REGENER8 POWER

SASSARI Ecovoltaic Park

Sardinia, Italy

May 2021

What is **Regener8ive** Solar ?

Solar development systems should be designed as an element of the landscape they belong to, according to an 'inclusive' design approach that does not focus only on the overall energy efficiency of the system, but extends to other additional vocational, ecological and landscape services implementing against Sustainable Development Goals.

Solar power production

- Energy System Efficiency
- Optimized system configuration

Carbon Management

- Natural Climate Solutions
- Certification of carbon reduction

Social Impact

- Early stage involvement of local community
- Possibility of community investment into the project

Multiple land use

- Combination with agricultural or alternative use
- Implementation of Nature Based Solution / Ecology revenue

Sustainability

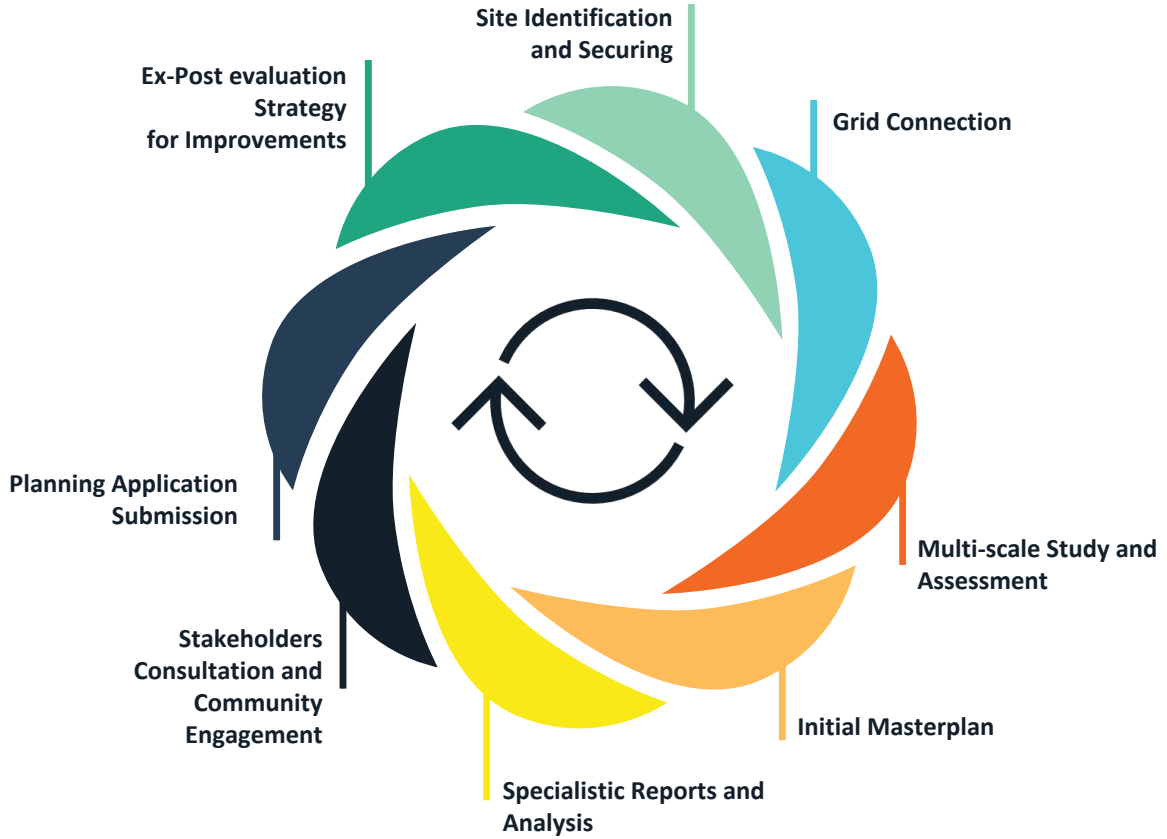
- Decommission freindly planning
- Recycling plan for all components
- Benchmarking of suppliers

Landscape and Biodiversity integrated within the Solar Design

- Solar design as a catalyst to rewilding

Our **Development** Process

1. Site identification via GIS
   Site securing (final lease Contract signed)
2. Grid connection application
   Grid connection offer and capacity secured
3. Multi-scale study, assessment of the context, constraints and site vocation / Identification of the main ecological issues
4. Characterisation of the soil and agricultural potential
   Crops identification based on climate data and water demand
5. Shading and radiation simulation and agricultural analysis Light saturation point of crops (shading tolerance)
6. Technology (frames and modules) selection
   Irradiance simluation and Yield
7. Identification of a spectrum of suitable species and habitats to enhance the provision of ecosystems services
8. Identification of potential environmental and socio-economic impacts and community benefits
9. Planning application
   Building permit submission

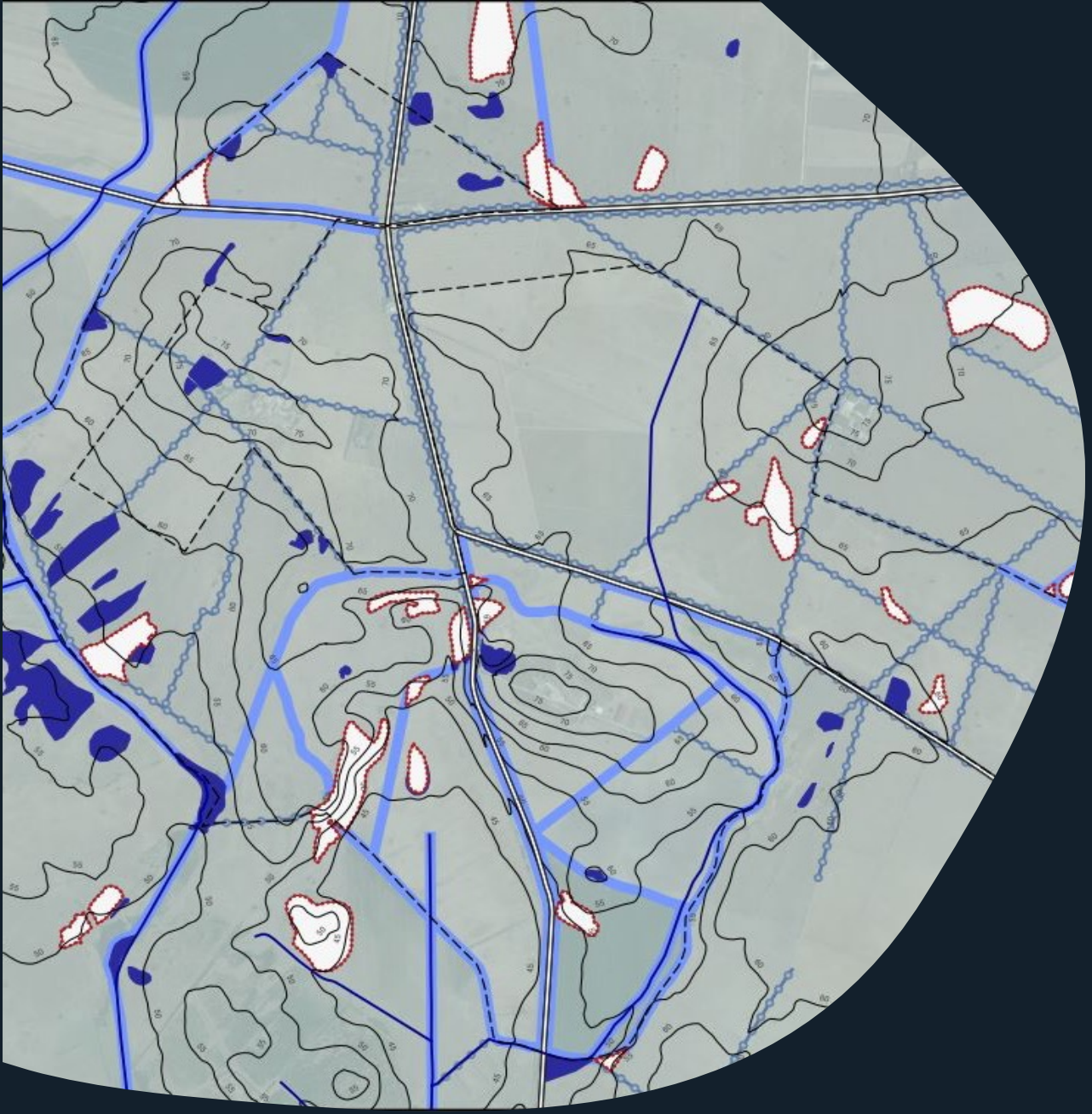


SITE

Site boundaries

- **Location**: Municipality of Sassari (SS), Italy
- **Extension**: of c. 327 ha
- **Classification**: Agricultural
- **Overview**: The area is mainly calcareous and clay; large part of the territory is affected by regular disturbance linked to agricultural activities, mainly fodder and annual mowing. Ecosystems appears to be fragmented as residuals of semi-natural areas linked to de-forestation, mowing, grazing, fertilisation and re-seeding. The actual vegetation is mainly composed of spontaneous vegetation typical of the Mediterranean climate, including holm and cork oaks, wild olive groves, myrtles, dwarf palms as well as poplars and eucalyptus. The area is characterized by a strong anthropic pressure:
  - Constant farming and sheep breeding;
  - Presence of infrastructures and HV masts and transmission lines;
  - Mining activities (presence of 2 quarries – NE and SW)

ECOLOGY



Existing ecological patches and corridors in the made semi-natural matrix

The uses associated with the loss of natural habitats and environmental fragmentation are mainly due to the agricultural activities and the present infrastructure. These modifications have determined a conversion of the environmental matrix, originally natural, into a semi-natural matrix with poor ecological potential. Map shows these residuals: high naturality elements, natural habitat, and ecological corridors.

