Christians Caring for the Environment in Papua New Guinea
A Handbook of Principles and Practice

Compiled by the Evangelical Alliance of Papua New Guinea
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Compiled by the Evangelical Alliance of Papua New Guinea
Team Leader: David Kima
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Foreword

Care for the environment is one of the most important issues facing the Nation of Papua New Guinea. Every citizen is affected by the state of our natural surroundings and the condition of our natural resources. And every citizen influences the wellbeing of our rich natural heritage. The future of the nation – our children and grandchildren – depends on the wise management of that inheritance. In fact, in the words of an ancient North American indigenous proverb “We do not inherit the earth from our parents, we borrow it from our children”.

In order for us to act wisely in relation to the environment we need both knowledge and commitment. For that reason I am very happy to give my blessing and encouragement to the publication and distribution of this book “Christians Caring for the Environment in Papua New Guinea”. I commend the Evangelical Alliance of PNG for taking this initiative to raise awareness and motivate the citizens of the nation to take very seriously their responsibilities as stewards of God’s creation.

The book contains relevant technical information. While some of it may seem rather difficult to understand, the main messages are clear. Careful study will be rewarded. Churches, schools and training programs are encouraged to package these pieces of information appropriately and communicate them far and wide.

The book also provides a Christian framework for personal and community understanding about the environment. This should help the churches to fulfill their important role of relating the social, economic and scientific factors of everyday life to the foundations of their faith. I encourage church leaders to preach and teach these messages and to challenge everyone to deep commitment that results in appropriate action.

Sir Paulias Matane  
Governor General of Papua New Guinea  
Port Moresby, September 2005
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Finally I would like to thank the churches who are members of the Evangelical Alliance of PNG for participating in and supporting this project and for granting me the time and opportunity to lead the production team.

David Kima  (General Secretary, Evangelical Alliance of PNG)
Team leader
Mount Hagen, WHP, PNG, September 2005

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Glossary

acid rain: rain that contains acids – caused by pollution in the atmosphere

aesthetic: related to beauty

agroforestry: farming that includes the growing of timber and other tree products for commercial sale

air pollution: the build-up in the air of impurities which are likely to be harmful to plants and animals including humans, once they reach certain concentrations

ammonium nitrate: a soluble chemical compound rich in nitrogen, often used as a plant fertilizer

ammonium sulphate: a soluble chemical compound containing nitrogen and sulphur, often used as a plant fertilizer

appropriate technology: the most suitable technology for the process, taking into account costs and skills. (It is not necessarily the most advanced technology available.)

artificial fertilisers: plant fertilisers made in factories

artisanal: type of activity carried out by skilled individuals (for example panning for gold, fishing)

atmosphere: the thin, fragile layer of gases that surrounds the earth

biochemical: related to the chemical processes occurring in living cells

biodiversity: the variety of all life forms, including the genes, species and ecosystems, of a region

chlorofluorocarbons: manufactured substances that contain chlorine, fluorine and carbon

contours: lines joining places of equal altitude – on a map or on the land surface

deforestation: the total clearing of forest from an area

degradation: to reduce the value of a resource – for example, soil degradation means the loss of soil productivity through processes such as erosion, salinisation and desertification

delta: area of sediment deposited at the mouth of a river

depleting: using up or reducing or exhausting or emptying

desertification: the process by which useful agricultural areas on desert fringes change into deserts due to drought and inferior farming practices

detoxifying: removing the poison

ecologically sustainable tourism: tourism that does not harm the environment or threaten the biodiversity of an area

ecology: the study of the interaction of living organisms (including humans) with each other and with their environment
ecosystem: the group of all the plants and animals (including microorganisms) in a certain area, together with the environment to which they have adapted

ecotourism: ecologically sustainable tourism based on the physical environment that aims to increase tourists' awareness and return benefits to the community

endangered: in danger of becoming extinct

environment: the surroundings of living and non-living things

evaporation: the process by which water changes to water vapour when heated

extinct: animal or plant species that have died out

food chain: the sequence of eating and being eaten; plants and animals feed off other living things while they, in turn, are food for other living things

fresh water: water that is not salt water

global warming: the warming of the atmosphere which some scientists believe is caused by the burning of fossil fuels

green manures: nitrogen fixing plants grown deliberately for their ability to enrich the soil – as a kind of manure or fertilizer.

greenhouse gases: the gases in the earth’s atmosphere that trap the heat reflected from the earth’s surface. These can be both naturally occurring and produced by human activity.

groundwater: water under the surface of the ground that has seeped through soil and rock, often used for drinking and irrigation

habitat: the natural environment of an animal or plant – the place where it is normally found

infiltration: the process by which water seeps into the soil

leaching: occurs in areas with high rainfall, when water continually runs down through the soil, dissolving soluble minerals in the topsoil and carrying them into the subsoil

mangroves: trees found in tropical or subtropical countries, growing in salty water or on salty mudflats

mechanisation: the process of equipping with machinery

phosphorus: a chemical element found in all living cells; necessary for plant growth

natural habitat: the natural home of an animal or plant – the place where it is normally found

nutrients: substances that provide nourishment (“food”) for plants and animals

ozone depletion: the thinning of the ozone layer above the earth by chemicals produced by human activity (The ozone layer is important in absorbing ultraviolet light from the sun.)
**photosynthesis**: the process by which energy in the form of sunlight is captured by green plants and converted into chemical energy to be used for the plants to grow

**potassium**: a chemical element found in all living cells; necessary for plant growth

**refugee**: a person who has been forced to flee from some danger or extreme difficulty in their home area

**resources**: things of value that can be used to produce goods and services

**run-off**: water from precipitation (rainfall) that runs off the surface of the land and into streams and lakes

**salinity**: saltiness

**salinization (or salinisation)**: the accumulation of salts near the surface of the soil, making it unsuitable for agriculture

**sediment**: material deposited in a stream or other body of water

**sewage**: the used water from a community – including waste water from homes, businesses and industry

**shifting cultivation**: moving the gardened or farmed area every few years because the soils in any one place are too poor to sustain repeated sowing of crops

**slash-and-burn**: a method of clearing land for agriculture by cutting down trees and shrubs and burning the remaining vegetation before crops are planted

**soil aeration**: entry of air into the soil between the soil particles

**soil organic matter**: the complex mixture of substances found in soils and originating from living organisms (All organic matter contains the element carbon.)

**species**: a group of plants or animals of the same kind, able to breed with each other

**spring**: place where underground water rises to the surface

**storages**: areas where water is stored, including lakes, reservoirs, oceans and the atmosphere

**tailings**: the leftovers from a mining operation

**toxic**: poisonous

**toxins**: poisonous substances of plant or animal origin

**water table**: the upper point at which water can be found in the ground (In times of flooding, the water table is at the surface.)

**wetlands**: areas which are covered permanently, occasionally or periodically by fresh or salt water up to a depth of six metres
Background

This handbook grew out of a partnership between the Alliance of Religions and Conservation (ARC), a UK-based ecumenical conservation foundation, and the Evangelical Alliance of PNG, as part of a World Bank initiative on Faiths and Environment. The World Bank provided substantial supplementary funding through ARC for a consultation on the Theology of the Environment held in Goroka, PNG, in May 2003. The 25 participant church leaders formulated a declaration on Christians and the Environment in PNG and committed themselves to producing a handbook and other materials as a contribution to improved understanding and appropriate action throughout the churches and the nation of PNG.

A follow-up workshop in April 2004 brought together a group of 15 leaders, practitioners, thinkers and writers to carry forward the process of writing the handbook. With assurance of further funding support through World Bank/ARC, the writers continued their work through the next year. The resultant publication is the combined product of many contributors.

Several participants in the 2004 workshop also committed to begin immediately to communicate the key messages reinforced at the workshop with their constituents – by way of sermons, studies, lessons and written articles. Some were also keen to initiate small conservation projects, following the example of one pastor who reported that as a result of the 2003 consultation he had established a successful tree nursery for distribution of seedlings and for sharing the related technologies. An up-to-date report on this project is included in the handbook.
Rationale

The initial consultation was a response to the widely recognised need for the churches of PNG to play a strong and active role in the national program of conservation and rehabilitation of the environment. In PNG, the churches are uniquely placed to raise awareness about the key concerns, and to motivate their members towards embracing constructive attitudes and actions. It was agreed from the beginning that a holistic approach is essential: considering and communicating both the biblical message about God’s purpose for His creation and the relevant practical issues: ecological, economic, cultural and political.

Production of the handbook was considered to be the top priority for this agenda. The aim was for it to fill a significant gap by providing a comprehensive (but far from exhaustive) resource in both basic English and Neo-Melanesian (Tok Pisin). It is meant to provide a useful and easily accessible foundation for church leaders, educators, local “practioners” connected with the various technical sectors and community motivators. The hope is that, as a result, many in PNG will be better informed about the issues, more highly motivated and committed to respond to the challenges of environmental care, protection, conservation, and rehabilitation, and better equipped to ensure that their responses are appropriate and effective.

Of course the handbook will need to be used in conjunction with other materials, especially those covering the technical aspects of environmental responsibility in more depth and detail and those designed for communication and education in specific contexts. Some of these materials exist already; others will need to be produced in the future.

Very deliberately, the handbook is focused on the teachings of the Bible. The publishers and writers believe that this is the best perspective and starting point for formation of healthy attitudes and motives in relation to the environment. Christians have often been criticised by environmental activists – either for their lack of concern or, worse, for being the main causes of environmental degradation. As we shall see, this criticism may be partly true. Whatever the case in that respect, there is no doubt that the biblical material can only mean that Christians ought to be taking the lead in practical environmental care; we have the
It almost goes without saying that we live in a beautiful, bountiful, marvellous world. Yet we see it being spoiled and polluted and degraded before our eyes. The situation in PNG was highlighted in very vivid and emotional terms by the participants in the Goroka consultation (2003) and the Goroka workshop (2004) mentioned above. These participants told personal stories of the changes in their childhood communities over the years since they were young. Almost without exception, the changes were dramatic and detrimental: dwindling rainforests, eroded hillslides, infertile soils, more frequent floods and landslides, silted up rivers, polluted and diminishing water supplies, poisoned and polluted streams, polluted air in the large towns, dying reefs, decreasing fish supplies, and reduced numbers of game animals.

The idea of working on a book that would give reasons for Christians to be involved in care of the environment arose from the experiences of a small conservation project at Hogave in the Lufa District of the Eastern Highlands. The people of this area were made aware of the many threats to their rainforest heritage, and the related impact on the whole

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* Peter Harris (International Director of A Rocha, a Christian environment organisation that he helped to found), in Environmental Concern Calls for Repentance and Holiness in God’s Stewards: The Role of Christians in Creation Care World Vision 2002, page 11.

i “game animals” – animals that are hunted for food and other products
Christians Caring for the Environment in Papua New Guinea

environment, and they were helped to act to conserve their forests while still maintaining their livelihood. (Further information about this project is included in Chapter 5)

Sadly, it is the human species, the pinnacle of creation, that is largely to blame for all the problems. In many cases, technical solutions are available, but these are not always widely understood. The remedy must include both technical knowledge and personal commitment. It will usually require group action and may even need strong political action.

For example, individuals and communities should:

• become more fully aware of the consequences of their destructive practices – and then work towards implementing constructive changes;

• participate in activities to reduce, reuse, and recycle waste to improve the environment;

• understand the ecological systems of an area and how to conserve and protect these systems – and take appropriate action;

• know how to enhance soil fertility using low-cost, environmentally-friendly methods – and adopt the best practices.

It is hoped that this handbook will suggest possible effective steps in all of these and more.

God has given mankind the responsibility of caring for the natural world and using its resources well. But we need to remember that, as well as being responsible for creation, we are part of it. When creation suffers, we suffer the most. When creation is healthy, we benefit.

“Human beings have become the predominant destructive force on Earth. With power of hands and minds amplified by machines, our impact exceeds that of great floods, hurricanes and earthquakes. The time has come when we can envisage the end of nature; the time has come to realise that we are able to destroy the Earth.”

* Calvin B. DeWitt “Creation’s Environmental Challenge to Evangelical Christianity” in Berry, R.J. “The care of creation: Focusing concern and action” IVP 2000
“Man is dependant on the physical environment. Thus when man becomes careless in the usage of his natural resources he faces all kinds of consequences.”

Suffering environment and suffering people

People have a particular value: this is why Christians can never treat the environment as a free-standing issue. Where nature is exploited, people are invariably being oppressed as well. The anguish of people and the suffering of nature are two sides of the same coin and it is irresponsible, if not impossible, to deal with one without also addressing the other.


Outline

- A Glossary, placed right at the beginning, before this introduction, gives explanations of the many technical and possibly unfamiliar terms that cannot be avoided in a book of this kind.

- Chapter 1 provides a brief overview of some of the main environmental issues affecting PNG.

- In Chapter 2 the main biblical teaching on the environment is summarised.

- Chapter 3 is a detailed survey of the biblical material referring to the environment.

- In chapter 4, background considerations such as economics, injustice, traditions and culture, national development and modernisation are related to the environmental issues facing PNG.

- In chapter 5 the main environmental issues relevant to PNG are discussed in detail, sector by sector.

- Chapter 6 provides some brief suggestions and pointers for Christian response.

- Three appendices are included:
  - “The Goroka Declaration on Christians and the Environment in PNG” which arose from the March 2003 Goroka consultation on Theology of the Environment – including a list of participants;
  - a list of the participants in the April 2004 workshop in Goroka that carried forward the process begun a year earlier to write this book;
  - selections from the writings of Kumalau Tawali, a renowned PNG author.

- Finally there are two lists: (a) a resource list including books and video tapes; and (b) relevant contact information.
Chapter 1

Key Environment Issues for PNG – in Global Context

The global context: seven degradations of creation

The World Council of Churches’ historic conference on “Justice, Peace, and the Integrity of Creation” held in Seoul, Korea in March 1990 stated:

“The destruction of the planet has approached an order of geological magnitude. The soil is eroded, 70 percent of the reefs where the fish breed are gone, the rivers are polluted from mine trailing, the forests reduced to bare ground. The world's people are wounded.”

This picture has been confirmed repeatedly, and without serious challenge, over the past half-century. Widespread awareness was precipitated by the publication in 1962 of Rachel Carson’s book Silent Spring which described the environmental consequences and health hazards resulting from the introduction into the environment of thousands of toxic substances – especially by industry and agriculture.

This increasing awareness gave rise to many environmental action groups and lobby groups. In many countries new laws have been passed, which are intended to protect the environment. And there have been impressive improvements in air and water quality. People in the “developed” world have learned to conserve resources, recycle many materials, and view their world more ecologically. Alternative energy sources, such as using the sun and the wind, have been developed and used. But many environmental challenges remain unsolved, and new ones regularly come to our attention. Most importantly, a combination of ignorance, apathy, and economic greed have often hindered advances. Tragically, the strong environment-friendly laws in some countries have resulted in the shifting of polluting industries to countries with weaker laws. The main victims are the poor and defenceless, who are rarely compensated for the impacts on their health and livelihoods.

Despite the increasing awareness of environmental issues and some impressive advances in responding to these, the fact remains that there is still a grave crisis.
Christian biologist, Calvin B. DeWitt, has devoted a lifetime to studying God’s creation and promoting environmental awareness from a Christian perspective. He is Professor of Environmental Studies at the University of Wisconsin, Madison, and Director of the Au Sable Institute of Environmental Studies, and he has written many books and articles on the subject. Dr DeWitt is perhaps most famous for his summary of the global environmental crisis which he calls “seven degradations of creation”:

“An analysis of the scientific literature produces a picture of Earth’s destruction describable as ‘seven degradations of creation’. These degradations, all of which interact, include:

1. **Alteration of Earth’s energy exchange** with the sun, which results in accelerated global warming and destruction of the Earth’s protective ozone shield.
2. **Land degradation**, which destroys land by erosion, salinization and desertification, and reduces available land for creatures and crops.
3. **Deforestation**, which annually removes some 100,000 square kilometres of primary forest – an area the size of Iceland – and degrades an equal amount by over-use.
4. **Species extinction**, which finds more than three species of plants and animals eliminated from Earth each day.
5. **Water-quality degradation**, which defiles groundwater, lakes, rivers and oceans.
6. **Waste generation and global toxification**, which result from atmospheric and oceanic circulation of the materials that people inject into the air and water.
7. **Human and cultural degradation**, which threatens and eliminates long-standing human communities that have lived sustainably and cooperatively with creation, and eliminates a multitude of longstanding varieties of food and garden plants.”

In the same article, Dr DeWitt makes it very clear that it is people who are the main problem:

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\[i\] about one fifth the area of PNG

* Calvin B. DeWitt “Creation’s Environmental Challenge to Evangelical Christianity” in Berry, R.J. “The care of creation: Focusing concern and action” IVP 2000
1. Key Environment Issues for PNG - in Global Context

“Human beings have become the predominant destructive force on Earth. With power of hands and minds amplified by machines, our impact exceeds that of great floods, hurricanes and earthquakes. The time has come when we can envisage the end of nature; the time has come to realise that we are able to destroy the Earth.”

The PNG context

Anyone who is at all familiar with the nation of Papua New Guinea will easily appreciate that all of Dr DeWitt’s “degradations” (except perhaps the first) are represented in some way in PNG. The following list would be widely affirmed as pointing to the main environmental issues facing PNG.

- **Deforestation** (for logging, agriculture, and urban expansion);
- **Extinction of plant and animal species** (mainly as a result of loss of rainforests)
- **Soil erosion** (as a result of deforestation, inappropriate agriculture, and failure to protect soil surfaces or control water run-off);
- **Water pollution** (caused by mining activities, uncontrolled sewage disposal, industrial waste, agricultural run-off, chemical contamination, and community waste);
- **Marine degradation** (from over-fishing and pollutants carried by rivers and other land water);
- **Air pollution** (resulting from widespread burning for land-clearing and household fires, motor vehicle exhaust fumes, and factory smoke).

To these we might add two “challenges” taken from a list of global environmental challenges compiled by Christian author Tom Sine: *

- relocating the growing number of “environmental refugees”
- creating affordable energy alternatives.

All of these topics are addressed in some detail in Chapter 5.

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"Papua New Guinea's land and waters have provided sustenance and shelter to the people of the country for thousands of years. The spiritual and emotional links between the people and the environment are deep and strong, and most traditional cultures recognize this reciprocal relationship and consider each generation to be the custodians of natural resources, with an obligation to ensure that their benefits are passed on to future generations. This is a great strength, but today, as in communities all over the world, the traditional respect and the mutually supportive relationship between people and the environment is starting to come under threat as the lure of short-term benefit confronts long-term concerns for the preservation of the environment. As Crocombe asserts, "no traditional precedents exist for chainsaws, bulldozers, hunting rifles, metal traps, power torches, spear-guns, scuba gear, filament nets, dynamite, outboard motors or global markets for timber, coral, bird of paradise feathers, sea shells, clams for soup and nautilus shells for tourist mantelpieces." There are concerns regarding the unsustainable use of forests, pollution of streams and rivers by extractive industries, the need for clean drinking water and, in general, tradeoffs between development and environmental sustainability. This makes it critical that we begin to ask questions about the kinds of pressures that are beginning to be felt and the steps that need to be taken so the people of the country can both realize the economic benefits from the resources and ensure their long-term survival." #

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* Crocombe, Ron *The South Pacific, 2001*, University of the South Pacific, p.26

# *World Bank 2002, page 4*
Plutonium Pride
Light and heat in supersonic motion
Instantaneous evaporation of living flesh
Poisonous poison ever tasted –

PLUTONIUM

Continents and oceans suffocated
The earth breathes no more.

Once computerised - civilisation:
scientific and medical marvels
heart transplant
test tube babies
cosmonauts

Now only hideous desolation and destruction
dried skeletons of humanoids
steel bones of skyscrapers

A cold, parched planet

E X T I N C T!

Chapter 2

Theology of the Environment – Summary of Biblical Teaching

The Bible has much to say about the environment. An account of the key passages that refer directly to God’s creation is given in the next chapter. The following is a summary of that material.

Note that the words “environment” and “nature” (as it relates to the environment) are not used in the Bible. The key idea is God’s Creation: the world and all that is in it and the heavenly bodies. In this handbook the word “Creation” will usually be preferred to the others.

A. God the Creator

- Everything was created by God: Father, Son, and Holy Spirit.
- God is distinct from His creation (He is not part of it), yet He is not distant from it: He is present and active in every part; He never rests and He holds everything together.
- God continues to have power over His created world; the “miracles” of Jesus demonstrate this.
- God created great diversity (variety) on the earth.
- God created the ability of living things to reproduce.
- In the beginning, everything worked together properly just as God intended.
- God created mechanisms for constant renewal and restoration of the balances that He had established.
- The pinnacle of God’s creation is people – human beings.
- By the Incarnation (God entering His world as a person), Jesus both affirmed the “goodness” of the physical world and showed there is no dividing line between the physical and the spiritual.
- Creation is a witness to God’s greatness and it shows us much about His nature: for example that He is generous, and a God of order, and unimaginably wise and “clever”.

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B. **God’s attitude towards His creation**

- God loves His creation and is happy with His creation; He made it good and beautiful.
- God cares for His creation; Jesus affirmed that message by His actions and words.
- Part of God’s purpose in creation is to provide water, food, and shelter for people—and for all the creatures.
- The earth is full of raw materials, which can enhance and enrich every dimension of human existence.
- The whole “natural world” is loved and valued by God and given significant “rights”—quite apart from its usefulness to humans.

C. **God’s ultimate purpose for creation**

- The whole of creation shares fully in God’s plan for “salvation”.
- All of creation—humanity, animals, and the wider environmental infrastructure—will participate in the coming golden age.
- The earth that we inhabit will be both purged and restored; the “new earth” will not be discontinuous with the “old” earth.

D. **God’s expectation for the human inhabitants**

- People are of the same essence as the other living creatures, yet different and special because they are “created in the image of God”, given special responsibilities, and given the power to communicate with God.
- “*Made in the image of God*” points to (a) reflecting God’s character, (b) being under God’s authority, and (c) representing God on earth in a responsible way.
- God gives people the responsibility to do the work of looking after the created world and making wise use of it, including developing its resources.
- Just as God loves the land and the animals, so must His people.
- People are created equal; therefore all injustice is unacceptable to God (God created all; therefore he cares equally for all).
2. Theology of the Environment – Summary of Biblical Teaching

- Because of human sin, the created world was spoiled. All the relationships established by God were broken.
- God gave rules and regulations aimed at preserving and enhancing the fertility of the land.
- Disobedience to God will ultimately result in judgment, including destruction of the natural environment.
- The only suitable response is repentance, thankfulness, and worship.

Powerful in majesty, throned in the heavens –
Sun, moon and stars by your word are upheld;
Time and eternity bow within your presence,
Lord of the nations: we praise and adore.

Michael Saward
The following summary contained in an Evangelical Declaration on the Environment (Berry, 2000, page 18) is a helpful crystallisation of these points:

- The cosmos, in all its beauty, wildness, and life-giving bounty, is the work of our personal and loving Creator.
- Our creating God is prior to and other than creation, yet intimately involved with it, upholding each thing in its freedom, and all things in relationships of intricate complexity. God is *transcendent*, while lovingly sustaining each creature; and *immanent*, while wholly other than creation and not to be confused with it.
- God the Creator is relational in very nature, revealed as three Persons in One. Likewise, the creation which God intended is a symphony of individual creatures in harmonious relationship. The Creator’s concern is for all creatures. God declares all creation “good” (Gen. 1:31); promises care in a covenant with all creatures (Gen. 9:9-17); delights in creatures which have no human apparent usefulness (Job 39:41); and wills, in Christ, “to reconcile all things to Himself” (Col. 1:20).
- Men, women, and children, have a unique responsibility to the Creator; at the same time we are *creatures*, shaped by the same processes and embedded in the same systems of physical, chemical, and biological interconnections which sustain other creatures.
- Men, women, and children, created in God’s image, also have a unique responsibility for creation. Our actions should both sustain creation’s fruitfulness and preserve creation’s powerful testimony to its Creator.
- Our God-given, stewardly talents have often been warped from their intended purpose: that we know, name, keep, and delight in God’s creatures; that we nourish civilisation in love, creativity and obedience to God; and that we offer creation and civilisation back in praise to the Creator. We have ignored our creaturely limits and have used the earth with greed, rather than care.
- The earthly result of human sin has been a perverted stewardship, a patchwork of garden and wasteland in which the waste is increasing. “There is no faithfulness, no love, no acknowledgment of God in the land. . . . Because of this, the land mourns, and all who live in it waste away” (Hosea 4:1,3). Thus, one consequence of our misuse of the earth is an unjust denial of God’s created bounty to other human beings, both now and in the future.
- God’s purpose in Christ is to heal and bring to wholeness not only persons but the entire created order. “For God was pleased to have all His fullness dwell in Him, and through Him to reconcile to Himself all things, whether things on earth or things in heaven, by making peace through His blood shed on the cross” (Col. 1:19-20).
- In Jesus Christ, believers are forgiven, transformed and brought into God’s kingdom. “If anyone is in Christ, he is a new creation” (2 Cor. 5:17). The presence of the kingdom of God is marked not only by renewed fellowship with God, but also by renewed harmony and justice between people, and by renewed harmony and justice between people and the rest of the created world. “You will go out with joy and be led forth in peace; the mountains and the hills will burst into song before you, and all the trees of the field will clap their hands” (Isa. 55:12).
2. Theology of the Environment – Summary of Biblical Teaching

Creation-keeping discipleship

Professor Calvin B. DeWitt has coined the term “creation-keeping discipleship” to highlight the responsibility of all Christians to act in a committed and constructive way to care for God’s creation. He and others have suggested some essential attitudes and steps. But, firstly, it is important to make some background observations.

**Background**

Christian responsibility to care for the environment has been noted throughout the history of the church. Unfortunately, this has not always been given high priority or disciplined application. All too often it has been neglected, either because “spiritual” matters were regarded as more important, or because economic prosperity was the main focus.

> “Often Christians have been so other-worldly, and so conscious of the pollution of sin and the fall that they (we) have been unduly negative about creation. This should not be. The world is still something glorious and awesome. If it was good enough for the Psalmists and Paul it should be good enough for us.”

In recent years, the church has been blamed for the global environmental crisis. The most famous expression of this view was made by the scientific historian, Dr Lynn White in 1967. White argued that Christianity has put humanity at the centre of the universe, nature being viewed as existing for humans to use and exploit as they wish. According to White, by destroying the fear of spirits in natural objects, Christianity allowed humans to exploit and destroy the earth. (We may note a PNG example where a sacred tree in Adiba village, in the Western Province was destroyed by Christians.) These lead to both Christians and non-Christians doing what they like with the environment. There is some truth in the claims of Dr White and those who support his views. Too often, Christians have acted self-centredly; they have failed to emphasise the need for good stewardship and practical care for the earth, and have not opposed thoughtless and

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# Lynn White Jr. *The Historical Roots of Our Ecological Crisis* Science 155, 10 March 1967, pages 1203-1207
Christians Caring for the Environment in Papua New Guinea

greedy exploitation. To this extent we must repent and put our house in order.

However, Lynn White was mistaken in two ways. Firstly, it is not just Christian-based cultures that fail in environmental care; for example Marxist Communism has a very bad environmental record, and the nations of Japan, China, and Malaysia, none of them with Christian foundations, are among the worst in contributing to environmental degradation.

Secondly, the church has rarely used the creation story as a licence for destroying the environment. The key verses in Genesis 1 about subduing the earth and having dominion over it are usually interpreted in terms of stewardship and care, and responsibility to sustain the order of the world that God created – consistently with the message of Genesis 2 and the rest of the Old Testament. The dominant view through most of church history is that the creation message is God-centred, not man-centred. The failures of the church in relation to the environment have a broader base that is related to human ignorance, thoughtlessness, and selfishness.

