

ENGLISH

Agroecology Qalisa!

TRAINING MATERIALS FOR PARTICIPANTS

These how-to materials were developed for participants who attend Biowatch's AE Qalisa! "introduction to agroecology" practical training course for smallholder farmers.



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Agroecology Qalisa!

These how-to materials were developed for participants who attend Biowatch's *AE Qalisa!* "introduction to agroecology" practical training course for smallholder farmers in KwaZulu-Natal, South Africa. They were developed specifically to support the first steps in applying agroecology practices in traditional homestead planning.

Please note: Because agroecology farming practices are context-specific and responsive to the local climate and culture, the practices shared in these materials may not be appropriate for all areas or climates, and should be adapted to suit your own context, climate and cultural preferences.

These materials are available in English and in isiZulu.

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WHAT IS AGROECOLOGY?

Agroecology learns from nature and applies this learning to the way we produce food and create just, sustainable and resilient food systems.

Agroecology is a bottom-up approach rooted in the experiences of millions of smallholder and family food producers around the globe who have been fishing, growing crops, herding livestock, and harvesting uncultivated food from their territories over generations. They have carefully observed their environment and adapted their food production practices to this.

Because the the landscape, soils, climate and socio-economic conditions as well as the culture in each place are unique and different, the way agroecology is practiced cannot be the same everywhere – we must find the best way to apply the principles where we are. This results in many different methods, practices, and food cultures around the world.

Agroecology is also a science that brings together and applies the wisdom and traditional knowledge of food producers and researchers in diverse disciplines who are deepening our understanding of how natural living systems work. Ecology = the study of the relationships between living organisms (including humans) and their environment.

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Together we work on the social, political and economic changes needed to transform the current food system to ensure human rights, including the right of people to eat and produce healthy and culturally-appropriate food produced and harvested through ecologically sound and sustainable methods.

This requires us to challenge and transform deep inequalities of power in society to return the control of seeds, biodiversity, land and territories, waters, knowledge, culture and the commons to Indigenous peoples and the family-farmers and smallholder producers who feed most people in the world.

Agroecology resists the dominant corporate trade and industrialised food system and instead promotes circular and solidarity economies through localised and territorial markets based on transparent networks between producers and consumers. This solidarity economy values mutual co-operation, fairness, and social and economic democratisation to support the wellbeing of people and the planet above profit.

Respecting women's contribution to food systems and their right to actively participate in all aspects of decision-making is fundamental.

WHAT CAN WE NOTICE ABOUT NATURAL ECOSYSTEMS?

When we carefully observe natural ecosystems, we see that even though living organisms and their environments look quite different from each other, there are processes and interactions that happen in the same way in all of them.

Agroecology copies nature by applying these common patterns and organising principles to our food production systems.

By using agroecological principles we support nature's tendency to become more complex by increasing diversity to encourage more helpful interactions between the soil, plants, and animals. Gradually no external inputs are needed because the system provides for its own soil quality and fertility and keeps organisms in balance, so none become a pest; nothing goes to waste; and production cycles through the seasons ensure nutritious and healthy food for people and animals.

Industrial agriculture tries to keep the agricultural ecosystem simple – in a disturbed “pioneer” phase – by ploughing and planting monocultures, and then uses toxic chemicals to go to war with the pests that attack the malnourished crops and the weeds that cover the exposed soil.

AGROECOLOGICAL PRODUCTION PRINCIPLES

Learning from ecology, there are five inter-linked principles that we try and apply to our food production systems so that these can be more sustainable.

① Build healthy living soil to grow diverse healthy plants

The sun is the source of energy that powers all ecological cycles. Plants are uniquely able to use sunlight, carbon dioxide from the air, and water and convert this into oxygen and glucose which is transformed into the carbohydrates that become food for everything else. These carbohydrates provide energy and form the compounds and parts of the growing plant. Some are also sent into the soil through the plants' roots in the form of carbon compounds.

Plants do this to attract and feed microbes in the soil which can bring nutrients (minerals from the rocks the soil is formed from or from the air) into their root zone. These organisms are eaten by others and in the process the plant can access the nutrients it needs in a useable form.

In agroecology we want to always make sure that the soil is healthy and alive with a diversity of organisms, and that there is a diversity of plants growing at all times in order to maintain this unique relationship between the soil, the soil organisms and living plants to feed the food web.

We can help to make a good home for soil organisms and increase their activity by ensuring there is organic matter in the soil to feed them, there is enough air and moisture in the soil, and the soil is protected with a cover of mulch or living plants.

② Recycle biomass and nutrients

In nature, matter is continually cycled through the web of life. There is no waste because any unused nutrients or dead organisms are eaten by others.

In agroecology we try to boost the nutrients that are available and ensure they are cycling through our production system in a balanced way. We do this by recycling biomass – mixing plant and animal systems and returning organic matter to the soil through a variety of composting and biological digestion methods.

③ Prevent resource losses due to energy, water and air flows

How we design our production systems influences if the energy, water and air that flows through them will help us or be destructive. We try to conserve and make the best use of available resources including energy, soil, water, and nutrients by linking elements to cycle the resources from one to the next (closed loops instead of linear throughputs); we create micro-climates; and prevent loss by managing water and soil through water harvesting techniques and soil cover.

④ Increase diversity

Natural ecosystems are stable and resilient to stress due to the richness of diversity. In agroecology we increase diversity within our production system in many ways. We diversify what we produce and increase the organisms that work together to make the system healthier and more productive and are useful to us. We can increase this diversity by increasing the different kinds of plants and animal species, and by increasing the genetic diversity within each species (for example different varieties of beans). We also increase diversity through space (above and below the ground and from the field to the wider landscape) and through time (changing through seasons and over years as the perennial plants grow and mature).

⑤ Enhance synergies

In natural ecosystems energy and resources are exchanged through co-operation between organisms. In agroecology we try and increase these helpful biological interactions between components within our production systems so that important ecological processes and services are taken care of. In other words, nature does the work creating a balanced ecosystem.

PUTTING AGROECOLOGICAL PRODUCTION PRINCIPLES INTO PRACTICE

The methods and practices we use to apply the above five principles should suit the context we are in and what we want to eat. We aim to avoid outside inputs and rather build on the natural resources that are available to us locally.

Below is a summary of some of the specific practices used by Biowatch-supported farmers in northern KwaZulu-Natal. These may also work for you. However, you should also observe your own environment, speak to elders in your community to gain traditional knowledge about the way food was produced in your area, and try your own experiments to apply the principles and see what works best for you.

PUTTING AGROECOLOGICAL PRODUCTION PRINCIPLES INTO PRACTICE

NO to synthetic chemical fertilisers!

YES to agroecological practices and methods!

to synthetic chemical pesticides and herbicides!

to genetically modified (GM) seeds and crops!

WHERE USED			AGROECOLOGICAL PRACTICE	AGROECOLOGICAL PRINCIPLES				
Vegetable garden	Seed plots	Rain-fed fields	<i>Agroecology learns from nature and applies this learning to the way we produce food.</i>	1. Build healthy living soil	2. Recycle biomass and nutrients	3. Prevent resource losses	4. Increase diversity	5. Enhance synergies
			Compost in a bag					
			Pit compost					
			Heap compost					
			Compost teas					
			Fertility beds: three types of fertility beds are prepared: • Deep trench bed • Double-dig beds • Single-dig beds					
			Bio-inputs for soil (e.g. Bokashi, Supermagro, native microbes)					
			Foliar sprays (ash brew, lime sulphur)					
			Planting basins					
			Mulching					
			Living soil cover with cover crops and green manures					
			Plant groundcover and grass around homestead instead of sweeping clean					
			Locate vegetable garden and fields below buildings to harvest run-off water					
			Dig swales on contour					
			Soak pits in pathways					
			Grey water recycling					
			Plant strong-smelling plants around gardens and fields, between plots					
			Plant flowering plants between plots and as borders (have flowers all year)					
			Create safe spaces for lizards, frogs, and birds					
			Companion planting and plant guilds					
			Crop rotation from season to season					
			Inter-cropping					
			Alley-cropping					
			Diverse livestock					
			Chicken tractor					
			Seed coating					
			Save seed					



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WORKSHEET

PLANNING MY FARM

- Use the questions in this worksheet to help you think about and plan your farm when you are at home.
- You will need some blank paper to sketch and note what you observe and to help you develop your plan. Don't be afraid to make mistakes and rework your ideas many times.
- Some of these questions may need you to sit and discuss as a family.

