Introduction to Participatory Environmental Planning (PEP) for Sustainable Urban Development

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Ingrid Duchhart
author

Frederique Grootenhuis
research

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Dedicated to our Green Town’s children:
Anna, Boni, Tracy, Edwin (Mazingira), Shalin, Rashid, Owino, Tom, Keith, Ngina, Nasimiyu, and Jabali

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Introduction to Participatory Environmental Planning (PEP) for Sustainable Urban Development

Ir. Ingrid Duchhart

Environment and Urban Development Training Project
Kenya

Ministry of Local Government - Nairobi
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When it comes to the compilation of this book—there is a near endless list of people who should be acknowledged and thanked, among them the founders of the Green Towns project—the late Zebedeo Owando, Jacintha Makokha and Robert Chutha and the teachers and professors at Wageningen University, who had such a profound influence on the foundation for this handbook—in particular Prof. K. Kerkstra, Prof. F. Kleefmann, and Prof. M. Vroom.

Regarding the content and set-up of the handbook, it is only through the daylong discussions with Frederique Grootenhuis, her enthusiasm, her critique and her training experience that the course in participatory environmental planning found its form. Through her we met, among others, Pamela Lynam, who emphasised and supported our ideas on adult education. She advised us to ask the training participants to apply their lessons learned in between the training modules. This made the first Green Towns training programme result in three environmental units within the Ministry of Lands and Settlement, the Ministry of Local Government, and the Government Training Institute—Mombasa. Frederique also introduced us to Rudolphine Aalders who helped us to develop a systematic evaluation and monitoring system.

The course set-up is truly participatory—the course participants do most of the work themselves. The handbook gives a framework to structure the thinking, the debate, and the discussions. Often videos are used to provide knowledge and stimulate the debate. Here, we owe our thanks to Dr. David Campbell, who introduced us to this challenging audio-visual media. It also through him—that we found the way to make the course participants to owe the knowledge they gather. This is done by first allowing the course participants to identify ‘their environmental problems’ and from here work towards their own solutions. In the light of this, the handbook goes one step further by stimulating the participants to take their own stance regarding environmental issues. Because of this approach many of the course participants became ‘Green Town’ change agents advocating the care for the environment within their work and private life.

We would like to thank all trainees who contributed through their vivid discussions and their committed participation. In particular, I want to thank Emmy M’mbwanga, Rose Okoth, Caleb Murila, Teresia Munyua, Paul Kirai, Kuria Gatharu, Asenath Omwega, Marianne Magenda, and Wilfred Korir. We should also thank all Kenyans who guided us around their small shamba and shared their environmental initiatives with us. To honour all these important inputs, discussions, collaboration, and shared knowledge, I wrote the handbook in the plural form—we!

Finally we all owe our gratitude to the Netherlands Government, who funded the Green Towns project and the production of this book and Wageningen University who allowed me extra time to write the book and finalise its production.
This training handbook is a result of the Environment and Urban Development Training Project, informally called the Green Towns Project. This project introduced participatory environmental planning for sustainable development of small and intermediate towns in Kenya. The human living environment was taken as the entry point.

Training was one of the main pillars. Other pillars were institutional capacity building, public awareness, and implementation of real-life example projects.

1 The Green Towns Project's overall objective was "the sustainable integration of environmental considerations into urban development, in order to achieve a healthy and attractive urban environment providing its inhabitants with their basic needs such as water, food, energy, and shelter". The project was carried out in two phases – the first phase concentrated on training and the second phase on putting in place an institutional framework. The project was selected as a Best Practice Initiative in Kenya for Habitat II Conference in 1996 and as a Habitat (UNCHS) Best Practice in 1998. The main implementing partners were the Kenya Ministry of Local Government, the Ministry of Lands and Settlement, Government Training Institute Mombasa, Kenya Green Towns Partnership Association, 30 Green Town Action Groups, and Wageningen University in the Netherlands. The project was financed by the Netherlands Government.


The Green Town's training programme in environmental planning knew two basic elements,

- A training of trainers programme 'Introduction to Applied Environmental Planning: Application of Natural Principles in Urban Development', and
- A 3-Day Workshop in Participatory Environmental Planning (PEP) that evolves around 7 discussion oriented videos.

The training of trainers programme was composed of seven training modules, namely: an introduction in landscape ecology and planning, four technical modules, an environmental planning field course, and the facilitation of the 3-Day PEP workshop. The four technical modules addressed soil, water conservation and agroforestry (SOWAT), public health and sanitation (WASH), environmental impact assessment (EIA), and experiences with environmental planning. The full training programme took about 9 weeks given over a period of one year.

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Why a Handbook on Environmental Planning?

Kenya is urbanising at a high rate. It is expected that in another 10 to 15 years, 19 million Kenyans will live in urban centres that is about 12 million people more than now. To have young professionals and the civic society face the environmental challenges this urbanisation will pose, Kenyan universities and graduated Green Town trainers envision to run more Green Town's training of trainers programmes. The handbook 'Participatory Environmental Planning for Sustainable Urban Development' will help them to do so.

As the field of participatory environmental planning is new to Kenya, the book focuses on the principles behind environmental planning and facilitation techniques. The book thus follows in principle the modules 'Introduction in landscape ecology and planning', 'Environmental planning field-course', and 'Participatory facilitation techniques' as taught in the Green Town's training. The topics addressed in the SOWAT, WASH, and EIA modules are well covered by Kenyan governmental and non-governmental institutions and not included in this handbook.
How to use it?

The handbook goes together with a series of videos and the ‘Facilitation Guide for 3-Day Workshop in Participatory Environmental Planning for Urban Centres’. Even though, it was initially written as a guide for the training facilitators, the book can also be used for self-study. Of course, self-study will gain in depth if you work in a small preferably interdisciplinary group composed of community representatives and local government officials.

Throughout the book, you find assignments and questions. It is critical to do the assignments. One reason is that often the following section is built on the outcome of the assignment. Another reason is that if you do the assignments, you can expect a much deeper level of understanding and learning. The assignments introduce you to various modes of learning, for example, real-life experiences, interviewing, debate, and sketching and drawing. You can use the questions as a tool to test your newly acquired knowledge.

What is in it?

In the opening chapter ‘Man and Nature, A disturbed relationship’, we invite you to identify the major global and local environmental issues. We are sure that this will challenge you to continue with the next section – ‘Man and Nature’. In this section, we introduce you to the intrinsic beauty of nature. Then, you are asked to establish the values of nature for human wellbeing. In section 2, you go out into the field and are stimulated to create in collaboration with the community a harmonious living environment for all. The last section addresses simple facilitation techniques and introduces you to the 3-Day Workshop in Participatory Environmental Planning.

What is in it for you! Green Town’s graduates claim that the training changed their lives. The experience challenged them to take active responsibility for the environment. Already many of them proved powerful change agents. They forged new environmentally and community sensitive policy papers within their institutions. They trained thousands of community members who in their turn became change agents within their urban centres reaching hundreds of thousands residents. We hope that this handbook radiates the same spirit and also changes you in an advocate for environmental enhancement and care!
Notes

The Green Towns Project is a regional planning initiative that focuses on sustainable development of small and medium-sized towns in Kenya. The project aims to create an environmental plan that will guide the growth of these towns in a sustainable manner.

Training was one of the main pillars. Other pillars were institutional capacity building, public awareness and implementation of real-life example projects.
Introduction

No one wants to learn about things that do not have their interest. Therefore, before introducing you to the principles behind environmental planning, we want you to think about environmental issues that concern you.

Teaching Techniques

- Active and critical watching of the video Our Planet – Our Health
- Plenary discussions
- Text box

Contents

- Current global and local environmental issues
Over the years much has been written about the environment, its degradation and the human limitations to curb this degradation process. Recently, the environmental problems caused by the massive urbanisation process are gaining attention. In this introductory section, you will watch a video addressing some of the world-wide environmental problems. This will be followed by a moment of contemplation in plenary or alone to list the environmental issues that you encounter in your own environment.

Global Environmental Issues ‘Our Planet, Our Health’

The video takes 18 minutes and shows the inter-linkages between the health of the planet and our life. The video concentrates on water, air and soil. Carey Newson is the producer. It is a Small World Production from TVE. World Health Organisation took the initiative and the Government of Italy provided the funds.

Video Assignment ‘Our Planet, Our Health’

- List down the environmental problems shown,
- Do you experience similar problems in your own environment,
- How do you address environmental problems in your work?
Summary Video ‘Our Planet, Our Health’

Most of the world’s water is unsafe to drink. Thousands of people, especially children, die every day from water-borne diseases such as yellow fever, river blindness, guinea worm, cholera, typhoid and dysentery. Acid rainwater corrodes the copper water pipes in Scandinavia making infants suffer from copper poisoning.

Air pollution from cars and industries are threatening the health of many. The fumes are also to be blamed for the global warming. The cooking on wood exposes many women and children to diseases of the lungs and the heart. The introduction of cooking stoves drastically reduces the smoke and uses only a quarter of the fuel for an open fire.

Our modern lifestyle results in a garbage production of 1 tonne per year per person. Toxic wastes and pesticides are polluting our soil, resulting in spoiled crops. The environmental problems are getting more serious, but we have the choice to safeguard or to destroy our planet. For example, we could recycle or compost our garbage. This would dramatically reduce the space we need to dump our garbage. Or we could choose for organic forms of pest control, which will help to minimise soil contamination and occupational diseases.

In the developing countries the installation of village pumps helps people with clean drinking water and to improve their health.

Discussion Video ‘Our Planet, Our Health’

The training participants discuss the problems they identified on the video. Among the problems are: unsafe drinking water, water-borne diseases, acid rains and copper poisoning, lead pollution, reduced IQ, global warming, industrial pollution, indoor air pollution, lung and heart diseases, contaminated soil and groundwater, acute poisoning from toxic wastes, skin diseases, and reduced yields.
Local Environmental Issues

The training participants, then, listed environmental problems they experienced in their daily life. The following list is taken from previous training courses.

- River pollution (Nairobi river)
- Contaminated drinking water
- Soil erosion
- Air pollution
- Overstocking
- Urbanisation
- Siltation
- Deforestation
- Land degradation
- Garbage
- Chemical pollution
- Desertification
- Floods

Some of the results that were mentioned, included, poverty, poor health, child labour, scavenging garbage dumps, lack of fuel wood. In the course of this handbook, we will come back to the issues of environmental destruction and degradation. Step by step, you will identify their causes and slowly discover what you may want to do about them.

At this stage, you should ask yourself who suffers from all these environmental problems? Who suffers most from the pollution of the Nairobi River, from the air pollution in town and its direct surroundings? Who suffers most from the deforestation of the hills and mountains in your country? The training participants concluded that although often women and children suffer most, ultimately we all, men or women, poor or rich breath the same air and depend on the same clean drinking water.
Epilogue

Kenya's towns are growing rapidly. In 1975 about 1.7 million people (13 per cent of Kenya's population) lived in urban centres. In 1995 this had increased to 7.7 million (28.6 per cent of the total population). It is anticipated that by the year 2015 the amount of people living in urban centres will have reached 19 million. This will be nearly half of Kenya's population. Originally, this growth was by and large absorbed by the capital Nairobi and was the result of the rural-urban migration. Currently the smaller and intermediate towns too are growing dramatically. Over a period of about 15 years, an additional 11.3 million people will need housing and services, such as clean drinking water, food, wood fuel and electricity. These are nearly twice as many people as in the period of 1975 - 1995. This will not be an easy task, considering that already one quarter to half of the population live in life-threatening circumstances in the illegal and informal settlements of Nairobi, Mombasa and Kisumu. Even in the smaller towns of Kenya, like Nanyuki, Nyeri, Mavoko, or Ol Kalou, you find informal settlements with limited or no facilities.

The urban environment, if not well cared for, will increasingly impact on the health and the livelihoods of people who live there. For example, The East African Standards reports in their March 19-25th 2001 issue on the malaria and typhoid outbreak in a small Kenyan town due to a lack of clean drinking water and a failure to dispose of sewage hygienically. Furthermore, many of the illegal and informal settlements are located in dangerous sites, such as steep slopes, floodplains, besides open sewers, and dump sites. Yearly you read in the Kenyan newspapers about floods sweeping away people, cars and houses. It is not surprising that the poor suffer most. However, environmental hazards, such as the exposure to chemical pollution of air and water, solid waste and noise pollution are on the increase – and they affect the poor and the rich equally. And yet, we are not even discussing issues such as the need of green and safe playgrounds for optimum development of our children.

Urban centres and cities can be appreciated as the hub for development. But to play their development role properly, the urban areas should be clean, green, and safe. However, the existing planning and management tools seem no longer appropriate for the enormous demands. New approaches are required. The UN report 'An Urbanizing World' from 1996 states the change that needs to take place is one from 'planning the city' to 'a city that plans'. The plan changes from a product (i.e. graphic image of a desirable future produced by specialized technical departments) to a process (i.e. consultations, initiatives and actions through which a city collectively maps its present situation, identifies problems and opportunities, develops an inherent vision of the future and translates it into social, economic, and physical objectives supported by clear and realistic strategies).

We believe that the Green Town's approach could be one of these new approaches. Some of its characteristics are:

- Creative planning respecting environmental restrictions and using opportunities form the foundation of the Green Town's approach,
- A participatory approach creating joint ownership and responsibility for planning, implementation and management of the urban environment between government and the people,
- The Green Town's emphasis is on the process. The unprecedented rate of urban growth requires innovative and fast planning processes that shape a common vision, sense of direction, and result in immediate action,
- The result is a kind of incremental planning based on short-term affordable actions that jointly realise the long-term vision of sustainable development.

With the help of this handbook, we guide you through this innovative Green Town's approach. Hopefully this will assist in finding ways to address your environmental concerns.

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Global Environment Outlook 2000, UNEP/EARTHSAN

Climate

In the late 1990s, annual emissions of carbon dioxide were almost four times the 1950 level and atmospheric concentrations of carbon dioxide had reached their highest level in 160,000 years. According to the Intergovernmental Panel on Climate Change, 'the balance of evidence suggests that there is a discernible human influence on global climate'. Expected results include a shifting of climatic zones, changes in species composition and the productivity of ecosystem and increase in extreme weather events and impacts on human health.

Through the United Nations Framework Convention on Climate Change and the Kyoto Protocol, efforts are under way to start controlling and reducing greenhouse gas emissions. During the Third Conference of the Parties in Buenos Aires in 1998, a plan of action was developed on how to use the new international policy instruments such as emission trading and the Clean Development Mechanism. However, the Kyoto Protocol alone will be insufficient to stabilize carbon dioxide levels in the atmosphere.

Stratospheric Ozone Depletion

Major reductions in the production, consumption and release of ozone-depleting substances (ODS) have been, and continue to be, achieved by the Montreal Protocol and its related amendments. The abundance of ODS in the lower atmosphere peaked in about 1994 and is now slowly declining. This is expected to bring about a recovery of the ozone layer to pre-19980 levels by around 2050.

Illegal trading, still a problem, is being addressed by national governments but substantial quantities of ODS are still being smuggled across national borders. The Multilateral Fund and the Global Environment Facility are helping developing countries and countries in transition to phase out ODS. Since 1 July 1999, these countries have, for the first time, had to start meeting obligations under the Montreal Protocol.

Nitrogen Loading

We are fertilizing the Earth on a global scale through intensive agriculture, fossil fuel combustion and widespread cultivation of leguminous crops. Evidence is growing that the huge additional quantities of nitrogen being used are exacerbating acidification, causing changes in the species composition of ecosystems, raising nitrate levels in freshwater supplies above acceptable limits for human consumption and causing eutrophication in many freshwater habitats. In addition, river discharges laden with nitrogen-rich sewage and fertilizer runoff tend to stimulate algal blooms in coastal waters, which can lead to oxygen starvation and subsequently fish kills at lower depths, and reduce marine biodiversity through competition. Nitrogen emissions to the atmosphere contribute to global warming. Consensus among researchers is growing that the scale of disruption to the nitrogen cycle may have global implications comparable to those caused by disruption of the carbon cycle.

