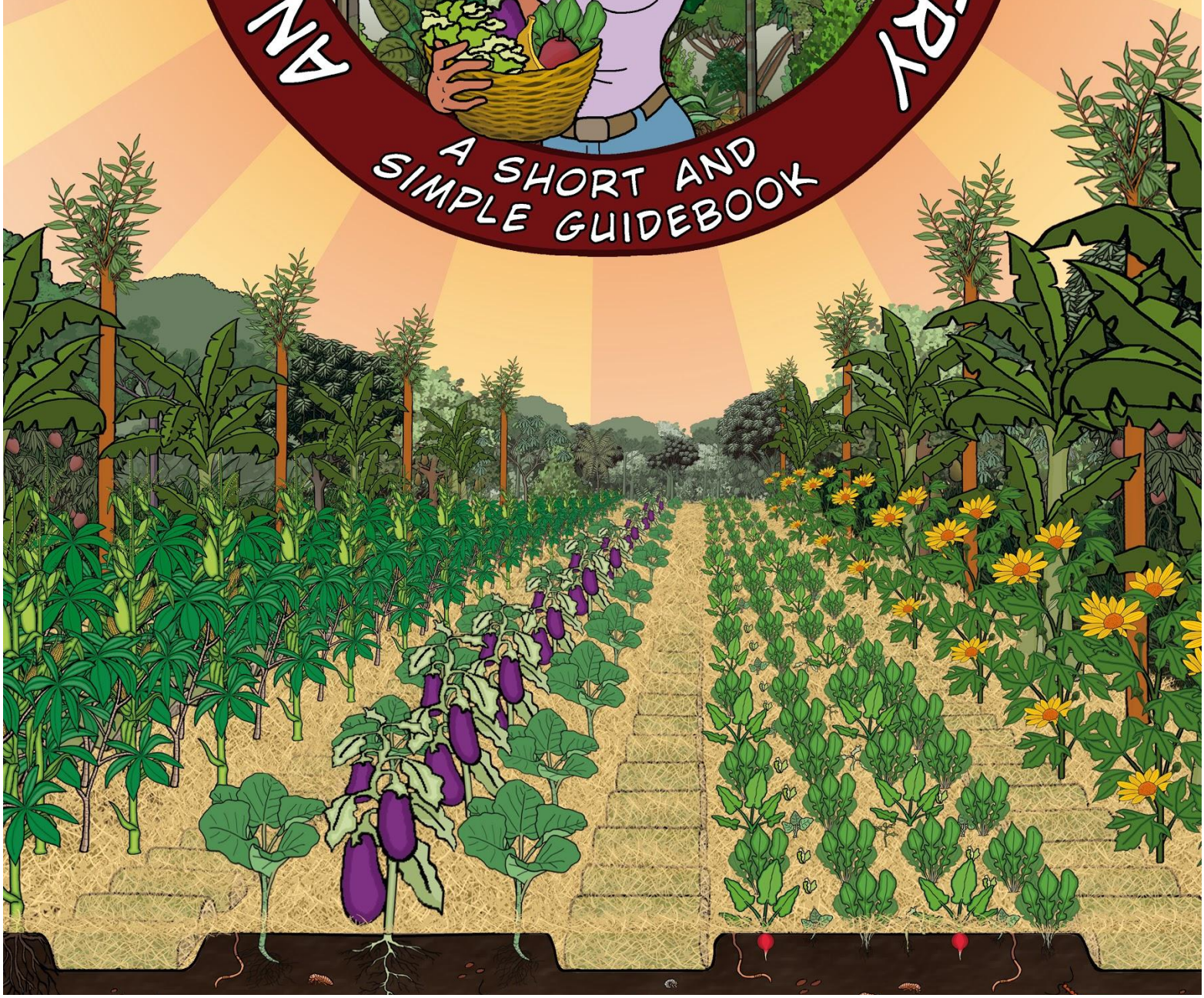
Beta version 0.1

An Illustrated Guide to Agroforestry

A short and simple guidebook



An illustrated guide to agroforestry

A short and simple guidebook

Organization

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Greetings!

On the following pages we will introduce you to forest farming. Our intention with this manual in the form of a comic book is to teach and create the joy. With the motto "for every drawing a seed" we present in a simple and objective way the first steps towards a way to grow food while at the same time taking care of the environment.

Many have helped and inspired us during our journey to create this manual. To you who participated in it, we leave our gratitude and admiration. In particular Fabiana, which gave us a super support on some technical problems. A big thank you also to our most important references:

Master Ernst Göstch: We honor you. Thank you for dedicating your life to forest farming and for having developed a stratified succession method. We have tried to explain it in a simple way, but as easier than we would like in this manual. Undoubtedly, your life and work is a great influence for us.

And to our dear Peter Webb, whose way of caring for people through the forest fascinates and teaches us so much. We are grateful that you have presented forestry farming in such a poetic and regenerative way.

Finally, we hope that this reading will awaken in you, the reader, the desire to reintegrate into a planet whose agriculture is expressed in the same shapes and patterns that nature uses.

We wish you an educational and fun experience,

João & César

Bora Permaculturar

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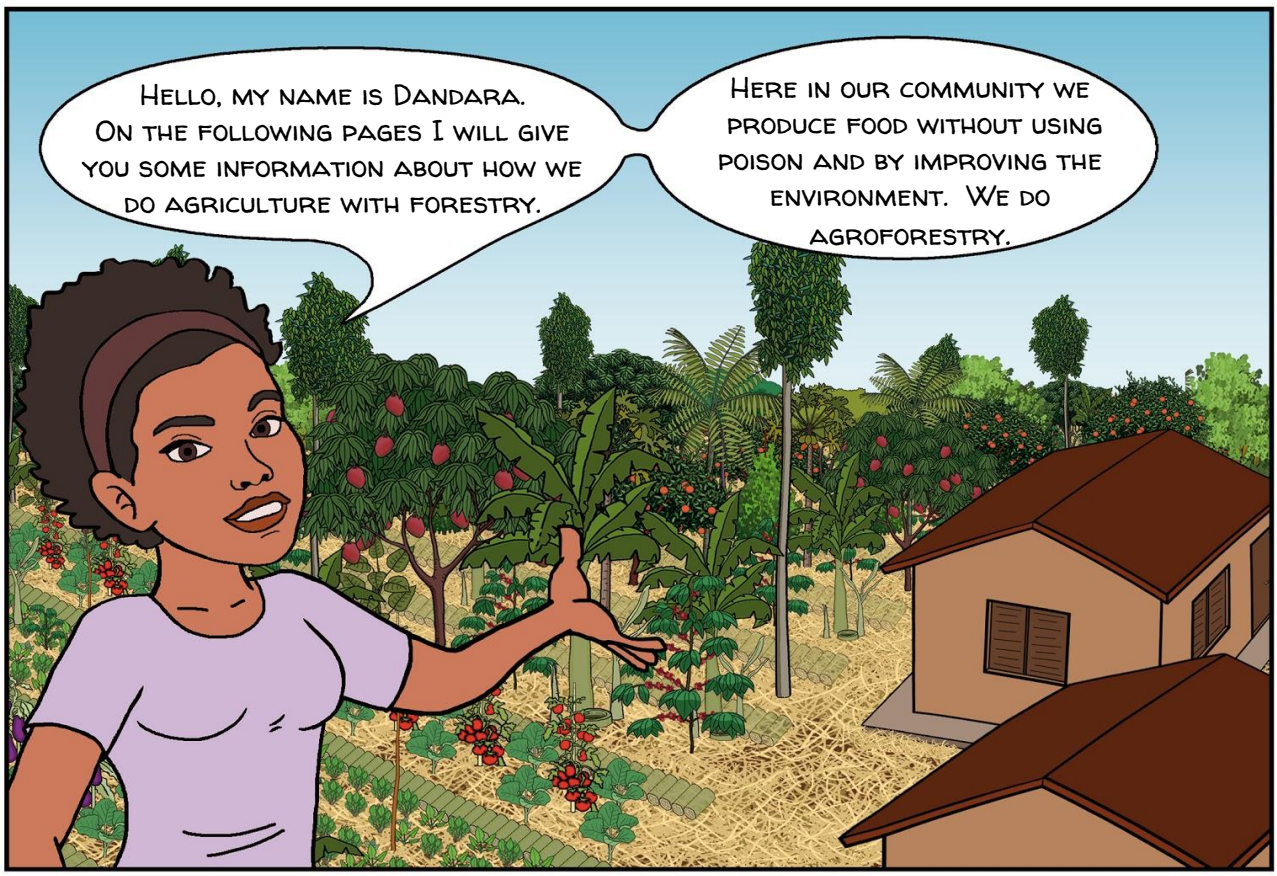
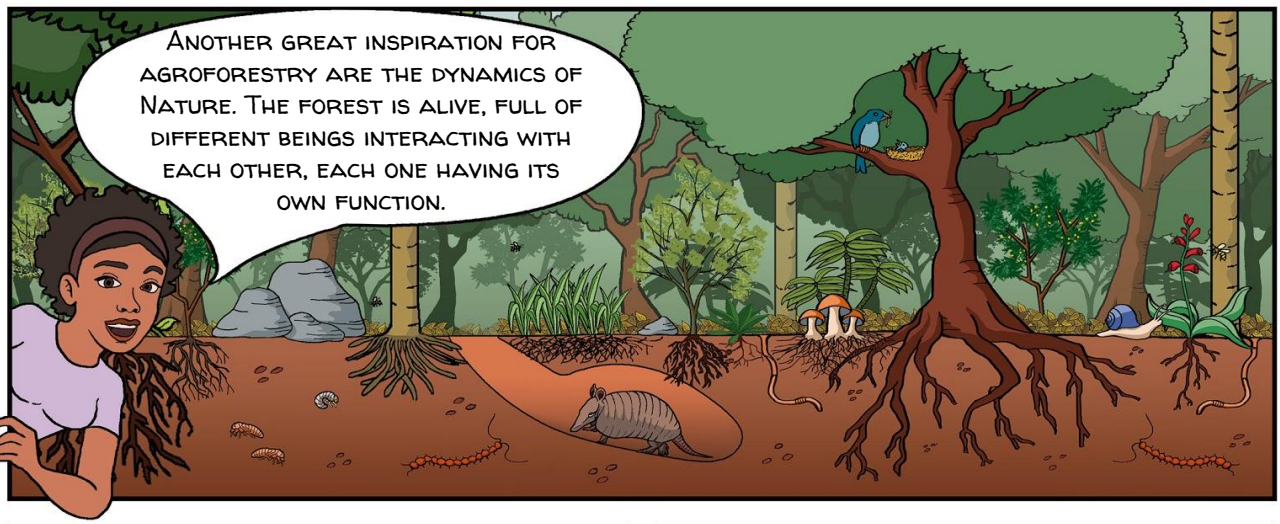
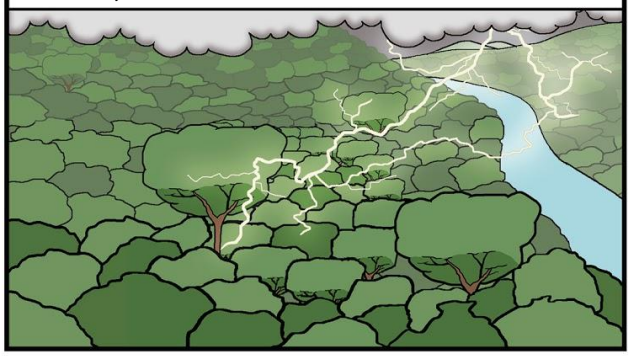


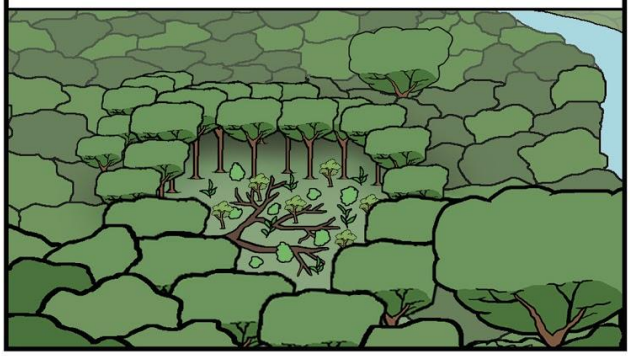
PRODUCING FOOD IN THE FORESTS IS AN ANCIENT TRADITION THAT WAS PRACTICED IN SOUTH AMERICA LONG BEFORE THE EUROPEAN OCCUPATION. THIS TRADITIONAL PRACTICE OF PRODUCING FOOD TURNED THE LAND INTO A CONTINUOUS FOREST–AGRICULTURE AREA. THIS POSSIBILITY TO LIVE WITH AND FROM THE FOREST IS ONE OF THE INSPIRATIONS OF AGROFORESTRY.



For example, if a clearing in the forest is opened, the environment changes...

