

**THE TROPICAL
PERMACULTURE
GUIDEBOOK**

INTERNATIONAL EDITION

A GIFT FROM TIMOR-LESTE

**VOLUME
ONE**

**PERMACULTURE
AND PEOPLE**

The Tropical Permaculture Guidebook – International Edition. A Gift from Timor-Leste.

Created by

Permatil (Permaculture Timor-Leste), in partnership with xpend Foundation and Disruptive Media

Authors

Lachlan McKenzie and Ego Lemos

Contributing writers

Julianne Hartmann, Rob Swain, Django van Tholen, Sasha Earle, Deirdre Nagle

Content advisor

Rosemary Morrow

Content contributors

Atai Claudio, Herminia Pinto, Adozinda Soares, Elsa Fatima, Hermenegildo Sarmento, Marito, Fernando Madeira, Chris Walsh, Steve Cran, Wayne Gum, Xisto Martins, Trish Morrow, IDEP Foundation staff.

Editors

Julianne Hartmann, Rob Swain, Emma Coupland, Lachlan McKenzie, Ego Lemos

Artists

Gibrael 'Aziby' Dias Soares Caroch, Simao 'Mong' Cardoso Periera, Eduardo 'Edo' Marques, Chimeng Tael Fraga, Moises 'Pelle' Daibela Pereira, Edson Arintes Da Costa Carminha, Grinaldo 'Kiki' Gilmarodep Fernandes-Zellara, Jose 'Osme' Fortunato Gonzalves, Jose 'Tony' de Jesus Amaral, Leo Marcal, Ozorio 'Azo' Jeronimo, Kathryn 'Cipi' Morgan, Lachlan 'Mr Laba Laba' McKenzie, Fidelis 'Dee' York

Design and production

Disruptive Media

Web design and development

Kargan Media

Project governance

xpend Foundation

Project team

Lachlan McKenzie, Andrew Mahar AM, Lyn Jenkin, Ego Lemos, Herminia Pinto, Karen McDonald, Emily Gray.

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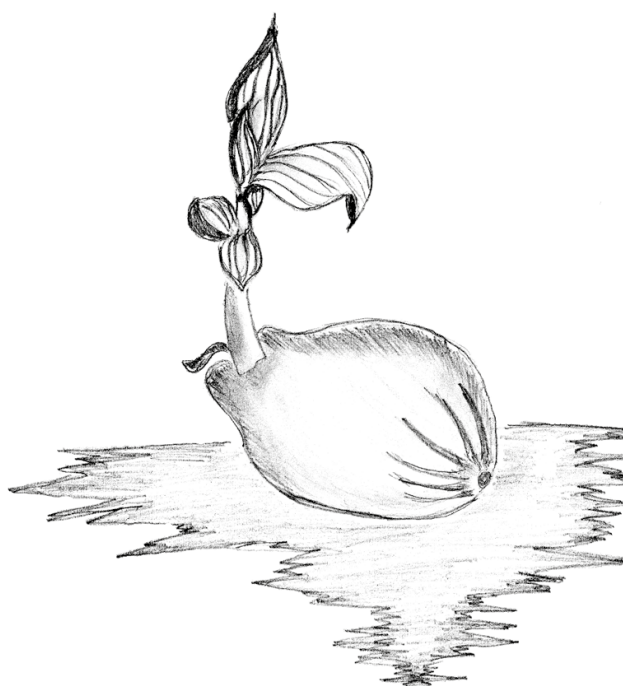
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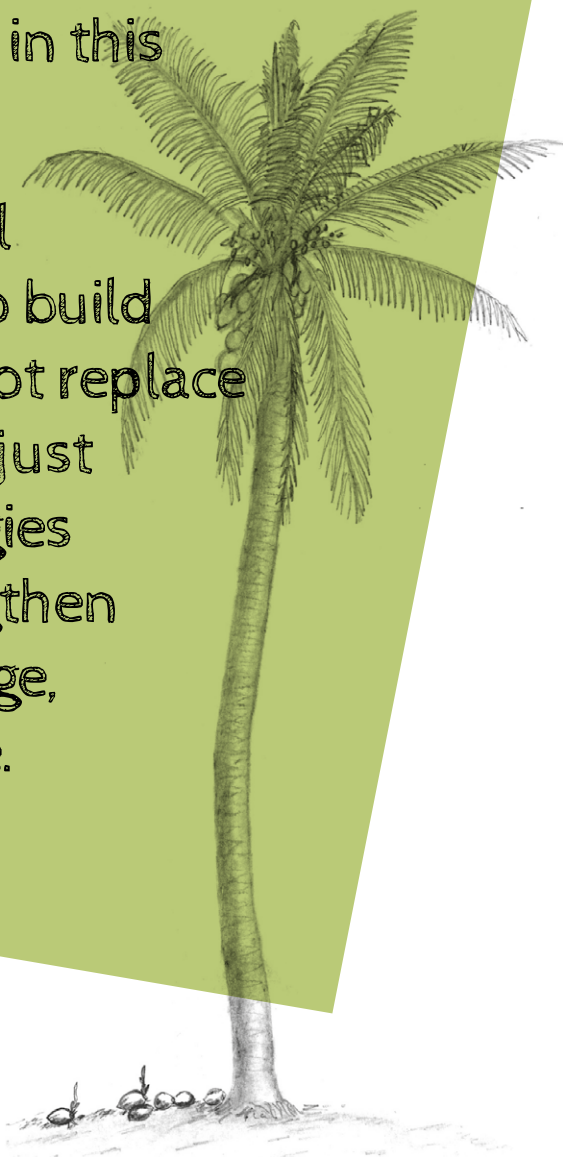
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A gift from Timor-Leste to the tropical world.

This guidebook is based on an original book written specifically for Timor-Leste by Permatil. The first edition was written with help and technical assistance from many Timorese and people from other countries living and working in Timor-Leste. The wealth of knowledge and incredible illustrations by Timorese artists from the original version is incorporated and expanded upon in this new edition.

It is a guidebook for all the tropical regions of the world. We want it to build on traditional knowledge bases, not replace them. The guidebook's goal is not just to introduce permaculture strategies and techniques, but also to strengthen and augment traditional knowledge, and complement cultural practice.





Foreword

David Holmgren

Permaculture was conceived in the 1970's at a time when there was a huge rise in interest in what today is called ecological sustainability. The oil crises of 1973 and 1979, the rise of resource nationalism and environmental and cultural challenges to the faith in modernism and technology contributed in both its conception and spread. Some of key influences on myself and Bill Mollison included indigenous and traditional land-use cultures, an earlier generation of organic agriculture visionaries and pioneers most notably Russell Smith's *Tree Crops*, Donnella Meadows' *Limits To Growth*, Howard Odum's energy systems ecology and Fritz Schumacher's economics and development concepts.

Although permaculture began in the cool temperate climate of Tasmania, the southern most state of Australia, the spread of permaculture around the world through the agency of the *Permaculture Design Course* was not confined to the affluent nations. In fact, as the economies of the affluent "north" recovered in the early 1980s on the back of falling commodity prices, debt payments from the developing "south" and impact of Friedmanite policies, the interest in permaculture contracted to those who valued self-reliance and connection to nature over industrial production and affluent consumerism. The same global dynamics enforced harsh policies in commodity producing countries and communities, generating more problems than benefits. This opened opportunities for permaculture ideas to gain a foothold with its emphasis on supporting self-reliance at the household, community and bioregional levels.

Bill Mollison's encyclopedic *Permaculture: A Designers Manual*, published in 1988 included a strong focus on the tropics with extensive graphic representation of permaculture designs that drew on and resonated with the best of indigenous and traditional land use systems. In small and large tropical countries as diverse as Brazil, Cuba, Vietnam, India, and Zimbabwe, permaculture teaching and ideas began to influence agricultural extension, community development programs, disaster recovery and environmental education. Following the independence of Timor-Leste, the publication of the first edition of the *Permaculture Guidebook from Timor-Leste* in 2008 was an important milestone in interpreting permaculture design, strategies and techniques relevant to communities, and a nation, emerging from trauma and deprivation.

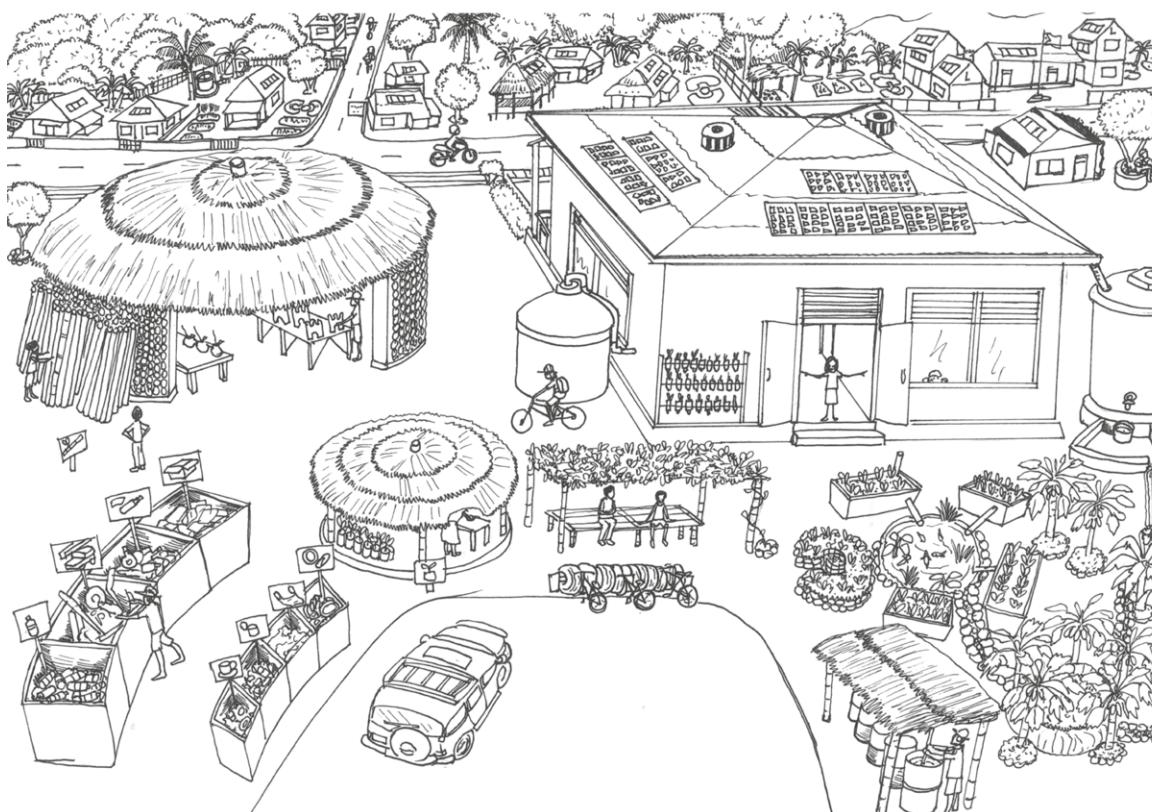
It's nearly 10 years since I received a copy of the original *Permaculture Guidebook from Timor-Leste*. It was the best example I had come across of the application of the Mollison lineage of teaching (in a practical manual for a specific place and culture). It was as if Mollison's encyclopedic *Permaculture: A Designers Manual* (1988) had produced offspring. Back then I had hardly set foot in the tropics or the majority world, having concentrated my permaculture expertise and activism helping pioneer the solutions for how the billion or so middle class people (mostly in rich countries of the temperate zones) might live in a way that lets the majority, in poorer countries (mostly in the tropics) follow a sustainable development pathway.

As the failures of globalised economic systems spill over into previously affluent countries, there is growing recognition that greater household, farm, and community level self-reliance is the foundation for equitable and ecological development in previously poor and rich countries and communities. This is expanding the potential for the spread of permaculture especially where the teaching and extension is grounded with well tested strategies and techniques relevant to peoples' immediate needs.

My experience in the tropics remains limited and I have not been to Timor-Leste to better understand the impact of the lineage of the *Tropical Permaculture Guidebook* in supporting appropriate ecological and community development. However the earlier editions of this work have been widely applied, updated and translated beyond Timor, a good sign that this resource has been tested in the field and has had the feedback essential to refine and improve any innovative work.

The credibility of the original authors and the input from other permaculture teachers and writers with a great depth and breadth of experience across the tropical world gives me confidence in recommending this great gift from one of the smallest nations to the diverse communities and nations of the tropical world.

The testing of the permaculture concept on a tropical nation with a population of a little over one million may prove to be as significant in the spread and ongoing evolution of permaculture design solutions, as its conception in cool temperate Tasmania was; with only half a million people. After all, island people are likely leaders in understanding that we all live on a planet with finite boundaries.



Aims of the guidebook

Our goal is to help families and communities become more resilient, sustainable and productive, not just to survive but to be able to reach their full potential and thrive.

The guidebook provides information to improve basic wealth for all people, not just material wealth, but wealth in the environment, the trees, the animals, vegetables and grains, and wealth in the people, and their knowledge, skills and connections with others. **Real wealth!**

We wrote and illustrated the guidebook for many different people to use:

- Farmers.
- Community groups and their members.
- Agriculture and university students.
- NGO and government workers.
- Permaculture trainers and practitioners.
- Demonstration sites.
- Businesses and cooperatives.
- Schools and school students.
- Anyone wanting to become more resilient, more sustainable and regenerate their environment!



The guidebook is created to help develop new projects and for redesigning and improving existing projects, houses, farms, environments and communities.

It is written and illustrated so that people with low literacy levels can use it and people with little or no income can benefit from it.

It provides techniques and solutions at all levels — for individuals, families, communities, businesses and governments, both regional and national.

We also want the guidebook book to improve over time. So, use it, share it, learn from the results of your work, and let us know your ideas for improvements to the guidebook and we will spread your experience. As the guidebook is on the internet, we can update it every year, and your input can create a better guidebook in the future!

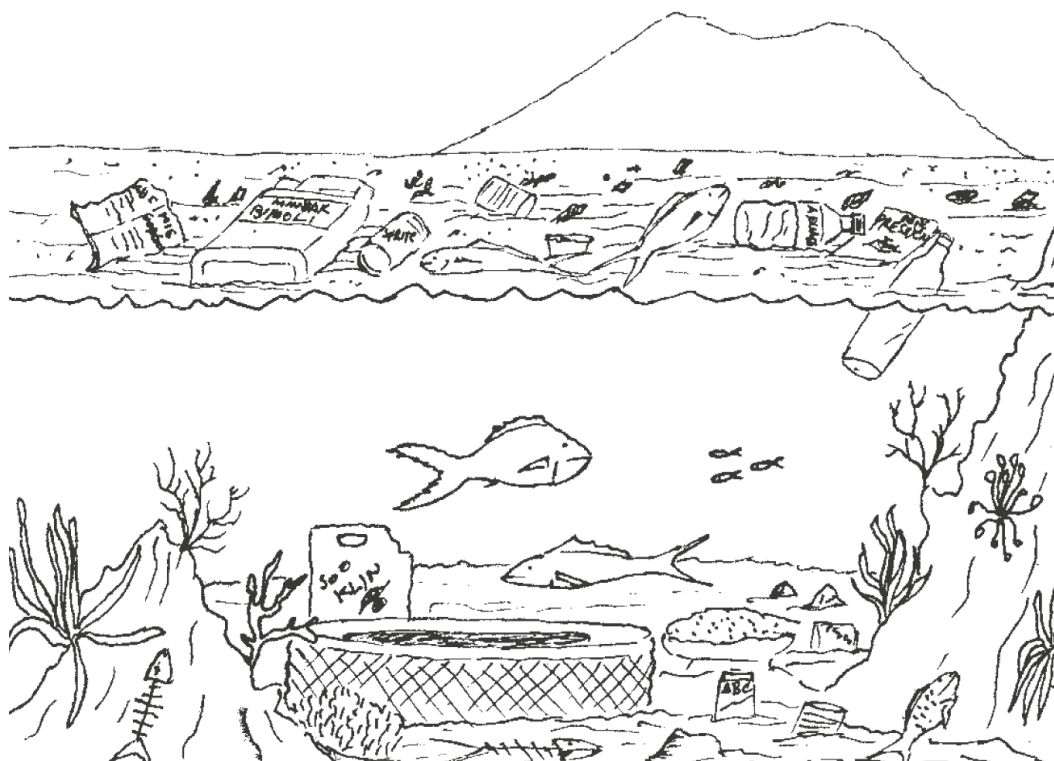
Our challenges

Globally we are facing many direct and serious challenges — to our environment, our productive land, our natural resources, and our social and community structures.

POLLUTION

Our land, water, oceans and air are in bad shape! All of them are being polluted by rubbish, chemicals, and the residues of our wasteful, destructive and careless ways of living.

Some of the problems can be repaired quickly — some will take much longer — but the solutions will have to come from big changes to how we live, how we produce and what we consume.



NATURAL RESOURCE DEPLETION

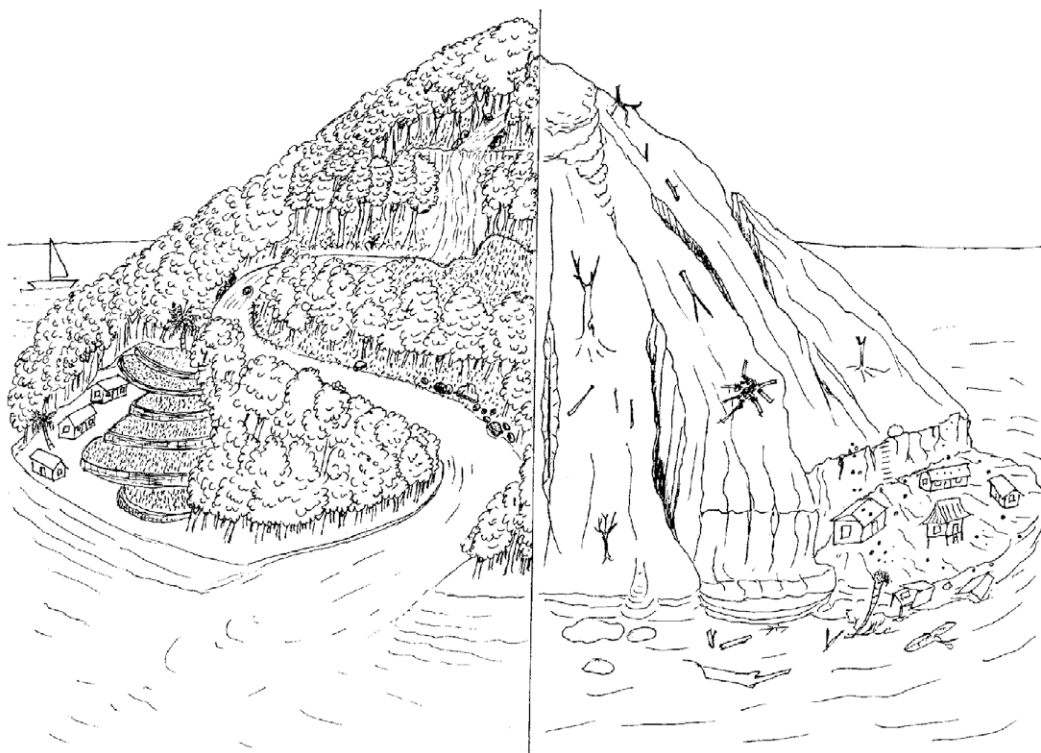
Water — underground supplies are quickly disappearing in many countries and, with bad land management and deforestation, the problem is getting worse. Rivers, lakes and oceans are more and more polluted, and rainfall is becoming more irregular as climate change takes effect.

Air — air pollution is increasing each year, causing sickness and sometimes even limiting our daily activities.

Soil — soil quality is decreasing worldwide, which increases water and resource use. Even worse is that each year there is an increase in the amount of land where the soil is so poor it cannot be used for agriculture.

Seeds — local varieties are quickly disappearing, and the range of seeds available for farmers is getting less and less. The problem leads to increased costs, higher pest problems, higher dependence and less genetic diversity.

Forests — deforestation continues and as it does, the amount of wood available to use decreases. Destruction of forests is a huge problem as not only do they affect rainfall, they are the world's lungs that turn the carbon produced through burning oil and gas into clean air. Forest depletion also negatively impacts on water supply, and causes erosion and landslides.

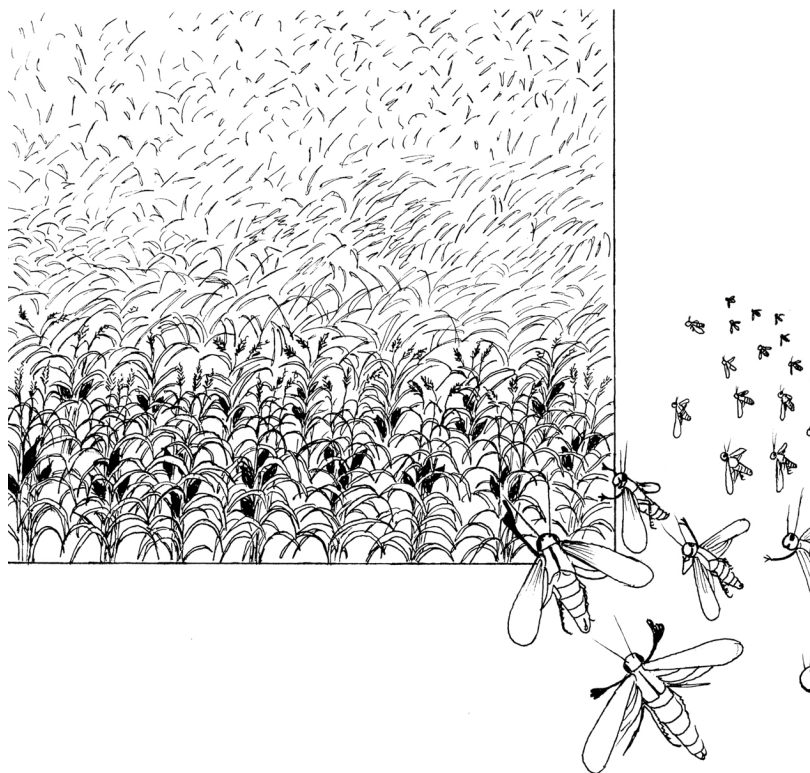


Plant, animal and insect diversity and numbers — The diversity of life on earth is decreasing rapidly creating imbalance for systems both in the natural environment and our food production. The systems become more fragile as a result and more vulnerable to climate change.

Oil, coal and natural gas — fossil fuels — these are finite resources and at the rate we are using them, we have reached the point where they are becoming more expensive, more environmentally destructive to extract and create pollution that we definitely cannot afford to create.

CLIMATE CHANGE

A lot of the technology and changes in our way of living that have helped to make life easier and better for many of us are also contributing to the huge global problem of climate change. It involves a long-term shift in world climate patterns, mainly the result of burning fossil fuels for our electricity, transport, food production, buildings and consumer goods.



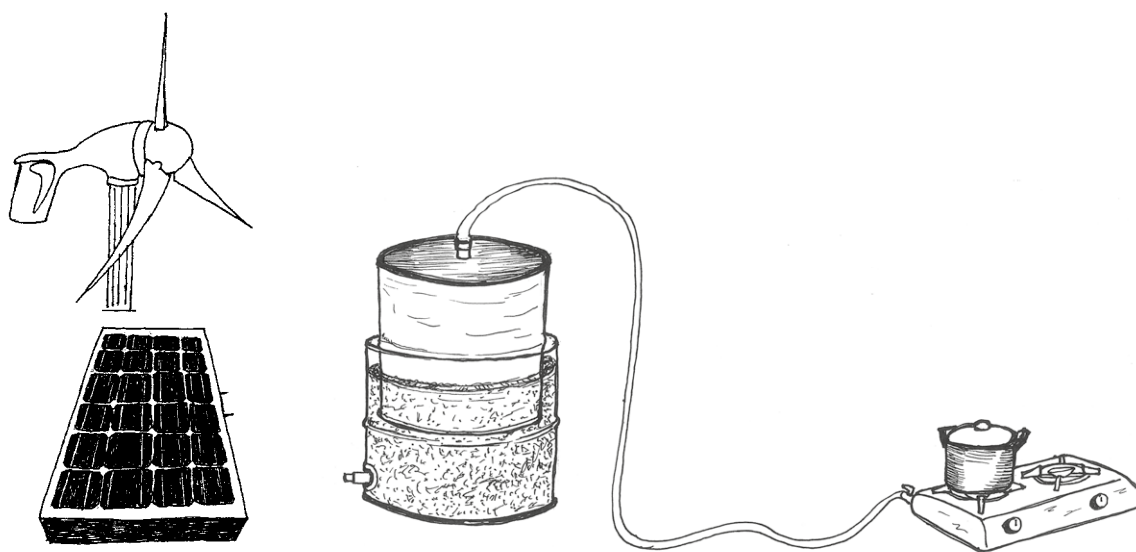
Industrial agriculture with large monoculture crops contributes to climate change

Too much carbon dioxide and methane gas — ‘greenhouse’ gasses — in the atmosphere is causing global warming, a rise in the earth’s surface temperature. Global climate patterns are changing; rainfall is less reliable, storms are becoming more intense and temperatures more extreme. Ice and snow are slowly melting in many places as the temperature increases. The sea levels will rise a lot as the ice at the north and south poles continues to melt if we do not find solutions quickly. Low-lying areas, such as in Bangladesh, are already facing rises in sea level which have made some coastal land unlivable.

Climate change is becoming a big problem and will get much worse unless we make rapid and significant changes in how we live and how we manage the natural environment. Rather than destroy the earth’s ecosystems, we must be stewards to protect it for all living things and pass on a healthy planet to our children, not controllers and consumers who leave nothing for future generations.

We are facing this global crisis because we have not understood or have ignored the consequences of our actions. Countries in the tropics have only contributed a small amount to the global problems, and yet the problems caused will affect every country. Every country must now act quickly to adopt lifestyles that will stop producing pollution, to contribute to regenerating the environment and to protect against the negative effects of climate change.

An imperative solution is to change to renewable energy sources, such as wind power, solar power, biogas, tidal and thermal energy, as quickly as possible. Changing how we produce our food and what we use and consume are also essential steps to take.



Climate change is occurring already but if we change quickly we can still minimise the impacts and consequences. If we do not act now climate change will get worse and make it very hard to live on the planet.

POPULATION

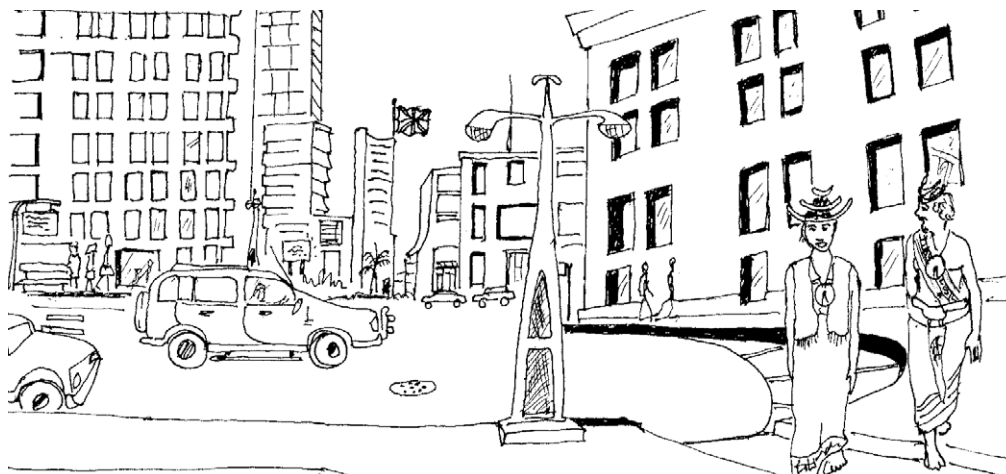
The world's population is rapidly rising, which increases pressure on resources, land for living and food production, and negatively affects the natural environment. Currently, the global population is almost 7.5 billion people!

We must:

- Find ways to reduce population growth in ways that are fair and just without imposing harsh regulations or creating hardship.
- Increase food production in a sustainable way that considers the impacts on the environment.
- Use and re-use all resources efficiently with an emphasis on quality, sustainability and recycling.
- Protect the natural environment and significantly limit our negative impacts.

URBANISATION

Urbanisation is when people move from rural to urban — cities and towns — areas. It is an enormous shift from a rural to an urban culture, especially with the changes in lifestyle that it involves. Over 50 per cent of the world's population now lives in urban areas, and this number continues to increase. Each of the world's top ten largest cities has at least 20 million people.



This creates specific pressures on the environment and natural resources that include:

- High levels of sewage and household waste.
- Much higher use of cement, steel and bitumen that increase urban temperatures.
- Bad air pollution.
- Polluted water, higher water use but less water catchment.
- High fuel use for cooking and for heating or cooling buildings.
- Houses and factories built on agricultural land.
- Resource depletion and environmental damage in the surrounding areas.

Solutions for sustainable urbanisation need to include larger-scale solutions for the challenges listed above.

GREED AND COMPETITION

The modern way of living and the values it incorporates have created many problems, such as:

- When our system values money and material wealth above all else, everything is consumed to get more money.
- Focusing on short-term material gain does not consider the long-term consequences on the environment or the planet.
- Consumerism and the consumption of goods that do not last or are quickly thrown away pollute the environment, which creates problems related to bad health, wasteful resource use and rubbish disposal.
- Many consumer goods are designed to last only a few years; they break and are replaced. The term for this is 'planned obsolescence' and it is to make more money for the businesses at the expense of the environment, causing resource depletion, pollution and climate change.
- Current financial systems still only react to problems rather than applying preventative measures so that problems do not arise at all — short-term solutions will not result in significant change.
- Big corporations and other powerful organisations/people control too many resources, are often not accountable for their actions and benefit only a few, which leads to inequality and the loss of rights and independence.



Our tools

The task of overcoming these problems seems huge, but it is achievable. However, unified action must come from the majority rather than the minority, and there must be a change of mentality:

- How do we really want to live on this earth?
- How do we live well and live sustainably?
- How do we live as a part of the earth and its ecosystems, not separate as we are now?
- How do we regenerate the damaged ecosystems and the depleted soil and natural resources?
- How do we live a life that leaves the earth in a better state than when we were born?

PERMACULTURE

Permaculture involves designing integrated systems for families and communities to gain self-sufficiency and live in balance with the world around them. It is a series of strategies that provide a flexible framework for any situation, and the ability to choose and integrate the technical tools required to achieve resilience and sustainability. It facilitates the need to change our focus quickly from quantity to quality and helps to address the challenges that we face.

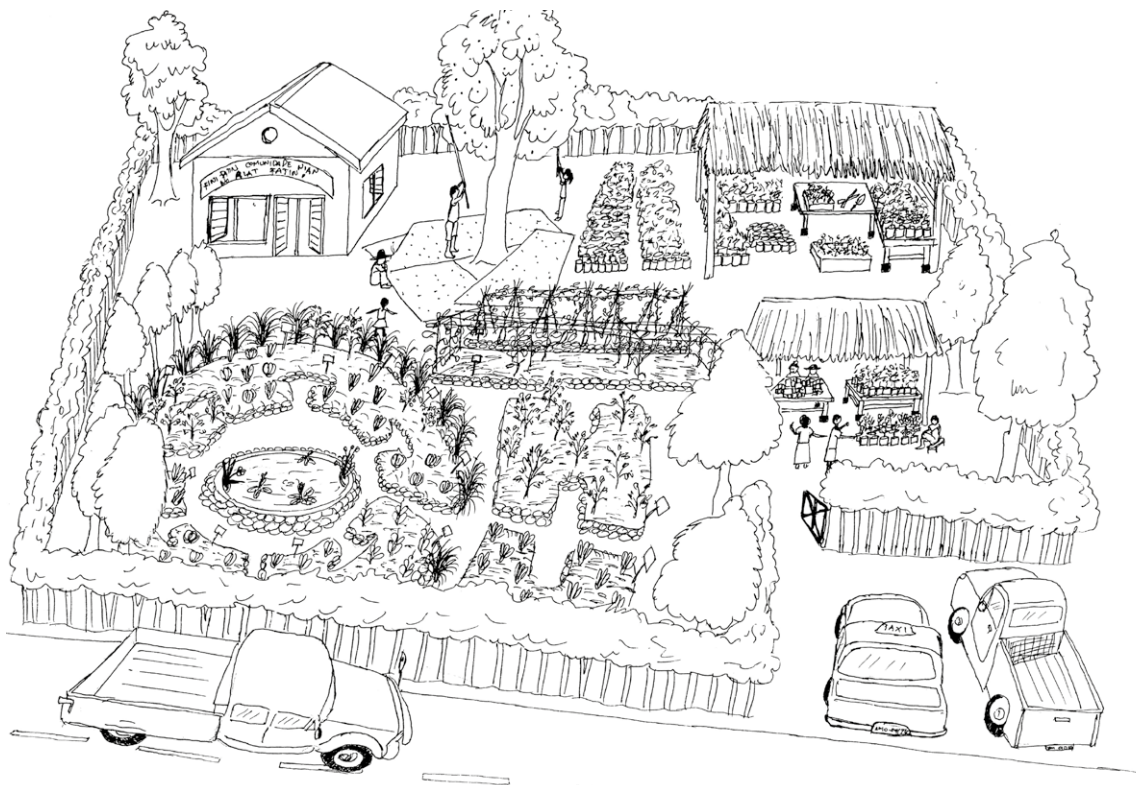
Permaculture is a regenerative process. This guidebook helps you to understand permaculture and how to apply it, especially in tropical regions. There is a lot more information available on specific topics from experts, training, books and the internet. Build on the knowledge the guidebook provides, bringing in other permaculture and sustainable living knowledge, and add your own experience too.



TRANSITION TOWNS

A concept born out of the permaculture movement, transition towns facilitate the conversion of communities from their current situation to being resilient, sustainable and regenerative. It encourages the growth from small actions to whole-town participation and provides the tools to achieve change in all facets of living — food production, transport, housing, energy and fuel, livelihoods (jobs), water, environment, economy, etc.

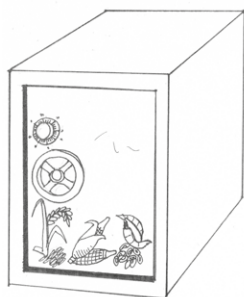
Read more in Urban and community permaculture (Ch 4).



FOOD SOVEREIGNTY

70 per cent of the world's food is produced on less than five acres of land, and women produce 70 per cent of that food. This is the reality which should be encouraged, rather than following the method of large-scale monoculture crops.

Producing enough food for everyone relies on smarter, more intensive production from small landholdings using soil improving, organic, regenerative methods. Now more and more organisations, farmers, communities and governments understand that this method is the way to go. The industrial agriculture model has failed due to its reliance on outside resources, chemicals and mechanisation, the high costs and its vast scale, all of which drive people from the land, reduce livelihood opportunities, lead to soil and water degradation, and large-scale environmental destruction.



Food sovereignty embraces small-scale organic farming and food production, as well as other essential individual, social and environmental factors for producing food:

- Food is a basic human right.
- You can own the land that you farm.
- Protect the natural resources that produce the food (and ensure the people and local communities own them).
- Reorganise food trade to promote local consumption and food self-sufficiency.
- End the globalisation of hunger and reduce food wastage by protecting production, through regulation, from price speculation and corporate influence.
- Social peace — everyone has the right to be free from violence; food and food production must not be used as weapons or as means of control.
- Democratic voice — smallholder farmers must have direct input into formulating agricultural policies at all levels. Everyone has the right to honest, accurate information, and open and democratic decision-making.

Read the Urban and community permaculture chapter (**Ch 4**) for more details about food sovereignty and why it is important for all communities to achieve.

GLOBAL CHANGE

There are hundreds of thousands of organisations and millions of people all over the world working to create positive change. Their work is in many different areas:

- Environmental conservation.
- Reforestation and land protection.
- Campaigning against the pollution of air, water and land.
- Sustainable agriculture (organic, biodynamic, agro-ecological).
- Permaculture.
- Transition Towns.
- Renewable energy.
- Food sovereignty.
- Protecting native seeds, land and water.
- Indigenous empowerment and action.
- Ocean protection.
- Providing a voice for ethnic minorities, especially traditional landowners.
- Human rights and justice.
- Community resilience.
- Local food consumption .
- Animal welfare.
- Culture and art.

These organisations are community groups, cooperatives, networks, businesses, government, non-governmental organisations, large international organisations, advocacy groups, political parties and so on.

Every organisation is making a small but vital contribution to change; together there is massive change already occurring, and it is spreading. You are part of it!



EDUCATION

Learning is a key for change. This guidebook contributes in its own small way to the larger goal of education as a basic right. To address the challenges we face, we need to have knowledge of the strategies and techniques needed for broad change to occur.



How to use the guidebook

The *Tropical Permaculture Guidebook* is divided into three volumes. These volumes each have a theme to make it easier to find the information you need. Each volume contains:

- An introduction.
- A table of contents to help you find what you want to read.
- A glossary explaining technical words and terms.
- A reference section for where to find more information about the different topics.

Each volume contains six chapters that divide the information into clear, easy-to-follow sections. They are systematically organised to help you to plan, design and implement the techniques.

In each chapter there are many references to other elements and sections in the guidebook; for example, there are links to windbreaks, compost making, swales, integrated pest management, animal production and much more. This shows the connections between the different chapters and makes it easier to find the information you need.

You decide how to use the guidebook:

- Read several chapters together.
- Read them one-by-one as you need the information.
- Look up the specific strategies and techniques you want using the table of contents (TOC).



Volume One: Permaculture and People

- Ch 1: Permaculture ethics and principles
- Ch 2: Natural patterns
- Ch 3 Permaculture design strategies and techniques
- Ch 4: Urban and community permaculture
- Ch 5: Cooperatives
- Ch 6: Trainers' guide

Chapters 1, 2 and 3 are the foundation for the whole guidebook, for volumes one, two and three. They provide the information to design systems and choose the appropriate techniques. They are vital to understanding how to create a complete system and the subsequent chapters in all volumes continually refer back to them. Designing and planning are part of the first step for all permaculture practice.

Water catchment methods, such as swales, micro-climates and windbreaks, as good examples of basic strategies and techniques, are included in **Ch 3 Permaculture design strategies and techniques** because they are relevant to most other chapters.

Chapters 4, 5 and 6 connect permaculture to people and communities, including practical information on:

- Local economies.
- Livelihoods, cooperatives and businesses.
- Permaculture for towns and urban areas.
- Organising and providing courses for new and experienced permaculture trainers.
- Links to related topics such as disaster risk reduction, food sovereignty and transition towns.



Volume Two: House and Garden

- Ch 7: Houses, water and energy
- Ch 8: Food, health and nutrition
- Ch 9: Soil
- Ch 10: Family gardens
- Ch 11: Seeds and propagation
- Ch 12: Plant nurseries

Volume two includes information that directly relates to families, family houses and family garden production. It also links these ideas to community-scale techniques because families are always part of communities and function better when they are part of a strong community. The chapters all have direct connection with each other, and can be read and used as parts of a single integrated system.

Chapters 9, 11 and 12 are foundation chapters for many chapters in Volume Three and an important starting and reference point. In Volume Three chapters, such as **Ch 14 Integrated pest management (IPM)** and **Ch 17 Animals**, are also important for referencing and linking with Volume Two.

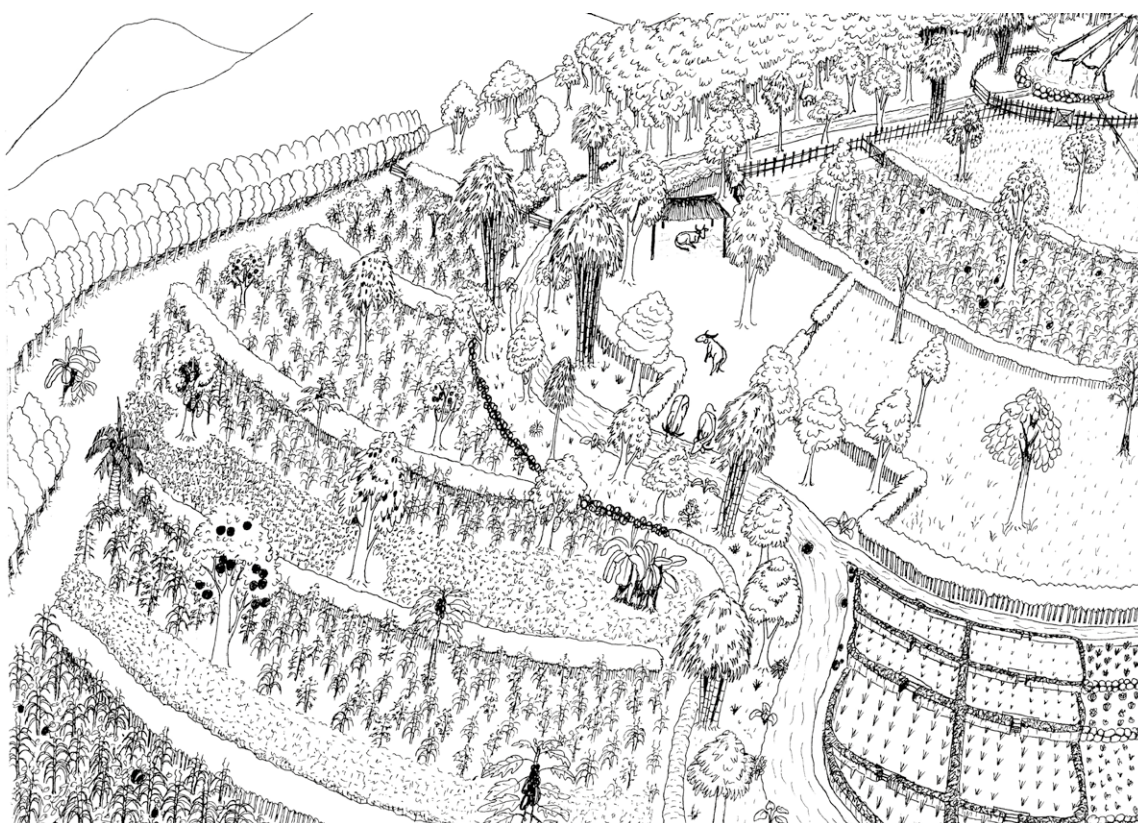


Volume Three: Regenerative Agriculture

- Ch 13: Sustainable agriculture
- Ch 14: Integrated pest management (IPM)
- Ch 15: Trees
- Ch 16: Bamboo
- Ch 17: Animals
- Ch 18: Aquaculture

This volume is called Regenerative Agriculture because the technique and strategies continuously improve the land, production and environment over time. All of the chapters in this volume refer to different parts of tropical agriculture and describe practical steps for achieving good results for families, communities and businesses. The chapters are also integrated with each other, reflected by the content and reference points within the chapters.

Volumes One and Two are important foundations for this Volume, with many chapters containing information vital for creating regenerative and productive agriculture. Volume Three also includes information in the chapters about environmental regeneration; repairing natural ecosystems and how it directly relates to healthy agricultural systems.



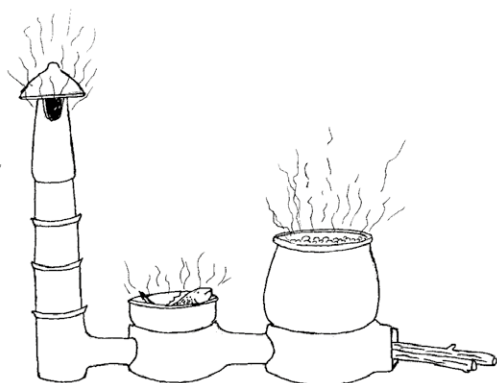
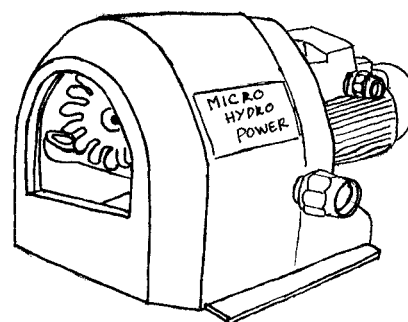
Appropriate technology

Appropriate technology:

- Is able to be understood and maintained by the people using it.
- Is affordable.
- Reduces energy use — electricity, labour, fuel, firewood, etc.
- Uses natural, renewable energy whenever possible.

Appropriate technology helps to improve the quality of life while allowing communities and countries to protect their land and the environment, and progress to a sustainable future.

In the original guidebook there was a separate chapter on appropriate technology. Instead, in this new edition these technologies as well as many new examples are included in the chapters where they fit best; there is no separate chapter. For example, renewable energy is in the Houses, Water and Energy chapter and clay stoves and solar dryers are in the Food, Health and Nutrition chapter.



We promote thoughtful and useful technological advances, not inappropriate technology that wastes resources just to make money. More and more countries in the world are moving to appropriate technology because it is smarter and more efficient. This is one of the changes we must make to reverse the current environment problems.

Think for yourself

Permaculture is about adaptation and creativity so use this book according to your needs.

If a technique mentions a material that you do not have, try to think of something else you can use to do the same job — improvise. Although the writers of the book have a lot of experience teaching and practising permaculture in tropical countries, we have not been to every household and farm in the tropics and may not know the best way to produce a solution for your situation. Follow the advice you find here and, by applying your knowledge and experience, adapt and improve it to create the best results.



One of the best techniques that permaculture can offer is how to think creatively about problems and solutions.

Use your community and join with other communities

When working with the ideas in this book remember to ask for advice from family, friends and elders in the community. The people close to you can help you plan the best design. Community cooperation and the sharing of knowledge are major elements of permaculture.



Permaculture design techniques and strategies are used in Asia, Europe, the Americas, Africa, the Pacific and Australasia – they are global! By practicing permaculture you become part of an international community. Although people adapt the techniques to suit the climate and conditions in each country, the basic permaculture concepts remain the same.

Many of these techniques and ideas are in books or are available on the internet. Use the reference section to connect you with the huge store of global knowledge. There are many good ideas and techniques being practised all over the world that you can adapt and use in your community — more are invented and used all the time.

Important ideas for implementing permaculture

DIVERSITY

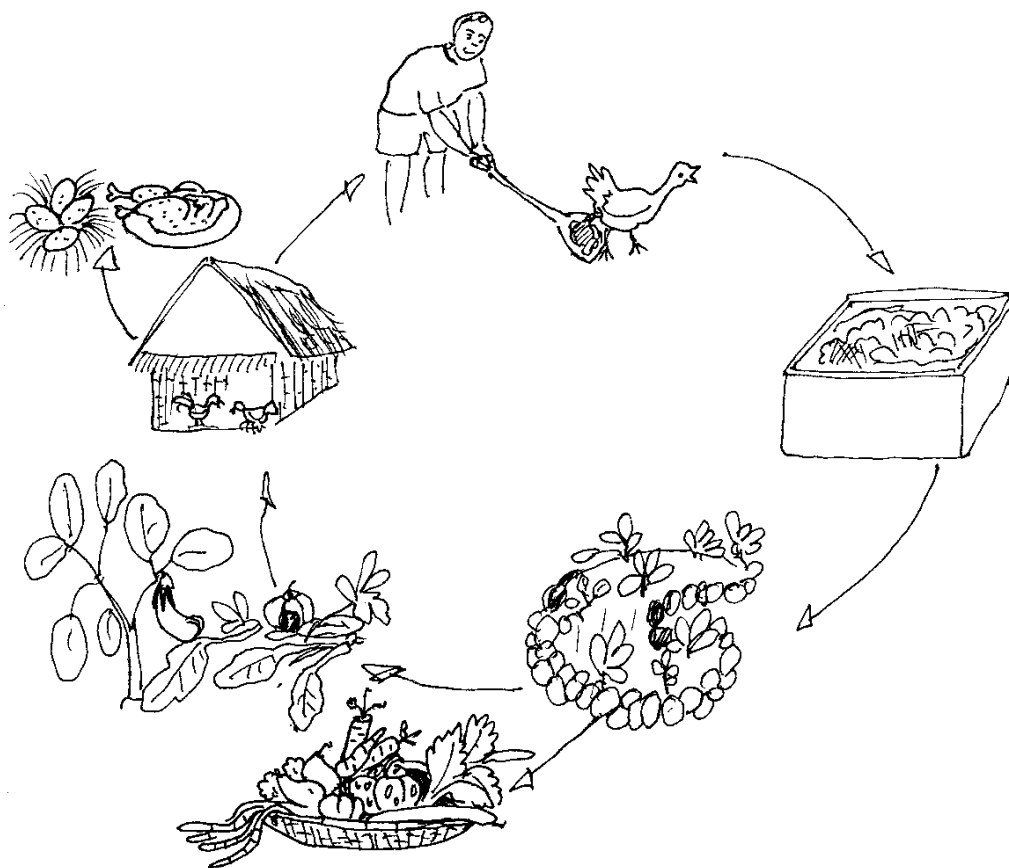
Each project, place, community or family that uses permaculture techniques is different. Each has a distinct plan using diverse techniques and various types of plants, animals and building materials. There is also diversity in climate, soil, trees and plants, water supply, knowledge and agricultural history, the shape of the land, etc., and these affect the techniques used. A technique, a plant or animal type that is appropriate in one place may not work well somewhere else, even if that place is nearby. Each situation is unique!



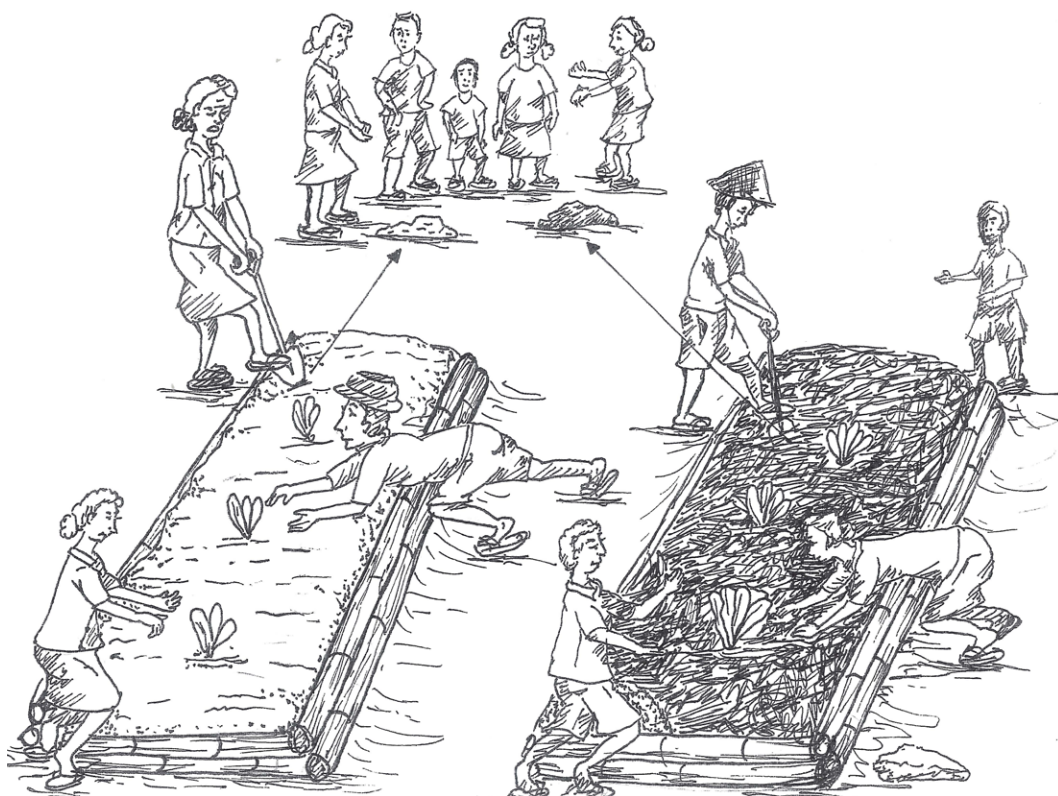
Swapping different bamboo species to increase diversity

When applying your permaculture learning remember:

- Aim to reduce inputs (outside resources needed) and continually increase outputs (production). Always look for new livelihood opportunities.



- Always use techniques that improve not degrade the land and communities every year.
- Apply the ethics, principles and design methods to guide how to choose and use the techniques. These guides remain the same but the techniques and strategies are different each time.
- Permaculture requires that you use your imagination and adapt to the situation. Remember, conditions always change. Continual observation and adjustment are essential for dealing with different situations and problems.
- Try new techniques and experiment, but research and learn first to make sure they work on a small scale before you try large-scale application. This way you can make mistakes, trying small experiments first to learn what works and what does not. Apply your learning to improve and try again. Community demonstration plots provide a good place for trying new strategies and techniques.



No mulch / Mulch experiments

- When you use strategies and techniques that improve, restore and replenish the land for agriculture and natural ecosystems, the environment works with you and the results can accelerate year-on-year. Good long-term results can occur faster and on a larger scale than you thought possible!
- Step-by-step:
 - Try one thing, e.g. mulching, then another, e.g. animal corrals, then another, e.g. making terraces for vegetable gardens to save water. Do this as your time, money and resources allow.
 - First focus on simple ideas that are the most important for improving basic production and health; these are the first step to applying many other ideas in the future. For example, consider water supply and storage, home gardens, animal housing, compost, compost toilets, small nurseries, and clay stoves.
 - Use the ideas in the Permaculture design strategies and techniques chapter (**Ch 3**) to choose the priorities which will make everything else work better.

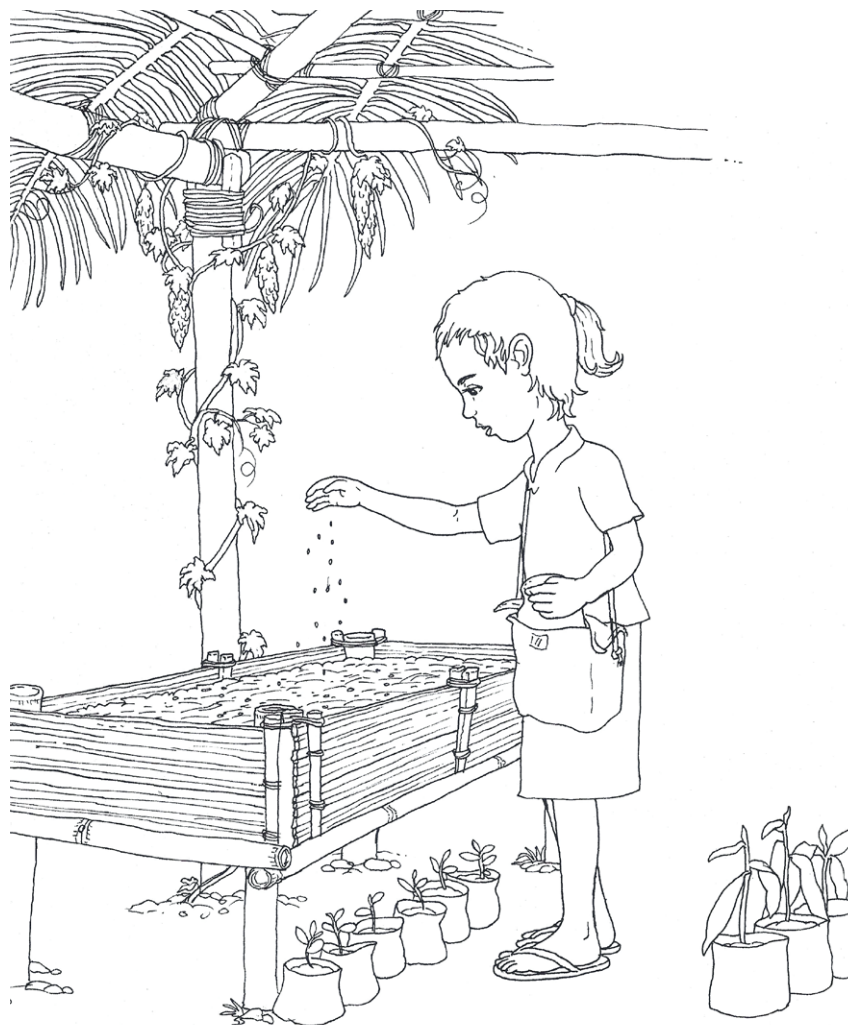
Permaculture techniques are important for reducing disaster risks, especially food shortages, erosion and landslides, flooding, drought, fires and even disease epidemics. Solutions start at the community level, while also requiring a coordinated national plan. Many techniques in this book can be used at both levels: They are easily duplicated in remote communities and integrated into short- and long-term disaster management plans.

Look towards the future. Many of the important community solutions will take time and effort to get good results: For example, improving soils, health and nutrition; building village economies and infrastructure; stopping erosion and; increasing production for fruit trees and in agro-forestry. These steps are the foundation for good health, good production and more secure incomes.

Many important environmental solutions, such as protecting forests, rivers and oceans; stopping erosion and; reducing burning, are not just about obtaining direct financial benefits. The future advantages, including gaining resilience and disaster reduction, are wide ranging and enormous. The work is necessary to protect and grow your community and your country for future generations.

The most important part of using this guidebook is to teach children and encourage their participation as they will carry the ideas into the future.

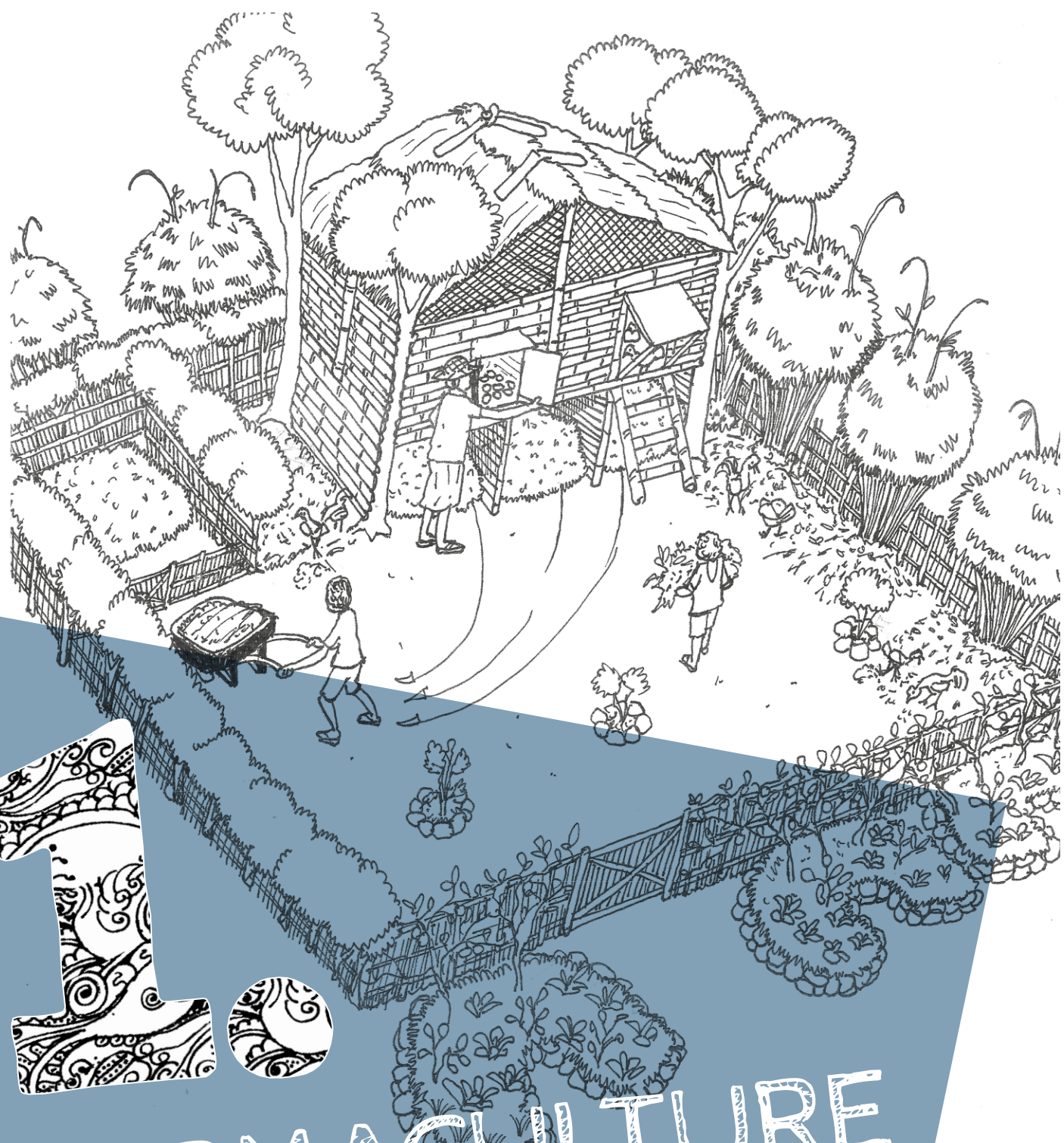
This book is dedicated to regenerating our earth and creating an abundant and sustainable future for all.





THE TROPICAL PERMACULTURE GUIDEBOOK — INTERNATIONAL EDITION. A GIFT FROM TIMOR-LESTE. INTRODUCTION Vol 1 | Pg 29

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1



PERMACULTURE ETHICS AND PRINCIPLES



PERMACULTURE ETHICS AND PRINCIPLES

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Through permaculture we see the world in a new way. Permaculture provides the framework to design, create and maintain communities where all parts of our lifestyle achieve sustainability and resilience.

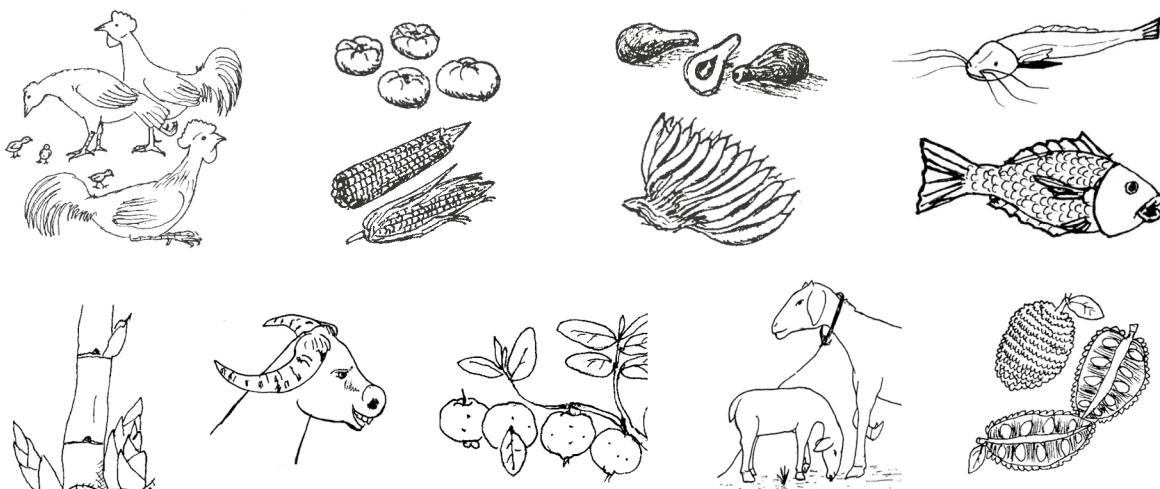
Techniques and strategies are based on natural science and patterns, using integration, innovation and regenerative practices to achieve our goals. The ethics ensure that we are considerate and thoughtful in working with the environment, respecting all people and acting to improve the future. Permaculture's principles encourage and challenge us to be creative, follow initiative and use our common sense.

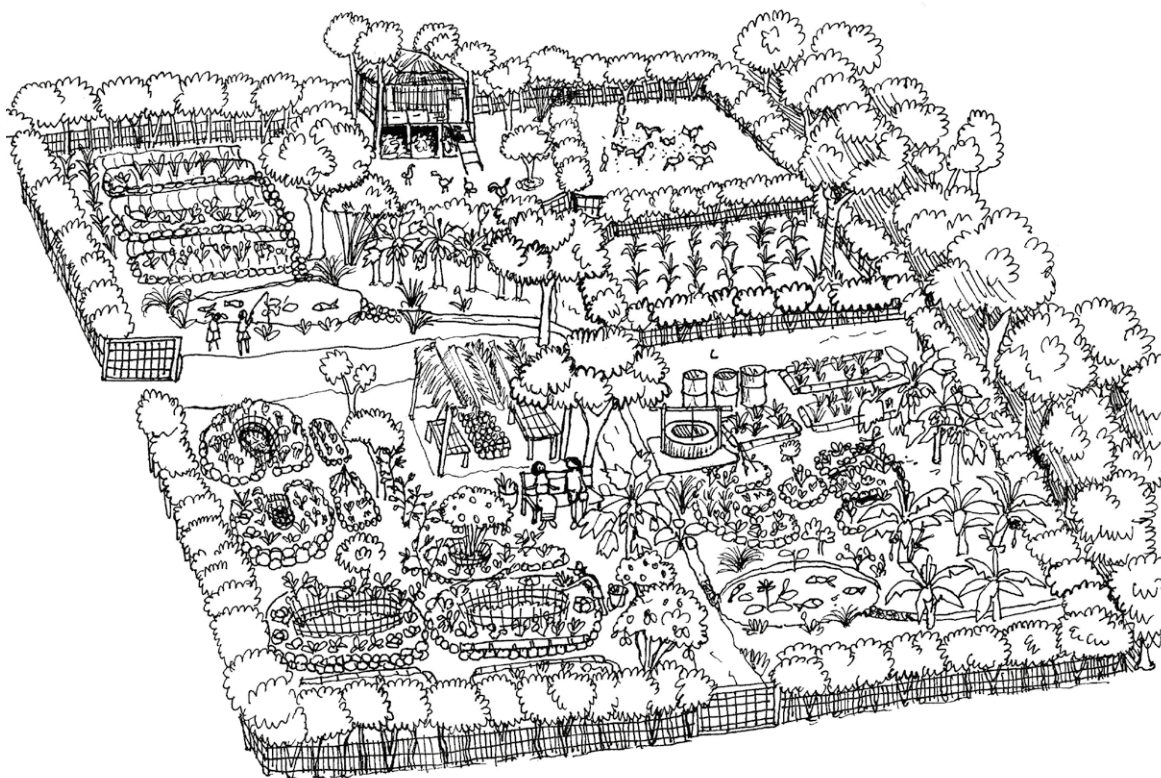
Permaculture

Permaculture can be described as Permanent agriculture and Permanent culture.

Permanent agriculture: involving family gardens, agriculture, agroforestry, animal management and aquaculture, improves the land, provides income and produce, and is sustainable now and in the future.

Permanent culture: means working with and protecting and encouraging a strong, resilient culture and environment. It means working with nature and people, not against or in competition with them, and learning from them. Progress is still important but strong and healthy culture and environment are also essential.





The permaculture concept was created by Bill Mollison and David Holmgren in Tasmania, Australia in the 1970s. It is a response to unsustainable methods of food production, especially industrialised agriculture, as well as unsustainable energy production, forestry, towns, cities, and 'modern' lifestyles. The design-based strategies come from traditional and sustainable agricultural knowledge, and techniques practiced in many—including tropical—countries, mixed with new sustainable strategies, technologies, and techniques.

Permaculture creates designs that copy and use patterns and relationships found in nature, while producing an abundance of food, fibre, and energy for local needs. People, their buildings, and their communities are central to permaculture.

Permaculture connects and integrates different strategies and techniques of living and agriculture, so that they support each other and become as self-maintaining as possible. These include aspects such as houses, water supply, health, waste management, agriculture, fruit trees and tree crops, aquaculture, rivers, forests, animals, etc.

Permaculture is about making the absolute most of what you have, reusing all natural waste as resources, and creating houses, farms, and communities that create most of the resources they need. This produces resilient and truly sustainable communities.

A key result of a successful permaculture project is that the land and people are better and healthier than when you started.

Permaculture achieves its 'permanence' by constantly changing, moving, and improving. Permanence is never achieved by staying the same, it involves continuous learning, using new techniques, and applying new experiences. This allows sustainable lifestyles, food sovereignty, and resilience to grow, leading to better and stronger families, communities and societies, and a healthy environment.

Permaculture is a framework for sustainable development that is now being taught and used in many different countries and cultures, and promotes practical and empowering solutions.



Permaculture's ethics and principles guide the designs people make and the strategies and techniques they use. They guide people to be more responsible for their own lives: with responsibility comes more control over their own destinies.

They guide people towards a secure future for themselves, their land, and their culture.

At present there are many problems in the world:

- Natural environments are being destroyed
- Farming land all over the world is being damaged and depleted
- Rivers, lakes, the land, the air, and the oceans are being polluted
- Climate change is occurring causing instability and rising ocean levels
- People, animals, birds, fish, and insects are being contaminated, and many species have become extinct
- Most of the world's population is very poor, while a small percentage of the population is very rich
- There is a loss of traditional culture, knowledge, celebrations, and languages

These problems are happening in every country, and people must take the steps towards building a sustainable future. Action and change must come from all levels of society—government, schools, businesses, community groups, workers, farmers, communities, families, men, women, and children. It involves considering every aspect of our lives followed by thoughtful change.

People have created these problems, and it is people who must change their ways for the earth to become healthy again. Future generations depend on it.

Permaculture is about techniques and ideas that move towards creating healthy environments, healthy cultures, and healthy people.

Permaculture strategies and techniques recognise and respect the value of every living being and that everything is connected, including humans. What we do to one being has impacts on many other beings including ourselves – every person, every animal, every insect, every tree, every plant, every fish, even the fungi and bacteria in the soil. Every living being has its role to play and its function. This must be considered and respected in creating a truly sustainable society, the benefits of which will flow into the future.



The ethics of permaculture

The ethics of permaculture are:

- Earth care – care for the earth and all that live on it
- People care – equality, respect, and opportunity
- Fair share – distribute surplus, limit consumption, care for the future

These ethics cover all countries and situations. As tropical communities grow and develop, population and consumption issues will need to be addressed, as part of caring for their future.



Earth care

Care for the earth and all that live on it.

Natural resources are the key to future prosperity. The natural environment must be protected and repaired.

This includes:

- The forests and the plants, animals, birds, and insects
- Lakes, rivers, river catchments, and estuaries
- The ocean, especially the coastline and the reefs
- The air

Any action that damages, pollutes, or destroys the natural environment has the same effect on people.

All farmland, including land for forestry and animals, must be thought of as the base of a country's wealth. If it is farmed responsibly and sustainably and the land is slowly improved, the country's wealth will grow.

The benefits are:

- Long-term productivity for farmers and their children
- Protection and health of the surrounding environment
- Protection and health of the people farming the land

Sustainable farming includes:

- Improving soil quality
- Taking all steps possible to stop erosion and mudslides
- Reducing and stopping burning
- Using natural materials, organic fertilisers, integrated organic pest and land management techniques
- Working with nature, the land, and its natural patterns
- Creating integrated and diverse systems
- Using cultural practice and traditional land laws to help protect and repair the land





People care

Equality, respect, and opportunity

People are also at the centre of permaculture strategies and techniques. Every person has the right to land, food, water, and a healthy future.

Permaculture improves basic food security and health for ALL people which include:

- Increasing production, diversity, and the quality of produce
- Food sovereignty from seed to market and plate
- Improving food storage and preservation
- Securing a clean water supply
- Improving nutrition
- Encouraging the use of and training on natural medicine, combined with modern medicine
- Improving house health and hygiene—especially for kitchens, water, toilets, and waste management

Permaculture promotes equality, security, and opportunities for all people through:

- Equal opportunities and rights for men, women, and children
- Improving basic wealth, not just in terms of money, but also in land and people
- Improving livelihoods and opportunities for people in rural and remote areas
- Taking action to reduce hard work, such as carrying water and firewood
- Sharing and trading knowledge and resources

Permaculture practice is working together with traditional cultures and strengthening them. Sometimes traditional practice is changed or improved but this is done through collaborating with people, not forcing new ideas onto people.

This is achieved through:

- Encouraging and using traditional ceremonies, beliefs, and knowledge
- New techniques and ideas recognising, respecting, and fitting together with traditional culture
- Educating children about traditional knowledge, language, and ceremonies and about how these can be part of a modern society
- Culturally appropriate permaculture training, books, posters, etc.





Fair share

Distribute surplus, limit consumption, and care about the future

To achieve a fair share we need to change our priorities. In the current world, economic systems and making money are the highest priorities. This leads to hoarding, excess consumption, and wasting precious resources.

We need to change this to 'quality of life' being the highest priority. Quality of life means having access to and sovereignty over food, water, housing, energy, transport, livelihoods, education, opportunities, and human rights. The foundation of the quality of life is equally supported by:

- A healthy economy
- A healthy environment
- A healthy society and culture



Then the fair share concept works.

At a family and community level, the more self-sufficient we are, the easier it is to achieve fair share. At a government level and nationally, some important functions in society need to be separated from profit making, such as health, water supply, education, and renewable electricity, and with technology developing quickly, this can happen.

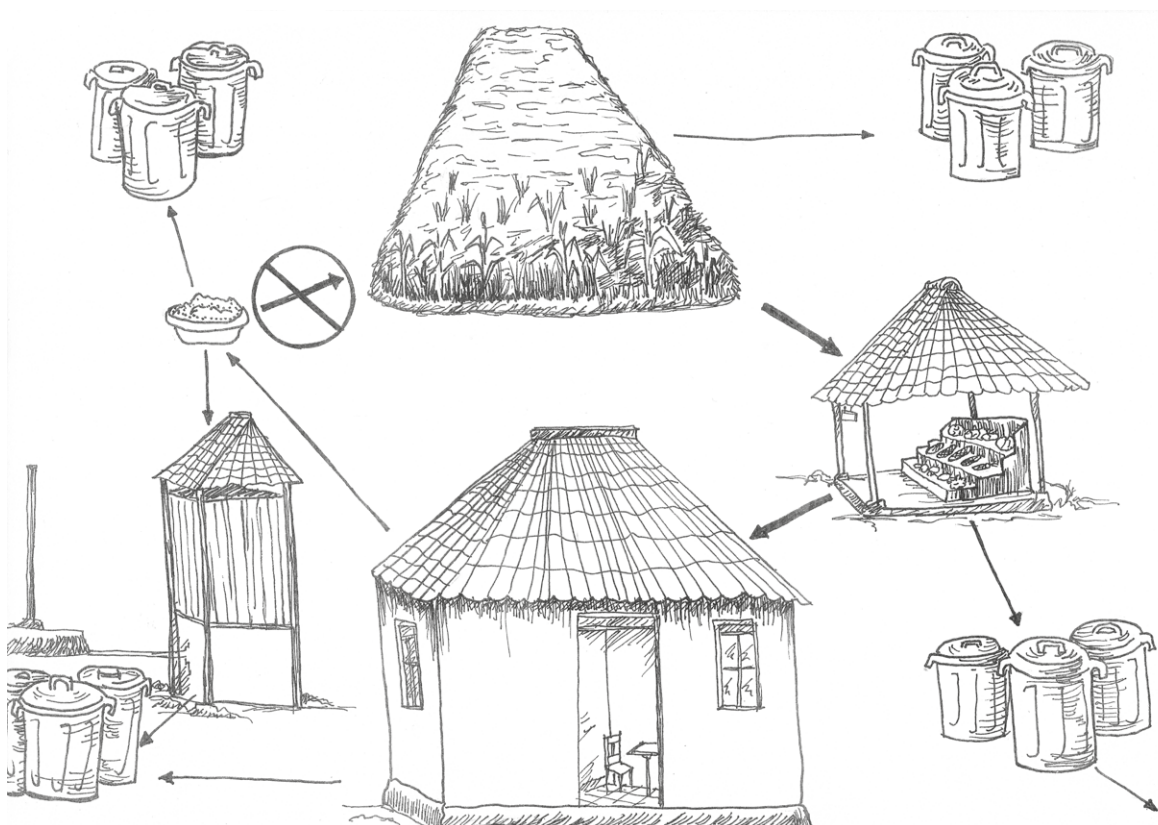
When there are surpluses of production, it is better to share them than hoard them.

Sharing the surpluses leads to:

- Equality
- Cooperation
- Feeling secure and content
- Community resilience
- Community strength
- More efficient use of resources

Hoarding surpluses leads to:

- Surplus waste—in some countries up to 50% of food is not eaten and thrown out!!
- Resource waste—water, soil, forests, etc.
- Inequality
- Division
- Envy



A system of waste where nothing is recycled and lots of new resources used

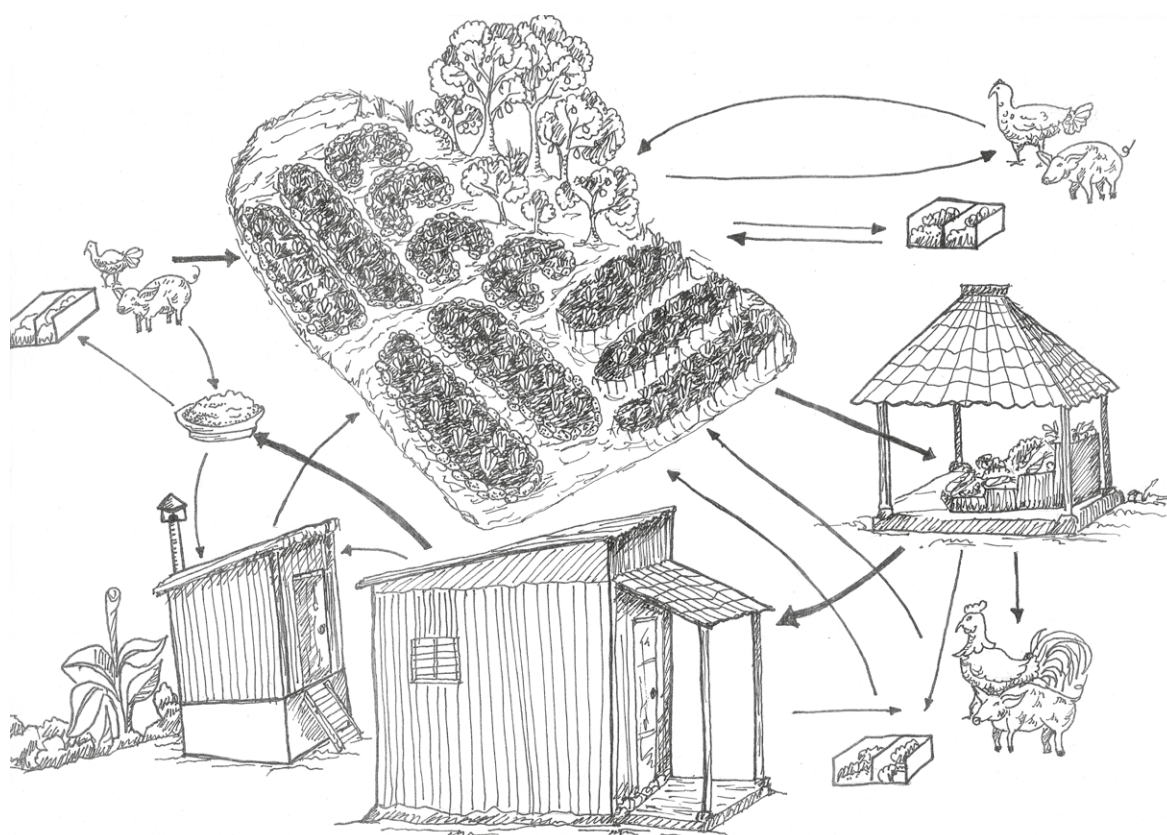
Excess produce can be shared and there are many groups and people who already do this.

Some methods are:

- Cooperatives and community groups
- Collecting and cooking food for the poor by religious organisations, charities, and non-government organisations (NGOs)
- Providing excess to children at schools and in orphanages
- Food swaps and direct bartering

Limit consumption and improve resource management:

- Continually look at ways of using less energy and changing to renewable energy.
- Localise!!! Transporting products that come from far away uses a lot of energy, and they often require more processing and packaging.
- Water is precious and we must do everything to store it, keep it clean, and not waste it.
- Organic food production uses local, sustainable, and low energy resources.
- Reduce, reuse, repair, and recycle!
- As food, water, and life security improve, population growth naturally decreases: this idea causes lots of debate and there are many factors around how many children people have. However, if the world's population keeps growing at the rate that it is, we will have resource depletion sooner than later, especially water and food. The best solution is to improve the quality of life, because when this improves, birth rates naturally decrease.
- Diet—balance sources of protein: high meat consumption creates huge environmental and health problems.
- Transport: use cars and other vehicles wisely not wastefully; use the most energy-efficient method possible, e.g. bicycles.



A permaculture system where everything has value and all waste is turned into resources

What we do now affects the future:

- All practices **MUST** consider the future.
- All current plans **MUST** also include plans for the future on all levels—government, district, communities, families, and individuals.
- Consider and plan not just for 10 years, but 20 years, 50 years, and 100 years in the future.
- Our children, our children's children, and their children will inherit this land. It is up to us to make it a good place for them to live.

The most important part of planning for the future is **EDUCATION**. Knowledge and information have to be taught and shared if your country's future is to be strong and healthy, and everybody benefits. This includes sharing and trading our extra resources and skills.

Cooperation not competition is the key:

- Use local and natural resources whenever possible
- Protect the natural environment
- Reduce the amount of packaging that is bought and waste that is produced
- Recycle and reuse waste whenever possible
- Move towards using renewable energy sources, such as biogas, solar, hydroelectric, and wind power

The future is ours to decide and it begins today!

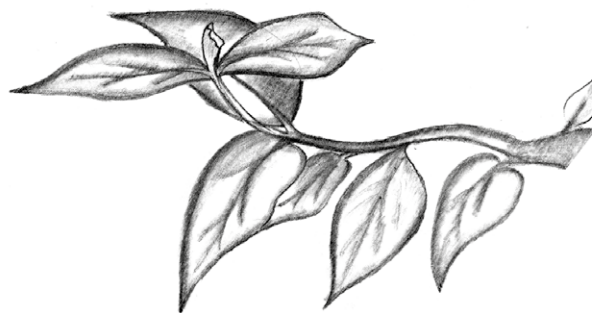


The design principles of permaculture

Permaculture principles are a guide for creating permaculture designs and implementing permaculture strategies and techniques.

Principles for permaculture design give a structure to maximise efficiency and production that:

1. Is sustainable for the future
2. Improves food security and income
3. Is affordable
4. Uses and manages LOCAL resources as much as possible
5. Improves and protects the soil, the land, the environment, and the people involved



The principles help you think more creatively and apply ideas that are different each time. Each place, situation, and family is different, and therefore plans, techniques, plants, animals, and building materials are different. However, for every place and every project, big or small, the same principles apply.

A lot of the principles are simply common sense ideas: do not just use them for permaculture!

Permaculture principles apply to new designs and for improving existing gardens, farms, agro-forestry, animal systems, houses, and communities.

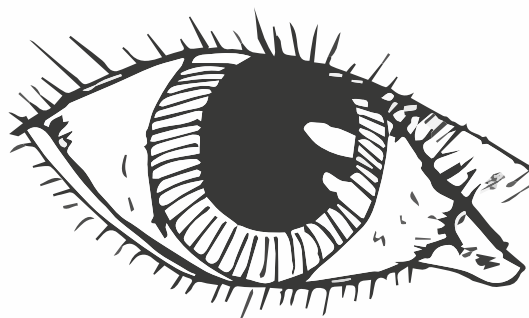


1. Observe and interact

Observation of the natural patterns and cycles of nature helps us to make better plans for our farms, houses, and gardens.

A natural forest or ecosystem has its own patterns, diversity, and relationships between the land, water, plants, birds, and animals to achieve its balance and productivity. Each part of the system is connected and has its own functions as part of the whole system: a holistic design. We can imitate this approach on a house, farm, village, region, and even at national level!

To interact in a sustainable, permaculture way is to work with the land's natural patterns. It is also to work on a small scale and make sure it is successful and sustainable before working on a large scale.



UNDERSTANDING THE LAND

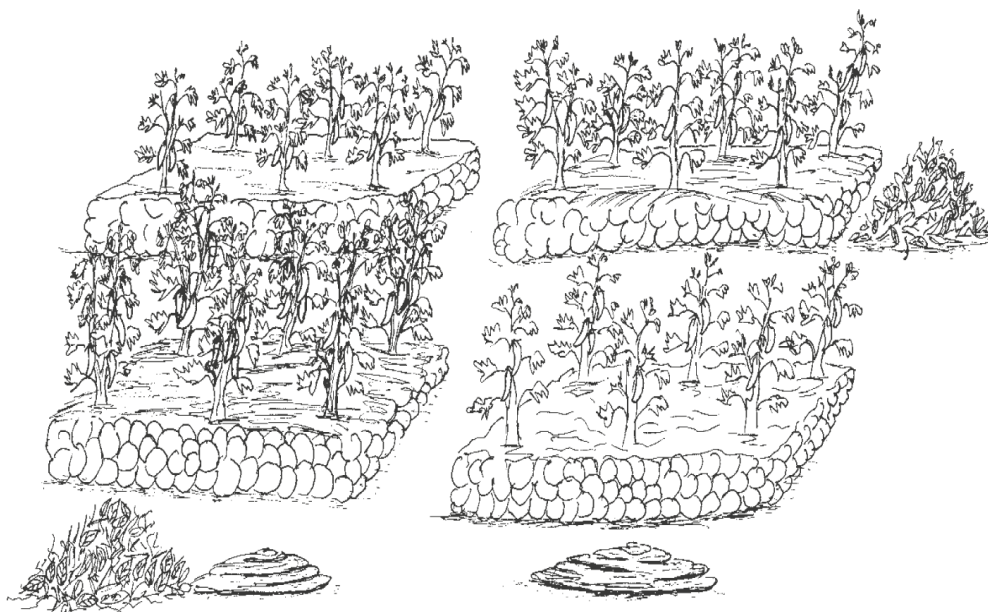
Observation of the land and its patterns provides you with a lot of information that is very important for achieving the most efficient and lowest waste-producing systems. Use it for continual improvement of land design and farming, agroforestry, family garden, and animal management.

It helps us learn by understanding things, such as:

- What works and what does not work and needs changing?
- Why does the same plant grow better in one place rather than another?
- What are the natural patterns of the land, including soil and rock types, and water movement?
- What are the natural cycles of the environment and climate, and how do we work with not against them?
- Do patterns occur when pests attack plants: e.g. are some plants or groups of plants affected while others in different areas are not?
- Which plants and animals produce the best for the least effort?
- Where does the water run through the land, where does it naturally collect, and which areas stay wetter in the dry season?
- Where does the sun shine all day or part of the day, and where is it shady?

A lot of these observations show you existing microclimates and where to create microclimates.
(Read **Ch 3** for more).

You can conduct simple experiments which show the best plants to grow and the best techniques for growing them. The results will be different for each area, so each community should conduct its own experiments.

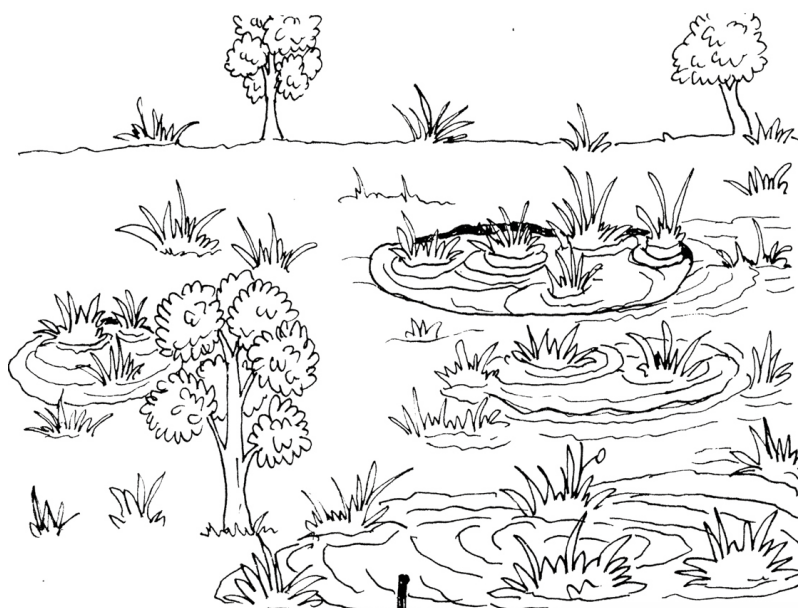


Vegetable production experiments

Observation, including gathering local knowledge, is also important for houses, waste management, and creating renewable energy supplies.



Farmer looking for pests



Using flat swamp lands to create productive aquaculture systems



SEE SOLUTIONS NOT PROBLEMS

Every problem we are faced with has a solution. Careful observation and fixing the **cause** not the **effect** of the problem is the key. This is combining observation and creativity to work with the land using sustainable strategies and techniques.

Often, the problem **becomes** the solution: we just need to look at it in the right way! Problem areas of land all have natural solutions, but we have to work with not against the land and the climate.

Good solutions make use of the problem, such as turning weeds into compost and mulch.

You can also create production and benefits from the solution:

- Windbreaks to reduce strong wind problems provide shelter and increase production in the sheltered areas, but they can **also** provide nuts, oils, fruit, bamboo poles, medicines, mulch, and habitats for birds that reduce pest problems.
- Instead of burning all the tree and plant waste which creates pollution, the waste can provide valuable organic matter and compost for future crops. All manures are a valuable resource too.
- Rocks can be used in dry areas to make simple terraces, and catch soil and water.
- Fruit trees can then be planted and will grow well because of the rock terraces.



"Look at my rocks!!"

"The rocks can be a solution"



Rocks become water and soil catchments to create productive land

Think creatively and find solutions for the long term.

An example is when drought-affected areas receive necessary food aid: it is a short-term solution and does not solve the problem. Only when people observe the whole system and look for the reasons why the crops have failed and why there is less rain will they find sustainable answers. People need to look at the water systems, the surrounding vegetation, the farming systems, and what they are growing. Then the basic, priority problems can be solved, and real solutions can be achieved.



2. Catch and store energy

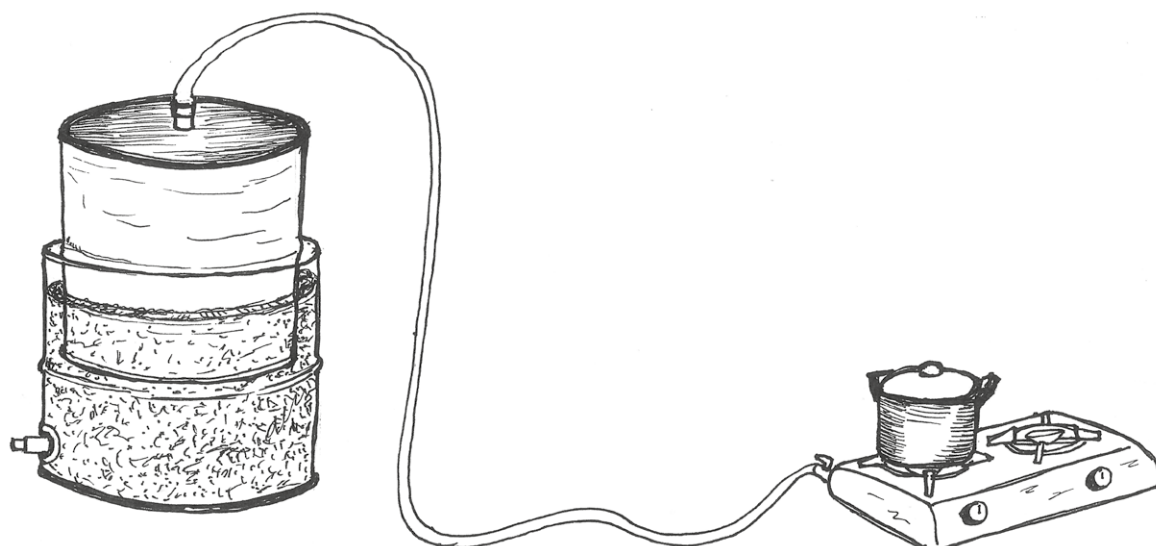
Good design reduces or eliminates the need for buying non-renewable and non-sustainable energy because natural energy is caught and stored.

- Compost collects and changes resources, reusing and storing the energy in the ground.
- Food is energy. In the tropics a lot of energy is stored in root vegetables, small animals, and fish. Wasted food is wasted energy. Some practices also waste a lot of stored energy too, such as poisoning whole ponds or sections of rivers for a few fish, burning large amounts of land for a few animals or using dynamite on coral reefs for a fish harvest.
- In colder regions rock walls collect heat energy from the sun during the day and release that energy at night to keep houses warm.
- All trees, grasses, and other plants use the sun's energy to grow. When they are burnt that energy is wasted and becomes pollution. When they are protected and used, that energy is stored and recycled.
- Natural food storage systems, such as coolgardie safes, use wind and water to cool food effectively and keep it fresh. Solar dryers use the sun and air to dry food quickly. (Read **Ch 8**)
- Solar, wind, microhydro, and other renewable energy systems provide electricity from natural energy.