In recent decades, there has been a growing call from within the churches for Christians to take their environmental responsibilities more seriously. The starting picture is very complex – for two key reasons: differences in denominational traditions, and the strong influence of culture. “The church is rooted in cultures which are so many and so various that inevitably the issue is approached very differently by Christian people and communities around the world. Christian leaders, whether working as environmental professionals or church leaders, have concerns that are extremely diverse.” *

Nevertheless, some common themes can be found. Many of these are covered by Calvin B. Dewitt’s list of biblical principles “to help bring disciples of Jesus Christ into proper relationship to creation”.

1. We must keep the creation as God keeps us. As God’s keeping of us is a loving, caring, nurturing and sustaining keeping, so must be ours of creation.

2. Theology of the Environment – Summary of Biblical Teaching

2. **We must be disciples of the Last Adam, not of the First Adam.** The key words are repentance, obedience, restoration, and reconciliation.

3. **We must not press creation relentlessly, but must provide for its Sabbath, or 7th year, or fallow rests which have been practised by our forefathers.** People, land, and creatures must not be relentlessly pressured.

4. **We may enjoy, but not destroy, the grace of God’s good creation.** The abundant gifts and fruitfulness of God’s creation are meant to be sustained and available for all generations.

5. **We must seek first the kingdom, not self-interest.** We must trust in God and submit to His Lordship in every area of life.

6. **We must seek contentment as our great gain.** Greed is a major cause of environmental irresponsibility; the antidote is to joyfully accept that God’s provision is sufficient, and His blessings are to be shared.

7. **We must not fail to act on what we know is right.** Knowing God’s requirements for stewardship is not enough; they must be practised, or they do absolutely no good. Hearing, discussing, singing and contemplating God’s message is not enough; we must do the truth, making God’s love for the world evident in our own deeds, energetically engaging in work and actions that are in accord, harmony, and fellowship with God, and God’s sacrificial love.

Following the Creator, Sustainer and Reconciler of all creation is much more than reading – or even acting upon – these seven biblical principles. But they can bring us more deeply into the scriptures and into contact with God’s wider creation. From this greater penetration and broader comprehension of God’s word and world we can become better disciples of Jesus Christ . . .

Our ultimate purpose is to honour God as Creator in such a way that Christian environmental stewardship is part and parcel of everything we do. Our goal is to make tending the garden of
creation in all its aspects an unquestioned and all-pervasive aspect of our service to each other, to our community, and to God’s world.*

Dr DeWitt goes on in the same article to suggest three practical steps for applying these principles:

1. **Awareness** (seeing, identifying, naming, locating) – consciously making ourselves aware of what is happening in God’s creation; only then can there be proper appreciation;

2. **Appreciation** (tolerating, respecting, valuing, esteeming, cherishing);

3. **Stewardship** (using, restoring, serving, keeping, entrusting) – especially:
   - restoring what has been abused in the past; this is practical reconciliation, and
   - serving – by maintaining, lovingly and caringly, that which we hold in trust

“Christian environmental stewardship – our loving care and keeping of creation – is a central, joyful, part of the human task. As communities of God’s stewards – as the body of the one who made, sustains, and reconciles the world – our churches and our lives can be, and must be, vibrant testimonies to our Redeemer and Creator.”*

Author Tom Sine agrees that churches should apply such principles and practices, but he is pessimistic about the prospects of this happening very much, at least in relation to modern materialistic cultures:

“We need to take a hard look at many of the fundamental assumptions underlying modern culture, especially our assumptions about what constitutes a better future. For much of the environmental degradation we are now experiencing is a direct by-product of seeing the better future in largely economic and materialistic terms – of ever-increasing consumerism. But as the church awakens to the emerging ecological

* Adapted from the article “Creation’s Environmental Challenge to Evangelical Christianity” in Berry, R.J. “The care of creation: Focusing concern and action” IVP 2000
* Adapted from the article “Creation’s Environmental Challenge to Evangelical Christianity” in Berry, R.J. ‘The care of creation: Focusing concern and action” IVP 2000
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crisis, I will be very surprised if leadership of any Christian tradition critically examines these assumptions. I am afraid what is more likely to happen is that we will continue to enjoy all the “perks” of our modern consumer culture while railing against the unpleasant side effects.

Working for the renewal of God’s created order, therefore, must begin with fundamentally calling into question the Western Dream of conquest and consumerism. It also demands we discover and embrace a new dream based upon a biblical vision that includes the restoration of the created order. And it requires the recovery of a vital spirituality and a re-examination of our relationship to all created life . . .

The biblical word shalom summarises the biblical vision of a future in which all things seen and unseen are united within the reign of the Creator. And that union can only take place when all that is twisted is made straight and the broken made whole. It is a non-hierarchical vision in which we live in harmony with the Creator God and all created life forever.” *

Tom Sine is talking about environmental renewal that starts with repentance, and this is the oft-repeated theme of most of his fellow Christian environmentalists. Theologian and pastor Dr Michael Northcott makes this point very strongly:

“A Christian environmental ethic involves as its first premise a confession of human sin and guilt for the desecration of God’s earth, and recognition that without the redemptive incarnation, crucifixion and resurrection of Jesus Christ, neither creation as a whole, nor humans within creation, are capable of recovering true relationality \(^i\) with the being of God. Similarly, the restoration of a just and respectful relationality \(^i\) between humans and created order depends upon the spiritual and embodied events of salvation that are focused in the life, death and resurrection of Christ. Confession of ecological sin, and the recognition of Jesus Christ as the locus \(^ii\) of ecological salvation, also involves a recognition of the anthropocentric \(^iii\) orientation that Christian theology, and, under its influence, secular modernity, have taken in the past. As earlier

* Tom Sine Wild Hope, Monarch, 1991, page 36

\(^i\) “relationality” – experience characterised by functioning in relationship

\(^ii\) “locus” – key starting point or point of reference

\(^iii\) “anthropocentric” – man-centred; making humans more important than anything else
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Christians recognised, and often expressed in stone, carols, icons and theology, on the holy tree of the cross of Christ the creation is healed and restored, and humanity’s sin, including sins against creation, is forgiven. Reconciliation and forgiveness are fundamental features of Christian ethics. Without reconciliation, we continue to inhabit an order characterised by sinfulness. It is also an essential element in a Christian environmental ethic. Environmental apocalyptic is very good at pointing the finger of blame and generating guilt. And judgment and guilt can so easily lead to denial, an inability to own shared human responsibility for environmental destruction and so to refusal to change.”

Dr Northcott goes on to emphasise the importance of worship (“praise of God as Creator, Governor and Upholder of all living things”), committed practice of the Christian virtues of love, justice, temperance, prudence, and courage, and finally, the building of active “communities of hope” having “as their focus the hope for the restoration of all created life that Christians find in the resurrection of Jesus Christ”.

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"apocalyptic" – prophetic messages

2. Theology of the Environment – Summary of Biblical Teaching
Chapter 3

Theology of the Environment – Biblical Foundations

Genesis chapters 1-3

The first few chapters of Genesis lay the foundation for all that the Bible declares about the environment (creation).

- **Everything was created by God.**
  
  1:1 *In the beginning God created the heavens and the earth.*
  
  God spoke and it was done (compare Psalm 33:6, John 1:3, Hebrews 11:3).

- **The role of the Spirit of God is mentioned right at the beginning.**
  
  1:2 . . . *the Spirit of God was hovering over the waters.*

> “It is important that each person of the Godhead is seen as active in creation. God the Father was active in creation (1 Corinthians 8:6). God the Son was active in creation (John 1:3; 1 Corinthians 8:6; Colossians 1:15-18). God the Holy Spirit was active in creation (Genesis 1:2).” *

- **God loves His creation and is happy with His creation.**

  In Genesis chapter 1 this is emphasised by the repeated refrain:

  > And God saw that it was good (verses 4,10,12,18,21,25).
  
  Verse 31 is even stronger:

  > God saw all that He had made, and it was very good.
3. Theology of the Environment – Biblical Foundations

Genesis chapter 2 begins with the seventh day of creation which signifies that the work is complete: God was satisfied with a job well done.

2:2 . . . God had finished the work He had been doing; so on the seventh day He rested from all His work.

What God created was both useful and beautiful:

2:9 And the LORD God made all kinds of trees grow out of the ground – trees that were pleasing to the eye and good for food.

“The emphasis on the goodness of creation in the first two chapters means that the theological significance of this point must be of at least equal importance with other key doctrines of the Bible.”

We may note a link between God’s love of creation in Genesis 1 and the well-known verse John 3:16:

“For God so loved the world that He gave His one and only Son.”

The Greek word for “world” is kosmos – not just the world of human beings, but the earth and all its inhabitants.

• God created great diversity on the earth.

A rich variety of plants and living creatures (and we may add microorganisms) were created to inhabit the earth, the sea and the air:

1:11-12 Then God said, “Let the land produce vegetation: seed-bearing plants and trees on the land that bear fruit with seed in it, according to their various kinds.” And it was so. The land produced vegetation: plants bearing seed according to their kinds and trees bearing fruit with seed in it according to their kinds.

1:20-21 And God said, "Let the water teem with living creatures, and let birds fly above the earth across the expanse of the sky.” So God created the great creatures of the sea and every living and moving thing with which the water teems, according to their kinds, and every winged bird according to its kind.

* Pastor Dulu Kiase, Evangelical Church of PNG, Mt Hagen.
Christians Caring for the Environment in Papua New Guinea

- **God created the ability of living things to reproduce:**

  1:22  God blessed them and said, “Be fruitful and increase in number and fill the water in the seas, and let the birds increase on the earth.”

  In the beginning God created (Genesis 1:1)
  On the seventh day He rested from all His work (Genesis 2:2)

- **In the beginning, everything worked together properly just as God intended.**

  For example, the soil provided nutrients for the plants and the plants provided food for the animals:

  1:29, 30  Then God said, “I give you every seed-bearing plant on the face of the whole earth and every tree that has fruit with seed in it. They will be yours for food. And to all the beasts of the earth and all the birds of the air and all the creatures that move on the ground – everything that has the breath of life in it – I give every green plant for food.”
• People are special.

The pinnacle of God’s creation is people – human beings. Biologically, people are of the same essence as the other living creatures:

- they are included among the land animals created on the sixth day of Genesis chapter 1;
- both animals and people are commanded to “be fruitful and increase in number” (1:22 compare 1:28);
- animals and people are provided with the same kinds of food (1:29, compare 1:30);
- humanity is “formed . . . from the . . . ground” (2:7); so are birds and beasts (v 19).

Yet humans are special and different from all the other animals because they are “created in the image of God” and given special responsibilities.

1:26-27 Then God said, "Let us make man in our image, in our likeness, and let them rule over the fish of the sea and the birds of the air, over the livestock, over all the earth, and over all the creatures that move along the ground."

So God created man in his own image,
in the image of God he created him;
male and female he created them.
There is much debate about the meaning of “made in the image of God” (Genesis 1:26-27).

At the very least, it points to people possessing some (but obviously not all) of God’s characteristics, such as those shown in this passage: love, care, generosity, order, appreciation of beauty, and ability to form relationships. This fits with Genesis 2:15 “The LORD God took the man and put him in the Garden of Eden to work it and take care of it”.

Secondly “made in the image of God” surely means that people are not gods; they have no authority of their own. Our authority is delegated authority. It is as “images of God”, not as autonomous, independent beings, that human persons are to “subdue the earth” and have “dominion” over other creatures. It is as creature, not as God, that government on the earth is to be undertaken, because the kingdom is really God’s and does not belong to its human tenants. It is not ours to deal with as we will. We are only stewards of the garden, expected to act consistently with God’s own character.

Thirdly “made in the image of God” has been taken as emphasising our calling to act as God’s deputies on earth. Our calling is to be a divine image-bearer in the midst of creation, to govern creation on God’s behalf and as His representative, to be like God in respect of the rest of creation. Long before we get to Genesis 3 and the “fall” it involves decisive action and effort, even struggle, to consolidate and extend the creative acts of God. This is essential to God’s overall plan.

Genesis chapters 2 and 3 show that people are also special because they are invited to communicate with God and they are created with a capacity to relate to God.

Examples:

2:16 And the LORD God commanded the man . . .

2:19 Now the LORD God had formed out of the ground all the beasts of the field and all the birds of the air. He brought them to the man to see what he would name them; and whatever the man called each living creature, that was its name.
3:8,9  Then the man and his wife heard the sound of the LORD God as He was walking in the garden in the cool of the day, and they hid from the LORD God among the trees of the garden. But the LORD God called to the man, “Where are you?”

- God gives people the responsibility to do the work of looking after the created world and making wise use of it.

Added to God’s expectation for people “to rule over all the earth” (1:26) are His commands “to fill the earth and subdue it” (1:28) and “to work it (the Garden of Eden) and take care of it” (2:15).

Taken together, these verses give a full and clear picture of what God intends for people in relation to His creation: to protect and conserve (even “restore”) it while using it constructively to meet needs. The human task of developing the resources that are part of the created world is clearly central to human life and purpose.

This task is sure to be successful, for it flows from an open relationship between humans and the Creator God who made them and remained in fellowship with them. But it is not “effortless”. It needs much thought, effort and ingenuity – self-giving that may be compared with God’s self-giving in creating humans:

2:7  the LORD God formed the man from the dust of the ground and breathed into his nostrils the breath of life, and the man became a living being.

- The Creation shows us what God is like.

For example, He is a God of order.

1:12  The land produced vegetation: plants bearing seed according to their kinds and trees bearing fruit with seed in it according to their kinds.

1:16-18  God made two great lights – the greater light to govern the day and the lesser light to govern the night. He also made the stars. God set them in the expanse of the sky to give light on the earth, to govern the day and the night, and to separate light from darkness.

1:25  God made the wild animals according to their kinds, the livestock according to their kinds, and all the creatures that move along the ground according to their kinds.
And He is a generous God.

1:22 God blessed them.
1:28 God blessed them.
1:29-30 Then God said, “I give . . . I give . . .”

Finally God is unimaginably “clever” – the great designer and artist and “craftsman”; the use of the verb “formed” (2:7,8,19) emphasises the great skill of the Creator in this work. This is a repeated theme in the Old Testament, especially in the Psalms and the prophets; for example, Jeremiah 10:12

But God made the earth by his power; he founded the world by his wisdom and stretched out the heavens by his understanding.

Note also Proverbs 3:19-20

By wisdom the LORD laid the earth’s foundations, by understanding he set the heavens in place; by his knowledge the deeps were divided, and the clouds let drop the dew.

• Because of human sin, the created world was spoiled.

The creation continued to function, but not as well as before. It needed more hard work by people to keep it operating well.

3:17-19 To Adam He said . . . “Cursed is the ground because of you; through painful toil you will eat of it all the days of your life. It will produce thorns and thistles for you, and you will eat the plants of the field. By the sweat of your brow you will eat your food until you return to the ground, since from it you were taken; for dust you are and to dust you will return.”

“Since the possibility of human responsibility for creation is based on a wholesome relationship with the Creator, the fact that things have gone so badly wrong ought to warn Christians that the root cause lies in a disturbed relationship with the Creator. This is, in fact, the way the problem is explained in Genesis 3.”*

* Ron Elsdon Greenhouse Theology: Biblical Perspectives on Caring for Creation
Monarch 1992, page 70
The words “rule” and “subdue” are very important and need to be properly understood. Christians have been criticised for using these commands as licence for thoughtless destruction of nature and selfish exploitation of the earth’s resources for their own benefit and pleasure. Admittedly the language of these commands is very strong. The Hebrew word translated “subdue” means “conquer” – usually by military action. The word for “rule over” is the language of government – kings governing their subjects, the nation Israel ruling over those who had previously oppressed it, the upright ruling over the wicked – especially royal government, with all its associated tasks of establishing and maintaining justice. The words imply aggressive action taken by a would-be king to win his kingdom and then to govern it well. Such language is not welcome to many who hold a more romantic vision of the world, a vision that knows only of harmony in the origin of things, nothing of struggle. But Genesis chapter 1 views nature as something requiring constantly to be governed if life is to flourish; and human beings have been given this task of governing as kings of this newly-created kingdom. But this does not mean we are free to do as we please. There are two main reasons. Firstly, the context of the verses talks about people being created in the image of God. This suggests that we should be loving and caring and responsible, reflecting the character of God the Creator that is being pictured in this passage. He wants it all to work together properly. He wants it to be blessed. He wants it to provide for needs. “Made in the image of God” also suggest that any authority given can be no more than delegated authority; there is no autonomy. Secondly, the Hebrew idea of kingship is not about acting harshly and selfishly. The ideal king pictured in the Old Testament is the shepherd king – exercising authority over his subjects but also totally responsible for their welfare. This is supremely portrayed in Psalm 72, whose opening words are:

“Endow the king with your justice, O God, the royal son with your righteousness. He will judge your people in righteousness, your afflicted ones with justice. The mountains will bring prosperity to the people, the hills the fruit of righteousness” (verses 1 and 2).

In summary, the words “rule” and “subdue” convey the idea of responsible care, not violent control nor selfish exploitation.
Summary: These chapters may be summarised by way of a diagram:

The triangle pictures the main theme of creation: “Relationships”.

The three lines:
- God’s relationship with the earth and its creatures: ownership, love, care.
- God’s relationship with people: love, fellowship, blessing, expectation of trust, and worship.
- God’s ideal plan for the relationship of people with the earth and its other creatures: stewardship.

The three corners (angles):
- God – perhaps the use of the plurals “we” and “us” hints at the Trinity and the fact of relationships between the Persons of the Godhead (1:2 refers to the Spirit of God and Colossians 1:15-17 adds that God the Son was the agent of creation).
- People – created “in the image of God”: therefore meant to be loving, caring, generous, etc.
- The Earth – all the parts working together properly, as purposed by God; interdependence.

* Based on ideas presented by Christopher J.H. Wright in *Living as the People of God* IVP 1983
This set of relationships is repeated again and again in the rest of the Bible, especially with respect to the nation of Israel – for which the corners of the triangle might be named “God”, “the people of God” and “the promised land”.

**Notice how key aspects are affirmed in the Psalms**: For example:

- *You brought forth the earth and the world* (90:2)
- *By the word of the LORD were the heavens made, their starry host by the breath of His mouth* (33:6)
- *In the beginning You laid the foundations of the earth, and the heavens are the work of Your hands* (102:25)
- *The earth is the LORD’s, and everything in it* (24:1a)
- *The LORD is good to all* (145:9)
- *You care for the land and water it; You enrich it abundantly* (65:9-10)
- *You renew the face of the earth* (104:30b)
- *The earth He has given to man* (115:16)
- *You made him ruler over the works of your hands* (8:6)
- *My help comes from the LORD, the Maker of heaven and earth* (121:2)
Note on interpreting the creation story

Genesis 1 is more like poetry than a detailed map. It is not focusing on timing or processes. Rather it is declaring great and wonderful truths:

- that our powerful and wise and generous God created the world and its life and the sun, moon, and stars,
- that the Creation is orderly and purposed and good,
- that the pinnacle of Creation is humankind,
- that God has special plans and privileges and responsibilities for humankind.

It does not attempt to answer questions about how and when. These questions are acceptable and important subjects for scientific study. Rather it answers questions of who and why. These questions are not addressed by science.

What is outlined in Genesis chapters 1 and 2 and described in other places is the big picture, observable by all who would care to open their eyes. It is wonderful, amazing, awe inspiring – whether we think of sheer beauty or function. The story highlights the great variety, the amazing complex of cycles, the finely tuned interaction between the different parts, and the plan for continuation of life far into the future.

“We should see God as a God of order, logic and reason, and as the master planner. The purpose of the Genesis account is not to answer all the questions of man. The purpose is not to make us astronomers or geologists. Rather, the purpose of the creation story is to lead us into worship of God Himself.” *

* Pastor Dulu Kiase, Evangelical Church of PNG, Mt Hagen
Psalm 104

Psalm 104 paints a beautiful picture of God’s relationship to His created world. Many of the ideas are similar to those of Genesis 1.

- **God is the great Creator of all things:**
  - **Verses 2b–9**
    
    *He stretches out the heavens like a tent*
    *and lays the beams of his upper chambers on their waters.*
    *He makes the clouds his chariot*
    *and rides on the wings of the wind.*
    *He makes winds his messengers,*
    *flames of fire his servants.*
    
    *He set the earth on its foundations;*
    *it can never be moved.*
    *But at your rebuke the waters fled,*
    *at the sound of your thunder they took to flight;*
    *they flowed over the mountains,*
    *they went down into the valleys,*
    *to the place you assigned for them.*
    *You set a boundary they cannot cross;*
    *never again will they cover the earth.*
  
  **Verses 24–26**
  
  *How many are your works, O LORD!*
  *In wisdom you made them all;*
  *the earth is full of your creatures.*
  *There is the sea, vast and spacious,*
  *teeming with creatures beyond number –*
  *living things both large and small.*
  *There the ships go to and fro,*
  *and the leviathan, which you formed to frolic there.*

There is an emphasis on the wonderful richness and diversity of created life and the wide distribution of the “creatures” over land and sea.

- **God is distinct from His creation.**

  He is not part of the creation. He is different. You cannot expect to find God inside “nature”. (“If you want to meet the cook, don’t expect to find her in the pie.”) This message is found throughout the
Psalm and it is developed even more clearly in Isaiah chapters 40 (especially verses 21–28) and 44 (especially verse 24).

- **Yet God is not distant from His creation.**

  He is very near. God is present and active in His creation; He never rests; He watches over the earth; He holds it all together (compare Colossians 1:17); He is constantly at work to hold it together and keep it working properly. He is not like a watchmaker who makes a watch and winds it up and leaves it to run by itself.

  Verse 10
  
  *He makes springs pour water into the ravines;*
  
  *it flows between the mountains.*

  Verses 13–16
  
  *He waters the mountains from his upper chambers;*
  
  *the earth is satisfied by the fruit of his work.*

  *He makes grass grow for the cattle,*
  
  *and plants for man to cultivate –*
  
  *bringing forth food from the earth:*

  *wine that gladdens the heart of man,*
  
  *oil to make his face shine,*
  
  *and bread that sustains his heart.*

  *The trees of the LORD are well watered,*
  
  *the cedars of Lebanon that he planted.*

  Psalm 139 teaches that although God is not part of the creation yet His Spirit is present in the whole of creation, sustaining it every moment of the day.

- **He cares for His creation.**

  He made it good and beautiful and He created mechanisms for constant renewal and restoration of the balances that He had established. Note verses 10, 13 and 16 (above) and also verse 30:

  *When you send your Spirit,*
  
  *they are created,*
  
  *and you renew the face of the earth.*
• **Part of God’s purpose in creation is to provide water, food and shelter for people – and for all the creatures.**

Note verses 12, 14, 15, 16 (above) and also:

Verse 11

*the wild donkeys quench their thirst*

Verses 17-18

*There the birds make their nests;*
  *the stork has its home in the pine trees.*
*The high mountains belong to the wild goats;*
  *the crags are a refuge for the coneys.*

Verses 21-22

*The lions roar for their prey*
  *and seek their food from God.*
*The sun rises, and they steal away;*
  *they return and lie down in their dens.*

Verses 27-28

*These all look to you*
  *to give them their food at the proper time.*
*When you give it to them,*
  *they gather it up;*
*when you open your hand,*
  *they are satisfied with good things.*

Many other Psalms contain this message. A beautiful example is Psalm 65:9-10

*You care for the land and water it;*
  *you enrich it abundantly.*
*The streams of God are filled with water*
  *to provide the people with corn,*
  *for so you have ordained it.*
*You drench its furrows*
  *and level its ridges;*
*you soften it with showers*
  *and bless its crops.*
Christians Caring for the Environment in Papua New Guinea

- The only suitable response to the message of Psalm 104 is thankfulness and worship.

Verse 1

Praise the LORD, O my soul.
O LORD my God, you are very great;
you are clothed with splendour and majesty.

 Verse 33

I will sing to the LORD all my life;
I will sing praise to my God as long as I live.

In fact this is exactly what is said to happen – **not just praise and worship by humans but by all of creation:**

**Psalm 148 is a magnificent expression of the whole of creation in a relationship of love and praise to God the Creator. All things are included in the anthem of praise, from the sun bringing its warmth and light (verse 3) to the stormy winds which also do God’s bidding (verse 8), from the lowliest creature living on earth (verse 10) to the greatest of the sea giants (verse 7), from the kings and rulers of empires (verse 11) to young children (verse 12).**

“Let every creature praise His holy name for ever and ever.”
(Psalm 145:21)

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3. Theology of the Environment – Biblical Foundations

Biblical descriptions and modern science:  
“Seven provisions of the Creator”  
Calvin B. De Witt has listed “seven provisions of the Creator” upon which creation, all creatures and human life depend. “These seven provisions – many of which are celebrated in Psalm 104 – are indicative of the remarkable integrity and beauty that have engendered awe, wonder and respect for the Creator and creation throughout the ages.

1. **Regulation of Earth’s energy exchange with the sun**, which keeps Earth’s temperatures at a level supportive of life through the longstanding greenhouse effect, and which protects life from the sun’s lethal ultraviolet radiation by filtering sunlight through the stratospheric ozone layer.

2. **Biogeochemical cycles and soil-building processes**, which cycle oxygen, carbon, water and other vital materials through living things and their habitats and build life-supporting soils and soil structure.

3. **Ecosystem energy transfer and materials recycling**, which continually energises life on Earth and allocates life-sustaining materials.

4. **Biological and ecological fruitfulness**, which supports and maintains the rich biodiversity of life on Earth by means of responsive and adaptive physiologies and behaviours.

5. **Water purification systems of the biosphere**, which distil, filter and purify surface waters and ground water upon which all life depends.

6. **Global circulations of water and air**, which distribute water, oxygen, carbon dioxide and other vital materials between living systems across the planet.

7. **Human ability to learn from creation and live in accord with its laws**, which makes it possible for people to live sustainably on Earth and safeguard the creation.”*

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* Calvin B. De Witt “Creation’s Environmental Challenge to Evangelical Christianity” in Berry, R.J. “The care of creation: Focusing concern and action” IVP 2000
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Job

The book of Job is one of the oldest stories in the Bible. It goes back many years before Abraham. Yet Job had a clear understanding of God the Creator.

In chapter 10, verses 8-13, Job appeals to the God who made him and then blessed him and cared for him. Note verse 12:

\[ \text{You gave me life and showed me kindness,} \]
\[ \text{and in Your providence watched over my spirit.} \]

• Chapters 38 and 39 are a magnificent poem in which God is the speaker.

God takes Job on a fascinating journey through His creation. The message is clear. God is the Creator of all things. What He created is wonderful. God enjoys pointing out some of the amazing details. He loves His creation and works continually to care for it.

Job’s response was total trust and humble acceptance of God’s will (40:4-5; 42:1-6). How could he question or argue with such a wise and mighty God? God is alive and active and He should be worshipped and obeyed.

These chapters (and the next two as well) also indicate that God delights in creatures which have no apparent usefulness for humans. Everything is valued first for its own sake – not for how it might contribute to human well-being.

• In chapter 31 Job draws two consequences from belief in God as Creator:

1. People are created equal. Therefore all injustice is unacceptable to God.

   Verses 13-15
   \[ \text{If I have denied justice to my menservants and maidservants} \]
   \[ \text{when they had a grievance against me,} \]
   \[ \text{what will I do when God confronts me?} \]
   \[ \text{What will I answer when called to account?} \]
   \[ \text{Did not he who made me in the womb make them?} \]
   \[ \text{Did not the same one form us both within our mothers?} \]

2. The land must be valued and not treated harshly; those who fail to care for it deserve to be punished.
3. Theology of the Environment – Biblical Foundations

Verses 38-40

if my land cries out against me
   and all its furrows are wet with tears,
if I have devoured its yield without payment
   or broken the spirit of its tenants,
then let briers come up instead of wheat
   and weeds instead of barley.

