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Agritopia
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Crop Cultivation

How We Will Grow Food

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In recent decades, agricultural practices have undergone substantial changes, resulting in significant impacts on the environment, biodiversity, and food production. Our common project Agritopia, situated in Zurich North, delves into reshaping modern farming and envisioning practices that balance productivity with ecological health. As we look at the challenges facing agriculture today, a vision emerges for a more sustainable and regenerative future.

Crop Cultivation Today



Within a hundred years, agriculture has undergone a transformation from manual work to a fully mechanised practice. In addition to a deterioration in soil quality due to compression, this has also encouraged the establishment of monocultures in particular.

Today, the farmed land on our site presents itself as a tidy, flat and well-maintained landscape of large fields with clear borders towards the city, infrastructure and the forest. This landscape is the result of a series of developments in farming infrastructure and techniques and also reflects how we as a society relate to the production of food stuff.





















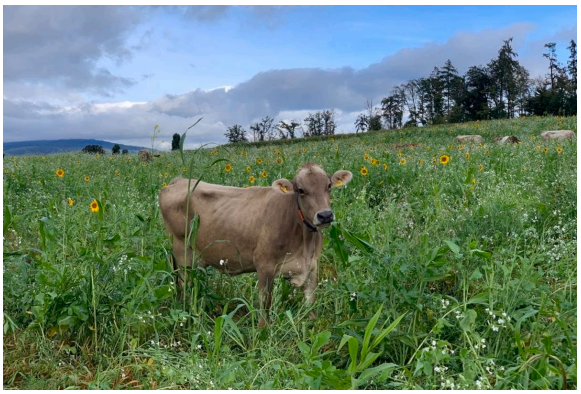

tractor









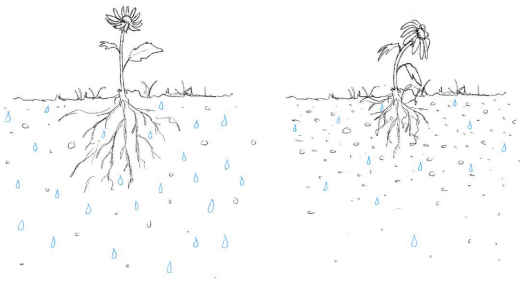


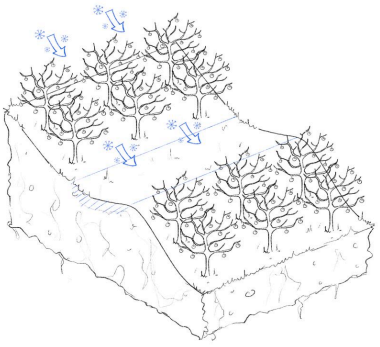

A Historical Shift

Industrialisation had a huge impact also in farming, it totally changed the ways how the land was cultivated. Within a hundred years, crop cultivation has shifted from manual labor to a totally mechanised practice.

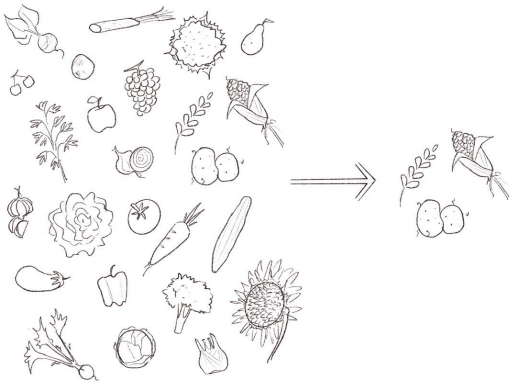
As a result, the productivity skyrocketed and one farmer could now cultivate a larger piece of land, leading to a receding farmer population. This trend increased reliance on tractors, and resulted in a shift towards fewer but larger farms.

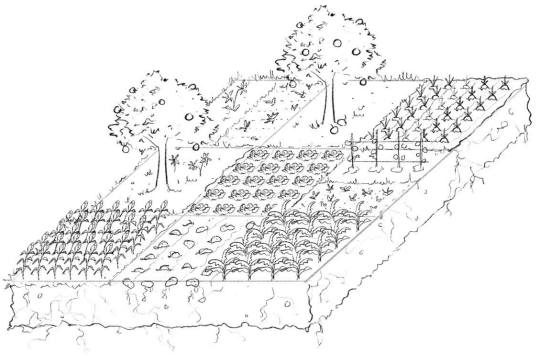
The utilisation of big tractors and heavy machinery leads to soil compaction, affecting the health of the soil.

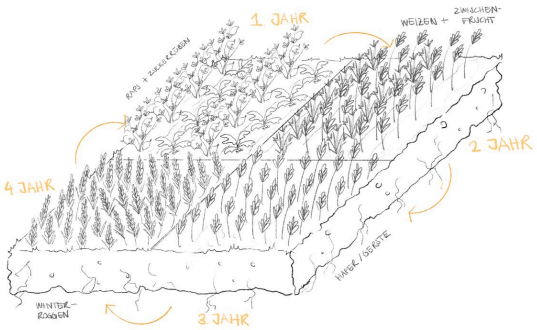


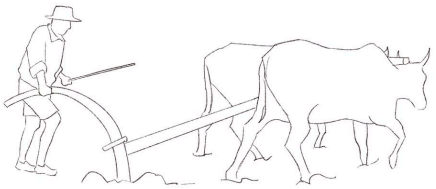


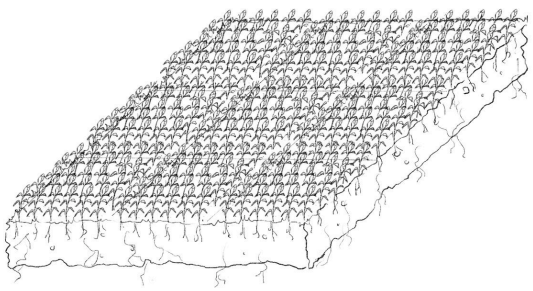
…soil compaction.

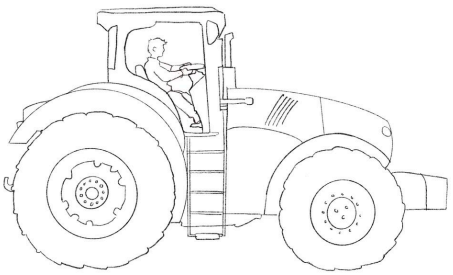




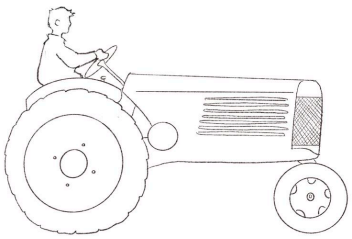


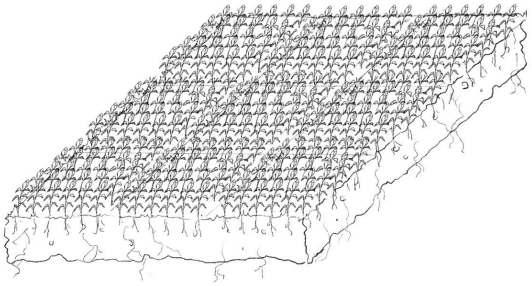




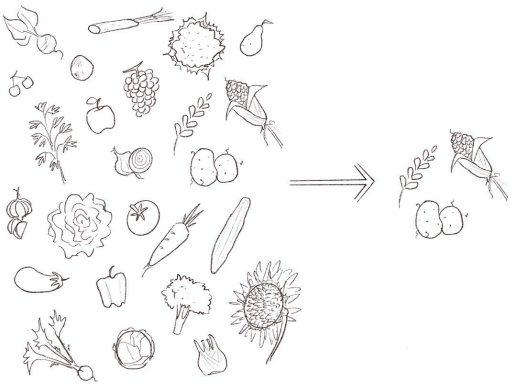


The use of tractors leads to…

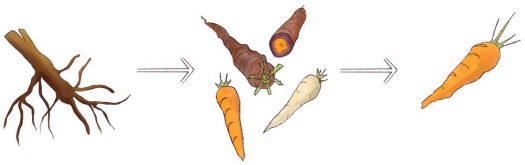




The use of tractors favours monocultures…



crop diversity



…which ultimately leads to the disappearance of certain cultures.

Ever-increasing sizes of tractors brought a demand for bigger fields, resulting in monocultural practices, since certain crops could be cultivated more quickly with the right machine.

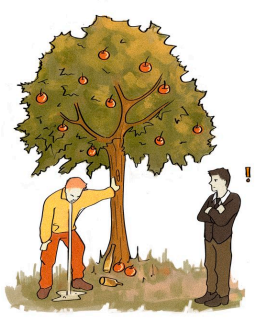
Industrial farming also led to a reduction in crop variety, a need for increased pesticide use and a decline in overall biodiversity. This poses a challenge to agricultural diversity, impacting the ecological balance and raises concerns about the ability to maintain sustainable agricultural ecosystems.

