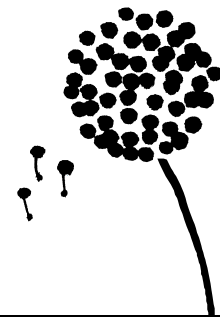


Agroforestry



TEARFUND

A PILLARS Guide

by Isabel Carter



Partnership in Local Language Resources



Agroforestry

A PILLARS Guide

by Isabel Carter

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Agroforestry

A PILLARS Guide

Introduction to PILLARS Guides

These guides are designed for use in small group situations where one or more people are literate and confident enough to lead others in group discussion. They aim to provide material for discussion around a subject either in isolation or as part of a regular group meeting; for example of farmers, literacy trainees, youth groups or Mothers Union members. Ideally just two or three pages should be used each time, allowing plenty of time for discussion of the issues raised and for carrying out some of the practical ideas suggested. No training is first necessary for the discussion leader.

PILLARS Guides aim to increase confidence among group members, so that they can successfully manage change within their own situation without the need for outside intervention. They try to build on existing knowledge and experiences among the members or within their community, so that different ideas can be tried out, adapted, and then either abandoned if not useful or appropriate, or found useful and adopted.

Objectives of this guide

- To increase awareness of the benefits of including trees with growing crops as part of sustainable agriculture
- To raise awareness of the value of agroforestry in improving soil fertility and preventing soil erosion
- To raise awareness of the nutritional benefits of various tree species recommended for agroforestry
- To gain understanding of the various benefits provided by recommended tree species

Anticipated outcomes

- Communities encouraged to regard agroforestry and tree planting as a normal activity on farmland
- The building and maintenance of tree nurseries in local communities and the introduction of a variety of recommended tree species
- Farmers encouraged to experiment and compare various techniques for tree planting
- People learn the value of local trees and gain confidence in their local knowledge
- The improvement of soil fertility and conservation
- The improvement of family nutrition
- Fuel wood becomes more available, benefiting the local environment
- The provision of opportunities to improve small holder income

Glossary of difficult words

agroforestry	growing crops and trees together so that both benefit
aim	broad, long-term, important goal
boundary	a dividing line which marks the edges of someone's land or field
erosion	the loss of good topsoil through the action of rainwater or wind
exotic	introduced from another country
fodder	food, usually green leaves or seed pods, for livestock
kernel	the softer, inner part of a seed which may be edible
objective	measurable activity which contributes towards achieving the main aim
pruning	cutting off unwanted branches from a tree or bush
soil fertility	the productive part of the soil, containing nutrients, water and organic matter
soil nutrients	particles in the soil which are used by crops and plants for growth (plant foods)
windbreak	a line of trees that provide protection from strong winds in a certain direction
zero grazing	a method of raising livestock, usually dairy cattle, in pens or small kraals where most of their fodder is grown elsewhere and carried to the pen

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Introduction to agroforestry

- Agroforestry is the practice of allowing trees and crops to grow together. This may be on farmland or in the forest. It is a way of making better use of the land available to get more products from the farm.
- Trees grown on farmland will change the growing conditions for the surrounding crops. These changes may be either positive or negative.
- What examples are there in your area where trees are grown on farmland? What characteristics do these trees have?



Discussion

F1

- Do all trees prevent crops from growing nearby or are some trees better at allowing crops to grow near them?
- Allow participants to discuss at length the advantages and disadvantages of trees growing near crops.
- Don't be afraid to let people list the problems, which may include trees taking away soil nutrients from crops, giving too much shade for crops to grow well or drying out the soil. Be sure to mention the example of eucalyptus which, though it is useful as a fast growing fuel wood tree, takes a lot of water from the soil so that crops will not grow near it. Eucalyptus is not a suitable agroforestry tree. Later draw the discussion to more positive benefits.
- These benefits include protecting soil fertility, protecting the soil from the effects of heavy rain on bare soil, and producing useful products such as fuel, fodder and fruit. Agroforestry depends on using trees that will not compete with food crops.

The benefits of agroforestry

- Trees help us in so many ways. See how many uses you can think of.
- Consider how much can grow in a forest and how fertile the forest soil can be. Agroforestry tries to introduce some of the benefits of the forest onto our farms. The trees used for agroforestry must not harm crops or the soil.
- Agroforestry trees may be either local trees, which have grown in your area for hundreds of years, or trees recently introduced from other countries. When trees from outside are introduced, these are called 'exotic' trees. Unfortunately people may regard local trees as 'planted by God' and not value them. It is often easier to encourage people to plant exotic trees because they are new.



■ The different uses of trees:

Participants are unlikely to need help as they begin to think of the different uses of trees. But they may not think of **all** the different benefits. After some discussion, you may need a few more ideas to encourage people's thinking. Here is a list of some of the benefits of trees:

- For fruit and leafy vegetables
- For shade
- As fences
- As windbreaks
- For building and furniture
- For firewood
- For charcoal
- For making paper and crafts
- For protecting the soil from erosion and improving soil fertility
- For medicines
- The sale of young trees or tree products brings income
- For fodder
- As sources of food in times of famine

■ What are the advantages and disadvantages of local trees and exotic trees?

First allow people to share their views. Here are some helpful points in case people do not suggest these:

- The qualities of local trees will be well known; they will be adapted to the local climate, and used to pests and diseases. However, they may be slow growing or limited in their usefulness.
- Exotic trees may not grow well in the local climate and they will not be adapted to pests and diseases. They may include citrus trees (oranges, lemons, grapefruit etc), eucalyptus, neem, leuceana and prosopis. However, exotic trees may be fast growing and have many benefits. It is usually best to grow a combination of both local and exotic trees.

■ Before the meeting, check on some examples of both local and exotic trees. Use the local names that people are comfortable with.

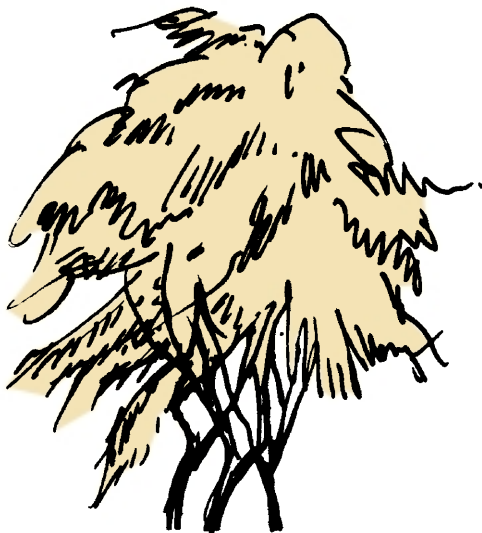
■ What are the priorities within your own household for the various uses of trees? Are these likely to be the same as your neighbours? Does everyone in your household share the same priorities?

