

CLIMATE CHANGE ADAPTATION

A manual for trainers

**Sustainable Gardens
in Papua New Guinea**



Supported by the European Union



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Line Art – Takus David, used with permission – (Chris Gard).



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You – as trainer?

What do you need to bring to any training so that effective training leads to the right kind of change in villager’s lives?

This manual provides you, a trainer with resources to assist you in training villagers in core topics relating to sustainability – being able to cope with climate change challenges along with increased pressure on the land from population growth. The manual provides you with resources, examples and new ideas. You bring your experience and your attitudes to the training... and what you bring is crucial to successful learning and change.

It provides you with suggested daily topics for the training – and activities. Those are suggestions. As you gain experience you will find you change things to suit the situation. Great.

Remember trainers are primarily doers. Don’t just be a talker. You will be so much ‘MORE’ if your training is coming from your own actions and garden experiences.

Be a life-long learner. Learn from whoever, wherever. Be open to changing your mind as you see things working well, or not working well.

One way of continuing to learn is by reading. We have lots of resources for you – in an online library, that is freely available. Help yourself. There’s training manuals and the search feature will find anything with the word you type. The library is small but has great resources.

<https://gutpela-png-gaden.net/library/record/list>

towards village training. Are you content to just share book knowledge? I’m not!

Please don't start a training without reading -

Training villagers in PNG!

You can download a copy here-

<http://gutpela-png-gaden.net/library/record/view/id/43>

Muntwiler and Askin, 2004. Training villagers in PNG - a manual for trainers.

Remember, training is much more than giving technical information. The Muntwiler and Askin manual will provide lots of useful information to assist the process of your training.

You must have a copy of the **Villager handbook on Sustainable Gardens**. That is the brata manual needed for you to make sense of this manual.

Humility is perhaps the most important – a willingness to learn from villagers AND a willingness to leave a cherished belief and change your mind. This is at the heart of science and learning. We do experiments, we read from others and we learn and change.

Climate change is pushing us to change many aspects of what we do in our gardens and lives more generally. We must change and assist others to change. Without the needed changes, our future looks bleak.

Please read the other resources we have for you. A key is your own attitude



Trainer Handbook – You and your objectives



I want to share with people my practical experience of doing what I teach. So, practice with your own gardens, your own livestock. Doing is critical. Training is a big responsibility.

Be a life-long learner. Learn from whoever, wherever. Be open to changing your mind as you see things working well, or not working well.

A good example is the way Vetiver grass was promoted as a core erosion control strategy for hill side farmers. Simbu province was viewed as a model province with lots of Vetiver planted in the 1990's. That has changed dramatically. Almost no vetiver is used. Why? I suspect it was viewed as being useful in erosion control BUT it reduced fertility and water for desired food plants. So, we as extension officers must adapt to farmer experience and desires. Farmers want to look after soil but will require plants that slow erosion AND provide benefits to their gardens. Look for local plants that can do the job vetiver had to do, but in a more appropriate way.

This is where partnership between you and the villagers is crucial. They know their local plants and situation.

Trainers' manual and Farmer manuals?

There are two manuals in each of the topics developed by the European Union funded Climate Change Action, managed by NARI.

This is the trainer manual for an introduction to sustainability and living well in a village where gardens provide most food. There is another in the same topic area produced as a Farmer manual (written in Tok Pisin and in English). You must have the villager manual for villagers to work from.

The series will be available in a website where other resources are also ready for you – normally freely available to anyone.

Resources

There are two key things to keep in mind – how to run excellent training and technical resources to provide extra information for this training.

How to run excellent training?

Here are three key resources that will guide you – as well as notes throughout this manual. Reading is important. Really important. As a trainer you are guiding villagers. They trust you to have wise advice, tested advice.

So, learn from others.

Training villagers in PNG – a manual for trainers – Markus MUntwiler and David Askin. <https://gutpela-png-gaden.net/library/record/view/id/43>

Conducting effective training workshops – <https://gutpela-png-gaden.net/library/record/view/id/64>
Robert Songan and Laurie Fooks.

Duck farmer training of trainers manual – <https://gutpela-png-gaden.net/library/record/view/id/40>
 Markus Muntwiler. Markus provides lots of useful 'hints' around running a training.

Extra technical resources

These will be added to as they are found. Meanwhile there are some extras at the end of this manual. The library at <https://gutpela-png-gaden.net/library/> has further resources and a Pacific Agriculture Information System is also coming on line.

