

GREEN PATHS

The Road to Regenerative Living



The basic principles of
Permaculture design
for youth workers



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As climate change reshapes the world around us, humanity is challenged to rethink how we live and grow our food. The increasing frequency of droughts, floods, and other extreme weather events disrupts food production worldwide, while projections from the United Nations estimate a global population of 10.4 billion by 2080. These challenges call for urgent action, pushing us to adopt sustainable, even regenerative, approaches to agriculture that not only meet our needs but restore and protect the environment.

This book, Green Paths, is the result of a shared journey undertaken by 22 participants from Bulgaria, Italy, Serbia, and Greece, who came together in Tramonti, Italy, for a two-week Erasmus+ funded project led by Acarbio. The project was designed to immerse participants in the principles of permaculture, a regenerative system of agriculture and living that focuses on creating sustainable human ecosystems by mimicking the patterns and relationships found in nature.

Guided by expert trainers from Cob.gr, a Greek organization renowned for its permaculture eco-farm, the participants combined theoretical learning with hands-on practice. They explored innovative approaches such as sustainable water management, composting, and the efficient use of local resources to build structures like stone ovens and solar cookers. More importantly, they learned that permaculture goes beyond just farming—it embraces a holistic way of living that addresses social and environmental challenges alike.

This book reflects the collective knowledge acquired during the project. Each chapter is shaped by the experiences, insights, and lessons learned by the participants. Through their voices, you will discover the core principles of permaculture and how they can be applied to create resilient, sustainable communities. Green Paths is not just a manual for regenerative agriculture; it is a call to action, a collaborative work born from the belief that together, we can make a difference for the future of our planet.

Author: Juliana Garcia Sarmiento with the help of all participants and trainers



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Green Paths

2-15 October 2023

Permaculture Design Course.

ELEMENT ANALYSIS OF A SYSTEM

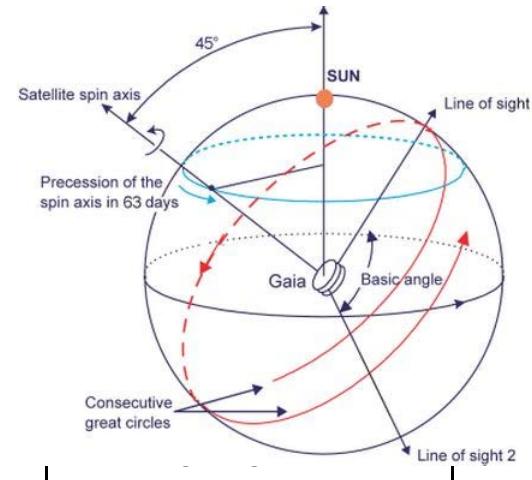
People as elements of a human system, with all characteristics.

Element	Input (needs)	Output (products)	Behavior	Intrinsic Characteri- stics
Christos	Origin of food	Deep listening	Loud	Blue eyes
Lana	Knowledge	Compassion	Sarcastic	Anxiety
Ilias	Nature	Energy	Funny	Stress
Lyubo	Chestnuts	Love	Caring	Overthinking
Roberta	Sun	Care	Calm	Overthinking
Lukas	Friend	Help	Happy	Anxiety

GAIA

James Lovelock.

THEORY

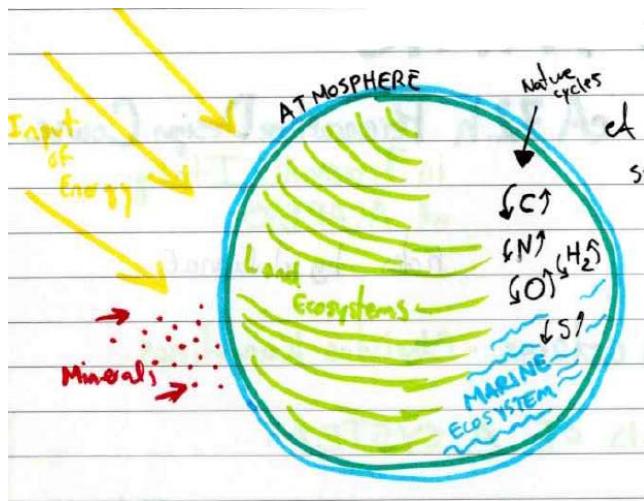


It is a living ecosystem that sustains the conditions of life through a dynamic balance and continuous exchange of the elements necessary for life.

Do humans have the tools to "save" the planet? > The planet can survive without us = (we) need to reconnect with nature = and survive as the human race.

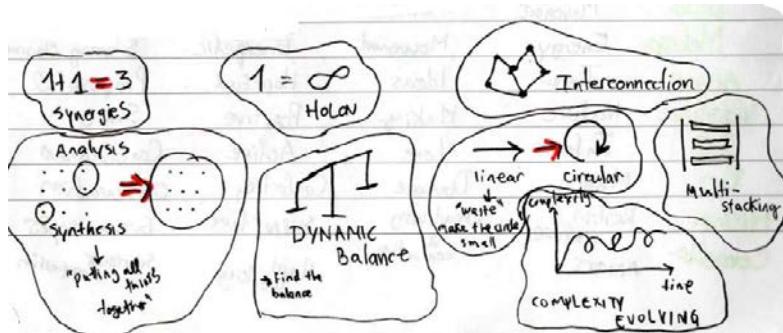
Life has existed within a certain temperature range (- 50° C - 50° C) for millions of years

GAIA	EQUILIBRIUM	GAIA	EQUILIBRIUM
CO ₂	0.04%	98% Air	1% 1%
N	78%	1% H ₂ O	96% 85%
O	21 %	0% Salt	3.5% 13%



SYSTEMS

System = set of elements that interact with each other.
 Permaculture is a tool to approach these systems analytically and reasonably, with the necessary tools. Always have the capacity to explain "WHY?".



THINKING

Each element needs 3 purposes = multifunction to get into the dynamic balance.

Conventional agriculture = entropic way instead of syntropic.
 Transformation of the energy → transformation of the system.
 The base is where we build a pattern.

Permaculture design means to be efficient, to close the loops. It imitates nature.

To regenerate the land, we need to regenerate ourselves. A PDC is an investment into what your life is, to what it will be.
 So, push the knowledge to the limit and keep critical thinking.

PERMACULTURE PRINCIPLES

The **12 principles of permaculture** were created by *David Holmgren*, an Australian environmental designer and educator, in the late 20th century.

Those principles are proposed to establish an understandable way of how nature works.

1. Observe and Interact.
2. Catch and Store Energy.
3. Obtain a Yield.
4. Apply Self-Regulation and Accept Feedback.
5. Use and Value Renewable Resources and Services.
6. Produce No Waste.
7. Design from Patterns to Details.
8. Integrate Rather Than Segregate.
9. Use Small and Slow Solutions.
10. Use and Value Diversity.



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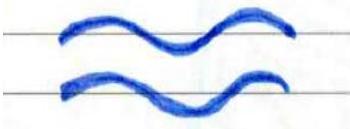
11. Use Edges and Value the Marginal.

12. Creatively Use and Respond to Change.

PATTERNS

Here, it is important to observe nature through an entity year.
Four seasons; to see/understand how nature evolves.

THE WAVE



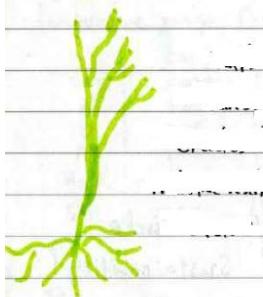
- ❖ Repeating with variations.
- ❖ The passing time, ages.
- ❖ Forever changing.

THE SPIRAL



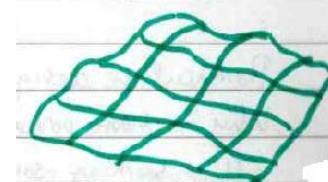
- ❖ Protects what's in the middle.
- ❖ Indefinite evolution.
- ❖ Effective use of space.

THE ROOTS



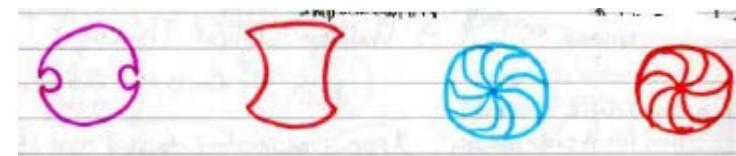
- ❖ Transports
- ❖ Creates a lack of borders.
- ❖ Natural resistant.
- ❖ Resilience.

THE NET



- ❖ Catching and collecting.
- ❖ Repairable.
- ❖ Distributes the tension.

The core model, which translates to the 3 dimension torus, is a pattern that Bill Mollison spoke widely of because of its transformative energy. **It is a pattern that reinforces balance** and can be a reminder of the duality of life and how there is a balancing force between the trunk that connects. This virtually eliminates the duality through the edge transference.



Pattern design helps to build the land (or other things) more naturally.

