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Pela Terra: Theory of Change for Regenerative Agriculture

The problem

Humans need food. However, the ways we currently grow it make agriculture one of the most significant contributors to the interlinked crises currently facing our planet: a changing climate, biodiversity collapse, degrading soils, and freshwater shortages.

Agriculture accounts for **72% of all freshwater withdrawals globally**.[i] The global agrifood system creates **over a third of anthropogenic greenhouse gas emissions**[ii]; the expansion of crop and grazing lands is **the single biggest driver of terrestrial biodiversity loss** globally.[iii] And agriculture is **among the primary drivers of soil degradation**.[iv]

Even as it contributes to the crises facing our planet, **agriculture is also among the economic sectors most negatively affected** by them, thanks to its heavy reliance on ecosystem services (healthy soils, pollinators), high water consumption, and vulnerability to extreme weather events and abnormal temperatures.[v]

All of these factors pose increasing threats to harvests – putting both food security and the financial future of the sector at risk. In countries such as Portugal, where agriculture has traditionally been the economic backbone of rural areas, the effects of these changes on communities have also been severe.[vi]

Finally, as well as harming the planet, **current agricultural practices are not producing the food we need**. Although global production of calories has kept pace with population growth in recent decades, the FAO still estimates that 9.2 per cent of the world's population, or around 750 million people, suffered from chronic hunger in 2022.[vii] Many more consume low-quality diets leading to micronutrient deficiencies, obesity, and non-communicable diseases. Globally, unhealthy diets pose a greater risk to morbidity than unsafe sex, alcohol, and tobacco use combined.[viii]

The solution

Research has identified agricultural approaches – some new, some which have existed for generations – that enable farmers to **produce higher yields of more nutritious food** while addressing the challenges of soil degradation, climate change, biodiversity collapse and water shortages.

Taken together, these approaches are widely known as '**regenerative agriculture**'. The academic literature notes variations in the way regenerative agriculture is defined, with some focussing on practices and others on outcomes. Other terms ('climate-smart farming' and 'sustainable agriculture') are also used, albeit less frequently. [ix]

All definitions, however, share a common focus on **improving soil health**, both through keeping soil covered and through replacing synthetic inputs (fertilizers, herbicides, and pesticides) with organic alternatives; as well as protecting and nurturing biodiversity both above and below ground.

There is also a growing body of research linking healthy soil, nutritious food, and overall human health..[x, xi,xii]

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What we do

As Pela Terra's funds acquire farms in Portugal, we are implementing a set of regenerative agricultural practices, including the following:

- Keep the soil covered:
  - Plant cover crops between orchard rows, selecting those with particular benefits to soil health (for example, those which fix nitrogen in the soil).
  - 'Chop and drop' – leave pruning residues and other organic matter on the soil.
- Work to consistently reduce the volume of synthetic inputs we use (fertilizers, herbicides, pesticides and other treatments) and replace them with organic substitutes (compost, manure, etc.).
- Minimise soil disturbance (tilling).
- Where feasible, integrate livestock (in both productive and non-productive areas).
- Control invasive species, monitoring for their presence and removing them where we find them.
- Set aside significant areas on each property which we manage for biodiversity.
- Plant waterlines, hedgerows, and other non-productive areas with indigenous species, creating high-quality, joined-up habitats for flora and fauna – including native pollinators, who provide vital ecosystem services to the orchards.
- Apply precision irrigation techniques, which both avoid wasting water and ensure that orchards are only watered when they need to be and as much as they need to be.
- Transition from fossil fuels (diesel generators, power contracts with suppliers who use fossil fuels) to renewable energy (through installing our own generation capacity and/or energy purchase contracts which only include renewables) across all our operations.
- Work to reduce energy use (through, for example, making fewer passes with tractors and machinery, and only irrigating when needed).

What outcomes we expect to see as a result

We anticipate that these interventions will produce the following **intermediate outcomes**, across six categories of impact:

Soil health

The soil on our farms will become healthier than it was when we acquired them, and able to hold more water, sequester more carbon, and support higher yields.

Water

Water use efficiency will increase, resulting in less stress on the water table. Run-off will be less, and less polluted.

Climate

We will sequester large amounts of carbon in both orchards and soil. Through this sequestration and through shifting to renewable energy sources, we will achieve a positive GHG balance (that is, we will sequester more than we emit).

Biodiversity

We will create plentiful, well-connected habitats on our farms - including in areas set aside especially for this purpose. This will result in thriving biodiversity.

Human health

The food that we produce will be safer (with fewer traces of pesticides and other harmful chemicals) and more nutritious (thanks to improved soil health) than it was when we acquired the farms.

Society

Our activity will create jobs and economic opportunities in the rural areas of Portugal where we invest, helping rural communities to prosper.

We therefore expect to achieve the following **overall longer-term outcomes**:

1. **Environment**: Pela Terra farms produce safe, nutritious food at scale while sequestering carbon, conserving water, and protecting and nurturing biodiversity.
2. **Business**: Pela Terra farms and yields are resilient to extreme weather events; returns rise as input costs fall and income streams are diversified; land values rise.
3. **Society**: Rural communities in areas where Pela Terra invests prosper.