Corridors can be divided in '*continuous ecological corridors*' (strips and grassland or riparian habitats) and '*stepping stones*' (small shrub cores). This ecological network represents an indispensable cognitive means to design and optimise natural dispersal routes for the conservation of biodiversity.

High naturality elements

Natural habitat

Ecological corridors

Stepping stones

HABITAT

Pseudo-steppe & grasses

Streams

Mediterranean scrub

Mosaic

Quercus ilex and forests

Wild olive woodland

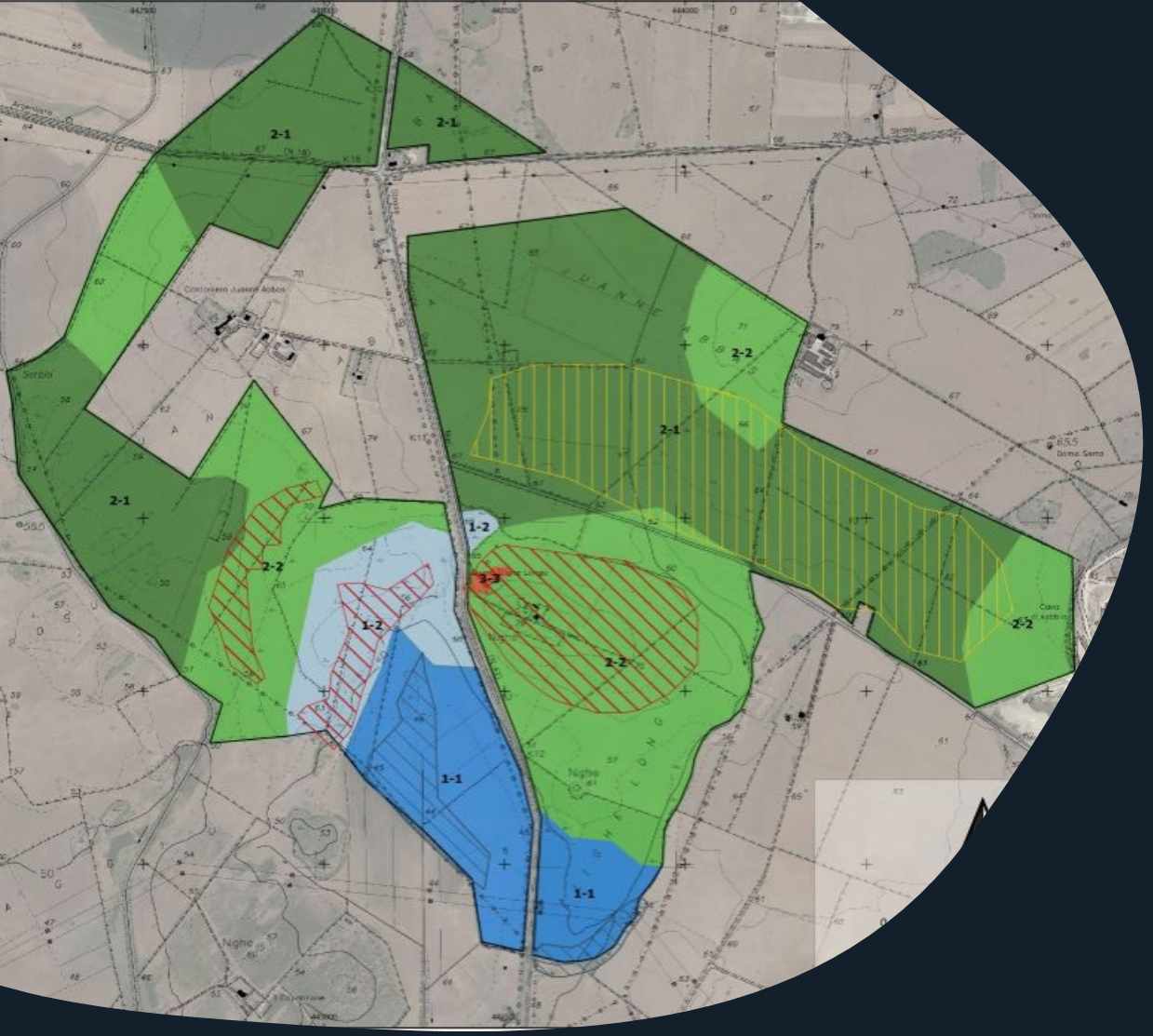
Habitats of community interest

Despite the largely semi-natural territorial matrix dedicated to extensive and non-irrigated farming, the residual natural communities in the agro-ecosystem presents a high conservation value as well as a great wealth of habitats.

At present, land use has reduced the number of purely forests habitats to a minimum. There is evidence of specific reduced habitats '*Quercetum ilicis*' , evergreen '*Quercus*' and wetlands for which is essential to provide appropriate forms of management for conservation.

These habitats strictly depends on anthropogenic activities of disturbance; the cessation of pastoral activities and a more sustainable agriculture can lead to the reconstitution of forest communities.

SOIL



Soil description

Soils are on average deep, with a clayey loam texture, not very permeable, with a slow drainage, characterized by temporary hydromorphy on some areas, especially in the SW sector.

Landscape Unit 1 – Alluvium

The area results suitable for agricultural, both irrigated and dry. However, the characteristics of these areas require a series of interventions to improve the structure, permeability and drainage. Thus, grazing is an activity, where possible, to be inhibited, especially cattle.

Landscape Unit 2- Limestones and Dolomites

The prevailing substrate is made up of limestones, dolomite and dolomitic limestone. Soils are usually shallow; in general, excessive grazing produced erosive processes. Agriculture is still possible although the activity should be limited and restoration of natural vegetation enhanced.