Using render to improve house insulation

A great example is biogas. (Read Houses, water, and energy **Ch 7**) Manures, fresh plant material, and water are put into a sealed chamber. As the materials decompose they release methane gas, which is caught in the container and used for cooking or turned into electricity. The materials and water become excellent liquid compost for growing fruit and vegetables.



A simple biogas system

QUALITY IS THE BEST USE OF ENERGY

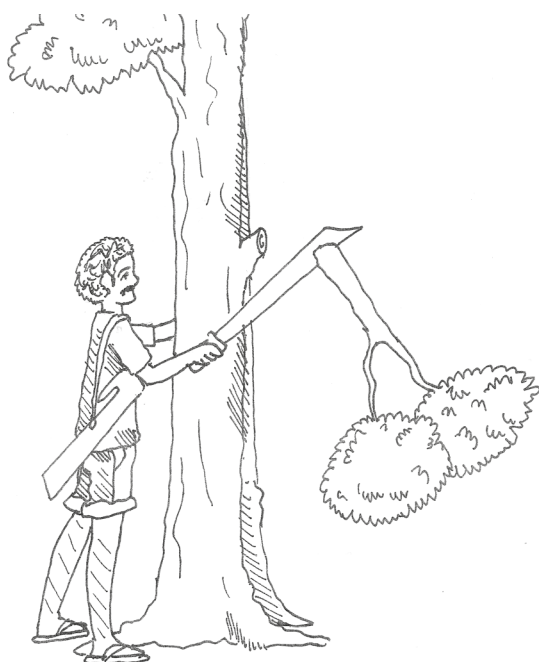
Good planning saves a lot of time and maintenance in the future.

Good implementation of the plan—taking time to do the job properly, using good materials—will save having to do the same job again the following year, and the year after, and the year after...

Something that is well made saves money, time, and energy. Everything that is made requires energy and resources. Much less energy and fewer resources are used when a product is made to last a long time. It also costs less money in the long run.

An example from Timor-Leste:

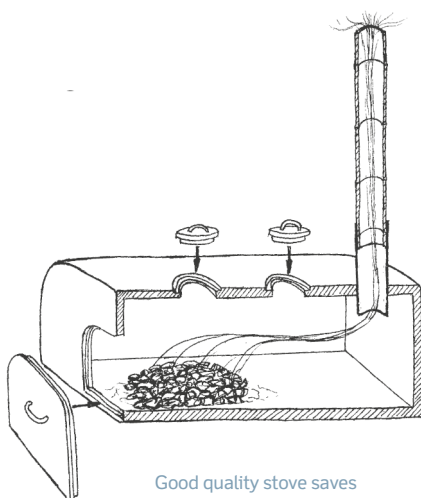
A good quality Timorese-made machete lasts longer than MANY cheap imported machetes. They are also easier to use. Quality shovels, hoes, axes, and other tools all last many times longer and are easier to use than cheap varieties. You do not have to replace them again and again and again...



Good quality machete



Poor quality machete



Good quality stove saves time and resources



3. Obtain a yield

Make sure that produce comes from hard work. This is very important for having a continuous supply of food to eat in the short term, and an increasing supply of food to eat and sell in the long term. It makes you feel good too.

- Put long-term plans in place, such as planting fruit and other productive trees, but still plant fast-yielding crops.
- Yields provide more than food or money: they provide satisfaction, encouragement, and optimism.
- Make sure that basic needs are met: DO NOT sell all of your crop at the market—keep some for family food.
- We must obtain a yield for the energy that we put in. Growing a crop or planting trees only to see goats and pigs destroy them because they were not protected is frustrating and costly.
- Growing a successful crop but then not saving good seeds for the next year costs money and loses the benefit of seed improvement from crop to crop.

As resources are scarce and valuable, you must make the most of what you have.



A garden that provides many different and continuous yields



Many yields from one multi-functional plant

MAKE THE SYSTEM WORK FOR YOU

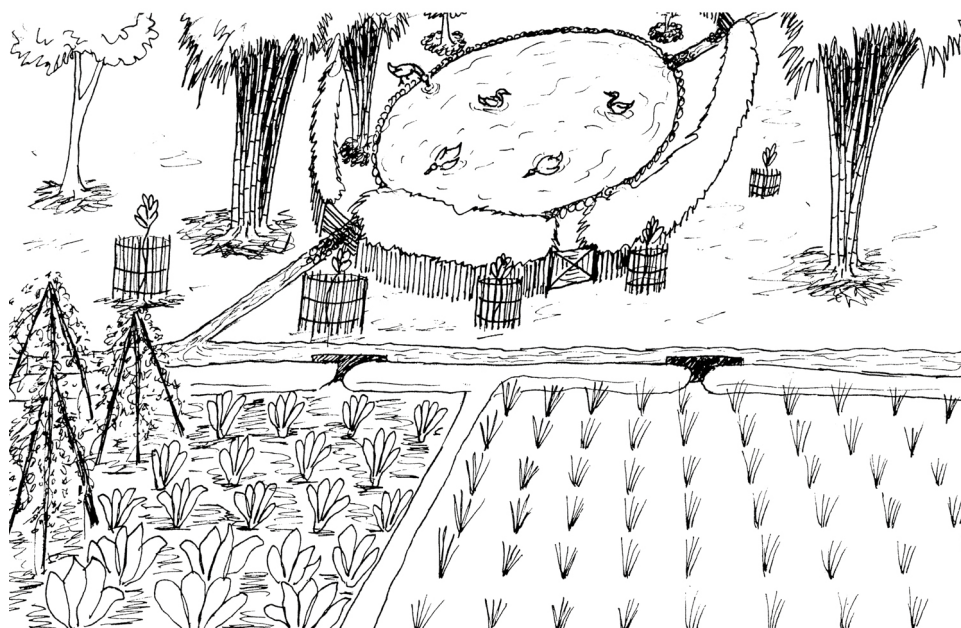
When a system starts to look after itself, you know you are on the right road. This is a yield that comes from good design. It is achieved by turning all wastes into resources and integrating different systems into a single larger system that works together. Therefore, your resources work for you, as well as providing products, and you receive many yields.



Every part of the system should be producing resources. Some examples of resources produced by plants are food, timber, fertiliser, mulch, firewood, shade, fencing, animal habitat, and windbreaks. The most important resource is clean air!

Examples of resources animals produce are food, labour, saleable items, and fertiliser.

The more resources each element produces, the fewer inputs are needed.



Irrigation water for rice paddies and vegetables is first run through a duck pond to collect natural fertilizer for the plants.



4. Apply self-regulation and accept feedback

This is the way to learn and improve yourself, your house, land, environment, and community.

It makes you stronger, and with more experience you make fewer mistakes and create more productive systems. Then you can keep building on what you have instead of having to start again.

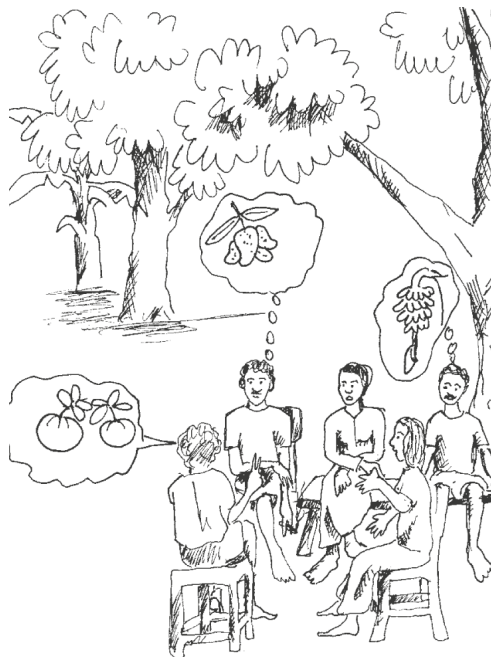
On a global level we **must** accept feedback from the environment. Pollution, animal extinction, water shortages, and climate change are showing us that the way we are living **MUST** change quickly to become sustainable and responsible, or these problems will only get worse.

PERSONAL RESPONSIBILITY

We are all responsible for our own actions! Our actions affect our own lives, our families' lives, our friends' lives, and anyone else who has direct or indirect contact with us. Individually and/or collectively we are responsible for the problems we face and the culture we create. This is true for men and women, and it is part of being a member of a community and citizen of a country.

If you and your community are to prosper, you must take responsibility for now and for the future. Educating children to be responsible for the land and its people is fundamental for the future of every country. This is an important role for adults and the elders.

Use the resources available now to repair the fragile environment, and plan, grow, and create resources for the future to the best of your abilities. This is how to develop a strong and resilient country.



Thinking to the future



Results in the future

WORK SMART NOT HARD



Poor compacted soil

Good quality non-compacted soil

Many people forget to use the most important part of their body before they begin work ... **their brain!!!**
If you use your brain first you can make a project much easier and plan for the long term.

And as you progress, learn from your experiences, successes, and mistakes to continually improve.

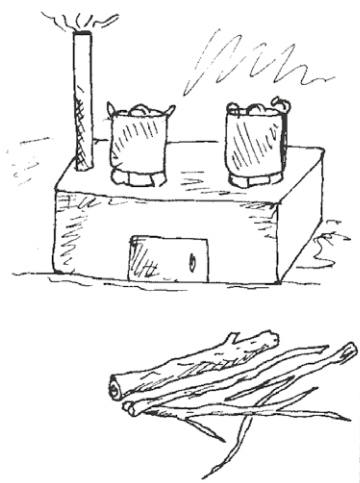
The benefits of engaging your brain first:

- Reduce your labour time, energy used, outside resources needed, and costs.
- Save work time in the future by doing a good job now.
- Make the system do the work for you.

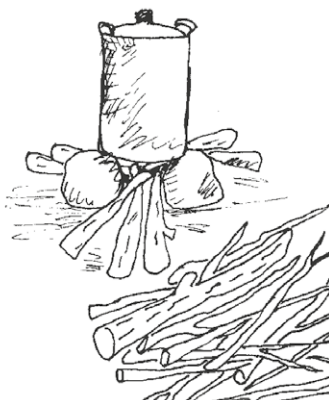
Asking an expert about your project provides you with a lot of great information to make it easier and better.
Do not forget that smart ideas can come from anyone, men and women, young and old. Working smart is important in the home, raising animals, growing crops, planting trees, selling produce, etc.

Some examples:

- Use stoves to reduce firewood use. This saves a lot of heavy work collecting wood, and saves money too.
- Use bamboo pipes to bring water to the house if the water source is close by instead of collecting it each day.
- Do not just make a normal fence, make a living fence. It protects the crops or houses the animals, as well as providing animal food, mulch, compost material, shade, firewood, and even nitrogen for the soil!



Save wood and time with a clay oven



Waste wood and time without an oven



5. Use and value renewable energy and resources

Renewable energy and resources are available now and are our future. The technology to use them is becoming better and cheaper all the time. They allow communities to look after their own energy needs and be more resilient and independent. Sometimes simple low technology solutions are still the best.

People, structures, water, plants, animals, fire, fuels (such as diesel, kerosene, petrol), machinery, and fertilisers all need energy to be produced and can be used to create more energy.

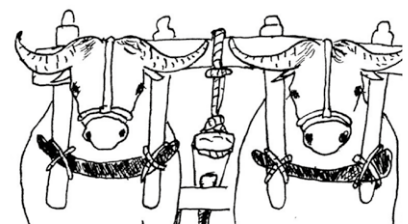
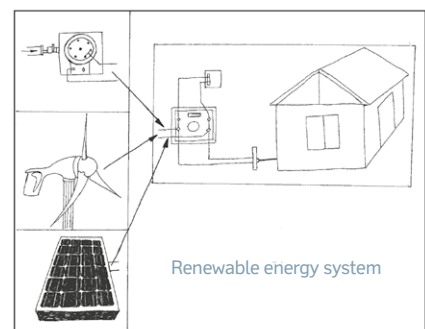
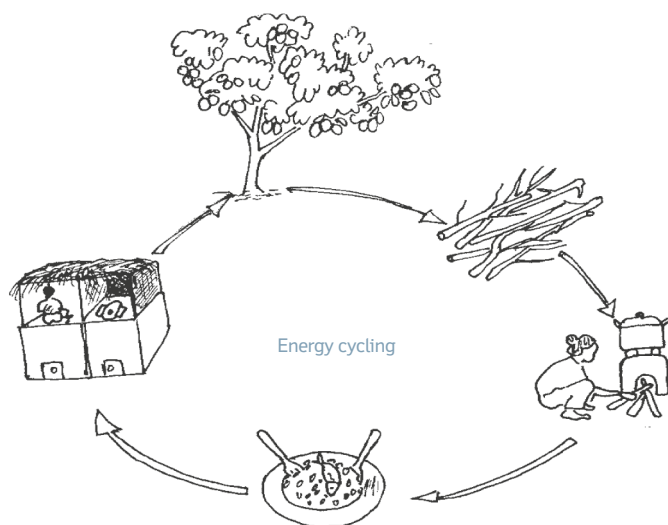
A basic energy-conserving rule in permaculture is that every element (plant, animal, or structure) must be placed so that it provides three or more functions (it is multifunctional).

Every function (e.g. water collection, vegetable production) is provided for in two or more ways. All the energy used costs time and money.

Therefore, it is good to use less energy, and this can be achieved by:

- Reusing waste and manure from animals, plants, people, houses, etc.
- Reducing energy needs through good design and practice: e.g. cows grow bigger and faster if they have shade and wind protection. The trees that give shade and wind protection also provide cow food!
- Using renewable energy sources: e.g. Hydroelectric, biogas, solar, wind
- Using technology to reduce energy needs: e.g. you need a lot less firewood if you use a clay oven.
- Using good design to reduce energy needs: e.g. a well-designed and built house stays much cooler and requires a lot less energy to make it cool.

Less time and money are used and the system supports itself.



Animal ploughs are renewable energy!

Renewable energy sources are the future, but energy still needs to be used wisely. There are higher costs setting up renewable systems, but the maintenance costs are small compared to buying diesel, oil, and spare parts for generators. Pollution and noise are greatly reduced as well.

If trees are used for firewood, plant more trees to replace them. Another example is to use buffalo ploughs instead of tractors. Buffalos need energy that is cheap and local; tractors need energy that is expensive and imported from overseas.

6. Produce no waste

Rubbish is only what you cannot reuse or recycle,
and if you are smart this is not much at all!
Waste that we do not reuse is pollution.

The pollution is in the ground (e.g. broken glass, cans, car oil, battery acid), in the water (e.g. excess chemicals and washing powder, plastic and other rubbish), and in the air (e.g. smoke from burning, fumes from engines). All these forms of pollution are already creating big problems and will cause even bigger problems in the future if they are not corrected now.

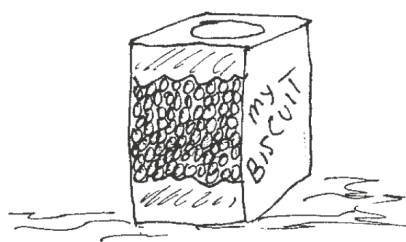


Round structure made
from old bicycle wheels!

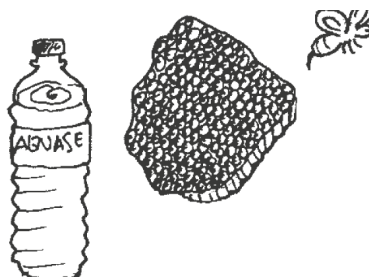
The best way to solve the problem is NOT to create the waste in the first place.

- Use as many local products made from local materials as possible to reduce waste created. It also supports local business and local economies.
- Make use of all available resources, especially natural resources.
- Reuse your household waste. This reduces pollution and saves on buying new products. Water, kitchen waste, and a lot of household rubbish can all be reused. Throughout the guidebook there are great ideas for reusing waste and reducing pollution.
- Create integrated farm systems that reuse waste as resources within the system.
- Avoid products with lots of packaging and plastic.
- Avoid processed foods as much as possible. They always come in packaging, and take a lot of energy and resources to make. Remember that waste does not only occur after you buy a processed product: much more waste occurs before you buy it.
- Recycle as much and as often as you can in as many creative ways as possible!

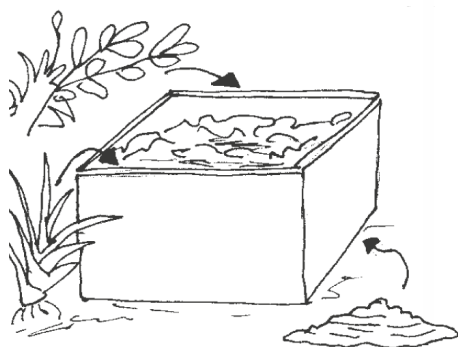
Remember that all rubbish can create problems and does not just disappear if it is burnt or dumped in the river. It just changes to air or water pollution. Ocean environments, animals, and beaches all suffer because of rubbish, and then we do too.



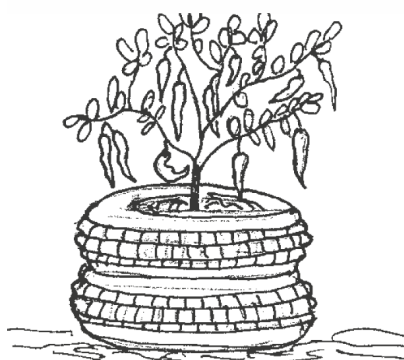
Seed storage tin



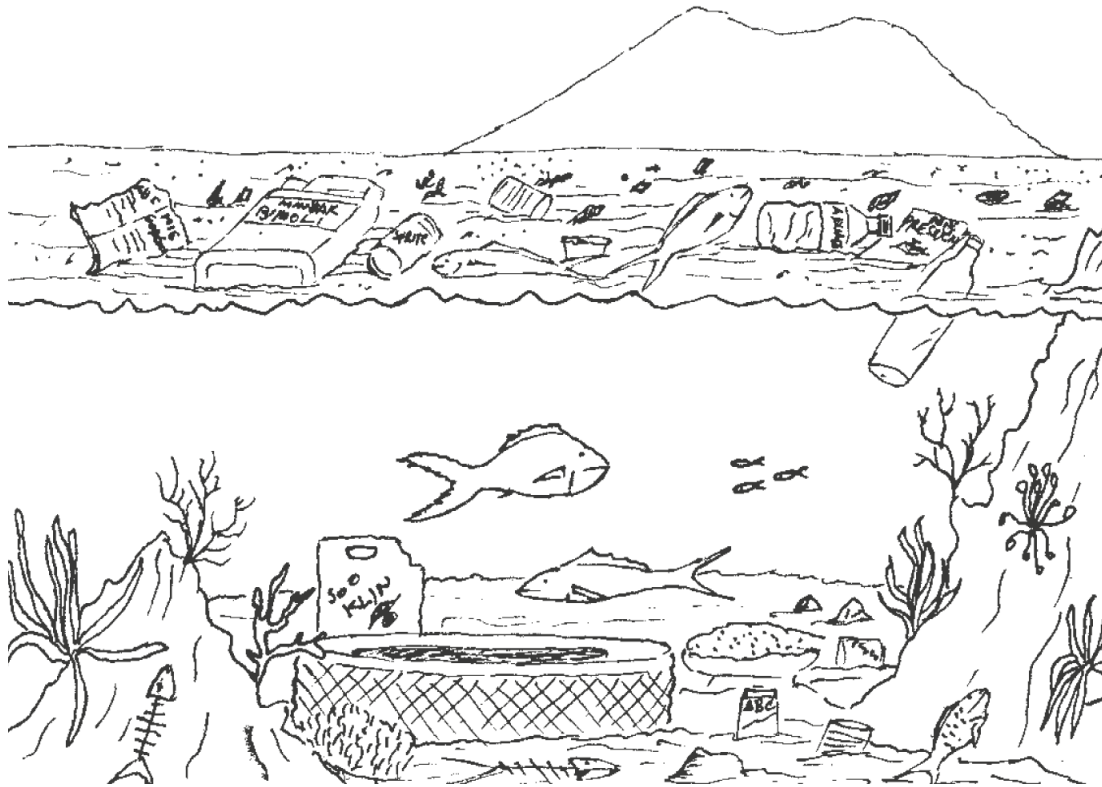
Plastic water bottles have many uses
including storing honey



Turning plant and animal waste into compost



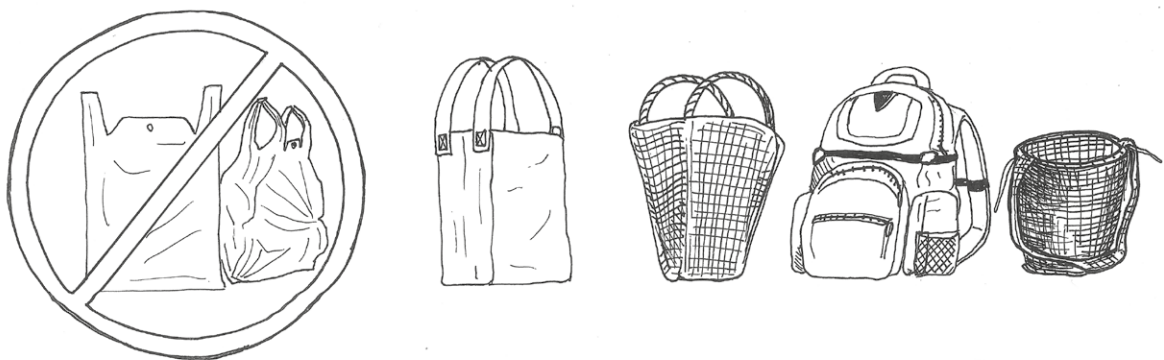
Old tires make good plant pots



Our rubbish pollutes the oceans

The best example of this is plastic bags: in the world 160,000 plastic bags are handed out every second! That is almost 10 million per minute!!! These bags take a lot of energy to make and are quickly thrown away after use, creating long lasting and damaging pollution to the land, rivers and oceans.

What is the solution? Plastic can be made from vegetable waste, such as sorghum stalks, corn stalks and cobs, rice stalks, and much more. Small factories can produce them as a local business idea. More importantly, STOP USING PLASTIC BAGS! Use bags made from palm leaves, grasses, and other natural materials, and reuse the plastic bags that you have, do not just throw them away.



The natural environment must be protected and well maintained to have a prosperous future.



7. Design from pattern to detail



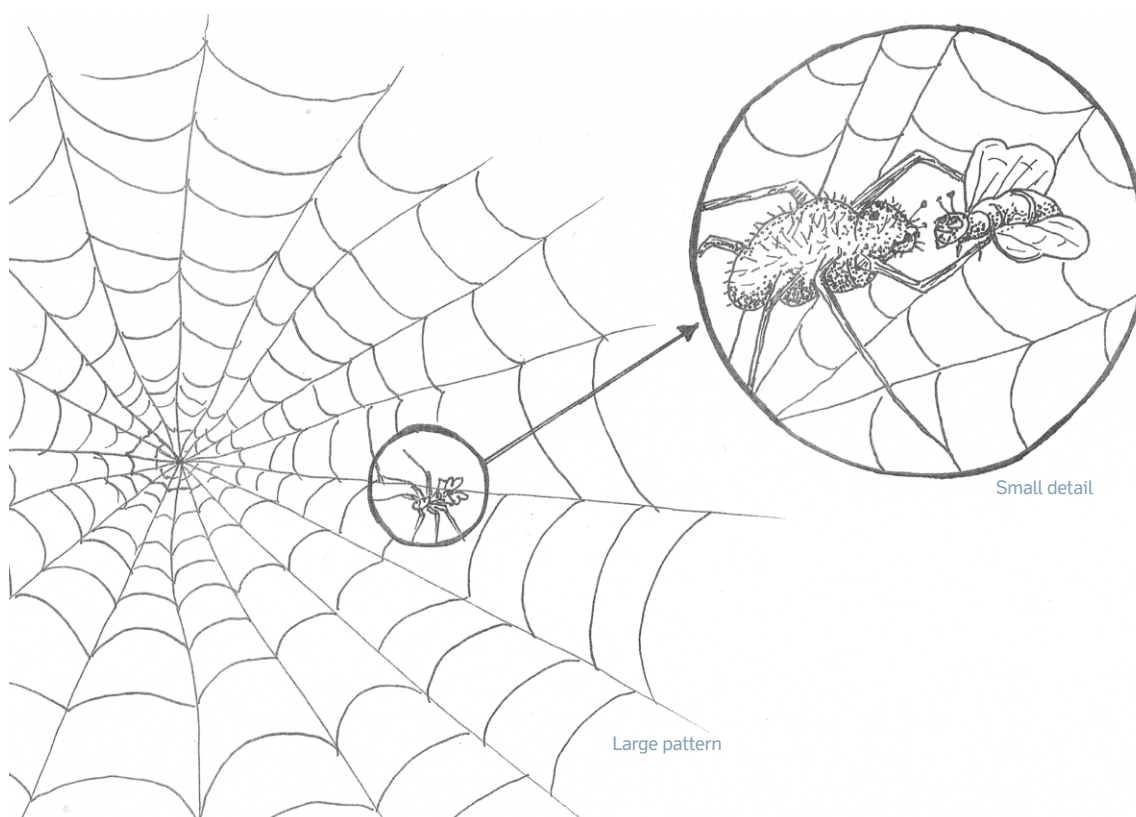
Everything in this world is a pattern or part of a pattern.

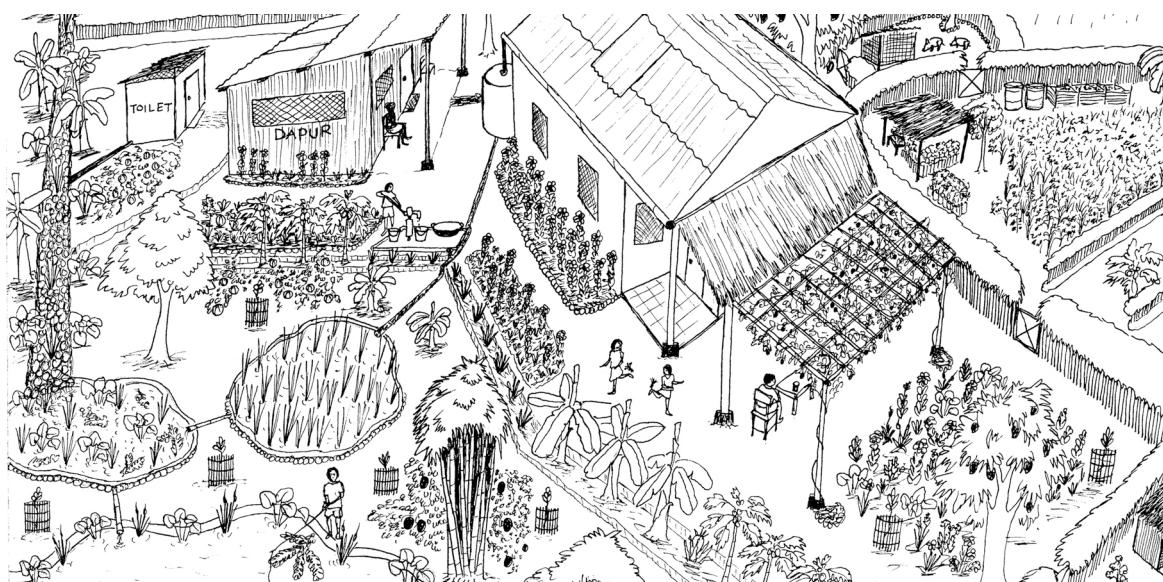
Work with not against nature's patterns to create sustainable farms, houses, and communities: e.g. land shapes, water movement, ecosystems, and weather patterns. Read more about patterns in Natural patterns (**Ch 2**)

When you do a permaculture design for a piece of land, create a large pattern showing everything you want to include, and use the site analysis from Permaculture design strategies and techniques (**Ch 3**) to account for and use natural patterns.

This is the same for a new design or improving an existing garden, farm, or house.

Plan what you want to achieve and produce, and create a design with all the elements included. This may only have basic detail, but it will show the best use of the land and integrated systems: how everything fits together and the connections between different areas. It can be a house, farm, or community design. This is the pattern, like a spider web.





A complete integrated house design pattern that includes many small details

Then add the detail. Each part/section of the overall design can then be looked at in detail, down to which flowers to plant, what building materials to use, what fish go in the fishponds, and what food to grow for the chickens, etc. When designing the details, keep referring back to the pattern to see if that needs to be changed and improved, and keep looking for integration opportunities too.

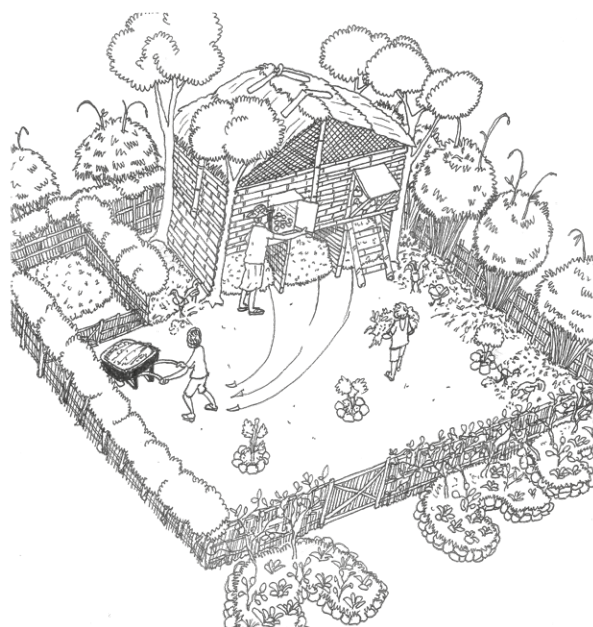
This guidebook is an example: **Chapters 1, 2, 3 and 17** give you the tools and techniques to design the pattern. **Chapters 4 to 16** give you the information to design and implement the details.

Here is an example for raising chickens:

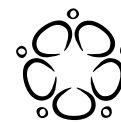
- Patterns are—the best location, chicken food production, resources in and out, integration opportunities, production goals, etc.
- Details are—what fruit trees, bamboo, other trees to plant, what materials to build the chicken house with, etc.

Without the pattern, the details could be in the wrong place so that:

- They do not fit together.
- They are not efficient.
- Maintenance and costs are much higher.
- Work has to be repeated.
- Resources and time are wasted.



8. Integrate rather than segregate



An integrated system combines different elements to work together in a single system.

If you create a system that has many different elements, such as fish, water crops, and fruit trees, production increases and the elements can help feed each other. Waste from one part of the system becomes a resource for another part.

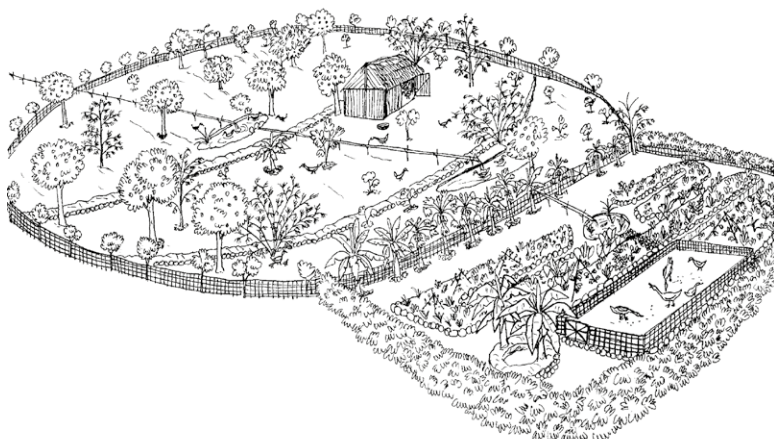
A well-designed integrated system will start looking after itself once it is established. The needs of a system are self-managing or require minimal input: e.g. chickens and ducks eat weeds and pests, eat rotten fruit and fertilise a fruit tree orchard.

Well-designed integrated systems rely on everything being multifunctional. (Read Permaculture design strategies and techniques **Ch 3**).

Integrated systems:

- Help maintain the diversity of plants, animals, and fish in one system
- Increase the diversity of production from one system
- Use fewer resources for greater production
- Help save energy and reduce waste of precious resources
- Make it easier to reuse energy that is produced and stored in a system
- Are more resilient and able to cope with extreme weather and climate change
- Suffer less from pest and disease problems

The whole farm, including house and living areas, should be thought of as one large integrated system. If we plan in this way, we can make use of all potential resources and maximise productivity. Separate systems use more resources, more time, and are more fragile.



COOPERATION NOT COMPETITION

Human integration in cooperative ways is essential for strong, healthy cultures and society.

Cooperation between people promotes:

- Community involvement
- Trading between members of the community
- Shared and improved skills
- Many benefactors rather than a few
- Less or no waste
- A strong and integrated knowledge base rather than fractured, incomplete information

Cooperation is important on all levels—in the family, the village, the regions, and as a whole nation.

Competition, on the other hand, creates conflict, jealousy, and anger within communities, especially if a resource is scarce. A good example is water use: usually the end result is that a few people have a lot, while the rest receive little.

Competition also leads to waste.

Those few with a lot would rather see their resource wasted than share it. This helps no one. Mistrust is bred in communities because, rather than sharing, everyone competes for the same resource. A cooperative solution would benefit all, and even increase the resource base.

Timor-Leste became an independent nation because its people worked together united in struggle. If each person tries to struggle on their own, they have no power, no strength. It also makes their spirit weaker. If people operate through competition, nothing is solved. Cooperation leads to strong connections together and problems can be solved.



One stick is easy to break

Many sticks together are strong

For example: if you have one stick in a woodpile, that stick can easily be broken, even by a child. However, if you bundle many sticks together, the sticks cannot be broken! Together they are strong and support each other.

Cooperation also extends between humans and nature, if not, the whole system goes out of balance and disasters occur. We cannot compete with nature because we are a part of it! Nature has its own methods of cooperation that support incredible diversity, and turn all waste into resources. We need to copy that and be a part of it.

9. Use small and slow solutions



Small systems are easier to maintain. This means that it is easier to achieve maximum yields and make the most of your work.

Often on large farms the yield is only moderate because there is not enough time, labour or resources to manage the farm properly. This is wasted energy.

Small-scale systems are much easier to manage, and pest and disease problems are less likely to occur.



Intensive terraced vegetable garden



SMART IDEA:

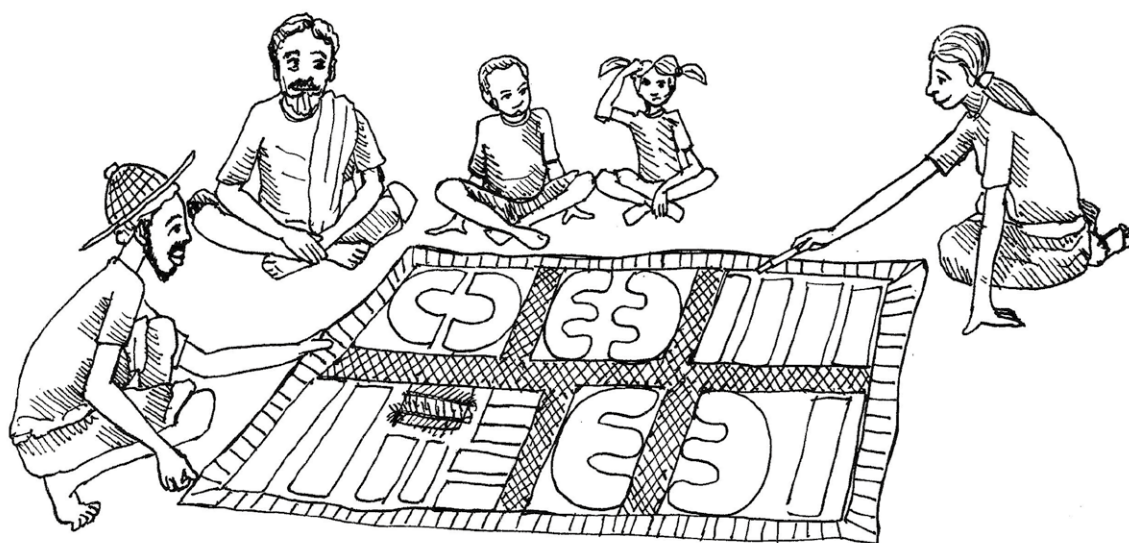
Only build what you can maintain,
and always maintain what you build.

DESIGN THE BIG PATTERN, WORK SLOW AND SMALL

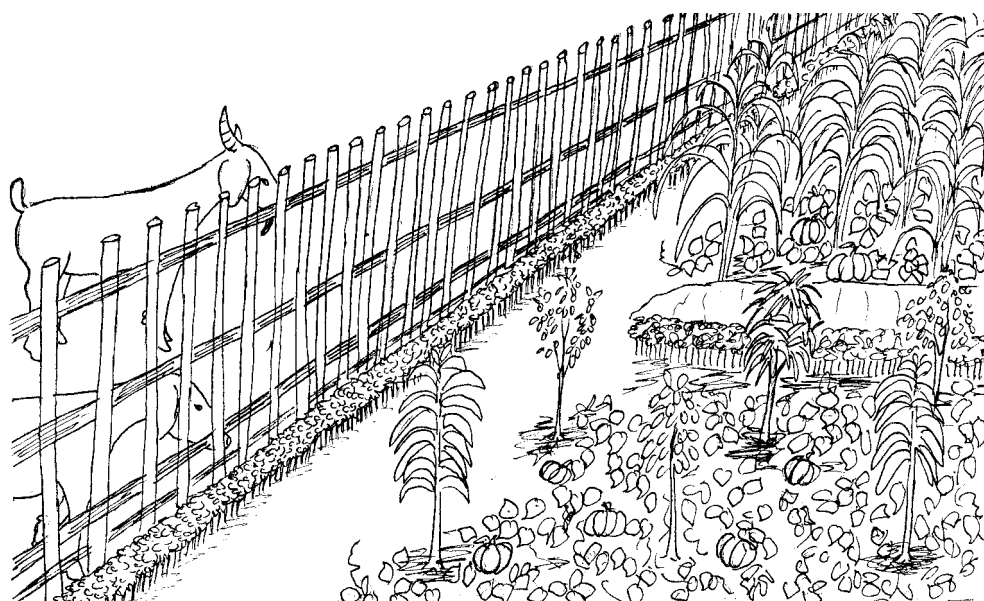
For a permaculture design—as explained in principle seven—create a complete design then add the detail. This is the same for a new design or improving an existing farm or house. When you work to implement the design, do not try to do it all at once!

- Slow solutions: implement the priorities that create a base for the future: e.g. water systems and management, paths, windbreaks, soil improvement, and planting long-term productive trees. This process is slower, but over a long period of time it produces much better and more stable results. Slow solutions also use less labour and fewer resources.
- Small solutions: choose small parts of the design and implement them well and completely so that you achieve good production from them: e.g. a few vegetable gardens, some fast-producing fruit trees, small animals. Then when these are well established, you can move onto other sections of the design.

Step by step...



Designing the access paths and water management for a garden



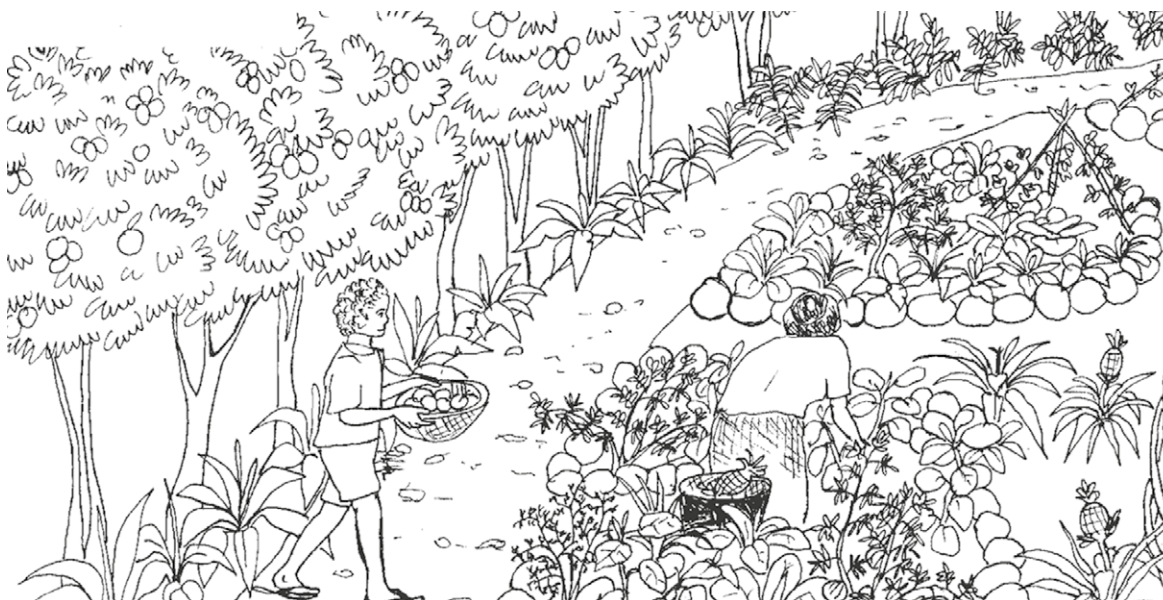
Fence with legume trees planted inside it to grow into a long-term living fence

10. Use and value diversity



In natural environments a greater diversity of plants and animals leads to a healthier, more balanced environment.

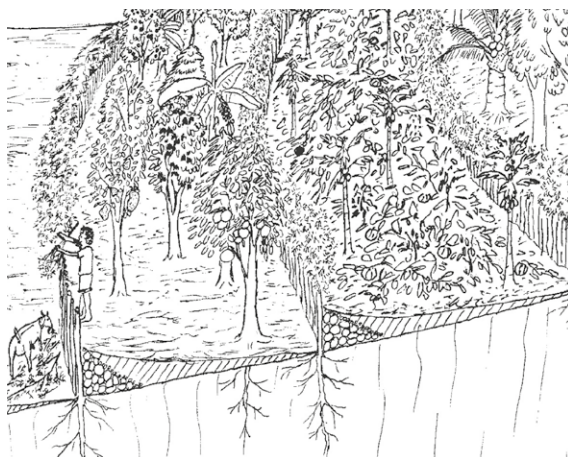
Diversity in a farm system means that we grow many different crops for food and for income, not just one or two: different types of vegetables, fruits, grains, tree products, animals, and goods.



Encouraging pest predators and pollinators, such as birds, frogs, spiders, bats, bees, beetles, and wasps, is another important part of diversity. These animals and insects do a lot of garden management for us.

A diverse system:

- Is more able to react to climate change and still produce
- Is more resilient to extreme weather and more flexible when sudden change occurs
- Produces food crops and cash crops more often during the year
- Means that if one crop fails or some animals die, other crops or animals still produce or may even produce more
- Suffers less from large-scale pest or disease problems
- Is more beautiful!



Diversity enables families and communities to be less reliant on big markets and crops produced just for income.

Moving successfully into the future also needs a diversity of cultures, ideas, and skills. This must come from all members of a family and from people in a community working together. It also means accepting, respecting, and enjoying differences rather than wanting everyone to be the same.

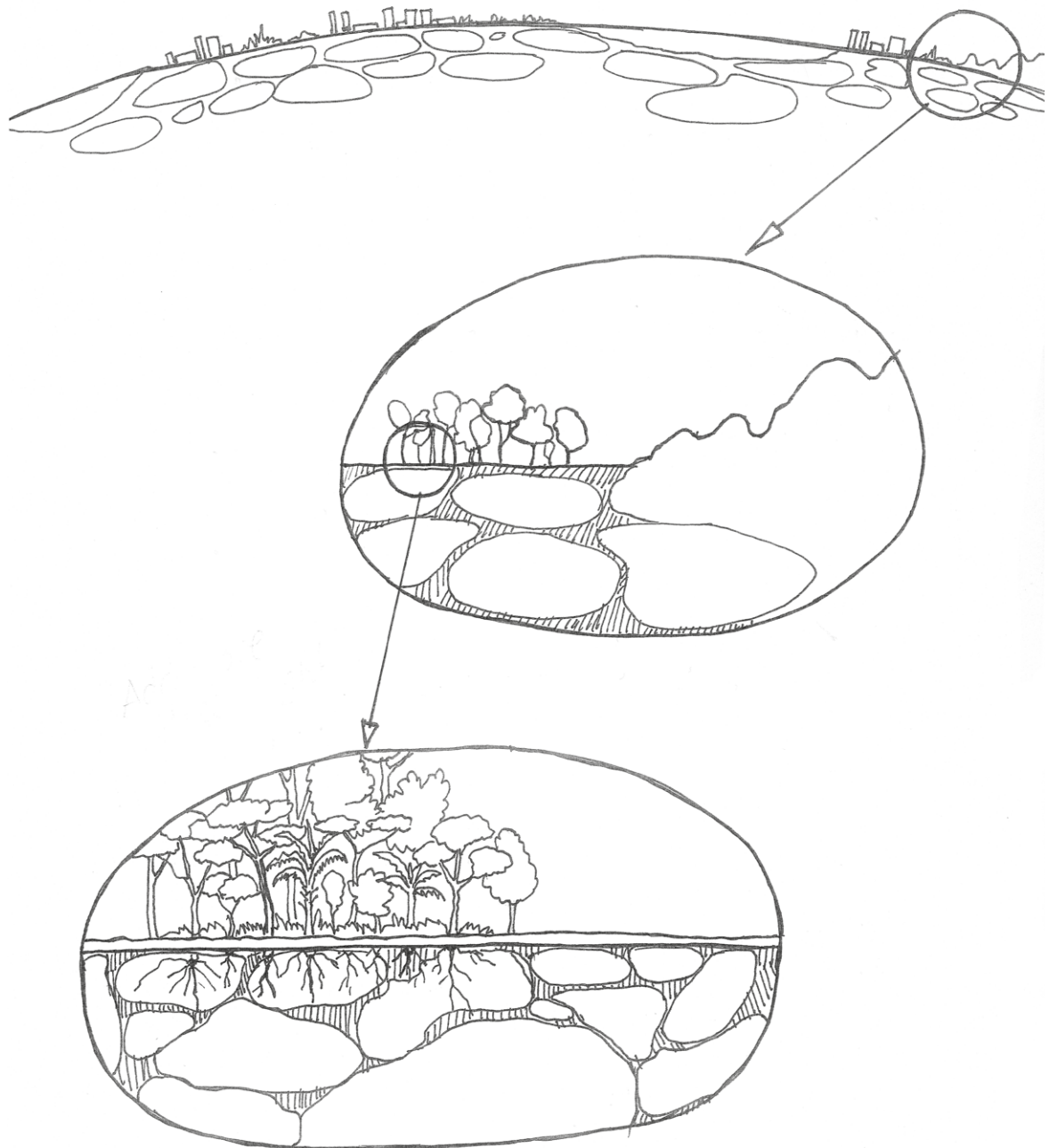
Diversity in action!



11. Use edges and value the marginal

The most important 'edge' on the planet is our soil.

It is the edge between the rocks below and sky above, and in many places it is only a few centimetres thick. Without it we cannot grow the food we need to live, and no plants or natural ecosystems could survive! We need to protect it and increase it with organic, long-term techniques.



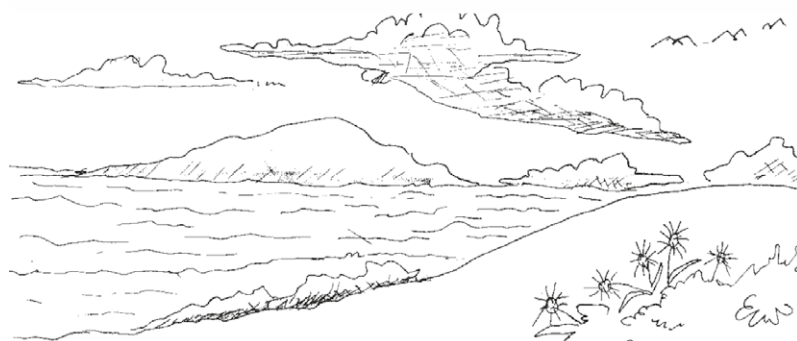
Edges also refer to things which are considered less important and not in the middle. These things are still vital to sustainable agriculture and cultures. For example: the plants around the edge of the garden might not produce food for you, but they provide mulch and other organic materials, homes for small animals and pest predators, and wind reduction.

EDGE EFFECT

In nature the 'edge effect' is when two different ecosystems meet and a new third ecosystem is created. The new ecosystem combines the other two ecosystems and is more complex and more productive.



The edge of a forest



The edge of an ocean



The edge of a river

This could be:

- The edge between the land and the sea
- The outer edge of a forest
- The edge of a river (river bank)

The edge is the most productive part of the environment because it contains more diverse plants animals, and insects, more fertility and sunlight. This idea can be copied and used in sustainable agriculture and animal systems, and even with houses.

For example:

- The edge of a clay fish pond is very productive, both in and out of the water.
- Make terraces or swales on sloped land to create many edges and improve production.
- The soil on the outside edge of an animal house is full of nutrients from the manure and is excellent for growing vegetables or fruit trees.

More edges mean more production and diversity. This is working with not against natural systems.



12. Creatively use and respond to change

The world is constantly changing. These changes occur on both a global and a local level. Technology and science is improving all the time and cultures are always changing too. There is also the process of natural change in the environment that happens through succession and evolution.

POSITIVE CHANGE

Good water and soil management and tree crops reduce the impact of climate change and other environmental problems. Community food sovereignty and transition towns (Read Urban and community permaculture **Ch 4**) are vital for working with the global and community changes that are occurring, and producing resilient and diverse systems that create positive change. Schools across the world are now teaching organic gardening and sustainability to educate the next generation and our future leaders.



Community leaders must facilitate appropriate change and progress, especially regarding local culture. Some progress is good—equality, women's rights, fair wages, and good working conditions. Sometimes changes are bad and affect cultures negatively: it is then necessary to protect food sovereignty and land rights, local languages, traditional knowledge, wisdom, and history.

SUCCESSION AND EVOLUTION: USING NATURAL CHANGE

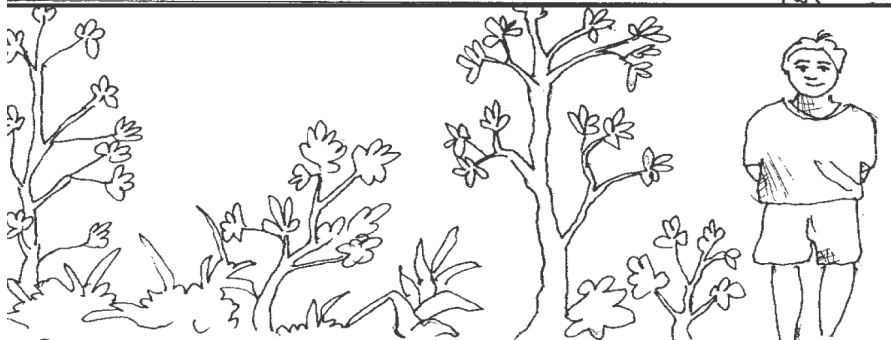
In a permaculture system you can use succession and evolution to speed up the growth and development of your system. You can also use it to improve the quality of animal and plant stock from year to year.

Evolution means that the strongest and most adaptable species survive and reproduce **as do** the strongest and most adaptable individuals from each species.

Natural evolution from bare land to established forest



1. Pioneer grasses and ground covers



2. Pioneer plants and trees



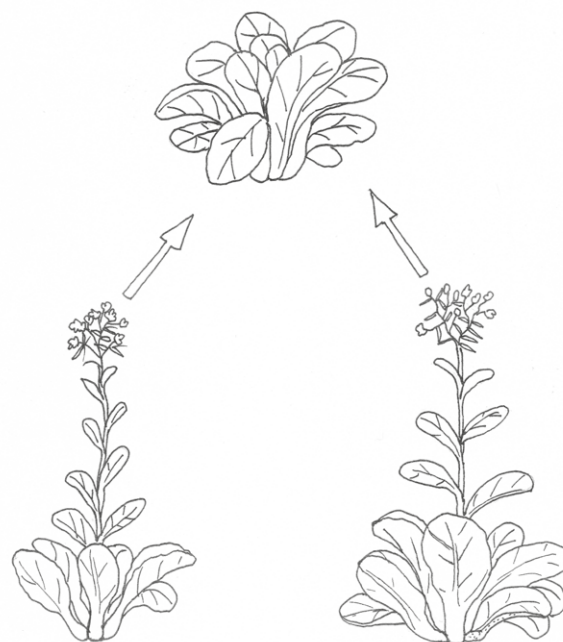
3. Canopy trees



4. Forest with under-story trees and shrubs

Examples of evolution:

- Pick the seed from the **best** plants each season to improve the quality of next season's plants.
- Experiment with different types of fruit and vegetables to find which ones grow the best.
- Experiment with different varieties of the same vegetable or fruit to compare growth, production, and disease-resistance rates. Then you can select the best variety for the land: e.g. varieties of tomato.
- When planting out trees for reforestation, plant too many, then weed out the smallest and weakest trees after one to two seasons. The trees that are weeded out provide mulch and the trees that are left are stronger and more productive.
- Learn from mistakes and consolidate knowledge from past experience: e.g. a farmer has unexpected success with a technique or crop and changes the future plans to include the new success.



Succession means the step by step process of a system's natural progression.

Examples of succession:

- Reforestation techniques work with the succession principal to speed up development and improve long-term success rates.
- Large fruit and nut trees take many years to reach full size and production. They grow better if given protection, nitrogen and mulch by legume trees when they are young. They must be planted the correct distance apart to allow them to reach their full size, which provides space in between the large trees for 5-10 years to plant and harvest from quick growing, short-lived trees or annual crops. When large trees are well established, animals, such as chickens, ducks, or even a few goats or buffalo, can be introduced to provide weed control and manure.



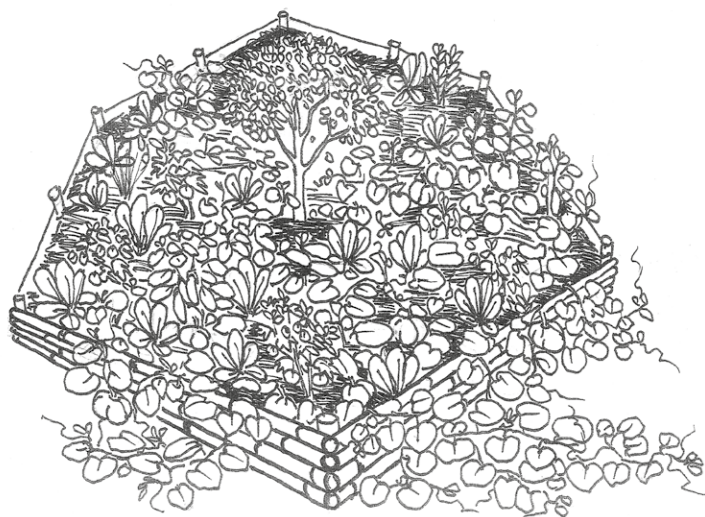
1. Legume pioneer trees

2. Removing some legumes and planting fruit and nut trees

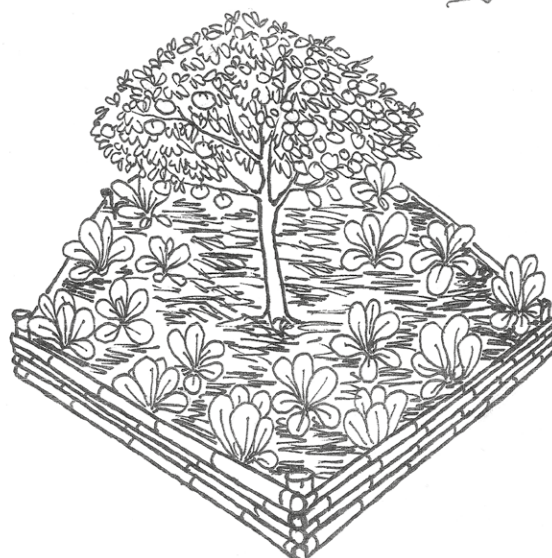
Using succession and evolution to improve orchard production



- Grow a vegetable garden around fruit trees. This strategy works very well for where you want high production from fruit trees, and also adapts well to seasonal planting. Create a raised garden bed 2 - 3m in diameter and plant a fruit tree in the middle. For three to five years you can grow vegetables around the fruit tree, then when the fruit tree matures and creates too much shade for the vegetables, grow herbs and spices. The fruit tree will grow much faster and produce a lot more fruit from the extra nutrients and better soil.



1. Fruit tree just planted, full vegetable garden planted around it



2. Fruit tree growing, sun loving vegetables planted around it



3. Fruit tree mature, shade loving vegetables, herbs and spices planted around it

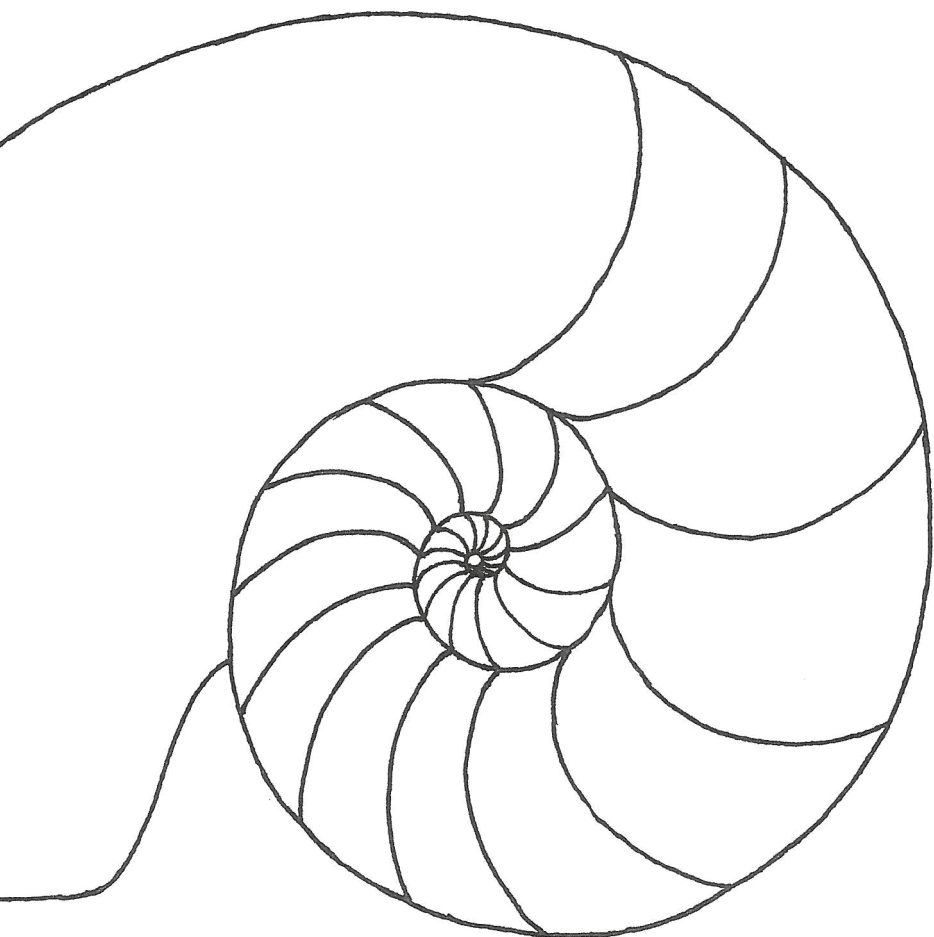


NATURAL PATTERNS



2 NATURAL PATTERNS

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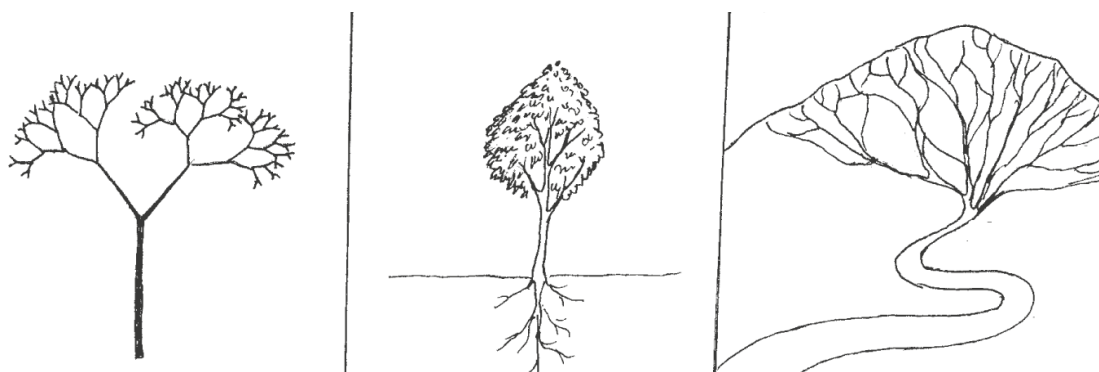
The world is made up of patterns.
Every aspect of the earth, from the
smallest animal to the largest mountain,
contains patterns. Even the passage of
time, divided into seasons and years, forms
patterns. Many patterns are repeated in
different forms, both living and non-living.

Natural patterns

All that we see around us, including ourselves, comes from a small number of simple patterns, such as circles, branching patterns, spirals, etc. Complex shapes and patterns are created from combining repeating or layering simple patterns.

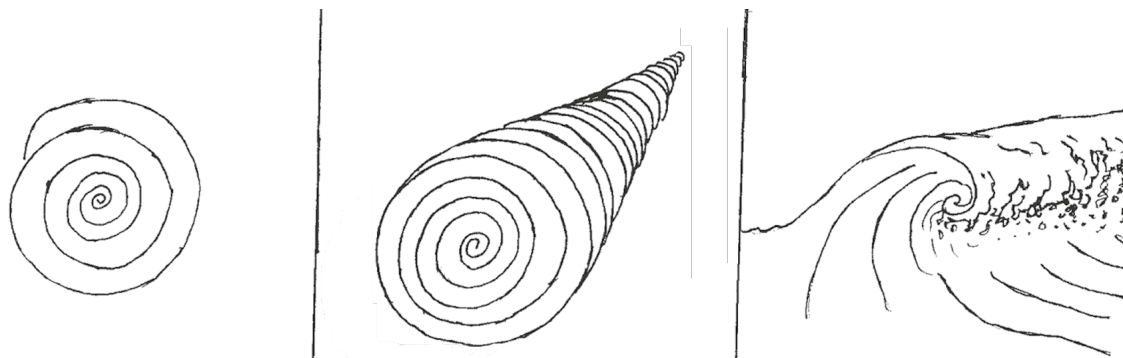
Patterns are the response to natural energy flows. The patterns that exist in nature:

- Enable energy to flow
- Provide solid structure
- Are natural responses to their surroundings
- Are what make life self-sustaining and self-perpetuating



Trees and rivers are examples of the same natural pattern

Remember that all energy flows: we can either assist the energy flow or inhibit it.

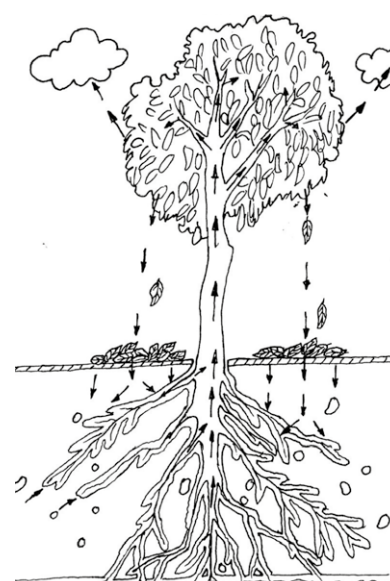


Spiral patterns in nature

Patterns serve specific functions in nature, and every part of nature uses patterns to fulfill functions: e.g. water flow, nutrient cycles, plant growth and ecosystem connections. They are often interactive: for example, the branching pattern of a tree combines with the circle of the tree trunk. A tree cannot live without either of these.

Patterns occur on a large (macro) scale and small to very small (micro) scale. Macro scale includes:

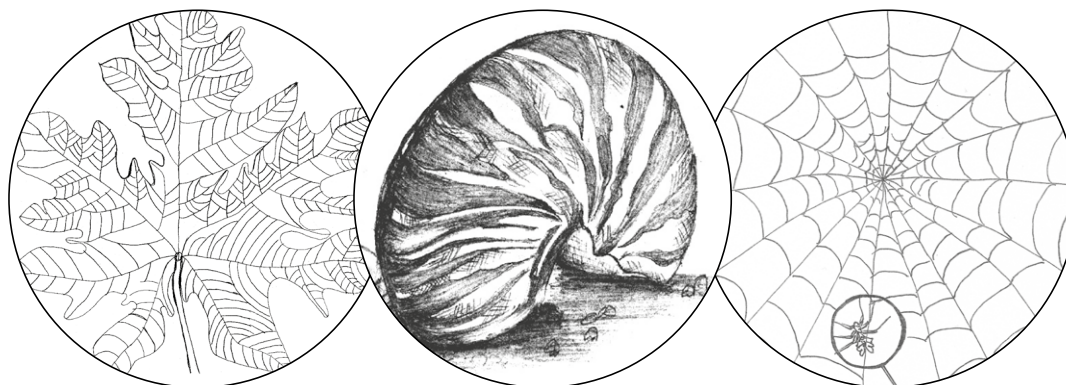
- Whole ecosystems
- Long-term climate patterns
- Weather patterns, including rainfall, cloud types, wind, rainbows
- Time
- Seasonal patterns
- Wave and tidal patterns
- Bio-regions—an area bound by natural rather than artificial borders, such as a mountain range or the edge of a climatic zone, that has characteristic flora and fauna, and includes one or more ecosystems

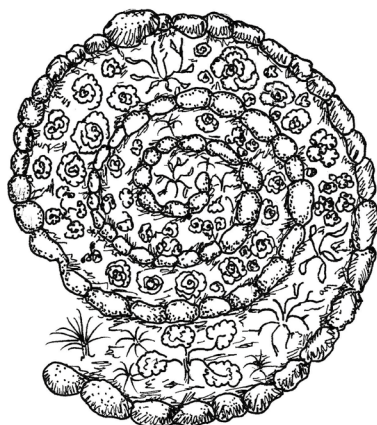


Water and nutrient flow in trees utilises natural patterns

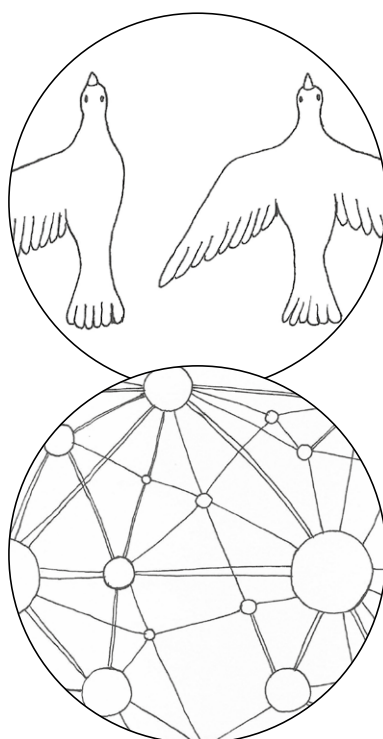
Micro patterns are infinite, including many that we cannot even see:

- Spider webs
- Leaf veins
- Fungus shapes
- Animal and fish scales
- Bee hives
- Shells
- Birds' nests
- Water flows





Spiral pattern in the garden



Top: A birds shape is a symmetry pattern
Bottom: The hub and route pattern

A pattern repeated many times creates a shape, like a song. Often patterns are symmetrical, like wings. Think of a bird with one wing and you understand why symmetry is important.

Birds use rhythmic patterns in their calls. Humans have copied many of these in our own songs, as well as creating many other ways of using patterns, such as music, dance, songs, pictures, cloth, house designs and much more. In traditional cultures, these patterns have had a particular connection with natural patterns.

Human settlements, travel and communication follow a natural pattern that many animals and birds use, and it is even how our brain works! This pattern is made up of collection points (hubs) and connections (routes) between these points.

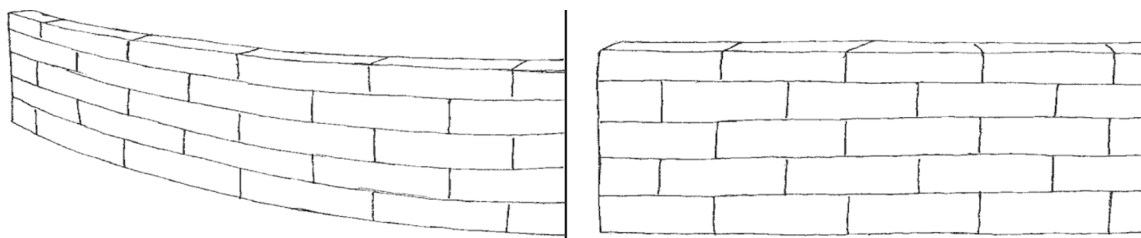
However, many human patterns, especially modern patterns, are not in harmony with the patterns of nature. These patterns are often responses to limited time and making money, and create unnatural shapes that do not allow good energy flow. The result is that these patterns require constant maintenance, and have constraints and cause problems. They also provide 'low quality' results that lack beauty and do not feel good or comfortable. The standardised patterns used to create profit rather than quality mean that the same low quality, high maintenance results are repeated everywhere, and different climates and landscapes are not taken into account.

Examples of this are box-shape houses, cities designed in squares and grids, and large-scale single crop agriculture.

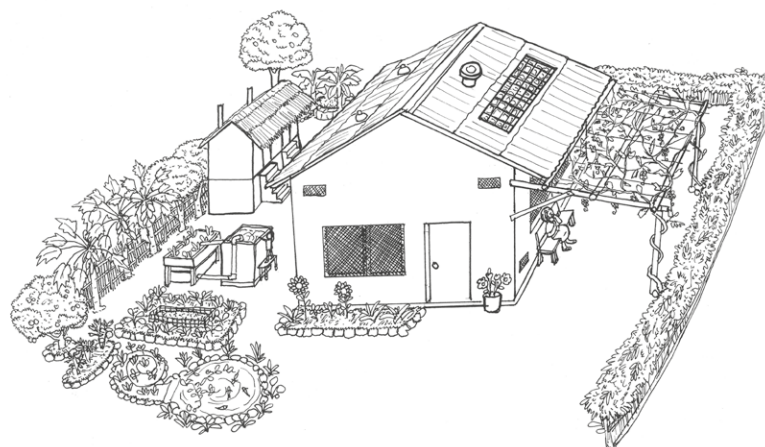
Are there any straight or square parts in our bodies?
Are there any straight lines in nature?



Which is stronger: a curved or a straight wall? A curved wall supports itself while a straight wall needs support.



When buildings, especially urban buildings, are designed badly, they need air conditioners. These cost lots of money to buy and use, waste resources, and cause pollution. When the building design works with nature's patterns, and trees and plants are planted outside the house, air conditioners are not needed.



Each country and region has its own patterns, and so do the people. These are unique! If we work with these patterns to create a house/farm/system/project, we achieve better harmony and results, and there is less maintenance.

Patterns in nature are beautiful and functional.
Natural patterns in design create beauty and function.

Natural designs and shapes should be used as much as possible to improve beauty and function, especially around the house. This increases productivity, makes the area much more pleasant to be in and gives a sense of pride.



A great example of natural patterns at work can be seen on land that is being naturally reforested, with occasional gentle assistance, at a place called the Solar Village near Darwin, Australia. The land, unlike most of the land around it, has not been burnt for more than 30 years. During this time, the land has undergone many changes as the natural vegetation has returned, and the natural patterns and cycles have been allowed to work. Now the land has incredibly diverse ecosystems and the vegetation changes from place to place, owing to different rock types, different amounts of water and sun. These are natural ecosystems and microclimates that are responses to the natural conditions.



Strider in the forest that he assisted to naturally evolve, while observing and documenting its many patterns

Time periods for cycles of natural patterns have also been observed, as the natural forest and ecosystems return. During this time, many different birds, animals and insects have returned, slowly at first, but numbers and different types have increased. Weeds have stopped growing as the natural forest has grown up. The different forest and plant systems are still changing and maturing.

Patterns and design

Permaculture strategies are based on natural science and existing natural patterns. If you understand the patterns, you can work with them to design and create strong resilient, diverse, and energy efficient systems.

Look at the pattern and how it functions, and use these functioning patterns in your permaculture design. Patterns are our main subject for design, and this is what we observe. This includes designs for farms, houses, family gardens, communities, agroforestry, animal systems, aquaculture, reforestation, etc.

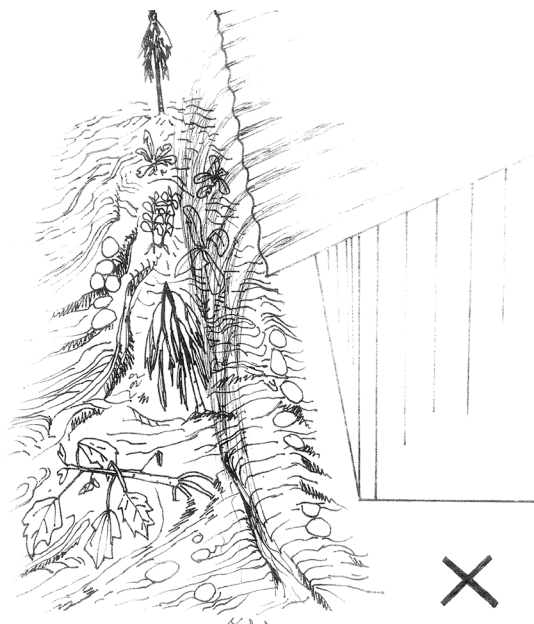
Working with natural patterns to create designs encourages you to use your intuition more, not just for the physical design, but also to anticipate changes over time.

Use your observations to read the land's patterns:

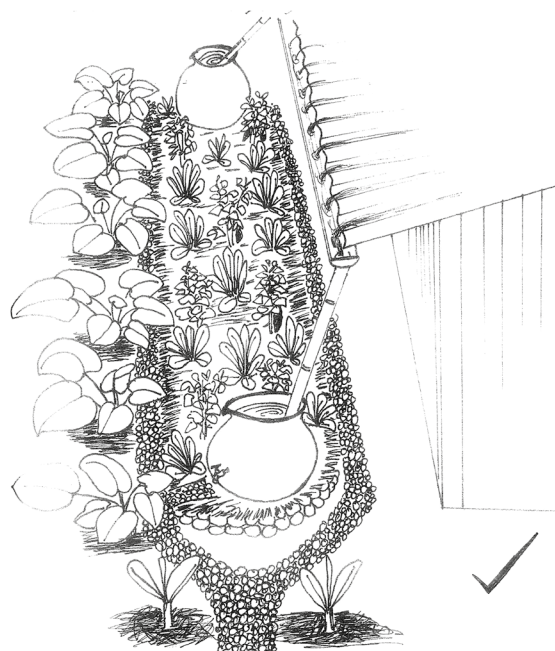
- Work with the land shape.
- Protect and replenish natural resources.
- Optimise good energy flows—human flows, water, plant growth, etc.
- Design from large (macro) scale to detail (micro).
- Use as many natural patterns as possible. Each one you use strengthens your garden/farm.
- Reverse degradation. Each natural pattern has a special function and you can use them to reverse degradation. Degradation patterns also exist, and if you observe them carefully, you will understand what you need to do to reverse the degradation: e.g. rain from a roof can be destructive (if it flows off the roof) or beneficial (if it is collected and used).



Gravity fed water supply and irrigation



Rainwater from roof being wasted and creating degradation



Rainwater from the roof now being harvested and controlled, preventing further degradation and utilising a valuable resource



Use patterns to create beauty. Good productivity is essential, but so is beauty: it is food for the soul. Natural patterns can be included in many ways to increase beauty, such as garden bed shapes, ponds, flowers and sculptures. Add creativity into the design of structures, such as gates, fences and trellising poles.



Natural patterns create spaces that feel much better to be in, as they are welcoming and comfortable. This can increase productivity because people want to spend more time in the garden!



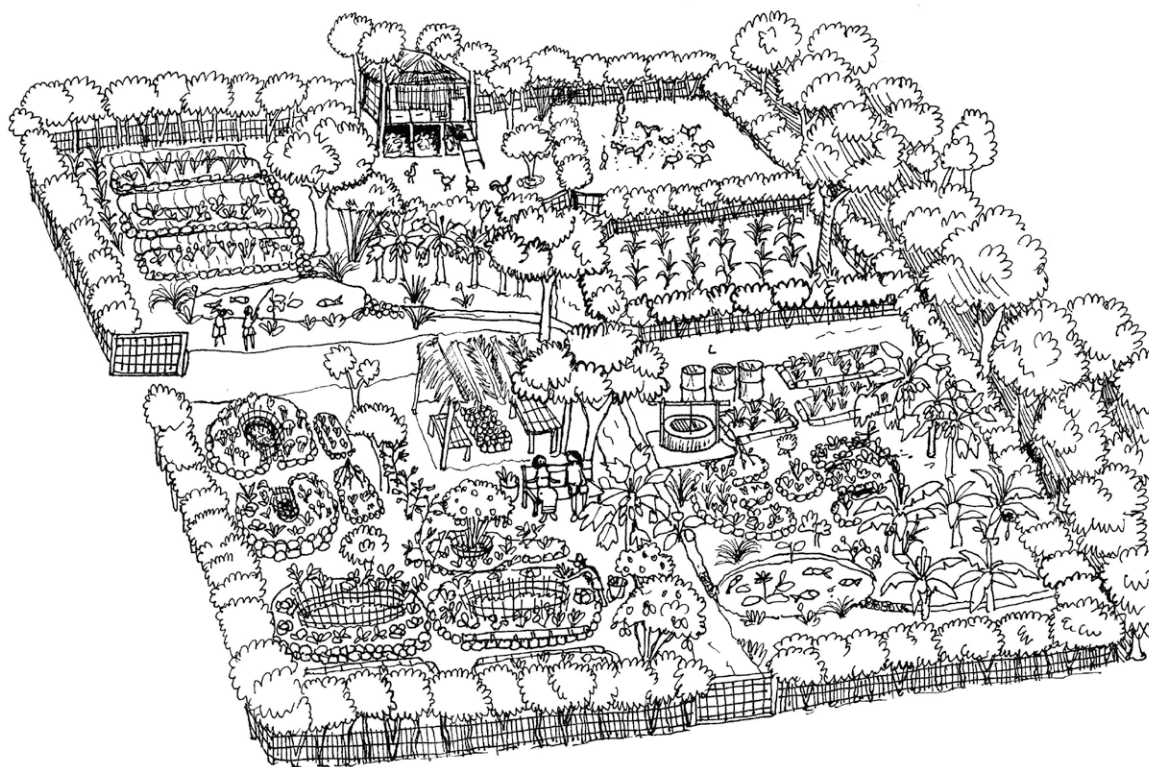
Natural patterns in practice

Working with natural patterns increases productivity while reducing maintenance.

GARDENS

The width of beds and paths, allowing easy access and good drainage are the most important design considerations for gardens. Follow this, and include natural patterns.

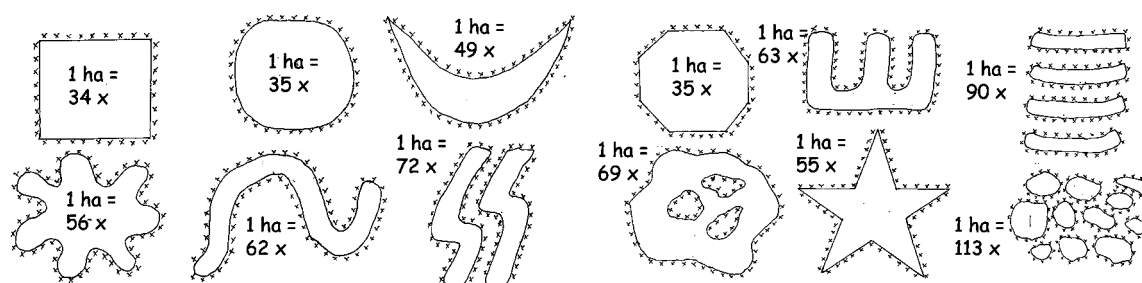
- On sloped land this means creating terraces, garden beds or swales that follow the land shape, catching and using water efficiently. These increase production and prevent erosion.
- On flat land you can choose whatever shapes you like. A mandala shape is actually more space efficient than a rectangle, as long as access is easy. Garden shapes can even follow traditional and cultural patterns.
- Spiral gardens are very efficient uses of space and increase the production area, as well as providing different microclimates.
- The African keyhole garden uses two circles shapes with a small entrance to create a very efficient and highly productive planting space.
- Including flowers and planting different vegetables together reduces pest problems. This follows the natural pattern of diversity.



FISHPONDS

Changing the shape of a fishpond can greatly affect its productivity. As the edge is the most productive area of a fishpond, increasing the edge increases productivity.

In reality, the shape of the pond should fit into the shape of the land. This means that the land dictates the shape, so do not change the land to fit the fishpond. **If you work with the natural shape, you will achieve productive results for the least amount of time and labour.**



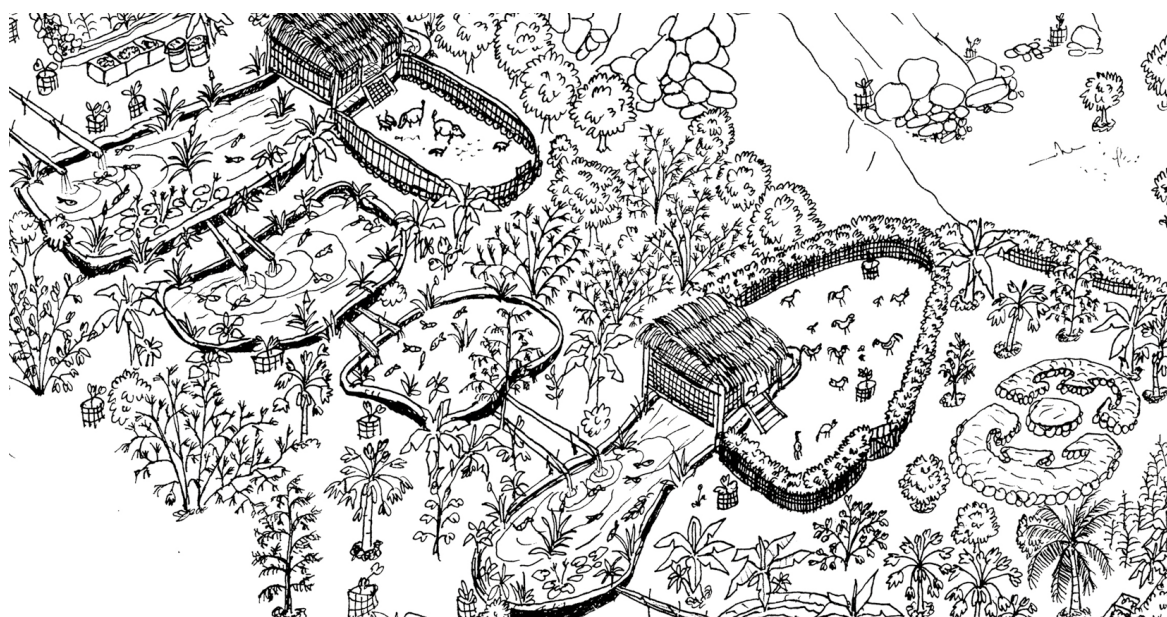
Fish pond shapes. The total amount of water area in each example is 1 hectare (ha)

Square shaped fishponds with vertical edges create areas that the fish do not naturally like – corners.

They think a corner is a trap, so this affects their growth and reduces their size. Vertical edges do not allow water plants to grow, and corners and vertical edges create spaces that are not used: this is wasted space.

When you create fishponds with more edges and sloped sides with the same amount of water, more trees and water plants can be planted around the edge. These trees and plants provide:

- Food for the fish from leaves and dropping fruit
- Shade for the pond to reduce evaporation and regulate the water temperature
- Food for people
- Erosion control
- More fish: as they mostly feed at the edge of ponds, more fish are produced in the same amount of water.
- More water plants: these provide food for humans and fish, and mulch for compost and gardens.
- More insect, birds and animal life around the pond: this improves pollination and natural pest control for vegetable growing, and provides more food for the fish.
- Healthier water



An integrated aquaculture system working with the shape of the land to maximise production with minimal costs

EDGES

Edges occur naturally on the land, but also result from human development. All edges can be used, and all usage increases production and diversity. Think of the shape of a river – if it has many bends, a lot grows on the edge, so many animals and birds live there and the water flow is slower. If it is straight, not as much can grow or live on the river edge, so the water flows faster and, over time, the environment gets more and more damaged.

All paths and roads have edges on both sides that are not often used for production. Paths and roads create water runoff from rain, and plants and trees on the edges benefit from the extra water. Planting path edges with fruit, vegetables and flowers will benefit you and the garden. Extra fruit and income, mulch for the soil, and extra birds and insects are some of the benefits. As the plants are along the path, they are easy to harvest too!



Planting road edges with bamboos and trees helps to stabilise roads and the soil next to them. They will provide extra products too.



WATER COLLECTION AND STORAGE

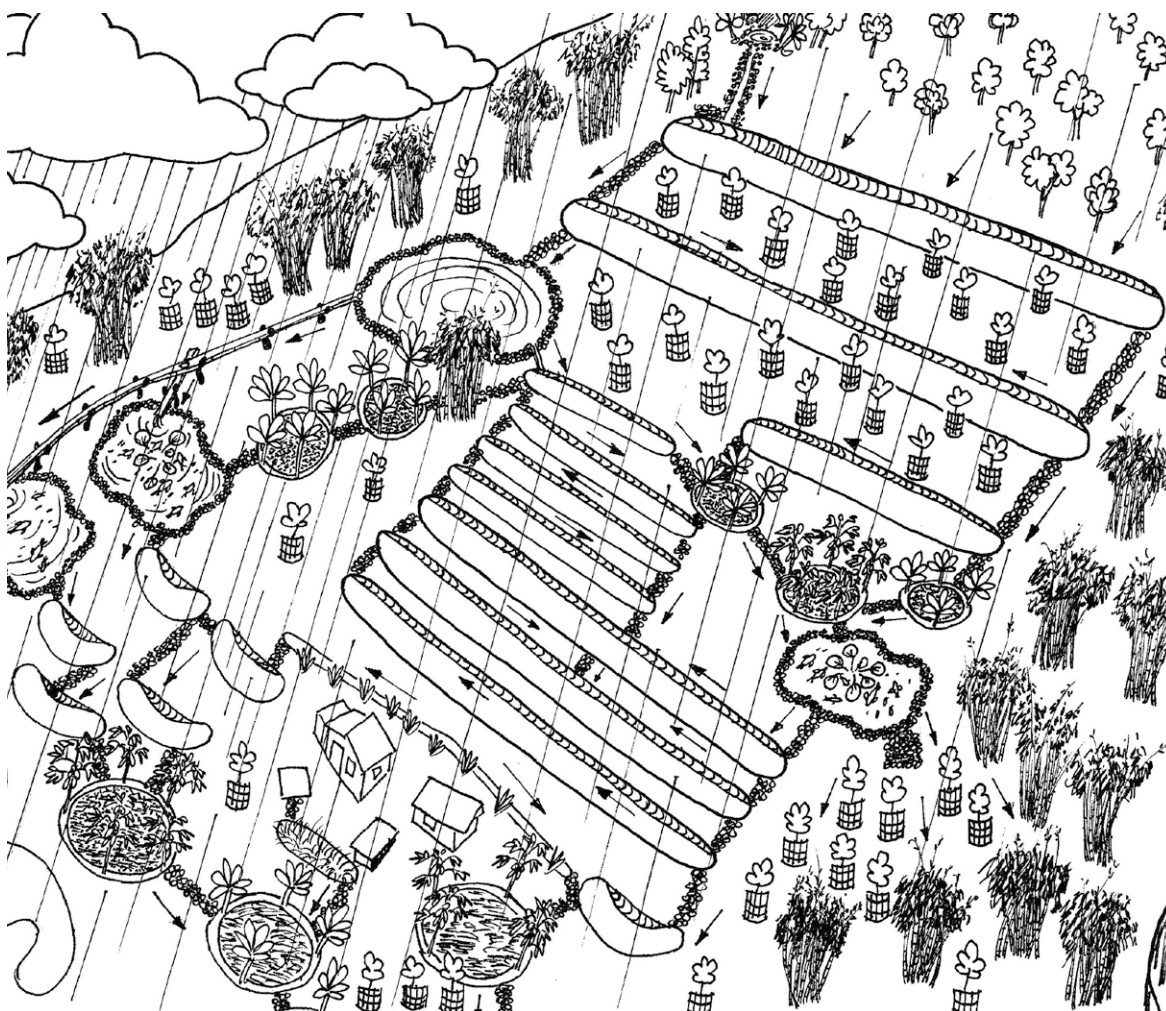
Follow the natural land patterns for successful and efficient water use. This improves results for sustainable agriculture, agroforestry, family gardens, animal systems and aquaculture, and it helps to integrate them.

When you work with the patterns of the land it is easy to:

- Catch and store water where you need it.
- Move water through your system.
- Spread water for agriculture and agroforestry using swales, trenches, terraces and pits.
- Minimise the risk of landslides and flooding.
- Protect and increase soil.
- Catch, store and use all the leaves, crop waste and weeds.
- Create efficient paddy systems for rice and vegetables.



Profile (cross section) of good water catchment

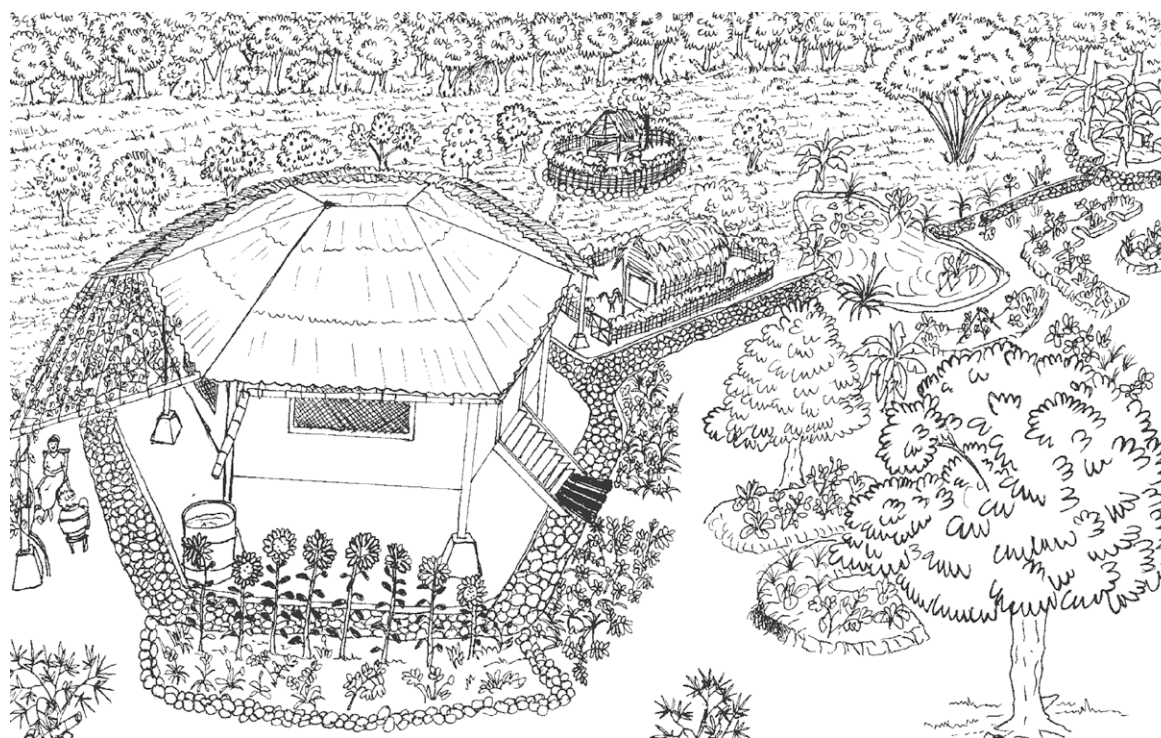


Slow, store and spread water to maximise benefits and prevent damage

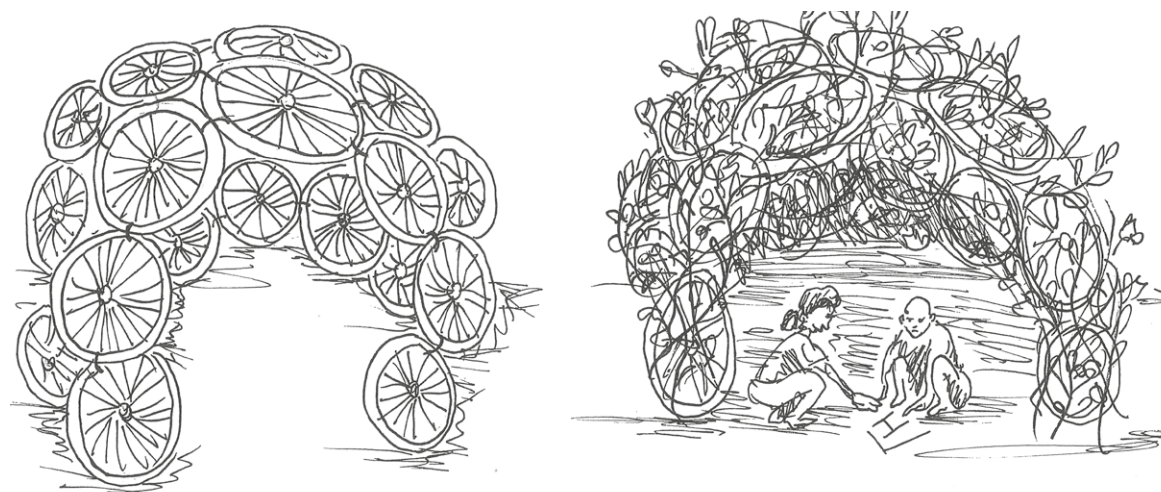
BUILDINGS AND OUTDOOR SPACES

Working with natural patterns will minimise energy use and increase comfort:

- Allow direct sunlight onto walls and into the house where and when you want it.
- Reduce strong winds, but allow light winds, cooled further by trees and plants.
- Prevent flooding, but use ponds to moderate temperatures.
- Use appropriate building materials for the climate: e.g. consider what you need for the hotter coastal regions and cooler mountain regions.
- Use natural ventilation to create air flow and remove hot air from the house.