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How we will measure these outcomes

We will measure and track the following indicators for each category of impact. It may not be practical to measure every indicator every year; some may be measured on two- or three-year cycles.

Land value

Value of our land and biological assets (e.g. orchards), €

Yields

Yields of produce produced annually, by farm and by hectare, tonnes.

Soil health

Level of Soil Organic Matter, %.

Physical properties of the soil (bulk density, infiltration, soil structure and macropores, soil depth, and water holding capacity).

Chemical properties of the soil (electrical conductivity, reactive carbon, soil nitrate, soil pH, and extractable phosphorus and potassium).

Soil microbiology (earthworms, microbial biomass C and N, particulate organic matter, potentially mineralizable N, soil enzymes, soil respiration, and total organic carbon).

Water use

Total water use by hectare, by crop type, and by tonne of yield, m3.

Level of water stress.

Human health

Nutritional value of our produce.

Level of contamination of produce with chemical residues.

Climate

Scope 1, 2 and 3 emissions, tonnes.

Carbon dioxide sequestered, tonnes.

Energy purchased, from renewable and non-renewable sources, kWh.

Renewable energy generated, kWh.

tCO2e avoided, tonnes.

Biodiversity

Area set aside and managed for biodiversity, ha, % of total land owned / controlled.

Flora species observed (including which are RELAPE – Rare, Endemic, Local, At risk, Protected or Endangered).

Fauna observed (including which are of high conservation interest).

An assessment of habitat health / condition, to be delivered by an external provider.

Society

Total amount invested in areas of low population density, €.

Number and type of jobs created, directly and indirectly.

Total spent with suppliers in areas of low population density, €.

Total investment in community and other social programmes, €.

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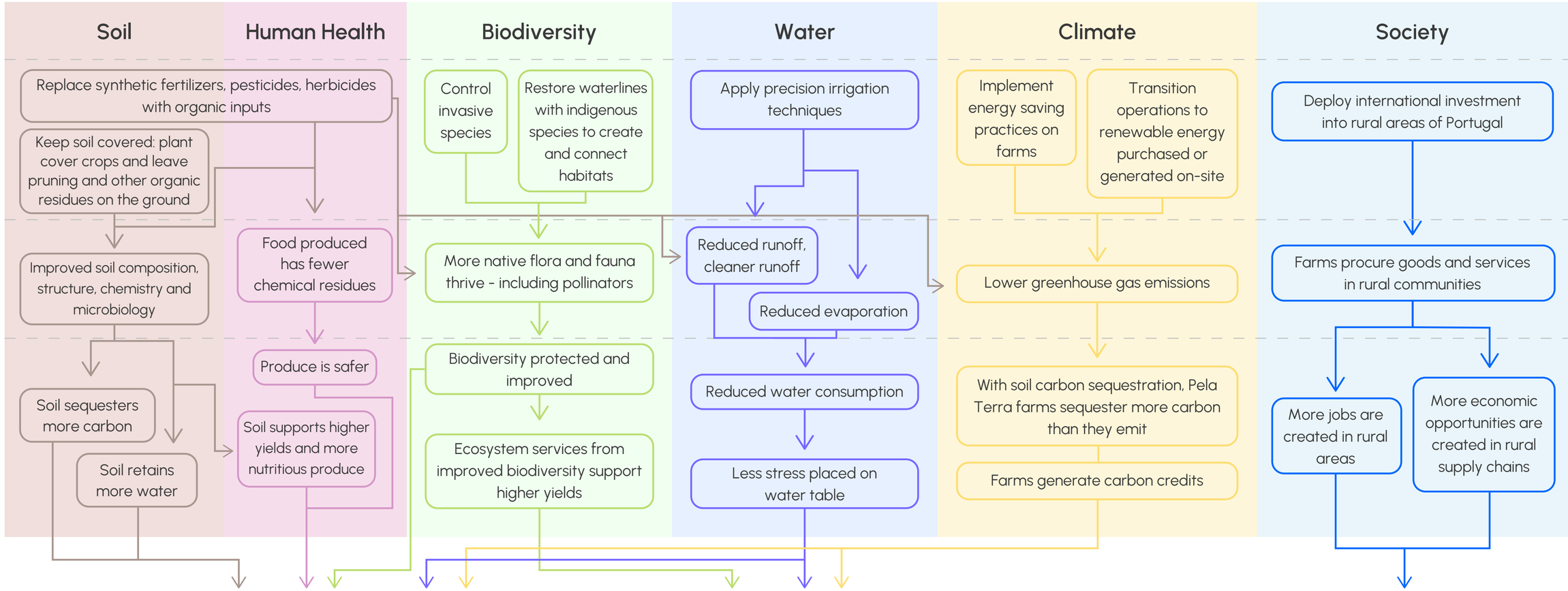
The problem

Due to over-reliance on synthetic fertilisers, herbicides and pesticides and wasteful irrigation practices, agriculture is among the biggest contributors to degraded soils, climate change, biodiversity collapse and water scarcity globally. It's also among the sectors most negatively affected by these phenomena, with yields and financial stability increasingly at risk, resulting in damage to rural communities.



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