1. Start with careful observation of what is there

Carefully observe your homestead and land. Note and record your observations of the following aspects and elements:

Sunlight and shadow

- Where does the sun rise and set?
- What is the path of the sun during winter compared to summer?
- Are there any parts of your land and homestead that are in deep shadow or are full and hot sun as the sun moves through the day and the seasons? Think about how this affects where elements can go e.g. keeping livestock cool in summer and warm in winter.

Wind and fire

- From which direction does wind come from most of the time? Does this change in different seasons? Do some of these tend to cause damage? Do you need a wind barrier on this side?
- Are you threatened by veld fires? Which direction do these come from? Do you need a fire break or fire resistant plantings on this side?

Trees

- What trees are there?
- They shouldn't be cut unless they are invasive plants or the roots are threatening your buildings. How can your plan include and benefit from these trees?

Slope

- Is your land flat or on a slope?
- Which way do the different slopes face – is it towards the morning, midday or afternoon sun or away from it? Does the way these face make them cooler or warmer, and when?

Water flows

- What paths does the water take when it rains?
- Where does it flow quickly? Where does it flow slowly? Where does the water disappear fast? Where does water pool and stay for longer after the rains?
- Can you capture and store water? Where is the best place to capture and store water? Can stored water flow by gravity to where you need it?
- Is water causing damage anywhere – for example is it washing away soil, or roads or the foundations of your buildings? Think about how this water can be slowed or re-routed to prevent damage and be stored in the ground.

Buildings and infrastructure

- Note where the buildings are – what are these used for?
- What is the location of the buildings where you prepare food, store food, store seed, and store tools and other items used on the farm? Are these easy to access from the gardens and fields?
- Is there a relationship between the different buildings and the outside that you can enhance? (For example, can the household garden be near to the kitchen so that you can easily pick vegetables and herbs for cooking?)
- What buildings will you need to build in the future as your family grows – where will these go and how will you reach them? Will this affect other parts of your land and farm?
- What other infrastructure is around your land such as roads or concrete pavements? Does this provide opportunities for marketing? Does the hard surfacing (roads, parking areas, pavements, bare ground) bring extra water and pollution into your land that you need to manage?

Homestead elements

- What farm elements do you have currently, where are these and what is the relationship between them? These include all the parts that make up your farm such as the household vegetable garden, fields near the houses, far fields, fruit orchards, seed plots, crop trial plots, stock pens and houses (e.g. cattle, goats, chickens, etc), grazing areas, composting areas, bee hives, dams, seed stores and granaries, woodlots, packing sheds, etc.

Natural wild areas

- Are there any parts of your land that have a lot of indigenous plants and trees or are next to these areas? How do these help you?
- Are there any parts of your land that have natural water courses or wetlands in them or are near to these? How do these help you?
- Think about how you can support the conservation of these areas and link corridors of natural plantings to them from your farm – they are important for sustaining the diversity of life and bring many benefits to us including insect pollinators and predators, beneficial microbes, wild foods including fruits, medicinal plants, building and craft materials, wind breaks and they hold water in times of flooding.

Soils

- Note the different types of soil on your land – what production would benefit from which soils?
- How deep are soils?
- Are there any soils that are too damaged or infertile to plant in? What can you do to heal this area?

Rocks

- Are there large rocks in the land – are they on the surface or under the surface?
- How can you collect water that runs off from large rocks on the surface?
- Do rocks under the soil affect deep-rooted plants or the way that water drains away?

2. Start planning

Now look carefully at all the elements and parts of your farm and start your plan. This will change many times as your understanding of the relationships between elements and the land grows, so be prepared to rethink and make changes.

You might want to make a model of your farm outside in the sand so that you can try moving things that represent your buildings and farm elements around to think through the best relationships between elements.

Start planning and planting from your door!

Organise your homestead in zones

The more of your time and attention something needs, the closer it should be to your house.

- What things need to be close to your home because they need more attention?
- What things need to be close to your home so you can protect them?
- What things only need to be visited now and then, and can be further away?

Use the “Zone planning example diagram” to help you.

Plan water management first

- Where do you need to redirect or trap water – design, measure and construct the main water conservation measures first. These could include swales, earth mounds, and small dams.
- Where will water storage go? Try to minimise pumping and let gravity help you. Be careful with where you store water – if a tank or dam breaks where can the water flow to safely and how will you make it flow that way?

Farm elements

- What farm elements do you have now, and what would you like to have in future?
- What is the best place for these?
- Should anything be moved to a better place?

Can you make connections between elements that would give you added benefits? (e.g. putting the chicken house next to the fruit orchard so the chickens can eat pest insects before they attack the fruit).

What different cropping plots do you need? Divide the productive land into plots that follow the natural contours and according to soils. Which ones need fencing?

Where do you need to grow living fences and hedges? These are important as windbreaks, habitat for wildlife and insects, animal fodder, pest repellent plant barriers, a source of mulch, to stop wandering livestock, and to trap and contain unwanted pollen drift.

Changes in time

Think about how each element will change through the seasons of summer, winter, autumn and spring:

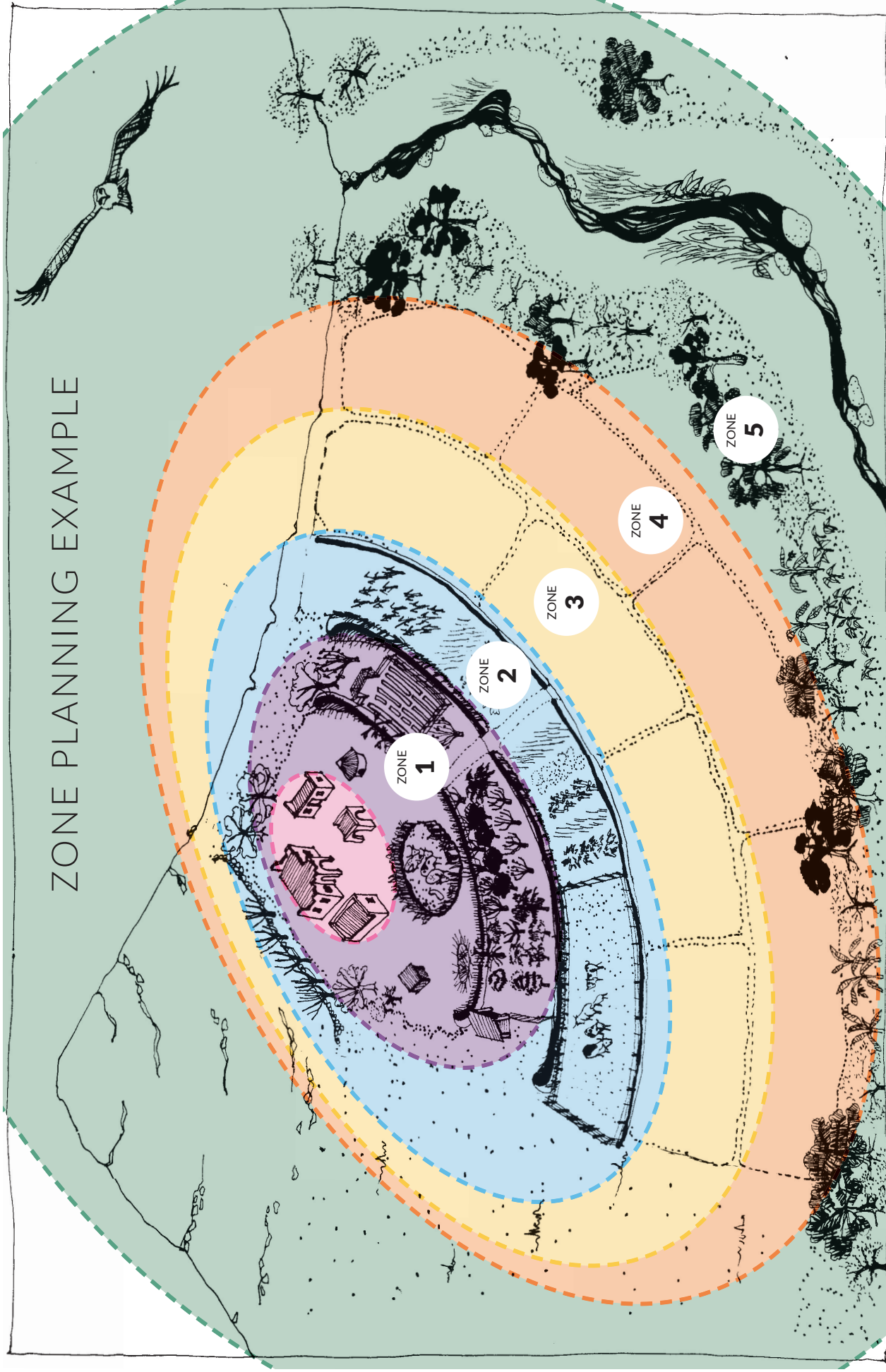
- For example, will they need protection from hot or cold weather; will they create shelter on hot or cold days; will fields be fallow; will trees lose leaves and let in more sun; will you need to get a bakkie to the area to harvest a seasonal product; etc.
- Think how you can create benefits from these seasonal changes.
- Are there seasonal changes that will create problems for you – for example, are you exposing vulnerable crops or animals to seasonal fires or bad weather?