The story of the nation of Israel

Here and throughout the Old Testament, creation theology is the basis for human behaviour. This is especially clear in the rules given to the nation of Israel, the wisdom of the Psalmist and the writers of Proverbs, and the message of the prophets.

God’s concern for His creation is shown by the rules He gave to the nation of Israel.

• The starting point is that He owns the land.
  
  Note, for example, Leviticus 25:23
  
  *The land must not be sold permanently, because the land is Mine and you are but aliens and My tenants.*

  Since God alone owns the land, then no Israelite had the right to treat his own land as if he “owned” it, in the sense of being able to do as he liked with it.

• The second key point is that God cares for the land and never rests from watching over it.
  
  Deuteronomy 11:11-12
  
  *But the land you are crossing the Jordan to take possession of is a land of mountains and valleys that drinks rain from heaven. It is a land the LORD your God cares for; the eyes of the LORD your God are continually on it from the beginning of the year to its end.*

• Just as God loves the land and the animals, so must His people.
  
  o The laws given in Leviticus 25 relating to Sabbath years and the jubilee show that the land itself has the right to rest and renewal.
Verses 2 to 5
When you enter the land I am going to give you, the land itself must observe a Sabbath to the LORD. For six years sow your fields, and for six years prune your vineyards and gather their crops. But in the seventh year the land is to have a Sabbath of rest, a Sabbath to the LORD. Do not sow your fields or prune your vineyards. Do not reap what grows of itself or harvest the grapes of your untended vines. The land is to have a year of rest.

Verse 11
The fiftieth year shall be a jubilee for you; do not sow and do not reap what grows of itself or harvest the untended vines.

These rules were meant to ensure that the fertility of the land was not reduced by bad agricultural methods or by over use. This issue was taken up by the prophet Jeremiah, who expressed the fear that human greed and irresponsibility would destroy the fertility and productivity of the land:

Jeremiah 12:10-11

Many shepherds will ruin my vineyard
and trample down my field;
they will turn my pleasant field
into a desolate wasteland.
It will be made a wasteland,
parched and desolate before me;
the whole land will be laid waste
because there is no-one who cares.

The prophet Hosea had a similar message, warning of the impact of sin on all of life, whether on the land or in the air or in the sea:

Hosea 4:1-3

Hear the word of the LORD, you Israelites,
because the LORD has a charge to bring
against you who live in the land:
“There is no faithfulness, no love,
no acknowledgment of God in the land.
There is only cursing, lying and murder,
stealing and adultery;
they break all bounds,
3. Theology of the Environment – Biblical Foundations

and bloodshed follows bloodshed.

Because of this the land mourns,
and all who live in it waste away;
the beasts of the field and the birds of the air
and the fish of the sea are dying.”

- The animals, like the land, had the right to rest. They were included in the original command to keep the Sabbath (Exodus 20:10), and repeated later in the detailed explanation of the laws:

  Exodus 23:12
  Six days do your work, but on the seventh day do not work, so that your ox and your donkey may rest.

God’s concern for the well-being of animals is shown in other commands:

Deuteronomy 25:4
Do not muzzle an ox while it is treading out the grain.

Deuteronomy 22:6
If you come across a bird’s nest beside the road, either in a tree or on the ground, and the mother is sitting on the young or on the eggs, do not take the mother with the young.

In fact such a basic understanding of God’s care for all animals, indeed for all life on earth, was revealed much earlier – when God made a covenant (promise) both with Noah’s family and descendants and with “every living creature” to “remember” them all (Genesis 9:8-17). [“Remember” means to note a need and respond appropriately.]

Genesis 9:8-10, 15-17
Then God said to Noah and to his sons with him: “I now establish My covenant with you and with your descendants after you and with every living creature that was with you – the birds, the livestock and all the wild animals, all those that came out of the ark with you – every living creature on earth. . . . I will remember My covenant between Me and you and all living creatures of every kind. Never again will the waters become a flood to destroy all life. Whenever the rainbow appears in the clouds, I will see it and remember . . .” So God said to Noah,
“This is the sign of the covenant I have established between Me and all life on the earth.”

Note also God’s concern for animals expressed in His rebuke of Jonah:

Jonah 4:11

*Should I not be concerned* about Nineveh, that great city, in which there are more than a hundred and twenty thousand persons . . . *and also many animals?*

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**God delights in all His creatures**

“The Bible teaches both that the non-human creation has worth and significance, quite apart from its usefulness to humanity, and also that persons alone are created in God’s image and called to be stewards of God’s good garden.

Anyone who thinks God created the non-human world merely for the benefit of persons has not read the Bible carefully. God feeds the birds and clothes the lilies (Matthew 6:26-30). God watches over the deer hind in the mountains, counting the months of her pregnancy and watching over her when she gives birth, though she never encounters a human being (Job 39:1-2). In the story of the flood, God makes a covenant, not just with Noah and his family, but also with the non-human creation (Genesis 9:9-10). **Knowing that they all give joy to their Creator, Christians will treasure every species.**”

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- **God promises “blessing”** (sufficient seasonal rain and continuing fertility of the soil) as long as His instructions are obeyed.

Leviticus 26:3-5:

*If you follow My decrees and are careful to obey My commands, I will send you rain in its season, and the ground will yield its crops and the trees of the field their fruit. Your threshing will continue until grape harvest and the grape harvest will continue until planting, and you will eat all the food you want.*

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* Ronald Sider *Biblical Foundations for Creation Care* in R.J.Berry *The Care of Creation* IVP 2000, page 47

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God made the promise (covenant) with Israel. The people then had to make a choice: live obediently and be prosperous, or live disobediently and face ruin on every level, including a polluted and infertile land. Note Deuteronomy 28:

Verses 2-6

All these blessings will come upon you and accompany you if you obey the LORD your God: You will be blessed in the city and blessed in the country. The fruit of your womb will be blessed, and the crops of your land and the young of your livestock – the calves of your herds and the lambs of your flocks. Your basket and your kneading trough will be blessed. You will be blessed when you come in and blessed when you go out.

Verses 11-12

The LORD will grant you abundant prosperity – in the fruit of your womb, the young of your livestock and the crops of your ground. . . The LORD will open the heavens, the storehouse of his bounty, to send rain on your land in season and to bless all the work of your hands.

The opposite to such blessing is cursing:

Verses 15-19

However, if you do not obey the LORD your God and do not carefully follow all His commands and decrees I am giving you today, all these curses will come upon you and overtake you: You will be cursed in the city and cursed in the country. Your basket and your kneading trough will be cursed. The fruit of your womb will be cursed, and the crops of your land, and the calves of your herds and the lambs of your flocks. You will be cursed when you come in and cursed when you go out.

Verses 22-24

The LORD will strike you with . . . scorching heat and drought, with blight and mildew, which will plague you until you perish. The sky over your head will be bronze, the ground beneath you iron. The LORD will turn the rain of your country into dust and powder.

This is not theoretical theology; it is about how to live successfully.
The curses resulting from disobedience may seem rather harsh, but they must not be ignored. They are important precisely because God loves His creation and wants it to be treated with care. The starting point is God’s generosity and His desire to bless.

The Psalmist recognised and understood this point clearly. God the Creator demands obedience (for the good of all) but most importantly He is the God of grace: He is the giver of unconditional help:

Psalm 121:1-2

*I lift up my eyes to the hills –
where does my help come from?*

*My help comes from the LORD,
the Maker of heaven and earth.*

God is the Creator of all: therefore He cares for all and He does not have favourites:

Psalm 145:9

*The LORD is good to all,
He has compassion on all He has made.”*

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**Natural resources in the Old Testament**

“The earth is crammed full of raw materials which can enhance and enrich every dimension of human existence. Genesis 2:12 mentions gold, aromatic resin and onyx; while Cain and Abel were agriculturalists (Genesis 4:2-5), Cain later built a city (Genesis 4:17, (though we cannot make too much of this – the Hebrew word can refer to human settlements both great and small); Tubal-Cain made tools from bronze and iron (Genesis 1:22). Exodus 35-39, with its detailed instructions for the construction of the Temple, shows how this diversity can be incorporated into worship, the highest activity of which we are capable. The land Israel received as a covenant gift was a land flowing with milk and honey’ (Ex 3:8, etc).”*

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* Ron Elsdon Greenhouse Theology: Biblical Perspectives on Caring for Creation
Monarch, 1992
3. Theology of the Environment – Biblical Foundations

- The prophets confirmed the message that disobedience to God would ultimately result in judgment, including destruction of the natural environment:

  Jeremiah 4:23-26
  
  I looked at the earth,  
  and it was formless and empty;  
  and at the heavens,  
  and their light was gone.  
  I looked at the mountains,  
  and they were quaking;  
  all the hills were swaying.  
  I looked, and there were no people;  
  every bird in the sky had flown away.  
  I looked, and the fruitful land was a desert;  
  all its towns lay in ruins  
  before the LORD, before his fierce anger.

  Jeremiah 5:23-25
  
  But these people have stubborn and rebellious hearts;  
  they have turned aside and gone away.  
  They do not say to themselves,  
  ‘Let us fear the LORD our God,  
  who gives autumn and spring rains in season,  
  who assures us of the regular weeks of harvest.’  
  Your wrongdoings have kept these away;  
  your sins have deprived you of good.

  This was the key point in God’s opposition to Ba’al worship. To pray to the local Canaanite fertility gods was to show a lack of trust in God the Creator to keep His promise to provide for all needs.

- In Deuteronomy 20:19, the “natural world” (represented by trees) is given basic rights that are even greater than the most pressing human needs:

  When you lay siege to a city for a long time, fighting against it to capture it, do not destroy its trees by putting an axe to them, because you can eat their fruit. **Do not cut them down. Are the trees of the field people, that you should besiege them?**
God and Ba’al

“There appears to have been a prolonged struggle in early Israel to bring them to realise that the LORD, the victorious God of their redemptive history, was also entirely competent in the matter of land use, rain, fertility, crops, and herds. The tendency to regard the Ba’als of the previous occupants of the land as more likely to ‘produce the goods’ in the economic realm seemed ineradicable, from the conquest to the exile.

This issue is explicitly tackled by Hosea, although it can be seen as early as Elijah and as late as Jeremiah. Speaking of Israel’s self-prostitution to the Ba’als as ‘lovers’, Hosea declares:

She said, ‘I will go after my lovers, who give me my food and my water, my wool and my linen, my oil and my drink.’ She has not acknowledged that I was the one who gave her the grain, the new wine and oil (Hos. 2:5,8).” *

• God’s concern for the environment is also shown by His command about the correct disposal of “human waste”.

Deuteronomy 23:13

Designate a place outside the camp where you can go to relieve yourself. As part of your equipment have something to dig with, and when you relieve yourself, dig a hole and cover up your excrement.

• Isaiah (11:1-9) includes all of Creation – humanity, animals, and the wider environmental infrastructure – in the coming golden age that was longed for by the people of Israel:

The wolf will live with the lamb,
the leopard will lie down with the goat,
the calf and the lion and the yearling together;
and a little child will lead them.

The cow will feed with the bear,
their young will lie down together,
and the lion will eat straw like the ox.
The infant will play near the hole of the cobra,

* Christopher J.H. Wright Living as the People of God IVP 1983, page 60
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and the young child put his hand into the viper’s nest.
They will neither harm nor destroy
on all my holy mountain,
for the earth will be full of the knowledge of the LORD
as the waters cover the sea.

- **Creation is a witness, showing the greatness of God and giving insights about His nature.**

This is a frequent theme in the Psalms. For example:

Psalm 19:1

*The heavens declare the glory of God;
the skies proclaim the work of His hands.*

The apostle Paul builds on this understanding in his outreach to non-Jewish people.

Similarly, the prophet Isaiah calls on the people to “look to the heavens” and consider God’s greatness:

Isaiah 40:25-26

*To whom will you compare me?
Or who is my equal?” says the Holy One.*

*Lift your eyes and look to the heavens:
Who created all these?
He who brings out the starry host one by one,
and calls them each by name.
Because of his great power and mighty strength,
not one of them is missing.*

- **After the years of exile in Babylon, the people reaffirmed this basic doctrine of creation in words that were simple yet powerful:**

Nehemiah 9:6

*You alone are the LORD. You made the heavens, even the highest heavens, and all their starry host, the earth and all that is on it, the seas and all that is in them. You give life to everything, and the multitudes of heaven worship You.*

These words are a suitable climax to the Old Testament teaching and an introduction to the New Testament.
New Testament references

The Gospels

• Jesus taught about God’s care for plant and animal life, including His special concern for people and their needs.

Matthew 6:26 and 30

Look at the birds of the air; they do not sow or reap or store away in barns, and yet your heavenly Father feeds them. Are you not much more valuable than they? . . . If that is how God clothes the grass of the field, which is here today and tomorrow is thrown into the fire, will He not much more clothe you . . ?.

• Especially powerful is the picture of God keeping records about His creatures. He personally knows and values them all. Jesus makes the point of God’s detailed care by pointing to the humble sparrow:

Luke 12:7

Are not five sparrows sold for two pennies? Yet not one of them is forgotten by God. Indeed, the very hairs of your head are all numbered. Don’t be afraid; you are worth more than many sparrows.

We are reminded of the word of the Psalmist:

Psalm 50:10-11

for every animal of the forest is mine,
and the cattle on a thousand hills.
I know every bird in the mountains,
and the creatures of the field are mine.

A matching theme is God’s personal accounting for the stars noted in Isaiah 40:26: He “calls them each by name” and “not one of them is missing”.

• Jesus often used the elements of “nature” in his teaching and preaching – indicating His own special interest in the details of creation: soil, water, rain, the wind, the seasons, harvest fields, seeds, weeds, trees, fruit, vines, sheep, donkeys, oxen, birds, eggs, the hen and its chickens, fish, snakes.

• Jesus showed himself to be the Lord of creation by his “miracles” – numerous acts of physical healings, expulsion of spirits, changing
water into wine, multiplying loaves and fish, calming a storm, walking on water, raising Lazarus from the dead.

- Jesus’ most important connection with “theology of the environment” is the Incarnation. The Creator entered His own creation in human form.

John 1:1-3 and 14

> In the beginning was the Word, and the Word was with God, and the Word was God. He was with God in the beginning. Through Him all things were made; without Him nothing was made that has been made. The Word became flesh and made His dwelling among us. We have seen His glory, the glory of the One and Only, who came from the Father, full of grace and truth.

In doing this, Jesus showed there is no dividing line between the physical and the spiritual, and proved beyond any question that Platonism is false. Platonism – the idea that all physical matter is sinful in comparison to the spirit or the powers of reason (which are good) – has often influenced the teachings of the church, leading to a neglect of social and economic issues, as spiritual matters are given far more importance. To quote the great Christian thinker and writer C.S. Lewis: “There’s no good trying to be more spiritual than God . . . He likes matter. He invented it.” *

**Acts and the Letters (Epistles)**

- The Apostle Paul used the message of God as the Creator who is alive and active and generous as a starting point for preaching the gospel to “Gentiles” – Greeks, Romans and other people without a Jewish background.

Acts 14:17

> Yet he has not left Himself without testimony: He has shown kindness by giving you rain from heaven and crops in their seasons; He provides you with plenty of food and fills your hearts with joy.

Acts 17:27

> From one man He made every nation of men, that they should inhabit the whole earth; and He determined the times set for them

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* C.S. Lewis *The Case for Christianity* Simon & Schuster 1996, pages 54-55
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and the exact places where they should live. God did this so that men would seek Him and perhaps reach out for Him and find Him, though He is not far from each one of us.

In his letter to the Romans (1:20), Paul takes up the same theme: 
*For since the beginning of the world God’s invisible qualities – His eternal power and divine nature – have been clearly seen, being understood from what has been made, so that men are without excuse.*

As in the Old Testament, the Creation is seen as a most important witness to the character of the Creator.

**The perfect creation is God's greatest and most persistent evangelist.**

Paul’s statement “*We are God’s offspring*” (Acts 17:29) is very significant. It links closely to Genesis 1:27 (“in the image of God He created him”) and to Job’s insight that if God is the maker of every person then injustice is totally unacceptable (Job 31:13-15). The conclusion is unavoidable: all people are created equal.

- The Apostle Paul understood that Christ the Son of God shared in carrying out the work of creation and that He continues working to maintain it all:

  1 Corinthians 8:6
  *
  **Yet for us there is but one God, the Father, from whom all things came and for whom we live; and there is but one Lord, Jesus Christ, through whom all things came and through whom we live.**

  Colossians 1:15-17
  *
  **He [Christ] is the image of the invisible God, the firstborn over all creation. For by Him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things were created by Him and for Him. He is before all things, and in Him all things hold together.**

Paul affirms both the physical nature of creation and, through Christ, the presence of God in every part of it.

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* Calvin B. DeWitt *Earth Wise* CRC 1994, page 54
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• Furthermore the whole of creation shares fully in God’s plan for “salvation”. Through the death of His Son, God wants “to reconcile all things to himself” (Colossians 1:20).

Paul repeats this idea in Romans 8:18-23 – but with the added affirmation that all the parts of creation (humans, animals, and the wider environment) are interrelated and awaiting a time when they will be fully set free from their suffering.

Romans 8:19-22

The creation waits in eager expectation for the sons of God to be revealed. For the creation was subjected to frustration, not by its own choice, but by the will of the One who subjected it, in hope that the creation itself will be liberated from its bondage to decay and brought into the glorious freedom of the children of God. We know that the whole creation has been groaning as in the pains of childbirth right up to the present time.

• 2 Peter 3:5-13 points to the hope of “a new heaven and a new earth” and this theme is taken up at the end of the book of Revelation (21:1).

The new heaven and new earth

Careful study shows that “the language of 2 Peter is not of destruction in the sense of complete obliteration but of purging and transformation – as happened with the flood. Just as Jesus’ resurrection body was the same yet different, so it will be with the new heaven and new earth. There will be dramatic and cataclysmic change, there will be judgment and fire to get rid of the evil – there will need to be violent change if snakes, lions, and wolves are to become harmless, and if all sickness and suffering are to be destroyed. But there will also be continuity – the new earth will bear some relation to the old one, just as the new Dave Bookless will bear some relation to the old sinful one. If you read the book of Revelation carefully, where the whole earth continues to give glory to God right up until the new earth and new heaven appear, you will see this very clearly.” *

Hebrews

The writer of Hebrews begins the famous passage on faith with an affirmation about the origin of the universe (11:3) –

By faith we understand that the universe was formed at God’s command, so that what is seen was not made out of what was visible.

God did not simply shape and arrange existing materials; He brought it all into existence.

Revelation

The book of Revelation confirms the teaching of the rest of Scripture about God the Creator. The heavenly worshippers sing repeatedly (4:11)

“You are worthy, our Lord and God, to receive glory and honour and power, for You created all things, and by Your will they were created and have their being.”

We find similar affirmations in 10:6

[The angel] swore by Him who lives for ever and ever, who created the heavens and all that is in them, the earth and all that is in it, and the sea and all that is in it.

and 14:7

Worship Him who made the heavens, the earth, the sea and the springs of water.

Revelation also records God’s attitude toward those who do not care for the earth. God promises judgment on those who cause destruction:

Revelation 11:18

The time has come . . . for destroying those who destroy the earth.

Finally, Revelation 21:1 points to “a new heaven and a new earth”, repeating the words of Isaiah 65:17 and 2 Peter 3:13. But, as we have seen, the old earth will not be completely destroyed; rather it will be renewed and restored, and it will have clear continuity with the new earth. In Revelation, the whole earth continues to give glory to God right up until the new earth and new heaven appear. This is a message of hope. And it affirms the eternal relevance of our physical world.
The Church is not only called to minister to the spiritual component of mankind but also to the physical and social aspects. These are closely linked to the natural environment in which we live. In our ministry we must be mindful of the fact that Christian morality includes very important principles for taking care of the environment. Therefore the Church cannot avoid addressing environmental issues in the light of the gospel.

“I believe biblical faith provides a solid foundation for caring for the creation entrusted to us by the Creator. Perhaps if more Christians engage in environmental practices that were consistent with biblical teaching more environmentalists would be ready to explore again the claim that a biblical framework would offer our best hope for a comprehensive Earth healing.”

* Pastor Mathew Tapus, Christian Apostolic Fellowship, Mount Hagen
# Ronald J. Sider Biblical Foundations for Creation Care, in R.J.Berry (ed.) The Care of Creation, Focusing Concern and Action IVP 2000, page 47
Chapter 4

*Key Environment Issues for PNG – Background Considerations*

1. Economic pressures and expediency

Is it more important to:

- conserve the fertility of the soil *than to* grow enough food?
- preserve the rain-forest *than to* survive economically from the sale of trees?
- minimise soil, water and air pollution *than to* lose jobs through closure of a factory?
- minimise soil, water and air pollution *than to* maximise crop production?
- protect endangered plant and animal species *than to* deprive thousands of people of water and hydroelectric power?
- keep the air clean and healthy *than to* use modern transport: motor vehicles and aeroplanes?

Such questions highlight a very important issue: the cost of caring for the environment. There are many reasons for the human actions that result in degradation of the environment. In some cases people simply follow their traditions – family, tribal and national – without understanding the consequences. In other cases people are aware of the environmental damage but believe that this is less important than the competing needs: for example to obtain food, to clear land for housing, to profit from minerals and timber, to secure water and power supplies, to cook food, to warm houses, or to use modern means of transport. This is very understandable. All of us act in ways that harm the environment in one way or another. Economic factors are often the most important.

All over the world economic pressures are resulting in damage to the environment. Everyone who cares about God’s creation and about the future of our world should be asking serious questions about this.

- Is this level of degradation inevitable and unavoidable?
- How long can it go on?
- What are the consequences – short term and long term?
- What alternatives are there?
4. Key Environment Issues for PNG - Background Considerations

- In what situations is it possible to be environmentally responsible without great economic sacrifice?

Some of these questions will be addressed in the following sections. The important point to note here is that we can usually afford to be optimistic about finding suitable solutions – but we may have to think carefully and work hard on these in a world that has developed strong habits of pursuing economic and other gains without proper concern for the environmental cost.

2. Injustice, marginalisation and survival

It is often claimed that environmental conservation is only possible for rich people.

We may ask whether it is fair to expect people who are struggling for survival to make economic sacrifices simply in order to preserve a few trees or to save a rare plant species or to maintain fish populations or to improve river water purity.

How much of the burden of “earthcare” should be borne by those who are already marginalised and exploited by unjust economic systems and who seem to have few, if any, alternatives? These are very important questions for much of the population of PNG.

A simple reply might be that survival is more important than worrying about the environment. But this is not adequate. A full answer must contain several parts:

- It is precisely conservation of the environment that is often the key to survival; history contains many examples of groups, even nations, that did not survive because they neglected the environment or did not know how to restore the damage.
- Appropriate technical solutions are available for most environmental problems – usually at low cost.
- In many cases investment in the environment will be more than repaid; it will result in a profit, not a loss.
- The success of conservation programs will often depend on appropriate political decisions and support – at least in part, and often at several levels; political will must go with technical skill.
- Alongside environmental conservation there is still the need to pursue justice: people, structures and systems that exploit and
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marginalise people must be confronted and changed so that survival does not remain such a difficult struggle.

3. Traditions, culture and modern science

Many traditional agricultural and forestry practices and other cultural elements have a positive impact on environmental conservation. In fact these customs have often been a major reason for the selective survival of many groups.

Examples of environmentally sound traditional practices:

• **nomadic cattle husbandry**
  
  **example**: the Fulani people of Sub-Saharan Africa who have no fixed settlements, but move with their cattle in search of water and feed; traditionally there was no over-grazing and the environment was conserved, but this has become increasingly difficult to sustain in face of increased populations, increased occupation of range land by settlers, and decreased rainfall;

• **low pressure slash and burn agriculture**
  
  **example**: hills tribes people of Southeast Asia who clear patches of forest or overgrown previous gardens by slashing and burning,
plant gardens in the ash then move on to a new patch after one or two years, allowing the land to regenerate over a period of 10 to 15 years before returning again;

- **multi-crop gardens**
  - **example**: the settled villages of Java where population pressures mean every available piece of land must be used sustainably; trees of many varieties help to conserve water and soils and the garden crops are rotated to reduce the risk of pest build-up and to make sure all plots receive the benefit of nitrogen-fixing plants;

- **terracing of hillsides**
  - **example**: most of the millions of rice farmers of East Asia; some (in the case of wet paddy fields) with a history of 1000 years of continuous production; terracing reduces soil erosion and conserves water;

- **recycling of animal and human waste products**
  - **example**: many parts of India and China where centuries of sustained fertility have been achieved by disciplined use of all or most manure, house-hold “waste”, and agricultural by-products – without burning;

- **balanced and gentle fishing methods**
  - **example**: traditional South Seas Islanders before the introduction of explosives and high technology equipment, and before encroachment of foreign commercial fishing fleets.

But do we always find such positive pictures among traditional groups? The answer has to be “No”. This can be demonstrated by way of a range of examples.

**Examples of environmentally unsound traditional practices:**

- **gardening methods that result in soil erosion and landslides**
  - **examples:**
    o Furrows that run up or down the hillside encourage water erosion of topsoil and reduce storage of water in the topsoil and subsoil.
    o Burning of agricultural residues deprives the soil of organic matter (which is important in supplying certain nutrients and for improving and stabilising soil structure) and surface mulch
(which is important to protect the soil surface from rain and sun and to reduce evaporation of soil moisture).

- Excessive digging or ploughing destroys soil structure and causes reduction in soil organic matter (ultimately producing extreme degradation of the soil, most notably huge “dust bowls” and deserts in the United States and Australia, but also in most areas of intensive agriculture).
- While removal of non-crop plants (trees, shrubs, groundcovers) may achieve the purpose of reducing competition for the main crop it may also have negative consequences on soil structure and water retention.

- **high pressure slash and burn agriculture resulting in depleted fertility**
  
  **examples:**
  - Cycles of more than fifteen years are contracted to less than ten years as garden land becomes increasingly scarce; such short cycles are not sufficient for replenishment of the soil fertility.
  - The burning activity associated with re-clearing gardens destroys important plant nutrients (nitrogen, phosphorus and sulphur) that accumulate in the natural regrowth.
  - As gardens become less productive there is further shortening of the cycles and added pressure to clear more forest areas to create new gardens.
  - Abandoned gardens are left to recover “naturally” without intentional use of green manures (plants that add nitrogen to the soil) to speed the recovery process.

- **open fireplace cooking and house-warming resulting in impaired health and rapid depletion of wood supplies**
  
  **examples:**
  - Open fireplaces are used for cooking in many parts of Africa, Asia and the Pacific. These are very inefficient, using approximately five times as much wood as a closed stove for the same useable heat, and the result is rapid removal of trees from the nearby forests. Usually there is no tradition of deliberate reforestation.
  - Smoke from cooking fires and household fires used for warmth and to repel insects pollutes the household air and then adds to
4. Key Environment Issues for PNG – Background Considerations

general atmospheric pollution. Smoke affects the lungs, causing cancer and other diseases and reducing lung efficiency.

- **over-exploitation of certain plants and animals often results in severe reduction in their numbers and even extinction of the species**
  - example:
    - The Maleo birds of Sulawesi, Indonesia, lay large eggs which are especially delicious as food and therefore in high demand in the markets of the villages and towns. As a consequence of uncontrolled collection of eggs as a source of immediate income these birds are almost extinct and the source of income has all but disappeared.

