Natural garden – nature in the garden

Ecological and natural horticulture

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Quote: "The *only ethical decision* is to take responsibility for our own existence and that of our children." Bill Mollison, inventor of permaculture

Age: 12-14

Age for adaptation: high school

Duration:
- **preparation:** 60'
- **activity:** 2x45' + 75' indoor and a few hours outdoor

Key competences:
- **mother tongue**
- **sciences**
- **social competences**
- **initiatives and entrepreneur competencies**

Subjects: geography, biology, technics

Key words: bio-product, kitchen garden, composting, organic farming, permaculture

Summary of activities

Number	Title	Method	Duration	Forms of works	Location
I. lesson 1. activity	Advantages of bio-gardening	directed conversation	10'	big group (class)	indoor
2. activity	My bio garden	planning, drawing, discussion	35'	smaller groups	indoor
II. lesson 3. activity	Where does compost grow?	directed conversation	5'	big group (class)	indoor
4. activity	What can we throw in?	knowledge test, discussion	15'	smaller groups	indoor
5. activity	Life of the compost bin	drama, discussion	25'	big group (class)	indoor
III. lesson 6. activity	Mother nature as a gardener	directed conversation	10'	big group (class)	indoor
7. activity	Components of permaculture	sorting exercise, discussion	20'	smaller groups	indoor
8. activity	Relations from the kitchen garden	relation analysis	15'	big group (class)	indoor
9. activity	Permaculture in the school	planning, discussion	30'	smaller groups	indoor
10. activity	Build it! (implementation of the project)	building, constructing, planting	a few hours	big group (class)	outdoor

3. OUTLINE OF THE MODULE:

Summary
We draw the problems of intensive agriculture, and get familiar with the advantages of organic farming, the construction of organic gardens and with the communication between plants. We plan our own organic garden. We get to know the advantages of composting, what to compost and what to not. We get familiar with the principles of permaculture, with its components, techniques, and we plan a small school garden based on these principles.

Goals
The primary goal of the module is to give knowledge about organic gardening, composting and permaculture. However, more important is to see the global effect and relations of close to nature farming, and its opportunities in our own lives. The goal of the module is to change the attitude of students, and increase their emotional insistence towards a small scaled and sustainable agriculture. They would prefer to buy healthier organic food. They would mind to grow own plants in their gardens, and taste the happiness of growing their own crop.

Tools and materials

I. lesson:
1. activity:
Printed or projected picture pair about a monoculture field and an organic garden.
2. activity:
4 large poster papers or brown papers. Coloured markers.
Printed or projected pictures about some nice and creative organic gardens.

III. lesson
7. activity:
Printed or projected pictures from permaculture farms, farm plans, and from the components of the permaculture.
9. activity:
4 large poster papers or brown papers. Coloured markers.
Printed or projected pictures from small, self-working plant growing solutions (see: activity 9.).

Preparations
2. activity: Copy 4 pieces from the ‘My bio garden’ table.
4. activity: Copy 4 pieces from the ‘What can we throw in’ table from Student’s page. Cut the tables to slips and pin together.
7. activity: Copy the agriculture components in 4 pieces, cut them to lines, shuffle them and pin them together.

Arranging place
Arrange classroom so that students could work together in 4 groups.

Connection points
All of us eat vegetables. Where do these grow? Are they healthy? are their production is sustainable and nature friendly? Who has a kitchen garden at home? What does grow in it? how does it tastes? Why does your relative like to work in the garden?

Background materials
Organic gardens:
During traditional monoculture farming we cannot avoid the usage of pesticides and chemical fertilizers. These chemicals poison our soils and waters, and are also dangerous for our health. Organic farmers do not use any synthetic and non-biodegradable chemicals.
Plants growing next to each other have various relationships. These can be simple competition for light or nutrients, which effects on the size of the plant, or its fruit. Allelopathy is the specific biochemical effect of a plant species to an other one. Biochemical materials produced of a population facilitates or retards the growth of the other one, or repels their pests. We use this phenomenon in mixed plant cultures.