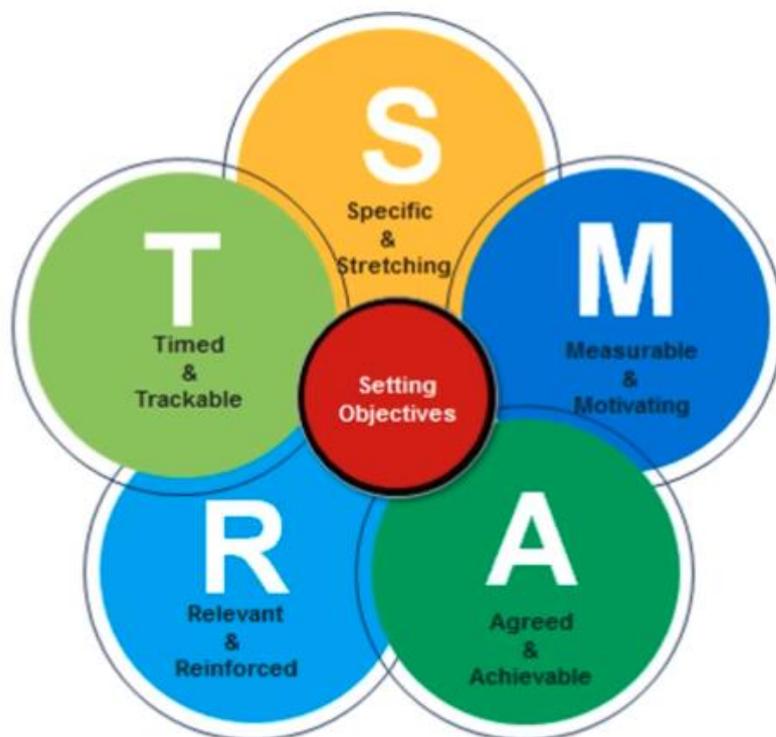
Learning goals

In each training for village families we provide you with some key Learning goals, broken down into

- New knowledge for men and women to discuss and understand,
- Behaviour (Attitudes) and
- New skills they learn by doing, not just watching.

We often refer to these as SMART Learning goals. What we have in mind is that your training will seek to result in changes that are →

Specific, Measurable, Achievable, Relevant (also realistic) / and Timebound / Trackable.



From - <https://www.youtube.com/watch?v=1T3o-ruJ8uA>



Trainer Handbook – You and your objectives



As a trainer, keep in mind the diagram above. Turn each topic into question and discussion starters. Questions at this level may be best shared among trainers during preparation.

You may like to watch the video (link provided above) where the topic is explained in more detail.

Markus Muntwiler who worked with Salvation Army as an Agricultural Extension Officer has this to say about training –

‘How often have you heard Agricultural Extension workers say *‘those farmers are stupid because they did not do what I told them to do’*? They tried, but because they did not involve the farmers fully in the process of adapting the new ideas to fit the farmers’ particular needs the farmers did not understand the ideas and therefore did not use them. The training course outline in this manual aims to help you to enable farmers to work out what they want to do, how they should implement the lessons and techniques they learn and how to make sure they will continue to use them in the future.

If you take the time now to read the manual carefully and see how straight forward the approach is and follow the instructions it will save you a lot of time and failures in the future.’¹

¹ From Duck farmer training of trainers manual available here –

<https://gutpela-png-gaden.net/library/record/view/id/40>

Training Day 1 - What is happening in our villages?

Getting started – a Reminder

You need the Training villagers in Papua New Guinea manual in your hands and mind! (and if possible the Conducting effective training workshops – Robert Songan and Laurie Fooks).

This day is about reflection – thinking together about what is happening in both village and gardens. Big picture issues are in our minds today – beyond the local village.

Make sure you allow village men and women to share their thoughts and experiences.

The activities are designed to help them reflect on what is important to them.

Learning goals (separate to the farmer learning)

Farmers will →



1. Start to get to know each other and start to trust the leadership of the training event.
2. Farmers will enjoy interacting with each other, listen respectfully to both men and women.
3. Learn new insights regarding climate change and population pressure.
4. Think together about changes occurring and the challenges those changes bring and
5. Develop strategies to overcome the challenges of increasing population pressure on their village lands.
6. And learn to trust you as trainer – your honesty is important. If you don't know – say so!

Population is growing very rapidly

Talking about population is really challenging, because we quickly come to family planning, family size and these are important topics. Some people tell us that our planet has way more people than it can cope with. Fertiliser – especially nitrogen fertiliser has been used globally to grow lots of traded food. That has helped population increase dramatically across the world.

So, how to talk about population and the damage over-population does to each village across PNG and beyond? That will take cultural sensitivity. Raising issues is fine. Raising them in an arrogant, I told you so manner is not.

Keep in mind that population pressure is a core issue, something we must not ignore.

If a Mum and a Dad have a family of 4 boys and 4 girls and each of them have the same. In two generations land that used to provide for just 2 people is now needing to provide for ... how many? How do we make more land? Is God making more land? Is sea level rise reducing land available?



Trainer Handbook – Day 1 – Past, present future



There is plenty here to help us change our attitude to family planning.

Climate and weather is changing

Villagers should be encouraged to remember that although weather is always changing, there are signs in PNG and around the world that our climate is changing because of what we as humans do.

Discussion – what does climate change mean?