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**Hazards of village level “development”**

In his book *The Environment and Christian Ethics* CUP 1996 (pages 28-32), Michael Northcott analyses the impact of modern development on the environment. However he notes that it is not just development in the modern urban context that has caused serious environmental damage. So-called “third world rural village development” has also produced devastating consequences. The main effects have been noted already: deforestation, intensified agriculture, increased use of agricultural chemicals (resulting in pollution of soil and water), depletion of ground water supplies, and soil degradation. Northcott points out the key influences of (a) land scarcity and (b) inadequate knowledge of the roles common agricultural methods play in causing these problems.

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**Are “modern” approaches any better?**

The emphasis of modern agriculture has usually been on increased production and profit, not on environmental conservation and rehabilitation. However since 1962, following the publication of “Silent Spring” by Rachel Carson, the focus has been changing. Many of our modern agricultural practices have had a devastating negative effect on the environment and on people’s lives. Rachel Carson showed how the use of agricultural and industrial chemicals results in widespread pollution of soils, lakes and rivers, and this in turn poisons fish, birds, and animals and causes serious health problems for humans.
Examples of modern agricultural practices that damage the environment:

- Pesticides and herbicides used in large scale banana production by a multinational company near Davao City in the southern Philippines result in many health problems and premature death of plantation workers and neighbouring villagers.

- Chemical fertilizers introduced as part of the “green revolution” (the growing of high yielding hybrid rice developed by the International Rice Research Institute) in Java in the 1970s resulted in death of the paddy field fish, frogs and eels, all very important as food sources.

- Intensive irrigation of horticultural crops (fruit and other commercial crops grown in gardens and orchards) along the Murray River in Australia has resulted in increased salinity of the soils to the point that huge areas are no longer suitable for any kind of commercial agriculture or horticulture.

- Widespread use of mono-cropping systems (replacing traditional multiple crop systems) demanded by mechanisation of sowing and harvesting has encouraged build-up and spread of plant diseases, most notably with corn, potatoes, wheat, and cotton.

Many non-agricultural by-products of the modern world also damage the environment.

Examples:

- DDT spray, used to kill mosquitoes in the fight against malaria in the decades after World War II, poisons fish and birds and causes serious human health problems.

- Fumes and smoke from factories, aeroplanes and motor vehicles contain carcinogens (cancer producing chemicals) and “greenhouse gases” (adding to the mixture of natural and industrial gases in the atmosphere that help reduce heat loss from the earth).

- Self propellant spray cans release CFCs (chloro-fluoro-carbons) which destroy ozone in the upper atmosphere, thus allowing increased amounts of ultra-violet light to reach the earth’s surface.)
Impact of industrial and economic “development” on the environment

Many books and papers have been written about this subject. Note especially Michael Northcott’s excellent summary of the situation in his book “The Environment and Christian Ethics” (CUP 1996). Here is a key passage (page 32):

“At the beginning of the twentieth century most of the land area of the earth was unpolluted, its primal forests were mostly intact, the oceans were mostly free of litter and sewage, the rivers mostly ran free from sediment and human waste. Pollution and environmental destruction were primarily limited to the small area of the earth's surface affected by industrial development in Northern Europe and in parts of North America. By the end of this century there is not a stretch of ocean and very few areas of forest which do not show signs of the industrial and commercial transformation of the earth into a materials bank for human exploitation. The extent of human interference and disruption of natural systems can be measured three miles above the North Pole in the loss of protective ozone, and one mile deep in the rift valleys of the ocean floor in the polluted sediments which trickle down from the waste products of modern consumerism. Students in my classes from all over the world share stories of the effects of environmental breakdown in their own regions. Monsoons or the rains no longer come in their predictable seasons, the frequency of typhoons, hurricanes and flash floods grows alarmingly, and cities in many parts of the globe have become too hot for comfort because of deforestation and local climate change. And with environmental chaos comes social chaos and anarchy.

Environmental disaster is now the biggest single cause of the movement of peoples across the globe. In parts of China land has been totally degraded by efforts to meet the absurd agricultural and iron smelting targets of the Cultural Revolution and people in their hundreds of thousands are leaving now infertile rural areas for the cities every day, to form the largest single movement of peoples in the history of Asia. In parts of Africa the land is so dry that aid agencies must sink wells thirty or forty metres to reach the water table. Ecological breakdown is also a growing cause of armed conflict as well as social anarchy. Struggles over the diminishing areas of fertile land have intensified in recent years, and land struggles continue to form the focus for civil war and resistance movements in many parts of the world.”
Deceptive development in PNG

“... the damage caused to the environment by loggers, fishing companies and miners in some parts of PNG now places a great burden on the local inhabitants and their natural resources.

Their once-pristine rivers, waterways, forests, lakes, hunting grounds, sacred sites and land for gardening is now polluted, destroyed, depleted, and barren.

Pililau Kunig, from Barum village in Madang Province, said in 1972 a company came to Transgogol and started its operations following an agreement.

He said a patrol officer (named), a provincial politician (named) and a national politician (named) came and said: “Yupela orait na kampani kisim graun” (All of you must agree so that the company will come and take over your land).

“Bihain bai yupela kisim gutpela benefit long dispela kampani” (Later you will all get good benefits from this company).

“Dispela rot bai kolta i ron” (This road will be sealed).

“Tasol nau nogat” (But now this has not happened).

“Em giaman bilong kampani wantaim Gavman” (These are lies from the company and the government.)

Mr Kunig is a classic example of an indigenous resource owner who now lives with his people like landless beggars on their own land after selling it to the State and a foreign company.

They have sold their land in the name of “development”, a word so many times used by some corporate companies, politicians and selfish indigenous people to reap resources swiftly, cheaply, and carelessly.

We could go on and quote grievances from other resource owners but for now let’s take Mr Kunig’s case as an example of how bad the situation is today in PNG.”*
4. Sustainable development: heritage for our children and grandchildren

Increasingly, people around the world are realising that we have been living on our natural capital, using our earth’s resources at a rate that is rapidly depleting supplies. It has been too easy to pursue all the rewards of “development” without counting the cost to the environment or considering the morality of grabbing resources that are not renewable. Consequently the idea of “sustainable development” has assumed a central place in all debates about our approach to economics and the environment.

**Sustainable development** is development which “meets the needs of the present without compromising the ability of future generations to meet their own needs”. *

There is wide agreement that as a global community we must work to redress the balance. We must reverse our direction. We must abandon some old habits that are wasteful and damaging to the environment. We must be prepared to share more justly and generously across generations. We must be prepared to sacrifice some aspects of our affluent lifestyles.

Without care of our natural environment we will leave to future generations nothing but polluted air and water and degraded soils; our descendants’ well-being will be jeopardised.

"*We do not inherit the earth from our parents; we borrow it from our children.*" North American Indian proverb

Not all “development” is bad or damaging to the environment. We now know ways of balancing the needs of the current human population with the rights of future generations while ensuring conservation of the environment. Already many industries and governments have established environment-friendly policies. Many individuals and

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* World Commission on Environment and Development *Our Common Future* Oxford UP 1987
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communities have become aware of the issues and made appropriate changes in their personal and communal lives. Technologies that focus on conserving the environment are being developed all the time and at an increasingly rapid rate. Research on key environmental issues and problems areas has increased greatly in the past few decades. Many practical ideas and solutions have been tested and adopted.

We live in hope. But this will only be experienced if we continue to apply ourselves with strong commitment, sound knowledge and careful wisdom.
4. Key Environment Issues for PNG - Background Considerations
Chapter 5

Key Environment Issues for PNG – Detailed Analysis

Introduction

In 2002 The World Bank published “a snap-shot of key environmental trends” in PNG. The “2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR” was prepared by a team from the National Research Institute led by John Sowei and a World Bank team led by Neeraj Prasad. This Monitor will be quoted and drawn upon extensively in the following pages. The following table (page 5 of the Monitor) summarises the findings.

PAPUA NEW GUINEA: A SUMMARY OF ENVIRONMENTAL ISSUES

<table>
<thead>
<tr>
<th>THEMES</th>
<th>ISSUES</th>
<th>IMPACTS AND NEEDS</th>
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<tbody>
<tr>
<td>I. Land and the People</td>
<td>The biological diversity belongs to the people, and is managed under traditional land tenure systems.</td>
<td>The use of natural resources should be conducted in a manner that is sustainable, while respecting the traditional relationship between the land and the people. This would require:</td>
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<td></td>
<td>Forests provide the basis of livelihood and cultural life to the 80% of Papua New Guineans who live in rural communities.</td>
<td>▪ Working with landowners to encourage continuation of traditional sense of stewardship</td>
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<td></td>
<td>Food supplies from the forests and seas remain a central component of diet.</td>
<td>▪ Establishing strong partnerships among the key stakeholders, including landowners, government, NGOs, the private sector, etc.</td>
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<td>PNG is greatly dependent on primary commodity exports.</td>
<td>▪ Getting good data and information systems and providing realistic and useful information to all stakeholders, and</td>
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<td></td>
<td>PNG is also currently experiencing strong macroeconomic challenges.</td>
<td>▪ Getting the policy framework right</td>
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<td>PNG is home to 5.1 million people. It also has</td>
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<tr>
<td>▪ 20,000 plant species</td>
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<td>▪ 600 fish species</td>
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<td>▪ 800 species of corals</td>
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<td>▪ 304 mammals species</td>
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<td>▪ 733 species of birds</td>
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<tr>
<td>▪ 298 species of reptiles</td>
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<tr>
<td>▪ 228 amphibian species</td>
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<tr>
<td>▪ 45 types of forest/wetlands</td>
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<tr>
<td>▪ Abundant fresh water</td>
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<tr>
<td>▪ Pollution free atmosphere</td>
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<tr>
<td>▪ Extensive mineral/oil deposits</td>
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5. Key Environment Issues for PNG - Detailed Analysis

<table>
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<tr>
<th>THEMES</th>
<th>ISSUES</th>
<th>IMPACTS AND NEEDS</th>
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| II. Forests and Biodiversity | - Forests: nearly 77% of PNG (36 million hectares) is still natural forest.  
- High deforestation rates: from 1975 to 1996, forest cover decreased 10%. Increasing with logging and conversion but not much quantified information available. | - Estimates at current rate of logging, first-cut logging in PNG can be exhausted within 25 years.  
- Some of these species could be lost forever if their numbers are hunted or their habitats are altered. |
|                             | - Bio-diversity: 5 to 7% of the world's species of plants and terrestrial life forms are found in PNG.  
- Increasing numbers of rare insects, birds and animals are threatened and endangered.  
- Growing illegal trade in wildlife; data difficult to quantify.  
- Official expenditure for bio-diversity conservation has decreased 60% from 1998 to 2002. |                                                                                                                                                                           |
| III. Mines                  | - Mining and oil provide 27% of PNG's GDP.  
- River and sea pollution from dumping of mining sediments and tailings into waters has been occurring for decades.  
- Loss or decline of river and oceanic fish stocks, loss of land, coral reefs, etc. resulting from disposal of toxic tailings. | - More responsible mining, understanding of impacts, better management of mitigation and benefits needed.  
- Closer governmental monitoring and enforcement required.                                                                                                    |
| IV. Marine Resources        | - PNG's marine resources are relatively well preserved.  
- Coastal and marine resources could be declining because of degradation resulting from mining and logging, and potential over-harvesting of fish, etc.  
- Mangroves loss may be taking place. | - Exploitation of marine resources is not fully measured, and more data collection and monitoring are needed.                                                             |
| V. Fresh water              | - PNG has more than 170,258 cubic meters of fresh water per person, one of the world's highest stocks of fresh water per capita.  
- Only 29% of rural population has access to improved water sources.  
- Pollution of water sources is taking place from mining and unregulated effluent runoffs, or domestic contamination.  
- High incidence of water-related diseases like diarrhoea. | - Improved water supply systems could probably contribute to the reduction of up to 40% of diarrhoeal mortalities and to improved health outcomes. |
As we consider in detail the most significant aspects of the PNG environment we will consistently use three headings:

1. Significance
2. Analysis of degradation
3. Conservation/ Sustainability/ Restoration

Rainforests

The Significance of Rainforests

- Habitat for people, birds and animals

The rainforests of PNG are the primary habitat for hundreds of thousands of people. The forests provide the main resources for sustaining life: food, water, shelter and fuel. In many cases they also supply useful traditional medicines and products for trade. Millions of people around the world share this way of life. In all cases the culture is closely linked to the forest environment.

The rainforests are also the essential habitat for many kinds of birds and animals. These creatures all play a part in the overall ecosystem.

- Livelihood

Rainforests are very important from an economic point of view. Apart from providing for the daily needs of the inhabitants they yield resources that can be harvested and sold or exchanged. Examples are forest fruits, seeds, nuts, latex, resin, flowers, orchids and other attractive plants, edible birds and animals, timber for building and firewood, and primary materials for arts and crafts: wood, rattan, pigments, lacquer, feathers, butterflies.

The importance of forests for Papua New Guineans

“Forests provide the basis of livelihood and cultural life to the 80% of Papua New Guineans who live in rural communities. These people continue to depend upon forest services and products to meet subsistence and development needs, including building materials, medicines, and food. Food supplies from the forests and seas remain a central component of the Papua New Guinean diet.”

Timber is potentially the most valuable economic product of the rainforest, but there are many complex issues related to its removal for sale. The costs of hauling out a valuable tree include damage to other trees and plants along the removal path, damage to vegetation and soils accompanying the clearing of entry tracks for equipment, and pollution of water courses by eroded soils. Questions of replacement and restoration are critical. Do the recipients of the money ensure there is adequate restoration of the damaged environment and cover all the costs?

The land itself is often regarded as an important economic resource. Rainforests are often cleared to establish plantations, most importantly oil palms and coffee and, in other countries, rubber. However the soils themselves are not very fertile and the plantations require continuing inputs of chemical fertilizers to maintain productivity. In other countries forests are cleared to establish cattle ranches. It is often argued that such enterprises create local employment and therefore are an advantage to the original “owners” of the forests. Yet the long term cost of the loss of the forest may well be much greater than any gain from the plantations. The cost of loss of traditional habitat is beyond accurate calculation, and the damage to water resources may have consequences that extend well beyond the original area of deforestation.

In other countries the economic issues have become very significant politically. The conflicts often result in violence. Note the story of Chico Mendes in Brazil (page 71).

- **Source of significant plant species**

Many of our most valuable plant species were first found in rainforests. Examples are tropical fruits such as mango, papaya, avocado, banana and jackfruit, many trees that yield high quality timber, a great variety of orchids and other ornamental plants, vanilla (an orchid) and plants that produce such pharmaceuticals as aspirin and quinine. It is obviously very important that all plant species are preserved, if for no other reason than that they are certain to include many that are potentially useful for human beings. For example some may be significant as sources of pharmaceuticals and perhaps other biochemical substances that help address important human needs. Others may provide new genetic strains of staple foods.
Other species may be vital for maintaining healthy forest ecosystems. Some ecologists believe that the loss of species diversity restricts the capacity of damaged forests to renew themselves after natural events such as droughts and fires or after further human damage.

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**The legend and inspiration of Chico Mendes**

“Chico Mendes, a Brazilian rubber worker, never intended to become an environmentalist. As he once put it, “we became ecologists without even knowing that word.” He certainly never planned to become the target of savage attacks and eventual martyrdom because of his work to save the Amazonian rain forests. For ten years he served as the leader of the National Council of Rubber Tappers, an organization representing some 150 thousand people who earn their income from the rain forests in Acre Province in Brazil. And Chico Mendes unwittingly began to place his life in peril from the moment he started to organize his fellow rubber workers to protect the forests from which they derived their livelihood.

Chico's work achieved results. Undoubtedly his greatest achievement was the negotiation of four "extractive reserves" in Acre and eight other Amazon states. These reserves will protect more than five million acres for rubber extraction, nuts, resins, and other forest projects.

But this work to prevent destruction of the forests raised the ire of wealthy landowners of Brazil who profit from destroying the forests. Three days before Christmas 1988, Chico Mendes was gunned down in his yard after having survived five previous attempts on his life. A local landowner who was benefitting by cutting down the rain forest confessed to the brutal murder and was finally tried and convicted.

This tragic assassination has . . . inspired people around the world to join in the important work Chico Mendes left behind.”

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**Conservation of water**

Rainforests play an extremely important role in conserving water. At least five mechanisms are involved:

- slowing the journey of some or all of the raindrops to the soil surface, thus allowing time for the water to be absorbed more

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* Tom Sine *Wild Hope* Monarch 1991, page 21
gradually and efficiently by the natural “sponges” (plants, surface litter and soil) and protecting the soil surface from the direct impact of raindrops (which tend to shatter soil particles, causing blockage of surface pores and therefore reduced opportunity for water absorption);

- storing great quantities of water in and on the plants themselves;
- creating surface litter which absorbs and stores water, reduces evaporation of soil water and, as with the plants themselves, protects the soil surface from the direct impact of raindrops;
- creating entry points for water into the soil by way of root channels; and
- shading the whole system, thus creating cooler conditions which result in reduced evaporation.

### PNG rainforests and biodiversity

“Papua New Guinea has a total land area of 46.28 million hectares, of which about 36 million ha, or 77% of total land area, is still covered by closed natural forest. This constitutes one of the most complex, species-rich significant tropical rainforest wildernesses remaining in the world. Although this biodiversity has not been extensively surveyed, the best current scientific estimates are that 5% to 7% of the world’s biodiversity is found in PNG. Terrestrial biodiversity includes 304 mammal species, 15,000-20,000 plant species, 1,500 tree species, and 733 bird species. This includes many unique species not found anywhere else on earth. Best known birds include the birds of paradise (90% of the world’s total species), bowerbirds, mound builders, and cassowaries. Many of PNG’s mammals are marsupials, and include the tree kangaroo, cuscus, and possum. PNG’s reptiles include an endemic freshwater crocodile and the world’s longest lizard. Outstanding PNG insects abound such as the world’s largest butterfly, Queen Alexandria’s Birdwing.”

As a result of these mechanisms forest springs tend to yield water continuously throughout the year, replenishing the streams and rivers and supplying basic human needs. Nearby ground-water tables remain

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1 “wildernesses” – areas of natural, unspoiled and sometimes remote land with very little settlement, especially places of great beauty

* 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR  World Bank 2002, page 10
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high and easily accessible. Removal of forests usually reduces the flow of springs and lowers the water tables.

- **Soil fertility**

Forest soils maintain a huge amount of productive growth without the addition of artificial fertilisers. They support a “sustainable ecosystem”. The main reason for this is recycling. After plant products (including leaves, fruit, flowers and branches) fall and contribute to the surface litter they are decomposed by micro-organisms. Eventually the products of decay are incorporated into the soil, available to be taken up by living roots as plant nutrients. Insects, birds and animals often play a part in the cycle.

Of special significance are the roots of trees, some of which penetrate quite deeply into the soil and catch the nutrients that are carried down in the soil water. Tree roots also absorb nutrients released by the gradual decomposition of soil rocks and minerals.

- **Soil protection**

The forest protects the soil surface from the damaging effects of raindrops (mentioned under “Conservation of water”) and the sun. The heating effect of the sun not only hastens evaporation, but it also accelerates decomposition of the soil organic matter. Although this process yields available plant nutrients, the immediate gain is not sustainable and the organic matter reserves are quickly reduced. Loss of organic matter also reduces the stability of the soil structure, and therefore reduces the capacity of the soil to absorb and store water and to support healthy plant growth.

Rainforests also protect the soil against erosion. This protection comes mainly from the abundant mass of living plant roots. After deforestation, the root network decreases and the soil becomes more vulnerable to the destructive force of flowing water.

- **Atmospheric renewal**

All plants use the energy of the sun to turn atmospheric carbon dioxide into oxygen. At the same time the carbon part of the CO₂ is built into new components for the growing plant. On a global scale, trees are the most important plants for this process and tropical rainforests are especially important.
The continuation of life on earth is absolutely dependent on this process. Almost all living organisms use oxygen from the atmosphere in the biochemical process called “respiration” which produces energy to drive the activities of the organism and emits carbon dioxide as a by-product. Similarly the burning of fuels to produce energy uses up oxygen and produces carbon dioxide. This happens whether the fuel is wood, oil, gasoline, an organic gas (such as methane or propane or LPG), or an organic liquid (such as methylated spirits). Plants “mop up” the carbon dioxide and renew the supply of oxygen.

This simple cycle is shown in the following diagram:

![Diagram of the carbon cycle]

In our world today the balance between oxygen and carbon dioxide is not stable. The level of carbon dioxide in the atmosphere is gradually increasing and this has harmful consequences, most importantly “global warming” – which in turn can lead to rising sea levels. Part of the response must be to limit industrial growth and to change those lifestyles that consume large quantities of carbon-based fuels. The other part must be to grow more plants, especially trees, and to limit the destruction of existing plants. Population growth is an important factor. Each additional person requires 20 mature trees to replenish the oxygen consumed throughout his or her life.

- **Aesthetic beauty and eco-tourism**

Most people appreciate the beauty of rainforests, both from a distance and from close quarters. People are attracted by the variety of plants and their flowers, leaves and fruit, together with the insects, birds and other
Christians Caring for the Environment in Papua New Guinea

organisms and such inanimate aspects as waterfalls, rivers and rock formations. Such beauty is worth preserving for its own sake. However in recent decades an important commercial and educational aspect has emerged: eco-tourism. Growing numbers of people, especially those from the non-tropical world, are prepared to invest in travel to tropical rainforest areas to experience their beauty and often to learn about their special ecological features. With appropriate management this can contribute significantly to the local economy and thus provide an alternative to simply clearing the forest or extracting forest resources for economic purposes.

**Experiencing a tropical rainforest**

“...to watch the mists rising from the damp canopies of trees coloured green, red, grey and yellow in a bright tropical dawn, and look down at the forest floor and observe the thousands of insects involved in recycling the tree products into the fragile soil, and, through the birds that live off the insects, back into the tree tops again; to hear the enveloping harmonic chorus of cicadas and other insects and birds in the forest night: such experiences of the natural world are glorious gifts to the human senses and spirit. Biodiversity is not just an ecological principle, an economic variable or a scientific discovery – it is the astonishing exuberance of the creation itself.”

* Michael Northcott  
**The Environment and Christian Ethics**  
CUP 1996, page 23

**Climate, especially micro-climate**

Tropical rainforests have a strong influence on the local climate, making it more humid and cool than would be the case if the forests were not present. Certainly, removal of areas of forest changes the microclimate in the direction of lower humidity and higher temperatures. This in turn influences cloud formation and thus rainfall. However the rain is not guaranteed to fall back on the forest area that produced the moisture for a particular cloud. Winds carry clouds away to other places before the rain falls – even across oceans. Deforestation on one continent (for example South America) can result in drought on another continent (for example Africa)

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The degradation of rainforests

- Deforestation

The main cause of degradation of rainforests is simply destruction by human beings. This is carried out for many reasons and by several different methods. Globally, the area of rainforest destroyed each year is 10 million hectares, about one fifth of the area of PNG.

The reasons for this activity are usually very logical: more gardens are needed; a plantation will improve the local economy and provide much-needed employment; logging will provide much needed funds for community development; more land is needed for housing a growing population and providing it with basic facilities such as roads, airports, sports fields, shopping centres, schools, hospitals and industrial areas.

No doubt much of this is inevitable and the destruction must be accepted as one of the costs of progress. Yet it is important to act carefully and with discipline. It may be possible to minimise the damage without sacrificing the desired outcome.

Often the method of destruction can be adjusted to reduce the damage.

- Slash and burn methods, especially common for clearing secondary growth of old gardens, can be replaced with less damaging methods that may require more work but which will result in cleaner air and more fertile soils.
- Highly destructive methods of logging can be replaced by approaches that are more gentle although probably more costly commercially.

<table>
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<th>Deforestation – a PNG issue</th>
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<td>“Approximately 150,000 to 180,000 hectares are selectively logged annually, arguably in an unsustainable manner. Another 25,000 hectares of natural forest are cleared for agricultural, clear-cutting, and infrastructure construction. It is estimated that shifting cultivation clears another 200,000 hectares, although it is not clear whether much of this is primary forest. A more likely problem is the reduced fallow period for regeneration, which results in degradation of forests, decreased yield, and a tendency to extend the range of the shifting agriculture pattern to other forest areas.”</td>
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Deforestation – a global issue

Deforestation in both temperate and tropical areas proceeds at an extraordinary rate. Of the remaining . . . virgin tropical forest, roughly . . . 400,000 hectares a week is subject to logging extraction or burnt by peasant cultivators and charcoal burners. In South East Asia and Amazonia vast areas are already completely denuded of trees. In their place is left either a wasteland of leached soils and weedy scrub plants, or grassland capable of supporting cattle or subsistence agriculture for a few years before the soil loses its fertility. Current rates of destruction of tropical forest mean that in twenty years' time only small tracts will survive outside of Zaire and New Guinea, where . . . governments have not exploited the forest at the same rate as those in South East Asia and Latin America.*

* Michael Northcott The Environment and Christian Ethics  CUP 1996, page 17
The impact of logging

“Selective logging of the largest trees leaves behind great devastation. Loggers who may only harvest the largest 2 per cent of the trees destroy at least 25 per cent through logging roads, bulldozing and damage to other trees, and this is in well-managed logging concessions. In logging concessions in Sarawak a colleague who observed the practice at first hand described to me how whole hillsides are destroyed by the extraction of one or two large trees. As the large tree is cut it brings down many smaller trees, while the loggers themselves then cut large numbers of small trees to provide a slip-way on which to drag the tree down to the river. This slip-way is then dressed with gallons of diesel oil to make it slippery and reduce the effort required to get the tree down to the water or the logging track. The ecological devastation caused by this kind of activity is far greater than the impacts of logging described by proponents of sustainable tropical timber extraction. There are few examples in the tropics of forests which have been commercially logged over time which have not been extensively degraded, and their capacity to support indigenous peoples, and non-human species, dramatically reduced.”

- Acid rain

Acid rain is not yet a major problem in PNG. It is the result of acidic compounds produced by factories and released into the air. It is of special significance in the highly industrialised areas of Europe and North America, where it has damaged huge areas of forest, many of which are dead or dying.

- Consequences of rainforest degradation

The consequences of destroying an area of rainforest are always very serious. All of the positive features outlined above are lost: soils are exposed to sun and rain, water supplies are polluted, water sources dry up, rainfall is not dispersed efficiently (resulting in flash floods, extremes of wet and dry, soil erosion and landslides), accumulated fertility is lost within two or three years, habitats for people and many

* Michael Northcott The Environment and Christian Ethics CUP 1996 page 18
other creatures are lost, survival of some species of plants, insects, birds and animals is threatened, and the atmosphere is both polluted by smoke and deprived of a contribution to oxygen replenishment. The local climate is altered adversely as rainforests are replaced by buildings, roads and open fields.

**Deforestation and climate change**

“In 1989, Great Britain's Meteorological Office and Department of the Environment completed a three-year simulation study on the Amazon Basin.\(^i\) They concluded that if the entire rain forest were converted to pasture land, there would be a 20 percent reduction in rainfall, and the region would be "substantially" hotter. That change, in turn, would likely alter the climate throughout the hemisphere.” \(^*)\)

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**Deforestation and the threat to biodiversity in PNG**

“There is general agreement that the most significant threat posed to PNG's biodiversity value stems from the degradation of terrestrial habitats by the total or partial removal of natural forest cover. This is caused by commercial logging, commercial agriculture and, to some extent, subsistence agriculture.” \(^#\)

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\(^i\) “the Amazon Basin” – in South America, mainly in Brazil

\(^*\) Tom Sine *Wild Hope* Monarch 1991, page 23

Rainforest destruction & species extinction – global summary

“It is estimated that around 10,000 species are destroyed annually as a consequence of human activity in the natural world. This compares with an estimated natural extinction rate over the many millennia of the earth’s existence of one species per year. The biggest single cause of species extinction is the destruction of the rainforests of Amazonia, Central Africa and South East Asia. These areas are the richest in species diversity on the planet, and the ecosystem of the forest is fragile. Three or four hectares of rainforest in South East Asia or Central America contain more tree species than the whole of Europe or North America. These trees are in turn home to thousands of species of insects, birds, epiphytic plants and reptiles. Tropical rainforests cover only 6 per cent of the earth’s surface and yet contain around 90 per cent of its species.”