Think about how things will change as time goes on:

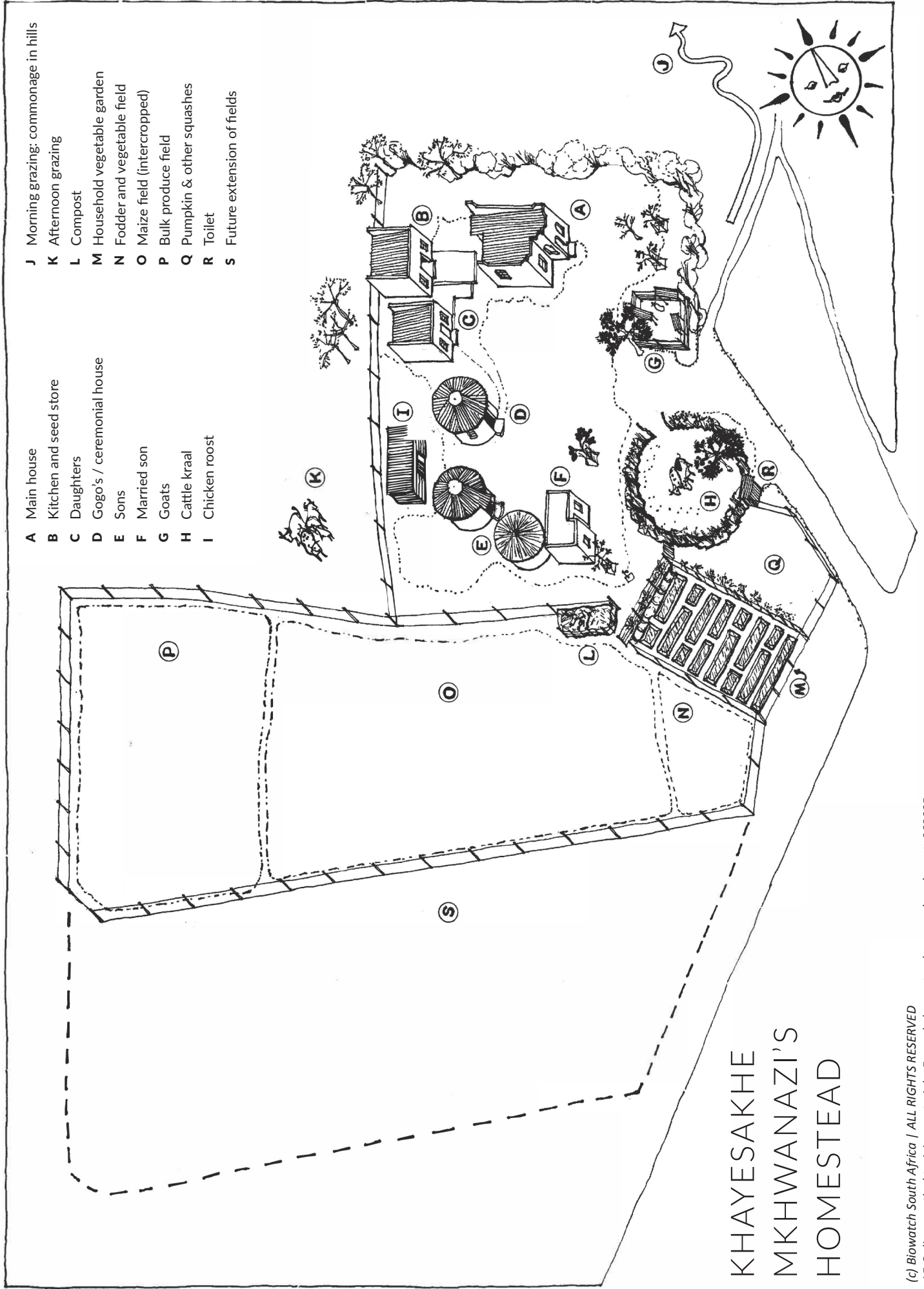
- Will they be in the right place when these changes happen – for example, will trees grow big and create wanted or unwanted shade and root networks?
- Have you allowed room for growth and extension?