Discuss with villagers what they think of when someone says climate change. The list below is for you to help the discussion. Don't provide these items – rather allow villagers to raise them as part of discussion.

We humans →



1. Cut and then burn down forests to make gardens
2. Large companies enter agreements with villagers – then remove forests and plant monocultures. What are the key differences between a monoculture (eg oil palm) and a natural forest ecosystem? What do villagers gain in this? What do they lose?
3. We burn fossil fuels – oil, gas and of course diesel and petrol. How does Carbon dioxide that is released when we burn fossil fuel harm the planet? (It acts just like a big blanket, warming the planet). If the planet warms too much, ice in Antarctica and the Arctic melts. That causes sea levels to rise. Has your village got first hand experience of king tides and flooding? Maybe wells are becoming salty?
4. We all want families that have plenty of children and so our population size continues to grow very fast. Is there a problem with large families? We sometimes fight over garden land. We might find it hard to make gardens for each family member.
5. We clear land to grow gardens on steep land that erodes easily in heavy rain. The top soil washing away is a loss to our gardens and maybe pollution to fishing beds as silt in coastal areas.
6. Others?

Now is the time to find out what the villagers are experiencing. Villagers experience? →

1. Are the patterns of rainfall – wet season and dry season changing in ways that hurt villagers food gardens?
2. Are villagers having to change what they eat from their gardens?
3. Are villagers finding that land hasn't got time to rest in a long fallow that builds large trees?
4. Are crops that used to grow only in lowland areas starting to grow successfully in highlands?



Trainer Handbook – Day 1 – Past, present future



5. In a recent (2015/16) drought insect pests – especially sweet potato weevils² caused very severe problems for many villagers. What were the key issues that villagers experienced where you are based for the training?
6. Are fires getting out of control more often, doing more harm than in the past?
7. Are some people tenant farmers in the village – renting land from a traditional land owner? In some places landlords – the owners – don't want tenants to plant trees. What effect does this have on the land and on both landlord and tenant?
8. Anything else that villagers want to talk about?



Sweet potato weevil damage during drought of 2015/16.

These discussions are crucial. They set a scene for a broad willingness and desire to change – to learn new things that will help with a challenging future where top soil has been lost, where garden fertility is not easily replaced and where each area needs to be producing lots of food.

Added information on climate change

There are many resources on you tube to help you increase your understanding of climate change. A blogger who does his best to review high quality – peer reviewed science- is potholer54.

Eg. <https://www.youtube.com/watch?v=8pa8duiMiSO>

Beware there is a lot of nonsense produced in you tube and on the internet.

What is clear is that various scientific teams have analysed 3,000,000 mm (3 km deep) of ice cores from the Antarctic and they believe that allows us to look back over 800,000 years. Air is trapped in the ice as it is falls as snow. The ice cores contain tiny bubbles that allow us to look at what was in the air many thousands of years ago. The key gas we are interested in is carbon dioxide (CO₂) and it is important as it helps act like a blanket on our planet – warming it. At no time over the last 800,000 years has the concentration of CO₂ in our atmosphere gone above 300 ppm in the atmosphere. Until now. Our use of fossil fuels – oil, gas, coal is releasing millions of tonnes of CO₂ into the atmosphere. Now we are at 400 ppm CO₂ and scientists believe this is warming our planet, causing increasingly severe storms, melting ice in glaciers and polar caps. This is causing sea level rise and many coastal communities in PNG are starting to experience this challenge.

Scientists expect increasingly severe droughts with fires caused by the dry conditions, and more severe storms and floods.

² Strategies to reduce Sweet potato weevil damage are given here - <https://gutpela-png-gaden.net/library/record/view/id/12>



Trainer Handbook – Day 1 – Past, present future



Have the village people you are working with experienced any of these challenges?

Don't treat soils like dirt!

Just a reminder. PNG has very diverse environments and soil types. Some big picture generalisations maybe helpful.

Many **inland valleys**, but not all, are highly productive, allowing high population densities to develop. Why? This is primarily about favourable temperatures with limited malaria challenges AND wonderful volcanic ash as a base for many soils. Where the volcanic ash is missing soils will be less productive.

Inland valleys can be infertile also – and that is often a result of steepness and lack of volcanic ash remaining. Think parts of Simbu province.

Where soils are the result of **long term erosion and high temperatures, coupled with high rainfall** – eg Western province and Sandaun for example – soils can appear to be fertile. This is because of healthy forests. But those soils are often very low fertility and removal (and burning) of forest can rapidly lead to poor yields of crops.

East New Britain – Kokopo and other areas with **highly fertile soil are a result of volcano's** that have delivered excellent material for growing crops.

The areas of greatest challenge for much of PNG are those areas away from coconut and beach resources, but not high enough to be in great climates and volcanic enriched soils.

It isn't all about soil... There's also climate and the length and severity of dry season – Central province has a long dry season with severe fire issues and challenges around crop production.

Knowing your soil is a crucial starting point. Seek advice regarding your unique situation.