Conservation/ Sustainability/ Restoration of Rainforests

- Reforestation

Rainforests are complex and fragile ecosystems that take at least 80 years to reach maturity. Yet they can be destroyed in a very short time by a combination of chainsaws and fire. Left to regenerate naturally they will take at least another 80 years to recover to their original state. The process can be speeded up by deliberate intervention, especially by way of selection, planting and nurturing of key tree species.

Reforestation is certainly possible, but considering the devastating consequences of damaging or destroying forests and the time required for restoration, the decision to eliminate an area of forest needs to be considered very carefully.

- Awareness raising

Traditional communities rarely have a complete understanding of the importance of their rainforests and the consequences of destruction. The same applies to many leaders of politics and commerce. One of the most important activities for achieving conservation of rainforests is

* Michael Northcott The Environment and Christian Ethics CUP 1996, page 21
awareness raising. School curricula should include courses on the environment that highlight the significance of rainforests and the importance of conservation. In PNG the churches play a significant educational role and it is imperative that they take a lead in raising awareness and encouraging soundly based commitment to caring and acting constructively.

• **Research**

Scientific and practical understanding of tropical rainforests is far from complete. In the Amazon forests of South America many new species of plants and insects are still being discovered. The complex ecological interactions are only gradually being understood. Research is extremely important both to understand the rainforest system (if only as a basis for wise planning) and to appreciate its value. Research findings can provide guidelines (a) for wise utilization of the rainforest in a sustainable way, (b) for ensuring minimal damage and loss where a piece of rainforest has to be cleared for good reasons, and (c) for using the best possible methods for reforestation in a particular situation.

• **Eco-tourism**

Eco-tourism can play several important roles in relation to rainforest conservation:

1. Firstly it can boost the local economy and thus reduce pressure for alternative and more destructive economic exploitation of the forests.

2. Secondly it can provide direct funding for conservation projects, perhaps by way of a levy on tourist-related enterprises, perhaps by way of fees charges for participation in project activities.

3. Thirdly it can be developed as an instrument of awareness raising about the key environment issues, both locally and internationally.

4. Fourthly it can be used as a stimulus for creating government and private partnerships for addressing environmental concerns.
Case study: Hogave Conservation Project

Hogave Conservation Project involves about 20 square kilometres of the virgin forest south west of Mt. Michael in the Eastern Highlands of PNG. Mt Michael is one the highest mountains in PNG with an altitude of more than 3600 metres.

The idea of Hogave Conservation came about as a result of people threatening the virgin forest with its fresh creeks which serves as the main drinking water supply source for the people who live below the mountains. The forest also has much wild life – including more than 30 birds of paradise, most notably the blue, the blue crest, and the long sickle billed birds of paradise. This wildlife needs to be conserved both for its heritage value and for ethical reasons.

The population of Hogave was increasing rapidly and resulting in people cutting trees, vines and bushes to make new gardens – without realising that these activities were gradually but permanently destroying their own habitat. In addition the potential for both logging and mineral exploration was real, indicated by the interest shown by people in these industries.

However the people of Hogave wisely opted for conservation. After several formal and informal meetings the Hogave people saw the reasons why they should care about their environment. It was not exactly easy or simple to convince the people that conservation was important. It took more than a decade for them to finally recognize the importance of conservation and commit themselves to protection of their forest with its wildlife.

The beautiful blue birds of paradise and many other birds that were previously rarely seen on the fringes of Hogave forest adjoining Mt. Michael can now be seen moving around quite freely. Especially in the designated project area where an eco-guesthouse has been built, the birds now feel quite safe to move around.

The total forest area around Mt. Michael is more that 100 square kilometres and it is hoped that the other tribes and clans who have ownership right to the forest area will join in the efforts to conserve their heritage. Success in this area could then impact other remaining pristine areas in the country as local people note what has happened and are motivated to begin to conserve their own flora and fauna.

* David Kima, Evangelical Alliance of PNG
Case study: Nipa-Laivalley Eco-forestry Project *

In January 1993 Pastor Simil Hondolwa of the Good News Christian Church at Nipa, west of Mendi in the Southern Highlands of Papua New Guinea, started on a life-changing journey. He felt called by God to begin a program to replace the trees that were being cut down in his area, including many trees used by the sawmill operated by his church. He started tree nurseries, learning by trial and error because he had no formal training or experience in this technology. Gradually he learned how to grow healthy seedlings of several useful tree species, starting with collecting and germinating the seeds. Advice and help from Provincial Forestry Officer Mr. Isaac Hekele was very valuable.

Sales of seedlings were slow at first, but then the word began to spread and by the end of the first year more than 3,000 seedlings were sold. Most of the work was carried out by Pastor Simil himself, but after a while a few other people started to catch the vision. For example, Mr. Aniki Uhae, a literacy worker at Sorip village, started his own nursery, trained and advised by Pastor Simil.

Following participation in the May 2003 Goroka consultation on theology of the environment Pastor Simil expanded his program. He took the message of caring for the environment to the churches and communities in the Nipa-Magarima area and the Lai Valley and beyond. He gave teaching and preaching from the Bible and made many practical recommendations. The people were hungry for this information and kept asking for more. Sixty church workers gladly spent a week at a workshop focused on the environment, and other workshops followed.

Along with “eco-forestry” (using trees to help conserve the environment) Pastor Simil raised awareness about soil erosion and suggested ways of stopping the erosion and making the soils more fertile. Before long his fame was spreading as gardens became more productive and previously dry soils remained moist and suitable for cropping. Tree planting became more popular and 4,000 trees were planted in the Lai Valley. The next plan was to start rice growing in small plots.

The success of the program in and through the churches resulted in Pastor Simil being invited to schools and community meetings to raise awareness about the environment. Video tapes were very useful for this purpose, especially the BBC series called “State of the Planet” by David Attenborough. Always there was great interest and enthusiasm to spread the message and take practical steps for conserving the environment.

A small tree-planting program has now become a mass movement of commitment to practical care for the environment – much more than Pastor Simil ever dreamed.

* David Kima, Evangelical Alliance of PNG
Practical Actions for Conservation & Renewal of Rainforests

⇒ Learn about the relevant issues and encourage others to do so too
⇒ Encourage community commitment to forest conservation and restoration
⇒ Only clear an area of forest or allow logging after very careful consideration of all the key factors and consequences
⇒ If after full and careful consideration, logging is implemented, ensure the methods used minimise other kinds of destruction
⇒ Ban burning as a method of forest clearing
⇒ Protect deforested areas by applying mulches, ground cover crops, green manures and (on slopes) effective water control measures (see below).
⇒ Implement reforestation programs to replace or compensate for every area that is cleared
⇒ Speed up reforestation of abandoned gardens by selecting and planting fast growing trees and shrubs
⇒ Establish community nurseries to promote and facilitate local reforestation programs
⇒ Participate in ongoing research on the issues of rainforest conservation
Soils and Land

The Significance of Soils and Land

Clearly land is the basis of the traditional economy in PNG. Tribal territory is a fundamental element of society. Conflicts over land are common. By world standards there is abundant land in PNG to support its population well into the future. Yet in many areas there is a strongly perceived shortage of land. Rapid development of urban areas and the associated transport links contributes to the pressure on available land. This then puts pressure on those who would argue for conservation of the forests.

It is not hard to identify the economic reasons land and soils play such a central role in the nation of PNG. They are the primary resource for village agriculture, the plantation economy, and animal production.

- Village agriculture

Perhaps “village gardening” would be the best description. Throughout the country, household gardens are central to the life and sustenance of the people. Most often the men clear the land and the women plant and tend the gardens, growing both food for family consumption and cash crops for sale in local and regional markets. In some areas the soils are rich and remain fertile even after many years of production. More often they decline in fertility and are either abandoned or treated with commercial fertilisers. Abandoned gardens are usually reused after several years of “rest” during which they are expected to recover some of the lost fertility.

- Plantation economy

Plantations are established on both traditional village garden land and newly cleared forest land. The most important plantation crops are coffee and oil palm. Agro-forestry – plantation growth of trees for commercial timber and fruit, combined with other compatible crops on the same plots – is also being introduced in some areas. Continued acceptable production usually requires addition of fertilisers, in practice almost always commercial chemicals. Establishment of plantations often results in serious shortages of land for village gardening.
5. Key Environment Issues for PNG - Detailed Analysis

- Animal production
In PNG the main traditional domesticated animals are pigs and chickens. Traditionally neither of these is regarded as needing specially allocated land. Yet land is needed for food production for these animals, except where decisions are taken to purchase commercial feed for hybrid chickens – and perhaps for local chickens or even pigs. Free-roaming pigs tend to damage and pollute the environment.

The most important introduced animals are cattle. These are generally inefficient users of land in the PNG context and their introduction frequently results in severe damage to the environment by way of destruction of forests (in opening up “ranch” land), pollution of water supplies and depletion of soil fertility.

- Pollution of water
From an environmental perspective the main negative impact of soils themselves is pollution of water resources. Surface soils are eroded and washed into springs and streams, silting up rivers and even damaging shoreline reefs in the vicinity of river mouths.

Degradation of soils and land
Much land in PNG has already been damaged and some parts now lie infertile and unused. In the past 50 years huge amounts of fertile topsoil have been washed down the rivers and now lie at the bottom of the ocean. Degradation and loss of fertile soils continues at an increasing rate as forests are cleared, garden soils are inadequately protected, toxic chemicals are applied, pollution is not prevented, and unwise cultivation practices are used.

- Erosion/landslides
The evidence of extensive soil erosion is not hard to find throughout PNG: barren hillsides, silted rivers, and discoloured oceans near the mouths of rivers. Wind erosion, so important in many other countries, is not a significant problem in PNG.

The common practice of making garden rows that run up and down the hill-slope (rather than horizontally across the hill) is a major contributor to soil degradation in PNG. This custom facilitates rapid water flows following rain, with consequent serious erosion. As will be emphasised below, the practice should be abandoned and avoided at all costs, and
replaced with the highly successful Sloping Agricultural Land Technology (SALT) used in other countries.

PNG is not alone in suffering loss of its precious topsoil. The annual global loss of topsoil is estimated at 25 billion tonnes – roughly equivalent to the whole area of PNG half a metre thick. Unless attitudes and actions are changed the world is in danger of losing irreversibly its most important resource for sustaining life.

Related to gradual erosion of the surface layers of soil – which are the most fertile – are the more drastic events known as landslides, which are increasingly common in PNG. Landslides are often due (at least partly) to removal of stabilising vegetation from sloping land. Certainly earthquakes and heavy rain are the most significant triggers of landslides, but deforestation and intensive gardening make hillsides much more vulnerable to the effects of the other activating influences.

- **Cultivation**

Apart from erosion causing physical loss of topsoils, soil fertility is lost in three main ways:
1. Loss of nutrients through uptake by plants, parts of which are then removed (as harvested crops, or eaten by grazing animals, or by burning) without matching replenishment.

2. Degradation of soil structure, causing limitations to (a) healthy aeration\(^i\) of the soil, (b) water intake and (c) accessible pores for root development. Causes of structural degradation include frequent digging and ploughing, reduction of the worm population by chemical poisoning, impact of raindrops, loss of organic matter, impact of animal feet, and impact of wheeled vehicles.

3. Salinization (effectively “poisoning by salt”) resulting from continued use of irrigation water that contains high levels of salt. This is not generally a problem in PNG but it would become important if salty springs and tidal rivers were to be used for irrigation of gardens and plantations.

In general these causes relate to the way the land is cultivated for agricultural production. The choices of approaches and practices have a great influence on the continuing fertility of the soil.

### Cultivated Land in PNG

“Available data indicate that cultivated land is not expanding rapidly in PNG, and more than 50% of the rural population practice low-intensity agriculture. However, the impact on land use systems is evident in the populated rural areas with more sensitive environments. While there is potential for soil erosion in localized parts of the country, with eventual significant impacts on biodiversity, soil retention techniques and planting of mixed crops in traditional gardens generally reduce the impacts of surface runoff and soil erosion.”

### Use of toxic chemicals

Uncultivated soils are alive with micro-organisms, worms, insects and the roots of plants. This population is vital for the health and fertility of the soil. But it can be severely affected by agricultural chemicals, both pesticides and chemical fertilisers. “Dead soils” can still produce crops but only by continued application of high cost chemicals and only for a

\(^i\) “aeration” – entry of air into the soil between the soil particles

limited time before the soil structure is so damaged that it is unsuitable for normal abundant plant growth. In particular depletion of the worm population through addition of nitrogen fertilizers (urea, ammonium sulphate, ammonium nitrate) interferes with the recycling of plant litter and aeration of the soil. A healthy worm population almost eliminates any need for regular digging, which is a great advantage for maintaining good soil structure and reducing labour requirements.

• **Waste disposal**

Soils can be polluted by unwise disposal of waste materials, especially industrial chemicals. By contrast, animal manures can be safely dumped on soils; indeed they usually improve soils by adding organic matter with a high content of essential plant nutrients.

• **Deforestation**

The fertility built up in forest systems over many years tends to disappear rapidly following clearing. If *burning* is part of the clearing process this immediately destroys many of the potential plant nutrients incorporated in the living and decomposing vegetation. All of the nitrogen and sulphur and most of the phosphorus is released as gases. These gases are soluble in water and some of them may be returned to that particular patch of land in the rain. However most are lost forever. The important nutrient potassium, together with small quantities of phosphorus, calcium and iron, remains in the ash produced by burning and this helps to give promising growth of the first crops after burning. However such early signs of fertility are deceptive. The remaining available nitrogen is soon depleted and even the potassium dissolves easily in water and, in the absence of sufficient absorptive organic matter, it is washed down into the soil, out of range of most plant roots.

**Exposure of the soil surface** to sun and rain following deforestation results in degradation due to erosion and rapid decomposition of organic matter. Loss of organic matter weakens soil structure and releases plant nutrients more quickly than they can be absorbed by the replacement plants, allowing the nutrients to be quickly washed away. Raindrops shatter small soil particles and this in turn tends to block surface pores and restrict the entry of air and water. Direct sunlight also heats the soil,
5. Key Environment Issues for PNG - Detailed Analysis

generating increased rates of evaporation which in turn leads to drying and hardening. The result is reduced soil fertility.

Elimination of trees removes an important instrument for renewing soil fertility: tree roots absorb nutrients from the deeper soil layers, transporting them to the leaves, fruit and flowers – which eventually fall and decompose, releasing the nutrients at the soil surface.

Logging operations themselves usually damage soils directly and severely. Bulldozing to clear tracks and roads disturbs surface soils and makes them and the newly exposed fragile deeper layers vulnerable to erosion. In addition large amounts of diesel oil are often used to lubricate the temporary wooden slipways that are constructed to remove the felled logs from the forest areas. Without quick protective action there is no hope of rescuing such areas from complete degradation.

Conservation/ Sustainability/ Restoration of Soils and Land

In light of the great importance of soils and land in PNG it is clear that appropriate actions must be taken to ensure they are conserved and that damaged soils are restored if at all possible. The most relevant approaches and technologies include organic agriculture, agroforestry, recycling, surface protection, water flow management, and control of animals.

- Organic agriculture

The organic agriculture movement is growing rapidly throughout the world. Related terms are “organic gardening” and “permaculture”. This approach is characterised by technologies that do not use inorganic chemical fertilizers and do not apply toxic pesticides. Crop production is sustained by applying organic fertilizers such as animal manures, compost, and leaves and other plant products. Pests are controlled by a variety of approaches including shield crops, multiple cropping, frequent rotations, resistant varieties and non-toxic sprays.

Nitrogen is the most important plant nutrient because it is a major component of all proteins. It is the element most likely to be in short supply in the soil and therefore it is the main component of chemical fertilizers. Animal manures (including urine) are rich in nitrogen and this makes them good organic fertilizers, either directly or incorporated into compost.
Compost is made by mixing raw organic waste materials (kitchen scraps, agricultural residues, leaves and fruit and flowers dropped from trees and shrubs, animal and fish wastes) under conditions where they are decomposed by micro-organisms and re-formed into soil-like organic substances. Small amounts of soil may be added to stimulate the process and worms may play a part in the final stages. The composting process generates heat which kills (a) most weed seeds and (b) any micro-organisms that could cause plant diseases. The product is an excellent fertilizer, safe to use and not toxic towards worms. It can be applied directly to the soil surface and covered with mulch; digging is not necessary.

Compost is suitable for small areas, but it is labour intensive to make and apply and the raw materials are often in short supply. For larger areas other methods are more suitable. The most important of these is “green manures”. Green manures are crops that are grown primarily to enrich the soil. Almost all of these are “nitrogen fixers”, meaning that their roots work together with certain soil bacteria to take nitrogen gas from the atmosphere and incorporate it into plant proteins. The leaves, stems and other parts of such plants are rich in nitrogen and when they decompose they release nitrogen into the soil. But even while these plants are growing their roots are releasing “fixed” nitrogen into the soil, making it available to neighbouring plants. In this way soil fertility is built up.

The most important nitrogen fixing plants are those belonging to the legume group. Many of these have double significance: they yield food and other valuable products and also act as green manures. These include all beans and peas (including peanuts, mung beans, cowpeas, pigeon peas, soy beans, snake beans or yardlong beans, and winged beans or arsebeans) and most plants that produce their seed in pods, such shrubs and trees as Leucena (a common cover crop for coffee), Sesbania, Gliricidia, wattle (Acacia), Desmodium and Albizia. Clovers and medics also belong in this group. These, along with other small legumes, are increasingly important around the world as nitrogen rich cover crops which grow quickly even in degraded soils, protect the soil surface, reduce weed growth and enrich the soil. Examples are the Tropical Lima Bean (Phaseolus lunatus), the Velvet Bean (Mucuna pruriens), the Jackbean (Canavalia ensiformis), the Swordbean...
(Canavalia gladiata), the Lablab Bean (Lablab purpureus), and the Tropical Kudzu (Peueria phaseoloides).

The variation of organic farming known as “permaculture” places great emphasis on integrated systems including both trees and animals (including birds). The specific use of trees in combination with other crops is often called “agroforestry”.

- **Agroforestry**

Trees play a key role in soil conservation and restoration. Agroforestry, the deliberate combination of suitably spaced trees with other desirable crops, is a form of sustainable agriculture that is becoming very widely used. The trees are usually selected for their own potential as producers of commercially valuable fruit or timber, but often their main virtue is simply their ability to (a) thrive in that context and (b) enrich and protect the soil. Legume trees (see above under “organic agriculture”) are especially valuable because their roots can fix nitrogen and make this available either to the roots of neighbouring plants or as leaves that can be used as surface mulch or as raw material in compost production.

On flat ground the trees are usually planted in rows running east-west to allow maximum entry of sunlight, and the other crops are planted between the rows. However on hillsides the tree rows are established on contour lines not necessarily running east-west. The tree rows are associated with contour banks and ditches, helping to stabilise them and support their role of controlling the flow of rainwater (see the following section on “water flow management”). This ensures that the crop beds can tend towards forming horizontal steps with contour ditches and banks between them, a form of terracing which helps to conserve water and reduce soil erosion.

The trees may have to be pruned frequently to reduce the amount of shading, and the prunings themselves can usually be used for firewood, mulch, raw organic fertilizer, compost ingredients, or animal fodder (food).

* A key reference is *Tropical Legumes: Resources for the Future* National Academy of Sciences 1979
• **Recycling**

Whether or not gardeners and farmers practise organic methods or agroforestry it is very important that they do all they can to recycle the unused by-products of their enterprises. This means that everything produced by the soil should be returned to the soil – except just that part that is removed for consumption or sale. Leaves, stems, pods, seeds, fruit skins, prunings, animal products, kitchen scraps, even weeds – all can and should be returned to the soil. Some may need to be stored, awaiting a suitable time, but usually they can simply be added to the soil surface as mulch as soon as they are available. However it would often be advantageous to use them to make compost.

**Especially important in this context is the question of burning.** Burning of plant residues is a common practice in PNG, yet it is very wasteful of resources and contributes enormously to soil degradation. As explained in the section on the role of deforestation in soil degradation, burning destroys most plant nutrients, especially nitrogen, and hastens the loss of potassium as soluble salts. Burning prevents recycling and should be avoided if at all possible.

• **Surface protection**

As with the need for recycling, whether or not gardeners and farmers practise organic methods or agroforestry it is very important that they do all they can to protect the surface of the soil. As explained in the section on the effect of deforestation on soil degradation, the direct impact of rain and sun can do serious damage to soils. Protection by shade plants, mulches and groundcover crops reduces erosion and enhances soil fertility.

• **Water flow management**

Flowing water has huge potential to damage soils. The faster the flow, the more serious the possible damage. In other countries, water flow management has been a major contributor to sustainable agriculture. The terraced fields found in China, Japan and throughout South East Asia are perhaps the best example. There are cases of continuous cropping with a history of more than 1,000 years.

More recently the introduction of Sloping Agricultural Land Technology (SALT) has transformed the lives of thousand of hillside farmers in the Philippines, Indonesia, Thailand, Central America and
South America. The key to this technology is construction of ditches and banks along spaced contour lines running horizontally across hillsides. These ditches and banks, which are stabilised with fast-growing grasses and shrubs and often trees as well, slow the flow of water following rain, collecting it in the ditches and behind the banks and giving it time for thorough absorption into the soil. The resulting wet strips retain their moisture for many months and sustain gardens planted between the contour strips. Both soil and water are retained on the hillside rather than being carried into the streams and rivers. Very often the system includes well stabilised (with rocks and grass) overflow channels at intervals across the hill, to carry excess water safely to the streams. Many thousands of situations in PNG would benefit from application of this simple technology.

In the context of water flow control it must be emphasised again that the common practice of making garden rows that run up and down the hill-slope (rather than horizontally across the hill) should be replaced with diligent application of contour methods such as SALT.

- **Control of animals**

In many countries, control of animals, both wild and domestic, is very important in conserving soils. This also has relevance in PNG where free roaming pigs tend to damage garden soils. Culturally acceptable ways must be found to curb the impact of pigs on the environment.

- **Awareness raising**

Traditional communities are well recognized for their expert understanding of their environments and their ability to obtain a livelihood from a limited resource base. However, as noted in relation to the rainforests, they rarely have a complete understanding of the environmental consequences of their practices or of ways to better conserve and restore their soils. Education and awareness raising are high priorities. School curricula should include courses that highlight sustainable agriculture in the PNG context and teach improved but low-cost methods of soil conservation and improvement. These programs should be extended to adults, especially women, who usually play the main hands-on role in gardening in PNG. The churches play a significant part in education throughout the nation and it is imperative that they take a lead in raising awareness, encouraging commitment to
soil conservation and improvement, and building up relevant knowledge and skills.

- **Research**

Scientific and practical understanding of sustainable agriculture in PNG is far from complete. Research is extremely important, especially (a) to test plant species that possess potential to enrich soils in a variety of PNG situations and (b) to gather information about successful local technologies with possibilities for wider application. Local wisdom is extremely important and must not be ignored.

Research findings can and should be incorporated in education programs and used to stimulate ongoing research at the local level. Government and community groups need to work together to establish appropriate technical recommendations and guidelines and to disseminate them accurately, clearly and widely.

**Practical Actions for Conservation & Renewal of Soils**

⇒*Learn about the relevant issues and encourage others to do so too*

⇒*Encourage community commitment to soil conservation and restoration*

⇒*Ban burning as a method of land preparation or plant residue disposal*

⇒*Protect open areas by applying mulches and ground-cover crops*

⇒*Implement technologies that conserve and improve soils: composting, green manuring, recycling, application of animal manures, agroforestry and other forms of intercropping, intensive use of nitrogen fixing plants, non-toxic pest control, and (especially on slopes) effective water control measures.*

⇒*Participate in ongoing research on the issues of soil conservation*
5. Key Environment Issues for PNG - Detailed Analysis

Case Study from the Philippines - Sloping Agricultural Land Technology*

The mountainous island of Cebu in the Philippines is about 200 km long and 50 km wide. It was once covered with thick rainforests, but by 1980 most of the trees had disappeared as the population increased and the demand for farm land kept growing. The hillsides were bare and rocky, a result of topsoil being washed into the rivers and eventually into the sea. The surrounding sea became brown and the rivers were full of silt.

In 1983 the farmers in the village of Guba, set in the hills above Cebu City, were very poor and full of despair. But life changed for them when a field worker with World Neighbors befriended them and suggested they use SALT: Sloping Agricultural Land Technology. Those who were willing to try it used an A-frame, a simple tool made from long sticks, to establish a series of horizontal (level) lines across their slopes. Along the lines they dug ditches with high banks on the downhill side. After the rains they planted Napier grass on the banks. The water trapped in the ditches and the nearby soil enabled the grass to keep growing right through the dry season, supplying plenty of feed for the cattle for the whole year. Soil started to build up in the ditches instead of being washed into the river. This soil became garden beds for corn, beans, and vegetables. The next year the farmers planted *Leucena*, a fast growing small tree, on the banks, along with the Napier grass. The *Leucena* enriched the soil and strengthened the banks. It grew quickly and provided firewood and rich fertilizer (in the form of its dropped leaves).

Soon all the other farmers were copying the few pioneers, and neighbouring villages were doing the same. The word spread quickly. The Guba farmers continued to improve their hillsides, carrying out experiments to find the best crops and combinations. They sold garden products and *Leucena* sticks in Cebu city. From their new wealth they improved their houses and opened a school, a clinic and a church. They responded to requests from all over Cebu to teach SALT. But for this they charged a fee: after all they were now consultants. The name they gave to their consultancy group was PEPPER: People Educating People for Proper Environmental Rehabilitation.

The whole of Cebu island has been transformed due to SALT and PEPPER. SALT has been adopted throughout the Philippines and it is now a very important government program. It was first promoted by Dr Harold Watson, a Baptist missionary and agricultural scientist who started a training school for rural pastors on the island of Mindanao. Harold Watson was concerned about the degradation of hillsides all over the Philippines so he conducted experiments and added “rehabilitation of hillsides” to lessons on “sustainable low cost agriculture”. He spread his ideas through churches, government officials and organisations such as World Neighbors. In 1983 he received one of the five annual Ramon Magsaysay awards for services to the people of Asia.

SALT has now been introduced in many countries. Precious water and soil now stay on the hillsides. Sloping lands have been transformed. Thousands of people have benefited.

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*Graeme Swincer*, international development programs consultant
Christians Caring for the Environment in Papua New Guinea

Diagram of Sloping Agricultural Land Technology
(from Harold R. Watson The Development Of Sloping Agricultural Land Technology (SALT) In The Philippines Mindanao Baptist Rural Life Center, Bansalan, Davao del Sur, Philippines 1995)
The Atmosphere

The Significance of the Atmosphere

A clean atmosphere is vital for the continuing well-being of all life on earth. In particular it is a basic requirement for human health. The “unpolluted” atmosphere consists of the gases nitrogen (N\textsubscript{2}, about 78\%) and oxygen (O\textsubscript{2}, almost 21\%) plus small amounts of the inert gas argon (1\%) and traces of the other inert gases: helium, neon, xenon and krypton, together with hydrogen (H\textsubscript{2}), carbon dioxide (CO\textsubscript{2}), ozone (O\textsubscript{3}), nitrous oxide (N\textsubscript{2}O) and methane (CH\textsubscript{4}). The atmosphere also contains water vapour and particles of dust.