In a mixed culture garden we plant different species in each rows, food, spice, herb and bedding plants are combined. To let plant relations act, rows should be half meter to each other. When choosing the species, we have to consider the plant relationships, the height of the plants and their breeding season. We divided the vegetables to A, B and C types according to height and breeding season (see Student's page). In type A there are main cultures, which grow from May to fall and/or are high. In type there are B moderate height and/or moderate breeding length plants. In type C there are small and/or short breeding species. The sequence of the rows should be A –C – B – C – A, so two main cultures are from 2 meters from each other, and a moderate demand culture is in the middle. Next to the main cultures we can plant small or short breeding cultures to support the growing of main cultures. They will be harvested soon to not compete with them. We can plan mixed rows also, with e.g. salad-radish or cauliflower-celery.

Composting:
Composting is an important component of organic gardening, by which we can provide organic nutrient support for the plants. During composting the biodegradation of raw plant waste occurs in well aerated conditions. The final product of composting is compost, a black or dark brown, loose, humus rich soil like material. If larger amount of plant waste is deposited in the compost bin, the following process occurs:
In the initial phase microorganisms (mesophilic bacteria) start the decomposition of materials; this increases the temperature of the hill.
In the thermal base temperature rises up to 60 °C. At this temperature only thermophilic gram positive spored bacteria and actinomycetes are active. Easily degradable materials, like sugars, starch, lipids and proteins are decomposed. Hardly degradable cellulose remains, temperature starts to decrease.
In the cooling phase fungi grow in the hill, and decompose cellulose. Mesophilic bacteria from the initial phase become active again. This phase lasts for a few weeks.
The final phase is maturation. The formation of complex aromatic humic acids occurs, which, joining with clay minerals, from the humus. Humus provides the loose structure of compost, and the nutrient storage. In this phase species of macrofauna colonises the compost hill (earth worms, nematodes, ants, millipedes, springtails); they take part in the mixing of the material. This phase takes some month or a half year. After that, compost can be dig out from the bottom of the compost bin. Compost bins should therefore have one side, which can be opened.
If larger amount of boiled food is deposited in the compost, the fast decomposition of easily degradable cooked material starts. The intensive biodegradation causes the lack of oxygen and anaerobic processes. Fermenting bacteria produce fermentation gases (ammonia, methane), and the compost hill becomes stinky. This attracts flies and maggots.
From what wastes can we get rid of on the compost hill? Unnecessary kitchen waste, raw food waste, green waste from the garden (cut grass, cut twigs, fallen leaf). We can forget leaf burning.
What is compost good for? Natural soil fertilizer. Improves soil structure, reduces soil drying, plant nutrients can be taken up optimally and for a long time, good nutrient source.

Permaculture:
Permaculture (permanent agriculture) means the planning and operation of agricultural systems, which achieve the diversity, stability and resiliency of natural ecosystems. Permacultures simulate the ecological processes of ecosystems, create synergy among its components, and minimises waste production, energy needs and human work resources. Permacultures are bio and chemical free. One principle of plant raising is the species rich, and habitat diverse plantation of mixed cultures (agroforestry, orchard with landraces, mixed kitchen garden, crop rotation). Pests are minimised by natural enemies (birds), for which diverse habitats are provided. Species richness is increased by smaller or larger ponds with diverse plant and animal species. Plants are sprayed with boiled or fermented solutions of herbs (nettle, comfrey). Poultry scratch freely in the garden; they eat pests and manure plants. Waste production is minimal; fertilization is made with manure and compost, wastewater is handled in root zone wastewater treatments. Buildings utilize renewable energy sources (solar cells, wind generator, shading with trees, orientation, earth roof). Water supply is provided by rainwater collection and driven well; watering is performed by little human work (self-irrigation systems, wicking beds, gutters, rain garden). Components are located in zones around the house: Zone 1 is for kitchen garden, compost bin, raised beds, intensively cultivated area. Trees for shading are here. In zone 2 there is agroforestry and less care plants. In zone 3 there are orchards and crop fields. In zone 4 there are trees for wood production, and grazing livestock. Zone 5 is a marginal part with unattended nature. Well established permaculture is able for self-maintenance with moderate human work, it produces small amounts from several kind of products.

Implementation

I. lesson: Organic garden at home

1. activity: Advantages of bio gardening (10')

Let us talk about the following questions: How vegetables in the supermarkets are produced? What are the disadvantages of monoculture production? Who has a kitchen garden at home?
What is an organic product? How is it produced? Is it good for the soil? For the wildlife? For us?
In a bio garden there are several plant species. Can plants communicate? Any plant can planted next to any other? Let us introduce allelopathy. Let us show or project a picture pair from a monoculture field and an organic garden.