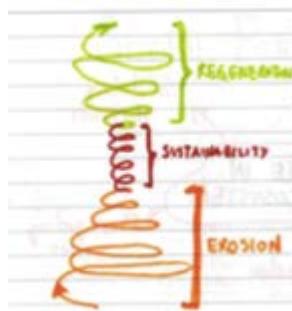


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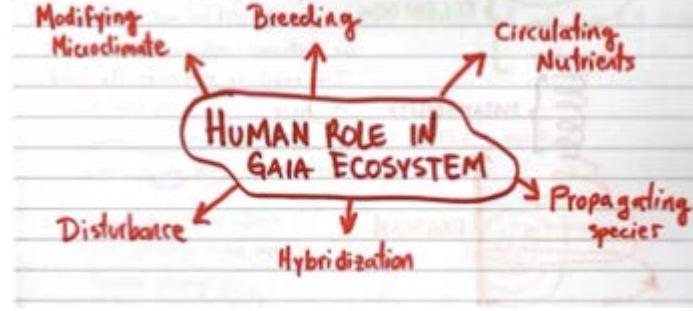
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Common goal → Bringing back ecosystems

Sustainability only means keeping hold of the current bad state of the planet.

Therefore **REGENERATION** is needed.



Difference between humans and other species regarding the destruction of the ecosystem?

→ Humans do it much faster

PERMACULTURE ETHICS



SOCIAL PERMACULTURE

ZONE 00:

How can I be regenerative?

Where do I spend my energy?

My emotions & relationships?

- Personal values: Patterns of behaviors
- Relationships
- Finding tools to be healthy

→ Reconnecting to nature(**GOING BACK TO YOUR ROOTS**)

CONCEPT OF LEADERSHIP:

Leadership is a role and not a permanent attribute

The absence of structure becomes structured chaos.

ALTERNATIVE STRUCTURES:

- Energy is seen as time, resources, relationships...
- Sense of belonging: Choosing a way of communication, which "saves" energy
- **Nurture regenerative relations from the beginning**
- Ecovillages
- Co-housing/Shared lives
- Fuel-free communities, local food, horizontal groups without delegation of power (non-hierarchical)

ALTERNATIVE COMMUNICATION & ORGANISATION:

- Language-based on needs & feelings → Non-violent communication (avoidance of unnecessary conflicts)
- Facilitation of groups (including experienced people knowing the concept)
- Knowing own role within a group
- **Sociocracy → Horizontal organization of group**
- Degrowth

ALTERNATIVE ECONOMY:

- Exchange networks
- Crowdfunding (solidarity economy)
- Community Supported Agriculture (CSA) consisting of a group of local producers
 - fixed amount of food/year

→ Safety for the farmers

→ Change of the approach of consumption (conventional vs. bio)

- Fair Trade Products= ethically produced food, no child work, good conditions.
- Social cooperations:

→ helping people in need

→ disabled people

- Alternative currencies:

→ crypto-currencies

→ circulation of goods

→ time banks: exchange of values/services

DECISION-MAKING TOOLS

SOCIOCRACY

To decide as a group, we need to have a defined common goal

Example:

- What is the goal of our group?
 - Connection with locals, networking, learning about permaculture, and having fun!



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- What is the tension?
 - We observe a gap in the organization, so we want to decide on cleaning dishes to do it properly
- Bring a proposal to the group:
 - "After eating, clean the plate and give it to the washing team"
- Some clarifying questions might follow;
 - Cooked food in the compost bin?
 - Where do we put the plates?
- Clearly reformulate the proposal and submit it to a group consensus. Three options are possible:
 - OK
 - OK, but I have some concerns - Good enough for now, safe enough to try.
 - Not OK, I have an objection -> Proposal needs to be reformulated

Pay attention to objections, and reformulate the proposals so everyone's needs are satisfied, but in case there are many objections repeatedly, it may be a good idea to check the initial goals. Attention to emotional space, **learn to separate emotions from decision making**.

It is recommended that the facilitator does not carry the proposal, but someone else.

Sociocratic events work better in groups of 5-12 people if the number of people is bigger, divide in smaller circles.

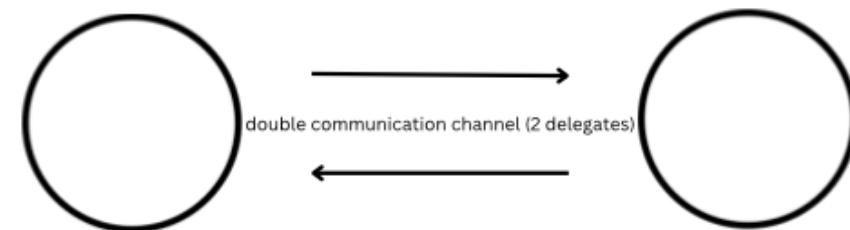
ROLE SELECTION

1. Round: Proposing name with justification + voting

2. Round: possibility to change the vote (without mentioning reasons)

Depending on the situation, it might be useful to use different roles (i.e.: Facilitator, Secretary, Delegate)

The circular structure of communication between groups:



- ensuring true communication
- integraty of all needed information

Source and more info at
sociocracy30.org.

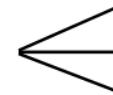
According to the sociocracy guide; instead of simply assigning people for roles, or making a choice based only on the majority, use the role selection process to:

- Tap collective intelligence by hearing and deliberating on reasons for nominations.
- Increase ownership over the decision.
- Ensure support for the role keeper by those affected.
- A prerequisite to the selection process is a clear description of the role's domain.

EMOTIONS

All emotions have a **bright side** and a **dark side**.



- Reactions to situations can be 
 - Flight
 - Fight
 - Freeze
- Shame → Driving emotions to build a social system = being ashamed.
- The shame emerges from social pressure (do babies have shame?)
Give space to the sadness, to recognize it, to show it, and to deal with it.

COMMUNICATION TIPS

The “I” language is the one that speaks for you to others. Pay attention to include everybody's opinion and change the perspective of your saying.

I language: I think, I know, I feel.

change of perspective: I think that we...

Confirm assumptions = rephrase and verify information.
Don't assume it is only you.

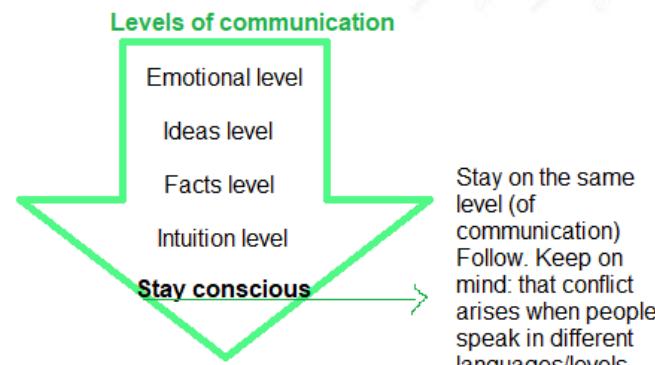


Take responsibility for your actions and feelings.

How I react to situations that occur outside of me is my responsibility and can obey my background.

Be specific: avoid absolutes and generalization. Especially when giving feedback.

Be authentic!!



Separate attitude from person = accept the diversity of attitudes and emotions that a person can have.

Give at least 5% of truth to the other person's opinion = **Benefit of doubt that allows communicating.**

Non-verbal communication = observe and be conscious of body language.

Avoid projections and expectations.

Speak about feelings and their impact.

Know and use your self-regulation tools.

From passive observer to action.

Appreciative language = Start with appreciation, try to avoid the word "but"; use instead "and". Both are true statements.

Take care of your space and time.

Choose what battles to take.



SOIL & SEEDS.

Seed = food sovereignty. (That's why it is important to keep the traditional seeds).

Nursery seeds = built-in beds.

Hybrids = are genetically unstable so, not sure what will come out and it is only for one season.

The seed has enough nutrients to sprout but **needs to get strong roots** to look for more nutrients after.

Stratification: fruits fall from a tree, get protected from other materials, and wait for the proper conditions to sprout, either cold or warm.



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Cold > Put the seeds in the freezer or refrigerator to stress the seeds.

Warm > Put seed on warm and water overnight.

The shape of the nursery is not the best, the best is to plant the seed directly on the soil... but sometimes a nursery is needed.

Nursery = sand + day soil / 1 pot clay + 3 pots sand.

Take out all organic materials.

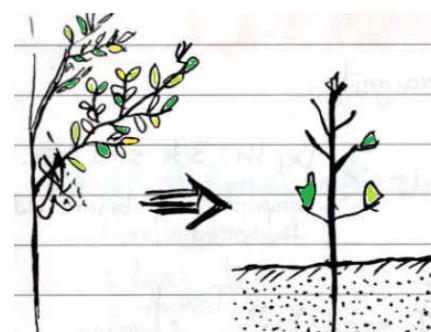
Rooting from branches = already mature plant.

Willow = growth hormone -> cut in pieces, add water, and then put the cuttings in there for at least 1 day

Willow is also used to tie the plants.

HOW TO MAKE A CUTTING?

In summer: younger branches.



In winter: branches from last year.

Each species can be better cut in different seasons.

Cut branch -> upper pat to enhance lower growth; cut most of the leaves.

It is also possible to propagate plants from the roots.

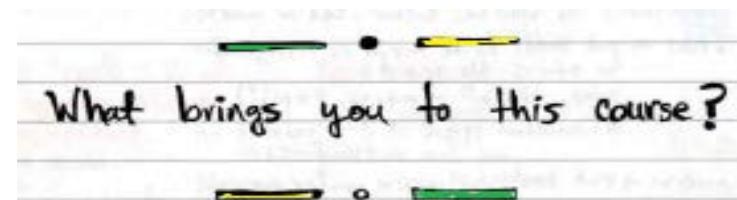
To take them out, it usually is good to wait one year. So, it gets one complete cycle of seasons.