The so-called “greenhouse gases” (most importantly CO\textsubscript{2} and CH\textsubscript{4}) in the atmosphere help to trap the sun’s energy, reducing its ability to escape back into space. In this way the surface temperature of the earth is kept at an average of 15 degrees Celsius, with a range which is ideal for life. This natural maintenance of the warmth of the atmosphere, and hence of the earth, is known as “the greenhouse effect”. All is well unless there is a change in the levels of the greenhouse gases. Observed increases in the natural “greenhouse gases”, as well as others that are “man-made”, are linked with global warming, which in turn is linked with changing climate patterns and rising sea levels.

The gases in the atmosphere also affect life on earth by filtering radiation arriving from the sun. Ozone (O\textsubscript{3}) in the upper atmosphere is especially important in this respect. Decreased levels of ozone are resulting in less effective filtering of ultraviolet rays from the sun, and this is linked to rising numbers of people suffering from skin cancers and other disorders.

Human health is endangered directly by the gaseous by-products of industry and petrol-driven and diesel-driven transport, and by smoke from household fires and land clearing operations. Exhaust gases and smoke are significant factors in respiratory disorders (asthma and bronchitis) and a variety of cancers, especially of the skin and lungs and also the blood (leukaemia).

By world standards PNG has a relatively clean atmosphere. The possible exceptions relate to motor vehicles and open fires; these will be discussed below under “Degradation of the atmosphere”.
PNG is significant in relation to the global atmosphere because of its large area of tropical rainforest which helps to absorb carbon dioxide and renew the oxygen supply.

### The importance of the ozone layer

The depletion of the ozone layer weakens the protection the atmosphere provides to human and non-human life from the damaging effects of too much ultraviolet light. This weakening will result in an increase in human skin cancers and eye cataracts, an increase already measurable in areas nearest to the Antarctic. It will also have effects on human immune systems, and on plant and animal life, including the destruction of plankton on which the ocean food chain depends, and the blinding of fish and mammals exposed to increased ultraviolet radiation. The human populations of Chile, New Zealand, Iceland and even Northern Scotland may soon have to begin taking precautionary measures if they are not to experience a significant increase in skin cancers.

### Degradation of the atmosphere

#### Pollutants that damage human health

The main atmosphere-related threats to human health in PNG are very localised:

- **in the main towns and cities** increasing use of motor vehicles is causing significant though still small increases in air pollution by way of exhaust gases;
- **in rural situations** extensive burning of “bush” is used to help clear land or “clean” gardens, thus causing temporary increases in atmospheric smoke;
- **inside village houses** open fires are used for cooking, warmth and insect repulsion, causing high concentration of smoke.

As indicated above, vehicle emissions and smoke both cause serious health problems.

In other countries the most important industrial pollutants are factory gases containing sulphur and nitrogen, which may combine with water vapour to form acids. These acids not only damage the forests and other

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*Michael Northcott, The Environment and Christian Ethics, CUP 1996, page 8*
5. Key Environment Issues for PNG - Detailed Analysis

vegetation but they can also damage the lungs and skin of people who live near the factory. Industrial emissions are not yet a major concern in PNG because there are still very few large factories. However this is no excuse for complacency; it will be important for the PNG authorities to ensure that any new industries implement effective atmospheric pollution control measures.

Vehicle emissions and human health

“The most significant contemporary source of air pollution is road transportation. Vehicle exhaust emissions, including carbon monoxide and nitrous oxides, petrol additives such as lead and benzene, and unburned fuel particulates from diesel engines, are linked with various diseases including asthma and bronchitis, with reductions in immunity to infection, with certain cancers and with damage to child development. Some studies have found an increased incidence of infectious disease amongst those living close to busy roads, while increases in childhood leukaemia and in the severity and frequency of asthma attacks are also thought to be linked with increases in road traffic emissions, though the precise causes of recent dramatic rises in the incidence of childhood and adult asthma remain unclear.” *

Climate

In the last 100 years the carbon dioxide concentration in the air has increased from less than 270 ppmv (parts per million by volume) – its maximum level for the previous 100,000 years – to about 370 ppmv. During the same period the temperature of the earth has increased by an average of 0.6 degrees Celsius (Alexander and White, 2004, page 177). Most scientists who study these matters agree that the link is one of cause and effect. It is predicted that even with the very best efforts that might be hoped for, the atmospheric carbon dioxide levels will reach at least 450 ppmv by the year 2020 and that this will result in further warming. Increased levels of methane (mainly from farm animals and their wastes), and the industrial by-products sulphur dioxide, nitrous oxide and the chlorofluorocarbons (CFCs) will also play a significant part. Altogether the average global temperature is predicted to increase by between 0.1 and 0.5 degrees Celsius per decade, depending on how successful the human inhabitants become in controlling the production and removal of greenhouse gases.

Global warming is likely to change the ecology of entire regions, and in 1990 the Intergovernmental Panel on Climate Change “predicted a range of startling effects including the occurrence of tropical diseases in formerly temperate climate zones, increases in flooding in coastal zones, exacerbation of drought conditions in dryland areas. Vegetation will not be able to adapt fast enough to the rapidity of climate change which is predicted in the next century and areas such as sub-Saharan Africa and Southern and Eastern Asia may see a one-fifth reduction in food production consequent upon increased heat. . . . According to the IPCC one of the more predictable effects will be a sea-level rise of 6 centimetres per decade, leading to a 65 centimetre rise by the end of the . . . century.” *

The icecaps and glaciers of the north and south polar areas are melting more quickly than previously, releasing huge amounts of water into the sea. The predicted resultant rise in sea level over the next few decades is enough to cause damage to many important coastal areas, islands and river deltas and river estuaries. People living on low-lying islands may

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well be forced to leave. Even whole nations may be in jeopardy: Tuvalu and the Maldives are the two most famous examples. “Ten per cent of the population of Bangladesh live on lands which would be regularly flooded with a sea-level rise of around 50 centimetres. Tidal cities like London, Venice and Bangkok, island cities like Hong Kong and Singapore, and river deltas such as the Nile, Niger, Yangtze, Mekong and Mississippi would be severely affected.” (Northcott, 1996, page 5)

Clearly this issue is important for PNG where large sections of the population live along the coasts and river banks and on low-lying islands. In many ways PNG is at the mercy of the large industrial nations which generate the bulk of the greenhouse gases and create the pressures for ongoing deforestation. However the people of PNG can play their small part by limiting the amount of burning of bush and forests and by resisting the pressure for extensive destruction of rainforests.

### Climate change and the future of life on earth

“... great uncertainties remain in the prediction of the effects of climate change. At its worst climate change may pose a fundamental threat to the delicate balance of temperature, gases, vegetation and moisture which provide the conditions for life on earth...”

“... the latest findings of the IPCC... indicate a new consensus... that, unless drastic action is taken, global warming could accelerate out of control by the end of the next century.” *

### Causes of ozone depletion

It is now generally accepted that the observed depletion of atmospheric ozone, including the famous “hole” over the Antarctic, originated from human pollution of the atmosphere in the form of chlorofluorocarbons (CFCs), which are used in refrigeration units, as aerosol propellants (the gases used in spray cans) and plastic expanders. Chlorine, released into the upper atmosphere by the CFCs, neutralises ozone. The existence of the “hole” locally reduces the greenhouse effect, which in turn results in

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* Michael Northcott *The Environment and Christian Ethics* CUP 1996, pages 5,6
the formation of ice clouds and ice particles which enhance the ozone depletion."

“The widening hole over the Antarctic is appearing for longer periods every year and covering larger areas, while there is also now a seasonal thinning of ozone over the Arctic, which again is growing in size and duration year by year.”*

Conservation/ Sustainability/ Restoration of the Atmosphere

- Approaches and technologies

Although PNG has a relatively clean atmosphere and is not a major contributor to the global problems of pollution, greenhouses gases and ozone depletion, there are significant local issues that can be addressed and important small contributions that can be made to solving the larger issues. The following approaches and technologies should all be given strong support.

  o Alternatives to fossil fuels – renewable fuels such as coconut oil and ethanol

PNG has great potential for using coconut oil as a diesel substitute – both in vehicles (including boats, both inboard and outboard motors), and for generating electricity. The technologies exist both for adapting diesel engines and for producing fuel quality coconut oil at the local level. Apart from its environmental payoff, use of this approach would produce a significant economic dividend. It would breathe new life into local and plantation level coconut production, make local transport more affordable, reduce the price of electricity and contribute to solving the national balance of payments dilemma.

Similar comments could be made about the potential use of ethanol as a fuel. PNG has significant potential for production of ethanol from a variety of widely grown sources of sugar and starch: sugar cane, sago, cassava, sweet potatoes, taro and palm nectar.

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# Michael Northcott *The Environment and Christian Ethics* CUP 1996, page 8

i “ethanol” – ordinary alcohol obtained by fermenting sugar or starch (there are many possible kinds of alcohol; the term “ethanol” is more exact than “alcohol”)
5. Key Environment Issues for PNG - Detailed Analysis

- **Limiting toxic emissions**
  Technologies exist for trapping and detoxifying emissions from vehicles and factories. These processes are somewhat costly, but the savings in terms of the environment and human health are much greater than the cost. Legislation may be needed to ensure that the appropriate technologies are applied.

- **Alternatives to CFCs**
  In many countries spray cans and refrigeration units containing CFCs are now illegal. PNG should follow this example and the people should refuse to buy spray cans that contain CFCs.

- **Better ventilated houses**
  Considering the threat to human health of smoke from household wood fires, improved ventilation of houses is an obvious first step for responding to this danger. This may work against the universal interest in reducing mosquito numbers in houses at night, but it is very important to decrease the smokiness and rely on other means to deal with the mosquitoes. Ideally mosquitoes should be controlled by use of bed nets, especially if they can be impregnated with the environmentally safe natural insecticide *permethrin*.

- **Fuel-efficient stoves**
  Traditional open fires are both wasteful of wood (which is often in short supply) and damaging to the environment. Fuel-efficient stoves are simple and cheap to construct and very effective in significantly reducing wood consumption. They produce much less smoke and this smoke can be directed outside the house by way of a simple chimney. The economic and health advantages are very great.

- **Role of rainforests**
  The importance of rainforests in mopping up CO₂ and renewing the oxygen supply has been emphasised already. The key point is that the forest area should be maintained and even expanded. Damage to forest areas should be restricted in every way possible – by seeking economic alternatives such as eco-tourism, using the most gentle and efficient methods and protecting newly exposed soils. Reforestation should be encouraged and implemented as a top priority.
Education and Research

As with the other segments, awareness raising and community education are extremely important. Specifically, control of smoke production is of primary importance in PNG. Traditional communities rarely have a complete understanding of the consequences of their burning practices for the environment, both inside and outside their houses. This topic warrants attention in school curricula and adult education programs, including health awareness programs. Again, the churches should play a leading role in encouraging understanding and commitment.

Perhaps the most important research subjects for PNG in relation to the atmosphere are the potential and possible strategies for use of renewable fuels and fuel-efficient stoves.

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**Pollution – uninvited, unwelcome and unavoidable**

“I will never forget visiting the beautiful valley known as Valle Ribiere, an hour or two south of the huge city of Sao Paolo in Brazil. Even though we drove in an air-conditioned car we could smell the sulphur fumes as we approached the main town. When we left the car to attend our meeting the smell was overwhelming. Our skin started to itch and our eyes started to water. The local people described how this pollution had started when the huge French industrial company Dupont had opened a match factory in the town. The factory provided much-needed employment but it made life very unpleasant and caused many health problems. Children were more often sick than well and the schools were half empty. Many children died before reaching teen years. The people tried to protest but they had no effective voice. The authorities in Sao Paolo were well paid for ensuring the factory continued to operate. Dupont was not allowed to set up such a factory in France, nor in many other countries, at least without effective emission controls. But in Brazil it was possible. The local people had no choice and paid the price in terms of their health. The multinational company made big profits which they shared with the Brazilian “big men” but not with the victims – who faced a daunting future with no escape.”

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# Graeme Swincer, international development programs consultant
Practical Actions for Conservation of the Atmosphere

⇒ Learn about the relevant issues and encourage others to do so too

⇒ Encourage community commitment to minimizing burning of gardens, “bush” and forests

⇒ Encourage community and household commitment to use of fuel-efficient stoves

⇒ Lobby national leaders to ensure there is legal prohibition of toxic factory emissions and legal minimization of toxic vehicle emissions

⇒ Participate in ongoing research on the issues related to producing and using renewable fuels
Fresh Water Resources

The Significance of Fresh Water Resources

PNG is rich in freshwater resources, most obviously its lakes, wetlands and rivers. These cover about 14% of the total area of the country. The 14 major rivers include the Fly, the Strickland, the Sepik, the Ramu, and the Markham. Easily accessible and high-quality groundwater is found in many parts of the country, especially near the coast, and countless springs and waterholes add to the total picture. In addition reliable rainfall is found over most of the nation; this is especially important for small islands. Even the widespread rainforests should be included as significant sites of stored water. Certainly some areas of the nation are much less well supplied than others, but the overall picture is one of abundance.

However, “despite this abundance of fresh water resources, Papua New Guinea ranks in the bottom ten countries of the world for access to safe water. In rural areas, only 29% of the population has access to an improved water source (including public standpipes, boreholes, protected wells, or springs). Most rural areas do not have a water supply infrastructure but take water directly from the source. There is direct consumption from major river tributaries, shallow wells on the coastal fringes or dug at the base of sago palms, and from rainwater harvesting. In urban areas, 91% have access to improved water, but only 60% of urban households have water piped directly into the home. Water hauling is a major preoccupation for many Papua New Guinean families, a task that is primarily undertaken by women and female children”.

It goes without saying that clean fresh water is necessary for household and institutional use: drinking, cooking, cleaning, washing, bathing – and also for animal production and fish production by aquaculture. Schools, hospitals, clinics, airports, offices, shops and factories all need plenty of good water. Water of possibly lower quality is needed for gardening and agricultural production and for secondary industry (notably, in PNG, coffee factories and mines).

* 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR World Bank 2002, Page 28
The lakes, wetlands and rivers possess significance that extends beyond provision of clean water for direct use by people for their lives and enterprises. They are vital for the continuing presence and well-being of fish, birds and other wildlife, indeed of whole ecosystems. Fresh water fish are indispensable as food in many areas, and they are also important for recreation. Recreational activities extend beyond fishing to water sports and tourism, involving appreciation of the scenic beauty of rivers, waterfalls and lakes. In a few situations fast-flowing mountain streams have been dammed and used for small-scale hydro-electric schemes. Finally rivers and lakes play a key role in transport by way of boats of many shapes and sizes.

**Degradation of Fresh Water Resources**

*Fresh water resources are degraded in two major ways: pollution and depletion.*

- **Pollution of Fresh Water Resources**

  **Water Pollution – a Global Problem**

  “Water pollution is the next most pervasive form of pollution after that of air pollution, affecting water in every form of its presence on earth from subterranean aquifers to rivers, lakes and oceans . . . Industrial effluent, sewage and agricultural products – fertiliser, pesticide, silage and slurry run-off from intensive animal-rearing systems – are the principal sources of river pollution. Chemical works and oil refineries are notorious polluters. Chemical companies traditionally locate their plants next to river estuaries, using river water as cheap, often free, dispersal mechanisms for toxic waste.” *

The 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR published by the World Bank gave the following summary (page 28)

“*Water pollution is caused mainly by unregulated runoff from industrial activities, illegal dynamite fishing, and the dumping of tailings by mining companies into rivers . . . Direct dumping of wastes (domestic solid wastes, hazardous* 

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*Michael Northcott *The Environment and Christian Ethics* CUP 1996, page 8
wastes, industrial effluent and sewage) into water bodies also contributes to water pollution. Additionally, sanitation facilities are underdeveloped in Papua New Guinea. Approximately 96% of rural households use traditional toilet facilities. Sanitation facilities are better in urban areas, but fewer than half of these households have flush toilets and many unplanned urban settlements have only very rudimentary facilities.”

- **Industrial Waste**

With very few large factories operating in PNG, the issue of industrial pollution of waterways is much less important than in Europe, Asia, North America and some of the South American countries.

Perhaps the most significant contributors to water pollution are coffee factories – large and small. “Processing of coffee is by the “wet” method, which causes large quantities of organic matter to be released into the water. Only coarse-level screening is carried out to separate the skin or pulp before discharging the organic-rich effluent directly into creeks and rivers. Although the effluent is not toxic, the high Biological Oxygen Demand (BOD) results in a depletion of oxygen in the water, affecting aquatic life. . . . Inspection of factories by the Bureau of Water Resources indicates that most factories screen the coffee pulp from wastewater before discharge. A few factories have oxidation ponds that may not be operating properly due to lack of proper engineering design and poor maintenance. This needs continued attention because 65% of coffee is grown and processed by small holders who cannot afford and do not have the skill for operating individually designed wastewater treatment systems.”

- **Household and community waste disposal**

Towns and villages in PNG often use rivers and streams as places to dump their garbage and even to pour some of their sewage. Over a period of a few years the solid materials accumulate and start to block the stream. Some components decompose quickly, other slowly. Toxic chemicals in containers are released as the containers corrode or disintegrate. Sewage may contain disease organisms which could enter the drinking water of households and communities further downstream.

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5. Key Environment Issues for PNG - Detailed Analysis

Fortunately the organisms are usually killed within a short time by the action of sunlight and oxygen in fast flowing or turbulent streams, but this takes longer if the water is flowing slowly or not at all. Waste that contains large amounts of phosphates, nitrates or ammonium salts will stimulate growth of weeds in the rivers, thus changing their ecosystems.

- **Agricultural chemicals**

PNG has participated in the worldwide raising of awareness of the environmental dangers of many agricultural chemicals and this has resulted in improvement in this area over the past 30 years. However some harmful pesticides are still available legally in PNG and in the absence of full information on their possible effects they continue to threaten the environment. Of particular concern are insecticides containing DDT and *dieldrin*. Wherever these are used, fish and eels in the nearby rivers are not safe for human consumption.

- **Topsoil**

The huge impact of eroded topsoil entering waterways as a result of deforestation and faulty agricultural practices has been discussed above in the section on Land and Soil.

- **Mining**

Mining is the best known and most devastating cause of water pollution in PNG. "*Unfortunately, the extraction industries in Papua New Guinea have been associated with river and sea pollution due to mine wastes for years. As early as 1988, landowners protested against the environmental damage caused by the Bougainville Panguna copper mine. This mine dumped approximately 150,000 tons of waste rock and tailings per day into the Kawerong River, from which it flowed into the Jaba River and to the coast. Over a ten-year period, more than 360 million tons of ore were deposited. Significant negative environmental effects include loss of fish throughout the entire 480 km. Jaba River watershed, declines in coastal fish stocks, declines in local wildlife populations, and loss of land for agriculture. The Ok Tedi mine . . . is another example of a mine that has caused considerable environmental damage through untreated river tailing disposal. The allowable discharges are regulated under the relevant water use permits issued by the Department of Environment and Conservation, however estimates of*"

\(^{i}\) “phosphates” – a group of chemical compounds that contain phosphorus
Christians Caring for the Environment in Papua New Guinea

"The generated wastes, particularly in remote areas, are difficult to quantify or monitor."

The sequence of events by which mining operations pollute the waterways and affect human life is outlined in the quotation from the 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR (World Bank) (page 18) in the following box.

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**Mine tailings and PNG waterways**

> "During mineral processing, the rock is crushed, and a variety of chemicals and heavy metals are added along with extreme heat (smelting) to extract the purified metal from the rock. Added chemicals or metals may include cyanide, mercury, arsenic, copper, cadmium, chromium, lead, iron, cobalt, kerosene, sodium sulfide, ammonia, and lime. The waste product is tailings (slurry containing at least 50% water and residual chemicals and metals from the extraction process). Tailings are usually disposed of in impoundments (dams) or in waterways. Environmental risks with impoundments include seepage of reagents (such as cyanide) or metals into surface or groundwater, the production and leaching of sulfuric acid, and significant potential risks of tailing dam rupture due to PNG’s high geologic instability/activity and high rainfall and storm waters. Where impoundments are considered too risky because of seismic instability, tailings are disposed of in rivers and in the marine environment.

Untreated tailing disposal has significant environmental effects. Disposal of toxic and other tailings into rivers affects water quality, stream hydrology, coral reef life, and aquatic biodiversity. Increased sedimentation clouds the waters, decreasing the amount of light available to aquatic plants for photosynthesis. Sedimentation and pollution are therefore some of the greatest threats to coral reefs. Sedimentation also eliminates food sources of other aquatic organisms by smothering benthic organisms (species occurring in the depths of the water habitat). Moreover, since some fish prefer slower moving clear water, the ability of fish to spawn and migrate may be impeded. Sedimentation may also decrease the depth of streams, resulting in a greater risk of flooding during times of high stream flow. In addition, since some species tolerate higher concentrations of metals and acidic water, aquatic biodiversity may be affected, with populations of various species being altered. finally, heavy metals such as mercury, bioaccumulate or increase in concentration as they move up the food chain, reaching the highest concentrations in humans."

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Polluted water has been identified as one reason for sickness and death of children due to diarrhoea – which is a major health issue in PNG. Other elements of personal and community hygiene and sanitation are now believed to be more important in relation to diarrhoea, but there is no doubt that water quality plays a key role.

“The Ok Tedi mine has been disposing its tailings into the Ok Tedi and Fly Rivers ever since successive major landslides forced the abandonment of a tailings dam construction, shortly after the mine started operating in 1984. Consequently, it has been discharging significant quantities of waste rock and tailings into the Fly River system at an average annual discharge rate of 65 million tons, and is expected to continue to do so until mining ceases. The Fly River System is the most significant river on the island of New Guinea in terms of biological value. The build-up of sediment has produced flooding of the Ok Tedi and Fly Rivers causing contaminated sediment deposition and a 100km\(^2\) dieback of vegetation on the flood plains, loss of food gardens, loss of fish habitat, and reduced fish populations.

As early as 1992, World Bank specialists prepared a review of environmental issues in the mining sector, which raised concerns regarding the environmental impacts of the Ok Tedi operation. The report also pointed out the need for improvements relating to
environmental legislation as well as regulatory and institutional capacity building needs.

“In 1994, ten years after Ok Tedi began operation and during which it became one of the world’s leading producers of copper, virtually all the landowners living along the Ok Tedi and Fly Rivers joined a lawsuit seeking compensation for environmental damages resulting from the river tailings disposal from the Ok Tedi mine. OTML signed an out-of-court settlement in 1996 with the communities for the payment of US$ 28.6 million to be paid out during a 13-year period as compensation for the severe environmental damages caused by the mine’s disposal of tailings.*

It is not only the large mines that can pollute waterways and other water resources. Small local mining operations can also cause significant damage unless appropriate precautions are taken and maintained with full discipline.

• Depletion

The fresh water resources available at a particular time and place are not necessarily permanent. They can be “degraded” not only by pollution but also by depletion. Water resources are depleted when loss and usage are greater than replacement. In many instances the mechanisms for replacement are so severely altered that depletion occurs even when there is zero usage. For example deforestation leads to drying up of springs, reduction of rainfall, silting of rivers and uneven flow of rivers (flooding followed by drying). Of particular importance are the large swamp areas that are gradually being lost. For example a survey quoted by the 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR published by the World Bank (page 27) indicated a decline of freshwater swamps by 24% between 1986 and 1997. These swamp areas are important both as key components of larger systems and as the basis of significant ecosystems in their own right.

So far there has not been the kind of widespread lowering of the water table experienced in some other countries. However growing populations around certain urban centres combined with local

* 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR World Bank 2002, page 19,
Source: World Bank documents, Register of Pacific Mining, and newspaper reports
deforestation could well result in depletion of ground water resources. Forests are vital for continuous replenishment of groundwater.

Part of the overall total of available freshwater resources is artificial storages: dams, tanks, ponds and wells. If these are not properly maintained the result is depletion of the overall supply and therefore an additional demand imposed on natural supplies.

Conservation/ Sustainability/ Restoration of Fresh Water Resources

- Approaches and technologies

*Responding to the realities and threats of pollution*

In many countries great progress has been made in reversing the water pollution disasters. Success has been due to a combination of public awareness, determined united action by community groups, and enactment of relevant legislation. The same is happening in PNG but, as with every other country, there is still room for improvement.

  o Industrial activities that cause pollution

Ideally owners of industrial units will voluntarily put in place practical control measures to ensure their factories, mines and logging operations do not allow polluted water or mine tailings to enter streams and rivers. If this is not happening then law-makers need to pass regulations that force the owners to act responsibly. In addition it is important that owners also take responsibility for past actions, funding and organising clean-up operations and making appropriate compensation payments to all the people who have been disadvantaged.

  o Community activities that cause pollution

Again, voluntary action is the ideal, with legal regulations providing suitable support and guidelines. Some relevant laws are already in place in PNG, but these may need to be supplemented by additional regulations at community, provincial or national level. Such actions and laws might relate to the issues of availability and use of agricultural chemicals, fishing methods (prohibiting dynamite fishing), disposal of household and commercial rubbish, and arrangements for dealing with sewage. In most cases, development and improvement of sanitation facilities must begin at the community level. In towns and cities the
town councils have responsibility for sanitation, but local groups can push for improvements and encourage appropriate public education.

Recycling of community and household waste that has some economic value usually requires cooperative action. Households can be encouraged to divide their waste into separate containers for plastics, paper and cardboard, metal cans and glass, and organic materials such as food scraps. None of these should be allowed to enter the waterways or ponds or wells. And, in sufficient quantities, each category has potential commercial value. In particular, paper can be processed to make “recycled paper” or cardboard boxes, or it can be used as fuel for fires. Organic materials can be made into compost which can be either sold as fertilizer or applied to community gardens.
Recycling in the United States

“Recycling efforts are springing up nationwide. The city of Seattle, for instance, has set the goal of 70 percent waste stream reduction through a community-wide recycling effort. It has contracted with several recyclers to experiment with different methods of collection. Essentially, the city collects glass, metal, paper, and plastics once a week. Seattle now leads the nation in reducing the waste stream. And a whole new industry is springing up in Seattle and elsewhere to recycle plastics, since they do not break down in the environment as other resources do. The recycled plastics are used for construction materials and drainage gutters in Europe, septic tanks in Thailand, and fill for sleeping bags and parkas in the United States?” *

Local community action – a global phenomenon

“All over the world local community groups are resisting environmental destruction of their local habitats and communities and it is this new local character of the contemporary phase of environmentalism which is perhaps its most distinctive feature. In parts of Europe and North America local communities are demanding that rivers such as the Mississippi, the Moyser and the Danube be undammed, and given back their natural meanders and flood plains so they can do the work of naturally removing pollutants and of absorbing heavy rainfall, and no longer threaten communities downstream in times of heavy rain.” #

Responding to the realities and threats of water depletion

As noted already, the single most important cause of depletion of water resources in PNG is deforestation. Community and government action is needed to ensure that this is kept to a minimum and that reforestation takes place wherever this is possible.

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i “parkas” – padded jackets
# Michael Northcott *The Environment and Christian Ethics* CUP 1996, page 35
Further contributions to maintaining natural water supplies can be made by reducing soil erosion and impeding runoff from sloping ground by use of contour banks, ditches and rows of plants.

