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# To the teacher ...

## The purpose of this book

This book is part of a series of five designed to convey a holistic understanding of ecological principles and contemporary environmental problems. Such a holistic understanding can provide us with the tools for solving environmental problems — on both a local and global level — thus allowing us to move toward a healthier future.

## Conveying a holistic understanding of the world

The theme for all five books of this series is provided by a simple notion: environmental problems — such as pollution, resource depletion, extinction of organisms, and over-population — exist because the human world does not model the conditions that generate **balance** (equilibrium or stability) in nature. If this notion is valid, it follows that environmental problems may be solved, or avoided, if the human world were to model those conditions.

Two questions arise from these statements: (1) What are the conditions for balance in nature? and (2) What characteristics of the modern human world differ from, or oppose, those conditions? Answers to these questions must deal with the following characteristics or principles governing the biosphere, *including* its human element:

1. Everything — living and nonliving — is in a constant state of change.
2. There is a constant exchange of materials between living things, and between living things and the physical environment.
3. Matter and energy cannot be created or destroyed, but may be transformed; as energy is used, it is ultimately transformed into heat, which largely dissipates into the atmosphere.
4. Populations of organisms tend to grow exponentially — that is, by doubling — a pattern characterized by staggering leaps in numbers following a gradual initial buildup.
5. Living things are interdependent with one another and with the physical environment.
6. Living things are the product of their heredity and environment.

Whether or not these six characteristics result in a state of balance is conditional. For example, if change is *gradual*, *minor*, or *occurring periodically* (such as seasonal change), an ecosystem can absorb the change or become part of a gradual, nondisruptive turnover of species and surroundings — as in natural succession. In such cases, a state of dynamic equilibrium — or balance — may exist at any point in time. If change is *abrupt and drastic*, on the other hand, as in the eruption of a volcano or the excavation of a pit mine, balance may not exist (at least in the region surrounding the event although it may be maintained on a larger scale).

*Nature* tends to maintain itself in a state of balance because of six conditions which are generally true of the characteristics outlined above. These conditions are presented schematically on the following page.

In contrast, the human world is characterized by:

1. **abrupt and drastic changes** — as in mining activity, excavation for homesites, deforestation, etc.
2. **cycles which are open in terms of human (as opposed to geologic) timespans** — as when raw materials are “locked up” in landfills rather than recycled.
3. **use of short-term (i.e. non-renewable) energy resources** — illustrated by a continuing dependence on fossil fuels.
4. **unchecked growth of the human population.**

These departures from the first four conditions for balance have resulted in disruption of nature and a deterioration of environmental health that further affects nature as well as ourselves. The remaining two conditions fostering balance in nature are modelled in some significant ways within the human world, but not in ways related to our treatment of the natural world around us.

5. **Webs of interdependence are simplified** — through monoculture farming, clear-felling of forests, etc.
6. **Adaptation of organisms to their environment is frequently destroyed** through alteration of their natural habitat or through alteration of their physiology by radiation or chemicals in the environment.

Modelling the conditions that generate balance in nature may alleviate environmental deterioration and promote harmony between the modern human world and the world of nature. The means to this end are feasible and do not require a discarding of technology. For example, organic wastes could be recycled as fertilizer, renewable energy resources could be put into large-scale use, the number of children born to a family could be voluntarily limited, and agricultural systems could be diversified. This concept of modelling the conditions for balance in nature appears in all five books of this series as the foundation for a holistic understanding of the world and its environmental problems.

# To the young energy user . . .

Hello, I'm Benjamin Franklin, the Black-footed Ferret from America. I am an endangered animal and I am visiting my good friend Meryl, the Mountain Pygmy-possum, who is also an endangered animal. In this book, I would like to help you discover how energy conservation and the use of cleaner sources of energy can help keep the environment healthy both for you human beings and for all living things.

In particular, you will see that the human world has some serious problems today because it has not acted like the world of nature in its choice of energy sources. You will learn how that human world is beginning to act like nature by putting **long-term (i.e. renewable)** and clean energy sources into use. And you will see that **conservation** is necessary to buy the time needed for putting those new energy sources into use on a large scale.



# What really is Energy?

1. Can you do the following things one right after the other? Try it!

Run 15 metres.

Do 10 star jumps.

Do a cartwheel.

Push or pull a friend 10 metres in a billycart.

WOW! You have a lot of energy! But what is energy? You can't see it. You can't smell it. You can't taste it. So, what in the world is it? To find out, you must first learn what FORCES and WORK mean to a scientist.

**A FORCE is a push or a pull.**

When you pushed or pulled a friend in a billycart you were **exerting a FORCE**.

**WORK is a force exerted over a distance.**

When you *moved* the billycart by pushing or pulling it, you did **WORK** on it.

2. Write W by each picture below which shows WORK being done. Put an X on the objects on which WORK is being done. Write F by pictures which show *only* a FORCE being exerted, but no WORK being done.