Natural patterns also create more beautiful houses and outdoor spaces too. Read Houses, water and energy (Ch 7) for detailed information.



A creative and beautiful structure made from old bicycle wheels - good for growing vines and a great shaded space

MEETING AND TRAINING SPACES

A place for meeting and training is important for every community. Make it a beautiful and inviting space, so your community uses it and looks after it.

Some considerations:

- Have indoor and outdoor areas with a big shade tree or two.
- Include traditional carvings in the design.
- Incorporate good ventilation and natural light.
- Use a different shape to the usual rectangle or square design.



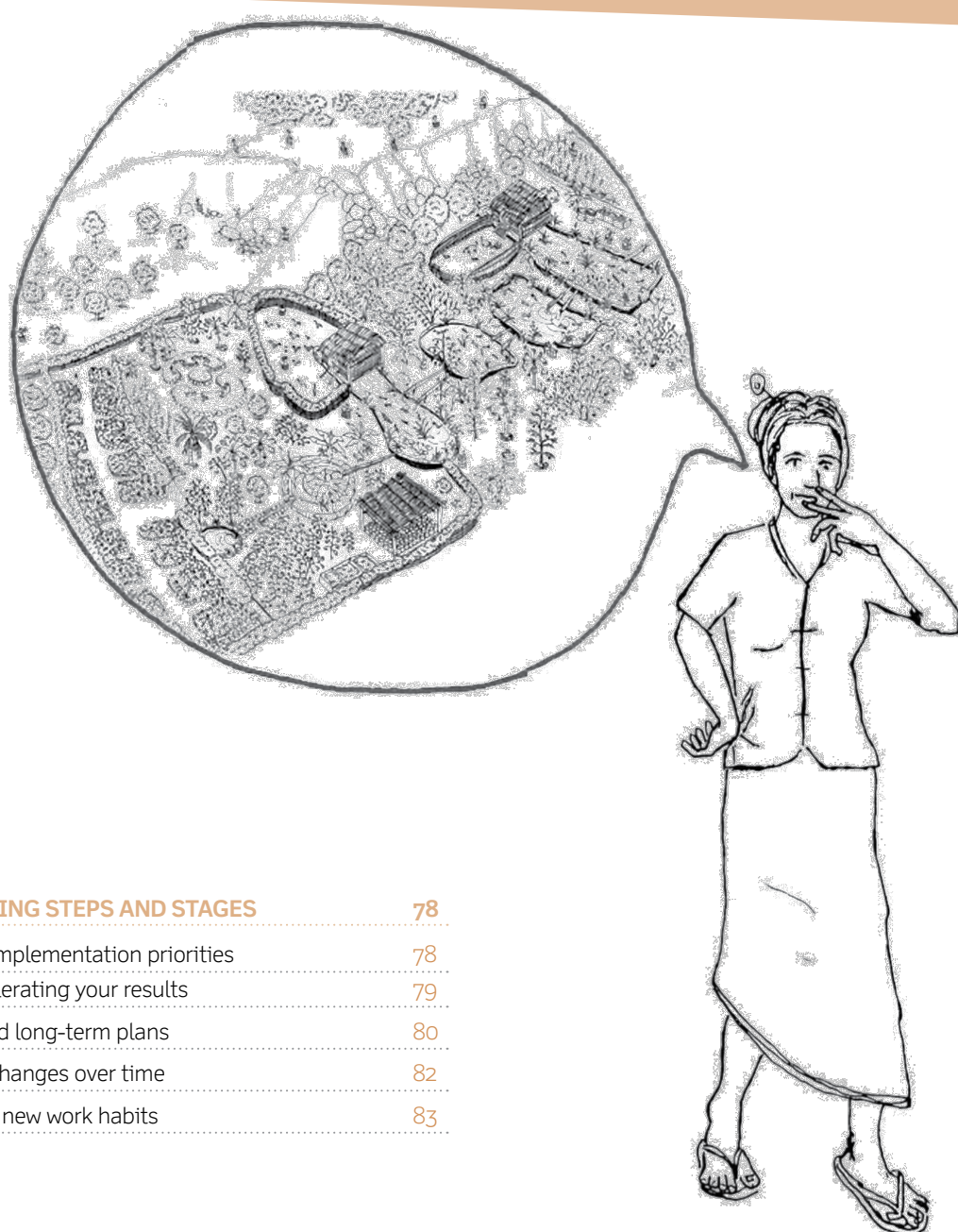


PERMACULTURE DESIGN STRATEGIES AND TECHNIQUES

3. PERMACULTURE DESIGN STRATEGIES AND TECHNIQUES

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To design is to create, plan, invent and arrange. It is how permaculture takes different elements and brings them together as an integrated, whole system, the same as a natural ecosystem. Thoughtful designing with permacultures' principles as the base will create resilient, diverse, sustainable, efficient and very productive systems.



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Permaculture design

Permaculture design looks at ideas and methods for creating long-term, sustainable, self-maintaining systems for agricultural land, animal systems, houses, projects and communities.

We look at the elements: An element is one of the fundamental components making up the whole or the different parts it contains.

Then we ask the questions:

“Where does this element go?”

“How can it be placed for maximum benefit in the system?”

Permaculture combines techniques and strategies.

Techniques are **how** to do things.

Strategies are **how** and **when** to do things.

Design is about making a **pattern** with the elements; working with the land to create a system.

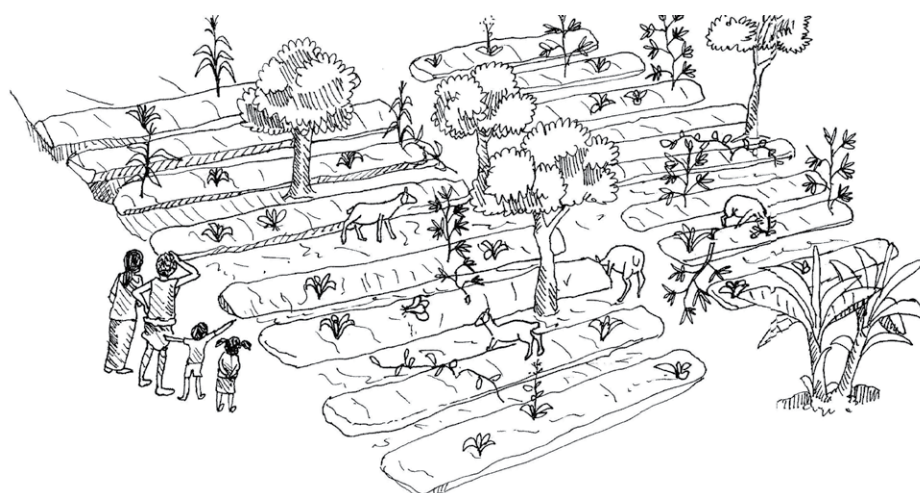
The design process creates a plan for the whole area; from the overall picture down to the fine details.

To create a design that will succeed, it is vital to use the concepts from Natural patterns (**Ch 2**) as a guide during the design process. Permaculture is based on understanding and using this information, about copying natural ecosystems and working with the land’s patterns to create stronger, healthier and more sustainable designs.

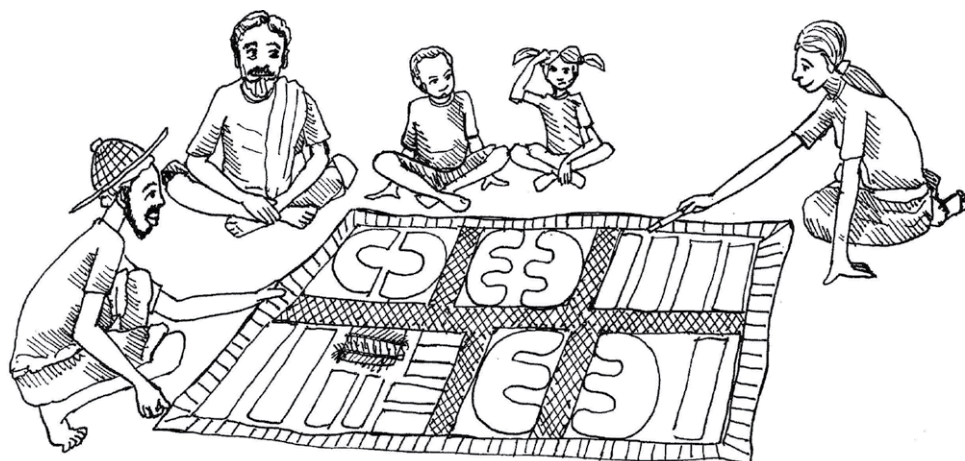
A permaculture design is a complete long-term plan for a site, whether it is a large or a small farm, a family home, a community or a business. However, the design is implemented in stages – step by step. It is important to begin with the right steps.

In permaculture you design the **space** and you design the **time frame**.

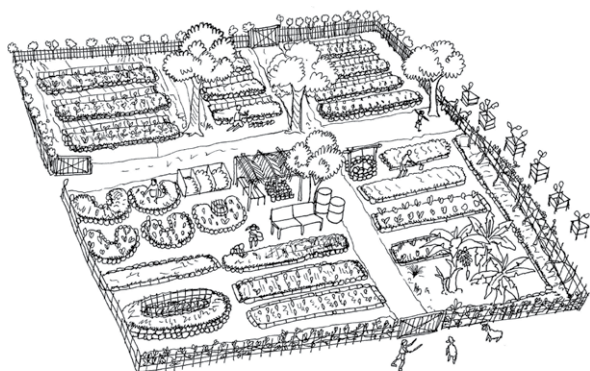
This chapter looks at many aspects of design, and the information here is the base for all of the chapters that follow.



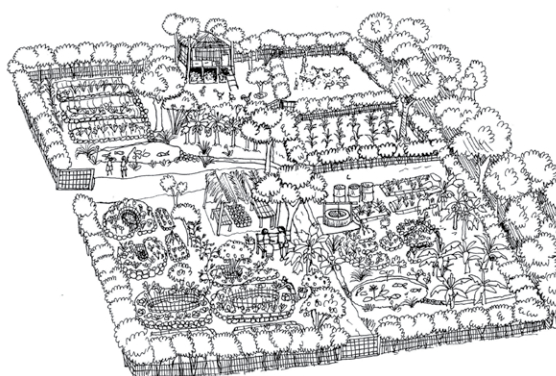
Existing garden



Creating a design for the new family garden



New garden after one year



New garden after three years

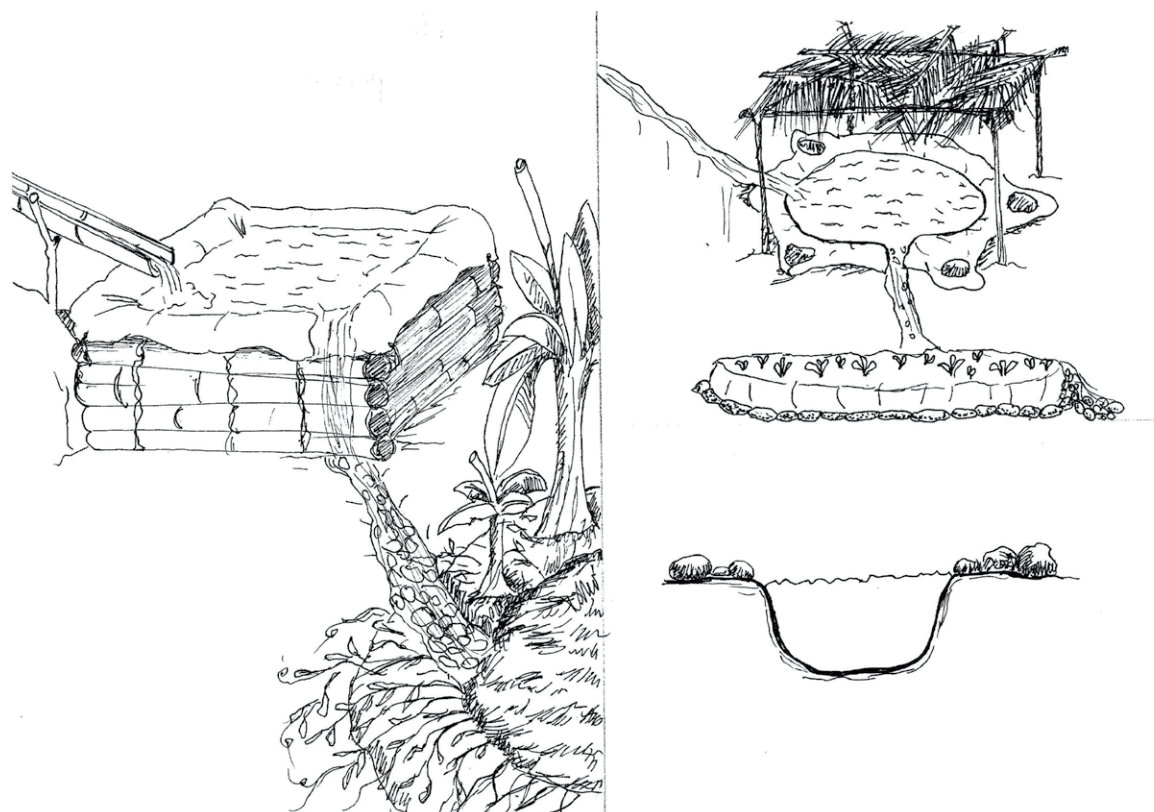
Why? Outcomes of good design

A good permaculture design:

- Creates a plan for now and the future.
- Accounts for all lifestyle aspects in the design.
- Reduces mistakes that need to be corrected later.
- Shows what the **priorities** are for establishing a successful farm or project.
- Enables you to see how to integrate parts of the system to save resources and labour, and increase production.
- Reduces the amount of work needed in the long term and helps you to gain maximum benefit for your work.
- Accelerates the growth of a farm or project because the right technique is used at the right time: e.g. creating your water catchment system and access ways first, planting fast-growing legume “mother trees” with fruit trees.

CLIMATE RESILIENCE

- Plan for extremes in the weather and climate – this is very important. If your farm can cope with droughts, floods and storms, and still produces, your family and community will continue to have food and income. There are many techniques in the guidebook to improve your ability to cope with droughts, floods and storms.
- Climate resilience also requires community responses. Urban and community permaculture (**Ch 4**) looks at community design and how people can work together to improve food, water and livelihood security, as well as reducing the negative impacts of climate change.



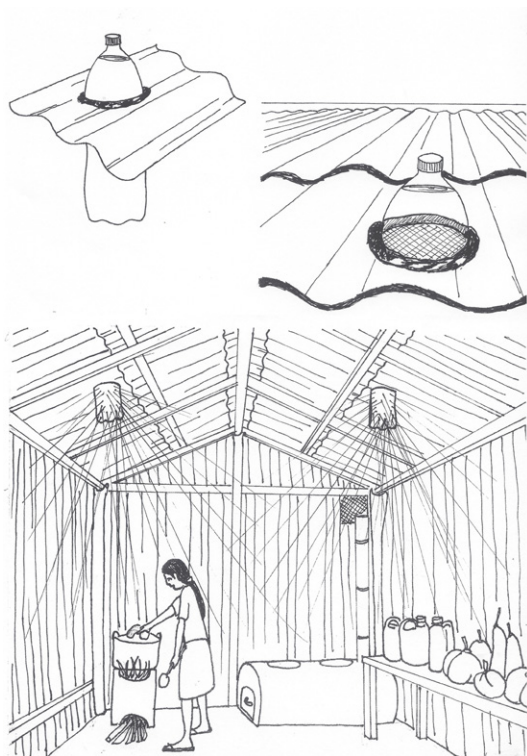
Catching and storing water for gardens, fruit trees and animals

The following benefits of good design are also important to create resilience to climate change and uncertain weather patterns.

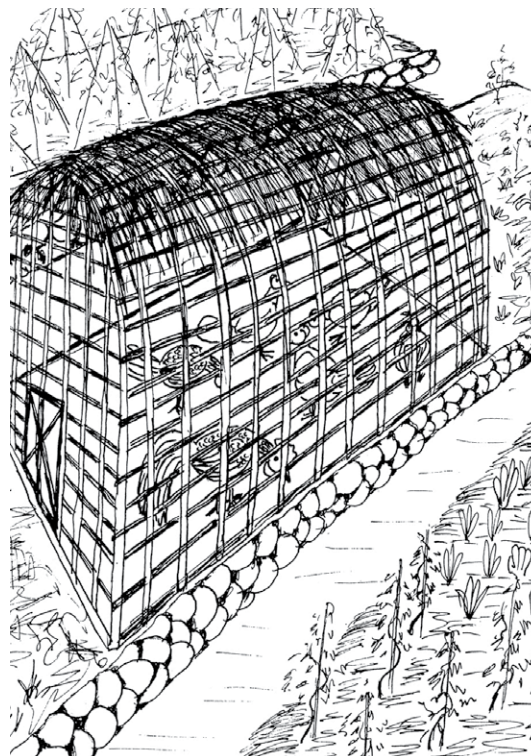


ENERGY EFFICIENCY

- Plan how to use waste from one section as a resource in another section, so all the elements are linked and all waste is reused.
- Houses and dwellings should be built or refitted to maximise energy efficiency and minimise energy use.
- Energy comes from renewable sources.
- Human labour is minimised through system integration.



Plastic bottle solar light



Chicken tractor saves energy and uses chicken habits to remove pests and weeds and fertilise the soil

FOOD AND WATER SECURITY

- Ensure there is a diversity of food and crops with emergency food supplies set aside.
- Have a diversity of crops so there are always some that grow well, with more focus on tree crops.
- Give crops the maximum opportunity to yield well through good land use and management, including producing continual resources for organic fertilisers and crop management needs.
- Reduce and prevent soil loss and other types of erosion.
- Catch and store rainwater.
- Store and spread rain on the land to allow maximum usage and the minimum of problems.
- Protecting and restoring springs, rivers and other natural water sources.
- Use water bodies in your design, including for cleaning and reusing dirty water.



ENVIRONMENTAL PROTECTION AND RESTORATION

Good design considers the natural environment as part of your overall design. Environment protection and restoration have many benefits, especially when considering climate change:

- Secure water sources.
- Less wind damage to crops.
- Higher pollination rates.
- Reduced erosion, landslides and potential storm damage.

A design, like a good framework to help you build a strong, long-lasting house, gives you order but with flexibility. Designs can change as circumstances change: As you have successes or make mistakes on your farm you can adjust the design accordingly.



Design techniques

Maps

“Where is everything?”

“What does the land look like?”

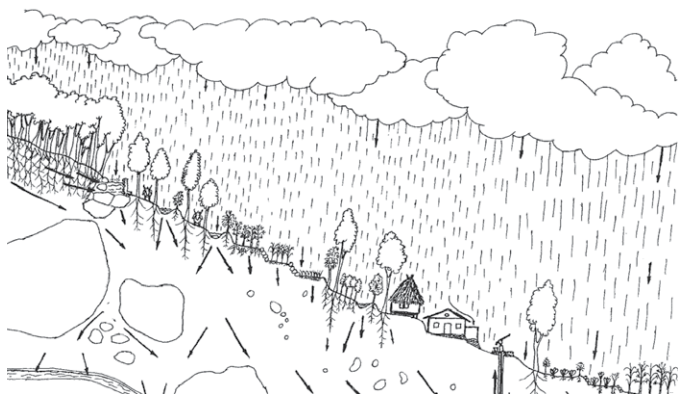
Creating a map of the land is a very good way to see where everything is. Draw an overview map as if you are looking down on the land from straight above, like an eagle looking down from the sky.

An overview map can also be made in the sand or dirt using models to represent the features on the land.

This is called a three-dimensional (3D) map and is often easier for people to make and understand. It is also more fun: You can represent mountain slopes, rivers and even create real water flow on your map!



3D model of mountain with swales and terraces



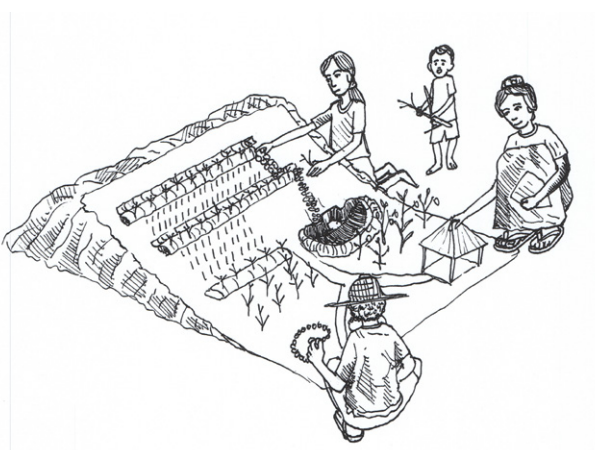
Profile (cross section) of good water catchment

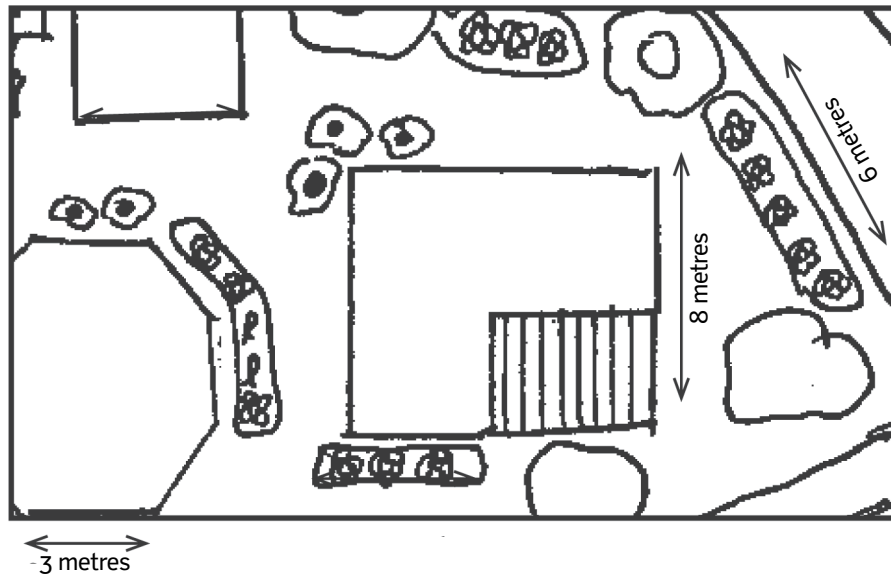
A profile (cross-section) map is a different way of looking at the land and is very good for sloping land or focusing on a particular section of land. It is the same as cutting a slice of cake and looking at the slice from the side view. The land surface is the top of cake, and the buildings, trees, and so on are on top with the tree roots growing into the cake. Profile maps show an overview map or three-dimensional (3D) map from a different perspective.

You need to draw all the different parts of the map “to scale”. This means that they are the same size in relation to and the same distance apart from each other on the map as they are in real life.

One way to make a “to scale” map is:

1. Measure the size of each section with equal-sized steps or paces.
2. Count the number of steps for each measurement.
3. Compare the area or number of steps for each section: For example, wall that is 20 paces should be drawn twice as long as one that is 10 paces. A garden bed that is 25 paces long should be drawn 5 times as long as one that is 5 paces.
4. Draw each section with the size of the area written next to it.
5. Measure the distances between the different elements on the land.





The maps do not need to be perfect but using this method helps you to draw them more accurately. A more accurate map helps you make a better design, reducing potential real life mistakes.

Show where the land is flat, gently sloping or steeply sloping. The later management of each section requires the use of different techniques and strategies, so showing the differences between them is important. Note also if there are river gullies, caves and other unusual land formations.

Maps need to show:

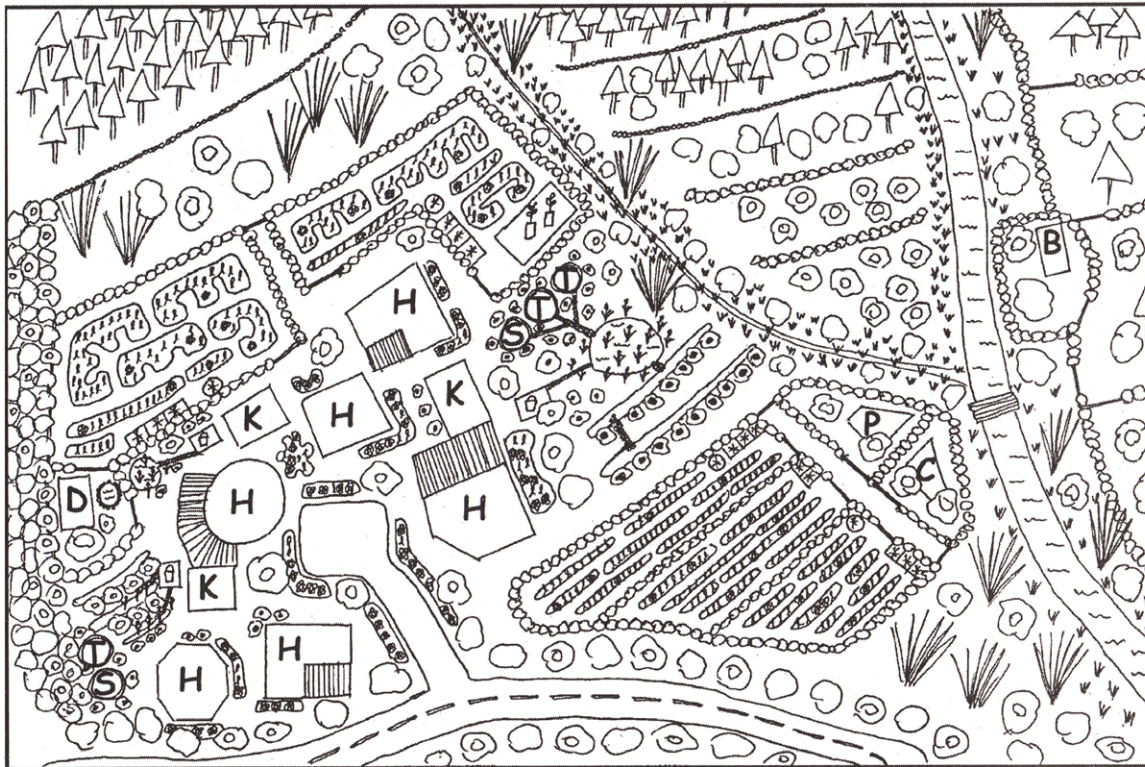
- Existing and future planned buildings.
- Existing and future vegetation.
- Existing and future gardens, grain crops and trees.
- Fences.
- Existing and future animals and animal shelters.
- Roads and paths.
- Rivers, creeks, natural springs, ponds and water movement.
- Land boundaries.
- Flat land and gently or steeply sloping land.
- Sun and wind direction.
- Pipes for water, electricity.
- Sacred (or cursed) land or sites.
- Land that has extremes in weather and/or problems: e.g. eroded areas, flood plains, rocky ground. (These topics are covered in detail in the next section – site analysis – with strategies for how to include them on maps.).
- A “key”.

The “key” is a section near the edge of the map which presents and explains all the different features. Each feature is represented by a different symbol, letter or number, which helps in understanding the information the map presents. The Key is like a key in real life; it unlocks the door to understanding the information presented on the map.



To make the map easier to read, use different colours to show the different features. For example: blue for water, green for trees, red for buildings, etc. Different colours are also important to show the existing features in contrast to future plans.

For sloping land, a map of the land's contours can be drawn onto tracing paper and laid over the top of the design map to show the land's shape.



KEY

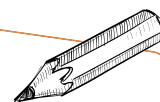
- House	- Shade Trellis	- Gate	- Large Fruit Tree
- Kitchen	- Shower	- Nursery	- Small Fruit Tree
- Toilet	- Forest Trees	- Compost	- Vegetable Plot
- Washing area	- Tree	- Liquid Compost	- Flower Garden
- Living Fence	- Vegetables	- Windbreak	- Road
- Grass	- Flowers	- Rock Swale	- River
- Waste water pond	- Bamboo	- Earth Swale	- Gully
- Animal House	- Duck Pond	- Water trench	
D - Duck			
C - Chicken			
P - Pig			
B - Buffalo			



A picture map showing many elements

SMART IDEAS:

- Use the following sections on elements, sites and zones to plan the map designs. They show you how to work out the best ideas to use and the best places to put them.
- Everyone who is part of the work should be involved in the map design; the whole family and any other workers too – the more ideas the better.
- To make it more relevant draw the family as an element in the design as well



Analysis of elements

“How do these things work together?”

A simple “needs and products” table is an easy and important way of understanding:

- What each element needs.
- What products each element gives us.

For example, if you keep chickens in a yard you gain many products, not just meat. To make a chicken yard and have healthy chickens consider everything they need and what products they give.

From this information you can see how to use waste products from one system as a resource for another system. This helps create self-maintaining, integrated systems that make the most of what you have and reuse waste.



CHICKENS' NEEDS

Food

House

Water

Laying box

Protection from predators

Shade

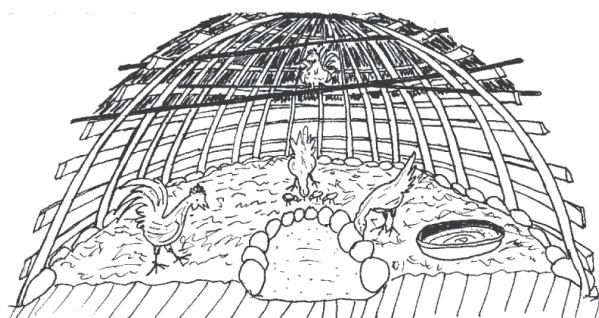
Medicine

Dry earth

Friends – other chickens

Fresh air

Crushed shells, crushed eggshells and sand



\$\$\$



CHICKEN PRODUCTS

Meat

Eggs

Manure

Feathers

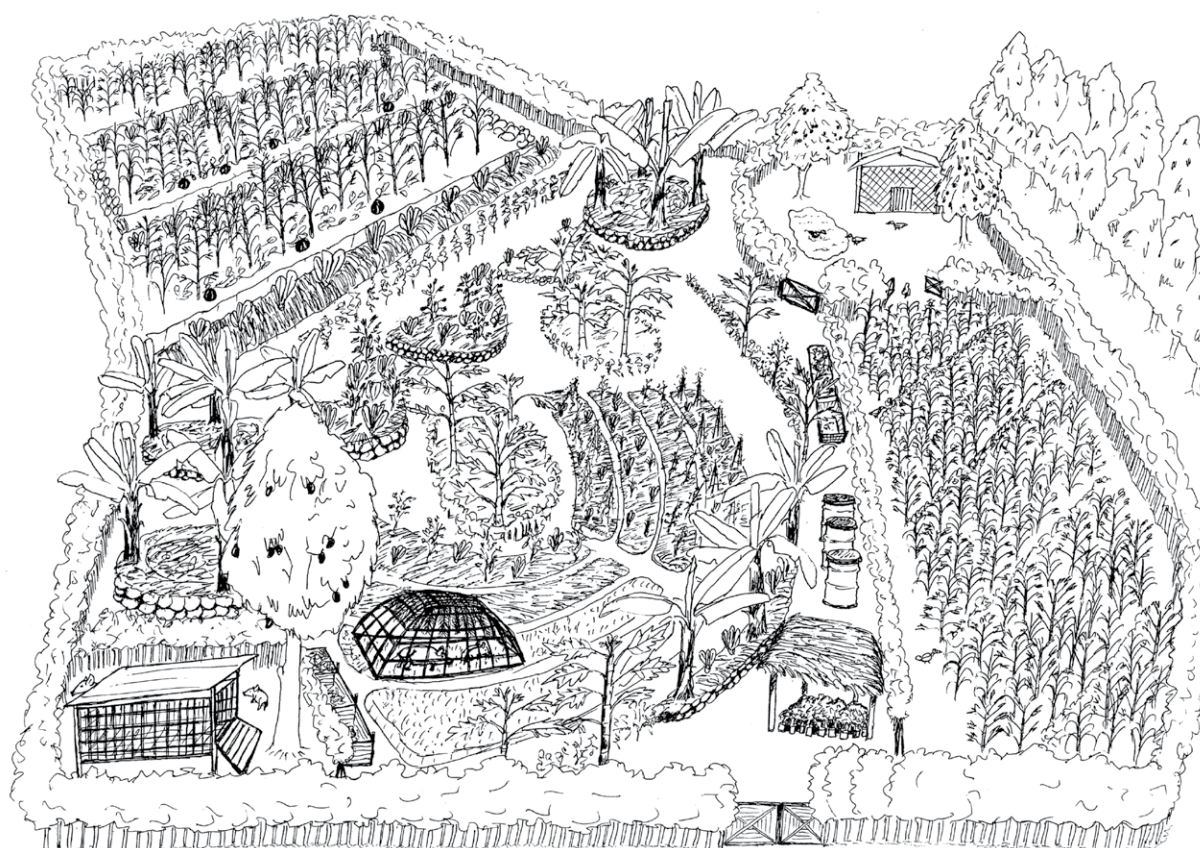
More chickens

Labour – they provide weed and pest control

Ability to trade for other goods or money

And we can look at a needs and products table for vegetable gardens.

VEGETABLE GARDEN – NEEDS	VEGETABLE GARDEN – PRODUCTS
Seeds	Vegetables
Compost, liquid fertiliser	Fruit
Mulch	Herbs and spices
Healthy soil	Flowers
Fences	Seeds
Seedling area (with shade)	Compost material
Cultivation – tools and labour	Animal feed
Water	Mulch material
Good drainage	Trellising material from living fences
Sunlight	Products from windbreaks
Weed control	Other products or money from trade
Wind protection e.g. planting windbreak trees, etc.	
Pest and disease control	



A family garden system where almost all the needs are produced within the garden



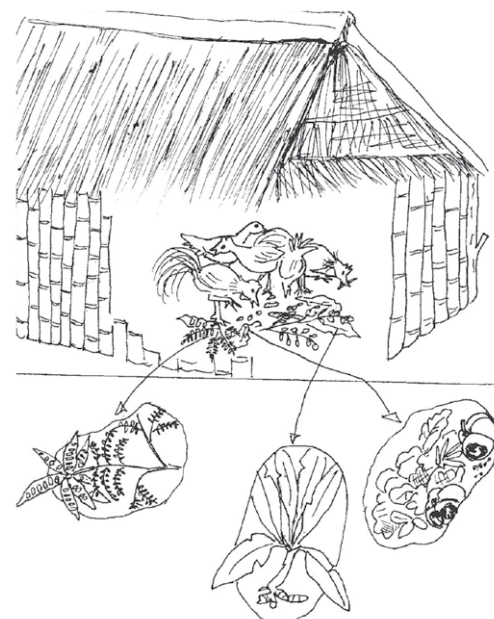
Use the needs and products tables to connect different elements between the systems and reduce the amount of resources from outside.

For example, chicken food can come from:

- Food waste after cooking (a product from the garden via the house).
- Weeds (products from the garden).
- Pruned material from trees (a product of the garden – living fences, shade trees, windbreaks).
- Rotten food (products from the house and garden).
- Diseased plants (products from the garden – giving them to chickens stops disease spreading).
- Insects and bugs chickens find themselves (a product of the chicken yard).

Chicken products are used in different systems:

- Eggs, meat, other chickens – for people/trade.
- Feathers – for cultural ceremonies, making dusters, bedding material.
- Manure – for compost and liquid compost for vegetable gardens and fruit trees.
- Labour – for orchard and garden weed and pest management.



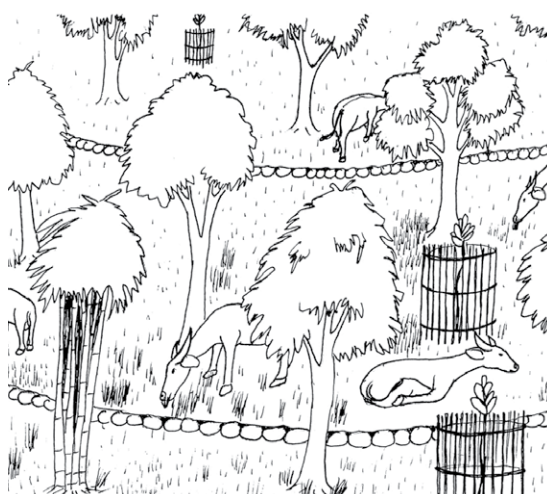
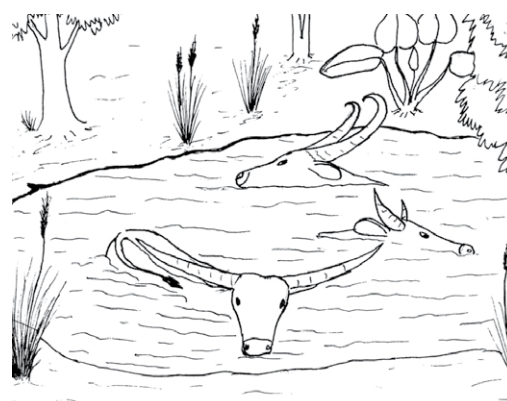
Sometimes the same source, such as trees around a chicken yard, can provide many different products:

- Food for people.
- Food for chickens from the leaves and rotten fruit.
- Shade.
- Windbreaks.
- Medicine.
- Fence posts.
- Mulch for vegetable gardens.

You can make needs and products tables for anything at all!

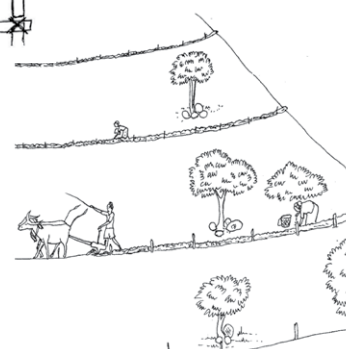
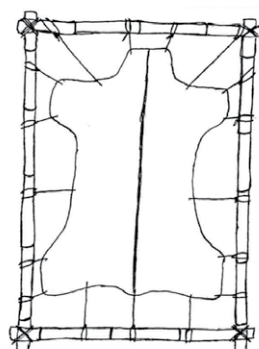
BUFFALO – NEEDS

Food
Water
Shelter
Grazing areas
Medicine
A plough – for labour
Training – to use a plough
Ropes
Waterholes for bathing
Friends – other chickens
Fresh air
Crushed shells, crushed eggshells and sand



BUFFALO – PRODUCTS

Food
Meat
Manure
Grass, weed control
Horns
Other buffalo
Ploughing
Leather
Other products or money for trade
Friends – other chickens
Fresh air
Crushed shells, crushed eggshells and sand



Site analysis

A site analysis looks at the basic site needs, the natural patterns of the land and the natural factors that affect the land and the levels of production.

A site analysis documents all the elements and design techniques then:

- Address the basic needs.
- Work with the land's natural patterns .
- Address the natural factors, such as sun, wind and water flows.

The knowledge gained from a complete site analysis leads to:

- Increased yields in a faster time frame.
- Increased efficiency.
- Fewer mistakes: e.g. not planting crops that are washed away after heavy rains and flooding.
- Resilience on the farm to deal with disasters and extreme conditions: e.g. fire, floods, erosion, strong winds.

The analysis comes from careful observation of the land and the plants that grow on it as well as researching for as much information as possible. Talk to other people, especially community elders.



A site analysis map

As you analyse the needs, patterns and factors, make a separate land map to show what needs to be addressed and what design techniques to use. It is good to start with a draft because there are likely to be changes as the map develops and you add extra factors. The final site analysis map complements the actual site design map and shows the design techniques that will be used.

The factors listed here provide a guide for the information to include on your map.

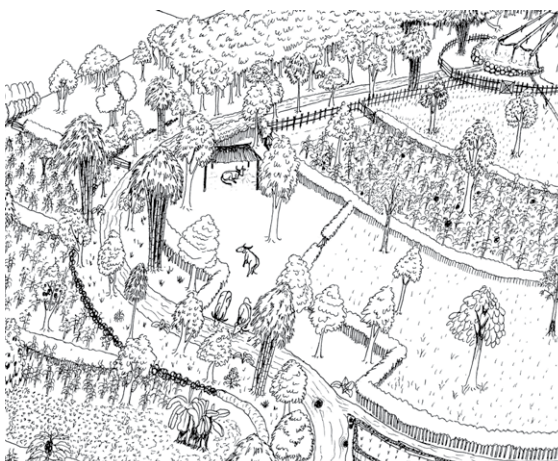
1. WATER AVAILABILITY

Analysis

Are there any springs or places where springs used to run?
Is there underground water? Where does house water come from? Where does crop water come from?

Design techniques

It is important to protect natural water courses and springs by planting trees and vegetation to prevent erosion. Establish water usage and collection points and irrigation (metal/bamboo pipes, rocked trenches) to channel water. Reforestation replenishes the ground water supply and dry springs start running again. Large tree crops and reforestation areas attract rainfall and can increase it in dry areas, especially in mountainous regions.



Mapping

Show all the water sources, main water and irrigation pipes, and all the water points including taps.



Water access points currently available

Add any new water sources (e.g. water tanks, dams) and water points (e.g. future irrigation, drinking areas for animals).

2. HUMAN ACCESS

Analysis

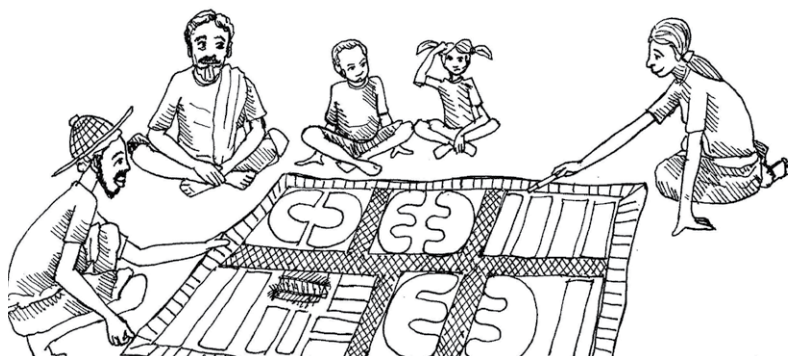
Access – being able to enter somewhere easily with your equipment – for what, and where is it needed: e.g. for someone walking, pushing a wheelbarrow, riding a bicycle, pulling a cart, riding a horse, driving a car, tractor, or truck? Where are the best locations to place transport routes?

Design techniques

Consider access and how easy it is to do the work needed with the minimum of energy.

Designing areas for access is most efficient when combined with water availability and flow systems, as paths and roads are good to use to catch water for storage.

A road or path in the wrong place can lead to continual road maintenance and create erosion or even flooding. Adequate drainage is an important aspect to consider. Follow the contour lines whenever possible when including a path, and plant vegetation alongside.



Mapping paths and access in a family garden



Mapping

Show all the current access paths.

Water availability and human access are the first and most important factors of design; all other issues and ideas follow after these are decided.



Current human access roads and paths

Add any new access paths, place them in the best positions possible and show the different access needs. Add the planting areas, water catchments and drainage points.

3. SUN

Analysis

The direction of the sun is important. By observing its path during the day you know where the maximum and minimum sun exposure areas are. Remember that these change from the wet season (the sun is higher in the sky) to the dry season (the sun is lower in the sky).

Design techniques

Use the sun's paths as calculated below to estimate where the sun and shade areas are at different times of the year. From this you can make design plans for where to place plants that need sun and plants and animals that need shade.

- Use the areas of maximum sun exposure first for the most important crops.
- Reforestation is more successful in areas of good sun exposure.
- The intensity (heat) of the sun is strongest before the wet season, so it is important to account for this in your design and plans.
- Areas of semi-shade are better for animals.
- Some crops, such as coffee and vanilla, grow better in semi-shade.
- Be aware when planting trees of where the shade will be when the trees are fully grown.
- Mapping the direction and changes in the sun's path helps to plan for a cool and comfortable house.

Too much shade



Good amount of sun



Mapping

Show the sun's path for:

- The lowest path – the shortest day and winter solstice: June 21st for the southern hemisphere, December 21st for the northern hemisphere.
- The highest path – the longest day and summer solstice: June 21st for the northern hemisphere, December 21st for the southern hemisphere.
- The middle path – equal length night and day, the equinoxes: March 21st and September 21st for both hemispheres.

To calculate the sun's path consult an excellent website for showing the sun's path anywhere in the world – (www.suncalc.net) with more detail in the reference chapter at the end of this guidebook.

Here is some information if you want to calculate it yourself:

(Note – ° means degrees or the angle the sun is in the sky.) The sun moves 46° across the sky from the tropic of Cancer (latitude north) to the tropic of Capricorn (latitude south) every half a year. That is 0.25° per day and 1.76° per week.

- If you hold your fist up to the sky, each knuckle is equal to 2° .
- You can calculate from any day where the sun will approximately be on the equinoxes and solstices.
- Example: in Timor-Leste, in the southern hemisphere on October 20:
 - October 20th is 9 weeks before the southern summer solstice (Dec 21st), 4 weeks after the second equinox (Sept 21st), and 17 weeks from the southern winter solstice (Jun 21st).
 - The calculations are: $9 \text{ (weeks)} \times 1.76^{\circ} \text{ (degrees of sun movement per week)} = 16^{\circ}$; $4 \times 1.76 = 7^{\circ}$; $17 \times 1.76 = 30^{\circ}$.
 - Hold your fist up to the sun around midday without looking directly at it.
 - For the summer solstice (Dec 21st), the sun's furthest point in the south, $16^{\circ} =$ eight knuckles or two hands width. From the first hand, (with your arm pointing at the sun) count two more hands moving south. The sun at the summer solstice will be after the second hand.
 - For the equinoxes (March 21st and Sept 21st), when the sun is directly over the equator, $7^{\circ} =$ three and a half knuckles. From the first hand, count one hand moving north. The sun will be where your fourth knuckle is.
 - For the winter solstice (June 21st), the sun's furthest point in the north, $30^{\circ} =$ 15 knuckles or almost 4 hands width. From the first hand count four hands to the north. The sun at the winter solstice will be at the end of the fourth hand.



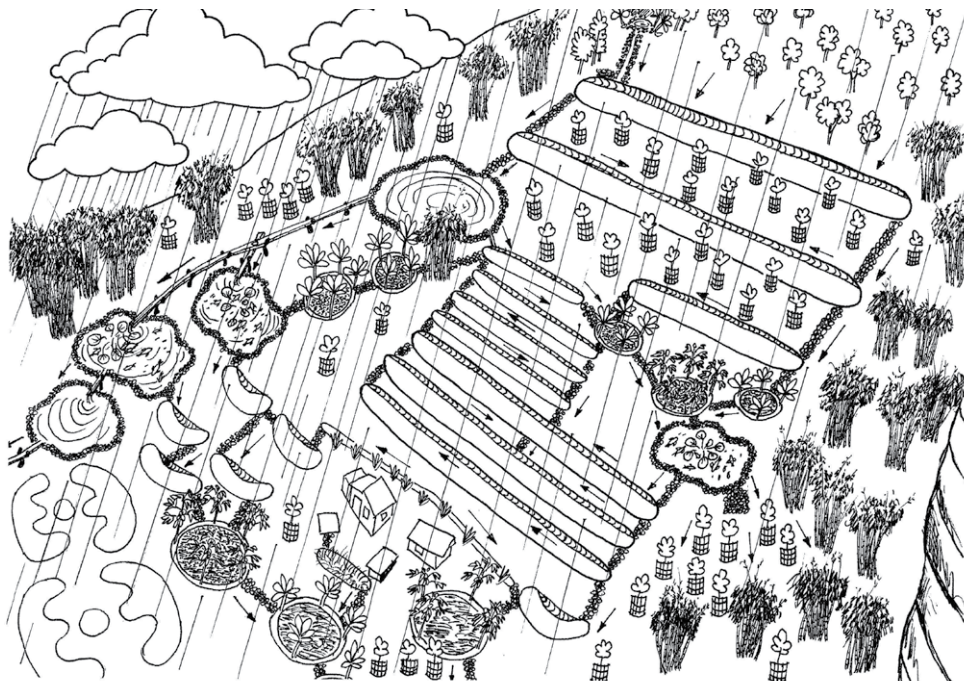
Use the information to calculate the sun's path where you live, and apply it using the design techniques above.



4. WATER FLOW AND LAND SLOPES

Analysis

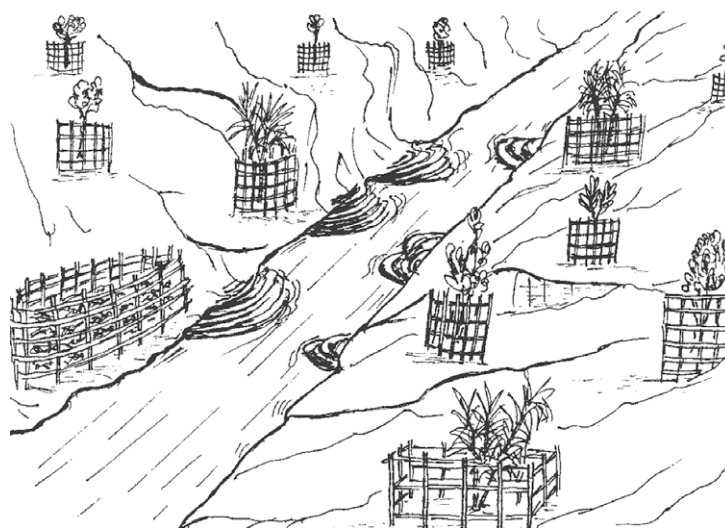
How steep are the slopes on the land? How can the soil be protected and the slopes used to benefit production? Where does the water flow from and to? Are there areas of erosion? Are there natural water collection points? Are there areas where water collection points could be made?



Design techniques

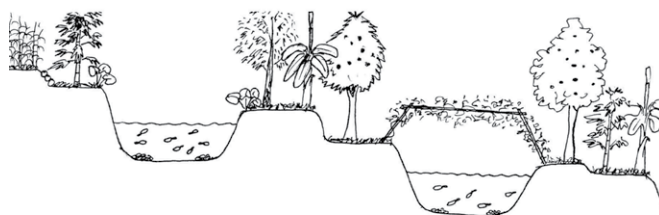
You can prevent or repair erosion damage by using techniques to slow, store and spread the water, such as building water catchments including swales and terraces, controlling animals and planting grasses, shrubs and trees. (Read the catching water: swale and terrace systems section later in this chapter for a detailed explanation.) These techniques also prevent potential mudslides and large-scale erosion which, if unchecked, cause huge problems.

Remember that every time erosion happens, valuable soil for crops is lost and the risk of mudslides increases. Erosion also causes problems in rivers and the ocean.



Repairing an eroded waterway

Catching and storing water in the ground improves agricultural production on sloping land and protects the soil. Different techniques, such as swales and terracing, can be used. Use gravity to irrigate both naturally by using swales and water trenches or with piping, bamboo or hoses. Gravity can also draw water into aquaculture systems or water catchments.



A profile (cross section) showing how using slopes can increase yield

Mapping

Show the rivers, wet season waterways, steep slopes, gentle slopes and erosion areas across the land.



Current water movement patterns

Add designs for river protection, stopping erosion, swales, terraces, and water channels for irrigation.

5. FLOODING

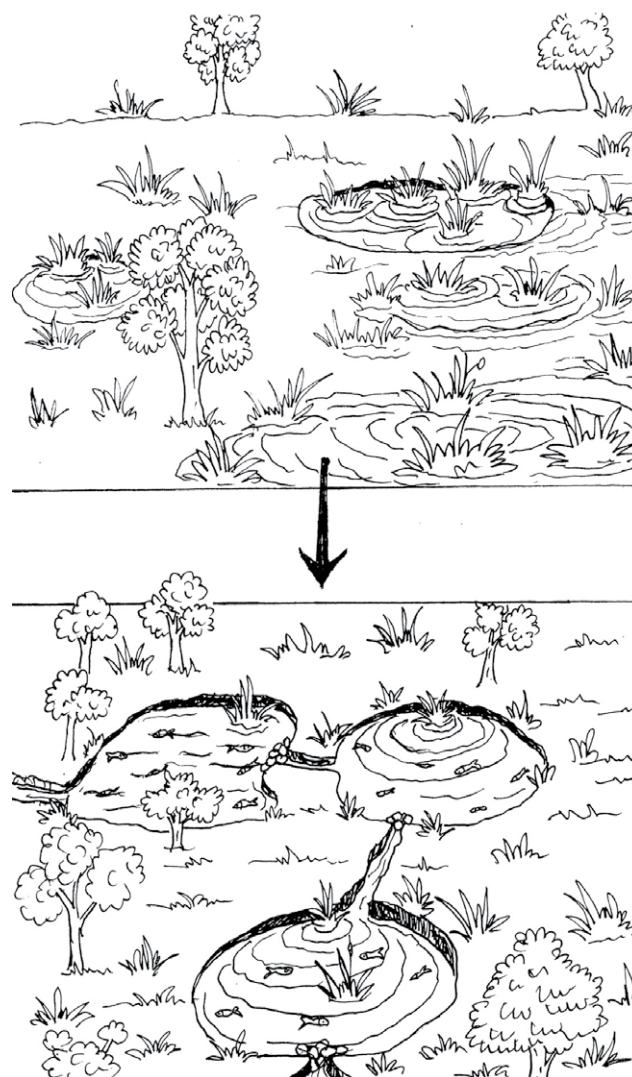
Analysis

Are there any areas of the land that flood in heavy rain? Look for naturally swampy areas, water plants and places along water courses that show evidence of over flowing water.

Design techniques

Observe where the water comes from and protect these areas from erosion and landslides. The best way to reduce flooding and the amount of water run-off is to use water catchments, swales, terraces and reforestation to **store** as much water in the ground, as high up in the land as possible.

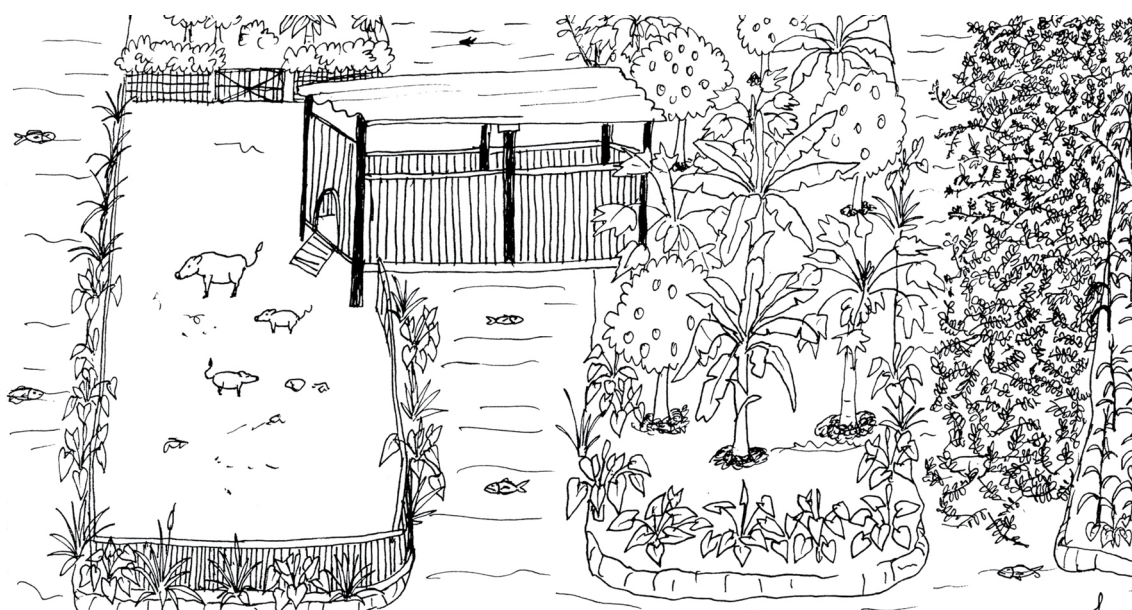
Take advantage of naturally swampy and flood-prone areas by growing compatible crops. For example, grow rice in paddies, water spinach, water cress and taro and introduce ducks, fish and freshwater prawns systems. This way water can be stored and used, and the overflow can be regulated.



Turning swamp land into a productive aquaculture system

Plant trees which cope with occasional flooding.

Reduce extreme flooding by using water channels. Look at Aquaculture (**Ch 18**) for many more ideas.



Mapping

Show where there is permanent water, wet season water, potential flood areas, river overflow areas, and sources for floodwater.

Add designs for fish ponds and water storage ponds, water drainage trenches, raised garden beds, banana pits and other water features.

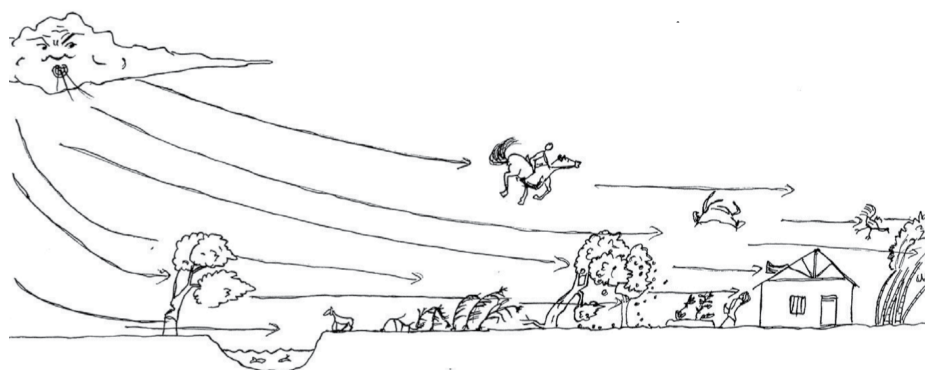
6. WIND

Analysis

Where does the wind usually come from? Does the direction change from season to season? How strong is the wind and how often is it strong? Is the house protected from the impact of wind? Wind greatly reduces plant growth and increases water use as it dries out plants.



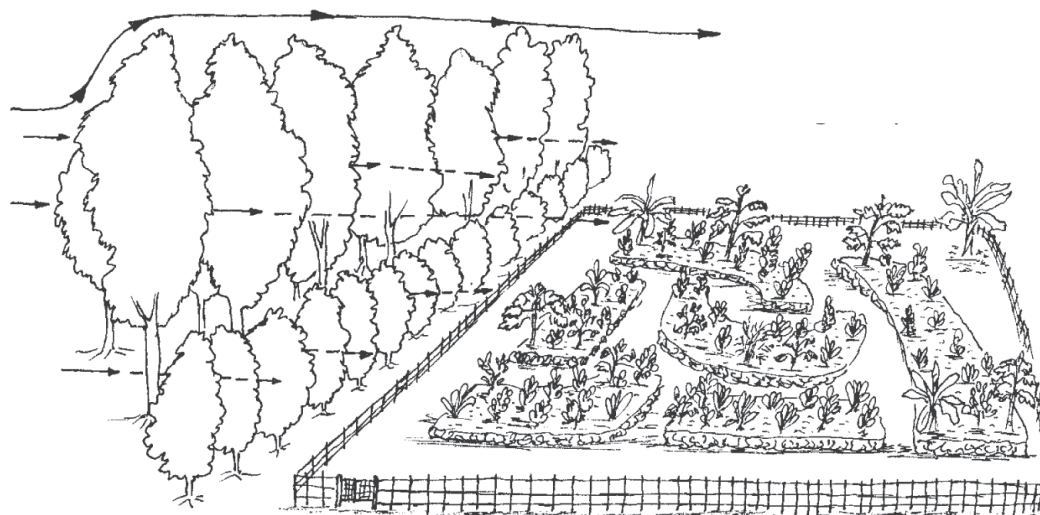
Current potential flooding areas



Destructive winds

Design techniques

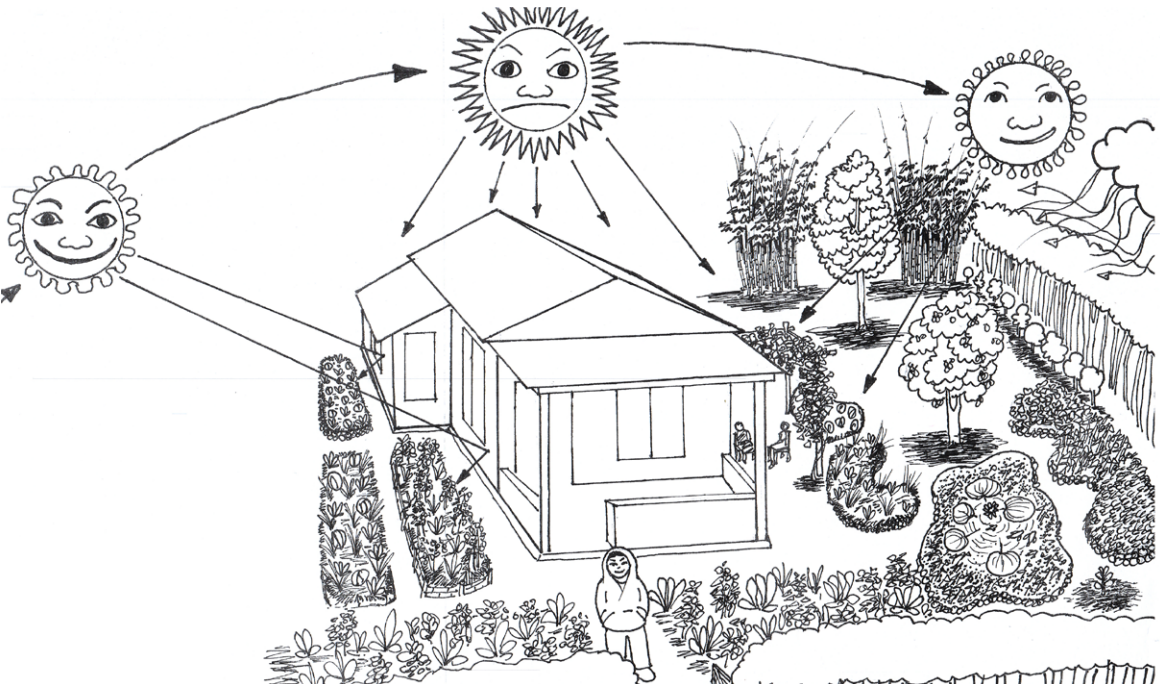
Plant wind breaks in appropriate areas to protect crops, animals, aquaculture and the area around the house. Plant tough trees in very exposed areas because the wind and sun will damage or kill some tree types.



Protecting crops



Protect houses from strong winds by including wind breaks and making house improvements.



Windbreak protecting house and gardens

Mapping

Show from where the winds most often come and at which time of year.

Add where you will place windbreaks and other designs to slow and soften strong winds to protect crops, houses, animals and water bodies.



7. FIRE

Analysis

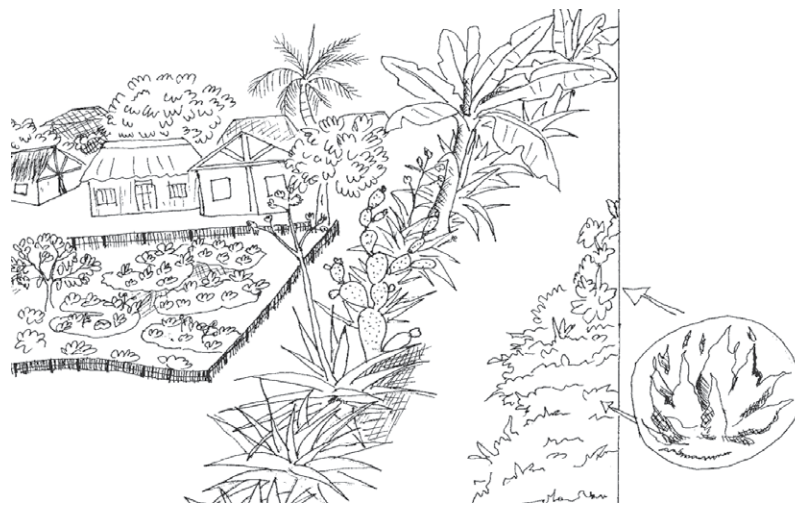
What direction is fire most likely to come from? Where has it come from in the past? Usually fire moves fastest going up the slope and from the direction the wind most often comes.

Design techniques

Clearing a five-metre wide path – a firebreak – along the length of where a fire could come from can slow down or stop a fire before it damages houses, sheds, crops and animals.

Planting a firebreak – two or three rows of fire-resistant trees in long lines with a cleared gap on either side – is even better: e.g. with bananas, papayas, figs, cacti, etc. A firebreak of trees is multifunctional as it also provides food, wood and other resources.

Firebreaks are very important to help protect buildings and animal housing, orchards, vegetable plots and other intensive agricultural areas.



Protecting your land from fire

A very important part of fire management is talking to your neighbours about fire and cooperating with them. Having community meetings about stopping burning, encouraging alternatives to burning and consider introducing compensation payments for fires which spread from one property to another. Firebreaks around whole communities are a great idea for high risk fire areas.

Mapping

If fire is a potential problem for your site, show from which direction it is likely to come.

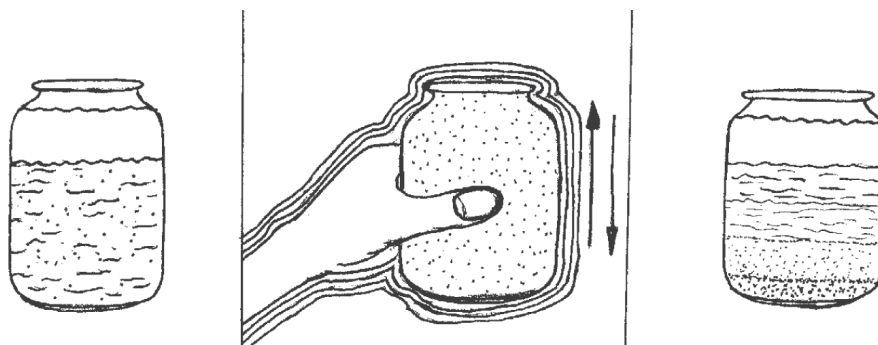
Add firebreaks and rows of fire-resistant trees to reduce or prevent damage from fire.



8. SOIL TYPES

Analysis

Does your land have different types of soil? Are there differences in the depth of the topsoil? How much water does the soil hold? Areas that are rocky, swampy or salty should be noted and treated differently. What is the pH of the soil and do different areas have different soil pH levels?



Testing the soil composition

Design techniques

Look at the soil types section in the chapter on Soil (**Ch 9**) and test your soil to find out what types you have. You can also test the pH of the soil (how acidic or alkaline it is) using a pH tester. Try to use the best soil areas for your most important crops; however, remember not to plant high maintenance crops too far away from your main working area as this costs time and labour. You can improve almost all soil to become productive and healthy if you use good management. Use tough trees for rocky and salty areas, and water-loving plants for swampy areas and think of long-term ideas to make these areas productive.



Making and using compost to improve soil for vegetable gardens and fruit trees



Mapping

Show different soil types on the map, especially any areas with very poor soil.

Mark areas that need special treatment for poor soil or have special features.



A simple example of a soil map.
After soil testing a more detailed map can be made.

9. SACRED OR CURSED LAND

Analysis

Are there any sacred or cursed areas on your land, and will this affect what can be done to the land?

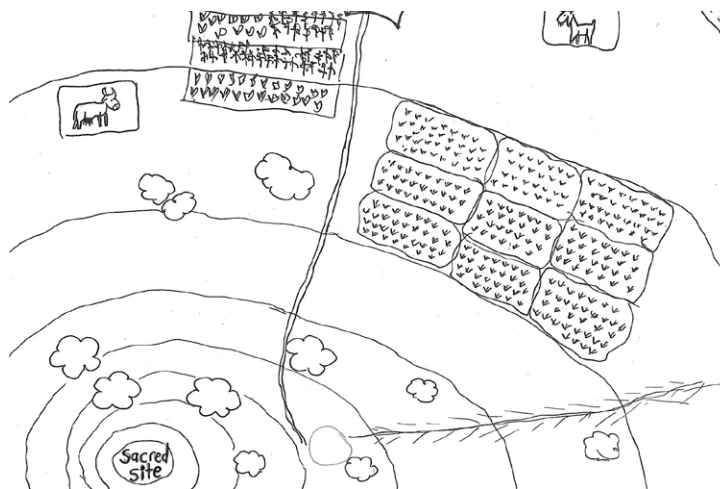
Design techniques

Talk to the elders and leaders of the village or community about the best way to use or heal the land, or if the land should be left untouched.

Mapping

Show any areas of land that are affected.

Add any strategies for working with the affected areas of land.

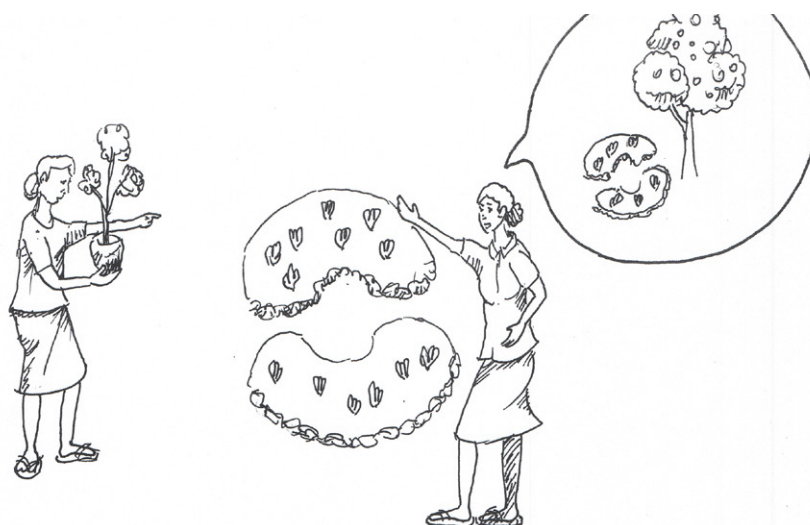


10. ADDITIONAL FACTORS

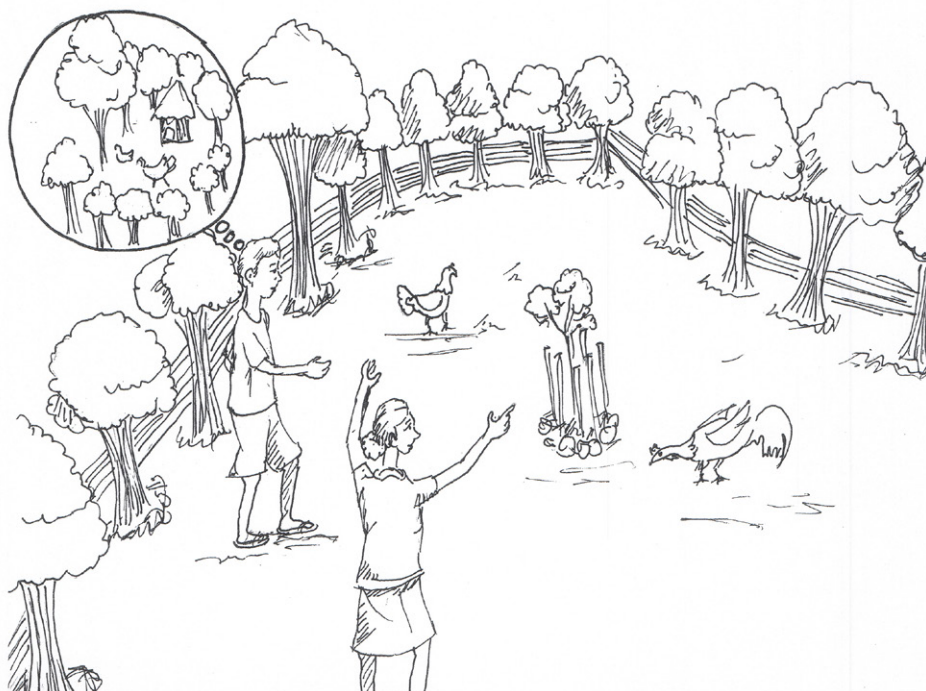
There are many other issues that may impact on the design; these vary from place to place. This includes wild animals, scenic views, neighbours and busy roads. Consider these and other factors in your analysis and include responses as necessary.

For example:

- Protecting crops from certain animals using fences or other animals.
- Preserving scenic views by not planting tall trees in the wrong place.
- Working with your neighbours and making sure that what you does not have a negative impact on them and their land.
- Creating visual and noise protection from busy roads using bamboo or tree hedges.



"Be careful, that tree will grow too big to be next to a vegetable garden"



"That tree will be perfect in the chicken yard because the chickens need some shade"

Zones

Creating and using a zone map greatly reduces the amount of time used and labour needed to create a permaculture system. They show best how to combine compatible elements of your system and help to make the land more efficient, productive and sustainable.

To create a zone map think of the farm as a series of zones. There are five different zones; from zone one starting at the house to zone five which represents land that is natural and untouched. Each zone represents a different area in the system.

The elements are placed in each zone according to:

- How often that element is visited: Zone one is most visited, zone five is least visited.
- How much maintenance is required: Zone one needs most maintenance, zone five needs least maintenance.
- Access to a water supply: Zone one requires daily access to water, zone five requires no extra water.
- The amount of land area that is needed: Zone one uses less land, zone five uses more land.
- Their compatibility with the land.
- Their compatibility with other elements around them.



A community with different elements in different zones



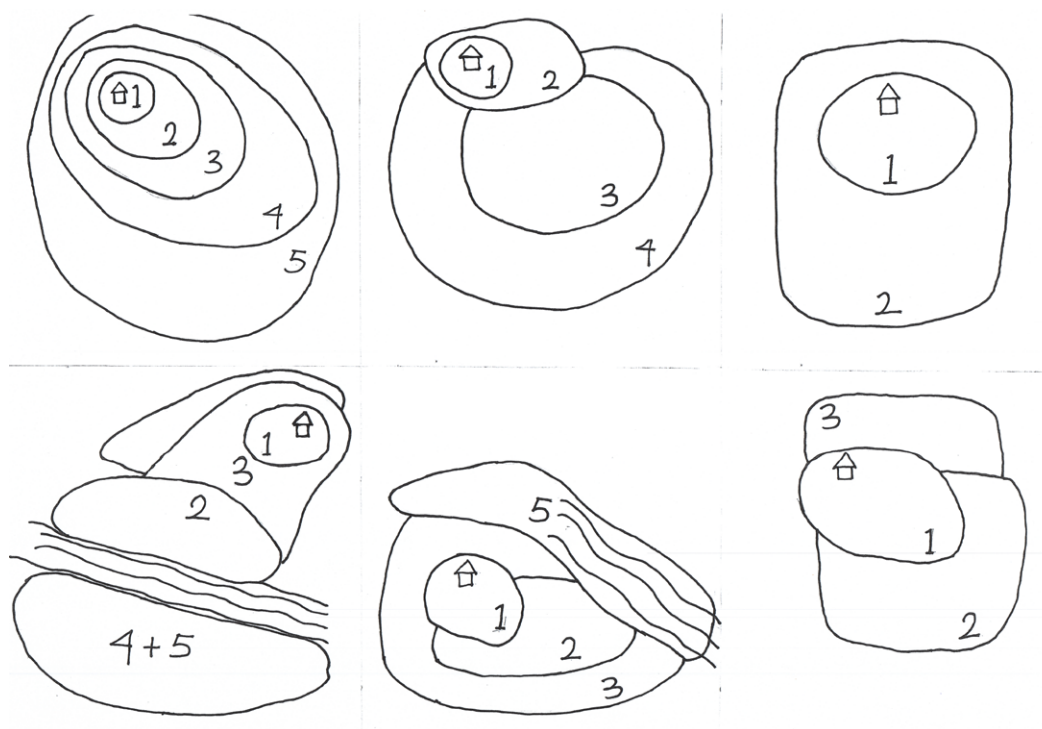
Different situations that affect how land is zoned include:

- Access to water: If there is access to a spring or irrigated water, the land holds many more possibilities for more intensive crops, fruit trees or animal systems.
- Access to roads: If the land is easily accessible by road, produce is easily transported and larger crops are possible. If it is not, is it possible to build a shared road or create access to an existing road?
- Amount of erosion: If erosion already exists or the ground is very steep, the soil must be stabilised with terracing, swales or trees before intensive agriculture can begin.
- Soil quality and the amount of rocks: Very poor or rocky soil either requires a lot of work over a few years to improve the soil or tree crops should be the main production focus. Usually it is better and easier first to establish tree crops then slowly work on small areas for crops and vegetables. Mulching the leaves and branches, the result of pruning the tree crops, helps the cropland to improve a lot quicker.

Using zones

There is **NO** need to include all five zones in every design. For example, in cities permaculture designs are mostly just zone one and sometimes zone two. Match the zones with the size and type of land and the outcome and production goals for the land.

Also, the zones are **never** round circles moving out from the middle. Sometimes they are drawn this way to help explain the differences in each zone and how close or far away they are from the house but, in reality, the zones will be differently shaped in each and every design. There are many factors that determine where zones are and this means that every zone map is different.



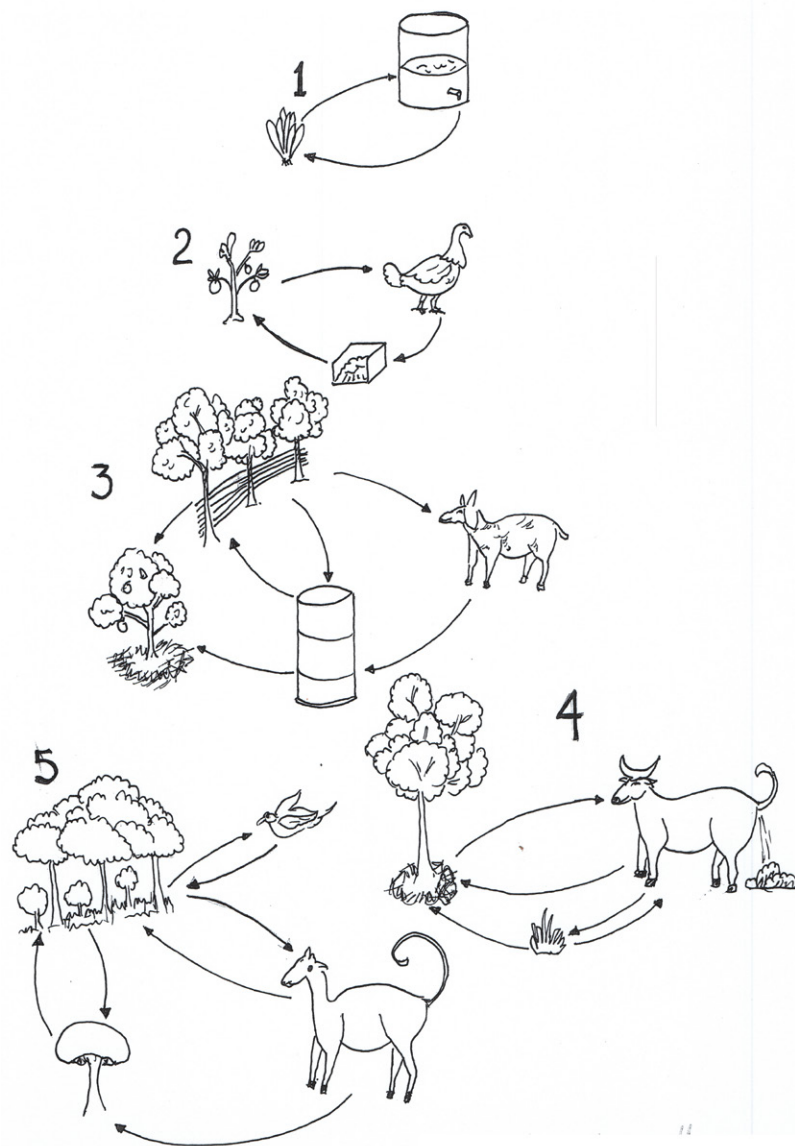
Various zone maps showing zoning possibilities for different situations

Most importantly, zones are about:

- Identifying what you want to do and fitting the elements into the appropriate area.
- How those elements can be made sustainable and self-managing.
- How the elements are connected and integrated within a zone.

Each zone should include how to fulfil the basic needs of that particular zone. This means that, as much as possible, each zone produces what its various elements require to work properly and flourish.

For example, a family garden requires fertiliser. Therefore, in or next to the family garden there should be compost and liquid compost, and most of the materials needed to make them – manures, leaves, legume plants, etc.



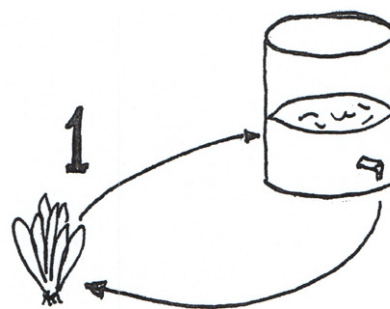
Cycling of elements within zones

The needs for each zone can be divided into categories:

1. **Nutrients** – for the plants and animals.
2. **Energy** – required and/or produced.
3. **Water** – for the plants, animals and people.
4. **Work** – required to achieve the desired results.
5. **Protection** – from sun, wind, pests, floods and other problems.

Zone one

Zone one is the house and its immediate surrounds. In zone one are the elements that are the most frequently accessed and used, require the most maintenance and provide daily household functions.



Cycling of elements within Zone One

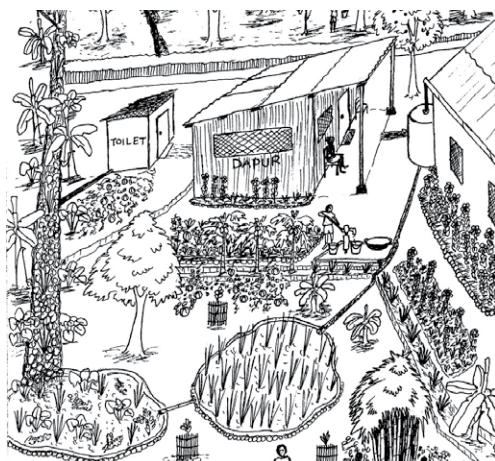
Elements in zone one include:

- House, kitchen, washroom, toilet.
- Nursery.
- Pergolas and vines.
- Intensive household gardens including spiral gardens, compost gardens and wicking gardens (read Family gardens **Ch 10**).
- A few shade/fruit trees.
- Water pump.
- Compost.
- Water tank.
- Waste-water pond.
- Aquaponic system.



Zone One on your map

Now that you have the elements in zone one the important task is to place them effectively together.



Some shade for the house from the afternoon sun is welcome, but too much shade for vegetable plots reduces production. The water pump should not be placed near the toilet to avoid water contamination from toilet waste. A pergola can be attached to the house and used for growing vines, providing a shady, cool area outside. On the sun setting (western) side for hot areas, a pergola keeps the house cooler by reducing direct sunlight.

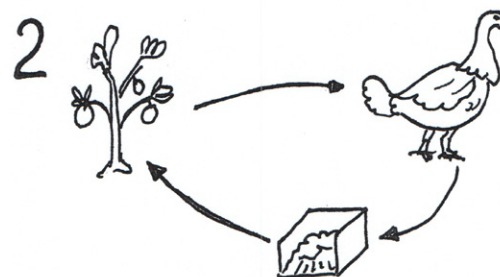
The idea is that those elements which share needs or use what another element provides are placed together. Therefore, the benefits are maximised, and labour and time are minimised. The same idea is used for all the zones and from one zone to another as well.

Zone two

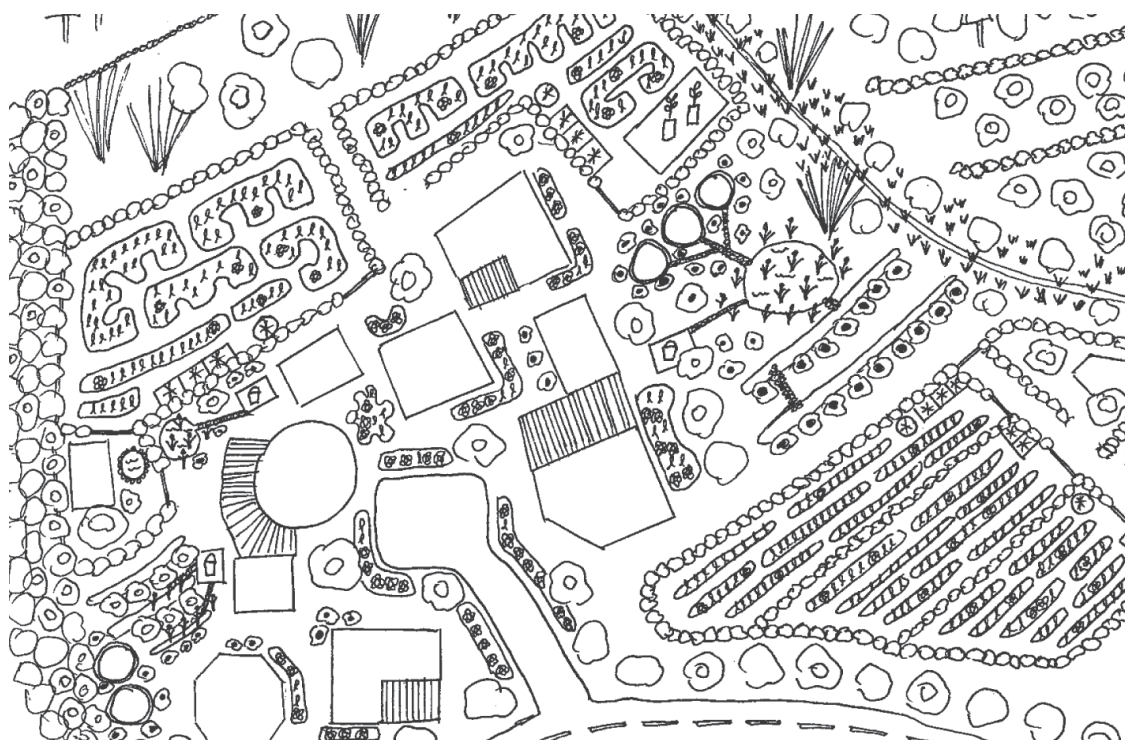
Zone two is for elements that are fairly intensive, requiring frequent visits and maintenance.

Zone two elements include:

- Intensive vegetable gardens and crops.
- Orchards and special fruit trees: e.g. grafted trees.
- Small animal systems: e.g. chickens, ducks, rabbits and sometimes pigs and horses.
- Aquaculture (small scale).
- Compost and liquid compost.
- Terracing.



Cycling of elements within Zone Two



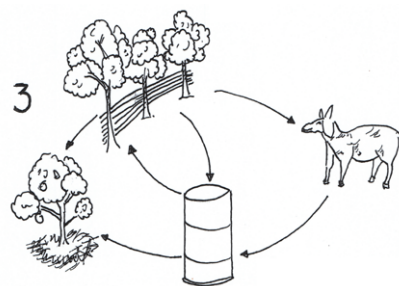
Zone One and Two on your map

Zone one and zone two should also emphasise beauty in the design because they are close to and include the house.

A design focus is reducing heavy work such as carrying water, transporting produce, transporting compost and manure, etc.

Zone three

Zone three systems are usually bigger, need more land but require less maintenance and fewer visits; therefore, they are further away from the house.



Cycling of elements within Zone Three

Zone three elements include:

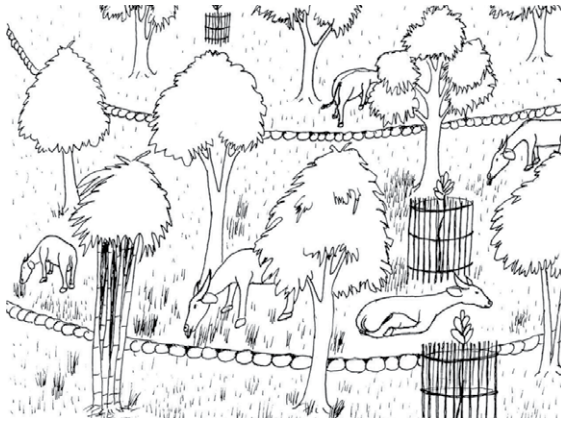
- Larger animal grazing and housing: e.g. goats, pigs, cows, buffalo and horses.
- Large vegetable and grain crops: e.g. rice, corn, cassava and sweet potatoes.
- Fruit trees that require less work and have a shorter harvest time: e.g. avocados, coconuts and jackfruit.
- Intensive reforestation with swales, growing crops, fruit and nut trees, legumes, bamboo, and so on.
- Windbreaks and firebreaks.
- Bamboo.
- Aquaculture.
- Liquid compost.
- Animal fodder trees.



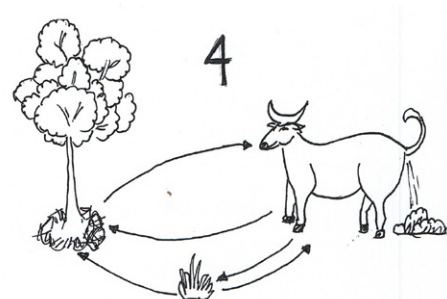
Some examples of Zone Three elements

Zone four

Zone four requires low maintenance and attention, which means minimal water and feeding. It requires more land area, and includes grazing land for large animals and tree crops which are too big and not compatible with zones one, two or three.



Some examples of Zone Four elements



Cycling of elements within Zone Four



Some examples of Zone Four elements

Zone four elements include:

- Nut trees.
- Firewood trees.
- Timber trees.
- Bamboo.
- Grazing land for buffalo, cows, goats, horses, etc..
- Large water bodies.
- Oil trees.
- Coffee plantations.
- Medicine trees.
- Animal fodder trees.
- Rice paddies if there is a water source.
- Swale reforestation with trees crops.

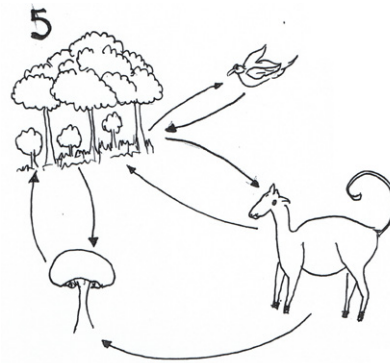


Zone five

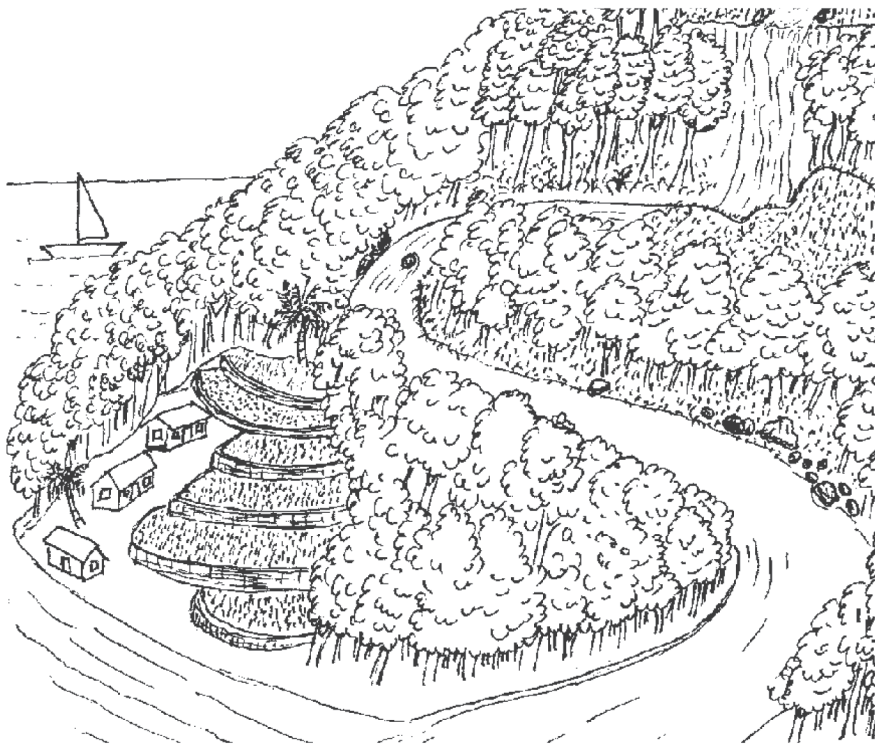
Zone five is land that is left untouched. This zone is very important especially as tropical countries have lost too much of their natural forests already. Natural forests provide many functions such as protecting water sources, food and medicine for humans, food and habitat for native animals, hunting and erosion protection.

