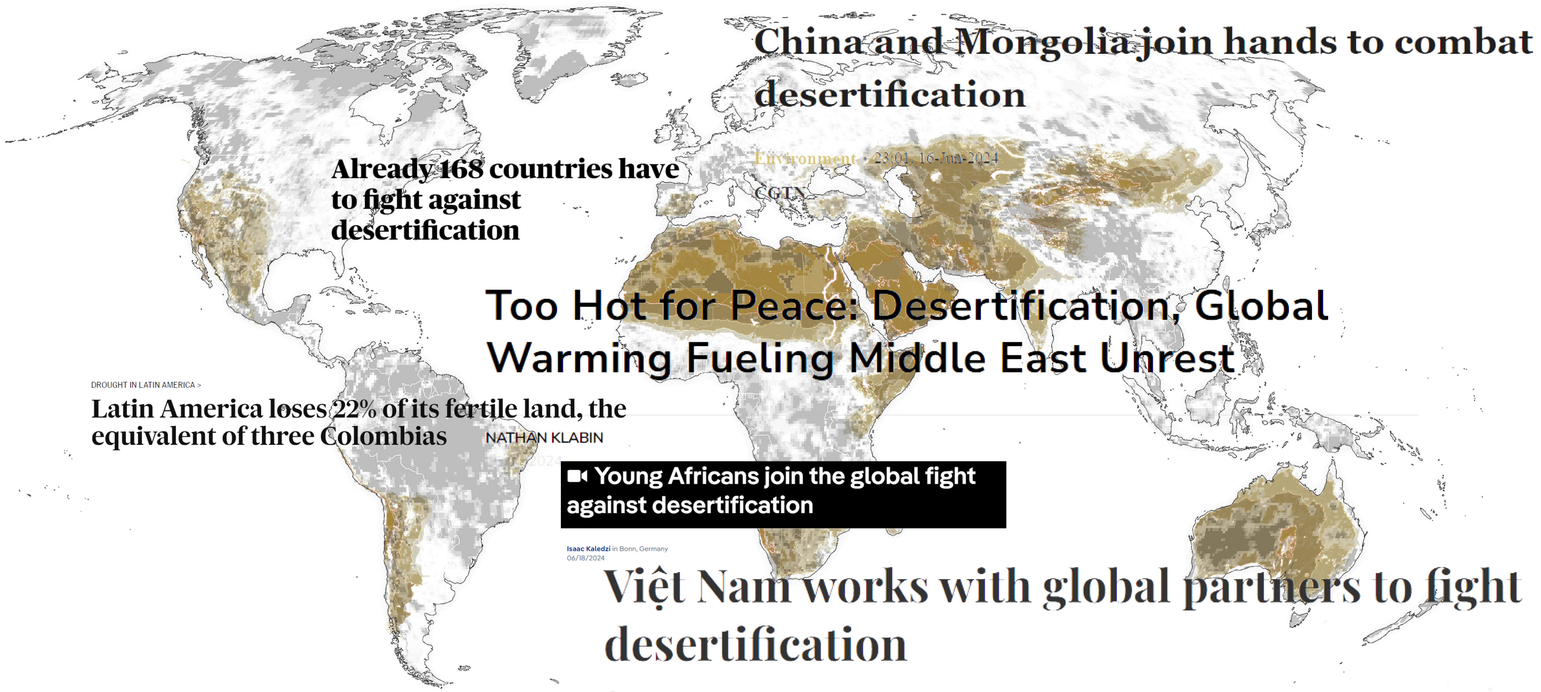
Germaine ter Brugge
P5 24.06.2024

Disruption

Hilma af Klint, the swan no. 2 (1914) & no. 1 (1914)

Content

Problematisation



At least 100 million hectares of healthy land now lost each year

Desertification?

Desertification refers to **land degradation** in arid, semi-arid and dry subhumid areas resulting from various factors, including **climatic variations** and **human activities** (UNCCD, 2017).

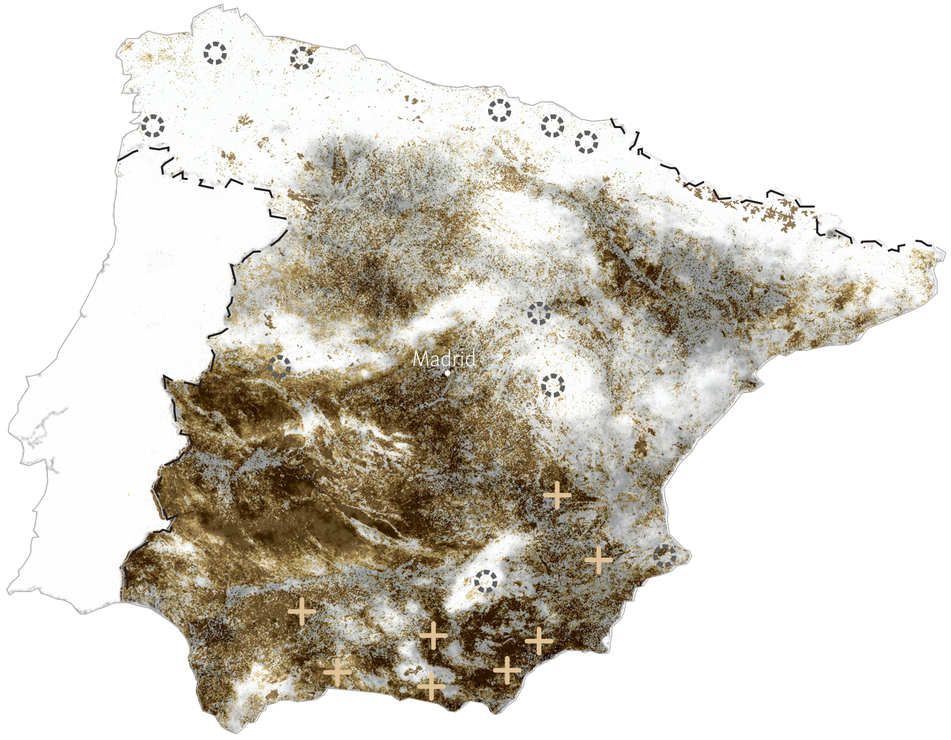
Emergency state of the Spanish landscape

May 11, 2023. NASA, 2023.

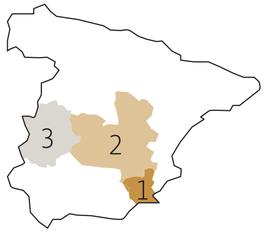
3/4
of Spain faces desertification

67.14%
total of arid, semi-arid and dry subhumid areas

159.337
of 506.061 km² is highly or affected by desertification



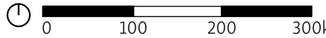
Autonomous Communities at risk of desertification:



1 Murcia
99,97%

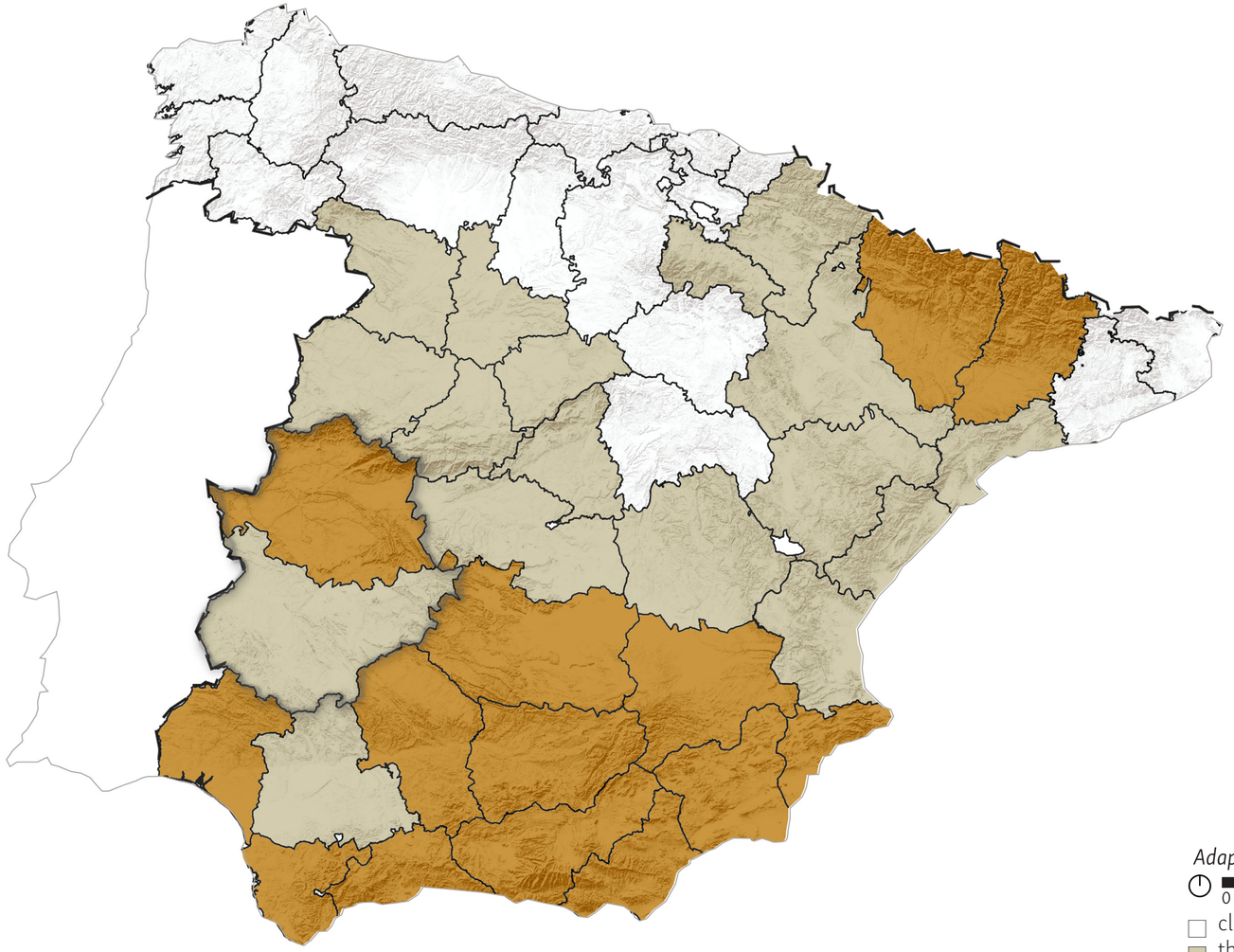
2 Castilla-La Mancha
94,4 %

3 Extremadura
90,2%



- wet subhumid
- dry subhumid
- semiarid
- arid
- vegetation cover decline between 0-15%
- vegetation cover decline between 15-30%
- water basin
- desertification hotspot

Factors contributing to desertification



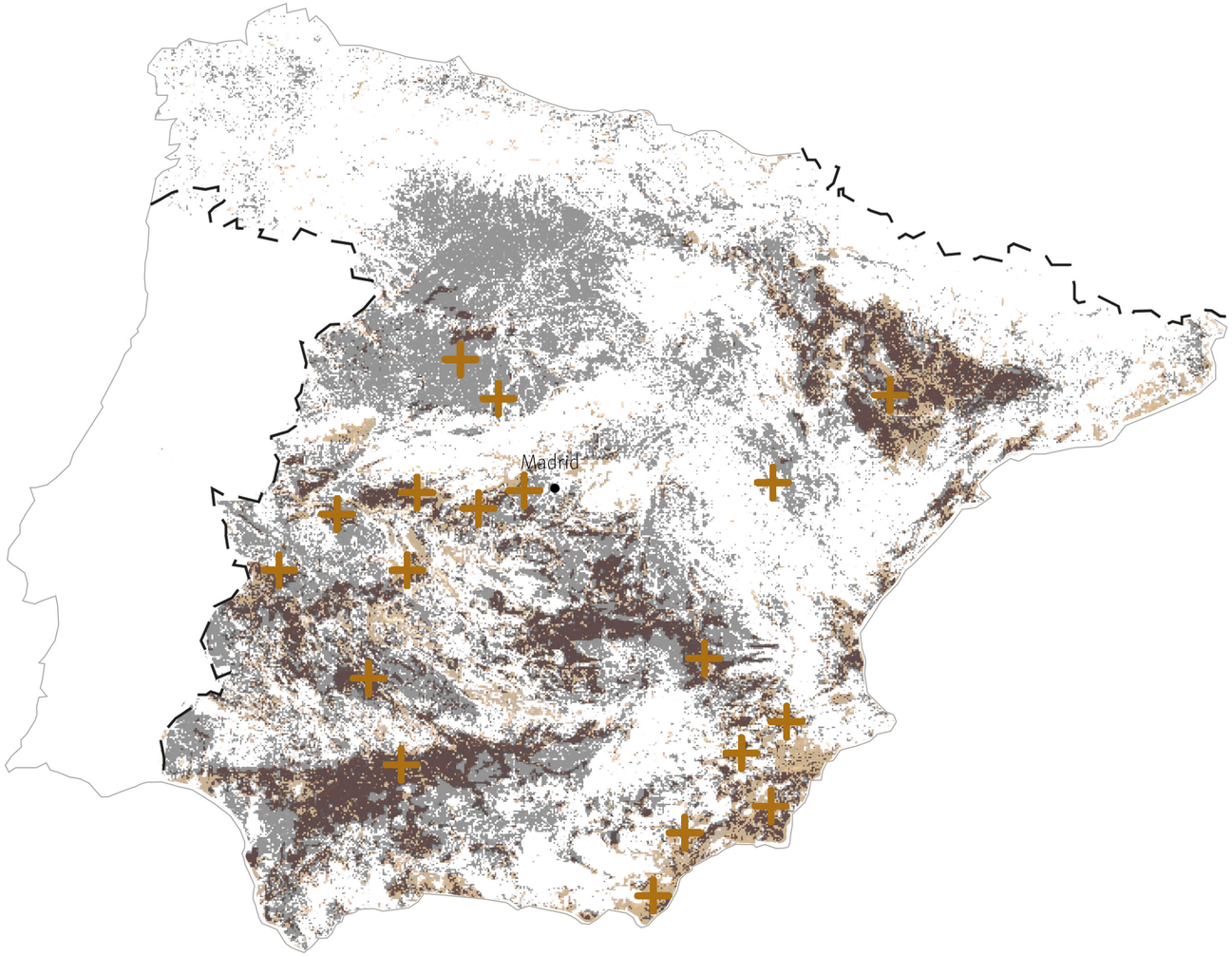
climatic conditions + socio-economic conditions

Adapted from Martínez-Valderrama al., 2022.