The extensive use of chemical pesticides and fertilisers has become a common practice in agriculture, contributing to environmental degradation, soil pollution, and potential threats to human health.

The reduction in orchards in the 1960s in Switzerland has impacted the diversity and visual richness of the landscape.



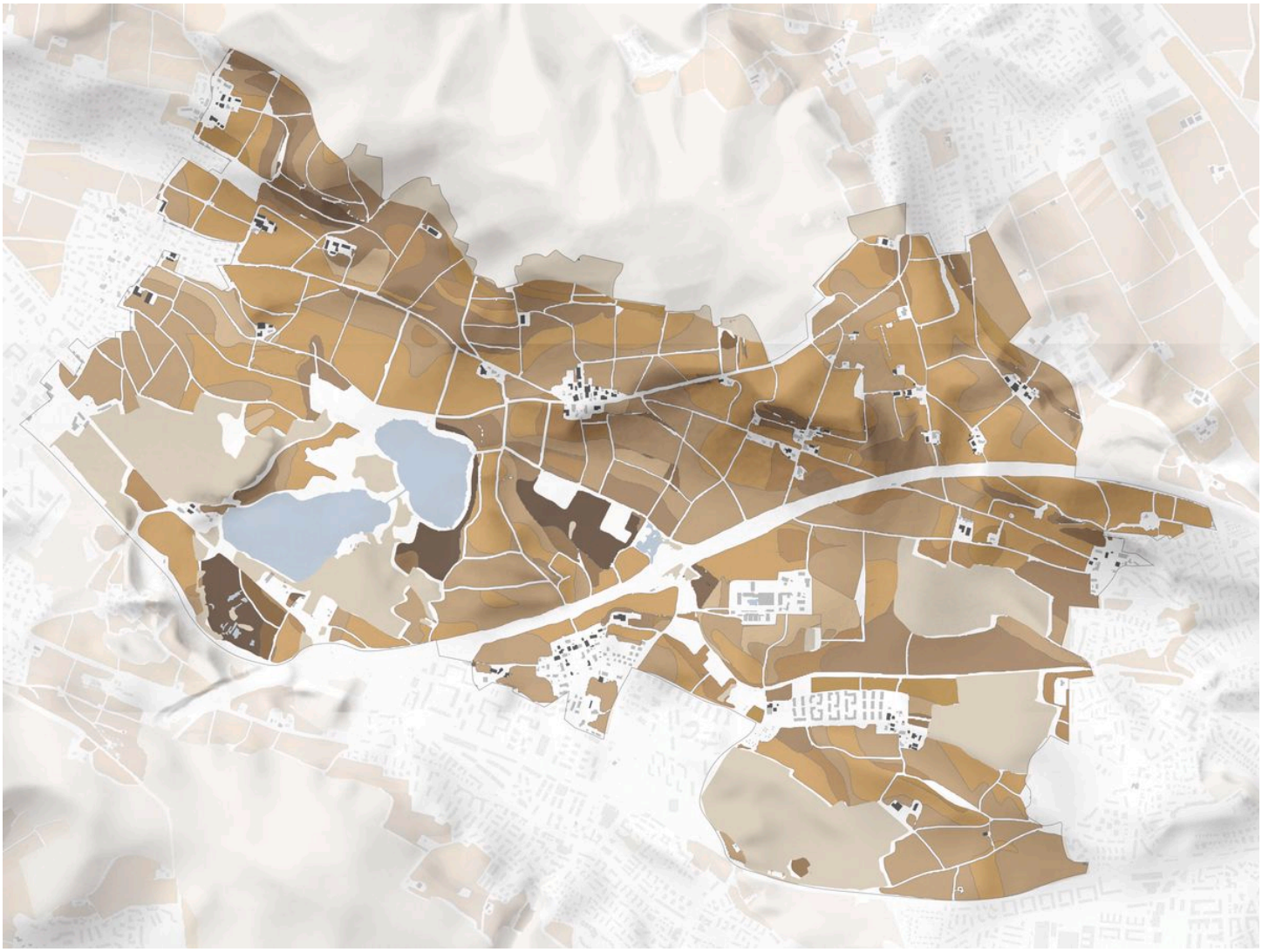
Chemical pesticides and fertilisers have led to environmental degradation…





…and cutting down orchards has impacted biodiversity and the landscape.

Agricultural Suitability on the Site



AGRICULTURAL SUITABILITY

Soil is divided into suitability categories ranging from unrestricted crop rotation to scattered land. The map incorporates data such as soil nutrition values, nitrate concentration, sun exposure, erosion, water storage capacity and many more. On the site, soil is mostly fertile, crops only experience worse growth conditions on slopes and on marshland.

- Unrestricted crop rotation 1st quality
- Unrestricted crop rotation 2nd quality
- Cereal-emphasized crop rotation 1st quality
- Cereal-emphasized crop rotation 2nd quality
- Fodder-centric crop rotation
- Fodder preferred, Arable restricted
- Good meadow and pasture
- Meadowland
- Extensive meadow and pasture
- Scattered land
- Water
- Forest
- Buildings
- Agriculture buildings

What Is Currently Being Grown?



CULTIVATED CROPS

An excess of grazing land and fodder production for livestock is clearly visible and gives rise to concerns about balanced land use that fully exploits the potential of the soil.

- Vines (1 %)
- Fruits (2 %)
- Potatoes (5 %)
- Vegetables (9 %)
- Oil plants (13 %)
- Corn (20 %)
- Grains (50 %)
- Others
- Meadows
- Organic
- Water
- Forest
- Buildings
- Agricultural buildings
- Fruit trees logged since 1946

Soil-Crop Mismatch



SOIL-CROP MISMATCH

Considering existing soil qualities, 62 % of the crops are grown at the wrong locations. In most cases, these are meadows that are cultivated on soils where more nutrient-rich crops such as vegetables could be grown.

- Vines (1 %)
- Fruits (2 %)
- Potatoes (5 %)
- Vegetables (9 %)
- Oil Plants (13 %)
- Corn (20 %)
- Grains (50 %)
- Others
- Soil-crop mismatch (62 %)
- Organic
- Water
- Forest
- Buildings
- Agriculture
- Fruit trees logged since 1946

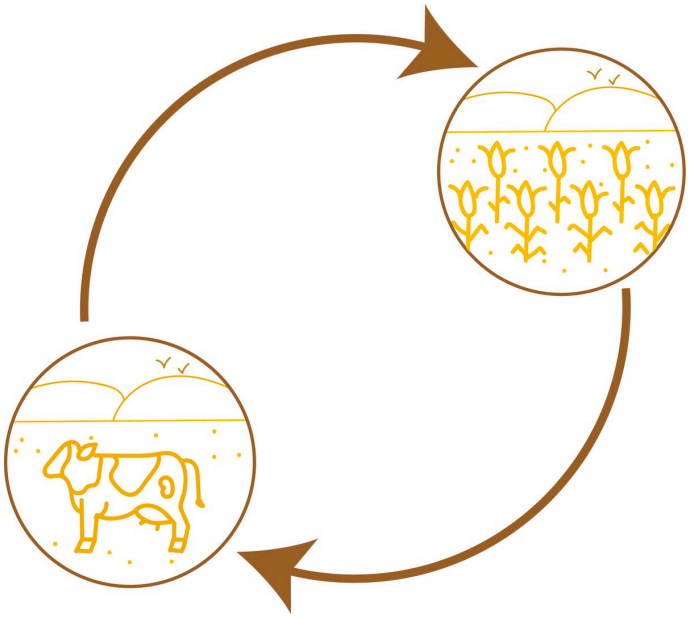
Croptopia: A Manifesto



Agriculture in Agritopia is reoriented to prioritise the production of diverse and nutritious food that benefits human health. By including pastures in crop rotation, which means that the land is not exclusively used for animals or fodder production, we increase food production for humans.

We prose a vision based on six main points for a landscape in 50 years which tackles current issues of farming, integrating soil suitability, the consume, biodiversity and a new attitude towards agriculture.