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ZONE PLANNING EXAMPLE

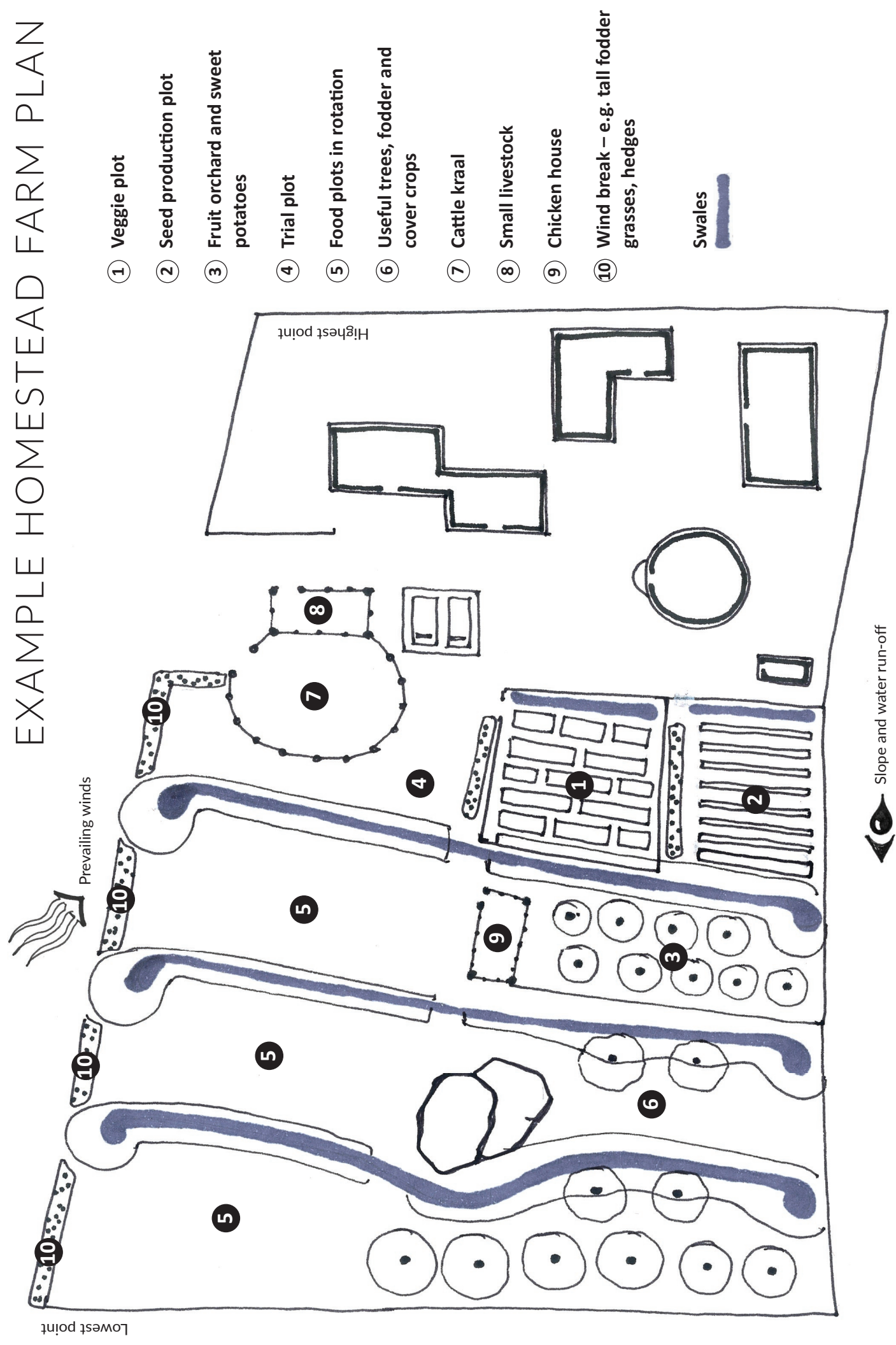


HOME	ZONE 1	VISIT DAILY	ZONE 2	VISIT FREQUENTLY	ZONE 3	VISIT OCCASIONALLY	ZONE 4	VISIT INFREQUENTLY	ZONE 5	OBSERVE and LEARN
	Household garden, animals that need daily attention, small fruits	Seed plot, orchards, less intensive vegetables	Near fields, rain fed field crops, bees	Far fields, woodland, forage, grazing, large water storage	Wild undisturbed indigenous ecosystems left for nature					



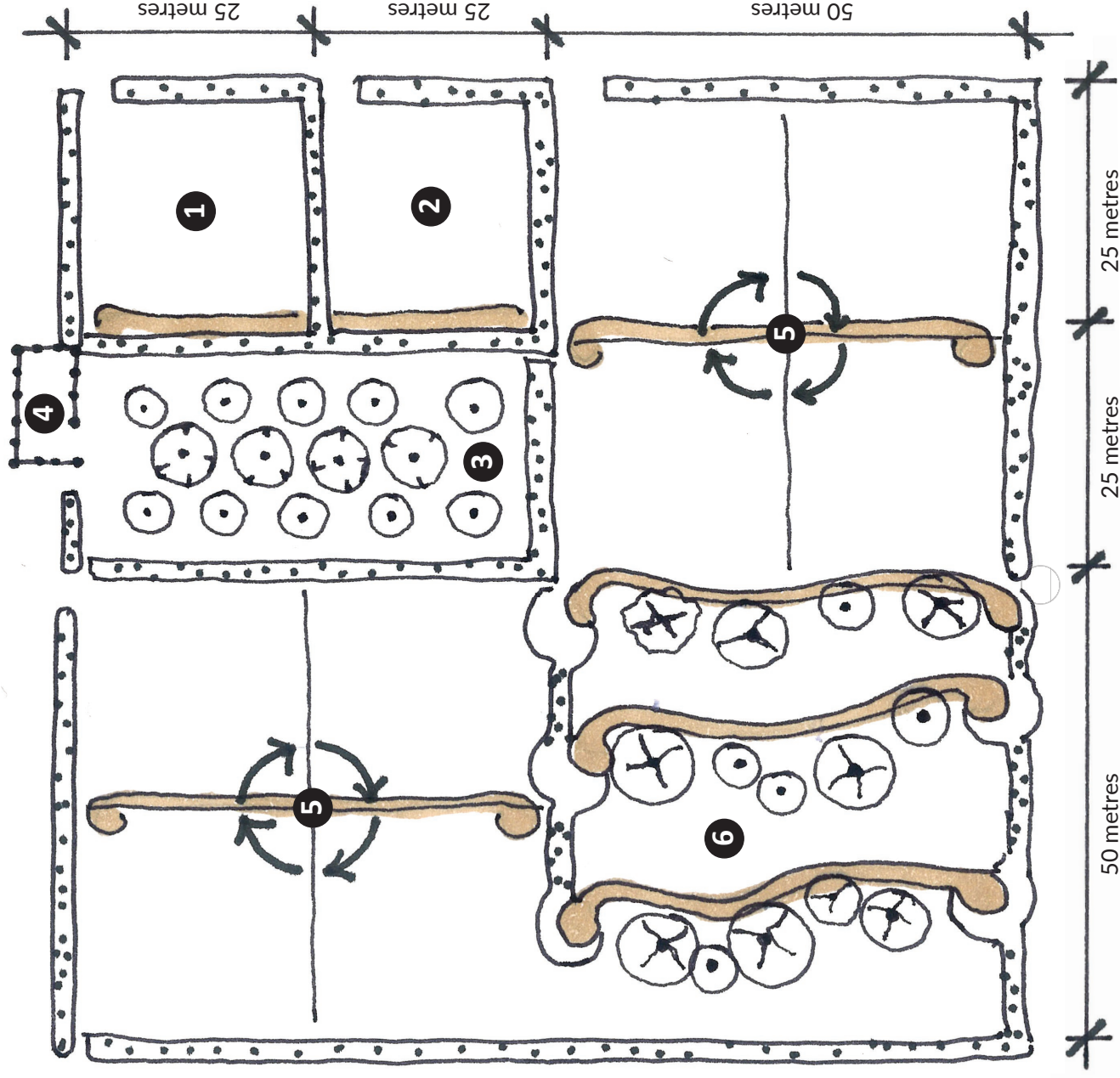
KHAYESAKHE MKHWANAZI'S HOMESTEAD

EXAMPLE HOMESTEAD FARM PLAN



EXAMPLE PLAN TO EXTEND PRODUCTION

- ① Seed plot
- ② Trial plot
- ③ Fruit orchard and sweet potatoes
- ④ Chickens
- ⑤ Food plots in rotations
- ⑥ Useful trees, fodder and cover crops