Zone five is usually furthest away from the house and can be on land that is difficult to use for more intensive cultivation: For example, steep slopes, waterways, mountains and rocky ground.

Plants grown in zone five should be the native trees of that area, and a variety of sizes, ages and species to copy and encourage the natural ecosystem.



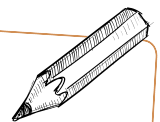
Cycling of elements within Zone Five



Some examples of Zones Four and Five elements

Land described as zones four and five often belongs to the community. Therefore, the best way to look after it is through a community process. In Timor-Leste, the Tara Bandu ceremony is an excellent communal way of protecting land and its resources. (Read Trees Ch 15 for details.) Other countries have their own ceremonies and culture for protecting land from fire, animal grazing and tree cutting. Community decisions also lead to greater understanding for everyone in the community.

SMART IDEAS FOR ALL ZONES:



- Some elements could be in many zones: e.g. corn, pigs and citrus trees. This depends on:
 - Land type, soil quality, area of land
 - Type of technique or strategy used
- Which elements are cash crops and which are for food, trade or family use?
- Integration possibilities with other elements

- Pathways are very important because they connect zones in efficient ways. They provide location points for liquid compost, animal houses and water access. Place productive plants along the pathway borders. The path borders can be small garden plots, flowers, herbs, vines and small fruit trees in zones one and two to low maintenance fruit and trees in the outer zones. This makes use of otherwise non-productive but easy to access land and makes the farm more beautiful!



- Zones can be implemented on a community or village level as well. This idea can help to reduce time, costs and resources for everyone. If the farms work together, production can be more efficient, resources can be reused and shared, and everyone benefits. Read Urban and community permaculture (**Ch 4**) for more information.



Small village with Zones Four and Five on the mountain above to protect from flooding and landslides

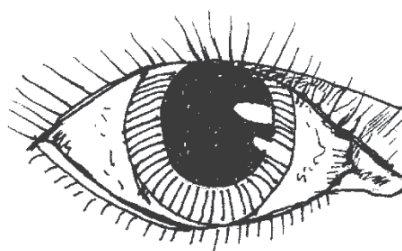
Design exercise for a group: draw a zone map with only the basic zone outlines. On a separate page, draw and cut out different elements (e.g. house, vegetable garden, chicken yard, pond, etc.). Take turns at placing the elements in different ways on the map to design your own farm. Use the information in the zones section to guide your decisions and especially to think about how the elements are connected by placing the relevant elements close to each other.

Observation and data collection

When making a plan for your land, observation is very important; it is the first step when considering what the land can be used for. Through observation you can see how the natural elements affect the land. For example, the same variety of tree grows differently from one area to another. Is this because of the amount of water available, different soil depths and types, wind exposure, amount of sun or another factor? Investigation gives you the answers and leads to a better design.

Nature gives signs that we can look for, such as:

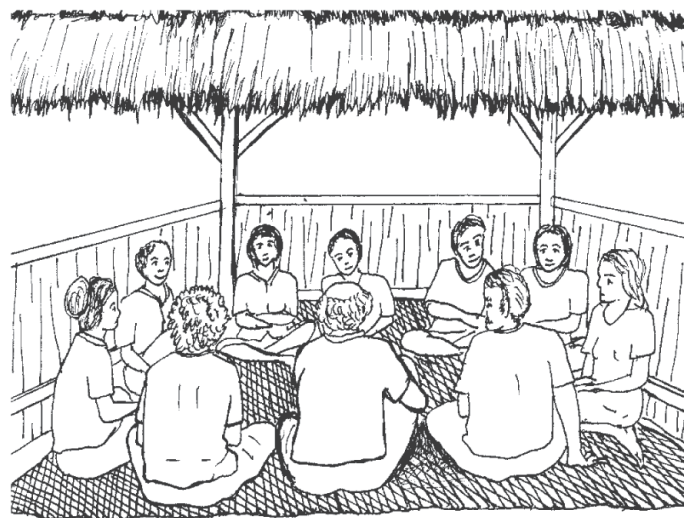
- Fleshy leaf plants and reeds grow better where water is present.
- If there is regular wind, the tall trees grow leaning in the direction the wind blows.
- If there are channels with no soil showing erosion, this is where the water runs in the wet season.
- If the wind is strong, the trees are smaller and stunted.
- Yellowing of the leaves and new growth, and early maturing and small sized fruit or flowers are all signs that nitrogen is deficient in the soil. (See **Ch 9** Soil for more) .



When you observe and work with nature less time and fewer resources are wasted.

Local knowledge

Local knowledge is always an important source of information. In many countries a lot of information is passed on verbally and not written down. Find out as much as possible about the local climate, natural factors, what grows well and what used to grow to reduce potential mistakes. The elders in the community are the best sources of information. This kind of information is also very important when planning for extremes of weather.



Local government

Government agricultural workers can provide information about government projects, weather patterns, seeds and plants, techniques and about what support is available. Setting up a farmers' group helps to make the most of any information and support. Farmer, community and seed-saving groups are also resource bases. Other support groups, such as women's groups, are also very important.

Your group can choose members to work with wider representative groups, such as national farmer networks, and with the government. This approach maximises the benefits of information sharing and support, and the whole community benefits.

Other sources of information are non-governmental organisations (NGOs), agricultural schools, radio, books from libraries, etc., universities and the internet.

Intuition

Use your intuition as part of decision-making processes.

Intuition is about sensing what is right or instinctively knowing what and when to do something. It comes from your insight and trusting yourself, based on your own, and your family and community's experiences and knowledge. It also comes from your spirit.

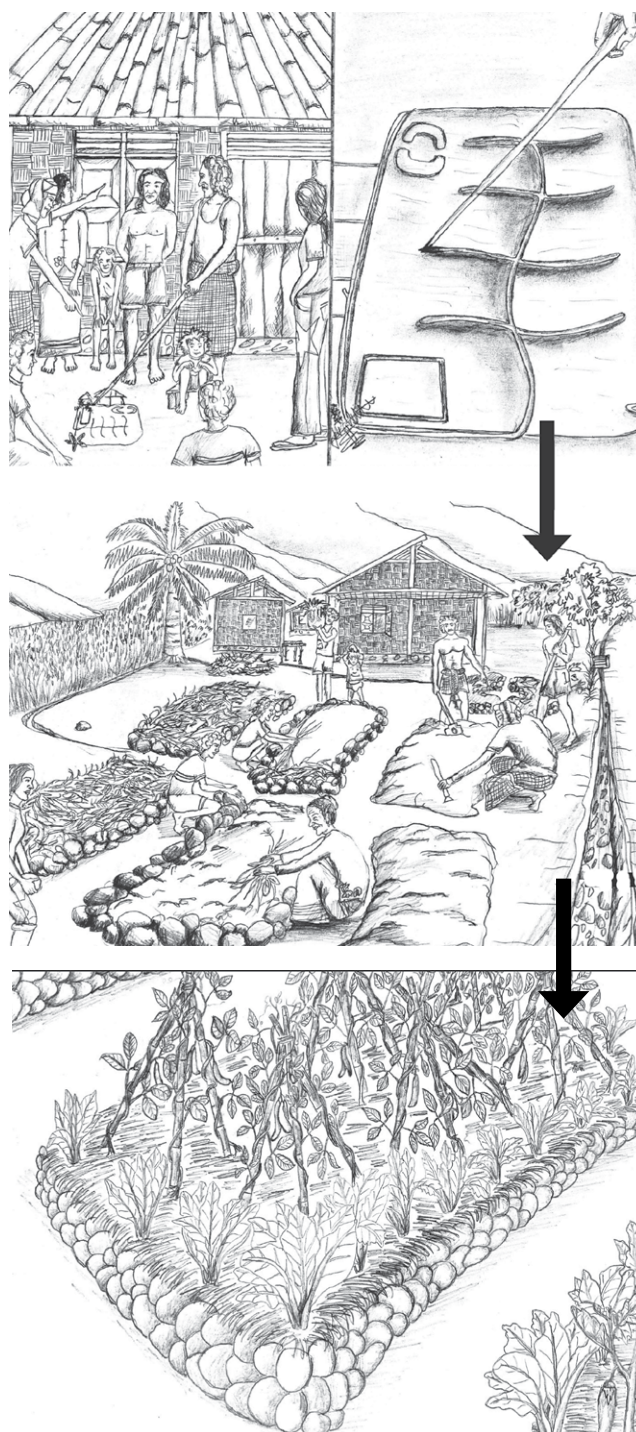
It is very important to look at all the facts and details – especially with technical work – but it is also important to follow your intuition. Intuition allows for new ideas, more creativity, more flexibility and more beauty.

Designs that grow

Creating plans and designs – particularly for the people who do the work – requires that they be included in design development. This means women and children must be part of the planning process, especially in zones one and two where women and often children do much of the work. This greatly reduces the risk of making mistakes and having inappropriate designs that may increase the amount of work and time needed.

Bringing together all the available information to make plans and designs has many benefits, both for now and the future.

Also remember that plans and maps change and can be adapted after one, two and even ten years as knowledge and experience grow. This happens as you learn more, use better techniques, have successes and make mistakes. This is **good!** Everyone makes mistakes and can learn from them to make better plans.



Design techniques

The following design techniques provide the base for any house, farm or project. They:

- Improve conditions for food and animal production and settlements.
- Create a more stable environment and increase diversity.
- Maximise energy efficiency.
- Use and enhance natural patterns.
- Protect against extreme conditions, increase resilience to climate change and provide adaption techniques.

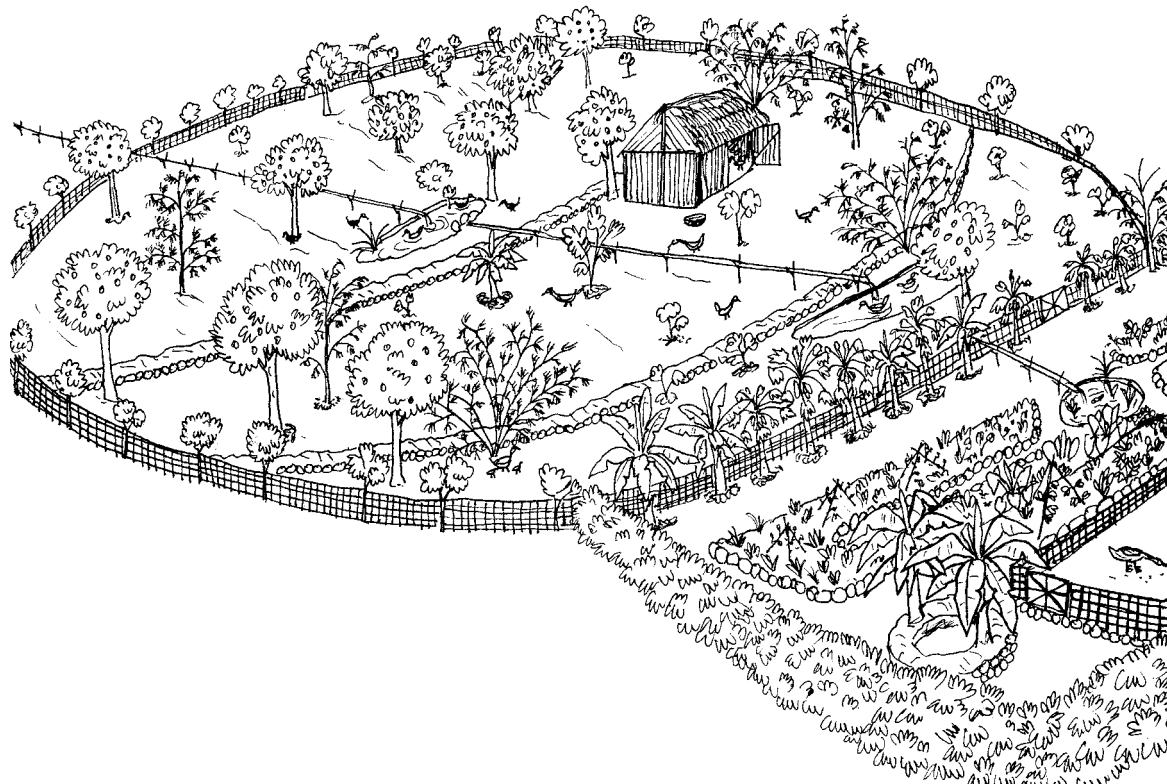
They are at the core of permaculture design principles and techniques and are relevant to every chapter in the guidebook. There are references to them in different chapters where it is appropriate, and you can refer back to this chapter when needed.

Multifunction

When an element is multifunctional it has more than one use. In a permaculture system, the more uses per element the better! Multifunction is also a technique for creating integration. **Every element in a system should be multifunctional.**

Choose elements that have multiple uses or products.

Example: Ducks provide meat, eggs, manure, feathers, weed management, pest control and money from the sale



Ducks provide weed and pest control for fruit trees and vegetable gardens, compost material and liquid fertiliser through the pond water



Position elements so they provide different functions.

Example: Many plants and trees can be grown as living fences and can support growing vines.

Reuse and recycle elements within the system so they provide multiple inputs.

Example: Household 'grey' or waste water can be reused in a pond to grow plants. The plants clean the water and are harvested for mulch. The water is then reused in vegetable gardens, for trees or animals.

The more products and functions each element provides means the more you produce as well as reducing the number of inputs needed.

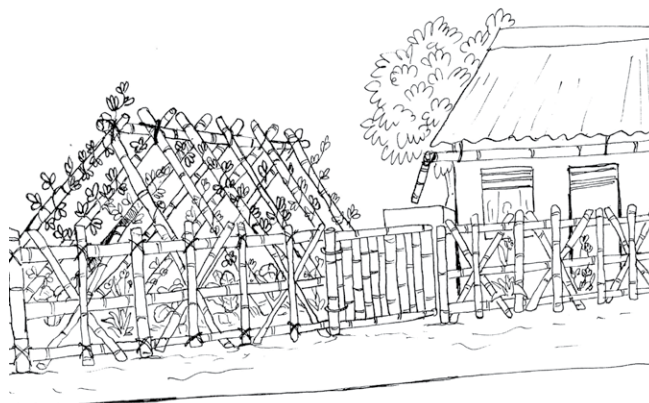
- Bamboo provides many products such as building materials, food, furniture, bags, mulch, buckets, musical instruments, and so on.



- If bamboo is well placed in a system, it can also fulfil others functions such as living fences, windbreaks, erosion control, reforestation and shade.



- If bamboo poles are reused within the system, they provide fences, irrigation, trellising for vines and plant pots.



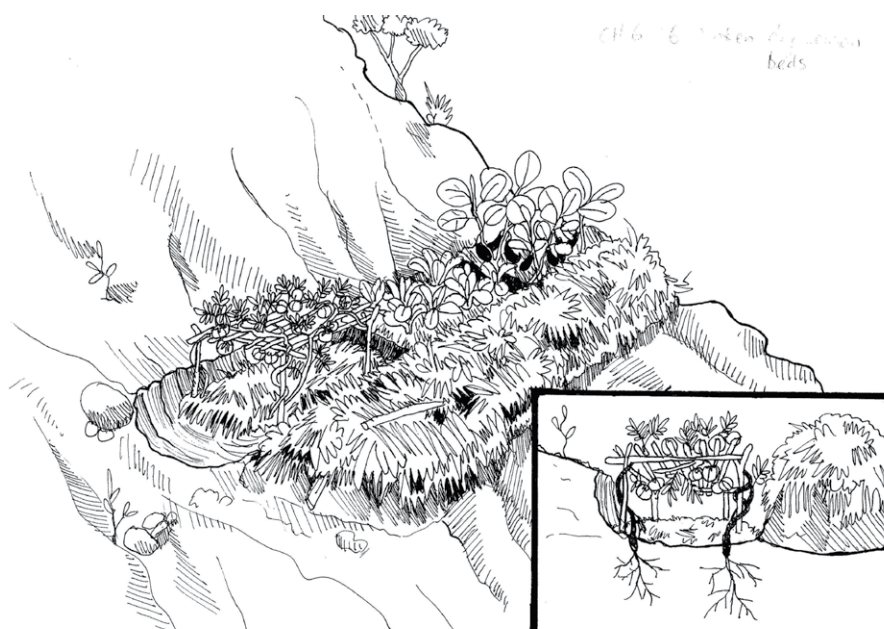
Microclimates

A microclimate is the climate in a particular area, usually different from the surrounding environment. It can be an area of one or two acres, a mountainside or as small as a gully or a swale. Microclimates can be created, changed and improved with good techniques.

Each type of plant has a microclimate in which it grows best. Most plants like microclimates with:

- Protection from strong winds.
- Available water.
- Good soil.
- Sunlight for most of the day.
- More shade when the plant is young.

Providing a good microclimate is especially important for young trees and plants. Plants are healthier and more productive. Any technique used to catch and store water and reduce erosion improves the microclimate and provides better growing conditions for plants.



A swale to catch water in the wet season provides the ideal microclimate for dry season garden bed

Animals prefer specific microclimates. If they are raised in a good microclimate, they are healthier, grow faster, and this may include:

- Some shade.
- Some protection from strong winds.
- An area protected from rain.
- A small area of dry ground.

Other benefits of good microclimates are:

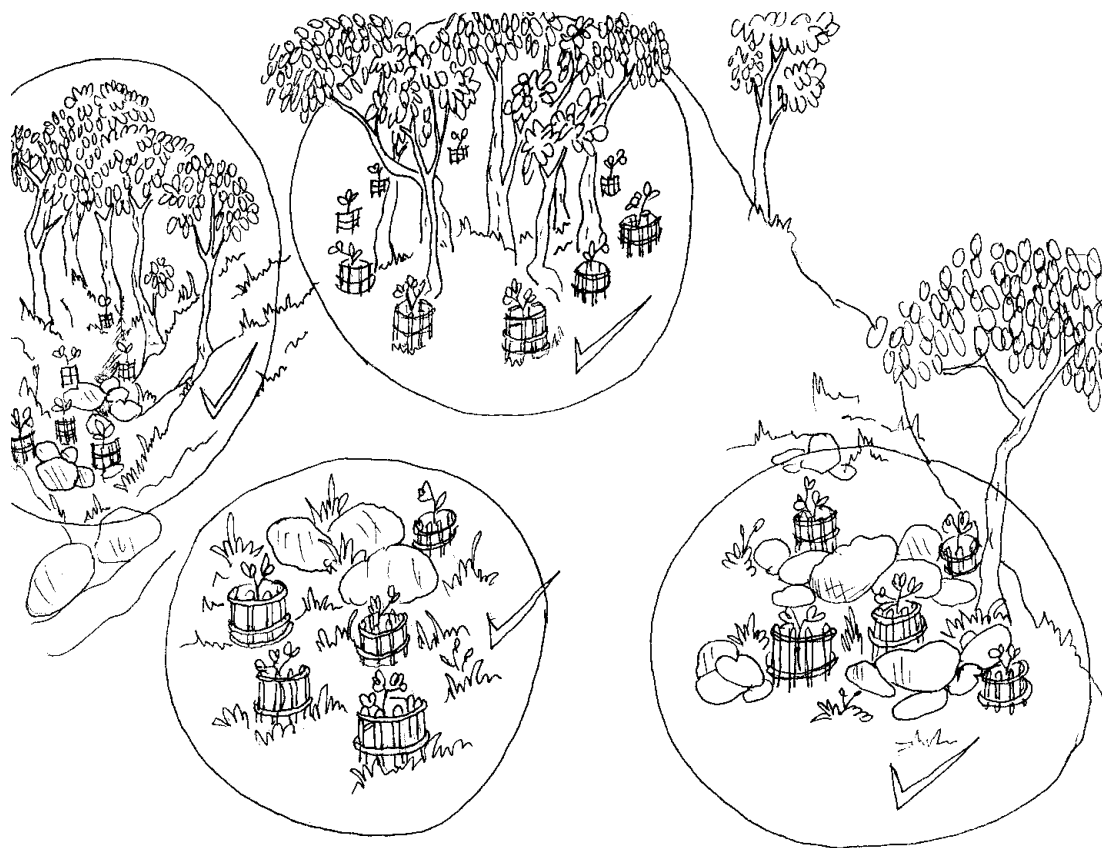
- Improved resilience.
- Increased diversity by creating conditions suitable for plants that previously would not grow.

People also prefer particular microclimates and are much happier and healthier when living in a good microclimate.

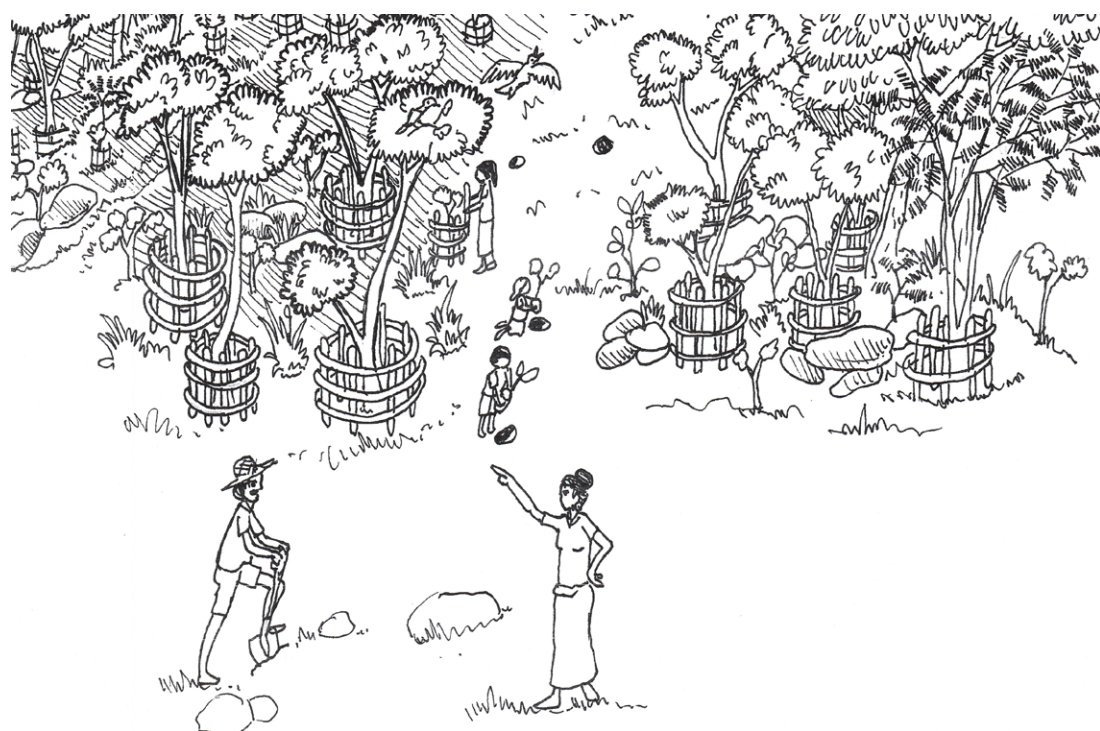


IDENTIFYING NATURAL MICROCLIMATES

Natural microclimates occur everywhere. Identify them by observing changes in soil, vegetation and tree types, moisture levels, sunlight, wind, and how these elements differ from the surrounding area.



Identifying good natural microclimates for reforestation



Building on these beneficial microclimates for further reforestation work in the future

CREATING MICROCLIMATES

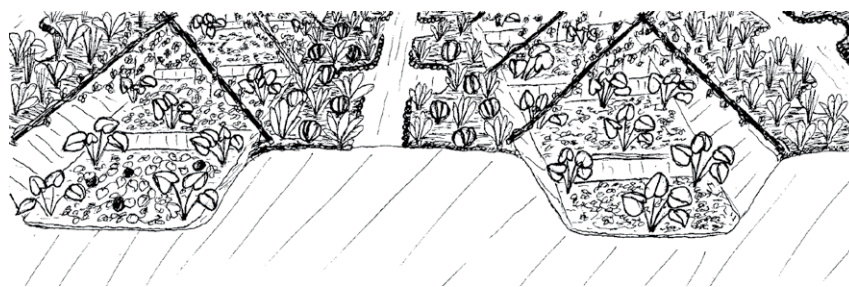
Create microclimates to suit your needs. With smart strategies and techniques you can adjust the natural conditions to become more beneficial for production.

WATER

Designing to catch, store and spread water is vital for healthy springs and underground water supplies, healthy environments and good production. It also creates many new microclimates for you to use.

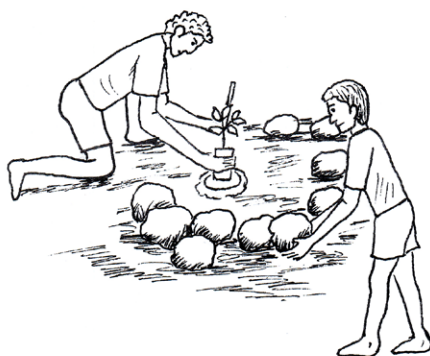
Swales create new microclimates – the trenches are often full of water in the wet season and usually damp. This is a great place for taro, water spinach, water cress and other water-loving plants.

Pit compost/banana pits are sometimes also full of water; they create a microclimate where the soil is wetter than the land around it. This extends the wet season and creates a great place to grow water-loving plants such as bananas.



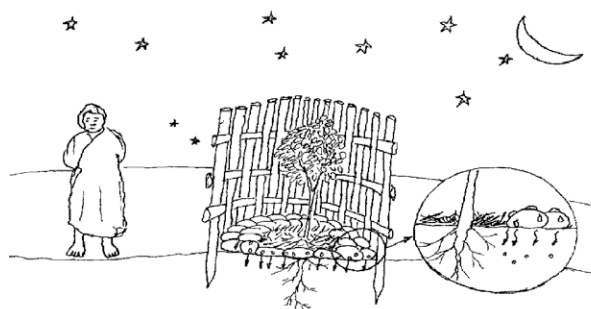
A cross section (profile) of a raised garden beds and sunken small paddies garden system, which creates good a drainage for vegetables and paddies for taro, water spinach, water cress, cannas and other plants

Any construction made from rocks – swales, terraces, net and pan systems, boomerang swales, etc. – helps to improve the microclimate and environment. The rocks also provide homes for small animals and insects. This is especially good for dry areas and for improving reforestation results.



Rocks water trees through condensation.

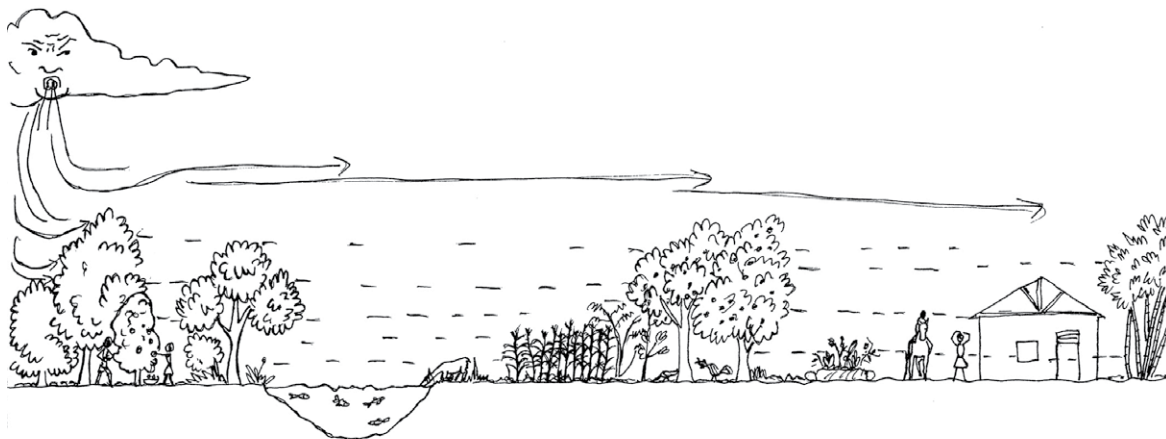
At night, when the temperature drops, the rocks cool down and moisture from the air collects on them. This moisture then drips off the rocks into the soil to be used by the plants. It is an important source of water in dry and, especially, mountainous areas.



WIND

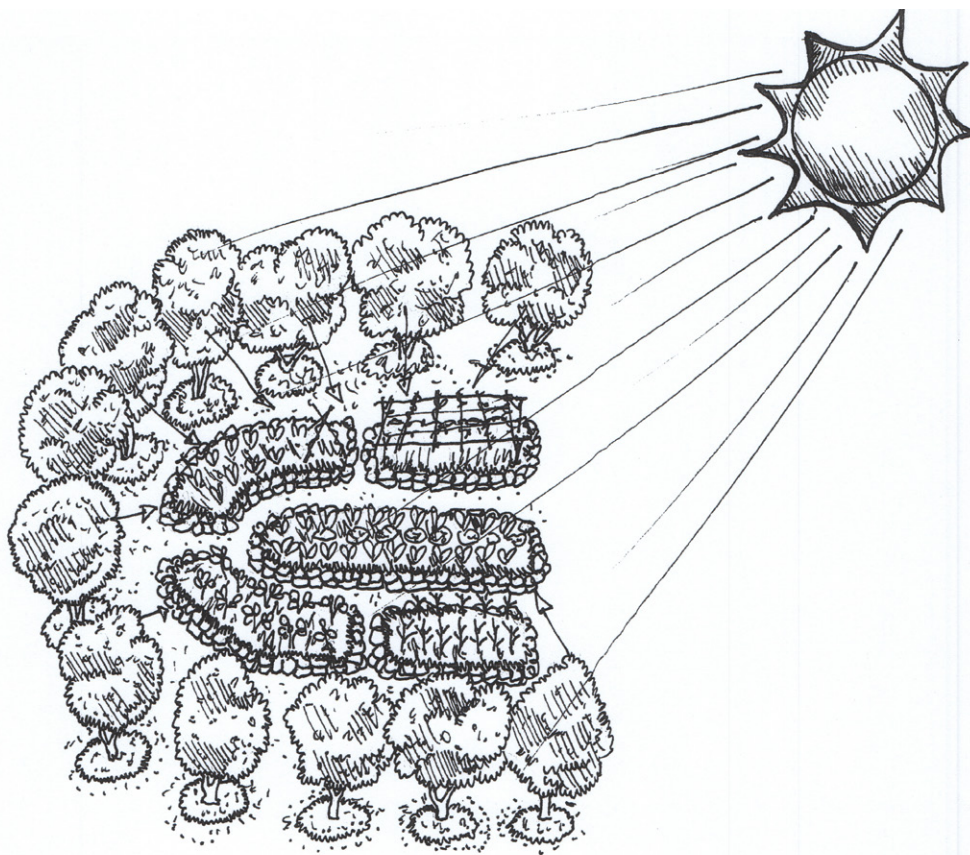
Strong winds are very destructive. As described later in the windbreak section, windbreaks create a microclimate where wind impact is reduced and production improved. They also make living areas much more comfortable.

Vines and hedges also act to reduce the wind and create more sheltered areas.



SUN

In most tropical areas getting enough sun is not a problem! However, in some high altitude areas catching some extra sun and heat can be good. Sun traps are a simple method for creating a warmer microclimate which has more sunlight than the land around it. Create a semicircle of thick waxy-leaf trees, such as guava, approximately ten metres in diameter, which faces north in the southern hemisphere and south in the northern hemisphere. The sun reflects off the leaves and into the semicircle. Vegetables, herbs, fruit trees and other plants grow better, and you can also grow plants that do not like the cold.



SHADE

Too much sun can sometimes be a problem, especially before the wet season, and many plants prefer a small amount of shade. Many methods for creating shade are included in this guidebook:

- Shade trees (**Ch 15**).
- Pre-wet season shade (**Ch 10**).
- Trellising (**Ch 10**).

People like shade as well! Pergolas, horizontal trellises and large trees create shade for meeting and sitting areas.

MODERATING HEAT

Pergolas and horizontal trellising also moderate heat. Windbreaks and trees transpire moisture which makes the wind cooler. Water bodies, such as fish ponds and small dams, heat up and cool down more slowly than the land around them. This moderates the temperature around them, making it slightly cooler during the day and slightly warmer at night.



MODERATING COLD

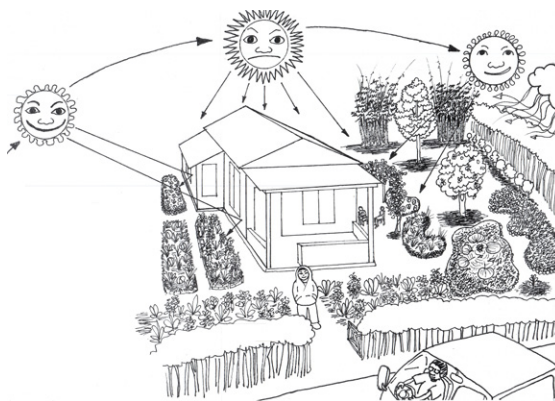
Water bodies in cold mountainous areas reduce or prevent frosts. Sun traps also moderate cold. For houses in mountainous areas solid walls, especially rock walls, store heat during the day then release their heat at night.

PLASTIC HOUSES

Plastic houses can be used for creating microclimates to improve conditions for vegetable growing. They can be different shapes – from closed tunnels to simple roofs – and different sizes, depending on what they are needed for. They are expensive to build and are best for growing commercial crops, especially as part of a cooperative. Different uses include:

- Preventing rain which allows plants, such as broccoli and cauliflower, to grow in mountainous areas and tomatoes to fruit for longer periods.
- Reducing the cold, which extends growing times for vegetables in cold mountainous areas.

USING HOUSES AS MICROCLIMATES



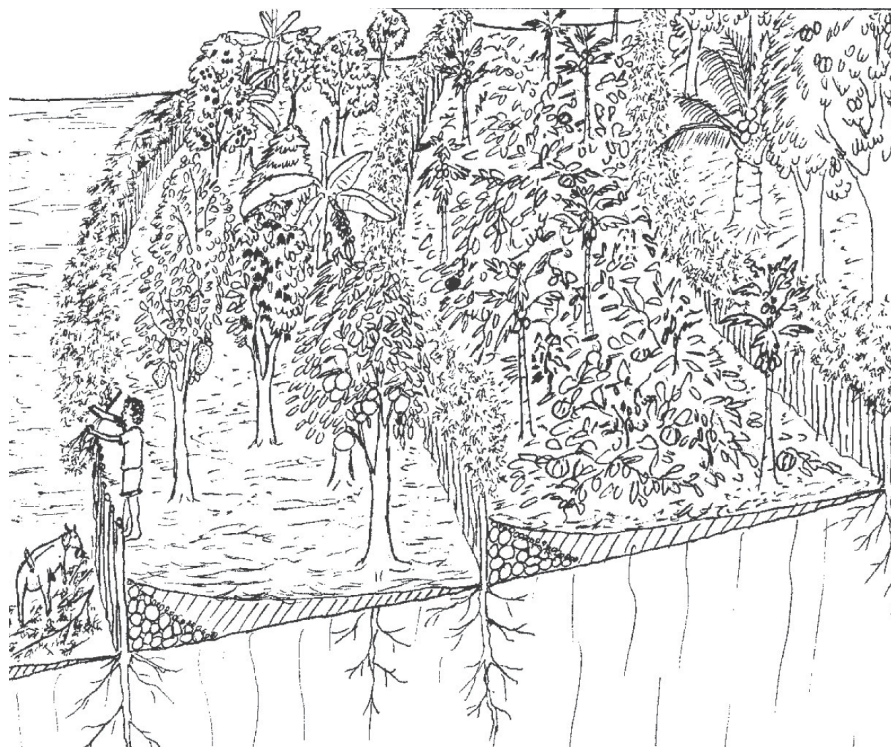
Houses can greatly improve plant growth and food production. Extremes of wind, sun, shade, cold and warmth all change around a house and, with good design, these changes can be used to grow plants.

Imitating natural ecosystems

One of the most important design tools of permaculture is to understand and copy how nature works. The balance of ecosystems is a response to the conditions and climate, and it is always changing and reacting. Nature does not waste anything; there are no rubbish dumps, and we should not have them either!

By imitating nature in our designs we ensure that we live within the limits of nature. If we exploit nature we live beyond its limits, the results of which are waste and destruction.

Natural ecosystems always have a lot of diversity. There are many examples of how a diverse production system helps us to be more resilient and have a more stable income. Read the diversity principle in **Ch 1**.



Diversity in a productive system

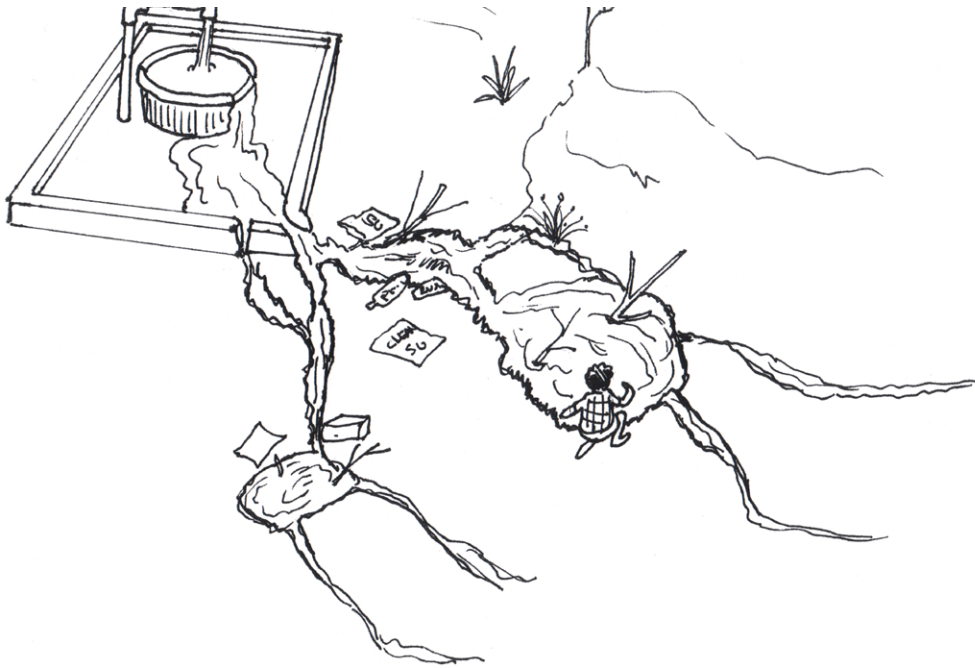
Natural ecosystems provide all their needs from within the system. Design your production systems to do the same. Some examples:

- Do not just to make your own fertilisers instead of buying them, but produce as many of the materials needed for the fertilisers as possible.
- Grow your building and construction materials.
- Grow as much animal food as possible.

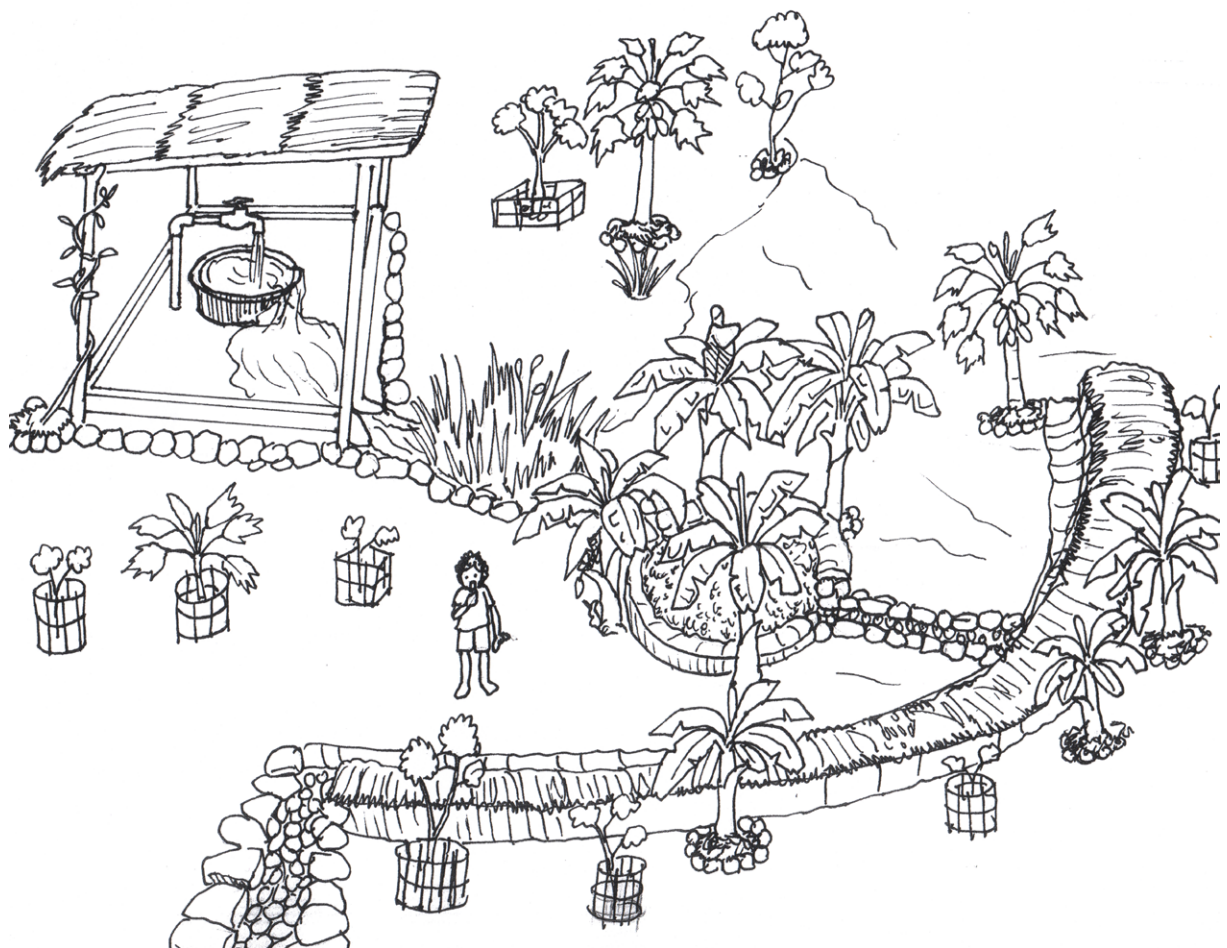
The “food forest” is the strategy of creating a productive ecosystem that imitates a natural forest. It has canopy trees, tall trees, understory trees, vines, shrubs, ground covers and root plants – the same as a forest – but they are all productive plants and they all grow well in that situation. The process of growing a food forest copies how a natural forest is established. Read more in Trees (**Ch 15**).

Natural ecosystems always find a balance between pests and predators. Integrated Pest Management (**Ch 14**) achieves the same balance for our productive systems to minimise pest attacks.

Natural ecosystems have self-cleaning mechanisms. Permaculture systems make sure all the land is healthy and all the water is cleaned of bacteria and excess nutrients and minerals (e.g. house water) so it can be safely used and reused.



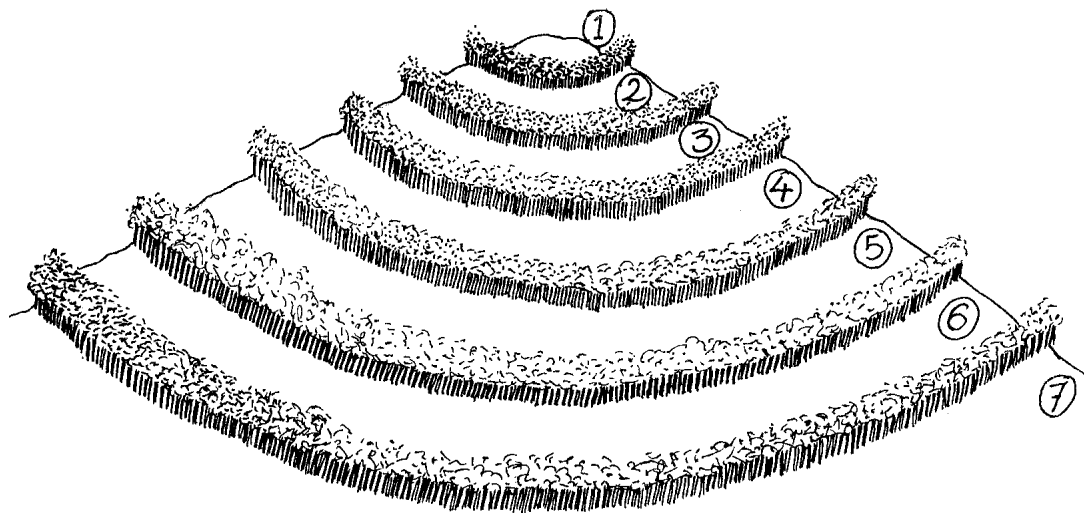
Water from community water tap is wasted and causing problems



Water from community tap being cleaned, caught and used for growing fruit trees

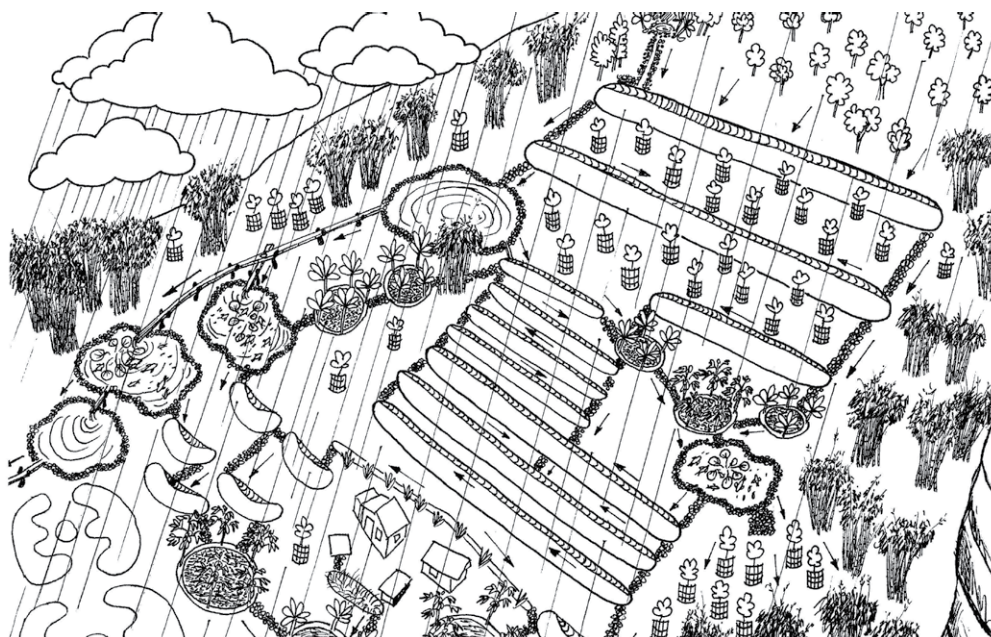
Catching water: swale and terrace systems

A swale is a trench that is dug **on contour** – the same level from end to end across a slope. The soil and rocks dug from the trench are put just below the trench to form a long mound (or a berm). It makes a level line from one end of the swale to the other end. Swales can also be a small wall built from rocks, branches or other materials. Usually many swales are dug on a hillside, one below the other. They are similar to terraces but are better at stopping and storing water, soil and mulch.



When you have a good swale system in place it controls where the rain and irrigation water goes.

1. It catches, spreads and stores water in the ground where you want it, which for most rain events, is all of the water.
2. For heavier rain events the swales allow excess water to flow easily through and out of the system without causing erosion and damage but still retaining most of the water.
3. For very heavy rain events the swales allow the rain to flow out of the system where **you** want it to go without causing damage or flooding.



BENEFITS OF SWALES

Swales provide many important benefits for agriculture and tree crops – they:

- Stop erosion.
- Improve the soil by holding compost, manure and mulch.
- Catch and spread rain and irrigation water.
- Extend the wet season by weeks and, by holding extra water in the ground, they reduce problems from dry periods during the wet season.
- Restore ground water levels.
- Reduce or prevent flooding.
- Protect and even renew natural springs.
- Create new microclimates on the land.
- Water that leaves the swale system via overflow points can then be directed for further use such as for irrigation, water catchments, aquaculture ponds, banana pits, rice paddies or soaked up by tree crops.



These benefits all lead to faster growth, higher production rates and fewer crop failures. Swales can be used for small or large amounts of land and on steep or gentle slopes.

Swales are great for vegetable crops, tree crops, animal systems, reforestation, bamboo or a combination of these. A combination provides more stability, and security of food and income.

Specific swale systems are also described in the Family gardens (**Ch 10**), Sustainable agriculture (**Ch 13**) and Trees (**Ch 15**).

Swales also provide other important benefits:

- Swale systems above houses and communities prevent most flooding by holding and moving the water away.
- They improve reforestation project success rates, especially in remote areas where it is difficult to water the trees.
- They catch, store and move large amounts of water and are excellent for collecting extra water for small dams, fish ponds and in-ground water storage tanks.

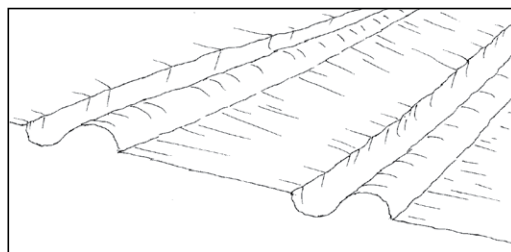
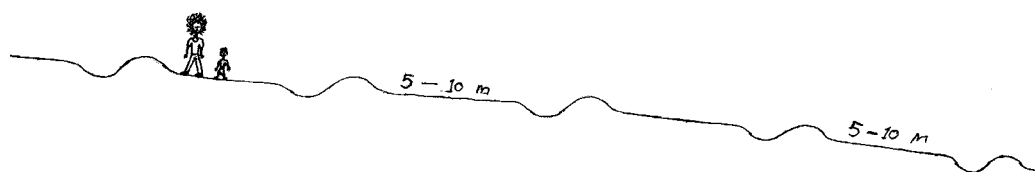
Important:

Some land has a limestone rock layer underneath. In very heavy rains, and if the soil is heavy with a lot of water, the soil can sometimes slip. This can be very destructive. Sometimes it cannot be prevented, but it is very important to reduce the risk as much as possible. The best way is to plant trees with deep roots. On land where swales are made and especially steep sloping land, trees **MUST** be planted straight away to help prevent this problem. The best trees to use are fast-growing large legumes, such as leucaena, gliricidia, albizia, acacia or casuarina, with other longer-lived trees that will eventually replace them.

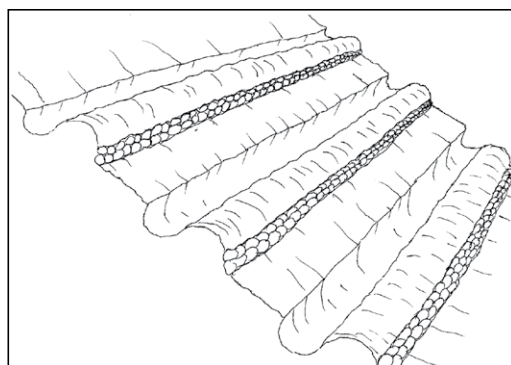
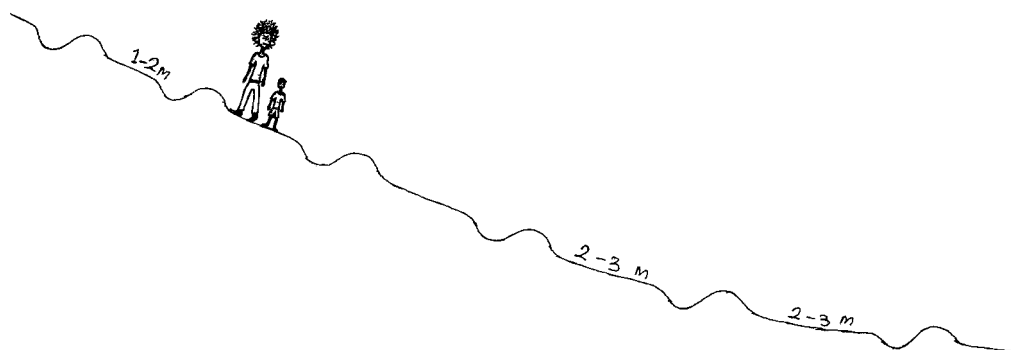


SWALE SIZES

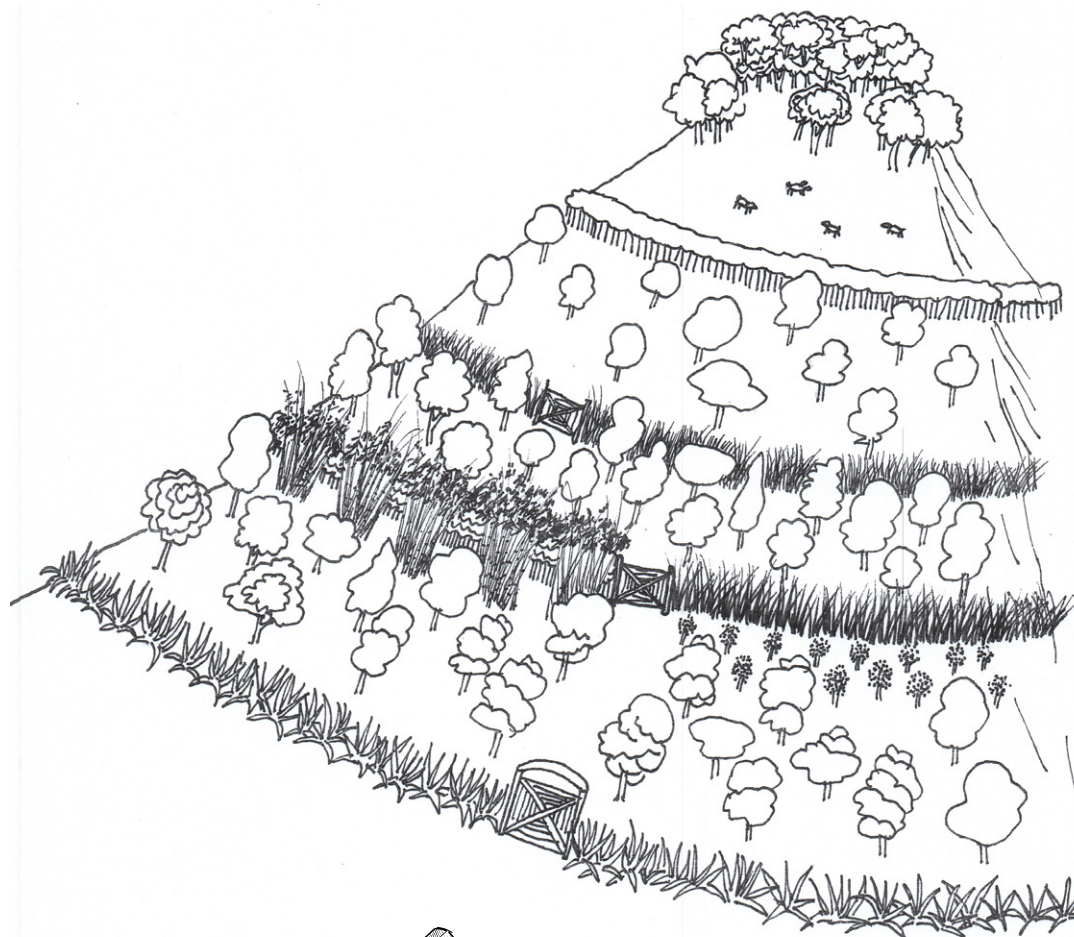
On gentle slopes swales are larger in size and made between three to ten metres apart, depending on the situation.



On steep slopes swales are smaller in size and made closer together. This is because water runs faster on steep slopes and must not be allowed to build up and flow fast. This causes erosion and can damage or break the swales. For steep slopes construct swales one to three metres apart, depending on what you want to plant. For vegetables make them closer together, for trees they can be further apart.



On very steep slopes it is best not to dig swales because the water runs too fast and the soil does not stay when the swale is dug. A good idea is to plant trees in the ground, on contour. If they are planted very close together they grow and form a living swale that slows the water and prevents erosion. Rocks and dead sticks can also be placed against the living swale to help stop more soil and water and improve the result. Eventually the soil builds up behind the trees and forms a small terrace. Other trees, or vines, such as pumpkin, luffa or passionfruit, can be grown as well.



SMART IDEA:



Head to toe alignment for swales

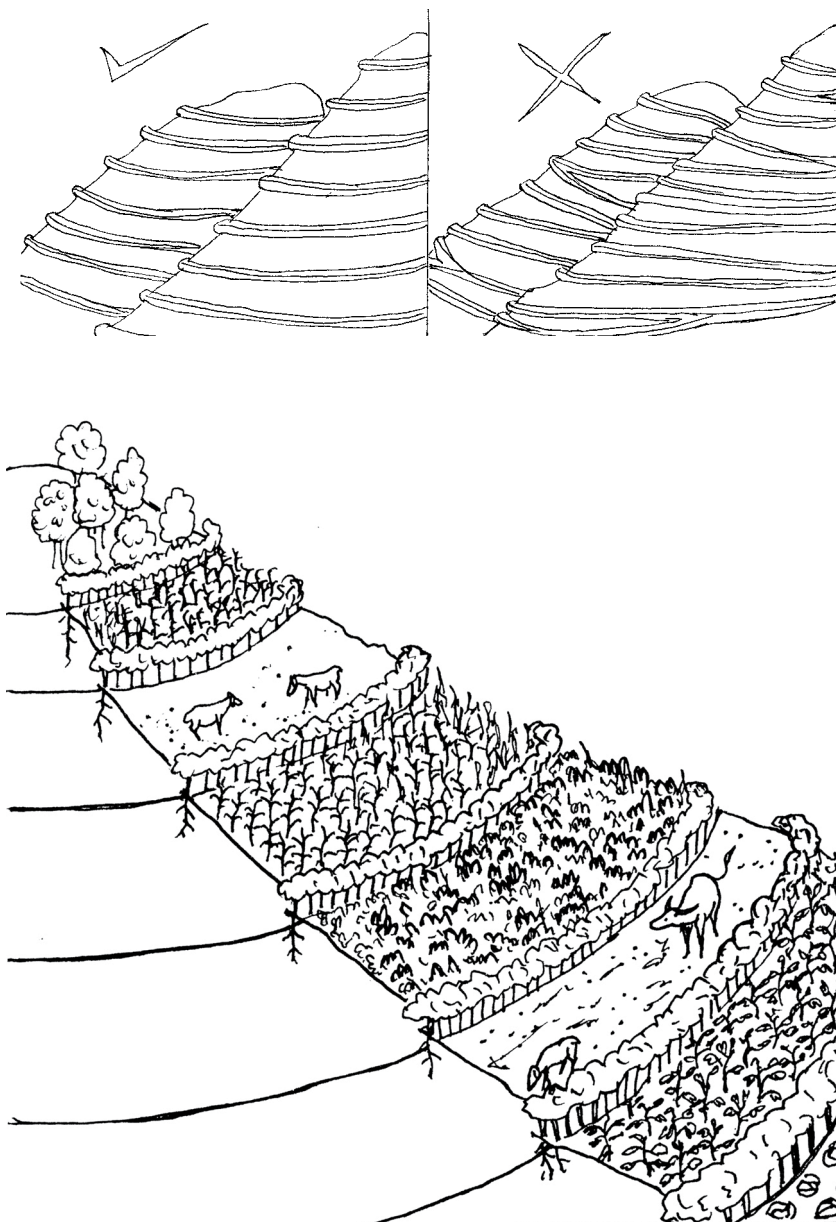
Swales can be made so that the toe (bottom) of a swale mound is the same height as the head (top) of the swale mound below it. A piece of string and a builder's spirit level are the easiest tools to use to determine the levels. This technique decides the distance between each swale. When the swales get closer than two metres apart it can be more successful to grow perennial rather than annual crops. When the land is too steep and head to toe swale alignment does not work, do not dig swales.



How to make a swale system

Observe and walk over the land where you plan to dig the swales. Include in the design how many swales you want to make and where they are to go. Remember to use the ideas about swale size and distance between the swales.

It is very important that the swales are level – on contour. If they are level, the water sits in the swales and soaks into the ground evenly. If they are not, the water runs along the swales and breaks them at the ends or at the lowest point. This causes a lot of damage.



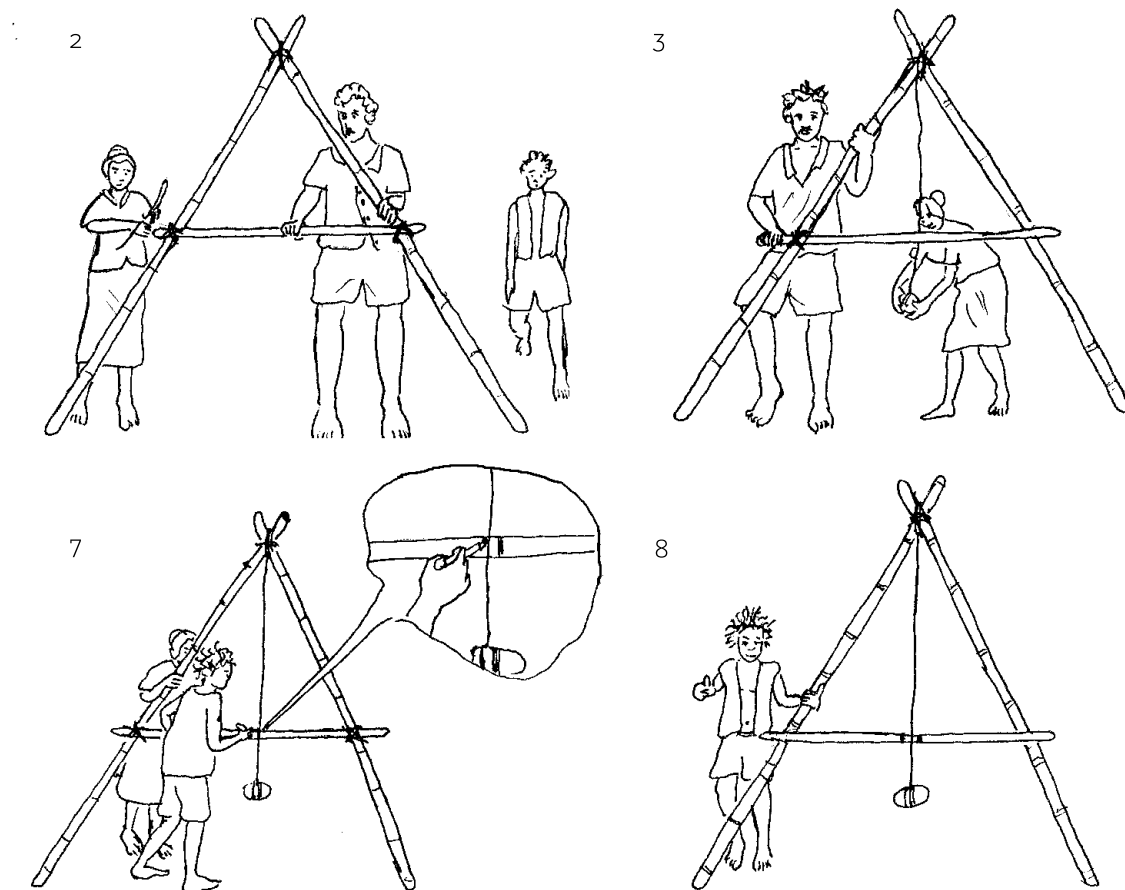
The first step is to mark out the contour lines using a simple tool. Two simple devices are an A-frame and a water level – both are easy to make and use – but the water level might require that you buy some equipment.

A-FRAME

An A-frame is a measuring tool made out of wood or bamboo that helps to make the swales level. It is about two metres high, two metres wide and is the shape of an "A". It is used to mark on the land where the swales are to go.

Construction

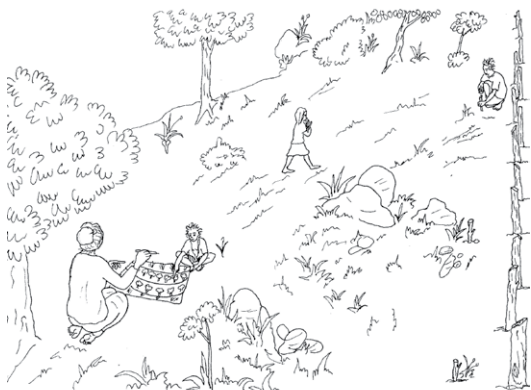
1. First, to construct the "A" from wood or bamboo, cut two legs of the same length (2m approximately) and a cross piece half the length of the legs.
2. Make sure the cross piece is the same distance from the top on both sides, and tie the "A" together securely.
3. Tie the string to the top of the A-frame, and tie the rock to the bottom of the string; the rock must be below the crosspiece.
4. Find a flat, level area to stand the A-frame.
5. Make a mark on the ground where the legs stand, and mark the cross piece with a knife or pen marker exactly where the string touches it.
6. Turn the A-frame around and place the legs on the marks on the ground.
7. Again, mark the cross piece where the string touches it.
8. The A-frame is exactly level when the string sits in the middle of the two marks. Put a third mark here.



HOW TO USE AN A-FRAME

Step 1:

Start at one end of the TOP swale you want to mark out. Cut any tall grasses that may obstruct marking out the contour lines.



Making a plan and preparing the site

Step 2:

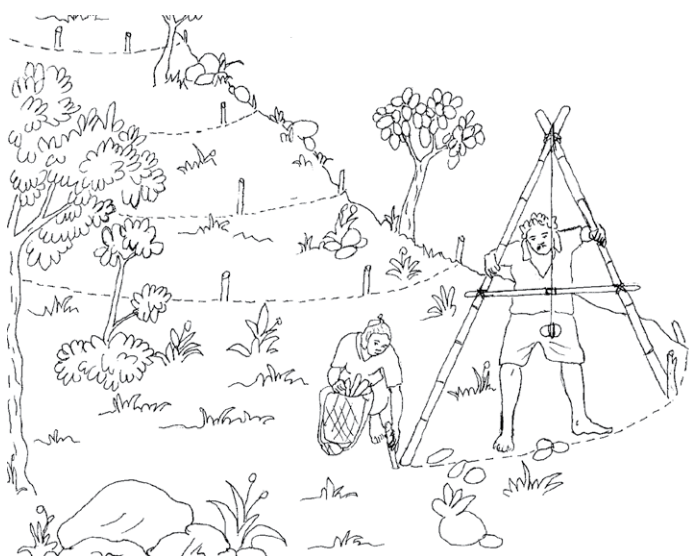
Place the A-frame on the ground so it is level and the string touches the middle mark on the crosspiece. The A-frame is now on contour. Place a stake at either end of the A-frame to start marking the line. Put the stakes below the frame legs and continue to do this with every stake.

Step 3:

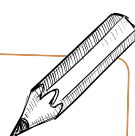
Move the A-frame across. Place the back leg at the stake where the front leg was and repeat Step 3. When the string shows the A-frame is level, put another stake below the front leg. As you continue, the line you mark out across the mountain is the contour line.

Step 4:

Repeat the process until the line is complete, and start again below with the next line. Continue until you have marked out with stakes all the contour lines you need.



SMART IDEAS:



- When using the A-frame it is a lot easier and faster with two people. One person can operate the A-frame while the other can mark out the contour line with the stakes.
- Do not place either end of the A-frame on rocks, on small mounds or in small holes. This makes the lines inaccurate and causes problems later.

Alternative method: If you have access to a spirit level (a tool to show if a surface is horizontal or vertical), you can tie it securely to the top of the cross piece. Use the A-frame in the same way, and find the contour line when the spirit level is flat.

WATER LEVEL

A water level uses water in a clear plastic tube with each end attached to a vertical pole and measurements marked alongside. When the land is level, the water in both sides of the tube should be at the same height on the poles, so you can mark out the contour lines on sloping land. It is very accurate and much quicker than an A-frame for larger areas.

A water level is most accurate and easiest to use when four people operate it; one person each to hold and move a pole and the other two to check the water level in the tube at each pole and put the marker stakes in the ground.

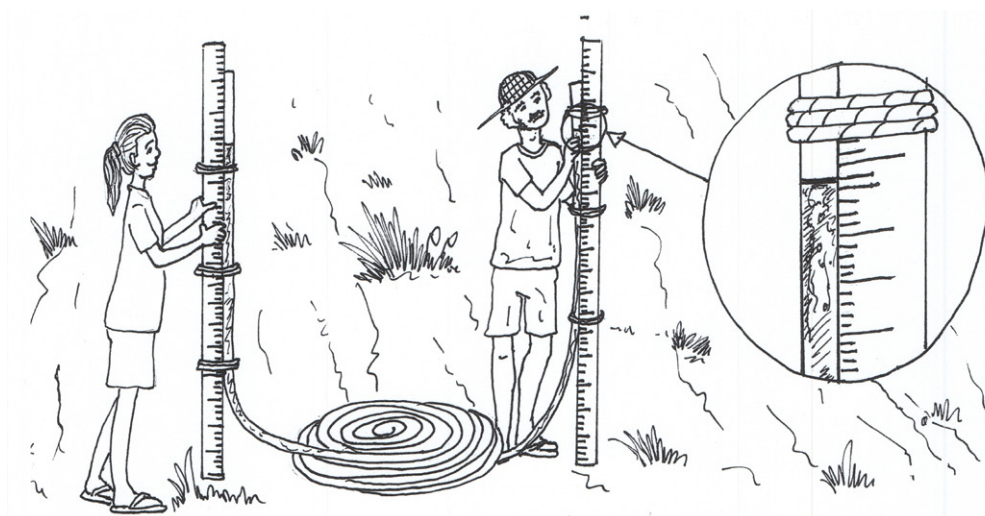
Materials:

- Two straight poles of wood or bamboo, both two metres in length.
- 10 metres of clear plastic tube 1 to 2 cm in diameter (you can use less, 5mm is the minimum, but 1 to 2cm is much easier).
- Tape.
- Permanent marking pens.
- Measuring tape or a ruler.
- Knife.

Construction

1. Use the tape to secure each end of the tube to the poles. The ends of the tube must both be 50cm from the top of the poles, and the tube must be taped near the top and again 50cm from the bottom.
2. From the bottom, use the measuring tape or ruler to mark out the measurements on the poles. Start 50cm from the bottom. Mark out every centimetre up to 1.5 metres with a permanent marker. For bamboo use a knife first then a permanent marker on each knife mark.
3. Starting from the bottom mark, either add a number to every fifth mark – 50, 55, 60, 65, etc. – or use a different colour for every fifth mark. These markers are to measure the height of water in the tube.
4. Fill the tube with water until it is full with no air bubbles and the water reaches approximately a metre high on both poles.

Now you are ready to go!

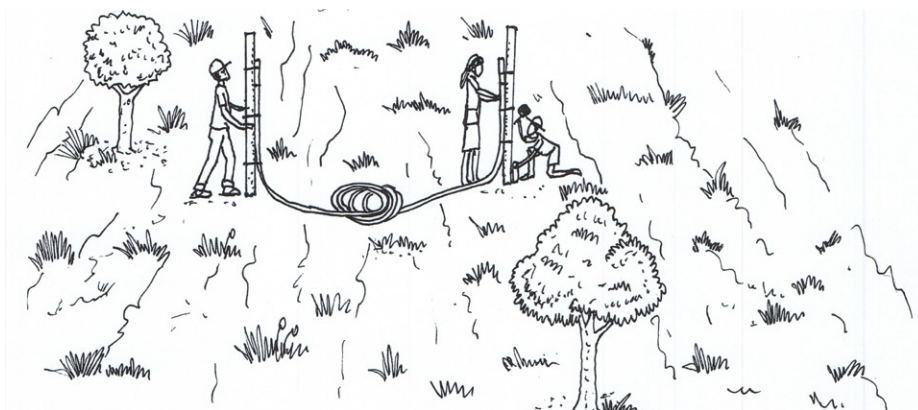




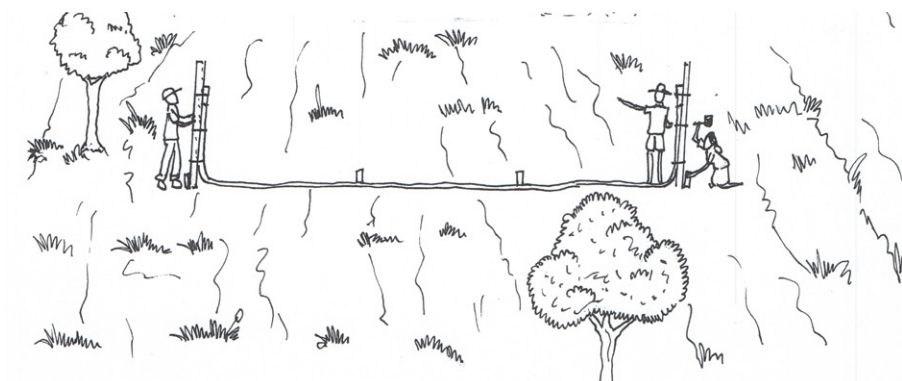
HOW TO USE A WATER LEVEL

Step 1: Start at one end of the **top** swale you want to mark out. Place one pole at the end point where the swale is to go and mark it with a stake.

Step 2: Move the second pole approximately two to three metres along. Observe where the water level is on each tube. Move the second pole up or down the slope until the water sits at **exactly** the same mark or measurement on each pole. It does not matter how high the water is; it only matters that it is at the same mark on either side. Now that you have found the contour line, place a stake where the second pole is.



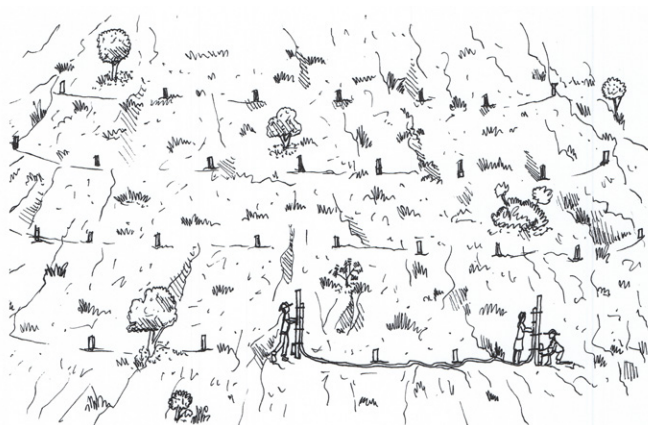
Step 3: Keep the first pole in place. Move the second pole a further two to three metres along and repeat step 2. Continue until the plastic tube is stretched to its maximum length.



Step 4: Move the first pole to the last marker in the ground and start again. Continue until you reach the end of the contour line.

Step 5: Once the first contour line is complete, go back to the start. Move down the slope to where you want the next contour line to be, and repeat steps 1 to 4. Continue this until all the contour lines are marked out.

Now you can construct the swales.



Types of swales

There are three main types of swales.

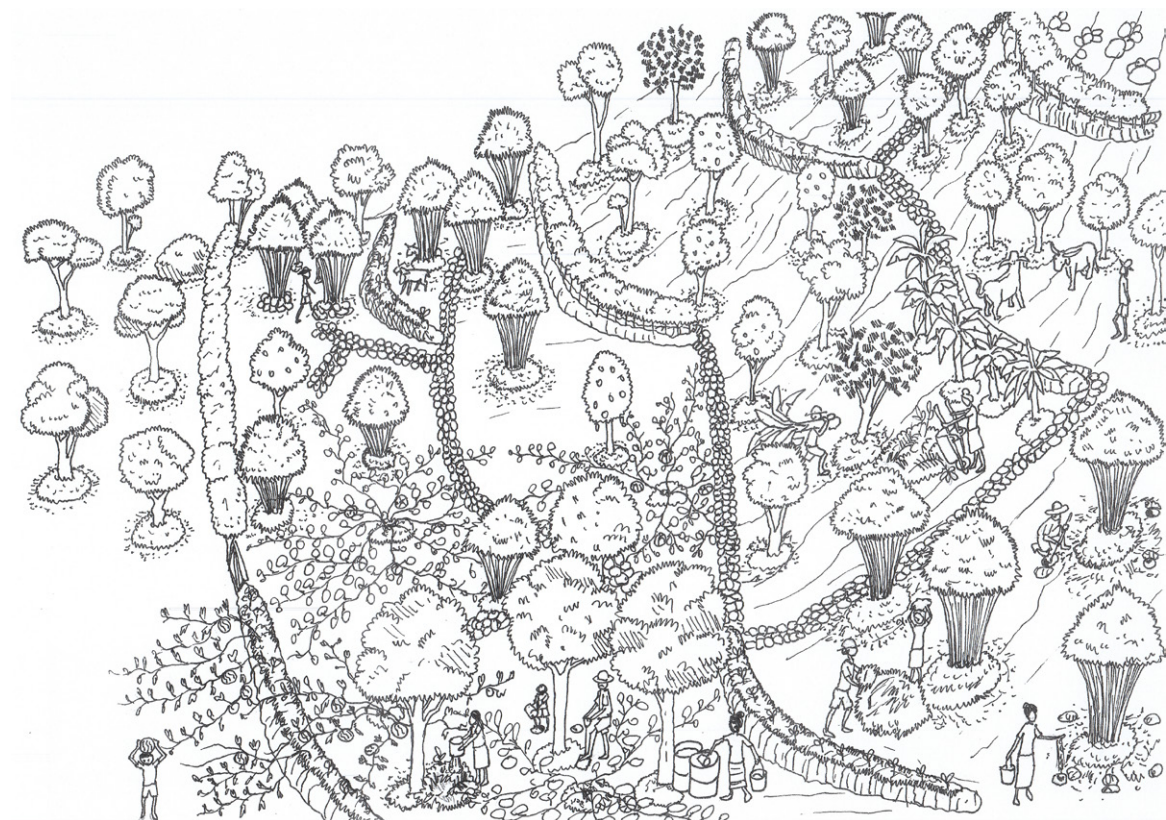
- Trench swales use the soil and rocks removed when digging the trench to put in the area below to form a mound (or a berm).
- Ploughed contour lines use a buffalo plough, hand tractor or tractor to plough a single furrow along the marked contour line.
- Rock swales are made from a mound or small wall of rocks instead of digging a trench.

There are usually rock swales where:

- The land is too hard to dig because it is very dry.
- There are too many rocks.
- There is a steep slope.

Which type of swale you use is up to you: You can use all on the same land. All three types should be planted immediately to:

- Hold the soil.
- Provide future tree or 'living' terraces.
- Provide mulch and nitrogen.



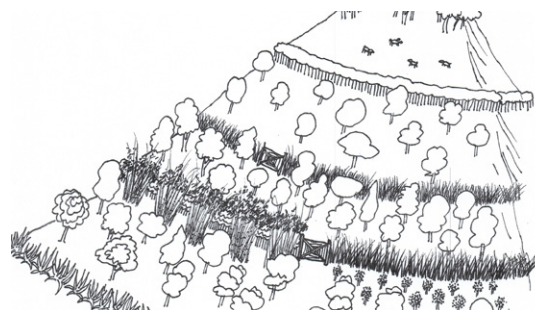
A mix of rock, trench and ploughed swales in one design



Begin by planting thick rows of legume trees or shrubs (gliricidia, pigeon pea), and vetiver grass, pineapples and sweet leaf are also great. A mix is best: Use annual crops, such as mung beans, together with perennial plants, especially for family gardens, smaller systems and gentle slopes. Bamboo, vetiver grass and legume trees are excellent for steep slopes.

Specific swale systems – including different plant combinations and integrating with animals – are also described in Family gardens (**Ch 10**), Sustainable agriculture (**Ch 13**), Trees (**Ch 15**) and Animals (**Ch 17**).

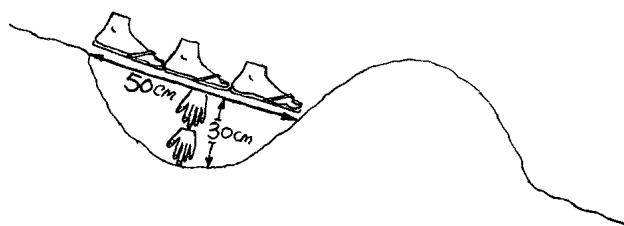
For reforestation projects plant the trees directly below the swales once the wet season starts. Rain water collects in the swales and soaks into the ground, slowly moving down the slope. Above each swale the soil is drier. See the reforestation section in Trees (**Ch 15**) for more.



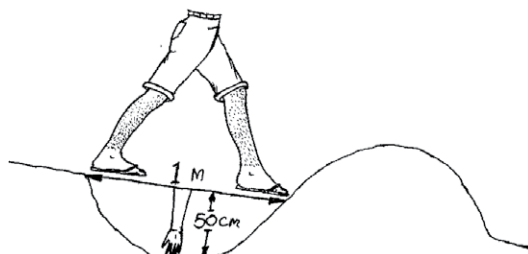
TRENCH SWALES

It is important to start at the top by digging the trench above the stake line. Make an even mound below the stake line from the soil dug up. The size of the trench depends on the slope of the land.

- **On steep slopes** the swales should be about three foot lengths wide (half a metre) and about two hand lengths deep (30cm).



- **On gentle slopes** the swales should be about a large step in width (a metre) and as deep as your elbow (about 40–50cm).



Continue until you have dug all the swales. For the best results, try to make the swales as similar as possible.



The bottom of the trench must also be level so, when water runs into the swale, it does not flow along the trench. This can be easily tested. If you have irrigation, run some water into the swale when you have almost finished digging and watch the way the water flows. Make changes as necessary to make the bottom level. If there is no water access, make the bottom as level as you can and wait until the first rains. Watch what happens as the water flows, and change the level if needed. Or, you can use the A-frame or water level to test it. This takes more time, but it is accurate.

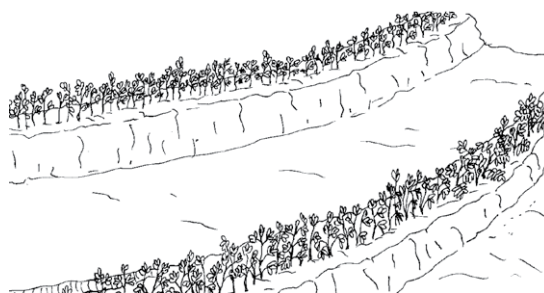
SMART IDEAS:

- To make the mound higher and, therefore, work better, first put rocks or old branches and add the soil on top.



To protect the soil mounds from erosion:

- Add a thick layer of mulch to the swales. It is good to put mulch in the trenches as well.
- Plant cuttings or seeds on the mounds straight away. The types of seeds you plant depends if the swale is for vegetables, tree crops or reforestation. Use the plants or trees that best suit your situation: e.g. legume trees, vetiver grass, sweet leaf, pumpkins, beans.



SWALE OVERFLOW POINTS

The overflow point of the swales is where you control the water flow once the trench is full. It is vital that you make the point strong and secure to prevent any erosion. In heavy rain events your overflow points allow excess water to move passively where you want it to go and not cause erosion or flooding.

Swales only work properly when the overflow points are in place.

What happens in very heavy rains and big storms?

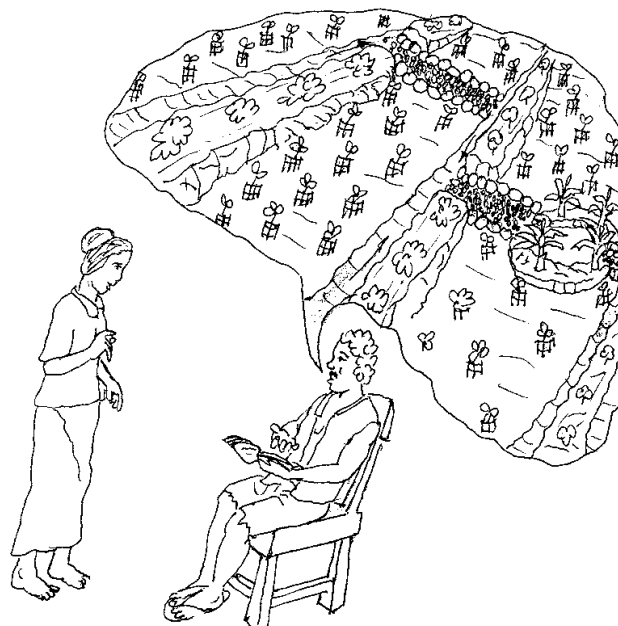
Although it may only happen once in two or three years, plan for extreme conditions to reduce or prevent the damage that may be caused.



“What if there is too much rain?”



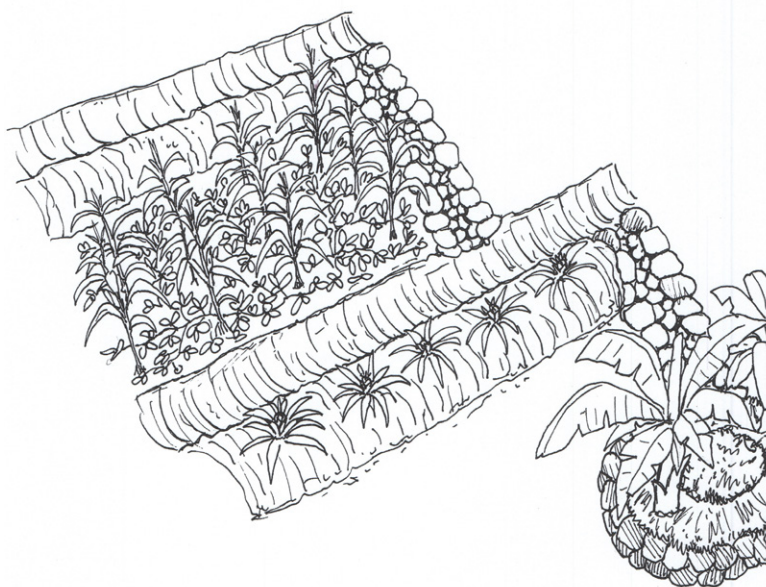
At one (or both) end of each swale make the mound lower than the rest of the swale, just below ground level is best so that you can direct where the overflow water goes. When the water reaches a certain height in heavy rains, it will then overflow where you want it to and not continue to build up and break the swale mound.



"We can build overflow points to control the water"

Place rocks around your overflow points to stop erosion. Plant grasses, such as vetiver grass or very small bamboo and ground cover plants, next to the overflow points to help further secure the soil.

A hole dug in the trench just before the overflow catches soil from the water as it flows out. This further reduces erosion and you can dig out the soil – which is good quality – to add to garden beds or place around trees.



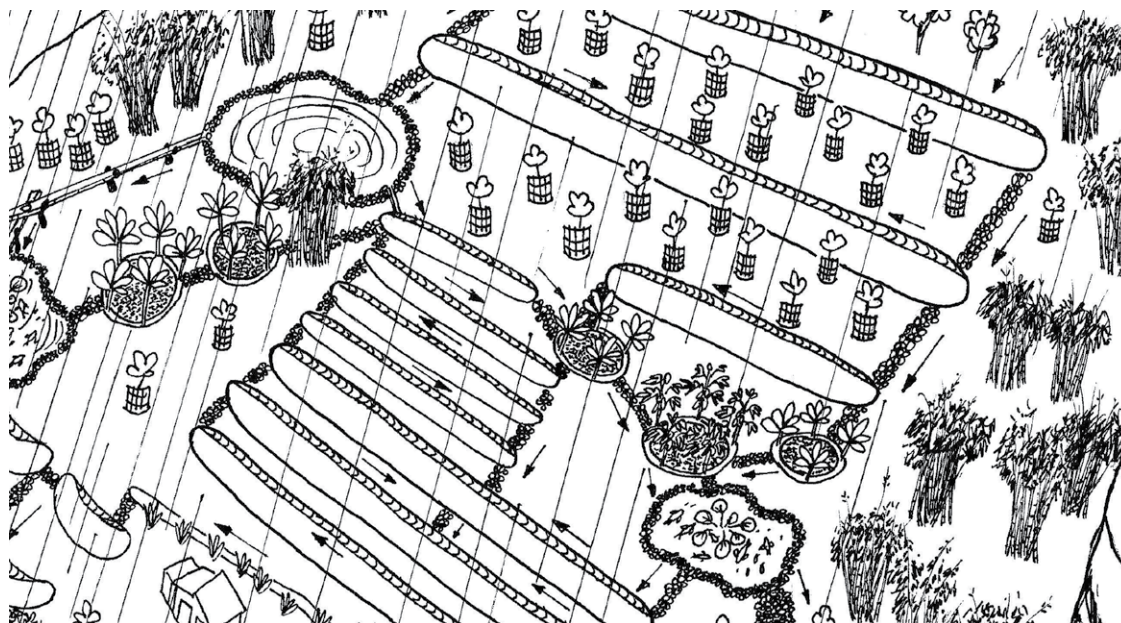
SMART IDEAS:



- A hole dug in the trench just before the lower end catches soil from the water as it flows out. This prevents ponds and dams filling up quickly with soil and you can dig it out – usually it is good quality – to add to garden beds or place around trees.
- Many small ponds catch smaller amounts of water and break up the water flow, and are useful even if you want to run the water into larger catchments. This prevents the problems caused by large amounts of water flowing at once.

CONNECTING SWALES TOGETHER

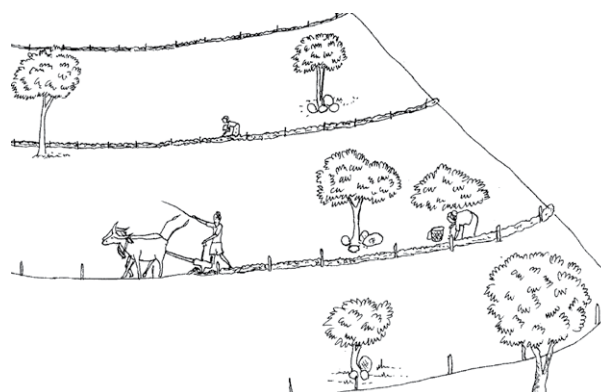
The overflow from one swale runs, via a shallow downhill trench, into the next, which runs into the next swale and the next, and so on. Between the swales you can also run the overflow water through banana pits. This helps to collect and use excess water and create highly productive bananas. See Family gardens (Ch 10). From the bottom swale the overflow water can run into water catchments for irrigation, aquaculture ponds, banana pits, or rice paddies or be soaked up by trees. Make sure the final overflow point is very secure; sometimes a lot of water will flow through it.



PLOUGHED CONTOUR LINES

A simple method is to plough along the contour line.

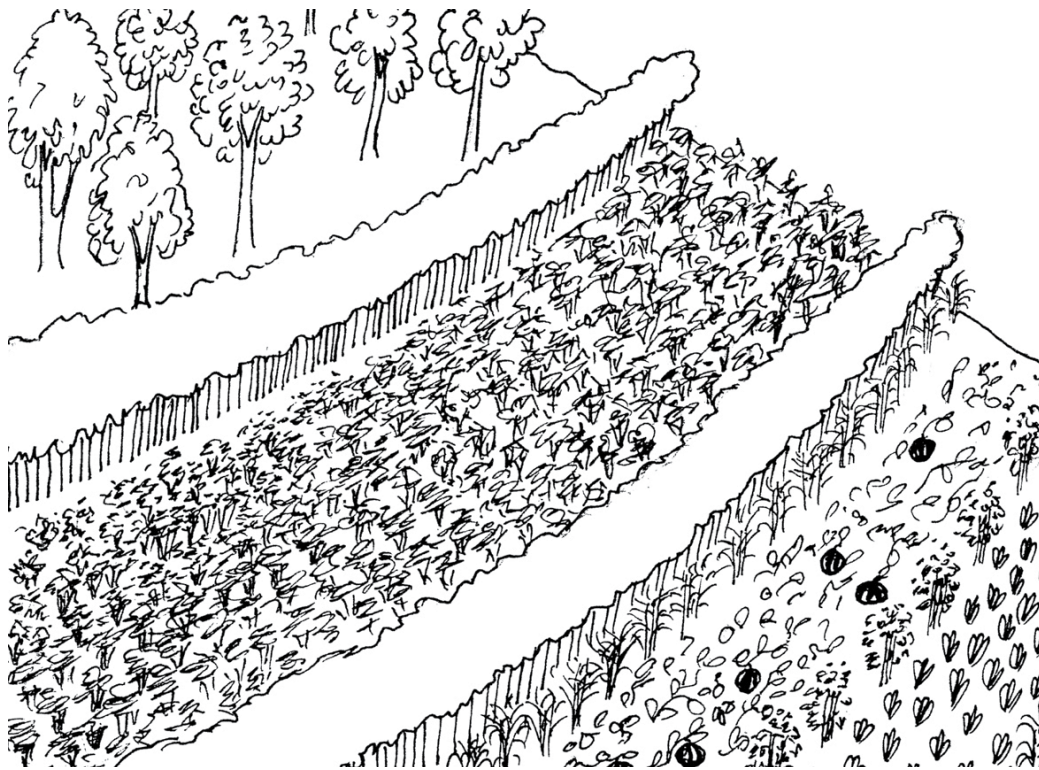
Use the stakes as a guide. Dig the plough line using a buffalo plough, a hand tractor or by hand. Buffalo ploughs are cheaper and usually the easiest and best. Only use a hand tractor or tractor if it has the right plough to cut a single deep furrow without turning the soil over.