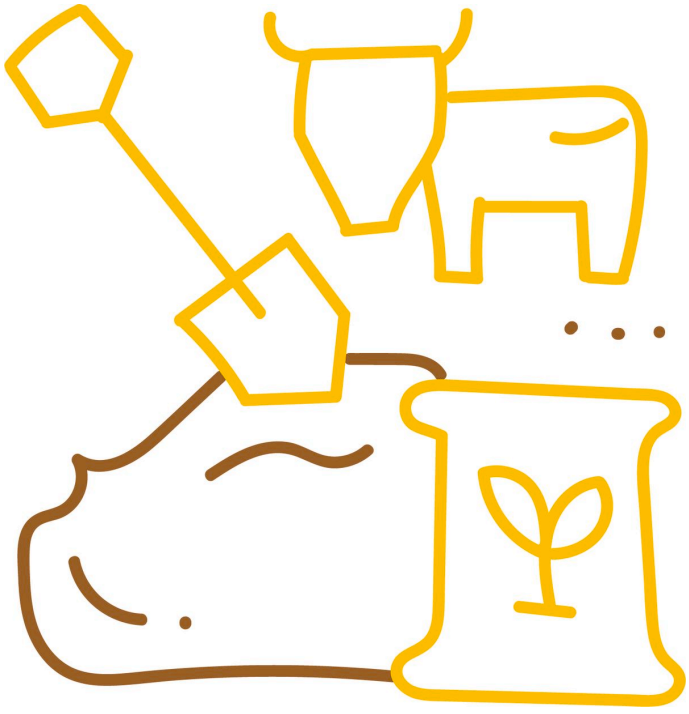
1) IN AGRITOPIA, THERE WILL BE MORE FOOD PRODUCTION FOR HUMANS.



Integration of pastures

2) IN AGRITOPIA, THE SOIL IS HEALTHY AND RESILIENT.

Sustainable soil management practices, for example organic fertilisers like animal and green manure, will be prioritized to ensure the ongoing health and resilience of our agricultural land.



Usage of manure.

3) IN AGRITOPIA, THE SITE DETERMINES WHAT TO GROW WHERE, NOT THE MARKET.

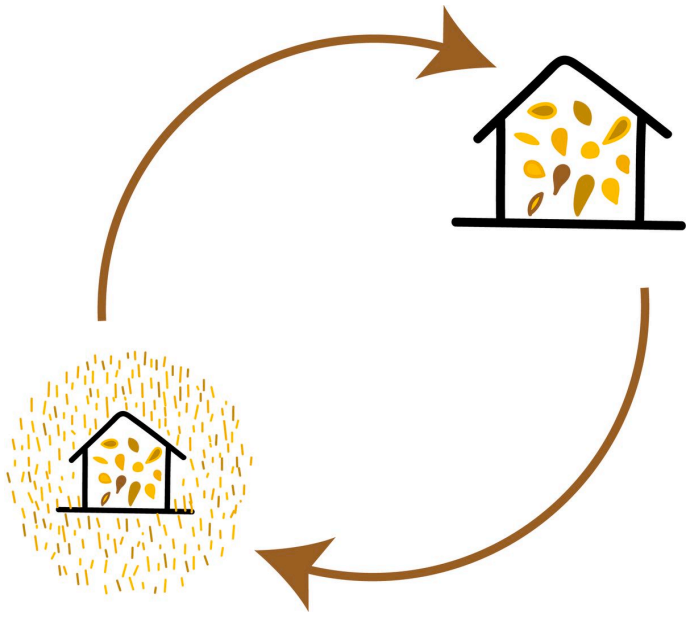
Using site-specific farming techniques and Crop varieties is integral to our vision, acknowledging and leveraging the unique characteristics and suitability of each parcel of land for optimal productivity.



Site specificity.

4) IN AGRITOPIA, THE CROPS ARE DIVERSE AND SEASONAL.

Transitioning to a farming model that emphasizes diverse, local and seasonal crops can promote both environmental sustainability and consumer well-being.



Local crop cycle.

5) IN AGRITOPIA, AGRICULTURE IS A SOCIAL ACTIVITY.

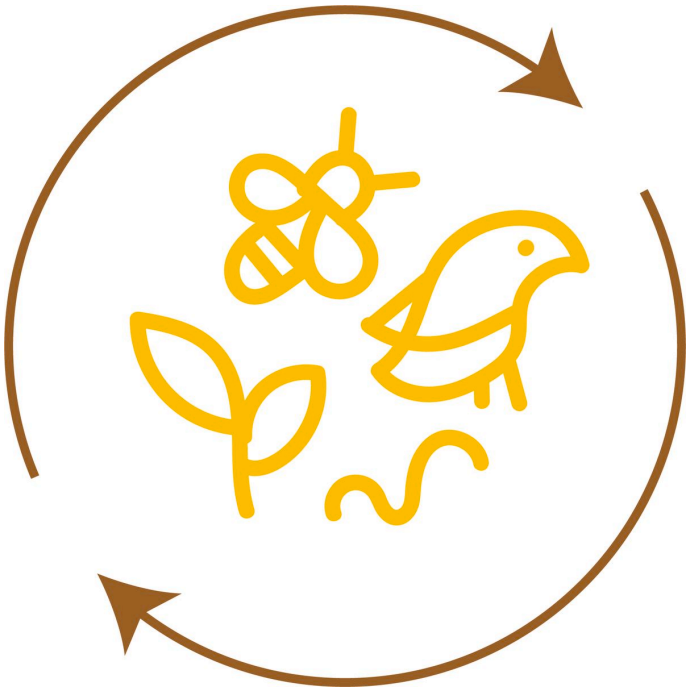
We aspire to reshape the perception of agriculture, positioning it as a social activity that promotes community engagement and instills a deep appreciation for the intricacies of the farming process.



Farming as social activity.

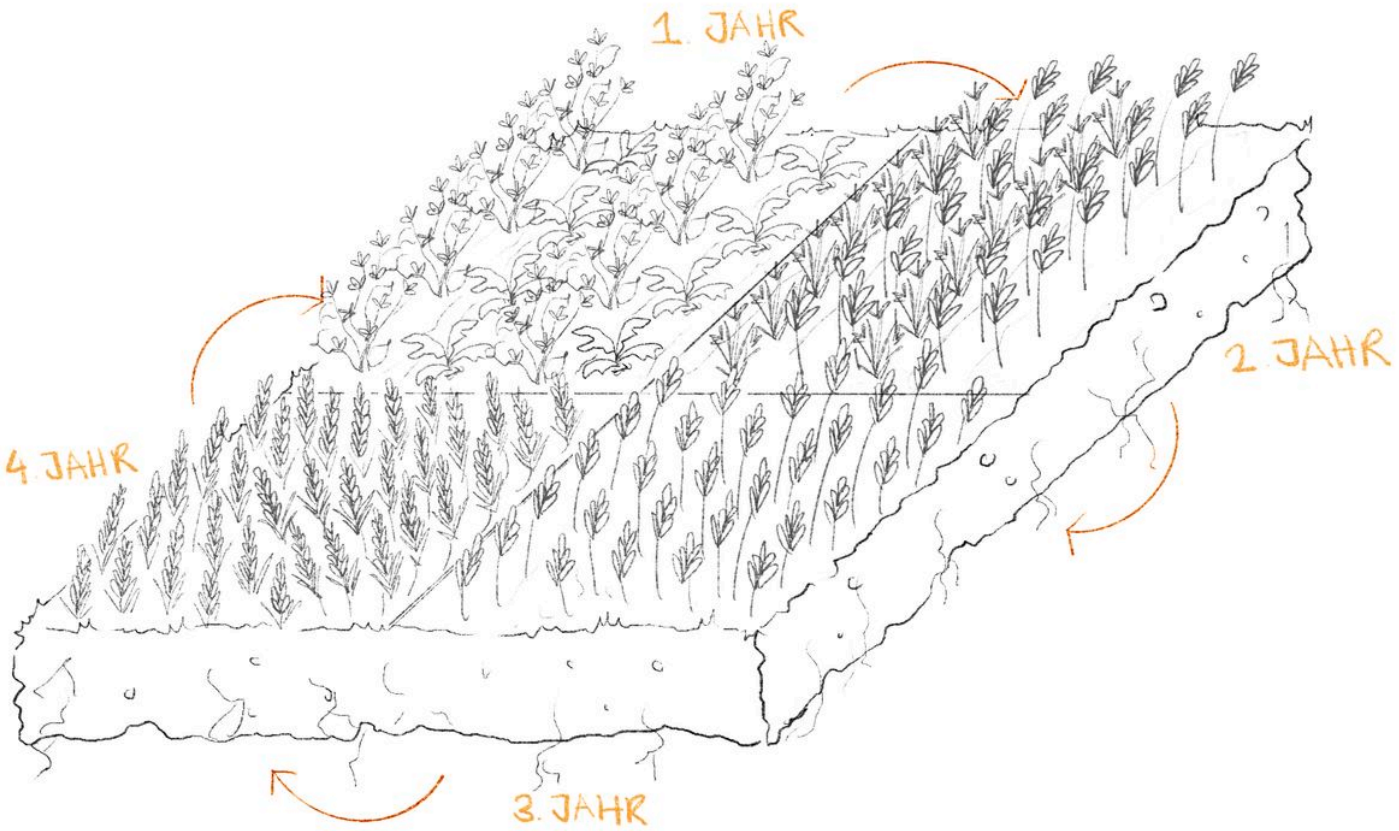
6) IN AGRITOPIA, AGRICULTURE IS PART OF A BIODIVERSE LANDSCAPE.