The names of trees

- Local trees usually have one or more names in each local language. However to help people who speak different languages identify the same tree, every tree also has a 'scientific' name in Latin that remains the same worldwide. These scientific names are long and difficult to remember and so they are often shortened for everyday use. Here are some examples:

Local name (eg: in Luo)	Scientific name	Common name
oyieko	<i>Cassia siamea</i>	cassia
chwaa	<i>Tamarindus indica</i>	tamarind
akudho	<i>Devyalis caffra</i>	kei apple

- Different trees have different characteristics and uses. Sometimes their names indicate their usefulness. Discuss the names of different trees known in the area and whether any of these names describe the characteristics of the trees.



Prosopis (*Prosopis juliflora*)

Examples of local names: algarrobo, khejiri, her, kirya, gaudi maaka



Tamarind (*Tamarindus indica*)

Examples of local names: chwaa, dakkar, tsamia, tamarinier



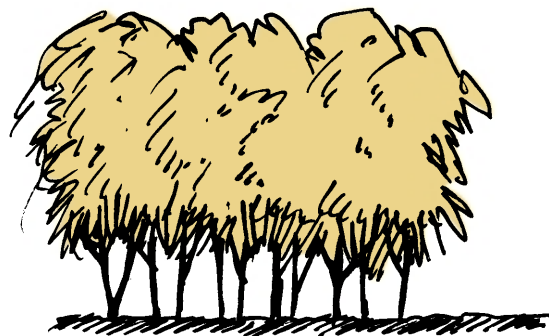
Discussion

F3

- Encourage participants to think of a number of local trees and their names and qualities. Then do the same for some exotic trees.
- Encourage discussion of the different names used for trees, particularly if any participant is from outside the area or is aware of the scientific names for certain trees.
- Consider the most useful trees in the area. Make sure all the participants know them. It may be useful to combine this discussion with a walk around the surrounding area, noting the various trees.

Qualities needed for agroforestry trees

- The best trees to grow together with crops are those with deep roots so they do not compete with crops for water and nutrients.
- They should allow light through their leaves to allow crops to grow.
- They should survive regular pruning and cutting back.
- They should add nutrients to the soil.
- Their leaves should provide either animal fodder or soil mulch.
- They should have uses that help the farm family.
- What local trees may have these qualities? How could you find out more? Do you know of any local trees which make the soil nearby good for crops?
- What exotic trees do you know which have these qualities?



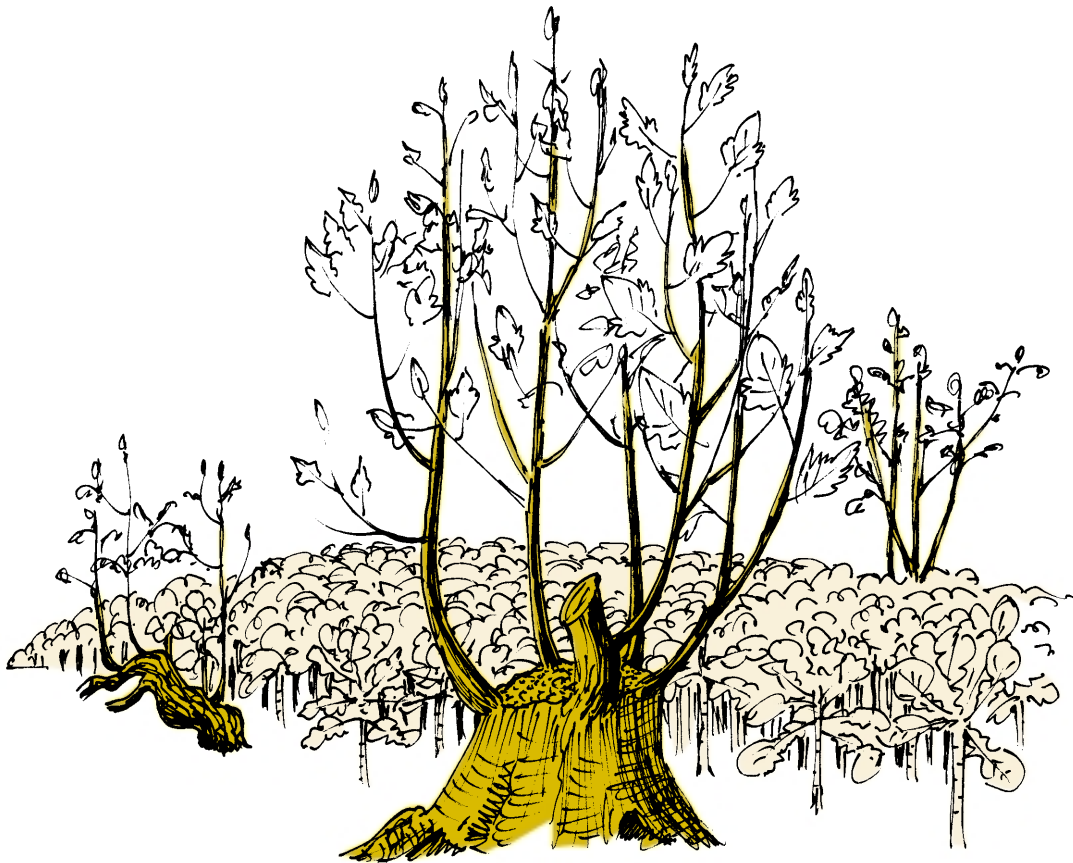
Discussion

F4

- If possible examine some examples of good agroforestry trees such as leuceana, cassia, prosopis, calliandra, acacia, sesbania and moringa. Do participants agree that they meet the suggested qualities for agroforestry trees?
- Examine their leaves, the way in which they grow and the amount of shade they give. If possible, dig up a young tree and examine the root structure.
- Compare examples of good agroforestry trees with trees such as mango and eucalyptus, which do not allow crops to grow nearby.
- Remember that the trees you decide to select need to provide the benefits agreed as priorities in an earlier discussion.

Encouraging tree growth

- Many local trees can be encouraged to grow without the need to plant seeds. If you only want a few seedlings of a local tree, it may be possible to find these growing naturally. If they are well placed they could simply be protected from animal damage and weeded. If they are in the wrong place you could move them but this should only be done when they are still very small at the beginning of the rains.
- You may also have old tree stumps either in the fields or in the field boundaries. Even after many years, these can still produce new shoots. Allow just one or two shoots to grow each year so that healthy trees develop.



Discussion

F5

- What seedlings can be found growing naturally? What are they useful for?
Discuss how easy it may be to move young trees. Has anyone in the group or in the community had experience in moving them successfully?
- Are people aware of old tree stumps on their land? Do these produce tiny shoots each year which are eaten by livestock? How could these be protected to allow just one or two shoots to regrow?