0 100 200 300km

- climatic conditions for desertification do not exist
- there are no socio-economic conditions for desertification
- both climatic and socio-economic conditions for desertification are found

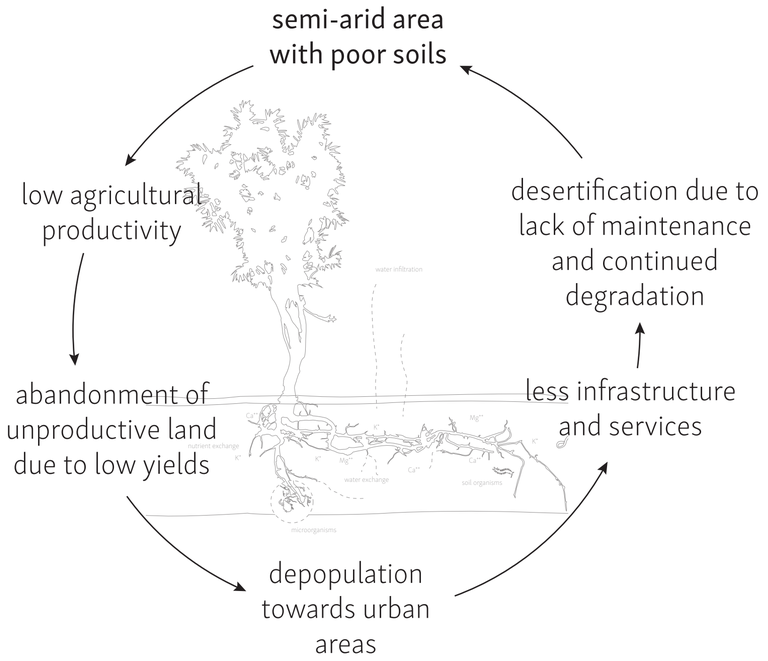
Agricultural land abandonment



agricultural land abandonment

0 100 200 300 km
agricultural land
organic matter <1
high risk on abandonment

Soil as an object



self-reinforcing feedback loop between desertification and depopulation

Lack of appropriate solutions

governmental actions

denial of rural populations

ambiguity in actions

depopulation

desertification

+

agricultural policies steering towards land abandonment and overexploitation

inadequate landmanagement

reduction of ecosystem services

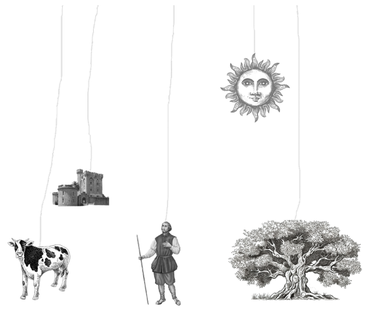
Image Oscar del Pozo / AFP

Problem statement

Escalating global heat, alongside depopulation pressures, is accelerating the risk of desertification in rural Spain and triggering a damaging cycle of land abandonment

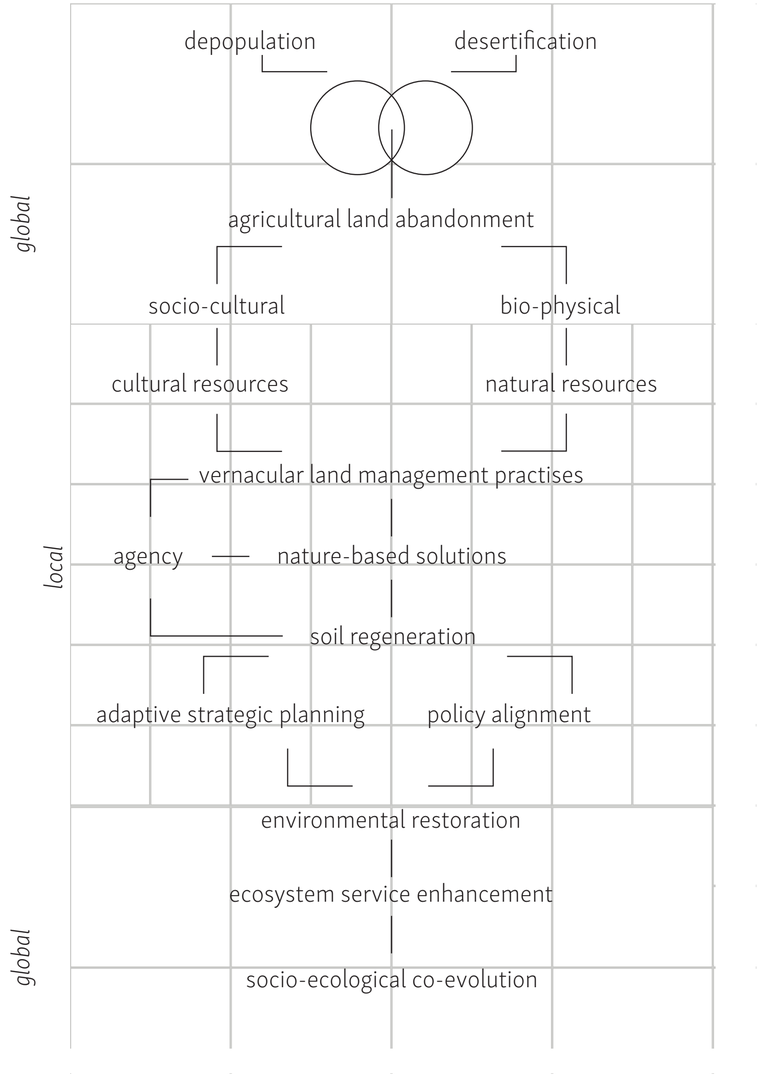
Aim

Escalating global heat, alongside depopulation pressures, is accelerating the risk of desertification in rural Spain and triggering a damaging cycle of land abandonment, calling for a local sentitive strategy to mitigate land degradation, implement nature-based solutions to regenerate soil, and increase environmental and social resilience.



Methodology

From global to local



Research question

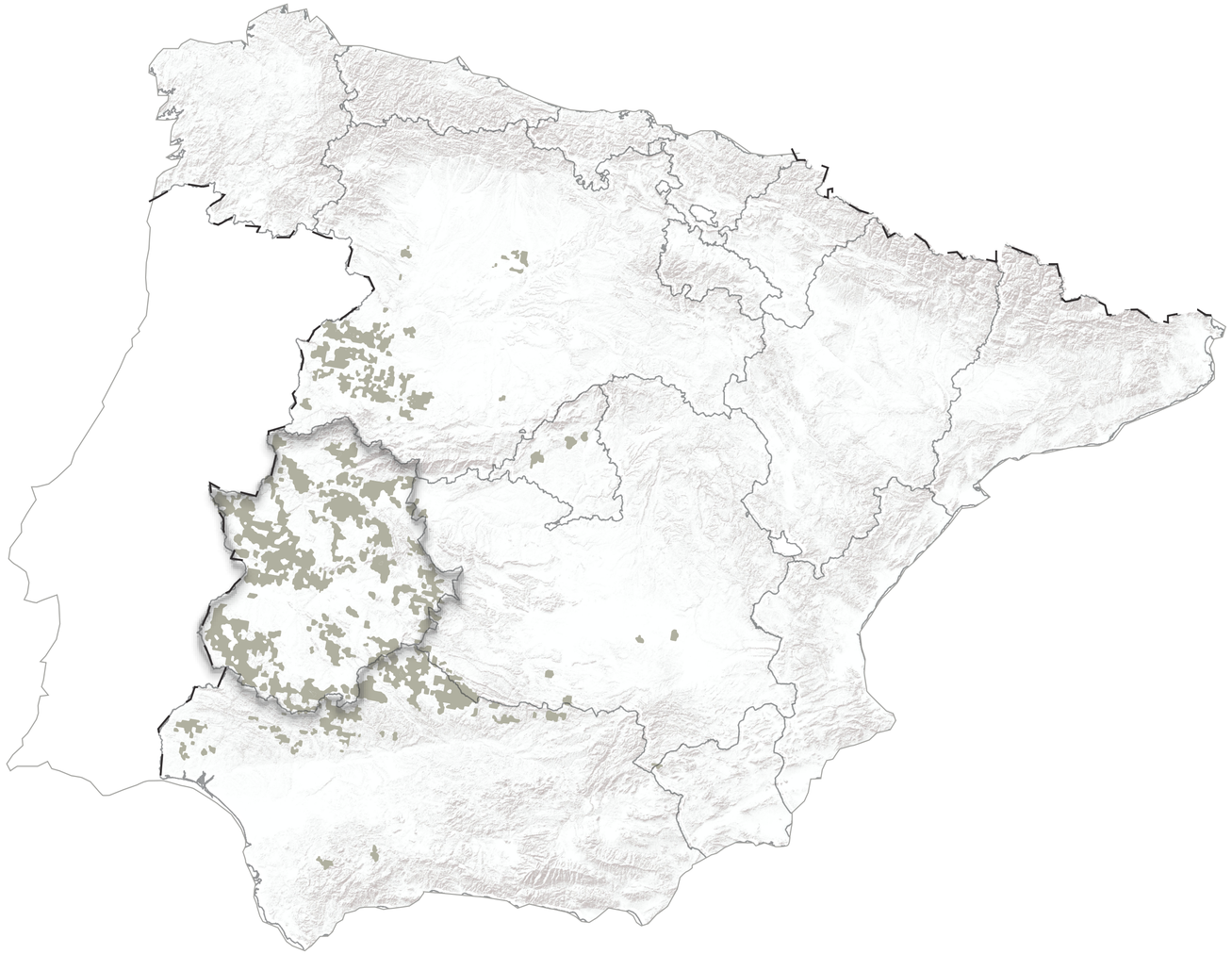
Starting from the dehesa in northern Extremadura, how can adaptive strategic planning (A) anticipate on capacities of local communities mitigating the socio-environmental impact of depopulation (B) and desertification (C) in rural regions?

Methodology

to assess	to design	to evaluate
What are the environmental, ecological, social, and economical impacts of desertification and depopulation in Extremadura?	How can a local adaptive strategic land management strategy contribute to a more resilient socio-ecological landscape?	To what extent can fieldwork inform an adaptive strategy to mitigate the processes of depopulation and desertification?
output		
Understanding the socio-ecological system including risks and opportunities	Forecast of conditions informing an adaptive strategy	Evaluation of the methodology

Case study

The dehesa in Extremadura



Based on SIOSE (2012) database.