Enhancing biodiversity entails incorporating diverse crop and plant varieties, reintroducing trees, and establishing natural habitats for animals and insects.



biodiversity

Learning from Crop Rotation

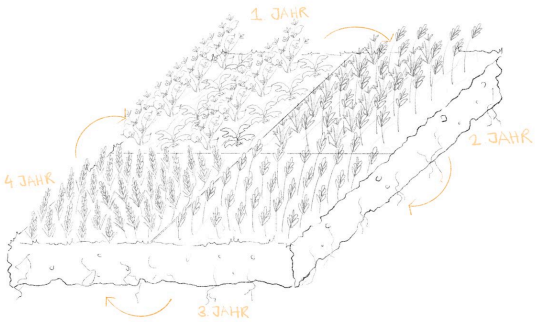


In order to implement this vision for Agritopia, different agricultural concepts and practices are closer examined. The basis is formed by crop rotation, which, over many centuries, has proven to be a sustainable approach to farming.

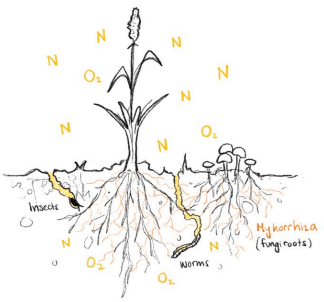
Crop rotation involves growing different crops annually for healthier soil and better pest management. Managing nutrient needs and regeneration involves leaving one field fallow each year to recuperate and build up again.

Nitrogen is a key nutrient element for plants and thus forms the basis for a sustainable crop rotation. The plant family of legumes play a crucial role in this cycle because of their ability to absorb nitrogen from the air and store it in their roots. Passing it further to the soil enables the next plantation to grow healthy.

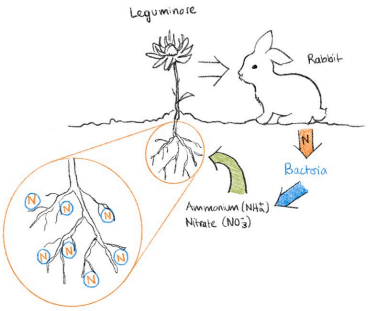
Manure is the best fertiliser for plants. It stores basically all nutrients a crop needs in their own life cycle. Furthermore, produced locally it is a closed system, and therefore resilient because no fertilisers need to be added.



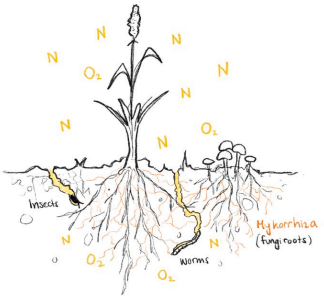
Crop rotation.



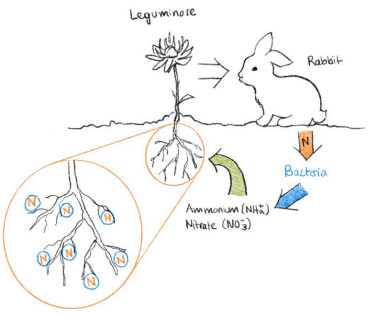
Nitrogen Cycle



Manure Cycle



Nitrogen cycle.



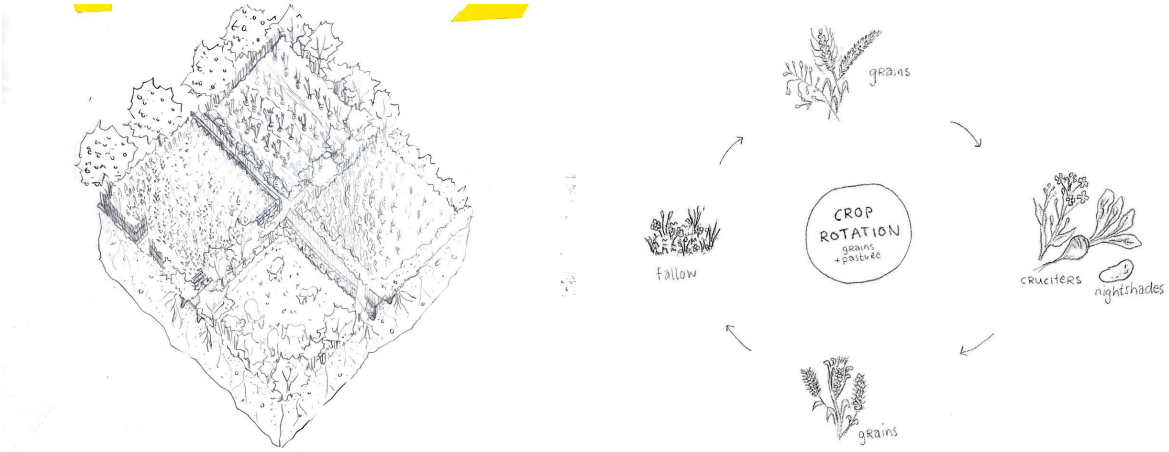
Manure cycle.

Typologies

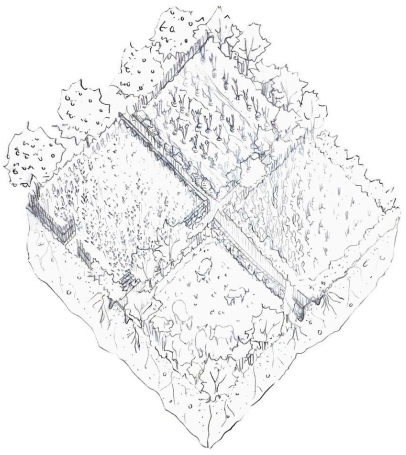
CROP ROTATION WITH BOCAGE

The first agricultural typology we implement in our project is the crop rotation with bocage, which forms a natural boundary with hedges, trees or stones for the fields. This cultivation method holds even more ecological benefits, ranging from insects or microclimates.

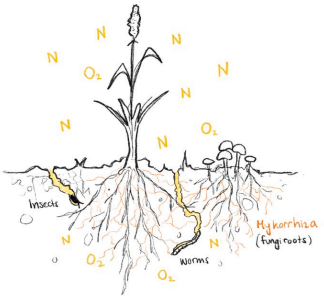
Showcasing one cycle, grains like wheat and oat are annually alternated by crucifers, like cabbage, turnips, rapeseed etc. and nightshades, like potatoes for example. Followed by leaving one field fallow each year for the soil to recuperate and build up again, which also creates a pasture for cattle, who can fertilise the soil with their manure.

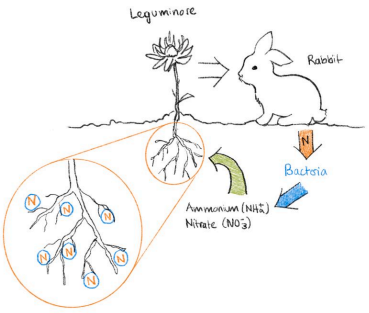


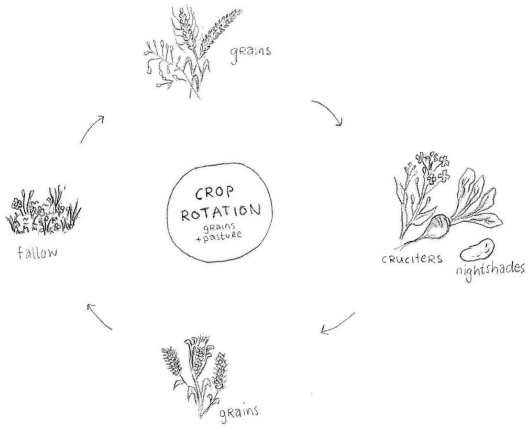
Crop Rotation



Crop rotation with bocage.







Crop rotation with grains.



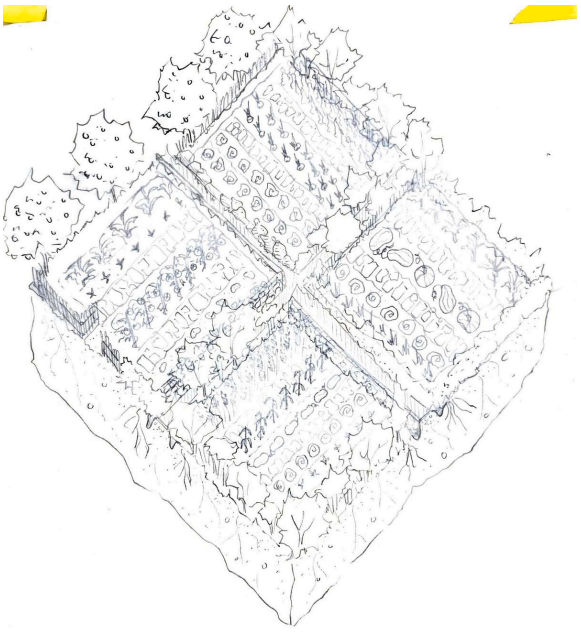
Crop rotation timeline.