Chemical Risks

With the massive expansion in the availability and use of chemicals throughout the world, exposure to pesticides, heavy metals, small particulates and other substances poses an increasing threat to the health of humans and their environment. Pesticide use causes 3.5 to 5 million acute poisonings a year. Worldwide, 400 millions tones of hazardous waste are generated each year. About 75 per cent of pesticide use and hazardous waste generation occurs in developed countries. Despite restrictions on toxic and persistent chemicals such as DDT, PCBs and dioxin in many developed countries, they are still manufactured for export and remain widely used in developing countries. Efforts are under way to promote cleaner production, to limit the emissions and phase out the use of some persistent organic pollutants, to control waste production and trade, and improve waste management.

Disasters

The frequency and effects of natural disasters such as earthquakes, volcanic eruptions, hurricanes, fires and floods are increasing. This not only affects the lives of millions of people directly, through death, injury and economic loses, but adds to environmental problems. As just one example, in 1996-98 uncontrolled wildfires swept through forests in Brazil, Canada, China’s north-eastern Inner Mongolia Autonomous Region, France, Greece, Indonesia,
Italy, Mexico, Turkey, the Russian Federation and the United States. The health impacts of forest fires can be serious. Experts consider a pollution index of 100 µ/m³ unhealthy; in Malaysia, the index reached 800 µ/m³. The estimated health cost of forest fires to the people of Southeast Asia was US$1.4 billion. Forest fires are also a serious threat to biodiversity, especially when protected areas are burnt. Early warning and response systems are still weak, particularly in developing countries; there is an urgent need for improved information infrastructures and increased technical response capabilities.

**El Nino**

Unusual weather conditions of the past two years are also attributed to the El Nino Southern Oscillation (ENSO). The 1997/98 El Nino developed more quickly and resulted in higher temperatures in the Pacific Ocean than ever recorded before. The presence of this mass of warm water dominated world climate patterns up to mid-1998, causing substantial disruption and damage in many areas, including temperate zones. Extreme rainfall and flooding, droughts and forest fires were among the major impacts. Forecasting and early warning systems, together with human, agricultural and infrastructural protection, have been substantially improved as a result of the most recent El Nino.

**Land, Forests and Biodiversity**

Forests, woodlands and grasslands are still being degraded or destroyed, marginal lands turned into deserts, and natural ecosystems reduced or fragmented, further threatening biodiversity. New evidence confirm that climate change may further aggravate soil erosion in many regions in the coming decades, and threaten food production. Deforestation continues at high rates in developing countries, mainly driven by the demand for wood products and the need for land for agriculture and other purposes. Some 65 million hectares of forest were lost between 1990 and 1995, out of a total of 3500 million hectares. An increase of 9 million hectares in the developed world only slightly offset this loss. The quality of the remaining forest is threatened by a range of pressures including acidification, fuelwood and water abstraction, and fire. Reduced or degraded habitats threaten biodiversity at gene, species and ecosystem level, hampering the provision of key products and services. The widespread introduction of exotic species is a further major cause of biodiversity loss. Most of the threatened species are land-based, with more than half occurring in forests. Freshwater and marine habitats, especially coral reefs, are also very vulnerable.

**Freshwater**

Rapid population growth combined with industrialization, urbanization, agricultural intensification and water-intensive lifestyles is resulting in a global water crisis. About 20 per cent of the population currently lacks safe drinking water, while 50 per cent lacks access to a safe sanitation system. Falling water tables are widespread and cause serious problems, both because they lead to water shortages and, in coastal areas, to salt intrusion. Contamination of drinking water is mostly felt in megacities, while nitrate pollution and increasing loads of heavy metals affect water quality nearly everywhere. The world supply of freshwater cannot be increased; more and more people depend on this fixed supply; and more and more of it is polluted. Water security, like food security, will become a major national and regional priority in many areas of the world in the decades to come.

**Marine and Coastal Areas**

Urban and industrial development, tourism, aquaculture, waste dumping and discharge into marine areas are degrading coastal areas around the world and destroying ecosystems such as wetlands, mangroves and coral reefs. Climate changes also affect the quality of ocean water as well as sea levels. Low-lying areas, including many small islands, risk inundation. The global marine fish catch almost doubled between 1975 and 1995, and the state of the world's fisheries has now reached crisis point. About 60 per cent of the world's fisheries are at or near the point at which yields decline.

**Atmosphere**

There is a major difference between air pollution trends in developed and developing countries. Strenuous efforts have begun to abate atmospheric pollution in many industrialized countries but urban air pollution is reaching crisis dimensions in most large cities of the developing world. Road traffic, the burning of coal and high-sulphur fuels, and forest fires are the major causes of air pollution.
People in developing countries are also exposed to high levels of indoor pollutants from open fires. Some 50 per cent of chronic respiratory illness is now thought to be associated with air pollution. Large areas of forest and farmland are also being degraded by acid rain.

**Urban Impacts**

Many environmental problems reinforce one another in small, densely-populated areas. Air pollution, garbage, hazardous wastes, noise and water contamination turn these areas into environmental hot spots. Children are the most vulnerable to the inevitable health risks. Some 30-60 per cent of the urban population in low-income countries still lack adequate housing with sanitary facilities, drainage systems and piping for clean water. Continuing urbanization and industrialization, combined with a lack of resources and expertise, are increasing the severity of the problem. However, many local authorities are now joining forces to promote the concept of the sustainable city.

**Regional Trends**

**Africa**

Poverty is a major cause and consequence of the environmental degradation and resource depletion that threaten the region. Major environmental challenges include deforestation, soil degradation and desertification, declining biodiversity and marine resources, water scarcity, and deteriorating water and air quality. Urbanization is an emerging issue, bringing with it the range of human health and environmental problems well known in urban areas throughout the world. Growing 'environmental debts' in many countries are a major concern because the cost of remedial action will be far greater than preventive action.

Although many African countries are implementing new national and multilateral environmental policies, their effectiveness is often low due to lack of adequate staff, expertise, funds and equipment for implementation and enforcement. Current environmental policies are mainly based on regulatory instruments but some countries have begun to consider a broader range, including economic incentives implemented through different tax systems. Although cleaner production centres have been created in a few countries, most industries have made little effort to adopt cleaner production approaches. However, some multinational corporations, large-scale mining companies and even local enterprises have recently voluntarily adopted precautionary environmental standards.

There is growing recognition that national environmental policies are more likely to be effectively implemented if they are supported by an informed and involved public. Environmental awareness and education programmes are expanding almost everywhere, while indigenous knowledge receives greater recognition and is increasingly used. Environmental information systems are still weak.

There is fairly high interest in many of the global MEAs (multilateral environmental agreement), and several regional MEAs have been developed to support the global ones. The compliance and implementation rate is, however, quite low, mainly due to lack of funds.
Introduction

Environmental planning is determined by the opportunities and restrictions offered by the natural environment and the socio-cultural forces that determine people's attitude towards nature. This first section gives an insight in the driving forces behind the relationship between nature and the society and helps to determine your own stand.

Learning Objectives

After studying this section, students should be able to:
- Understand the intricate inter-linkages between nature and society
- Insight in some natural basic organising principles
- Clarify the basis of some societal environmental norms and attitudes
- Explain the forces behind environmental degradation
- Comprehend the workings of landscape ecology in the rural and urban environments
- Identify an environmental planning approach

Teaching Techniques

- Key note
- Critical watching of videos
- Text boxes
- Focussed (group) discussions

Contents

- Relations between nature and society – a theoretical model
- Nature – its functioning and roles for the society
- Society – its attitudes towards nature
- Landscape ecology in the rural and urban environment
- Environmental planning
Introduction

Prof. F. Kleefman developed during his professorship in Physical Planning at the Wageningen University in the Netherlands an abstract model to explain the enormously complex interaction between man and nature. He developed the model around 1986.¹

Learning Objectives:
After studying this chapter, you should be able to:

- Understand which forces shape the environment

Teaching Techniques

- Key note
- Discussion

Contents

- A theoretical model illustrating the relations between man and nature
The object of environmental planning is the environment. It is thus important that we build a common understanding of what we mean with environment. We also have to know about the forces that shape, influence, change, develop, and sometimes threaten the environment.

Prof. Kleefman, emeritus professor Physical Planning Department at Wageningen University, developed a model that visualises human interaction with nature in a simplified way. We take you step by step through the model. The basic idea behind the model is that nature is the life-sustaining base for human existence. Hereby, nature is transformed into suitable conditions for the society. In this model, it is the physical reflection of this transformation that we perceive as environment.

Illustration 1: Kleefman developed a simple model to symbolise the forces that shape the environment.

Kleefman identifies two sub-systems that regulate nature’s organisation:
- Abiotic sub-system representing the non-living nature (e.g. soil, water, air), and
- Biotic sub-system concerning living organisms, inclusive the biotic dimensions of human beings. These two sub-systems are highly interrelated and self-organising.

Illustration 2. Nature is nearly self-regulating through the biotic and abiotic organisation principles

Society

Within the society, Kleefman identifies three major sub-systems that influence the interactions of the society with nature:
- Economic sub-system representing the organisation of production,
- Cultural sub-system representing shared norms and values, and
- Political sub-system representing the intermediary between the two others.

Illustration 3. Within the society the driving forces are based on economic, cultural, and political organisation principles.

Social development is derived from forces that drive the three subsystems and their interactions. Kleefman states that the main driving force is the economic subsystem, which is regulated by national and international economic regimes. The political subsystem has to provide measures for growth and development. The political subsystem ensures itself of an income through taxes to invest in welfare programmes and social security. Through the latter, the political subsystem generates and maintains public support.
Interactions between Nature and Society

The main question here is – are the self-regulating forces within the natural organisation working in the same direction as the driving forces within the society. If they work in the same direction, Kleefman states that there is a kind of balance between the natural carrying capacity and the human land use.

If the driving forces within nature and society work in different directions all kinds of environmental problems arise. As the environmental problems can occur in each subsystem, it is not very easy to determine the cause of the problem or to identify a solution.

Environmental planning is to advise on balancing the natural and social organising principles. It is there to assist in determining possible causes and even more so to help searching for durable solutions.

Illustration 4. In a balanced and sustainable environment all forces work in the same direction.

Illustration 5. In an unbalanced environment the various forces work against one another resulting in a degraded environment and an impoverished society.

Q

- Can you give examples of how economic forces work against and how they work with natural forces?
- Answer the same questions for the cultural and political sub-systems?
Introduction

Nature's driving forces are complex and as yet not fully understood. Some basic understanding though is critical if you want to make meaningful and purposeful interventions that benefit the present and future society. Two videos are used in this chapter. The first video shows the workings of nature in a virgin tropical rainforest in Cameroon. The second video illustrates what happens when people interfere with a tropical forest in Tanzania.

Teaching Techniques

- Theoretical key note
- Active video watching
- Discussions

Learning Objectives

After studying this section you should be able to:
- Describe some characteristics of old and mature natural ecosystems
- Describe some characteristics of young ecosystems
- Understand ecosystem development
- Understand the forces behind environmental degradation
- See the potentials for environmental improvement by using natural forces
In the previous chapter, you learned that the abiotic (soil, water, etc) and the biotic (flora and fauna) systems are the two main natural sub-systems. The two are highly interrelated and self-organising. According to Odum, the main organising force is the transformation of energy from one form into the other. These transformations result in time and place specific interrelations, which we then call ecosystems. An ecosystem can be young, such as a pioneer vegetation on a sand dune or more mature, such as a forest. Ecosystems vary in size — depending on the scale level we look at it. For example, a fishpond but also the East African rangeland or Kakamega forest, can be described as an ecosystem. An ecosystem can be untouched and fully developed through its own internal natural processes, or is externally influenced, for example, through a fertiliser input or a harvest output.

Organising Principles - Energy Laws

As referred to in the introduction, Odum states that the main natural organising principle is based on the transformation of energy. There are two laws that govern the behaviour of energy, known as the laws of thermodynamics.

- The first law states that energy may be transformed from one form (such as light) into another type (such as food), but is never created or destroyed.
- The second law states that energy transformation always goes together with degradation of energy from a concentrated form (such as food, gasoline or sunlight) into a dispersed form (such as heat). Although energy is neither created nor destroyed during transformation, some of it is changed in an unavailable or less available form, such as dispersed heat. The second law is also known as entropy (in [en] transformation [tropy] law).

The two laws are illustrated by the energy flow through an oak leaf in Illustration 6.

Organisms and ecosystems transform energy from low to high utility states. In the successive transfers the quality of the energy form will be greatly enhanced. As a by-product dispersed forms of energy, such as heat, will be produced. Respiration is nature's way to remove this form of energy that is no longer useful to the plant or animal. If this would not occur, the system would quickly become overheated (Odum, p.70).

Illustration 6: Energy flow through an oak leaf (from Odum)

Solar Energy

Solar radiation is the main energy source for natural systems. Illustration 7 shows how plants and animals use directly or indirectly sunlight for the production of food (Odum, p 74).

Illustration 7: Solar energy is the main source of energy for natural systems (from Odum)

At each transformation useful work is accomplished, not just in the biological part, but all along the food chain. For example, the dissipation of solar radiation as it passes into the atmosphere, the oceans, and the green belts warms the biosphere to life-sustaining levels and drives the hydrological and nutrient cycles. Furthermore, at each transformation the quality of energy increases. Or in other words, as the quantity declines along the chain, the capacity to perform work per unit of quantity (calorie) increases. For example, solar energy is very dilute (less concentrated). You cannot directly eat it or cook your food with it. Solar energy has to be converted into a more concentrated form of energy, such as fuel wood.
Ecosystem Development

Ecosystems - an ecological system in which the non-living elements and the living community function together - go through a youth-to-maturity development process analogue to the growth and development of an individual organism. Primary succession is a succession that begins on a sterile field, such as a sand dune or lava flow. Development on such sites is very slow in some cases up to 1,000 years. Secondary succession is used for community development on sites previously occupied by well-developed communities, such as abandoned cropland or newly opened up spots in forests. Illustration 8 shows the development of an abandoned cropland to forest vegetation.

Ecosystem development results from:
- Modification of the physical environment by the biotic community,
- Competition and coexistence between individuals and populations (group of individuals), and
- Shift in energy flow from production to respiration as more and more of the available energy is required to maintain the increasing organic structure.

Illustration 9 gives a schematic impression of the energy flows in a young (developing) and a mature (climax) ecosystem. In a young system most energy is put into growth, in a more mature systems the energy is put in maintaining order, that is, in sustaining itself.

Illustration 8: Secondary ecosystem development from cropland to forest. (from Odum)

Illustration 9: Energy flows in young and in mature ecosystems. (from Odum)

Table 1 gives the changes in ecosystems while they ‘mature’. In the development process, the diversity in species and spatial organisation increases, mineral and nutrient cycles close, specialisations develop, and complexity in food chains and symbioses get highly advanced. In the maturing process, a fundamental shift in energy allocation from production of biomass to maintenance and protection (respiration) takes place. The high biomass production of a young ecosystem can only be maintained with a continuous input, such as, fertilisers - otherwise the natural self-organising process will direct itself towards more complex structures with a lower biomass production (a lower yield).

The actual ‘how’ and ‘why’ is still debated and largely unknown. One hypothesis is based on the inherent capacity of non-equilibrium systems to search for a balance with natural selection as the ultimate control. Modern ideas are based on the second law of thermodynamics. The overall ‘strategy’ involves decreasing disorder (sometimes called regulating or buffering capacity), increasing information (order), increasing the ecosystem’s ability to survive disturbances or ‘overheating’ (resistance, stability), and increasing efficiency of energy and nutrient utilization (Odum). In the next section, we will see that mankind needs nature’s regulating and stabilising capacity of mature ecosystems as much as the production capacity of younger systems.
### Table 1: A model for ecological succession of a self-driven green plant's ecosystem (changes and succession in the animal world is not addressed) (Adapted from Odum).

This rather abstract and complex theoretical exploration will get clearer once you watch the video 'Korup'. This video shows in live the complex interrelations among living organisms, soil and water of a mature ecosystem.