After ploughing, immediately plant the lines 30 to 50cm apart with seeds or cuttings of legume trees to be cut back a few times each year.

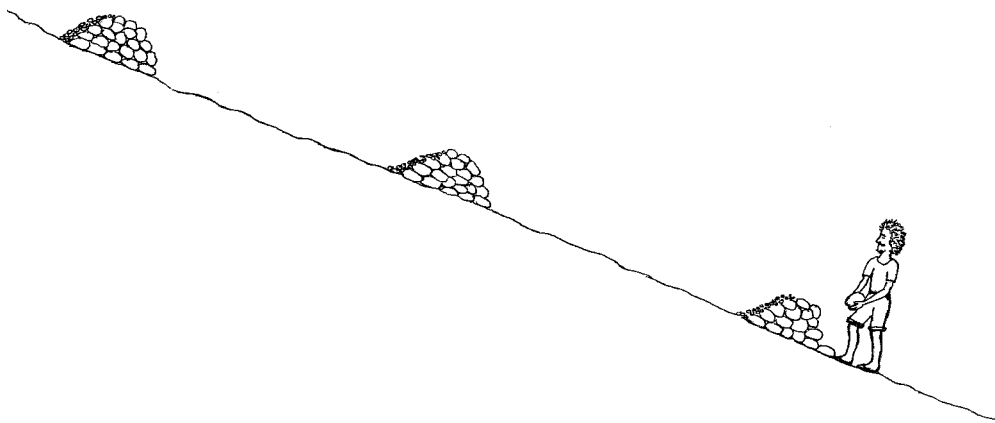
Ploughed contour lines take one or two years longer to create the same benefits as swales, but they take less time to make. They are good if you are working on large amounts of land.

It is best to prepare the swales or ploughed contour lines before the start of the wet season. This depends on what type of soil you have. Dig when it is easiest, but allow as much time as possible in the wet season for plants to become established.



Rock swales

Rock swales are important where the land is rocky or hard and digging swales is difficult. They also work very well for reforestation, especially in drier areas. To make them, follow the same steps and guidelines used to make trench swales.



Cross section (profile) of rock swales

Step 1: Plan how many and where you want the rock swales.

Step 2: Use an A-frame or water level and stakes to mark out the contour lines for the swales.

Step 3: Make a mound or small wall along the contour line using the rocks. Build the rock swales up to adult knee height if possible, even higher if there are lots of rocks.

The rock swales slow down the flow of rain water on the slope. The soil it contains is stopped and released at the base of the rock swale, along with sticks and leaves. Slowly the material brought down in the flow blocks all the holes and eventually builds up and creates a terrace. Over time you can raise the height of the rock swales as the flow process creates the terrace.

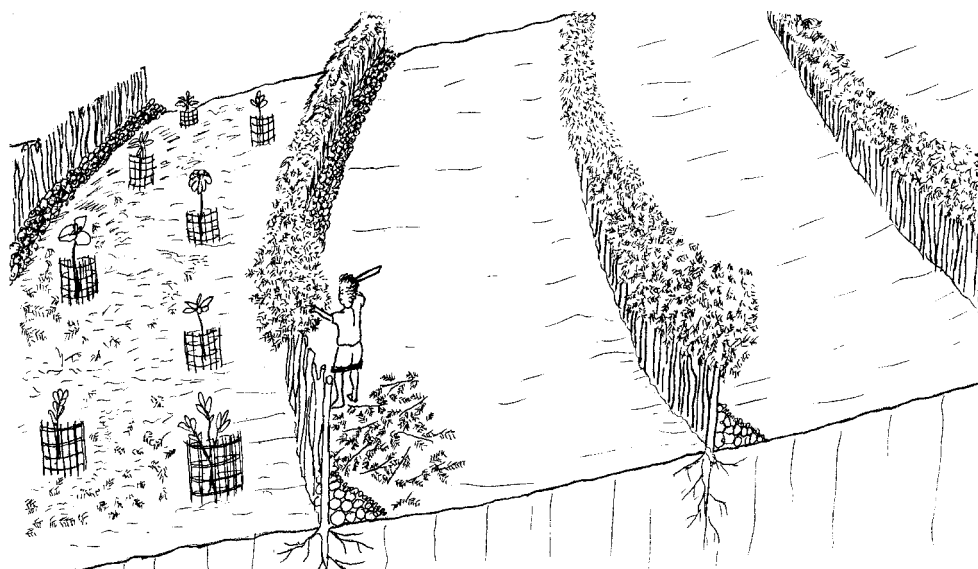


Cross section (profile) of natural terraces created by rock swales

Rock swales can also be used for vegetable gardens on gentle slopes as the resulting small terraces are highly productive growing areas.



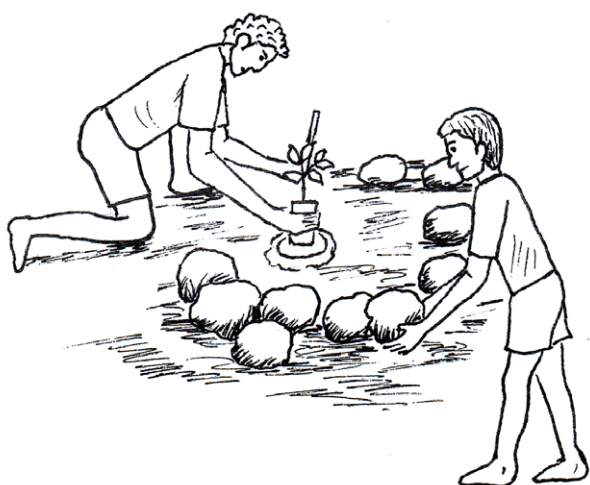
For tree crops on rock swales: plant legume trees as soon as possible. The legumes improve the soil and provide fertiliser, mulch and shade. You can remove the legumes as you need room for trees or other crops. The process is slower than trench swales but the long-term result is the same.



For reforestation on rock swales: plant pioneer species first to establish the area in the same way as for tree crops (Trees **Ch 15**).

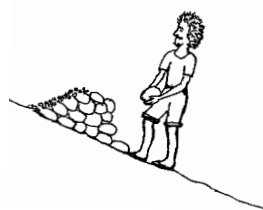
Rock swales can be used for large and small areas, for steep slopes and have many different patterns and shapes. Even if you do not create long swales, by putting rocks in place to stop water and soil moving, you improve the land and the results of your work.

See Trees (**Ch 15**) for detailed techniques.



SMART IDEAS:

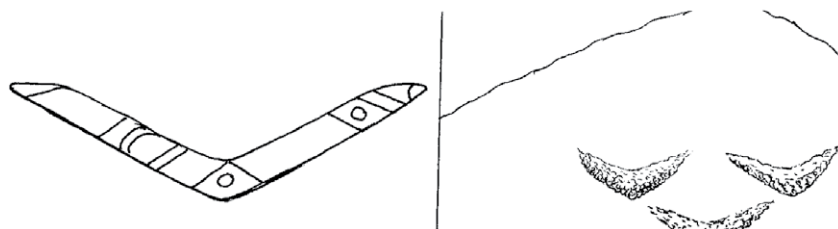
- Put larger rocks at the back of the swale (bottom side) and smaller rocks at the front. The smaller rocks stop more soil and water than the larger rocks.



- Tall rock swales are natural fences for buffalo and cows – limiting the areas where they eat – and they make them move along the contour which reduces erosion from animal tracks. Alternatively, build rock walls on contours, which can be used to control goats as well. You can leave gaps in the swales and build gates so animals can pass through.

BOOMERANG SWALES

A boomerang is a traditional hunting weapon of the Australian Aboriginal people. Boomerang swales (sometimes called keyhole swales) have their name because they are the same shape as a boomerang.

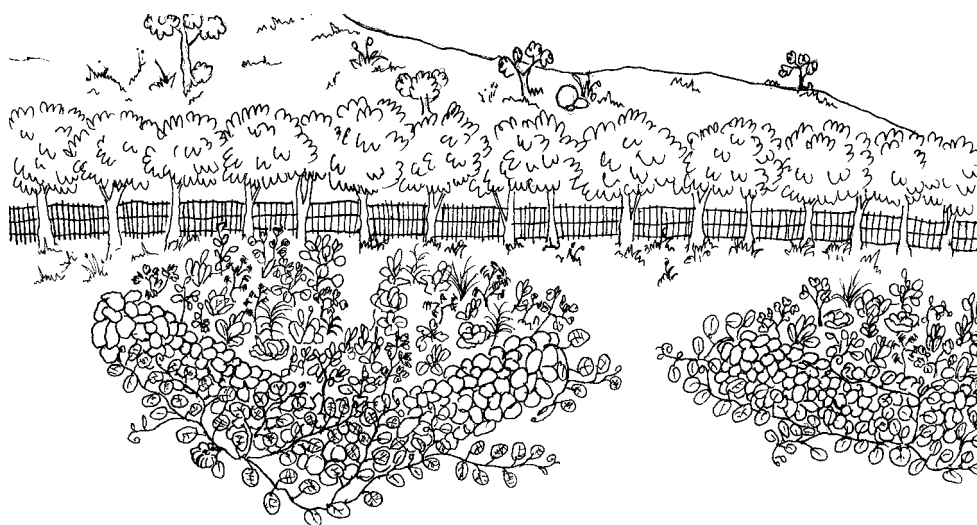


Boomerang swales are much smaller than trench swales. The general size is three to five metres long but they can be bigger if you are building them to plant trees. They can be made of rocks or are dug out, or a combination of both. For the best results, the boomerang swale mounds should be about adult knee height.



First, mark out the swale. Place a thick layer of dry leaves or rice/coffee husks – up to 20cm if possible – where the soil and/or rocks are to go.

Put smaller rocks on the front (top) side and large rocks on the back (bottom) side, the same as for rock swales. This collects soil, water, leaves and plant material faster. Like other swales, boomerang swales need a secure overflow point to prevent erosion and flooding.



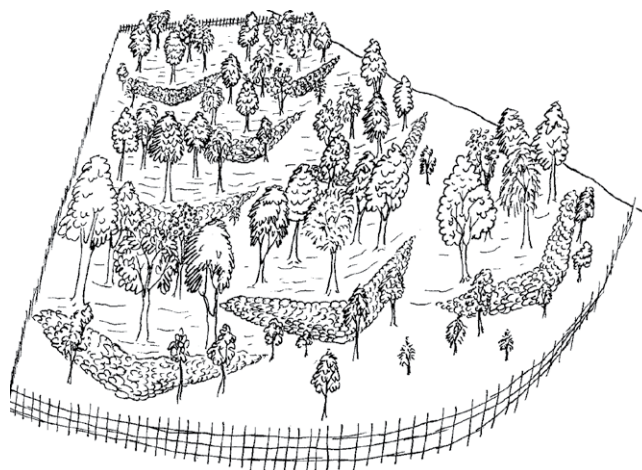
Boomerang swale vegetable gardens



Planting in boomerang swales

Start by planting trees in the middle and directly below the swales, and expand to other areas as the trees become established. It is a good idea to start with legume trees and seed balls (read the seed ball section in Trees **Ch 15**). When these trees grow they hold and improve the soil. The legumes later provide the new trees you plant with mulch, nitrogen and protection from wind and sun.

If you build many boomerang swales in one area – a system called net and pan swales – they can run any excess water from one to another. This improves the results and productivity of all the boomerang swales.



WATER-MOVING SWALES (OFF-CONTOUR SWALES)

Sometimes a swale is needed to move water onwards rather than catch it.

The two main reasons for this are:

- Diverting water away from a flood-prone area and houses.
- Moving water to catch it for irrigation or animal water in dams, ponds or other water catchments.



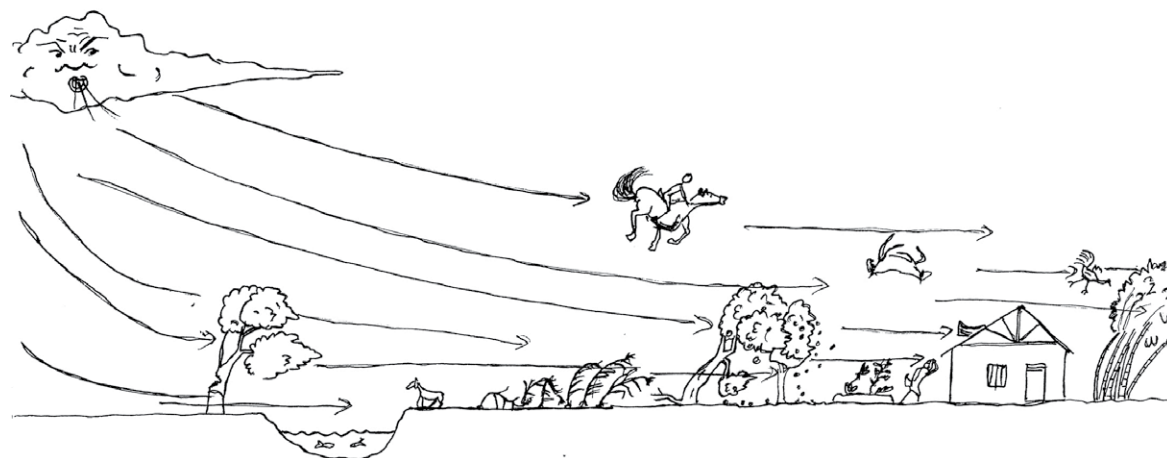
Method

Mark out the contour lines using the A-frame or water level, start at the end that will be highest and moving towards where the water will be going. Place the first stake as normal, then when you find the point for the second stake, put it in the ground 1cm lower than the level point. Continue to do this with every stake along the line. If you use a 2m wide A-frame this will create a drop of 25cm for a 50m swale. This will allow some water to sink into the ground and some water to move down the swale.

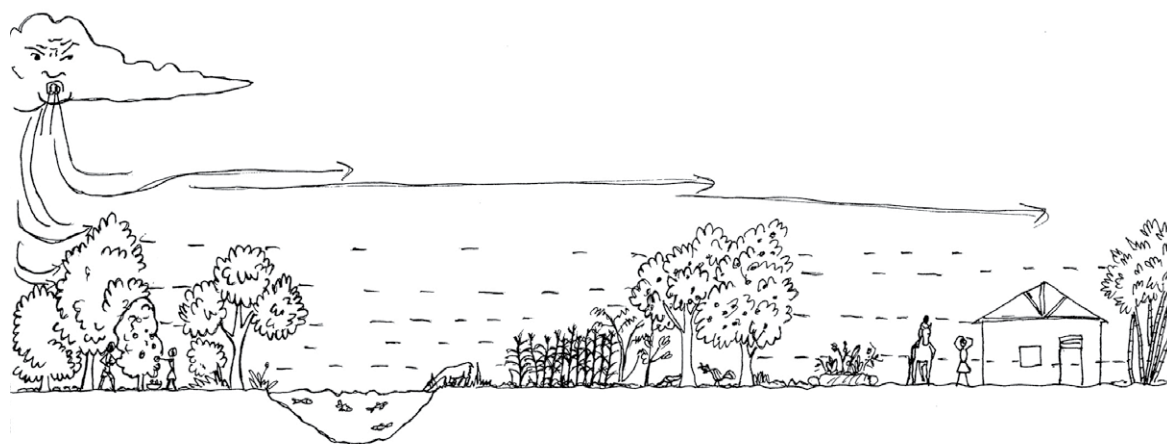
Be careful: If you make the swale too steep, causing the water to flow too fast, it will cause erosion and flooding problems.

Windbreaks

Light winds are good for agriculture and life generally. Strong winds, however, slow down growth, cause a lot of damage to plants and trees, and make life difficult for people and animals.



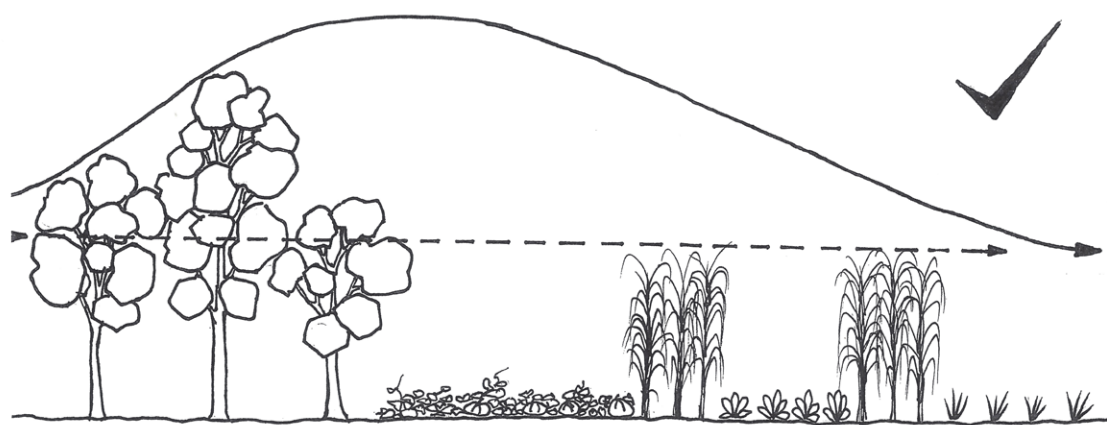
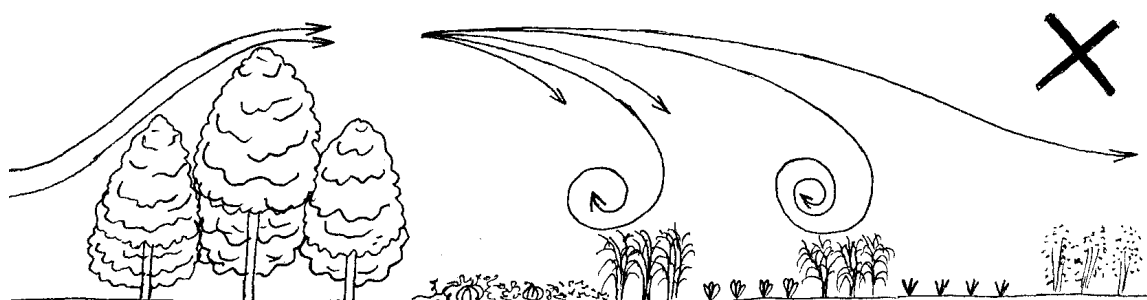
Windbreaks are especially important for places where strong winds continually blow for many months of the year. **Even a small windbreak can improve production for a large area of land.** Windbreaks are important for improving vegetable gardens, sustainable agriculture, tree crops, animal production, aquaculture and house and living areas. Windbreaks to reduce or prevent salty sea winds are important for improving production in areas near the ocean.



A windbreak is made up of rows of trees planted together to slow and redirect strong winds while still allowing light winds to flow. The number of rows for maximum benefit is five but, in situations where this is not possible, try to have two or more rows and maintain the trees well. A good windbreak blocks 50% of the wind forcing it up and over the trees and slows down 50% of the wind as it passes through the trees.

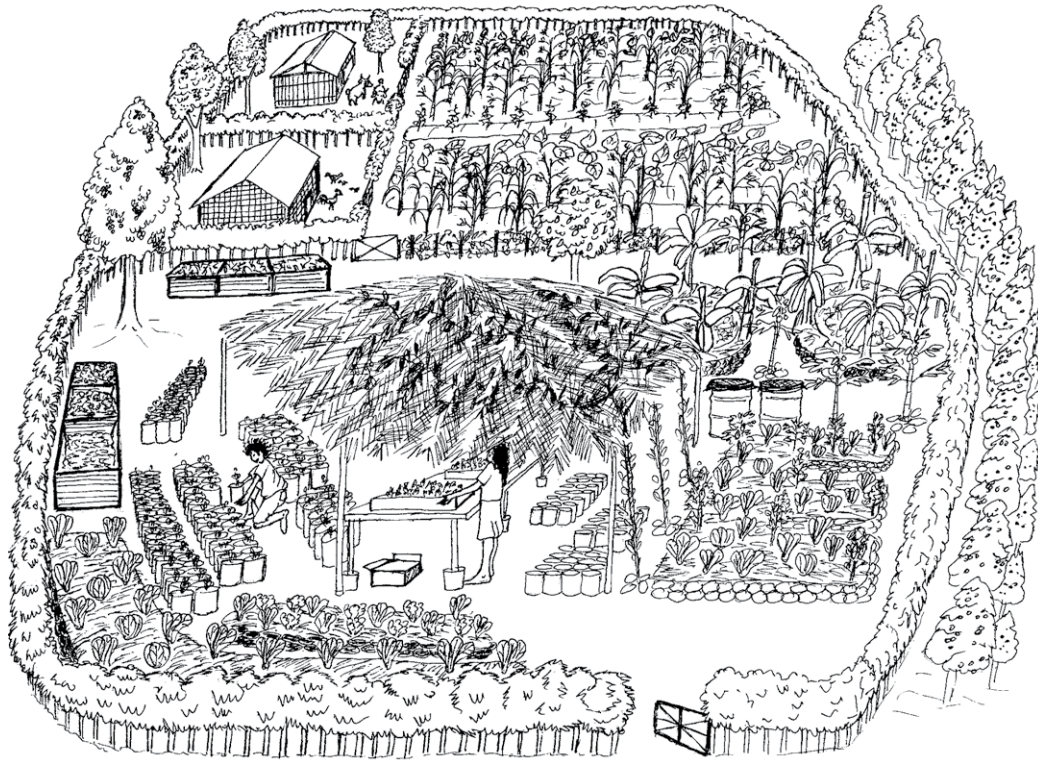
SMART IDEAS:

- Every region should develop lists of trees, bamboo and shrubs to grow in windbreaks.
- Use taller windbreaks for protecting tree crops – 10 to 15 metres high is best.
- Use some fire-resistant trees if fire is also a potential problem



The direct benefits of windbreaks for agriculture:

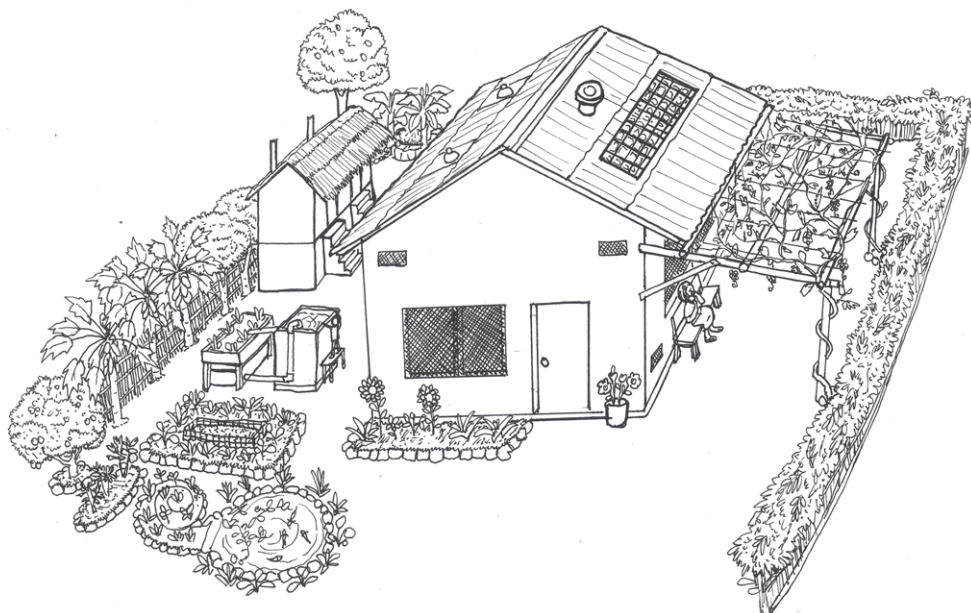
- Reduced stress on plants which, therefore, increases growth rate.
- Reduced wind damage to plants.
- Reduced erosion from the wind removing topsoil.
- Reduced water evaporation from plants and the soil, and plants use water more efficiently.
- The soil temperature does not change as much (not as hot or cold). This creates a better temperature for healthy plant roots and soil biota.
- Pest and disease problems are reduced because plants are less stressed.
- Pollination rates rise because the number of birds and insects increase. This increases the number of grains, vegetables or fruit on each plant.
- If you use a lot of legume trees, the nitrogen in the soil increases around the windbreaks and on the land below them.
- Reduced salt build-up in plants and soils for areas near the ocean.



Windbreak protecting plant nursery, vegetable gardens and animals

Other benefits:

- Creating habitat for birds, insects and small animals is beneficial for the greater environment.
- Windbreak trees also provide animal food, nuts, oils, timber, mulch, fibre, medicines, seed collection, and much more. Windbreak trees produce less than other trees, however, because they are affected by the strong winds.
- Windbreak trees can be used for trellising for yams and beans.
- Dropped dead wood can be collected for firewood.
- Water evaporation from rice paddies, ponds and aquaculture is reduced.
- Animals are healthier and less stressed. This increases the amount and the quality of meat produced, and reduces animal sickness.
- Areas around the house are much more comfortable.



Windbreak creating a comfortable and productive house site

WINDBREAK LOCATION

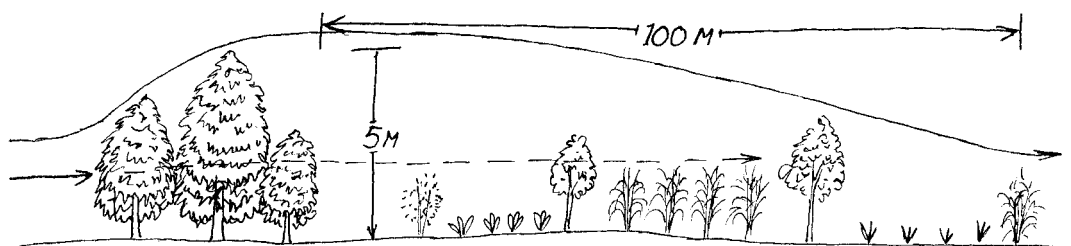
Where do strong winds most often come from? Usually there are two main directions.

Think about what you need to protect from strong winds: e.g. house, animals, crops, fruit trees, fish ponds, and so on.

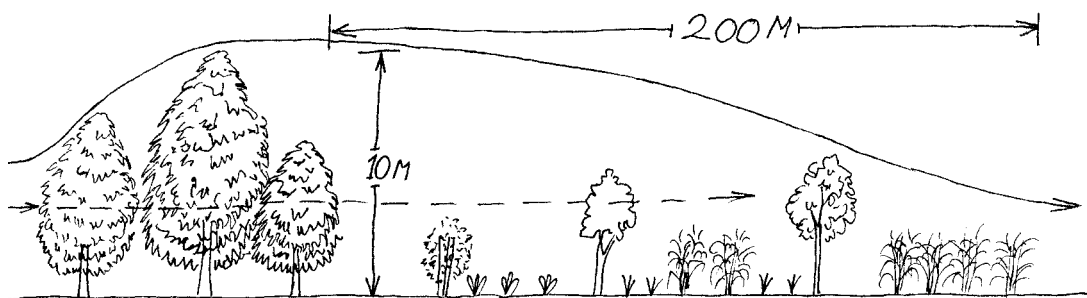
Does the slope and shape of the land affect the wind direction and strength? For example, some areas are more exposed to winds while others are more protected.

By answering these questions you can work out the best locations for windbreaks.

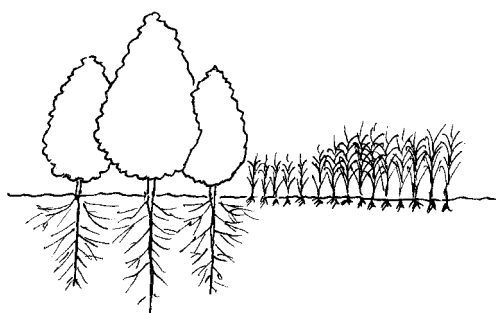
The area of land improved by windbreaks depends on how high the windbreak is. A 5 metre high windbreak slows the wind for more than 100 metres of land behind the windbreak.



A 10 metre high windbreak slows the wind for more than 200 metres of land.



Roots of windbreak trees reduce the productivity of any crops grown next to the trees. Shade from large trees when they are fully grown can affect crops. However, very tall trees are not usually needed for windbreaks.



SMART IDEA:

If the inner row of a windbreak is legume trees, crop productivity is less affected if the row is pruned back in the non-windy season.

WINDBREAK CONSTRUCTION

Choose windbreak trees that produce good results, such as:

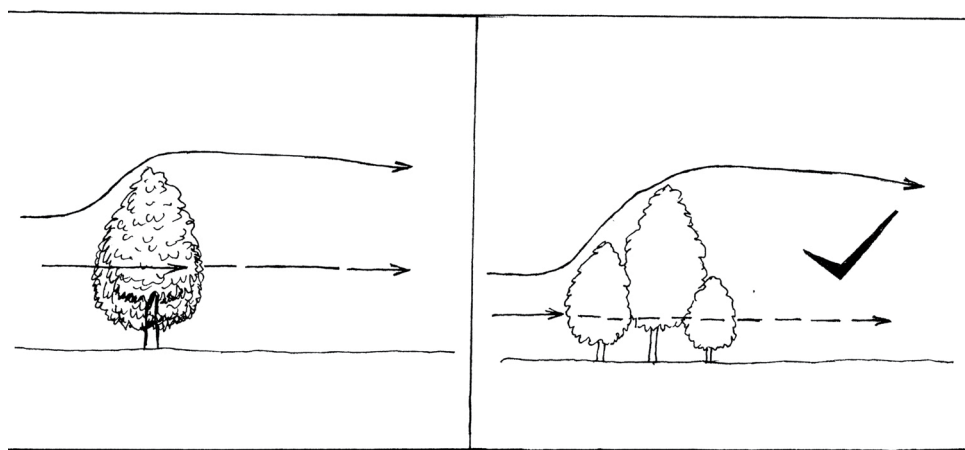
- Tough trees that do not mind strong winds.
- Long living trees.
- Trees that do not lose their shape over time.

Different types of trees are needed for different rows:

Outside row(s) facing the wind – very tough, bushy shape, medium height.

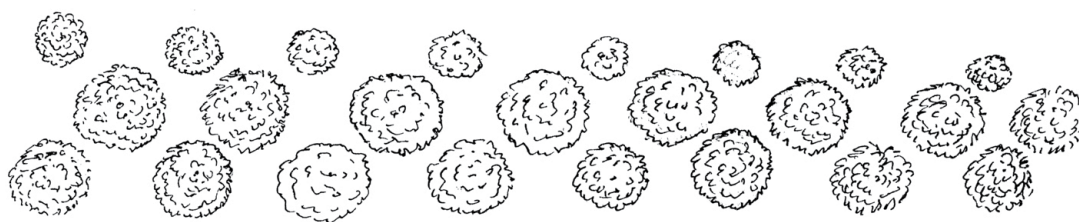
Middle row(s) – taller, rounded shape is preferable, not easily blown over in storms.

Inside row(s) – smaller than the middle row, legume if the windbreak is for protecting vegetable or tree crops, can be productive trees as this row is more protected.



Bamboo is great for windbreaks if it is well maintained and planted as a complete row. It also provides a firebreak as well, but only if you remove the dropped leaves and put them on gardens and composts. Bamboo also needs to be well maintained so that culms (poles) older than four to five years are removed.

Use a zigzag planting pattern to maximise the effectiveness of the windbreak.

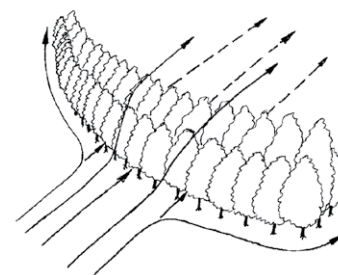


The length and shape of the windbreak depend on what you need it for. The wind flows around the sides, so always make the windbreak longer than the area that needs protecting.

Windbreaks can be planted:

- In straight lines.
- In sections – wind is concentrated and stronger where there is a gap.
- In curved lines – always make the outside edges curve away from the wind.

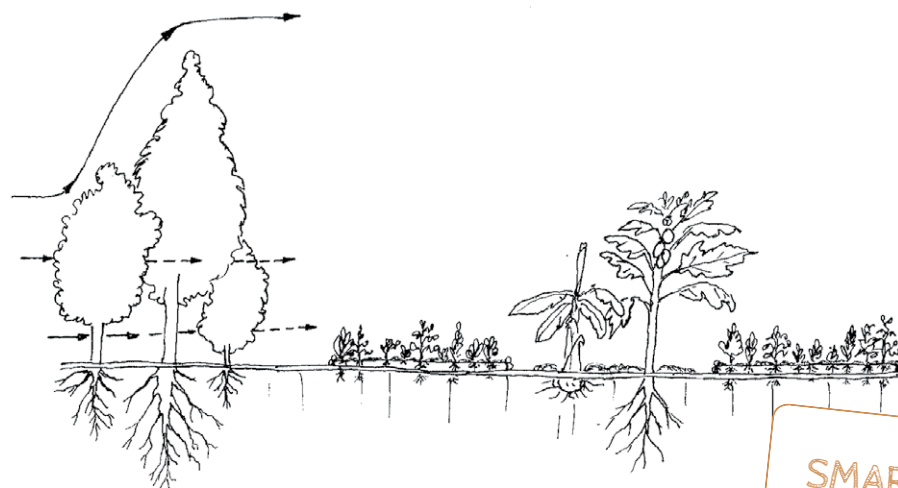
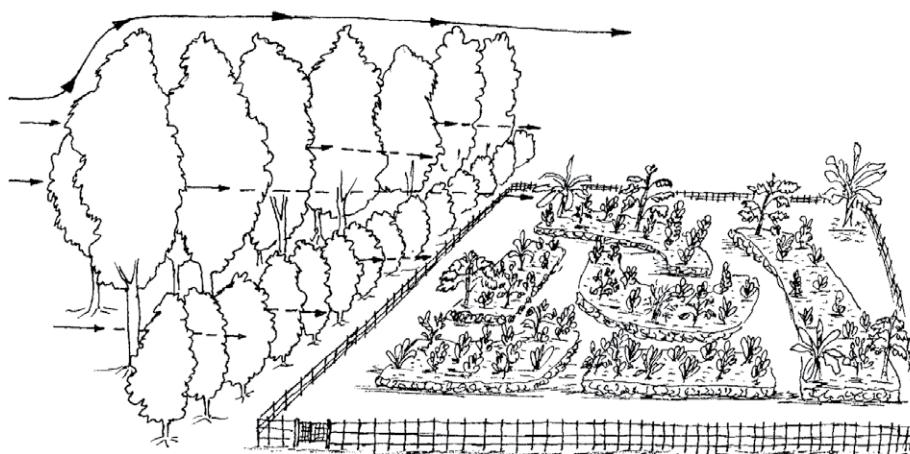
The windbreak's shape depends on its main function, its size, the shape of the land, and the wind's characteristics.





WINDBREAK MAINTENANCE

While the windbreak trees are young, they need protection from animals. Replace any trees that die, especially when they are small. It is very important not to have gaps in the windbreak. Do not cut all the bottom branches for firewood or let animals eat too much from the bottom of the trees. This allows the wind to flow under the windbreak. Keeping an even tree shape provides the best results.

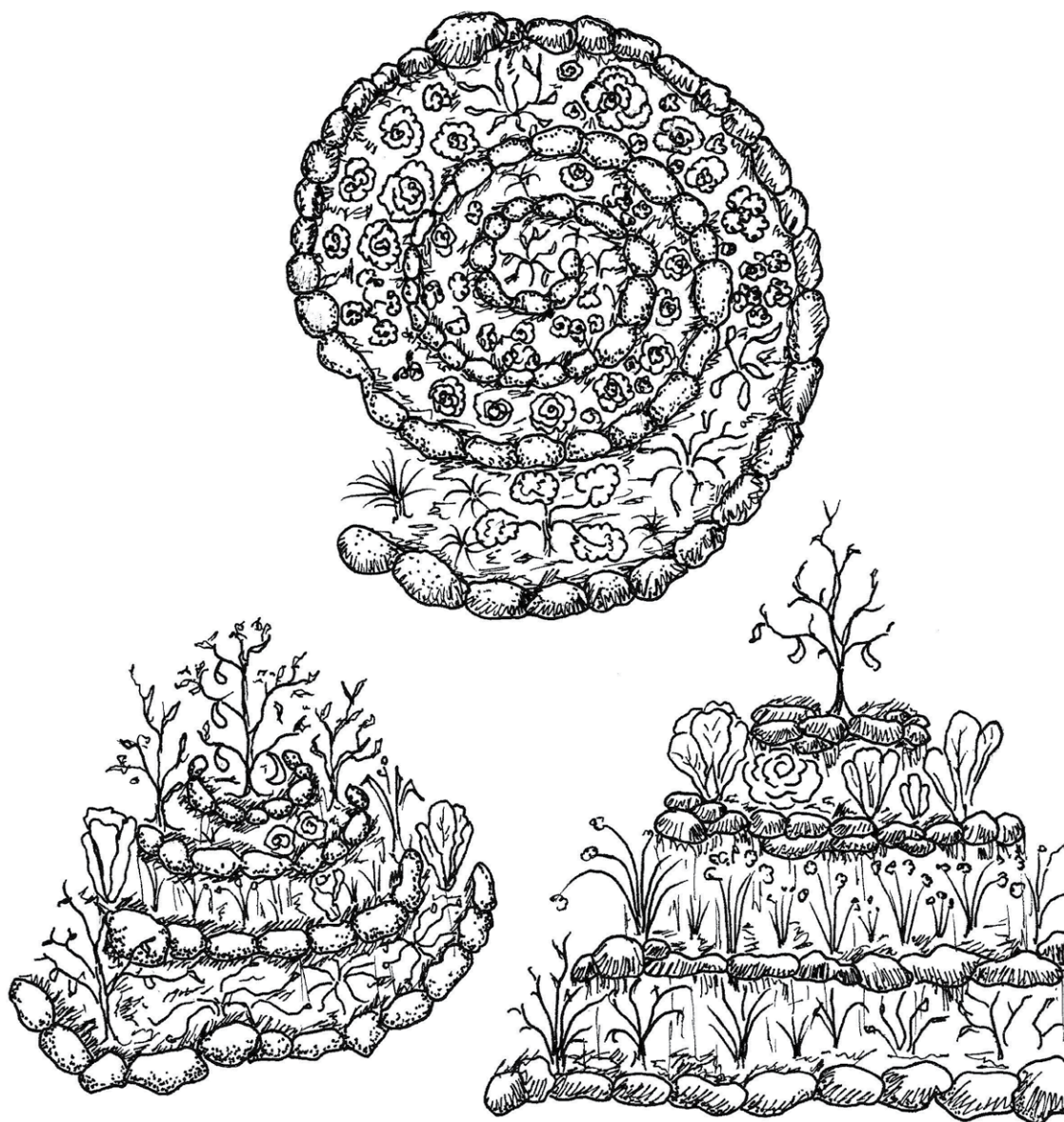


SMART IDEAS:

- Every region should develop lists of trees, bamboo and shrubs to grow in windbreaks.
- Use taller windbreaks for protecting tree crops – 10 to 15 metres high is best.
- Use some fire-resistant trees if fire is also a potential problem.

Include beauty in design

Highly productive land can also be very beautiful. If it is beautiful, it is also a much more pleasant place to be and work! It is the same for the house area. Beautiful environments are complemented by beautiful gardens and houses. Creativity, imagination and beauty are encouraged in design, and from all family members – men, women and children.





A beautiful house and garden is something to be proud of, and it helps productivity and diversity:

- Design your gardens and fishponds in beautiful shapes.
- Grow flowers next to and between the vegetables.
- Plant flowering small trees and legumes with fruit trees.

Integrate culture into the design by carving traditional symbols in the wooden structures around your house and farm. Combining traditional art and sculpture in your gardens not only adds beauty but helps to strengthen culture.



Designing steps and stages

Designing is not just about what to do and where to do it: It is also about when to do it. When people do not implement their designs in the right order, the potential for mistakes is great, wasting a lot of time. With a good step-by-step plan, you can achieve good results faster with fewer mistakes along the way.

Design implementation priorities

It is important to implement your design in the right order for bare land and new designs. It is just as important for changing and improving existing farms, houses and production systems.

The first two priorities are access and water. See the site analysis section earlier in this chapter for explanations. Good access means working on the land is easier and access routes do not have to be remade later. Prioritise the creation of water systems and water storage – small dams, fish ponds, irrigation, swales, terraces, trenches and other water-related structures – because they often require large-scale digging and earthworks. Once water is available and secure, all other work becomes faster, and there are no difficulties arising from flooding or other problems.



Protecting the spring and securing the water supply for animals and irrigation



The following steps are all important and can happen at the same time and/or as needed:

- Soil stabilisation and improvement, including green manure, cover crops and creating compost and liquid compost.
- Fences and living fences.
- Planting long-term trees and legume pioneer trees.
- Establishing at least a couple of vegetable gardens and annual crop areas so some produce is provided quickly to obtain a yield!
- Animal houses and food plants for animals.

ACCELERATING YOUR RESULTS

Exponential growth is a pattern of growth that occurs naturally. It can be written as a mathematical equation and represented as a curve on a graph showing growth over a period of time. As time passes the growth increases at a continually faster rate; for example, the number of microorganisms dividing in half – 1, 2, 4, 16, 32, 64, etc. – is twice the number of the day before. Exponential growth is how human, animal and plant populations change over time, and it occurs in designed and natural systems. When we understand how it happens and work with it, we can use it to our advantage. If we do not, it can have negative impacts.



Making a banana pit for growing bananas



Exponential results from using good techniques

A good example is rice grown in a flooded paddy system compared to using the system of rice intensification (SRI): Rice plants grown using SRI start slower and take time to develop root systems but, because they have more space, more food and better conditions, they end up growing much bigger and producing much more than rice grown in flooded paddy systems.



SRI grown rice plants with high yields

For design: starting with the right steps to improve a system or create a new one accelerates the growth of your system over time. It is a solid base to build on. Making the first wrong steps might start production sooner but, as time passes, you will need to fix mistakes and make changes to infrastructure. Over time production is much less.

An 'exponential' example: would you take an immediate payment of \$1,000,000 or instead receive 1 cent and double that cent every day for a month?

After 10 days, 1 cent doubled is \$5.12.

After 20 days it is \$5,242.88.

After 30 days it is \$5,368,709.12!!



Good design creates conditions for exponential growth



Short and long-term plans

In a design there can be a short-term, medium-term and a long-term plans.

For example, if you plan to make the most of your income from fruit and production trees, you also need short-term crops, such as vegetables, small fruit trees and chickens/eggs, to provide income while waiting for the fruit trees to mature. These can often be planted between the fruit/production trees and smart management will enable them to help your long-term trees to grow faster.



A fruit tree grown with a vegetable garden around ti will provide lots of vegetables at first then over time a very healthy and productive fruit tree

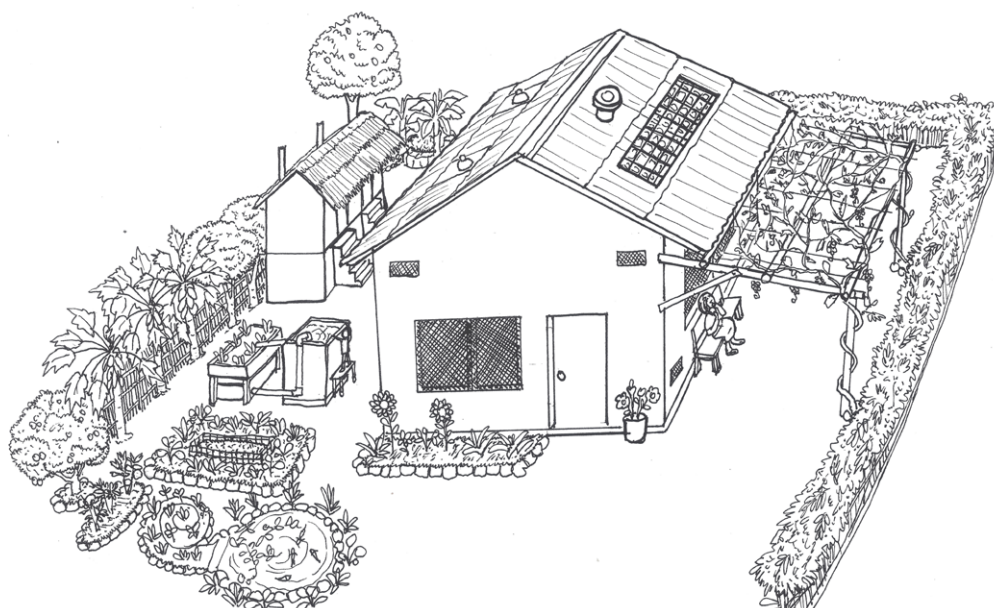
Design changes over time

There are many reasons why your design will change over time. It is much better to change and continue to grow:

- Integrate new knowledge – learning strategies and techniques – and use new technology.
- Seek new ideas on what to grow, and new markets for different products.
- A good design includes many integrated small systems. Over time the small systems become closely integrated, creating new systems.
- Accept and learn from feedback and mistakes. We all make mistakes and it is important to learn from them to improve. Sometimes, problems or surprise benefits do not come from mistakes but from unexpected situations or results. Accepting and using this feedback is part of creating a stronger and more resilient system over time.
- Adjust and respond to a changing climate. Changes are necessary as the climate and weather become less regular and more unpredictable. More diverse systems based on a higher percentage of tree crops with maximum water catching, storing and recycling will help.



Before



After



Creating new work habits

Many of these techniques may be new for you, but it is good to try new techniques and ideas. Sometimes this requires changing work habits, which is often the hardest part of implementing new techniques. You need persistence to keep working as you form new habits, and they become part of your daily cycle.

Most importantly, for groups and families, a work list of daily tasks makes sure that everyone follows the new techniques and they become part of daily life. This schedule includes the little everyday tasks. It also includes weekly tasks (e.g. weeding), monthly tasks (e.g. liquid fertilising, making compost), and others completed every three months or more (e.g. fertilising fruit trees, mulching), and so on.

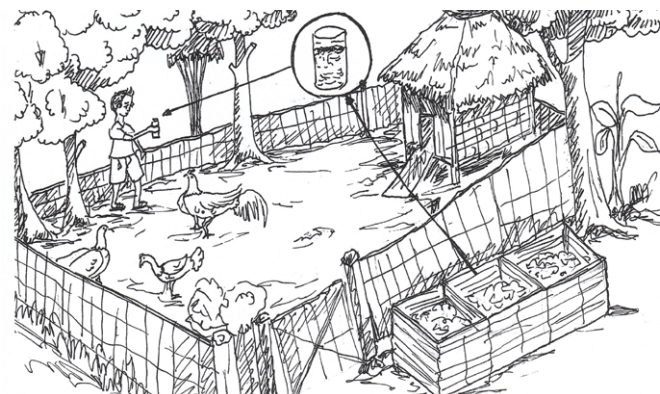
For example – the work involved in maintaining a permanent chicken yard requires that you carry out daily tasks which are unnecessary if the chickens roam free.

Morning:

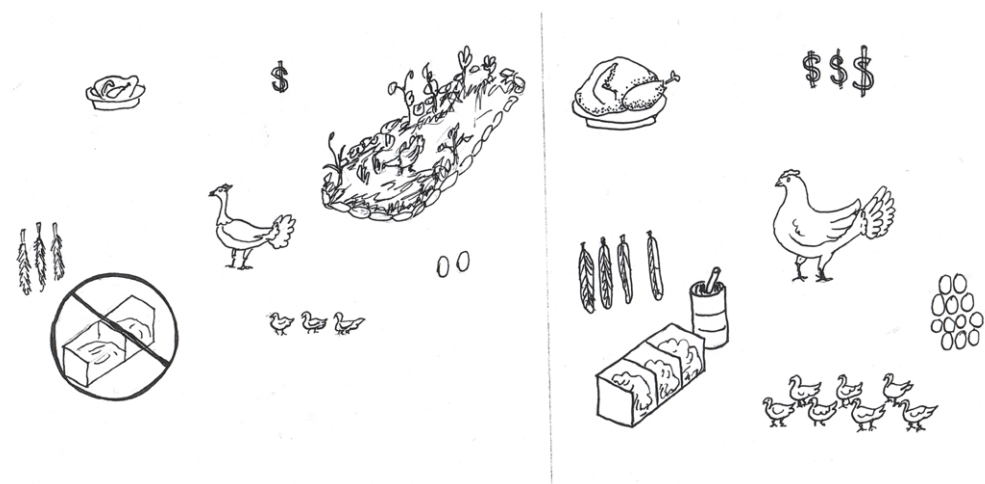
- Let them out of their night house.
- Give them a small amount of grain.
- Check their water.
- Give them some fresh greens.
- Give them a cup of fly larvae if you are able to grow them.

Late afternoon:

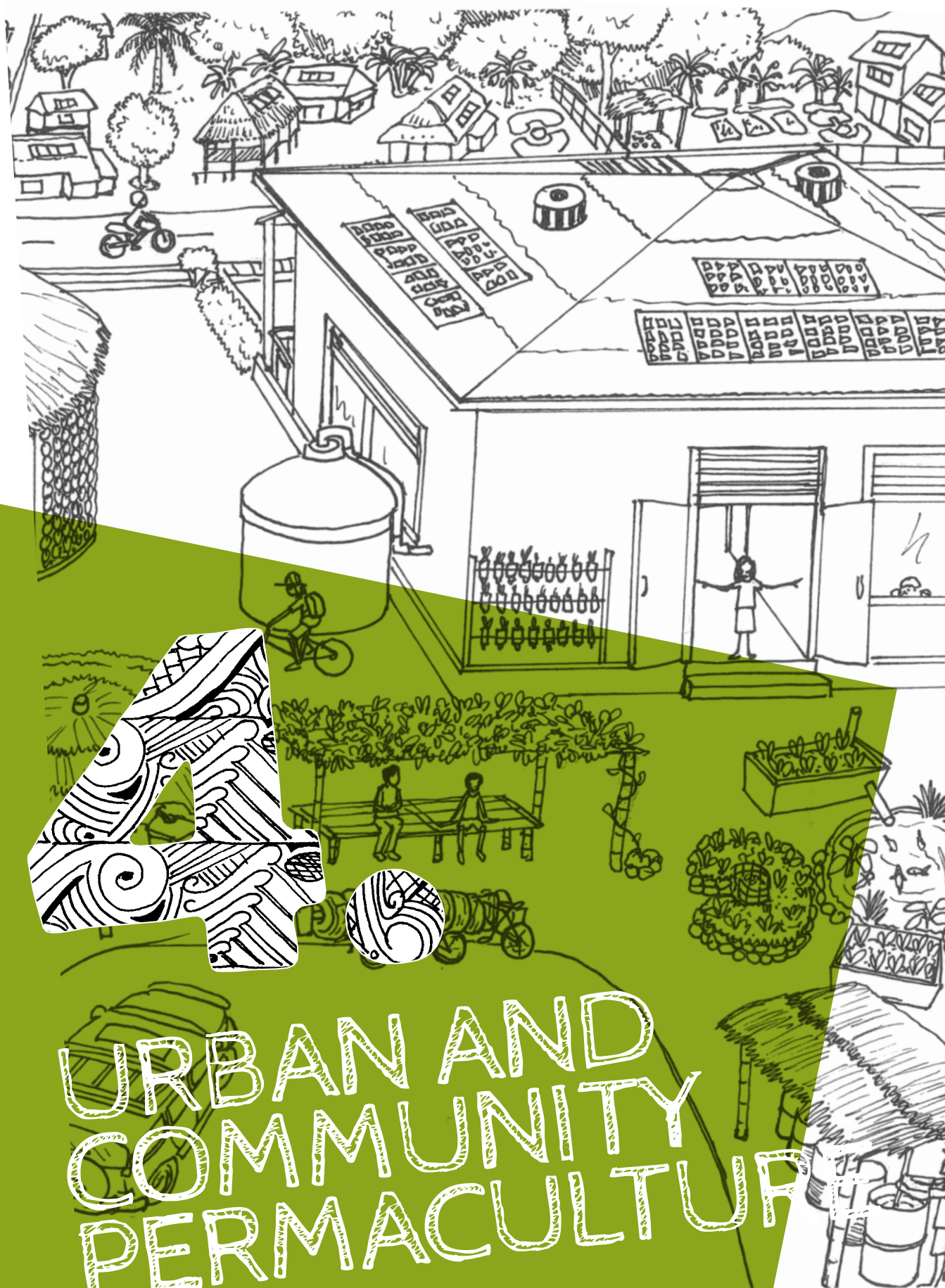
- Give them lots of weeds.
- Give them a small amount of grain.
- Check their water.
- Collect their eggs.
- Lock the chickens in their night house.



Tasks which are completed weekly, monthly or over longer periods include breeding insects for chickens, cleaning out manure and old weeds to add to compost or liquid compost, and growing vegetables on the chicken yard fences. It seems like a lot of work, but chickens that live in a permanent house have more chicks, provide more eggs, are healthier and, therefore, their meat is a higher quality, provide better weed and pest control, and lots of manure!



Comparing production of a free roaming chicken to a well managed chicken



URBAN AND COMMUNITY PERMACULTURE



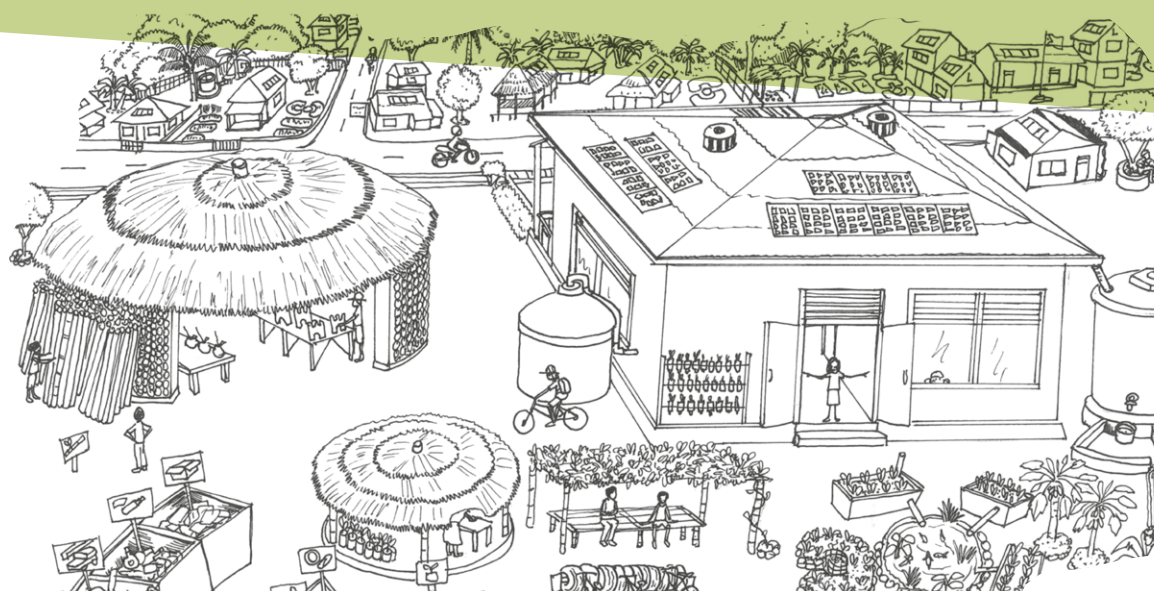
URBAN AND COMMUNITY PERMACULTURE

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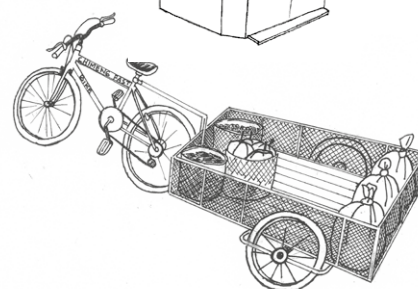
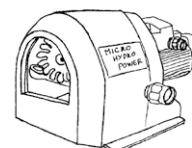
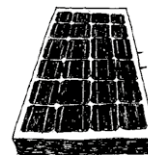
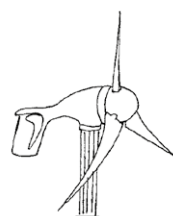
Permaculture is as important for cities and urban areas as it is for farms and rural areas. Cities must become more self-sustaining, less polluting and be powered by renewable energy. They must also become more community focused, produce more food and have higher numbers of trees and more vegetation. Permaculture strategies and techniques can be used to achieve these goals. As cities grow, it is vital to have strategic designs for towns and urban areas to enable people to achieve a healthy, sustainable, good quality life.

This chapter relates to Sustainable Development Goal 11 to “make cities and human settlements inclusive, safe, resilient and sustainable”.



Designing and creating sustainable, functional urban and community areas involve improving all elements of living for everyone in the urban population. This includes:

- Local organic food production and consumption
- Energy-efficient housing and buildings made from appropriate, sustainable, locally sourced materials
- Energy from renewable energy sources
- A clean and secure water supply, collection and storage
- Rainwater catchment, management and drainage systems
- Waste management based on reducing, reusing, repairing and recycling
- Efficient transport systems prioritising public transport and bicycles
- Sustainable livelihoods
- Markets that are easy to access and focus on local produce
- Community groups and communal spaces
- An economy based on local, inclusive and sustainable activities



- Social equality, inclusivity, consultation and integration
- Art, culture, sport and social activities
- Disaster risk reduction, prevention and management
- Reducing wind and dust by increasing the amount of vegetation
- Recreation areas, parks, street trees and natural areas
- Healthy and protected rivers and lakes
- Public buildings that are demonstrations of sustainable methods and technology

The first step is to redesign towns and cities to function so they support the population's capacity to be sustainable, as well as improve environmental regeneration and promote small-scale organic farming in and around the cities.



Small-scale urban organic farm

In our cities and towns “**quality of life**” needs to be the highest priority, supported equally by:

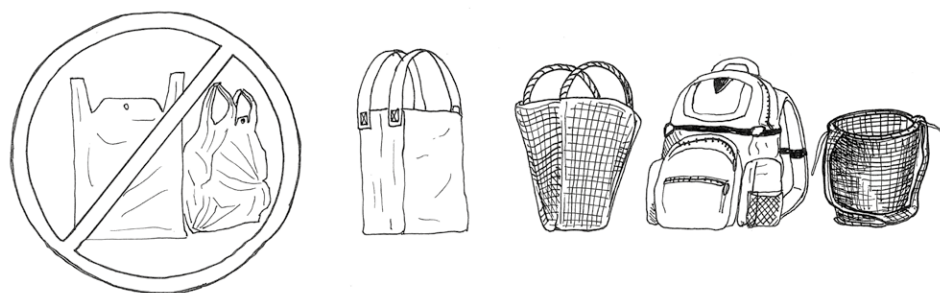
- A healthy economy
- A healthy environment
- A healthy culture

Everyone benefits from community redesign and regeneration towards truly sustainable living, both now and in the future. Current approaches that design cities mostly to suit individual needs, current consumption levels and high energy usage must change!



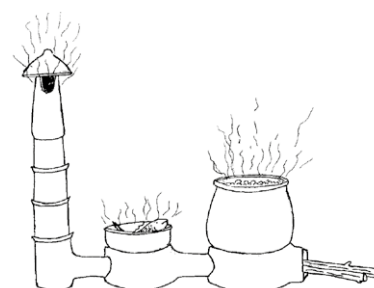
Urban waste ends up in our oceans, we must change our habits to stop this!

Urgent changes to our lifestyles are necessary to reduce climate change, water shortages, environmental destruction and social inequality. All citizens must be involved and their first task is to take responsibility as urban consumers to buy less plastic stuff! People buy a lot of unnecessary, poor-quality products that end up as waste. Urban areas consume the most resources, often wastefully and unsustainably, and create the most pollution. However, they are also places where positive change has the biggest impact because it not only influences the urban area but also creates a positive result where the city's resources come from – near or far.



Changing from plastic bags to long lasting bags

For example: A program to provide cooking stoves in a city improves the lives of the people using them because they pay less money for wood, create less smoke, and suffer less smoke-related illness. Fewer trees are cut down for firewood in rural areas which is vital for a healthy environment. People on land which produces firewood can change to more sustainable agro-forestry systems including growing more tree crops and high-quality timber poles. This makes their land more productive and their livelihoods more secure in the long term.



To achieve rapid, widespread change all levels of government must be involved – from local to national. It is necessary to create and share climate appropriate, low energy-use building designs so individual builders understand and use energy-efficient materials and techniques. Changing and enforcing building regulations ensure that developers have strong environmental and social guidelines to follow. Community groups that represent stakeholders (households, market sellers, water-users, etc.) are vital for lobbying government and policy makers to achieve the necessary changes.

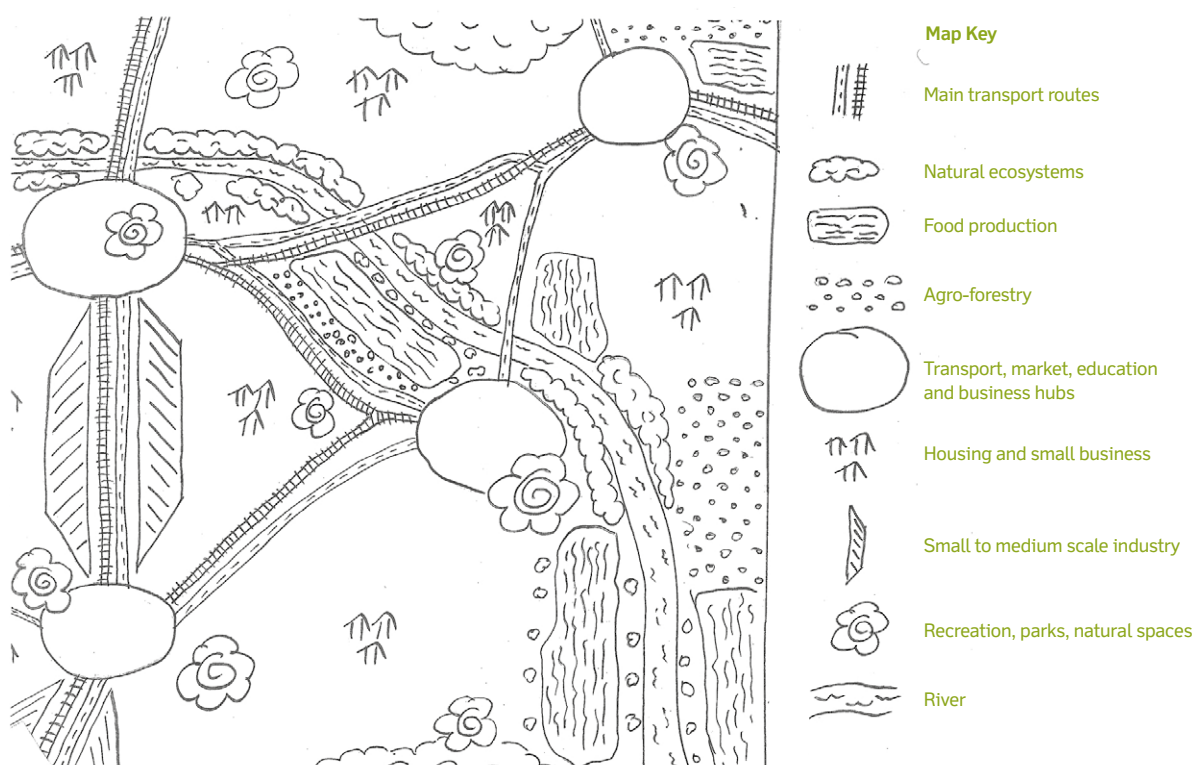




Town planners are especially important in this process. Planning and redesigning decisions include:

- Establishing and maintaining healthy forest and water catchment environments around cities and on the outer edges. These have multiple functions including cleaning air and water, and providing vital relaxation spaces.
- Identifying inner-city land and the surrounding areas to supply most of the food for the city's population, reversing the trend of urban areas taking over farming land.
- Ensuring city/town design revolves around "hubs" created for transport, markets, community centres, renewable electricity generation, community information, etc.
- Providing good quality living with a focus on social and mental well-being.

A lot of the strategies included in this chapter not only strengthen and improve communities but also quickly spread the knowledge throughout the community. This chapter is a starting point to provide a design framework for urban and community permaculture. There are many specific examples in other chapters and lots of websites in the reference chapter.



CAPACITY TO ADAPT TO FUTURE CHANGES

Good community design takes changes into account and adapts to them, including:

- Increases in population
- Higher density urbanisation
- Rising pressures on the environment and resources

Adapting to change is vital when designing urban areas and incorporating sustainable expansion.

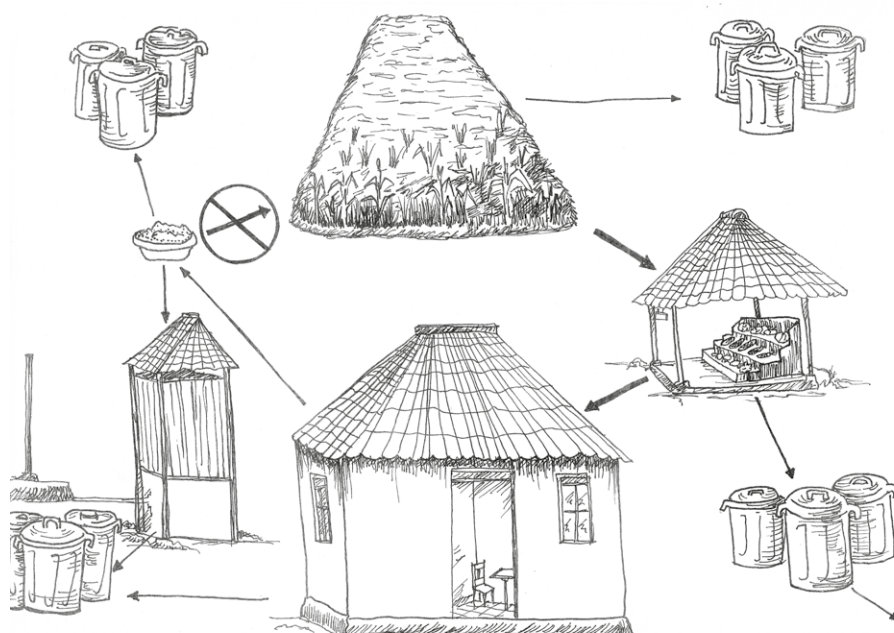
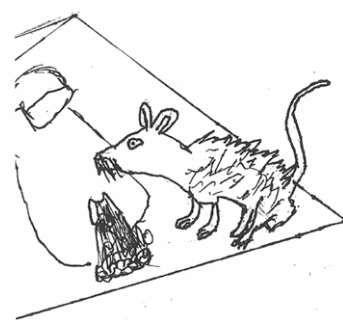
Urban and community design

To regenerate cities and communities sustainably, we do not just work with houses and families; we must redesign much larger areas. A design could cover all of a small town and the surrounding area. However, a larger town or city would need one overall design and many smaller, more detailed designs, focusing on the different residential and inner-city areas, to fit together into the larger plan.

Part of urban design is to understand the specific problems and opportunities relevant to urbanisation so as to identify solutions and maximise opportunities.

Problems of urbanisation:

- People are disconnected and removed from traditional culture, food, medicines, etc
- More pollution and toxins, dirtier water, more dust and excess waste created leading to negative impacts on population health
- Continual damage to the local and surrounding environments as urban areas expand
- More regulations and restrictions
- More intensive pest problems such as rats, cockroaches and mosquitoes
- Less access to producers and land
- Less space and smaller houses for most people
- Higher levels of renting rather than owning houses
- Homelessness and social dislocation
- Rural migration to overcrowded city areas
- Ever-increasing population leads to job shortages and thus poverty
- Problems of stress, social isolation, depression and other mental health concerns
- Attitudes change, potentially leading to more violence, theft and vandalism
- More animal and human waste to dispose of

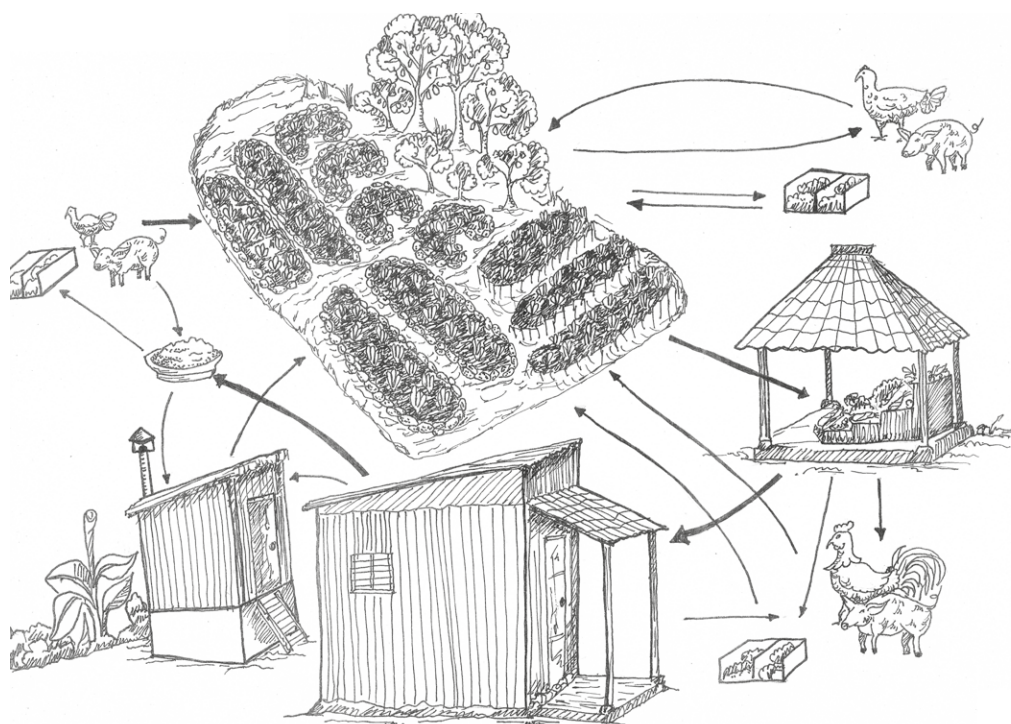
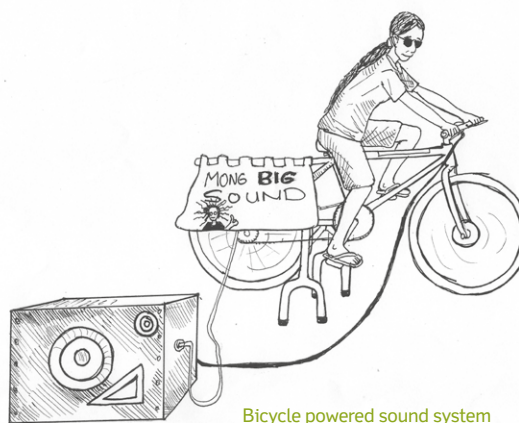


Unsustainable actions lead to waste problems and resource shortages



Opportunities of urbanisation:

- Better medical and educational facilities
- Clean water and sanitation
- More available and diverse jobs leading to increased financial security
- Greater availability of public transport
- Increased social integration leading to higher social tolerance
- Greater access to goods and services, including those for leisure and entertainment
- Bigger markets to sell products
- Lots of waste to reuse, repair and recycle creating business opportunities
- Rooftops (only if structurally sound) and vertical spaces to use; for example, for energy creation and food production
- Reusing empty buildings
- Sharing renewable energy between more households
- Greater opportunity to demonstrate new technology
- More groups and people's movements to link with
- Old and new cultures can co-exist
- More investment opportunities



When sustainable solutions are used then waste is turned into resources and problems into opportunities

The design tools explained in Permaculture Design (**Ch 3**) are applicable for urban and community design as well. Read **Ch 3** for more detailed information.

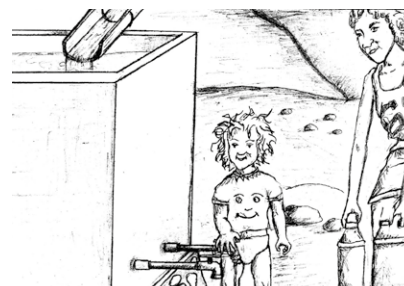
COMMUNITY SITE ANALYSIS

A community site analysis involves an assessment of the different elements undertaken by representatives of the entire community, especially from families, the disadvantaged and poor. Through community meetings a site analysis collects information on:

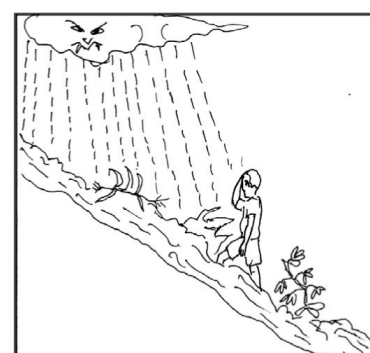
- What is needed for a sustainable healthy community?
- What are the biggest problems currently facing the community?
- What resources are available and what are needed?
- What community infrastructure is available – water supply, transport access, community buildings, markets, schools, electricity sources and supply, wet season access?
- What education and knowledge are needed?
- What skills are available?
- What products are made in the community?
- What are the potential disaster risks – floods, landslides, earthquakes, drought, volcanic eruptions, etc.?
- What is the impact from the natural elements – sun, water flow and flooding, wind, fire, soil types, sacred and cursed land?
- What are the yearly cycles, including ceremonies and seasonal activities?
- Are there hungry periods? In many tropical countries, especially for poorer families, there are hungry periods, usually from the start of the wet season for two to three months, where there is not enough food available. A community food calendar, which identifies when the hungry periods occur and what types of food are deficient, can be included to help provide solutions.
- Is there equal access to services?
- Are there adequate community spaces?
- Is the natural environment healthy and abundant?
- What are the goals for the community?
- Where are the spaces for growing food?

From this information, a good design that meets everyone's needs is much easier to create. The community members can design and implement the solutions.

It is important to include government representatives and work with the government on the solutions. However, sometimes government support is not possible and it is better for communities to do as much as possible for themselves. The benefits add up to much more than the effort.



Community water supply



Flooding is a disaster risk for many communities



Community members identifying their resources and needs



COMMUNITY ZONES

For a lot of communities and small towns it makes more sense to have a zone map for the community rather than for individuals. Use the information in the zones section of **Ch 3** and, through inclusive consultation, adapt it to the community level.

Zone 1: The town, village or area within a city

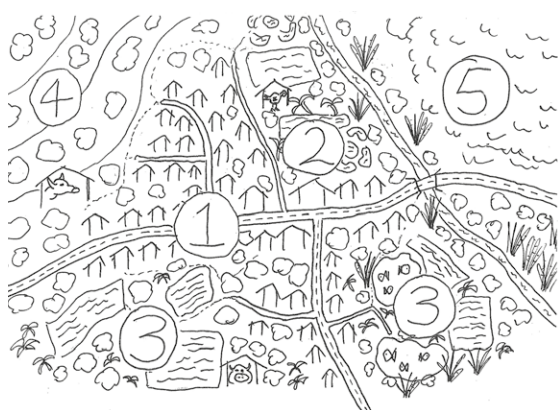
Zone 2: The main family gardens area, smaller farm animals and the area surrounding the town/village/city

Zone 3: Fruit tree crops, sustainable agriculture/annual crop land, aquaculture and intensive animal-grazing land

Zone 4: Nut, fruit, medicine and timber trees, animal-grazing land, further from the village and harder to access and maintain

Zone 5: Rivers, natural forest, land to protect and preserve in its natural state

Each zone includes, as much as possible, all the elements required to support the needs within it, so these community zones can become more efficient and productive. The zone approach meets needs using less energy and finds methods for people to work together to achieve common goals. At the community level there is always a Zone 5 and it is vital to identify this area (or areas), regenerate it if need be and protect it using local traditional law.



An example of community zones for a village



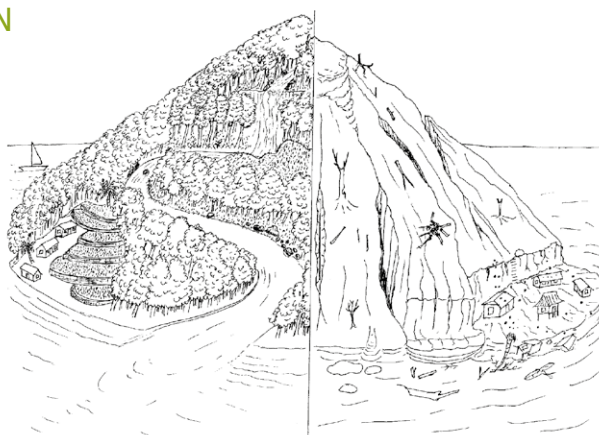
An example of community zones for a city

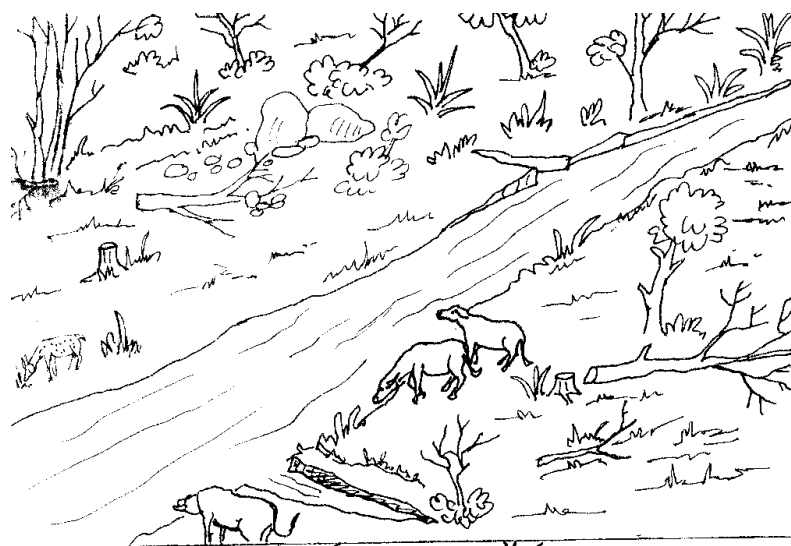
DISASTER AND DISEASE RISK REDUCTION

Disasters and disease can occur anywhere. While the impacts are often worse in urban areas, it is much harder to provide relief for and repair damage in rural areas. **National strategies for disaster risk reduction are important**, and must be implemented at national, regional and community levels.

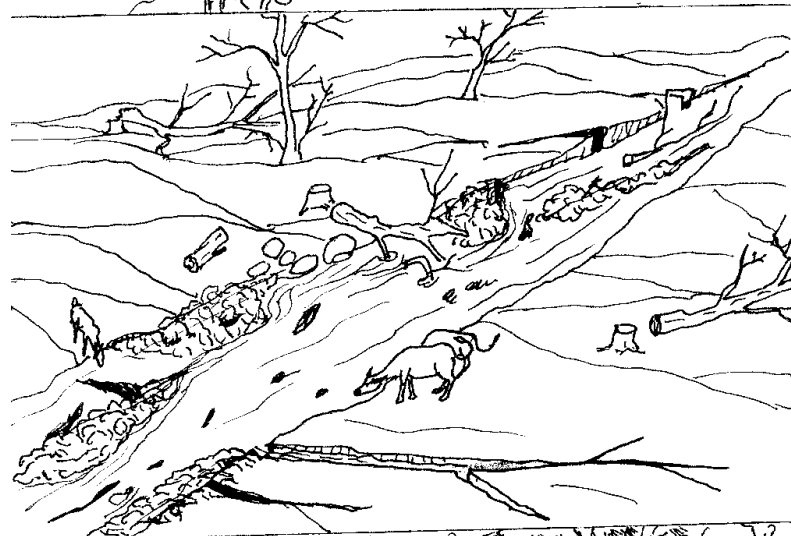
These strategies must educate about issues such as:

- Water – supply, security, cleanliness
- Waste management – human waste and rubbish
- Preventing disasters – responsible water and land management, appropriate building design and location, effective waste management
- Disaster likelihood, preparedness and response
- Promotion and education about good health, good hygiene and disease prevention





Now

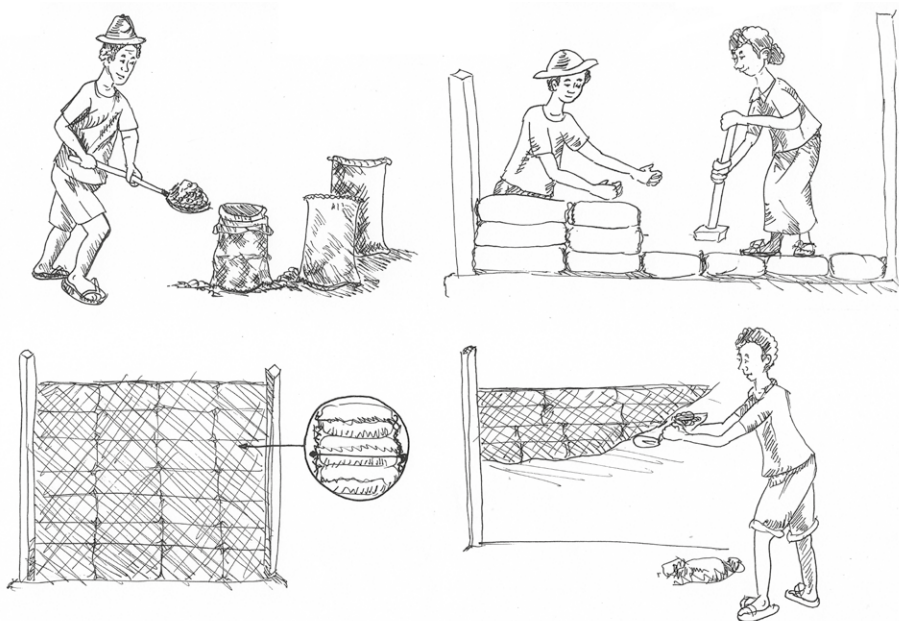


Future with no land management plan, creating a disaster



Future with good land management plans, preventing disaster and ensuring sustainable production

With good strategies and their effective implementation, it is possible to prevent many disasters and greatly reduce the damaging results of events such as flooding, food shortages, landslides, fires and earthquakes. It is also possible to reduce the impact of or prevent post-disaster disease outbreaks and other health consequences with effective community plans and responses.

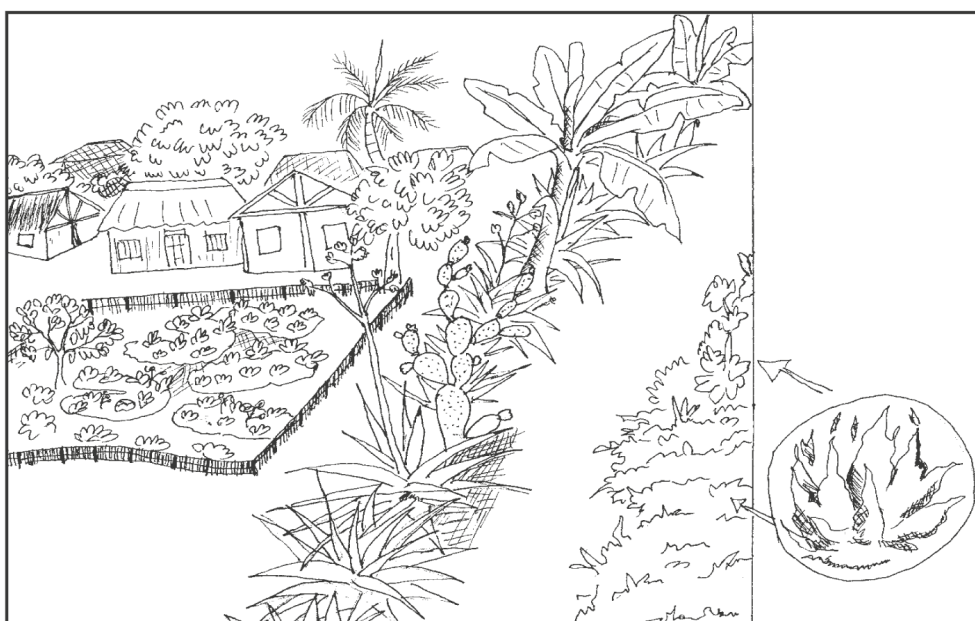


Earth bag buildings are very resilient in earthquake prone regions

All programmes must use a preventative focus, combining long-term permaculture design methods, appropriate techniques and technologies, and environmental repair and protection. An effective and continually updated disaster response plan must be in place in case prevention strategies are not totally successful. A community response plan in readiness, with a good understanding of which disasters could occur, involves evacuation plans, emergency aid kits and knowledge, and emergency food reserves. Government agencies can even have emergency tent and blanket supplies stored.

Communities need to work together with the government to develop plans. The first step is that the government must hear from communities about what is most needed and how the government and communities can work together. As most governments do not have a lot of money or resources, it is often essential for communities to do much of the work by themselves.

Read in the **reference section** for more information on disaster risk reduction and prevention.

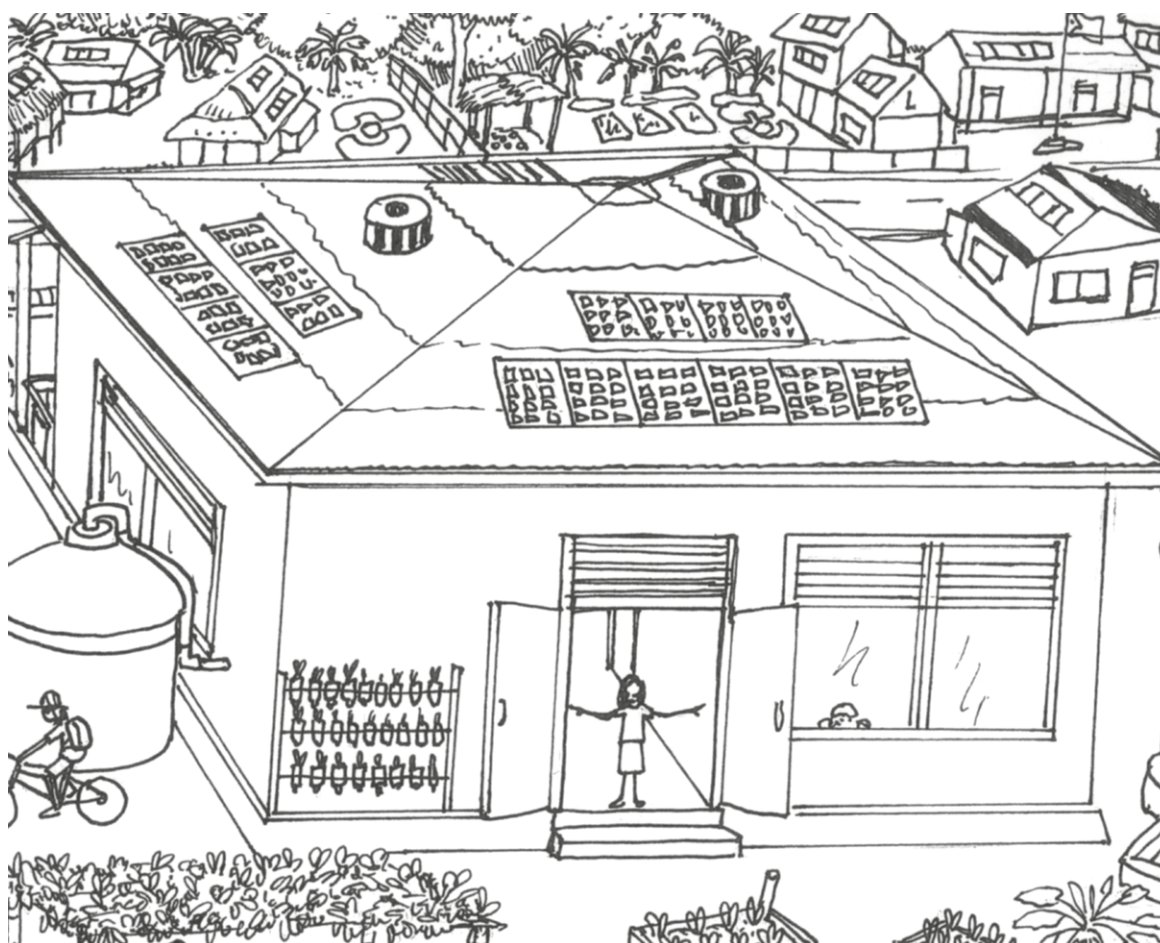


Firebreaks can reduce or prevent fire damage on your land

LAND ALLOCATION AND USE

Governments usually decide on land allocation but citizens can and should have input into the decision-making process. There are some important regulations and considerations in designing cities, and using land to achieve greater resilience and self-sufficiency for cities and regions. This includes:

1. Keep the best agricultural land for agriculture, especially vegetable production! Too often the land is used for housing, leaving poor land for vegetables and crops, which results in much lower yields. This is happening all over the world as populations rise and it greatly reduces production at a time when more production is needed. It is very important for city planners and landowners not to make this mistake!
2. Recreational spaces and parks are part of a healthy society, and must be part of long-term planning. Street trees and shade-providing trees are very important and can also be productive.
3. Public buildings can provide a lot of benefits. It is possible to use their roof spaces for lots of activities, such as solar panels, gardens and water storage, but only if they are structurally strong enough to cope with the extra weight. Land around public buildings can also be used for growing nuts, fruit and vegetables.



Community building with solar panels for electricity generation

Elements of urban and community life

Building design

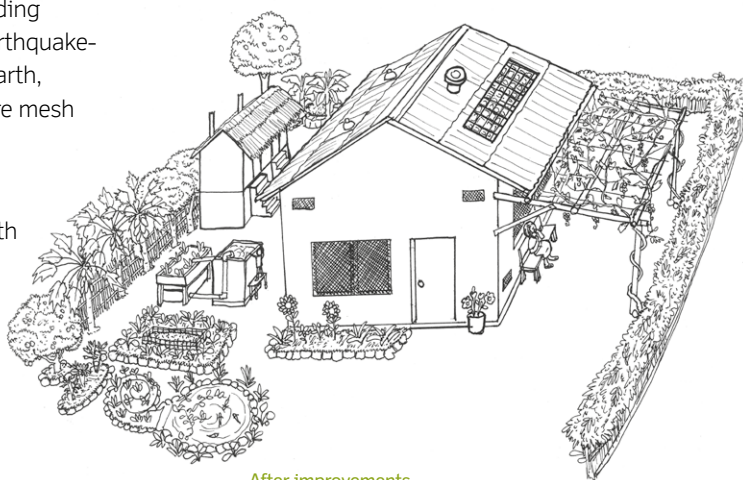
Good building design includes using local resources that are sustainably sourced and climate appropriate. It also involves the shape, orientation, roof size and ventilation of the house. **Building designs need to consider people's disabilities, and allow easy access and building use.** Passive heating and cooling techniques are important: this means that houses naturally stay cooler in the heat and warmer during cold months in mountainous regions. Using trees and plants around the house moderates hot temperatures and is especially important in urban areas where there is a lot of cement and metal that store heat and glass that reflects it.

An example of a cheap and appropriate building material, especially for mountainous and earthquake-prone areas, is earth bags: bags filled with earth, which are laid out like bricks, bound with wire mesh and covered with render.

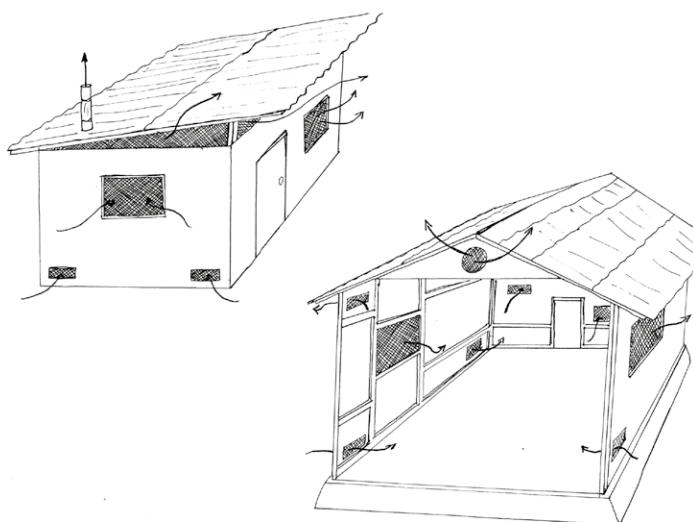
Good design reduces energy use and allows more light, better airflow and improved health and comfort. When urban buildings are designed badly they need air conditioners constantly, which cost lots of money to buy, use and maintain. When the building design works with nature's patterns air conditioners are used occasionally or not at all.



