

# THE EARTH CARE MANUAL

REVISED & UPDATED

Patrick Whitefield



A Permaculture Handbook  
for Britain and other Temperate Climates

This book is much more about solutions than about problems, more about what we can do in the present situation than about how we came to be in it in the first place. Yet there's no escaping the fact that the Earth is in a dire state, and getting worse. In the twenty-three years I've been actively involved in the ecological movement almost every aspect of planetary health has got worse.

This raises the question: Is it all worth it? If we do our best to heal the Earth and make our place in her a sustainable one, is there a good chance that we will succeed? Or is it a forlorn hope? It's a big question, and one which can lead to depression if we look at the facts honestly and dispassionately. But to my mind it's the wrong question. Even if we could answer it – and we can never know anything about the future for certain – it would beg the question, How do I want to live my life?.

Here I find the teaching of Mahatma Gandhi very useful. One of his precepts was that of non-attachment to the fruits of our labour. All we can do in life is to make sure that we play our own part in it the best way we can. Much as we would like to, we can never do more than that. Everything we do is so complex, and relies for its ultimate completion on so many different people and natural forces, that we can never take responsibility for the final outcome of our actions. We can only take responsibility for our actions themselves.

So my answer to the question, How do I want to live my life? is that I want to be a part of the solution rather than a part of the problem.





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# The Author

Patrick Whitefield is a permaculture teacher, writer, designer and consulting editor for *Permaculture Magazine*. He is the author of the mini-classic, *Permaculture in a Nutshell*, which has been translated into four languages, and *How to Make a Forest Garden*.

He grew up on a smallholding in rural Somerset and qualified in agriculture at Shuttleworth College, Bedfordshire. He has wide experience of farming in Britain, the Middle East and Africa.

He has experience in many diverse areas. These include organic gardening, nature conservation, country crafts and green politics. Patrick has found that his mixed experiences have led him to the logical conclusion of permaculture and are directly relevant to his present work. He inspires respect, affection and a good measure of action wherever he imparts his considerable knowledge.

# Acknowledgements

First of all I would like to acknowledge my debt to Bill Mollison and David Holmgren, who first devised the concept of permaculture, and to the many others who have originated the material which I have collected together in this book. If it was based only on my own personal experience it would be a much shorter book!

The following people have read and commented on various parts of the book, pointed out mistakes and made suggestions for improvements: Alison Malcom, Ben Law, Caroline Haynes, Cristina Crossingham, Claire Roper, Jimmie Hepburn, Mark Moodie, Martin Wolfe, Matt Dunwell, Michael Littlewood, Pauline Pears, Peter Harper, Phil Corbett, Phil Hinton, Rebecca Laughton, Rob Hopkins, Robin Roper and Tony Currivan. Sarah Lagden has read the entire text and made many useful suggestions for changes. I'm grateful to them all for their time and expertise, but I take full responsibility for any errors which may remain.

My special thanks go to my publishers, Maddy and Tim Harland and their team. Working with them is a truly co-operative venture, full of mutual support and genuine friendship. I hope and trust that the quality of our relationship is reflected in the all-round quality of this book. Equally special thanks to Cathy, my wife, who has put up with a lot while I've been writing it.

## Preface to the Second edition

This is not a completely new edition. Most of the information in the first edition is as relevant now as it was when I finished writing it a decade ago. The main exception is in the field of energy, where the technology is changing fast, and I've completely revised Chapter 6, Energy and Materials. Allied to energy is the topic of climate change, and I've rewritten the Climate Change section in Chapter 4, Climate and Microclimate. The new version not only reflects the advance in our knowledge of climate change but also my own views on the subject, which have undergone a sea change. I'm grateful to Shaun Chamberlin who has read through my major changes and made some useful suggestions. But any errors of fact which may remain are entirely my responsibility.

Apart from that I've made a few changes and updates here and there. I've altered the emphasis in the To Till or Not to Till? section of Chapter 3, Soil, and added a postscript to the Native or Exotic? section in Chapter 12, Biodiversity. And that's about it.

PW  
May 2011

# About This Book

The aim of this book is to provide practical information on permaculture for people living in Britain and other temperate countries. It came to be written for two reasons.

Firstly, I wrote it to support my main work, which is teaching permaculture to adults. The standard course, the Permaculture Design Course, is only 72 hours long, and you can't pack a great deal of information into that amount of time. The course gives people the experience of permaculture design and, I hope, inspires them, but it has always left me with the feeling that the students could use a lot more information. This book contains that information.