2. activity: My bio garden (35')

Divide the class into four smaller groups.
Ask students to plan an organic garden, in which they do not use any chemicals. The garden can be a project for a future school garden; in this case give the shape and size of the garden area. If there is school garden already, they can plan a garden for their home. Give them a copy from Student's page table. Let them choose, what plants they want to grow, how many rows, and in what sequence do they plant. Introduce A, B and C rows, mention some important plant interactions. Draw the garden plan on poster or brown papers. Ask them to make a side view also, to imagine the height of plants. Take care about orientation, where is South? For ideas, show them some printed or projected pictures from nice and creative organic gardens. Discuss the ready plans. Which plants did they choose? How long will their garden be green during the years? Did they use bedding plants? Did they use compost bin? Which plan is the best?

II. lecture: Secrets of our compost bin

3. activity: Where does compost grow? (5')

Discuss the following questions with the students: What is compost? How to produce it? Why is composting good? From what can we get rid of in compost? What can we do with the final product: the compost material? (see: Background)

4.activity: What can we throw in? (15')

Divide the class into four smaller groups.
Dispense the paper slips cut from the Student's page. Ask them to take a paper, divide it in the middle, and write these titles on the two sides: TO THE COMPOST, NO COMPOST. Is the given thing compostable? They should put the paper slips on the appropriate side. If they are ready, let us check: Each group can choose one thing, and say, whether is compostable or not. The paper slip of already mention things should be turned down. (answers on Teacher's page)

5.activity: Life of the compost bin (25')

The challenge of the class will be to play an extempore drama from the production of a compost bin and its life. The scenario is on the Teacher's page.
At the extempore drama the teacher should be the Narrator. If we have more time, we can copy the scenario, give to the students, and let them to prepare. Let us divide the persons in advance, students should raise on each persons.
In the extemporary form let us read the first scene to the class. Persons should impersonate animals, objects – what should it think in the situation? Persons should play the scene, speak and show. After this, let us read the following scene. Now, they should play this.
At the end, discuss the experiences, and processes that hinder composting.

III. lesson: Back to nature - permaculture

6. activity: Mother nature as a gardener (10')

Ask students: Does nature need chemical fertilizers? Spraying and pesticide killing? How these thinks work in a natural community?
Tell them that there is an agricultural form, called permaculture, which simulates the working of natural ecosystems. Let us mention some components, e.g. chicken hunt for pests in the garden, while they mould the plants; watering is made from collected rainwater and drainage on the area. Then read the principles of permaculture from David Holmgren from the Teacher's page. Discuss, which principle means what in practice?

7. activity: Components of permaculture (20')
Divide the class into four smaller groups.
Which is permaculture, and which not? For introduction, let us show or project some pictures about permaculture farms, and components of the permaculture. Let us copy, cut, shuffle and dispense the component descriptions from the Student's page. They should read them, and select, what can be in a permaculture and what not? Selected components should be ordered on their table. Go around: each group can say one element. Discuss it briefly – what is the use of? Then everybody should turn this slip of paper down. At the end, let's identify the components on the pictures!

8. activity: Relations from the kitchen garden (15')
What relationships can we reveal in the topics of close to nature agriculture and sustainability? Let us write on the two sides of the blackboard: Sustainable and Non sustainable. Now, read the keywords below for the class, one by one. Students will say sustainable, or not. Property markers should be written in the middle. If all keywords are on, try to find relationships between them. Show them with arrows, and +/- signals. An arrangement example is on the Teacher's site.
Keywords: organic garden, intensive agriculture, pesticide-free, soil and water pollution, manure, chemical fertilizer, composting, species richness, ecological stability, biological interactions, carbon footprint, permaculture, bulk crop, happiness of planting, estrangement from food and nature, mixed culture, monoculture, local products, gene modified organisms, farmers market, multinational supermarkets, healthy food, food sovereignty