Village walk and Village mapping exercise

Prepare well

Discuss your planned walk with village leaders – include women in this discussion. If possible do the walk prior to the training, so both you and farmers you will visit are well prepared for discussions that may arise during the actual walk.

This first walk is an opportunity for you as trainer to encourage lots of question and discussion, without feeling the need to be a TRAINER.

*Relax. Listen.
question - be a learner.*

You may well visit gardens that women do most of the work in. This means you want to be careful about the comments you make – be sensitive that you are talking about a person's work and effort. They take pride in their gardens – as you know.

There may be comments made during the walk. Now is not the key training time. Now is time to listen and learn. Learn why things are done the way they are. Seek to understand challenges village families are facing. Think about food supply through the year, market surplus, water quality and

supply, shortages of timber? Are insect pests and diseases a problem? Have some new crops



Trainer Handbook – Day 1 – Past, present future



been planted recently? Maybe African yam is a new crop? Maybe in the past cassava was for pigs and now people are planting to eat? Are new banana diseases causing fear and challenge?

Drawing three maps – past, present and future

So, we suggest three maps are drawn by the villagers.

Remember – do the walk first – it will help to clarify the mapping exercise, especially if during the walk, you discuss the mapping that will be done.

Get started on maps straight away, only if it is raining too hard to go outside for a village walk about.



What is needed for drawing maps together?

- Felt pens – white board markers work well for this exercise.
- Large A3 paper is the smallest you can use. A2 is better or cut from a roll of brown paper.
- Blue tack, Sellotape – to hold finished maps on wall? What is going to be acceptable?
- Groups of about 5 people works well.

A map of time before

A map of when the oldest men and women were young. Clean water, birds and animals in forest that had many high-quality timber trees of many species and food producing trees. What else did the forest provide the villagers with?

Villagers may not remember to consider how the healthy forest helps to hold moisture during rain and allow that moisture to replenish creeks and rivers giving people adequate water for many months.

A map of now

Include all the elements described in the villager handbook. Make sure that men and women, young and old are all contributing to this process.

Lots of trees have gone. Rain comes and falls on almost bare ground, or ground with some grass and weeds and food crops. It is easy for much of this water to run off carrying good soil with it.

A map of a future the villagers hope to create

This is where it gets interesting. Villagers are encouraged to draw this map... but it could be drawn at the very end of the training. Or they might draw a map of their desires at the start of training and come back and modify when the training is finished. Encourage detail. The map could become a Village Plan. An Action plan. Remember this training is meant to encourage change in villagers lives.



Summary discussion / presentation – how is land used

	<p>How is land used?</p> <ul style="list-style-type: none"> • Each village community will have different approaches to land. • Encourage discussion as villagers think about what they have described in their maps. They may have current food gardens, old food gardens in a weed fallow, areas pigs are allowed in, cash crops of pineapple, cocoa or coffee and cash crops that are short term like onion, aibika, tomato, kaukau (sweet potato) or corn etc. • How much of their land is always producing food? This kind of garden is right at home. Some people don't have this kind of garden. • Most Melanesian gardens are very complex with fruit trees like mango, soursop, guava mixed in with various food plants. That complexity is a wonderful strength of gardens. Why? (Think shared fertility, timing of harvest, insect pest burden reduced, varied food crops that cope with various environmental challenges).
	<p>Discussion</p> <p>The farmer workbook provides questions.</p> <p>Encourage farmers to consider the maps they have drawn so that the discussion looks at past, present and future.</p> <p>What has been happening? Good and bad? What trends can be and need to be stopped? Plastic rubbish? Loss of trees?</p> <p>What new directions might the village community agree on? Maybe they might agree that planting trees for firewood and building needs can happen much closer to their village in a 5-10 year fallow?</p> <p>Encourage farmers to discuss these issues together – making sure men and women, young and old are heard.</p> <p>Capture key answers on paper that can be put on the walls of the hall or school you are using to gather in.</p>

Choices – which way next? Is change needed?



Training Day 2 - Water shed management

This is a ‘big picture’ or ‘big idea’ day. The big picture of how ‘our’ village fits into the bigger picture of rivers and mountains, gardens and forest, people, housing, schools, churches, roads and businesses.

Globally water is easily as important as oil (diesel and petrol). Water is crucial to life. Today we think about the good and bad of water.

Here’s a list of key Learning goals for your training.