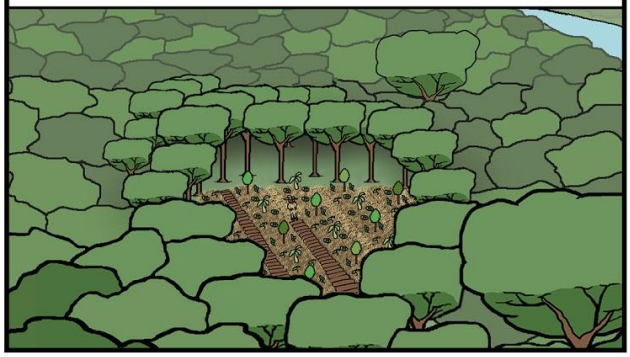


and new interactions between the living beings that live there begin to happen.

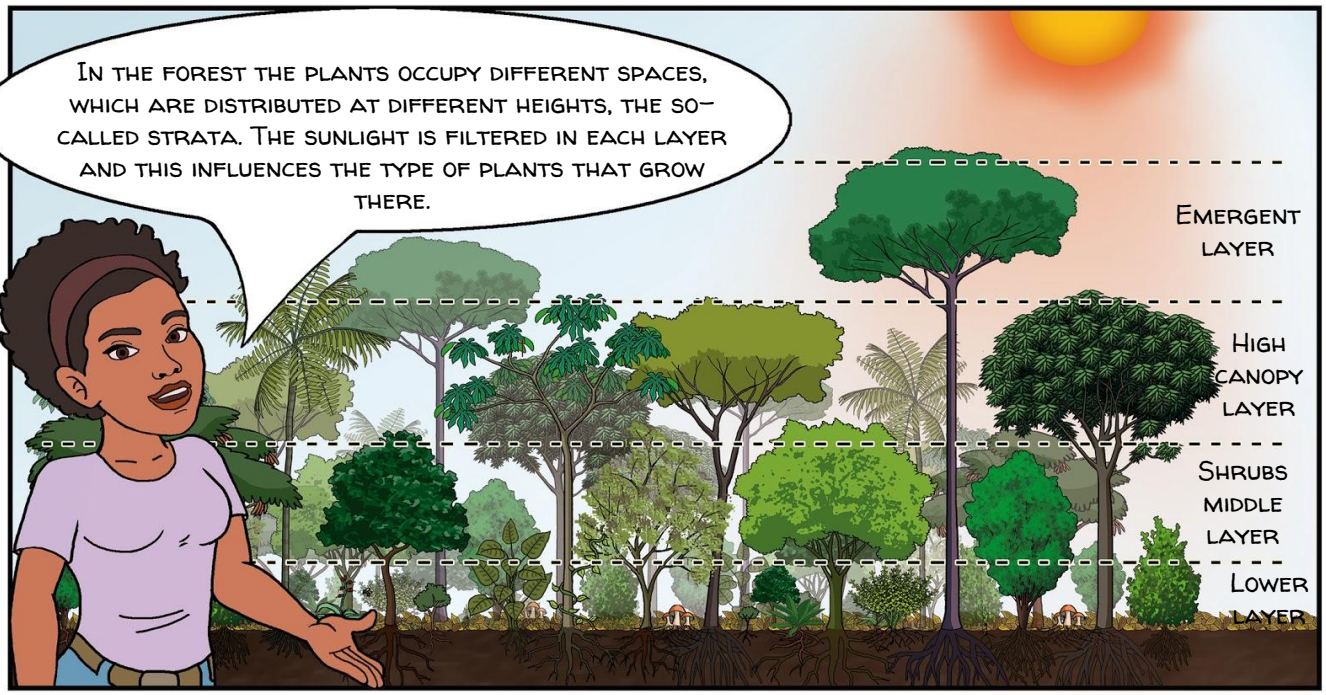


some species disappear and others appear according to the new characteristics of the environment.

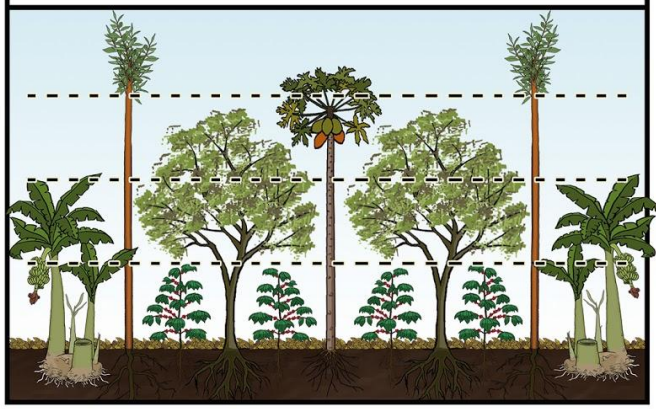
In agroforestry we try to replicate and optimize these processes...



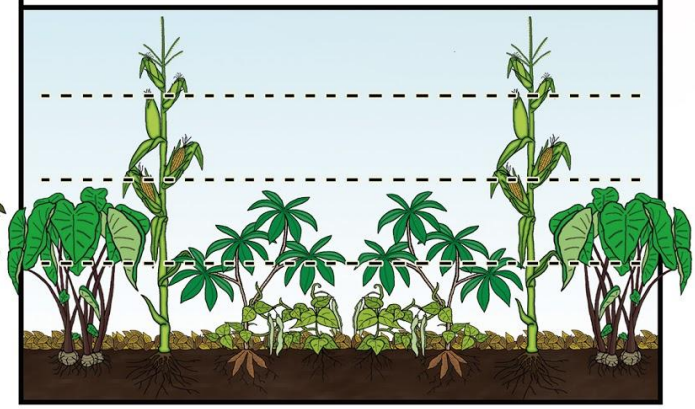
in order to produce food and improve the environment.



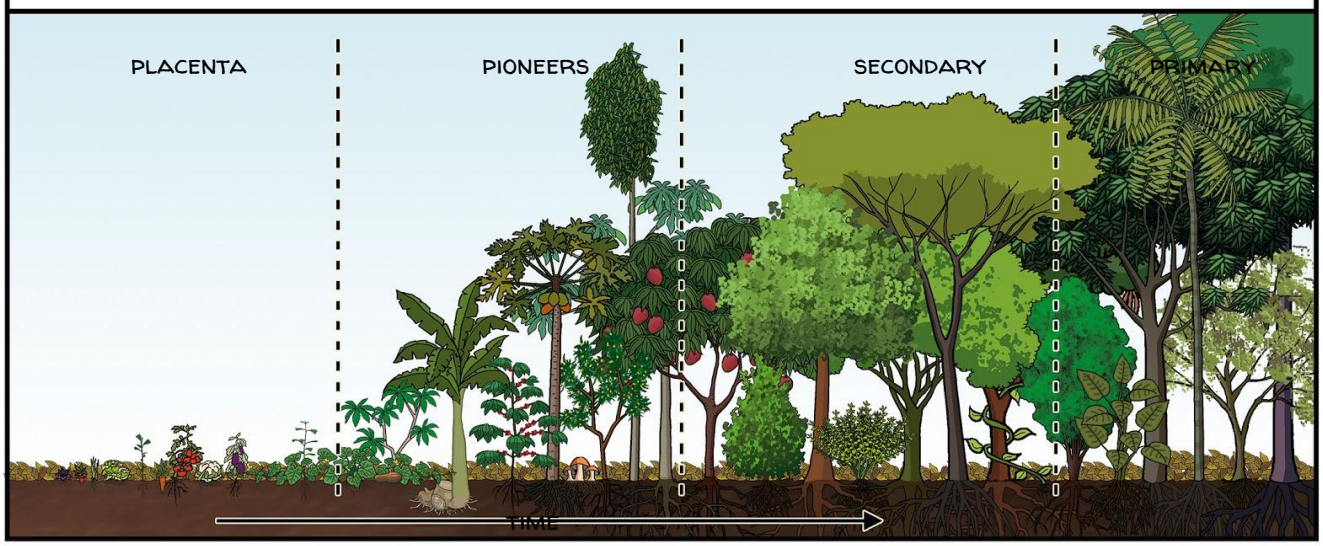
When we plant a foodforest, we follow the same system.



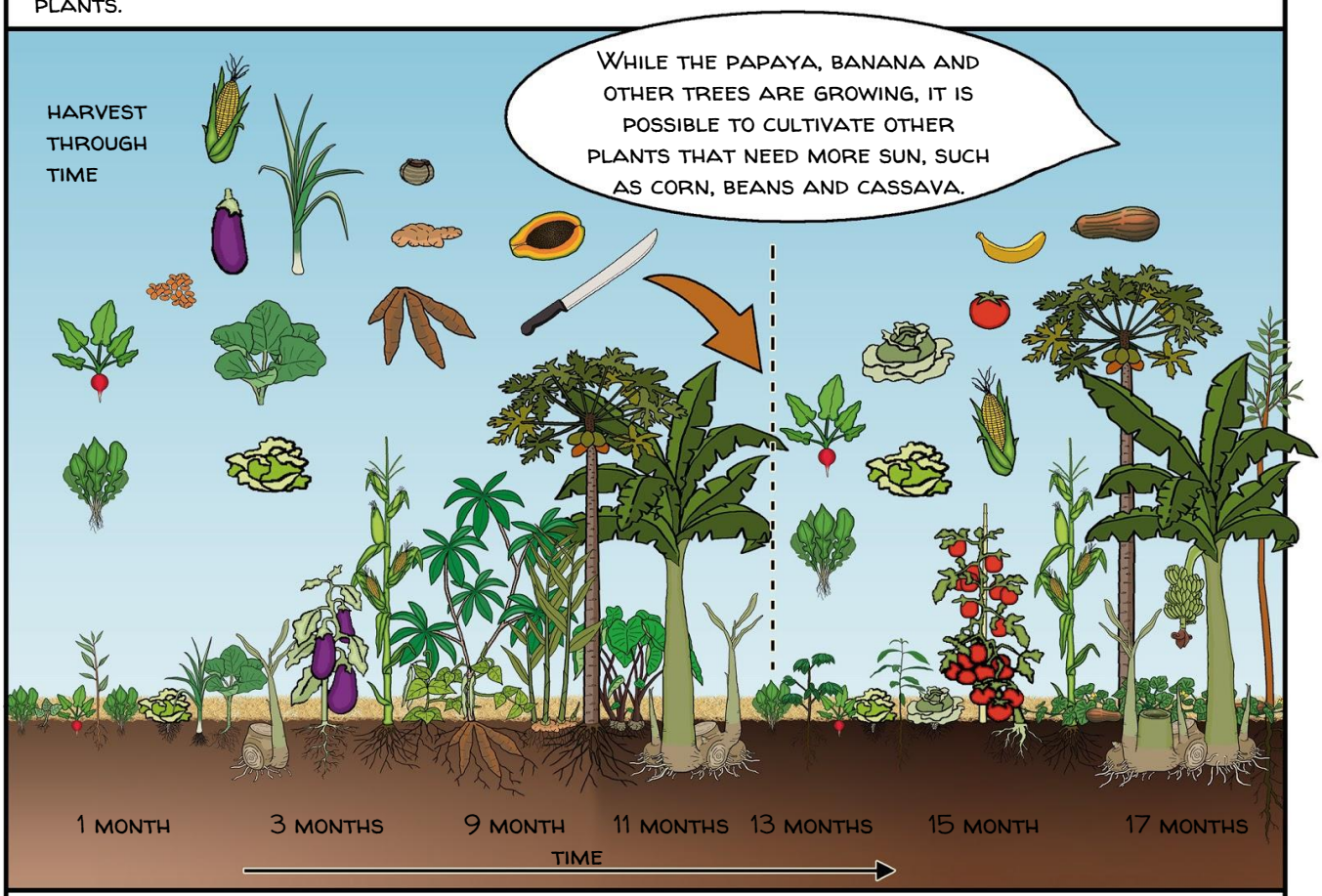
This logic can also be applied to the most diverse fields in agriculture and horticulture.



Another important factor in the organization of the forest is time. Every plant has a life cycle with different growth rates, which are also influenced by the characteristics of the site. We call this the organization of time in ecological succession.