<table>
<thead>
<tr>
<th>Ecosystem Characteristics</th>
<th>Trend in Ecological Development</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Community Structure</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Species composition</strong></td>
</tr>
<tr>
<td></td>
<td>Changes rapidly at first, then more gradually</td>
</tr>
<tr>
<td></td>
<td><strong>Size of individuals</strong></td>
</tr>
<tr>
<td></td>
<td>Tends to increase</td>
</tr>
<tr>
<td></td>
<td><strong>Species diversity</strong></td>
</tr>
<tr>
<td></td>
<td>Increases initially, then becomes stabilised or declines in older ages as size of individuals increases</td>
</tr>
<tr>
<td></td>
<td><strong>Total biomass</strong></td>
</tr>
<tr>
<td></td>
<td>Increases</td>
</tr>
<tr>
<td></td>
<td><strong>Nonliving organic matter</strong></td>
</tr>
<tr>
<td></td>
<td>Increases</td>
</tr>
<tr>
<td></td>
<td><strong>Energy Flow</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Gross Production</strong></td>
</tr>
<tr>
<td></td>
<td>Increases during early phase of primary succession; little or no increase during secondary succession</td>
</tr>
</tbody>
</table>
|                           | **Net community production (yield)**
|                           | Decreases                        |
|                           | **Community respiration (maintenance)**
|                           | Increases                        |
|                           | **Gross production/maintenance ratio**
|                           | Decreases until they are equal   |
|                           | **Biomass supported by unit energy**
|                           | Increases                        |
|                           | **Food chains**                  |
|                           | From linear chains to more complex food webs |
|                           | **Biogeochemical Cycles**        |
|                           | **Mineral cycles**               |
|                           | Become more closed               |
|                           | **Turnover time and storage of essential elements**
|                           | Increases                        |
|                           | **Internal cycling**             |
|                           | Increases                        |
|                           | **Nutrient conservation**        |
|                           | Increases                        |
|                           | **Natural Selection and Regulation**
|                           | **Growth form**                  |
|                           | From rapid growth selection to feedback control selection |
|                           | **Life cycles**                  |
|                           | Increasing specialisation, length, and complexity |
|                           | **Symbioses (living together)**   |
|                           | Increasing more plants and animals living together |
|                           | **Entropy (non-available energy/chaos)**
|                           | Decreases                        |
|                           | **Information**                  |
|                           | Increases                        |
|                           | **Overall efficiency of energy and nutrient utilisation**
|                           | Increases                        |
Korup - Nature's functioning in practice

The video Korup shows an old tropical rainforest in Cameroon. Michael Rosenberg from Partridge Film produced the video under the auspices of Earthlife World Wildlife Fund. Scientific Advisors were Stephen Gatlan and Peter G. Waterman. The video takes about 58 minutes.

With the previous introductory theory on ecosystem development in mind, you should be able to answer the following questions and do the assignments while you are watching the video Korup.

A Video Assignment 'Korup'

- How old is the Korup forest?
- Give some examples of interdependency?
- List the major characteristics of the Korup rain forest
- Who suffers first in a deteriorating forest?
- Explain the nutrient cycle.

Summary Korup Video

The Korup rainforest is an old and mature ecosystem that evolved over more than a million years. The Korup video shows the high bio-diversity, the specialisation of plants and animals, and the actions to maintain the ecosystem. The forest houses half of the earth's known plant and animal species, among them you find the most ancient species on earth.

The forest has the heaviest rainfall of the world up to 30 feet per year creating the most-perfect conditions for plant growth. Far below the canopy there is a twilight world where only occasionally light penetrates. To survive there, plants and animals need to be specially equipped. The forest behaves as a single organism. Plants and animals form all kinds of symbiotic relations. The video shows how a tree forms a home for a colony of black ants, while the ants keep the tree free from smothering creepers.
When, a tree dies and falls down light penetrates onto the forest floor. This moment plays an important role in maintaining the forest's diversity. For example, the reproduction of the red-iron-wood tree depends on such a clearance. The light activates its seeds to germinate. The seedling grows rapidly towards the sky. Once the tree reaches the canopy, it branches and shuts out the light denying others the live-giving sunlight.

The huge plant and animal community of the Korup forest largely depends on the micro-organisms that live on the forest floor. The vital nutrients of dead leaves that fall on the forest floor are absorbed by these organisms, who pass them on to plants and trees, thus, creating a closed nutrient cycle. In fact, the Korup ecosystem survives on a thin layer of decomposting organic matter on one of the poorest soils.

However, the highly specialised relations make the forest also vulnerable. Any disturbance in this fine balance reduces the forest's ability to maintain itself. Africa has already lost more than half of its forests. The rest might disappear in the coming 30 years. And with it, the extinction of perhaps half of the plant and animal species on earth, which may irreversibly alter the course of evolution.

Discussion Korup Video
Take some time to discuss or contemplate the video. Compare your answers to the questions posed earlier. In the previous chapter, we gave a tabular model for ecological succession in a self-steering system without any influence from outside. The some of the ecosystem characteristics of a mature ecosystem that were given, follow:

- Community Structure
  - Species composition
  - Size of individuals
- Species diversity
- Total biomass
- Nonliving organic matter
- Energy Flow
  - Gross production
  - Net community production
  - Community respiration
- Food chains
- Biogeochemical cycles
  - Mineral cycles
  - Internal cycling
  - Nutrient conservation
- Natural selection and regulation
  - Specialisation, length, and complexity in life cycle
  - Symbioses (living together)
- Information available within the system
- Overall efficiency of energy and nutrient utilization
Assess the quality of the Korup tropical rainforest against the listed ecosystem characteristics. For example, the species diversity in the Korup forest is high. The food chain is long and complex and has the form of a web. The available genetic information is enormous (half of the world's known species) and unique, etc.

Nature’s Functioning when Influenced by People

From Taking Action, An Environmental Guide for You and Your Community
Edited by Adam Rogers
Published by UNEP in association with United Nations Non-governmental Liaison Service 1995, 217 pg.

A Changing Relationship

Human beings are just one of many species that form the ecosystem. Like all our ‘planetary roommates’ we have always interacted with our environment and, in the process, shaped it to some extent. Unlike other species, however, our role in these processes has changed dramatically over time. We humans are unique in many ways, especially in the extent to which we are able to affect our ecosystems – for better or worse. Since ancient times, the use of fire has altered flora and fauna, farmers have cut forests and domesticated certain species of animals and early civilizations have transformed deserts through irrigation.

Our environmental impact has grown in scale, become more rapid and changed in character. Whereas we once affected only small regions, today we are transforming the Earth itself on a global scale unprecedented in history. Changes which once took decades or centuries are now taking place within a few years. While we once affected the Earth in relatively insignificant ways, we are now changing the fundamental elements of the planet’s life support systems.

The video Korup showed us the primeval forest – a climax ecosystem evolved without human interference. There are few of such ecosystems left on earth. Most of the environments that are surrounding us are transformed nature for the benefit of people. The following video ‘Once there was a forest’ shows us how people interfered with nature, overexploited its resources, and eventually how they try to restore nature’s glory. The Sambara people, who feature in this video learned nature’s functioning the hard way.
The Usambara Mountains reach up to 2500 meters above sea level towering over the Masaai Plains. The mountains were covered with a thick rain forest. The tallest trees reached 60 meters height and below them were several layers of vegetation intertwined with lianas. On the floor lies a thick carpet of dead leaves and wood. The forest floor holds the rainwater like a sponge slowly releasing the water in clear streams that never dry up. The ecosystem is rich and complex, yet the soils are poor.

The Sambara people living in the forest used this rich and complex system for agriculture. The existing trees are inter-planted with their crops. Beans and Albizzia trees are planted to return nitrogen into the soil. Pas-
sion fruit climbs the trees. The Sambara produced over 30 different crops. The indigenous farming system imitates the forest — there are different forest layers (trees), ground covers (beans), and lianas (passion fruit). The people lived in balance with the forest.

In 1894, the Gennans colonised Tanzania and exploited the forest for timber. Ceder, mahogany, and camphor were cut down for export. Later European plantations were established. At independence in 1962, little forest had remained. The Sambara cleared the last remaining bits of forests within a couple of years after independence. It took about 10 years to use up the natural richness of the forest and to exhaust the forest soil. Poor mineral soil was all what was left.

Heavy rains washed away the land and the crops. A barren and unprotected landscape remained. The Sambara had the choice to leave the area or to stay and invest in the land. New ecological farming methods are introduced. Trees are planted together with maize and beans. Hedgerows of Leucaena are grown in between the crops. They help to fix nitrogen, provide fodder, green manure, and firewood. Mulch is applied to protect the soil. Zero grazing is introduced to reduce land pressure. This ecological way of farming is labour intensive. The paths are rough and difficult — but a new balance between people's needs and nature's requirements must be forged.

Discussion ‘Once there was a Forest Video’

In order to structure the answers to the video assignment, you could place the answers in a table as this was done in the Green Town’s training (see the result in Table 2). ‘Once there was a forest’ showed different types of man-nature relationships. These relationships can be described as an old and balanced indigenous system (mature ecosystem), a young agricultural production system (young ecosystem), an eroded system, and a system in which man looks for a new balance with nature (rejuvenated system). Compare this video with the ‘Korup’ video.
### Table 2: Various ecosystem stages compared

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mature Indigenous Ecosystem</th>
<th>Young Production Ecosystem</th>
<th>Eroded Ecosystem</th>
<th>Rejuvenated Ecosystem</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Very old</td>
<td>Young – 10 to 15 years</td>
<td>One time rainstorm may destroy the system</td>
<td>Takes long (maybe more than one generation) before it is established</td>
</tr>
<tr>
<td>Food chains</td>
<td>Complex relations / food webs</td>
<td>Simple food chain</td>
<td>No food chain – mineral soils remain</td>
<td>Simple but can develop in an increasingly more complex food chain</td>
</tr>
<tr>
<td>Inter-dependency/ symbiose</td>
<td>High interdependency</td>
<td>Low rate of interdependency</td>
<td>No interdependency</td>
<td>Medium rate of inter-dependency – but can increase over time</td>
</tr>
<tr>
<td>Self-stabilising and regulating</td>
<td>Develops towards a self-sustained, self-steering eco-system– balancing disturbances</td>
<td>Can only be maintained through external inputs</td>
<td>Cannot regulate or protect itself from influences from outside (such as a rainstorm)</td>
<td>Needs external support, maintenance, and input</td>
</tr>
<tr>
<td>Water cycle</td>
<td>Closed water cycle, water is maintained in the system – the forest floor acts as a sponge, rivers dry never up</td>
<td>Water cycle is relatively open – lots of water runs off</td>
<td>Water cycle is completely open – most/all rainwater runs off, developing dangerous and erosive energies</td>
<td>Increasingly more closed</td>
</tr>
<tr>
<td>Nutrient cycle</td>
<td>Closed nutrient cycle – nutrients do not leave the system but are re-cycled</td>
<td>Nutrient cycle is open – nutrient sink as the nutrients are taken of the land</td>
<td>Nutrient cycle is absent</td>
<td>Nutrient cycle is open – but more nutrients can be recycled</td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Increasing biodiversity then stabilised diversity</td>
<td>Mostly a mono-culture with low biodiversity</td>
<td>Biodiversity reduces to zero</td>
<td>Biodiversity can increase over time</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Self-maintaining and sustainable</td>
<td>The system cannot maintain itself – after 10 years the system was worn out</td>
<td>Unstable</td>
<td>Can be made sustainable, but not self-maintaining</td>
</tr>
<tr>
<td>Productivity</td>
<td>Productivity is oriented towards protection and maintenance</td>
<td>Productivity is oriented towards yields and growth</td>
<td>Lost all productivity</td>
<td>Productivity is oriented towards yield and growth and partially towards maintenance</td>
</tr>
</tbody>
</table>
Values of Nature

From the video, it is clear that the nature's organising principles not automatically serve human economic goals. We saw that the organising systems evolve towards maintenance and protection, while human goals are served with the highest yields of marketable products. But people do not live by food alone, we also need clean water, oxygen, shelter and the like. So, people need both the protective and the productive ecosystems. "The most pleasant and certainly the safest landscape to live in is one containing a mixture of communities of different ecological ages, that is a variety of crops, forests, lakes, streams, vegetated roadsides, marshes, seashores, and waste places." Kenyatta says in his book 'Facing Mount Kenya'. 'It is important that in every district there were pasture lands where livestock grazed in common. There were also saltlicks and mineral springs, the access was free to all those in the district. In addition to these there were public places reserved for meetings and dances. And also public roads and paths as well as sacred groves where national sacrifices were offered to Ngai... Along the rivers where sugar cane, bananas, and arum lily were cultivated. Near homesteads there were also pasture lands, owing to the system of cultivating the lands in rotation, and besides this there was also woodland, reserved for building materials and firewood. If we consider for a moment the pasture lands, salt-licks, public meeting and dance places, the woodlands, including big forests along the frontier of the Gikuyu and the neighbouring tribes, we will at once see that there were big tracts of lands used for other purposes than cultivation and which was equally important to the community."

At this point we revisit the 'Once there was a Forest' video. List down alone or in a group, the resources nature offered in the balanced and undisturbed system, the misuse that followed, and the action the Sambaras took to rejuvenate the eroded system. A check-list follows in Table 3.

Many planners and scientists consider the potentials of the natural environment to fulfil human needs a fruitful basis for valuation. Maarel and Dauvellier introduced the categories of production, regulation, information and carrier functions of nature. The participants of the Green Town's training identified the following categories: production, space, intrinsic values, protection, and information. Under production values they mentioned clean air, food, wood fuel, raw materials for utensils, building materials, minerals, and fossil and solar energy. Space was seen as the surface or land required for interaction with others, to build houses, the space to produce food and to dispose of waste. Under the category intrinsic values, the Kenyans mentioned beauty, source of corn.

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fort and life, base for culture, literature, art, music, and religion. Protection values were seen in carbon cycle, buffering and balancing of rainstorms, biological cleaning, shelter against harmful sunrays, herbal medicines, maintaining of soil fertility, and the like. Issues such as gene source, medical research, and future source of knowledge were categorised under information.

The participants concluded that although the production function of nature apparently dominates, it is crucial to undertake protective measures otherwise our life sustaining base will be destroyed and so will be humanity.

The Green Town's trainees were asked to write five values of nature on cards. The cards were verified (this is, all participants were requested if the card was valid) and pinned on the wall. After this the cards were categorised resulting in the mentioned categories. In other words, there is no scientific base to these categories.
Introduction

In this chapter, we turn away from the workings of the natural system, and look at how the society respects, treats, and values nature. From Kleefmann's theoretical model, we know that the society is organized through cultural, economic and political subsystems. We look in particular at the cultural sub-system.

Teaching Techniques

- Introductory keynote
- Discussion
- Text box

Teaching Objectives

After this session, you will have developed:

- Your own personal vision
- Insight in your society's attitudes and norms towards nature

Societal Attitudes Towards Nature

Contents

- Four forms of human relationships with nature
- Your own attitude towards nature
This chapter will be short. The social organising principles as meant by Kleefmann are much more complicated than can be described in this section. The economical and political sub-systems are not discussed, while the economic sub-system has a profound influence on the (mis)use of nature’s resources. Much of the world has adopted the capitalistic system in which the costs of environmental exploitation and extraction of natural resources is hardly ever included. The political system could play an important role in giving the environment the attention it requires for sustainable development. Although, environmental issues are more and more placed on the political agenda for a real impact much more remains to be done. The political system is inter-linked with the cultural system. Once the society as a whole will see environmental care as something that is normal and needs to be done, the political system will follow. With political will, the economic sub-system will have to include environmental costs at one stage.

The previous chapters made clear that without doubt nature is important for the humankind. Unfortunately, as Rolston describes very well in the book on environmental ethics, ‘Humans have more understanding than ever of the natural world ... more predictive power to foresee the intended and unintended results of their actions and more power to reverse the undesirable consequences. The duties that such power and vision generate no longer attach simply to individuals or persons but are emerging duties to specific forms of life. The wrong that humans are doing, or allowing to happen through carelessness, is stopping the historical vitality of life, the flow of natural kinds’.

The attitudes towards nature are taken in this handbook as an entry point towards the other sub-systems. We believe that by reading this book or following the Green Town’s training course, you will take up a personal stance towards the environment. We hope you will live up to your responsibilities and that positive change will follow.

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Human Relations with Nature

Nature simply is, without objective value; the preference of people establish value and the values generate what *ought* to be. Only people are ethical subjects and have a sense of duty. So, environmental ethics describe the principles that guide humanity’s relationship to the environment. There are about four different basic ethical models:

1. People are afraid of nature.
   - Discontinuity between humans and nature.
   - No understanding of nature.
   - Nature receives respect on the basis of fear.

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2: People are one with nature.
- People are part of a larger unity (including nature).
- Nature has a value in itself.
- Nature needs to be treated with respect.