Learning goals

	<p>Farmers will →</p> <ul style="list-style-type: none"> • Know what a water shed is – and how their village fits into the watershed. • Understand the crucial role of forest in water sheds and water management. • Be aware of their precious resource – water and the need to look after it. • Know how to reduce erosion in gardens AND take steps to reduce erosion (of precious top soil) that occurs during heavy rain – in their own gardens. • Understand how important organic matter is – and how organic matter is both lost and improved in their gardens’ soil- AND take steps to manage and improve organic matter in their own gardens. • Realise that fire needs very careful management it is both good and bad. They will establish discussions leading to community agreements around fire management – especially during dry or drought periods. • Know the steps to improving fallows – when garden land is recovering fertility Short term with green manure legumes and Long term with trees. They will have planting material and establish improved fallows in their own gardens – as examples for others. • Understand the crucial roles livestock play in sustainable gardens. • Understand the good and bad of nitrogen – a key nutrient, but a toxic challenge when used as fertiliser in an unwise manner.
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Healthy land is one of the fundamentals to living well. Villagers know this. But villagers are often following gardening practices that worked fine with a small population. With far more people needing to garden on scarce land we must think of necessary changes to gardening techniques. There are also new pests and diseases that challenge our farmers.

This next section covers the biggest topics in coping with climate change and managing to live well. The Learning goals above lists the key topics.

	<h3>Create a map of the watershed</h3> <ul style="list-style-type: none">• This takes time before the training starts. You need a (good) map. Google Earth is your best starting point.• You need to look at the mountains and rivers that contribute forest and water resources for the villagers.• Create and / or print out a big map, before the training. This will be of the watershed that the villagers are part of.• For coastal villagers, the water shed is potentially very large, and they will have no control over pollution added to rivers that start many miles away.• Bring this to the training as a resource for discussion.• Villagers may be surprised at how big their watershed is.
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Beware. These topics are meant to be taught by people who are doing what they are talking about. Don't pretend. If some of this is new to you – go back to your land and put these things to the test. Do the work in the garden. You'll love the results!

Maybe you were not able to visit a forest. We are making videos and photos available for you to use, to help farmers remember and think about forest.



Let's go walking! Refer villager manual.

Listen, question – helping villagers to look at things they have seen all their lives. They need to have open eyes to see change happening!

And... don't pretend with farmers. If it is new to you, say so. Then you are all on the same side – learning together. That's fine.

These next sections are treating the watershed as a series of inter-related elements. Organic matter, livestock, erosion control, mulch – all are important.

At the end of this section the big picture of watershed management is considered in a way that village men and women can discuss - with their village maps in mind.

Forests are crucial

Forests play several crucial roles in our watersheds. They are like guardians for our villages, providing protection from floods, providing food and much more. Encourage farmers to think about forests as much more than somewhere to go and hunt and find timber for a house or church or school.

Don't pretend with farmers. If it is new to you, say so. Then you are all on the same side - learning together. That's fine

Forests protect villages and gardens from flood and drought

Forests protect soil in our gardens from floods and from droughts – by managing heavy rain. A healthy forest can trap great amounts of water in the soil and litter above the soil and in the moss and lichens that grow.

Healthy forests release water slowly – reducing the intensity of floods and helps to keep small creeks flowing, even when rain stops falling during

drought.

But the opposite is true also. When forests are cleared for gardens, there is often very little to keep the water in the ground. Heavy rain washes away fertile top soil exposing sub-soil that has few nutrients AND is not good at holding water.

Later we will look at making a simple experiment – showing the value of topsoil AND animal manure.



Forests store nutrients

Forests provide a home (habitat) for birds and animals

Provides fruit, nuts, timber, vines and more

These topics are described in the villager manual.

Now... we come to something really important – soil erosion. The precious topsoil that farmers need for today and for their children – is often given away in a heavy rain. No compensation paid by those who receive it!

Managing heavy rain – reducing erosion

There is an experiment to do – Have you got three buckets and corn seeds?

Top soil is crucial to healthy crops. Whatever a farmer chooses to grow – it will always grow best in a deep top soil. Protecting top soil is very important.

Top soil holds nutrients and moisture. Subsoil is not good at either task.

Protect top soil. This is a key message for your farmers and they need to hear your own experiences of managing and protecting soil in your garden.

If you are not a gardener – you should not be running this training! Find someone else who can speak from their experiences...

Establish a simple experiment or trial with corn plants to show how important top soil is, and how hard it is to grow good crops when top soil is lost and sub-soil is all that is left.

Here's a sweet potato (kaukau) garden with no topsoil left.

Corn, if planted into soil like this will try and set corn cobs when less than 30 cm tall. A useless crop is the result. Topsoil matters!

Talking is not good enough. Make trash barriers to slow soil loss. Then discuss what stops villagers doing these things in their own garden?

Topsoil matters!

Video or look or discuss

Show a video of heavy rain and soil moving in the water. Show the way soil is lost and transported in ditches. Show how some farmers are creating simple barriers in their gardens to slow soil loss.



Barriers in drainage ditches

Most PNG gardens have periods where the soil is too wet and vertical drainage ditches are commonly dug, to get rid of excess water. Great. BUT, when heavy rain comes lots (and lots) of fertile top soil is carried away during heavy rain. That precious top soil is given to people you have never met... or worse still it is carried all the way out to sea. There, it falls as sediments harming fish breeding areas – and causing pollution.

How can farmers keep that top soil in their gardens?

Barriers are the key as described in the farmer manual.