Before improvements

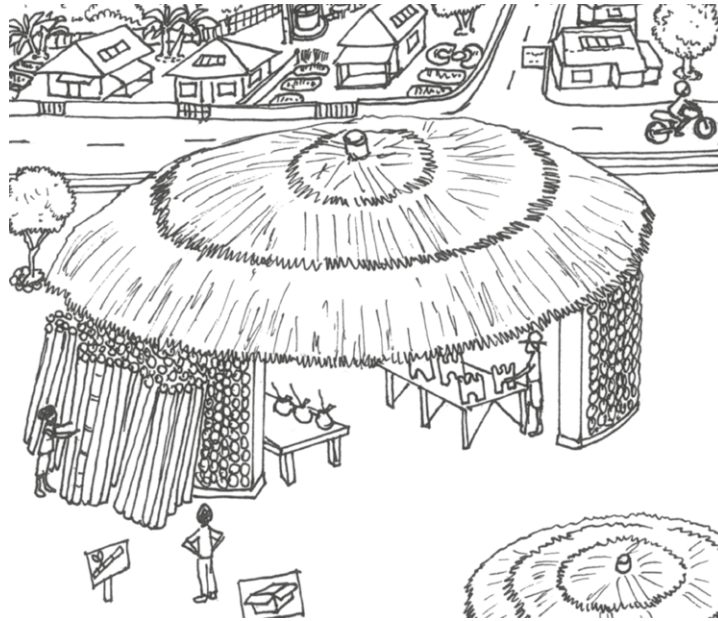


After improvements



Good air convection creates natural cooling for the house

Government support for community education programmes and promoting good designs using local materials can help a lot, as well as providing regulations for developers. Government buildings should be leading examples of efficient and innovative design.

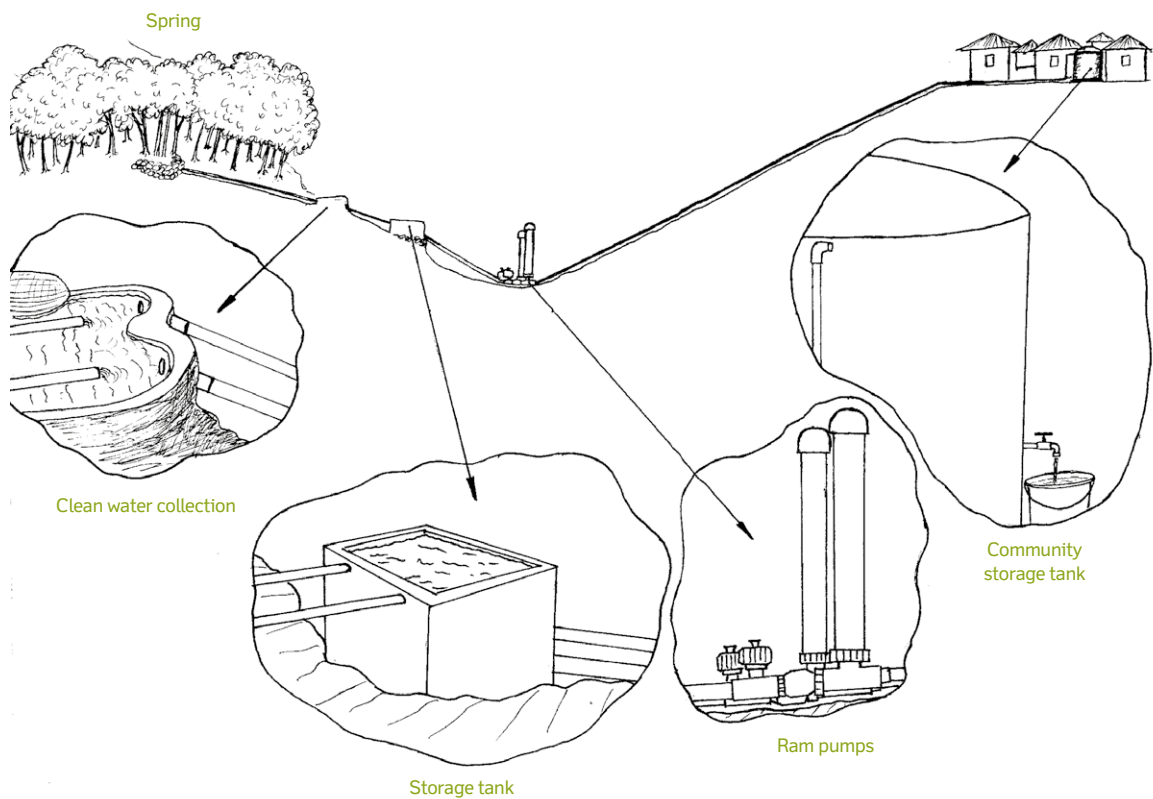


Community building using old bottles as part of the construction materials

Read Houses, water and energy (**Ch 7**) for more on building designs.

Water collection, storage, use and reuse

Water and its availability is a major concern in many urban areas. Urban rivers are often dirty, full of bacteria and mixed with other materials including rubbish, especially in the wet season. Equal access to safe water is a global problem; some cities and towns have a piped water supply, but this water is often dirty and carries bacteria, and is not available to everyone.



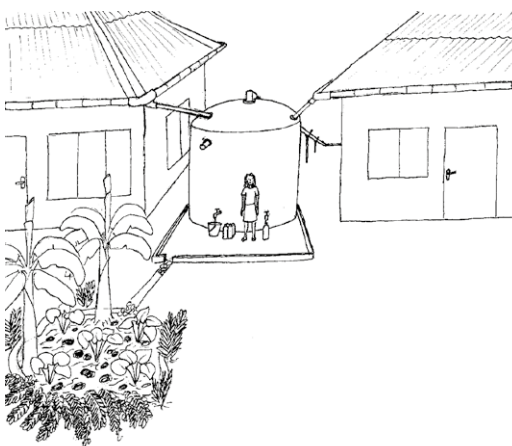
A ram pump moves water from a spring to a village community water tank



Providing clean water to cities and towns requires a government response. However, communities and households can implement solutions for urban areas, and business and governments can join in with different local and regional strategies.

COMMUNITY WATER SUPPLY

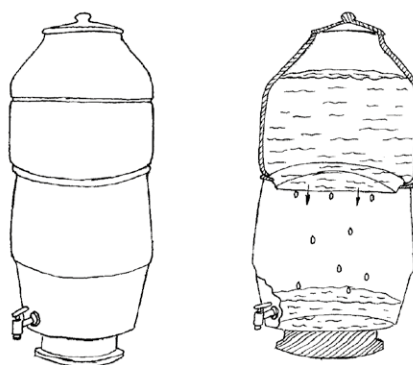
Community wells, bores and water tanks are the most common methods for collecting water. Communities need clear guidelines and education for management and maintenance, so the water stays clean. Read Houses, water and energy (**Ch 7**) for ideas and techniques.



PURIFYING WATER

Cleaning water for drinking is very important and different purification systems can work on a large scale in urban areas. Moringa seeds, clay filters and sand/charcoal are three methods described in **Ch 7** Houses, water and energy. For the cleanest water, it is best to use more than one method.

Another option for larger-scale water purification uses ultra violet (UV) light. This removes harmful bacteria and diseases, but the water must also be filtered to remove dirt and other particles. UV systems are now common in many countries and are a great small business or cooperative idea.



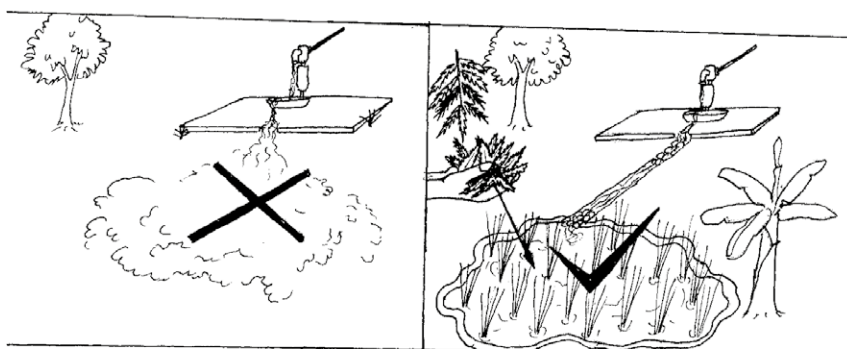
Clay water filter

KEEP WATER MOVING AND CLEAN

Prevent water lying in pools and becoming stagnant, especially in the wet season. This reduces water- and mosquito-borne diseases. Moving water into permanent water bodies, such as ponds or lakes, into the ground, to rivers, or to the ocean for coastal towns and cities, prevents the water from becoming dirty. Constructing water trenches, drains, swales and pipes allows water to move from place to place and remain clean.

Important factors for permanent water bodies:

- Reduce mosquito-borne disease by adding small insect-eating fish that eat the mosquito larvae, or mix neem oil in the water regularly.
- If wastewater or water containing chemicals, oil and bacteria enters the water body, use water-cleaning plants to filter and clean the water as much as possible. Do not harvest the plants for food because they can store chemicals and excess nutrients from the water they have cleaned.



FLOOD MITIGATION AND PREVENTION

The first step in reducing the force of floods is to identify where water can come from and use techniques to prevent water moving from those areas. This involves slowing and storing water, in the ground if possible, using swales, tree planting and rock walls on contour, and other methods. They prevent a large amount of water moving across the land, and they slow and reduce the water that flows into rivers. Storing water in the ground is also a key technique for maintaining consistent underground water levels for springs, wells and bores in the land below.



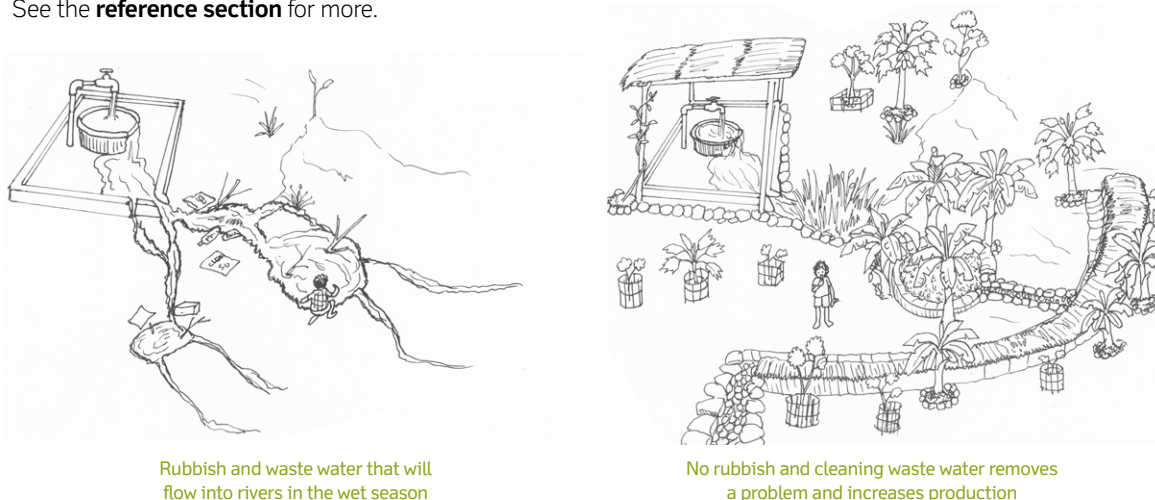
Water catchments and trees above the houses will reduce flooding risk

Any land where mudslides and landslides are likely in heavy rains MUST have a cover of vegetation, ideally including some deep-rooted trees and permanent grasses such as bamboo and vetiver.





It is also important not to throw rubbish into rivers: not in the dry season or the wet season! Waste-polluted rivers are not only dirty and ugly; the rubbish builds up until it blocks the water movement, causing rivers to overflow. It is a very common but preventable cause of flooding in big towns and cities. New technology is available for transforming large amounts of plastic into poles and building materials, turning the problem into a solution! See the **reference section** for more.

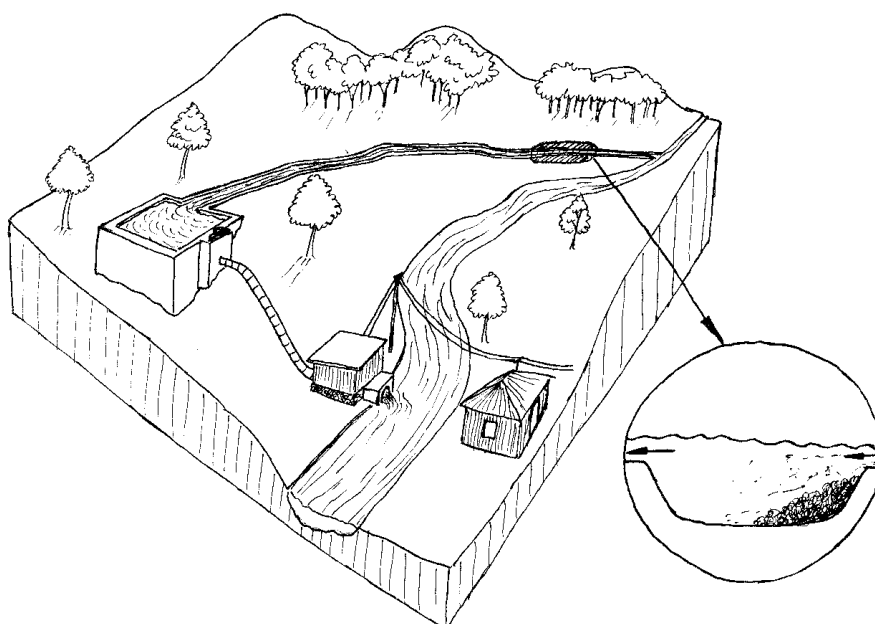


Energy creation and use

As important as the supply of energy to urban areas is to have building designs that are smart, cool and reduce the electricity used. See building designs above.

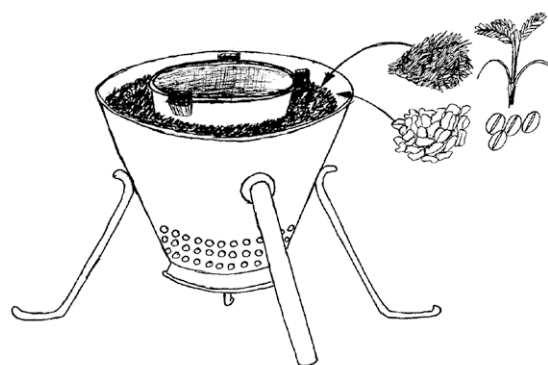
Smart houses still need some electricity and it is a part of urban living for most people. As more communities gain access to electricity, it is very important to consider how it is generated. With the development of new technology and the increasing impacts of climate change, the best and cheapest method is renewable energy. Solar, wind, micro-hydro and biogas are all renewable energy sources, and there are many more. These can be community-owned power supplies, where a group of families or neighbours join together to buy and install a renewable energy system. This can be small—providing enough for a shared space with lights, fans and possibly a refrigerator—or bigger systems that supply small amounts of electricity to each house.

Regional, national and government strategies are part of energy supply systems. With new technology it is possible to create electricity for towns and cities from renewable sources and to link them into a large electricity grid, or into many smaller grids. Examples are solar, solar thermal, small-scale hydroelectric, large-scale biogas and wind. Moving to these smart systems creates long-term energy security and reduces costs for everyone, including the government and the environment.



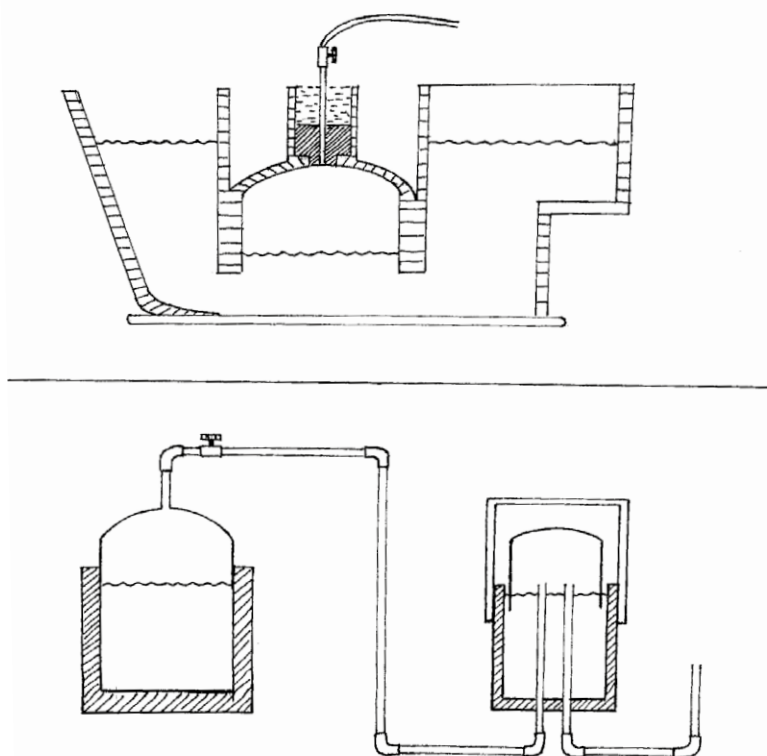
Micro-hydro electricity generation

Cooking also uses fuel; for example, wood, kerosene, gas, electricity, charcoal, bamboo, coal, sawdust, dried manure, etc. It is most important to use as little fuel as possible and only that which is from a sustainable source; if possible, do not use wood. Using wood in a city or an urban area creates a lot of smoke pollution as well as deforestation in the land around the city. Read Food, health and nutrition (**Ch 8**) for lots of information on cooking stoves, ovens and solar cookers; check the **reference section** for websites.



A cooking stove that uses rice and coffee husks

The most sustainable fuel is methane from biogas; in an urban situation, individual households can make biogas in metal drums or it can be made on a larger scale, such as through a government-supported project or business, for many houses.

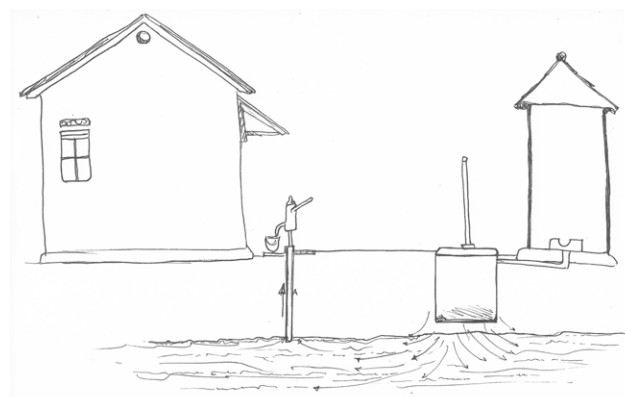


Different designs for community size biogas chambers

Waste management

HUMAN WASTE

In most tropical towns and cities there is either a system of septic tanks to store human waste under or by each house or no facility at all. Not having any method to store human waste leads to massive health and pollution problems, especially contamination of the water supply. However, septic tanks are usually not much better; emptying them often depends if families can afford it and they leak into the ground surrounding them. Eventually, the waste liquid enters the underground water supply, spreading harmful bacteria.



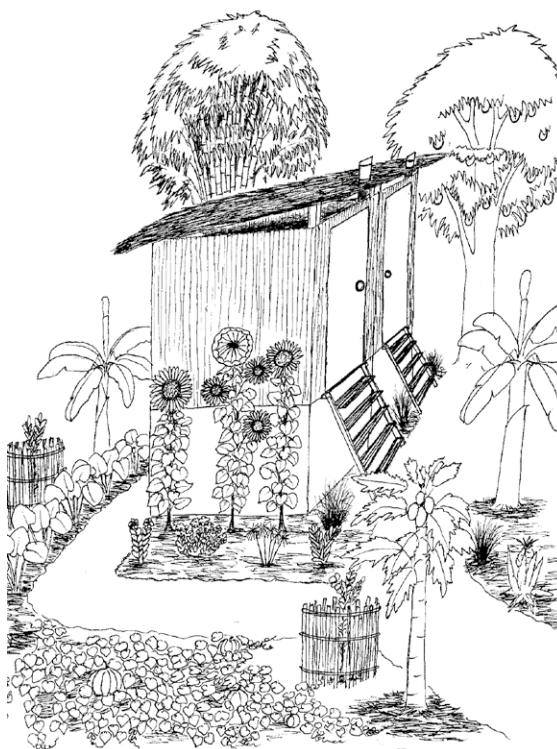
Septic tank leaking into the ground water



Compost toilets (closed systems, not pit toilets, see **Ch 7**) are better than septic tanks, because they contain and clean all the manure, removing harmful bacteria. Human waste, sometimes called 'humanure', is a valuable resource that is mostly not used and so it is wasted. It is a vital part of recycling nutrients back into the environment for trees and plants. In urban areas, communities can build compost toilets to provide clean waste disposal for many families. People need to know how to use them correctly and there should be a plan for how to use the compost.

Biogas (see **Ch 7**) systems can use human manure. If the waste product is composted properly afterwards, biogas systems can be a very useful urban and community solution.

Where there are sewage systems for removing human waste, they often just take it to the ocean. This is very harmful to the marine environment and completely unsustainable. Governments need to work towards cleaning and reusing water from town sewage on fruit trees, forestry, parks, shade trees and reforestation projects. There are many successful examples of this already and, with less water security in the future, this is an important part of recycling water for use in public parks and on trees.



Two-box compost toilet system

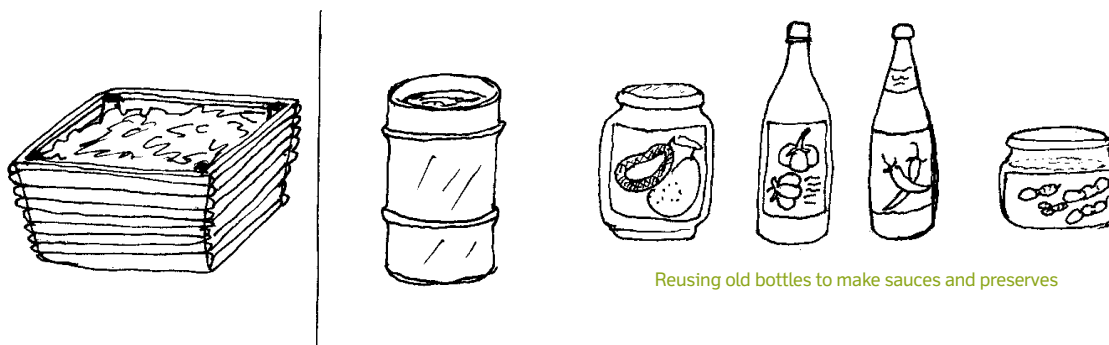
REPAIR AND RECYCLE

Repairing goods is much better than throwing them away. Specialist repairing is a business opportunity for cooperatives or individuals.

Recycling materials provides many financial opportunities for cooperatives and businesses. Many products can be made from what people throw away (what some consider rubbish), creating a good income: making and selling compost is an example. While there is more waste created in urban areas, there are also more markets for selling goods made from that waste. Reuse and recycle products to stop them going to the waste dump; it save precious resources and removes the problem of waste disposal. Read Houses, water and energy (**Ch 7**) for more.



Repairing clothes



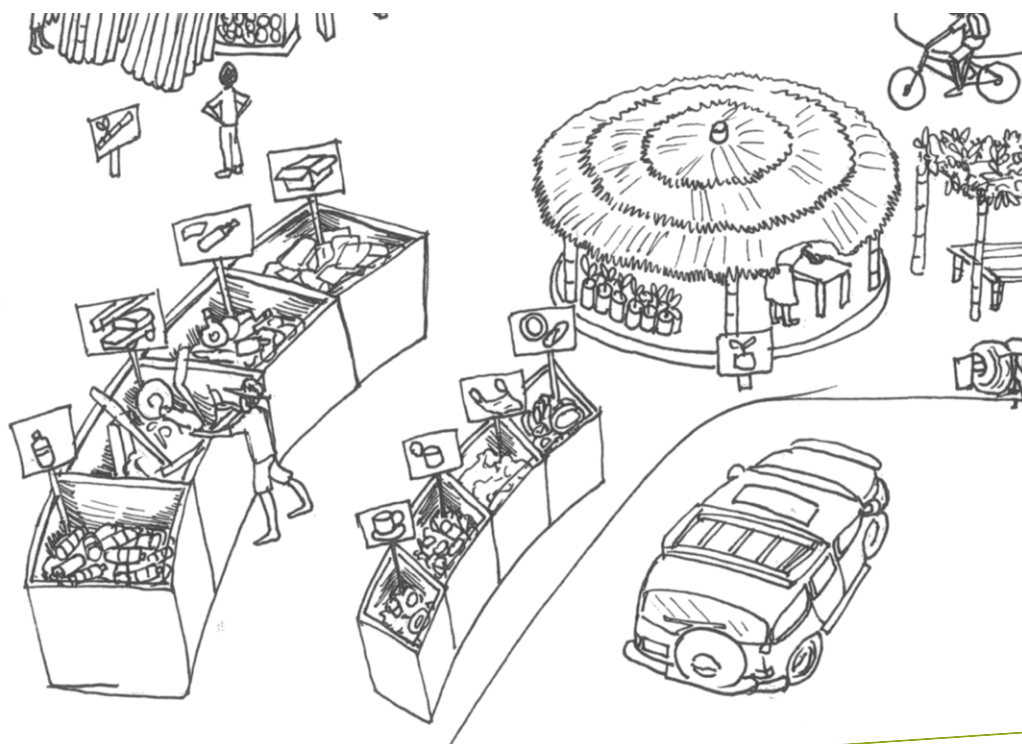
Reusing old bottles to make sauces and preserves

Make compost and liquid compost instead of buying chemical fertilisers

WASTE-RECYCLING STATIONS

Waste-recycling stations improve waste management a lot, especially in towns. They separate and recycle as much rubbish as possible: a growing number of municipalities around the world have introduced facilities to achieve a 'zero-waste' goal. On a community level, recycling includes:

- All metal for scrap.
- Bottles and all glass.
- Old tyres to make terraces: use them in swales to replace rocks. Plant trees below or even inside the tyres.
- Making compost from all leaves, manure, food scraps, etc.
- Crushing and reusing old cement, bricks and tiles for building, such as for an earth bag building, gravel for construction and for roads.
- All plastic. Some can be recycled or reused, and there are machines that turn plastic waste into oil, or into building structural materials to make furniture and even houses. See the **reference section** for more.



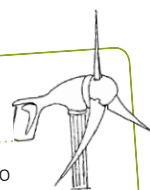
With good recycling technology and facilities, the amount of waste which remains after recycling and reusing should be almost zero!

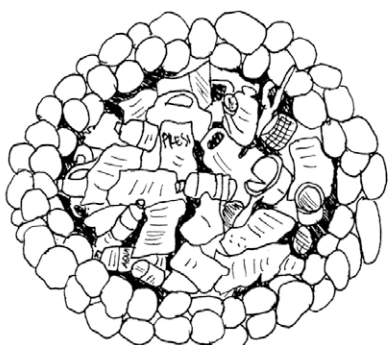
It is important for governments and communities to think about the future and work towards proper storage and recycling of waste to replace burning. With new available technology, it is possible to reduce the amount of waste produced to almost nothing very quickly and the products that result from the process can create business opportunities.

The creation of a burning area in your community reduces smoke and environment problems by increasing the temperature at which the rubbish burns; however, burning should always be the **last** option for rubbish removal. Make a circle out of large rocks about 2 metres wide and 1 metre high (similar to but bigger than the description in Houses, water and energy [Ch 7]). Do not burn the rubbish unless the area is full and do not include anything that can be recycled or anything toxic such as batteries, plastic, tyres or medical waste. Remember trees, leaves and other vegetation are for composting not burning!

SMART IDEAS:

- Remember – the best way to deal with waste is not to create it in the first place! Use natural, local materials whenever possible.
- Read more about housing design, earth-bag houses, water supply, renewable energy, biogas, recycling, compost toilets and waste management in Houses, water and energy (Ch 7) and look in the reference section for where to find more information.





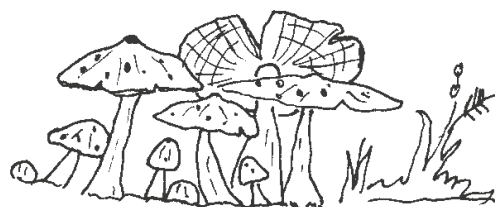
Rock burning circle - view from above



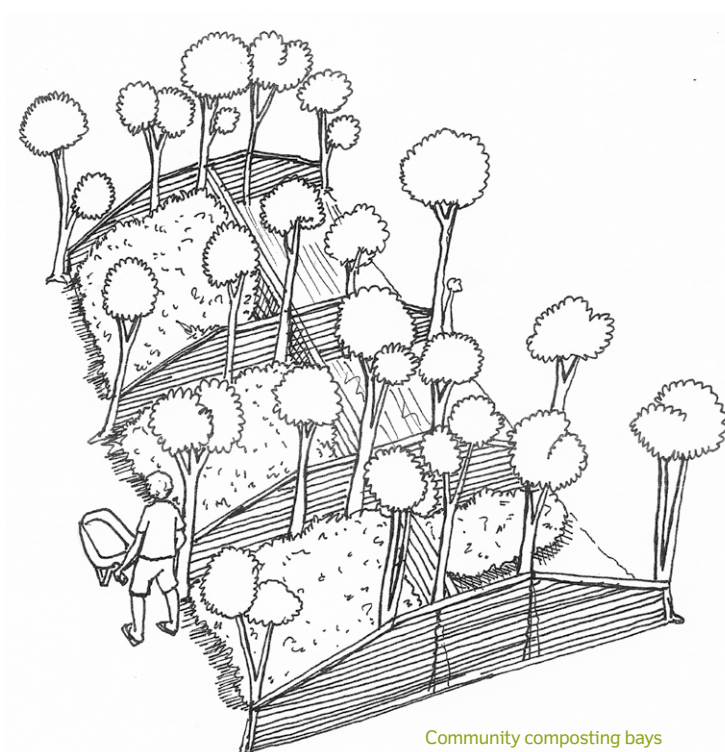
SITE REHABILITATION

Many rivers and other natural areas need urgent rehabilitation and repair. This is especially true in urban areas and towns where the problems include pollution, rubbish, weeds, removal of plants and erosion.

When soil is polluted by oil and other chemicals there is an organic solution. Research has discovered that growing oyster mushrooms on the sites helps break down the chemicals. See the **reference section** for more information.



For most sites, it is a process of carefully cleaning up, replanting appropriate plants and good management that enables sites to repair quickly. Healthy clean natural areas within cities and towns improve the whole region so they can function as part of a healthy ecosystem instead of degrading it.



Community composting bays

FOOD WASTE/ COMPOSTABLE WASTE

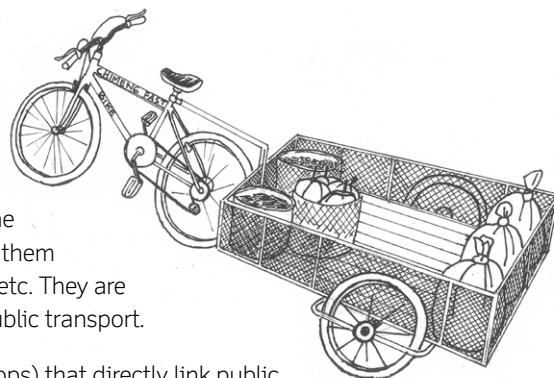
Food should never be wasted! Even old food that cannot be sold still has uses, as do food scraps. Some ideas include:

- Pickling and fermentation
- Feeding animals
- Community composting
- Feeding worms – worms love old food and produce great fertiliser and liquid fertiliser

All of these ideas are potential small business or cooperative ventures.

Transport

Too many cars in cities create huge pollution problems and contribute to climate change. They make roads dangerous for other forms of transport, especially bicycles and carts carrying goods. Making more roads is never the answer; they just create space for more cars! Cities around the world are starting to remove roads for cars and are replacing them with green spaces and paths for bicycles, carts, pedestrians, etc. They are also making parts of roads car free and encouraging more public transport.



Transport hubs (centres where public transport starts and stops) that directly link public transport to local markets are a traditional part of most tropical cultures. It is important to keep and improve them as part of modern transport systems.

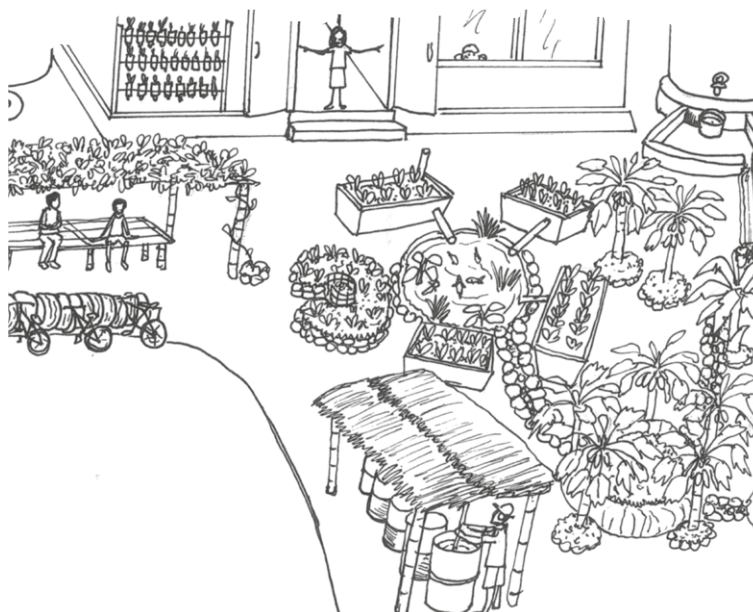
Bicycles are the best method for most small journeys. Many cities include bicycle lanes on the roads to make riding safer; this is a necessary part of planning for the future of road transport. There are bicycles with bamboo frames, and they can combine with many types of trailers and carriers for carrying goods and people.

Urban food production

It is possible to meet much of a city's food needs by growing it within the city. Use all the available space!

Food gardens – big or small – can fit almost anywhere:

- Footpaths
- Parks
- Schools (combined with education outcomes and school lunch programmes)
- Universities (combined with research)
- Hospitals and clinics (combined with health and nutrition education)
- Government buildings
- Land around houses
- Balconies and verandas
- Roofs and walls (see below)



Community food garden with vertical garden against building wall, wicking beds, banana pits, nursery, liquid composts and ponds

Cities need to reuse a lot of the waste they produce to help grow food. Consider:

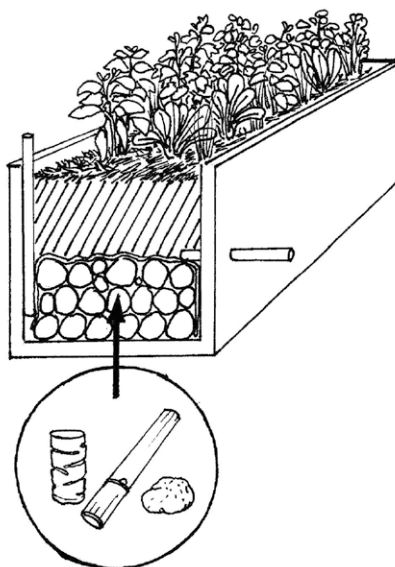
- Cleaning and reusing wastewater for food crops
- Turning manure, food scraps, wastepaper, etc. into compost or worm farm food
- Transforming rubbish, such as old fridges, TVs, foam boxes and drink bottles into garden beds and containers



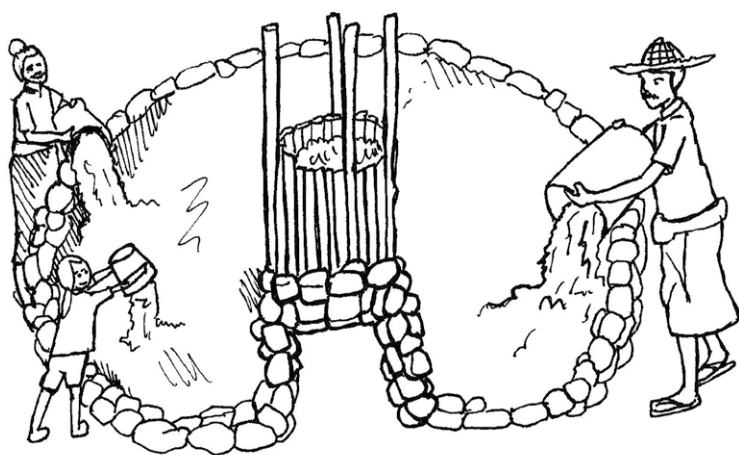
APPROPRIATE TECHNIQUES FOR URBAN FOOD PRODUCTION

Urban food cultivation has to maximise production from small spaces. The focus is not just on producing food but also making fertiliser and reusing wastewater. Some techniques are detailed in other chapters of this guidebook:

- Raised beds (See **Ch 10**)
- Wicking beds (See **Ch 10**)
- African keyhole beds (See **Ch 10**)

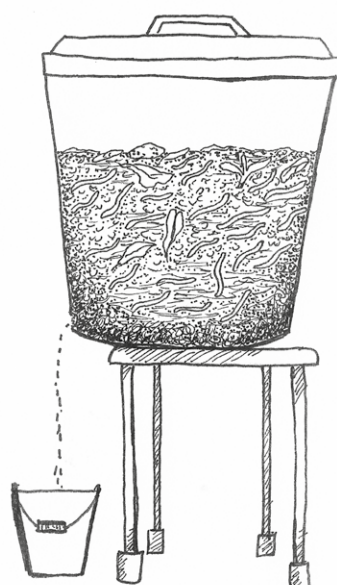


Cross section of a wicking bed



Making an African keyhole bed

- Spiral gardens (See **Ch 10**)
- Rooftop and vertical gardens (see later in this section)
- Trellising and crop integration (See **Ch 10**)
- Chicken house and yard (See **Ch 17**)
- Worm farms (See **Ch 9**)
- Liquid compost (See **Ch 9**)



Cross section of a worm farm

COMMUNITY GARDENS

Community gardens are as much about growing the community as growing food.

Communities can create their gardens on any unused land, as long as they have a suitable arrangement with the landowners. This includes government land, such as schools, clinics, fire stations, police stations, etc., and private land owned by businesses, individual landholders, sports clubs, etc.

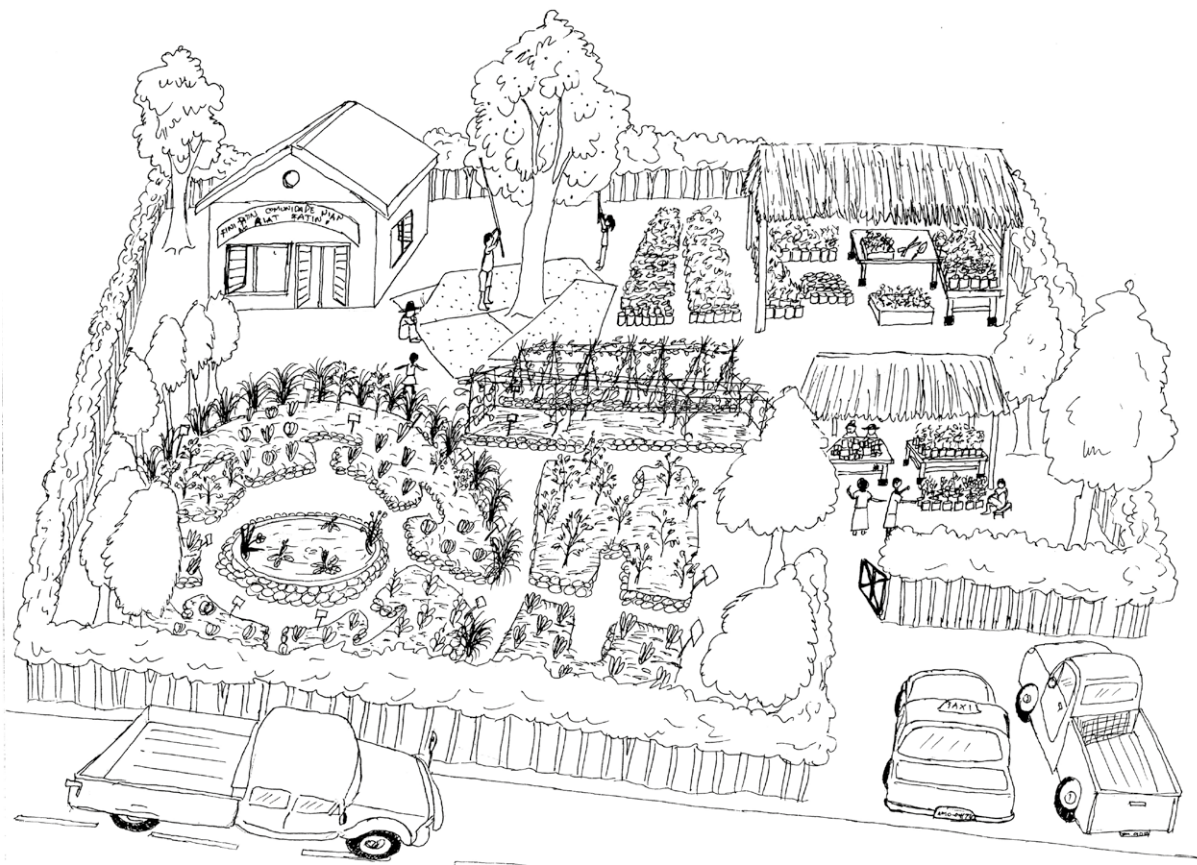
A community garden can have a variety of models – from 100% private garden beds or 50% private garden beds/50% shared by the members together or 100% jointly shared by all the members, or any combination in between. There are also other versions such as private gardens with shared orchard/animals, and so on. It depends on what the community and the landholders want.

A community garden has many benefits:

- More urban food production
- Education space for food production, health and nutrition
- Living research laboratory for school and communities
- Demonstration site for new gardening techniques
- Seed and plant bank (supplier) for surrounding communities
- Meeting place and relaxation space
- Education opportunities
- Potential shop/cafe for the community-grown produce



Community duck and pig house and fruit orchard



Community garden, plant nursery and seed production



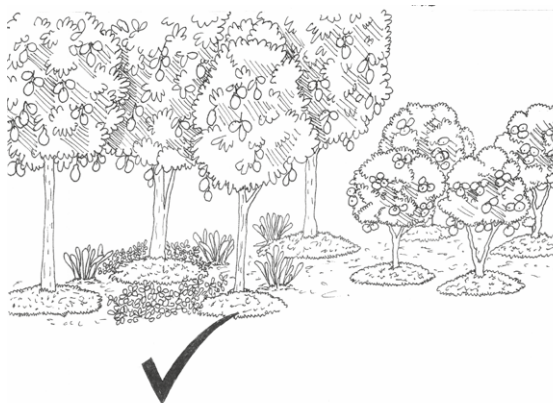
ROOF TOP AND VERTICAL GARDENS

Gardens on rooftops are an excellent use of space and even help to keep the inside of your house cooler. However, a roof garden can be very heavy so before its construction you MUST have the building checked to make sure it is structurally strong and safe. As soil cannot touch the roof directly, containers and pots are best. Wicking beds are also great for rooftops.

Vertical gardens attach to walls, usually by growing plants in small pots. With smart design the water that overflows from one pot can fall into the pot below it, then to the next pot and so on. They look great, provide food and herbs, and keep the inside of the building cooler too.

PARK AND ROADSIDE GARDENS

The trees in parks and on roadsides can provide food as well as shade! It is important to choose trees that do not lose lots of leaves/branches. Many trees that produce fruit, nuts, spices and more look great and provide food as well. The government or landowner has to decide what to do with the food. It could go to schools, hospitals or clinics, be sold to help provide wages for the staff who manage the parks and roadsides, or it could go to the poor, homeless and disadvantaged.



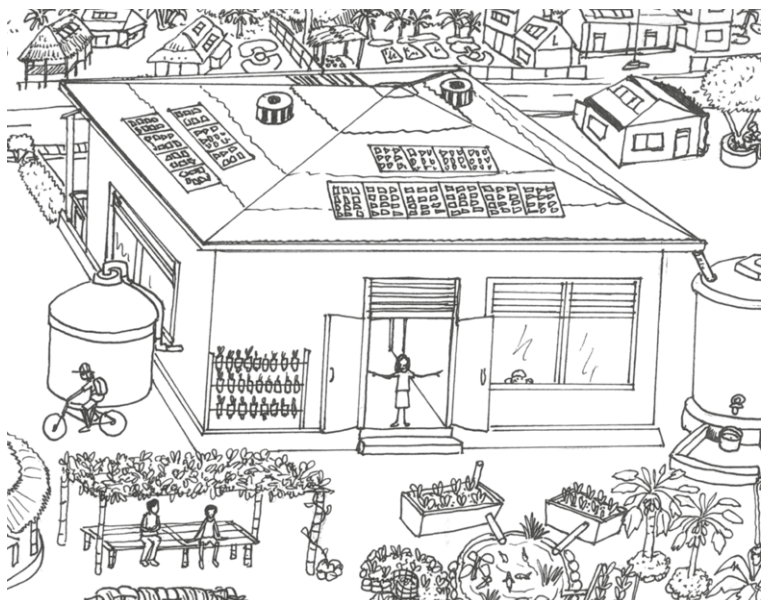
Community centres

A communal building or centre is an essential part of a healthy community. It is a place for music, theatre, education and produce markets; it provides community groups with a place to meet and do their business, and can be a neutral building for settling disputes.

Community buildings and land are excellent ways to give examples of how to improve the lives of people in the community. This can include:

- Smart and appropriate building design
- Compost toilets
- Collecting and storing water
- Electricity generation from renewable energy such as solar or biogas
- Stoves, ovens, food solar dryers and other appropriate technology
- Gardens, nurseries, tool banks and seed banks

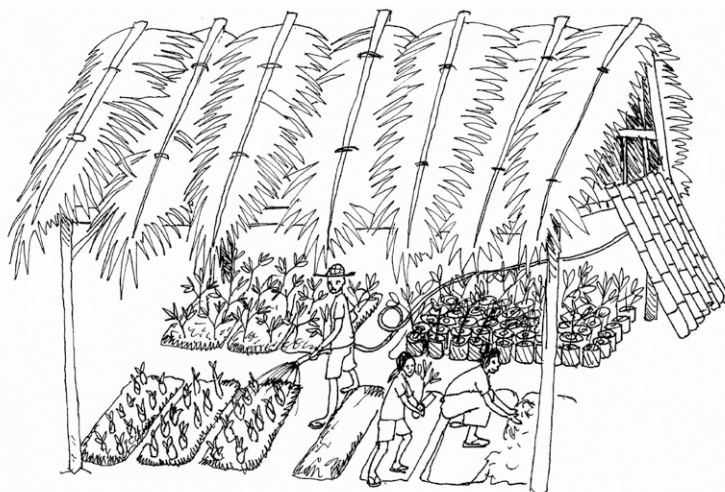
Schools and other government or religious buildings can collect rainwater and be examples of different techniques.



Small businesses and cooperatives

The right to quality and sustainable livelihoods is an essential part of a healthy society. Businesses and cooperatives that are part of the community and have a diverse range of products are more successful. Asking the government to support local enterprise by developing policies and regulations helps a lot too. Read more in the later section 'Local economy' in this chapter.

Cooperatives can be a method for successfully transporting goods, making products, accessing markets, managing land, recycling and processing waste, collecting and storing water building houses, and so on. Cooperatives achieve results where individuals cannot and they make a community stronger. In an urban environment cooperatives can bring individuals together. Read the Cooperatives chapter (**Ch 5**) for more ideas.



Bamboo nursery and poles small business

Markets

Fresh food markets are vital for urban environments, providing:

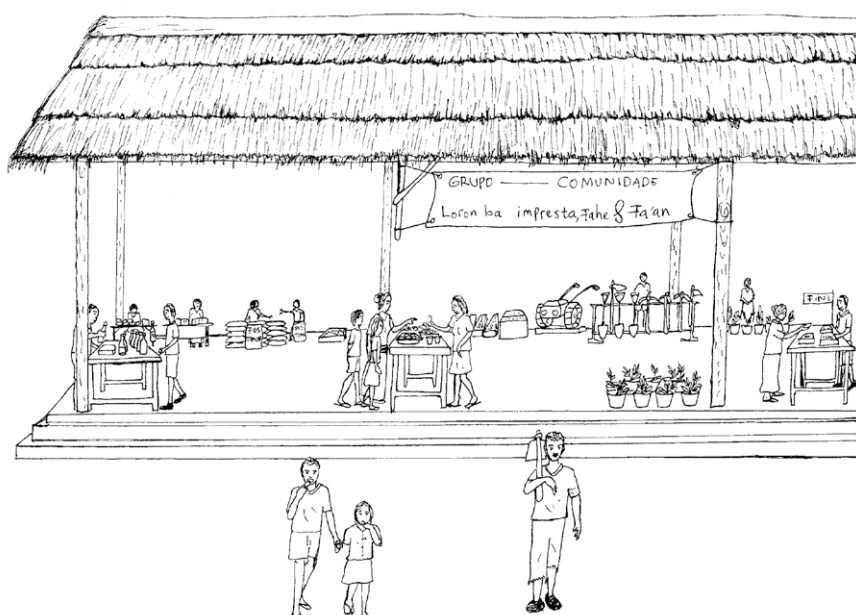
- A direct link between farmers and consumers
- Food that is fresher and healthier
- Support for local farmers and producers, not those from far away
- A healthier natural environment
- Farmers with higher incomes while keeping the prices cheap for consumers, because there is less transport required and fewer 'middle men' (people linking the producers to the consumers) in the system





Non-food markets for local products promote and sustain a strong community. They work best when they combine with food markets. One example is a central bamboo and wood market, where opportunities include:

- Introducing quality control measures e.g. certifying that the wood is sustainably harvested; ensuring the wood meets quality and size standards, etc.
- Linking growers with wholesalers and tradespeople
- Ensuring better prices for sellers and buyers
- Exploring opportunities to add value to timber and bamboo products through milling, craft items, small furniture and tool handle manufacture, and packaging of products such as honey, traditional medicines and fruit harvested from the wild

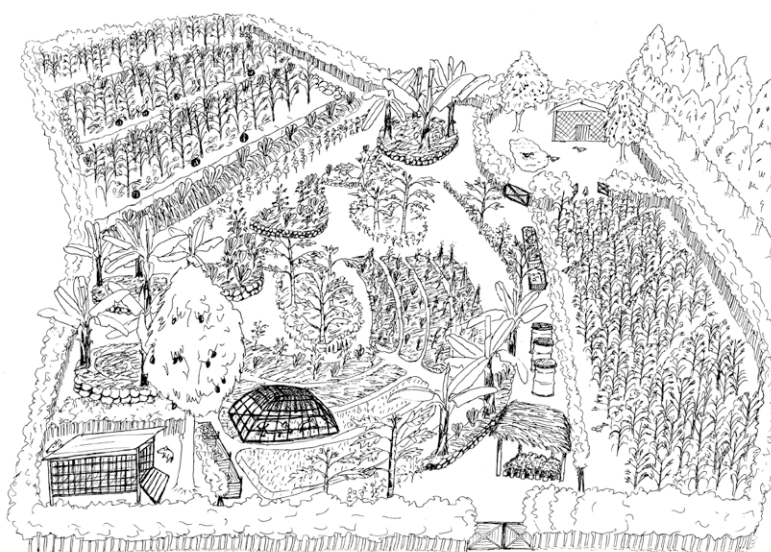


COMMUNITY-SUPPORTED AGRICULTURE (CSA)

This is a farmer/community cooperative or small business where every week farmers supply vegetables, fruit and other produce to members. They deliver food to a central point and divide it into boxes or bags of various sizes, according to how much money members pay each week. There are many benefits:

- There is direct trade between the farmers and buyers, and no 'middle men', which allows a better price for the farmers and a cheaper price for the buyers.
- Farmers have a guaranteed market because buyers commit to regular purchases.
- Buyers know who is growing their food and what methods they use.
- Urban buyers get fresh food directly from the farmers.

There are many different systems for CSA: look in the reference chapter for examples.



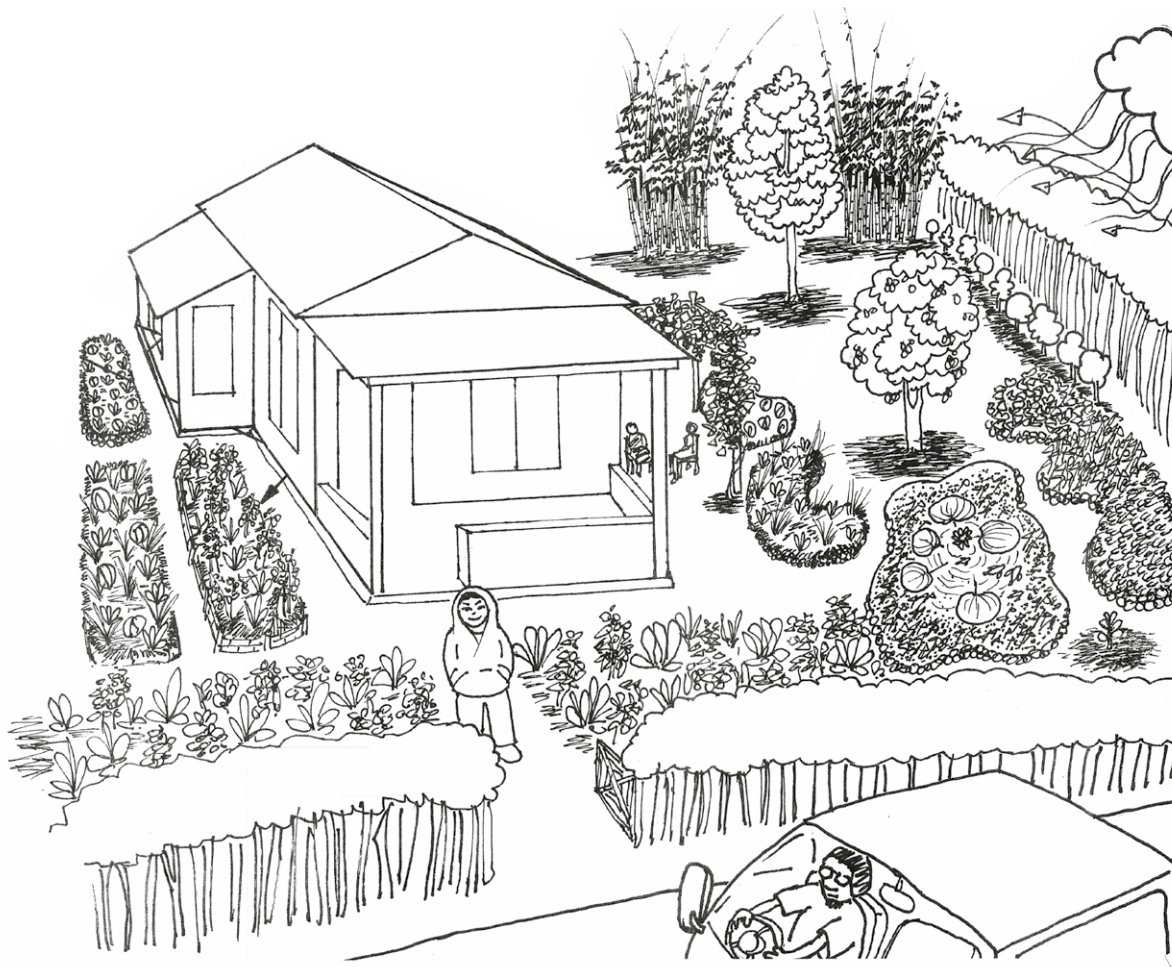
CSA market garden

Urban environment and ecology

Even our cities and towns can be a part of the environment if they are re-designed and managed well. Trees, parks, gardens and recreation areas make cities look greener and feel cooler. This contributes to improved social connections and mental wellbeing for residents, which reduces crime and conflict. Rivers are beautiful when they are well managed and the result is a healthier environment and reduction of flooding.

Windbreak trees that grow around or within cities and towns make living more comfortable and reduce dust problems. Windbreaks also provide other benefits: read the windbreaks section of Permaculture Design (**Ch 3**) for more.

Dust is a huge problem in many towns and cities causing health problems such as asthma and other allergies. Good strategies can improve dust management by identifying and planting drought-tolerant grass and ground cover and small to medium size drought-resistant shrubs for catching dust and providing screens. If they are drought resistant, it ensures they survive long dry seasons without much water.



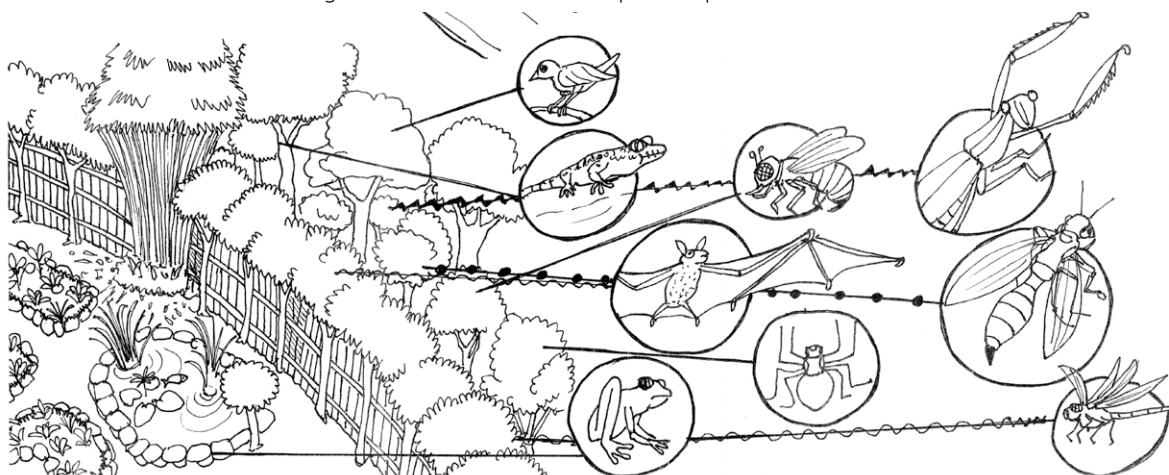
Windbreaks slow the wind, small shrubs along the road reduce dust problems, all the plants provide bird and insect habitats

Animals, such as goats and pigs, often walk around uncontrolled, even in urban areas. They can easily eat and damage dust-reducing plants, newly planted trees and river edges. Community plans, in cooperation with governments, need to manage and prevent this problem.

BIRD, SMALL ANIMAL AND INSECT HABITATS

It is very important to have spaces in towns and cities where native birds, bees, small animals and insects can live, eat and move. Often our cities are built next to water and on or near areas where large numbers of native species used to live. The growth of cities has pushed birds, small animals and insects into smaller and smaller spaces or left them with nowhere to live. Worse is that many have become extinct, so we need to provide some space for those that are left and rebuild their populations.

It is especially important to protect bees as their populations are struggling to survive with too much chemical herbicide and pesticide use and not enough food plants. These animals and birds are vital for a healthy ecosystem; they also help to pollinate your plants and reduce pest problems in your garden! (Read IPM **Ch 14**) The areas do not have to be big – even a small amount of space helps a lot.



Habitats for birds, small animals and beneficial insects

Techniques and strategies include:

- Replanting along rivers and waterways (this also helps to reduce flooding and erosion)
- Creating wildlife corridors by connecting rivers, waterways and parks using native and productive plants and trees: every house and building can plant trees and create ponds with plants, especially some native plants and flowers that support birds, bees and other animals
- Planting native trees and plants along the roadsides to provide homes and food

Strong community

A strong community is an essential base for a healthy society. Strong communities achieve a lot more than divided communities where everyone thinks only about themselves.

A permaculture system does not work if people are not interested in making it successful and a big part of this is to work together as a community. To be strong and resilient, communities need to be able to design and manage all areas of life; from food production, transport, electricity and housing to the local economy, business, trading policies and regulations. Communities work better when they own their buildings and other assets, and their own livelihoods.

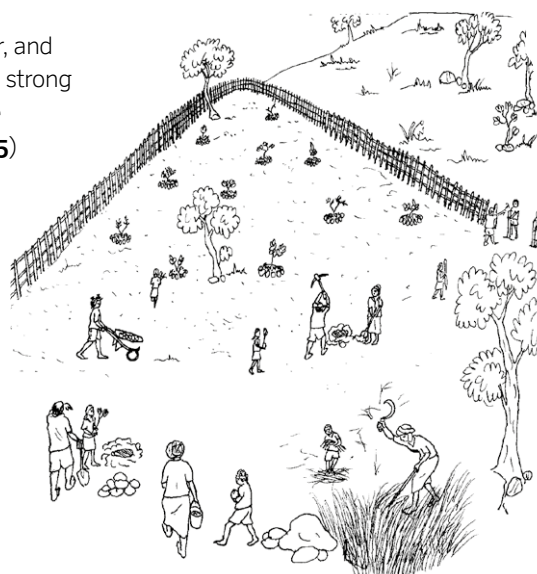


The right to quality and sustainable livelihoods is a key driver for creating positive community change.



Building earth bag rainwater tanks is a small business opportunity

The following sections build on the first half of this chapter, and provide different strategies and techniques for achieving a strong community. This is relevant for all communities – from the biggest city to the smallest village. See Cooperatives (Ch 5) for important ideas as well.



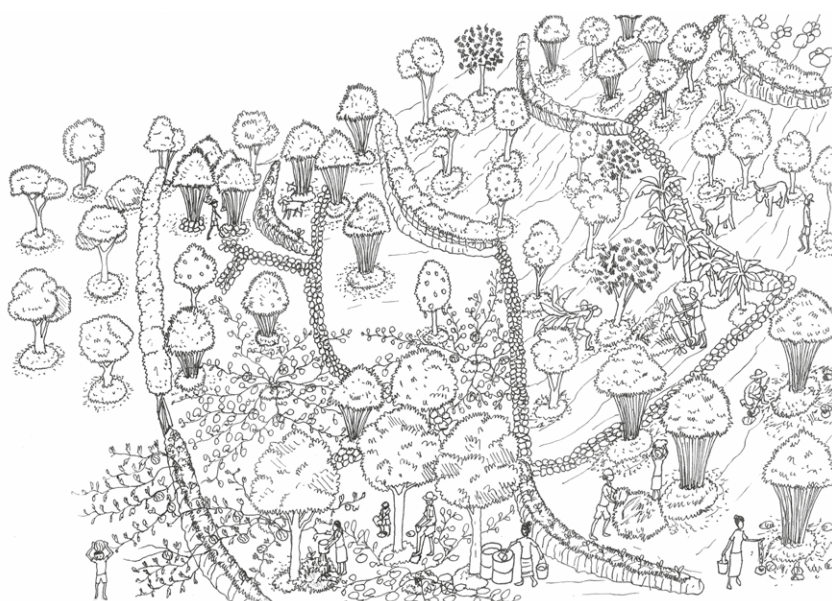
Community reforestation project



Food sovereignty

Food sovereignty is, quoting the “Declaration of Nyéléni” in Sélingué, Mali, 27 February 2007, (available at: <https://nyeleni.org/IMG/pdf/DeclNyeleni-en.pdf>):

1. “The right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems.”
2. Placing “those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations.”
3. To “defend the interests and inclusion of the next generation.”
4. To “offer a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers.”
5. To “prioritise local and national economies and markets and empowering peasant and family farmer-driven agriculture, artisanal fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability.”



Adopting food sovereignty is vital for communities to be strong, resilient, environmentally sustainable and able to reduce and withstand climate change.

Food sovereignty is NOT just food security. Food security is only having access to food, without any control over its production, source, economic or environmental impact and its price.

SIX PRINCIPLES TO ACHIEVE FOOD SOVEREIGNTY

The following is quoted with thanks from the Synthesis Report from Nyéléni 2007 Forum for Food Sovereignty, Mali (available at <https://nyeleni.org/IMG/pdf/31Mar2007NyeleniSynthesisReport-en.pdf>).

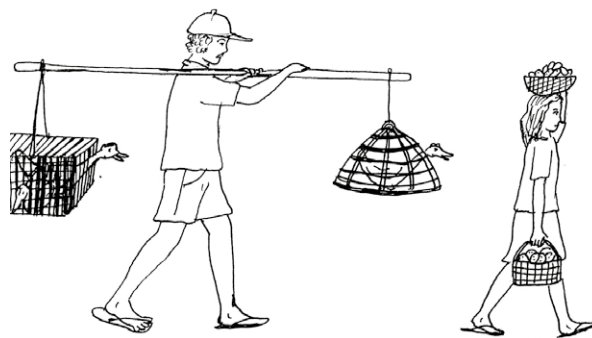
1) Focuses on Food for People

Food sovereignty puts people, including those who are hungry, under occupation, in conflict zones and marginalised, at the centre of food, agriculture, livestock and fisheries policies, (ensuring) sufficient, healthy and culturally appropriate food for all individuals, peoples, and communities; and rejects the proposition that food is just another commodity or component for international agri-business.



2) Values Food Providers

Food sovereignty values and supports the contributions, and respects the rights of women and men, peasants and small scale family farmers, pastoralists, artisanal fisherfolk, forest dwellers, indigenous peoples and agricultural and fisheries workers, including migrants, who cultivate, grow, harvest and process food; and rejects those policies, actions and programmes that undervalue them, threaten their livelihoods and eliminate them.



3) Localises Food Systems

Food sovereignty brings food providers and customers closer together; puts providers and consumers at the centre of decision-making on food issues; protects food providers from the dumping of food and food aid in local markets; protects consumers from poor quality and unhealthy food, inappropriate food aid and food tainted with genetically modified organisms; and resists governance structures, agreements and practices that depend on and promote unsustainable and inequitable international trade and give power to remote and unaccountable corporations.

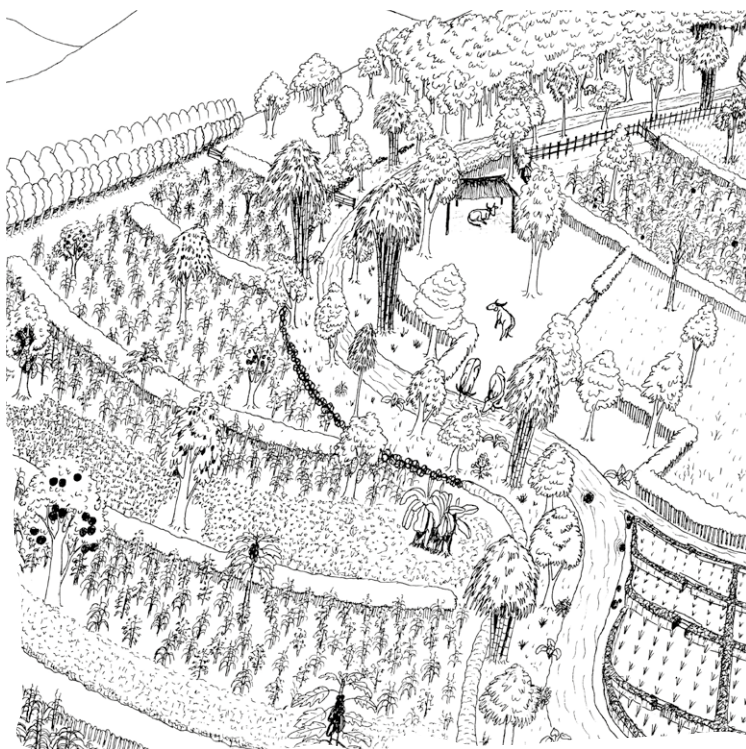
4) Puts Control Locally

Food sovereignty places control over territory, land, grazing, water, seeds, livestock and fish populations on local food providers and respects their rights. They can use and share them in socially and environmentally sustainable ways which conserve diversity; it recognises that local territories often cross geopolitical borders and ensures the right of local communities to inhabit and use their territories; it promotes positive interaction between food providers in different regions and territories and from different sectors that helps resolve internal conflicts or conflicts with local and national authorities; and rejects the privatisation of natural resources through laws, commercial contracts and intellectual property rights regimes.



5) Builds Knowledge and Skills

Food sovereignty builds on the skills and local knowledge of food providers and their local organisations that conserve, develop and manage localised food production and harvesting systems, developing appropriate research systems to support this and passing on this wisdom to future generations; and rejects technologies that undermine, threaten or contaminate these, e.g. genetic engineering.



6) Works with Nature

Food sovereignty uses the contributions of nature in diverse, low external input agro-ecological food production and harvesting methods that maximise the contribution of ecosystems and improve resilience and adaptation, especially in the face of climate change; it seeks to heal the planet so that the planet may heal us; and, rejects methods that harm beneficial ecosystem functions that depend on energy intensive monocultures and livestock factories, destructive fishing practices and other industrialised production methods, which damage the environment and contribute to global warming.

Read in the **reference section** for more information. There are organisations in most countries that work with communities towards achieving food sovereignty.

Transition towns

Born out of the permaculture movement, a transition town is a concept for facilitating the transition of communities from their current situation to becoming resilient and sustainable. It encourages the growth of small actions and whole-town participation and provides the tools to create action on all facets of living – food production, transport, housing, energy and fuel, livelihoods (jobs), water, environment, economy, etc. It also works to encourage and include government participation on all levels.

Transition towns link local production, local business and local economies with independent renewable energy systems, resilience and food sovereignty.

The transition town method is divided into three sections:

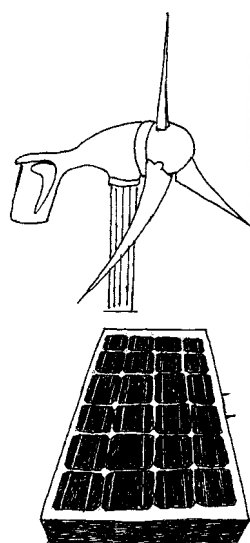
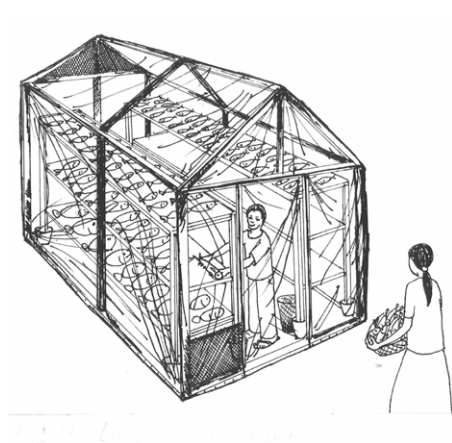
1. **The Head** - A process of educating people about the urgent need for change. It involves understanding the problems we face environmentally and concerns the over-use of resources, especially fossil fuels, as well as the solutions to these problems. The process occurs through a series of community events including talks, discussions and films, and by providing educational materials, such as books and websites, for people to read.



2. **The Heart** - The stage where people change themselves, which is necessary in order to change their habits and actions. This also deals with overcoming barriers to change and the fact that changing living habits is often similar to overcoming addictions, such cigarette smoking! We are addicted to cheap and easy solutions: we MUST change this but change is not easy. This process provides the tools for creating the change, both individually and as a community.



3. **The Hands** - The action stage! Change in the community starts by looking at all of people's needs and rights. The process involves establishing small groups to oversee and guide parts of the transition; for example, renewable energy, recycling and waste management, urban food production, etc. The movement supports groups that are already making change possible. These groups can work directly with the communities, supporting them and providing the skills and information they need. Secure local livelihoods are essential, as is a focus on supporting integrated businesses and cooperatives, including the reuse of all waste through businesses to create more opportunities. Creating change also involves building local economies and trading systems, and updating policies and regulations to ensure sustainable practices become normal and a cultural shift occurs.





Community growth, inclusion and conflict resolution

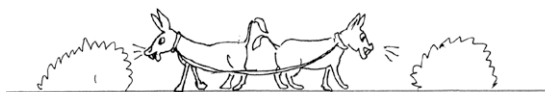
In communities, especially in cities and large towns, the links and relationships between people are weaker than they used to be. This can lead to social problems, such as higher crime rates and conflict, and personal problems, such as poorer mental health and more poverty.

Many of the ideas included in this chapter will improve how people work together in communities, such as through cooperatives, community centres and recreation spaces. However, there are many more strategies and techniques that build communities, provide mechanisms for conflict resolution and support for people who are struggling. These aspects are just as important and include:

- Community celebrations and events: for example, they can be cultural, seasonal, artistic, sport related, musical or remember significant historical events
- Transparency and continual engagement in all community processes and functions, both practical and social: these are keys to avoiding conflict
- Integrating traditional methods of decision making, conflict resolution and community building
- Using new processes for decision making and conflict resolution that are inclusive and based on transparent group process, such as deep democracy and sociocracy (methods of inclusively governing which shares authority, focusing on social responsibility and self-organisation). Look in the **reference section** for where to find more information
- Expanding social inclusion, tolerance and respect through programs and education
- Meeting the mental, physical and cultural needs of urban children
- Raising more awareness and acceptance of mental health problems through programs and education
- Providing food and shelter for the most disadvantaged and poor

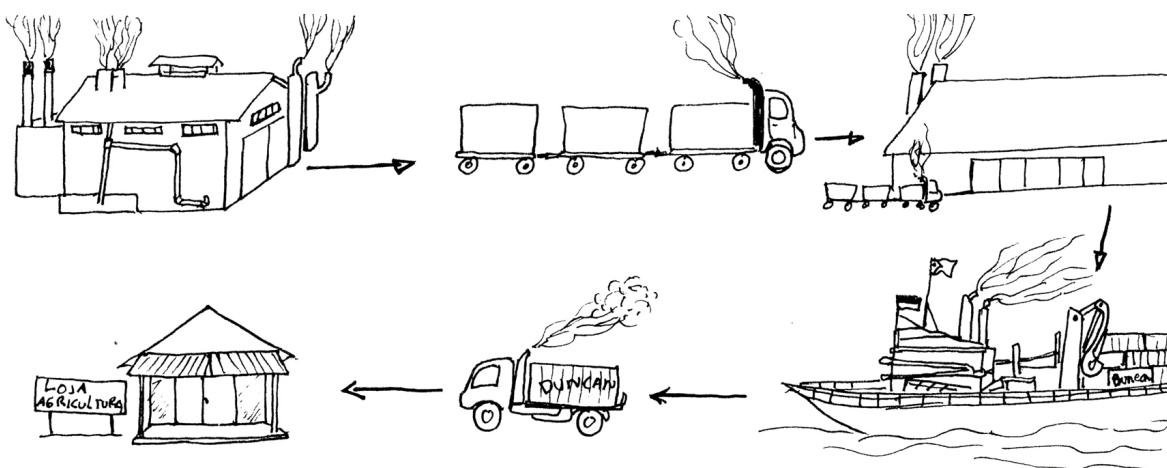
Sometimes new ideas and techniques are not easily accepted in communities. People who have busy and often difficult lives find it hard to try new things. Some methods to improve engagement with new concepts and participation in projects are:

- Making it easy for people to join activities and leave when they choose, with no pressure at either stage
- Lots of communication about and follow up on activities
- Providing an encouraging and safe environment for the participation of both men and women
- Basing projects around people's needs by consulting them



Local economy

A healthy and strong economy is essential for our communities, cities and countries to function properly. Currently, global financial systems focus on continual economic growth and making money as their highest priorities. This approach is not healthy or sustainable: it is destroying our environment, and weakening communities and culture through hoarding, excess consumption and wasting precious resources.

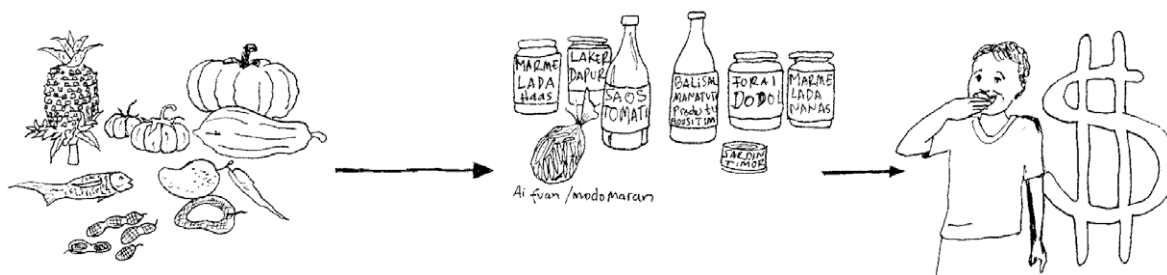


Current production systems use lots of energy, use lots of transport and create lots of waste

To achieve a good balance we need to change our priorities. We need “quality of life” as our highest priority, supported equally by:

- A healthy economy
- A healthy environment
- A healthy culture

Part of this change is to relocalise most parts of the economy. Some globalisation is good, but the economy should be based on local products and markets, with surplus goods traded elsewhere. At the moment it is often the other way around and this benefits only a few people, creating more poverty for the majority. The goal is to find a good balance between local resilience and trade, while always focusing on sustainable income sources.



Locally grown produce creates locally made products, which creates good food, good health and local income

PRODUCT ZONES

The design method of zones (see earlier in this chapter and Permaculture Design [Ch 3]) can also be applied here:

Zone 1 – produced or made in the local community/town from local materials

Zone 2 – produced or made in the local region from local or regional materials

Zone 3 – produced or made in a region bordering your region

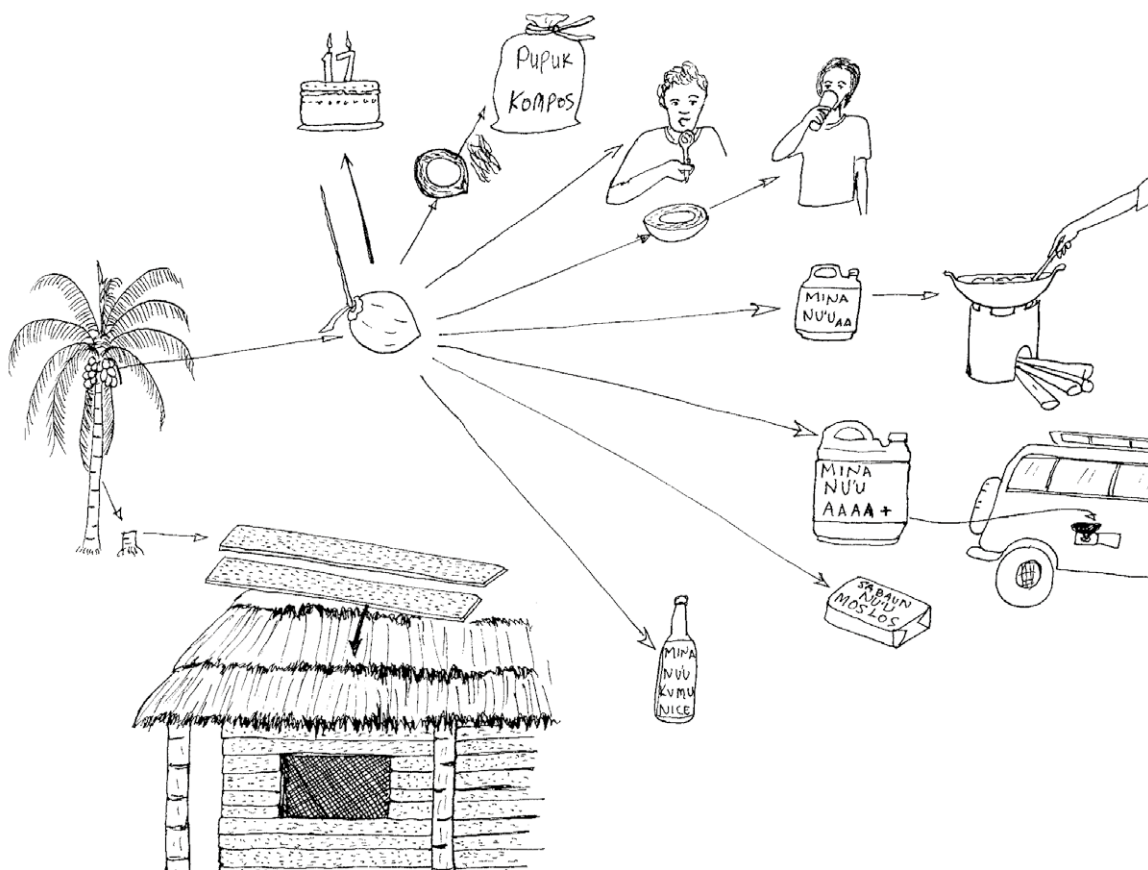
Zone 4 – produced or made nationally or from a nation close to yours

Zone 5 – produced or made internationally from a distant nation or continent

Basic day-to-day trading should be Zone 1, then Zone 2. Trading for specialised goods or larger quantities of some goods can be from Zone 3 or 4. Only highly specialised goods that you cannot buy from the other zones should come from Zone 5.

Why is the product zone method important?

- It supports local businesses and livelihoods.
- It reduces the amount of damage and spoilage in produce transportation and so there is less waste.
- Transport costs are lower.
- Money stays in the community.
- There is less packaging.
- The environment benefits and it reduces climate change.



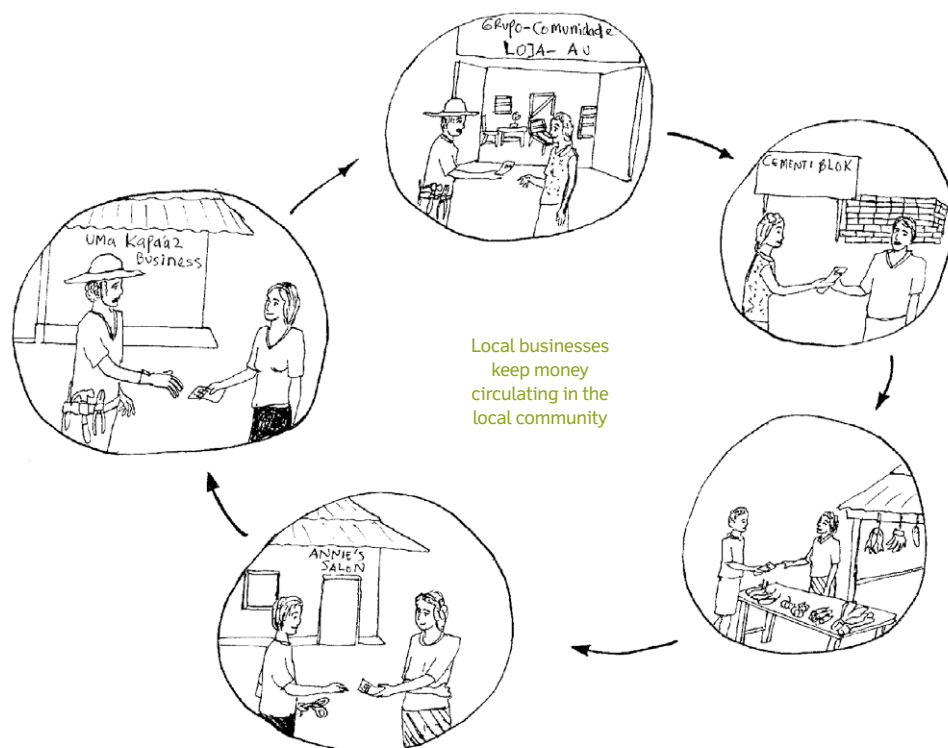
The coconut tree, always in Zone 1 or 2 in the tropics, can provide so many different products for local consumption and income

KEEP MONEY IN THE LOCAL ECONOMY

Buying local products keeps money in your community, which supports and creates more local jobs. It is achieved through:

- Consumers carefully choosing what they purchase
- Business and government actions that support locally made products
- Adding value to local produce within the community instead of sending it away; for example, making soap, oil, jam, furniture, building products, tools, etc. See Cooperatives (**Ch 5**) for more ideas on value adding
- Cooperative support – see Cooperatives (**Ch 5**)
- Small low-interest loans to support local businesses; see later this chapter in microfinance

This guidebook encourages the use of local resources. This is because every tropical country and region has many natural resources which can provide for many of its needs. Most importantly, whenever people buy or trade local resources the wealth STAYS in the community.



Using labour, building materials, food, etc. sourced locally is the best way to build wealth and the community's economy. This is especially important for rural and remote areas.

Consider this important question: which produce imported into a community can be made locally or is already being made locally?

For Timor-Leste, two examples of widely used products are rice and bamboo. A lot of the rice eaten in Timor-Leste is imported, especially true in the capital Dili; however, several areas of the country grow their own rice. And most bamboo products sold in Timor-Leste are imported, even though some people make furniture from the locally grown high quality bamboo. What are the examples from your country?

Which exports could your community also sell or trade locally?





Studies have shown that most big supermarket chains do not help build strong local economies:

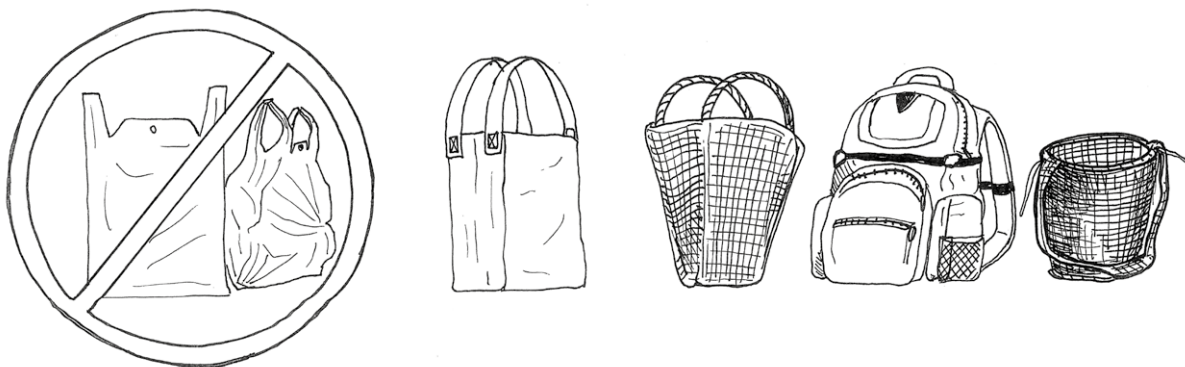
- Many of the goods they sell are imported, involving the environmental cost of global transportation.
- The goods may be produced through exploitative labour practices or from companies with poor environmental records; for example, clothing from sweatshops or palm oil production via deforestation.
- Between 85 to 95% of the profits leave the community and go to the supermarket headquarters, never to return.
- They often put small producers and local companies out of business by providing cheaper goods; their ability to buy produce in large amounts from all over the world allows them to pay lower prices.
- The number of people employed by supermarkets is a lot fewer than for the same amount of food sold in small shops and markets.
- There is a lot more packaging and a lot more food is wasted.

In recent years, some big supermarkets have been more willing to support local farmers and businesses. This is an improvement, but there is a long way to go before their methods are fair and sustainable, and they move beyond the industrialised food system. In the end, it is the producers who pay for the cost of cheap convenient supermarket food, not the consumers.

Another important step to strengthen local economies is moving to small-scale organic farming, and improving the farmer's and small producer's direct access to markets. This is often the most difficult part for farmers and small producers, and too often they do not receive enough money for their produce.

BUY LESS STUFF!

Buying whatever we want, whenever we want it, is based on an idea of having infinite resources. We do not have infinite resources! In fact, many of our world's resources are already in short supply. We simply cannot keep buying products at the same rate without considering if we need them or not.



We need to move away from plastic now!

The best way to ensure a high standard of living, with the best technology possible, is to CHOOSE to buy less and to buy good quality, so the finite resources we have are used carefully. So many products are made from cheap plastic using polluting wasteful methods; when they break we throw them away. We must change habits so we buy and use quality, not quantity. Reducing the waste by avoiding cheap plastic products will go a long way towards making cities and communities sustainable. More ideas are to buy:

- Locally made products – this is the BEST method!
- Good quality products that can be easily repaired.
- Recycled and recyclable products.
- Products with no packaging or with recyclable/compostable packaging, such as cardboard.

Government regulations will help to make this change, but it is also the direct responsibility of people to lobby to government to change regulations and to choose carefully what we buy.



A good quality locally made machete will last many years, do many jobs and support local business



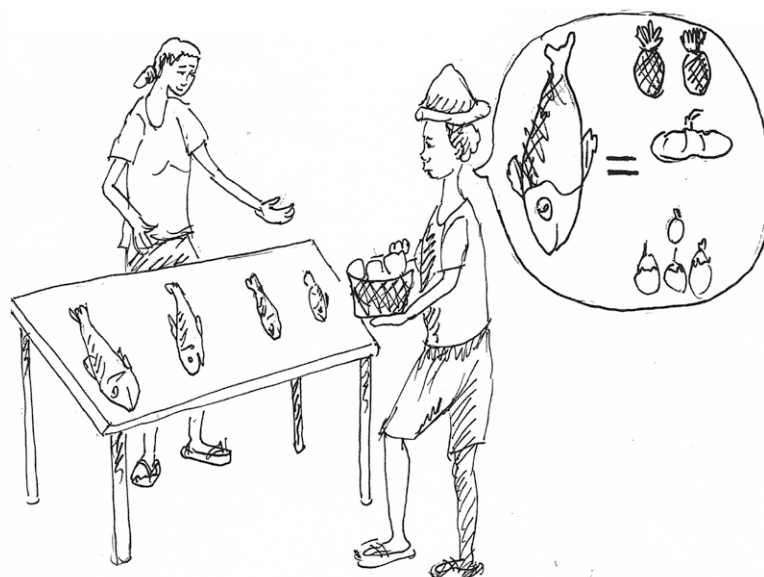
A poor quality imported machete will not last long, will achieve poor results and your money will leave your community

Trading methods

Creating a strong healthy local economy is not just about what products you buy and from whom you buy them. It is also about the methods of trading. There are methods that keep more money within your local economy as well as those that require less money.

BARTERING

A lot of trading already happens in tropical countries and there are many complex systems that communities use. Some of these systems use bartering, which is the direct trade of products without using money. Usually one or two commonly traded and used products are the base for setting the trade price: for example, in Savu, a small island in Indonesia, the entire system of exchange was based on the sugar syrup from the lontar palm and the areca nut. Some systems use a mix of bartered products and money. These trading systems might seem simple, but they are important and should be encouraged.





LOCAL ENTERPRISE TRADING SCHEME (LETS)

An excellent way to strengthen a community and its economy is to start a trading group. A trading group encourages more trading and it is an official part of the community economy. A system used in many countries is called the Local Enterprise Trading System (LETS); it is a network where the members help each other by exchanging goods and services.

Anyone in a community can become a member and people's names, and their skills and resources are compiled in a book.

Here is an example of LETS:



Martina



Aderito



Esperanca

1. Martina Soares

Skills – Cooking, making clothes and weaving traditional cloth (tais), growing vegetables and trees, curing leather, weaving baskets, producing fish

Resources – Land, fishponds and fish, woven products, seeds, compost, leather goods, vegetables, fruit trees, weaving grasses

2. Aderito da Costa

Skills – Ploughing with buffalo, building, making natural pesticide and medicines, growing vegetables, raising animals

Resources – Land, animals, trained buffalo, building tools, natural pesticide plants, natural pesticides, medicines and bamboo

3. Esperanca Ximenes

Skills – Bookkeeping, computer skills, cooking, making clothes, hairdresser, growing vegetables

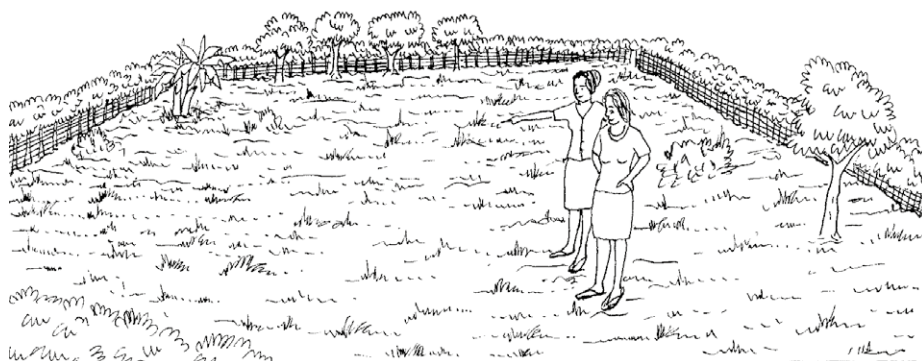
Resources – clothes, vegetables, computer training, hairdressing

LETS – HOW DOES IT WORK?

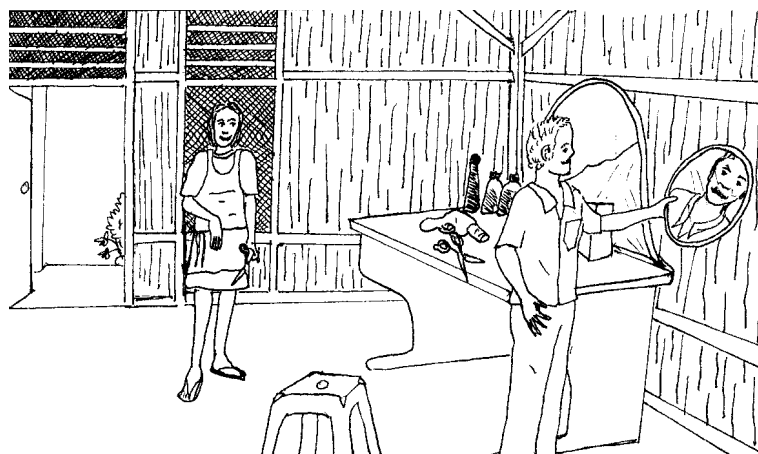
1. A member asks another member for a product. A money value is agreed for the trade, but no money changes hands.
2. The trade is written down in the LETS members' book. The person giving the product gets a credit; the person receiving the product gets a debit.
3. The LETS book keeps a record of every trade that takes place.
4. Only members can trade and be a part of the system. The idea is that each member over time has, more or less, an equal amount of credit and debit.
5. It is not essential that every member stays at equal amounts and usually it balances by itself. The credits and debits are added up at the end of three or six months, so there is a record of what people have traded.
6. This system is based on individual honesty to keep an even number of credits and debits. However, as each trade is recorded it is clear to all members if someone is receiving more than they are giving.
7. When each person becomes a member they agree to a system for paying back excess debits, to deal with any problems.