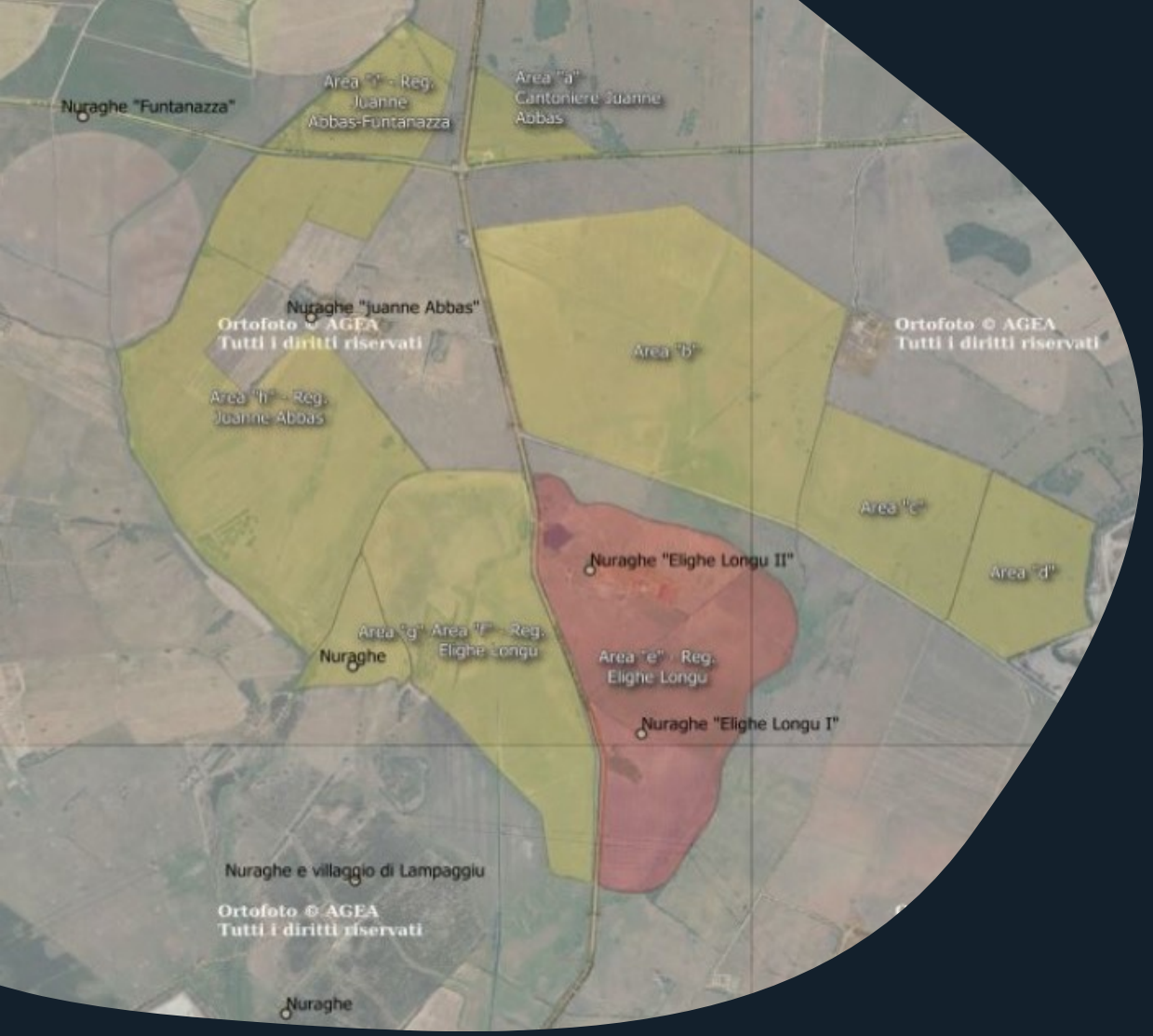
Unit 1- Landscape on Alluviums

- Sub-unit 1
- Sub-unit 2
- Moderate erosive risk

Unit 2 - Landscape on limestones

- Sub-unit 1
- Sub-unit 2
- High petrosity

HERITAGE



Archaeological assessment

The study showed the presence of an important peopling phase in the Protohistoric period, articulated in complex settlements and single-tower '*nuraghi*'. The number and quality of the identifiable sites within the area of the land provides the image of a densely populated and lively landscape studded with a plurality of sites of various kinds.

The nuraghi are the most evident manifestation of this particularly lively period which testify the real intensify of the settlements network of the period.

The majority of these risks are regulated by the Sassari's zoning plan according to the national legislation and prescriptions. The plan provides all the details concerning preclusions, conditional and absolute protections depending on the nature of the risk as well as instructions relating to interventions and alterations of the landscape.

For high-risk areas no alterations are permitted in order to preserve the existing landscape, vegetation and guarantee intervisibility and fruition. Activities like recovery, restoration and agriculture are permitted and incentivised subject to the prescriptions and regulations.

High risk Low-medium risk '*Nuraghe*'

CONSTRAINTS

Landscape:

- RIVER BUFFER: according to current prescriptions a 150m buffer shall have to be left free of any installation pursuant DLgs 42/2004
- SCENIC ROADS: Regional landscape plan identifies provincial roads crossing the site as having scenic landscape value. An adequate buffer from main roads to be considered

HERITAGE:

An high-risk archaelogical areas has been identified due to the presence of '*nuraghi*'. Thus, no new constructions or modifications are allowed in this area; differently, agricultural activities will be permitted according to prescriptions.

NATURAL & SEMI-NATURAL AREAS:

Regional plan identifies 3 main semi-natural areas which have to be protected and free of any interventions. The vegetation within these areas is now reduced to a minimum these areas will be destinated for local tree plantation and enhancement of ecosystem services.

Archeological Buffer

High Interst Natural Areas

150m River Buffer

Natural Climate Solutions

- **Carbon Removal / Avoidance**
- **Habitat for wildlife**
- **Water Pollution Reduction**
- **Flood mitigation**
- **Food supply security**

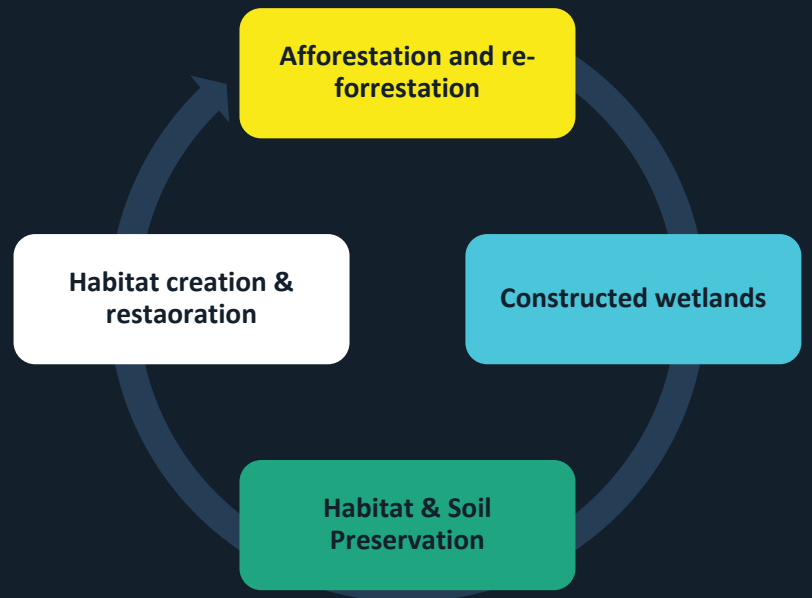
Carbon and Ecology credits

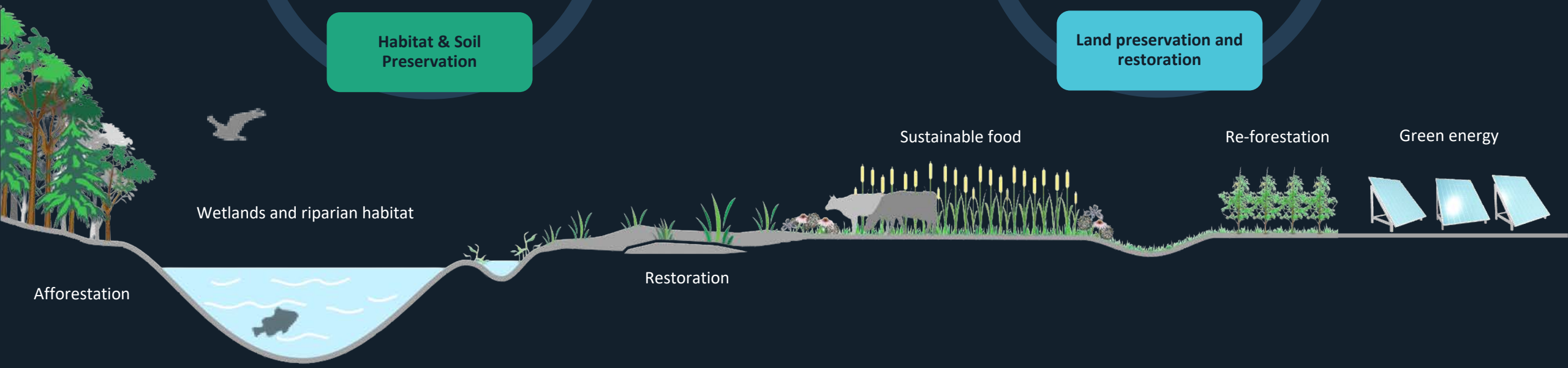
PROVISIONING SERVICES:
Sustainable Food
Water, Timber and Fiber

REGULATING SERVICES:
Clean air
Water purification and quality;
Human health
Pollination
Soil health
Biodiversity
Erosion and flood control/regulation
Carbon storage