0 100 200 km

dehesa

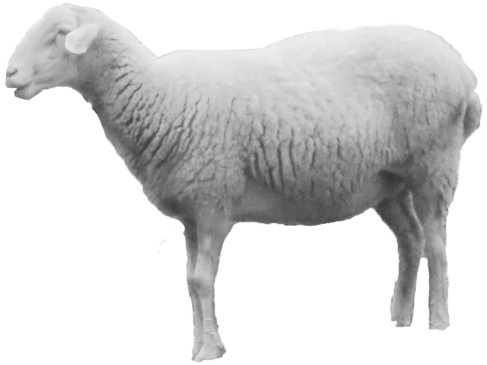
elevation

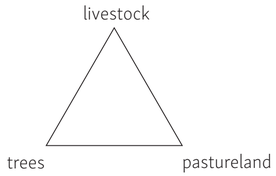
regional border

national border

Balance between livestock - trees - pasture

social value

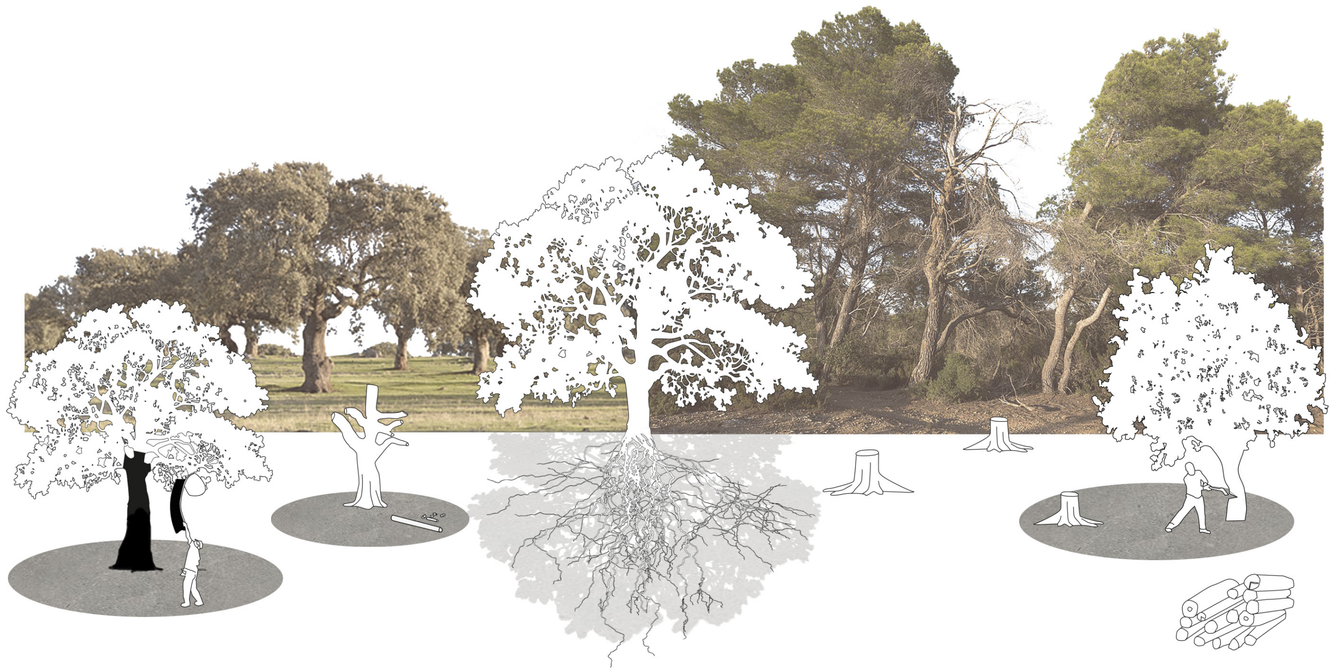




ecological value

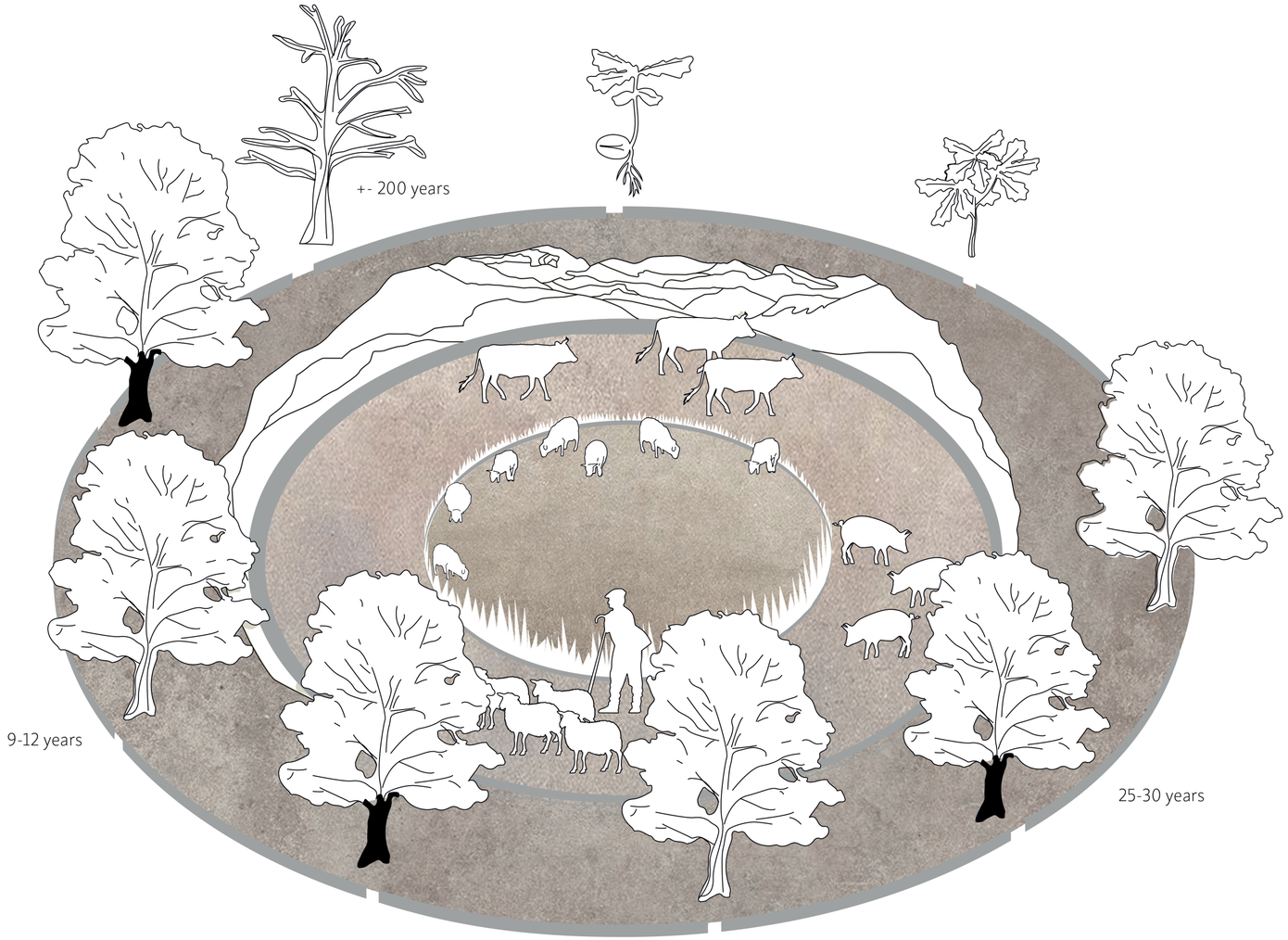
economical value

Systematic interventions



Pictures: Christian Ferrer, 2014;
Gertjan de Zoete, 2012

Mangement and natural processes



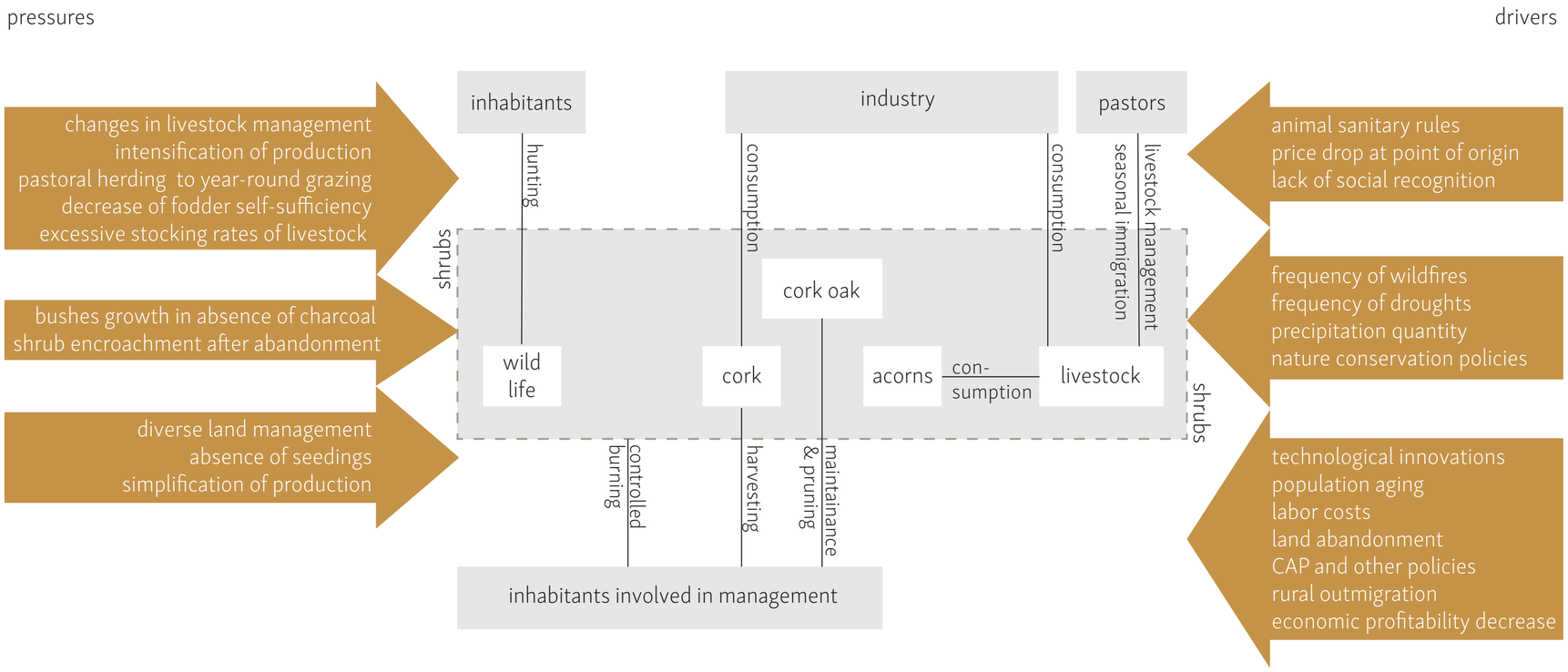
Connecting landscapes

Based on https://gestionagroganadera.com/rutas-trashumantes-de-espana/

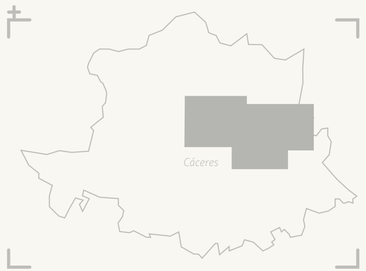
0 100 200 km

- route
- elevation
- regional border
- national border

Accumulation



Fieldwork



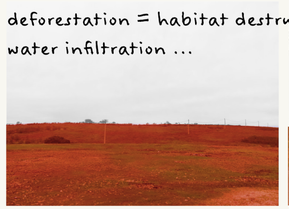
Monfragüe National Park

coping capacity of communities

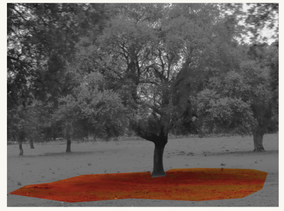
traditions, values, patterns, interactions

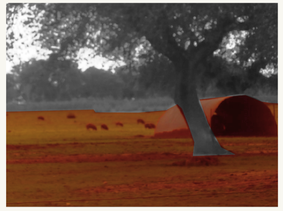
Validation of the problem

deforestation = habitat destruction, soil degradation, reduced water infiltration ...

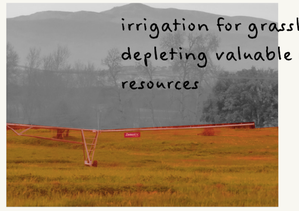


exposed soil highly susceptible to erosion, caused by large scale olive tree groves



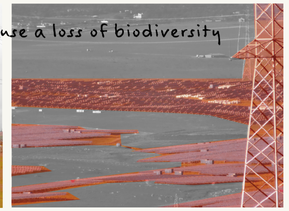


irrigation for grasslands, depleting valuable water resources



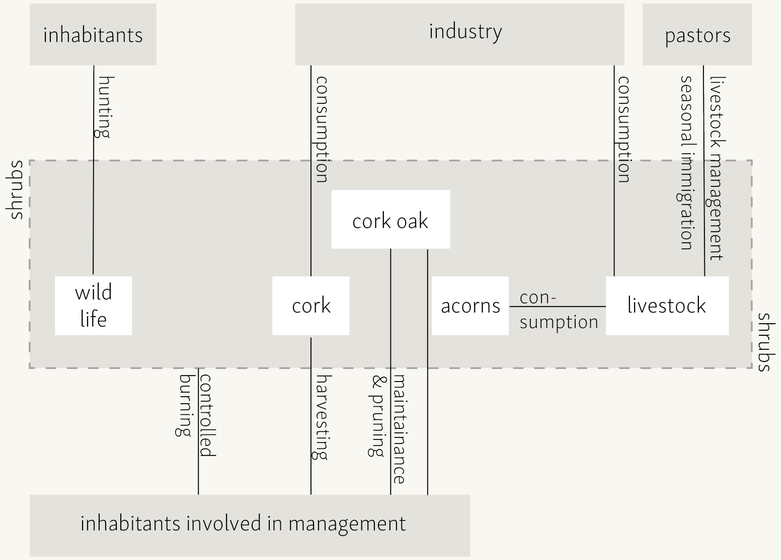
grazing without proper management and rotation, leaving the soil bare

immense solar panel fields cause a loss of biodiversity and destroy habitats

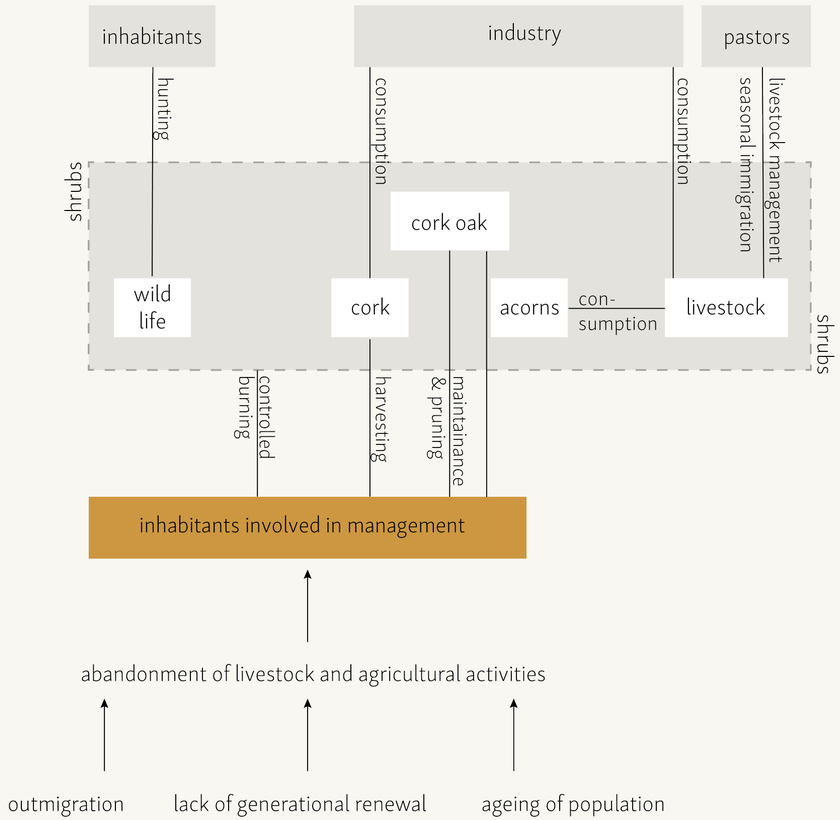


land over exploitation for economic profit

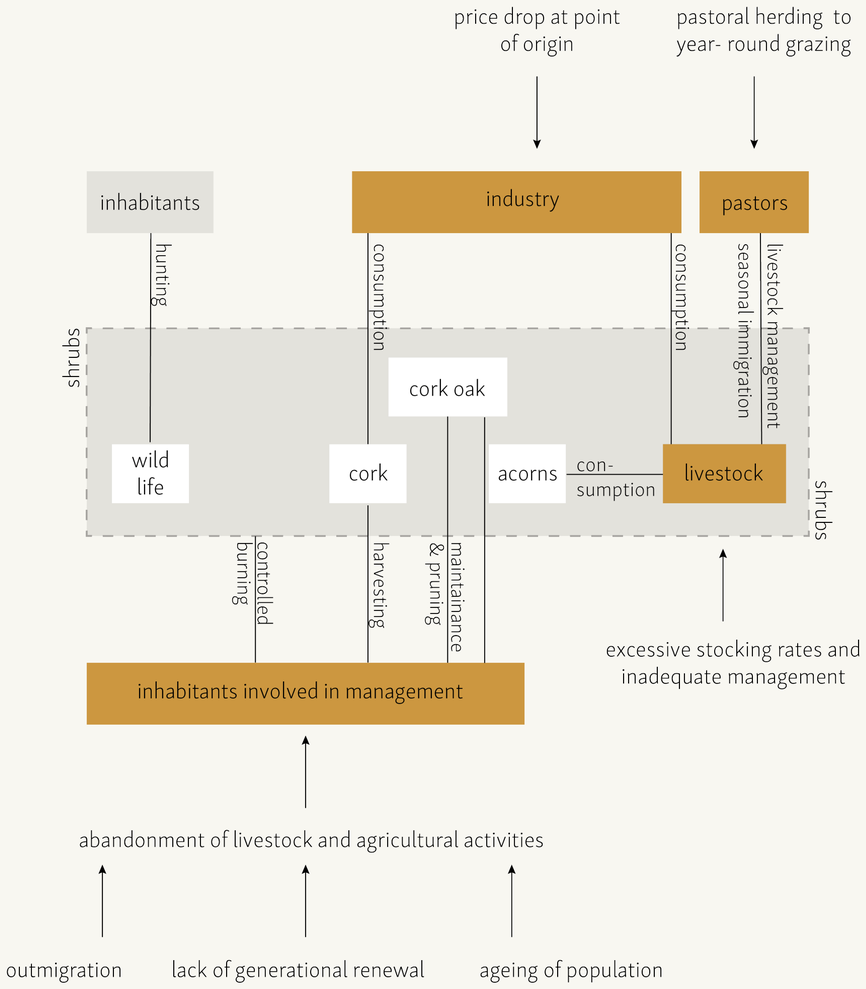
Validation of pressures and drivers



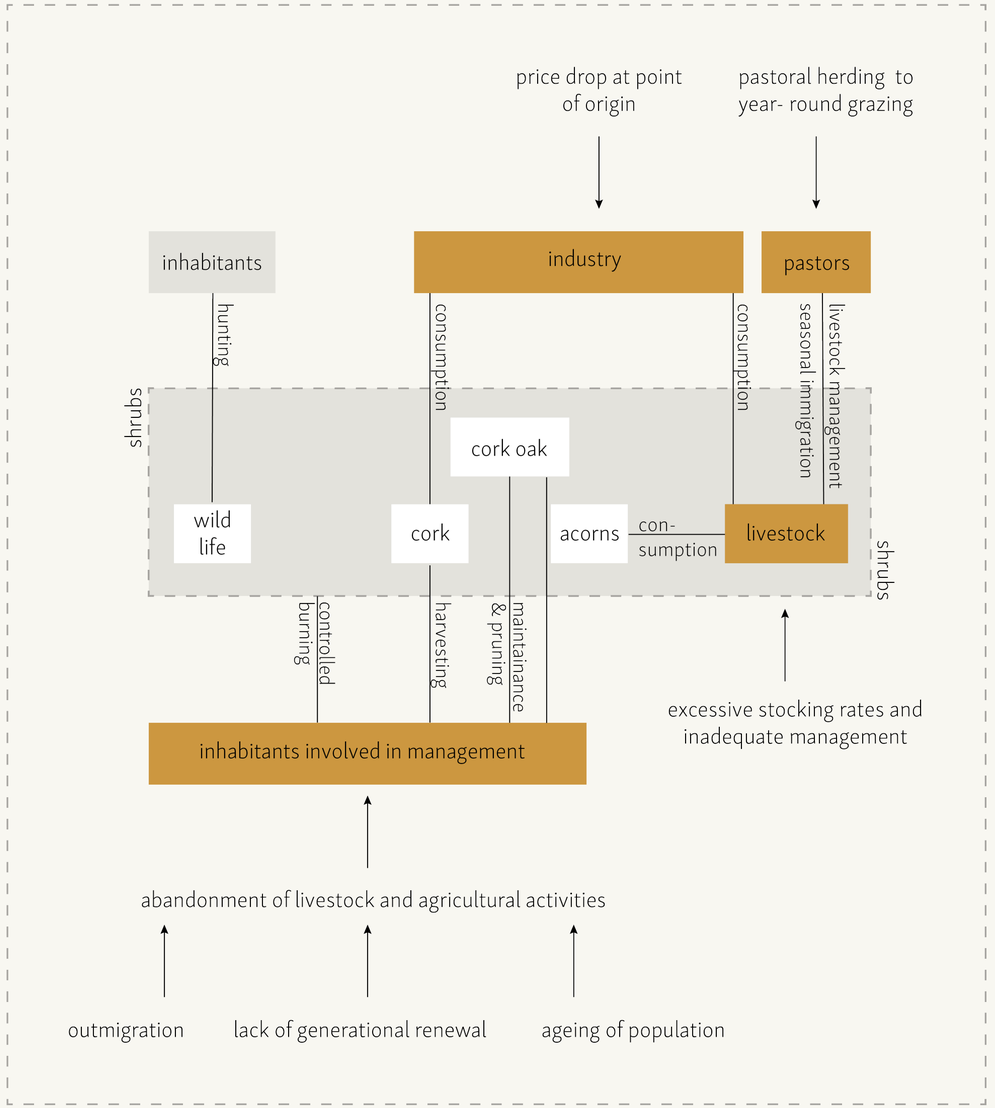
Validation of pressures and drivers



Validation of pressures and drivers



Validation of pressures and drivers



lack of social recognition

lack of future for the youth

CAP and other policies

economic profitability decrease

Determining stakeholders

"if it is getting dryer in the future I don't know what to do"