Obtaining young trees

- You may be fortunate to have a nearby nursery that has a good supply of tree seedlings.
- However, most farmers who want to plant a lot of trees will find it best to grow their own trees. This means you can choose the kind of trees you want; you can have seeds or seedlings available when you need them and you can raise money by selling extra trees to other farmers.
- Many farmers simply let trees grow themselves. However, to grow trees and crops together, you need to plant useful trees exactly where you want them. For most local trees you will be able to collect your own seed. Ask an extension or forestry worker about how to obtain exotic tree seed.



Discussion

F6

- Discuss the availability of tree seedlings in the area. Are there any tree nurseries nearby? What tree types do they have? How easy is it for farmers to get trees from the nursery?
- When do most local trees produce seed? How easy are they to collect?
- Do any participants have experience in collecting, storing and planting tree seeds?
- Do participants have any ideas on where tree seeds can be obtained? Usually there are some good sources in each country.

Collecting and storing tree seeds

- Make it a habit to carry some bags or old envelopes with you so you are always ready to collect seed from good trees.
- Collect only fully ripened seed from strong healthy trees. Take seeds from the best examples of the tree available. Seeds in pods or fruits need to be removed. With sticky fruits like tamarind, prosopis and balanites they need to be either eaten or soaked in water before the seeds can be removed and dried.
- Seed must be very well dried before storing. Use clear labels. Some seeds, especially those that are very hard, may stay good for many years. However some soft seeds such as neem or kei apple only keep for a few weeks. Use fresh seed whenever possible.



- What are the characteristics of a good seed tree? This will depend on people's reasons for growing trees. For example, a tree with good fruit will provide a good fruit tree and a tall straight tree will provide good timber.
- Discuss what kinds of containers are available which would be useful for storing seed. They need to be clean, dry and able to keep out air and damp. Some ideas include jars, tins, plastic containers, plastic bags or gourds.
- As a group, prepare suitable containers and labels. Then, if possible go out and collect some seeds. You can only do this at certain times of the year for most tree species. Allow the seeds to dry well before putting them in the containers.
- What sources of tree seeds do participants know about? These may include the Forestry Department, the Ministry of Agriculture or local NGOs. If you are unable to find seeds in your country for the trees you want, small samples of some seeds can be obtained from:

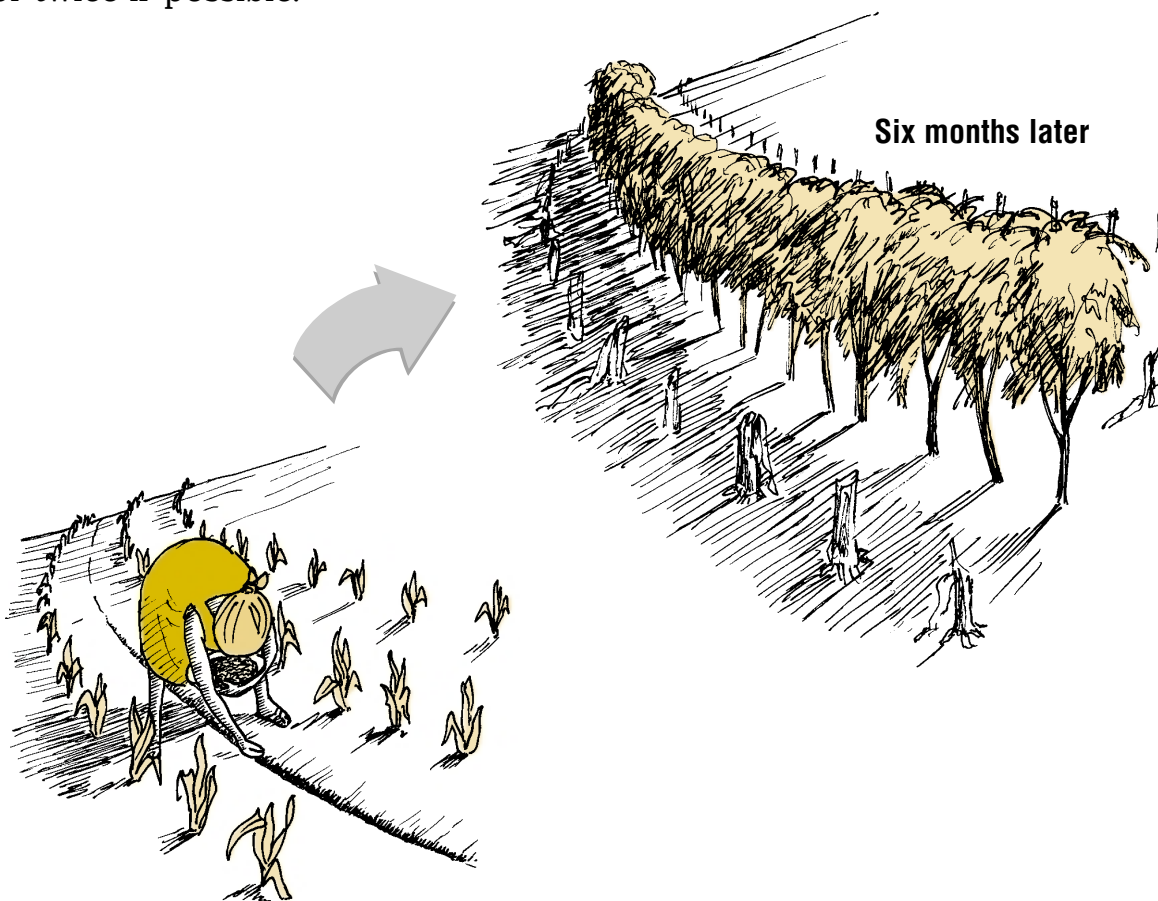
ECHO – 17391 Durrance Road, North Fort Myers, FL 33917, USA

E-mail: echo@echonet.org Fax: +941 543 5317

HDRA – Centre for Organic Gardening, Ryton on Dunsmore, Coventry, CV8 3LG, UK.

Direct planting of tree seeds

- Many trees can be sown directly into the ground. Plant lines of seeds following the contour line, or around the outside of a plot of land.
- Plant the seeds either just before the rains begin or early in the rainy season. If the rains fail, it may be worth the effort of watering the young seedlings once or twice if possible.



- Some trees can also be grown from cuttings or stakes. Cut poles from trees like gliricidia, moringa and calliandra into sections. Remove most of the leaves. The cuttings can either be 30–40cm long and planted at an angle, or alternatively they can be up to two metres long and planted upright so that the shoots will be out of reach of animals.



Discussion

F8

- What are the advantages of direct planting of seeds compared to the work of establishing a nursery?
- Do any participants have experience of planting trees directly from seed? What sorts of trees may be more suitable for direct planting?
- Do any of the participants have experience of planting trees directly from cuttings or stakes? Which species were successful and how was it done?
- If possible, visit a farmer who has already planted lines of agroforestry trees to learn from their experience.
- Arrange a convenient time to go and plant some lines of trees on one or more of the participant's farms.