CULTURAL AND SOCIAL SERVICES:
Recreational/Educational & Aesthetic

Ecosystem Services

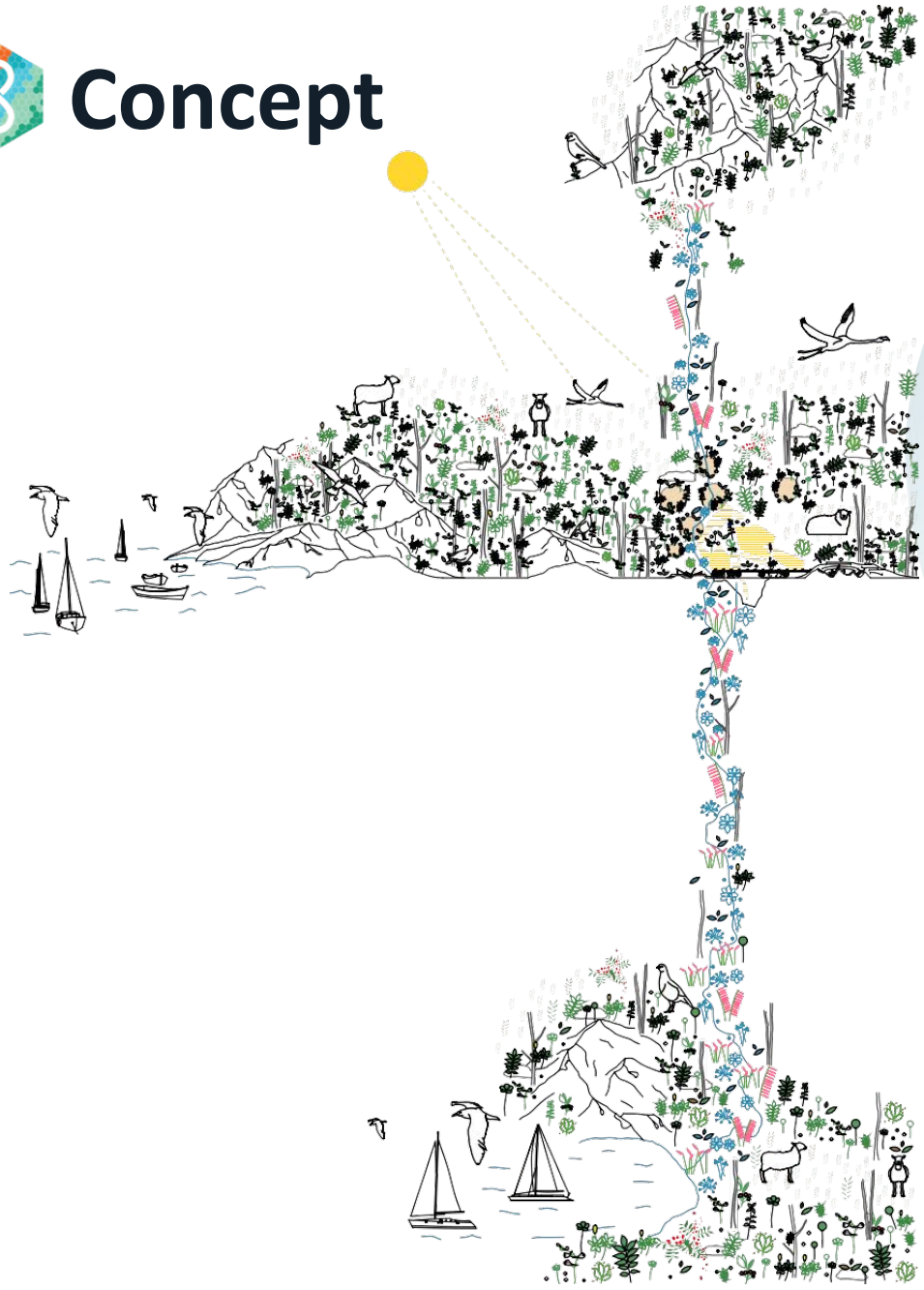


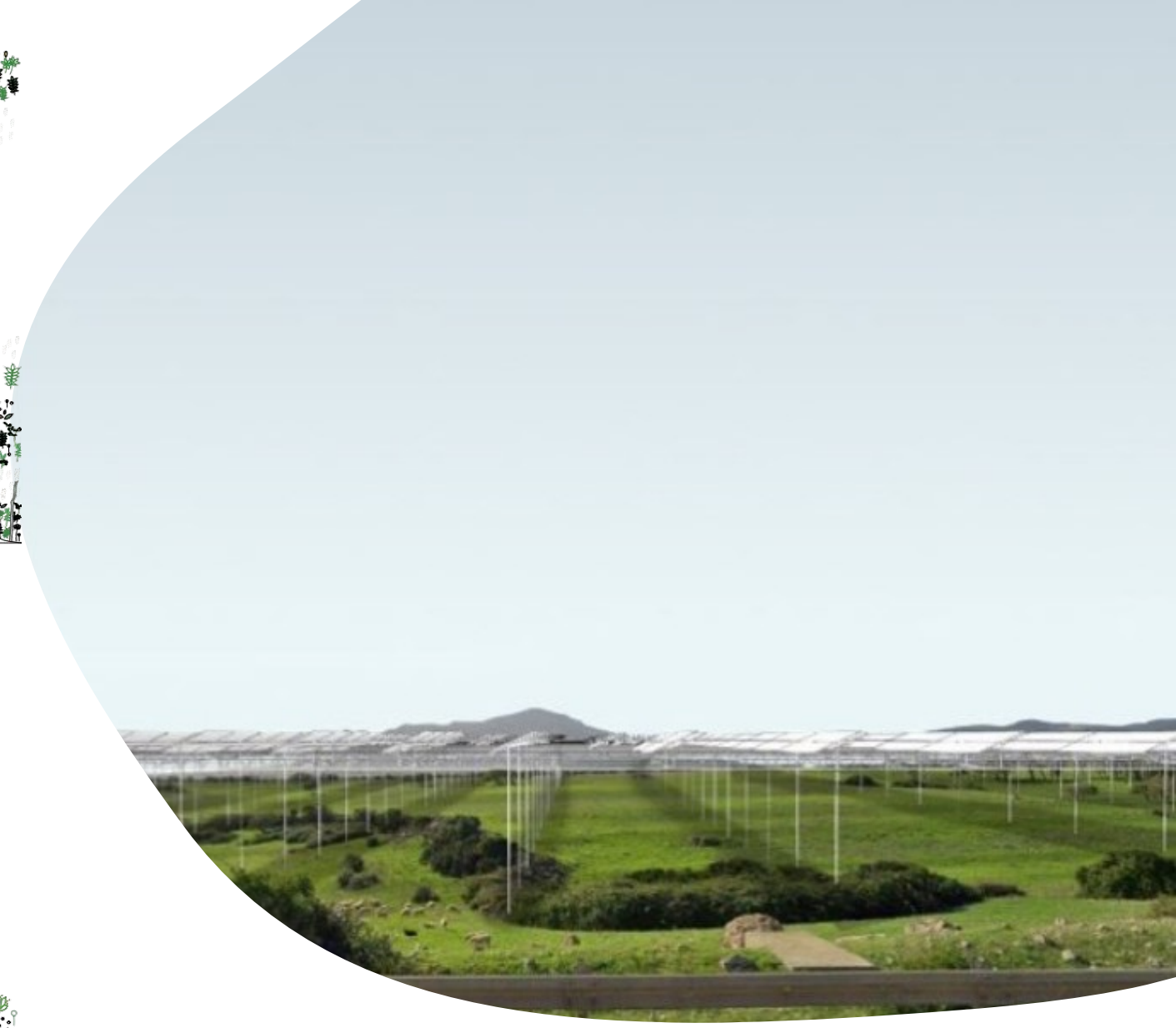


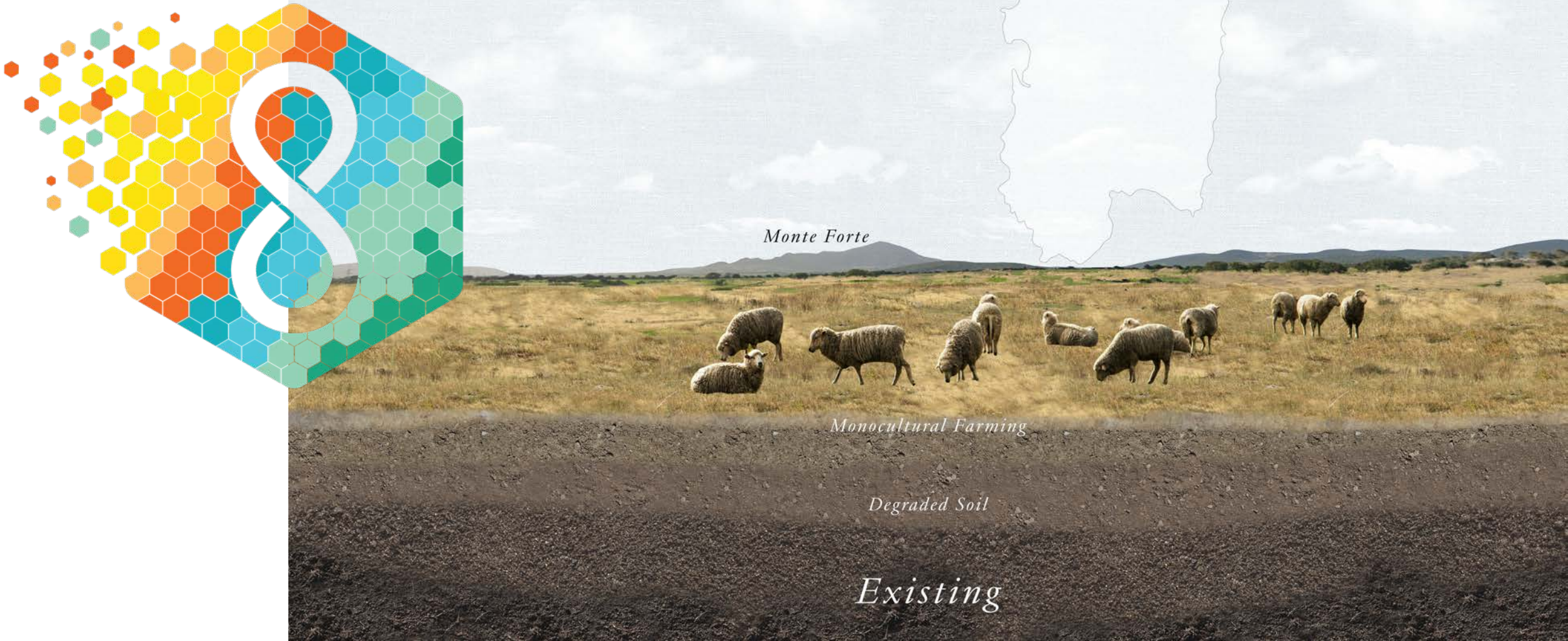
Solar APV Farm

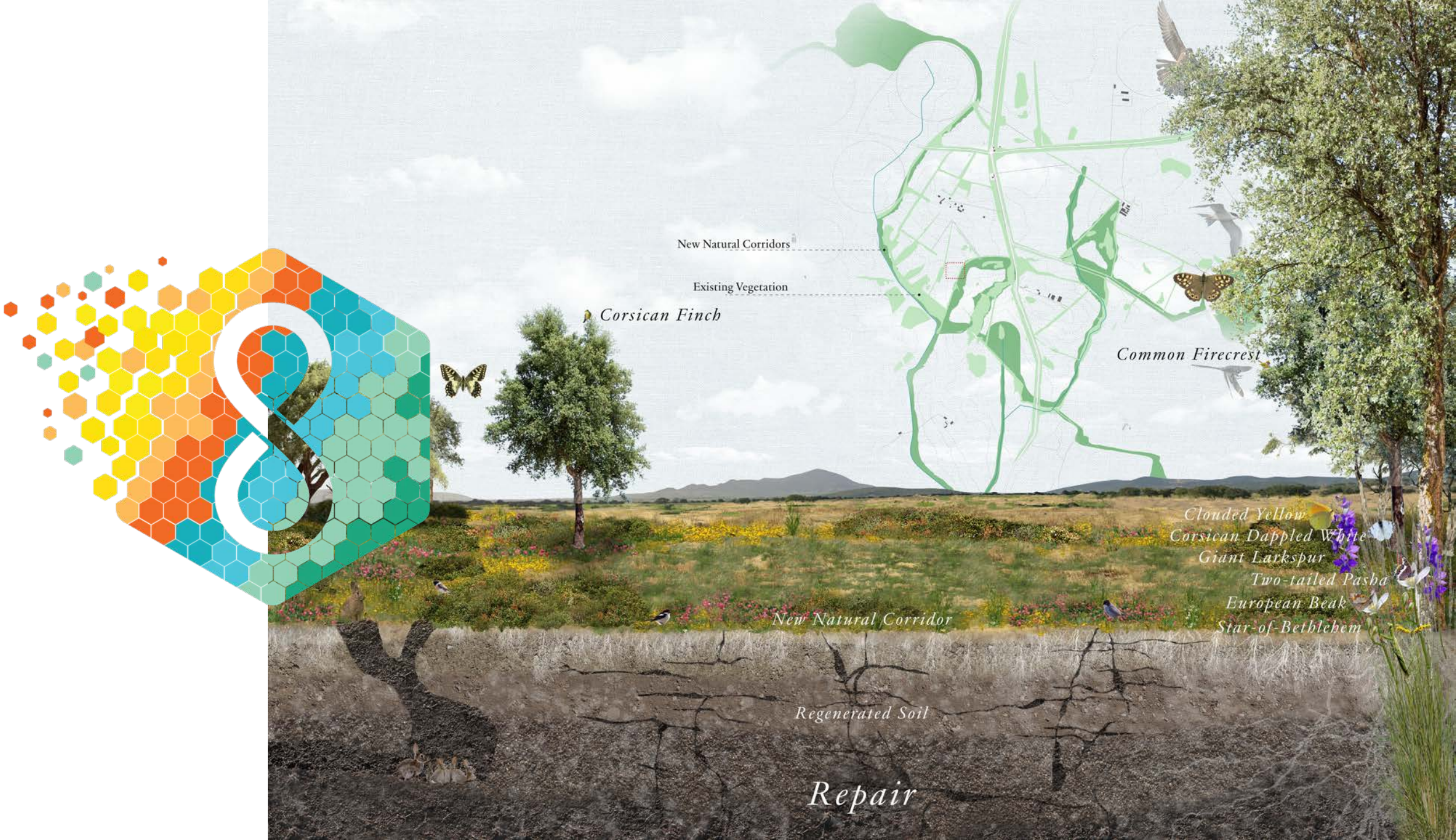
- Rising demand for solar generation is leading to increased land used competition, and thus to potential economic and social conflict.
- A solution to this challenge is to produce sustainable food and green energy within an agri-photovoltaic (APV) system
- The combination of high standing structures and semi-transparent panels allow crops to grow underneath without affecting the annual yield
- Depending on the sites latitudes and climate, the combination and identification of solar structures and crops follows an iterative process in order to keep a beneficial price-performance ratio