3: People dominate nature.
- Discontinuity between humans and nature.
- Only people have an intrinsic value.
- Nature as a resource for human use.

4: People have stewardship over nature.
- Human beings are interrelated with nature, but do have a unique position.
- In addition to, nature as a resource, nature has intrinsic values.
- Responsible and respectful use of nature.

Basically, these models are derived from people's perception of the world. Each of the models imply a different conduct, a different sense of responsibility and duty. The way the world is informs the way it ought to be. People always shape their values in accord with their notion of the kind of universe they live in. As mentioned earlier people have more understanding of what is then ever before. As a result, more and more, we are searching for a conduct, proper attitudes and norms, that fits this knowledge. In the process, a general sense of responsibility to the biospheric earth is emerging (Holmes Rolston III, 1992).

Your Responsibilities

Above, reference is made to the fact that our attitude or conduct is shaped by how we perceive the reality of our world. Is this reality based on a religious, scientific, or man-centred world? Hooker, identifies about 18 different ways to clarify why, for what, and to whom we should be responsible for the environment or nature in general. They are derived from the questions 'for', 'to', and 'why' responsibility is taken for the environment. (The context, such as constraints and conditions, is not considered here for the purpose of simplicity). ‘We may be responsible for either nature or ourselves; to either God, nature or just ourselves; and (why?) because either God commands it, it is prudentially in our self-interest or it is ethically required (Here ‘God’ can stand for any nature-transcendent appeal, and while nature includes ourselves as natural animals it will be simpler to take it here as excluding culture)’. He developed a diagram with three axis - to, why, and for (see Illustration 10).

In the Green Town's training we asked participants to place themselves in the diagramme. The categories that emerged were based on a utilitarian view - we take care of the environment for ourselves, we are responsible towards ourselves, and because otherwise our environment will no longer provide us with our basic needs. Partly there was a religious view as some felt that the responsibility was towards 'God' and because 'God' wishes us to take good care of his creation. However, the last group was smaller than we expected from the quite religious Kenyan society.

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You are now asked either in a plenary exercise or alone to fill in your attitude towards nature. Read the text box on pages 36-37. Use Illustration 10 to answer the questions, Why? would you care for nature, what For, and To whom are you responsible?

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European culture has at times been compelled to revise its conception of nature. What is nature? What is the place of man in it? How are we entitled to treat nature? These questions have once again become a current interest. I shall approach the questions by considering four attitudes of man towards nature which have played an especially important role in the history of our civilization. I call them utilist, humanism, mysticism, and naturism.

By 'utilism' I mean an attitude or way of thinking that nature exists only for the welfare of humankind, its substantial characteristics might be stated as follows: (i) End: A high level of welfare for people. (ii) Conception of nature: Nature is a system regulated by causal laws; it provides a huge and valuable source of energy and raw materials. (iii) Legitimization: Humanity has an unlimited right to use nature for the welfare of people. (iv) Relation to technology: Science and technology are all-important, especially technology which helps us improve the effectiveness of production and thereby improves human welfare. (v) Optimism: All problems related to the welfare of humankind can be solved by promoting science and technology.

From the historical point of view, utilism together with the idea of possessive individualism is a product of the breakthrough of a new mode of scientific thinking in the 17th century. We are now familiar with the serious damage that life founded on utilism caused in natural ecosystems. The growth of human population, intensive building and pollution have caused great changes in natural ecosystems. The main problem of utilism is that it probably turns out to be contrafinal. Of course it is difficult to state with certainty what kind of development turns out to be fatal for the welfare of humankind, but if we do not find tenable solutions to the problems caused by pollution and the growth of human population, the contrafinal nature of utilism will soon prove true. Continuing a utilistic way of life presupposes that we believe in the power of science and technology, along with rational economy and politics, to solve all problems. If this belief turns out to be groundless, as might be expected, alternatives to utilism must be found.

One alternative is what I call 'humanism'. Like utilism, it is a purely human-centered attitude, but it ends are different. Humanism postulates the intellectual and moral perfectibility of mankind and promote such Socratic virtues as intellectual activity, moral strength, the sense of beauty, friendship and mental harmony. The main features of humanism are as follows: (i) End: Intellectual and moral development of man, i.e. promotion of Socratic virtues. (ii) Conception of nature: Nature, as such, is raw and primitive, but it contains possibilities for the development of human culture. (iii) Legitimization: Humanity has the right to use nature for promoting intellectual and moral development of people through education. (iv) Relation to technology: Science and technology are necessary, but they should be developed and used in accordance with the ends of humanism. (v) Optimism: The development of culture is believed to be progressive, even though from time to time humankind has to suffer trials and tribulations.

Humanism is a rational attitude. It rates knowledge and science highly, as well as technology that is needed for human education. But the rationality of humanism encompasses more than mere technical and economical rationality. Such ideals as justice, mental peace and friendship must be counted among these ends. We might speak here of ethical rationality in contrast to technical rationality.

Of course humanism must accept the use of natural resources for human welfare. But, moreover, it requires that nature should provide aesthetic satisfaction for people and advance their moral character. Nature should also promote mental health and positive relations (feelings of friendship, etc.) between persons. Therefore, in our treatment of nature we must consider aesthetic values and remember our responsibility for nature. Pure utilism does not concern itself with these values. But is it possible to fulfill all the various demands of humanism? Is it possible to advance the human culture with Socratic virtues without causing damage similar to those of the utilistic way of life does? Is it possible to invent technology and production that would serve humanistic ends but would avoid the problems of utilism? This is the main challenge for humanism.

Unlike humanism, 'mysticism' does not trust rational knowledge and human intellect. It seeks something beyond reason. Mystical movements become especially popular during cultural crises, when old habits, values and norms lose their significance and new ones have not yet become established. Mysticism aims at the experience of unity, a feeling that one is united with something infinitely great and powerful. When this feeling of unity occupies one's mind, the limits of time and space are removed and one feels everywhere the presence of something infinite, eternal and sacred.

European mysticism has often been a minor branch of the humanistic tradition. Plato's philosophy contained a large measure of mysticism. It was also easy to move towards mysticism from German romanticism and Hegelian philosophy, as in fact happened during the first half of the 19th century when American transcendentalism developed. The writings of Ralph Emerson and Henry Thoreau contain clear elements of mysticism. Of the present mystically oriented attitudes towards nature, Rudolf Steiner's anthroposophical science of spirit and Henrik Skolimowski's 'ecophilosophy' might be mentioned. Both of these trends of ideas gained some popularity for instance in Finland. The main characteristics of mysticism are as follows: (i) End: Experience of the unity of humankind and nature. (ii) Conception of nature: Nature is essential a spiritual and divine totality. (iii) Legitimization: Nature represents sanctity, the achievement of which is the highest end for human life. (iv) Relation to technology: Science and technology should be rejected, because they violate the spirituality of nature and undermine the human potential to achieve the experience of mystical unity. (v) Optimism: Although humanity can cause serious damage to nature, its divine force can never be destroyed.

Respect for the natural world is inherent in mysticism. However, mysticism faces the same problem as humanism: how
The inherent value of nature. (i) Relation to technology: All technology be characterized by the following principles: (i) End: The con­bly to nature. This
servation of nature in
ecological disturbance must be rejected. 
(ii) Equality: All species should be regarded as equally important in the sense of making the world as plentiful and perfect as possible, and as having therefore the same right to exist. The special posi­tion of humanity began to be questioned. Charles Darwin’s The Origin of the Species (1859) showed decisively that hu­ankind is descended from other species according to the prin­ciples of natural selection. Humanity thus belongs insepara­bly to nature. This forms part of the background of ‘biocentrism’ which as a general attitude towards nature can be characterized by the following principles: (i) End: The con­ervation of nature in as original and as primordial condition as possible. (ii) Conception of nature: Nature is a uniform sys­tem acting according to the laws of ecology, and man is part of the system. (iii) Legitimation: All parts of nature are of equal intrinsic value, and people should respect the intrinsic value of nature. (iv) Relation to technology: All technology that endangers the life of other species and causes excessive ecological disturbance must be rejected. (v) Optimism: If hu­mankind abandons the privileges with respect to nature and ac­cepts Homo sapiens as a species among others, nature can be conserved. Otherwise it will be destroyed.

The inherent value of nature has been justified in various ways. David Ehrenfeld suggests what he calls the Noah principle: ‘Species and communities should be conserved because they exist and because this existence is itself but the present ex­pression of continuing historical process of immense anti­quity and majesty.’ Other authors have argued that animals, at least sentient ones, have the same basic moral right to life and freedom as humanity has. It seems also meaningful to talk in an Aristotelian manner about the good of any living being, because living beings can be said to be well or ill, to thrive, or to flourish. Not only higher animals, but also plants and even simple organisms such as one-celled protozoa have a good of their own in this sense. Paul W. Taylor has recently developed a system of environmental ethics which is based on the principle that we should equally respect the food of all living beings.

The main practical difficulty of biocentrism is obvious: men do not easily reject the privileges they have gained – their welfare, technology, science, civilization and comfort. Taylor suggests certain principles for solving the difficult problem of adjusting the food of man to the welfare of other living beings, but it is doubtful whether they will achieve the goal inten­ted. Biocentrism requires that men reduce their influence on nature to a minimum, and live under primitive conditions. These ideas will probably not attract very many people.

Which one of the four basic attitudes is best justified? Utilism will most probably turn out to be contrafinal. The moral legit­imization of humanism seems to be firmer. However, it is an extremely difficult task to find a reconciliation between the intellectual and moral progress of human beings and the vitality of nature. Until this problem is solved, the legitimate basis of humanism remains unsatisfactory. Mysticism, if embraced generally, could save nature from disaster. But because it does not give a satisfactory answer to the problem of human welfare, it will only provide an escape from rather than a solution to the serious difficulties humankind is encountering. Biocentrism as a solution to the serious difficulties of human­kind is without doubt morally appealing, but it requires that people renounce their interests for the well-being of nature to such an extent that it cannot be expected to receive much support.

Perhaps we have to conclude that it would be best to have proponents of all the four attitudes, altering, however, the rela­tive strength from utilism towards the other three attitudes. But would it help? Nobody knows. It is quite possible that no proper balance between our interest and the tolerance of nature can be found.
Introduction
The forces that shape the environment were described in the previous chapters. In the explanations and the videos there was a certain emphasis on the nature’s driving forces. In the coming chapter, we invite you to look at man-made environments included your own daily environment. In this chapter, we look how a rural environment is built up.
Earlier, nature’s values for people were identified. In this chapter, we show that these values differ for men, women and children.

Teaching Techniques
- Key note
- Case study
- Group exercises
- Discussions

Learning Objectives
After studying this section you should be able to:
- Comprehend how people make use of the natural resources
- Understand the inter-linkages between soil, water, vegetation, land form, animals and people expressed in unique landscape units
- Understand the inter-linkages between the landscape units
- Appreciate socio-cultural forces expressed as gender issues

Landscape Ecology in a Rural Environment

Contents
- Landscape ecological concept
- Concept of landscape units and land-use systems illustrated through South-West Kano, Kenya case study
- User groups (men, women, boy and girl child)
The ‘Usambara’ video showed that people have the capacity to change natural ecosystems in well-functioning man-made ecosystems. The indigenous Sambara carefully worked in line with nature’s driving forces. They used age-old combinations of trees, climbers, shrubs, and groundcover. Their successors unsuccessfully exploited the natural system down to the level of complete destruction. Currently, the Sambara are trying in a process of trial and error to develop an ecosystem that again is in tune with nature.

Successful adaptation of the natural resources requires people creatively using the opportunities offered by the natural environment while respecting its restrictions. For example, when people look for a place to settle, they search for fertile soils to grow their crops, land to graze their animals, a source of water, a place to build their houses, while at the same time they are protected from floods, rains, sun, and cold. Certain areas remain untouched. In this way a creative network of areas with production functions, i.e. the cultivated areas and grazing, alternates with areas with protection functions, i.e. forests and scrubs. This network is not at randomly chosen, but closely linked to the area’s suitability and the required protective measures. Landscape ecology studies how these networks are set-up and functioning.

In this context, we refer to the origins of the word ecology. The English word ecology is derived from the Greek word for house, oikos. Ecology, thus, literally means the study of our house. So, the description of an ecosystem can be explained as a description of ‘how our household is put together and how it works’.

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Illustration 11: The vertical inter-linkages in a landscape unit are well described in a cross-section. As an example, we use here the Kisii landscape.
tionships result from the inter-linkages among plants, animals, air, water and soil within a relatively homogenous spatial unit, which we call here landscape units. While the ‘horizontal’ relations focus on the links among the units. Examples of landscape units are: mountainous with very steep slopes, dissected by deep valleys, with shallow soils excessively drained with forests or grazing areas; or as foot slopes, flat to undulating with deep well drained fertile clay soils with predominantly arable land, farm houses and urban villages.

These basically vertical relationships can be well illustrated in a cross-section. Illustration 11 gives an example of such a cross-section.

As mentioned earlier, landscape units are inter-linked. Water run-off is an excellent example of how one landscape unit can be linked to another. The rainwater that falls on steep de-vegetated slopes of a mountainous landscape unit will accumulate in the landscape unit of the lower-lying foot slopes. Here the run off can cause serious floods or replenish water dams and springs. Landscape units are not only inter-linked through natural processes, but also by people’s actions. For example, the population of an urban centre requires food. They will buy this from surrounding farmers. The farmers react on this ready market by growing the required products. Agricultural production therefore changes under the influence of the urban centre. Even wildlife can link one unit with the other, for example, they may forage in one and rest in the other. Once the landscape units are mapped and their unique characteristics are described the horizontal relationships start to reveal.

As part of the introduction on the next case study, we dwell a bit longer on the integrated use by a farming family of various landscape units, sometimes called farming system. The farming family will locate their arable land on the lighter and sandy soils and their grazing area on the heavy, fertile but difficult to cultivate black clay soils. Their compounds can be found on the lighter soils as these soils form a good foundation for their houses. The black coloured clay soil shrinks and swells dramatically, destroying the foundations of the houses and roots of most plants and trees. On a more detailed scale level, men, women, boy and girl children may make use of different landscape units. Women make use of the fertile land around the farm compounds for the production of food for the family, the girl will fetch water from springs or wells while the boy grazes the animals. Changes in the landscape units, for example, the removal of trees and bushes on the slopes of the hills may dry up springs and force girls and women to look for water elsewhere often much further away if available at all. The farming family will thus look for sections of land in different landscape units in order to build up a sustainable and prosperous farm while making use of nature’s resources.

With this understanding of landscapes and landscape units, their unique location and interactions, we invite you to read the case study ‘Landscape Analysis: A Design Tool for Sustainable Irrigation Development, An example from South-West Kano, Kenya’ written by Ingrid Duchhart and Sylvester Povel in 1991. Although section 3 of the article addresses most clearly the concept of landscape units and table 1 the specific uses and user groups (men, women, girls or boys), we present an integral version of the article. In this way, you will not only grasp the concept of landscape units, but you will also see why it is useful to have such knowledge.
Kano Plains – A Case Study

Key words: assessment of irrigation, development options, Kenya, Kano Plains, landscape analysis; smallholder irrigation development

Abstract. By taking the proposed smallholder South-West Kano irrigation scheme as a case study, this article illustrates that designing sustainable irrigation schemes requires knowledge of the present landscape and insight into the demands of the society on the environment at present and in the future. First, the effects of irrigated rice production on farming households in four existing irrigation schemes in the Kano Plains in Kenya are evaluated. Second, a landscape analysis is applied to the South-West Kano project area to evaluate the uses and functions of the current landscape. The design criteria formulated from the perspective of these two evaluations form the basis of an assessment of four options of irrigation development in the South-West Kano project area. As socio-economic processes are reflected in the landscape, landscape analysis can be instrumental in visualizing and quantifying data not easily grasped otherwise. It may thus help to make discussions between farmers and engineers more concrete and to the point.

1. Introduction

Experience with irrigation schemes in developing countries shows that irrigated agriculture is, generally, one of the many activities of a farming household and not the only activity, as was often wrongly assumed before. It is for this reason that irrigated agriculture should be designed as an integrated part of all the activities within the farming household. This article illustrates how a design concept can be achieved by applying a landscape analysis to a smallholder irrigation project area and by assessing possible options for irrigation development on the basis of this analysis.