You as a trainer must not just go to a village and (just) talk about this. Divide people into groups and make drainage barriers, then discuss. Why don't people do this? Is tidiness a good enough value to accept soil loss? No, it is better for a garden to look a bit untidy AND hold soil during heavy rain.

Create simple barriers to slow down soil erosion with your farmers.

Don't just talk.

After heavy rain, look at the soil that has collected upstream of the barrier. Dig that out. Collect in a bucket. Think about how much soil is lost. The corn demonstration discussed should help people realise how important top soil is.

What else can farmers do to reduce soil loss?

Barriers between sweet potato (kaukau) mounds.

Some people in PNG make large kaukau mounds and the inter-mound area becomes a place where a lot of soil is lost as water runs freely during heavy rain.

Remember, fast flowing water carries soil. Slow it down!



Make some barriers

- Collect some trash, and some sticks to hold the trash
- Make barriers between mounds or
- Make barriers in ditches.
- Encourage farmers to assess how helpful the barriers are after heavy rain has fallen.

Remember, don't visit gardens and talk. Make some erosion control barriers with the famers gathered. Then discuss. Remember that there are many traditional understandings underpinning garden practice. Beauty is one of them. Trash slowing soil loss isn't beautiful. What do people make of this?



Trash between large (Engan) mounds, ready to collect soil that is being lost from this sloping garden.

Trashlines, Contour planting and using A-frames

The two big issues – help local people think about local plants AND make a trial – a demonstration.

Now, pls read the villager manual!

Are there bad things that happen with controlling erosion? Yes, maybe the land will slump if it gets too wet...

For Strengths, weaknesses opportunities and threats – you will need some large paper and pens. Remember it isn't for you to answer. Rather to encourage discussion and encourage the quiet men and the quiet women to speak and ensure they are heard.

Be a facilitator. Not a know it all!

Take another look at the Training Adults in PNG manual. It has great ideas.

Live fences

This is like the topic above. There are many options. You will know some. Farmers will know some that are specific to their area.

What are the characteristics you are looking for when discussing options with farmers?

Make sure to establish a live fence – across the contour is great – to help slow erosion loss.

Consider how live fences may help to control animals...

Remember, caring for topsoil matters!

Thes two photos with Flemingia are from hills in the Philippines. On the left, 400 t/ha of soil were lost each year in a traditional garden. On the right less than 2 t/ha of soil were lost each year, by planting rows of legumes on contour lines.

Make sure people understand the difference in soil loss is due to rows of legumes planted across the hill. Your children need topsoil. Don't waste it!



Strip gardening on slopes

What is strip gardening? This is a technique used in other countries to slow down top soil loss. Instead of contour rows, part of the hill side is left in fallow plants. As heavy rain falls, this 3-5 m wide (un-gardened/uncleaned) area of fallow plants captures and holds precious top soil.

Villagers are unlikely to be keen to do this. Why? This is where discussion is helpful. Walking onto sloping ground and looking at new and old gardens, looking at soil characteristics is crucial. In a new garden where soil is in good condition, there will be plenty of top soil, lots of fine material. However, when the garden has been exposed to a few years of heavy rain, it is very likely that fine material is gone, and only coarse material is left. Soil loss is long term, permanent damage to the garden and soil. It won't feed the family well, when top soil is lost.



Discussion questions

Relate the discussion of water resources in a water shed back to the changes that have occurred over the last 50 or so years – using memories of those in the room.

- Review the maps villagers have drawn.
- How far has the forest receded from the village in last 40 years?
- What are the key issues learned today – about water and how to manage it well?
- Encourage farmers to discuss issues together – making sure men and women, young and old are heard.
- Capture key answers on paper that can be put on the walls of the hall or school you are using to gather in.



Training Day 3 - Organic matter – crucial to healthy soil

Learning goals



Farmers will →

1. Know what organic material and organic matter (humus) is and why it is so important.
2. Be able to manage organic material to benefit their soil and garden produce.
3. Have changed attitudes to fire – knowing how good and how bad it can be.

This topic is crucial. So often we waste precious organic matter. Often it produces smoke which isn't healthy for us.

Your training started (Day 1) by encouraging men and women to think together about their village and the ways the village has been changing. They have considered the way the climate is changing and how this is affected by what people all over the world are doing. (Burning of fossil fuels causing increases in CO₂, with increased temperatures causing bigger storms, droughts / fires and sea level rise.

On our second day together, we thought about and discussed the big picture of water sheds and the importance of top soil and reducing erosion.

Today on our third day, we 'dig' into a whole new topic – how to care for the soil we live from. This requires us to think about and discuss the importance of organic matter.

How is organic matter lost and gained?

We start by thinking about organic matter- and the way in which we can use it or lose it! The quickest way to lose organic matter is to burn it. We must continually add organic matter to keep soils healthy.

How else do we lose organic matter from our soils? We lose organic matter when we cultivate the soil for a garden. Then add hot tropical temperatures PLUS moisture and we have an oven that literally cooks up organic matter. It is gone quite quickly. So, we need strategies with our farmers to maintain and look after organic matter.