Secondly, it exists to supplement the existing books on permaculture, almost all of which are by Australian writers. Australia is mainly a tropical country – its latitude makes it equivalent to a stretch of land from Spain to Nigeria – and there has long been a need for a full-length permaculture book for the temperate world. The principles travel well enough but the details of what you can do in a tropical climate are not relevant here.

I trust this book will be of use to people in all temperate countries but I have written it primarily from a British point of view. One of the chief characteristics of sustainable solutions to world problems is that they are local, tailored to the unique conditions of each place. I, immersed as I am in British ecology and culture, can only write with confidence about Britain – and even here I must allow for wide differences between different parts of the country and even between neighbouring localities. You, whether you live in Britain or another country, are best able to judge what is applicable to your home and what is not.

Even if you live just round the corner from me, I'm not here to tell you what to do. My aim is to give you the wherewithal to make your own decisions. This includes information, but perhaps more importantly it includes concepts and perspectives. The most important thing to know in any situation is which questions to ask. Then at least we have a chance of coming up with the right answer. If we ask the wrong questions we have no chance.

In fact permaculture covers such a wide field of human activity that it would be impossible to give all the detailed information you may need in one book. But most of that information is readily available elsewhere, and I have concentrated here on the particular contributions which permaculture can make. For example, in the chapter on gardening you will not find detailed information on how to grow carrots and peas, but you will find details

on vegetable polycultures, perennial vegetables, no-dig gardening, the application of permaculture design principles to the garden and so on.

You may already have the relevant skills, as a gardener, farmer, forester, architect or whatever, or you may be a complete beginner. This book should work for you either way. Adding the permaculture perspective to existing skills gives a powerful combination. Equally it's a good perspective to start from, and an understanding of permaculture can help you recognise the wheat and the chaff in the sometimes bewildering mass of knowledge on offer these days.

One area of activity which is usually included in permaculture but which I have not covered in this book is economics. This is partly because I have no personal knowledge or skill in this area and partly because an excellent book already exists on the subject of green economics, Richard Douthwaite's *Short Circuit*. Nothing I could write on the subject could match it, and if I tried to I would only end up plagiarising it. I warmly recommend it to anyone who's interested in sustainability and community development. It's a vibrant, readable book, and requires no previous knowledge of the subject. (See Appendix A, Further Reading.)

My aim throughout this book is to give information which is practical and reliable. With an innovative subject like permaculture this can present a problem. So many of the ideas in permaculture are new, or depart so radically from the mainstream of our culture, that they have not been tried and tested as thoroughly as the conventional ideas which they seek to replace. This by no means applies to everything in the book. For example, raised bed gardening has been practised for hundreds if not thousands of years and its advantages are well known, whereas growing crops through a permanent understorey of clover is new and experimental. I have tried to make plain in the text whether I'm talking about something which is well-established and known or something which is on the cutting edge of our knowledge.

Nevertheless there has to be an element of experiment in something as radical as permaculture. There is absolutely no doubt that it represents the direction we must go in if we're going to survive on this planet. But, when virtually all scientific and commercial development has been in the opposite direction, it's inevitable that there will be doubts about some of the details. If you want to play safe you can go a fair way along the path to permaculture, but if you want to go the whole way I have to say, "Welcome to the experiment."

# How To Use This Book

If you choose to start at page one and read this book right through you'll find that it has a logical sequence and each chapter builds on what has gone before. But it can also be dipped into.

The breadth of subjects covered by permaculture, and the fact that all these subjects are interconnected, means that there are many topics which could easily fit into a number of different chapters. Rather than repeat them unnecessarily I have had to choose where to place them. This means there may be something to interest you in chapters which you would not at first think were relevant to you.

For example, if your main interest is in gardening and you never envisage growing an orchard or farming, you may still find ideas and information in the chapters on orchards and farms which are relevant to you. One such is the technique of growing crops, including vegetables, through a permanent sward of clover, which is described in Chapter 10, Farms and Food Links. Similarly, if your interest is in smallholding you may find much of interest in Chapter 8, though its main focus is on domestic gardening. In either case you will find relevant information in Chapters 3 and 4, which deal with soil and microclimate.

So I invite you to dip around: you never know what you might find. However I do suggest you read the first two chapters, *What is Permaculture?* and *The Principles of Permaculture*, first. The rest of the book is based on the ideas presented in these two chapters, and can be understood more fully in the light of them.