Attention to not take them out too soon!

The cycle of a plant

Autumn = energy goes to soil

Spring = energy goes up to the leaves and fruits.



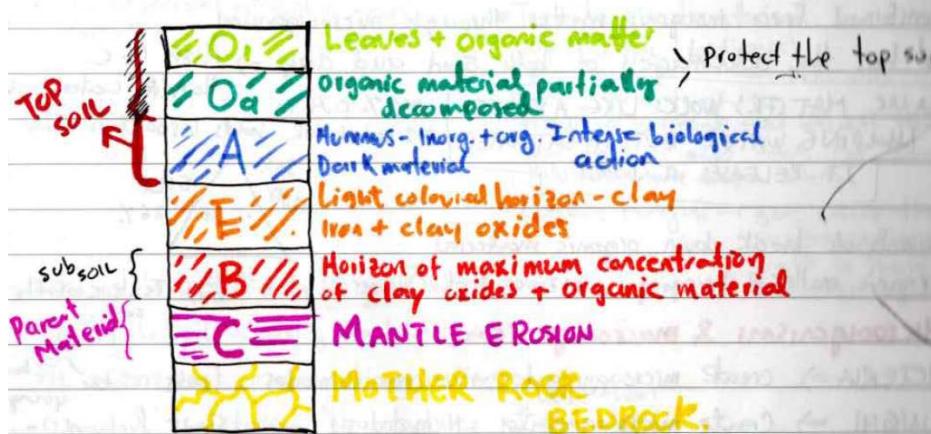
- ❖ Get closer to the land.
- ❖ Get out of traditional patterns, and change them!
- ❖ Put the knowledge in a systematic order and use it!

PROFILE OF THE SOIL

Soil is composed of an organic part (carbon + organism) and an inorganic part (no carbon + other minerals).

Soil composition: the soil is composed of three parts:

- 1.- Minerals = bonds.
- 2.- Organic matter.
- 3.- Organic (full of carbon bonds).



Some extra details to keep in mind about this profile:

- 1.- Organic matter (undisrupted).
- 2.- Organic matter (partially decomposed).
- 3.- Top soil = hummus = dark horizon of mixed inorganic + organic materials.
- 4.- Leaching zone = light coloured horizon. It has clay and organic material.
- 7.- Bedrock = mother rock > where everything starts.

Inorganic side of the soil:

Soil texture: clay: $\phi < 2 \mu\text{m}$
 ϕ : grain size silt: $2 \mu\text{m} < \phi < 50 \mu\text{m}$
 sand: $5 \mu\text{m} < \phi < 2 \text{ mm}$



 The texture of the soil determines the exchange capacity of its cation.

Testing with a jar:
 $\frac{1}{3}$ water, $\frac{1}{3}$ sand, and $\frac{1}{3}$ air.

It separates the phases of the soil when it is shaken, and leaves it one night to see how the elements settle.

SANDY SOIL	CLAY SOIL
Low cation exchange capacity (CEC). Drains the water. Inactive. Brittle. No chemical reactions.	High CEC (cation exchange capacity). Absorb water and seals It is dynamic and sticky. Bonds are created through chemical reactions

The **CEC** is the ability of soils to bind and store a particular group of nutrients by electrical attraction, those that form positively charged cations.

THE ORGANIC SIDE OF THE SOIL



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Fungi Categories.

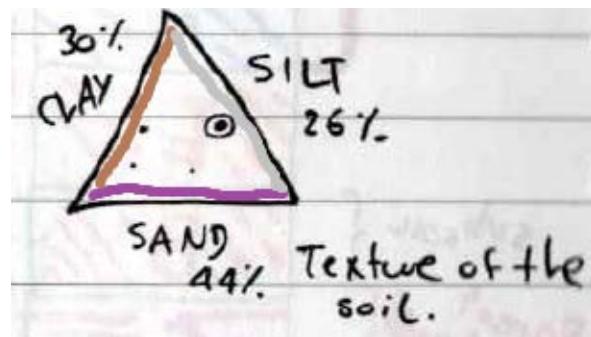


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Looks lacking and small particles > break down into basic structures, and are transformed from inorganic matter through microorganisms.



It has the advantages of both sand and clay = High C.E.C + handles water well.

Organic matter works like a

sponge holding water, but if saturated it releases it (down).

1% of Organic matter is present in 0.1 hectare of soil, it holds 16800 liters of water.

Worms, ants, etc. break down organic material into organic matter and bring enzymes of other things.

MICROORGANISM AND MACROORGANISM

Death material gives place to a new life.

Bacteria > create micro aggregates = micro-arthropods.

Fungi > create macro aggregates = nematodes.

Protozoa.

PARASITICS	SAPROPHYTES	MYCORRHIZAL
<ul style="list-style-type: none"> - Feed on living organisms. - Colonized places like viruses, can not feed by themselves. 	<ul style="list-style-type: none"> - Feed on dead material and convert it into organic mud. - Mostly carbon. 	<ul style="list-style-type: none"> - Feed through association with the roots of plants.

Some parasitic turn into saprophytes.

Mycelium = asexual reproduction underground!

The mushrooms are the fruit of the fungi, and they spread spores.

Mycelium can go endlessly if not disrupted; thanks to water and nutrients.



Source Google image. Public Domain.

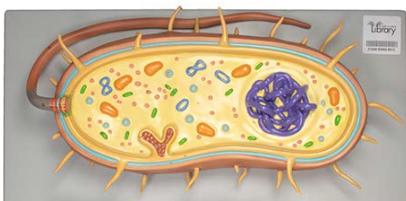


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Source Google image. Public Domain.

Bacteria.

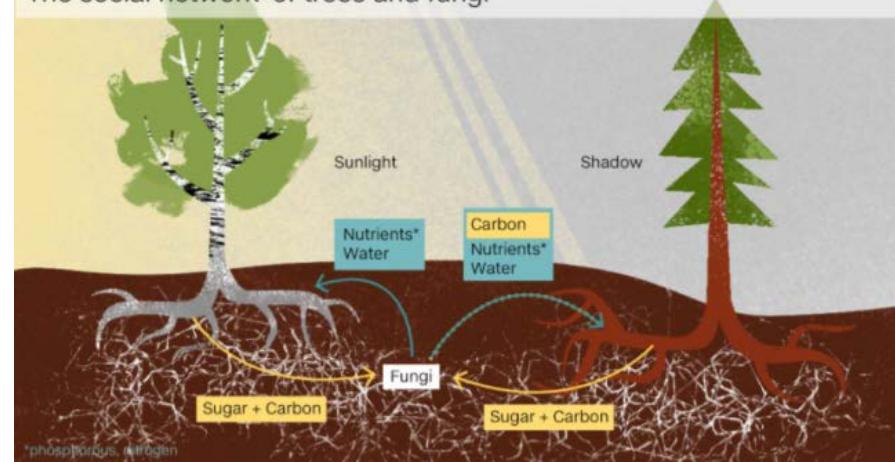
C/N = 30 → metabolic relationships = diet of the solid (just like humans).

Mycorrhiza is a symbiotic association between a fungus and a plant that takes nutrients from photosynthesis.

and a plant that takes nutrients from photosynthesis.

Source Google image. Public Domain.

'The social network' of trees and fungi

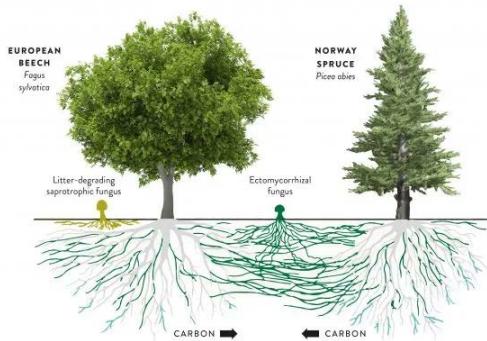


Stress is transferred as information to other plants, for example, a fire in the forest.

Mycelium can hold many times its weight, so it can be used to filter oil from water.

Fungi are very adaptable and smart organisms. Millions of years on Earth support them!

Source Google image. Public Domain.



gets inside the nervous system and makes them walk to the highest point to release spores.

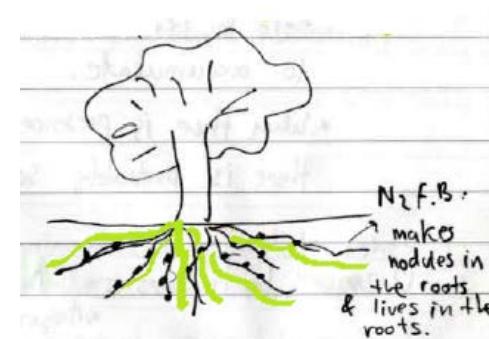
What is the problem with the soil?

Turning the soil and mixing the layers of the soil are the worst consequences of conventional agriculture because they **disturb the structure of the soil** and compact it, and also destroy the work of plants and fungi. It is worse than pesticides! Because of it, the soil loses humidity and stops being like a sponge. **So, Keep the soil covered = regenerative farming!** To regenerate the soil, protect it from the Sun and add organic material.

Regeneration of the soil:

- N- N-fixing bacteria.