For example (for villages):

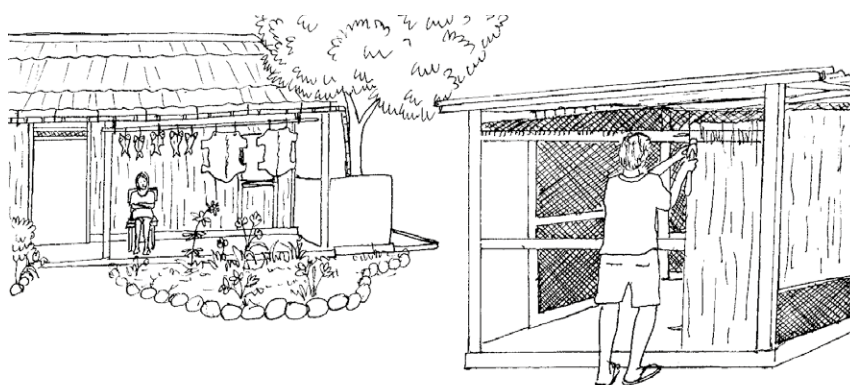
- A. Esperanca wants to grow some vegetables, but she does not have land available. She asks to rent land from Martina. They work out a price and the trade is recorded in the book.



- B. Aderito needs some new clothes and a haircut because he has fallen in love. He asks Esperanca to trade him some clothes and a haircut. They agree on a price and the trade is recorded.



- C. Martina produces a lot of leather and seeds, and has started drying fish, but she needs some storage space. She asks Aderito to build her a small storehouse to protect her produce. They work out a price and the trade is recorded.



PERSON	TRADE	CREDIT	DEBIT
Esperanca	Land for vegetables		\$20/month
Martina	Land for vegetables	\$20/month	
Aderito	Haircut and clothes		\$30
Esperanca	Haircut and clothes	\$30	
Martina	Storehouse		\$80
Aderito	Storehouse	\$80	

DIRECT TRADE

Direct trading can also be a part of this system.

For example: Martina wants to learn computers skills from Esperanca and Esperanca wants to buy leather to make some wallets. They agree on the prices for each product. If the price is the same, a simple exchange can take place. If not, both exchanges can be written down in the LETS book.



Swapping different types of bamboo

PART MONEY – PART TRADE

It is also possible to combine a trading system with money. When buying goods members can cover some of the cost by trading produce they may have; this reduces the price and helps support local goods. The percentage of the cost that is money or trade is decided by the members involved in each transaction and it is still recorded in the trading book.

For example:

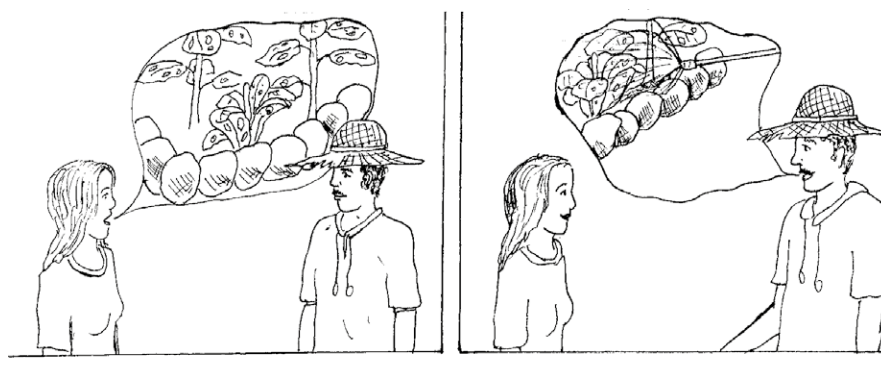
- A. Aderito wants to buy a lot of fish from Martina but cannot afford to pay the whole cost. They agree that he pays 50% in money and 50% is traded.



- B. Martina has land she needs ploughed so she can plant vegetables. She wants to save herself time and labour, but she does not have the money to plough the whole field. She asks Aderito to use his buffalo plough and they agree on a price. Martina pays 30% in money and 70% by trade.



C. Esperanca needs some natural pesticides to stop insects destroying her vegetables. She asks Aderito to spray her crops, and they agree on 75% in money and 25% by trade.



PERSON	TRADE	CREDIT	DEBIT
Aderito	Fish		\$30 (50% of total)
Martina	Fish	\$30 (50% of total)	
Martina	Ploughing land		\$70 (70% of total)
Aderito	Ploughing land	\$70 (70% of total)	
Esperanca	Natural pest spray		\$20 (25% of total)
Aderito	Natural pest spray	\$20 (25% of total)	

Shops, restaurants and other small businesses can also be LETS members. They can sell their goods partly for money and partly by trade but only to other members. Usually, this would be about 80% in money and 20% by trade.



Local currency

Introducing local money or currency is another way to strengthen small communities as it keeps money in the area. The local currency can only be used in the area's shops and encourages people to buy local products which helps to develop village and town economies. There are many successful examples of local currencies in communities from all over the world, used in combination with trading systems and the national currency.



Local products that can be sold using local currency

Key points for a successful local currency:

- Shops offer part or full payment for goods in their region's local currency, but it is not possible to use a local currency from another region. Not all shops will join in, but the more there are the better it will work.
- Local market traders, restaurants, builders, carpenters, etc. can also offer full or part payment for their services and products in the local currency; again the more who use it the better.
- The value of the currency is linked to the national currency, usually at the same or a similar value.
- The notes and coins of the currency are sometimes traded in and replaced with new notes and coins. There is a limit to how much can be traded in, which prevents the problem of hoarding.
- There must be security against counterfeit (fake) money being made and used.

Look in the **reference section** for where to find out more about local currencies.

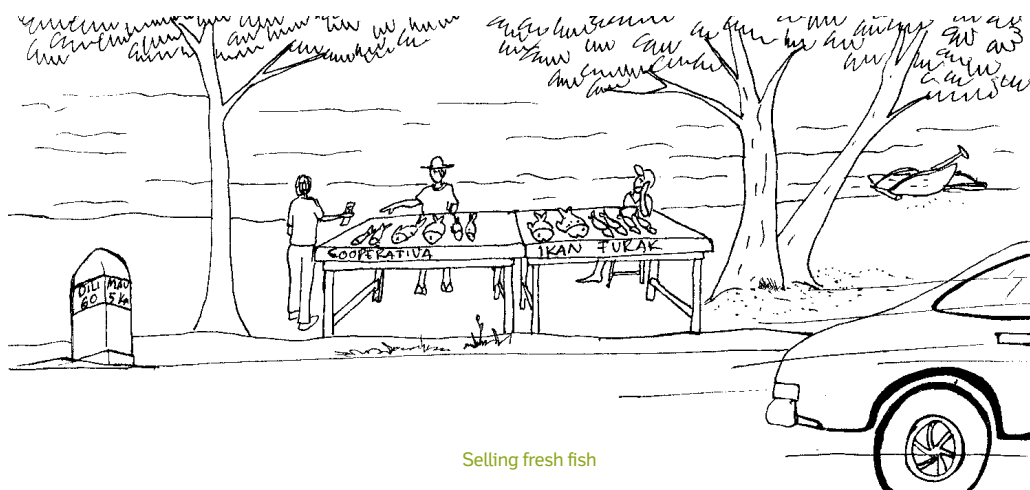
MICROFINANCE

Microfinance is a way for people to improve their incomes and living situations. There are some microfinance groups operating in most tropical countries already.

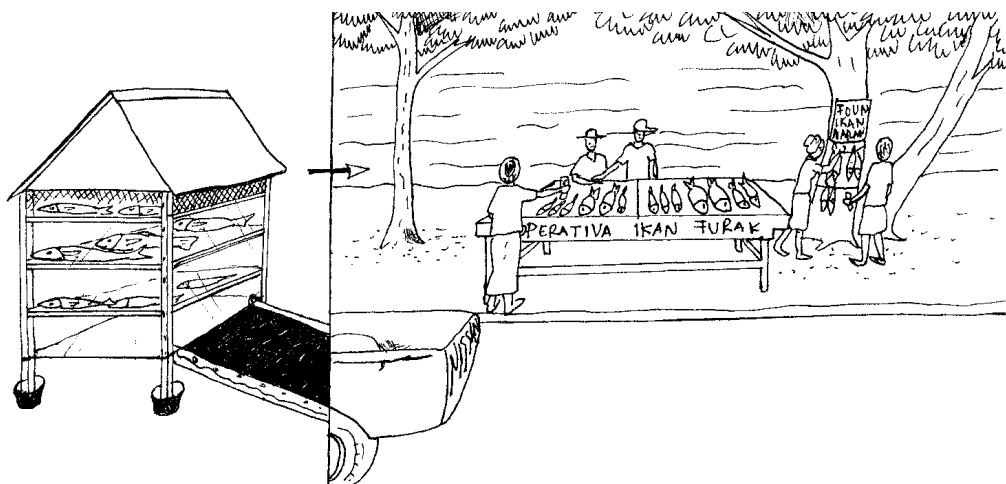
Microfinance can be very effective at helping to improve community living standards and injecting money into communities that do not have much. The process of improving the economy does not mean that money replaces trading; the two can function together. However, if the financial changes are not implemented carefully and correctly they can cause problems and have little or no positive effects.

Microfinance from respected organisations is much better than obtaining private credit because it has much lower interest rates and the responsibility to pay the money back is shared by a group rather than by the individual. Be careful with the rate of interest charged on the loan: it can cause problems and people often pay back much more than they expected.

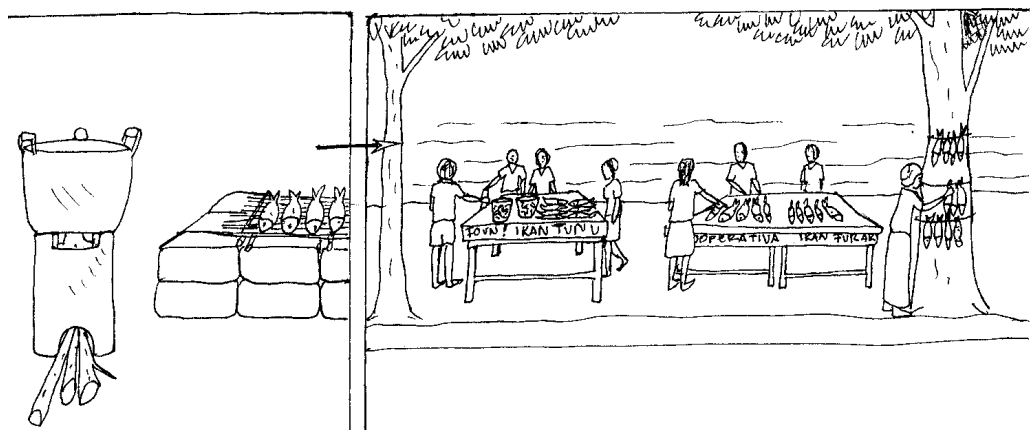
The aim of microfinance is to help people to help themselves and to take responsibility for improving their situation. It is not a system of dependence or free money.



Selling fresh fish



With a solar dryer, now selling fresh and dried fish



With a stove, now selling fresh, dried and cooked fish

The basic system:

1. Microfinance groups identify people in need.
2. Those people in a community form a group and provide a plan for a small business.
3. Once the plan is approved a loan amount is decided and provided to the group.
4. A system of repayments is set and the group pays back an amount each week or month until the money is repaid in full.



MICROFINANCE CASE STUDY

An example from Timor-Leste of a successful microfinance provider is Moris Rasik (Independent Life). They started in 2000 supported by CASHPOR, a network of organisations developed from and modelled on Grameen Bank, founded in 1983 in Bangladesh. After ten years, Moris Rasik had not only become financially self-sufficient, but it had loaned money to well over 200,000 women, had more than 12,000 clients on their books, from 570 centres with 121 staff. Another seven years on and the organisation had loaned \$7.3 million from 14 branches and 778 centres.

Their goal is to provide microfinance services to poor rural women based on their needs, so they can change their lives at the household and community level. By helping women Moris Rasik aims to reduce rural poverty and increase the quality of life in communities.



Making a plan for a small business

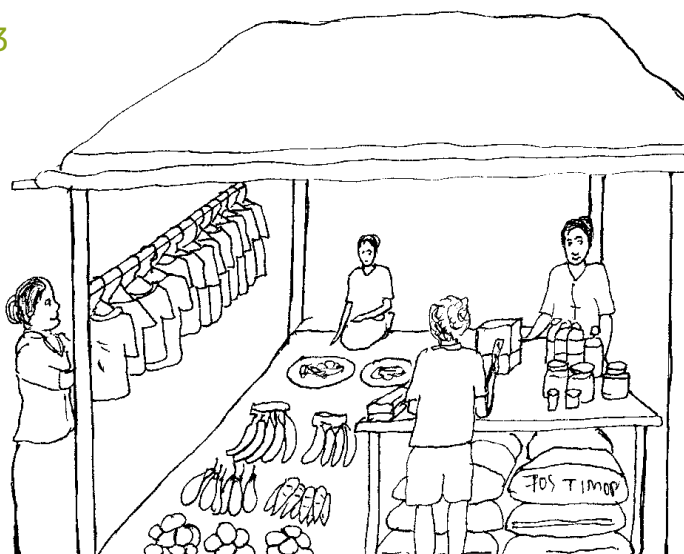
Moris Rasik uses the Grameen Bank model where a woman interested in applying for a loan (with interest) joins with other women in similar situations to form a group of five. The five members are jointly responsible for the individual loans in the group ensuring that all the loans are repaid. After some basic financial training, the five members then join about eight to ten other groups to make a village-level centre. The centre holds scheduled weekly meetings for all its transactions facilitated by Moris Rasik field officers.



Starting the business

There are two different loans for groups. Both have a maximum limit of USD 5,000 and an option of weekly or monthly repayments. One must be repaid in full between 25 and 50 weeks while the other is between 50 and 75 weeks. Individuals can also apply for two different types of loans. Both have a minimum rate of USD 500 and monthly repayments, to be fully repaid within 12 months.

3



The business grows

There are numerous challenges to operating a microfinance organisation in Timor-Leste. Poor roads and transport, limited electricity and communications infrastructure, and a small, widespread population make providing financial services difficult for Moris Rasik. Borrowers are restricted by the basic rural economy and limited access to markets which do not allow many production opportunities or value-added trading activities. Despite these problems, Moris Rasik is the country's most successful microfinance provider and has long since reached more than 10% of the poorest rural households, providing livelihoods and transforming communities.

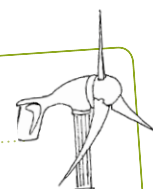
4



And the business grows!

SMART IDEAS:

- Micro-finance is more effective if the organisations providing loans work in partnership with groups, such as NGOs, farmers collectives and government workers, who can provide training and skills in areas such as permaculture, sustainable agriculture, craft making, tool making, food preservation, animal production and marketing.
- Groups providing these skills and who have projects to improve community wealth and livelihoods can work with microfinance organisations to help facilitate better long term self-reliance.





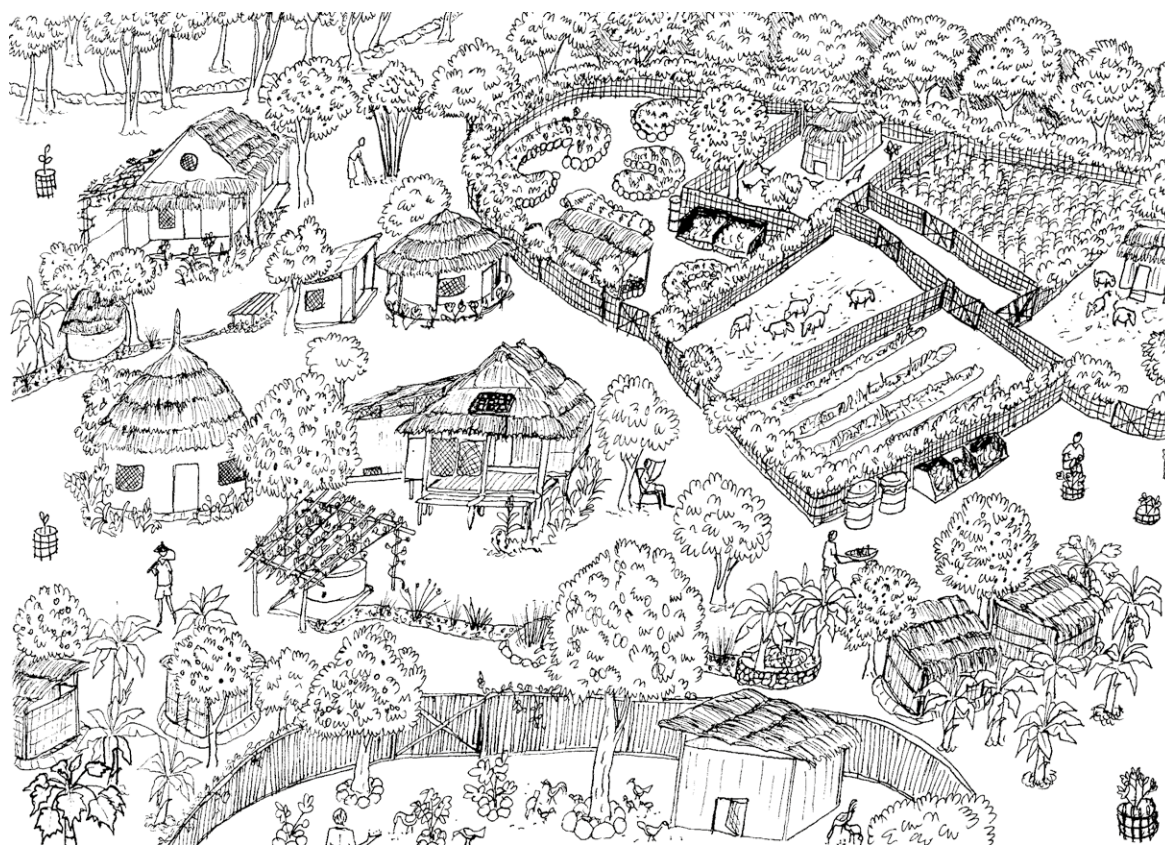
Reversing urbanisation

Not everyone who moves to a city finds opportunities. For most people, urban life is difficult, and the growing problems of disease and pollution problems are part of daily living.

If people follow the techniques and strategies outlined in this and other chapters, the trend of people moving from rural to urban areas can reverse! Some of these ideas are:

- Food sovereignty
- A return to small-scale intensive, organic agriculture
- Localisation of work, economies, resource use and skills development
- Access to cheap, renewable and reliable electricity
- Access to information and education
- Access to clean and regular water supply

As more jobs and technology become available in rural areas, young people will be less likely to leave and city dwellers will move back.





COOPERATIVES



COOPERATIVES

IMPORTANCE OF COMMUNITY COOPERATIVES

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Cooperatives and community groups are a traditional part of every culture, and are simply an extension of families and communities working together. In return they strengthen the community, bring in more resources and income, and add new skills. They can be a small group that helps to share and maximise resources and improve production, or they can be bigger cooperatives or community businesses that produce and sell products. They can also be local NGOs.

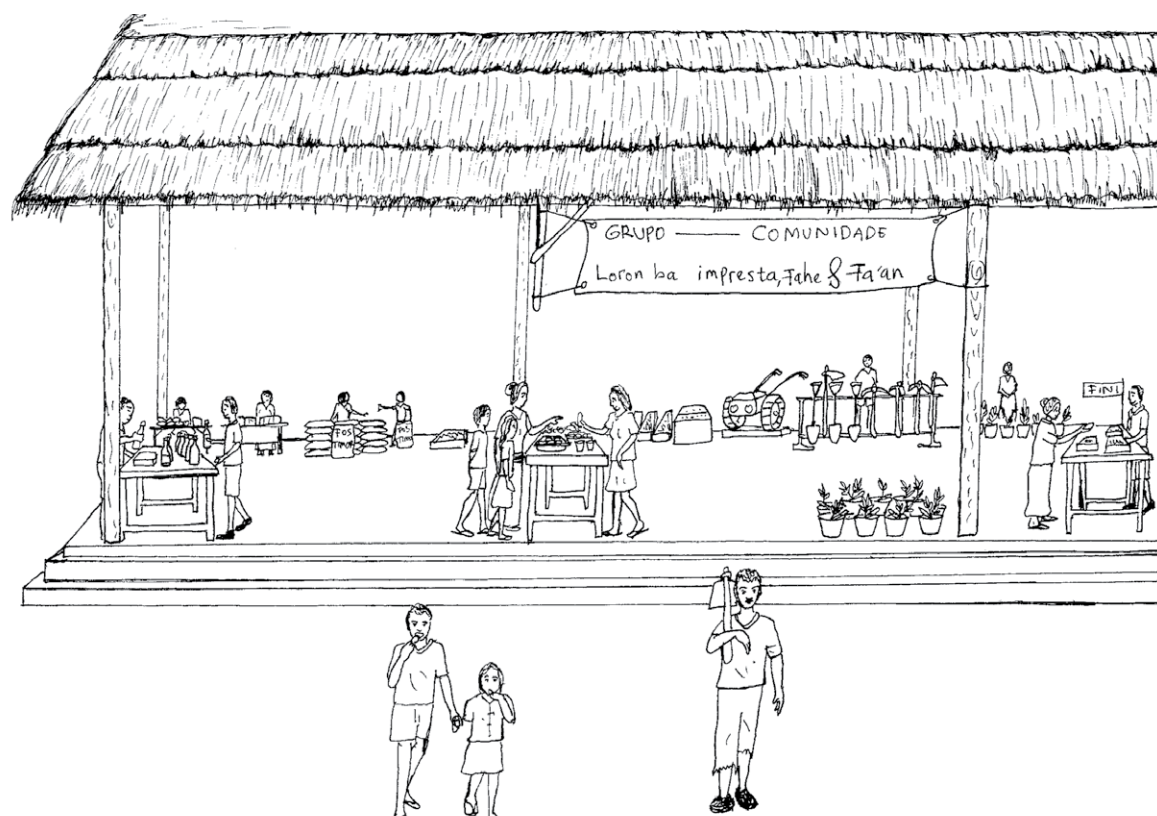


Cooperatives are based on the idea of achieving something that cannot be achieved by individuals, by using their collective ability to work for a common goal. This need/goal/objective can be economic, social or provide a service; the important thing is that it is the community and individuals within it which benefit.

True cooperatives are based on equality and transparency. They are democratically organised, managed and run by the communities themselves. They help the communities undertake activities of benefit to the communities, and can be small or big groups, depending on their objectives. An example is a traditional farmers' cooperative: five to ten people share labour for pre-planting, planting and harvesting, and rotate from one farm to another.

In some places cooperatives have been given a bad name by business people, military and government workers using the word 'cooperative' in their business name, but without the sharing or equality, and often working against community needs.

The name or the actual structure of the cooperative or group is not important. What is important is that the members of the organisation use the principles of equality and democracy, and work together for a collective benefit. Many names are used: cooperative, community group, community business, farmers' group. It is up to you to choose which name and structure is best. This information is useful for all of them.



Cooperatives, strong local economies and food sovereignty directly support and allow the permaculture ethics of people care, fair share and earth care to be fulfilled. Without them it is impossible to facilitate the environmental protection and repair, and move to organic and sustainable farming methods that are needed.

Finding markets to sell their produce and enough people interested in buying are often difficult for farmers and small producers, and they often sell their produce for too low a price.

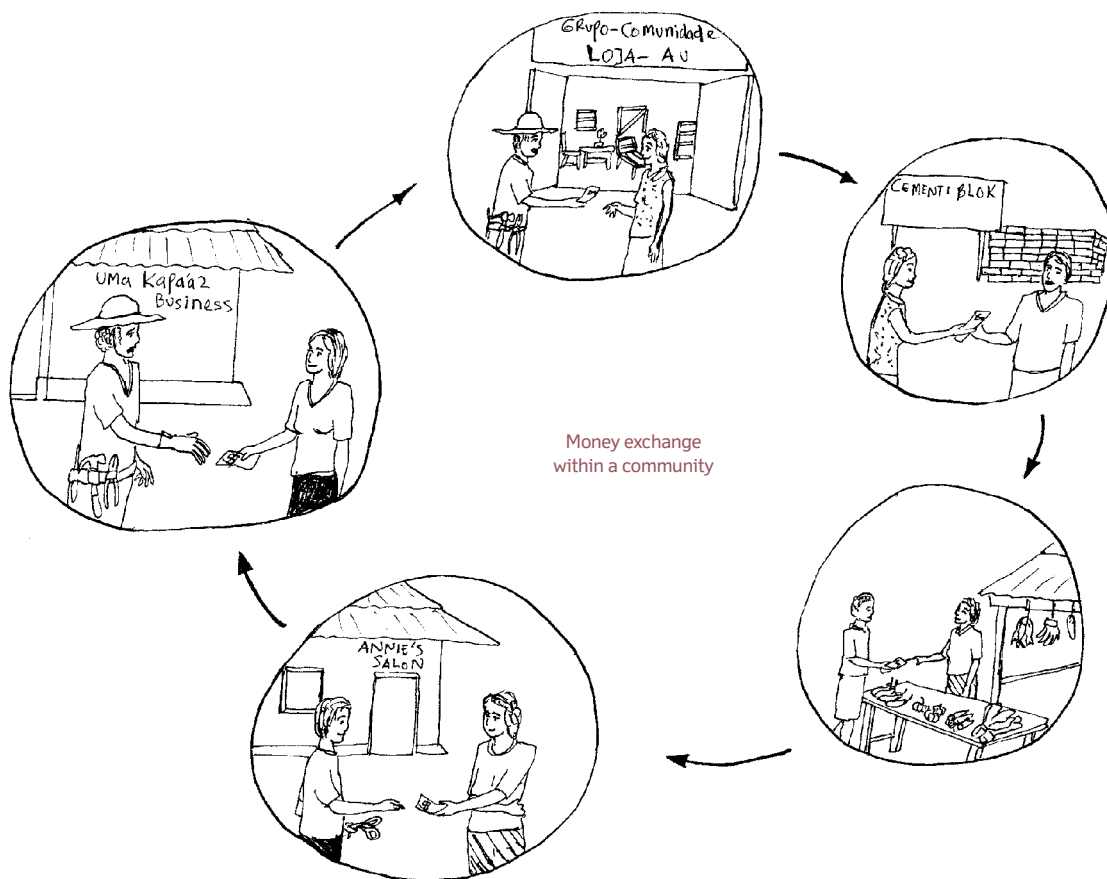
This chapter looks at the many benefits of cooperatives, including improving market access and creating community resilience. The Urban and community permaculture chapter (**Ch 4**) explains how to develop strong local economies, food sovereignty and transition towns.

Importance of community cooperatives

Benefits to the whole community

With a cooperative, knowledge, skills, resources and labour are shared, and community participation is strengthened. There are more jobs in the community as well.

A cooperative increases income in the community, and people have more money to spend on other products. Even a small amount of money makes a big difference, especially when it is spent in the community. Therefore, other businesses and people in the community, such as farmers, brick makers, builders, carpenters, shops, restaurants, hairdressers, blacksmiths and more, also benefit. People have more products to trade with others in the community.



Communities take pride in making their livelihood from selling something they have created themselves and having their names on the products.

Easier and cheaper to collect and buy materials

Group or collective buying power means that materials are less expensive. This is true for cooperatives, small businesses and farmers groups, and even a group of families.

- Materials bought in large amounts (in bulk) are cheaper than purchasing in small amounts.
- Groups can buy tools or food to share.
- Transport is cheaper if costs are shared.
- More money is available to buy better quality materials.
- Different families have different resources they can provide: e.g. bamboo, wood, ponies or a truck for transporting materials, labour skills, etc.

Increased product range

One person or one family might not have time to make large products (e.g. furniture) or large amounts of a product: e.g. jam, tools, natural pesticide, soap, etc.

However, a group of people or families working together can make much more. This gives the group more products to sell.

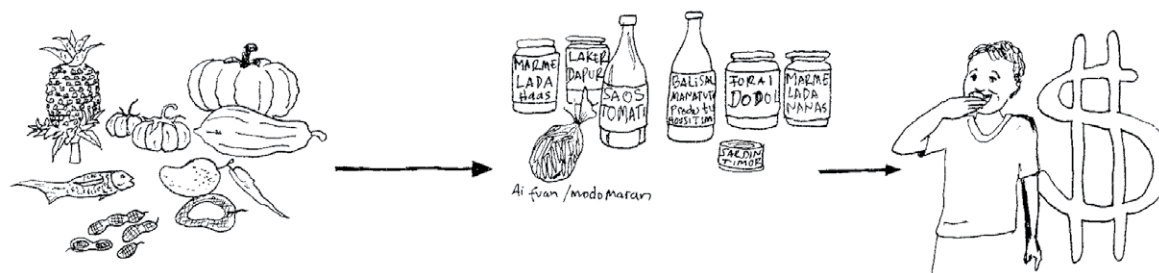
It also means that the products are cheaper to make. Therefore, they can be sold more cheaply and compete better with products from overseas. This is very important for businesses in small communities.

Better community representation and opportunities

A community group/cooperative/business is much more likely to get training, financial assistance, equipment, and partners to start and run an enterprise. Training can be provided by the government, NGOs, private investors or other civil society groups.

A cooperative is also more likely to be able to attain assistance or information from the government on important issues, such as marketing, transport, information sharing, health care or education needs.

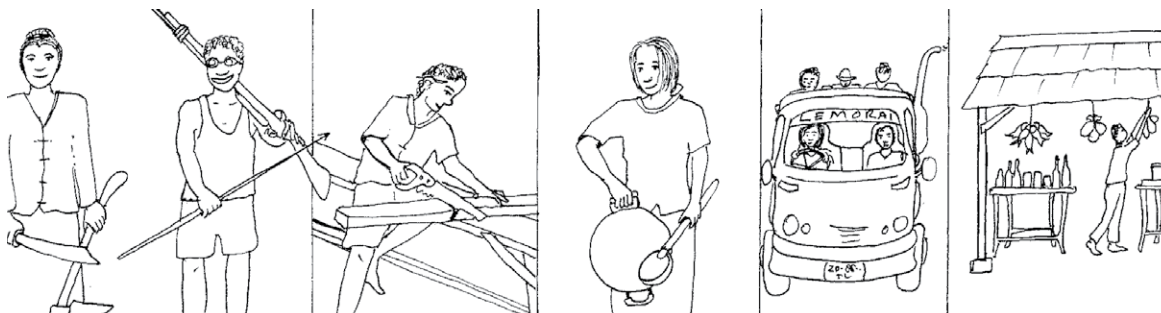
Lobbying as a group instead of as individuals gives individuals within the organisation a louder voice.



Using different skills

Different people in a community have various skills: e.g. builders, cooks, book keepers, agriculture skills, carpenters etc.

In a co-op these different skills can be used together to make products or in other ways which benefit the group.



Improved marketing, transporting and selling goods

Transport is one of the most expensive parts of selling produce, especially for people in remote places.



Selling products to restaurants

Sharing costs and safely transporting as much as possible each time is important. Coordinating the production and transportation of products within regions maximises the use of limited resources. It helps a lot to create a mutually beneficial, simple transportation system or schedule in the community –within the cooperative and also between different community groups.

Marketing (or identifying buyers for and promoting) products is much easier through a group. Representatives from the group can work to arrange marketing for and places to sell products: e.g. at markets, restaurants, supermarkets, shops, through social media and media advertising. It is very hard for one person or family to have time to do this important job well.

Also, a group or organisation often has more influence than one person, and a group usually reflects a higher level of responsibility. Making a product as a group means the group can give its name to the product: e.g. 'Permatil Seeds'. This can help with marketing goods, where quality and reliability are important factors affecting the creation of a sustainable market base. Being able to provide a regular supply of products is always one of the most important marketing factors. A group or cooperative is much more able to achieve a regular, sufficient supply.

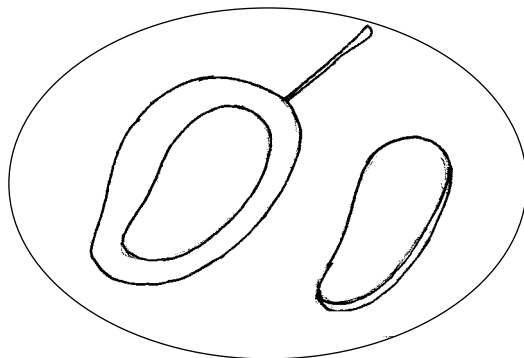
Individual benefits

Individuals working in a cooperative feel better because they:

- Have work that they previously could not do alone but can do now as part of a group
- Work together with community members and participate in their community
- Provide more for their family
- Are learning new skills and achieving goals
- Become more confident and creative

How to set up and manage

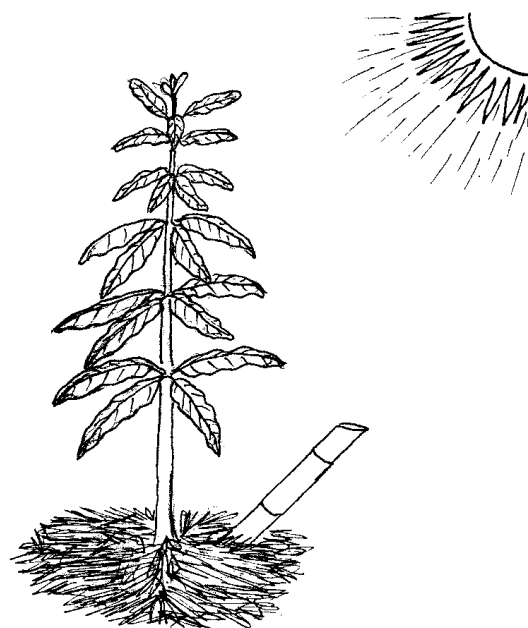
A good co-op or community business model is like a tree:
e.g. a mango tree. First of all you start with a seed. The seed is an idea.

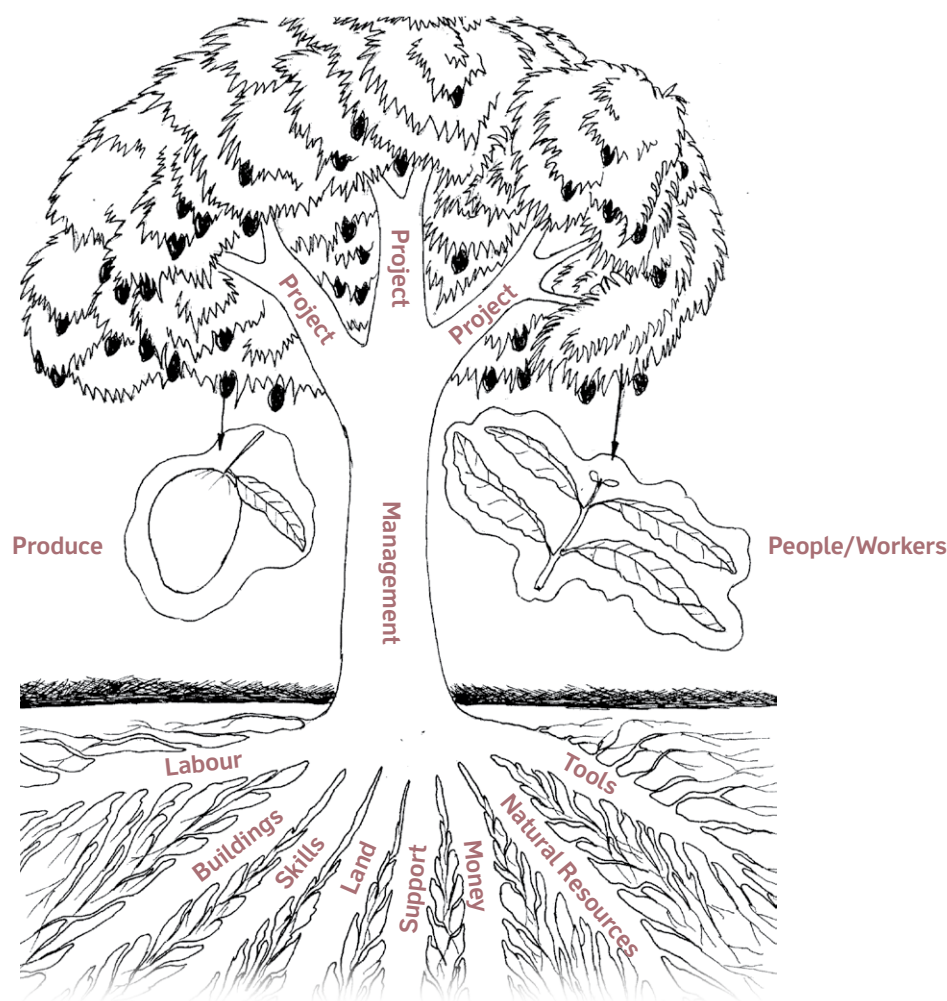


As the seed grows, it starts developing roots, a trunk and leaves. It searches for water and nutrients. This represents an analysis of the co-op's needs, local resources available, possible products, marketing or potential buyers, etc.: developing the idea.

To grow well the seed needs good soil, water and sunlight. It also needs to be in a place where it can grow to its full size. These aspects represent the right place, good planning and structure, and a vision for the future. Also important is attaining community support, training, possibly microfinancing, transport, etc.

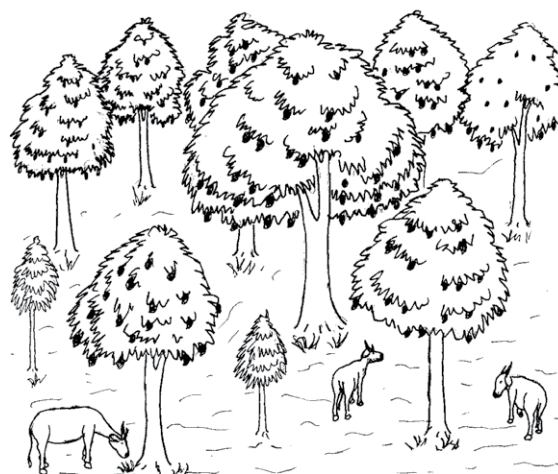
To become a full size tree producing a lot of fruit it needs compost and mulch, pruning and organic weed/pest management. This maintenance represents setting up and operating a strong management and financial system that keeps the organisation running well.





As it is growing and when fully grown a healthy tree has a strong root system, a strong supporting trunk, and many branches and leaves. It will produce lots of flowers, fruit and seeds.

- **The roots are the resource base.** Land, labour, natural resources, skills, equipment, buildings, money, NGO/government/community connections and support, etc.
- **The trunk is the management structure.** It enables an efficient flow from the resources to the projects, and must be strong and supporting. Management decides which projects (branches) to support.
- **The branches are the different projects.** Many smaller projects are better and more sustainable than one big project, though it is better to start with one or two, on a small scale, and establish them first. Strength is in diversity!
- **The leaves are the people responsible for these projects.** Working together ensures the projects are successful, because without people, like a tree without leaves, an organisation cannot live or grow.
- **The fruit is the produce from the projects.** It must be picked, stored, marketed and sold so that the projects are sustainable and make money.
- **The seeds are new co-ops or community businesses that grow from the first tree.**



Many trees together make a forest.

The trees grow better together than one tree growing alone. They support and shelter each other from storms and strong winds, provide a network of nutrients (resources) for each other and a habitat for animals and birds. It is the same for co-ops and small businesses.

Produce ideas - the seed

Here are some examples of products that could be made and sold by community groups.

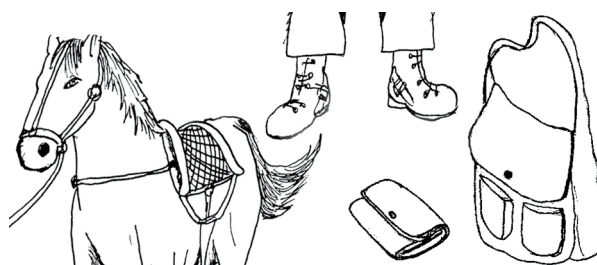
FOOD

- Fresh food
- Dried food—fish, meat, fruit, vegetables
- Preserved food—fruit, vegetables
- Sauces, pickles, jams, oils
- Honey, honeycomb
- Fermented foods
- High-value restaurant food



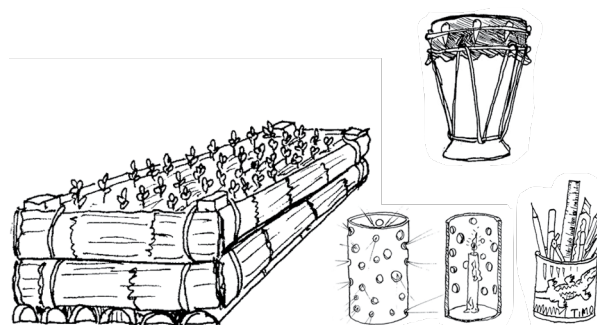
LEATHER PRODUCTS

- Clothes
- Shoes
- Knife and machete holders
- Horse equipment
- Bags



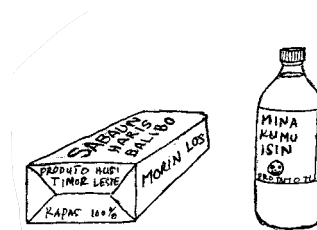
BAMBOO

- Plant containers
- Decorated and carved storage containers
- Furniture
- Food for selling and preserving
- Musical instruments
- Buckets
- Carved candle holders



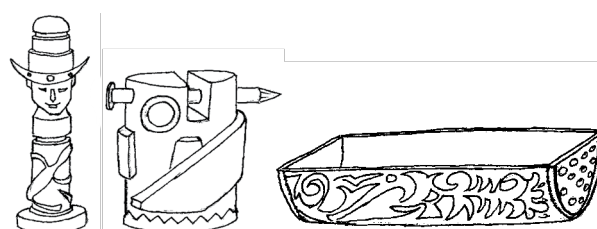
NATURAL HEALTH CARE PRODUCTS

- Soaps
- Massage oils
- Traditional medicines
- Insect repellants



ART

- Sculptures and carvings
- Pictures and paintings





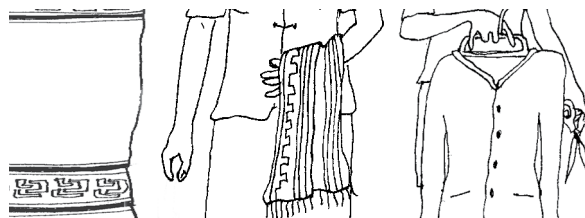
AGRICULTURAL PRODUCTS

- Plants
- Seeds
- Fresh and dried flowers
- Tools
- Manure
- Compost
- Natural pesticides and herbicides



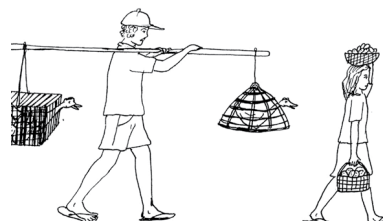
TRADITIONAL FABRICS

- Blankets
- Clothes
- House furnishings
- Wallets, document folders and purses



WOVEN GOODS

- Baskets, mats, bags, purses, coasters, etc.



KAPOK PRODUCTS

- Cushions, bolsters, etc.

CLAY PRODUCTS

- Stoves, cooking pots, food storage, water filters, bricks, etc.



BUILDING MATERIALS

- Bricks, wood, treated bamboo, metal work

And there are many, many more product ideas.

Value adding

Adding value is where the production process increases the value of an existing product.

For example; making jam adds value to fruit grown and picked to be sold, making tempe from beans, making oil from sandalwood, coconut or candlenut, making clothes from traditional material, processed cashews instead of unprocessed cashews and making bamboo furniture from bamboo.

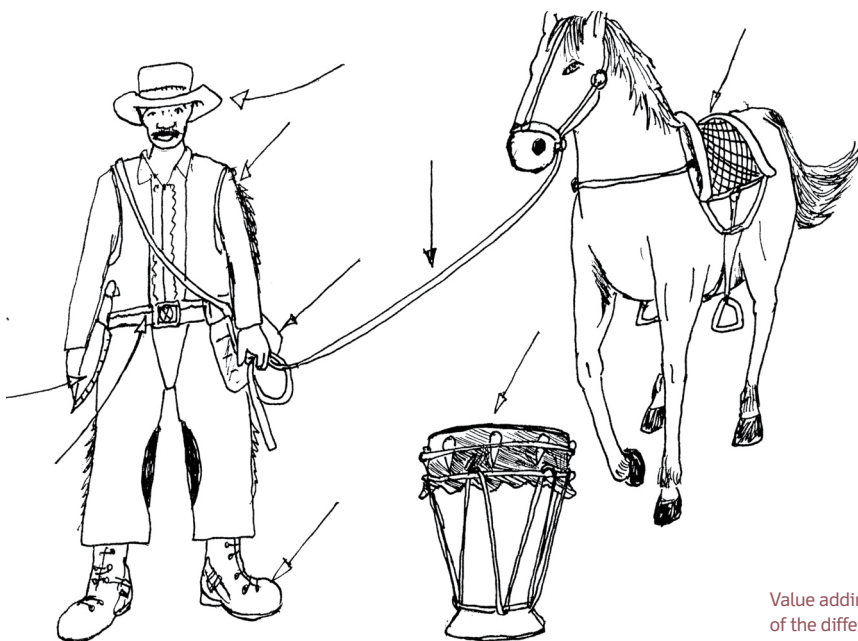
The cooperative can sell the new product for more money. It also adds new products—diversity—and new ways of selling the original product. The increase in the product's selling price is because a basic product has been improved using labour and materials. The result is the cooperative creates new jobs for its members using existing resources in the community to make new products to sell.

Excess food that would otherwise go rotten can be turned into products to be used, traded or sold: e.g. sauce made from old tomatoes. It is important to make the new products locally. This increases skills and jobs for the community and keeps the money in the area: e.g. if the bamboo is sold as poles to a business in a big city or another country to make the furniture, that business makes most of the money. The money is lost from the community with no chance of receiving more benefit from local resources.



Value adding coconut example showing many of the different coconut based products

Reducing the level of imports from overseas increases the amount of money and employment in your country, uses local resources and gives the benefit back to your community.



Value adding leather example showing many of the different leather based products

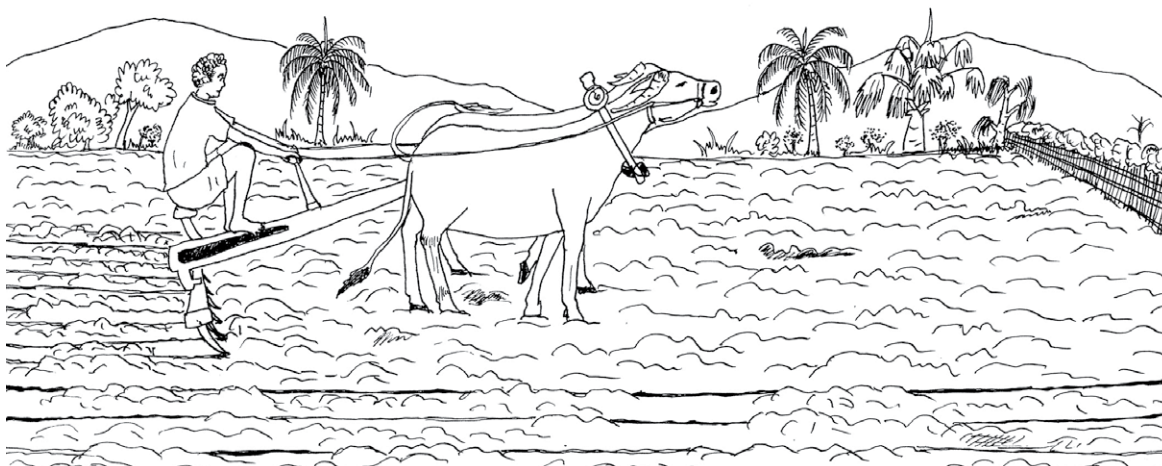
On a community level the benefits from making local products and value adding local resources include:

- The whole value of the product is received by the community, not just a small part.
- It provides employment for the community.
- Future potential activities receive money and income levels increase.
- Skills are learned or retained locally.
- Members' sense of worth from their activities improves.
- Young people's skills develop and they get jobs in the community, which is especially important in rural areas.

PROVIDING SERVICES

Groups can also provide services as a small business. Some ideas are:

- Providing training: e.g. agriculture, computers, buffalo ploughing, etc.
- Accommodation, restaurants
- Boat tours, fishing trips, guided walks, mountain bike tours
- Cultural performances, knowledge and tours

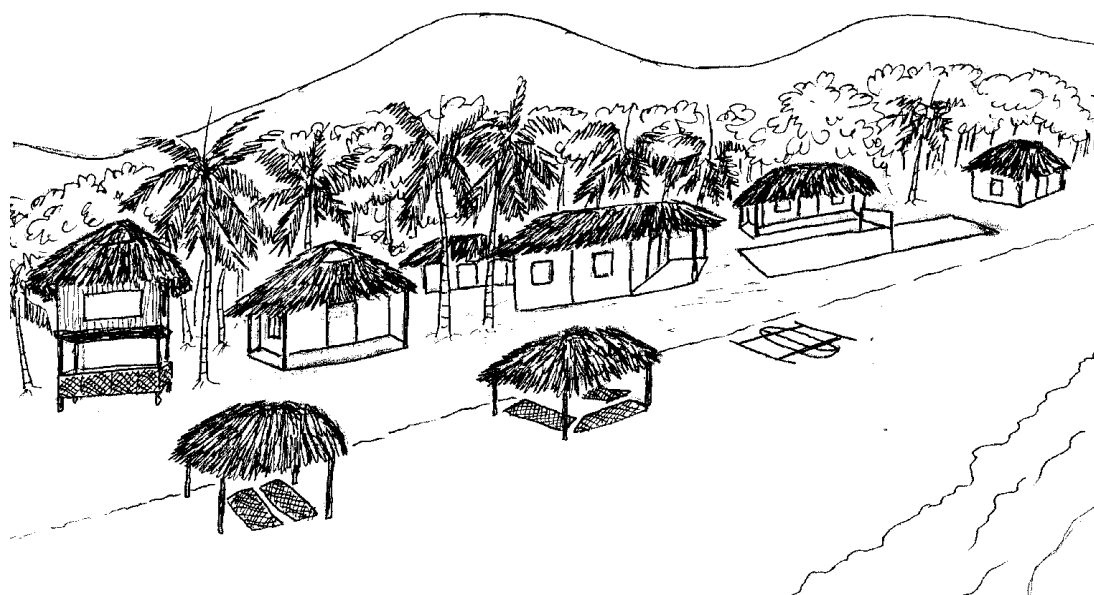


Ecotourism

Ecotourism highlights rather than destroys amazingly beautiful natural places, and is sustainable tourism.

Big hotel and casino complexes waste huge amounts of resources, create a lot of environmental damage, import most of their food and do not really contribute to local economies. Most of the money goes out of the area. Ecotourism provides for the tourists' needs and, at the same time, protects the surrounding environment, culture and people. Ecotourism incorporates good waste management, renewable energy supplies, uses local workers, food and traditional materials, grows produce and provides local knowledge of interest to visiting tourists.

Natural resources and local knowledge become valuable in ecotourism ventures. Knowing about the forests, caves, rivers, mountains, the ocean and sea life, traditional farming methods and history, historical and traditional stories in your area can contribute to different ecotourism projects. Instead of exploiting these resources for short term benefit, looking after them has multiple benefits for ecotourism in the present and future. Natural treasures will remain healthy, and future generations will be able to enjoy the benefits from the natural environment.



A good example of accommodation based on successful ecotourism is Barry's Place on Atauro Island, north of Dili, Timor-Leste. They have traditional huts made from bamboo and local materials, solar power, compost showers and toilets, vegetable gardens, fruit trees, animals and are replanting local trees. Barry's Place employs 30 local staff, and supports many other local workers through buying local food and promoting other activities and businesses. They also work with the community to protect the amazing nearby reef, and teach people about the complex reef ecosystems.

The example of Barry's Place and many other ecotourism ventures show that money goes to nearby communities and local people get jobs. Tourists go to see the beautiful natural environment as well as supporting sustainable tourism. Therefore, for the future of ecotourism, the environment must be protected by the people who live as part of it. People and the environment together make ecotourism.

Resource and product analysis - the seed grows

Analysis is an important part of working out the best projects and products for a community group or cooperative to get involved in.



When you have a list of ideas, you can ask some simple questions to help decide what will work best for your group.

Product questions

Is the product you want to make already made locally? If not, good, but if yes, are there enough people who want to buy that product for you also to make it?

Do not start making something that is already sold in your community or you will find selling your product very hard, unless you have a better product or a different market.

Resource questions

- What resources are locally available?
- What resources could be grown or made locally in the future?
- How much will it cost to buy and transport the other resources needed?
- What necessary tools/buildings exist already and what do not?
- What technology is required to make the product: e.g. electricity, machinery, basic materials, etc.?
- Can the technology be purchased in the region? Does it cost too much? Can this be used without constant maintenance? Is the technology suitable for the community?
- How much money is available and is financing (a money loan) a good idea?
- What skills do people in the community have?
- What skills are they interested in learning: e.g. carpentry, food production, making new products from traditional materials?
- Is there training available for new skills? Can local people provide training or is there access to skilled people from outside your region or country?



Marketing questions

- What market or demand is there for your products?
- How many products can be made initially and in the future?
- Where will the products be sold?
- How much will you sell the product for?
- What are the transport costs? What is the form of transport: e.g. pony, bicycle, motorbike, car, truck, cart, bus, etc.?

Management structure - the tree trunk

It is very important to set up a good management structure before starting the project.

It is also very important that everyone in the group helps to make the management structure. It is good to include help and advice from other people who have experience and knowledge about cooperatives, as well as local elders, government workers, community leaders, etc.

The type of structure depends on the type of group and the different projects.

Small cooperatives that provide tool exchanges, food exchange, bulk food purchases, etc, are different. You can find more detail about them later in the chapter, but small co-ops still need a simple management structure and bookkeeping. Larger cooperatives, groups and community businesses need a strong structure, transparent management and bookkeeping to work well.

A good management structure includes the following:

1. VISION STATEMENT

A vision statement is written together by everyone involved in the group. It states how the group will work together and with the community. It also states the group's short and longer term goals, and it should be short and simple.

2. ETHICAL STRUCTURE

These are the guidelines and principles for how the group functions. Everyone in the group must be part of deciding on the guidelines and principles, and all must agree to work by them as part of their involvement with the group. This helps the organisation to work effectively. It also helps individuals to understand the organisation and how it makes decisions based on these principles.

It can include:

- Workers rights
- Community involvement
- Environment protection
- Good waste management
- Sustainable use of resources
- Equality for men and women, especially in meetings
- Resolution strategies for disputes





3. A MANAGEMENT SYSTEM

The type of management system most appropriate for the co-op will depend on how big the group is and what it plans to do.

For a larger group, the management structure may include a:

- Steering committee
- Coordinator(s)
- Finance officer(s)
- Secretary
- Production worker(s)
- Transport worker(s)
- Section for marketing and sellers

The steering committee must be separate from the coordinators and might include a community leader or elder, a government representative, a religious or civil society representative and other community representatives. The production, transport and marketing workers must have representatives who are part of the coordinating group. In a cooperative, the different producers are the coordinators and are involved in marketing and selling. It is important that all the producers are a part of the decision-making process. If only one or two people make the decisions for a group, it is not a cooperative. Decision making must be based on the organisation's ethical structure or principles which guide all the members of the group. It is important that the finance officer(s) and secretary are separate from the coordinators.

SMALL GROUP EXAMPLE:

In a small group the same people may have several different roles, but it is important that all the roles are covered. This is because a group needs to be able to work out how well the business is going and if changes should be made: for example, how to improve working within time and costs limits.

For both big and small groups it is important to share the work and coordinate as much as possible.

Some groups have a structure where the coordinator(s) are changed every one or two years. This helps to share the management and more people can gain experience, which is very important for building capacity. However, the people who take on the coordinator role must receive some training first and be assisted by other coordinators for a time, so they understand what to do.

4. A SET WAGE, PRICE AND PROFIT STRUCTURE

It is important, especially for large groups, to have a pricing, wage and profit-sharing structure for transparency and to maintain equality for the cooperative's different workers. The wages and prices can change if needed, but changes should be the decision of the whole group. How profits will be distributed must be decided before the cooperative has started. As with all other activities, the profits must be used to achieve the objectives of the organisation: e.g. divide profits between the members, invest in cooperative improvements, social activities or services like road repair, school improvements, etc.

Here is an example of a cooperative for fish production. If a group of fish farmers join together to form a cooperative group, they can support each other, and make production better and cheaper. It is important that, as a group, they set prices for selling the different types of fish, decided on what they will pay for transport and manage other costs as well, even if they sell the fish individually. Prices may also change depending on where they sell the fish. Local markets, city markets, supermarkets and restaurants all might buy at different prices. All these prices need to be set by the group.



5. A THOROUGH BOOKKEEPING SYSTEM

Bookkeeping is part of the finance officer's work, which also includes distributing and storing/saving money. Bookkeeping involves:

- Recording everything that is bought and sold
- Recording all wages
- Keeping records for daily, weekly, monthly and yearly expenses and income
- Recording profits



Careful: this is the one part of a cooperative that has the potential to cause the most problems! Transparency and accountability are very important here. To reduce potential problems:

- Two or three people need to sign for money withdrawals.
- All withdrawals and deposits are recorded and reported regularly to the group.
- Regular independent auditing is necessary.

6. A PLAN FOR FUTURE CHANGE AND DEVELOPMENT

A group needs to be open to changing and growing. This includes increasing production, making new products, selling in new market places, making the group larger or smaller, changing production methods and improving infrastructure, etc.

The most important thing is to ensure that the group is providing its members with an income that is worthy of people's work, providing support and improving the members' livelihoods.

Cooperatives should continue to be guided by this principle and strengthen their community base.

All decisions relating to development and changes must be made as a group, so that everyone understands and is part of the process.

Groups usually start with a small number of products. As groups grow confident and develop, it is good for the number of different products to increase. This allows organisations to diversify and respond to the market, while remaining competitive.

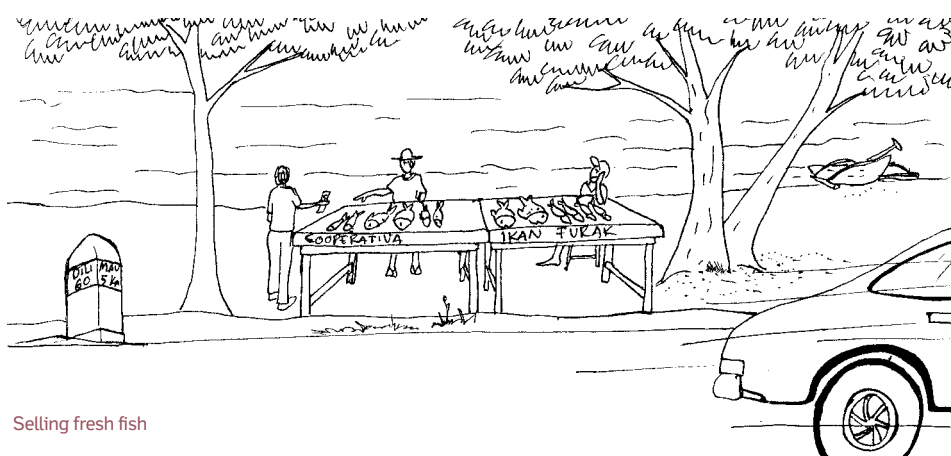
Changes are also necessary to maximise efficiency.

It should be a continuing goal to ensure the more efficient the method of production, the cheaper the costs will be. This goal improves incomes and reduces the price of the products. This is important for competing with overseas products.

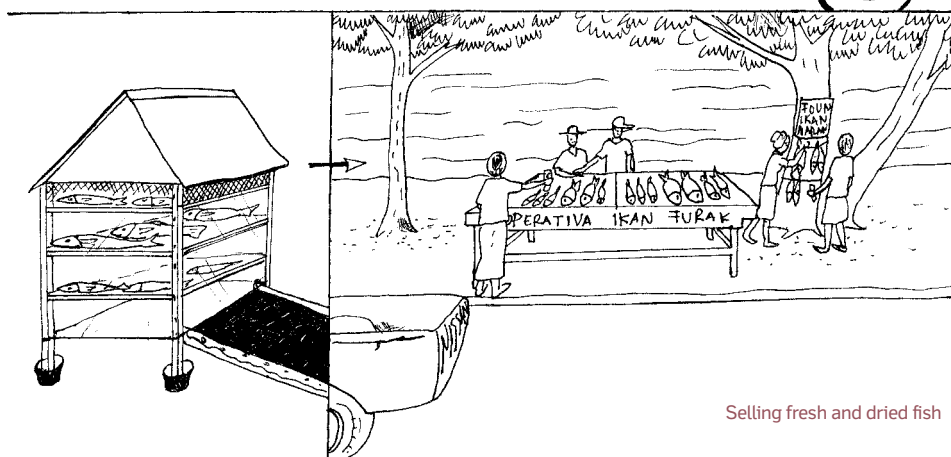
Organisational flexibility is very important as well: being able to change as markets change. Bringing in new technology that can improve and diversify production is another part of being flexible. e.g. using a computer for bookkeeping, buying solar drier for drying produce.

Markets and the economic situation can change quickly, so it is important members can react quickly and work together to adjust plans for the group. This relies on the ability to use effectively the group's management system set out at the beginning, to change and evolve continually.

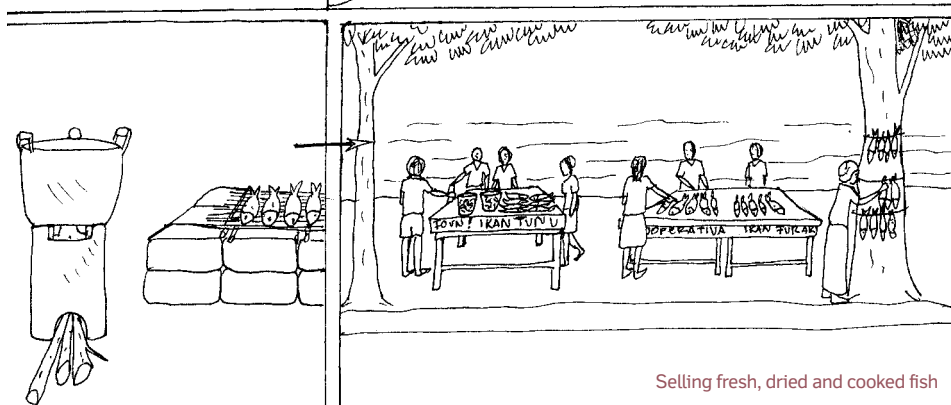
A strong ethical structure and clear principles allow members to make these decisions quickly and clearly, while still following sustainable and ethical guidelines.



Selling fresh fish



Selling fresh and dried fish



Selling fresh, dried and cooked fish

Potential problems

Establishing and maintaining a clear management structure should minimise potential problems. However, disagreements over money, use of resources, sharing labour time and lack of decision sharing can happen. The best time to stop these problems is BEFORE they happen. This can be achieved through:

1. Community consultation
2. A good plan that provides management structure, short and long term goals and shared decision-making arrangements
3. Transparency and accountability with bookkeeping and all money matters

If problems do happen, then a collectively decided, preplanned course of action should follow as quickly as possible. It is best if this involves traditional community methods for finding solutions.

Types of cooperatives

Whatever the type of cooperative, the most important function is to support the community.

This includes:

- Encouraging community participation and strengthening
- Keeping money in a community
- Improving the amount of food in a community
- Improving and supporting production at all levels – home gardens, animals, large-scale agriculture, information and knowledge sharing, resource sharing: e.g. seeds, manure, building materials

Small business cooperatives

The most common type of cooperative is a small business, it is set up by community members to start making and selling products.

It follows the cooperative structure and provides opportunities that are not possible to individuals.

Women's groups or cooperatives

Women's cooperatives are a source of support, labour and advice, and are especially helpful for women who do not have the time or resources to start up their own business.

They give representation to women in the community and beyond. They also allow women to have much more control over their lives and the decisions they make.

Some examples of small business or women's group cooperatives are:

PLANT NURSERY

Growing and selling plants is important for every community and can make money too. As a cooperative, it is more achievable to build a large nursery, buy a coconut husk shredding machine for potting mix and a steam soil sterilisation machine. These innovations will improve results a lot.

STOVES, OVENS AND WATER FILTERS

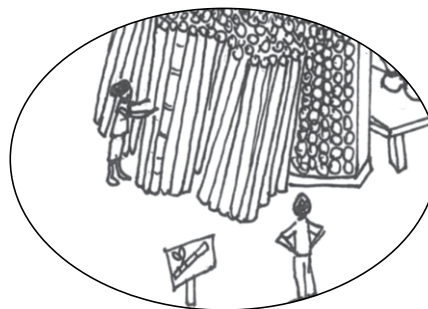
A lot of deforestation occurs for fuel to cook food and boil water. This can easily be reduced by using stoves, ovens and water filters. They can be made out of a variety of materials and are great products for a community cooperative. These products also save a lot of money and hard work!

It is important to have a marketing and demonstration campaign, and recipes for the stoves and ovens to increase interest and use. If your government gets involved too, it is even better.



BAMBOO

All facets of bamboo production—from propagation, growing, harvesting, drying, curing and using the poles—are easier as a cooperative. A group can buy the tools and equipment that expand the range of products made and make use of all the bamboo harvest, such as making cooking bricks from bamboo sawdust.



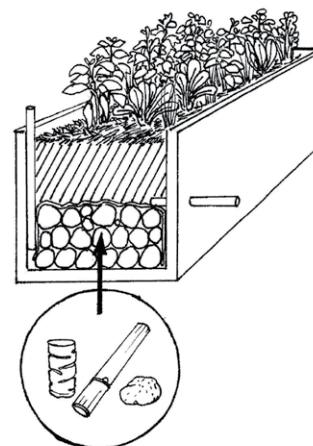
BIOCHAR

Activated charcoal to improve soil fertility, or biochar, is a valuable and highly useful farming product that is more easily produced on a bigger scale, which is suitable for a cooperative.

RECYCLING WASTE

Cooperatives can be set up to make products from waste:

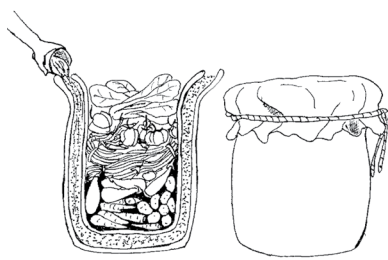
- Flower pots and garden equipment
- New strong carry bags from old plastic bags
- Wicking bed gardens from old fridges (read **Ch 10**)
- Furniture, shoes, household goods
- Art and sculpture
- There is even a new machine which turns plastic waste back into oil!
- Many, many more.



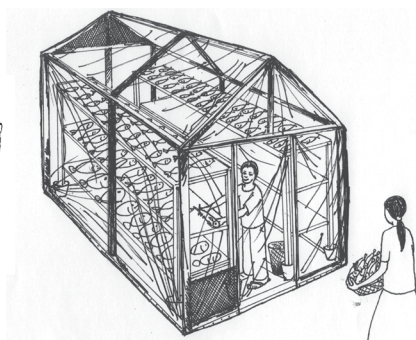
FOOD DRYING AND STORAGE COOPERATIVES

A cooperative or community group for drying and processing food helps make the work and costs manageable.

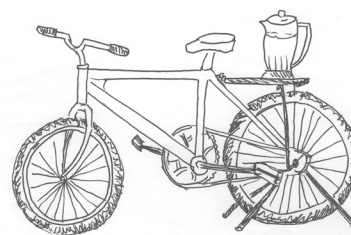
Buying clay pots or other storage containers to make fresh food last longer is much easier. This type of group is excellent for supporting market sellers.



Clay pot, cross section of two clay pots



Solar fish dryer



Pedal powered grinder

Farmers' cooperatives

Cooperatives can be set up by farmers primarily for selling produce.

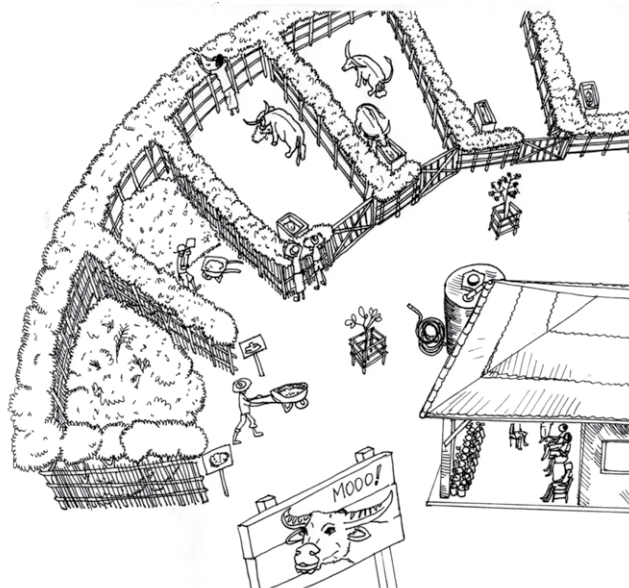
They are excellent for:

- Getting better prices for goods
- Reducing transport costs
- Finding and entering bigger markets

They are also important to improve efficiency and reduce costs for:

- Storing produce, such as corn and grains
- Buying farming tools and other materials
- Sharing labour: e.g. five to ten people share labour for pre-planting, planting and harvesting, and rotate from one farm to another.
- Producing natural fertilisers, pesticides and fungicides

The biggest benefit is to **share knowledge and experience!**



Food cooperatives

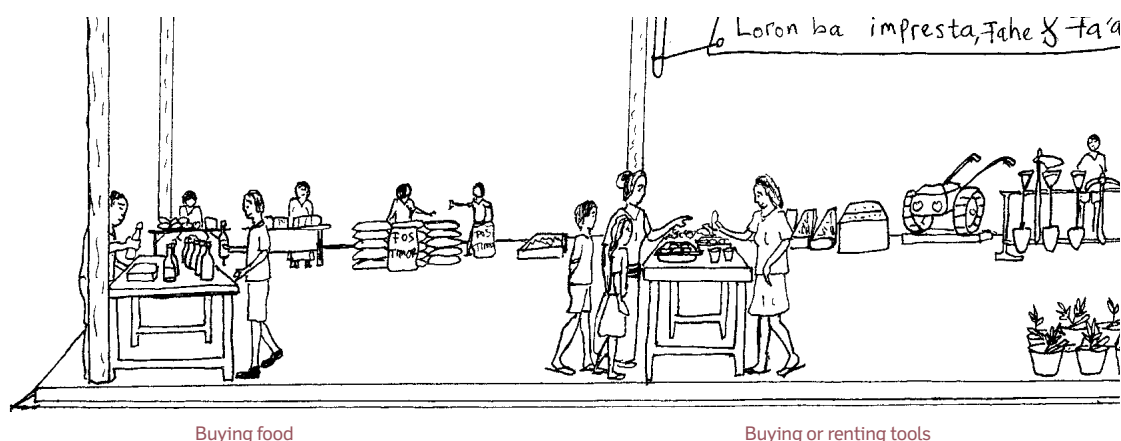
A group of people form a cooperative to buy food (e.g. rice, beans, oil, etc.). The food can be bought in large amounts at a cheaper price.

Transport costs can also be shared. The food is then divided between the members, and everyone saves money. With a food cooperative, it is also possible to buy slightly more expensive local products rather than imported products because the price is lowered by buying in bulk.

Community Supported Agriculture (csa)

This is a farmer/community cooperative where farmers supply weekly vegetables, fruit and other produce to members of a cooperative. There are many benefits:

- There is a direct trade between the farmers and buyers, with no middle men, which allows a better selling price for the farmers and a cheaper price for the buyers.
- Farmers have a guaranteed market.
- Buyers know who is growing their food and what methods they use.
- It is great for urban buyers to get fresh food directly from the farmers.



Buying food

Buying or renting tools

Tool and resource cooperatives

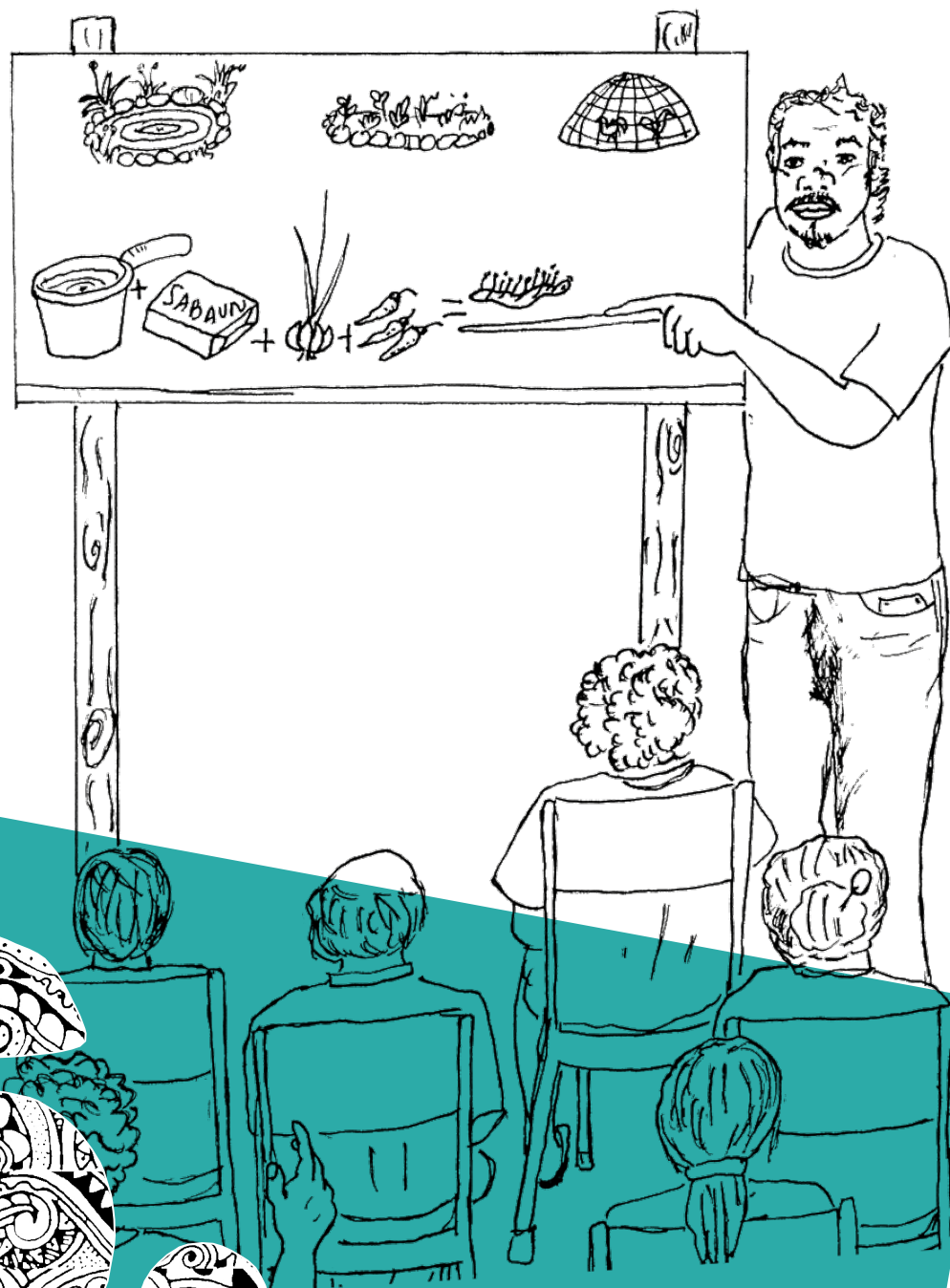
A group of families or farmers can join together to share tools and farming resources, which means there are more tools to use.

A cooperative can trade local resources: e.g. manures, seeds, building materials. Other imported resources can be bought in large amounts for the whole group so that they are cheaper. This can also include labour, and sharing labour will save time and effort. It is important that the cooperative does not use money or have lending costs, except perhaps for more expensive tools or a hand tractor. A system must be in place to deal with tools that get broken.

Even small cooperatives need a simple management structure, including bookkeeping, to record money, goods and work, and to be transparent. Cooperatives, community groups and small businesses work better and help the community more if they link with local trading systems and a local currency.



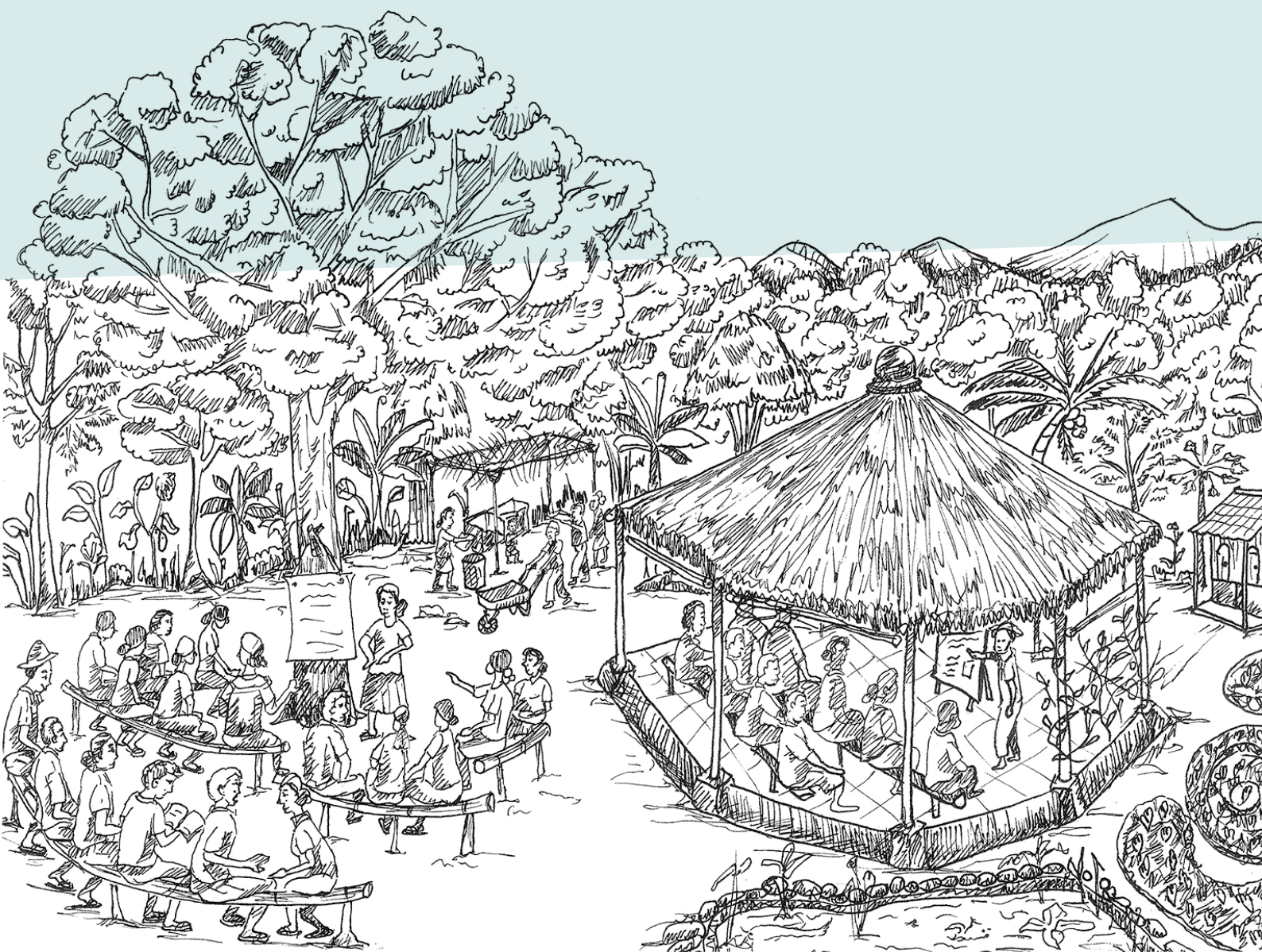
Pg 24 | Ch 5 | Vol 1 COOPERATIVES THE TROPICAL PERMACULTURE GUIDEBOOK — INTERNATIONAL EDITION. A GIFT FROM TIMOR-LESTE.



TRAINER'S GUIDE

6 TRAINER'S GUIDE

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Permaculture trainers' guide

This chapter is for people who want to teach permaculture courses. Only people who have experience preparing and providing training and who have a lot of permaculture experience should teach permaculture courses.

To provide an accredited Permaculture Design Course (PDC), you need the necessary approval from an accredited permaculture institute and/or teacher, including having your curriculum approved. For smaller courses, this is not necessary but having training and permaculture experience is essential.

A good way to become a trainer is to gain practical experience on demonstration plots and projects, and be an apprentice trainer for courses. This involves assisting trainers and supporting their training until you gain the experience to run courses yourself. Doing a teaching course helps a lot as well.

Good trainers are like performers; they hold the students' attention and engage with them. They also use many different techniques to facilitate learning. For a successful course, you can use illustrations, discussions, demonstrations, designs, maps, student research, flip charts, films, photos and field trips, as well as games, singing and other inclusive activities. See classroom techniques later in this chapter for ideas.



1. Bamboo practical - Digging up cuttings to plant



2. Bamboo practical - Cutting culm into individual plants



3. Bamboo practical - Planting the new bamboo plants



Course planning

There are several things that can guide you when planning a permaculture course.

Many students on permaculture courses in tropical countries, especially in remote areas, farm small plots of land. Often they have limited education, which is especially so for women. This means that many permaculture students may have difficulty reading and writing, and lack confidence in a traditional classroom. They also have difficulty concentrating for long periods each day and for many days in a row.

Before teaching a course, consider these kinds of barriers to learning and practise teaching methods that help all your students to benefit from permaculture training.

This section provides ideas for planning a course, choosing classroom activities and how to provide ongoing support so that students receive the greatest benefit from the training.



Reading and writing can be hard for some students

Women and permaculture training

One of permaculture's priorities is to create long-term solutions that improve the day-to-day lives of ordinary people. These solutions work best when all members of a system or community work together equally, in balance with each other, as they would in a permaculture system.

Permaculture considers the equal happiness and wellbeing of all individuals. This means that men and women must have the same opportunities to learn and receive training.

In many countries, opportunities for men and women are not equal. For a number of reasons, women are much less likely to receive training than men. Permaculture trainers must give time and energy to consider women's needs and to ensure that permaculture techniques reach women.



Barriers to women's learning

Identifying the barriers to learning women experience is an important step towards women's empowerment. Eliminating the barriers requires careful and positive management to allow women greater access to knowledge.

The following is a list of problems women face when attending training, and they apply to all kinds of training, not just permaculture.

1. **Age and status:** Young women with young children who lack female support in the household are less likely to attend training or a meeting than older women or women from wealthier families. These women require extra support to participate in permaculture courses.
2. **Childcare:** Childcare responsibilities either prevent women's attendance or reduce their full participation in training. Women with children who are old enough can benefit from childcare arrangements. However, women with very young babies are unlikely to attend any kind of training.
3. **Education:** Women often have fewer years of schooling and lower levels of literacy than men. As they have less education, women have more difficulty with analysis and lack confidence in a classroom.
4. **Language:** Women are more likely to speak local languages than the official national languages.
5. **Mobility:** As most women organise and run their households, they are less likely to be able to travel to training outside their local area.
6. **Free time:** Women have less free time than men because they work both in the home and on the farm. For example women sometimes having to excuse themselves from training in order to cook their family's midday meal.
7. **Inequality in mixed groups:** Women participate less in group discussions when men are present. This is because men often dominate discussions and may either prevent women from speaking or do not respect women's opinions when they do speak. Many women lack confidence to voice their own opinions or ideas.
8. **Lack of women decision makers:** There are few women in the position of community decision makers or leaders as men generally represent villages and regions. For permaculture trainers, it can be difficult to identify women's needs. Working with women's groups and women's cooperatives can solve this problem.
9. **Women's attitudes to training:** Many rural women believe that technical information is too complicated for them to understand and that new information is difficult to learn. Women in some areas also assume that permaculture and agricultural techniques mean heavy labour beyond their capacity.
10. **Community attitudes to training:** A big barrier to women's participation in training in some countries is cultural resistance to women's formal education. Women's education in some places is considered disruptive to families and the village way of life because it presents women with opportunities and livelihood choices outside their family duties. As a result, training for women is sometimes mistakenly thought to be in direct conflict with the interests of social stability, and the maintenance of culture and community in the village.



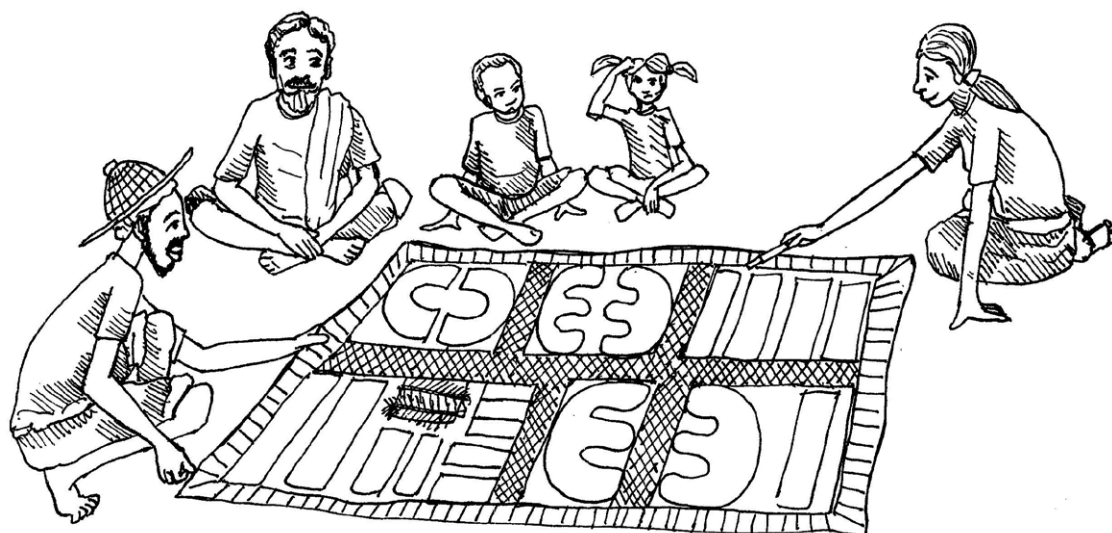
Problems and solutions

Some barriers to learning affect both men and women: e.g. low levels of education, age, status/poverty and language abilities.

Use the table below to help you remove the barriers people may have to attending and learning in a permaculture course.

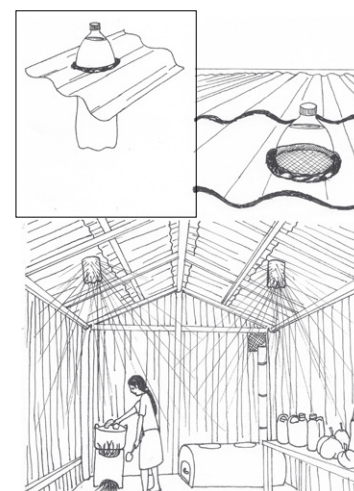
MEN AND WOMEN

PROBLEMS	SOLUTIONS
Age and status	• Practical support for household and other daily duties. • Active encouragement from the trainer.
Childcare	• Organise childcare within the family during training hours. • Children can be looked after by neighbours.
Education	• Visual training resources. • Practical demonstrations and activities. • Short films and videos of dramas and demonstrations. • Positive encouragement from the trainers. • Activities involving the whole group: e.g. role play, discussions, group mapping. • Simultaneous interpretation into a local language
Language	• Pre-training language preparation for the interpreter.



WOMEN

PROBLEMS	SOLUTIONS
Mobility	• Arrange the training closer to home.
Free time	• Organise family childcare. • Employ people not involved in the training to cook for the participants. • Encourage women to rearrange cooking responsibilities at home, so they do not have to cook during course hours. • Get the support of local leaders to ensure that students are formally supported.
Inequality in mixed groups	• Ensure the trainers are gender aware. • Have a neutral or female interpreter. • Focus on topics about which women have knowledge. • Use resources specifically designed for women. • Provide women-only training coordinated with their free time.
Lack of female decision makers	• Pre-training preparation with influential leaders. • Include high-status women in pre-training preparation. • Work with local women's groups.
Women's attitudes to training	• Present the benefits of permaculture and the positive outcomes for women. • Present the training as specifically providing information for women. • Build women's confidence as experts on their work and their land. • Emphasise beauty and function. • Use teaching techniques that do not rely on group literacy.. • Emphasise labour-saving techniques • Encourage the adaptation of techniques.
Community attitudes to training	• Educate the leaders first. • Present the benefits of permaculture as a way of supporting and improving traditional values and way of life. • Allow enough time to inform the community of the course and what it is for.



Permaculture includes appropriate technologies that improve health and life

Permaculture systems work best with the equal participation of all community members. As women experience more barriers to learning than men, these are concerns for the whole community. If women are unable to attend training, their families, and the wider community, are less likely to benefit from permaculture techniques in areas where women work, including health, nutrition, family gardens, raising animals and other economic activities.

A permaculture course

Type of course to choose

There are different methods for providing training, and the type that you choose depends on:

- the needs of the community and what they want from the training.
- the education level of the students.
- how to fit training around seasonal work, ceremonies, daily tasks, etc.
- course costs and available funding.
- the needs of partner organisations and their projects.

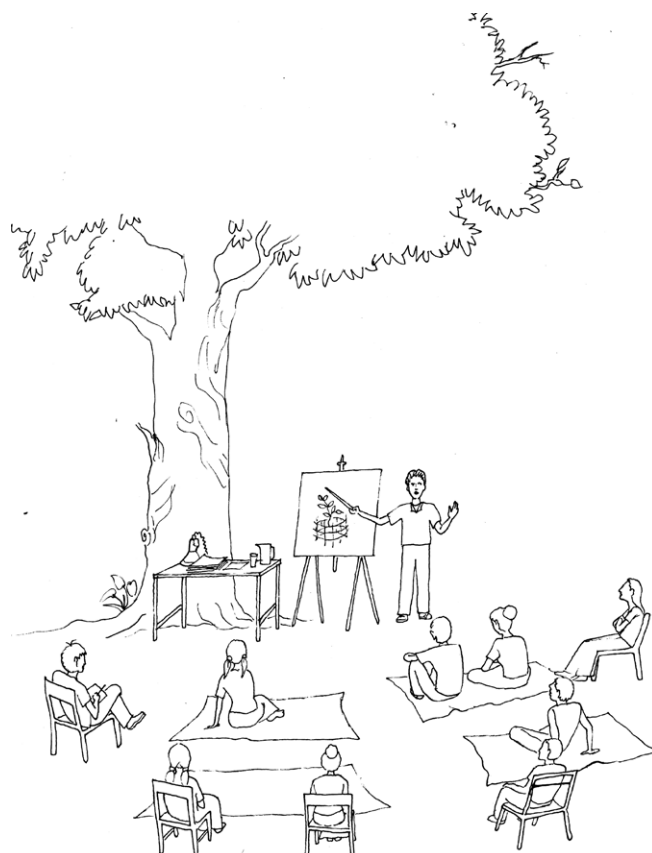
There are two main types of courses.

Permaculture Design Course (PDC)

As previously explained, to provide an accredited Permaculture Design Course, you need the necessary approval from an accredited permaculture institute and/or teacher, including having your curriculum approved. This ensures the delivery of quality training that covers the basics of permaculture and design, and gives the students a certificate of value.

Although the course is the same as 72 hours full-time study and usually runs over two weeks, it is still only a starting point for permaculture. Follow up and future research is essential, as well as more specific training on topics of choice: e.g. seed saving and propagation, aquaculture, renewable energy systems, etc.

While the two-week PDC is valuable, it also has limitations. For instance, one of the most important developments in permaculture work in Timor-Leste was a shift from two-week courses to many small courses with more follow-up work and ongoing demonstrations.