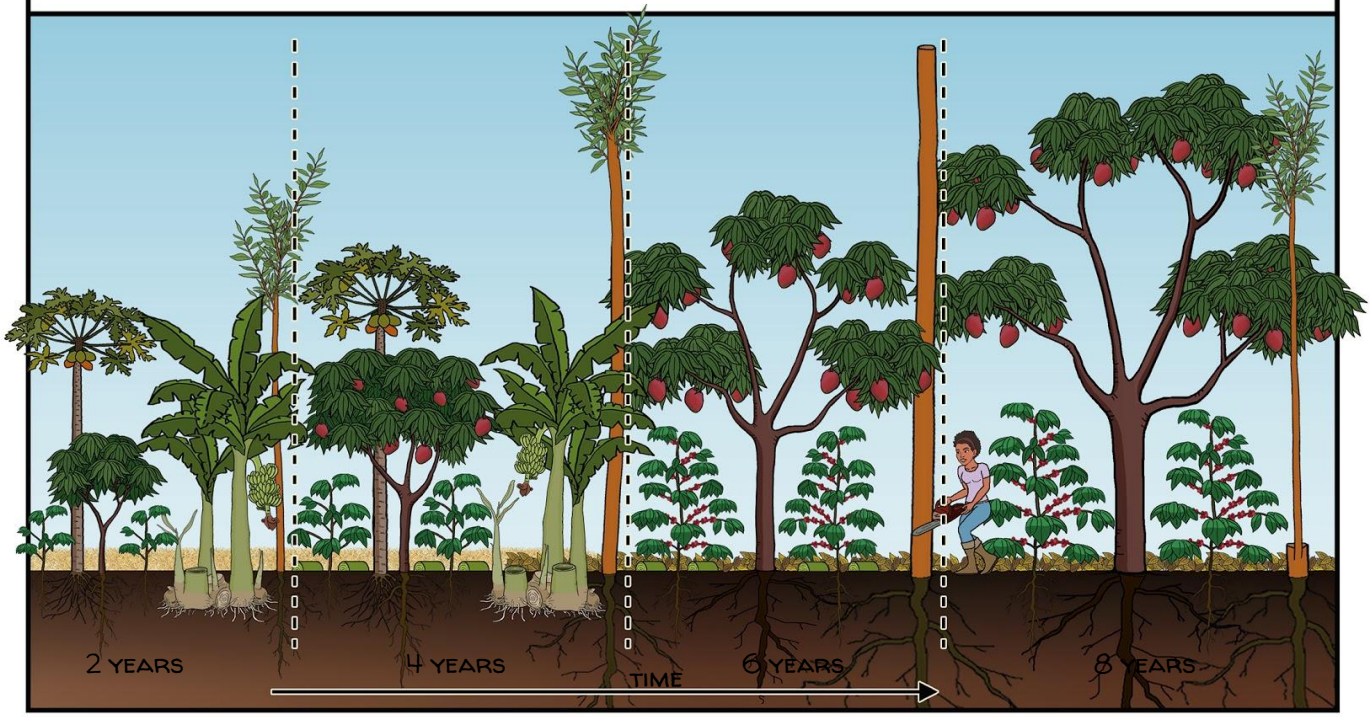


Therefore, the agroforestry plan should consider layers and succession to combine the chosen plants.



By pruning the banana trees, we let the sunlight enter again. In this way we can support the cultivation of plants that need more light.

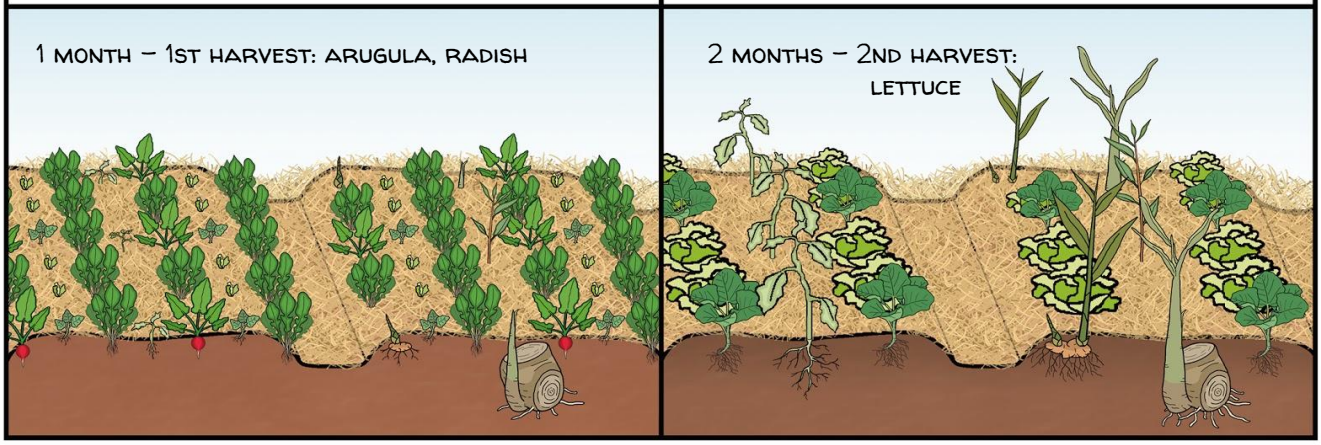
Over time, the farmer can manage the site by selecting the plants he prefers to grow by pruning and putting the organic matter on the ground as mulch and fertilizer. In this way the environment will improve and other plants will start to grow.



For example, when we start a vegetable garden, we combine plants with different cycles (lifetimes) and layers (strata) for optimal use of the place.

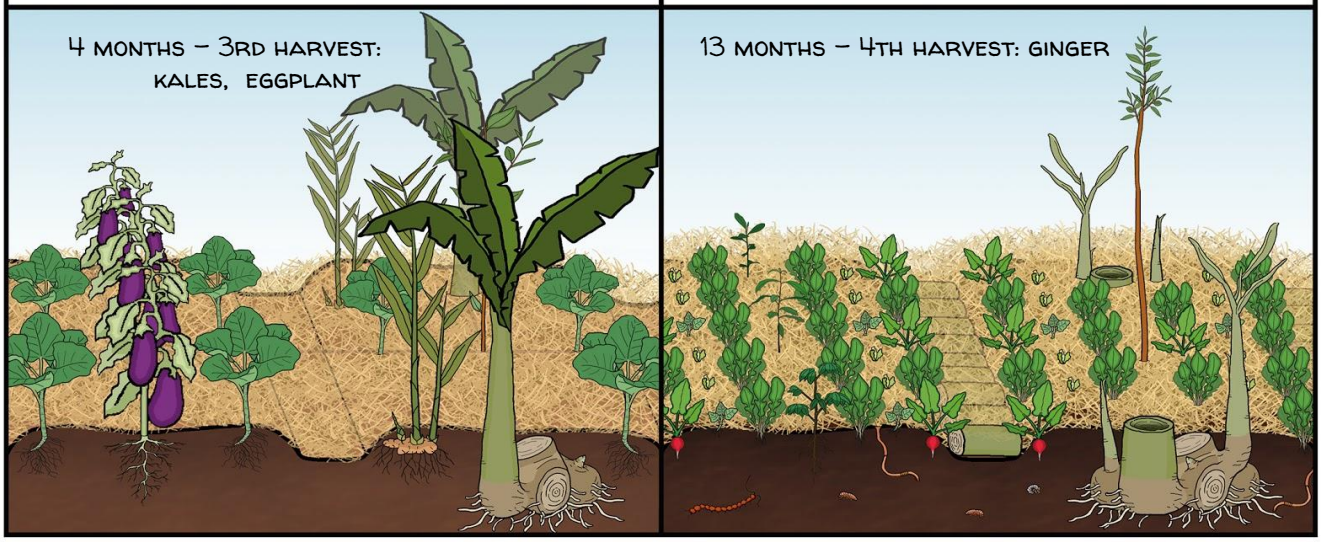
30 days after planting, the fast-growing plants already occupy the largest space and protect the slower growing seedlings.

After the first harvest, the former space of these plants is gradually occupied by those with slower growth.



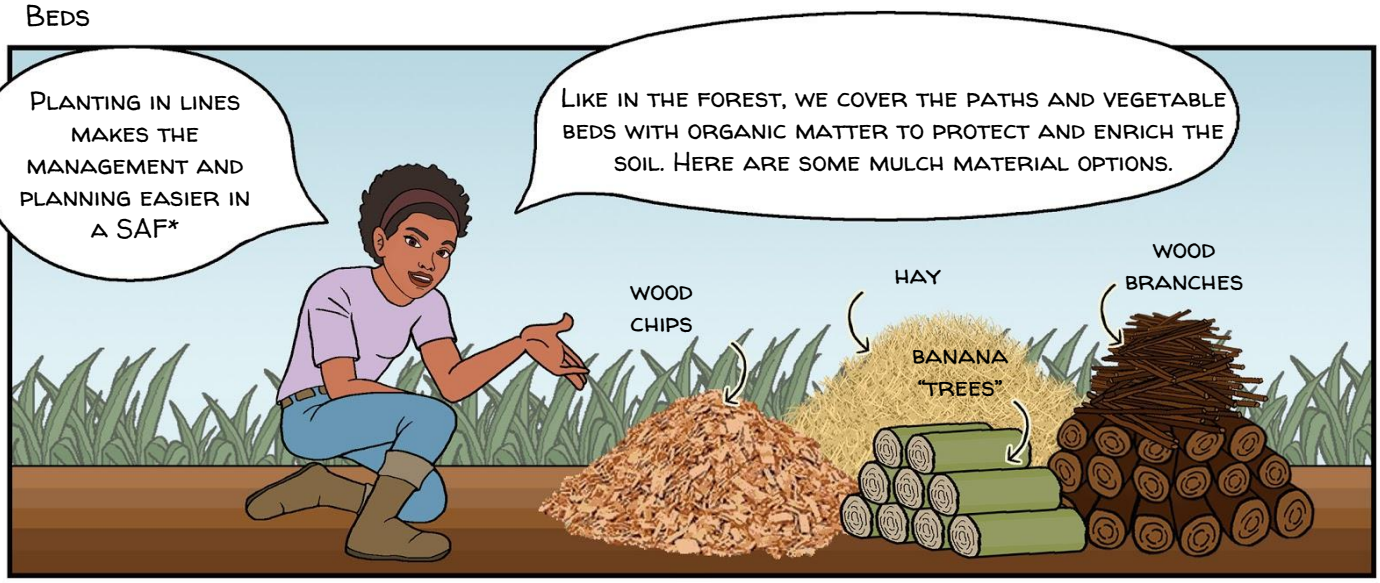
After another harvest, the space is free again for plants with a longer life cycle, which continue to grow in the beds.

Finally, when it's time to renew the beds, we prune the trees and bananas, transforming them into organic soil cover and start planting again.



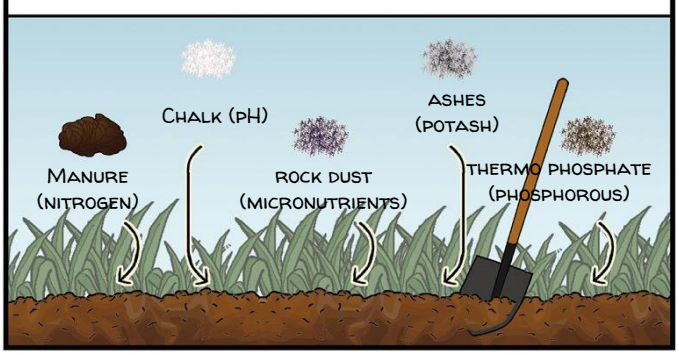
In this way we plant a plot of land once and have four harvests over time!
Another tip is to replant the beds at different times. For example, one bed every week. This is how we ensure that different cycles occur during the same period, which gives us a greater variety of food.

Beds

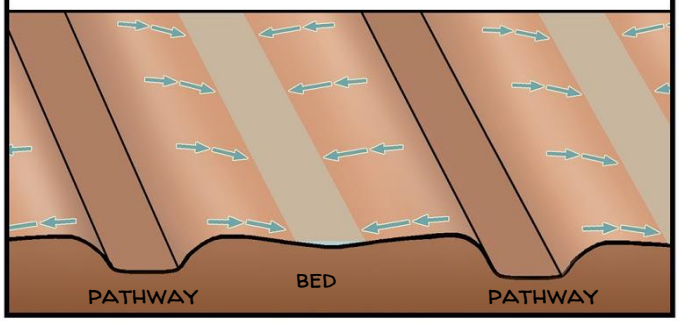


1. For the set up of the vegetable beds we open up the ground and mark the paths and beds.

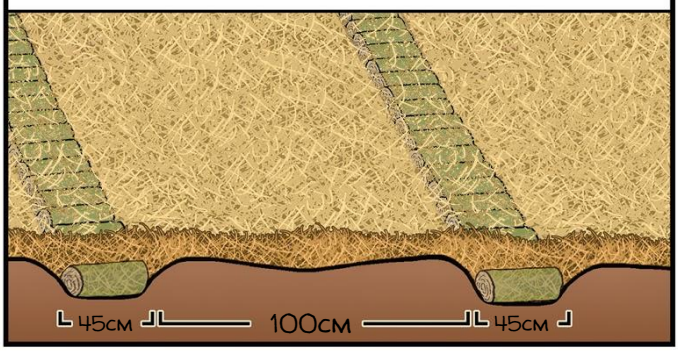
2. We mineralize and fertilize the ground by adding the inputs to the soil.



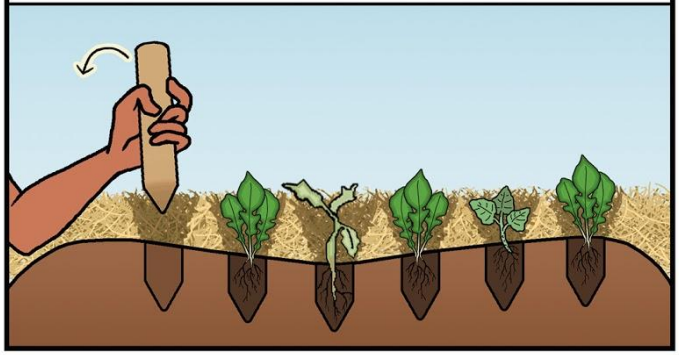
3. We form a nest shaped bed (the sides slightly higher than in the middle) so that we don't lose water and nutrients to the paths.



4. We cover everything with organic matter and pay special attention to the edges of the beds.



5. We remove the soil covering of the planting place for each seedling and plant them with the help of a planting stick according to the chosen consortium.