Preparing a tree nursery

- It is very simple to build and look after a tree nursery. This can range from just a few trees growing in shade near your home to a large nursery with hundreds of young trees.
- A larger nursery should be close to a permanent water source and on level ground that does not flood during the rainy season. The soil should be fairly fertile. The site should be kept free from animals.
- For a small nursery, it is probably best to have it near the home where the young trees will be protected from animals and thieves.
- Unless there are large trees to provide good shade, you will need to build shades.



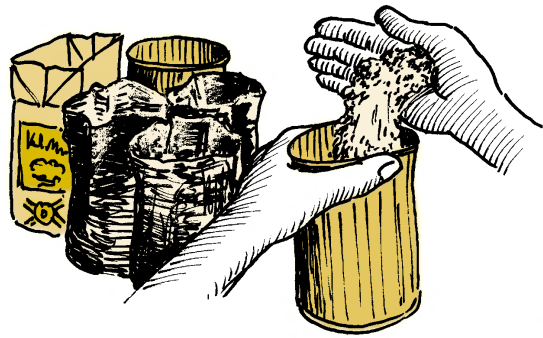
Discussion

F9

- Visit an example of a good tree nursery. If possible, visit a large nursery and a small one.
- Discuss the experiences of any local farmers who have built tree nurseries.
- Encourage participants to think of suitable shade trees near their homes where they could grow a few tree seedlings. How would they protect them from chickens and goats and any other livestock?
- Discuss the different site characteristics needed for growing seedlings in seedbeds, from those needed if all the seedlings are grown in containers. Is the soil type important?
- Discuss possible nearby sites that might be suitable for a group of farmers to build a larger tree nursery.

Suitable containers for tree seeds

- Seeds can be planted in all kinds of containers. Plastic tubes, milk cartons, plastic bags, tins or broken pots all make good growing containers. All should have a few holes in the base for water to drain out.



- Seeds can also be planted in beds. Make raised beds 60cm wide and as long as required, using timber, split poles, stones or freshly split sisal poles. If you have plenty of timber you can also make small moveable boxes 40cm x 40cm with wooden bases. Paint timber with old engine oil.

- Use good fertile soil for filling containers and seed beds. If possible some of this soil should come from underneath well-established trees, as this soil will contain organisms that help the growth of tree roots. Mix four parts of good soil with two parts of clean river sand and one part of old dry manure. Mix together well when dry. Fill containers carefully and shake down the soil to allow for settling.



Discussion

F10

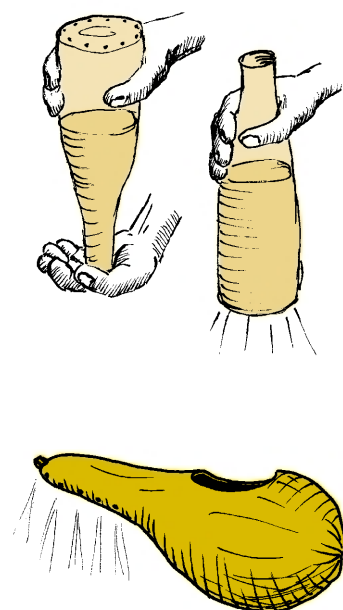
- What kinds of containers could be used for planting tree seeds? Can you think of a source of plastic forestry containers from some nearby organisation? Or a source of plastic bags?
- Where are good sources of clean sand and old manure available?
- Can you work together to prepare containers ready for planting?
- When would be the best time to plant seeds so the young trees would be ready early in the rainy season?

Sowing seeds

- Plan sowing so tree seedlings will be ready during the rainy season. Many tree seedlings need about four to six months in a tree nursery before planting out.
- Water the containers very well before planting with seed. After sowing, water the containers once a day, either in the early morning or evening.
- Plant two or three seeds into each container. Some trees have very hard seed coats and may need help to begin growing. Seeds such as acacia and leuceana, should be soaked overnight in very hot (not boiling) water to help germination. Or you can use sandpaper or a very sharp knife to make a tiny cut in the seed coat.
- If you are planting in beds, sow seeds in lines unless the seed is too tiny to handle. Mix tiny seeds with dry fine sand before scattering. Cover seed with a little fine soil.



Watering equipment



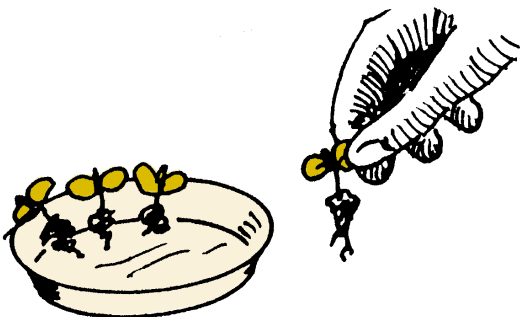
Discussion

F11

- Is it a waste of seed to plant two or three seeds in each pot?
- Some tree seeds are designed to grow after forest fires. How does the use of hot water help to copy the heat of fire?
- Seeds with very hard seed coats may take many months to begin growing unless they are treated with hot water or sometimes rubbed with sandpaper to weaken the tough seed coat. Discuss how you could experiment to find the best method.
- What kind of local tree seeds might need special treatment?
- If possible, collect a number of different kinds of tree seeds and consider the differences in treatment they may need.
- Do you have watering cans available? If not could you make watering equipment from gourds like that shown in the diagram, or make holes in the base of large tins or plastic bottles?

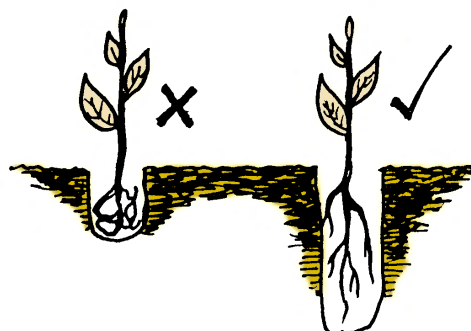
Care of young seedlings

- As the seeds grow, they develop into seedlings. These need room to develop. Thin out to leave just one seedling in each container and well-spaced seedlings about 5cm (the length of a finger) apart in beds.



- With care, you can prick out seedlings into empty bags or new beds. Loosen the soil with a knife. Lift seedlings up gently with some soil attached to the roots. Replant them carefully into empty containers or beds.

- Use a stick to first make a hole and place the seedling into this, allowing plenty of room for the roots. Press soil firmly around the seedling. Do not plant it any deeper than it was before. Keep young seedlings well weeded.