- On deteriorated land (not suitable for agriculture activities), ecological interventions present another interesting opportunity to restore the landscape and create habitats, allowing soils to recover, re-new the minerals and nutrients as well as acting as carbon storage.
- These interventions contribute, not only to green energy generation and sustainable food production, but also as catalyst to restore landscapes and enhance the ecosystems services.

Concept

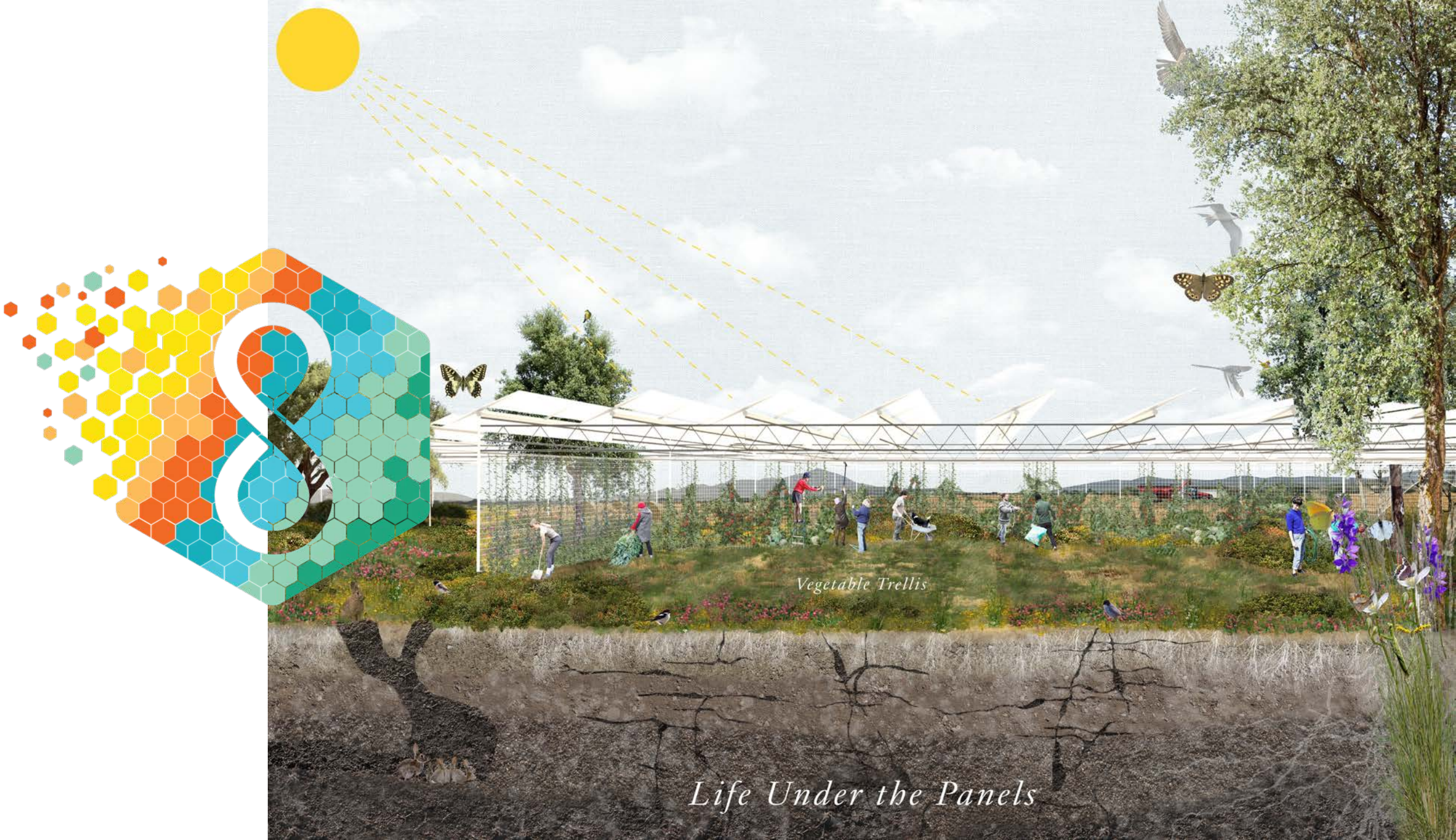





• Project Site
Monte Forte
Monocultural Farming
Degraded Soil
Existing

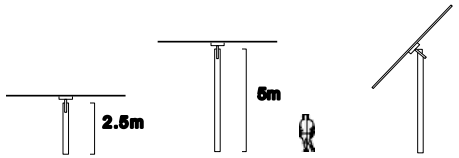

New Natural Corridors
Existing Vegetation
Corsican Finch
Common Firecrest
Clouded Yellow
Corsican Dappled White
Giant Larkspur
Two-tailed Pasha
European Beak
Star-of-Bethlehem
New Natural Corridor
Regenerated Soil
Repair