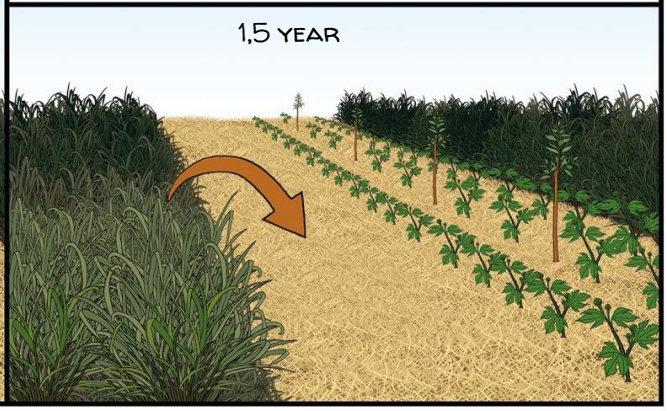
For the renewal of the beds it is only necessary to carry out fertilization and loosening of the soil, preferably without turning it. For example, if you insert a broadfork into the soil and just move it, you'll ventilate the soil without turning it over.

*Agroforestry system

Agroforestry can also be used as a technique for soil regeneration in degraded areas. This was the case in our community farm, where we used the "bush" to help to build the plantation.

In the first year, we use our own weeds to build up organic material at the site of the future seed beds.

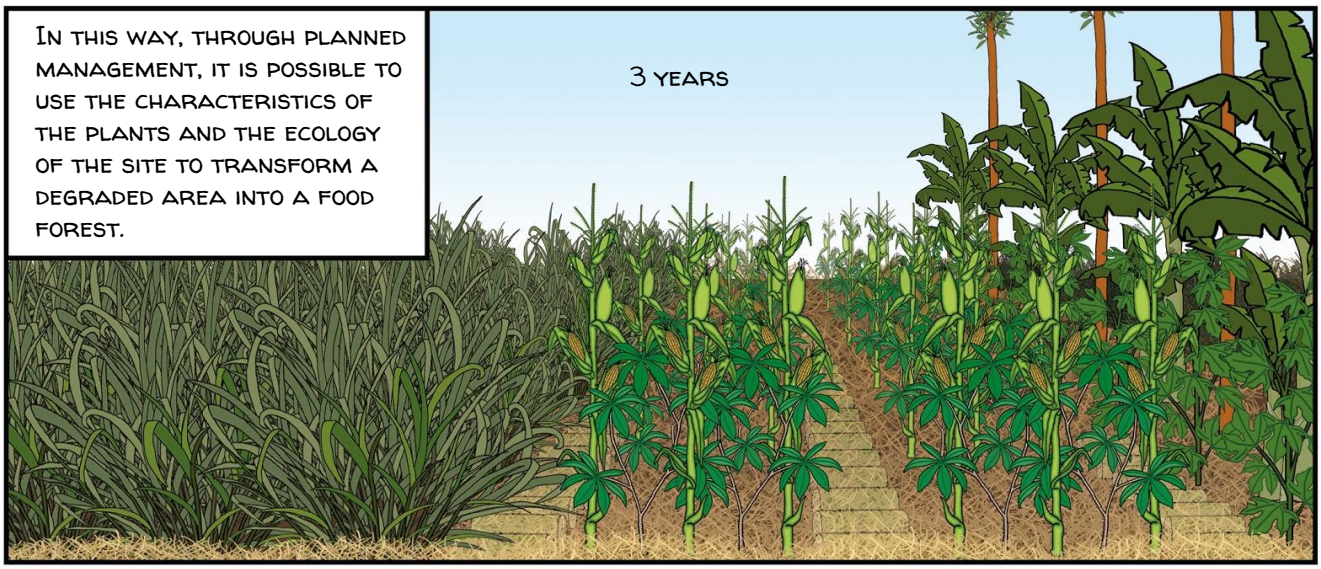
The accumulation of organic material in the future bed begins to alter soil characteristics and allows the planting of fertilizer crops such as legumes and mexican sunflowers.



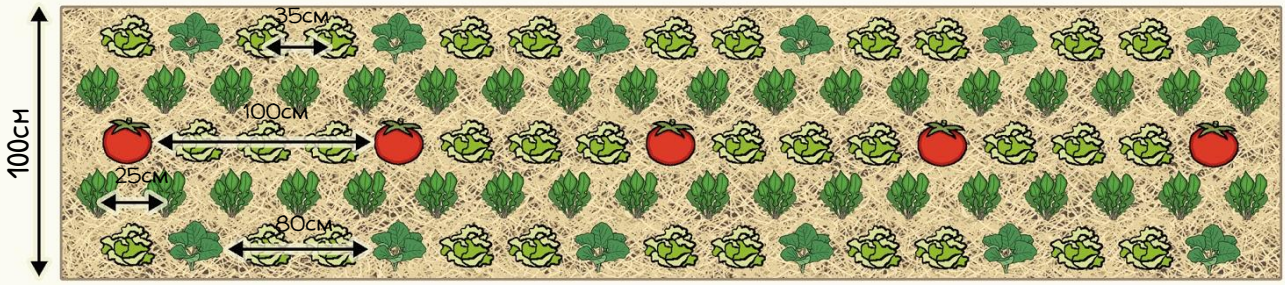
The abundance and variety of organic matter produced by the first beds will further improve the environment. As soils become richer and richer, structure, water storage capacity and nutrient availability improve and allow for greater diversity.

see Agroflorestando o mundo do trator ao facão

In this way, through planned management, it is possible to use the characteristics of the plants and the ecology of the site to transform a degraded area into a food forest.



This is the planting scheme of our successional vegetable garden.



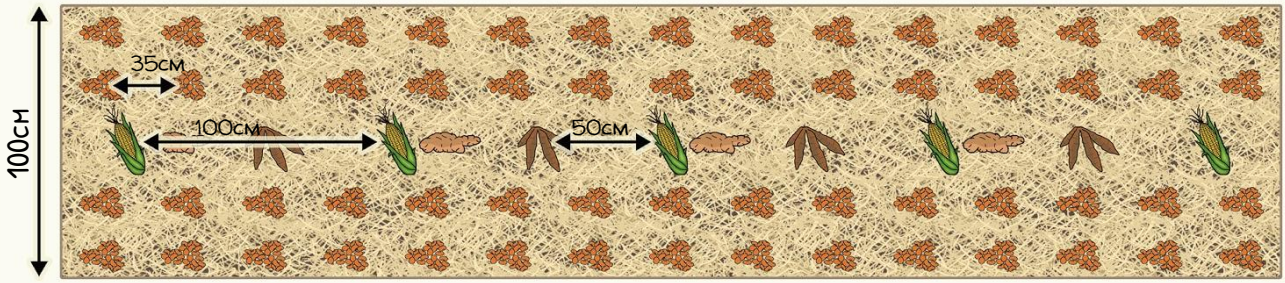

25-day cycle system for harvesting e.g. rocket/ arugula or radish


45-60-day cycle system for harvesting e.g: salad or chard


90-day cycle system for harvesting e.g: cabbage


120-day cycle system for harvesting e.g. tomato or eggplant

and our plantation for a yearly cycle was planned in this way:



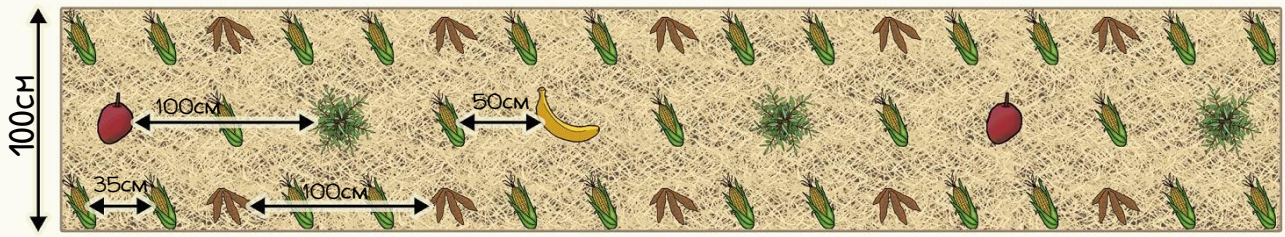

3-4 months cycle system for harvesting e.g. corn or okra


3 months cycle system for harvesting e.g: beans


9 months cycle system for harvesting e.g: cassava


12 months cycle system for harvesting e.g. ginger

and the lines of fertilizer trees, banana trees and fruit trees were already like this:




Eucalyptus

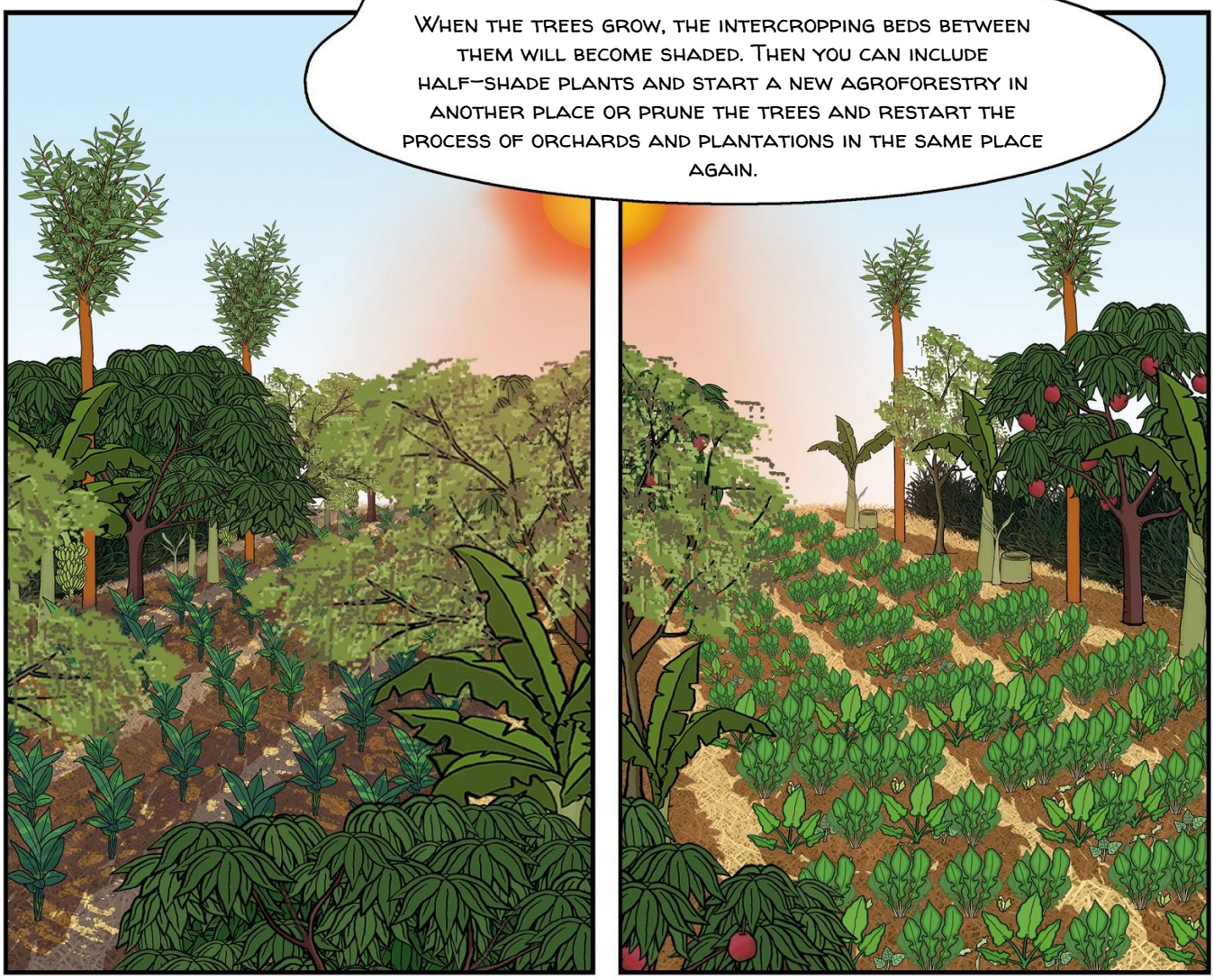

Banana

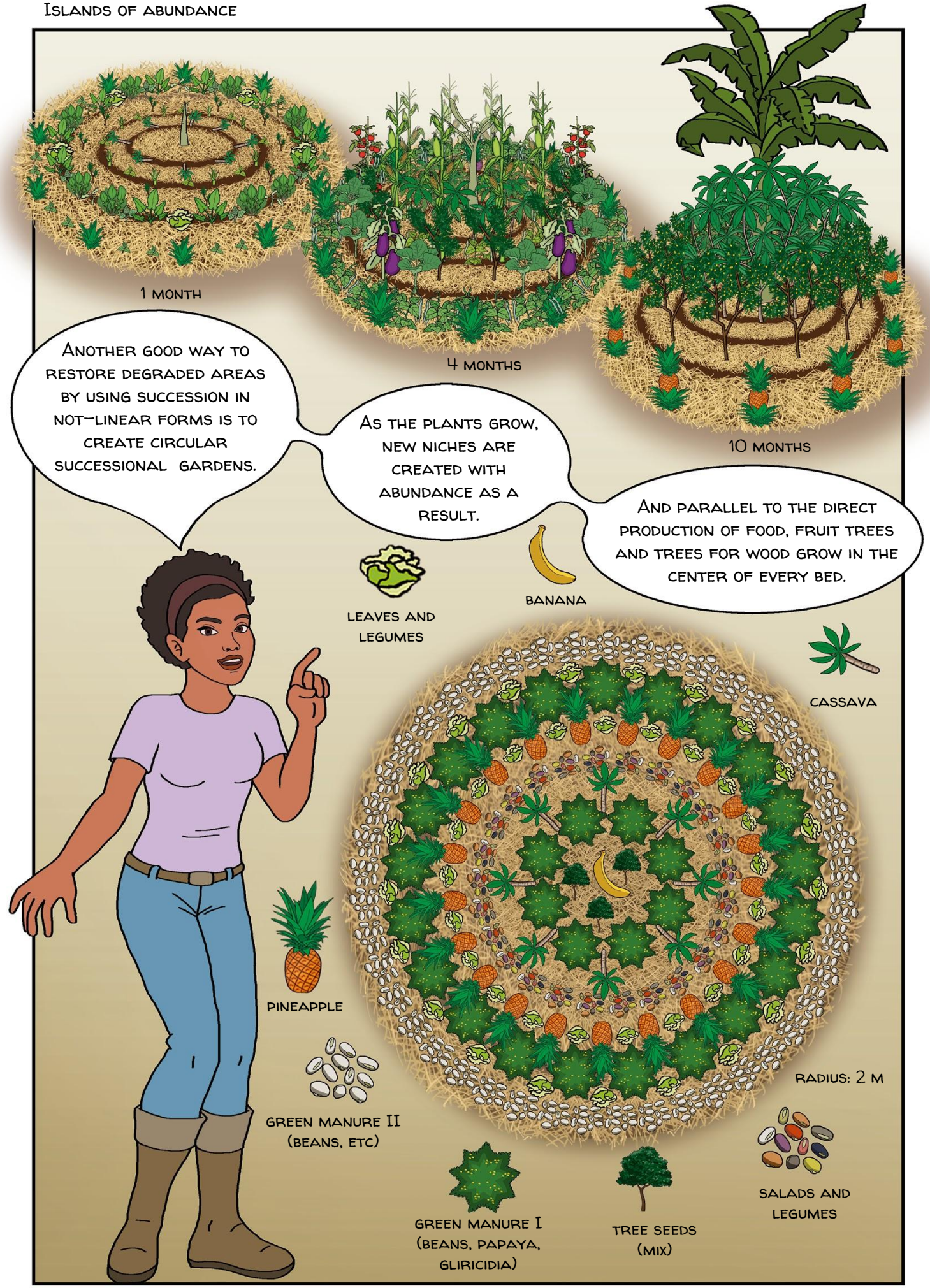

Fruit tree


Manioc

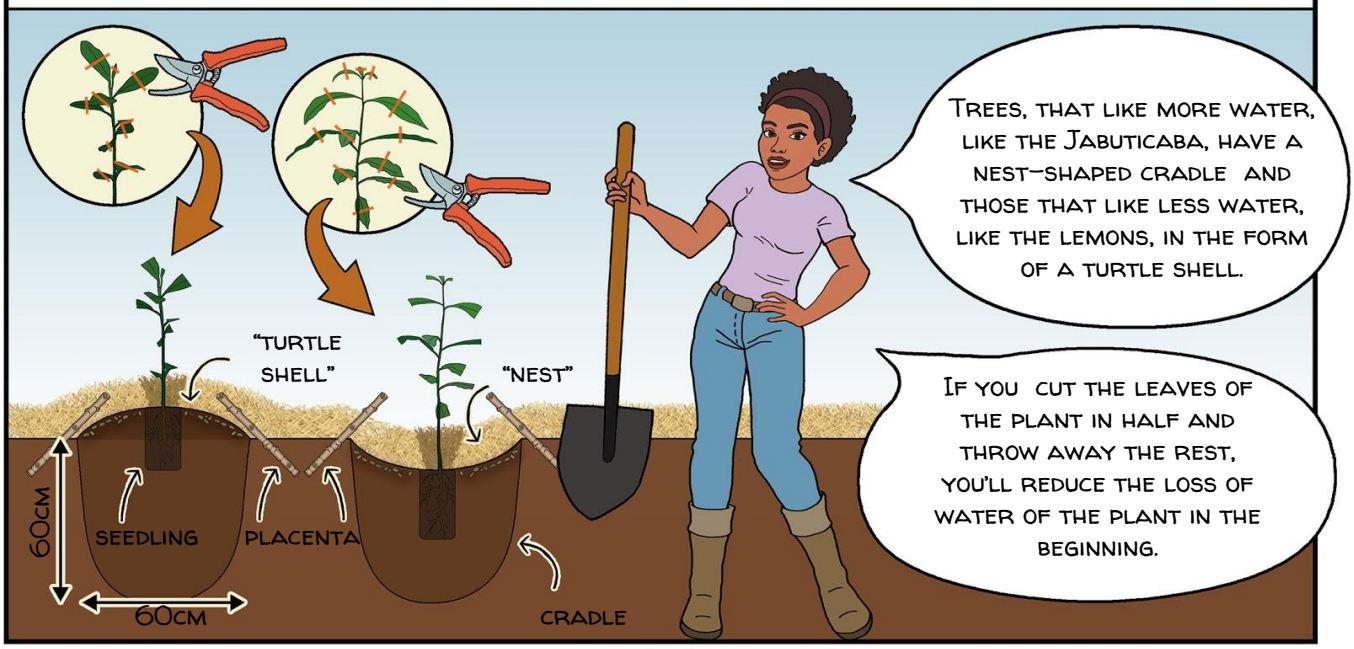

Corn


In general we plant all trees, like trees for mulch and fertilization, fruit trees and trees for wood harvesting, in rows. Between the rows of these trees, we realize plantations or vegetable gardens.
TREE LINE
INTERCROP GARDEN
TREE LINE
5 METERS
1 METER

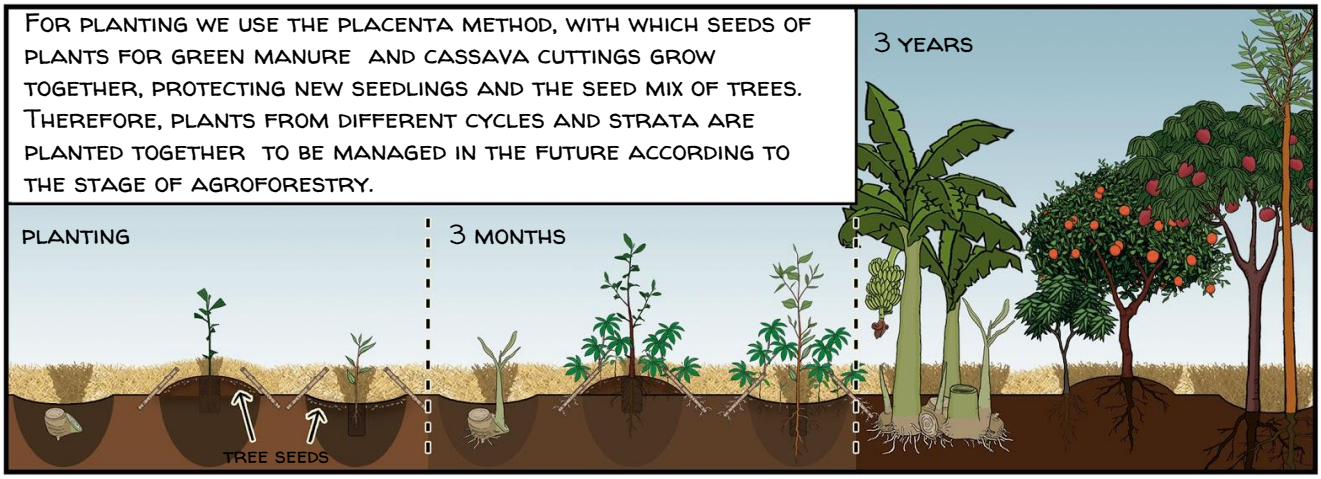

When the trees grow, the intercropping beds between them will become shaded. Then you can include half-shade plants and start a new agroforestry in another place or prune the trees and restart the process of orchards and plantations in the same place again.

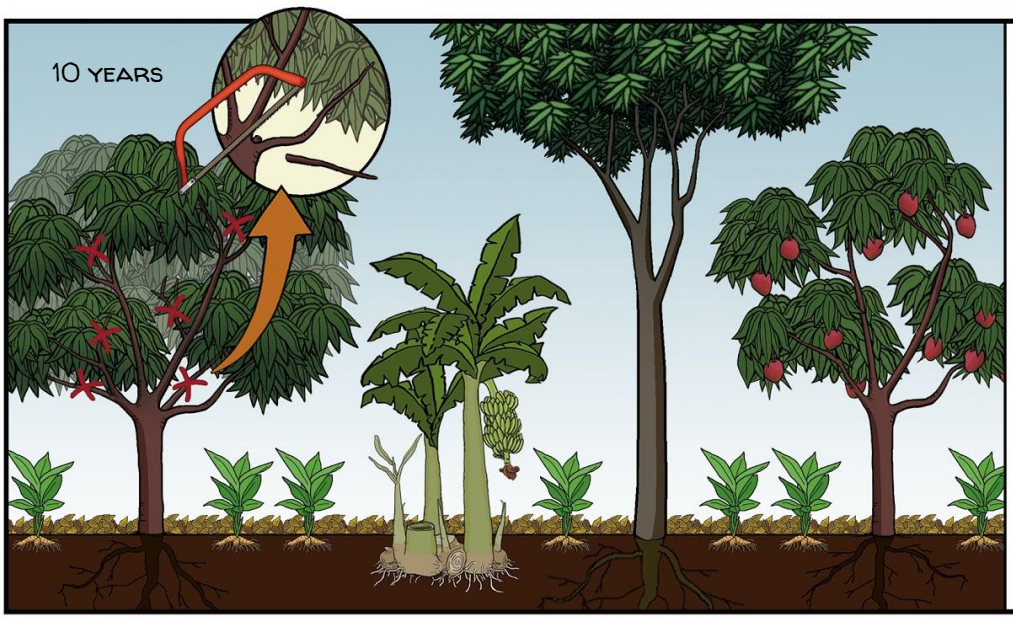

1 month
4 months
10 months
Another good way to restore degraded areas by using succession in not-linear forms is to create circular successional gardens.
As the plants grow, new niches are created with abundance as a result.
And parallel to the direct production of food, fruit trees and trees for wood grow in the center of every bed.
Leaves and legumes
Banana
Cassava
Pineapple
Green manure II (beans, etc)
Radius: 2 m
Green manure I (beans, papaya, gliricidia)
Tree seeds (mix)
Salads and legumes

If we invest time and energy at the beginning of planting by creating good cradles (planting holes), the small plants will use their energy to grow more vigorously. It is important that the cradle hole is much larger than the root clod and well fed with water, minerals and compost.