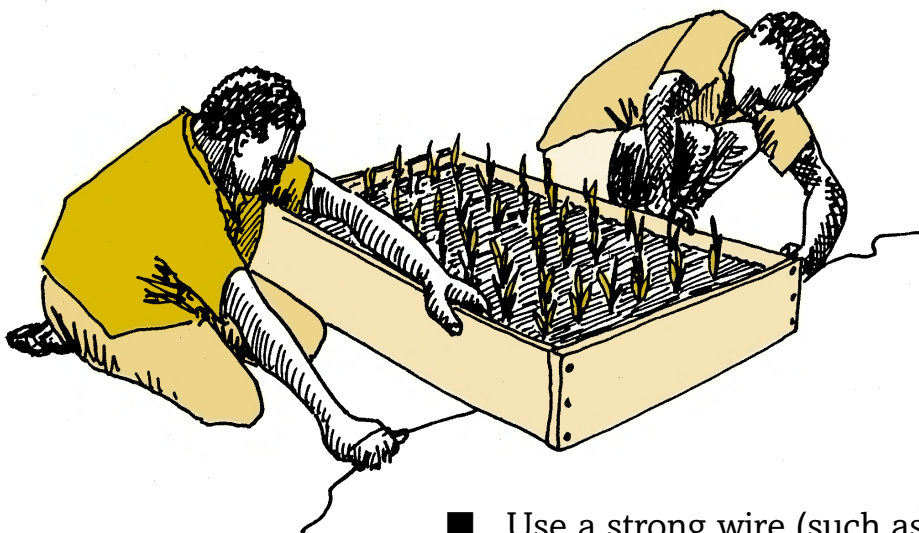
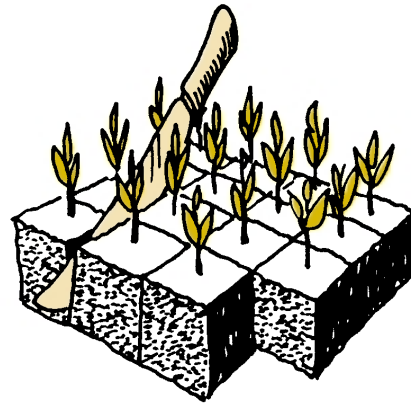
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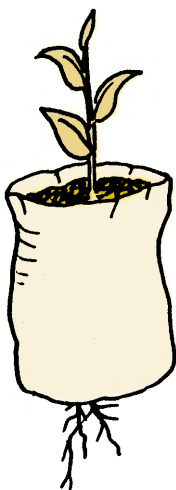
- What are the advantages and disadvantages of planting seeds directly into containers?
- What are the advantages and disadvantages of sowing seeds into small trays and then pricking them out into containers?
- How difficult is it to prick out seedlings carefully, so that they quickly begin growing again?
- Try practising pricking out seedlings. Use tree seedlings if you have plenty available. Alternatively, you can practise using tomato seedlings. See how many seedlings are still growing after a few weeks.

Root pruning

- Seedlings planted in large seed beds need special care to prevent the roots growing together and becoming mixed up. As the seedlings grow, the roots should be regularly pruned to encourage strong root growth. Cut the soil into squares to separate the roots.



- Use a strong wire (such as an old guitar string) to prune the roots underneath the beds as well. This work is easier with two people.



- With trees growing in containers, simply move them each month and cut any roots growing outside the container.



Discussion

F13

- Discuss what effect root pruning may have on the young seedlings. Draw out the fact that root pruning helps the seedlings to develop a strong, compact root system when done regularly. It also reduces damage at the time of transplanting.
- When might root pruning damage the young seedlings? Draw out the fact that if root pruning is left too late, the young seedlings may develop very strong roots outside the containers. Pruning such strong roots may damage and even kill the seedling trees.
- If possible visit a tree nursery and observe the benefits and need for root pruning.

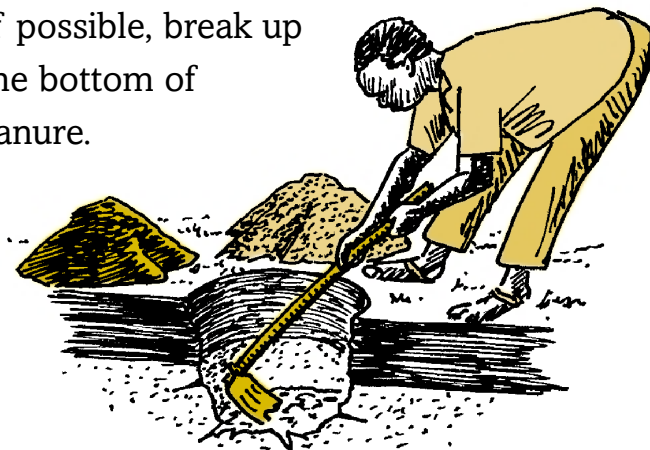
Hardening off

- For the last four to six weeks in the nursery the seedling trees need to be 'taught' how to survive outside the nursery where there is no shade and where it does not rain every day. This is called 'hardening off'.



- If a shade has been built over the seedlings, gradually remove the shade over several weeks. Slowly reduce the amount of water. However, do not let the seedlings wilt in hot sun. If grown under a tree, move the seedlings to the edge of the shade so they are in full sun for part of the day.

- A week or two before planting out, prepare planting holes. Dig a hole about half a metre deep (nearly knee deep). If possible, break up the hard rocky subsoil in the bottom of the hole and add a little manure.



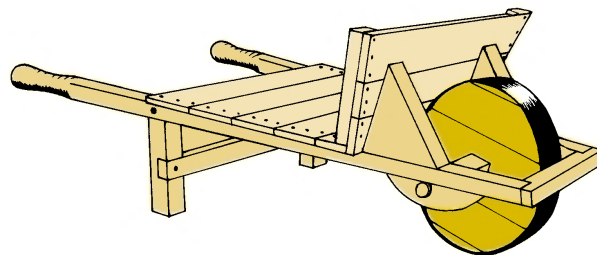
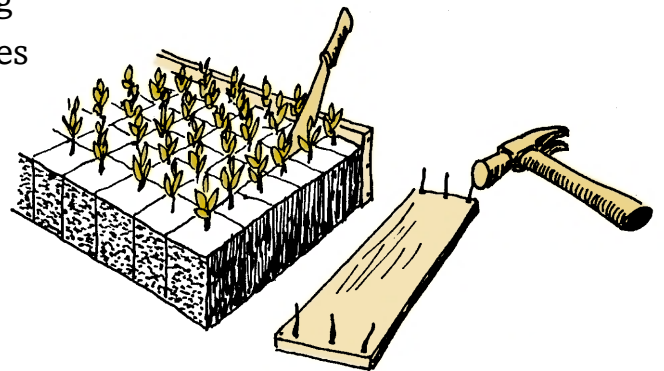
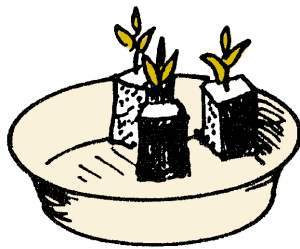
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F14

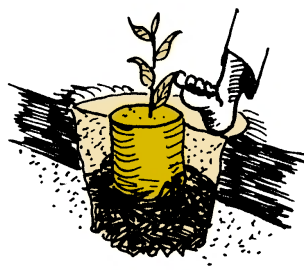
- Discuss the benefits of 'hardening off'. Could this be done for vegetables growing in a nursery bed as well?
- What would happen to young trees which were planted out immediately without 'hardening off'?
- What would happen if young tree seedlings were planted straight into hard rocky soil?
- Discuss how deep planting holes should be for young seedlings. (They should ideally be at least twice the depth of the root ball and filled with good soil to enable the tree to have a good start.)