Problems with two-week courses in Timor-Leste:

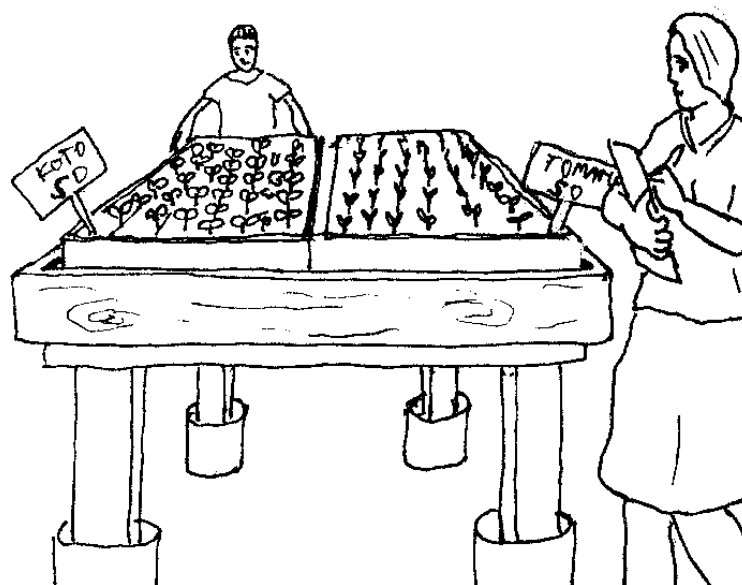
- They are inaccessible to many people who cannot spend that amount of time away from their families or land, especially women.
- It is hard for many people to concentrate for so long and absorb the information, given the historically low levels of education.
- A lot of the benefits are lost due to the lack of follow up or ongoing support.
- It is often hard for people to participate for the whole two weeks, especially due to cultural needs.
- They are very tiring for trainers and other course workers.

Two-week permaculture design courses are very important and appropriate for the right students in the right situation, but they may not suit every context.

Smaller training sessions and long-term partnerships

Using a method of smaller training courses and creating partnerships have worked well in Timor-Leste for Permatil (Permaculture Timor-Leste). The model, developed by trial and error over many years, is good for the developing-country context.

Permatil found it was best to work with groups for a minimum of a year, preferably two to three years as a base, and maintain contact with further training and technical support as appropriate. Every year Permatil runs three to four training sessions, with each on a particular subject.



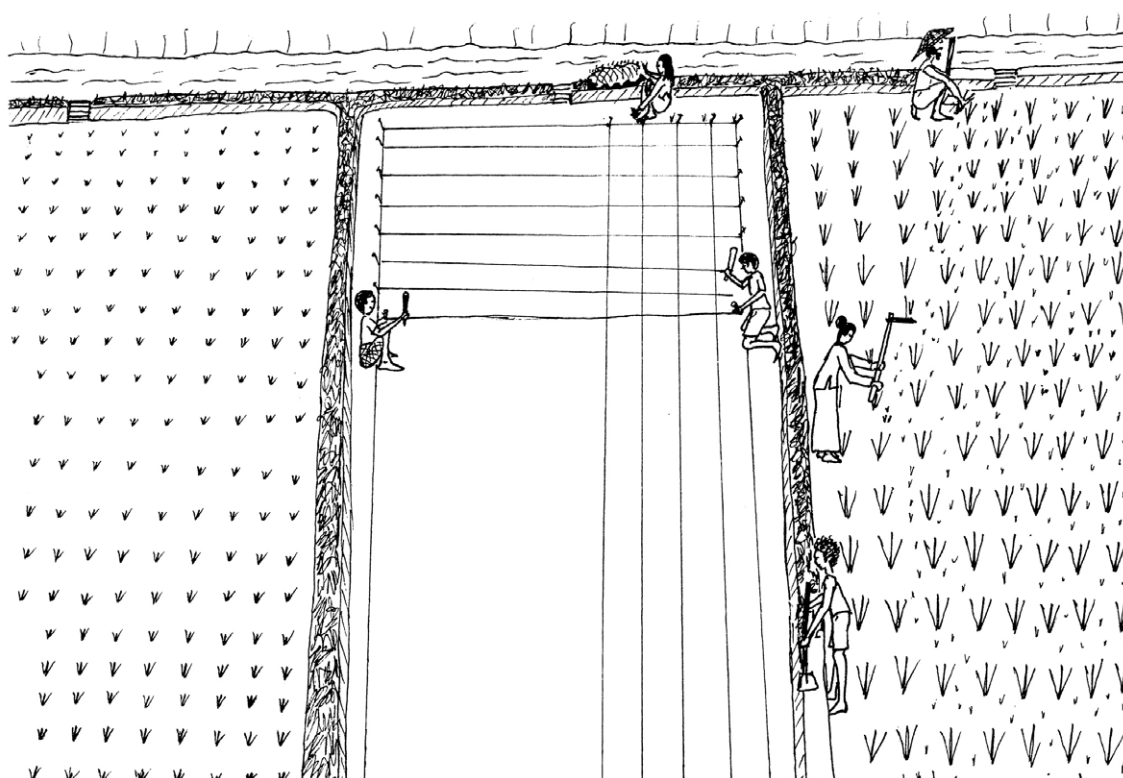
Seed viability test training

Such a method can follow the chapters of this guidebook, with each as a separate complete training session, which still fits into the bigger picture: e.g. introduction to permaculture, family gardens, soil management, nurseries and seed saving, clay-cook stoves, solar-food driers, animal and agro-forestry integration, System of Rice Intensification (SRI), annual crop production techniques, aquaculture systems and so on.



While the training courses are separate, each is part of the wider permaculture system and considers another piece of a larger picture. Together, all of the training provides a holistic picture and the practical demonstrations all fit into an overall design. It is still very important to include design, integration and reference to permaculture concepts and principles in all training and ongoing demonstrations.

The training sessions range from one to five days, depending on the content. Between the training, arrange monthly field trips to the community – usually two to three days each – to answer questions, provide encouragement and technical support, and plan for future training. It is also important to assess the various permaculture techniques shared, not necessarily considering whether the technique is successful, but whether community members continue to use it and copy it or not.



System of Rice Intensification (SRI) training

This system allows:

- much greater flexibility – training better suits community needs,
- better balance with seasonal activities such as harvest times and ceremonies,
- more women to attend training,
- much higher community uptake of techniques,
- better community understanding of permaculture,
- the development of ongoing relationships with communities,
- the improvement of training and programs over time due to continual feedback and assessment,
- greater chances of permanent changes in behaviour.

Permaculture course planning

The aim of a permaculture course is to give students new ideas and practical techniques that improve their everyday lives.

There are three main phases of any successful permaculture course:

- Pre-training preparation.
- Training.
- Post-training follow-up.

Pre-training preparation

All trainers planning a permaculture course need to make preparations. The trainers should be backed by administrative support for the preparation stage, especially for organising meetings and resources.

1. CHOOSE THE COMMUNITY

The process of choosing your students and where they come from may already be decided for you, depending on your organisation and its projects. If you are not from the village/town where you plan to teach, you need a contact person to set up meetings and liaise between you and the community. This person or group of people is very important for the planning stages.

2. MEET THE COMMUNITY LEADERS

Spend time introducing the concept of permaculture. The starting point of any training is to meet and speak with the community leaders who include the village/town/regional leaders, religious and social leaders, and men and women from local important families. The support of leaders gives your training a much better chance of success.

It is good to show how permaculture techniques work. Some ideas are:

- Take community representatives to see a permaculture demonstration site.
- Show “before and after” photos of using permaculture strategies and techniques.
- Talk about the successes of permaculture techniques in other communities.





As there may be resistance to women's education, you need to show village leaders the positive aspects of educating women in permaculture techniques. These include:

- Improving women's knowledge about soil, planting, harvesting and nutrition means better food for the family. Better food means healthier, stronger, smarter, more productive people.
- Teaching women about waste water and waste recycling preserves resources and saves labour.

The specific benefits vary according to each course and the type of training you plan to give. Show village leaders that permaculture's communal and family aspects support and strengthen the family unit and the village way of life, not undermine it.

The benefits of permaculture include:

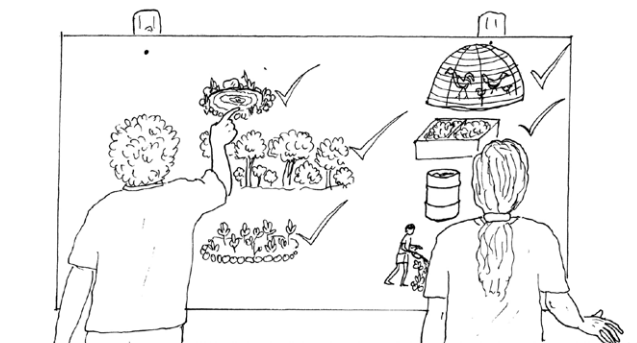
- Stronger connections to traditional culture and practice.
- Long-term food and water security.
- Preservation of natural resources.
- Methods to improve farm yields and storage.
- Improved family health.
- Cooperative and work group solutions.
- Better, healthier housing using appropriate local materials.
- Reduced waste.

3. SURVEY COMMUNITY NEEDS

Conduct a community meeting followed by small focus groups. Discussions in separate men's and women's groups are a valuable opportunity for the students to voice their concerns and needs prior to training. **It is very important for students to understand that permaculture is about helping to create solutions rather than giving out tools or money.**

Important information to guide the course content includes:

- Identify what resources the community has including its infrastructure, skills, plants, animals, water and land types, etc. This is achieved through a community mapping exercise, working with as many community members as possible.
- Identify everyday tasks and the main concerns of the communities. A day-mapping exercise to find out the amount of time spent working on which tasks helps.
- Students' anticipated course attendance and potential problems impacting negatively on attendance.
- The main agricultural and livelihood work in the community: As trainers, use your own observations of the land and the community to augment this information.
- Environmental concerns including water sources and storage, erosion, the amount of forest, the natural ecological health, etc.
- What are the community's future goals, plans and ideas for livelihoods, food production, sustainability and improved health?



You may not have to conduct as much research if the course has been requested by the community for a specific purpose – e.g. the members of a local women's group want permaculture training on family gardens.

4. COURSE PLANNING

If the leaders accept the training, you can begin the course planning. The next meeting should cover all the organisational points that need the leaders' help or approval.

- **What?** What type of course will you provide? What will the training topics be? How many training sessions? See “type of course to choose” at the beginning of this section.
- **When?** Set a date in consultation with community leaders considering seasonal work and ceremonial calendars. For example, harvest times, planting times, ceremonies and festivals are obvious times when students will not attend class.
- **Where?** Choose an appropriate site in the village for demonstration activities and decide where classroom activities will take place.
- **Who?** Make a list of possible students.
- **How?** Discuss the support to be given by the community, e.g. childcare, cooking, interpreter. Discuss support to be provided by the trainers, e.g. food, trainers, course material, follow-up monitoring.
- **Purchasing the course food:** how much, who will buy food and cook, etc.? Encourage and insist on local, traditional foods. This is a big benefit to a community as they can sell local food and local people are then employed to cook and serve it.
- **Arrange practical support for the students:** ensure that childcare is arranged with the families of students who need it and make arrangements so that female students do not have to go home to cook for their families.
- **Organise an interpreter if necessary.**
 - If the trainer is unable to communicate fluently in the appropriate language.
 - In remote communities women are less likely to speak the national languages; therefore a local-language interpreter is needed.
 - If the interpreter is unfamiliar with permaculture, you need to spend time explaining basic concepts and providing technical vocabulary. If possible, take the interpreter to visit a demonstration garden.
 - The interpreter must also understand that his or her role is to provide interpretation without intervening or contributing to the class discussion.
 - If possible, locate a female interpreter for women-only courses.



5. PREPARE THE COURSE SCHEDULE

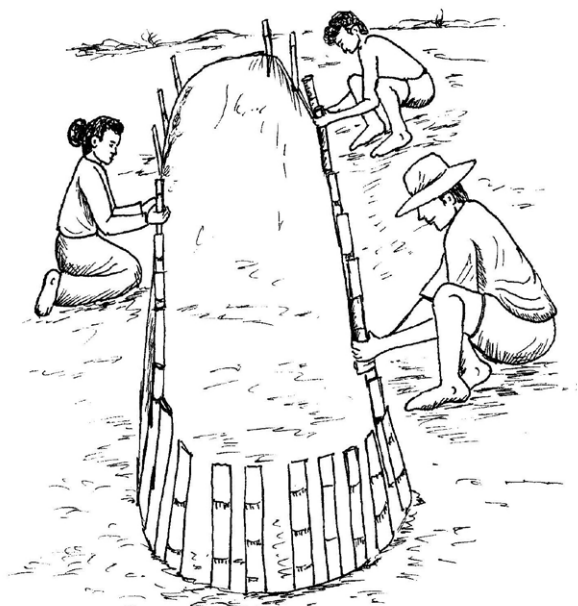
Design a permaculture course schedule which suits the lives and needs of your students. Use the information from the community meetings, the discussion groups, the students and your own observations to plan the course.

Make the training as interesting and practical for your students as possible. A practical course also means basing what you teach on the information the students need and will use. Schedule the course with the students' daily responsibilities in mind.

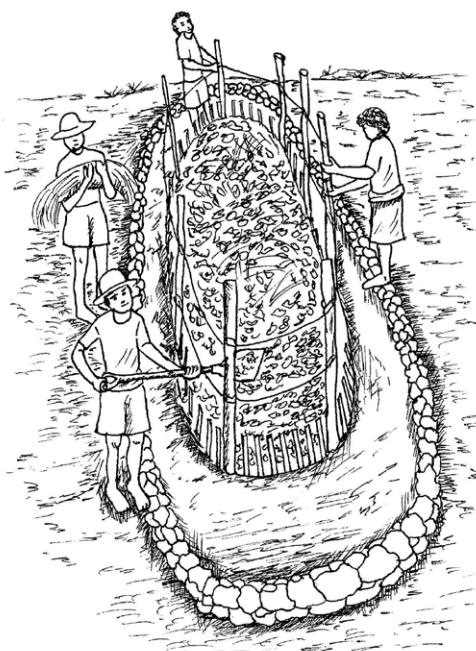
6. PREPARE THE SITE

Prepare the demonstration site and check the training room facilities. Depending on the facilities available, you may need to make compost pit toilets and/or an open-air shelter.

Prepare the materials you need for the example demonstrations: e.g. liquid or dry compost; mulched and un-mulched garden beds; 3-D design models; nursery building materials; and solar food drier materials. These must be ready before the course; if you have to prepare the materials during the course you will lose a lot of course time.



Preparing a compost garden bed before a training



Making a compost garden bed during a training

Delivering the training

Trainers

A permaculture trainer must have practical experience of permaculture techniques and knowledge to teach others how to work with permaculture designs. However, permaculture is relatively new to many countries, and agricultural workers in the government, local NGOs and university teachers will also want to teach the material in this manual.

They can still teach the practical and specific techniques, but it is highly recommended that they do a permaculture course before teaching permaculture and permaculture design methods. Whatever their background, it is very important for a permaculture trainer to provide clear practical demonstrations and information.

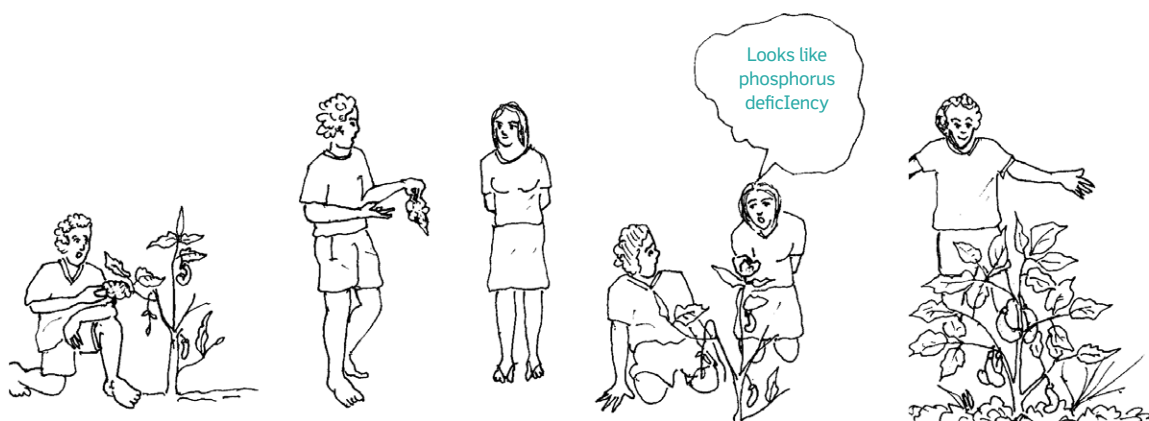
There should be two trainers for all workshops and training to provide support, offer more practical examples and experience, and share the work of preparing and delivering lessons. This gives the chance to have one experienced permaculture trainer and another trainer who could be a government or NGO worker, a teacher or an apprentice permaculture trainer.

This section is a guide to help you run your permaculture course in a way that encourages equal participation, class enjoyment and long-term effectiveness of the teaching material. You want your students to remember what they have learnt and to enjoy the process of learning.



Women trainers

If you are a woman trainer, you can play an important role in the teaching of permaculture techniques. Permaculture is an opportunity to educate other women about practices that make their lives and the lives of their families better. You will also inspire and build confidence in women to think practically and creatively about designs which affect their everyday lives. The permaculture ethic of caring for people demands equality and this is a good way to start that.



WOMEN-ONLY TRAINING

Women-only training builds women's confidence to participate in group discussions and class activities with other students who respect their opinion and can interact equally.

Depending on the resources available to your organisation, you can run simultaneous separate men's and women's training sessions. These groups could come together for certain activities but cover different topics in class, according to the students' needs. They would also be run by separate male and female trainers and provide a working example of equality and cooperation between men and women.



A discussion group during a women-only training

Classroom techniques

TEACHING

During a permaculture course, trainers need to transfer a certain amount of knowledge to their students, and the way it is done is very important. A good permaculture trainer does not just stand and talk at the students. This style is not a good way to encourage any learning, especially of permaculture.

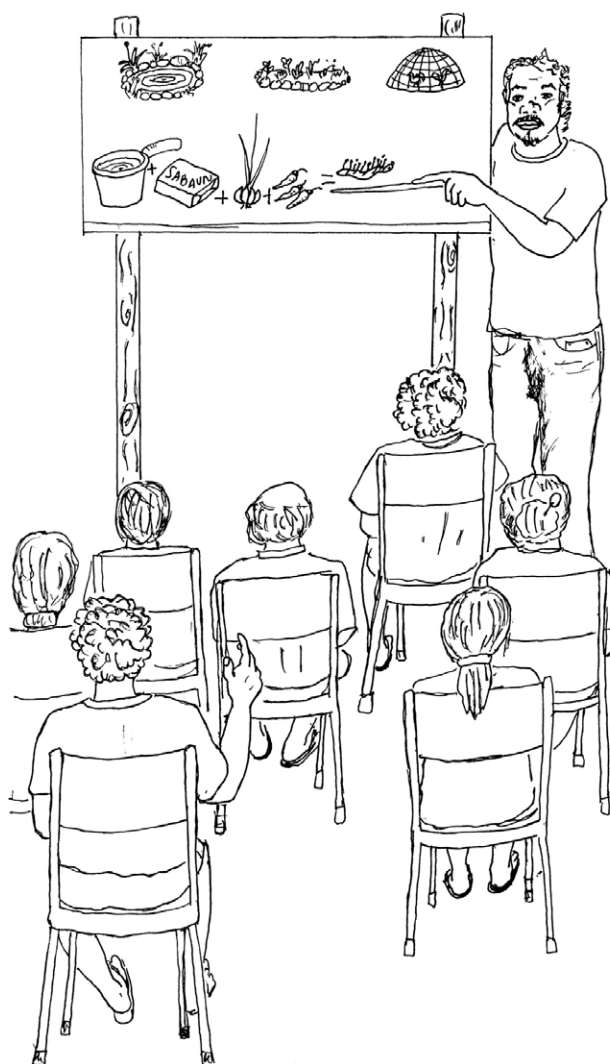
As a permaculture trainer, your job is much more than just communicating a set of practices and techniques. You are responsible for the learning environment or the 'culture' of your class. The class should be a comfortable, open and inclusive space where all students feel that they can voice their opinions, and be heard and respected by others. For women, this is especially important. The best way to create this kind of 'culture' is to practice it yourself. The atmosphere of the class is vital to the students' learning process and how they remember the knowledge and techniques.

Important techniques include:

- **Participation:** ask your class questions. Invite them to share their knowledge and encourage the class to discuss course topics between themselves. Asking for students' opinions and valuing their knowledge are good ways to build their confidence and increase their participation in the course. **Try to give everyone time to speak**, and gently encourage those who are shy. The more students feel involved in discussion, the more interested they will be.
- **Keywords:** write keywords on a board or on big sheets of paper, but not too many. Be aware of the students' educational level. Use information handouts so students do not feel they have to write a lot.
- **Illustrations and diagrams:** Use pictures to explain the techniques; this improves understanding a lot, especially for semi-literate and illiterate students. Sometimes it is good to prepare drawings ahead of training or use flip charts, and sometimes it is good to draw as you teach. If you are not confident, **some practice beforehand helps a lot and remember that simple drawings are more effective.**
- Use lots of examples from your experiences to help explain how techniques work.

SMART IDEA:

A teacher drawing in class is interesting for students to watch, but if you talk while you draw, make sure you speak loudly and clearly. If you have something to say, it is best to pause when drawing and face the students to speak.





HANDOUTS

Deciding what information to hand out to the students in written form is an important part of both your preparation and training delivery.

- Provide handouts for more detailed information with illustrations for students to read afterwards.
- Chapters or sections of chapters from this guidebook make great handouts.
- Leave room for students to add notes to the handouts if necessary.
- Handouts allow students to focus on what is being discussed and drawn rather than having to write everything down.

CREATIVITY

Permaculture is about making the best use of the resources available. Use all your talents to make the course more interesting.

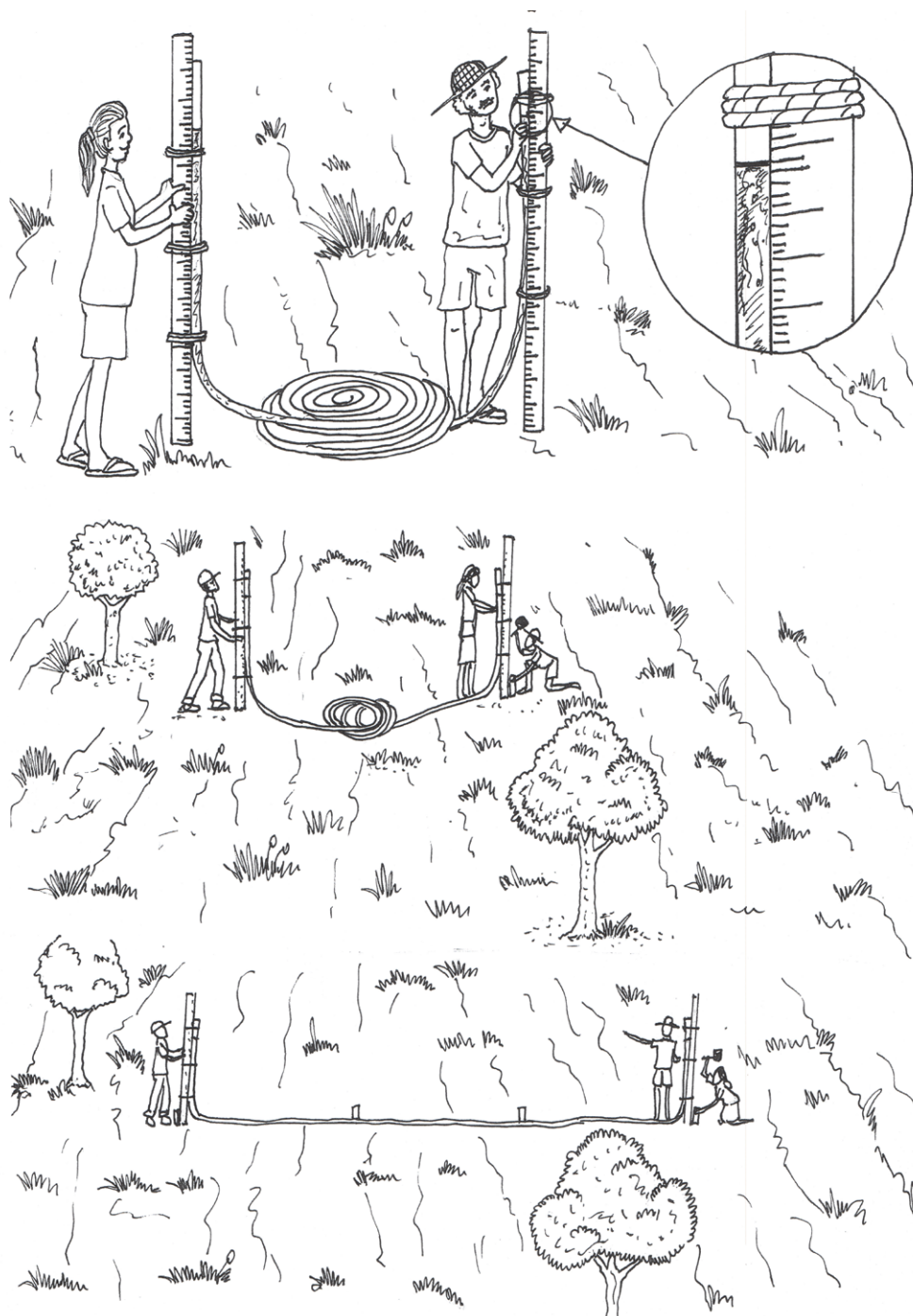
- Use songs and rhymes as a learning tool or as a break in class time.
- Use art to help explain concepts or to make your designs more beautiful.
- Tell stories, or use poetry to make a point.
- Play games to help students remember facts and learn concepts.
- Use games to refresh students, get their brains working better and give them a break between lessons (look in the reference chapter for resources).

Students learn better in a fun and creative class. The more effort you put into creative teaching, the more your students will participate and use their own talents. The class is also more fun to teach.



PRACTICAL DEMONSTRATIONS

For most courses, a lot of the time is spent outside the classroom, especially when teaching farmers and communities with low literacy levels. All techniques should be demonstrated so that people understand them and can copy them on their own land.



Learning to use a water level to find and mark out contour lines

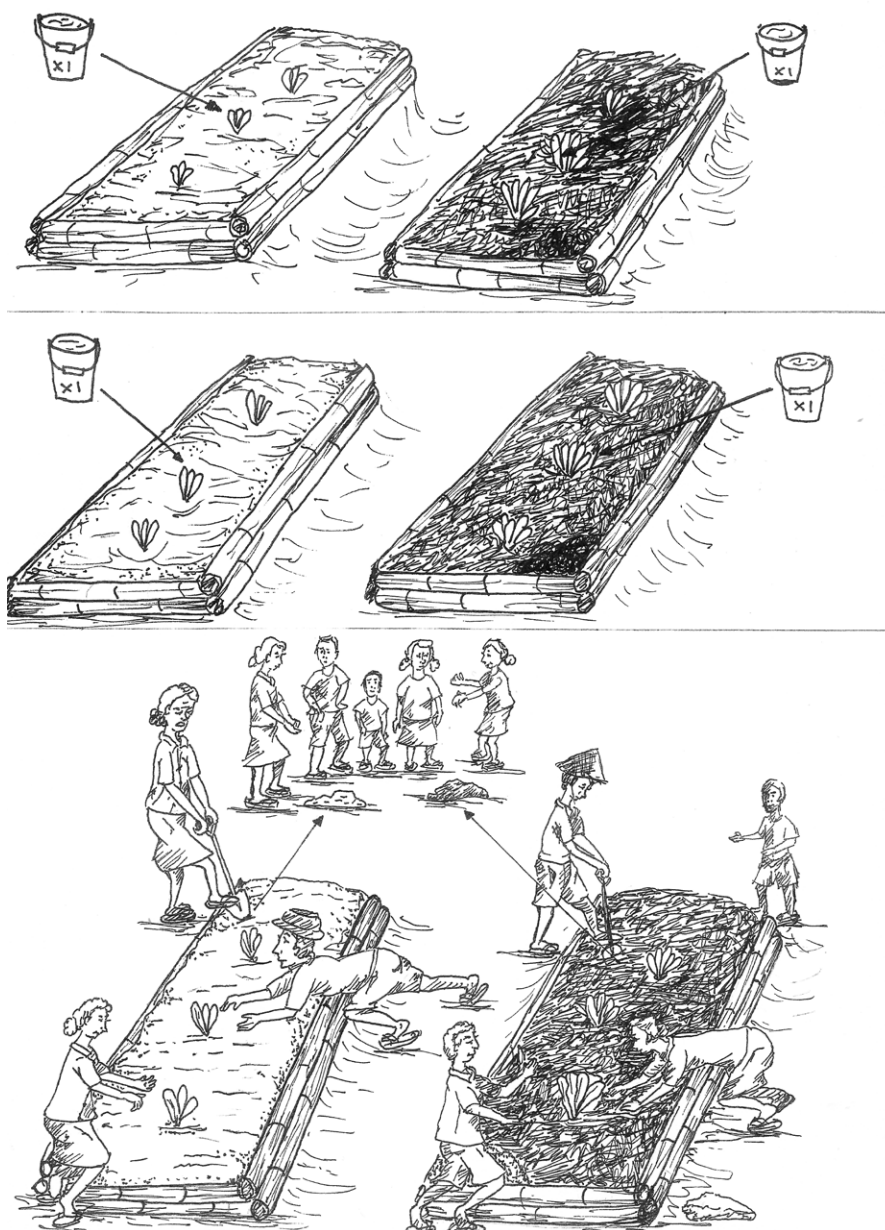
Good permaculture trainers work alongside their students to produce the practical examples and demonstrations. Students also need to understand why the demonstrations will benefit them and provide better results, not just how to make them.

Make sure you are well prepared with all the materials organised and ready to use.

Some demonstrations can run over a few days or even longer. Examples include:

- Comparing mulched and non-mulched garden beds
- Repairing and protecting natural springs
- Making and using natural pesticides
- Making and using solar food dryers, clay ovens and solar ovens
- Building nurseries, making potting mix

Plan the practical times so that they do not make the students too tired to concentrate in the classroom afterwards. Dividing up practical and class/discussion times each day enables better learning and maintains interest.



Mulch / No mulch experiment

DISCUSSION GROUPS

Divide the class into groups to work on small projects: e.g. a list of useful trees for aquaculture; creating a land design for the village; local resources lists for natural pesticides and fungicides.

Small groups help to concentrate thought and produce better results with several people working together. Students often find it easier to speak in a small group of peers rather than as individuals in front of a class. They can keep the results for future reference as well.

Group discussions on course topics are a great way to collect information and encourage participation from all students. Each group can present their results back to the whole class afterwards.



DESIGN AND MAPPING EXERCISES

Designs and maps are an essential part of learning permaculture and show that the students understand the concepts and strategies. They can be family gardens, houses, farms, reforestation areas, demonstration sites or whole communities and should be the result of what students have learnt in the course or combined knowledge from multiple courses. They can be used as plans for the future.

Mapping exercises are usually done in small groups, but occasionally they can be individual or whole class activities.

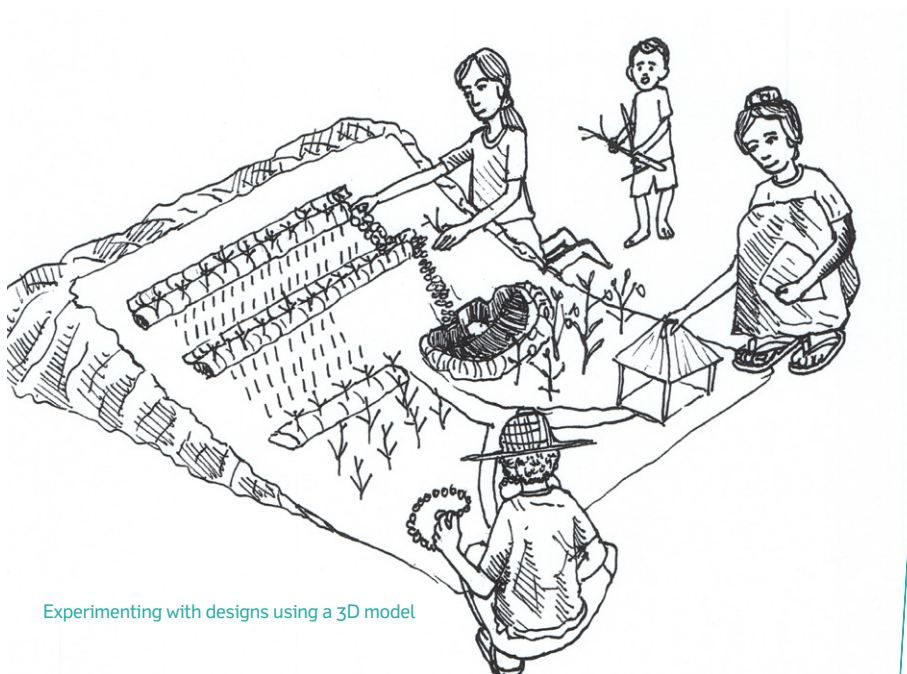


3D model of mountains to show contours and water catchments

Students are often more confident designing and creating than writing

Different methods for creating designs and maps include:

- Using coloured markers, pencils on large paper.
- 3-D maps using earth, sticks, leaves and other materials to represent different parts of the map.
- Computer models – not relevant for many regions but they are becoming increasingly common in urban areas.



Experimenting with designs using a 3D model

SMART IDEAS:

- Encourage creativity in the designs.
- Include people in the designs, such as the family who owns the land. It makes the designs more real and relevant.

ROLE PLAY

Put students into groups and give them a situation that they have to perform to the class: e.g. a non-sustainable vs sustainable land practice; forming a seed saving group; finding markets for value-added local products; whether or not to use cooking stoves; balancing food groups for the evening meal.

Role play is highly successful in permaculture courses and is a non-threatening method of highlighting the benefits of new techniques compared to current practices. Students have lots of fun and enjoy watching and participating.



FILMS AND PHOTOS WITH DISCUSSION

Films and photos are excellent for adding new information or a different perspective on information you have provided. They also show permaculture in action and can be very inspiring for students. Make sure you allow some discussion time afterwards so that important points can be talked about and reinforced.



Photo showing what materials to add to an aquaculture pond to create fish food



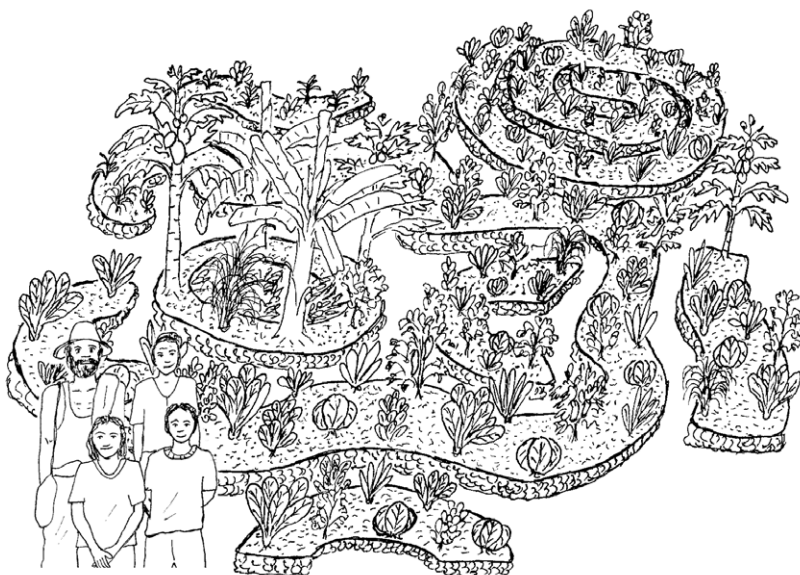
TRAINING IN DIFFERENT AND NATURAL LOCATIONS

Use different training sites and natural locations, especially for discussions: e.g. under large trees, next to rivers, in a demonstration garden, etc. For longer training, this technique is great to keep students attentive and involved.

FIELD TRIPS AND ONGOING EXCHANGE VISITS

Visiting farms, demonstration sites and existing examples of what you teach is an excellent method for getting students to understand techniques and to see them as part of a bigger system. This is especially important for teaching permaculture where you are teaching about large integrated designs that are sometimes hard to understand in theory and even in drawings.

Ongoing visits help to remind students of the strategies and techniques, how they work in different seasons and to encourage students to experiment for themselves.



CELEBRATION

The final night party is a tradition for permaculture design courses. Plan a party for the end of the course so the students can celebrate their achievements. There are lots of ways to make this interesting:

- Play games – e.g. a permaculture quiz with the class in two teams.
- Play music.
- Ask the class members to present items for a small concert.
- Give funny prizes to students who did silly things during the course.

The final night is the chance to have fun when the formal learning is over. Even short courses should have a final gathering/meal to celebrate a successful course.

Training feedback and monitoring

It is a good idea to ask a series of questions about the information that will be included in the training, before and after the training sessions. This assesses exactly how much has been learnt during the training – which parts were understood and which were not. This improves future training and provides information on what to focus on in follow up work with the groups.

POST-TRAINING FOLLOW UP

Training is only the first part of your work with the students. When the course is finished you should visit the village regularly. As permaculture is about sustainable solutions, your job as a trainer is not complete until students use the practices and techniques as part of their everyday lives, and their neighbours are copying them as well. Effective follow-up is the key to a successful course.



INDIVIDUAL AND GROUP PROJECTS

Set students a long-term project to work on after the course finishes. It can be designed around the home, the family garden or the farm, or may be some aspect of community-based work: e.g. a cooperative. Work with each student, or group of students to decide on which project is the most appropriate for them. Relate the projects directly to what was taught in the course.

On each visit, monitor progress and offer technical advice and encouragement. You can facilitate their problem-solving process, but be careful not to offer solutions. Help students to think through problems themselves. This gives them the confidence to try new techniques in the future, especially for women.

Encourage the students to form their own permaculture group so they can advise each other and give practical help. This also brings in other members of the community.

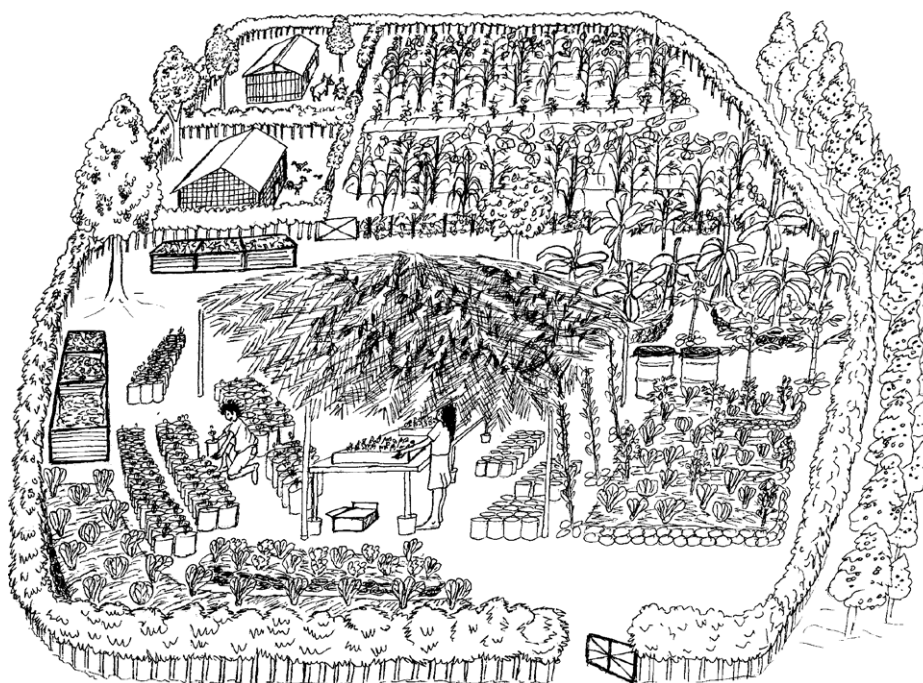
Use your visits to the community to assess your own teaching methods and to decide which techniques are most useful and successful. Follow-up is a valuable learning opportunity for the trainer as well.



COMMUNITY PROJECTS

Demonstration sites are excellent for showing practical examples of individual techniques and integrated strategies.

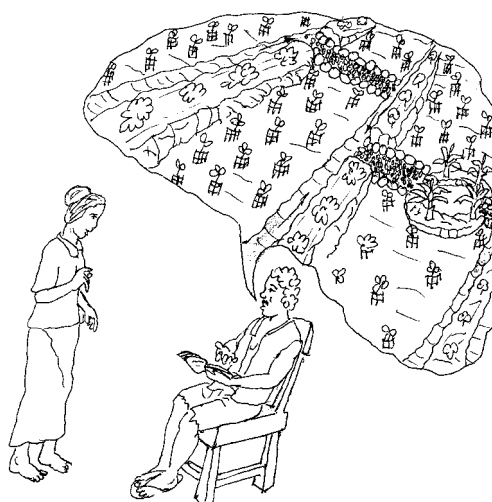
- They can show new techniques that farmers are unlikely use or are culturally not accepted, until they see them work with good results: e.g. mulch is considered messy and lazy in some cultures, but after it is proven to work, farmers will start to use it.
- They show techniques that are not possible to create on an individual level but need a group to make them: e.g. biogas, a community nursery.
- Most farmers and families will not risk losing produce, time or money on a new technique because they cannot afford to, but a community demonstration site gives the opportunity to practice and perfect techniques before people use them: e.g. System of rice intensification (SRI)
- Demonstration sites can show fully integrated permaculture systems in action to help explain permaculture design strategies: e.g. chicken/fish/vegetable garden systems.
- Other communities can come and visit.

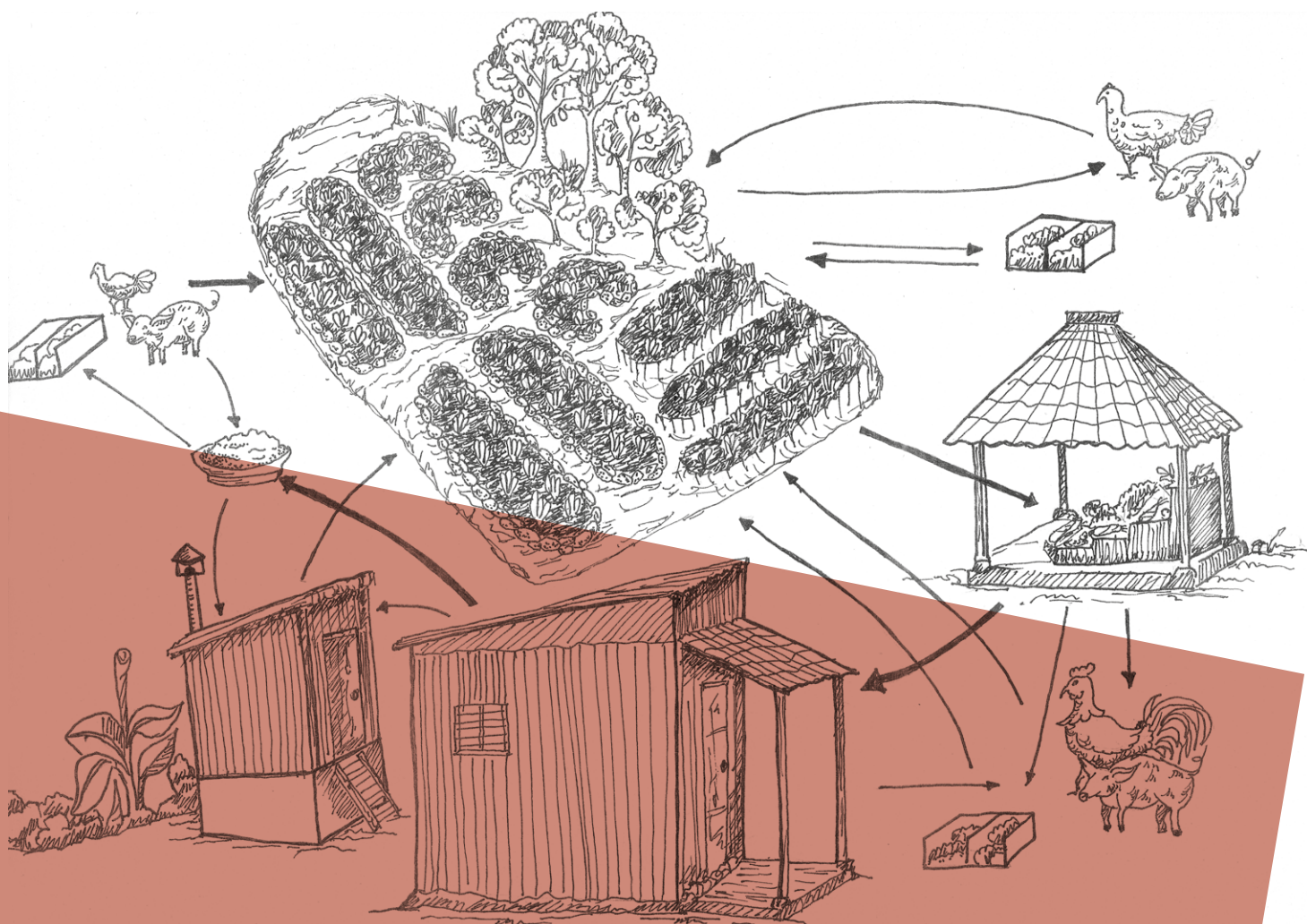


A community plant nursery, gardens and animal houses

Farmers' days, expos and workshops are community projects to help share information and encourage participation.

Working with communities to make their own "how to" fact sheets on permaculture techniques and strategies that they use helps people feel ownership and promotes pride in their achievements. They are more likely to share the knowledge as well.





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References

Websites for permaculture and sustainable communities

We searched a great many websites as we wrote this guidebook. To the website authors and information providers, thank you – you have all contributed to the content of this guidebook!

The growing number of websites providing detailed information and techniques allow better access for everyone and a more equal spread of information. However, sometimes it is hard to find and separate the good websites from those that are not so useful, especially when the internet is slow and/or expensive. Therefore, we have collated some of the best and most useful sites we found and listed them here. We have also included websites that build on the knowledge provided in the guidebook, especially for topics that are too large to explain in detail. Use these sites to research topics, design better permaculture systems and successfully implement your ideas. Bookmark them to make future access easier and share the links.

As the internet grows, it is also becoming more interactive, allowing you to collect and share information, network from local to global perspectives, participate in online workshops and training, generate business and much more.

The following list starts with general websites that provide information and access to large databases on permaculture, sustainability and regenerative practices as well as permaculture groups that you can join. The section after it links websites to the chapters in the guidebook and parts within each chapter to make finding what you need as simple as possible.

Please note: Websites update regularly, may modify their addresses or links, close occasionally and sometimes change permission for use. The following list is only up-to-date at the time of publication. We will update this list regularly and apologise if you have problems, but any changes to the websites are beyond our control.

Contact us if you have any websites to add to this list or notice any problems or changes with websites that are listed here. Thanks!

BEWARE of viruses and scams! There are many viruses that can wipe data from or, at worst, permanently damage your computer, external hard drive or flash drive (USB). Internet cafes have an especially bad reputation for sharing viruses. Only use your external hard drive or flash drive in computers that have up-to-date virus protection, and when your computer is connected to the internet be very careful what you download and which websites you visit.

Search engines

Search engines are incredibly useful, especially when you type in at least four key words to make your search accurate and specific. However, every search on the internet uses energy because of the vast amount of computer processing needed for each search to happen quickly.

There are many different types of search engines now. Some are more sustainable and ethical, such as Ecosia, which donate money from every search to environmental and reforestation projects to offset the search energy used. Another is DuckDuckGo, which does not save or sell your searches to big companies, protecting your privacy. Other search engines are more environmentally aware as they use renewable energy for their computer processing or donate money to charities. Research the search engines available and choose wisely!

General websites

<http://permacultureaustralia.org.au>

The website for Permaculture Australia and home of Permafund, which supports grassroots permaculture projects across the globe. Contains a lot of excellent news and information too.

www.holmgren.com.au

About the work of Permaculture co-ordinator David Holmgren, with a lot of useful information and links, especially the 'Permaculture' and 'Ideas and actions' tabs.

<https://knowledgebase.permaculture.org.uk>

A fantastic store of practical knowledge, links and resources on the Permaculture Association Britain website.

<https://permies.com>

Where permaculturists around the world present and discuss techniques and strategies on anything to do with permaculture.

<https://permaculturenews.org>

The Permaculture Research Institute website is a huge store of articles and information on permaculture as well as online forums and the permaculture global network.

<http://www.appropedia.org>

Amazing and extensive website - a continuously growing source of information on a huge range of topics. Almost every chapter of this guidebook can link to this website for further information. Use their portals then browse portal topics or search for what ever topic you want in the top right search box.

www.journeytoforever.org

An NGO website that covers a huge range of detailed technical information. Topics include community development, organic gardening, alternative technology, seed saving, reforestation and much more. Extensive links to other websites and a great schools project section as well.

www.villagevolunteers.org/resources/sustainable-village-library

A very useful collection of projects, research, curricula, and guides.

<http://tropical.theferns.info>

Amazing tropical plants database, full of information including cultivation, food uses, medicinal uses and propagation techniques.

www.foodtank.com

General food related website by a think tank pushing for food systems change, with lots of articles and links to related networks and groups.

<http://www.infonet-biovision.org>

A Kenya based and African focused website but very useful information for all tropical regions. Good for specific information on all organic farming and agriculture, human health, good nutrition and environmental management.

<http://answers.practicalaction.org/our-resources>

Available in multiple languages with videos or PDFs for download. A huge range of practical information on topics relating to permaculture

https://www.zotero.org/groups/1855053/permaculture_research/items

A permaculture research library that covers many different permaculture and permaculture-related topics.

<https://www.wikipedia.org>

Wikipedia: a general free reference source in multiple languages - very important and a great example of open source information. A great starting point for any research and detailed information on plant varieties.

<https://www.permaculture.org.uk/about/international>

Current location for the following international permaculture networks and projects:

- **CoLab - Collaborative Laboratory:** An emerging online network for scaling up permaculture locally to globally
- **PIRN - Permaculture International Research Network:** Connecting researchers, showcasing results, providing a permaculture evidence base
- **IPEN - International Permaculture Education Network:** Practical actions to make permaculture education more effective and cohesive

<http://ecovillage.org/>

Homepage for the Global Ecovillage Network which 'envision[s] a world of empowered citizens and communities, designing and implementing pathways to a regenerative future, while building bridges of hope and international solidarity.' This multi-language website links to active groups around the world, and the resources tab leads to news, blogs, a solutions library and more.

<http://www.regenerationhub.co>

Multi-language website for Regeneration International, connecting the global regeneration movement and providing a platform where you can access projects and groups across the world.

<https://www.thebigfix.org/>

Collating and sharing positive news and information about solutions to our global problems

Volume 1 Permaculture and people

Ch 1 Permaculture ethics and principles

<https://permacultureprinciples.com/resources/free-downloads/>

Free downloads of David Holmgren's Essence of Permaculture and colour posters in multiple languages

Ch 2 Natural Patterns

<https://vimeo.com/138951606>

A fundamentals of patterns lecture given by Bill Mollison. Copyright to Network Productions Inc (www.networkearth.org)

<https://vimeo.com/139753183>

A patterns application lecture given by Bill Mollison. Copyright to Network Productions Inc (www.networkearth.org)

https://en.wikipedia.org/wiki/Patterns_in_nature

Provides background knowledge about patterns in nature including how and why they occur.

Ch 3 Permaculture design techniques and strategies

<https://www.youtube.com/watch?v=y6j103TDhMg>

'What is permaculture?' short video by Rosemary Morrow in English with French subtitles. Good for the basics of permaculture, patterns and design.

<http://www.rivendellvillage.org/beginners-guide-to-permaculture.pdf>

A PDF download with some good information on design techniques and lots of great illustrations

<http://www.suncalc.net>

Very useful tool for calculating sun position and movement at any time of year at any location around the world.

Ch 4 Urban and community permaculture

<https://transitionnetwork.org>

The transition network is an international movement of communities coming together to reimagine and rebuild our world. The website explains the transition idea, process and goals, how to join or create transition groups and has lots of articles, stories, information and blogs.

DISASTER RISK REDUCTION AND PREVENTION

<https://lists.riseup.net/www/subscribe/permaculturedrr>

A global permaculture group working to support and promote permaculture for disaster risk reduction (DRR), disaster prevention and emergency preparedness. Also a Facebook group: Permaculture and disaster risk reduction.

www.idepfoundation.org

Loads of fantastic resources on disaster risk reduction can be purchased through their media page -

<http://www.idepmedia.com/> or contact them at info@idepfoundation.org

Cookstoves, ovens and solar cookers – See Ch 8 Food, health and nutrition section

Sustainable house design and construction – See Ch 7 Houses, water and energy section



TREATING CONTAMINATED SOILS WITH FUNGI

<http://www.resilience.org/stories/2014-07-07/mycoremediation-bioremediation-with-fungi-growing-mushrooms-to-clean-the-earth-a-mini-review/>

A good technical explanation of the process, but hard for people without good English language skills. Contains links to other articles and papers too.

Use search words 'clean contaminated soil with bioremediation fungi' to find many videos, including -

https://www.youtube.com/watch?v=KO1WjFRL_XA about how mushrooms are helping to clean up oil spills in the Ecuadorian Amazon.

COMMUNITY SUPPORTED AGRICULTURE (CSA)

<https://communitysupportedagriculture.org.uk/what-is-csa>

An explanation on community supported agriculture with further links at the bottom of the page.

https://en.wikipedia.org/wiki/Community-supported_agriculture

A detailed explanation of the American version of community supported agriculture.

FOOD SOVEREIGNTY

<http://www.globaljustice.org.uk/what-food-sovereignty>

Good explanation of food sovereignty and some of the groups working with communities and farmers to achieve it. The 'Find out more' section at the bottom of the page is very useful.

www.viacampesina.org

Comprehensive multi-language website of the international peasant movement for food sovereignty. With lots of information, articles, manuals and videos available, the website is easy to use and easy to find local groups and events.

<http://www.foodsovereignty.org>

Global initiative representing food sovereignty efforts and producing articles and guidelines enabling local groups and communities to be more effective and better equipped.

www.foodfirst.org

The website of Food First who work to end the injustices that cause hunger and help communities to take back control of their food systems through research, education and action.

SOCIOCRACY AND DEEP DEMOCRACY DECISION MAKING AND GOVERNANCE TOOLS

<http://www.sociocracy.info/about-sociocracy/what-is-sociocracy>

Very detailed website about what sociocracy is and how it can be applied and used.

<http://sociocracy30.org>

Slightly different version of sociocracy with detailed information and all open-source.

<http://www.deepdemocracyinstitute.org>

Website for the Deep Democracy Institute that explains about deep democracy and the methods, purpose and programmes involved.

<http://deep-democracy.net>

Deep democracy training and information.

LOCAL ECONOMIES AND CURRENCIES

<https://transitionnetwork.org/about-the-movement/what-is-transition/reconomy>

These pages from the Transition Network website provide information and links on creating strong and resilient local economies, including local currencies.

<http://www.centerforneweconomics.org/content/local-currencies>

Detailed information about local currencies and a large list of links to further resources and organisations.

https://www.community-exchange.org/docs/Community_Currency_Guide.pdf

Excellent PDF about community currencies - what they are, how to set one up and case studies.

<http://grassrootseconomics.org/bangla>

Local currency initiative in Kenya with great explanatory video.

<https://www.community-exchange.org/home>

Global community exchange portal where you can connect with groups around the world that operate various types of exchange systems for goods and services.

Ch 5 Cooperatives

www.ica.coop

The International Cooperative Alliance multi-language website is an extensive and detailed website. It is very useful and based on cooperative ideals. A lot of the information is based around larger organisations, not small community cooperatives, but it can be adapted.

Ch 6 Trainers Guide

Rosemary Morrow has an excellent book called 'Earth User's Guide to Teaching Permaculture'. It is very useful for anyone teaching or wanting to teach Permaculture Design Courses and is available from **<http://www.bluemountainspermacultureinstitute.com.au>** or other online permaculture bookshops.

<http://www.bluemountainspermacultureinstitute.com.au/resources/permaculture-teaching-matters>

Rosemary Morrow's free-to-download guide for a Training of Trainers course. This is very important for improving the quality and effectiveness of all permaculture training. Just reading this book is very useful! In this guide there is a **reference section (P178)** that provides many links to many other articles, websites and training information.

<https://www.learning-styles-online.com/overview>

This page outlines seven different styles of learning and you can click on each style to learn more about them. Here is a good infographic: **<http://edudemic.com/wp-content/uploads/2012/11/7-styles-of-learning.jpg>**

<https://www.permaculture.org.uk/ipen>

Current website for the International Permaculture Education Network (IPEN) project. Through practical actions IPEN is looking to increase coherence and effectiveness of permaculture education across the world with a strong focus on tropical countries.

<https://www.permaculture.org.uk/ipen/education-resources>

A range of downloadable resources for permaculture education.



Volume 2 House and Garden

Ch 7 Houses, Water and Energy

HOUSES AND BUILDING

<http://naturalhomes.org>

Full of amazing pictures, lots of information and inspiration about natural building, natural energy and much more. A lot of the information is for temperate climates but many ideas can be adapted for tropical climates.

<http://www.earthbagstructures.com>

Very detailed multi-language website describing many different examples of earth bag building in words, photos and diagrams. There are links at the bottom of the page to other useful natural building websites and blog sites.

<https://insteadof.com/blog/earthbag-homes/>

Great range of examples of earth bag building - photos, videos, explanations and many links to other good websites too.

www.networkearth.org

Use the “Art of Natural Building” section in this website to find a lot of information about natural building with explanations of how to use different building materials. Great information, but unfortunately not many pictures. Has information on other topics as well.

www.oasisdesign.net

Has a lot of good information about all aspects of house design and construction, compost toilets, grey water systems etc. Use the links button to find many other useful websites

<http://theconstructor.org/structural-engg/bamboo-reinforced-concrete-mix-design-construction/15054>

Detailed information about using bamboo instead of reinforced steel for building foundations

<http://inhabitat.com/this-amazing-bangladeshi-air-cooler-is-made-from-plastic-bottles-and-uses-no-electricity>

or

<http://observers.france24.com/en/20160602-bangladesh-air-conditioner-plastic-bottles-technology>

Build a natural air conditioner for cooling a house using simple materials including old plastic drink bottles

<http://www.climatechangenews.com/2012/01/10/let-there-be-light-solar-power-bottles-bring-affordable-light-to-the-masses>

Article and video on using plastic bottles to make solar sky-lights.

COMPOST TOILETS

<http://www.pacificwater.org/userfiles/file/mr0249.pdf>

Excellent PDF on compost toilets explaining about different types for different situations, with lots of illustrations and simple clear text.

WASTE

www.theworldcounts.com

Amazing real-time facts about resource use, waste and over-consumption.

<https://wasteaid.org.uk/toolkit>

Great range of PDF downloads on waste management, reusing waste and creating small businesses from reusing waste products.

<https://inhabitat.com/lego-like-building-blocks-of-recycled-plastic-allow-colombians-to-build-their-own-homes>

One of many examples about turning plastic waste into building products or furniture.

WATER

<http://www.warkawater.org>

A website about a project, technologies and products for collecting, storing and providing clean water in difficult places. Click on **<http://www.warkawater.org/warka-tower/>** for information specifically about the water collection technology.

<http://www.fastcodesign.com/1670546/a-simple-solar-oven-makes-salt-water-drinkable>

A simple solar oven design for making salt water drinkable on a family scale.

https://en.wikipedia.org/wiki/Portable_water_purification

Good general information about various forms of water purification and how they work.

<https://sawyer.com/products/sawyer-mini-filter>

A product that can be used for filtration of water to drink, and the website also explains about the process of micron filtration.

WATER PUMPS

<http://www.climate-kic.org/case-studies/turning-on-the-tap-with-aqystas-barsha-pump>

A water pump that uses water flow energy to pump water for irrigation.

<https://answers.practicalaction.org/our-resources/collection/mechanical-power-1>

Webpage with PDF downloads about various water pumps.

ENERGY

<https://answers.practicalaction.org/our-resources/community/energy-6>

A great multi-language resource of guides, projects, case studies and examples about a range of energy topics – biogas, solar, wind, hydro, biofuels, mechanical power and more.

https://energypedia.info/wiki/Main_Page

Comprehensive website that explains in detail about different forms of renewable energy and fuels. It provides case studies from many countries and information on how to build, maintain and secure an appropriate energy supply.

<http://www.energyplanet.info>

Alternative energy news, and information about renewable energy technologies. Use the index on the right to access a range of websites on specific topics.

<http://reneweconomy.com.au>

A good website for following the latest developments in renewable energy. It is Australian focused but also has a lot of articles from around the world.

https://www.youtube.com/watch?time_continue=5&v=3AZv6MjZylo

The first part of this video explains a very simple biogas system, after that a more complex system is explained, which could easily be adapted and simplified.

<http://thepreppingguide.com/make-your-own-biogas/>

Information on how to make a simple biogas system with photos, and a good video at the bottom of the article for a larger biogas system using simple materials. Please note - we are only referring to this page of the website, which is not a recommendation to the entire website.

BICYCLE POWERED TECHNOLOGIES

<http://offgridquest.com/energy/pedal-power-how-to-build-a-bike-generator>

How to build a bicycle powered generator

<http://www.dacres.org/media/articles/energy/Bicycle-powered-food-station.pdf>

A PDF about how to build a grain grinder and food processor using bicycle technology



<https://simplyresourceful.blogspot.com.au/2017/01/how-to-build-bicycle-powered-grain-mill.html>

A blog page with instructions, photos and video on how to make a pedal powered grain grinder.

CH 8 Food, Health and Nutrition

NATURAL NUTRITION

<http://foodplantsolutions.org/programs-category/programs>

Click on the country you want for simple but detailed and excellent information on nutritious local plants in many tropical countries in downloadable PDF format. Some country information is still in draft format because the project is steadily developing new materials for more countries.

http://aciagov.au/files/node/15487/factsheets_web_version_pdf_74613.pdf

PDF factsheets about nutrient dense green vegetables for the tropics with information about growing, harvesting and using the vegetables as well as the nutrient content.

FERMENTED FOODS

<http://bonzaiaphrodite.com/2010/07/eat-your-beasties-the-importance-of-cultured-and-fermented-foods>

Good website page for information and recipes for fermented food. All in English, and not very easy for non-native English readers, but the recipes are easy to follow and simple. Follow the links at the bottom of the page for specific recipes.

SOLAR DRYERS

http://solarcooking.wikia.com/wiki/Solar_food_drying

A multi-language website containing a lot of information, diagrams, videos and links.

https://energypedia.info/wiki/Solar_Drying

Webpage with great information on solar driers including references, further reading and project examples.

PRESERVING FOOD

<http://answers.practicalaction.org/our-resources/community/food-processing-1-2>

Very useful information in multiple languages on a range of food processing techniques including preserves, vinegars, dairy and drying foods, oil pressing, bottling techniques, hygiene and much more.

OIL EXTRACTION

<http://answers.practicalaction.org/our-resources/collection/nut-processing-and-oil-extraction-1>

A huge range of downloadable PDFs in multiple languages that explain and provide technical details for different types of oil extraction.

STOVES AND COOKERS

<http://cleancookstoves.org/home/index.html>

A website for an organisation promoting clean cooking options across the world. The clean cook catalogue under the technologies and fuels section shows the huge range available, with a variety of fuels including solar.

<http://answers.practicalaction.org/our-resources/item/rocket-stoves-options>

A small PDF showing a range of rocket stove options.

www.solarcookers.org

An excellent multi-language website about making and using solar cookers of many varieties, as well as other food technology. http://solarcooking.wikia.com/wiki/Category:Solar_cooker_plans takes you to plans for building many different cookers.



https://energypedia.info/wiki/Portal:Improved_Cooking

Large and in-depth page with information on stove types, fuels, impacts, monitoring, stove use, creating projects and much more.

Biochar cooking stoves – see Biochar and biochar cook stoves section in Ch 9 Soils.

Ch 9 Soils

COMPOST

<http://www.compostguy.com>

All about compost, liquid compost and worm farms.

BIOCHAR AND BIOCHAR COOK STOVES

<http://biochar.bioenergylists.org>

Full of information including downloadable pdfs and lots of small videos to watch about all aspects of biochar. It also has a discussion group and a list for many other useful biochar website links.

<http://www.biochar-international.org>

Comprehensive website about the international biochar movement, with lots of information under the 'Learn' and 'Resources' tabs

<http://www.biochar-international.org/technology/stoves>

A good explanation of the various benefits and types of biochar cooking stoves with some illustrations and many links to more information

<http://www.soil-carbon-regeneration.co.uk/biochar>

Good information on biochar including detailed instructions on how to make various biochar stoves. It has photos and diagrams as well.

<http://servalsgroup.blogspot.co.uk/2009/05/tlud-gasifier-stoves-wood-stove-with.html>

A social enterprise company website for their biochar cookstove including a short video on how to use it.

BIODYNAMICS

<https://www.biodynamics.com>

Official Biodynamics Association website. Good basic information and blogs, contact them about local farms, networks, courses, newsletters and more.

<http://www.biodynamics.in>

Indian Biodynamic website, with good basic information about biodynamics and a contact point for finding Indian biodynamic farms and courses.

BACTERIAL ACTIVATORS

<http://www.compostjunkie.com>

Has detailed info on bacterial activators and all things compost. Its also a shop but all the ingredients can be substituted with locally available suitable materials. You can sign up for free booklets as well.

CONTAINER WORM FARMS

<http://working-worms.com/how-to-make-your-own-worm-farm>

Easy to use, detailed information about making and maintaining worm farms including illustrations, short videos and pdfs to download. The techniques they use can be adapted to build worm farms with other materials as well.

<http://www.countryfarm-lifestyles.com/Worm-Farming.html>

Detailed information on building and maintaining worm farms but not many illustrations or photos.



http://journeytoforever.org/compost_worm.html

Really good general information which can be easily adapted for other materials.

<http://www.redwormcomposting.com>

A huge amount of information can be found by following the tabs on the left - for people who want to learn a lot!

Ch 10 Family Gardens

Biodynamics – see websites in Ch 9 Soils

AFRICAN KEYHOLE BEDS

<https://www.sendacow.org>

<https://www.youtube.com/watch?v=ykCXfjzfac0>

This is their short video on making an African keyhole bed.

WICKING BEDS

<http://gawlerenvironmentcentre.org.au/wp-content/uploads/2016/07/Handout-2016-Wicking-Bed-Info.pdf>

<http://gawlerenvironmentcentre.org.au/wp-content/uploads/2016/07/Handout-2016-How-To-wicking-Foam-box.pdf>

<http://gawlerenvironmentcentre.org.au/wp-content/uploads/2016/07/Handout-2016-How-To-wicking-Raised-bed.pdf>

Easy-to-follow PDFs about wicking beds, making them in foam boxes and making raised garden wicking beds.

HUGELKULTUR

<http://www.inspirationgreen.com/hugelkultur.html>

Good simple explanation of hugelkultur with great illustrations, photos, examples and links.

CH 11 Seed saving and propagation

www.seedsavers.net

The Seed Savers Network are based in Australia and have provided workshops and helped start a numerous seed saving groups in Australia and many other countries. Their website provides a lot of information, photos and blogs, as well as books and films to purchase.

GRAFTING

<http://www.extension.umn.edu/garden/yard-garden/fruit/grafting-and-budding-fruit-trees>

A good website that explains all the basic aspects of grafting in words and pictures. Easy to find what you want.

<http://www.wikihow.com/Graft-a-Tree>

Very detailed step-by-step guide for many different types of grafting, with excellent illustrations.

SEED VIABILITY TESTING

<http://www.theprairiehomestead.com/2015/03/how-to-test-seeds-for-viability.html>

A simple easy to follow guide for testing your seed viability rate.

Volume 3 Regenerative Agriculture

Ch 13 Sustainable Agriculture

Biodynamics – See Ch 9 Soils references

www.vetiver.org

A comprehensive website all about vetiver grass! Each section comes as an online or downloadable pdf and they all have lots of photos and very useful, simple explanations.

ALLEY CROPPING (A TYPE OF AGRO-FORESTRY)

<http://www.ingafoundation.org>

A great website that explains about alley cropping using the Inga tree. Some good short videos, lots of photos and information in Spanish as well.

<http://rainforestsaver.org>

Another great websites that explains about alley cropping using the Inga tree. Detailed information including a step-by-step guide and a great animated short video explanation

WATER CATCHMENTS

https://en.wikipedia.org/wiki/Keyline_design

A starting point for understanding good land design for water catchments using the keyline design system, with has links to further information and related topics.

SYSTEM OF RICE INTENSIFICATION (SRI)

<http://sri.cals.cornell.edu>

A multi-language website that contains a huge base of information on SRI for rice and other crops, including field studies, manuals, photos, videos and much more.

<http://ciifad.cals.cornell.edu/sites/ciifad.cals.cornell.edu/files/shared/documents/Styger.pdf>

An extensive PDF about SRI for rice and wheat that is practical, easy to read and mostly explained through photos.

<https://www.oxfamamerica.org/publications/more-rice-for-people-more-water-for-the-planet>

A download PDF publication about SRI showing case studies and results from Mali, India and Vietnam

MUSHROOMS

<http://www.wikihow.com/Grow-Organic-Mushrooms>

Simple step-by-step instructions and illustrations for growing fungi on logs and with coffee grounds.

http://journeytoforever.org/farm_library/AD40.pdf

Detailed PDF for download about the basic techniques for mushroom production

Ch 14 Integrated Pest Management (IPM)

<http://www.oisat.org>

Excellent online information service for non-chemical pest management in the tropics. Access the information via tabs for principles, crops, pests or control methods. It also has an extensive library and links.

http://www.infonet-biovision.org/plant_pests

A Kenya based and African focused website but has detailed pest descriptions and organic control methods that are very useful for all tropical regions.

<https://www.hortzone.com/blog/2016/10/16/proven-insect-repelling-plants>

Good article describing many different insect repelling plants, which also provide many other products and benefits. Other articles on this website have some good information but sometimes aren't very holistic and are occasionally linked to conventional methods or products.

https://www.softfootalliance.com/uploads/8/5/0/7/85075002/the_mobile-boma.pdf

Great PDF explaining a traditional method for protecting livestock from large wild predators

NEEM

www.neemfoundation.org

Excellent website for detailed information about neem trees, neem products and how neem works.

<http://www.youthinfarming.org/2011/10/produce-neem-oil-at-home-and-earn-extra.html>

Good description about extracting neem oil for household use

Ch 15 Trees

ALLEY CROPPING (A TYPE OF AGRO-FORESTRY)

<http://www.ingafoundation.org>

A great website that explains about alley cropping using the Inga tree. Some good short videos, lots of photos and information in Spanish as well.

<http://rainforestsaver.org>

Another great websites that explains about alley cropping using the Inga tree. Detailed information including step-by-step guide and a great animated short video explanation.

GRAFTING

<http://www.extension.umn.edu/garden/yard-garden/fruit/grafting-and-budding-fruit-trees>

A good website that explains all the basic aspects of grafting in words and pictures. Easy to find what you want.

<http://www.wikihow.com/Graft-a-Tree>

Very detailed step-by-step guide for many different types of grafting with excellent illustrations.

MORINGA

<http://www.treesforlife.org/our-work/our-initiatives/moringa>

An excellent website explaining all about Moringa's many uses and benefits. The site has a lot of other useful information too.

www.moringanews.org

A very good general website for moringa information in French and English. Also excellent for networking and the links to other groups and websites.

VETIVER GRASS

www.vetiver.org

A comprehensive website all about vetiver grass! Each section comes as an online or downloadable pdf and they all have lots of photos and very useful, simple explanations.

Ch 16 Bamboo

www.inbar.int

The International Network for Bamboo and Rattan (INBAR) website has a lot of information. It explains how bamboo can help in achieving many sustainable development goals (SDGs), offers links to a range of projects and through their resource tab offers a wide range of information about growing, harvesting and using bamboo through books, downloadable PDFs and articles.

<http://www.bamboocentral.org/index1.htm>

Instructions for treating bamboo with boron can be downloaded from the Environmental Bamboo Foundation - click on the treatment manual tab to access the PDF

<http://www.completebamboo.com>

Aimed at a USA audience, but contains a lot of good basic information on growing and maintaining bamboo for all countries.

<http://www.guaduabamboo.com>

A large amount of information and articles under the bamboo tab as well as free PDF downloads on lots of topics including bamboo building and bamboo furniture. (<https://www.guaduabamboo.com/bamboo-pdfs>)

http://humanitarianlibrary.org/sites/default/files/2014/02/INBAR_technical_report_no20.pdf

A large and comprehensive PDF on bamboo and using bamboo for construction

<http://theconstructor.org/structural-engg/bamboo-reinforced-concrete-mix-design-construction/15054>

Information for using bamboo instead of reinforced steel for building foundations. This website has other good articles on bamboo as well.

Bamboo The Gift of the Gods 2003 Oscar Hidalgo – Lopez ISBN 958-33-4298-X

This is an important book if you want to build with bamboo, especially for large buildings and for creating a livelihood from bamboo building. South American architects and engineers have been developing this technology for many years.

Ch 17 Animals

ANIMAL FEED

<http://www.tropicalforages.info>

A detailed website with a huge database of forage plants for animals. Use the selection tool to insert your details then access appropriate forage plants, or use the forages fact sheets to find out about any plant.

<http://www.feedipedia.org>

Multi-language website that provide valuable information on all types of animal feed, especially forage plants. Use the feed category tabs on the left side

CHICKEN HEALTH

<http://www.worldpoultry.net/Breeders/General/2009/7/Herbal-trees-used-as-antibiotics-for-broilers-WP006936W/>

An article on using plants as natural antibiotics and the results for the different plants



<http://www.countryfarm-lifestyles.com/aloe-vera-for-chickens.html#.WAYlvdw7SVs>

An article on using aloe vera for general chicken health and treating some sicknesses.

GOAT MANAGEMENT

http://publications.cta.int/media/publications/downloads/371_PDF.pdf

A comprehensive PDF on managing goats in the tropics. Good basic information although some of medical treatments rely too much on curative chemical treatments rather than preventative and/or natural treatments.

www.fiascofarm.com

This website contains a lot of information about goat farming, milking goats and making products from goat milk. The methods described are all natural and mostly simple. Some products described are not available here, but it still provides many useful techniques and a lot of good information.

COWS AND BUFFALOS

http://pdf.usaid.gov/pdf_docs/PNADQ897.pdf

A PDF on making silage for high quality livestock feed

https://www.softfootalliance.com/uploads/8/5/0/7/85075002/the_mobile-boma.pdf

Great PDF explaining a traditional method for protecting livestock from large wild predators

BEEKEEPING

<http://answers.practicalaction.org/our-resources/collection/beekeeping-6>

A range of PDFs on beekeeping in multiple languages

<http://www.beesfordevelopment.org/resource-centre>

The Bees for Development resource centre is divided into different sections to make finding what you need much easier, with an extensive library, teaching resources, movies, journals and more.

http://www.buzzaboutbees.net/support-files/how_to_build_a_tbh.pdf

A PDF to download on making a top bar bee hive. It has lots of photos, and is easy to follow.

http://www.planbee.org.uk/uploads/Bees_for_Development_Beekeeping_with_top-bar_hives_March_2006.pdf

Good basic management information for top bar hives in a small PDF

http://publications.cta.int/media/publications/downloads/1290_PDF.pdf

A PDF about bee products - the range of products and how to collect, make, market and sell them.

Ch 18 Aquaculture

www.enaca.org

Network of Aquaculture Centres in Asia-Pacific website. The information - articles, audio and video - is more for larger scale fish ponds and some information is based on high-external inputs or chemical treatments but it also has a lot of information that is relevant and useful.

<http://www.aquaculturewithoutfrontiers.org>

A range of information and presentations along with education resources in the form of blogs, articles, videos and slideshows as well as many links to other organisations and networks.

<https://steemit.com/permaculture/@reville/aquaculture>

From West Timor, in English language but with an Indonesian perspective. Lots of good basic information and photos, with integration techniques for other food production systems too.



Books

Books and other educational materials are vital for ongoing development. Websites are great but books can be used anywhere and provide practical references for successful projects and for reducing mistakes. Good books become treasures, to be shared and valued well beyond their worth.

We encourage local groups, organisations and cooperatives to develop a library of education resources for themselves and for the wider community to use as well. This includes:

- Books large and small
- Reference guides
- Comic style educational readers
- Children's books
- Posters and information sheets
- Flip-charts

Part of community resilience is to have education tools to develop, overcome problems and be self-sustaining.

BOOKS REFERENCED FOR THIS GUIDEBOOK

We are deeply thankful for all the information referenced and learned during the researching for this guidebook. Thank you, the writers and illustrators, for all your efforts in providing these books and reference materials. You have all contributed greatly to expanding the knowledge and resource base for tropical permaculture worldwide.

Earth User's Guide to Permaculture

Rosemary Morrow
Kangaroo Press, 1993

Earth User's Guide to Permaculture – Teachers Notes

Rosemary Morrow
Kangaroo Press, 1997

Bamboo Rediscovered

Victor Cusack
Earth Garden Books, 1997

The Seed Savers Handbook

Michel and Jude Fanton
The Seed Saver's Network, 1993

Permaculture, A Designers Manual

Bill Mollison
Tagari Publications, 1988

Introduction to Permaculture

Bill Mollison
Tagari Publications, 1991

Permaculture – Principles and pathways beyond sustainability

David Holmgren
Holmgren Design Services, 2002

Liklik Buk

Edited by Amanda Twohig
Published by Liklik Buk Information Centre,
Lae, Papua New Guinea, 1986

Sapa, The natural way of growing food in the Solomon Islands

Joini Tutua with Toni Jansen
APACE, 1994

Community Seed Saving – A South Pacific Trainers Manual

Emma Stone
Kastom Gaden Association, 2002

Energy From Nature, 11th Edition

Compiled by Peter Pedals
Rainbow Power Company, 2001

Mud Brick Techniques

Ron Edwards
The Ram Skull Press, 1990

Farming in Ponds and Dams

Nick Romanowski
Lothian, 1994

Fish for Farm Dams

Malcolm R McKinnon
Queensland Department of Primary Industries, 1989

Natural Pest and Disease Control

Henry Elwell and Anita Maas
The Natural Farming Network, Harare Zimbabwe, 1995

Minanao Baptist Rural Life Centre Series (SALT)

Minanao, Phillipines

Notes from Permaculture Design Course and Permaculture for Third World and Indigenous Peoples Course

Robyn Francis
Djanbung Gardens Permaculture Education Centre

Manual for the promotion of Family-Scale Aquaculture in the Northwest Provinces of Cambodia

Prepared by Wayne Gum for UNOPS/CARERE

Organic Gardening

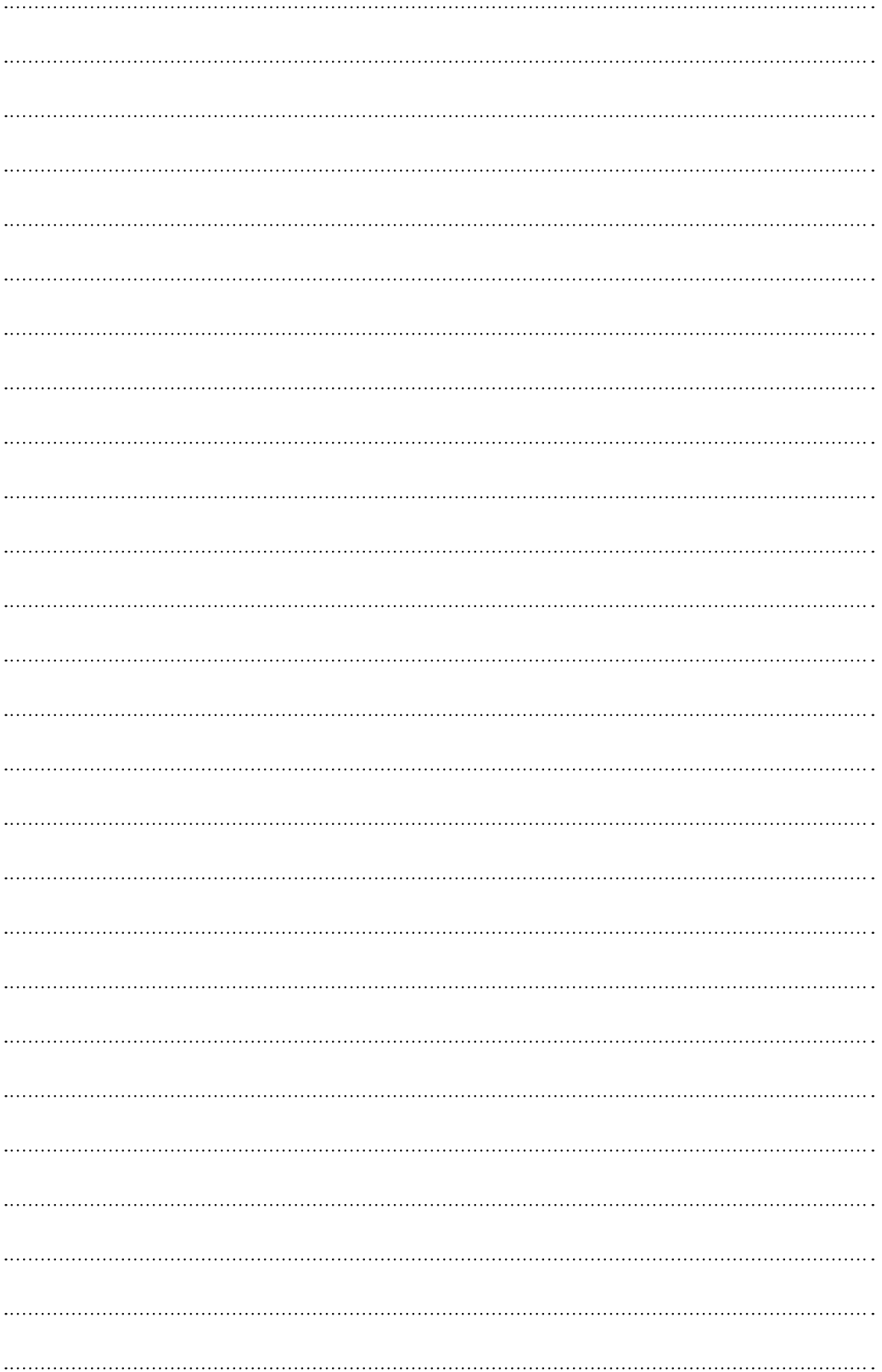
Peter Bennett
Child & Associates Publishing Pty Ltd, 1979

Companion Gardening in Australia

Judith Collins
Lothian



THE TROPICAL PERMACULTURE GUIDEBOOK — INTERNATIONAL EDITION. A GIFT FROM TIMOR-LESTE. REFERENCES Pg 19





GLOSSARY

A

Aerate

To provide air or enable air to circulate – e.g. aerate the soil.

Agroecology

The study of ecological processes applied to agricultural production systems; the application of ecology to agriculture, as in the conservation of soil and water resources, minimising pollution, and the use of natural fertilisers and pesticides. An ecological approach to agriculture is one that views agricultural areas as ecosystems and is concerned with the ecological impact of agricultural practices.

Alignment

Organisation in a straight line, or a line/s made as such – e.g. contour lines.

Animal tractor

A small to medium sized cage with an open bottom or a fenced area usually for chickens, pigs or ducks but can be for other commonly raised animals too. The animals turn the soil, removing weeds and seeds, and fertilise it with manure. After a period of time – e.g. when the animals have cleaned or turned the ground – the tractor or fenced area is moved to a new position. This method is used after harvest and before planting the next crop.

Annual

A plant that completes its life cycle in one year.

Aquaculture

Aquaculture or aquafarming is any type of water, pond or wetland environment which grows or farms aquatic animals (e.g. fish, eels, crayfish, prawns, etc.) and plants.

B

Biochar (activated charcoal)

Biochar is a stable form of charcoal produced by heating natural organic materials in a high temperature (300 °C to 700 °C), low oxygen process known as pyrolysis. The charcoal is then made active with beneficial micro-organisms, fungi and nutrients.

Biomass

Organic matter – especially plant matter – that can be converted compost, mulch, animal fodder, fuel and soil improver.

Bulb

A bud, usually underground and circular, from which leaves, stems and flowers grow at the top, and roots from the bottom.

C

Canopy

The covering or highest layer of a forest or of an area of plants and trees provided by the tree tops, similar to the roof of a house.

Citrus

A general name for a group of trees of the same family that produce sharp tasting, often large fruit – e.g. orange, lemon, lime, mandarin, grapefruit, pomelo.

Compost

Natural high-quality fertiliser and soil improver that is made from decomposing manure, plant materials and other natural ingredients.

“To compost” is to turn plant materials, manure and other natural ingredients into fertiliser.

Compost bay	A structure built and used to make and contain compost.
Condensation	The process of changing from a gas or vapour to a liquid or solid form – e.g. the water droplets that appear on cold surfaces as a result of hot air or steam cooling.
Contour line	A line connecting points of equal height, at the same level from end to end, across a slope.
Cooperative	A farm or enterprise that is communally owned and managed for the economic benefit of its members.
Cross pollination	The transfer of pollen from the male part of the flower of one plant to the female part of the flower of another plant.
Cutting	A piece of a branch from a plant that when planted grows into a new plant.

D

Deficient	Not enough; of a quantity not able to fulfill a need or requirement – e.g. nutrient deficient soil means the soil does not have enough nutrients or not all the nutrients that a plant needs.
Design	To conceive, invent, plan, devise, formulate; Permaculture design applies permaculture ethics, principles and methods to create an outcome that reflects permaculture in action no matter the location, need situation or size. The sequence of activities to complete a design is called a design process.
Diversity	Many different and mixed varieties of animals and/or plants in one area. – e.g. a healthy natural forest has a diversity of plants, animals and birds.

E

Element	One of the fundamental components making up the whole. The elements of something are the different parts it contains.
Energy	The capacity of an organism or physical system to do work. Physical systems can be people, animals, machines, etc. Energy can be created, stored and used.
Evaporation	To change from a liquid or solid shape into a vapour or gas – e.g. water when it boils or water when it dries on the road after rain.

F

Feature (on map)	An important or unique part of the land that is mapped – e.g. house, river, fence.
Fermentation	A chemical process caused by yeasts, bacteria and moulds where organic food is converted into simpler compounds, and chemical energy is produced. It is used for preserving, and making food and drinks – e.g. tempeh, yoghurt.
Fingerling	A young fish usually under a year old, about the size of an adult finger.

Fry (in aquaculture)

Young, baby fish.

Function

The intended use or purpose of a person or thing – e.g. some functions of bamboo are to stop erosion, make a living fence, reduce wind, provide poles, provide food, etc.

G

Garden bed

An area for growing small plants. Permaculture garden beds suit the land and climate, and are designed for protecting and building soil. They are usually raised, with paths on the outside and sometimes have borders.

Germination

The process of a seed coming to life and growing.

H

Hedge

A thick row of bushes or small trees.

Holistic

Looking at the whole of something or someone and not just its parts. Permaculture uses this approach to observe and include all separate parts into a single integrated design.

I

Input

Something that is a resource needed for a system to function properly. In a permaculture system an input is carefully chosen; preferably it is local, sustainable, renewable and waste or output from a different system.

Integrate

Bringing together two or more individual parts or systems so they become connected and inter-related, creating a new whole system.

Integrated Pest Management (IPM)

Combines different natural techniques for pest management to reduce the chances of pest problems, the size of the pest population if problems occur and natural control techniques if necessary.

L

Larva

An insect after it has hatched from an egg and before it changes into its adult form. More than one larva is larvae.

Leach

To lose soluble elements from a substance by a liquid passing through it – e.g. when soil loses nutrients as a result of wet season rain.

Living fence

A fence built by growing living plants close together in a row. If legume trees are planted they which can be pruned regularly to produce animal food, compost material, mulch and nitrogen in the soil.

M

Microclimate The summation of environmental conditions at a particular site as affected by local factors rather than regional ones.

Micronutrient A mineral or vitamin required in very small amounts by plants and animals for health and growth.

Mineral A naturally occurring solid inorganic substance with a characteristic chemical composition and structure.

Mulch Organic material spread on the ground and covering the soil, usually around plants, to inhibit weed growth, prevent excessive evaporation or erosion, enrich the soil and moderate soil temperatures, etc. (Mulch can be inorganic, such as plastic, but it is not recommended or sustainable.)

N

Nematode The general name for a class of very small worms which live in most environments including the soil. Most types of soil nematodes are beneficial but some types are parasitic and cause damage to plant roots by eating them.

Nursery A protected area where plants are grown from seeds, seedlings or by propagation in order to transplant into other areas or to sell when they have reached the appropriate healthy size.

Nutrient A substance that provides the food necessary for life and growth.

O

Organic matter (OM) Material in or on top of the soil which is of plant or animal origin.

Output Materials, products or yields that are created. In permaculture all outputs, even waste, are used and reused as inputs in other parts of a house, community or production system.

P

Pathogen Any virus, bacterium or other micro-organism that can produce disease.

Perennial A plant that continues its growth for three or more years.

Pest predator A bird, animal, insect or spider that eats the pests which damage crops.

Photosynthesis The chemical process by which a plant uses sunlight and chlorophyll to make sugars from water and carbon dioxide absorbed from the air.

Pioneer A plant that is usually the first to start growing in a new area of land, which has possibly been damaged by fire or has no other vegetation – e.g. pioneer plant.

Pollination

When a powder produced by the male part of a flower is carried by insects or the wind and causes the female part of the same type of flower to produce seeds.

Prevailing wind

The usual direction the wind comes from.

Propagation

To take a section of a plant from which to grow more plants.

Prune

To cut off some parts of a tree or bush so that it grows better, removes dead or diseased branches or improves the shape.

R**Regenerate**

To re-create, renew, reconstitute, or restore, especially in a better form or condition. In permaculture this can refer to trees, soil, rivers, an ecosystem and even a community. Regeneration promotes health, diversity and resilience.

Resilient

Capable of recovering easily and quickly from misfortune or illness and less prone to suffering during times of stress or hardship – e.g. Improved water catchment and storage will increase plant survival rates during drought conditions.

S**Scale (on map)**

The ratio between the size of something real and that of a representation of it.

Seed saving

The act of preserving, using and increasing a seed supply from quality plant sources, by careful growing, selecting, cleaning, drying and storing the seeds each season.

Soil biota

The mainly microscopic plant and animal life in the soil.

Soil improver

A material that enhances the quality of soil, increasing biological and healthy fungal activity and/or the amount of humus or organic matter.

Succession

The gradual and orderly process of change in an ecosystem brought about by the progressive replacement of one community by another over time until a stable climax is established.

Sustainable

Something that lasts and can go on indefinitely, based on available resources. It is midway between degenerative and regenerative.

Swale

A swale is a trench dug in a line along the contour of a piece of land with a mound of soil, rocks or other materials made in a line directly below it. It is built to collect, spread and store water in the ground, and also to catch soil and organic matter. Sometimes on difficult land it is only possible to make the mound.

System

The manner in which parts of something fit or function together; a network or set of methods for doing something – e.g. a permaculture design brings separate strategies and techniques together into one system.



T

Tree (or living) terrace

A system of raised flat banks of soil, usually on a hillside, for planting crops where the bank is formed and stabilised by a row of closely planted trees or plants, carefully chosen to be productive, good at protecting the soil from erosion, non-competitive and easily managed.

V

Value-added

When a product or material is changed, improved or processed in order to create a new product or material and increase its price or worth – e.g. making jam or marmalade from fruit; making furniture from bamboo poles; making compost from manure, leaves and kitchen waste.

Ventilation

When fresh air is allowed to enter an enclosed space.

W

Wholefood

Food that is not packaged or changed from its original form. It can be fresh, dried or naturally preserved.

Y

Yield

The results of human work and/or a natural process – e.g. In a permaculture system there are many results or yields by using all of the different functions of each element.

Partners



Sponsors



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Dedication

Rob Swain, 1955–2017, lived his life as he worked with us on this guidebook: with endless generosity, humble wisdom, joyful enthusiasm, careful dedication, a profound respect for our earth and much grace and laughter. We will continue your legacy, grow from your knowledge and remember you with love. Journey well.

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Sustainable Development Goals (SDGs)

The Tropical Permaculture Guidebook enables these 12 UN Sustainable Development Goals to be advanced and achieved.



CarbonSocial

We are working towards carbon neutrality by offsetting through CarbonSocial – the first ethical, social and environmental carbon credits from Timor-Leste.

CarbonSocial credits are produced under the WithOneSeed community forestry program and are the only internationally certified Gold Standard credits available from Timor-Leste. Importantly, funds raised from the sale of CarbonSocial credits are used to directly pay small landholder subsistence farmers to plant and manage the forests where they live, through the WithOneSeed program.