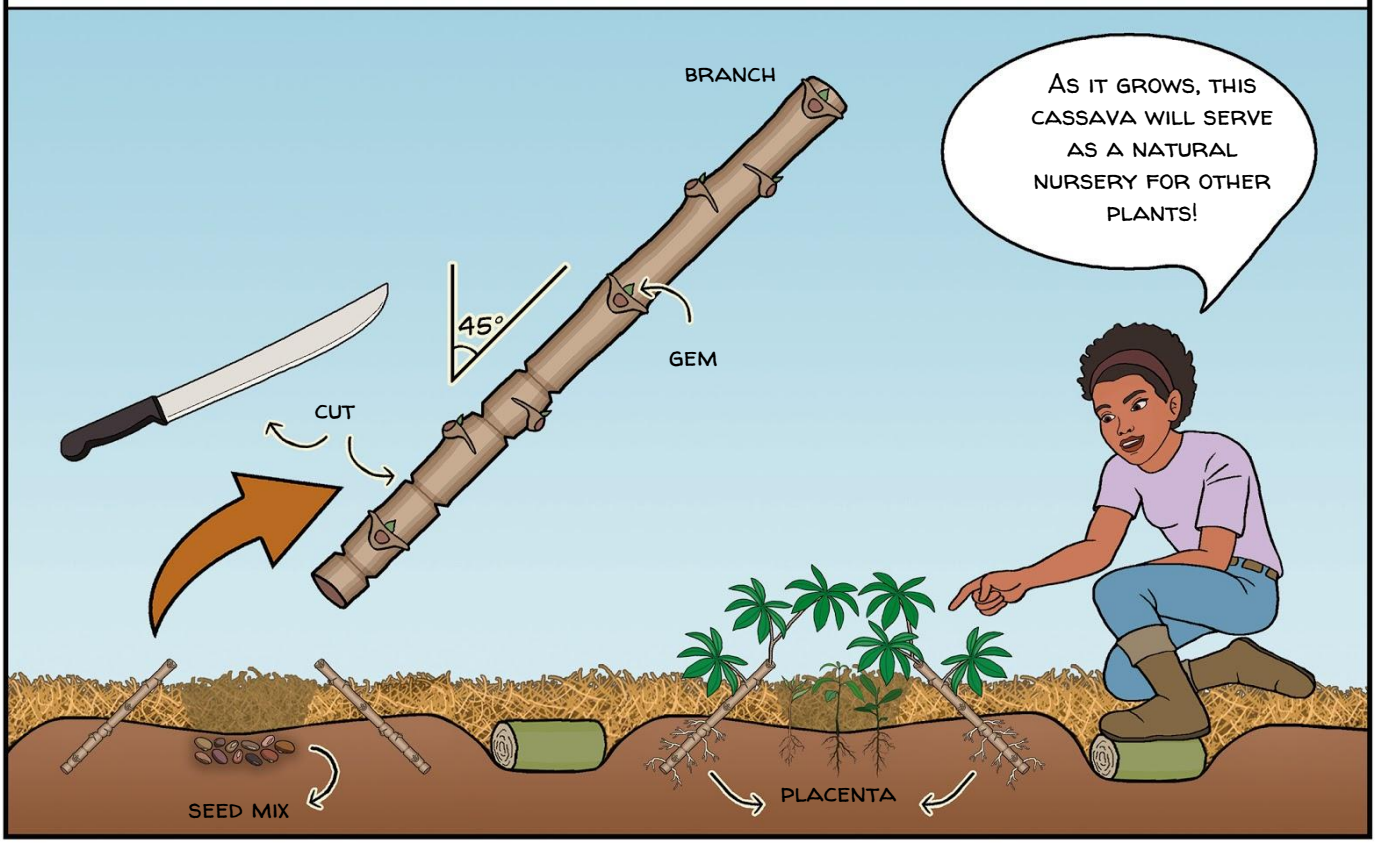
For planting we use the placenta method, with which seeds of plants for green manure and cassava cuttings grow together, protecting new seedlings and the seed mix of trees. Therefore, plants from different cycles and strata are planted together to be managed in the future according to the stage of agroforestry.



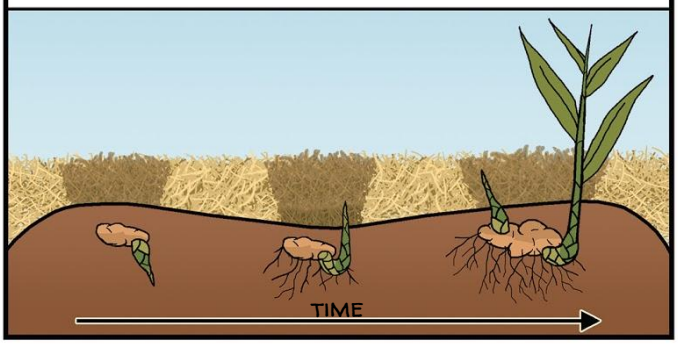


In this way, a pioneer tree that prefers the direct sun from an early age will grow and change the environment so that a secondary tree that prefers a little more shade will develop better and so on.
In the meantime, it is our job to observe, take care and prune if necessary.

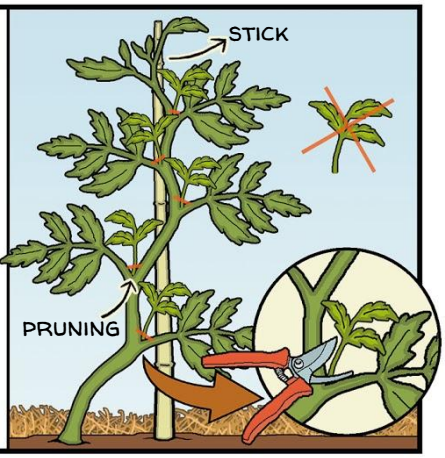
To plant the cassava, we cut off the branches, position them with the buds upwards and make some cuts in the lower part to facilitate root formation.
We plant the branches by leading the roots out of the bed at an angle of 45 degrees.



Roots such as yams, turmeric and ginger are planted with eyes (shoots) pointing downwards.



For tomatoes, we use bamboo or a guideline and cut new branches so that all the plant's energy is dedicated to the fruits of the main branch.



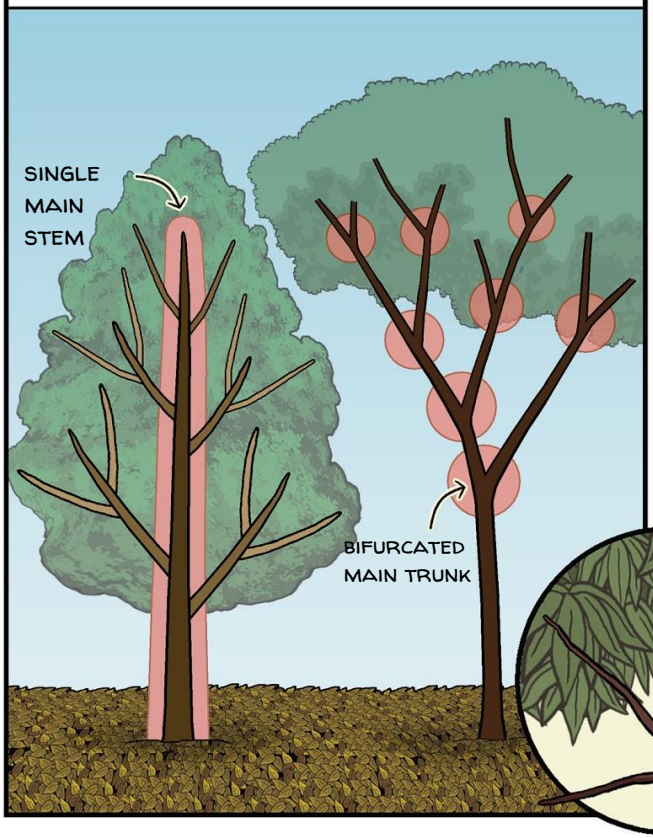
For the direct planting of seeds, e.g. radish and carrots, we remove the straw layer in rows where we distribute the seeds and then thin them.

For other no-till crops, such as corn or beans, we use our machete to open straw and soil for sowing. Keep the back of the machete to the side of the hand while planting the seeds!

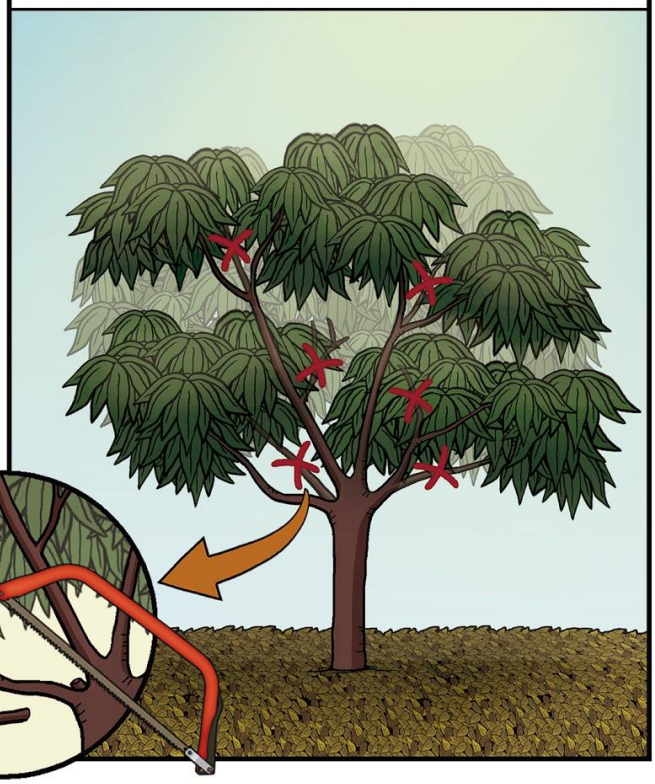
Management tips: pruning

In addition to planting, pruning is also an essential part of managing an agroforestry system. In this way we produce organic matter, encourage the entry of light or eliminate something from the system.

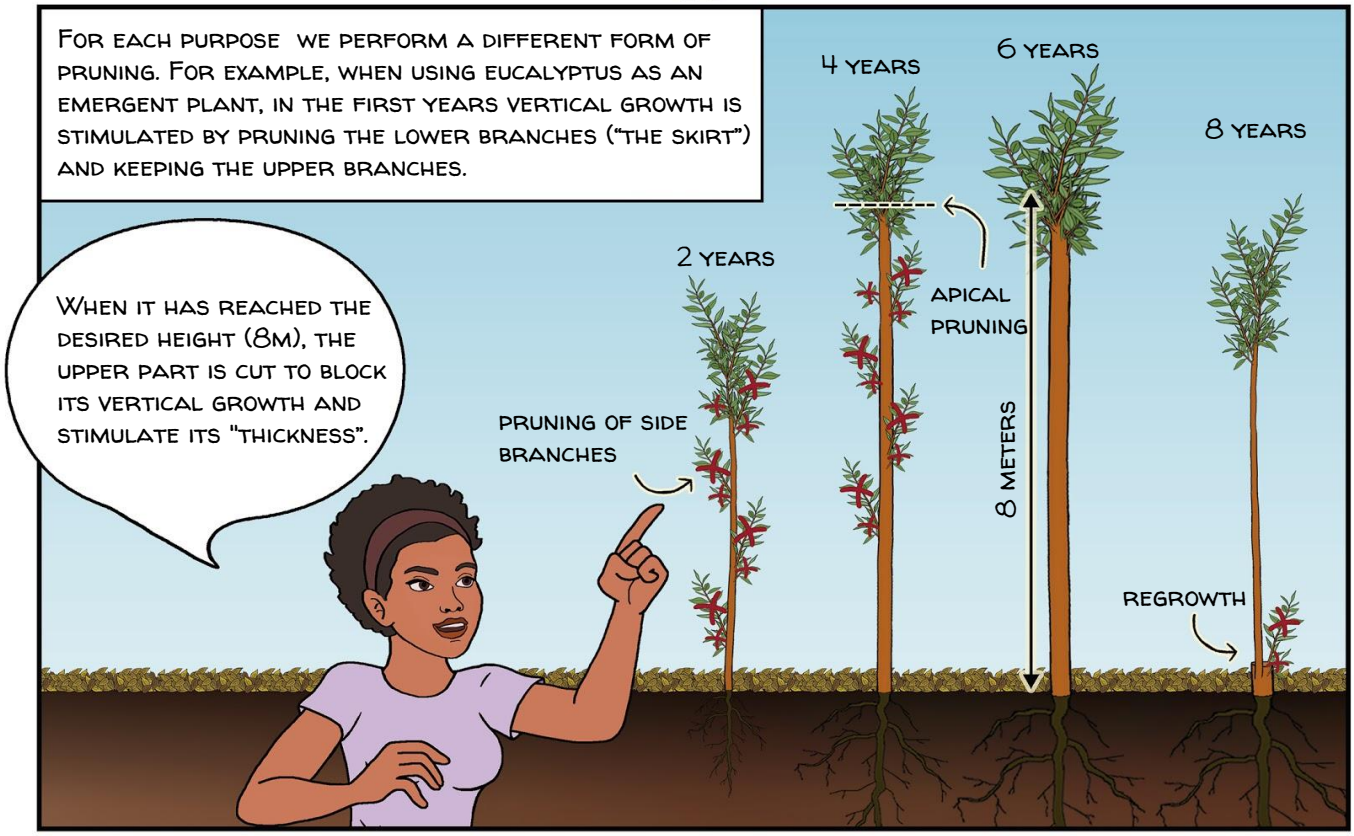
When pruning a tree, it is important to preserve its natural structure (architecture).



For most fruit trees, we open the canopy for more light and keep the horizontal branches to stimulate fruit production.