Planting out tree seedlings

- If possible, only plant out seedlings on cloudy days when rain has made the soil really wet. Late afternoon is the best time to plant them out.
- Water large seed beds well the evening before planting. Remove two end pieces and cut the trees out carefully. Carry them carefully in a bowl or box to the planting site.



- Don't water containers before planting. The soil will then stay firm when the container is removed so the roots will not be disturbed. They will also be easy to carry! Water them well straight after planting.



- Place the seedling in the hole at the right level, gently remove the bag or container without disturbing the roots, replace the soil and press down firmly. Cover the soil with cut grass or leaves to keep the soil damp.



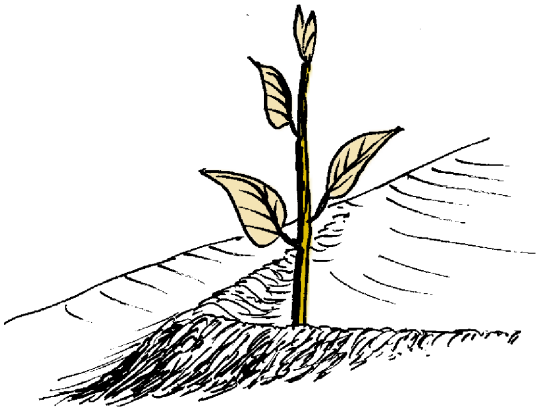
Discussion

F15

- Why is it better to plant out trees in the late afternoon?
- Why should you not water young trees in containers before carrying to the planting site?
- Discuss how best to avoid any damage to the root ball.
- Why is it so important to avoid damaging the root ball? Encourage people to understand that a good solid root ball will make it much easier for the young seedling to survive, as most of the fine roots will remain, allowing the seedling to take in water and begin to grow.

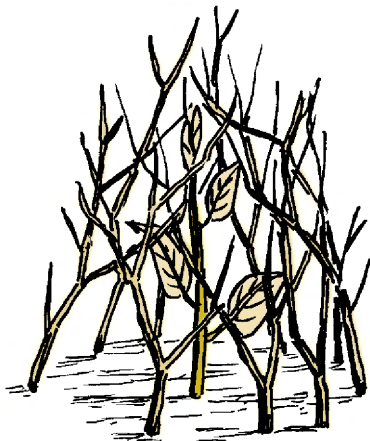
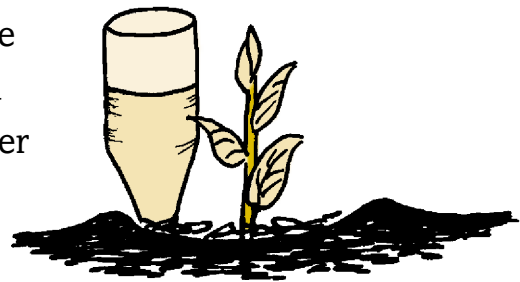
Giving young trees a good start

- Make a small hollow around the tree to catch water. Keep clear of weeds.



- If trees are planted on a slope, make V-shaped ridges to catch and hold rainwater.

- During dry periods, if seedlings are planted near the house or a water source, fill a bottle with water. Quickly turn it upside-down and press it into the soil near the roots. The water will slowly seep into the soil.



- Protect the trees from animals by using branches or thorns or a fence built round the tree.



Discussion

F16

- Why is it important to remove weeds from around the base of young seedlings?
- Do any participants have experience of using such V-shaped ridges? How effective might they be in trapping rainwater? Would they be difficult to make?
- Try to build a few such ridges around young trees planted on one of the participant's land.
- Do any participants have experience of using bottles of water in this way? You could also use an old plastic bottle with its base removed and bury this in the soil near the tree. When water is poured in at dry times, it goes deep into the soil to where the roots are. Try using this idea with young trees or vegetables.
- Do participants have any other ideas for protecting young trees from animals?

Alley cropping

- A common method of agroforestry is called 'alley cropping'. Closely planted lines of suitable trees are spaced about five metres apart – usually by direct seeding or transplanting from tree nurseries. The lines are placed across a slope, within areas where crops or vegetables are grown.



- The lines of trees are planted closely together so that they grow to form a hedge. If possible, it is a good idea to mix several different species to form a hedge. Once the trees reach 1–2 metres high they are cut right back to just 20–30cm high. The leaves can either be left on the ground as a mulch to rot down and add nutrients to the soil, or alternatively they can be used to provide good animal fodder. The remaining stumps quickly regrow and the cutting back can be repeated for many years.



Discussion

F17

- Only certain trees will tolerate this system of cutting back. The most useful are trees belonging to the legume family, since their roots also add plant nutrients to the soil. These include leuceana, calliandra, prosopis, acacia, sesbania and moringa. Do participants have any experience with any of these? Are seeds available?
- Discuss how the lines can be planted along the contour on sloping land. If possible, visit a nearby farm which uses contour planting or hedges to prevent erosion.
- How does alley cropping improve the soil and control erosion? Try to bring out in the discussion the facts that repeated mulching of the soil improves soil fertility and the ability of the soil to hold water. The lines of trees and their roots protect the soil from erosion. Legume trees also add nutrients to the soil.
- Discuss what kind of crops could be grown with alley cropping.
- What kind of areas would benefit most from introducing alley cropping?

Trees for farm boundaries

- Some trees are useful to plant on the edges of fields and farms. They can be used to mark boundaries and to provide protection from strong winds.
- Choose trees which are fast growing and which allow crops to grow nearby. They should be trees that will allow pruning or use as fence posts. If possible plant trees that have many uses: for fuel, fodder, timber and fruit production.
- Many local trees will make good boundary trees. It is often good to use a number of different species, especially if hedges are being planted. Boundary hedges help prevent soil erosion.



Discussion

F18

- Discuss what plants are often used to mark boundaries (such as sisal, euphorbia or date palm) and whether other trees would make good replacements.
- What local trees would be useful as boundary trees?
- Discuss what exotic trees could be used. Where could seed or seedlings be obtained? Some useful examples include cashew, gliricidia, sesbania, acacia, casuarina, calliandra and moringa.
- Discuss how trees on the boundary can protect the soil from erosion.