INTERCROPPING WITH BOCAGE

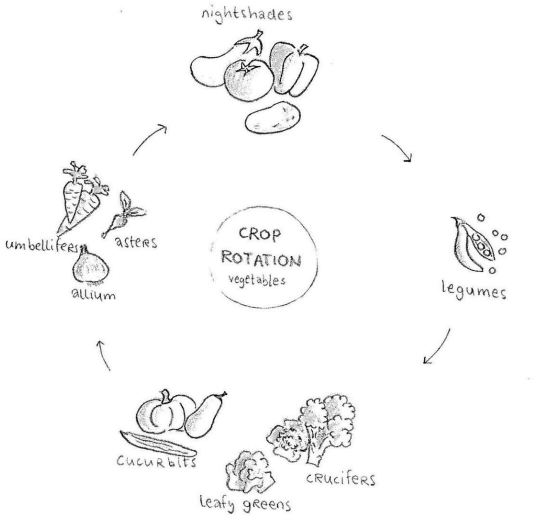
As an alternative to crop rotation, intercropping or mixed crop rotations are implemented for vegetable farming. This type of cultivation tries to have a diverse stock of crops growing right next to each other. On one patch, many vegetables from different plant families alternate after one another. Thus, a more balanced ecosystem is being created that has enough beneficial organisms to buffer pests. Compared to the crop rotation system, mixed crop rotation is very labor intensive and becomes very demanding above a certain field size. In Agritopia, mixed crop rotation as well as crop rotation are embedded in a bocage typology.

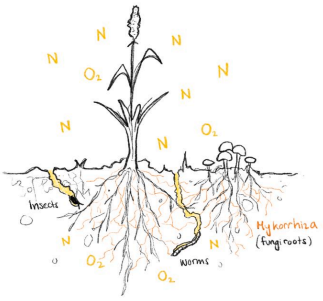
This crop rotation cycle rotates 4 plant families each year. After one of the nightshade vegetable, for example potatoes are harvested, the soil will be used to grow legumes. Since potatoes use a lot of nitrogen, legumes, a type of green manure like peas can regenerate the soil by building up nitrogen again. After, a crucifer like cauliflower follows, and to close this circle, umbellifers, for example carrots, will be planted.

Again in a timeline example, you can see the crops growing in “guilds” or in “company” of other sorts of plants: for example, a row of potatoes will be planted next to a row of mint and to another row of kale.

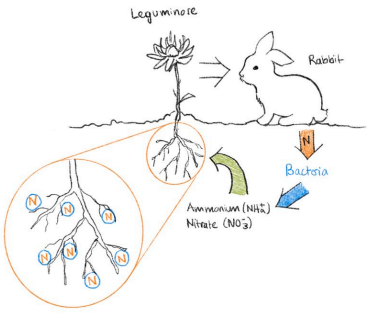


Intercropping

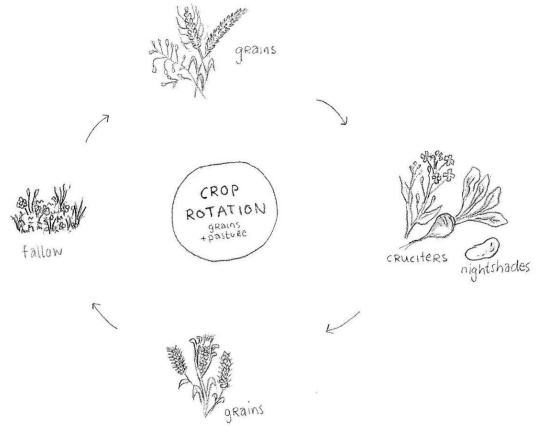




Nitrogen Cycle



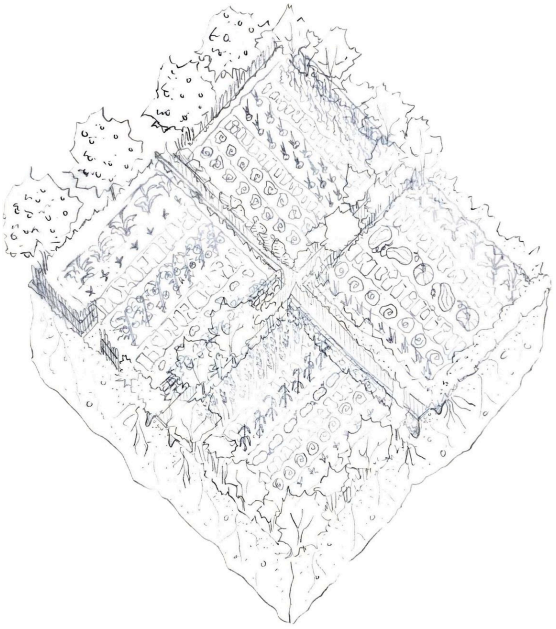
Manure cycle



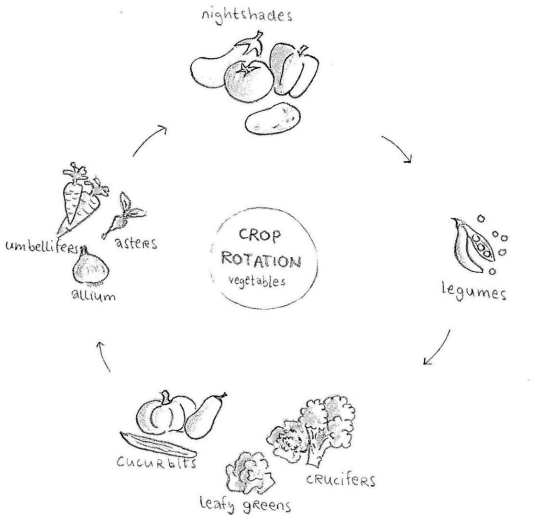
Crop Rotation with grains and pastures



Timeline



Intercropping with bocage.



Crop rotation with vegetables.

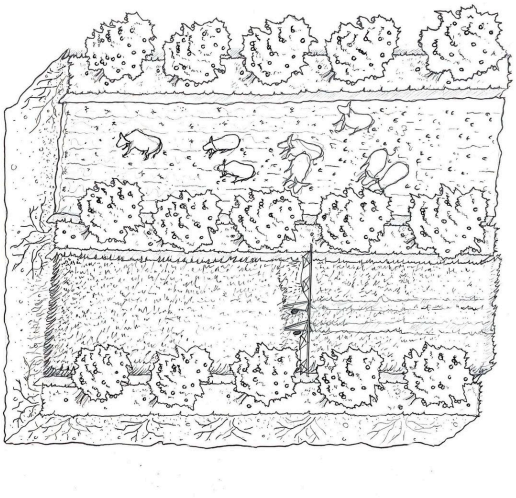


Crop rotation timeline.

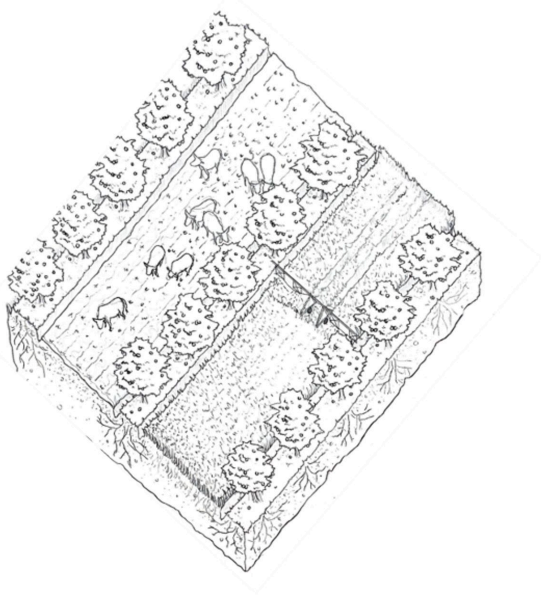
AGROFORESTRY

Agroforestry is a type of cultivation, where on long strips of land, crop rotation for grains is practiced between rows of trees. Soil benefits from healthy interactions between roots of trees, crops and organic manure.

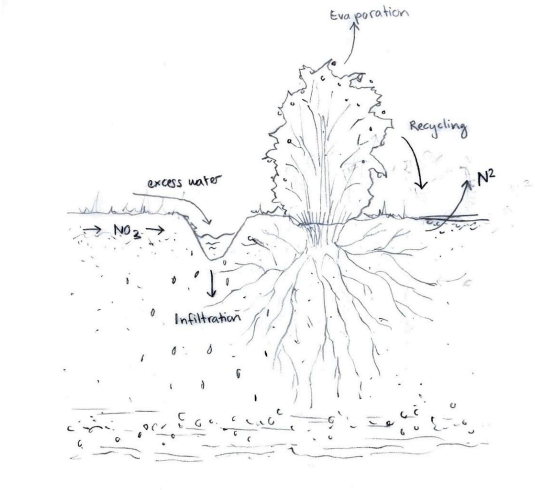
This form of cultivation is site-specific, since it is dependent on slope, sun incidence angle and water drainage (implemented in form of keylines by the Hydrotopia group [https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS23-Hydrotopia-1]). It is located on slopes as an alternative strategy to crop rotation.