9. activity: Permaculture in the school (30')
Divide the class into four smaller groups.
We cannot make a self-sustainable farm in the school. But we can plan a small garden based on the permaculture view! Let us plan a complex and self-working ecological system to a particular place of the school. Plan according to our facilities. This can be: Large indoor terrarium, a green corner in the school hall or flight of stairs, indoor hanging garden along the stairs, balcony box garden in outdoor windows and stairs, flower box or raised bed on the concrete ground, outdoor garden in the school corner, kitchen garden in the school ground, rain garden near the gutter, hügelkultur.
Let us try to incorporate as much as possible from the following elements: mixed culture with different plants, different breeding lengths, self-watering systems (watering wick, plant irrigator, wicking bed), compost or manure starting, compost supplement, recycling of produced biomass directly into the pottery or by external composting, settlement of soil animals (we can make soil observed window), hiding place for animals (insects, birds), reused material in the construction (PET flask, plastic dishes, hand-basins, paint buckets…). For ideas, show pictures from such small scaled solutions for the students.

10. activity: Build it! (project implementation, half day)
It is time to work after planning! Let us implement the followings according to our facilities:
1. Build a compost bin on the school ground. Let us support the selective collection of compostable food remainings in the classrooms. Assign responsible students, who empty the selective dustbins to the compost bin.
2. Build the permacultural view, self-working green corner/garden that you planned in activity 9!
3. If you do not have a school garden yet, do it now! Build the organic garden planned in activity 2 during spring. Work out the maintenance system, divide the duties. It should not be a weed plantation in a month!

Sources, literature

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4. STUDENT'S PAGE

2. activity. Main characteristics and relationships of some vegetable species

height	m h	m	m	l	b	l	l	m	l	h	m	h	l	l	l	l	l	b	m	l	m
breeding time	l	s	l	m	l	m	m s	m l	s m	l	l	l	m l	s	s	m l	s l	l	l	l	m
row type	A	B C	A	B C	A	B C	B C	A B	B C	A	A	A	B C	C	C	B C	B C	A	A	B	B
	bean	**peas**	**potato**	**red beat**	**zucchini**	**garlic**	**onion**	**brassicas**	**kohlrabi**	**corn**	**paprika**	**tomato**	**parsley**	**radish**	**salad**	**carrot**	**spinach**	**marrow**	**cucumber**	**celery**	**green beans**
bean		-	+		+	-	-	+	+	+		+		+	+		+		+		
peas			-		+	-	-	+	+	+		-		+	+	+	+		+	+	-
potato				-				+	+	+		-					+			-	+
red beat					+	+	+	+	+	-		+			+		-		+		+
zucchini							+			+											
garlic								-	-			+				+			+		-
onion								-				+			+	+			+		-
brassicas												+		+	+		+		+	+	+
kohlrabi												+		+	+		+			+	+
corn												+			+			+	+	-	
paprika																					
tomato													+	+	+	+	+		-	+	+
parsley															-						
radish															+	+	+		-		
salad																+			+	-	+
carrot																					
spinach																				+	
marrow																					
cucumber																				+	+
celery																					+
green beans																					

Legends: Height: h - high, m - moderate, l - low, b - big space requirement
Breeding time: l - long breeding time, m - medium breeding time, s - short breeding time
+: favourable neighbourship, -: unfavourable neighbourship. Coloured relationships are particularly significant.

Some important relations:
- Garlic protects against fungal diseases, voles and snails.
- Carrots together with dill are healthier.
- Spices and herbs (camomile, coriander, caraway) improves the flavour of brassicas.
- Green beans together with savory are protected against black aphis.
- Chervil protects salads from oidium.
- Basil protects cucumber and zucchini from oidium.
- Borage and parsnip loosens soil.
- Marigold and tagetes repels nematodes.

- Spinach repels flea beetles.
- Onion and carrot repels mutually onion flies and carrot flies.
- Celery repels cabbage flies.
- Radish and salad planted together are protected against flea beetles.
- Paprika does not like other plants. Plant it alone!

4. activity: What can we throw in the compost bin?

Plastic bag	Tired oil	Snotty napkin
Potato peel	Soup remnant	Rotten vegetables and fruits
Orange peel	Thin bones, fishbone	Brown rot fruits
Cut grass	Mouldy bread	Wood ash
Fallen leaves	Cigarette stub	Meat cut
Twigs	Apple-core	Seedy weeds
Cooked potatoes	Used table napkin	Coloured magazines

7. activity
Components of permaculture:

Agroforestry: Intensively cultivated part, where shade tolerant vegetables are planted together with demanding fruit trees, berries, herbs, melliferous bushes. This three level association provides appropriate ecological relationships (microclimate effects, nutrient rotation, pest - enemy equilibrium). Sunlight utilisation of the three level association is better, crop is larger.