Trees for livestock fodder

- Many trees suitable for agroforestry have leaves and pods that are edible by animals such as cattle, goats and sheep. They can be cut regularly and carried to feed livestock. Green leaves from trees can often be cut in seasons when other green fodder is unavailable.
- It is usually better to mix leaves from several different kinds of trees with other kinds of fodder. Feeding animals leaves from just one kind of tree can sometimes cause problems.
- Fodder production will be much higher if leaves are cut and taken to animals rather than allowing animals to graze directly from the trees.



Discussion

F19

- Discuss which local trees growing in the area are liked by animals. Could these be planted on the farm?
- Exotic trees which are good for providing animal fodder include moringa, calliandra, sesbania, acacia, leuceana and gliricidia.
- Visit a zero grazing or stall feeding unit and discuss what they use for fodder. How would fodder trees fit into this system?
- If zero grazing or stall feeding is not practised in your area, discuss whether fodder could be grown in this way and brought to where the animals are kept at night.

Firewood trees

- Often when trees are grown on the farm by men, they are grown for timber. Women are not allowed to cut these trees for firewood.
- Special trees may also be planted by women on farmland for use as firewood. Many trees used in agroforestry like sesbania, leuceana and calliandra are ideal for women to plant as firewood.
- Such trees may also be planted as wood lots in a corner of the farm or along a particular border.



Discussion

F20

- Discuss where participants collect firewood.
- Discuss the idea of women planting trees, and especially the idea of planting trees for firewood.
- What trees are preferred for firewood? Is it possible to plant any of these near homes?
- How much wood is needed for cooking and heating water? What other practices can be introduced to help solve the fuel problem?

Fruit trees

- All kinds of fruit trees can be grown near crops. They are often very suitable to plant as boundary trees, near to the home or as small plantations mixed with other kinds of trees.
- Some fruit trees grow very large and develop dense shade. These need room to grow and are not suited to combine with growing crops nearby. They include mango and tamarind.
- Other trees have a more open growth and do not develop dense shade. These can be used as boundary trees or grown near crops. They include guava, citrus, banana and cashew nut.
- Passion fruit and chayote are climbers that can be trained to grow up established trees.

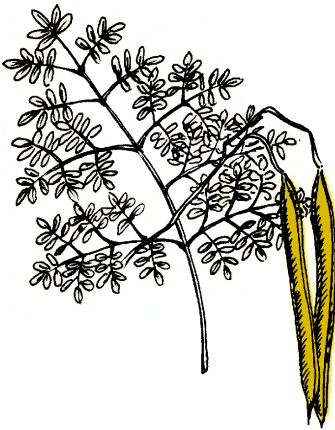


Discussion

F21

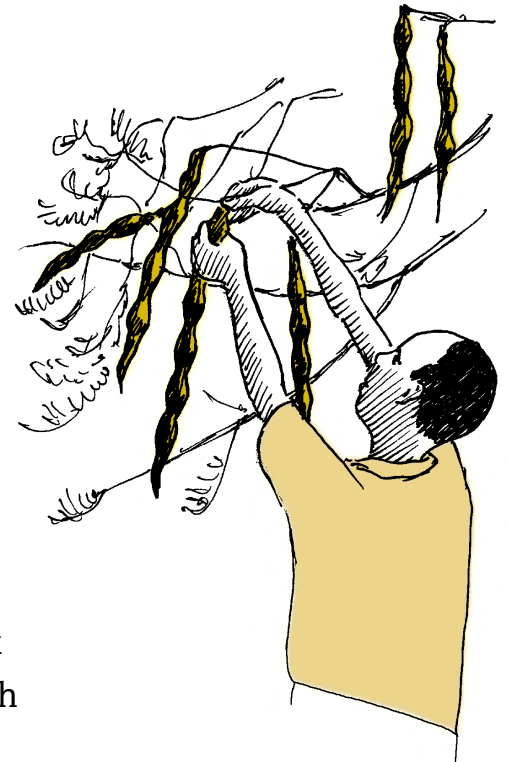
- Discuss the planting of local fruit trees. Are they ever grown near the home? What kind of fruit is available?
- Is plenty of fruit produced through the year? Or is there a very limited variety of fruit available with most of the harvest coming at the same time of year. Discuss the reasons for this.
- Where can fruit tree seedlings be obtained? Can people grow their own?
- What sort of market is there for different fruits (if children can be kept away)?
- Fruit has many benefits. All kinds have many vitamins that help the body to fight disease. Avocado makes a rich weaning food for babies.

Moringa – a tree with special properties



- Moringa is a small tree with many valuable properties. It grows fast and it continues to grow if cut back. The leaves can be cooked as a green vegetable or used for animal fodder. It is a legume and improves soil fertility. It also produces seed pods that make a delicious vegetable when young.

- However, the seeds are also very valuable. When crushed, the seed kernels produce a good cooking oil and the paste makes a good animal food. The crushed seed kernels can also be used to clean water. When a very small amount of crushed kernel paste is mixed with water, it causes any particles and diseases in the water to form clumps, which quickly sink to the bottom. The water can be filtered through a cloth and is then safer to drink.



Discussion

F22

- Do participants have any experience with moringa? Are there any trees growing in your area? Where could seeds be obtained from?
- Have participants ever eaten tree leaves as vegetables? Would it be useful to have such edible leaves available as a source of food, especially at times when vegetables are scarce?
- Obtain some moringa seeds, crush them, and use them to clean a sample of muddy river or pond water so that people can watch the result.
- Try encouraging people to use the young pods as a green vegetable in cooking. Would there be a market for these locally?
- What methods could be used for extracting the oil from the kernels? Again would there be a good market for this excellent cooking oil?
- Moringa leaves can also be used to prevent or cure malnutrition. Dry moringa leaves well and powder them in a mortar and pestle. Store in a jar or plastic bag and add just one teaspoon per person to stews, porridge, soups or baby cereal just before eating. The dried leaves are rich in vitamins, minerals and proteins.

Bible studies

These Bible studies are designed to use in small groups. They may provide a useful introduction to a meeting where different topics from the Guide are being discussed. Choose a study that will be linked to the topic you plan to study or that is relevant to your situation. During the studies, encourage people to reflect on what they read, to discuss the meaning and the implications of what they learn and, finally, to pray together about what they have learnt.

BIBLE STUDY 1

God's view of trees

Trees are mentioned at both ends of the Bible, and play a crucial role in both situations.

Read Genesis 2:8-9.

- How does God regard trees?

Read Revelation 22:1-2.

- Why do you think God chose a tree to illustrate eternal life?

This tree symbolises the completion of God's saving grace in Jesus Christ. How grateful we are that it was on another tree – the cross – that our sin (which began with Adam and Eve disobeying God and picking the fruit from the one forbidden tree) was forgiven.