In South-West Kano, Kisumu District, Nyanza Province, Kenya, the Provincial Irrigation Unit (PIU) is planning a smallholder irrigation development to be completed by 1997 (Republic of Kenya and Agrar und Hydrotechnik 1981; Republic of Kenya 1984, 1986b). In the project area, which comprises 5800 ha, two schemes, Obange and Nyatini, have already been brought under irrigation by the farmers themselves. Water availability and distribution, drainage, pests, and diseases are the most serious problems related to rice cultivation in these two schemes. To overcome the first three problems, the Provincial Irrigation Unit started the construction of a major water-intake structure from the Nyando River in April 1990, and intends to construct a conveyance system. It will also assist the local farmers in extending the present irrigable area. Currently, rice is the main irrigated crop, but farmers are, in principle, free to grow any crop of their choice under irrigation. This article focuses on an approach to identifying new scheme areas suitable for irrigation, and possible consequences of the layout of the canal network for the land-use system in a project area.

In a rural area, such as South-West Kano, the local population gradually through a process of trial and error – develops a land-use system that fits best in the ecology of the area, the prevailing norms and values, and the level of technology attained. All factors interact, and any influence, wither from inside (e.g. norms and values) or outside (e.g. national economy, climate, or technology), tends to set off a change-reaction that forces farming households to find a new balance in its land-use system (Kortenhorst 1980). The introduction of an irrigation project will involve major changes. New irrigation canals, for example, will bring land not irrigated before under command and replace its current use, such as rainfed agriculture, woodlots and grazing. In order to be able to design for sustainable irrigation development, it will be necessary to appraise these changes. Therefore, two interrelated types of research activities are needed. First, an evaluation of the impact of existing irrigated agriculture on the land-use system. For this purpose, recent studies of four irrigation schemes in the Kano area are examined. Second, a landscape analysis to gain insight into the current land-use processes and environmental resources. For this, the landscape of the South-West Kano project area is analyzed on the basis of field visits, aerial photographs and aerial slides, and the statistical analysis of land uses form the aerial slides by EcoSystems (EcoSystem 1986; Duchhart 1986, 1989). The results of these two research activities are integrated, and then visualized by devising four development options, each of which is followed by a discussion of its consequences for the land-use system.

2. The impact of irrigation on land use in four schemes in the Kano Plains

Several studies of four irrigation schemes in the Kano area are evaluated here. The evaluation is restricted to those aspects that may have implications for the South-West Kano smallholder irrigation scheme to be designed.

Three of the four schemes, Obange, Nyatini and Kore, were initiated by small groups of farmers. The Obange rice scheme started in 1950 (Republic of Kenya 1979), and the other two rice schemes in the late 1970s (Republic of Kenya 1986a, Povel-Speleers 1982, Dibbits and Povel-Speleers, 1983). Obange and Nyatini, almost equal in size and totalling about 350 ha, are situated within the South-West Kano project area, whereas Kore lies 4 km north of it. The fourth scheme, Ahero, is a large-scale irrigation scheme bordering the project area to the north. It was initiated and implemented by the Kenya government, and is under government management.

The people of the smallholders' schemes mainly live from subsistence farming and livestock keeping. The predominant cash crop is irrigated rice, of which 70% is usually sold and the remainder largely used for payment of labour and partly for home consumption. The average size of a rice plot ranges from 0.4 ha (Kore) to 0.9 ha (Obange). The food crops are mainly maize and sorghum, which are rainfed. The main reasons for keeping livestock are capital investment and the availability of milk, meat, and draught power. A family, on average, consists of 10 members, of whom seven actually live on the compound. Every family member has his or her own role in the farming system. The work on the land is done by men and women in a complementary way, whereby men take up the heavier tasks, like clearing and ploughing, the women the lighter but more labour-intensive tasks, like weeding and harvesting. In general, the men and boys are more occupied with earning cash income and herding cattle. The women and girls are responsible for the subsistence crops, food processing, water and firewood collection, cleaning, washing, cooking, and taking care of the children. Besides farming the families spend...
The average labour time spent on irrigated rice is between 2,000 and 2,500 hours per ha. Children also participate in the cultivation, especially in transplanting the seedlings. In order to get the work done the farmers have to hire labour, and even then the rice fields are not used to their full capacity. Women give priority to their food crops. This means that the cultivation of rice does not start before the food crops have been taken care of. In the Kore Scheme women complain of an increase of their workload, which, in their opinion, is caused by a shortage of ox-plough and the schooling of their children. Yet they regard the rice yield as indispensable to support their families (Povel-Speepers 1982). In the study of the Obange Scheme it is stated that farmers are in favour of irrigation development for rice production, but only if it does not entail large-scale uprooting of homesteads to give way to schemes. Rice accounts for about 41% of the total income of the Obange Scheme, of which about half is spent on casual labour. The average size of land owned by a family is 3.6 ha, of which 2.1 ha outside and 1.5 ha inside the scheme area. A farmer, on average, cultivates 0.9 ha of irrigated rice and approximately 1.3 ha of rainfed food crops, maize and sorghum, mixed with cotton. The remaining 1.4 ha is used for the compound, grazing and firewood (the ration between irrigated land, rainfed land, and other land uses is 1:1.4:1.5) (Republic of Kenya 1979).

Of the four schemes the large-scale Ahero Scheme has been studied most intensively. Surveys of health conditions of rice-growing families in the Kano Plains reveal precarious nutritional conditions among the tenants living at Ahero Scheme (Niemijer 1985). In-depth research findings show that 50 to 60% of the tenants' children weigh below 80% of the standard weight (Noij & Niemijer 1988). Tenants who also grow crops outside the scheme, and smallholders in the Kano Plains are in a significant better situation. The observed differences in nutritional conditions are related to variations in access to resources, such as the production of subsistence crops, livestock keeping, income from off-farming activities and cash crops, access to firewood, and clean drinking water. The resident tenants who almost wholly depend on irrigated rice production, had the smallest resource base and poor nutritional conditions. (Noij & Niemijer 1988).

The off-farm activities of the non-resident farmers yield approximately 75% of the household income, whereas no more than 25% is earned through rice production because of the very high production costs in this scheme. The cash income of male household members, which is used for irregular expenses, including staple food in the dry season, school fees, and household repairs, is also important for optimising the rice production. The farmers need a certain amount of work capital to finance hired labour in the peak periods of rice cultivation. Women grow the subsistence crops, of which the surplus is sold. About 70% of the tenant families use the bunds at the time the adjoining lands are irrigated to grow these crops. In addition, they grow rainfed crops in gardens on scheme land or in the compound, while 30% grows these on land, owned or rented, outside the scheme. The total area available for non-irrigation activities, like rainfed agriculture, communal activities and expansion of compounds—which is badly needed for the polygamous and multigeneration households of the tenants—is insufficient. Because of this lack of space some of the tenants have even moved out of the scheme villages. About all tenants own livestock, mostly as a form of saving. However, as grazing land is scarce, and grazing inside the scheme is not officially allowed, the herd is usually kept by relatives outside the scheme in exchange for milk produce. There are neither woodlots nor bushes at the Ahero Scheme. Tenants have to obtain the wood from off-scheme land, or they have to buy it. Half of the families do not boil drinking water because of firewood expenses, which results in a high rate of diarrhoea.1

The study by Noij & Niemijer (1988) also concludes that there is a significant relation between the paddy yields in the Ahero Scheme and the conditions of the irrigation block, such as the distance of the block to the main canal, levelling of the field and soil type. Rehabilitation of some blocks under bad conditions has proved not to be sustainable as after four crops the yield levels have dropped again to the level before rehabilitation. In view of the high production costs farmers who cultivate these blocks find growing rice hardly profitable.

What can be learnt from these studies?

Although the above studies cover different subjects and are different in nature and depth, some general implications for the design of the South-West Kano irrigation project can be found. These include:

- The nutritional condition of the farmers in the Kano Plains is positively related to access to a large diversity of resources. The resource base should include the production of subsistence and cash crops, off-farm income, livestock, firewood and clean drinking water.
- High priority should be given to maintaining the cultivation and improving the production per area (mainly by improved drainage) of rainfed subsistence crops, maize and sorghum. The farmers are not used to irrigating their food crops. Nor do they as yet intend to do so.
- The farmers consider livestock, and, consequently, grazing areas, very important.
- The smallholders are interested in the production of rice. Rice, though increasingly used as food by the smallholder families, is still predominantly a cash crop; 25 to 40% of the farmers' income is earned through paddy production.
- The paddy yields depend highly on the condition of the field. In order to make paddy production cost-effective, only highly suitable land should be used for irrigation.
- The introduction of irrigated rice production in the farming system will drastically increase the workload of the farming family, especially that of women, as they are as much involved in the production and sales of rice as the men are.
- At present the rice fields in both the smallholder and the large-scale irrigation schemes are not used to their full capacity because of shortage of labour or cash to pay for labour.
- Irrigation restricts the possibilities for other non-irrigated land uses, like land needed for the extension of compounds, woodlots and schools.

1 A general problem found in many developing countries is that scarcity of firewood has forced women to change the family diet to less heat consuming food, or even to skip meals altogether (Agarwal 1986).
From these conclusions, the major criterion for the design of irrigation schemes in the Kano Plains may be deduced as follows:

- A balance should be found between irrigated and non-irrigated land in order to ensure:
  - a sufficiently diverse resource base for the farming household,
  - and an effective use of land according to its suitability.

3. Landscape analysis of the South-West Kano smallholder irrigation scheme

This section examines the South-West Kano landscape and its functions for the users. The landscape analysis is largely based on visual material such as aerial photographs, aerial slides and field observations. The information thus gathered was collected in 1986. Interviews of farmers and relevant literature, including the studies dealt with above, have provided additional data supporting the landscape analysis.

The aerial slides, taken by Ecosystems in 1986, have played an important role in accurately qualifying and quantifying the data. The accurate statistics of the actual land use, as presented in Table 1, were obtained by categorizing all relevant land-use features and calculating their relative areas by sampling. To that end, each slide was projected on a standardized sample grid of very small unit areas as developed by Ecosystem. These unit areas were then specified and tallied according to their areas by sampling. To that end, each slide was projected on a standardized sample grid of very small unit areas as developed by Ecosystem. These unit areas were then specified and tallied according to their use, including the settlement pattern, was obtained by projecting the slides on accurate topographical maps (scale 1:10,000). The settlement pattern in the project area, has been derived from this land-use map. Slides of one flight line were projected on a scale 1:2,000 in order to visualize a representative cross-section.

The Kano plains form a distinct physiographic unit walled in by the Nyando Escarpment, the Nyabondo Plateau, the Tindert Highland and the Lava Hills. Lake Victoria forms the western boundary. The plains are relatively flat, gently sloping towards the lake. Rivers running from the surrounding hills and plateaus meander through the area and finally drain their water into the lake. Throughout the centuries erosion and sedimentation processes have been taking place, interweaving lake and river sediments (Da Costa 1969; Italeconsult 1982). The micro relief of the plains is undulating due to minor ridges and levees formed by rivers, streams and varying lake levels. Its main features are low-lying permanent and seasonal swamps and marshes, and slightly more elevated ridges and levees. The difference in elevation is not more than 1 m (Van Engelen, 1987). Micro relief is an important land-use structuring factor as will be illustrated later.

The climate in the area is humid (above 62%) with moderate average temperatures (annual, average daily temperature is around 21 °C). The annual precipitation is about 1,200 mm. Evaporation can reach 2,000 mm per year. There are two seasons of rainfall, from middle of March to the end of May, and from the end of October to the middle of December. During the rainy seasons flooding is a common feature, and between the rainfall periods periodic droughts may occur (Republic of Kenya 1984; Republic of Kenya and Agrar- und Hydrotechnik 1981). Rainfed agriculture over the last five years has often failed because of serious floods rather than droughts.

The soils in the area are characterized by a very high clay content (60-80%), a good nutrient status and a very low permeability. There is a nitrogen deficiency caused by a lack of organic matter. The soils are sticky and plastic when wet, and hard when dry, two aspects that make land preparation difficult. The soils on the ridges contain slightly more loam and are more permeable than the soils in the depressions. The soils of the southern permanent swamps near the lake shore are highly saline and sodic. The high clay content of the majority of the soils combined with the relatively flat topography, causes water logging (Da Costa 1969; Van Engelen 1987).

Land Use

The first settlers, probably, found a landscape in which bush covered the ridges, and papyrus, reeds, and sedges filled the swamps and marshes. They built their huts on the ridges and avoided the wet and marshy depressions. The majority of the people currently living in the area and belonging to the Luo tribe (Ochieng 1979), also occupy the higher areas. The pattern of their settlement can be seen in the landscape. On the ridges roads, homesteads, trees, bushes, crop land and grazing land can be found. The trees and shrubs are used for fuel and building materials, and to provide shade. Rainfed crops like maize and sorghum are also grown within the compounds.

<table>
<thead>
<tr>
<th>Type of land use</th>
<th>Per cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marsh/swamp</td>
<td>4</td>
</tr>
<tr>
<td>Rice</td>
<td>12</td>
</tr>
<tr>
<td>Rainfed crops</td>
<td>29</td>
</tr>
<tr>
<td>Fallow land</td>
<td>12</td>
</tr>
<tr>
<td>Bush cover within village area</td>
<td>15</td>
</tr>
<tr>
<td>Bush cover</td>
<td>3.5</td>
</tr>
<tr>
<td>Grassland within village area</td>
<td>7</td>
</tr>
<tr>
<td>Grassland</td>
<td>14</td>
</tr>
<tr>
<td>Compound</td>
<td>10</td>
</tr>
<tr>
<td>Hedges/windows/woodlots</td>
<td>3</td>
</tr>
<tr>
<td>Miscellaneous, including open water</td>
<td>3</td>
</tr>
</tbody>
</table>

Table 1. Proportions of land-use types in rounded figures in the South-West Kano project area based on the statistics of Ecosystems (1986).

From the ridges the land is cultivated in long strips into the direction of the marshes, each strip belonging to a different landowner. The herds graze on communally used grazings and on fallow or bush land. Approximately 20% of the overall project area has a grass cover (see Table 1). If the area under bush cover and the land left fallow are added to this percentage, 36% of the total project area is used for grazing (Ecosystems 1986). Grazing areas are also found around the homesteads and along the edges of the rice fields. When the annual rice season is over, the paddy fields are used for grazing. In the last decade the availability of good agricultural land per family has been decreasing steadily because of a growing population (Aron 1986). Land shortage has led to a drastic reduction of grazing area and firewood. In spite of an impressive reduction of the herds and cattle being sent to relatives living in remote grazing areas, yet some overgrazing can be observed in the project area. The swamps along Lake Victoria are currently covered with papyrus. The depressions have a vegetation of reeds, sedges, and grasses. The population uses this

1 Bushes consist of Acacia spp., Cassia spp., Parkinsonia aculeata, Eucalyptus spp., Spatodes campasapala, Lantana camara, some old ficus trees (Ficus spp.), and there are hedges of Espplphilus tirucalli, and of Thesvetia peruviana.
vegetation for thatching and roofing. The marshes are impor­tant for the survival of cattle during dry spells when grass and water can only be found in these areas. Some of the marshes have been reclaimed and are used for rice cultivation, as, for example, in Obange and Nyatini. Irrigation water comes from minor streams and the drain of the Ahero Irrigation Scheme. In some places along the marshes maize and sugar cane are grown.

The main drinking water sources are the Nyando River, streams, irrigated fields, watercourses and marshes. In some areas shallow wells have been constructed. Very few households practice roofwater catchment.

Table 1 presents the numerical distribution of land uses as derived from the aerial slides. Figure 1 shows a more detailed landscape analysis of a representative area covering the various land-use types used by a community (scale 1:2,000). Three major landscape units can be distinguished: the ‘village’ (landscape unit A), the ‘maize’ (landscape unit B), and the ‘marsh’ unit (landscape unit C). Each landscape unit has its own characteristic features and can be easily recognized. The farmer and his family are the users of these landscapes. Every family member has his or her own tasks and role in the farming system. Because of these different responsibilities and tasks the family members make use of different landscape units. The women, for example, grow their subsistence crop and collect firewood mainly in the ‘maize’ unit while men are active in collecting roof thatching materials in the ‘marsh’ unit. Table 2 gives the relations between landscape units, land uses and users’ groups.