"We have long understood that the soil is the source of life"

Determining potential agency

How important is the natural environment to you?

“very important” 17

“important” 2

Do you feel connected to the landscape?

Yes: 17

No answer: 1

Other: “the politicians have ruined the ‘old’ commitment of the rural population to their environment.”

Taking care of the landscape as a part of identity

"the **care** of the landscape"

"Yes, in the sense of **preserving** the work of our forefathers"

"that they are well **cared** for"

"to be **preserved** in its natural state but with the corresponding maintenance"

"Yes. We have tried to take **care** of our countryside"

"Yes, it is **shaped** by the community"

"Yes, in how we take **care** of it"

"Yes, the landscape says a lot. Everything if it is well **cared** for"

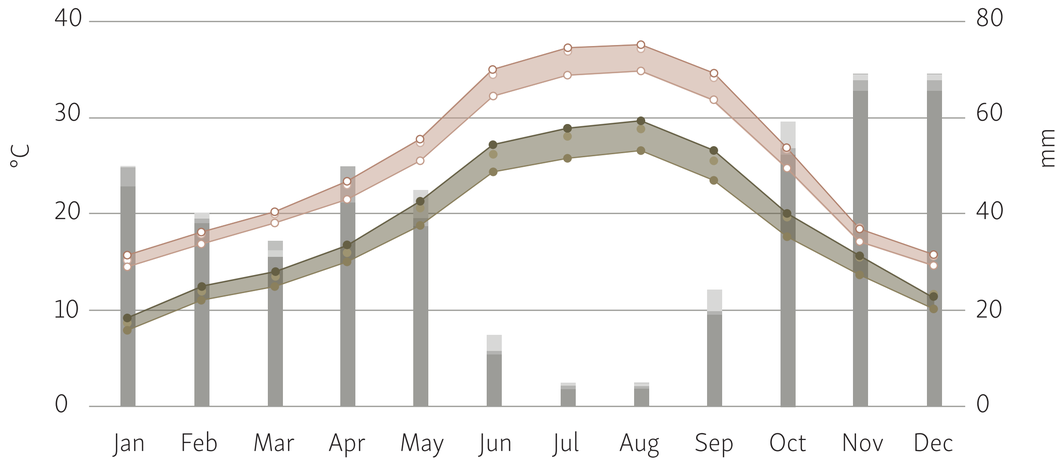
what they value the most about the landscape, is how they are taking care of it

Contribution to a transition

people want to take care of the landscape and of each other

Projections

Climatic forecast



Adapted from World Bank Climate Change Knowledge Portal, 2021.

- average maximum temperature
- maximum air temperature SSP5-8.5
- maximum air temperature SSP2-4.5
- average mean temperature
- average air temperature SSP5-8.5
- average air temperature SSP2-4.5
- average precipitation
- precipitation change SSP2-4.5
- precipitation change SSP5-8.5

Consequences for the landscape under continuation

forest

grazed dehesa

dehesa

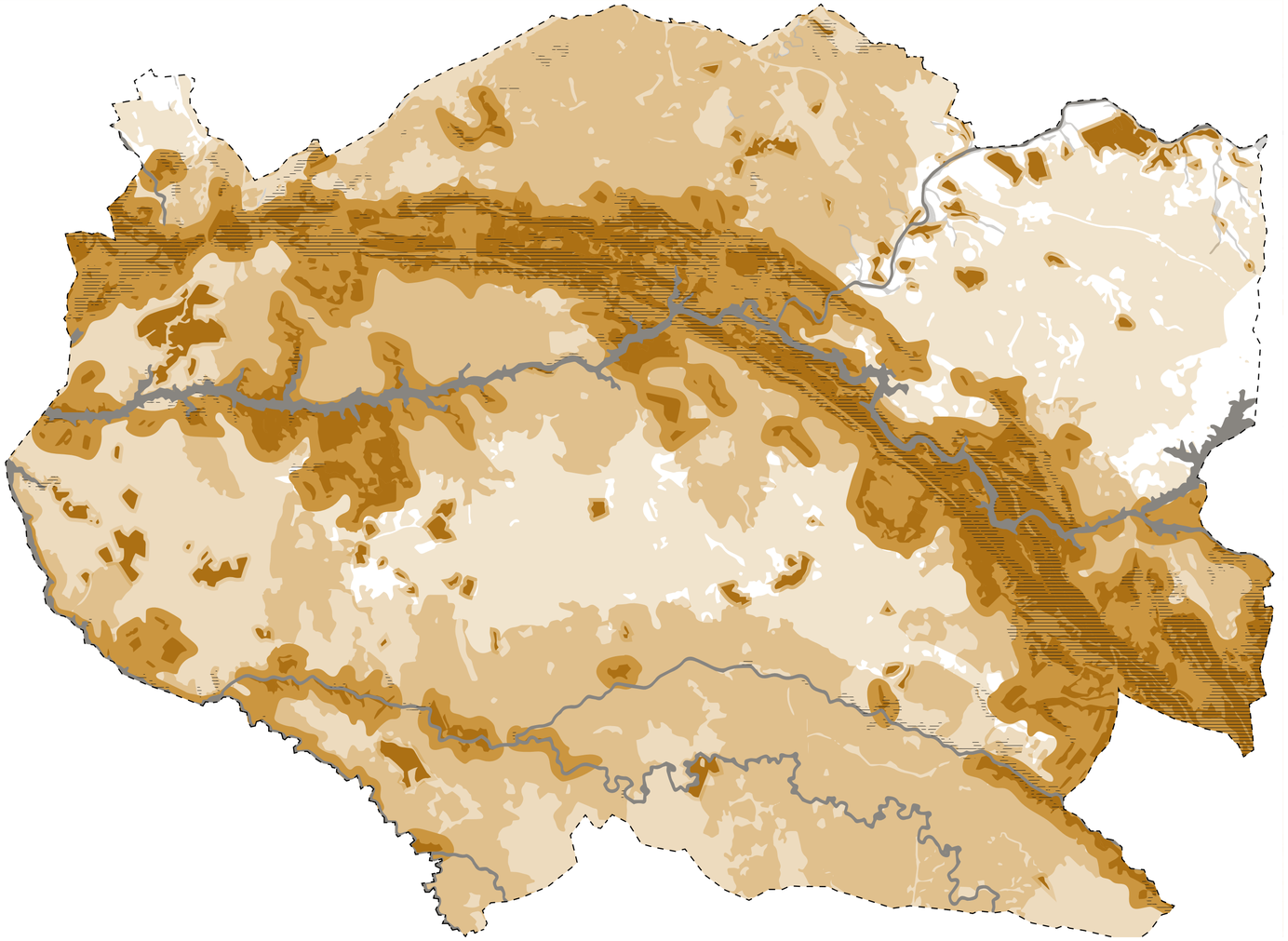
fire outbreaks -

overgrazing -

shrub dominance -

Development of the landscape under two climate scenarios

Spatial impact



Spatial impact map highlighting areas with high risks. Based on National Inventory of Soil Erosion, 2022; Copernicus, 2018

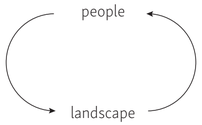
0 2,5 5 7,5km

- terrain
- water reservoir
- river
- erosion
- forest
- forest buffer 200 meter
- forest buffer 500 meter
- dehesa
- sand layer

Adaptive strategic planning

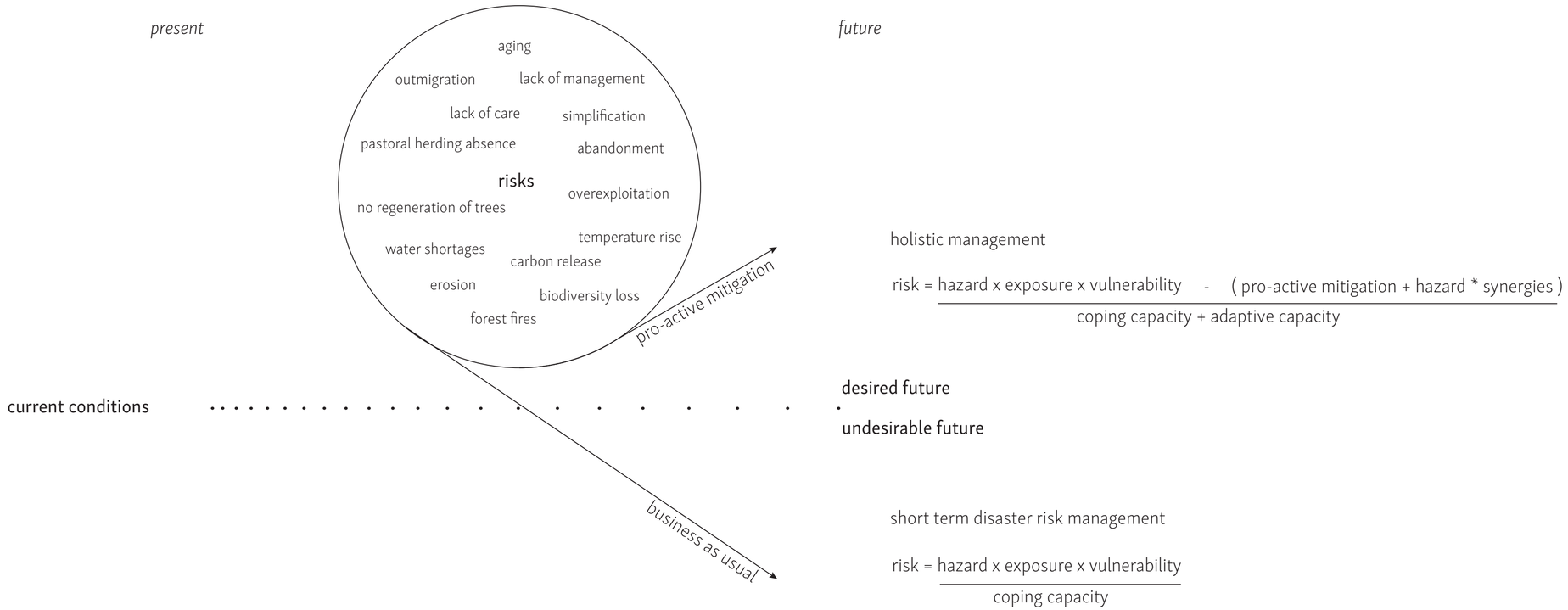
What is needed?