Vegetable garden/kitchen garden: Some vegetables and herbs require full sunlight. These are planted on the southern side of the house, close to it.

Crop rotation fields: In a period of 4-5 years, different species are planted on the same field from year to year. Advantages: Different plants utilise soil nutrients in a different way. Weed killing and weed growing plants can be alternated. Pests cannot proliferate seriously.

Orchard with landraces: Various species of locally adapted landraces are planted to get a diverse, and well adapted orchard. The orchard is grassy, poultry is let in to manure, it contains hide places for birds and insectivorous mammals.

Tyre pond: This is a small pond, which can be formed in a tractor tyre. Its main role is to increase the diversity of vegetable gardens and agroforestries to increase the stability of the ecosystem. Several predators find habitats here (frogs, dragonflies), which are pest enemies. May-flies and mosquitoes are food for birds.

Chick-yard: Besides meat production, chickens have other important roles, like weed control, soil loosening, pest clearing and manure. A portion of their feed is produced by the garden (berries, insects, weed seeds, green plants). They are let in the agroforestries, orchards and pasture.

Policultural lake: In policultural lakes we create a natural-like wetland, with several benefits: Edible and basketwork plants, different fish species, crayfish, waterfowls, frogs or turtles to eat. Moreover, such community has a very nice aesthetic value.

Root zone water treatment plants : A shallow, insulated bed filled with porous material (road metal, pebbles, sand), which is planted with reed. It has a slow wastewater inflow. The bacterial biomass is 100x more on the root surface of the reed, than in the surrounding, so it effectively decomposes the dissolved organic matter.

Rainwater collection, driven well: Sprinkle water is collected from rainwater on the roofs, or from local driven well.

Rain garden: Rain water is directed into already present or artificial depressions and infiltrates here. These water rich places are planted with water demanding species and flowers. It is not necessary to sprinkle.

Water channels: On sloping terrain, rain water can be directed to drier areas by water channels, or rain water can be held on an area.

Compost hill, manure: Plant and animal fertilizers are used.

Spraying with herbal solutions: Plants are sprayed with boiled or fermented solutions of herbs (nettle, comfrey, tobacco).

Mulching: Mulch is a protective cover placed over the soil. Any material can be used as mulch, like stones, leaves, cardboard, wood chips, gravel, though in permaculture mulches of organic material are the most common because they perform more functions. These include: absorbing rainfall, reducing evaporation, providing nutrients, increasing organic matter in the soil, feeding and creating habitat for soil organisms, suppressing weed growth and seed germination, moderating diurnal temperature swings, protecting against frost, and reducing erosion.

Orientation, shading: Properly oriented houses benefit much from sunlight heating. Natural shadings are deciduous trees, natural insulation can be earth roofs.

Self-watering wicking beds: We put insulation layer on the bottom of a raised bed. Larger stones and porous material is put in the bed, then geotextile layer, and the soil with the plants. The wicking bed can be watered by a water pipe, we can fill the porous layer completely with water. There is an overflow at the geotextile layer. Wicking beds prove watering for a long time, without refilling.

Hügelkultur: These are raised, hill-like beds, which contain organic debris, wood, and compost in their core. They retain water well, they are often watered by drain pipes. They are planted with mixed cultures and mulched. Its advantages are the water retention capacity, perfect soil, increased planting area, mixed cultures and good yields.

Self-watering potteries: Self-watering systems can be made in small scale. Examples: Self-watering balcony. Plant irrigator: We push a glass or flask upside down with its neck into the soil of the plant. The neck is closed, only small holes let the water out. Water ooze slowly from the bottle. Watering wick: We put a watering bottle near the pottery. The watering wick comes from the bottle, and spirals a circle in the upper soil of out plant in the pottery. The wick suck out water and pass it to the soil of our plant.

Components of intensive agriculture:

Fish farming: We cultivate 1-2 fish species in a pond or pond section. They are fed daily with fodder or slaughter waste.

Chemical fertilizers: For nutrient supplement, inorganic nutrient salts are spread on the field.

Pest spraying: To clean pests we spray chemical agents on the plants.

Herbicides: Growing weeds are killed efficiently with chemicals, to which our crop is not sensitive.