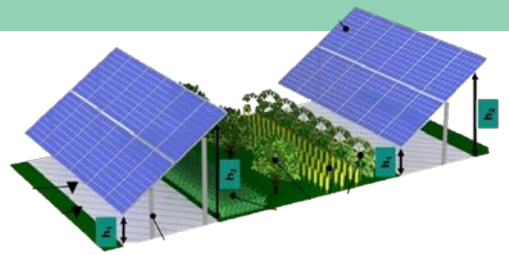

Dwarf Palm
Wild Fruit Orchard
Legumes + Sheep
Holm Oak + Truffles
Shared Garden
Apiary
Didactic Garden
Aromatic Herbs + Orchard
Olive Grove
Cork Oak
Poplar Grove
Ancient Sardinian Grains
Biodiverse Farming
Ancient Grains


Vegetable Trellis
Life Under the Panels

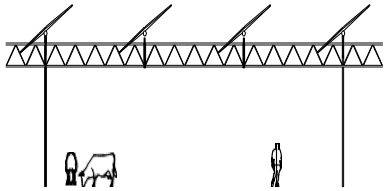
Technology screening

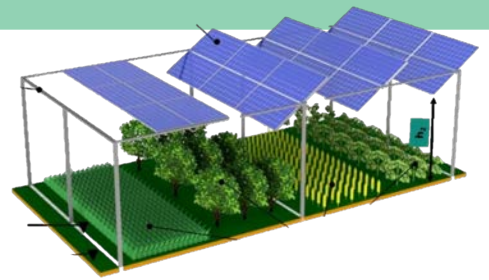
Ground mounted systems



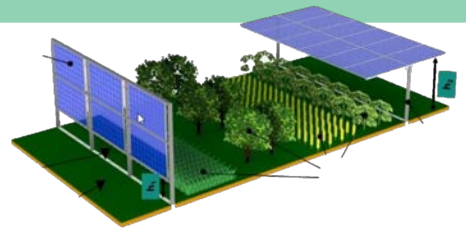


Overhead systems





Vertical systems

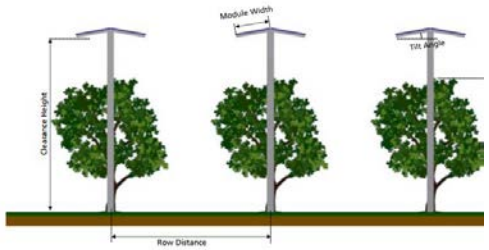


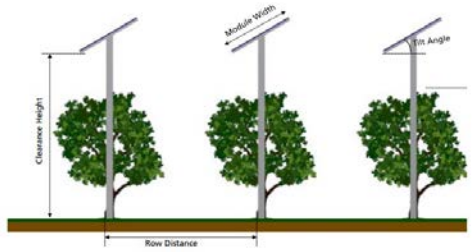
Solar frames

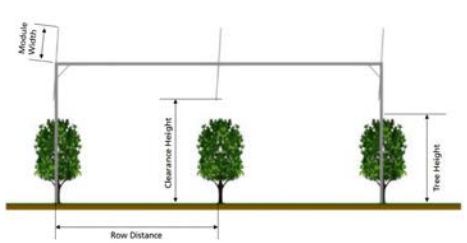
Suitable area for agriculture and solar APV

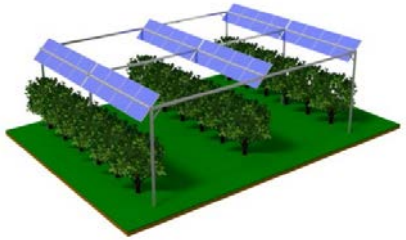
Technology screening

Overhead structures



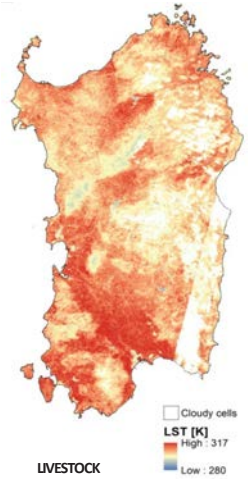






Crops

Weather Average



Temperature Map

Most of the land area of Sardinia is unsuitable for agriculture; the most important exception is the Campidano Plain, a corridor of fertile lowlands in the southwest stretching from the Gulf of Cagliari to the Gulf of Oristano.

Table 2. CORINE land cover classes and groups.

	LEAC Groups	CORINE Land Cover Classes [1]			
URB	Artificial (urbanized) areas	1.*			
APC	Arable and permanent crops	2.1.*	2.2.*	2.4.1	
MCP	Mosaic crops and pastures	2.3.*	2.4.2	2.4.3	2.4.4
FSW	Forests, shrubs, and woodlands	3.1.*	3.2.4		
HNGS	Heathland, natural grasslands, and sclerophyllous vegetation	3.2.1	3.2.2	3.2.3	
OPSP	Open spaces with sparse or absent vegetation	3.3.*			
WAT	Water bodies and wetlands	4.*	5.* (except 523-sea)		

The asterisk (*) marks any sub-classes of a given class, or any sub-sub-classes of a given sub-class. (CORINE: Coordination of Information on the Environment).

Land Cover Classes

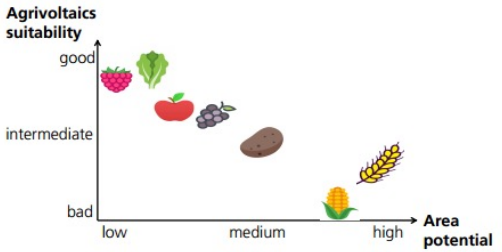
Weather Average

CONTINUOUS GRAZING

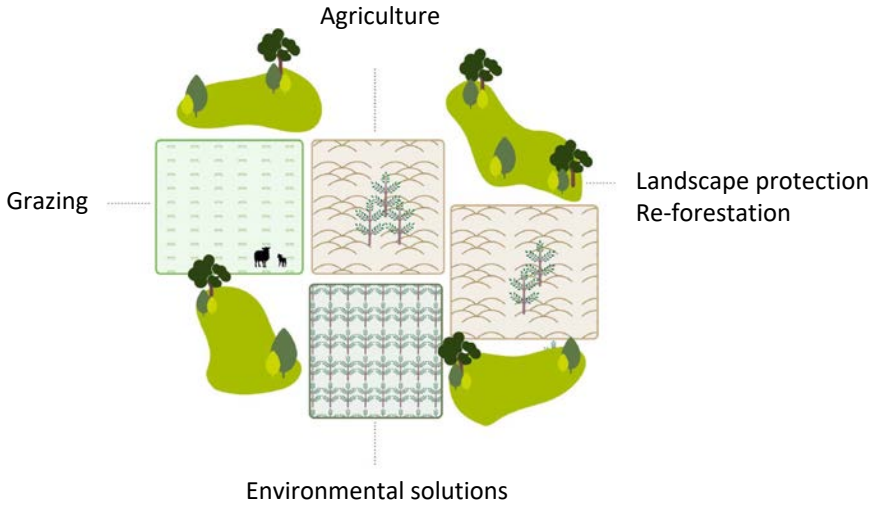
Continuous grazing leads to depleted root systems, a decline in plant diversity, the encroachment of more grazing tolerant/increaser plant varieties, increased erosion, depleted soil and often sub-par animal performance and returns per acre.