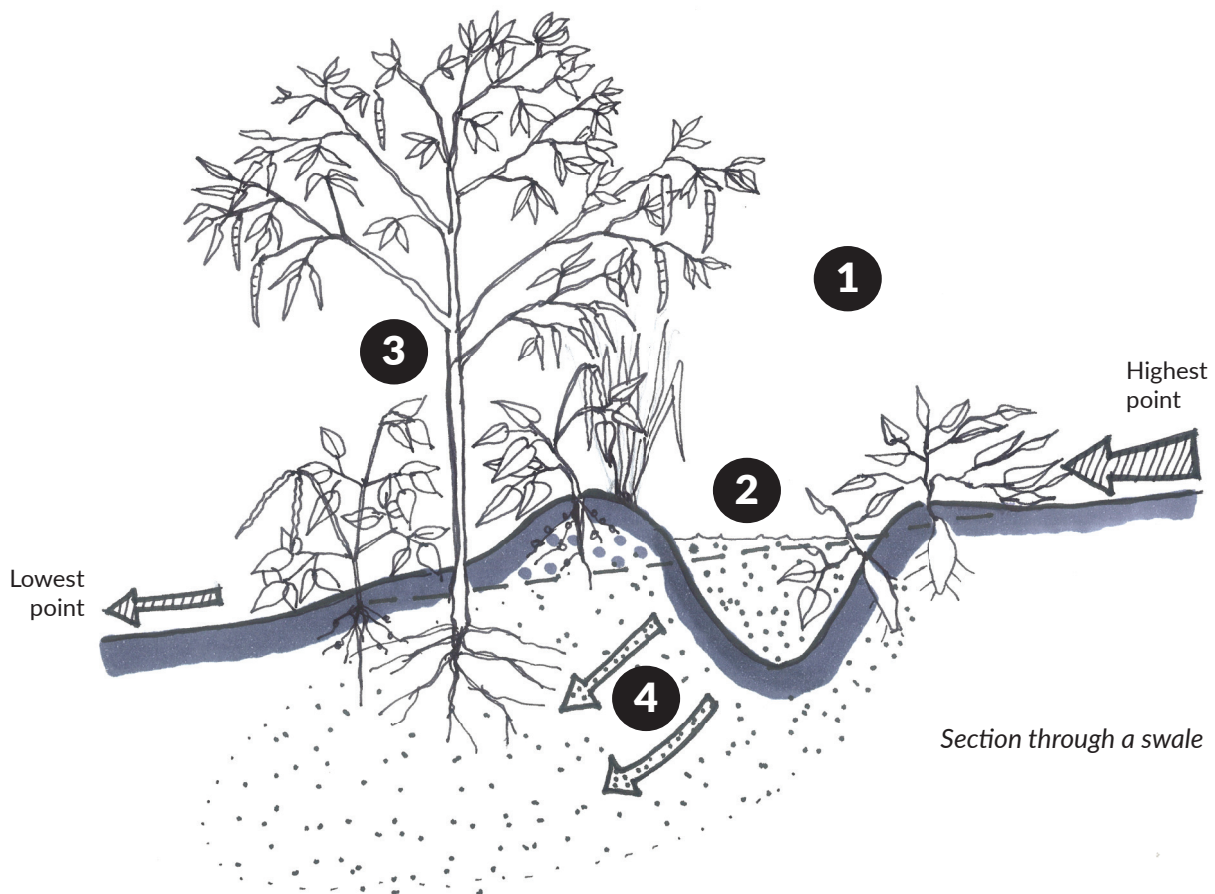
Slope and water run-off



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HOW TO MAKE A SWALE



- ① Use an A-frame level (or a Dumpy level) to peg out the contour line (points of equal height on the slope) where you need the swale.
- ② Dig out the soil to make a trench that connects your pegs along the contour line. Use the soil you dug out to make a mound (called a berm) on the downslope side of the trench. It is important that you smooth out the sides of the trench and the berm with gentle slopes so that small animals can easily crawl out.
- ③ Immediately add compost and plant on the mound and upper edge of the trench. You need the plants' roots to hold the soil in place as soon as possible. Make sure that these are always covered with crops including sweet potatoes and legumes. You can also plant perennial herbs and grasses like lemon grass on the berm. This will hold the soil in all seasons and make sure the water is held in the swale when it rains.
- ④ When it rains the swale dams the water allowing it to seep slowly into the ground. Most of the water will seep downslope of the swale creating deep soil moisture in the area under and downslope of the berm. This is the ideal place to plant important perennial crops that like water.

WHY DO WE DIG SWALES?

- Slow and spread water.
- Stop water and soil erosion.
- Save water in the soil where plants need it.

Swales slow down stormwater allowing it to filter into the ground. This helps to conserve water that falls on our land and prevents soil erosion. By capturing this water into our soil the area downslope of the swale has more moisture for a longer time helping the crops to be more resilient in dry spells.

Swales are especially important for harvesting water so that you can establish useful trees across the farm, which improves the micro-climate, creates wind breaks and adds beneficial diversity to your farming system.

However, if you are using the swale to harvest water in your vegetable garden or smaller fields where there is no space for trees, then you can plant other water-needy perennial plants below the swale berm. Depending on the space you have this could include pigeon pea bushes (for nitrogen fixing and wind breaks) and in smaller spaces crops like peppers; herb bushes like Lavender and Rose geranium; or grasses like lemon grass.

HOW BIG SHOULD A SWALE BE?

The size of the swale is influenced by how much space you have and the slope of your land. A good size is about 30–60cm deep and one spade wide (100–120cm). Be careful not to make deep and narrow trenches that people or livestock could fall into and hurt themselves.

The bigger your swale is the more water it can hold. Beware, big swales can be dangerous if the berm breaks in a heavy storm!

HOW MANY SWALES DO I DIG?

The steeper your land is, the more swales you should have down the slope.

It is better to dig more smaller swales than have one or two bigger swales, which create a greater risk if the berms break.

WHY DO I NEED TO PEG THE CONTOUR USING THE A-FRAME?

Swales must be dug on the contour line (points of equal height on the slope) so that the swale is level along its length. If the swale is not level the water will not stand still so that it can seep into the ground. Instead, it will travel down towards the lowest point and this can cause the water to break through washing away soil and beds downslope. Don't rely on your eyes to decide where to dig your swales as heights are very deceptive in the field. Also, make sure that you are not placing the A-frame legs on stones or hard clumps of soil that will give you false readings.

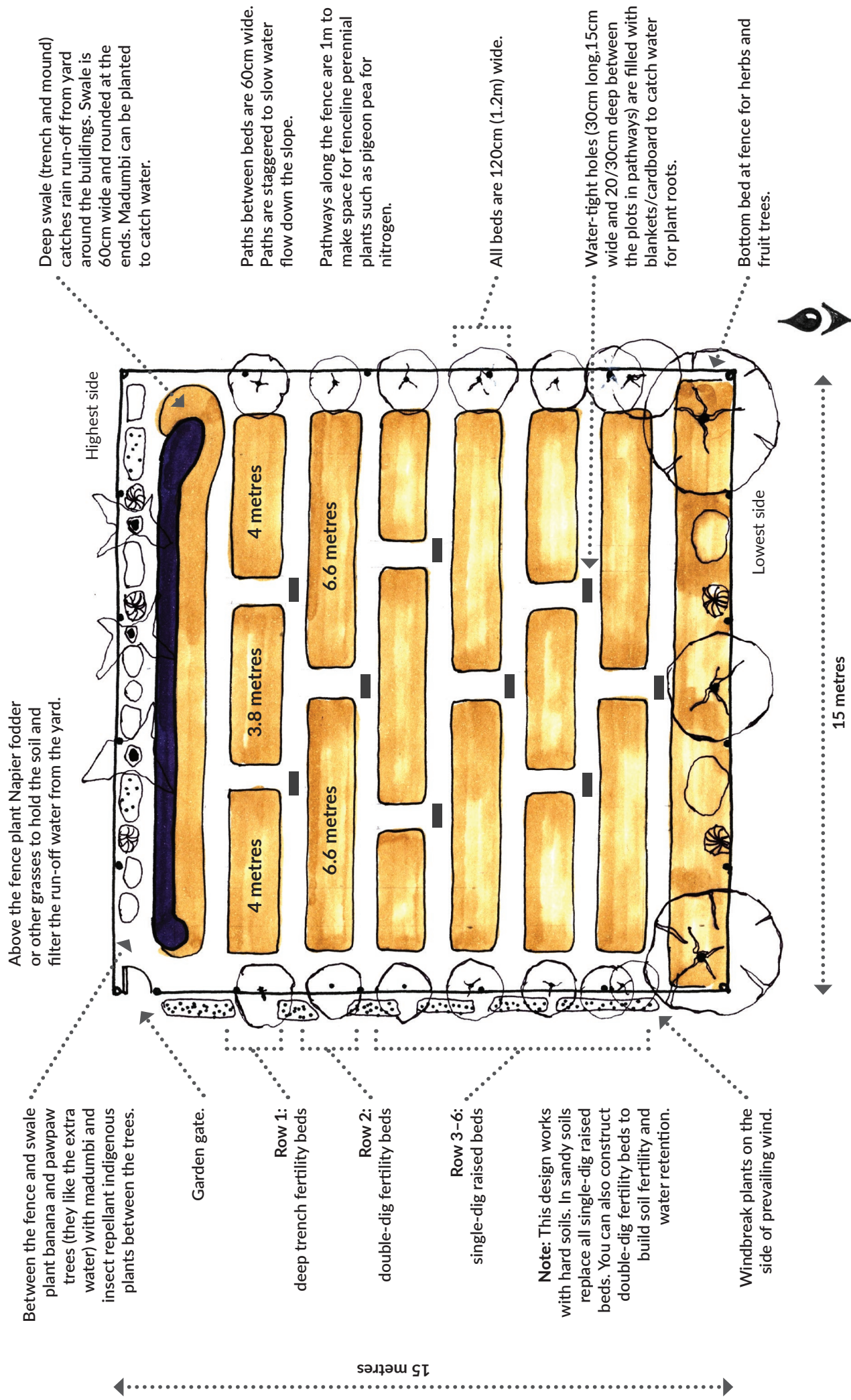
Some people dig the trenches in sections instead of along the entire length of the contour. They leave a pathway of soil between these sections that are half the depth of the full trench. This keeps the water controlled in each section of trench while allowing it to spill over to the next section when full.