Water can also be trapped or collected in artificial dams, ponds, and tanks, thus supplementing the supply and reducing the amounts that may need to be drawn from the natural sources. Effective new structures will be needed to meet the demands of a growing population, as will rehabilitation of temporarily damaged or inefficient existing storages. In particular there would seem to be great potential for sinking more wells and capping more springs – to be linked to community storages by gravity-flow piping.

Proper maintenance of water supply facilities is a key issue: “Communities have not always been willing to take responsibility for ongoing maintenance of installations with the result that a high percentage can become inoperable after a few years. Clearly, the challenge lies in both educating the users and in providing services.” *

**Education**

As with the other segments, awareness raising and community education are extremely important in relation to conservation of fresh water resources. Understanding of the importance of preventing pollution needs to be reinforced in all sectors and levels of society.

The same applies to the need for ensuring water resources are not depleted – but rather that they should be preserved, supplemented and even enhanced. The motivation and commitment to maintain water supply installations is a high priority.

Similarly this topic warrants attention in school curricula and adult education programs, including health awareness programs. Again, the churches should play a leading role in encouraging understanding and commitment.

Practical Actions for Conservation of Fresh Water Resources
⇒ Learn about the relevant issues and encourage others to do so too
⇒ Encourage community commitment to minimizing pollution of rivers, ponds and wells
⇒ Encourage community and household commitment to use recycling of wastes
⇒ Lobby community, provincial and national leaders to ensure there is appropriate legal control of pollution produced by industrial units
⇒ Encourage community commitment to preserving, supplementing and enhancing natural water resources
⇒ Encourage community commitment to maintaining water supply installations

Unheard Songs

The river never stops
But flows in abundant kindness.
The grass beside the banks laugh
And bend their heads in thankfulness.
The mountain breeze blows
And makes the lilies dance.
Oh they break forth into songs,
The songs we never hear;
But the Father does.
You are the songs of life
The songs that rise to the heavens,
To draw from the skies,
The anointing of the Father:
"Behold what manner of love." (1 John 3:1)

Kumalau Tawali
Marine Resources

The Significance and Degradation of Marine Resources

The following summary of the significance and degradation of marine resources in PNG is extracted (with slight amendments) from the 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR published by the World Bank, beginning at page 22.

“Papua New Guinea is surrounded by three major water masses – the Bismarck Sea, the Solomon Sea, and the Coral Sea. The total sea area is 3,120,000 sq. km, and there is over 17,110 km of coastline. The principal environments include coral reefs, mangroves, sea grass beds, sandy beaches, river deltas, rocky shorelines, inter-tidal flats with gradual mud or sand accumulation, estuaries, lagoons, and reef walls that drop off the continental slope. The marine environments of PNG are still relatively close to pristine, but are surprisingly poorly studied and there is a general lack of information on the resources. This makes it increasingly difficult to determine the rate of exploitation, and may lead to resources being degraded to dangerously low levels before their loss is realized.”

- Coral Reefs

Significance

“The coral reefs of PNG are among the richest and most diverse in the world, and cover a total area of 40,000 sq km. Recent surveys and anecdotal accounts indicate that most reefs in PNG are in very good condition. Reefs surveyed recently had relatively high coral cover and little evidence of damage from human activity. This largely reflects the country’s dispersed and isolated population and lack of technological development. . . . .”

“Reef coral is utilized for traditional jewellery, road construction, building materials by logging companies, and is also dried and crushed to produce lime for betel nut chewing.”

Degradation

“. . . . reefs close to the shore, where there is increased access by humans, have experienced localized degrading effects. . . . Threats to reefs result from fishing, boats, motors, anchors, and explosives. In addition, high influxes of sediment and freshwater into marine coral
habitats, especially near river mouths, are disruptive to coral reef development. There is evidence of loss of coral reefs near mouths of major rivers and degraded shorelines. Some of the most serious threats to coral reefs and the associated coastal ecosystems are from terrestrial activities such as large-scale forestry and agriculture, as extensive tracts of coastal forest have been cleared or allocated for logging. Increased erosion and sedimentation creates turbid waters that cut off light needed for photosynthesis, and clogs and suffocates coral polyps. Studies in the region have indicated a direct relationship between inland activities and sedimentation; partial clearing of virgin forest can generate two to three times as much sediment as non-active forest areas, and clear-cutting can increase sedimentation load ten-fold.”

**Reef fishing in PNG**

“Subsistence and artisanal fishing is the predominant human activity on PNG reefs. In general, reef fish harvests are thought to be below sustainable levels. However, there is evidence of over-fishing around Port Moresby and other large coastal centres. There is also evidence of substantial over-fishing of invertebrates such as sea cucumbers, trochus, green snail, and giant clams in many locations, particularly the Western and Milne Bay Provinces. The pressures on reef resources in PNG will almost certainly increase as the population continues to grow, especially in large coastal towns.”

**Mangroves**

**Significance**

“Papua New Guinea supports large tracts of extensive coastal mangrove ecosystems (150,000 hectares), and is a centre of biodiversity, including 37 species belonging to 20 different genera. Mangroves are largely found on the southern coast of PNG, and in major river systems throughout the country, notably the Fly, Kikori, and Purari Rivers. They are internationally significant as spawning and nursery grounds for prawn and fin fisheries that are harvested.”

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*“genera” (plural of “genus”) – groups of closely related species*
Mangrove forests are also utilized for firewood, medicines, and building materials.”

Degradation

“Large tracts of mangrove forests have been cut down, opening up mangrove canopies, which has resulted in short, stunted species of some fish. There have been proposals to selectively log mangrove communities (for valuable commercial mangrove cedar and other species); if carried out, this will diminish the values of commercial fisheries and subsistence fishing. In addition, mangrove habitats are greatly affected and even destroyed by polluted waters and heavy metals from mine tailings, oil spills, industrial wastes, and sewage and farm fertilizer runoff. There has been a considerable loss of mangrove vegetation along the Hanuabada and Motukea coastline on the outskirts of Port Moresby; however, such losses in mangrove ecosystems around the country are not documented or monitored.”

“Several saltwater and freshwater species are endangered by human activities. Saltwater and freshwater crocodile populations are the best-known examples of species that were threatened with extinction in the 1950s and 1960s because of over-hunting for their skins. In 1969, the Crocodile Trade Protection Act banned the trade in skins below 5.1 centimetres belly width, helping to slow the decline in numbers. It also led to the emergence of commercial crocodile ranch-farming, replacing the trade in wild skins by captive-raised populations. In spite of this, it appears that the trade of crocodile products is underreported and unsustainable. A 1994 survey showed damage to populations based on observed trends, and led to CITES (Convention on International Trade of Endangered and Threatened Species) imposing management restrictions on the crocodile trade. There are also other marine species at risk, particularly sedentary and slow-moving species that are easily accessible in shallow reefs, and are susceptible to overexploitation. These include sea cucumber, green snail, mother of pearl shells, giant clams, and trochus shells. Giant clams are listed by CITES, and some species are extinct in many other Pacific countries. Fishing is also moving to previously unexploited areas, exposing new sedentary populations to threats.”
5. Key Environment Issues for PNG - Detailed Analysis

- Commercial and Subsistence Fishing

Significance

“PNG has an Exclusive Economic Zone (EEZ) of 2,437,480 sq. km, and the fisheries industries contribute export earnings of over 200 million Kina (2001) and employ 3,500 individuals in the formal fisheries sector. The economic contribution towards the GDP is small, but growing, and the importance of fisheries to the coastal population and in particular at the subsistence level is significant. Tuna fishing is primarily undertaken by purse seine vessels (a large purse-like net designed to be operated by two boats to encircle an entire school of fish). The total annual catch has fluctuated between 135,000 and 330,000 MT per year over the last ten years, with variations reflecting oceanographic conditions and the status of access arrangements. The domestic tuna industry has recorded very large growth, particularly in long-line fishing, surface tuna fisheries, and onshore processing (canning). In 1997, 6,250 MT were exported at a value of 14 million Kina, rising in 2001 to 40,730 MT at a value of 144 million Kina . .”

“The other main commercial fishing is prawn trawling in the Gulf of Papua, the Torres Strait, and in the Orangerie Bay. The main species captured are tiger prawns, banana prawns, and endeavour prawns . .”

“While the largest overall catch is taken by the commercial sector, subsistence and artisanal fishing remains the most important in socio-economic terms to most Papua New Guineans. Subsistence fishing uses low technological methods and uses virtually everything that is caught. The artisanal sector sells catch for cash income, and uses a variety of traditional and modern methods to harvest fish products. This sector provides the most fish for the domestic market, as well as some for export.”

Degradation

Sustainability is the central issue for all sectors of the fishing industry in PNG. Over-fishing of certain species, leading to depletion of breeding stock and eventually to severe reduction of the species population, is a very real danger. Large scale commercial fishing by foreign interests is of particular concern. Damage to habitat, especially breeding environments, may also threaten sustainability.
A balanced assessment of the situation is provided by the 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR published by the World Bank, from which the following quotations are taken, beginning at page 24.

- **In general, PNG’s fisheries are relatively unexploited compared to some of its Asian and Pacific neighbours. In spite of this, localized species depletions have been recorded. However, good data on the numbers, diversity, catch rates, non-target (or by-catch) catch rates, and harvest rates of various species are severely lacking. Because there is no monitoring or awareness of these issues, many fisheries could be in danger of being over-fished.**

- **Tuna** “PNG and seven neighbouring countries have a long-standing agreement not to allow the number of licensed purse seine vessels to exceed 205. Taiwan, Philippines, Korea, and other countries operate foreign-based purse seiners. The total foreign vessels catch in 2000 was estimated at 160,000 MT, valued at approximately at US$ 100 million. However, there is considerable concern that the vessels are catching non-target species of fish (by-catch) as well, such as big eye tuna whose stock is more vulnerable to over-exploitation. The fact that full data is not available for these catches could lead to a risk of resource overexploitation; this warrants further study.”

- **Prawns** “Several fisheries have established Mean Sustainable Yields (MSY) and catch quotas to manage their fisheries. Others are managed using limited entry, established annual total allowable catch levels, and area closures to protect nursery stock. However, as with tuna, there is a large unutilised by-catch of non-target fish species, which in many cases is greater in weight than the prawns. The National Fisheries Authority limits prawn fishing in the Gulf of Papua to 15 licenses a year, including two reserved for traditional resource owners, and a 4-month closure of the main fishing grounds to limit fishing and protect juveniles after the spawning season. These limitations generally keep catches within the estimated sustainable average of 600 MT of banana prawns per year. In addition, trawl fishing is not permitted within the 3-mile limit of the gulf in order to protect juvenile prawns and breeding stocks, and not to transgress on traditional fishing areas.”
Summary and recommendations

“This sector suffers from a severe lack of data, thereby hampering efforts to effectively understand and manage the priorities for PNG. It is not clear if this is a priority area yet, but if the experience with logging is any indication, it is quite likely that the current levels of fish-catch are pushing the limits of sustainability and that by-catch and target fish catch should be monitored. There are serious threats to some species, and some are at risk of disappearing altogether. It is also necessary to monitor the impact of introduced fish species, and to better understand the dynamics of freshwater and marine ecosystems. Initiatives on community fisheries management and enforcement of fisheries regulations should be supported. Improved public awareness, and enforcement and management systems using community-based initiatives are important for sustainable economic returns for the resource owners.”

Conservation/ Sustainability/ Restoration of Marine Resources
As indicated in the quotations from the 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR published by the World Bank, there are four keys to ensuring sustainability of PNG’s marine resources:

1. **Relevant Research** – on (a) marine ecosystems and their response to human activities including the impact of introduced species, and (b) sustainable fishing levels in relation to the most important commercial species. (Government and industry groups need to lead this process.)

### Ocean pollution: a global issue

“The principal causes of ocean pollution are oil spillage, the dumping of chemical and human waste in coastal waters from waste pipes, and in the deep sea by ships and the outfalls of polluted rivers carrying loads of industrial and human effluent or silt from human activities such as logging. The 'out of sight, out of mind' principle is one which has been pursued by humanity living on the edge of the ocean for centuries. When humans were relatively few in number, and most pollutants occurred from natural processes, the oceans were able to cope. However, the quantities of toxic chemicals and of human waste that are now piped or shipped to the sea have begun seriously to impact upon ocean ecosystems.

The deep oceans are showing the effects of billions of tons of toxic contaminants dumped in the seas over many decades. The quantities of heavy metals, petroleum and plastics by-products which are now in the oceans become concentrated through ocean food chains in the fat of higher mammals, especially seals and whales. Those whales which have survived the onslaught of industrial whaling are now threatened with extinction by pollution. Even the polar seas and ice-caps are showing signs of pollution from human industrial farming and manufacturing. In the north polar region ice-floes and the Arctic Sea are polluted with soil from dust storms in degraded agricultural areas in China, Central Asia and North America, and with toxic waste from the polluting industries of the Northern hemisphere. The shallow North Sea, between Britain and Europe, is one of the most heavily polluted oceans in the world. Hundreds of thousands of tons of heavy and poisonous metals such as mercury, chromium and cadmium were dumped in the sea in just one seven-year period between 1975 and 1982, and similar amounts of plastic and oil-refining residues. These quantities of toxic chemicals represent a serious threat to all forms of sea life. Shellfish absorb significant amounts of waste metals which in turn may harm the health of those who consume them, both human and non-human, while vertebrate fish in the North Sea show signs of genetic
2. **Appropriate Regulations** – to ensure (a) pollution of marine resources is minimised, (b) important marine species are not over-exploited and (c) suitable management systems are implemented. (These regulations should be enacted and enforced at all levels: local, provincial and national.)

3. **Effective Management** – at all levels (community, industry, and government), taking into consideration both the findings of research and the legal framework, and ensuring fair distribution of both responsibilities and benefits, especially sustainable economic returns for the resource owners. (Committed and moral leadership is needed in every sector, and this must be supported by all the participants.)

4. **Wide Public Awareness** – of the key issues, resulting in active and informed participation in community-based initiatives for sustainable use of marine resources. (This can be achieved by way of national and local media, public education programs – schools and adult education courses – and communication through the churches)

**Practical Actions for Conservation of Marine Resources**

⇒ *Learn about the relevant issues and encourage others to do so too*

⇒ *Encourage community commitment to minimizing pollution of rivers and sea coasts*

⇒ *Encourage community commitment to proper management of all fishing activities including avoiding over-fishing and ensuring fair sharing of the benefits*

⇒ *Lobby community, provincial and national leaders to ensure there is appropriate legal control of the harvesting of marine resources*

⇒ *Encourage continuing research on sustainability of marine resources and understanding of marine ecosystems*

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*Michael Northcott* *The Environment and Christian Ethics* CUP 1996, page 11
Participate in national and local awareness raising programs about the issues related to conservation and sustainable use of marine resources.
A case study of community success: the PNG National Coastal Clean-Up Campaign

The PNG National Coastal Clean-Up Campaign was initiated by Conservation International (CIPNG) in conjunction with Eda Ranu in September 1999. The program was started in Port Moresby to encourage local communities in looking after the coastal environment. The PNG National Coastal Clean-Up Association has 16 full-time members representing various stakeholders, and is affiliated with the Centre of Ocean Conservancy, USA.

Print and electronic media, as well as billboards and advertisements, are used to raise awareness. The target groups are primary, lower secondary, and upper secondary school children, and the general public. The message is to care for the environment and be responsible for rubbish and litter. The increasing number of participants indicates the success of the clean-up campaign. The first year of the campaign attracted more than 3000 participants; this increased to more than 10,500 in 2000 and 38,000 in 2001. The success of the campaign improved the rating of PNG from 38th to 3rd within the 138 affiliated countries of Conservation International.

It is envisaged that the Coastal Clean-Up Campaign will be incorporated into the environmental education program through the Department of Education for elementary, primary, secondary, and vocational schools. A marine conservation and resource management module will be developed and tested in a pilot program in Milne Bay.

The community support for the program is an indication of the coastal community’s concern for its environment, and for the marine ecosystem that is being affected by non-biodegradable waste generated from rural and urban maritime communities. Various foreign diplomats were involved in the clean-up campaign in 2000, and the Prime Minister of PNG was the patron of the Association in 2001. The initiative has also attracted support from businesses. The success of this campaign is an indication that Papua New Guineans do care and are willing to participate in looking after the environment for the benefit of both present and future generations.

**Mining and Petroleum**

**Significance of the mining and petroleum sector for PNG**

The following summary of the significance of the mining and petroleum sector for PNG is extracted from the 2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR published by the World Bank, beginning at page 22.

“Mining is of major economic significance in PNG, but has in the past had some of the most disastrous environmental and social impacts compared to anywhere else in the world. It has been a significant contributor to the economy since PNG’s first large mine (Panguna) came on stream in 1972, and contributes 17.1% to the nation’s gross domestic product. In 2001, the mining sector alone contributed approximately 49% of foreign export earnings. Primary commodities mined are gold, copper, silver, nickel, cobalt, petroleum, and natural gas. In 2000, Papua New Guinea was the 13th largest copper and the 11th largest gold mining country in the world. Mining is, therefore, a very large and important part of the national economic activity. Although the mining sector in PNG has potential for growth and much of the country remains to be explored, exports have not grown over the past few years and mineral exploration activities have declined. Some of the factors that have contributed to this are exceedingly difficult terrain, poor infrastructure, extreme weather conditions, unpredictable tax levies, political unrest, land disputes, and unstable world prices for minerals. . . . Mining activities range in scale from artisanal (by individuals using shovels and pans), to large-scale, or industrial mining (with significant capital investments of up to US$50 million for large heavy equipment and specific high-technology processing plants). Medium- to large-scale mining is highly capital intensive and generally only employs about 3% of the workforce. Small-scale mining directly employs approximately 80,000 people.”

“Severe impacts to the environment can occur at all stages in the mining cycle from exploration, construction, operation, and closure, to post-closure. All these impacts are being felt in PNG.”

“During mineral exploration, large expanses of land are subjected to test drilling, trenches, and shafts by heavy drill rigs and machinery, and
ore is accessed by rock-blasting with explosives; material is then transported to crushers and processing plants. Hard-rock mineral processing generates significant waste from overburden (soil and vegetation located above the ore deposit) and further adjacent land is cleared to store the overburden.”

The mineral extraction process and the contribution of the waste products to water pollution are discussed under the section on Fresh Water Resources.

“PETROLEUM: The petroleum sector contributes 9.1% to the GDP. A refinery is being constructed in Port Moresby, but currently there are no operating oil refineries in PNG, and all oil production is transported to Asian and Australian markets for processing via the Gulf of Papua. Chevron Asiatic Ltd is working on a proposed natural gas pipeline that would extend from the PNG highlands to the central eastern coast of Queensland, Australia. This would include 635 km of pipeline in PNG (320 km onshore, 315 km offshore) and 2,615 km within Australian territory.

The petroleum sector has a lower environmental impact than mining; oil extraction requires digging of offshore or land wells, and transport of crude oil by trucks or lengthy pipelines to refineries. The clearing of land and soil in the exploration and development stages contributes to some habitat loss, erosion, flooding, and landslides.”

Conservation/ Sustainability/ Restoration in relation to Minerals, Oil and Gas

The main responsibility for preventing environmental degradation and restoring already degraded ecosystems clearly lies with the mining companies. The roles to be played by PNG citizens include lobbying national and provincial leaders, encouraging them to ensure that all new mining contracts include adequate provisions for protection of the environment. Strong policies must be devised and accepted by all parties before the mining is commenced.

Public awareness raising is important to ensure there is widespread support for maintaining the balance between economic needs and environmental needs. In particular the implementation and regulation of small scale mining must be guided by well informed local communities. The relevant issues should be communicated in education programs of schools, communities and churches.
The Ok Tedi Mine: Lessons and Environmental Trade-offs

The Ok Tedi mine is located on Mount Fubilan in the remote highlands of the Star Mountains on the Ok Tedi River. It is the world’s largest copper mine and contributes significantly to the economy of PNG. Ok Tedi Mining Ltd. (OTML) operates the mine, with a 20% Government stake. The operation provides approximately 10% of PNG’s gross domestic product, and nearly 20% of its export income.

OTML acknowledged the social and environmental impact of the mine’s operation, and commissioned various studies to assess the available options to address the environmental problems. In 1998, it commissioned a risk assessment to identify and quantify the risks associated with various waste mitigation options and the financial exposure associated with each option. This included assessing the impacts of (1) continued mining until the scheduled end of mine life, with continued dredging of sediment to reduce downstream impacts, (2) discontinue dredging immediately, and continue mining until the scheduled end of mine life, (3) continue operation until 2001, and divert and store tailings by constructing a dam, and (4) discontinue all mining operations immediately.

In 1999, the Government asked the World Bank to carry out a desk review of the Risk Assessment. According to the review, ‘significant and unacceptable’ environmental impacts much greater than originally predicted appeared to be occurring, and the impacts downstream of the mine would be felt for a long time after mine closure.

The trade-off was that the best environment option, early closure of the mine, would severely affect national and provincial economies and have significant impacts on the social stability, benefits, and well-being of the affected communities, especially in the enclave surrounding it. The Government subsequently indicated that an early closure of the Ok Tedi mine was not acceptable. On its own, OTML set up the Ok Tedi Development Trust. The fund allocates US$ 3 million per year to help build local infrastructure and to introduce sustainable development projects for affected communities. It will also work with communities to help them support themselves after the mine closes. In spite of this, the question remains whether the lessons learned from Ok Tedi will be used to guide new projects, and whether a regulatory and policy framework is in place to prevent such a recurrence. Or can this happen again? *

Practical Actions for addressing the environmental issues related to the Mining and Petroleum sector

⇒ Learn about the relevant issues and encourage others to do so too

⇒ Lobby community, provincial and national leaders to ensure there is appropriate legal control of large scale mining and petroleum extraction operations

⇒ Encourage commitment to environmental responsibility for all small scale mining operations

⇒ Participate in national and local awareness raising programs about the issues related to mining

Ok Tedi mine
picture from Earthworks, www.earthworkssanction.org
**“Environmental refugees”**

Around the world millions of people have been forced to leave their homes because of degradation of their environments. They congregate in squatter areas and shanty towns on the edges of large cities, trying to find sustenance after rural lands have been exhausted by intensive farming or overgrazing, or the food available from rivers and forests has been reduced by intensive logging activity. It is estimated that there are now more “environmental refugees” (at least 25 million and increasing rapidly) than refugees of the traditional kind (about 22 million). *

“Environmental disaster is now the biggest single cause of the movement of peoples across the globe. In parts of China land has been totally degraded by efforts to meet the absurd agricultural and iron smelting targets of the Cultural Revolution and people in their hundreds of thousands are leaving now infertile rural areas for the cities every day, to form the largest single movement of peoples in the history of Asia. In parts of Africa the land is so dry that aid agencies must sink wells thirty or forty metres to reach the water table. Ecological breakdown is also a growing cause of armed conflict as well as social anarchy. Struggles over the diminishing areas of fertile land have intensified in recent years, and land struggles continue to form the focus for civil war and resistance movements in many parts of the world.” #

In PNG thousands of people, especially young people, have left their home communities and migrated to other communities, mainly the larger towns and cities. This process continues with increasing momentum. It is almost always for social and economic reasons; in many cases it is related to education and hopes of employment. Some may be interested in returning to their home communities, but this is not common. Part of the reason for the reluctance of young people to return to the rural areas could well be environmental degradation, resulting in reduced economic possibilities and less pleasant living conditions. The same set of environmental factors could well become increasingly important in encouraging people to leave their homes. Unless environmental degradation is reversed, PNG faces the possibility of having to deal with increasing numbers of environmental refugees. The economic consequences would be immense. Such a possibility should give additional incentive – along with all the other reasons discussed earlier – for everyone in PNG to work toward conserving and restoring the environment.

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* Denis Alexander & Robert S. White *Beyond Belief*  Lion 2004, page 180
# Michael Northcott *The Environment and Christian Ethics*  CUP 1996, page 33
Chapter 6

The Challenge to respond appropriately

Caring for the environment requires many different actions. Suggestions for constructive practical actions have been made at the end of each main section of chapter 5. These relate to technical, social, cultural, political and educational matters.

However experience has shown that response to environmental challenges requires more than understanding the issues and knowing what to do about them. **What is needed is a deep level of commitment arising from strongly held values.** In PNG where around 95% of the population acknowledge adherence to Christianity, the teachings of the Bible provide the best framework for motivating people towards determined and positive action.

The starting point is appropriate attitudes. The foundations have been laid in chapters 2 and 3 on the “theology of the environment”. We noted the concerns of Calvin B. de Witt, Tom Sine and others that the churches of the affluent “West” had proved to be strangely reluctant to take strong leadership in relation to conservation of the environment. One reason for this is the tendency of Western Christians to follow the rest of society in thinking of the future in terms of personal material well-being, not in terms of God’s purpose for His creation. The churches of PNG may face different challenges, but the issues are still about the basis of our hopes for the future.

“We must not fail to act on what we know is right. Knowing God’s requirements for stewardship is not enough; they must be practised, or they do absolutely no good. Hearing, discussing, singing and contemplating God’s message is not enough; we must *do* the truth, making God’s love for the world evident in our own deeds, energetically engaging in work and actions that are in accord, harmony, and fellowship with God, and God’s sacrificial love.” *

* Calvin B. De Witt  Creation’s Environmental Challenge to Evangelical Christianity in Berry, R.J. “The care of creation: Focusing concern and action” IVP 2000
What attitudes and actions does God expect?

1. **Love God’s creation.** Because it is clear that God loves His creation it follows that His people should do no less. While “love” includes emotional aspects, the more important aspect is decision. Just as “love your neighbour” is a command to “act deliberately in the interests of the other person whatever the cost” so “Love God’s creation” means to “act deliberately in the interests of the environment”.

   Such love should lead to growing awareness of the beauty and wonder of God’s creation, thankfulness for it, and worship of the Creator. It will mean deep appreciation and respect for the environment, and dismay at all human activities that damage or destroy it.

2. **Repent of our failings.** The call to repent – to recognise our wrong actions and change direction – is fundamental to the Christian faith.

   *It requires honesty and humility.* This applies even where we have previously acted destructively towards God’s creation without understanding our behaviour or its consequences. Certainly we must repent whenever we have not cared for God’s world enough to be thoughtful about how we treat it, or when self-interest or greed are our guiding principles. God always requires His people to change course when their actions and habits are wrong. And for this He promises spiritual help.

   “A Christian environmental ethic involves as its first premise a confession of human sin and guilt for the desecration of God’s earth, and recognition that without the redemptive incarnation, crucifixion and resurrection of Jesus Christ, neither creation as a whole, nor humans within creation, are capable of recovering true relationality with the being of God.” *

3. **Rethink our priorities.** Commitment to caring for the environment always leads to difficult decisions. Conflicts may come in the form

   \[i\] “relationality” – experience characterised by functioning in relationship

of economic pressures or cultural demands or community (or family) opposition or cost factors (to pay for restoration for preventive measures) or rationing of personal time and energy. Translating commitment into action will need very careful thought, research, consultation and planning – and much patience. The full light of God’s Word will be needed to guide us through these questions: both the “theology of the environment” and the general ethical principles for living as God’s people. Central to everything are the values of trusting God to provide for our needs and sharing God’s blessings generously.

“Our ultimate purpose is to honour God as Creator in such a way that Christian environmental stewardship is part and parcel of everything we do. Our goal is to make tending the garden of creation in all its aspects an unquestioned and all-pervasive aspect of our service to each other, to our community, and to God’s world.”

4. Make stewardship of creation a way of life. God has given the resources of this world for our use and enjoyment. But He has also given us the responsibility of active care – to conserve, protect, restore, nurture and enhance. Degradation must be prevented or kept to a minimum. Resources must be re-used and recycled. Waste must be reduced. Pollution must be minimised and controlled. Appropriate technologies must be applied. Development must be sustainable. Restraint must be exercised so that resources are not over-exploited. Renewable energy resources must be used as much as possible.