BIBLE STUDY 2

Trees and difficult times

Read Deuteronomy 20:19-20.

- What commands are given here about the use of trees during war?

In war the rules of life change. People can forget to love in the same way. The environment suffers too. In those days, trees were cut down to use in attacking enemy cities. God could not stop that, as wars sometimes become unavoidable. Instead he tried to limit the damage caused by war. So fruit trees were not to be cut down. Why? Because it was not in their future interests. No fruit trees mean no fruit, less food and hungry people. Here is plain teaching that we have no right to destroy trees and forests without a real need.

- Can you think of mistakes made in your local area, which have later meant less food (or worse health)?

BIBLE STUDY 3

Bearing fruit as Christians

Read Mark 11:12-14 and 11:20-21.

This story seems out of character for Jesus. He normally gave encouragement to others so it seems surprising that he cursed this fig tree. The tree was covered in healthy leaves, which are usually produced at the same time as the flower buds from which figs later develop. The flower buds resemble the ripe fig in appearance. But Jesus found no flower buds or ripe fruits – only lots of leaves.

- Did Jesus curse the tree because he was tired or hungry? Or did he have another reason for doing this?
- What was Jesus teaching about the need for us to bear fruit?
- What kind of fruit should we be bearing as Christians?
- What can give the appearance of a full Christian life – like the leaves – without actually producing any fruit?
- Who do you think Jesus was talking to here? His disciples, the crowd or the religious authorities?

This is a parable that provides us with a clear lesson on the need to ensure that our lives don't just look good from the outside but are producing the kind of fruit that Jesus wants to see.

BIBLE STUDY 4

Responsibility to God

Read Deuteronomy 6:4-5, Genesis 1:26 and Genesis 2:15.

These verses all teach us something about our duty towards the land and God's creation.

- Discuss the part that God expects us to play. What does this mean in practical terms in our own lives?
- When we work in our farms and gardens, look after our animals and care for the sick, on whose behalf are we really working? See Psalm 24:1-2.
- When our children or our neighbours are sick or unhealthy because they are not properly fed, who is most concerned?
- In what ways is it possible for us to spoil things that belong to God?

Discuss how we can work together to care for God's creation. Pray that we will learn more effectively what it means to be responsible stewards.

BIBLE STUDY 5

Caring for the environment

Read Matthew 10:29-31.

- Are small birds important to God? Yes! He feeds them and he even ‘clothes’ the plants with beautiful flowers (Matthew 6:25-30). But even more, he cares for people. We were created in his image. He can even check if one of our hairs has gone missing! So while we should care for the environment (and birds and plants) because God cares, we should care for people even more.
- Are there any changes in our local area which should be made, because they will clearly help the people who live there?
- If changes are made, will some other people oppose it because the environment (trees, animals, rivers etc) is more ‘special’ to them than the people who would benefit? How can you solve this problem for the good of the community?

In the Bible the whole creation is important, as well as the people. We are meant to work in harmony with the world God has made to support us. Take courage when you seek to protect the environment and the people who live there! This difficult project is also on God’s agenda.

BIBLE STUDY 6

Conserving creation’s fruitfulness

‘How many are your works Oh Lord! In wisdom you have made them all; the earth is full of your creatures’ (Psalm 104:24). God wants us to conserve creation’s fruitfulness.

Read Ezekiel 34:17-19.

- What does this passage reveal about how we should treat God’s creation?
- How should we consider the needs of other people and other creatures?

Because God made all things and holds all things together through Jesus (Colossians 1:15-20), everything belongs to him. While God leads us to green pastures and pure water (Psalm 23), the earth belongs to God alone (Psalm 24:1). His are gifts we do not own. His are gifts that must never be taken from us or the other creatures!

- What are we doing to care for creation and God’s creatures? Do we resist the desire to be greedy (Matthew 6:33)?
- Do we provide places for flowers and birds on our land or in our communities?

Keeping our places fruitful for all God’s creatures brings praise to God, the creator and owner of all things!

BIBLE STUDY 7

Our Father the gardener

We have learned in this guide how to help young trees to grow well – by providing them with manure, compost or fertiliser as they are planted. Trees also grow best and produce most fruit in full sunshine. Here we consider the kind of care and teaching we need as Christians to produce plenty of fruit. This passage pictures God as a careful gardener.

Read John 15:1-8.

- Jesus longs for our lives to be fruitful for him. Are you growing in the full sunlight of God's love? Reflect on your life and compare it to the growth of a vine or fruit tree.
- Are you firmly grafted into the vine so that its life can flow into you? Are you looking after your relationship to Jesus through study of God's word, prayer and fellowship with his people?
- What kind of fruit are we bearing for God?
- Do we need God to prune any parts of our lives in order to bear more fruit for him?

In verse 15 Jesus tells us that we can do nothing apart from him. We can only bear fruit for him if we try and become like him and love God with all our hearts, souls, minds and strength. The key word here is 'all', not just 'some' or 'most' but with 'all'. When we do this, then our lives will shine out with his love for others and we will indeed bear much fruit.

BIBLE STUDY 8

Our need and not our greed

Read Proverbs 30:7-9.

It is good to stop and consider what attitudes control our approach both to farming and to our lives.

- What should our attitude be to what we get from the land?
- How should we treat other people, especially those less fortunate than ourselves?
- How should we regard money?
- What are our reasons for wanting to improve our health and farming? Is it just in order to raise our standard of living – or is it so that we can glorify God in everything that we do?

Pray that we will learn more effectively what it means to be responsible stewards.

BIBLE STUDY 9

Trees as a picture of faith

Read Psalm 1:1-5 and Jeremiah 17:7-8.

- How can Christians be compared to trees? How many comparisons can you find in these passages? What do these verses teach about the Christian faith and what happens in times of difficulty?
- Have you found this true in your lives? If not, why do you think this might be?

Checklist of names for useful agroforestry trees

Common name	Scientific name	Local names
acacia	<i>Acacia albida</i> <i>Acacia auriculiformis</i>	
cashew	<i>Anacardium occidentale</i>	
neem	<i>Azadirachta indica</i>	
desert date (balanites)	<i>Balanites aegyptiaca</i>	
calliandra	<i>Calliandra calothyrsus</i>	
cassia	<i>Cassia siamea</i> <i>Cassia occidentalis</i>	
casuarina	<i>Casuarina equisetifolia</i>	
kei apple	<i>Devyalis caffra</i>	
gliricidia	<i>Gliricidia sepium</i>	
leuceana	<i>Leuceana leucocephala</i>	
melia	<i>Melia azedarach</i>	
moringa	<i>Moringa oleifera</i>	
mesquite (prosopis)	<i>Prosopis juliflora</i> <i>Prosopis chilensis</i>	
sesbania	<i>Sesbania grandiflora</i>	
tamarind	<i>Tamarindus indica</i>	

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