If the rain run-off is coming from one area above the swale then it is better to make a continuous trench so that the water can spread evenly along the whole swale and water the crops below evenly.

MAINTAINING YOUR SWALES

It is important to plant the berms and the upslope side of the trench straight away with permanent plant cover to hold the shape of the swale and prevent it from washing away when it rains. A well planted swale will also trap soil that is washed from the beds and over time the land between swales will flatten out. This is easier for cultivation and conserves soil, water and nutrients. You may need to dig out the swale trenches again to maintain their depth and water holding capacity.

HOUSEHOLD VEGETABLE GARDEN LAYOUT





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HOW TO MAKE A DEEP TRENCH FERTILITY BED

To make your deep trench fertility bed follow the numbered steps from 1–14:

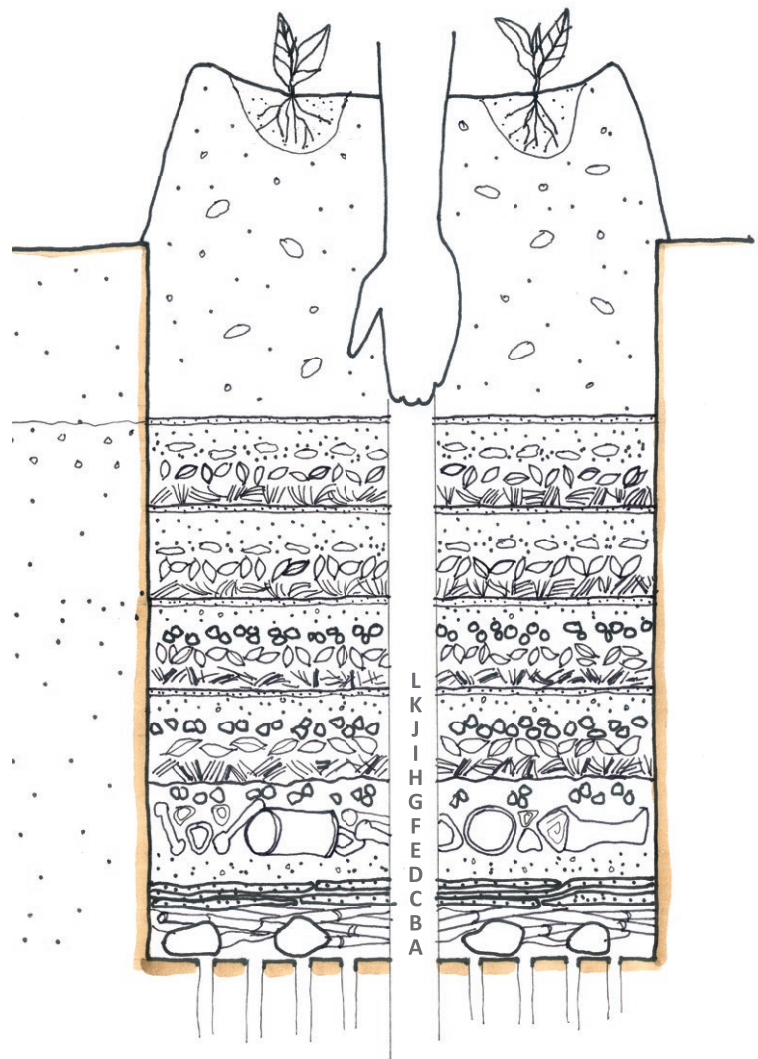
- ① Dig a trench the width and length of your bed. The width of the trench shouldn't be more than 1.2 metres but can be as long as you have space for.
- ② Dig the trench down to 60cm (above the knee when you stand in the hole) with a flat bottom.
- ③ Save the dark topsoil to one side for later.
- ④ Spread the subsoil (lighter soil) that you dig out on the pathways between your beds.
- ⑤ Loosen the soil at the bottom of the trench with a garden fork.
- ⑥ In the trench, replace the soil with the following layers **from the bottom up**:

- A** One layer of medium stones for aeration. If you have no stones just use small branches.
- B** Maize stalks and small branches.
- C** Green materials.
- D** Cardboard and old blankets.
- E** Layer of subsoil.
- F** A few bones and 4–5 rusty tins (these must be steel tins from food, not aluminium drinks cans).

- G** Fresh animal manure.

- ⑦ Then repeat the following layers up to halfway:

- H** Dry plant material.
- I** Green plant material.
- J** Old animal manure (e.g. chicken, goat or cow).
- K** Subsoil.
- L** Water and wood ash slurry.



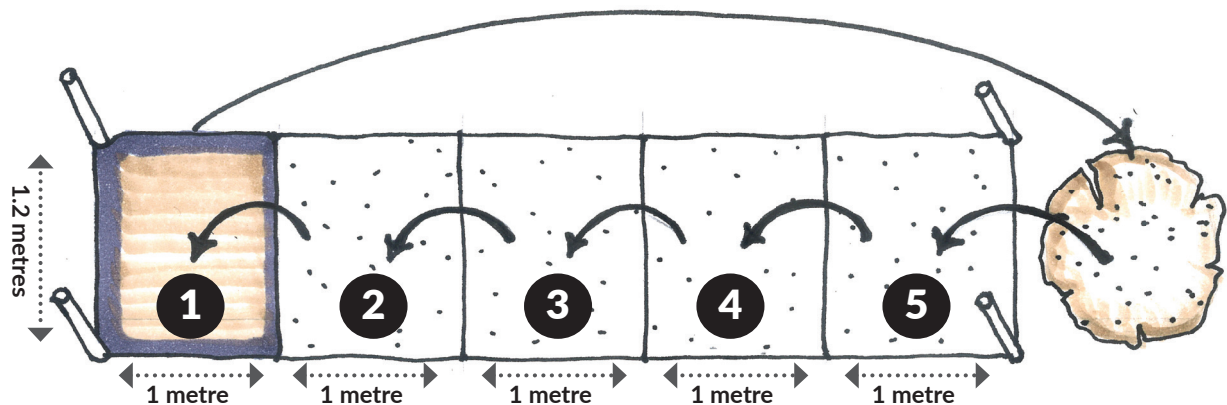
- ⑧ In the next 30cm (the second half) repeat the layers but replace the fresh animal manure with old manure and use only the topsoil for the soil layer.
- ⑨ Stop layering at a depth of one-hand below the surface of the ground.
- ⑩ Take the topsoil you set aside and mix it well with soil, ash, old manure and compost. Fill in the rest of the trench and continue piling the mixture to 15cm above the normal ground level.
- ⑪ Rake and use your hands to form this raised bed into a tray shape to hold water then cover it with mulch.
- ⑫ Plant into the raised bed by opening small spaces in the mulch and planting into the soil below adding one cup of compost per plant.
- ⑬ Pour a slurry of cow dung, wood ash and water around each plant (the smell chases cut worms) and you can also sprinkle crushed egg shells.
- ⑭ Make a tea of green weeds and let it ferment for 3 days – use this tea to water the seedlings, once during the first 3 days from planting.



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HOW TO MAKE A DOUBLE-DIG FERTILITY BED



- Peg out the size of your bed – this should be 1.2 metres wide and as long as the space you have. Divide the length of the bed into 1 metre sections. Don't forget to leave some space for pathways.
- Dig out the first section of the bed to knee height (30–50cm) and store the soil on the pathway at the other end of the bed.
- Fork the subsoil at the bottom of the hole you have dug out to loosen it.
- Fill up the hole with mixed dry and green organic materials (including garden clippings, leaves, weeds, and kitchen scraps); dry kraal manure; and ash from a wood fire. Dampen all the materials before layering them in the hole.
- Dig out the next section, and fill the dark topsoil back on top of the organic waste in the first hole – this will create a high raised bed. You can put any subsoil on the pathway, except if you have very shallow topsoil or sandy soil in which case put all of it into the hole. Rake the soil into a tray shape to catch the water.
Note: when you are farming in very sandy soil you will struggle to get a raised bed as the sand doesn't hold the shape and sinks down more after filling. Don't worry – the organic matter will help with fertility and water retention.
- You can carry on filling and digging out sections as you have time and organic waste.
- You can plant into the soil after one day, but it is better to allow the new sections a little bit of time to settle and start decomposing – about 2–3 weeks.
- Remember to mulch each section well as you complete it. If you are not in a rush to use the bed and you take longer than 3 weeks before planting, then it is also good to mix some Bokashi into the soil as you add it on top of the organic materials to fill the hole.