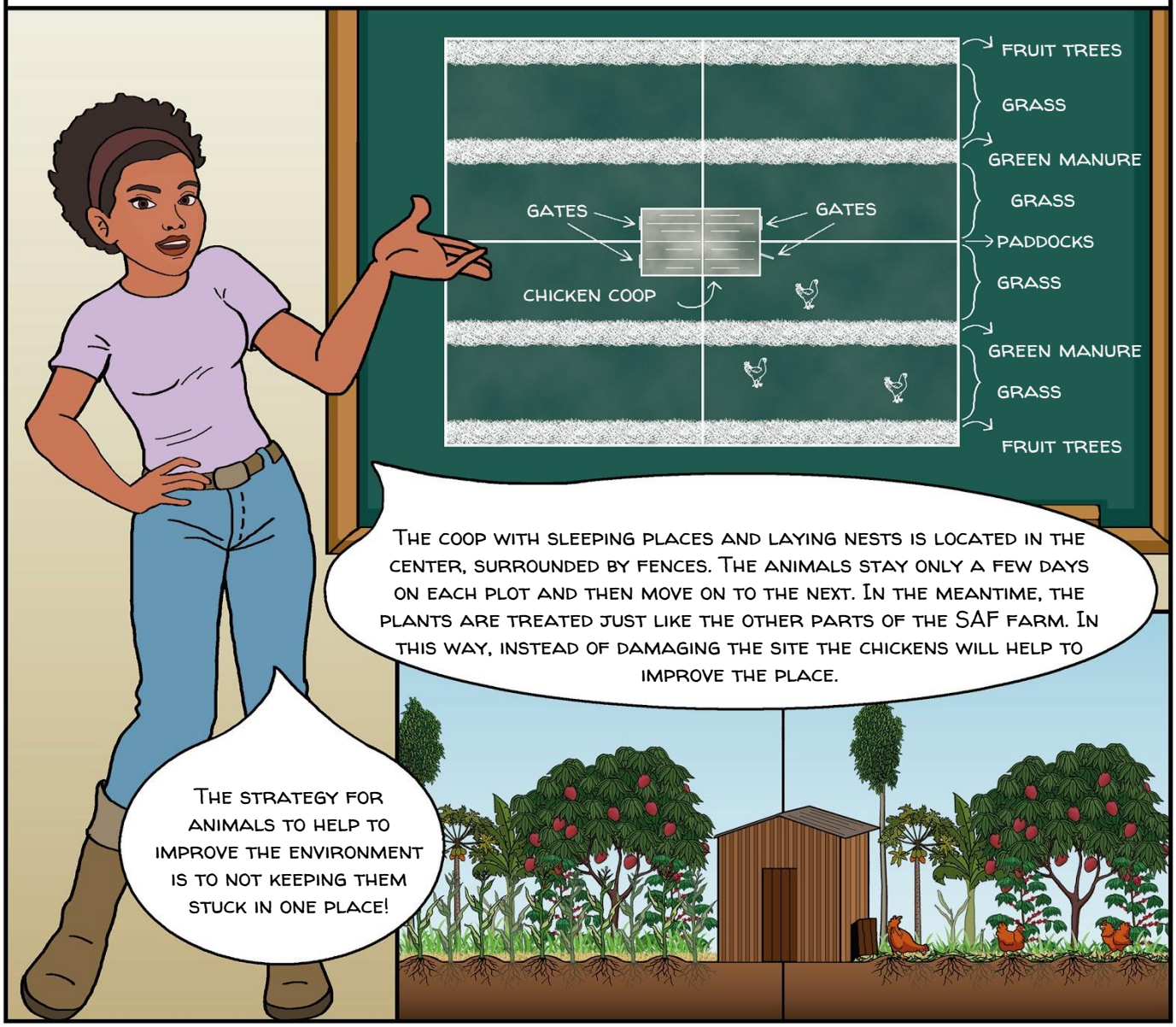


For each purpose we perform a different form of pruning. For example, when using eucalyptus as an emergent plant, in the first years vertical growth is stimulated by pruning the lower branches ("the skirt") and keeping the upper branches.

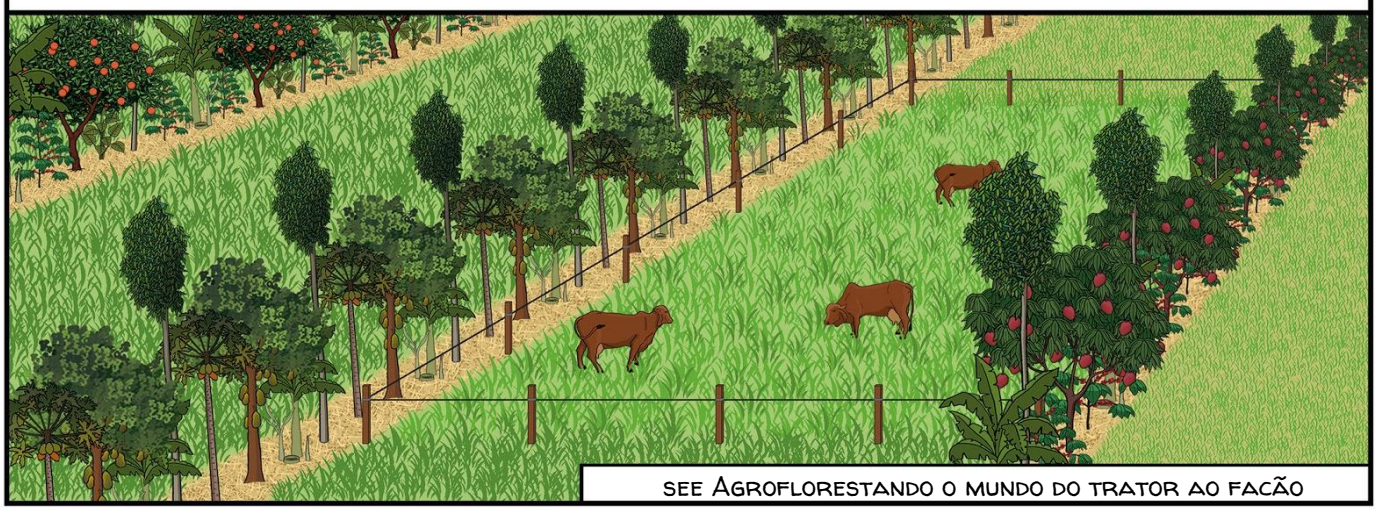



The banana is a very good plant to produce organic matter, easy to replicate and with constant regrowth. To have a good fruit production, the plants are always kept at different stages of development: "grandmothers, mothers and daughters"
To plant a new plant, we remove the seedling and prepare its "potato", which should be about 1 kg. We clean the potato by cutting the roots and making a 45 degree cut between base and stem.
45°
"potato"
grandmother
If the scion is sick, we put the "potato" in a bucket of water for 24 hours before we plant it, and in the last two hours, we put a few tablespoons of chlorine or bleach in the water.
sickness
mother
daughter
We dig a cradle and plant the "potato" of the banana tree sideways, with the cut of the mother plant upwards. This procedure ensures that the new individual is healthy and produces a good bunch already in the first cycle.
grand daughter
crib
bowl
After the banana harvest we cut the banana tree. The remaining part of the "potato" should be cut into a bowl, to prevent further contamination and disease.

Agroforestry is also a good place to breed animals. For example, if we include a chicken coop with permanent pickets in the middle of the SAF farm, the tree and lawn areas will provide a diverse, nutritious and healthy environment for the animals.



Another way to move the animals within the SAF farm is to use mobile electric fences between the lines. In this way, the animals feed intensively in one particular place that changes daily, forcing an intense environmental stress, followed by rest and vigorous regrowth.



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Sketch

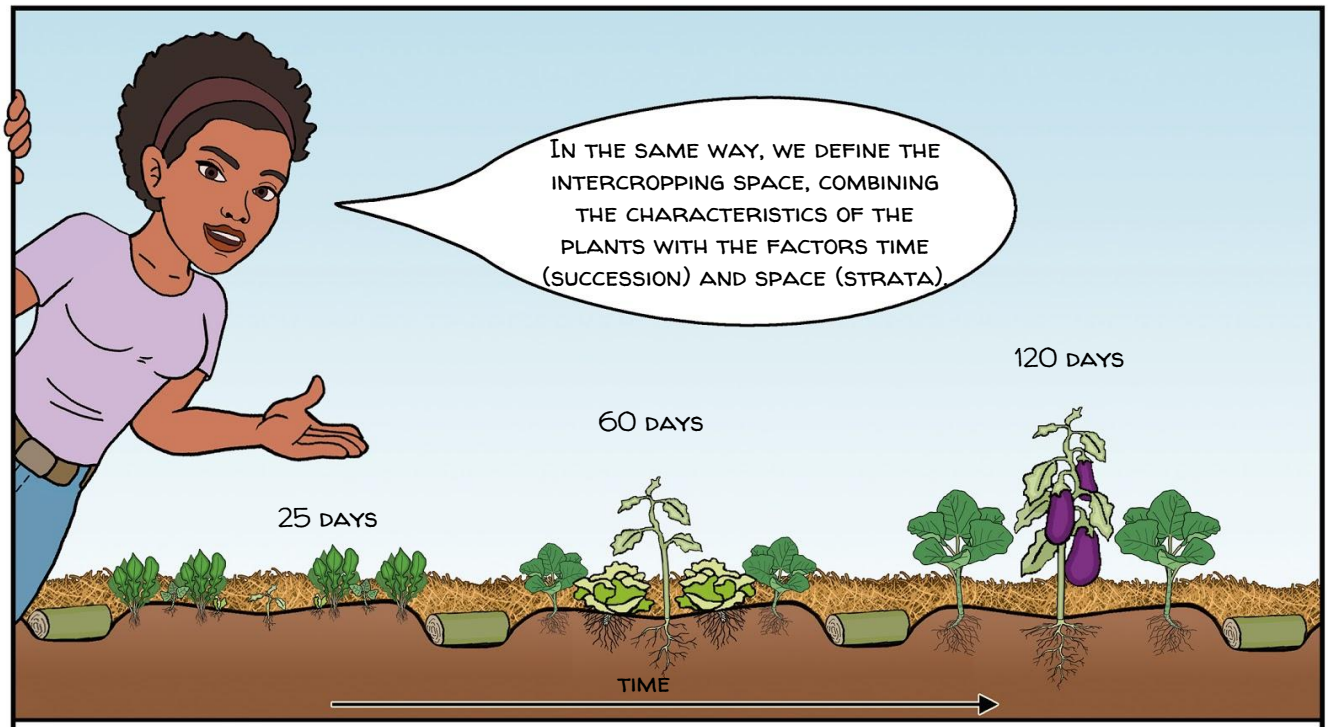
When planning an agroforestry it is important to draw your sketch.
In it we define each plant species in the area. Remember that the tree lines will consist of fertilizer and fruit species from different strata and successions (see the table on page 24 for various examples).

FRUITS
EG. MANGO

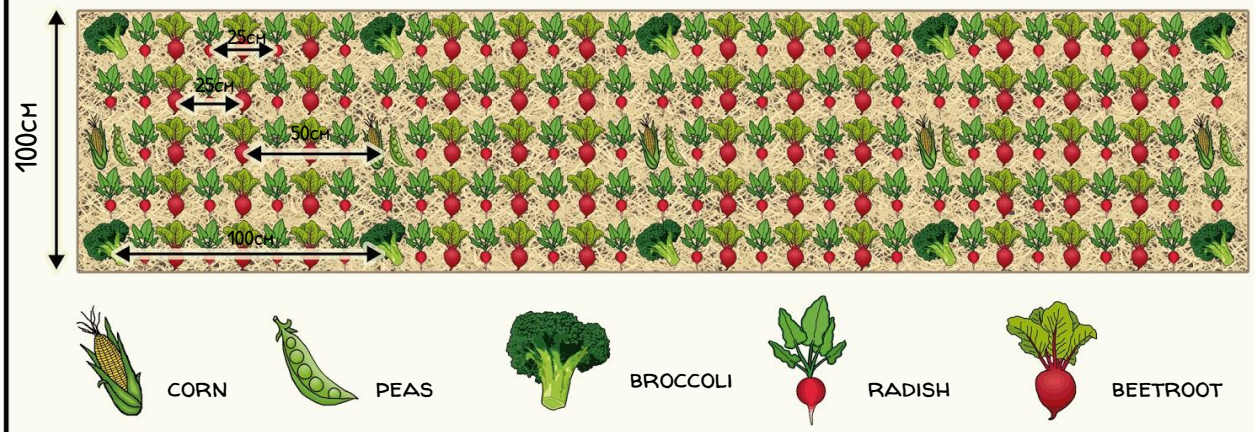
GREEN MANURE
EG. BANANA

WOOD
EG. EUCALYPTUS

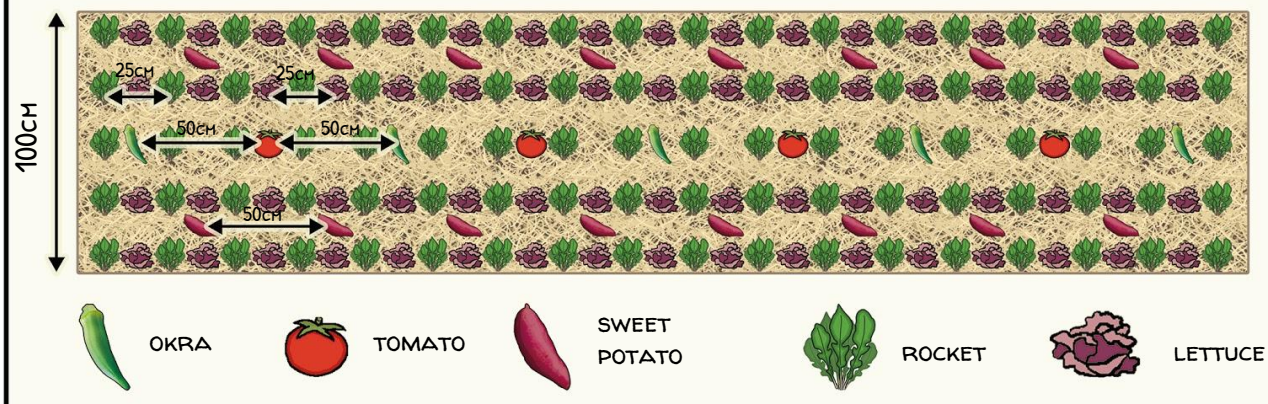
PLACENTA
EG. CASSAVA



For example in the lower consortium we have 3 cycles in one planted bed.
In the 90-day cycle we have corn with emergent stratum on every meter and beetroot with medium stratum on every 25 cm. Together with it we include a 60-day cycle of broccoli (high stratum) and climbing beans to climb the emergent stratum corn. And, also a quick 25 days cycle of radish.