Special roles for mulch

I believe mulch and mulching are absolute keys to improving food resilience and food security in challenging times.



Trainer Handbook – Day 3

Organic matter, mulch and fire



How do you as trainer learn the value of mulch?

You make your own simple with mulch and without mulch experiments to show the effect of mulch.

Let's recap. We have many people. We have few areas of forest left to make gardens in. We must learn from rain forest ecosystems. By this I mean – we must learn from key features of how rainforests work.

One key feature is they protect the soil from heavy rain and hot sun – with leaves above and litter or mulch on the soil – protecting it.

Let's see. Can we protect soil in the same way with our crops above and LOTS of mulch on our soil? The answer is yes indeed!

But how will you as trainer really believe in the value of mulch? You make your own simple 'mulch and without mulch experiments.

Fire – good and bad

In tropical gardens one of the biggest challenges is fire. Matches. People sweep leaves and instead of putting them in a hole to plant African yam for example... they burn them. Burning leaves is bad for smoke and air quality – but also a silly loss of organic matter.

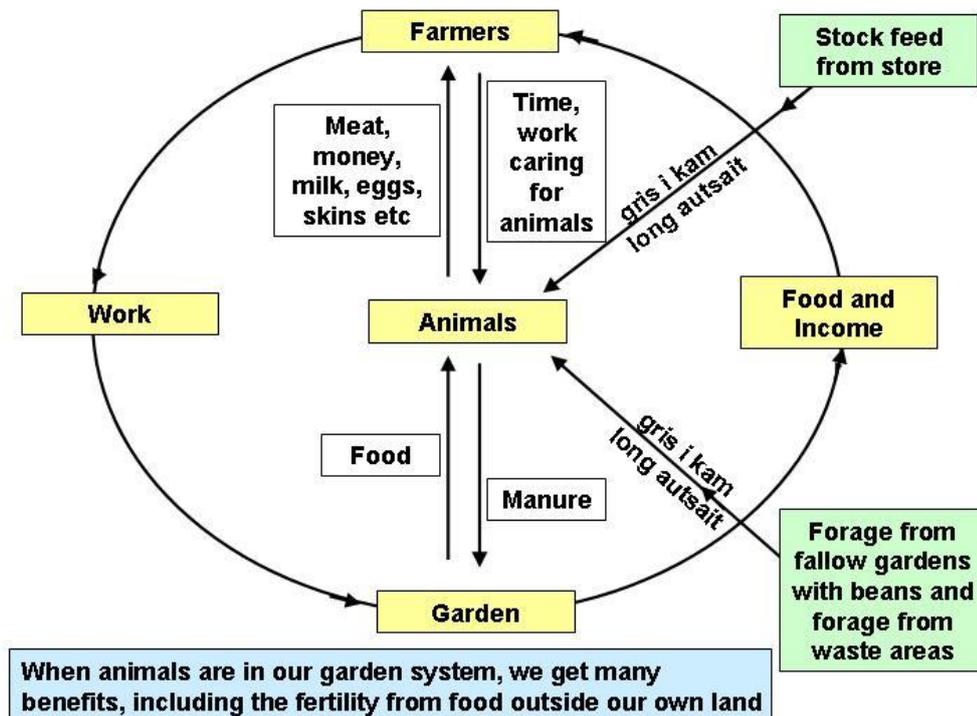
Organic matter is simply too precious to just toss away and burn.



Compost and kitchen gardens

Don't make too much of compost! Mulching is simpler and fits better with a PNG garden. Compost can be a Yam hole, partially filled then plant a yam and move to another hole for another yam...

Role of animals in soil fertility and family well-being



Help your farmers understand how animals can help in gardens.

Help them to act strategically when drought starts.

Those who sell livestock early in a drought, will achieve two things.

- Cash in hand to buy rice or noodles as drought food
- More food in the garden as animals won't be competing with your family for food.

Those who wait too long (to sell) will have skinny animals that are hungry and poor quality. Price will go down.

Animal manure really does work and make a difference. Do the experiments yourself.



Trainer Handbook – Day 3

Organic matter, mulch and fire



Collect some manure and make a simple experiment with a crop like pak choi or corn.

Chinese cabbage, with manure and without manure



Training Day 4 Improving fallow

This is challenging. There is a good chance your own garden shows you don't care about fallow land management. It is probably just resting, full of weeds that are producing seeds that won't help you.

So, in this section – be a learner with the farmers – now turn to the farmer manual please!

Learning goals



Farmers will →

1. Understand the changes that have been occurring due to population pressure with gardens and fallow land management.
2. Understand how to and take actions to care for soil that is resting – in fallow.
3. Go home and plant legumes under their maturing corn to see the value of crop rotation.
4. Take every opportunity to improve the value of their fallow land so that it produces well, in next cropping phase.