Agroforestry



Agroforestry.

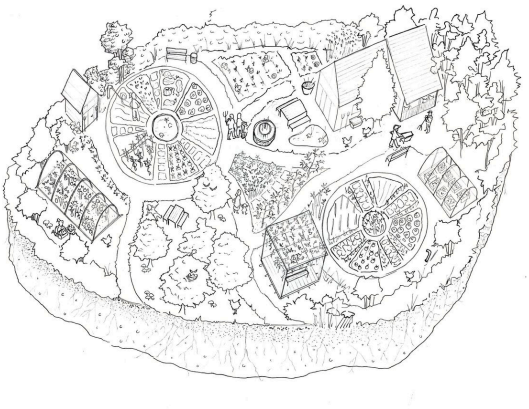


Water drainage.

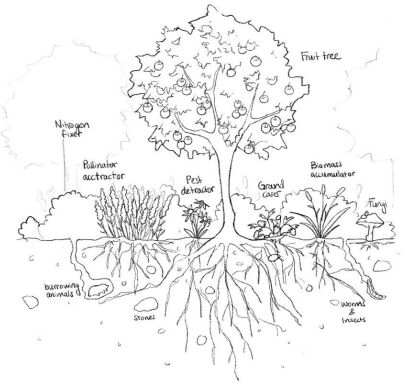
PERMACULTURE

Permaculture is a form of agriculture where the concept of plant guilds and consortia are prevalent. There, soil, topography, weather, exposure to sun and wind are weighed carefully against each other, tapping deep into the very site potentials.

In a plant guild, the natural capabilities of plants enhance each other and ideally form an exceptional resilience to outside influence. Being much more labour-intensive, it cannot be implemented at a large scale. Permaculture is also used on our site for the production of Agritopia's seedlings.



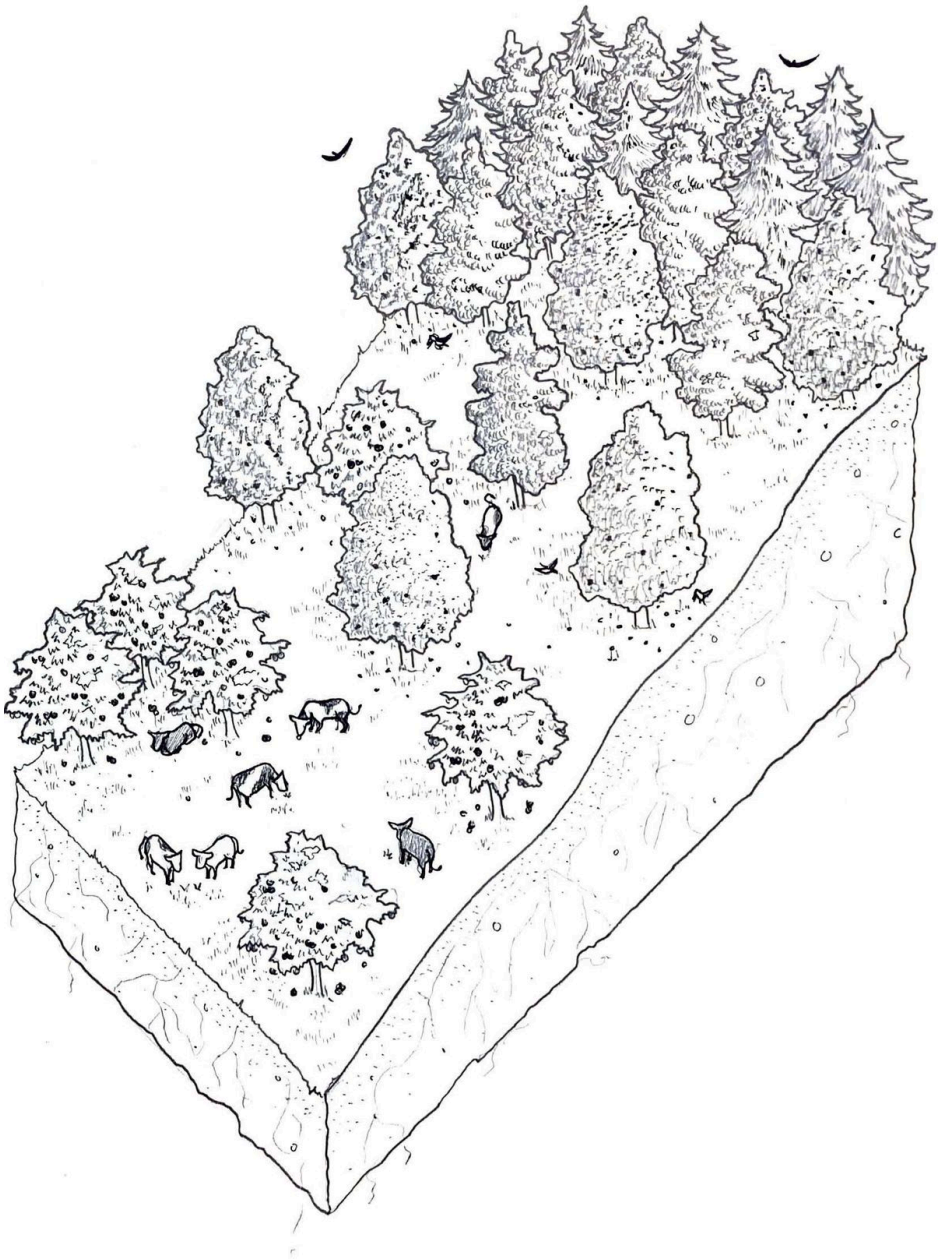
Permaculture.



Plant guild.

ORCHARDS

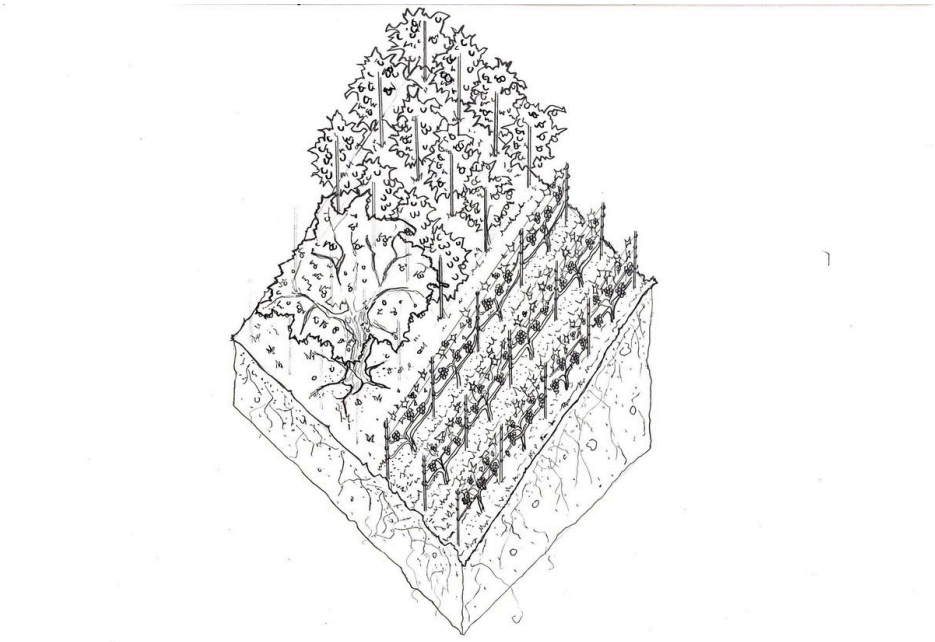
In Agritopia, orchards integrate pastures beneath trees for cattle to roam. Orchards, in contrast to plain fields, hold biodiversity benefits as for example bird life.



Orchards.