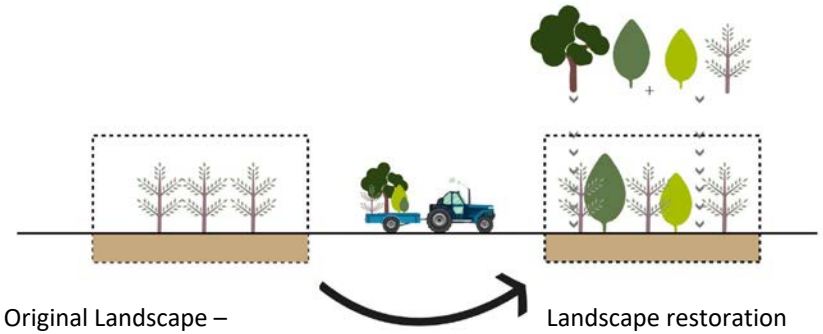
ROTATIONAL GRAZING

The rotational grazing system is developed by subdividing a large pasture into two or more smaller paddocks and grazing these paddocks in a planned sequence. This provides rest periods for plants while others are being grazed.

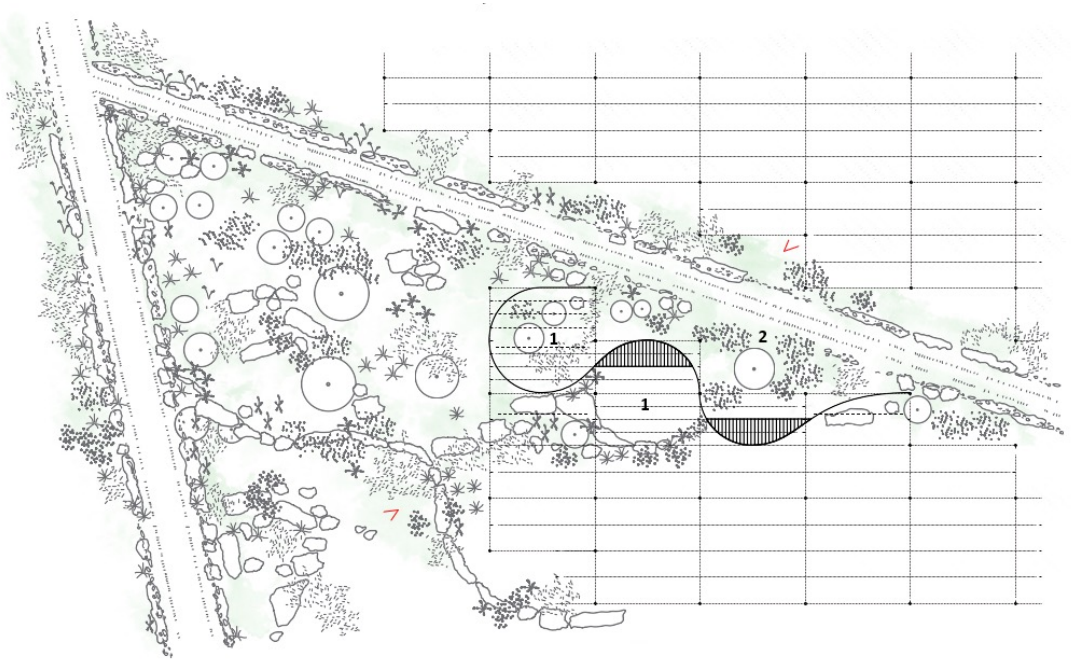


- Crops selection strictly depend on the climate and the type and quality of the soil as well as the water demand
- A qualitative assessment is required to identify suitable crops along with an economic feasibility and social accepatance