A renewed symbiosis

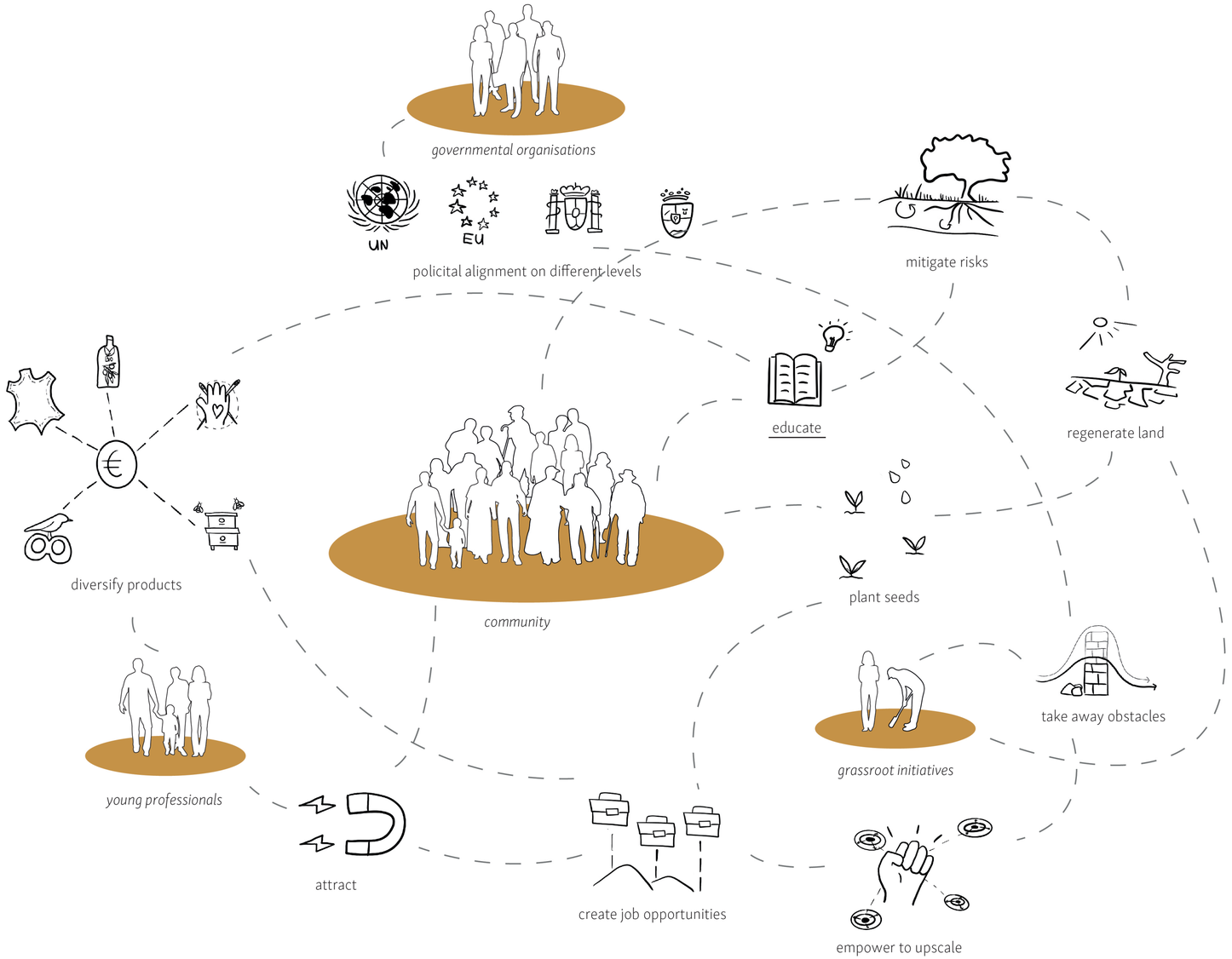


A system of mutal care: a local adaptive strategic plan

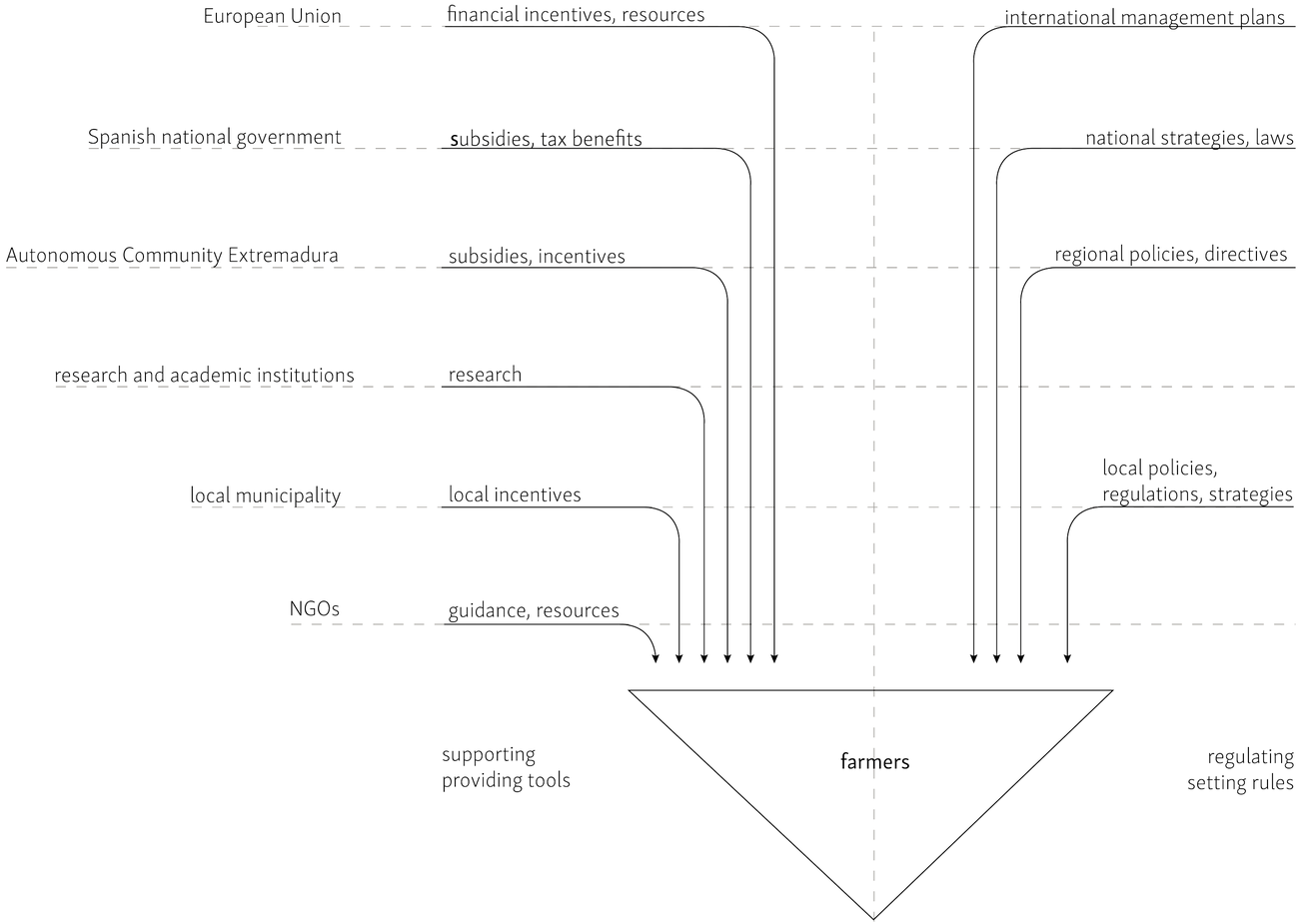
How?

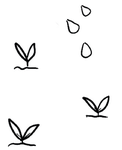

present
future
aging
outmigration
lack of management
lack of care
simplification
pastoral herding absence
abandonment
risks
overexploitation
no regeneration of trees
temperature rise
water shortages
carbon release
erosion
biodiversity loss
forest fires
pro-active mitigation
current conditions
desired future
undesirable future
business as usual
holistic management
risk = hazard x exposure x vulnerability - (pro-active mitigation + hazard * synergies)
coping capacity + adaptive capacity
short term disaster risk management
risk = hazard x exposure x vulnerability
coping capacity

Systematic care



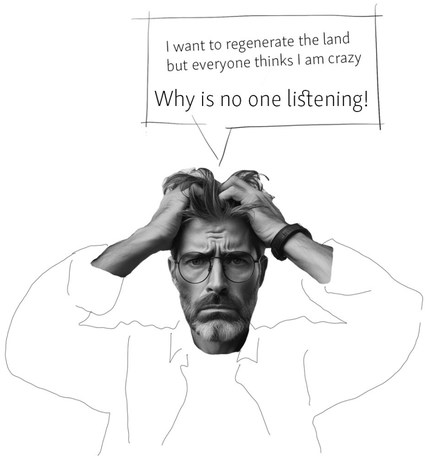
Bottom-up and top-down



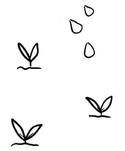


Sharing knowlegde between farmers

traditional farmers



grass-root farmers

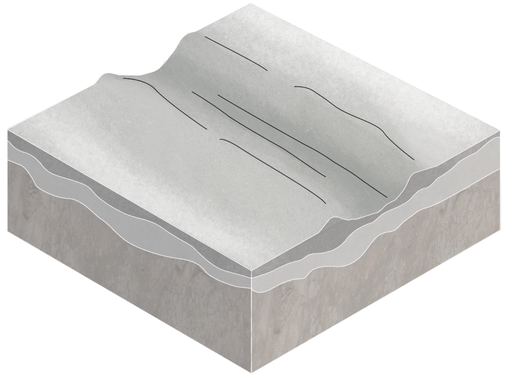


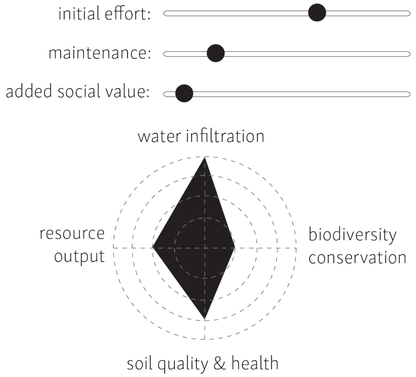
Nature-based solutions as a tool

"Actions to **protect, sustainably manage, and restore** natural or modified ecosystems that address **societal challenges** effectively and adaptively, simultaneously providing human **well-being and biodiversity benefits**." (IUCN, 2016).

water ditches

microbiology field **farm** community landscape

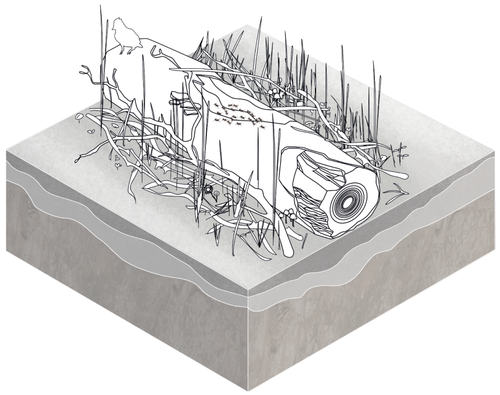


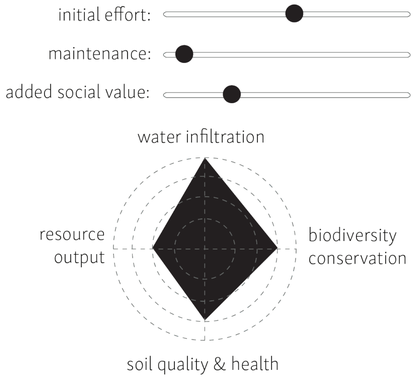


Water ditches, designed to enhance water infiltration, capture and direct rainfall into the soil. By strategically placing them in the landscape surface runoff can be reduced, allowing more water to seep into the ground, replenishing groundwater reserves and maintaining soil moisture. The ditches help prevent soil erosion, improve soil structure, and promote the growth of vegetation.

wooded banks

microbiology **field** farm community landscape



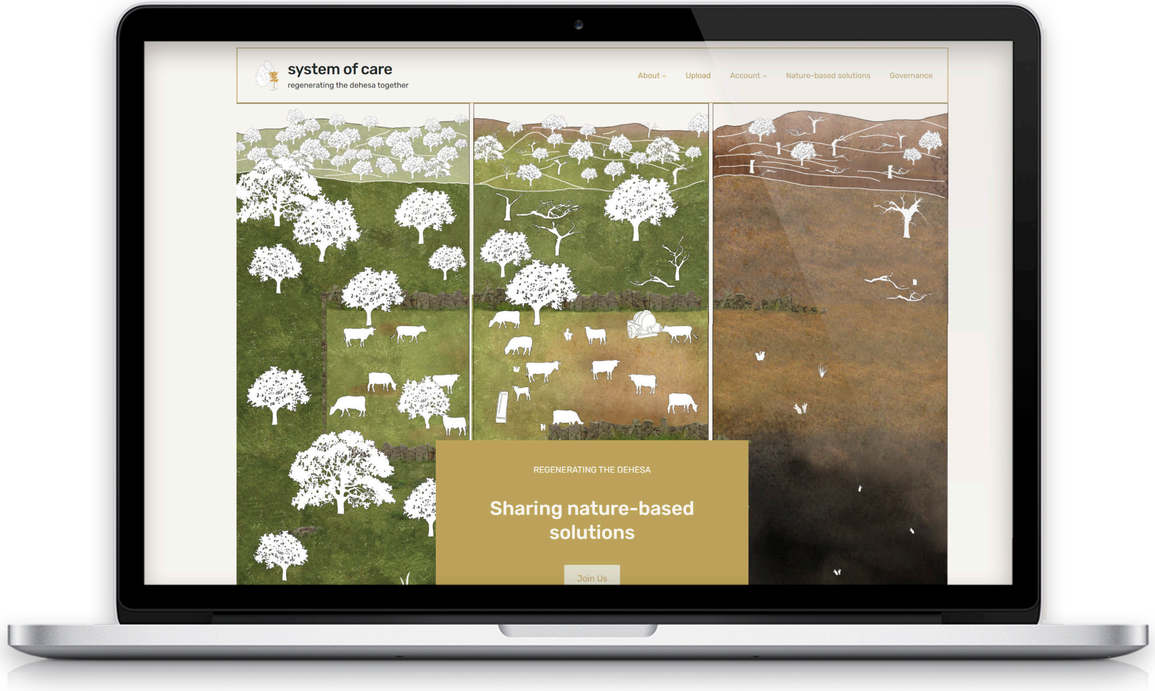


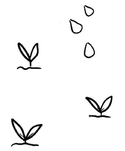
Wooded banks are designed to enhance water infiltration, recharge groundwater, stabilize the soil, and foster a diverse habitat. Lined with trees, branches, and left-overs from pruning, act as natural barriers that slow down water flow, allowing more water to seep into the ground. This method reduces surface runoff, prevents soil erosion, and improves soil structure. The roots of the vegetation help anchor the soil, while shade is provided and biodiversity is supported and enhanced.

plant seeds

educate

regeneramosladehesa.es





Building on current capacities

Upload your nature-based solution

In the form below, upload the information on the nature-based solution you tested. After an evalution, the solution will be shared with other farmers. Help others to regenerate land!

Name of nature-based solution

Scale of solution

○ microbiology ○ field ○ farm ○ community ○ landscape

Type of landscape

◉ dehesa ○ pastureland ○ forest

Photo of solution

Bestand kiezen Geen bestand gekozen

Difficulty

◉ easy ○ moderate ○ hard

Maintenance

◉ low ○ medium ○ high

Short description on what is important while implementing this solution

engagement by farmers

Knowledge building and expanding

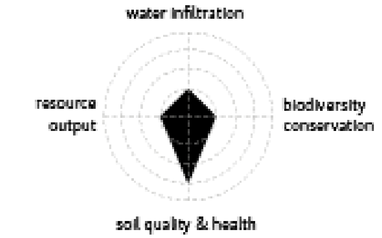
Assessing soil health

microbiology field farm community landscape

initial effort:

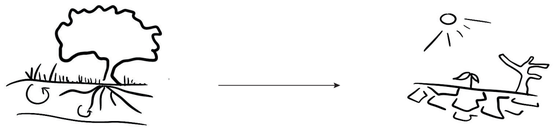
maintenance:

added social value:



By using animals on the land soil fertility and structure can be enhanced. Essential nutrients as nitrogen, phosphorus, and potassium are added to the soil and improve fertility for plants. The organic matter in manure improves its soil structure and water-holding capacity, which contributs to a healthier soil. This way nutrients are recycled that would otherwise be wasted.