- Leguminosae makes an association with these bacteria.
- Some make nitrates > NO₂
- Some others make ammonium > NH₂
- Nitrogen is the key ingredient of proteins.



continuously trim the plant and put it on the ground.

No matter which technique, it needed to find the equilibrium.

In chemistry, the pH scale is used as a measure of how acidic or alkaline a substance is, which in this case is soil. **The pH scale ranges from 0 to 14**, where a pH of 7 is neutral.

Most plants prefer neutral soil around pH 6.5 to 7.5 and will grow favorably in the broader pH range of 5.5 to 8.

Soil is one of nature's most complex ecosystems, so it should be no surprise that **changing the soil pH will have many flow-on effects on plants**, both positive and negative. Soil pH affects not only nutrient availability, it also affects soil microbe activity and the mobility of heavy metals.

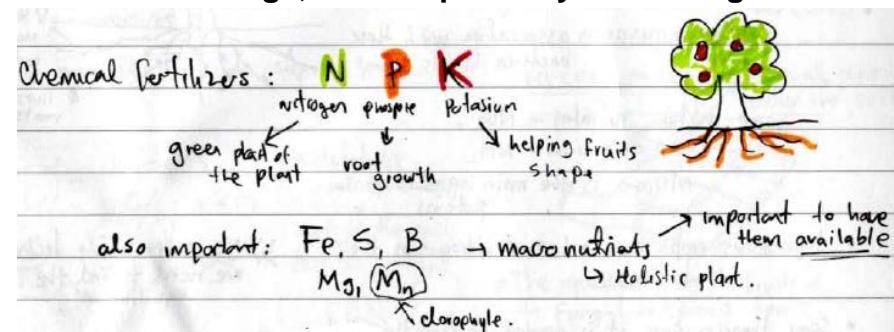
Compost can help to fix the soil!

FIXING THE SOIL.

- Adding sulfur (inorganic fertilizers) lowers the acidity (S-2).



- Adding calcium/lime/marble dust C+2 > raises the acidity.
 - Calcium can compete with phosphorus (P).
 - **Consider PH values according to the desired plants.**
 - Some plants can work as bio-indicators (weeds, nettles). These, for example, show a lack of nutrients since heavy metals try to accumulate.
 - **When there is a presence of a plant that takes over other things, there is probably something to fix.**



Find the balance between nutrients, organic matter, etc.

So, the plant can absorb nutrients! And remember, not all nutrients are absorbed at the same speed.

Remember, too, that minor deficiencies can be seen through the leaves

BUILDING ORGANIC MATTER.

Green Manure: Mix of Fabaceae (70%), Poaceae (20%), and Brassicaceae (10%) for High-Demand vegetables.
Top top-to-bottom technique is more inefficient than adding manure right in the soil itself.



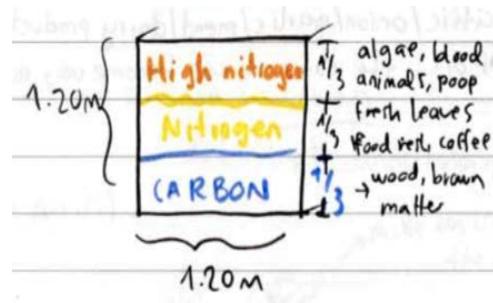
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COMPOST.

This means the process of organic matter turning into nutrients.

Bokashi Method:



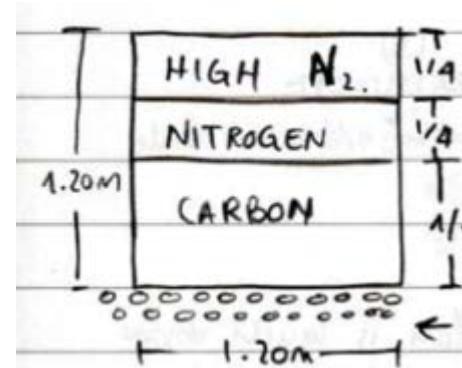
- Reproduction of microorganisms through composting
- Ready in 12 days after frequent turning
- Aerobic composting without humidity

Hot Compost:

Ingredients: microorganisms, minerals (clay), metals, ashes, old compost, sugar, water

- Water: Measuring the right amount by taking a handful of compost → 1 single drop ideally should come out
 - Temperature: ideally 55 degrees Celsius
 - Oxygen: daily turning to prevent having it compacted
- Playing and Observing is the key to success
- pH-value is important (too much acid slows down the process → pH-value should be neutral)
 - Compost pile should covered at all times

Cold Compost:



- 6 months
- No turning!
- Aerobic composting
 - Johnson-Su Bioreactor (pile covered in black and usage of PVC pipes for water circulation)

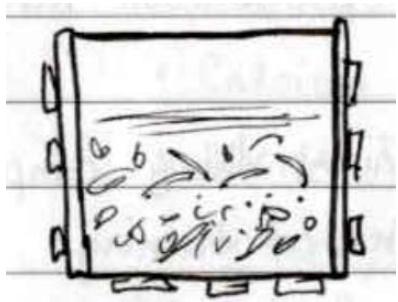
Home Compost:



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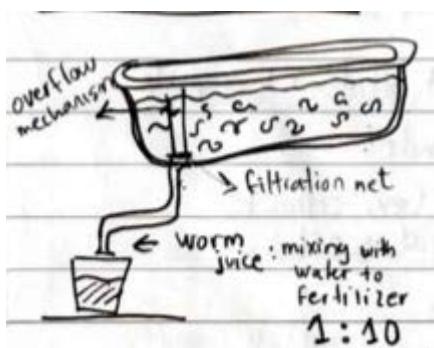


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- For keeping the C/N ration: when adding nitrogen (food) also the same amount of carbon needed (paper, leaves)
- Being careful about acids is important (citrus, onion, garlic...) could make it too acid

Worm Farm:

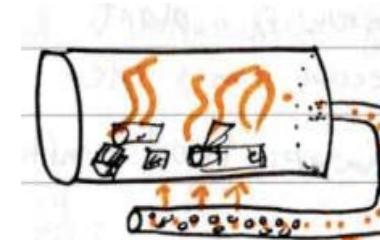


- Digested manure or compost with carbonated matter + additional food

YES	NO
FRuits coffee carbonated leaves	citrus garlic Onions oil animal feed cooked food

- Cultivation of worms → 1 handful in manure/compost and they will reproduce

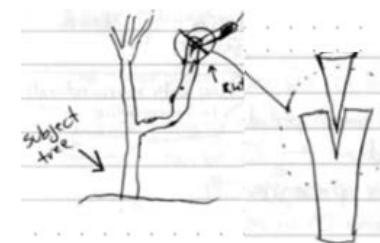
Biochar:



- Consists of burnt matter/carbon concentrated anaerobic combustion (wood)

GRAFTING

Depending on the plant there are different techniques for grafting. It is used to combine two types of varieties to get the best outcome (i.e. base with a strong root system, top with usable fruits)



Process:

- Elimination of unnecessary branches
- Creating an incision to insert branch (cut from other plants)
- Combining parts of the skins with each other
- Using a sharp knife for a clean cut without air



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- The treated part needs to be sealed to prevent humidity/mushrooms (i.e. mud, clay, wax)

variety, but
Why grafting?



- stronger/more productive plants
- usually the subject is a wild
- we prefer other varieties
- more varieties on one plant
- even potatoes+tomatoes possible

COMPOST TEA



Needed materials:

For the bag: old T-shirt filled with worm compost

For liquid: - water (free of Chlorine, i.e. rainwater)

- Carbs (melasse, sugar)
- Marble dust (minerals)
- Lime
- Oxygen

Process:

- Adding everything & stirring 3 minutes 3x/day

- 24h-48h until ready
- foam can act as an indicator of the presence of microorganisms
- stable temperature: around 15 degrees Celsius
- For usage: 1:10 proportion with water
- Possibility to:
 - spray in soil
 - spray on the upper part of the leaves

GETTING TO KNOW THE ASPECTS OF PERMACULTURE

What is Permaculture?

- Designing/Doing agriculture in a certain way that works without causing a CO₂ footprint
- Nice way of thinking, including making decisions that protect the environment

Energy aspect of Permaculture:

- Trying to be even & just to the planet and every living creature on Earth.
- Difficulty of quick change due to 60 years of humans being destructive (humans use more planets than are available each year → Earth Overshoot Day)
- Every decision affects our own footprint!
- all the energy on Earth comes from the sun



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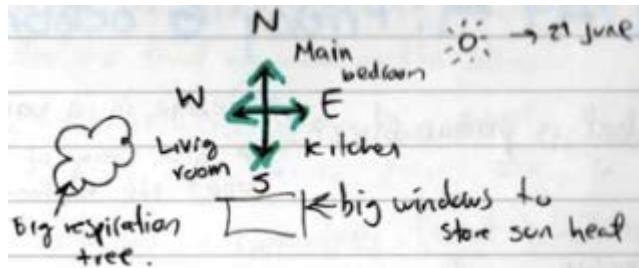


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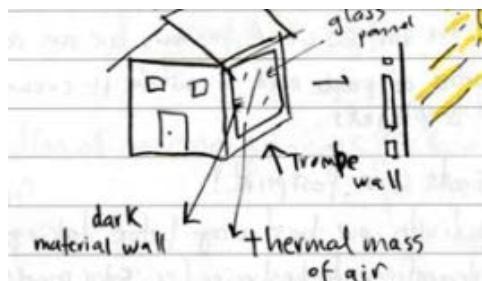


Scheme of a house - according to the sun



Heating

Nowadays, there are many passive systems for heating.