The Glossary, Appendix B, is designed to help readers who want to dip into the book. It gives definitions of words and phrases which may be unfamiliar to the general reader. Many of them will have already been defined in the text, but looking them up in the glossary is quicker and easier than using the index to find the original entry.

The fact that so many topics could have fitted into a number of different places has led to a fair number of cross-references in the text. You should not need to use

these in order to understand any passage you're reading, but you might like to follow them up if you want to get a fuller picture of the subject in hand.

Appendix A gives suggestions for Further Reading, with a general section and sections for each chapter. Virtually all the books listed are practical how-to books which give the detailed information you need to put permaculture into action on the ground.

Sources of information on more specialised subjects are to be found in the Notes on pp423-435, referred to by superscript numbers in the text. To some extent the notes refer to supporting evidence for statements made in the text. But their main purpose is to point the way to information which may only be of interest to a minority of readers. There are also a few notes which are comments of my own which I have left out of the main text so as not to break the flow.

The list of Scientific Names, Appendix C, gives the botanical or zoological name of every plant and invertebrate animal mentioned in the text. This may be particularly useful to readers who don't have English as their first language, and to American readers who may know some plants by different names.

I have used metric measurements throughout. If you're more familiar with the old imperial measurements don't feel intimidated. It's really quite easy once you get acquainted with a few basic equivalents, and I've given these in Appendix F.

## FEEDBACK

If you, the reader, should find any mistakes or misinformation in this book, or have any suggestions for improvements, please contact me, by letter or email, via the publishers. This will help to improve the quality of any future editions.

Patrick Whitefield  
Glastonbury, Somerset  
May 2011

**PART ONE**

**BASICS**

## Chapter 1

# WHAT IS PERMACULTURE?

Permaculture means different things to different people, but at root it means taking natural ecosystems as the model for our own human habitats. Natural ecosystems are, almost by definition, sustainable, and if we can understand the way they work we can use that understanding to make our own lives more sustainable. An insight into how natural ecosystems work can be had by comparing a wild woodland, which is the natural vegetation of this country, with a wheat field.

The wildwood, containing trees, shrubs, herbaceous plants and climbers, has a much greater biomass than the wheat field, which is only about half a metre high and contains just one type of plant. Not only that but the amount of new biomass produced each year is much greater.<sup>1</sup>

The wildwood needs no external resources other than sunshine, rain and the rock from which it makes its own soil. By contrast the wheat field needs an annual round of ploughing, harrowing, sowing, manuring, weeding, pest control and disease control, and far from accumulating soil it suffers a net loss through soil erosion.

There's a catch, of course. About half of the biomass in the wheat field is edible grain, and even the straw is useful to us, whereas the wildwood contains a very low proportion of human food, and we can only make use of a certain amount of timber. How happy we would be if we could create systems which combine the yield and self-reliance of the wildwood with the highly edible nature of the wheat field!

This is the inspiration for permaculture, but the practice of it is more than simply making direct imitations of natural ecosystems. We can do that: a forest garden is a direct imitation of a natural woodland with the wild plants replaced by edible fruits and vegetables, and there is a place for forest gardens in permaculture. But there is a great deal more to permaculture than that. We go beyond the surface appearance of ecosystems and look at the principles on which they operate. If we can understand these principles and apply them more widely, we can get the benefits of natural ecosystems in buildings, gardens, farms and whole settlements which don't outwardly resemble natural ecosystems at all.

So what makes natural ecosystems work? One of their best-known attributes is diversity. This does not

simply mean a high number of species. You could collect together a thousand randomly assorted species of plants and animals and put them down in one place but you wouldn't get an ecosystem. You'd get a mess. What makes an ecosystem work is the diversity of beneficial relationships between its components, the plants, animals, microbes and non-living components which make it up.

For example, one species of plant provides shelter for another, protecting it from wind and maintaining the humidity it requires; another plant, by co-operating with certain bacteria, provides nitrogen for itself and its neighbours; fungi extract minerals from the soil and exchange them with green plants for sugars; insects pollinate plants and receive nectar in exchange; closely related species of animals consume slightly different diets and thus avoid competition with each other; water-loving plants and animals colonise marshy ground, making it productive without any need for drainage.

Every ecosystem is composed of a vast web of beneficial relationships of this kind. This web of relationships is the fundamental principle which enables natural ecosystems to be highly productive without the level of inputs needed by our wheat field. It's also the central idea of permaculture, and it can be applied both to food production and to a wide range of other human activities.