- When you plant into the bed you can intercrop companion plants or plant a different vegetable in each 1 metre block.
- Plant into the raised bed by opening small spaces in the mulch and planting into the soil below adding 1 cup of compost per plant.
- Pour a slurry of cow dung, wood ash and water around each plant (the smell chases cut worms) and you can also sprinkle crushed egg shells.
- Make a tea of green weeds and let it ferment for 3 days – use this tea to water the seedlings, once during the first 3 days from planting.
- When you have filled the last hole with organic material, then use the soil you stored from the first hole to complete the bed.



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HOW TO MAKE A SINGLE-DIG RAISED BED

- Peg out the size of your bed – this should be 1.2 metres wide and as long as the space you have in your household garden allowing for pathways.
- Collect and mix wood ash and old kraal manure and spread this on the unprepared ground. You need 1 full wheelbarrow of this mixture for every 1 metre length of bed.
- Once you have spread the manure and ash evenly, loosen the soil with a pick and then a fork. This should allow air into the soil, making it raise higher than the original ground.
As you go, fork the manure and ash mix into the soil well. You can also fork some Bokashi into the soil as this will add beneficial micro-organisms.
- As you are forking, pull out any weeds in the bed and throw these on the pathways.
- Don't fork or loosen the pathways between beds. Slash the grass and weeds and let them lie in place, unless you have very problematic weeds to suppress that must be pulled out.
- Use a rake to shape the loosened soil of the bed into a tray shape to collect water.
- Mulch, and then water the bed.
- Although you can plant into the bed straight away, it is better to let the bed rest for 3-4 weeks. If you have added Bokashi to the soil, then you must wait for 3-4 weeks or the activity of the micro-organisms will burn your plants.
- Open small spaces in the mulch and plant into the soil below adding one cup of compost per plant.
- Pour a slurry of cow dung, wood ash and water around each plant (the smell chases cut worms) and you can also sprinkle crushed egg shells.
- Make a tea of green weeds and let it ferment for 3 days – use this tea to water the seedlings, once during the first 3 days from planting.



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HEALTHY SOILS

Healthy soil = healthy plants = healthier people

Soil has:

- ① **Eroded rock and minerals (approx. 45%)**
- ② **Air and gasses (25%)**
- ③ **Water (25%)**
- ④ **Organic matter (at least 3-6%)**
- ⑤ **The living organisms inhabiting the soil**

CHARACTERISTICS OF GOOD HEALTHY LIVING SOILS

- No chemicals or toxins that could harm the soil life or plants.
- It has a balance of sand and silt particles with a little clay, and contains organic matter and humus (decomposed organic matter).
- Healthy soils contain lots of plant food from decomposed organic matter, which is held by the clay and humus, and minerals from the parent rock.
- Good soil “tilth” – the right combination of moisture, texture, looseness and drainage for planting. An ideal soil is crumbly and has a fresh smell.
- Sufficient depth (about 60cm deep).
- Contains moisture but also has good drainage without leaching nutrients.
- Sufficient nutrients, including minerals from the parent rock as well as from decomposing organic matter.
- Contain lots of air – the soil has not been compacted (squashed by machines or feet) and the soil structure allows air flow. Air flow is essential for the life in the soil and for the flow of nutrients that come into the soil from the air.
- Fewer weeds, especially those that are a sign of degraded soils.
- Visible and microscopic soil organisms, which play an important role in maintaining fertility, structure, drainage, and aeration of soil. They also break down plant and animal tissues, releasing stored nutrients and converting them into forms that can be used by plants. These organisms include microbes (such as bacteria, archaea, actinomycetes, protozoa, algae and fungi) and larger organisms including nematodes, flatworms, earthworms, and populations of insects, arachnids (spiders, etc.) and small animals.

INCREASE THE HEALTH AND FERTILITY OF SOILS

- ① Avoid synthetic chemical fertiliser and pesticides. These kill soil life resulting in poor fertility, soil structure and water holding.**
- ② Avoid ploughing and using equipment on the soil which compacts it, kills soil life and releases carbon dioxide which contributes to climate change.**
- ③ Build the fertility of the soil by adding organic matter and creating a good home for soil life.**

For smallholders this can include the following:

- Fertility beds.
- Planting basins to add fertility and capture water.
- Inter-cropping.
- Cover crops and “green” manures of legumes in fields.
- Composts and compost teas.
- Applications of bio-inputs like bokashi, which combine organic material and living microbes.
- Integrating managed livestock to directly till and manure beds and fields (such as chicken tractors).



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HOW TO MAKE BAG COMPOST

① Collect the following materials before you start

- One 50 litre or 80 litre bag or sack.
- Two buckets (one for measuring water and one for mixing ingredients).
- Ingredients:
 - Greens (fresh green plants chopped up and soaked in water).
 - Dry manure from animals taken where they sleep.
 - “Soup”:
 - Fresh (wet) dung.
 - Ash (use wood ash but no ash from burnt coal, plastic or chemicals).
 - Mix the dung and ash together with water in the one bucket to make a “soup”.
 - Dry material (grass and leaves soaked in water).

② Fill your compost bag from the bottom up in layers

Add a thick layer of dry materials at the top, but leave enough space so you can fold the top of the bag over, making sure rain cannot get in.

Keep the bag closed with a stone.

Keep adding layers in the same order (greens, manure, soup, dry material), one bucketful at a time until the bag is almost full.

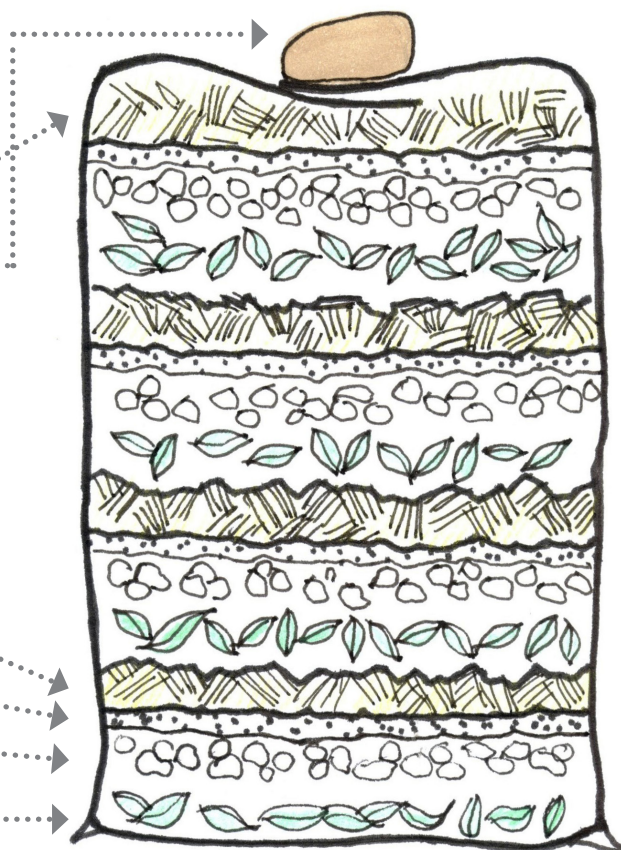
How to add layers in a compost bag from the bottom up:

layer of dry materials

soup of dung and ash

manure

greens



③ Place the bag under a tree or shelter. Make sure no rain can get into the bag.

④ Check the bag every week. Add enough grey water to the top to keep the compost moist.