Known examples are Trombe walls that store the heat in the room.



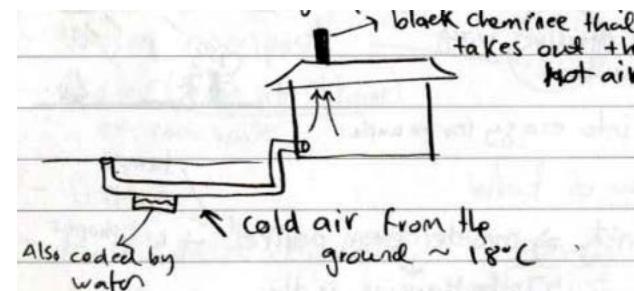
Another example is the dry water heater.

With 10 m. in length.
2 cm in diameter

Check the height and location of the system, volume, and heat capacity.

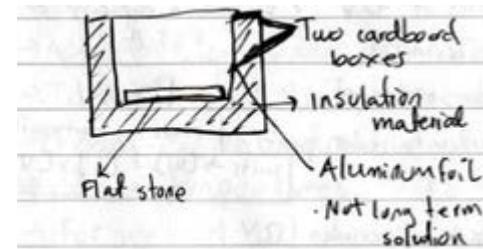
Cooling:

You can use physical principles → hot air up, cold air down

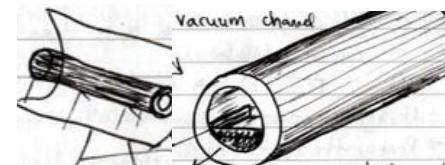


Passive cooking systems:

1.) Solar oven:



2.) Parabolic panel:





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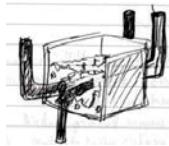


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- Sunlight is reflected by mirrors hitting the tube and heating it up (200 degrees Celsius in 20mins)
 - Outer layer with vacuum chamber
 - The tube is industrially made but could save tons of CO2
- 3.) Hot Compost:



- Can be used for heating water
- Pipes through compost which heat fluid/air
- Can be used for housing (water heating).

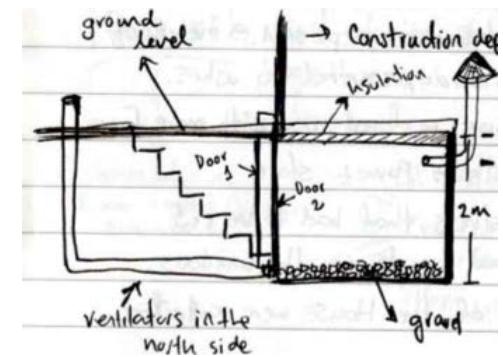
Food preservation



- 1.) Solar dehydrator.
 - Usage is mostly in summer.
 - The temperature should be 20-40 degrees Celsius.
 - Creates hot airflow
 - Using glass as a Trombe wall causes an upward hot airstream.
- Trays with nets to let air pass through.

2.) Root cellars.

- Storing food below the ground.
- Constant temperature underground.
- 2-4 degrees (winter), 95% humidity, 18 degrees (summer).



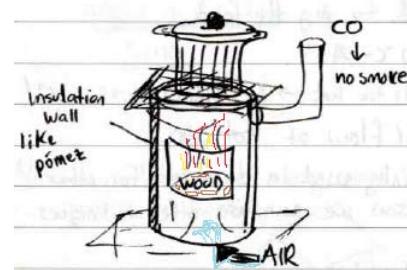
Be organized, label food needs to be checked from time to time.



The root cellar technique is ideally in clay soil; it allows it to breathe properly as well as there is moisture exchange.

3.) Rocket stove.

Fast flow, so the fire burns the smoke > chamber so it can go fast ignition.



VISITING TO THE NATURAL BUILDING IN ACARBIO.



Located in Tramonti in a zone that was destroyed by the Vesuvio explosion, everything was burnt to death, covered by ashes.

Then nature was restored even with more force. The soil is rich in nutrients; it has pome stone. Also, the place has Chinese chestnuts that had to be cut and they used the dead trucks in the windows.

The house's materials were collected around the place and the technique used for the house was the natural building. The one that allows the place to breathe.

Structure of the soil.

- **Organic:** the roots go with the pre-volcanic soil.
- **Pomez:** acts as draining and water circulation.
- **Pozzolana:** great building material.
- **Old soil = Clay:** most common building material > flat structure.

Sand is rocks!
Bright colors when wet (red, blue, white).
Slippery or sticky when wet / depending on the (if it sticks we have a building material).

Orientation of the particles.
When dry, it cracks.

The Jar test: to get the map of the soil. It is needed to keep the good proportions. After the math is done, some tests need to be done.

Since the clay shrinks, we need to add sand.
75% sand > bigger grain size
25% clay > enough to stick two sand grains.

Pomez stone: it is useful for drainage, insulation (+ mud), and even for food. It is a material that makes us travel back 2000 years because it is what of the earth, in the volcanos.

Pozzolana = volcanic ashes, used also in plastering, together with lime (calcium); it is waterproof. Known also as Roman cement.



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For the oven construction → in clay wait until it dries to be plastered.

When plastering, it is necessary to play among permeability and water to make it breathable.

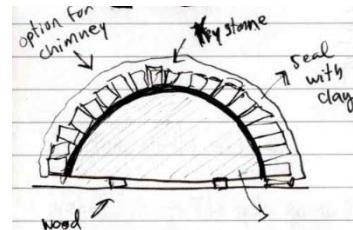
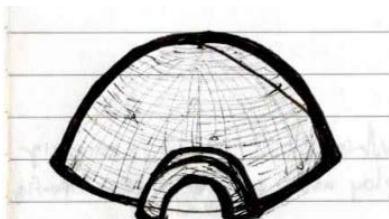
Chestnuts don't like limestone.



CONSTRUCTION WITH EARTH & ENERGY MANAGEMENT

Construction of a solar oven + a rocket stove.

- cleaning the surface and checking for upper trees and branches to prevent forest fires
- build the structural shape (ex. branches) of sand
- cover it with tiles to reinforce the structure and use clay as glue
- once we place the last tile, we should remove the sand/ if well-built, it will hold

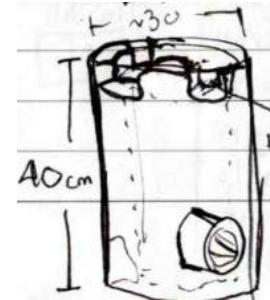


Rocket Stove: the structure can be built with different materials

- use rocks and tiles for support

Construction of a dome/ oven

- make the inner surface smooth so air does not create turbulences that slow down the flow
- first fires help to dry the structure



3 projects:

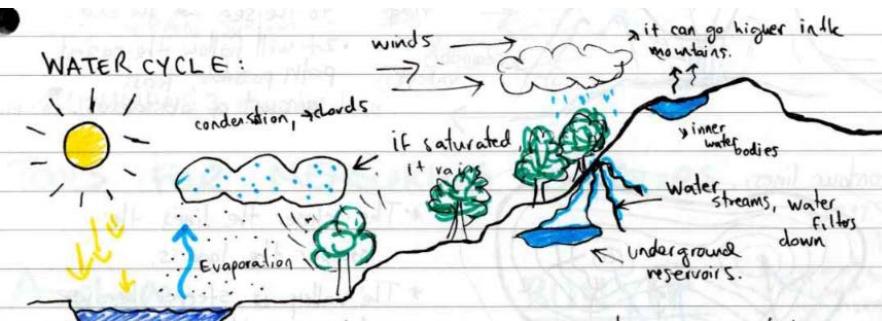
- construction of a Stirling engine
- construction of a solar passive & parabolic cooker
- calculation of energy requirements of the ACARBIO office in kWh → for 3 days of autonomy (solar panels)

WATER MANAGEMENT - IN THE CHESTNUT FOREST

How is the surrounding landscape? - What are strategies/ technologies to manage water

To understand water, we need to understand how it works!

ACQUA - BOAA - AGUA - NERO - WATER - EAU - ΥΔΩΡ



Precertification:

- Close to the sea: rain-snow-hail
- Strategy to destroy hail storms: radar

Desertification:

- if water does not penetrate the soil, we lose sweet water that would have been available to us
- instead: EROSION → up to the bedrock
- "What once looked like a strong person now remains only bones."

Platon refers to the eroded landscape after cutting trees and building boats

- **Plant rain by planting trees**
- bacteria in the leaves
- different ions/ elements

What are the solutions? = **3S**

- SLOW down the water before it arrives at the sea
- SPREAD the water into the landscape
- SOAK the soil, let the water go into the land

"Water brings life, but it can also destroy everything in its path."

- Think about the destruction of Petra.



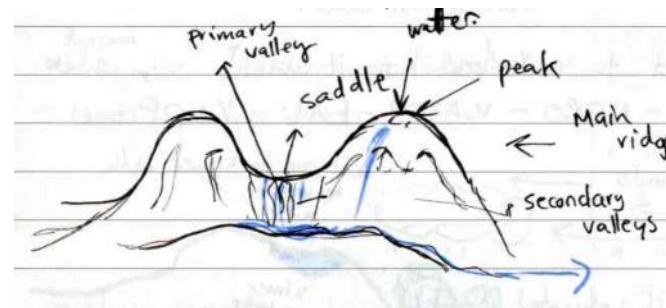
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- Very civilized.
- Good mechanics.
- Great understanding of water → Water calls for more water (dams → failure (water washed the city away) → No proper overflow processes

By planting trees, the landscape is restored. They slow down the water and the canopy keeps the forest fresh.