Towards regeneration on landscape scale



mitigate risks

regenerate land

Decomposing the landscape

vulnerable dehesa

forest

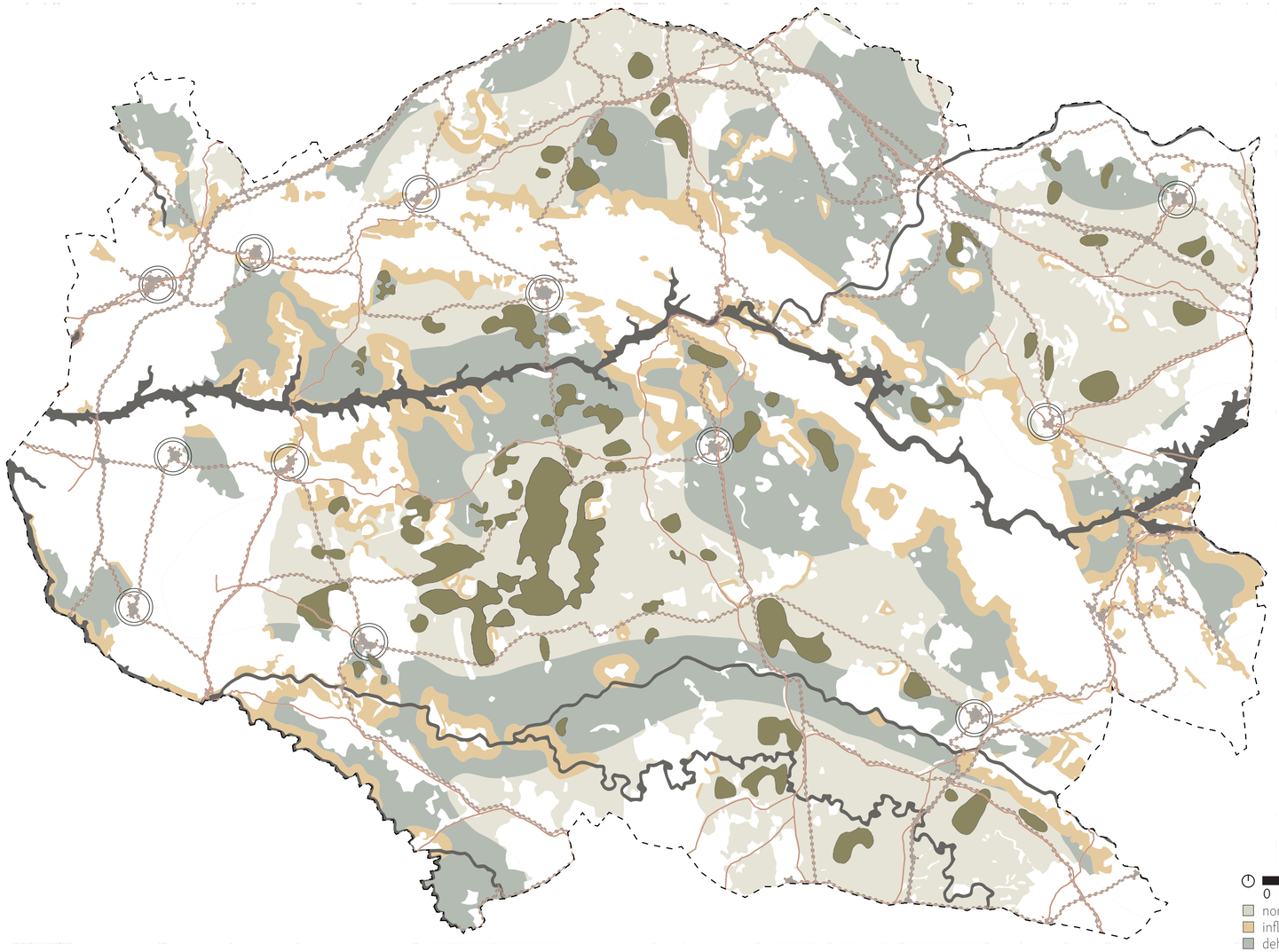
tree densification

dehesa

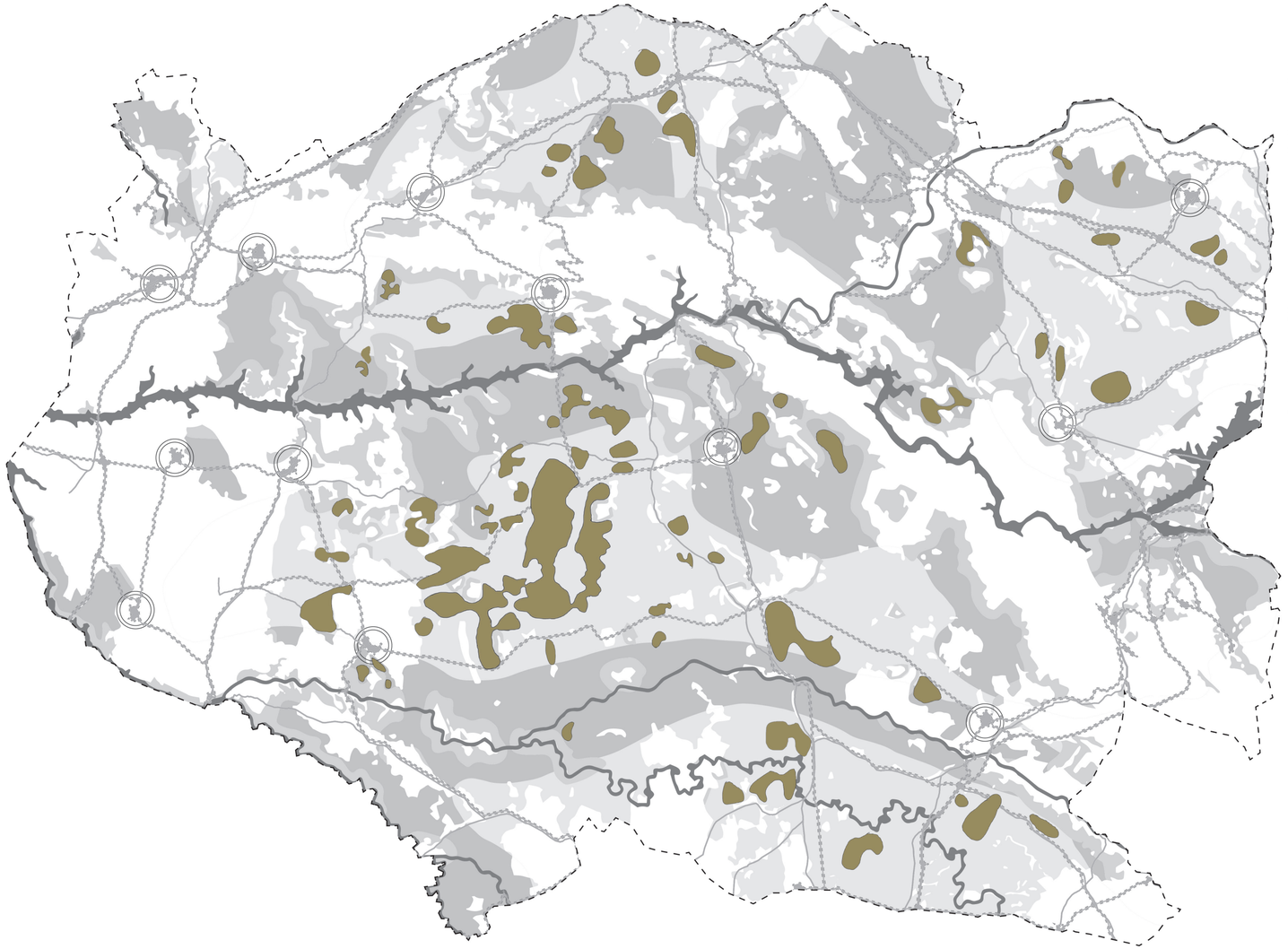
water infiltration opportunities

territory

Situating actions



Linking sites, actions, and outcomes



0 5 10 km

the empty dehesa

mitigate risks regenerate land

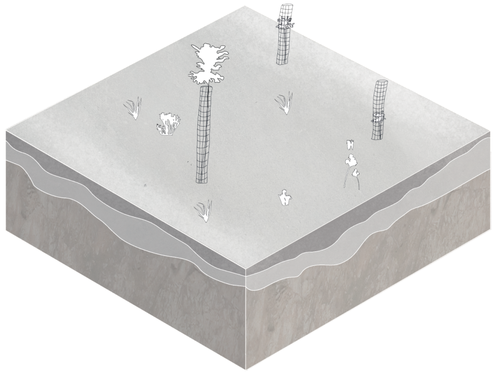
Tree regeneration

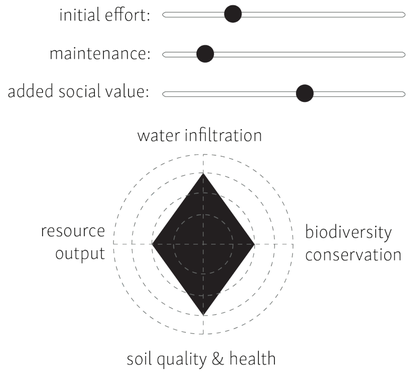
mitigate risks regenerate land

Repair through regenerative practises

active reforestation and protection

microbiology **field** farm community landscape

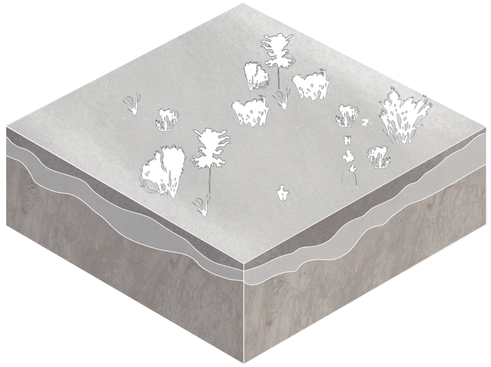


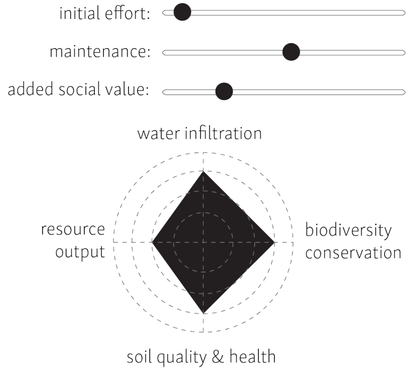


By planting new trees and protecting them with a mesh fence, more young trees will be able to grow into new oaks, enabling te continuity of the dehesa in the future. The fence unables birds as well as livestock to eat the saplings. The initial effort to undertake this is minimal, and there is almost no need for maintenance. The creation of new forests together with the community can have a large social value.

passive reforestation with shrub enhancement

microbiology **field** farm community landscape





With the initial absence of livestock, the regeneration of trees can start. As shrubs grow and saplings grow, the land starts to transform. When the shrubs start to take up the space and light that the saplings need, maintenance is needed in shortening the bushes. This is also needed to make sure the shrubland does not have an enlarged risk on fires.

the empty dehesa

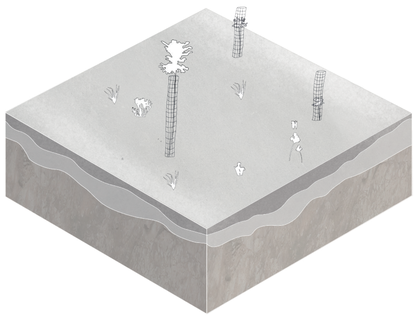
Risks

Opportunities

Methodologies

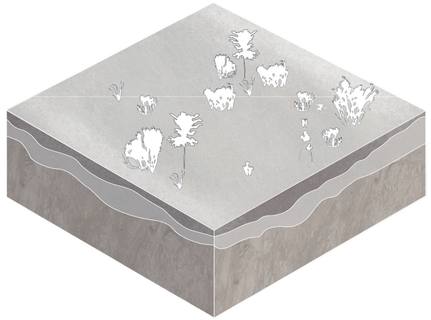
Facilitating a come-back and continuation of the system by planting new trees and stimulating growth.

1



active reforestation and protection with livestock

2

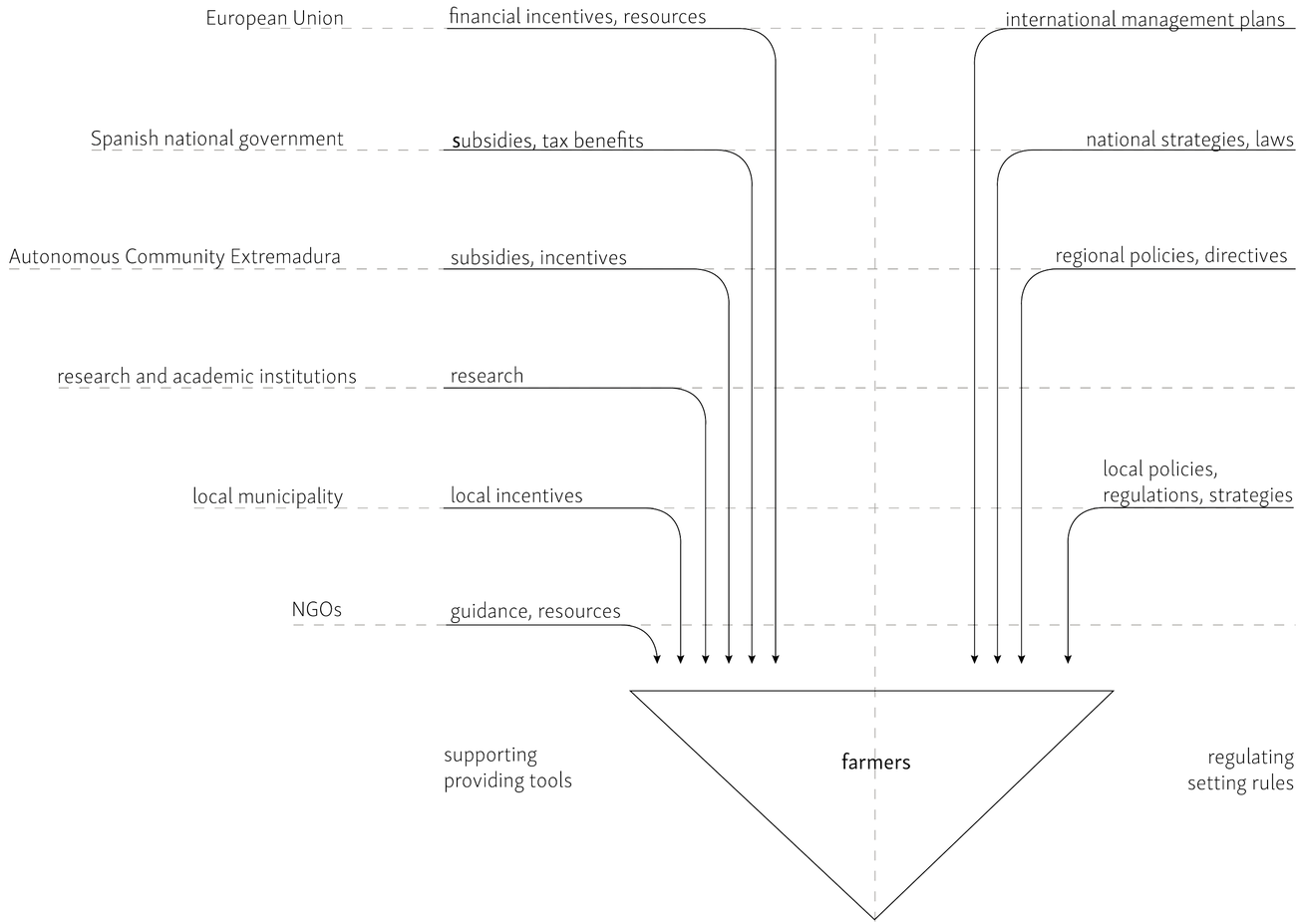


reforestation with shrub enhancement without livestock

Socio-ecological result

A dehesa with a high diversity of aged trees. A relativetly closed foliage prevents soil from eroding by the wind. As the trees act as nutrient pumps and provide shadow to plants, grasses wil grow below them and infiltration will be maximised. A wide range of birds and other animals take shelter in the landscape.