What can be learned from this landscape analysis?

As to the development of the South-West Kano smallholder irrigation project the following conclusions can be drawn:

- Each landscape unit has its own function for the farming household. Even areas currently not cultivated, such as fallow and bush land, play a specific role in the land-use system.
- Family members have different responsibilities and make use of different parts of the landscape. Therefore, the Provincial Irrigation Unit and the farmers should discuss irrigation as part of the land-use system.
- Land is getting scarce, resulting in overgrazing and firewood shortage. It will, therefore, not be easy for the people to find a substitute area for their various uses of land when irrigation is introduced.

From these conclusions the following design criterion for the future of South-West Kano smallholder irrigation scheme can be deduced:

The design of the future scheme should be evaluated with respect to its implications for:

- the resource base provided by the physical environment, and
- the division of labour within the farming household and the access of the individual family members to the various resources.
4. The consequences of the location of the canal network for future land use

The alignment of a network of conveyance canals connecting individual village schemes is conventionally determined by engineers, who base their design mainly on a soil suitability map and topographical maps. The location and the dimensions of primary and secondary canals determine the boundaries of the schemes and the areas left for other uses, such as rainfed crop production, firewood collection, and housing. In other words, they will form the preconditions within which the farmers will develop a new land-use system. In order to illustrate the consequences of the layout of the canal network on the land-use system, four optional layouts are discussed below. The options show situations of increased irrigation development by subsequently bringing the swamp, maize, and village landscape units under irrigation command (see Fig. 2).

It is assumed that for the first five years the area to be irrigated will mainly be used for rice production.

Four options for a command area

In Option 1 the network primary and secondary canals has been laid out with a view to irrigating all areas already under rice and substituting all the marshes and fallow land in the depressions for irrigated land. According to the statistics of EcoSystems, 16% of the project area is, at present, either used for rice cultivation or covered by marshes. So, Option 1 brings an area of 930 ha under irrigation, including the 350 ha of the present two schemes of Nyatini and Obange.

The consequences of this option will be that the landscape units now used for grazing and gathering grasses and reeds for roof thatching will be reduced. To a certain extent, however, this loss can be counterbalanced. As for grazing it may be assumed that off-season rice land will partly compensate the loss of grazing land. The swamps and marshes south of the project area may provide the farmers with the necessary building materials. Here the soil characteristics of the land make the area unsuitable for reclamation.

Moreover, the marshes act as a water reservoir, and are vital for the survival for cattle in dry periods. They have a regulation effect on the hydrology of the area, as they work as a kind of sponge. Canals and drains will certainly influence this condition. It can be expected that flood irrigation will keep quite an amount of water in the depressions, and thus may fulfill a similar role as the marshes in the hydrological cycle.

In Option 2, the canal network has been laid out with a view to developing a command area including the depressions as dealt with in Option 1, as well as the area directly surrounding these depressions. According to the statistics of EcoSystems, the (total) land taken up by rainfed crops comprises 30%. EcoSystems does not make a distinction between rainfed crops in the relatively wetter zones and those in the drier ones. From the analysis of the aerial slices and field visits, however, it appears that approximately 15% of the total rainfed cultivated area is located in the wetter areas. Consequently, an area of 4.5% (15% of 30%, see Table 1) of the total project areas will additionally be replaced by irrigation. A relatively large portion of fallow land can be found in the zone surrounding the depressions. It is assumed that approximately 50% of the total fallow land, i.e. 6% if the total project area, will be added to the irrigated area. So, Option 2 shows a situation in which 26% (Option 1 plus 4.5% plus 6%) of the overall area, i.e. 1500 ha, will be brought under irrigation.

The area added in this option is nowadays used for subsistence cropping and grazing. The replacement of the rainfed food crops, cultivated in the lower and wetter areas, will, during droughts, enhance the risk factor of a food crop failure for the farming households. Substituting the fallow and bush land for irrigated land will reduce the total area now used for grazing. The source of firewood will also be reduced, causing an even greater shortage of this scarce product. It should be noted here, that within the irrigated fields very little space is available for growing trees. Besides, in this area not tree species do well near irrigated rice. Tree planting for firewood and building materials, which should be substantially increased in order to alleviate the current shortage, will have to be concentrated in the non-irrigated areas.

<table>
<thead>
<tr>
<th>Landscape Unit A: 'Village'</th>
<th>Landscape features</th>
<th>Functions</th>
<th>Users' groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houses</td>
<td>Shelter</td>
<td>Family</td>
<td></td>
</tr>
<tr>
<td>Major routes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rainfed agriculture (maize, sorghum, beans)</td>
<td>Subsistence crops</td>
<td>Women/men</td>
<td></td>
</tr>
<tr>
<td>(cotton)</td>
<td>Cash crops</td>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Fallow</td>
<td>Grazing</td>
<td>Family</td>
<td></td>
</tr>
<tr>
<td>Soil quality recovery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hedges</td>
<td>Protection, privacy</td>
<td>Family</td>
<td></td>
</tr>
<tr>
<td>Wind rows</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Woodlots</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bush cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grassland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scattered trees</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landscape Unit B: 'Maize'</th>
<th>Landscape features</th>
<th>Functions</th>
<th>Users' groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rainfed agriculture (maize, sorghum, beans)</td>
<td>Subsistence</td>
<td>Women/men</td>
<td></td>
</tr>
<tr>
<td>(cotton, sugar cane)</td>
<td>Cash</td>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Grassland</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bush cover</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fallow land</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shallow wells</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Landscape Unit C: 'Marsh'</th>
<th>Landscape features</th>
<th>Functions</th>
<th>Users' groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice</td>
<td>Cash/subsistence</td>
<td>Family</td>
<td></td>
</tr>
<tr>
<td>Papyrus swamps</td>
<td>Roof thatching</td>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Marsh</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grass cover</td>
<td>Grasses for roof thatching</td>
<td>Men</td>
<td></td>
</tr>
<tr>
<td>Fallow land</td>
<td>Grazing</td>
<td>Family</td>
<td></td>
</tr>
<tr>
<td>Open water</td>
<td>Water source</td>
<td>Women</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Landscape units, their uses and user's groups
In Option 3 a canal network has been laid out with a view to an irrigation development comprising most of the project area with the exception of the elevated ridges. In this option the remaining area used for rainfed crops, the fallow land, most of the bush cover and a substantial part of the grazing will be taken up by irrigation. Calculation gives: the remaining food crop area (25%), bush cover (outside compounds: 3.5%), fallow land (65%), and grasslands, which amounts to 41% of the total project area. So, Option 3 shows a situation in which 67% (Option 2 plus 41%) of the overall area i.e. 3900 ha, will be brought under irrigation.

The replacement of the rainfed crops by irrigated crops will out most of the subsistence crops. The region as a whole will no longer be self-sufficient in its food production and will suffer a serious shortage of firewood. In addition, it will no longer be possible to keep herds. The land-use system will be seriously disturbed because of a drastic reduction of the resource base for the farmers. The cash earned by the sale of paddy will have to be used to obtain food, dairy products and firewood. Traditionally cash income is largely controlled by men. Food and energy are predominantly the responsibility of women. So, Option 3 will only be successful if a social change can be realized in which women are allowed more say in spending cash income. In addition, it may be questioned if the current labour capacity for rice cultivation will be sufficient to cultivate the whole area effectively.

In Option 4 the command area laid out will comprise all the irrigable land in the project area. The consequence of this option is that irrigated agriculture will take the place of households, compounds and the area surrounding them, which now provides the farming household with a variety of uses, such as shelter, grazing land, building materials, firewood and other tree products, and with roads. This option will lead to a situation similar to the one examined at the Ahero Scheme, where the villagers have been resettled. The resource base of the farmers will be too narrow for them to subsist.

5. Summary and Conclusions

In order to facilitate the design of a sustainable, relatively large, smallholder irrigation development in the South-West Kano Plains, the effects of irrigated rice production on the local land-use systems in various small-scale, farmer-managed schemes and in the large-scale, centrally-managed Ahero Scheme have been evaluated. It has been found that rice production is part of a land-use system as a whole, and that where irrigated rice is the dominant feature of land utilization, as at the Ahero Scheme, the general health condition of the farming family deteriorates. Therefore, landscape analysis of how and why farmers make use of the natural resources, should be applied as a design tool for irrigation development.

The understanding that socio-economic processes are reflected in the landscape makes it possible to relate land users' groups to specific landscape units. This relationship, in its turn, is a helpful tool in assessing the impacts of changes in the landscape for the different groups concerned. Visualizing the present and the future physical environment in maps and cross-sections makes these interrelationships even more tangible. The choices to be made will be more obvious and the discussion between the various parties involved will, thus, be more creative and to the point.

One of the major design criteria discussed in this article, is that the introduction of an irrigation system should not hamper the farming households in their access to resources such as subsistence crops, firewood, drinking water, sufficient grazing, building materials, land for compound expansion and community facilities. It appears that access to a diverse resource base that includes a cash income from an irrigated rice crop, present good chances for improving the living standard of the farming households.

As an illustration for this statement, we have assessed four options for irrigation development in which the resource base for the farming household gradually narrows from irrigating just the depressions to irrigating the whole area. The reclamation of the depressions and their direct surroundings as discussed in Option 2, will, in our opinion, disturb the land-use system in a minimum way, and will offer an opportunity for increased agricultural production. Here the diversity of types of land use, irrigated land, rainfed cropped land, bush cover,
village area and grazing, all of these vital for a sustainable farming system, approaches the present situation at Obange where, after 30 years of irrigated agriculture, the ration between irrigated and non-irigated land is approximately 1 to 3. If Option 2 is chosen, about 1500 ha can be developed for irrigated crop production including the rehabilitation of the existing schemes. In this option, only the most suitable areas for rice irrigation will be developed for irrigation. Furthermore, the fact that nowadays the existing schemes are not used to their full capacity, and that on the short term irrigation will not be used for food crops, is another indication that the initial irrigable area should not exceed the 1 to 3 ratio, at least for the time being. Option 2 could allow gradual extension of the irrigable area if needed.

The landscape analysis described in this article will be instrumental in setting the boundary conditions for the design of an irrigation scheme in which the non-irrigated areas are taken into account. Moreover, we recommend that simultaneous with the introduction of the new irrigation system, development programmes for agroforestry, drinking water, and livestock should be initiated. These programmes will help the farming households find a new balance in their land-use system and develop a sufficiently broad resource base that makes them less dependent on the scarce resources from inside and outside the project.

Acknowledgements

The authors are very grateful to Andrew Opiyo, M. Makao, and Carmen Aalbers for their assistance in preparing the land-use and layout maps, to Professor Lucas Horst and Piet van den Boom for commenting the manuscript, and to Franciska Povel-Speleers for editing the English language and giving valuable comments. Gerrit Kleinrensink and Henk van Aggelen made the artwork.

References


After reading the article, you should be able to answer the following questions:

• How did the original Kano landscape look like?
• How did the Luo community modify this landscape to make it fit for their purposes?
• What landscape units can be identified in the present Kano Plains?
• Identify vertical relationships for each unit? What is the dominant structuring factor?
• Identify horizontal linkages? What is the most dominant factor?
• Point out protective and productive land uses?
• Which option of irrigation development would be your preference?

The landscapes or environments we see around us are the visible expression of all the interactions described in the South-West Kano article and earlier in the videos. As it were, the environment is a mirror. Once you know how to 'read' the environment and to observe people their actions, you can even without maps and aerial photographs understand the landscape ecological processes. To practice your knowledge we invite you to visualise in maps and cross-sections and describe in a narrative your own home-area landscape. Take a field walk, have open-ended interviews, observe the land use, talk with your grandmother and grandfather about how it was, with your father and mother on how it is, and the youngsters (boys and girls) how they see the future. During your observations ask questions, such as, why are there trees on this place, what are they used for, why is this area wet, why is the soil different here, where does this depression comes from, who is responsible for what, how is the land ownership. If you see cows ask where they graze. Note if there is intercropping or monocultures or terracing. Talk to men and women separately. Ask about their difficulties and their wishes. Look at the larger structures — hills, mountains, valleys, plateaus and then fill in the details. Identify land protective measures and list the resources nature supplies. People may not easily talk about places for worship or collection of herbal medicines. Still it is important that you find out about these more special and often overlooked natural resources.

1 During the Green Town’s Training programme, the participants were asked to form groups according to their location of their home area. The groups then carried out an analysis of their home areas. Later the findings were presented to each other. The participants were well informed and as a consequence the analysis was rich. The discussion led to the collection of additional information.
Introduction

In the previous chapter, we provided tools to observe, analyse, understand and describe the rural environment. In this chapter, we use the same tools to appreciate the inter-linkages between nature and society in urban areas. Because of the intensely built-up character of the urban areas, it is here much more complicated to identify nature's functions than in a rural environment.

Teaching Techniques

- A discovery tour (field trip)

Learning Objectives

After studying this section and going out in the field, you will be able to:
- Distinguish homogenous landscape units in an urban environment
- Identify the functions of the natural environment in an urban setting

Man and Nature

A Theoretical Model

- Nature's functioning
- Societial attitudes

Landscape Ecology in Urban Environment

Landscape Ecology in Rural Environment

Environmental Planning

A Purposeful Intervention in Man and Nature Relations

Contents

- Landscape units and landscape ecological principles in urban areas. Nairobi and its environs will serve as an example.
Urban ecology is as yet not widely studied. Areas that are covered address energy flows (incoming produce versus outgoing garbage), air and noise pollution, and the development of heat islands. In this handbook, we approach landscape ecology in urban areas in the same way as the ecology in the rural areas. Vertical relationships between soil, water, and relief form the basis for the suitability for urban development, while horizontal relations come forth from services such as roads, water pipes, and electricity. We look at the city of Nairobi to illustrate the ecology of the urban environment. A text box provides a general background on Nairobi including the landscape units found in the city. We invite you on a discovery tour for you to identify landscape ecological principles in urban areas. Photographs of Nairobi give a visual impression of the tour and the findings.

In the densely built-up surface of the urban centres, nature, in the form of trees, patches of forests, parks, grassed road reserves, cultivated valleys, and spring and water catchment protection, fulfill important functions for a healthy urban life. In this chapter, we introduce you to some of these functions.

The Green Town’s training participants went on a discovery tour across Nairobi in 1993 and 1995. Different groups took different routes. One route covered Thika-Nairobi road – Karura Forest – Ngecha and Lower Kabete – Nairobi River – River Road – Kibera – Mathare Valley – Korongocho and Dandora dump – KPCU and Kariobangi sewage treatment. Another route went along Nairobi city market – Loresho ridge – Mathare north – Huruma – Buru Buru – Kiambui. Each route contained green and lush neighbourhoods provided with all possible urban services, the city centre, and some slum area without any greenery and services. Both groups went to the roof of ARDI house. From this high point they had a good view over town enabling them to identify Nairobi’s main landscape units. The photo series on pages 52 – 58 gives an impression of what they saw.

We asked the trainees to fill in a record sheet and to prepare a cross-section on which they had to give an impression of the identified landscape units, land uses, their characteristics and environmental problems, and other remarks, sensations and feelings. After the field trip plenary reports were given. It is worthwhile to note – although as central and local government officers much of the management of the urban environment falls under their responsibility that many of the participants never went deep into the slum areas. Some of the participants suffered a culture-shock as they could not believe the existence of the degenerated living circumstances in slum areas.

Table 4 gives the findings of the trainees. In summary, the high-income housing areas are located on the best suitable areas with a pleasant, relatively cool

Nairobi City – A Discovery Tour

Nairobi City centre is built at the footslopes of the Kikuyu slopes. The centre gets flooded whenever it rains. Traffic comes to a standstill.

Nairobi centre is intensely built up with many high rise buildings. Traffic is heavy during the day. Air pollution is increasing.
climate. Roads are wide and gardens large. There is plenty of vegetation and all facilities are available. However, there is a trend of splitting up plots into smaller ones or into ‘town-house’ estates. This increases the hard surface dramatically and thus stormwater run-off. During rains roads and houses are now getting damaged by the force of the run-off water. Middle and low-income housing can be found in the relatively densely built-up plains at the east of Nairobi. Vegetation is rare and gardens small, but most facilities are present. Garbage collection is limited. The slums are located on most unsuitable areas, basically slopes and valleys of the main rivers that run into the lower areas of Nairobi. Heavy black cotton soils make it difficult to built houses and maintain roads. The density of population is extremely high with hardly any place for services and facilities, such as roads and drains. Garbage remains uncollected. Living circumstances are harsh and difficult. People live here are at a continuous health risk.