Big floods in Greece: good water management with trees **is important to not have stagnant water.**



- Water flows in different paths, but will arrive at the sea at the end
- It will follow the easiest path possible with the least amount of obstacles

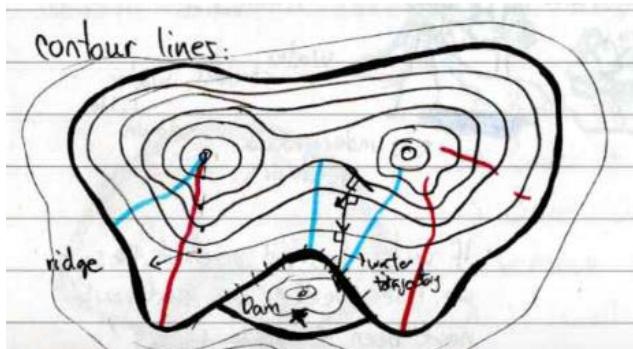


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Udruga Brane Šimića



Contour lines:

- the closer the lines, the steeper the land is.
- the valley is steeper because water digs the terrain.
- **key point:** point in the valley where you can harvest more water ... → create a dam to store water
- **key line:** guide to cultivate → good distribution of water.
- when building the dam separate the soils (clay).
- **PAY ATTENTION TO OVERFLOW → SPILLWAYS**
(controlled system)

Water management (books):

- Water for every farm - Mark Shepard
- P. A. Yeomans
- Restoration Agriculture - M. Shepard
- Douglas Bourne? - water ...

Terraces are also a good tool for water management

- they can prevent erosion

- SWALE (tree planting system): dig a channel in contour lines

- the shape depends on the inclination

DIVERSION DRAINS:

- to direct water to other places, because we want to cultivate there, or because we went/ need to dry another place

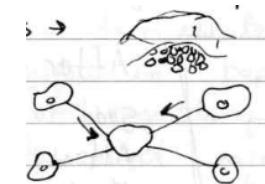
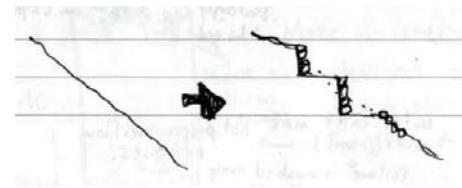
RIP-RAPS: Rocks as obstacles to stop the water

MEDIAS LUNAS (half-moons) → distribution of water

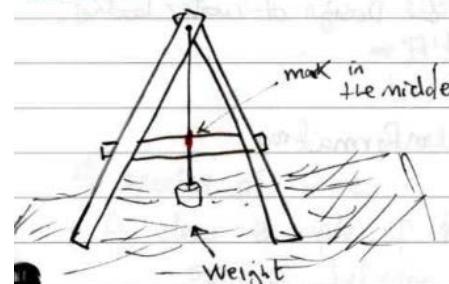
NET and PAN system:

CHINAMPAS: elevated beds

TOOLS FOR MEASURING CONTOURS



A-shape



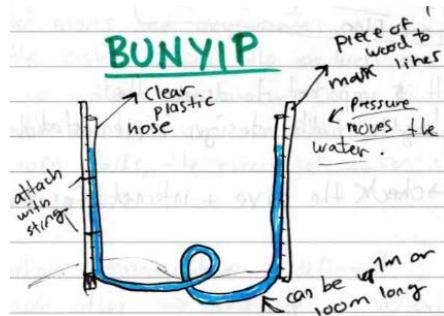
→ Same elevation points are indicated when the weight stays in the middle.



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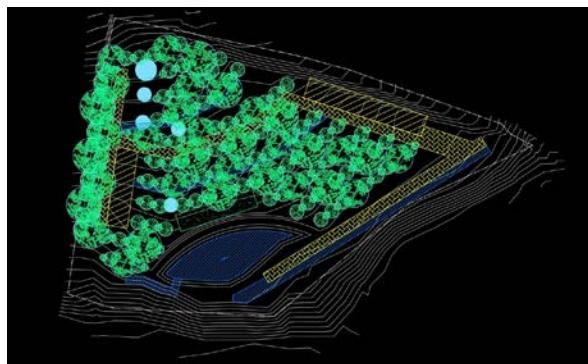
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→ To keep the same elevation,
both ends of the pipe should
mark the same measure.
**Barriers to the content of the
water and soil**



DESIGN OF A LAND - EXAMPLE made by Cob.gr



URBAN WATER MANAGEMENT *

VEGETABLE BEDS

Visit to Minori → water management: lemon farm and grape farms
Vesuvius ashes did not arrive here → Other strategies



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- the high presence of terraces to cultivate
- the presence of grafting (willow (very strong and flexible) on poplars)



Cistern system:

- to collect rainwater from the stair
- used to irrigate the fields while directing the water to avoid floods
- covered by water lentils so it reduces evaporation & creates a temperature difference so water moves and oxygenates
- when the cistern is full, the conducts are closed, so the water level sinks
- it's better to have an overflow, so when lots of rain falls, it well manages the excess of water

4 species of wine (on the terraces)

- a clear example of urban Permaculture → different species helping each other → good use of vertical space

- observation of the climate & introduction of species (banana, mango, avocado, chirimoya)
- choice of plants that don't need too much care
- lemons are covered against the wind and to get more fruits by bending the branches down.

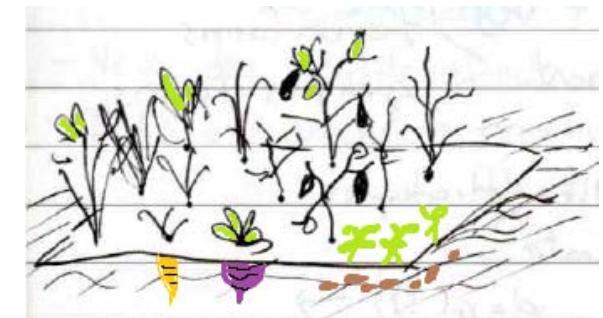
VEGETABLE GARDEN.

Keep in mind that annual plants take a lot of nutrients from the soil, so in the same space, grow different species. **The diversification manages the use and production of nutrients.**

How can we regenerate the soil?

Permaculture promotes perennial species because they familiarize themselves with the soil, generate biomass, etc.

There are different techniques to regenerate the soil, for example, the use of green manure and cover crops, organic compost, crop rotation, and so on.



To produce an abundance of food while regenerating!
Convenience + efficiency = good, good job!

Use the least amount of energy (more time for us) and get a good income (cultivate efficiently, so we don't start from zero every year?)



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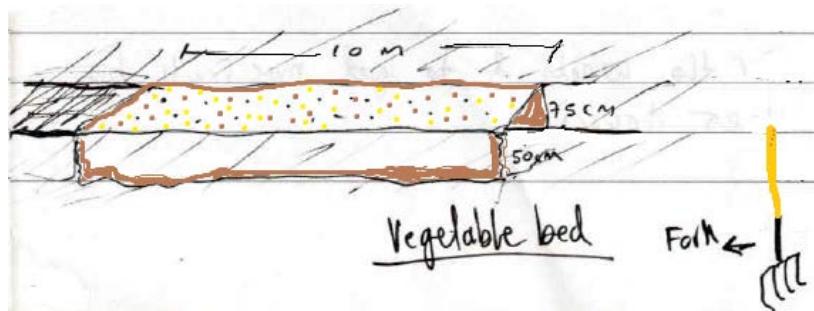
When covering the soil with carbon, nitrogen is taken from the plants too, so it can be harmful. Some people add food waste to the soil.

Bio-intensive Garden Market = high biological activity.

Not planting the same species in the same spot every year.

Vegetable bed:

- It is important to plant according to the needs of people and the conditions and needs of the place. It all depends if it is too dry or too rainy.



- Depth = 50 cm of compost to start.
- Width = 75 cm - walkable from side to side.
- Length = 10 m - important to have good irrigation.

It is an enormous investment in the beginning and then it pays off (very) soon.

Remember to protect the beds from wind with perennial trees or bushes.

To plant → the soil needs to be aerated when preparing the next crop.

Cover with a tarp for ½ months.

In permaculture, nothing is “bad”, the choices above material will depend on the gain that can be obtained from it. For example: plastic tarp.

Fresh soil = good soil → prevents weeds/grass from getting strong and with the root system → they don't like rich soil

But not all weeds are unwanted, right? **A balance should be designed.**

QROP = tool to plan the veggie bed.



Business Plan → with the design of the land.

Questions like:

Which vegetables to plant?

To whom will I sell?

Where is the need for my vegetables?

Remember that to get productive and efficient land, it is necessary to plan very well.

To convince many people, we have to be smart!

Before starting the garden → clean the land properly, and be organized and tidy, it is important!; another way to clean is to kill the plants to cover them from sunlight.

Keep the paths dry.

Plant the bed with almost no space between the plants so the sunlight can hit the ground.

Plant densely!!