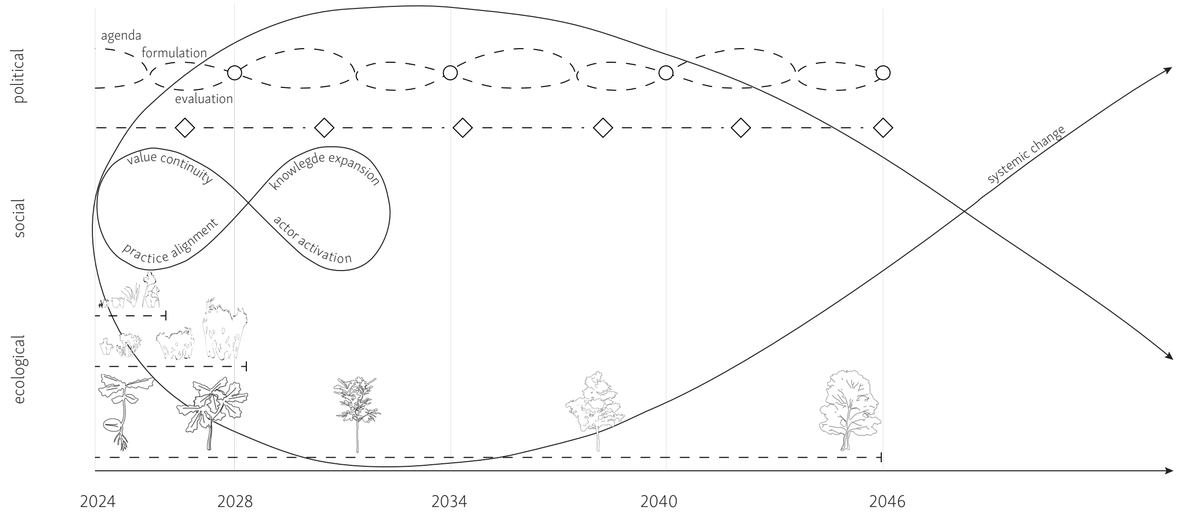
Regulation with incentives



Integrating ecosystem services into incentives

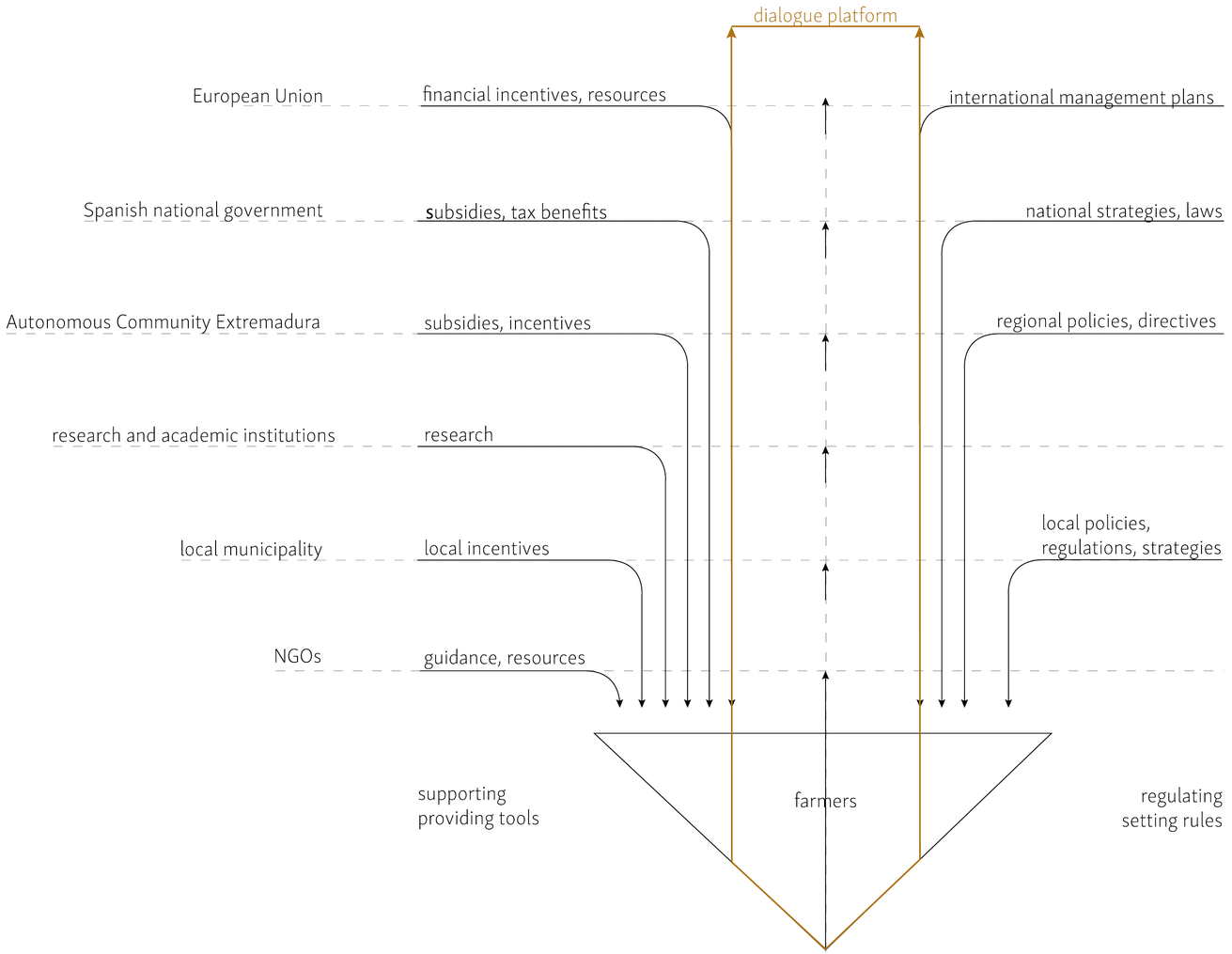
"Ecosystem services are the **benefits people obtain from ecosystems.** These include **provisioning** services such as food and water; **regulating** services such as flood and disease control; **cultural** services such as spiritual, recreational, and cultural benefits; and **supporting** services, such as nutrient cycling, that maintain the conditions for life on Earth." (United Nations, 2005)

Top-down systemic care



Payment for ecosystem services

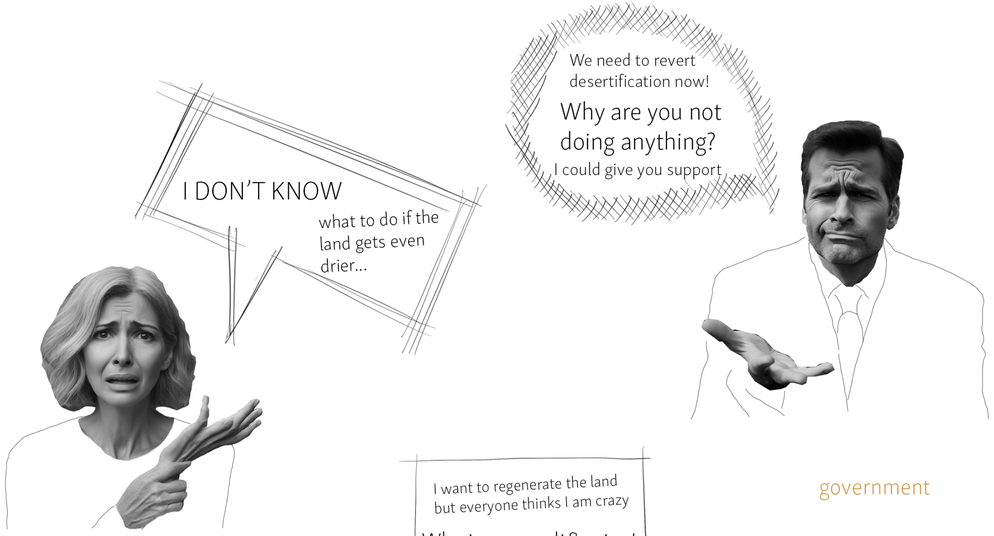
Bridging the gap between policies and actions