Historical Background of Nairobi
Nairobi has railway encampment as its pre-urban nucleus. To the engineers building the Uganda railway in 1899, the site of what is now Nairobi offered many advantages. The building of the railway started at Mombasa in 1896 and by 1899 had reached 327 miles from the coast. Port Florence (now Kisumu), the destination of the railway, lay a further 257 miles to the north-west. Behind lay the relatively easy terrain of the Athi Plain. Ahead lay much steeper slopes and the Rift Valley escarpment presenting great constructional problems. A suitable point for descending the escarpment was essential. To the north was the Aberdare Range and to the south were the gong Hills. The obvious choice lay between the two. The Nairobi River provided more than adequate water supply. Further south streams were seasonal only. The topographical nature of the site also offered certain advantages: there was ample level land on the edge of the plains for tracks, sidings and the other impediments of a railway, yet close at hand was an elevated, cooler area suitable for the houses of senior officials. Thus it was that the physical characteristics of the site and its relationship with the surrounding country made Nairobi an excellent choice for the purpose for which it was intended.

During the next few years, grave doubts arose as to the suitability of the site for a large settlement. After two outbreaks of plague in 1901-2 and in 1904, strong representations were made to the British Government to have the town removed to a healthier site. It was suggested that the new settlement should be moved further into the highlands where the deep red soil would afford much better conditions for building and drainage than the black soil and rocky outcrops of the existing site. These constraints could only be overcome at high costs and the application of considerable technical skills. In 1906 the Williams Commission endorsed the official view that the town’s removal to ‘another site was outside the bounds of practical politics’. So, Nairobi stayed where it was!

A

Read the text box on Nairobi and study the photographs and the table in this chapter.
The existing boundary of Nairobi includes parts of the Kikuyu slopes/highlands and the Athi Basin, nearly touching the Ngong Hills in the south and Athi River (Mavoko) in the east. Care was taken to avoid good agricultural land in the north—that is the well-drained red soil of the Kikuyu slope—and in the south-east to protect the Nairobi National Park. Nevertheless, we find in the red soils high-income residential housing (Lower Kabete, Kituru, Muthaiga, Gigiri, Kilimani and Lavington). The Karura Forest, a semi-deciduous forest typical for Nairobi, borders Nairobi in the north. On the undissected slope we find the areas Langata-Rongai and Karen.

The centre of town developed close to the railway station. Its location is in the flat Athi Basin at the foot of the Kikuyu slopes. Here we also find the industrial area and most of the low to middle-income housing (Umoja, Dandora, Buru Buru) and in the lowest parts informal settlements (Mathare, Kibera). The climatic conditions are harsh—the soil is hard during the dry seasons and muddy, sticky during the rainy seasons. Not much can grow here. These large-scale grazings originally housed the famous African wildlife. Now still found in the Nairobi National Park. The geographically higher Kikuyu slope drains in the Athi Basin. This is partly the reason why the centre of Nairobi floods and traffic comes to a standstill during heavy rains.

The railway to Kisumu climbs the undissected Kikuyu Slope in north-western direction—skirting the river heads of the dissected slope. To Mombasa the railway first heads east and then moves south-east to Athi River. The illustration on the previous page gives a schematic impression of the dominant landscape units found in and around Nairobi.

The houses are built right up to the Mathare River. At some spots people grow maize. One week later then the picture was taken on the night of the 13th to the 14th January 2001 people had to run for their lives. The water had swollen because of the heavy rains taken the houses on their way.

Mathare North – the direct environment of the houses are kept clean. There is no other place to dry the wash than across the road.
<table>
<thead>
<tr>
<th>Location</th>
<th>Landscape Characteristics</th>
<th>Ecological Principles / Environmental Problems</th>
<th>Consequences</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| ARDHI HOUSE (high point in town with a great view) | Several landscape units are observed:  
- City centre located in a flat area with little vegetation characteristic high-rise buildings  
- Direction of the airport south of the centre a flat area with grassed lands  
- Eastlands densely populated without vegetation  
- High sloping in western direction medium densely populated with plenty of vegetation  
- High land in north-west, low density area dissected with valleys | In city centre:  
- Heavy yellowish/greyish air, air pollution from cars and industry  
- Lots of noise  
- Congested land use with high traffic rates and many people | In city centre:  
- Poor health  
- Poor visibility  
- Acid and dirty rains  
- Limited space for recreation  
Slopes of the north-west and low-lying city centre:  
- Due to the large amount of hard surface the run-off of storm water creates floods in and around city centre  
- Little to no infiltration of rainwater resulting in depletion of ground water.  
- The rainstorms damage the road surface | The northern and western areas are well served with roads and rich in vegetation.  
The eastern areas are characterised by densely populated land use without vegetation. Seems a poor urban environment.  
Trees are dying. A result of polluted and congested environment in the centre of town?  
Uhuru Park at foot of the higher land and the low and flat city centre allows for water infiltration and partly protects the city centre against floods. The park also helps to mitigate high temperatures in the centre. |
| CITY CENTRE AROUND THE MARKET | Man-made landscape without vegetation  
- Intensive land use | Lack of waste disposal  
- Inadequate space  
- Inadequate facilities such as water and toilets  
- Toilets are close to food stalls | Diseases such as typhoid can easily spread | Stinking and over-crowded place |
| BROOKSIDE DRIVE | Relatively high land dissected with valleys and ridges  
- Medium to low density housing  
- Lots of trees, hedges and other greens | New buildings, with a relative high density built on steep river slopes and even in valley bottom  
- Deforestation of river slopes  
- Large gardens and road verges allow water infiltration and limit dangers for floods lower stream  
- The lavish greenery maintains biodiversity, in some cases with indigenous vegetation  
- The many trees regulate the climate and air pollution | Danger of increased water run-off  
- Flooding of roads and housing area  
- Erosion of valley slopes Reduced infiltration due to removal of natural vegetation replaced by roads and buildings  
- Increased risks of floods downstream i.e. city centre and slums | The allowance to built on the steep river banks and in valley bottom shows lack of environmental concern with the officials concerned |
| LOWER KABETE | Jua-kali tree and flower nurseries  
- Some horticulture | | | |
<p>| MUTHAIGA | | | | |
| KYUNA | | | | |
| LAVINGTON | | | | |
| KILELESHWA | | | | |</p>
<table>
<thead>
<tr>
<th>Location</th>
<th>Landscape Characteristics</th>
<th>Ecological Principles / Environmental Problems</th>
<th>Consequences</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>CITY PARK</td>
<td>Relative high land with forested steep slopes</td>
<td>Cutting of trees; Some buildings coming up in park area; Minimal maintenance</td>
<td>Deforestation of steep slopes will lead to erosion and floods; Further degradation will lead to loss of biodiversity in fauna and flora</td>
<td>The efforts to conserve the forest are appreciated as they will protect the river banks and prevent flooding of lower-lying densely built-up land</td>
</tr>
<tr>
<td>MATHARE VALLEY</td>
<td>Gitathuru River and Nairobi River slopes and valley located in relatively low-lying plains and swamps in the east and south of Nairobi</td>
<td>Lack of garbage collection illustrated by huge dumps of refuse in the area; Large scale slum, densely populated, poor accessibility; Lack of drains or drains blocked with garbage; Lack of clean drinking water; Lack of vegetation i.e trees, grass, shrubs; Lack of recreational areas; Lack of sanitary facilities; Contamination of rivers and open areas with human waste; Garbage dumping in Nairobi Dam; Siltation of Nairobi Dam</td>
<td>Poor environmental sanitation resulting in high health risks; Crime due to overpopulation; Nairobi Dam fills up and thus will jeopardise the Nairobi water supply; Contamination of rivers and dam leads to loss of aquatic life and reduced use of river water down stream; Low-lying position and the lack of proper drainage places high risks of floods damaging houses and killing people</td>
<td>Immediate action is required to improve the poor environmental conditions and to alleviate poverty</td>
</tr>
<tr>
<td>KIBERA MAILA SABA</td>
<td>Land unsuitable for urban development; Extremely densely populated with semi-permanent housing and some 3-6 floor high buildings</td>
<td></td>
<td></td>
<td>Some small-scale agricultural activities are observed immediately along the rivers using raw sewage for irrigation. Nevertheless, Maila Saba's urban agriculture is ranked as impressive.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Car wash along rivers and the mushrooming of other illegal jua-kali industrial structures threaten the water quality of Nairobi and Gitathuru River</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Industrial area upstream Nairobi River pollutes the river and makes it unsuitable for human use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>People have limited access to energy or fuel for cooking food and water</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>Drinking water is expensive</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Land tenure is insecure</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Nairobi's Ecology

The problems identified by the training participants originated partly because of the typical location of Nairobi (see the text box and Table 4). In particular, the low-income housing estates and the slums on the low-lying black soils of the Athi Basin suffered from inadequate drainage and flooding. The congestion, the lack of the most primary services of sewage, clean drinking water, roads and garbage collection makes life difficult and unhealthy.

The forested Kikuyu slope and the large gardens of the rich in Muthaiga, Kyuna, Kileleshwa and Lavington, allow for the infiltration of large amounts of rainwater during the rains. However, the process of splitting up plots and giving out of river valley to developers, reduces the water-retaining capacity of the area. Without proper mitigating measures, this may result in even more dramatic floods of the low-lying parts of Nairobi. This will lead to a further deterioration of the living environment of the poor, resulting in outbreaks of environment related diseases, such as cholera, typhoid, plague and respiratory diseases. Ultimately, these diseases will also affect the rich.

In conclusion, the man-made Nairobi environment is for the majority of its inhabitants unsatisfactory and even life-threatening. Currently, between 2.5 and 3 million people live in Nairobi of which 55 per cent lives in the urban slums. Meaning that about 1 to 1.5 million Nairobians barely survive in a disturbed and unbalanced living environment which does not supply the population in their most basic needs. There is limited access to clean drinking water, while only 58 per cent of the population are connected to a sewer system. Many people are forced to use the water of the Nairobi River that is highly contaminated with sewage and industrial pollution. The river is so dirty that it lacks sufficient oxygen for biological purification. It should be noted here that the small-scale industrial pollution, in particular, in the slum areas highly contribute to the non-conducive living environment. Although each individual business may have a limited effect but because there are so many in dispersed locations the total effect on the living environment and on surface and groundwater is substantial.

The smog noticed by the Green Town's trainees is the visual result of the highly polluted air above the industrial area and the city centre. The concentration of suspended particular matter is far above the World Health Organisation guidelines. Lack of pavements and undeveloped plots contribute to high amounts of dust in the air which is a major cause of asthma, lung and eye diseases. Our Green Towns office had to be dusted twice per day to keep it reasonably clean. Eight years of work in the centre of Nairobi left me with 'smokers lungs' although I am a non-smoker. On the other hand, life for the privileged living on the higher slopes is comfortable and pleasant.

In Frijs, Jos, Paul Kirai, Joyce Maombe, and Bas van Vliet. Pollution Control of Small-Scale Metal Industries in Nairobi, Department of Sociology Wageningen University and Centre for the Urban Environment, 1997, 159 pages
The roads are wide and have proper road verges and drains.

Environmental Problems in Third World Cities

The findings of the Green Town’s training participants are in line with the findings of Jorge Hardoy, Diana Mitlin and David Satterthwaite. They identify three major environmental issues in relation to the cities of the third world:

1. Biological pathogens or pollutants in the human environment which can damage human health,
2. People’s access to natural resources essential to human health (especially fresh water), and
3. Physical hazards within the city, such as the risks of flooding, mudslides or landslides.

The main causes are the presence of contaminated and inadequate quantities of water; inadequate provision of sanitation (sewers and drains) and the disposal of solid and liquid wastes; inadequate measures to control disease vectors (especially insects); poor quality and overcrowded housing; inadequate health services; inadequate environmental and occupational health legislation. This situation contributes to millions of preventable deaths and leave hundreds of millions in ill health or disabled every year. They see human excrement as the most serious ‘toxic’ waste. It are the poor who suffer most and in particular children and women. A child born in the disadvantaged slum areas has a chance to die before the age of five that is 4 to 5 times higher than a child born in a more privileged environment or 40-50 times higher than a child born in a western nation. The overcrowded living circumstances increasingly lead to psychosocial disorders and negatively influence child development.

They also mention an increase in industrial pollution with heavy metals, hospital waste and agricultural pollution with pesticides. This toxic and hazardous wastes can be quite serious, among others, because the industrial production processes are less controlled than in the western world while the controlling legislative measures are limited. Air and noise pollution are emerging issues. They also address in their book the inter-linkages between the city and the wider environment. Cities demand high input of resources for their populations and enterprises – the richer the more populous the city the greater the demand and, in general, the larger the area from which these resources are drawn. The distances vary from some kilometres, to hundreds kilometres, up to any distance world-wide. Like the Green Town’s trainees, Hardoy et all. see as most critical environmental problem, the lack of proper environmental sanitation. According to them, this issue should be immediately addressed.

1 Hardoy, Jorge E., Diana Mitlin and David Satterthwaite, Environmental Problems in Third World Cities, Earthscan, IIED, London, 1992, 302 pages
Functions of Nature in Urban Areas

The previous sections make clear that integration of natural elements in the urban environment may fulfill important life-saving functions. The most crucial ones are related to:
- maintaining a healthy living environment, and
- regulation of hydrological processes.

Edward Cook\(^3\) also ranks hydrological processes high in the functions of the natural environment for the hot and dry city of Phoenix-Arizona. He lists the following functions:
- Hydrological processes – drainage corridors, when in a viable state, can serve as filters for surface runoff, helping to purify water before it returns to water supply sources. They also help groundwater recharge, to contain floods, and prevent soil erosion.
- Biological diversity – within an urban context more natural areas function as refuge or forage areas for fauna and flora.
- Climate amelioration – the natural vegetation can modify climate in particular in urban areas which often suffer from ‘urban heat island effect’. Negative wind effects can also be mitigated.
- Recreation – most suitable activities are hiking, cycling, nature observation, picnicking and the like.
- Aesthetics – the image of a town is largely based on the existence, or lack, of natural landscape characteristics.
- Education and human psychology – as a society becomes more urbanised, the danger of losing touch with nature becomes real. Natural areas within cities strengthen education and human psychological ties with nature.

- Cultural and historical significance for the use and appreciation of future generations.
- Land-use buffers and markers – separation of incompatible land uses is a frequent use of open space patches and corridors. They also help delineate property boundaries.

Epilogue

In the previous chapter, the links between man and nature are relatively strong as illustrated with the South-West Kano case study. In the urban environment, the links are weak and nature’s restrictions largely ignored with devastating effects.

In a city as Nairobi, in particular for the poor, the man-made urban ecosystem is unstable and unhealthy. World-wide 1.1 billion urban residents live in such ‘life-and health’ threatening neighbourhoods. Of this 1.1 billion, 835 up to 950 million (49 per cent of the total urban population) live in the developing world. This means that all these 950 million people have inadequate access to space and infrastructure; water, sanitation and waste management; live in unsuitable environments exposing them to environment related diseases; in dangerous houses with inadequate security and security of tenure. Nevertheless, the Habitat Agenda states that “Urban settlements, properly planned and managed, hold the promise for human development and the protection of the world’s natural resources through their ability to support large numbers of people while limiting their impact on the natural environment.”\(^4\) It is our challenge to realise this promise of healthy, wealthy, and efficient cities.

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\(^3\) Cook Edward A., 2000, Ecological Networks in Urban Landscapes, Wageningen University, The Netherlands, 201 pages

\(^4\) United Nations Centre for Human Settlements (Habitat), 1999, Basic Facts on Urbanization, Nairobi, 24 pages
Environmental Problems in Third World Cities

1. The main causes of environmental degradation in Third World cities are often linked to urbanization and industrialization.

2. People's access to natural resources essential to human health (food, water, and air) can be compromised.

3. Physical hazards within the city, such as the state of decay of buildings and roads, also contribute.

The main causes are the presence of contaminated and inadequate quantities of water, inadequate provisions of sanitation (sewers and drains), and the disposal of solid and liquid wastes. Inadequate water systems lead to diseases, vectors (especially insects), poor hygiene and overcrowding, and also increase the risk of illness. Environmental degradation in Third World cities is often irreversible.