In a home-scale garden, it is possible to try everything. On a bigger scale, working with monocultures is more efficient.



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Material to use: carton, manure (**Attention to fleas!**), compost.
Measure the beds.

Cover the soil with fast vegetables like lettuce, onions, etc.

Earthworks need to be very well thought out because it will change the topography of the place and it should be regenerative.

SEEDS MANAGEMENT

There is a political face of keeping the seed. This represents the origin of domestication of crops, the quality of food, and the collective knowledge reflected in a seed.

- Natural selection of seeds: some will adapt better to certain environments.
Seeds wait for the better conditions to sprout.

A “Movement of organic farming” gives a certificate of seeds. It is very close to regenerative farming. It's known as biological farming and it allows the use of pesticides but needs to be organic. Nevertheless, it is still far from holistic farming.



To better know about the integration of vegetables and plants in water bodies. Check the literature of Masanobu Fukuoka about seed management and the literature as well, about “chinampas”.

How to avoid plagues/diseases? by making the plant healthy, with good nutrients and microorganisms.

John Kempf found out which nutrients plants need to be healthy and which plagues, diseases and insects can resist.

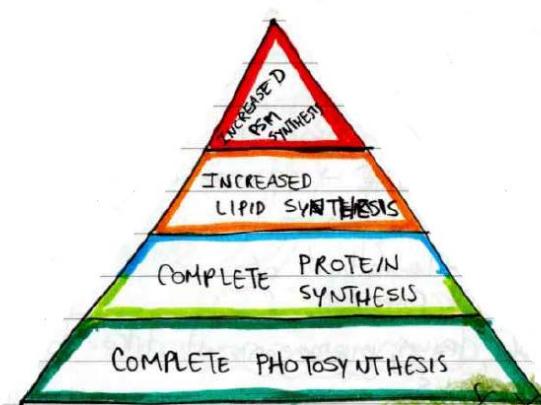
Role of natural selection → eliminate weak species.

Healthy plants transmit special frequencies.

PLANT HEALTH PYRAMID

The Plant Health Pyramid covers the soil and air-borne pathogens, fungal and bacterial diseases, simple and complex digestive system insects, and the impact that plants' sugar, protein, lipid, and PSM production has upon them (KindHarvest. 2023).

by John Kempf



Lab analysis of plants to know their state, what is missing or having extra; and after they can spread if necessary nutrients.



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Sap analysis is particularly beneficial to production and yields when analyzed routinely, allowing farmers to make adjustments to amendments and additives.

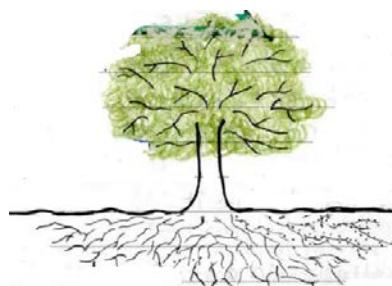
"A plant's sap pH represents the percentage of hydrogen ions in a solution or the liquid (sap) from the plant cell."

Measure the "bricks" in the plants with electromagnetic devices.

TREES

Some functions of trees:

- Pumping H₂O up and into the atmosphere.
- Reaching aquifers.
- Regulating temperatures → evaporation (=drops temperature) and condensations (increase temperature).
- Pollarding.
- Coppicing.
- Create biomass.
- Provide shade to the soil and animals.
- Root system → soil, mycelium. M.O.



- Serves as windbreak = flexed trees, dance with the wind.
- Affect soil pH.
- Habitat of animals + attracts pollinators.
- Photosynthesis (potent energy).
- Allelopathy.
- Produce oxygen (O₂) & CO₂ (soil).
- Create rain (humidifying).
- Microclimates.
- Timber.
- Dehumidifying.
- Erosion prevention.
- Biodiversity.
-

TEKU KANA TECHNIQUE

It means life in motion in the Japanese language.

It reproduces forest microorganisms in the soil and it boosts conditions 3 times faster by taking some microorganisms.

To prepare:

Mix it with easy food → sugar, husk, rice, shells, carrots, flour + water → squeeze method = 1 drop for hand squeeze.
 Compression → creation of microorganisms → enhances the nutrients of the fruit forest.
 Mix all (sugar, water, leaves, microorganisms)



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Proportions and materials:

- 1 sac of organic material = microorganisms.
- 2 sacs of rice/husk/ corn flour.
- 10 kg of sugar.
- Water.
- 100 L barrel to store it.

Can be used after 40 days, the first time.

The second time can be ready after 30 days with an initial inoculum.

After the 3rd or 4th time, it can even be eaten as a probiotic.

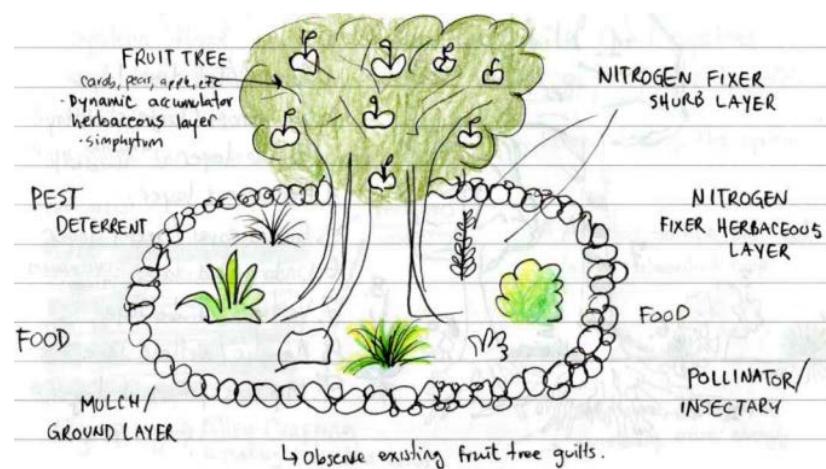


Great as a complement to food animals.

Wash the barrel well, close it well, and keep it in the shade.

FRUIT TREE GUILDS

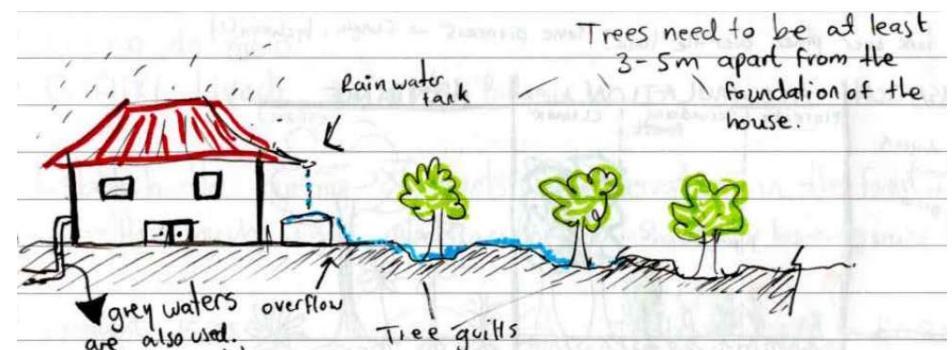
A guild is a group of plants that grow and support each other by recycling nutrients back into the soil, providing shade and conserving water, attracting beneficial insects, repelling pests and diseases, building soil, and preventing erosion.



All plants interact with each other and can cooperate and prevent diseases and plagues.

They can be watered with rainwater if designed properly. Grey water (soap, detergent, etc) can be used for edible plants.

Black waters are not used that way since they are contaminated (pollutants, poop, biological risks)



Brad Lancaster -> Rainwater harvesting for drylands and beyond (book)
<https://www.harvestingrainwater.com/>



Rainwater Harvesting for Drylands & Beyond
by Brad Lancaster



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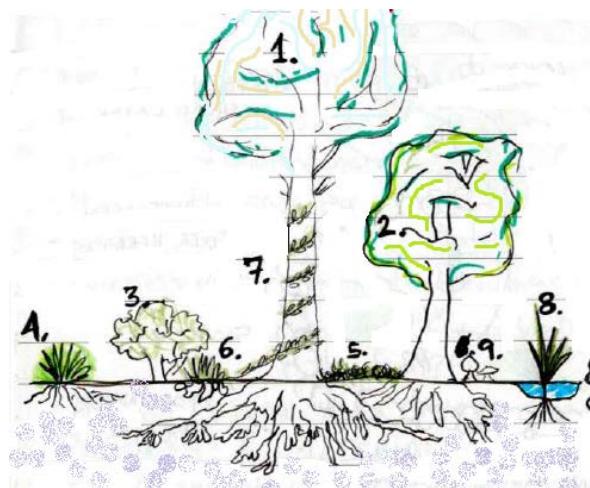
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NINE LAYERS OF THE EDIBLE FOREST GARDEN

1. Canopy/tall tree layer.
2. Sub canopy/large shrub layer.
3. Shrub layer (sambucus, hazelnut...).
4. Herbaceous layer.
5. Ground cover /creeper layer.
6. Underground layer: cyclamines, tubers.
7. Vertical/climber layer.
8. Aquatic/wetland layer.
9. Mycelial/fungal layer.