mitigate risks

regenerate land

Sharing knowlegde



traditional farmers

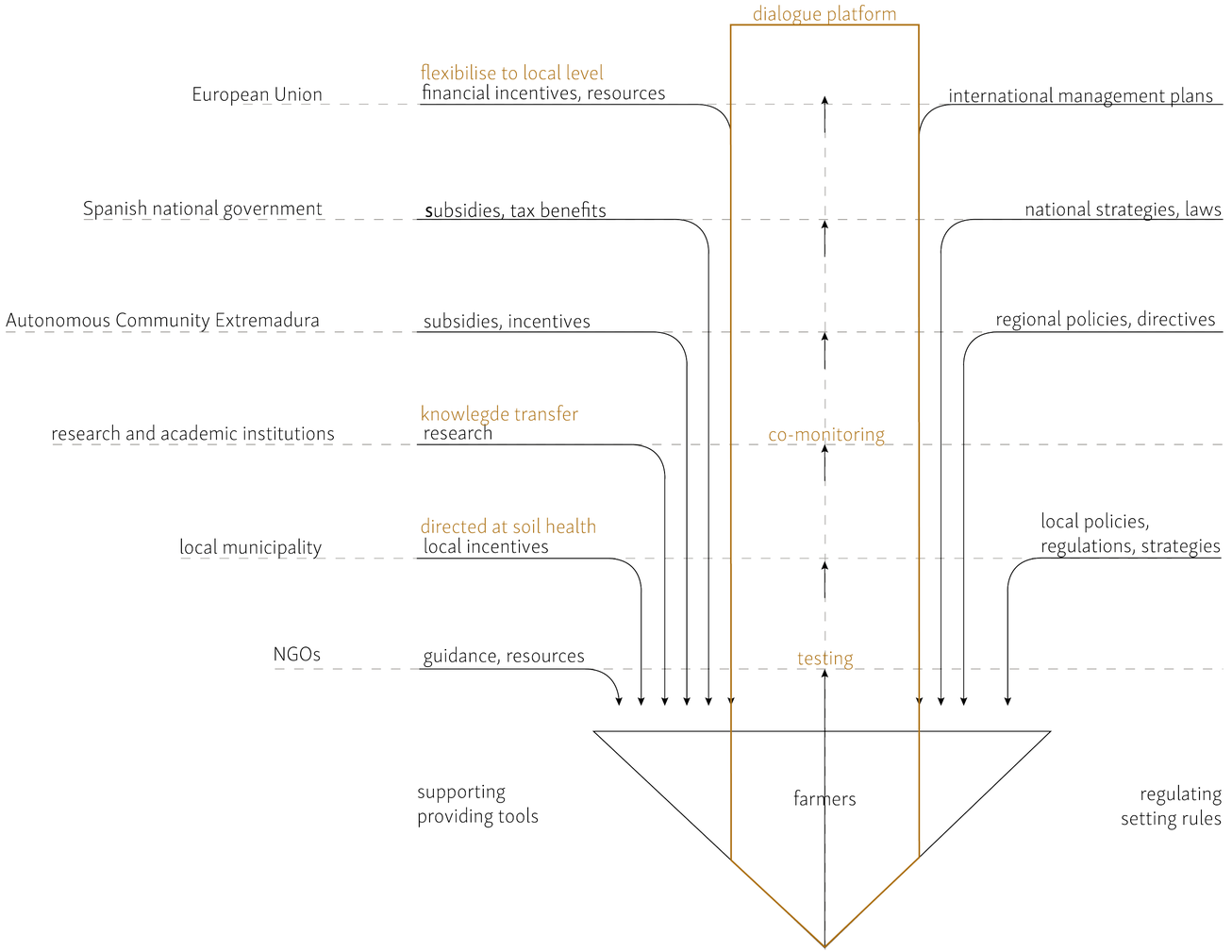
government

grass-root farmers

mitigate risks

regenerate land

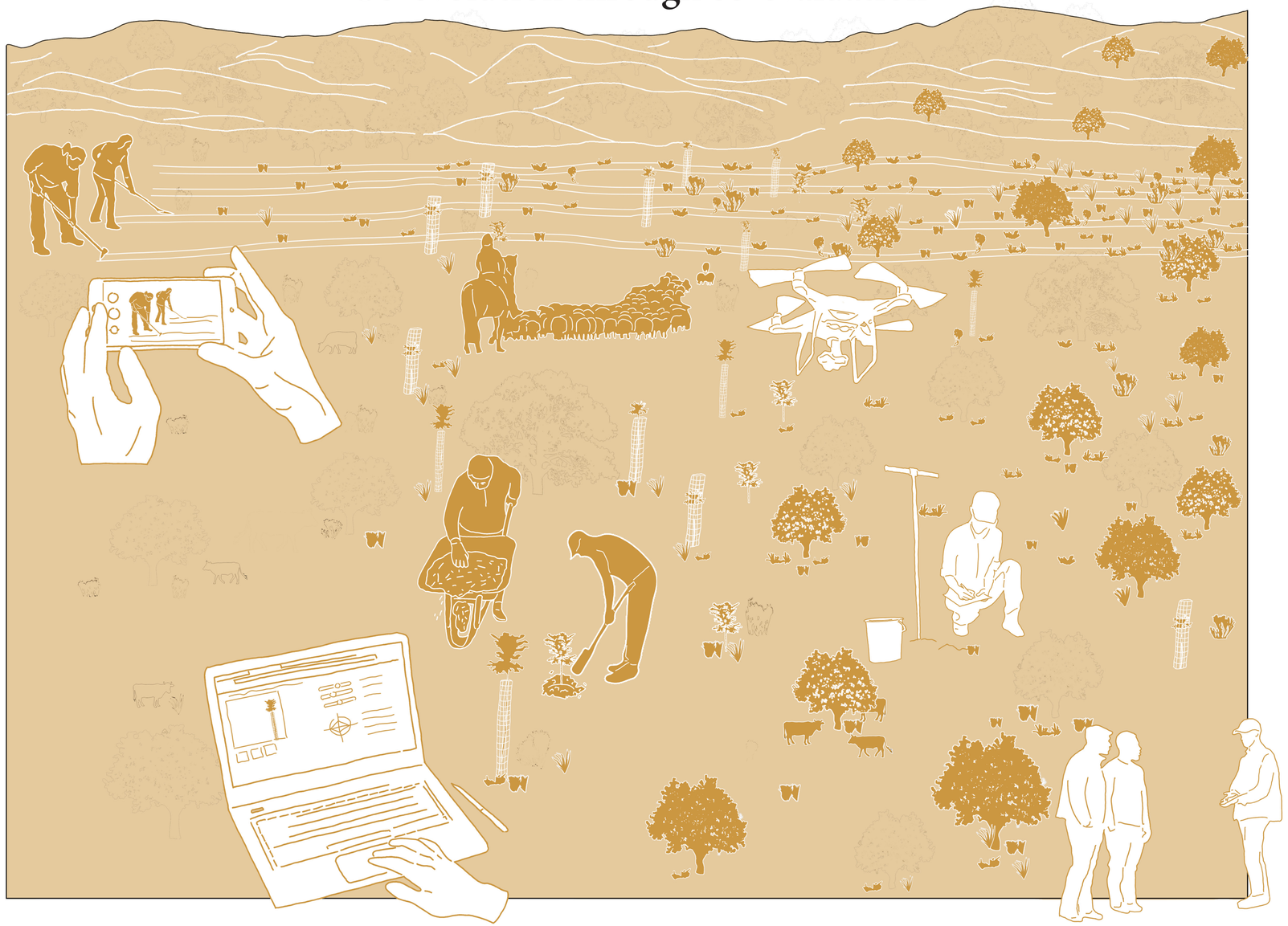
Co-monitoring



mitigate risks

regenerate land

Co-evolution through co-evaluation



Evaluation

Towards a resilient network

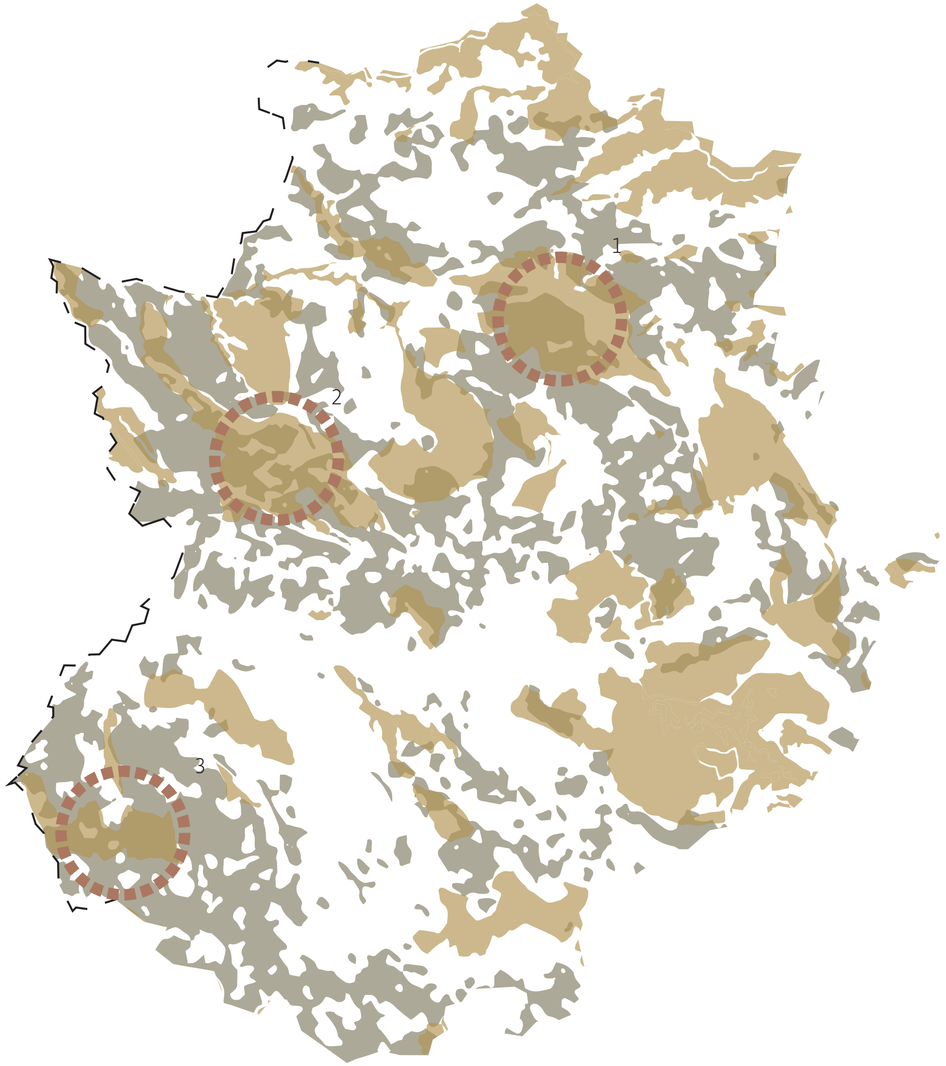
a collective landscape

0 100 200 km

- dehesa
- route
- territory
- regional border
- national border

A manifesto for action

Dehesas and protected landscapes



Elaboration:

Natura 2000 vs CAP / other protected area

natura 2000 is already protecting it, but with lots of regulations, which also causes abandonment. The areas around the protected areas may get lost while biodiversity is also high there. Decay in the unprotected land may be faster.

After European Environment Agency, 2021; Images by Fínibus, Carlos Criado, Víctor Manuel Pizarro

0 20 40 km

- dehesa
- natura 2000
- national border
- highlighted protected areas

Why Extremadura?

landcover & use
- aridity
- projected changes to arier types
- vegetation trends
- land utilisation
- risk on abandonment
- abandonment within natura 2000 areas
- irrigated agricultural land

geology
- morphology
- height
- slope
- potential erosion
- organic carbon

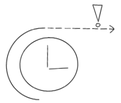
demography
- population change
- villages with less than 500 citizens
- share of farmers older than 65 years
- remoteness

resource management
- water overexploitation
- water consumption
- soil condition

Where is all the output from the interviews?

To improve the ability of the soil to function as a sponge and to improve the water cycle, no machinery is used, and no chemicals are applied. Moreover, a vegetation cover is always left under the trees in the small olive grove. She notices, that as they started to manage the cattles among these ideas, the earth gives back in quality and quantity. This also saves money.

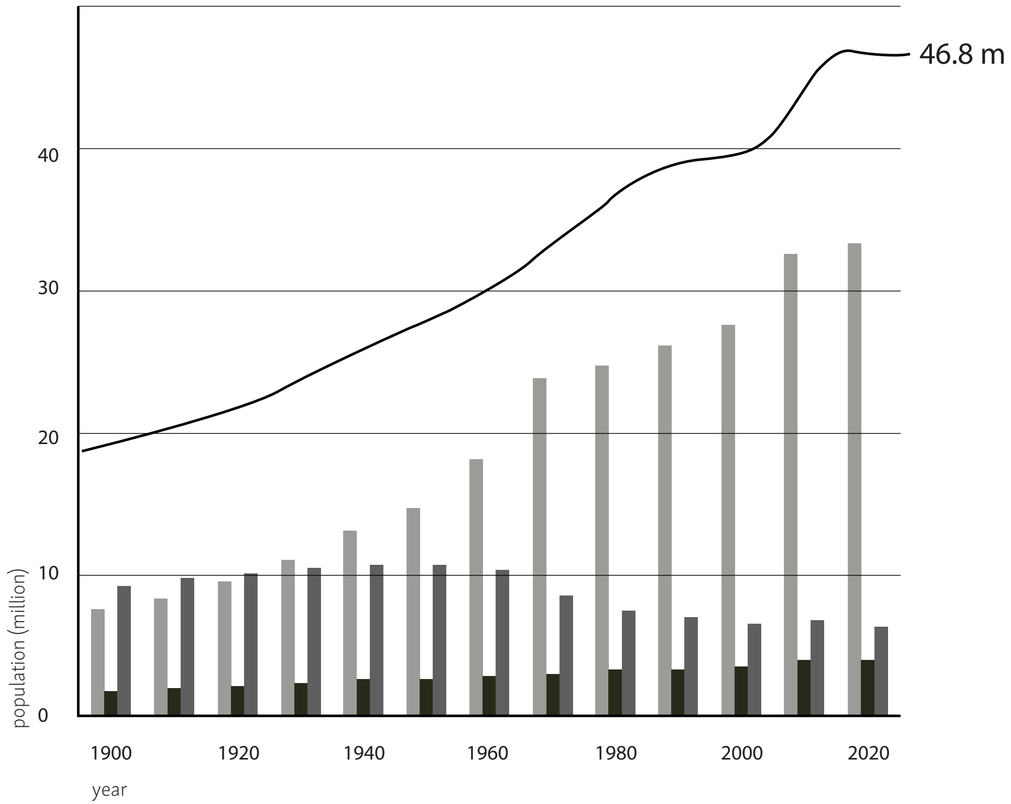
nautre-based solutions



When she started to apply these management techniques, many people interfered. They told her that she was demolishing the land if she continued. However, after improvement of the soil started to become noticablem they slowly started being interested. As this management takes more time and effort, and they are not used to it, spreading the change is hard.

operalisation of system of care

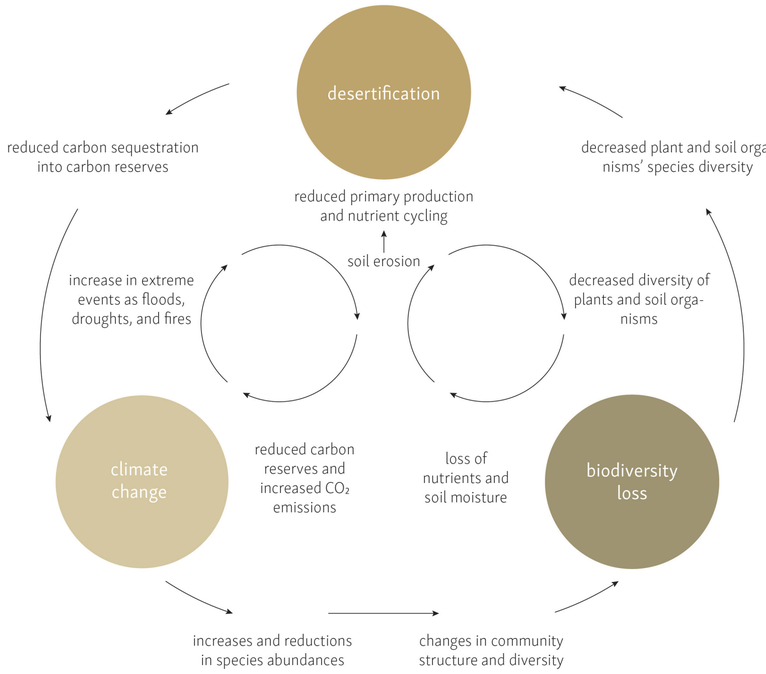
Depopulation in Spain



After Víctor Gómez Valenzuela & Adelheid Holl; UN DESA & Gapminder

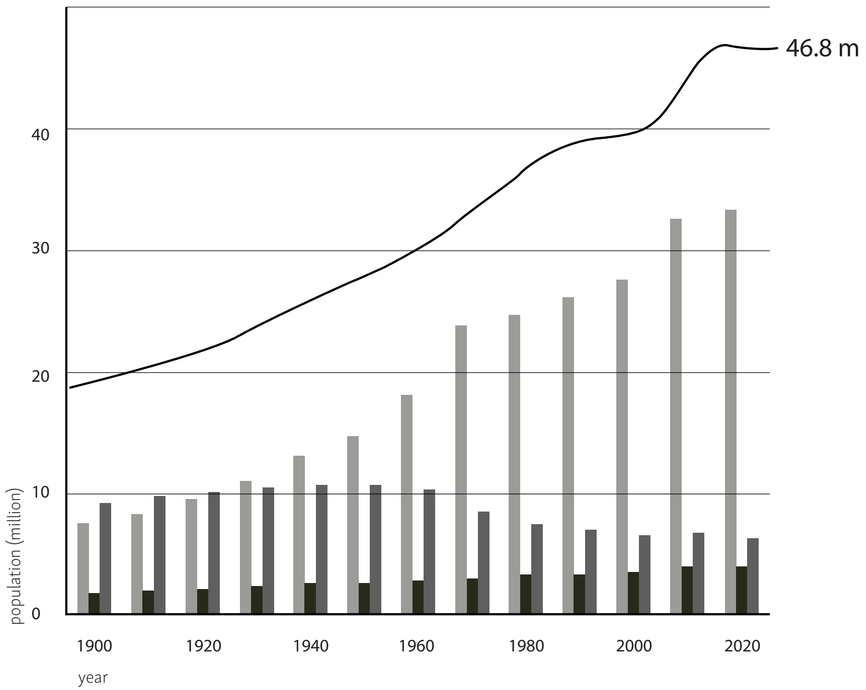
- urban population (>30.000 inhabitants)
- small rural town population (10.000-30.000 inhabitants)
- rural population
- total Spanish population

Intertwined phenomena



Based on World Resources Institute, 2005 ; Millenium Ecosystem Asessment, 2005.

Accumulation of pressures and drivers: depopulation



After Víctor Gómez Valenzuela & Adelheid Holl; UN DESA & Gapminder

- urban population (>30.000 inhabitants)
- small rural town population (10.000-30.000 inhabitants)
- rural population
- total Spanish population

Desertification and land abandonment explained

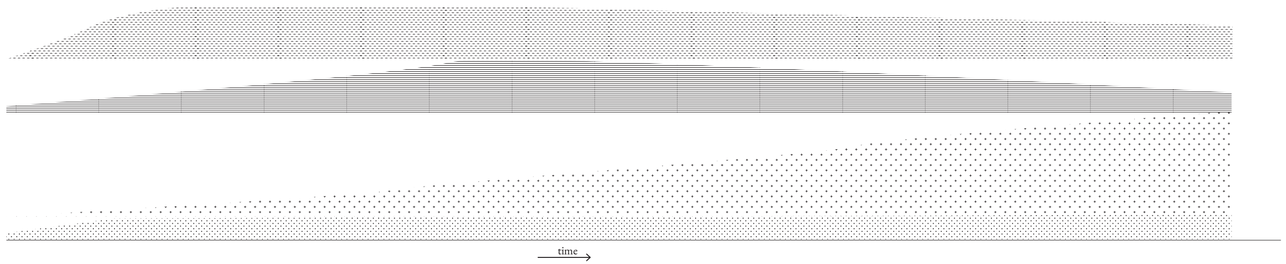
poor land management practices such as overgrazing, excessive irrigation, monoculture, and soil sealing significantly degrade soil quality. Prolonged overgrazing degrades vegetation, leading to a reduction in plant diversity, soil organic matter. **The low biological productivity of the land after overexploitation causes people to leave**, leaving the land in an even worse state.

mitigate

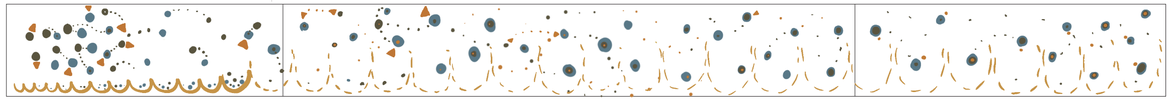
educate

regenerate

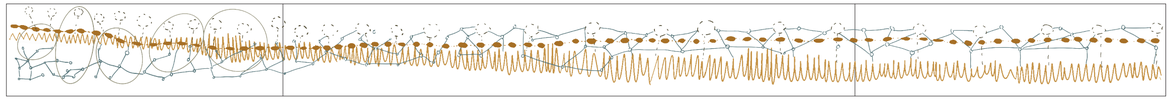
co-monitor



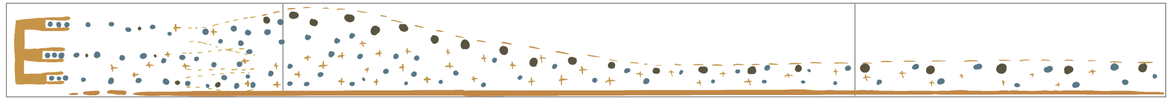
knowledge



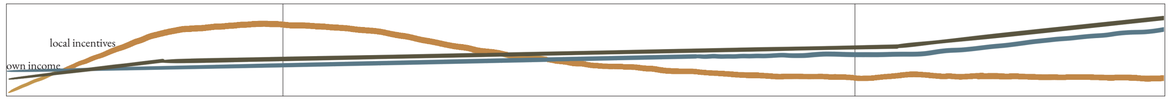
communication



regulation



economics



2024 2028 2030 2034 2040 205(

technical assistence | educate | take away obstacles | new cap with PES | align policy | feedback + evaluation | empower to upscale | diversify prodcts | create job opportunities