In this other consortium we have okra (emergent – 120 days), tomato (High stratum – 120 days), sweet potato (Low – 100 days), purple and curly salad (medium – 45 days) and rocket (medium – 25 days).




Finally, I suggest that you choose a place where you can put this new knowledge into practice. Follow the tips in the manual and use the space below to plan your first Agroforestry implementation.
And remember, agroforestry you learn by planting! Have fun and let's plant!
AGROFLORESTA EM QUINTAIS SONHADOS

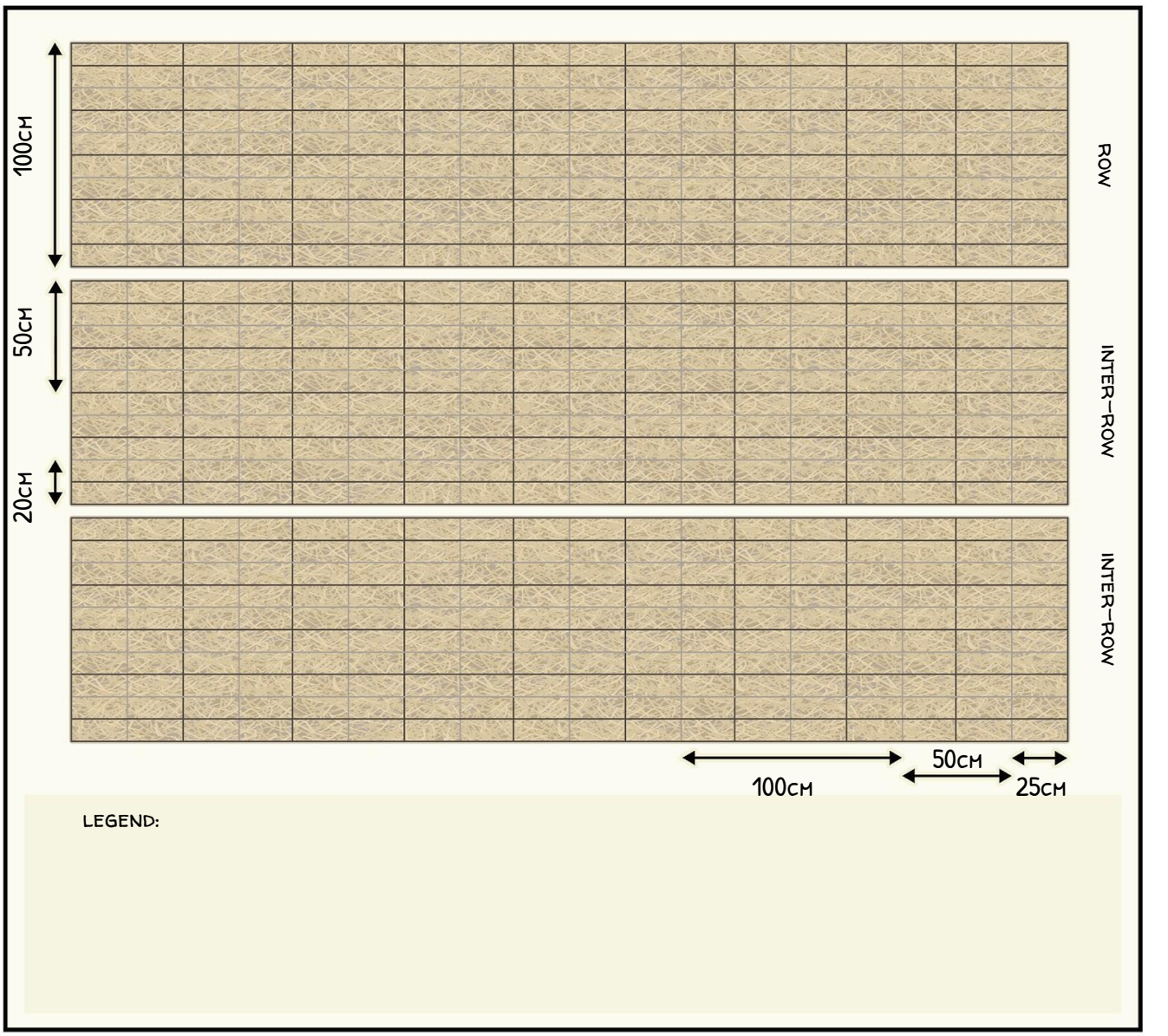

100cm
50cm
20cm
row
inter-row
inter-row
100cm
50cm
25cm
LEGEND:

Table of cycles and layers

LAYER	OCCUPIED SPACE	CYCLES/SUCCESSION						
		45 DAYS	60 DAYS	90 DAYS	6 MONTHS	3 YEARS	BIOMASS / WOOD	FRUITS / NUTS
EMERGENT	20%	SUNN HEMP	SUNFLOWER	CORN	OKRA	CASTOR-OIL PLANT	TASMANIA BLUE GUM	BRAZILIAN PINE
				SESAME		PAPAYA	AFRICAN MAHOGANY	PECAN NUT
				AMARANTH			ROBLE	PUPUNHA PALM TREE
							JAPAN GRAPE	
CANOPY	40%		CAULIFLOWER	TOMATO	COWITCH	CASSAVA	BRAZILIAN ORCHID TREE	JACK FRUIT
			BROCCOLI	PEA	EGG PLANT	YACON	MEXICAN LILAC	MANGO
			PEARL MILLET	CHIVES	SWEET BASIL	CONGO BEAN	DWARF BANANA	DWARF BANANA
			SORGHUM	CABBAGE	PEPPER	SWEET BASIL	PORTUGUESE PLUM	JAMBO
			COW PEA	WHEAT		LEMON BASIL	ICE CREAM BEAN/INGA	INGA AND BARU NUT
			CLIMBER PEA	BELL PEPPER			SOMBREIRO	GUAVA
				ROSELLE			MEXICAN SUNFLOWER	KAKIFRUIT
				GILO			TIGERWOOD	CHERRIES OF RIO GRANDE
				KALE				JUCARA PALM TREE
MEDIUM	60%	RADISH	LETTUCE	POTATO	ONION	TABASCO PEPPER	BANANA MACA TROPICAL	EGG PLANT TREE
		ROCKET	3 MONTHS' RICE	CANADA LETTUCE	PEPPER	ARRACACHA	BANANA PAO	MULBERRY
		LETTUCE	CHICORY	FLAX	RICE	GARLIC	DWARF BANANA	BANANA PRATA
		PURPLE LETTUCE	ALMEIRAO	LEEK	BROAD BEAN	HANGING LOBSTER CLAW	CABAGE	CAMBUCI
		CORIANDER	CHARD	CARROT	PUMPKIN	GREATER BURDOCK	WHEAT	GRUMICHAMA
			RADISH	BEETROOT			BELL PEPPER	BRAZILIAN CHERRY
			TURNIP	WILD CELEREY			ROSELLE	UVAIA
				ZUQUINI			GILO	MANDARIN
				RICE			KALE	PEACH
LOWER	80%		BLACK TURTLE BEANS	JACK BEAN	PEANUTS	GINGER		COFFEE
			WATERCRESS	WATERMELON	PARSLEY	NIRA E TARO		LEMON
			KIDNEY BEANS	SWEET POTATO	MINT	OREGANO		PINEAPPLE
			CUCUMBER	MELON		PENNYROYAL		TAHTI LEMON
			GHERKIN	SPINACH		ARROWROOT		LIME
			GREEN BEAN	SOY		MARJORAM		JABUTICABA SABARA
				AZUKI BEAN		BUTTERFLY GINGER		COCOA
						ARROWLEAF		QUINCE

AGROFLORESTA: APRENDENDO A PRODUZIR COM A NATUREZA / STEENBOCK W., VEZZANI F.M. - CURITIBA, 2013.

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DA HORTA À FLORESTA - FROM GARDEN TO FOREST / AGENDA GOTSCH (VÍDEO).

RESTAURAÇÃO ECOLÓGICA COM SISTEMAS AGROFLORESTAIS: COMO CONCILIAR CONSERVAÇÃO COM PRODUÇÃO. OPÇÕES PARA CERRADO E CAATINGA / MICCOLIS A. ... ET AL. BRASÍLIA, 2016.

SISTEMAS AGROFLORESTAIS: USO DA SUCESSÃO E DA ESTRATIFICAÇÃO EM CONSÓRCIOS ENTRE LAVOURAS E HORTALIÇAS / FLYER COOPERAFLORESTA.

The manual "an illustrated guide to agroforestry" was created to facilitate the introduction to stratified successional agroforestry. The example presented here is just one of the many possibilities for the biomes of the Atlantic forest. Each system is unique. For each place there is a story and a context that must be understood with eyes and ears wide open both towards people and towards nature.

Bora Permaculturar

AGROFLORESTA EM QUADRINHOS
PEQUENO MANUAL PRÁTICO

Scientific names

Ananas comosus	Solanum tuberosum	Canavalia ensiformis	Ricinus communis	Capsicum baccatum var. pendulum
Pouteria caimito	Ipomoea batatas	Cajanus cajan	Manihot esculenta	Capsicum baccatum
Cucurbita sp.	Solanum melongena	Phaseolus vulgaris 'Black Turtle'	Arracacia xanthorrhiza	Capsicum frutescens 'Malagueta'
Cucurbita pepo	Beta vulgaris esculenta	Zingiber officinale	Mangifera indica	Capsicum annuum
Beta vulgaris subsp. vulgaris	Brassica oleracea L. var. itálica	Sesamum indicum	Xanthosoma sagittifolium	Eugenia uniflora
Nasturtium officinale	Theobroma cacao	Helianthus annuus	Ocimum basilicum	Mentha pulegium
Lactuca sativa var. capitata	Coffea sp.	Gliricidia sepium	Origanum majorana	Citrus reticulata
Lactuca sativa var. crispa	Campomanesia phaea	Psidium guajava	Sphagneticola trilobata	Abelmoschus esculentus
Lactuca sativa L.	Diospyros kaki	Eugenia brasiliensis	Cydonia oblonga	Raphanus raphanistrum subsp. sativus
Ocimum basilicum var. pilosum	Allium cepa	Heliconia rostrata	Cucumis anguria	Brassica oleracea var. capitata
Allium sativum	Allium schoenoprasum	Mentha spicata	Cucumis melo	Eruca sativa
Allium porrum	Daucus carota subsp. sativus	Inga edulis	Pennisetum americanum	Apium graveolens
Cichorium intybus	Eugenia aggregata	Dioscorea sp.	Zea mays	Petroselinum crispum
Lactuca canadensis	Cichorium intybus	Tabebuia sp.	Khaya ivorensis	Glycine max
Arachis hypogaea	Coriandrum sativum	Plinia trunciflora	Mucuna pruriens	Clitoria fairchildiana R. A. Howard
Morus sp.	Brassica oleracea	Artocarpus heterophyllus	Guazuma ulmifolia	Sorghum bicolor
Maranta arundinacea	Brassica oleracea var. botrytis	Syzygium cumini	Brassica rapa subsp. rapa	Xanthosoma sagittifolium
Araucaria angustifolia	Crotalárea junceae	Syzygium jambos	Raphanus sativus L.	Solanum lycopersicum
Astronium fraxinifolium	Pisum sativum var. saccharatum	Solanum aethiopicum	Allium tuberosum	Triticum sp.
Oryza sativa	Spinacia oleracea	Citrus limettioides	Carya illinoinensis	Hovenia dulcis
Musa acuminata	Eucalyptus globulus	Citrus x limonia	Origanum vulgare	Eugenia pyriformis
Musa acuminata 'Dwarf Cavendish'	Vicia faba	Citrus x latifolia	Bauhinia forficata	Phaseolus vulgaris
Musa x paradisiaca	Vigna angularis	Linum usitatissimum	Cucumis sativus	Phaseolus vulgaris L.
Musa acuminata x balbisiana	Phaseolus vulgaris Pinto group	Hedychium coronarium	Aspidosperma polyneuron	Hibiscus sabdariffa
Arctium lappa	Vigna unguiculata	Carica papaya	Prunus persica	Smallanthus sonchifolius

When João first showed me Agrofloresta in Quadrinhos at the Food Autonomy Festival in Amsterdam I was an immediate fan. The nice drawings and the detailed information came beautiful together. This is the perfect way to present this hopeful message. So when João asked me to help with the English translation I felt very honored.

As the traditional agriculture with monoculture on a massive scale is exhausting the planet, the need for an alternative system that is building up the soil and enriching biodiversity is felt stronger than ever.

In the time that I spent in Brazil I saw that the examples of smaller and bigger agrofloresta farms are gaining impact. Via local organic markets their products find their way to consumers who are supportive and willing to pay a fair price.

I hope this guide will help you to participate in this growing mondial movement towards abundance and a healthier world.

Hans Boersma

PARTNERS

ORGANIZATION