Managing fallow land

Many fallow gardens grow lots of weeds. These weeds produce seeds that cost gardeners lots of time in weeding. So, this isn't just about fertility. It is about the work of those who weed – and often this is women.

Strategies we as trainers help farmers put in place that reduce work are really important.



Using Green manure legumes



Tumbuna pasin bilong yumi

- Remember that in taim bipo there was plenty of land for everyone and fallow periods were long, allowing trees to naturally regenerate. Now, there is less land and we have to put some effort into making each fallow period a really useful fertility building time.
- Learning from our ancestors is always worthwhile.

Working together

- In half of a garden that is almost finished- ready for taim bilong malolo- plant seed of plants like velvet bean, Dolichos, snake bean, cowpea under the old food crop (photos starting on page **Error! Bookmark not defined.**).
- Leave the other half of the garden to rest in whatever grows there- weeds, grass etc.
- Leave both parts of the garden for about 6 months.

Later



- After 6 months, plant corn in both areas, to see what effect the legume has had.

Discussion



- List good and bad points relating to adding legumes to your garden system
- What stops us from planting legumes under a maturing crop?
- How can you make use of legumes and animals to help your food security?



Case studies of Green Manure legumes

This example is a great way of showing how fallow can be improved. Have you established a demonstration/train?

1. Tomatoes at Vudal, ENB - cowpea or weeds planted.



These two photos were part of one garden at Vudal- growing tomatoes. The farmer left the left hand side as we normally do, to let weeds grow during the rest or fallow period. On the right, the farmer planted some cowpea seeds at the base of the dying tomato plants. They grew really well.

- | | |
|--|--|
| | <ul style="list-style-type: none"> • Which is the best system? • Why? • What stops you doing this on your land? |
|--|--|

Storing seeds – Trainer – have you stored some seed?

- Seeds must be stored in a dry and rat/insect proof place.
- Even plastic drink bottles can be a safe, insect proof place to store seeds.
- Remember, dry the seeds very well.
- Bite the dry seed. If it squeezes it is not dry. If it breaks it is dry.





Trainer Handbook – Day 4

Improving fallows



- Now put them in a bottle with a lid on. Store out of sun. Look the next day and the next. If there are signs of moisture on the side of the bottle – the seeds are not dry enough.

Improving long term fallows

Long term fallows normally involve trees – forest trees. In many areas close to towns in PNG, tenant farmers are not allowed to plant trees because of potential problems when the trees are mature. Who planted this tree becomes an important statement of ownership... so landlords say to tenants – no tree planting.

The villager manual explains this topic – but may not cover why people don't plant trees. Sometimes tenant farmers are not allowed to plant trees. Sometimes people just plain believe the country is full of trees.

What do you think?



Extra resources for you

Making sense of claims people make – Doing Field Research!

When you are training villagers, you will hear people say... *'if only farmers used this or that (magic) product farmers yields would rise dramatically'*.

Today I watched on Facebook as people were told that chicken manure bought from Singapore is so much better than the chicken manure from your own chickens... It has been treated with something special. It costs ten times as much as your own... but it is magic and wonderful. Is this true? (What do you think?).

So, how do you encourage farmers to think like good scientists? How do you as a trainer think well?

How do you make sense of these amazing claims?

Mostly, it is simple and a little time consuming. Let's stay with the example above – a special, organic chicken manure, imported from Singapore.

Firstly, ask the seller to show you test results of the Singapore manure when compared with chicken manure from local chickens as well as compared with a control. A control is a plot of corn say, that got no fertiliser.

So in the simplest possible trial you would have 3 treatments.

1. Control – corn with no added fertiliser.
2. Corn with a weighed amount or standard volume of local chicken manure/plot
3. Corn with a weighed amount or standard volume of special Singapore chicken manure/plot
4. (You could add more to this experiment... eg fertiliser from store or other animal manure).

Measure the yields and do the analysis of cost:benefit. ie Perhaps the Fertiliser was best, but how much did it cost to get the extra growth?

Want to learn more about Doing Field Research – there's heaps of resources in the library here - <https://gutpela-png-gaden.net/library/>



Using Fertilizers bought from stores

Some trainers believe fertiliser will kill the soil and destroy every living organism. Not true.

The lime you eat with betel nut hasn't killed too many people – at least not directly! But the truth is we are best to rely on the organic principles outlined as our primary methods of growing food.

That said sometimes fertiliser is helpful. There are some further thoughts in the villager manual-



We will continue to add photos of plants to our E-platform – with information for each. Being developed.

The villager handbook has quite a few photos.



Action Plan

Action plans are important. You don't want the training to be just talk.

So finish with an Action Plan.

Try and record individual action plans from individual farmers – THEN make sure to follow up AND make sure to tell us back in the co-ordinating and leadership role what the farmers – men and women have done with the training.

Thankyou.

Evaluation

Refer to the Villager manual.

Please remember evaluation and future desires – these are very important.

We want you to send in the summary of evaluations please.