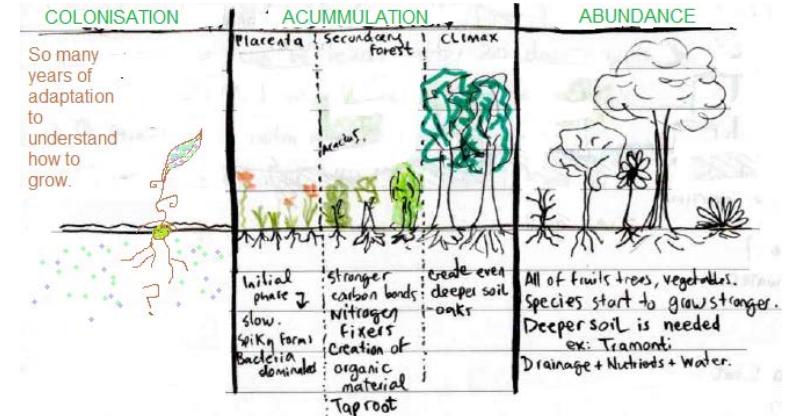


Animals can be part of the fruit forest if chosen to accord with the needs of both the plants and the animals.

NATURAL SUCCESSION

How do plants take over the place of the land? → some pioneers → fungi, lychee.

Ernst Göetch: “Use the mimicking of natural succession to create a fruit forest.”



AGROFORESTRY

A system that combines agriculture with forest systems.
To get the benefits of the trees while getting the benefits of other plants.

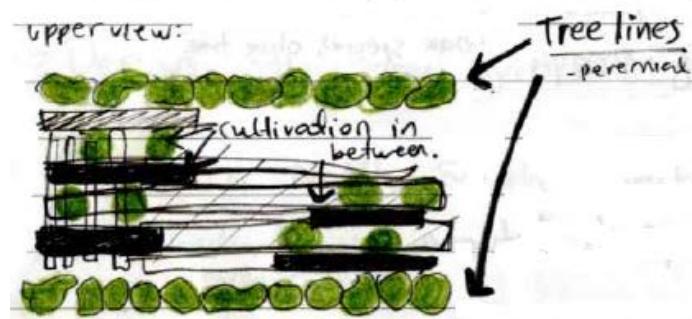
Agriculture can mean the use of animals

too



→ perennializing the system.

Attention to the Sun and to the primordial crop.





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- Check out: "Alley Cropping"--> planting trees and shrubs → Syntropia differs from Entropia. It generates more energy.

Syntropic Forest!

Philosophy originated in Brazil = natural mimicking.

Remember, life in syntropy by Ernst Götsch.

For references check out the: "quinta das abeñas", "freixo do meio" and "chiflikli livadi".

Establish the layering of plants by observation in the forest.



How much light does plants need? how to generate plant associations?.

It is important to keep in mind the design of the shade/ top layer/ ground layer/ etc.

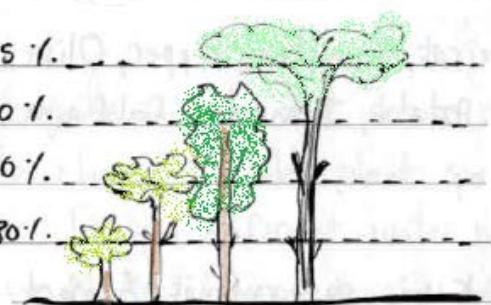
The emergent group of trees does not depend on the size of the tree but on the amount of light that is needed. ↓

Emergent: 15-25 %.

High : 30-40 %.

Medium : 40-60 %.

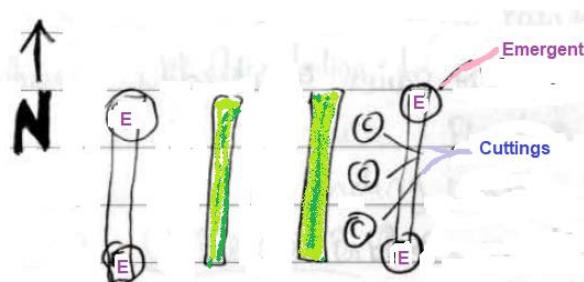
Low : 60-80 %.



This philosophy is deeply related to life cycles.

Life cycle	Duration	Example Species
Placenta 1	UP TO 6 Months	Radishes, tomatoes, corn, melons
Placenta 2	12 - 24 months	Artichoke, cabbage, garlic, onions
Secondary forest (short)	3 - 80 years	Calendula, Poplar, eucalyptus, willow, tagasaste
Secondary forest (Medium)	15 - 300 years	Blackberry, peach, Fig, grape, mulberry, citrus, apple.
Secondary forest (Long)	30 - 500 years	Cherry, pear, walnut, chestnut
Primary forest	Potentially +1000 yrs	Oak species, olive tree

- Create an association between the plants, and between the sessions.
- Prune /chops and drop when needed → grow again and feed.
- Before the pioneer species flower → prune/chope them.
- GROWTH SENESCENCE → HORMONES → 1.- activated by pruning “.- stimulate the growth of plants.



- Layers - Fruits:

Emergent: pal, oak, chestnut, cherry, walnut, pear, corn, sunflower.

Support: eucalyptus, cypress, pine, poplars, maple, cannabis, artichoke.



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High: - 40% coverage:

Fruits: apple, mulberry, apricot, eggplant, pepper, olive, mango, avocado, cardo, fig, potato, tomato, cabbage.

Medium: 60% coverage:

Fruits: citrus, plums, peach, kiwi, passion fruit, almond, wine, dragon fruit, basil, beans, kiwi, strawberry, lettuce, beetroot.

Low: -80 % coverage.

Fruits: pomegranate, pistachio, hazelnut, blueberry, currants, asparagus, sambucus, physalis, pumpkin.

Ground cover:

Fruits: strawberry, thyme, purslane, sweet potato, cyclamimn, carobrotus.



Source Google image. Public Domain.

Design with some syntropic principles!

Plant in North-South orientation
(instead of doing some contour work) → plants know what to do; so they can take the bigger amount of Sun.

CLIMATE

Climate is the long-term weather pattern area, scale around 30 years long"

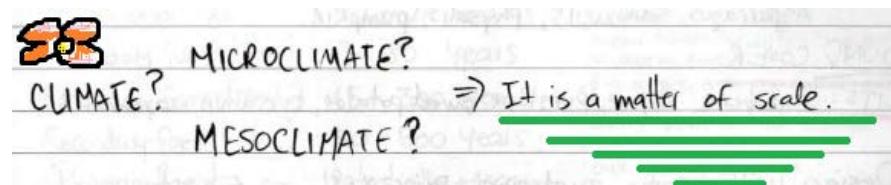
The main difference between climate and weather is duration
Weather is a set of conditions in the atmosphere in one location for a short period of time"

Why is the climate important in a Permaculture design?

It allows to:

- Choose suitable plant species
- Design efficient water management systems
- Make informed decisions about planting seasons and irrigation strategies
- Design efficient systems and buildings that align with the natural rhythms of the place
- Choose proper ways of harvesting

Scale of permanence → climate is the basis of the scale; we have to design according to it.





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Distance → distance from the sea and big lakes affect the humidity from water bodies.

Meteorological variables describe the weather conditions.

- Radiation - Condensation - Temperature - Humidity - Atmospheric pressure -Wind - Precipitation -Cloud cover - Evapotranspiration.

Radiation → Incoming sunlight to the earth varies considerably depending on the latitude.

Wind → Global air currents and climate = patterns of wind-
Global atmospheric circulation.
(Connection) (Turbulences).

Atmospheric → Low pressure = turbulent weather
High pressure = calm weather.

Climate factor → terrestrial factors influencing the weather =
latitude, longitude, sea currents, topography, plants altitude.

Altitude → for every 10 m up, temperature decreases 1 ° C =
change in pressure.

Topography → relief = affects temperature, humidity, rain, and snowfall.

Soil → type (clay, humus, dark rock) affects temperature.



KOPPEN CLIMATE CLASSIFICATION (5 climate zones):

- Zone A: Tropical climate - 3 subzones.
- Zone B: Dry climate - 9 subzones.
- Zone C: Temperate climate.
- Zone D: Continental climate.
- Zone E: Polar & alpine climate.

A: Rain > evaporation > huge biomass.
Growth & decomposition.
Nutrients stored in plants & trees.
Erosion due to rainfall.
Orientation to prevailing wind (not sure).
Tree houses -floating.
No standing water.

Ex: Chinampas (Mexican technique) -> peninsulas created by dredging high nutrient material from the bottom of a pond, swamp or lake to grow water loving crops in wet places.



About chinampas:

https://www.youtube.com/watch?v=86gyW0vUmVs&pp=ugMI_CgJlcxABGAHKBQIjaGluYW1wYXM%3D

B: Rain + condensation < evaporation.

Construction according to seasons.

Prevail passive winds.

Plants survive using reduced transpiration.

CLIMATE CHANGE

It has so many causes, like the large concentration of greenhouse gases, the disruption of water currents due to temperature changes, the wind currents (like the turbulences), the hot winters, few rain.

Some of its effects are ice melting, sea level rising, lost of biodiversity, catastrophic events (floods, droughts, tornados, hurricanes, spread of diseases).

IMPLEMENTATION OF AN AGROFORESTRY SYSTEM

Hybrid design with 2 lines, 3 m apart from each other, every dor75 cm. Green color are the queen species, and red species are the support → come planted in the same hole; irrigation each 22 cm.

GREEN PATHS

The Road to Regenerative Living



Erasmus+



Agenzia Italiana
per la Gioventù

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