To illustrate this central idea, let's look at an example: the choice between having a free-standing greenhouse in a domestic garden or placing a greenhouse against the south-facing wall of the house, as a conservatory.

If the greenhouse is free-standing, at night it will radiate heat out in all directions and cool down rapidly, but if it's alongside the wall of the house much of the day's heat will be absorbed by the wall and re-radiated at night to keep the greenhouse warm. This can keep it frost-free all winter without the need to burn fuel and will keep plants growing during the cooler seasons of the year.

The house itself can also gain some of the heat collected by the greenhouse during the day, again reducing the need to burn fuel.

One of the greatest benefits of the house-conservatory combination is in the relationship between the people in the house and the plants in the greenhouse. This is especially true when the conservatory is used to bring on

young plants in the spring. It's much easier to give them the care and attention they need when all you have to do is to pass from one room in your house to another rather than make a trip outside, especially in inclement weather. The plants receive all the attention they need, and getting them off to a good start when they're young is essential to successful crops.

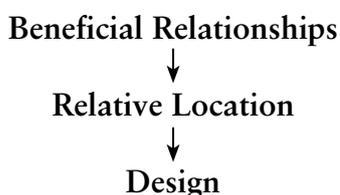
The people also benefit directly from having a pleasant, semi-outdoor place to be in when the weather is too cold or wet to enjoy being outside.



*John and Donna Butterworth produce organic fruit trees in their nursery in Ayrshire, specialising in old Scottish varieties. As they are in a rather frost-prone area the conservatory which runs along the front of their house is important for their business. It also reduces the heating season in their house by a full two months.*

This example shows how a network of beneficial relationships can go to make up a system which minimises the inputs, both of fossil fuel and of human effort, and maximises the outputs. In practice careful design will be needed to make sure the system works as intended, and of course a conservatory will not be appropriate for every household. But it illustrates the central idea of permaculture.

Since our aim is to set up a network of beneficial relationships, where we place things in relation to each other is very much of the essence. In the greenhouse example the benefits depend on the two structures actually being joined together. This means that permaculture is basically a matter of design. The aim is to put the maximum effort into the initial design of a system so as to save unnecessary effort once the system is in operation. Permaculture can be described as: careful thought followed by minimum action, rather than hasty action followed by long-term regrets.



## A Brief History

Permaculture, or something very close to it, has been practised for thousands of years in various parts of the world, and still is here and there, by people who have never heard the word permaculture. For example, the Chagga people of northern Tanzania and the inhabitants of the Kandy area of Sri Lanka both cultivate gardens which are modified versions of the natural forest vegetation. Productive trees, vines, shrubs, herbs and vegetables grow together, each providing the conditions the other needs to grow in. These gardens suffer no soil erosion, require no heavy energy input, and production is very high. They provide the people with all or much of their food, most of their medicines and fibres, and some cash crop, all on a very small area of land.

But the conscious idea of permaculture and the word itself were formulated in the 1970s by two Australians, Bill Mollison and David Holmgren. They set out their ideas in a book, *Permaculture One, a perennial agriculture for human settlements*. The opening paragraphs of the book state that:

Permaculture is a word we have coined for an integrated, evolving system of perennial or self-perpetuating plant and animal species useful to man [sic]. It is, in essence, a complete agricultural ecosystem. . . It would suit any climatic region, and is designed to fit in urban situations.

We jointly evolved the system in the first place as an attempt to improve extant agricultural practices, both those of Western agribusiness, and the peasant grain culture of the third world. The former system is energy-expensive, mechanistic and destructive of soil structure and quality. The latter makes drudges of men [sic], and combined with itinerant herding, deserts of what once were forests. Perhaps we seek the Garden of Eden, and why not? We believe that a low-energy, high-yielding agriculture is a possible aim for the whole world, and that it needs only human energy and intellect to achieve this.<sup>2</sup>

Permaculture has developed over time, and continues to change and develop. In its original form, as laid out in *Permaculture One*, the emphasis was on a fairly direct imitation of natural ecosystems. I call this 'original permaculture'. A garden or farm designed along the lines of original permaculture actually looks like a natural ecosystem. The soil is not ploughed or dug and is always kept covered, while the majority of crop plants are perennials, especially trees. The classic example is a forest garden.

But, as we have seen, what makes a natural ecosystem work is not its components but the network of beneficial relationships which knits them together, and this principle can be used to make any human-made systems more efficient and sustainable whether they actually look like a natural ecosystem or not. The originators of permaculture discovered that they had invented a design