Monoculture farming: Only one plant species is grown on one agricultural field. Seeding, handling and harvesting can be done fast, and efficiently.

Intensive livestock: To reach big yields, animals are kept in stables or cages, and fed with special calorie rich food.

Antibiotics in livestock: Against diseases during intensive livestock farming, antibiotic injections are given to animals.

5. TEACHER'S PAGE

4. activity answers:
We can throw in compost: Snotty napkin, Potato peel, Rotten vegetables and fruits, Thin bones, fishbone, Cut grass, Mouldy bread, Wood ash (little), Fallen leaves, Twigs, Apple-core, Used table napkin.

5. activity: Life of the compost bin. Drama.

Persona (25 students): Narrator, Farmer, Friend, Guest, Compost bin, Wastes (Raw vegetable, Cut grass, Goulash, Plastic cup, Colour magazine), Bacteria (2 students), Fungi (2 students), Earth worm, Nematode, Millipede, Clay minerals (3 students), humic acid (min. 5 students). Other students can be further humic acids. Narrator reads the scene before each scenes.

Scenario:
1. Friend talks to Farmer about his own compost bin. It works very well. Farmer becomes interested, and asks the Friend to build one in the Farmer's garden. They take wood stuff, saw, and make the cubic frame of the bin. The bottom is free, one side is openable. They clinch up the side boards. Farmer thanks, Friend leaves.
2. The Compost bin starts to speak, he is happy to be born. Later he cries and shames that he is empty. After grass cut, Farmer takes the first Wastes to the bin: Cut grass and Raw vegetables. Compost bin is very happy, he is full. Life starts in his stomach!
3. Bacteria starts to eat and grow, Fungi similarly. Narrator says that temperature is increasing. One mesophilic Bacterium starts to sweat, then dies and go away. The other spored Bacterium becomes happy and starts to grow. The dead bacterium comes back to the scene as a spored one. Thwo fungi play the same: The dry-rot Fungi dies out, the actinomycetes Fungi grows. Narrator comments that everything goes well, Compost bin enjoys the warm.
4. Guest throws a disposable Plastic cup to the compost. Compost bin shames, Plastic cup cries: he would have gone to the selective container to become a polar pullover instead. Guest throws a Coloured magazine to the bin. Compost bin shames, Coloured magazine cries: he would have gone to the selective container to become recycled paper again. Fortunately Farmer comes, and takes the extraneous elements out. Everybody lighten.
5. Guest takes a half kettle Goulash on the bin. Compost bin starts to worry seriously. This food will spoil his stomach! One Bacterium becomes very happy. He dances in happiness, than starts to gobble and grow. Chews the goulash. Narrator tells that oxygen disappeared, and this is an anaerobic fermenting Bacterium. Bacterium starts to emit stinky ammonium gases. Compost bin feels very bad, his stomach is aching, sniffs at the smell. Fortunately Farmer also feels the smell, and comes, stirs up the compost, and puts straw in it. Compost bin keeps calm, Narrator says that everything is all right now.
6. In two month Bacteria and Fungi are very satisfied. Earth worm, Nematode and Millipede appears. They praise the compost, stir, and enjoy.
7. In six month big event is coming! Humic acids born, say hello, and are happy. They stand to the middle of the compost bin, starts to talk, touches each others hand. Then they stand up to longer chains. Clay minerals also say hello, but with less emotion. Humic acids surround clay minerals, cross-bond each other, and make a huge complex. Now everybody is shouting happily. Humus has born, compost is ready! They raise up their hands. Finally they become quiet.
8. Farmer appears to this big sound. He fondles the Compost bin, then takes out one side of it, digs the compost out, brings it to the plant beds and spreads it on the field.
- the end -

6. activity: Principles of permaculture according to David Holmgren

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
11. Use edges and value the marginal
12. Creatively use and respond to change

8. activity: Relations from the kitchen garden

Sustainable		**Non sustainable**
organic garden		intensive agriculture
pesticide-free	↔	soil and water pollution
manure	↔	chemical fertilizer
composting		
high	species richness	low
high	ecological stability	low
many	biological interactions	few
small	carbon footprint	large
permaculture	↔	bulk crop
happiness of planting	↔	estrangement from food and nature
mixed culture	↔	monoculture
local products		gene modified organisms
farmers market	↔	multinational supermarkets
healthy food		
food sovereignty		