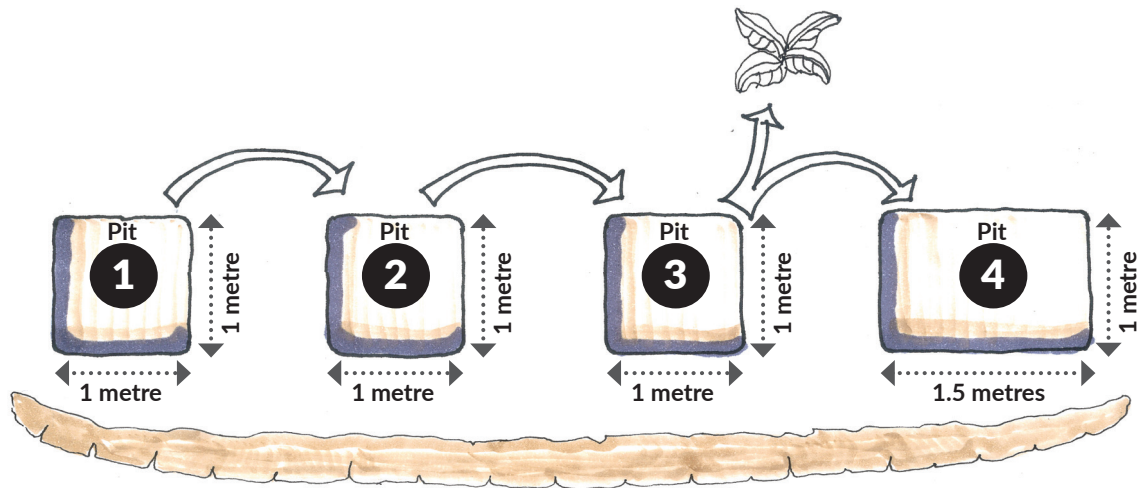
The compost should be decomposed and ready to use in 21–28 days.



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HOW TO MAKE PIT COMPOST



Biowatch has shared this method of compost making for many years because it:

- uses the organic materials you have as these become available;
- requires less work;
- is neat and can be protected from livestock and rodents;
- works in hot and water scarce areas because no extra water is needed, and the ground insulates the compost and conserves moisture.

MAKING AND MANAGING YOUR PIT COMPOST

- 1** Dig three pits of 1 metre x 1 metre square. Then dig a fourth bigger pit at the end of the row – 1 metre wide x 1.5 (or 2) metres long.
All the pits should be about 60cm deep (knee deep) and spaced 1 metre apart. If possible, these pits should be dug along the contour on sloping ground.
- 2** Spread the soil you dig out of the holes to make a long mound across the slope on the lower side of the pits. The mound will dam any water that runs down the slope so that it can keep the compost in the pits moist.
We can help the composting process by creating a good home for helpful organisms with the right mix of compost ingredients. We add any natural and organic materials (that can rot or were alive) to our compost, but not any synthetic human-made materials like plastics.
- 3** Fill up the first pit by adding any organic waste that becomes available. This can include cut grass, kitchen scraps, manures, old leaves and garden trimmings. Also include a little wood ash from the fire. When the pit is full cover it with thick mulch. Some people also use old carpet or zinc sheets so livestock can't fall in or scratch in the pit.
- 4** After 21 days, turn the material from pit 1 into pit 2. You can now start filling pit 1 with fresh materials. In another 21 days, turn the materials from pit 2 into pit 3; and from pit 1 into pit 2.
- 5** In another 21 days (63 days after filling the pit) the first compost should be ready. You can either take it to the garden to use, or turn it over a last time into the larger pit 4 where the finished compost is stored until you need it. You can also turn pits 1 and 2 into the next pit and start filling the first one again to ensure a constant supply of compost.



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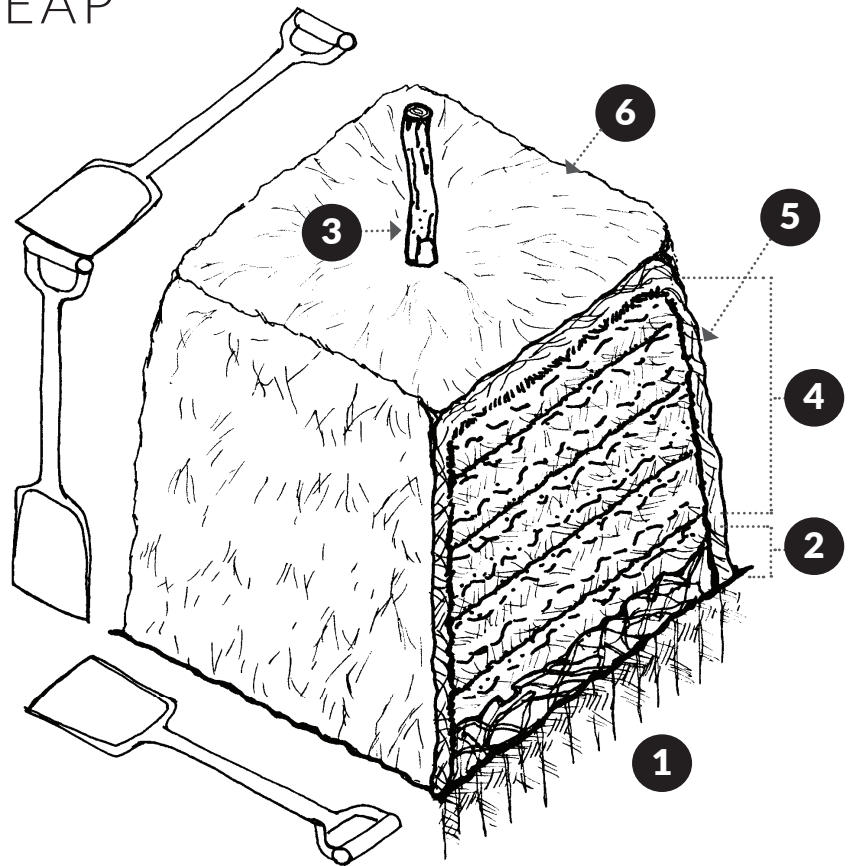
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HOW TO MAKE HEAP COMPOST

An ideal compost heap heats up enough to kill off weed seeds and disease-causing organisms, but isn't so hot that all the useful organisms needed for composting die.

A heap that is one spade high by one spade wide and at least one spade long is an ideal size for a compost heap. You can make it longer if you have space.

It is better to store materials and build the right size heap in one go – if you add materials slowly over time the heap won't heat up enough to kill unwanted organisms and will take longer to decompose.



BUILDING YOUR COMPOST HEAP

- ① Start by loosening the soil where you will build your heap. Use a garden fork.
- ② On the soil, lay a 20cm layer of coarse dry materials that will bring air into the bottom of the heap.
- ③ Build the heap around a central pole – this is pulled out at the end to create an air vent where you can also feel the temperature of the heap.
- ④ Build the rest of the heap by alternating 5cm layers of nitrogen-rich materials (e.g. green plants and manures) with 5–10cm layers of carbon-rich materials (e.g. dry and brown plants, grass, leaves, straw, crop stalks), until you have built the heap as high as one spade or the height of your hip.

You can also mix the materials as you go in a ratio of two parts carbon to one part nitrogen. Don't forget that all your material should be moistened before adding to the heap.
- ⑤ Every few layers, add a sprinkling of rich topsoil or finished compost to add good microbes to your compost. You can also add a very small sprinkle of mineral supplements like wood ash, clay, gypsum and bone meal depending on your soil needs. Rather don't add lime to compost – it will slow decomposition in the pile.
- ⑥ Cover the heap with dry grass or straw. Straw stops the compost from getting too wet in the rainy season and drying out in the heat – you can also put an old carpet over the top or plaster the outside with a layer of dung.

CHECK AND TURN THE COMPOST

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The **first three days** check the temperature of your compost every day. You can put your hand into the air hole where you have pulled out the pole or into the side of the compost. It should be hot but not too hot to keep your hand there – around 60°C is best.

Depending on the weather, it takes 24–36 hours to start heating. Check that the temperature of the compost is high for three days after making the compost. If the compost is too hot, sprinkle some water over it – but not more than 10 litres, depending on the weather.

If the compost does not get hot, there is too little nitrogen in your mix. You must mix the compost again with more nitrogen – a fresh cow dung slurry is good to use.

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Turn the compost **after the first seven days and once a week for the next three weeks**. Then leave it to stand. Make sure that the compost doesn't dry out – it should always be a little moist so sprinkle some water over it in hot weather.

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Eight weeks later (or a little longer in cold weather) the compost should be ready.