“We must keep the creation as God keeps us . . . The abundant gifts and fruitfulness of God’s creation are meant to be sustained and available for all generations”. *

* Calvin B. De Witt Creation’s Environmental Challenge to Evangelical Christianity in Berry, R.J. ‘The care of creation: Focusing concern and action”, IVP, 2000)
5. **Share the message of active care for the environment.** This message is central both to our basic set of beliefs and to the future of our nation and our world. It must be proclaimed far and wide. Personal example and demonstration is a useful start. But this must be supplemented by written materials, school lessons, public awareness campaigns, lectures, seminars, sermons, and media features. We must be both teachable – always learning more about caring for the environment – and ready to teach.

“Christian environmental stewardship – our loving care and keeping of creation – is a central, joyful, part of the human task. As communities of God’s stewards – as the body of the One who made, sustains, and reconciles the world – our churches and our lives can be, and must be, vibrant testimonies to our Redeemer and Creator.”

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**Spirituality and Care for the Environment**

“... governments alone cannot make us good. Moral change concerning the duties and virtues which make us better people, and which make for a more ecologically harmonious way of living, will only come about through a process of education and the adoption of moral 'habits of the heart' in communities, in families, in neighbourhood, educational and work communities, and in religious communities. This is why the activation of so many local communities around the world in environmental protest and change is such a hopeful sign. But protest without spirituality will not endure. Rebellion against one kind of establishment is no basis for a new social and moral order. The hope that we can find peace in human life and harmony with the natural world needs the anchor, the spiritual sustenance, of the religious traditions of the world, for without that transcendent reference, environmental protest is still at risk of cynicism and boredom, despondency and hopelessness.”

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* Calvin B. De Witt in *Creation’s Environmental Challenge to Evangelical Christianity* in Berry, R.J. *The care of creation: Focusing concern and action*, IVP, 2000

# Michael Northcott *The Environment and Christian Ethics* CUP 1996, page 38
6. The Challenge to respond appropriately
The lifestyle of Christians and the concerns of the church should reflect a far greater awareness of our ecological catastrophe than they presently do. As those who believe that a personal, loving God created the earth, we Christians have a particular responsibility to take care of it and make proper use of it for long lasting benefits. *

The final word must belong to one of PNG’s most respected promoters of active care for God’s creation, Kumalau Tawali, pastor, teacher, poet, author and journalist:

“We must educate our people to the truth that having more and more things is not the true measure of a good life. What makes life more meaningful and joyful are spiritual values, which help us to respect our rivers, mountains, sea, and one another. Therefore, we need a massive global theological renewal and reconstruction regarding our understanding of God, the Creator and the Sustainer, in light of the environmental crisis facing the earth. Creation protests its treatment by human beings. It groans and travails in all its parts. Christians, you are “earth keepers”. Rise up to your calling.” #

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* Pastor Jonathan H. Inapelo, Tega Baptist Church, Mt. Hagen
* Kumalau Tawali "Vanishing Islands" in So is my Nation Self published 1994, page 37
6. The Challenge to respond appropriately
Appendix 1

Goroka Declaration on Christians and the Environment May 2003 *

An inter-church commitment to care of the environment in Papua New Guinea – undergirded by the Evangelical Alliance of PNG

We Christian leaders who have met in Goroka for a week (May 25-30, 2003) of consultation on the theology of the environment declare that from now on we are making a serious commitment to promoting care of the environment in PNG through education, advocacy, motivation and practical support. We will preach the message in our churches and provide a variety of relevant written materials.

As followers of Jesus Christ, committed to the full authority of the Scriptures, we confess we have not always taken an active and positive role in the solution of our ecological problems. We are aware that many environment conservation initiatives are being undertaken by individuals and organisations, both government and non-government, and we acknowledge and applaud these efforts. We believe it is now time for the churches to play their part more strongly than in the past, and therefore we commit ourselves to acting strongly and wisely to this end, giving full consideration to our special cultural and physical context.

We declare that:

• Because we worship and honour the Creator, we seek to cherish and care for the creation.
• Because we have been ignorant we have failed in our stewardship of creation; therefore we repent of the way we have allowed the destruction of the Creator's work.
• Because, in Christ, God has healed our alienation from God and extended to us the first fruits of the reconciliation of all things, we commit ourselves to working in the power of the Holy Spirit to share the Good News of Christ in word and deed, to work for the

* Acknowledgement is made of the significant role of An Evangelical Declaration on the Care of Creation (from Berry, 2000, pages 18-22) in providing inspiration and key formulations for the development of this declaration.
Appendix 1. Goroka Declaration on Christians and the Environment

reconciliation of all people in Christ, and to extend Christ’s healing to suffering creation.

• Because we are called to be stewards of God’s creation as commanded in Genesis 1:28 and 2:15, we commit ourselves to action that is caring, informed and constructive.

Many concerned people, convinced that environmental problems are more spiritual than technological, are exploring the world’s ideologies and religions in search of non-Christian spiritual resources for the healing of the earth. As followers of Jesus Christ, we believe that the Bible calls us to respond in four ways:

• First, God calls us to confess and repent of attitudes which devalue creation, and which twist or ignore biblical revelation to support our misuse of it. Forgetting that ‘the earth is the Lord’s’; we have often simply used creation and forgotten our responsibility to care for it.

• Second, our actions and attitudes towards the earth need to proceed from the centre of our faith, and be rooted in the fullness of God’s revelation in Christ and the Scriptures. We resist both ideologies which would presume the Gospel has nothing to do with the care of non-human creation and also ideologies which would reduce the Gospel to nothing more than the care of that creation.

• Third, we seek carefully to learn all that the Bible tells us about the Creator, creation, and the human task. In our life and words we declare that full good news for all creation which is still waiting ‘with eager longing for the revealing of the children of God’ (Rom. 8:19).

• Fourth, we seek to understand what creation reveals about God’s divinity, sustaining presence, and everlasting power, and what creation teaches us of its God-given order and the principles by which it works.

We believe that in Christ there is hope, not only for men, women and children, but also for the rest of creation which is suffering from the consequences of human sin.

• Therefore we call upon all Christians to reaffirm that all creation is God's; that God created it good; and that God is renewing it in Christ.

• We encourage deeper reflection on the substantial biblical and theological teaching which speaks of God's work of redemption in terms of the renewal and completion of God's purpose in creation.
Christians Caring for the Environment in Papua New Guinea

• We seek a deeper reflection on the wonders of God’s creation and the principles by which creation works. We also urge a careful consideration of how our corporate and individual actions respect and comply with God’s ordinances for creation.

• We encourage Christians to incorporate the extravagant creativity of God into their lives by increasing the nurturing role of beauty and the arts in their personal, ecclesiastical, and social patterns.

• We urge individual Christians and churches to be centres of creation’s care and renewal, both delighting in creation as God's gift, and enjoying it as God's provision, in ways which sustain and heal the damaged fabric of the creation which God has entrusted to us.

• We recall Jesus’ words that our lives do not consist in the abundance of our possessions, and therefore we urge followers of Jesus to resist the allure of wastefulness and over-consumption by making personal lifestyle choices that express humility, forbearance, self-restraint and frugality.

• We call on Christians to work for godly, just, and sustainable economies which reflect God's sovereign economy and enable men, women and children to flourish along with all the diversity of creation. We recognize that poverty forces people to degrade creation in order to survive; therefore we support the development of just, free economies which empower the poor and create abundance without diminishing creation’s bounty.

• We commit ourselves to work for responsible public policies which embody the principles of biblical stewardship of creation.

• We invite Christians – individuals, congregations and organizations – to join with us in this Christian declaration on the environment, becoming a covenant people in an ever-widening circle of biblical care for creation.

• We call upon Christians to listen to and work with all those who are concerned about the healing of creation, with an eagerness both to learn from them and also to share with them our conviction that the God whom all people sense in creation (Acts 17:27) is known fully only in the Word made flesh in Christ the living God, who made and sustains all things.

• We make this declaration knowing that until Christ returns to reconcile all things, we are called to be faithful stewards of God’s good garden, our earthly home.
Appendix 1. Goroka Declaration on Christians and the Environment

Signatories

**Belden Kepi**  Research & Conservation Foundation, Goroka  
**Pastor Boisen Asi**  Christian Revival Crusade, Goroka  
**Bishop Clarence Kapali**  United Church Highlands Region, Mendi  
**David Kima**  EAPNG, General Secretary, Banz  
**Bishop Denys Ririka**  Anglican Church of PNG, Goroka  
**Major Dinunu Neneva**  The Salvation Army, Goroka  
**Pastor George Manman**  Christian Outreach Centre, Goroka  
**Pastor Gireva Gireva**  Christian Life Centre (Pinewood Church), Goroka  
**Pastor Martin Wayne**  Baptist Union of PNG  
**Pastor Mathew Tapus**  Christian Apostolic Fellowship, Mt Hagen  
**Captain Patrick Wascu**  The Salvation Army, Goroka  
**Pastor Simon Agateva**  Open Bible Church, Goroka  
**Pastor Simil Hondolwa**  Tiliba (Good News) Christian Church, Mendi  
**Rev. Siulangi Kavora**  United Church, Goroka  
**Rev. Taiya Zawia**  St John’s Lutheran Church, Goroka  
**Pastor Tamat Irarue**  Lihona Village Representative (CLC), Goroka  
**Pastor Wilson Reré**  Foursquare Church, Goroka
Appendix 2

Participants: Workshop to write a handbook on Theology of the Environment for PNG

Goroka, PNG, April 5-10, 2004

Pastor Bruno Kabopnak  Faiwol Baptist Association/ Wangbin Local Baptist Church, Tabubil, WP
David Kima  General Secretary, EAPNG, Banz WHP
Pastor Dulu Kiase  ECPNG, Mt. Hagen WHP
Pastor George Manman  Christian Outreach Centre, Goroka EHP
Dr Graeme Swincer  National Indigenous Training Association, Australia
Pastor Joe Cornelius  President, SSEC PNG, Wewak ESP
Pastor Kumalau Tawali  Baptist Church Madang
Pastor Mathias Hamaga  President, EAPNG, Mt. Hagen WHP
Rev. Minwas More  Lecturer, CLTC, Banz WHP
Newton Ekoda  Diocesan Youth Coordinator, Anglican Diocese of Aipo Rongo, Mt. Hagen WHP
Nickson Soal  Recordist/ Coordinator, LRI Inc. PNG, Banz WHP
Pastor Reuben Semi  Tabubil Baptist Church, Tabubil WP
Pastor Rex Bulu  Faith Fellowship Church, GOROKA EHP
Pastor Roland Ifu  Foursquare Church of PNG, GOROKA EHP
Samuel Kongiye  Student, CLTC, Banz WHP
Pastor Simil Hondolwa  Good News (Tiliba) Christian Church, MENDI SHP
Rev Taiya Zawia  St John’s Lutheran Church, GOROKA EHP
Pastor Kumalau Tawali (right) in conversation with Pastor Simil Hondolwa at the April 2004 Goroka workshop to write a handbook on theology of the environment for PNG
Appendix 3

Selections from “So is my Nation” by
Kumalau Tawali

Renowned PNG pastor, teacher, poet, author and journalist

Vanishing Islands

(Pages 34ff)

When I was growing up in my fishing village in Manus, life was simple but happy. Even as a child of five I had already begun accompanying my father and other men for fishing expeditions. When I was a little older, I could fish on my own at low tide with other children.

One of the great wonders of nature that haunted my childhood imagination was the vastness and depth of the sea I saw around me. When the sea was calm, it was majestic in its vastness. When it was blown by the wind, its awesome power was terrifying. When I was able to go dive fishing on the reefs, I can recall, how my being would literally reach out with joy to the beauty of the marine life about me. Oh! The myriads of fish with their colours, and the sheer beauty of the crystal clear sea were, for me, a deep religious experience.

In 1966, the elders of my village decided to relocate our people near the coast on the main island of Manus. That, for me, meant leaving the atoll where I was born and grown up as a child. I was leaving behind part of my life; a life of simplicity and dependence upon a sea, which provided abundantly. Even though I would come back and fish on our traditional fishing ground, it was no longer the same.

The last time I was home was in 1992. At that time, I noticed that at our new village location, a good amount of land near the shore had gone under the sea. Coconut trees, which we planted in 1966, now lie in the sea 37 years later. The small atolls where, as children, my friends and I would go and play and look for seagulls’ nests and eggs have also gone into the sea. I was
nostalgic and sad that such beauty could disappear. It was as if a whole way of life, a whole civilisation, is fast disappearing.

The greenhouse effect, resulting in global warming, is not a theory of some nightmare environmental scientists, and with which the Greenpeace movements are possessed. It is a fact. It is an alarming fact.

I was further challenged to the horror of the global environmental crisis when I listened to a lecture given by a world-renowned environmental activist, Dr David Suzuki, recently. I learned that the extinction of human existence on the planet is intimately related to the predominating economic systems of Western Europe and North America. The illusion of “unlimited growth” that the economists of the northern nations are pushing is resulting in the ruthless exploitation of the planet’s resources.

The people of the northern nations of the world, are now addicted to materialism. Just like the drug addict who needs a quick fix to make him feel good, people just want more and more goods to get an instant feeling of satisfaction. This demonic desire drives the economically- and technologically-powerful nations to go plundering the earth’s resources to satisfy the insatiable greed of just a small proportion of the world population, to the peril of human extinction.

The deforesting of vast areas of the earth, and continuing use of fossil fuels, are resulting in the warming of the earth, bringing about the rise of sea levels. It is forecast that the small island nations of the Pacific Ocean will find their homelands of thousands of years unsuitable to live in because of the rise in the sea level. In fact, I have heard that a few of them are now importing fresh water because their own source has become too salty to drink.

Our nation is incredibly rich. But the wealth from our land, forests, mines, and the sea are rapidly going out of the country to make others rich, while we remain poor, and our environment is destroyed. Logging is not sustainable. No one has ever grown a rainforest. By the year 2000, only four areas of the earth will have their rainforest intact. Papua New Guinea is one of them.
It is up to our leaders and local communities to stand up to the horror of this “unlimited” exploitation of our heritage and stop it. We do not have to copy the economic system of the north. Many years ago I read a book called *Small is Beautiful*. We must challenge the worldview that has brought about the destructive “macho-technology”. Indeed this macho-technology is extremely destructive, and insensitive to ecological balance. The nations are finding out, for instance, that big dams are not good. Big mostly is not always good.

We need not copy the Western nations. We ought, with dignity, and importantly, rise up and design our own technology. We need appropriate technology. We must keep our holistic worldview, which helps keep the harmonious balance between humankind’s activities and the environment. We need a technology, which will help us reap the benefits of our forests and seas without destroying them.

We, as a planet and civilisation, have only a few short years in which to reverse the environmental crisis and the trend towards human extinction.

In 1979, Earl Mountbatten warned, “The world now stands on the brink of the final abyss. Let us resolve to take all possible steps to ensure that we do not through our own folly, go over the edge”. We must reverse the worldview of “unlimited growth”. The earth’s resources are limited.

There can only be sustainability if we regard the rest of creation as gifts from the Creator, who has given us a command to care for the earth. When we care for the forests, the rivers, and the seas, they, in turn, care for us and supply all our needs. And so we maintain a beautiful coexistence and renewal.

The unethical economic worldview of the “North America” will make us “go over the edge”. There is wisdom, given by the Creator, that surpasses the diverse ethics promoted around the world, and which is greater, and can help preserve human survival on the planet. We have our own wisdom. We need not sell our dignity by doing away with our worldview and accepting economic systems which are demonically destructive to our very existence.
Appendix 3 – Selections from “So is my Nation” by Kumalau Tawali

We must educate our people to the truth that having more and more things is not the true measure of a good life. What makes life more meaningful and joyful are spiritual values, which help us to respect our rivers, mountains, sea, and one another.

Therefore, we need a massive global theological renewal and reconstruction regarding our understanding of God, the Creator and the Sustainer, in light of the environmental crisis facing the earth. Creation protests its treatment by human beings. It groans and travails in all its part.

Christians, you are “earth keepers”. Rise up to your calling.

For the Oceania people

(Pages 38ff)

The days when the Oceania people, Micronesians, Melanesians, and Polynesians used to live at ease, are quite over. Their once-paradise homelands are facing cataclysmic changes, beyond their control.

Our once-pristine blue ocean water has become a waste dumping area, for super powers, especially nuclear waste. The long-term environmental effects, no matter how much scientific statistics may assure us, can only be truly known by our children and their children.

Some of us, true children of the ocean, dream a positive dream of our water heritage as a food basket for the dangerously increasing people of the world. Some estimates have it that by AD 2000, half the global population will be living under the poverty line. This poverty will partially be the result of the sheer increase of numbers, and partially the result of the unbalanced consumption of the earth’s resources. Some even give the horrendous figure of 90 percent of global population starving, in order to make the other 10 percent live in luxury.

The side effects of global warming are being seen and felt by our small island nations. In another 15 to 20 years, some of our low-lying countries like Tuvalu or Kiribati may be facing non-existence. The shorelines of bigger islands like Papua New
Guinea are being markedly inundated by the swelling waters of the Pacific Ocean. My own observation tells me that the atolls I once played on in childhood, and caught birds, are fast disappearing into the sea.

Beyond all these is the increasing globalisation of the control of our natural resources. It has become frustrationly obvious that the oceanic people are no longer masters of their resources. Indeed, economically, we are being relegated to cheap labour and forced to dance to the tune of our new economic masters in our own land.

My purpose in painting briefly these scenarios is not to arouse our people to a bitter uprising. No, we cannot even dream of violence or war in our region. We want to be able to speak a message of peace to the rest of the world, as a region. Nor could anyone in his or her right mind ever imagine a war of global magnitude in our era. That would be sheer genocide on a scale never dreamed of before.

My purpose is to awaken our people, particularly our leaders, to the truth that our long-term survival, if it can be helped, will only be assured by sincere cooperation and understanding by the global community.

We need assurance from our economic partners. We need assurance from those who possess superior military technology of mass destruction. We need the assurance by those who have the means that our children and their children will not become victims of global greed and destruction. We need the assurance that we will still be given the respect of being owners of our vast marine resources, able to negotiate on equal footing at regional economic meetings with economic super-powers.

Already, we are feeling the pinch of economic crisis, heralding the dawn of mass poverty in our once-paradise “flowing with milk and honey”. About 850,000 children in our region are already malnourished. Recent surveys conducted by the PNG National Research Institute, reveal the rise of poverty here in our country.

Even as short as 20 years ago, many of us would have been shocked, if it was suggested that there would be mass malnutrition and poverty among the people of the Pacific.
Poverty! We would have exclaimed. No, that’s only found in India, Bangladesh, and Africa. It cannot happen here. Ours would have been the prophetic words of a song I heard in the early 1970s:

So far away, so far away
So far, so far, that it never can be
In the land of I love me.

We are facing crisis! Let us face this fact squarely. This gathering of our regional leaders, we pray, will be inspired by wisdom from above, to truly seek “Pacific solidarity of the common good” and nothing less. This is the hour when we can no longer think small or selfish.

“If everybody cares enough, and everybody shares enough, wouldn’t everybody have enough?”

Throughout the Pacific may we all, with tears, pray to our heavenly Father, that He will enable our people to enjoy a future of plenty.

The choices before us

(Pages 41ff)

It was heartening to hear and know that Papua New Guinea was one of three Melanesian states that took a common stand in condemning the resumption of nuclear testing by France in the Pacific. I hope we can go beyond rhetoric in this matter.

We are part and parcel of a greater humanity whose survival is threatened on many fronts by man-made dangers. We are faced with the dangers of global environmental destruction – a danger which, unattended, may result in the slow but inevitable death of the planet. Then there is the ominous threat of the nuclear bomb, which is the supreme height in the militarisation of nations. The world is in catastrophe – prone condition. Technological developments in nuclear arsenals may themselves lead to a nuclear war and possible elimination of humankind, despite efforts by political leaders to avoid it!

To avoid future catastrophes we will need to have a strong vision of the future, as well as make correct moral choices. Such things
as technology, economics, and security are moral issues as well as practical. Only moral vision can determine whether we move towards greater social justice within and between countries.

The other evening, I was talking with two of the leading Christian leaders in our region. We were sharing our vision of a Pacific that would, in the future, play an increasing role in the humanisation of world communities. I exchanged with my friends that, perhaps, the South Pacific region may be known as a region of peace. Our nations could be peacemakers at home and peacemakers in the world. That could be a higher vision to hold for ourselves. We need such higher vision to keep us above our national or regional parochial issues.

Albert Einstein said in 1946, “We need an essentially new way of thinking, if mankind is to survive.” We are going to have to think not only in terms of nations and regions, but as someone said, “We are to think in terms of continents.” The challenges before us are of such magnitude that our usual ability to adapt by solving problems may not serve. There is a “wholly new order of problems” facing us, such that we are going to have to think radically of different approaches to solve the greater needs facing us. We are finding that future solutions to human conflicts may not be solved by a simple resort to technology, new resources, or new weaponry alone.

One of the greatest needs of the future is that of a fundamental shift in our thinking, especially in relationships among the nations on the planet. We have to change our thinking on things like resources. Resources are not infinite as we may have come to believe. Then there are weapons. Instead of them becoming means of deterrence, they can spur us to violence. Our technologies, which have become a symbol of our ability to do good things beyond our size, may become used for evil purposes. Instead of being a means of security, technology may cause unforeseen social problems.
Resource List

The following Resource List includes all of the books quoted in the text of this handbook together with several other books that provided helpful suggestion and ideas.

Books

Alexander, Denis & Robert S. White *Beyond Belief: Science, faith and ethical challenges* Lion 2004

Berry, R.J. *The care of creation: Focusing concern and action* IVP 2000

Brandt, Don (ed.) *God’s Stewards: the Role of Christians in Creation Care* World Vision 2002

Burnie, David *Earth watch: The young person’s guide to protecting the planet* Dorking Kindersley 2001

Carson, Rachel *Silent Spring* Penguin 1965

Carwardine, Mark *The WWF Environment Handbook* Optima 1990

Deane-Drummond Celia *A Handbook in Theology and Ecology* SCM 1996


De Witt, Calvin B. *Earthwise* CRC 1994

De Witt, Calvin B. *Caring for Creation* Baker 1998

De Witt, Calvin B. & Ghillean T. Prance *Missionary Earthkeeping* Mercer UP 1992

Drane, John *Cultural Change and the Biblical Faith* Paternoster 2000

Elsdon, Ron *Greenhouse Theology: Biblical Perspectives on Caring for Creation* Monarch 1992

Gnanakan, Ken *God’s World: A Theology of the Environment* SPCK 1999

Granberg-Michaelson, Wesley *Redeeming the Creation – The Rio Earth Summit: Challenges for the Churches* WCC 1992


Jackson, Ben *Poverty and the Planet: A Question of Survival* Penguin 1990

Kidner, Derek *Genesis* Tyndale 1967

Christians Caring for the Environment in Papua New Guinea


Nisbet, E. G. *Leaving Eden: To Protect and Manage the Earth* Cambridge UP 1991

Northcott, Michael S. *The Environment and Christian Ethics* Cambridge UP 1996


Schaeffer, Francis *Pollution and the Death of Man: the Christian View of Ecology* Tyndale 1970

Seymour, John and Herbert Giradet *Blueprint for a Green Planet* Angus & Robertson 1987

Sine, Tom *Wild Hope* Monarch 1991

Tawali, Kumalau *So is My Nation* Self published 1994

Valerio, Ruth *L is for Lifestyle* IVP 2004


World Bank *2002 PAPUA NEW GUINEA ENVIRONMENT MONITOR* World Bank 2002

World Commission on Environment and Development *Our Common Future* Oxford UP 1987

Wright, Christopher J.H. *Living as the People of God* IVP 1983

**Videos Tapes**

ABC, Australia *Attenborough in Paradise* BBC 1996

ABC, Australia *David Attenborough: The Living Planet (2 parts)* BBC 1987

ABC, Australia *State of the Planet: David Attenborough examines the past, present and future of life on the Earth* BBC 2000

The Edge Cinema, Katoomba, Australia *The Edge, The Movie: The Ultimate Blue Mountain Wilderness Experience* Padali 1995

Contact information

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  3, Hooper St, Cambridge CB1 2NZ, UK
  Tel / fax (+44) 1387 710 286
  Email: international@arocha.org
  Website: [www.arocha.org](http://www.arocha.org)

- **ARC (Alliance of Religions and Conservation)**
  3 Wynasty Grove, Fallowfield, Manchester M14 6XG, UK
  tel (+44) 161 248 5731
  Email: info@arcworld.org

- **Au Sable Institute**
  3770 Lake Drive SE, Grand Rapids, MI 49546, USA
  tel (+1) 616 526 9952   fax (+ 1) 616 526 9955
  e-mail: administration@ausable.org

- **Christians for Environmental Stewardship**
  P.O. Box 284, Brush Prairie, WA 98606, USA
  Tel (+1) 360 574 8230
  Website: [www.christianecology.org](http://www.christianecology.org)

- **Earth Ministry**
  6512 23rd Ave NW, Ste 317, Seattle WA 98117 USA
  Tel (+1) 206 632 2426   Fax (+1) 206 632 2082
  Website: [www.earthministry.org](http://www.earthministry.org)

- **Evangelical Alliance of PNG**
  PO Box 382, Mt Hagen, WHP, PNG
  Tel (C/- CLTC) (+675) 542 2797 or 546 1004
  Email: eapng@cltc.ac.pg

- **Evangelical Environmental Network & Creation Care Magazine**
  10 East Lancaster Ave. Wynnewood, PA 19096, USA
  Tel (+1) 202 554 1955
  Website: [www.creationcare.org](http://www.creationcare.org)

- **Fund for Christian Ecology**
  P.O. Box 6369, Boise, ID 83707-6369, USA
  Tel (+1) 208 330 2978
  Website: [www.christianecology.org](http://www.christianecology.org)

- **National Research Institute**
  PO Box 5854, Boroko, NCD, Papua New Guinea
  Email: nri@global.net.pg
“Stewardship of the environment is God’s first mandate to human beings. For Papua New Guineans the environment is their supermarket, their religious shrine and their priceless heritage. The environment binds the people to the past and it releases them for the future. *Christians Caring for the Environment in Papua New Guinea* deserves a place in every home, on the list of essential text books for every theological and Bible college student, and as a worthy addition in all institutional libraries. I commend EAPNG and all who contributed to it on this fine production. It is my prayer that it will achieve the purposes enshrined in its pages.”

**Rev. Dr. Joshua Damoi**  
*Principal of Christian Leaders Training College, PNG*

“Strong spiritual bonds of the people of Papua New Guinea to their land, forests, rivers and sea are good reasons for concern at present-day threats to the environment, their heritage, needed for the lives of generations to come. Changes in weather patterns, deforestation, soil erosion, polluted waterways, rising sea levels etc. are worrying signs which require corrective action. *Christians Caring for the Environment in PNG* is a timely response for the environment.

A reflection on the rich Biblical references to God’s creation lays the foundation for appreciation for all these blessings, for awareness of problems and appropriate action. The Churches, being close to the people, are challenged to raise awareness and encourage practical responses to real concerns for our environment. A useful handbook and guide.”

**Archbishop Sir Brian J. Barnes, OFM, KBE, DD**  
*Archbishop of Port Moresby*

In the Light of “Global Warming” I warm to this book. The reading of this book is a must for better appreciation and effective management of the environment.

**Colonel Andrew Kalai**  
*Territorial Commander*  
*The Salvation Army, PNG*