VINEYARDS

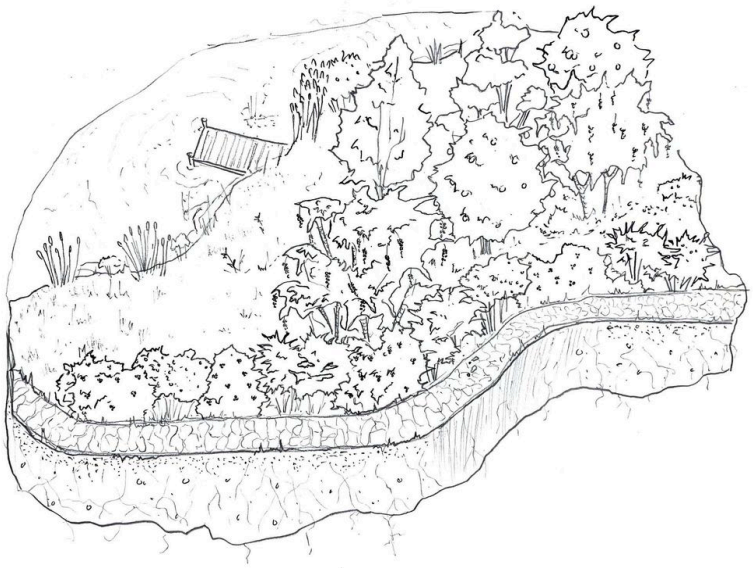
Vineyards are a type of agriculture, which is heavily dependent on sun, slope, climate and soil.



Vienyards

BERRIES

Focusing on berries like blueberries, cranberries and sloes, they are very site specific, needing a marshy terrain and low ph-values to grow. They, like orchards, also promote cohabitation of animals like birds, insects or amphibians and can act as a buffer zone between protected areas and farmland.



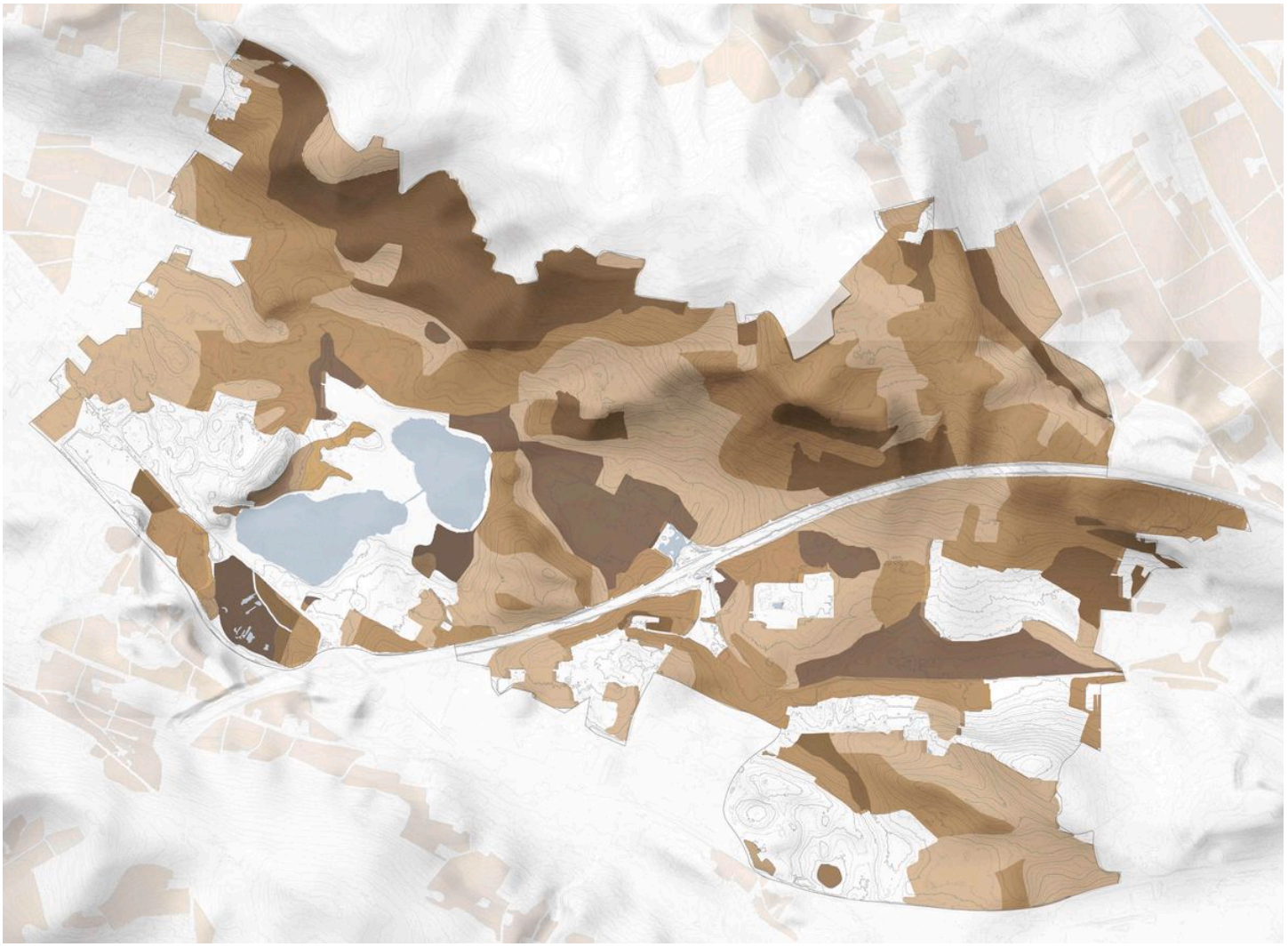
Berries.

Creating a Cultivation Scheme



Based on the Agricultural Suitability Map, cultivation will be divided in four categories: unrestricted crop rotation, cereal-emphasized crop rotation, wine slopes and pastures and marshland.

In general, the soils on our site are heavy and clayey, which is good for cultivating crops such as corn, legumes or potatoes. On the other hand, umbellifers like carrots or parsnips have a rather hard time growing.



AGRICULTURAL SUITABILITY

Looking at a map for agricultural suitability, the soil can be divided in four categories: unrestricted crop rotation, cereal-emphasized crop rotation, wine slopes and pastures and marshland.

- Unrestricted crop rotation
- Cereal-emphasized crop rotation
- Wine slopes and pastures
- Marshland
- Water

UNRESTRICTED CROP ROTATION

Unrestricted crop rotation means that most crops can be cultivated on this soil. They are best used for growing vegetables from plant families, like nightshades, cucurbit or leafy greens, that have a demand for a humus- and nutrient rich soil.

CEREAL-EMPHASIZED CROP ROTATION

Cereal-emphasized crop rotation has slightly less nutrition values and is thus more suitable for grains like wheat or barley.