Regeneration



1. market / event space

2. car / park

restored vegetation:
thermo-med, pre-desert scrub,
pseudo-steppe grasses

existing stone walls

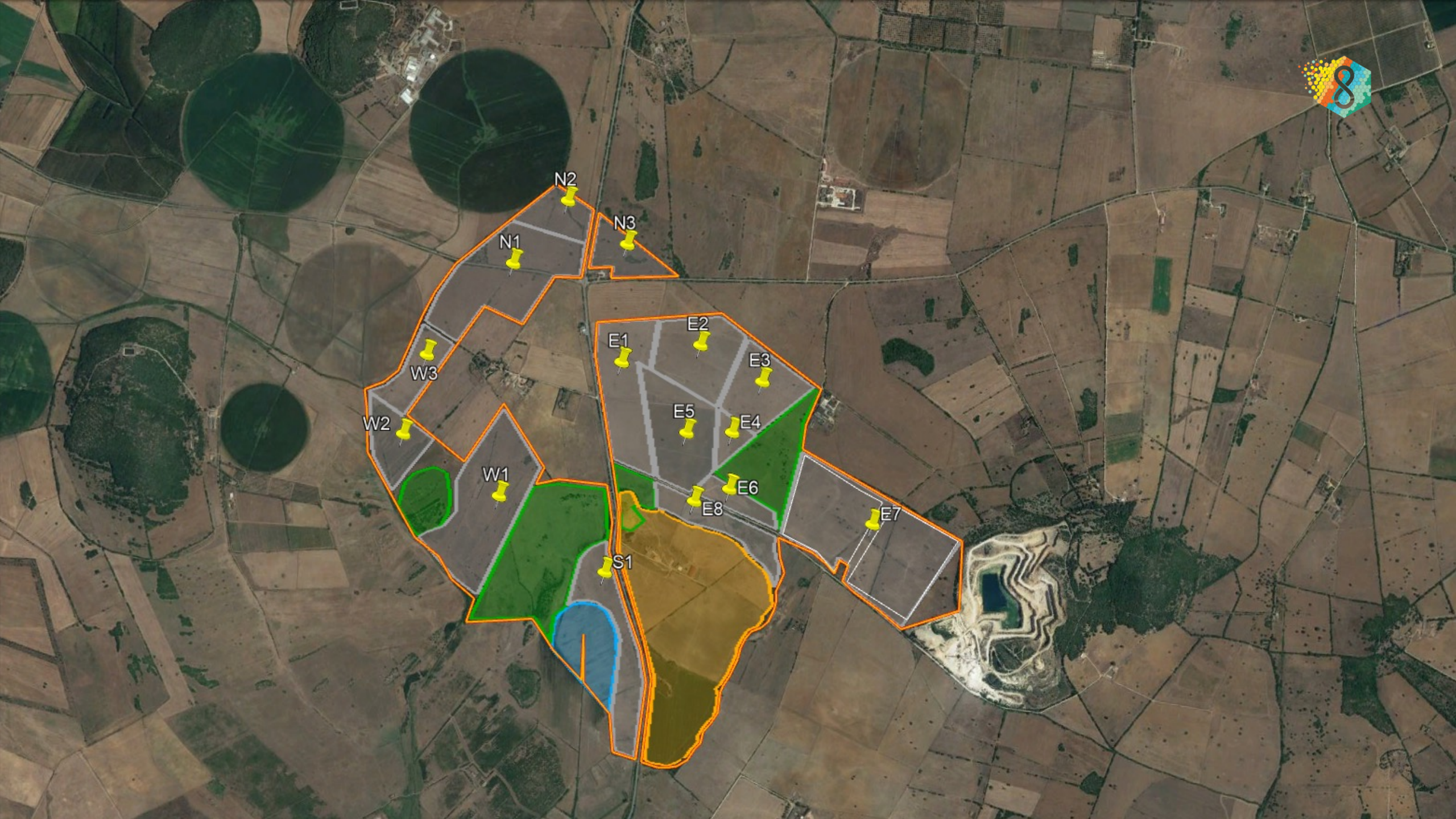
farming

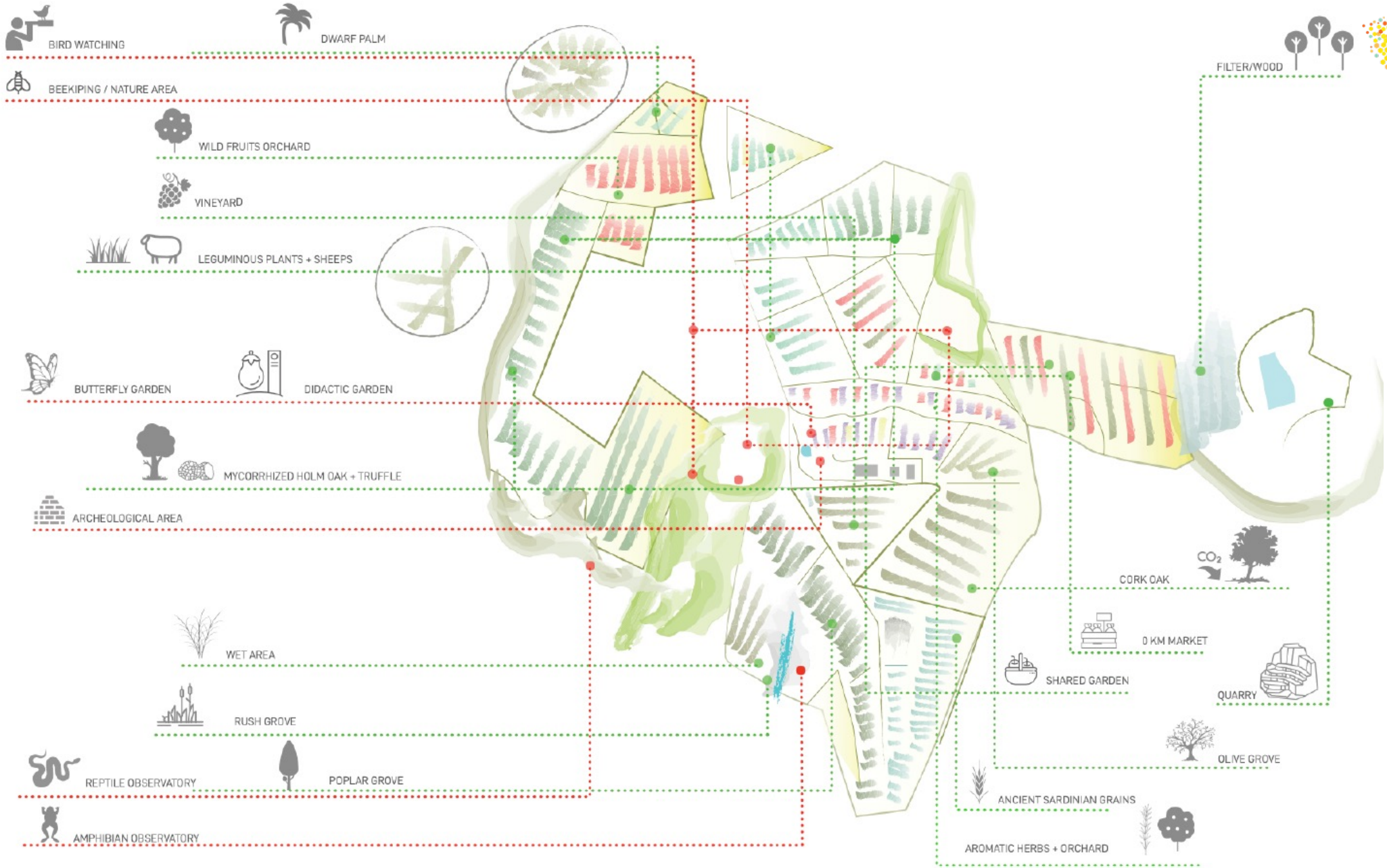
elevated photovoltaics

platforms between p.v
structure

mesh curtain /plant trellis

Community


N2
N3
N1
E1
E2
E3
W3
E5
E4
W2
W1
E6
E8
E7
S1


BIRD WATCHING
DWARF PALM
BEEKIPING / NATURE AREA
WILD FRUITS ORCHARD
VINEYARD
LEGUMINOUS PLANTS + SHEEPS
BUTTERFLY GARDEN
DIDACTIC GARDEN
MYCORRHIZED HOLM OAK + TRUFFLE
ARCHEOLOGICAL AREA
WET AREA
RUSH GROVE
REPTILE OBSERVATORY
POPLAR GROVE
AMPHIBIAN OBSERVATORY
FILTER/WOOD
CORK OAK
0 KM MARKET
SHARED GARDEN
QUARRY
OLIVE GROVE
ANCIENT SARDINIAN GRAINS
AROMATIC HERBS + ORCHARD

Project Pillars

Environmental services

Land restoration & re-naturalisation

Landscape protection & re-connection

Green energy generation
eco-compatible development

Sustainable agriculture & 0km sustainable food production

Social & community benefits

Conclusions 1/2

Total site surface c. 320 ha

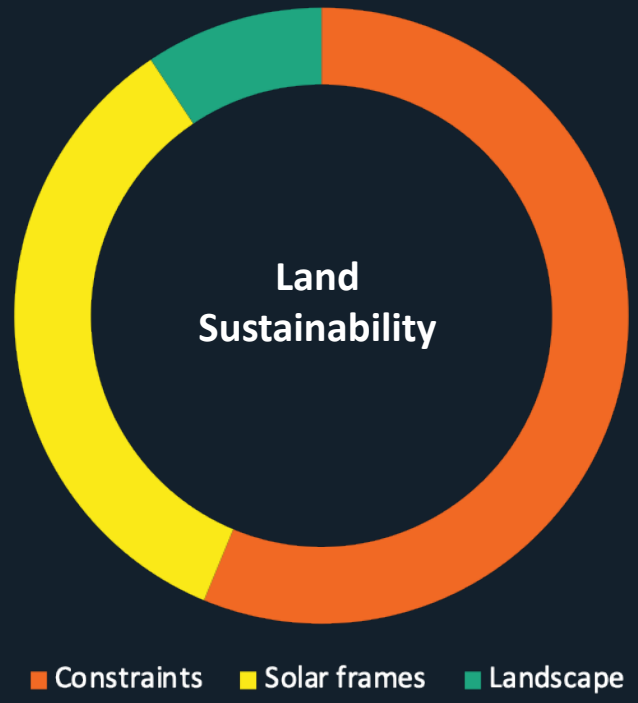
Constrained areas c. 110 ha (not suitable for solar energy purposes)

- Seminatural areas c. 40ha
  - **c. 10 ha** of existing local vegetation;
  - **c. 30 ha** of local trees to be planted to enhance ecosystems services
- High-risk archaeological areas **c. 60 ha**
- Landscape restrictions due to the presence of a river **c. 10ha**

Areas destinated for **APV solar frames c. 180 ha** (green energy generation)

- agriculture activities underneath the solar frames for sustainable food production **c. 80ha**
- 0km Market underneath overhead solar structures to involve community and social life **c. 10 ha**
- Crops for medical uses and land restoration (expected to recover agricultural potential) **c. 20ha**
- Ecological protection of residual vegetation, new trees plantation and enhancement of ecosystems services (habitat riparian) **c. 70 ha**

Areas destinated to **mitigation** (landscape restoration) along the site perimeter **c. 30 ha**



Conclusions 2/2

Ecological enhancement (re-forestation and habitat riparian), land regeneration and original landscape restoration **c. 100 ha**

- **c. 30 ha** within semi-natural constrained areas;
- **c. 30 ha** of vegetation around the site perimeter to restore landscape and mitigate visual impact;
- **c. 10 ha** to be located underneath the panel to intensify some natural residuals.
- **c. 20 ha** destinated to crops for medical uses and soil recovery
- **c. 10 ha** destinated to wetlands and new habitats

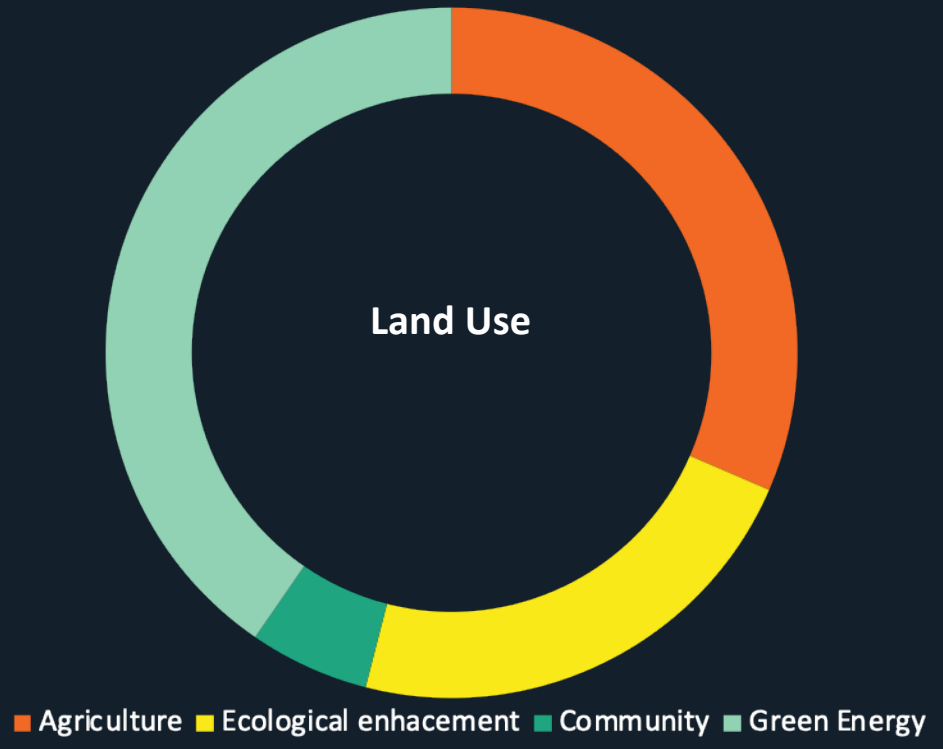
Suitable area for agriculture

(sustainable food production) **c. 140 ha**

- Underneath or in combination with solar frames **c. 80 ha**
- **c. 60 ha** for agricultural activities within archaeological constrained area;

Community and socio-economic benefits c. 15 ha

- **c. 10 ha** 0km Market
- **c. 5 ha** destinated for workshops, research (data analysis) and activities for schools (including building refurbishments)



THANK YOU

Deepak Sareen
deepak@regener8power.com