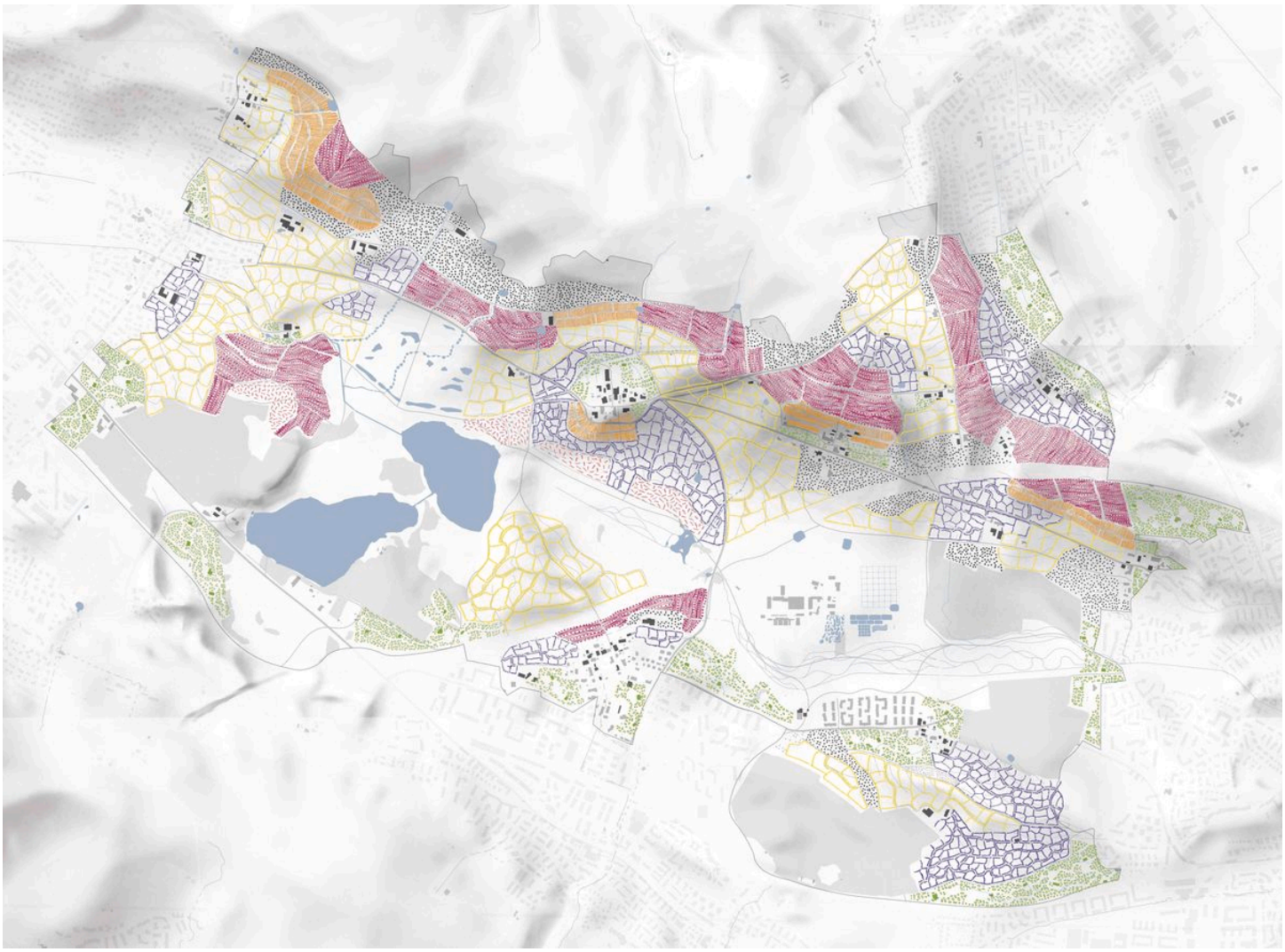
WINE SLOPES AND PASTURES

The next soil lies on slopes and therefore, is more prone to eluviation, faster winds, droughts. Holding few nutrients, it is best suitable for plants who need this kind of soil like vines or fruit trees.

MARSHLANDS

The last soil is in many things the opposite of the slope soil. Holding a lot of water and having low ph-numbers means that also very specific plants can grow here, like blueberries or mulberries.

Implementations in Agritopia



CULTIVATION SCHEME

- Berries (2 %)
- Vineyards (4 %)
- Rotational grazing slopes (13 %)
- Bocage with intercropping (15 %)
- Permaculture gardens (14 %)
- Paludiculture (18 %)
- Bocage with rotational grazing (25 %)
- Farms
- Buildings
- Forest
- Water

BERRIES

Berries find their spots near the lakes and wetlands, where soil is still marshy enough. They also act as a boundary between protected areas and more intensive forms of agriculture.

VINEYARDS

Vineyards are located on the south-facing slopes of our site, needing this very specific type of soil and increased exposure to sun. Considering climate change, we rethink crop choices, introducing also olive trees and citrus fruits to our site.

SILVA PASTURE ORCHARDS

These orchard fields, that allow cattle to graze under, are located on the steep hills, near the forest edge.

ROTATIONAL GRAZING SLOPES

This type of Agroforestry is located on slopes and hilltops, where there is suitable soil for grain cultivation and grazing land.

BOCAGE WITH INTERCROPPING

Intercropping, despite being labor-intensive, is strategically implemented near hamlets on high-quality, unrestricted soil.

PERMACULTURE GARDENS

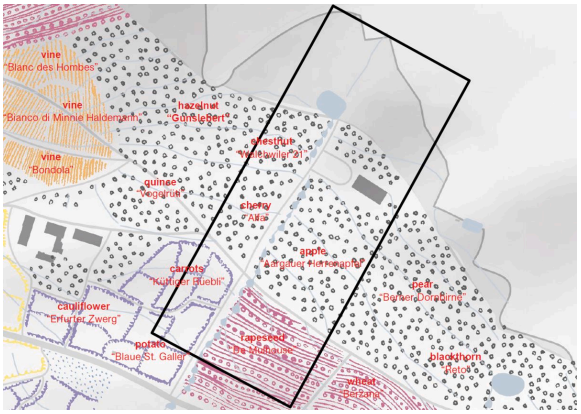
Permaculture, a work-intensive practice in agriculture, is located near city borders and hamlets.

BOCAGE WITH ROTATIONAL GRAZING

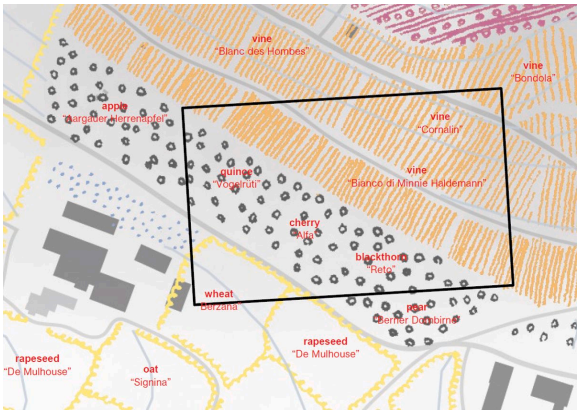
Crop rotation, the predominant agricultural method focusing on grain production, utilizes larger fields, is more compatible with machinery, and is therefore not tied to specific locations. Typically, crop rotation is preferred on soils primarily suited for cereal production.

Elements of the Landscape

Looking closer at specific locations, a site-based proposal for cultivation is created. A selection of precise species of plants are defined, choosing also domestic and rare species to secure the genetic and historico-cultural diversity of the site and to retain a rich basis for our diet.



Forest edge.



Rotational grazing.



Permaculture garden.

Agritopia 2070



Our project considers multiple facets, spanning hydraulics, biodiversity, and farm animals. Furthermore, the locations of the farms, where the workers are situated, play a crucial role in the farmers' agriculture plan. The aim is to nurture the Agritopian's through interconnected networks facilitated by judiciously arranged roads.





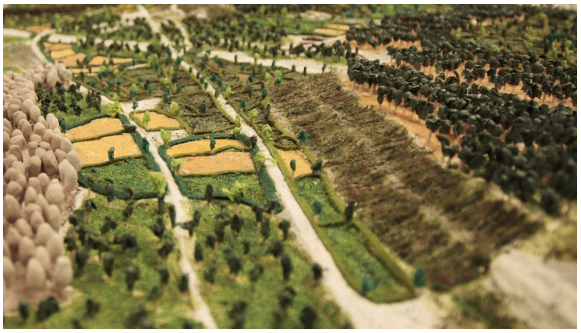




bocage and agroforestry landscape

orchards and vineyards landscape





Bocage and agroforestry landscape.

Orchards and vineyards landscape.



PERMACULTURE GARDEN
Model: Future Farmers
[https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS23-Becoming-An-Agricitizen].



SILVOPASTURE ORCHARDS
Model: Animal Farming
[https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS23-Animal-Landscapers].



Permaculture *(source: Movement, Food)*



Rotational grazing and Crop rotation *(source: Cohabitopia)*



ROTATIONAL GRAZING AND CROP ROTATION
Model: Cohabitopia
[https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS23-Interwoven-Landscapes].



PERMACULTURE
Model: Future Movements
[https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS23-Connecting-Agritopia].



CROPTOPIA

Our agricultural project is not only a reforested landscape but also a diversified space for both the crops sown and the various agricultural practices upheld by Agritopians.

ACKNOWLEDGEMENTS

We would like to thank the farmers Luis Honegger from Dürnten, David and Frank from Meh als Gmües and Michael Gujer, from Obsthaus Guyer, who gave us the opportunity to interview them. We would also like to thank Kenza Benabderrazik for giving us her valuable knowledge as a specialist in agroecology.

SOURCES

- “Agrarbericht 2018 ”. Kanton Zürich. Accessed October 2023. https://www.zh.ch/content/dam/zhweb/bilder-dokumente/themen/umwelt-tiere/landwirtschaft/agrarbericht_2018.pdf
- Crippa, Ronan, et al. “Restoring Soil Fertility.” *Architecture of Territory* online. Accessed 31 October 2023. https://topalovic.arch.ethz.ch/Courses/Student-Projects/HS20-Restoring-Soil-Fertility
- “EJP Soil Stocktake – Beitrag der Schweiz”. Agroscope. Accessed October 2023. https://www.agroscope.admin.ch/agroscope/fr/home/publikationen/suchen.exturl.html/aHR0cHM6Ly9pcmEuYWdyb3Njb3BlLmNoL2ZyLUNlL3B1YmxpY2/F0aW9uLzQ1Nzgz.html
- Fischli Peter, Weiss David. *Visible World*. Köln: Verlag Walther König, 1997.
- Mollison Bill, Holmgren David. *Permaculture One: A Perennial Agricultural System for Human Settlements*. Sydney: Tagari Publications, 1981.
- Rosa da Silveira, Mateus, et al. “Intensive Agriculture.” *Architecture of Territory* online. Accessed 31 October 2023.
- Seymour, John. *The New Complete Book of Self-Sufficiency*. London: Corgi, 1978.
- Seymour, John. *The Self-Sufficient Gardener: A Complete Guide to Growing and Preserving All Your Own Food*. London: Corgi, 1999.
- “Swiss Land governance”. Agridea. Accessed October 2023.

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