What are the functions of the environmental education in a more polluted environment? What is the role of a woman in environmental education? How can we improve the environment through education?
Introduction

The previous chapter ended with the challenge to create wealthy and healthy urban environments for all. By now, you are aware that these environments do not develop automatically. Purposeful action is required – the natural and social organising principles must be brought into harmony to meet our challenge.

Teaching Techniques

- Guided study tour to Pumwani villages assisted by Undugu Society Nairobi
- Focused group discussions
- Lecturette

Learning Objectives

After studying this section, you should be able to:

- Identify causes and effects of environmental problems
- Appreciate the restrictions and opportunities of the socio-cultural and economic environment
- See opportunities for harmonious environmental development
- Identify an action and community oriented environmental planning method

Environmental Planning

'A purposeful intervention in man and nature relations'

Man and Nature
A Theoretical Model

Nature's functioning

Societal attitudes

Landscape Ecology
in Rural Environment

Landscape Ecology
in Urban Environment

Environmental Planning
A Purposeful Intervention in Man and Nature Relations

Contents

- Environmental planning – a case study in Nairobi
- History of (environmental) planning
- An appropriate environmental planning method
First we introduce you to an integrated environmental planning case study on the villages Kanuku and Kinyago in Nairobi which was undertaken in 1986. Start this chapter by reading the background information on the case. Make notes of the planning steps that were followed to come to the implementation plan and strategy. Pay special attention to the opportunities and restrictions for improvement. Give your points of critique.

Then, you watch the Green Town’s Video 4: Working Together. This video introduces you to the Kanuku and Kinyago people and their environmental actions. The video was taken in 1994 and gives a good impression of the results. To close this section, we included an interview with the man behind the implementation process, Kuria Gathuru. Kuria was interviewed in 2000.

From here, we look at how (environmental) planning in the western world has evolved over time. This will help to place the planning strategy used for the earlier mentioned case study in an international context. With this wider perspective, we present you a planning method suitable for the Kenyan conditions as identified by the Green Town’s training participants.

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### Kanuku and Kinyago Villages – Pumwani Nairobi

#### Summary

In 1986, Undugu Society had just finalised a non-income housing project in Pumwani. They realised that although the housing condition had dramatically improved, the direct living environment was in a pathetic condition threatening the health of the Pumwani dwellers. A strategy was developed to also improve the environment. In 1987, Undugu Society received some money from the Netherlands Habitat Committee in the context of the UN Year ’Shelter for the Homeless’, to implement the proposed environmental improvements in the villages Kanuku and Kinyago. In the course of the next 5 years, the village community improved their houses, put up gutters and water tanks to catch roof water, dug drains, planted vegetables and trees, and removed old and dirty pit latrines and built new ones. Undugu Society supported the process. In particular, women were active in the urban agriculture programme. In the end, a small vegetable market flourished.

The case study addresses the environmental planning process that was followed, the opportunities and restrictions, the resulting plan, and the implementation process.

#### The Kinyago and Kanuku People

Most of Kinyago and Kanuku people came from the rural areas to Nairobi with the hope of well-paid jobs. They lived in plastic structures near the banks of the Nairobi River. After a fire, the dwellers approached Undugu Society in 1984/1985 to assist them to build better, fire-proof houses. Undugu Society agreed to assist them, but on the condition that the people themselves would contribute as much as possible in the form of labour and materials. In about half a year, the community built over 500 semi-permanent houses made of wattle and mud with a corrugated iron roof. It is estimated that one house accommodates about 6 people. The area is about 1.6 ha (4 acres) and houses thus approximately 3,000 people.

The people belonged to the poorest of Nairobi. For some to earn an income, they sub-let part of their (one-room) house (up to three lodgers in a room). Others engage in commercial sex or small-business, such as carpentry, ironing and washing, selling of vegetables and water.

#### The Site

Kinyago and Kanuku villages are located in the neighbourhood Pumwani in the eastern part of Nairobi (on the scale of Nairobi and environs, this neighbourhood is located in the Athi Upper Basin landscape unit. See the previous chapter) On a neighbourhood scale, the villages are built on the two distinct landscape (sub)-units, e.g. the slopes and floodplain of the Nairobi River. The difference in elevation between the top of the slope and the floodplain is about 8 meters. The slope is short and rather steep. The soil is rocky. The floodplain is about 25 meters wide. The area gets regularly flooded and is badly drained. The soil is fertile and suitable for agricultural production.

The houses were built in lines perpendicular to the slopes and clustered in 6 houses around a small open space. This open space had a ‘semi-private’ character and was actively used. Otherwise the houses were built very close together. The lowest houses at the foot of the slope would get flooded and damaged during the rains. The houses were not connected to the sewer system. A few pit latrines were built in the floodplain, but fell apart due to high water levels and floods. The floodplain was used as public toilet and garbage dump. In some areas, soil was excavated for the construction of the houses leaving pools of stagnant water. Youngsters played football and toddlers roomed around in the garbage.

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1 During the Green Town’s training programme, the training participants visited the villages in 7 groups under the guidance of two guides. They observed the terrain and interviewed the inhabitants in order to identify the environmental problems. After their survey and observation, there was a large meeting with the community to discuss possible solutions in the community hall. The training participants aired their findings and views, while the community reacted with answers, constraints but also with questions for the participants (of which many were government officers). The trainees gave their advice and offered their help.

2 This case study description is an excerpt from the article Evaluation and Options for Improvement of the Environment in a Slum Upgrading Project in Nairobi, Kenya by Ir. Ingrid Duijnhart, in Landscape and Urban Planning, 18 (1989) 153-174, Elsevier Science Publishers B.V. Amsterdam.
Illustration 1. Suggestions for improvement in Kanuku and Kinyago.

3 Tree planting:
   for shade to enforce communal meeting places

3 Fruit trees:
   for fruit and shade

3 Tree lanes:
   for stabilizing embankments along road and river

3 Forestry:
   for fuel and timber wood production

2 Horticulture:
   mainly for local vegetables

1 Garbage collection

1 Drains:
   to guide rainwater down the slope into the Nairobi river

1 Water tanks/gutters:
   for collection of rainwater and reduction of run off

1 Fish ponds:
   for cleaning stagnant water in pits

A few roads ran from the top down. During the rains, the rainwater gushed down the roofs and roads and accumulated in the floodplain, damaging houses and eroding roads. Meanwhile, the already contaminated and polluted Nairobi River would flood (Illustration 2 gives a cross-section). The damaging water would thus come from two sides.

The climate is hot and there are no trees to provide shade. Water is (expensively) sold at selling-points. Due to uncollected garbage, human excrements, stagnant water, crowded living circumstances, high temperatures and limited access to sufficient clean water, the direct living environment was unhealthy. In particular, children would suffer from diarrhoea, fevers, slow curing wounds, and the like.

Intervening Environment

From the early eighties, the Kenyan Government recognised their limitations in providing the poor with affordable houses. The government thus encouraged small-scale firms and the self-employed to provide a substantial share of the infrastructure, in particular houses, roads, water pipes, and sewage. They appealed to the non-governmental organisations to support the population in the provision of their basic needs. The government assisted by facilitating the initiatives taken by the ngo's. At Kanuku, the local chief approached Undugu for support. Later, he negotiated with the District Officer, the Provincial Commissioner, and with the City Commission for the site of the present day Kinyago Village. The administration guaranteed that the villagers could not be evicted without being given an alternative piece of land.

Undugu Society has a clear philosophy. Although they aim at the improvement of the living conditions of the non-income and low-income groups – they only want to do this through full involvement and commitment of the people themselves. This means for example that the community has to give their own (affordable) input. Labour is one way, but the community also agreed to build a community centre and to assist old and sick people who were not able to build for themselves. Undugu hired a contractor who taught the villagers how to construct their houses. The building technique was simple and
easy to manage for the villagers. Undugu, intentionally did not just provide, but tried to build a community mentally 'owning' their place.

In conclusion, in 1986 the intervening factors were among others:
- A facilitating government;
- An ONGO - that promotes community ownership;
- A willing, but extremely poor community with a reasonable amount of security; and
- A physical site composed of a steep slope and badly drained floodplain.

All these factors will influence the ways and options for improving the direct living environment and determine the available means.

Environmental Planning
Improvement of the direct living environment, in the case of the Kanuku and Kinyago Villages, addressed two planning levels:
- Individual or household level; and
- Community or village level.

The individual households struggled with shortage of water, space, bad sanitary facilities, earning an income on a day-to-day basis, sick children and family members. On a village level, bad drainage, floods, uncollected garbage and human waste dominated the environment of the village. The mismanagement on a village level was the cause of some of the devastating living circumstances for the household.

A successful environmental intervention had to include the following:
- Integrate the relevant planning levels - environmental planning in a slum area must respect individual interests. Only then the individual will put efforts in improving the communal environment.
- Address (daily) human needs, such as, adequate nutrition, shelter and clothing, conveniently accessible and clean water, good health and education.
- Assess the site - the people in Kanuku and Kinyago have to cope with problems that would not have occurred if the site characteristics had been taken into account. If the access roads would have been located parallel in stead of perpendicular to the contour lines, erosion of the roads and damage to the houses would have been less.
- Plan flexibly with an eye on possible future but as yet not affordable improvements and the fast changing socio-economic and population conditions.

With these starting points in mind, Undugu Society adopted the following strategy to further improve the life in the villages.

Suggestions for the Improvement of the Living Environment in Kanuku and Kinyago
The strategy for improvement is based on three groups of suggestions evolving around environmental hygiene, urban agriculture, and urban tree planting including forestry (Illustration I gives a schematic impression).

Improvement of environmental hygiene (No's 1 in Illustration I)
Sustainable improvement must take into account the landscape ecological process and more specifically the rainwater flow.
1. The roof surface covers about 70 per cent of the area. Water tanks and gutters collecting roof water will dramatically reduce the amount of rainwater run-off. The erosive strength of the run-off water will be reduced and there will be less stagnant water in the floodplain.
2. The remaining water should be guided down and out of the floodplain into the Nairobi River through a simple drainage system.
3. Education on the importance of environmental hygiene resulting in improved use and maintenance of pit latrines and management of garbage, is critical for community health.
4. The excavated areas could be enlarged and improved to make fishponds. Some fish species eat waste, mosquito larvae and snails, thus keeping the ponds free from vectors to water-born diseases.
5. A low dike parallel to the Nairobi River will reduce the effects of flooding.
The water tanks will give individuals access to relatively clean water in the house. This will reduce household expenses and increase hygienic conditions while at the same time on a community level the environmental hygiene improves. The other activities will all assist to reduce incidences of environment related diseases and, thus, saving the family on costs for medicines and doctors (and maybe lives).

Urban agriculture (No's 2 in Illustration 1)  
Some people already grew vegetables in the floodplain. This activity could be extended as the soils are fertile and the water is nearby. Women groups could start vegetable gardens for subsistence. The surplus could be sold. The women will earn an income and save on household expenses. This activity provides profits on a short term. Possible threats might be land issues and theft.

Urban tree planting and forestry (No's 3 in Illustration 1)  
Three youth groups approached Undugu to assist them in starting a tree nursery and tree-planting programme. They expressed an interest in planting fruit trees in and around the villages. The advice of KENGO was called in. According to KENGO such a programme would be viable. A nursery could be set up within six months and would give profits within a year’s time. The area chief will appoint a location. There are several options for tree planting:

1. Forestry for fuel wood and timber (building poles) production along the river and in the floodplain;
2. Tree lanes along side the village periphery and main road and the river to stabilise the embankments;
3. Fruit trees within the clusters of 6 houses for fruits and shade;
4. Ornamental trees around the shopping areas for shade at communal meeting places;
5. Tree nursery to produce trees for the villages as in points 1-4 and as an income generating activity.

The tree planting serves a variety of secondary purposes. The area will look beautiful and less attractive places as the garbage disposal points and pit latrines can be screened off. The fruits of the fruit trees will be a food supplement to the youth and may even generate an income. The trees ameliorate the hot, dry and dusty climate.

In addition, the suggested improvements would increase indirectly the well-being of the villagers, as follows;

- Involving the community in the maintenance and improvement of their immediate living environment would strengthen the community sense. Consequently, the building of the houses would not remain an isolated “highlighted” activity, but rather one of the many activities to build a village.
- The higher the quality of the environment and community maintenance, the fewer arguments could be raised against the ‘informal’ non-legalised, low-income villages.
- The negotiation position of the community vis-a-vis possible moves to evict them would strengthen.
Programme Implementation and Conclusions

As mentioned in the introduction, Undugu Society received some funds from the Netherlands Habitat Committee to facilitate the implementation of the suggested programmes. Undugu Society hired Kuria Gathuru as a social worker/urban agriculturalist. Kuria for and utmost worked through the community—educated them, talked with them, listened to their problems and their ideas and patiently assisted the community in identifying their needs and priorities. Within a year's time, the community constructed:

1. Water tanks and simultaneously cemented the walls of their houses to improve their durability;
2. Vegetable gardens were started by women groups;
3. The chief allocated a site for a tree nursery;
4. Stagnant water ponds were used to keep geese (their meat was preferred above fish);
5. Some shade trees were planted and taken care off;
6. With the assistance of UNICEF, Undugu was in the process of removing the old pit latrines and constructing toilet blocks on the higher site of the villages.

All activities were linked together in a network of relations—the gutters and water tanks on the slopes create new opportunities for the use of the floodplain. The activities scheduled in the flood plain not only gave the area a purposeful use, but they also decreased its misuse as toilet and indiscriminate garbage disposal. There was an increase of cleanliness and social control. One activity supported the other and together they improved the environment and the life of the inhabitants.

The integration of the individual/household interest with community interests seems a workable formula. However, the 'word' of the administration that the villagers would not be evicted without the guarantee of a new place, did not sufficiently secure the villagers of their shelter. This made the work of Undugu Society go slower than if the villagers had felt fully secure.

Q

- What were the opportunities and restrictions for a successful environmental planning intervention in Kinyago and Kanuku?
- How did the different suggested activities relate to each other?
Green Town's Video - Working Together

In the coming video, you will see the results of the planning intervention in the Kinyago and Kanuku villagers after six years of hard work.

The Green Town's video 4 is one of the 7 training videos that are produced by the Agricultural Information Centre, Nairobi and the Environment and Urban Development Training Project in collaboration with Wageningen University and Television Trust for the Environment. The first half of video 4 shows the results of the environmental improvement programme discussed in the previous excerpt on the intervention of Undugu Society. The video is filmed in 1994. Kuria Gathuru is your (video) guide. The ‘Undugu’ section takes about 7 minutes.

**Video Assignment ‘Working Together’**

- Which environmental problems did you observe and which ones does the community mention?
- How are the problems linked?
- What are the causes and effects of the observed problems?
- Which solutions were found and how do they support each other?

**Summary Video ‘Working Together’**

The ‘Undugu’ section of the video illustrates three crucial areas of environmental planning in a slum situation:

1. By linking one solution to the other, long-lasting solutions to environmental problems can be found;
2. Through a partnership among the government, the community, and a facilitating ngo life-threatening environmental problems were solved;

3 The second half of the video “Working Together” addresses a similar case study in Kisii Town. This part of the video focuses on the collaboration between the community, local government and the Kisii Green Towns Action Group. Their combined efforts result in a durable improvement of the Daraja Mbili market.
3. Income-generating elements were rubbed on the environmental improvements to commit the non-income community.

Mr. Kuria tells how Undugu Society got involved with the Kanuku, Kinyago community in 1983/1984. In 1986, Undugu Society concluded that environmental management would further improve the living conditions of the village community. They asked for advice (see the previous case study) and employed Mr. Kuria. He explains that during the following year, the community participated in workshops and focussed group discussions. Together they decided to change the floodplain of the Nairobi River into a more productive and pleasant environment. The video then shows the actions and results of the community's work in 1994. Drains and water tanks were constructed. Banana trees and other fruit trees were planted to protect their vegetables and houses, while toilets were built higher up the slope. The income earned from the agricultural products improved the life of the group members (mainly women). It allowed them to pay, among other things, the school fees for their children and plan independently their development. Although there were painful lessons - the intervention slowly brought welcome social, economic and environmental changes.

Discussion
The Green Town's participants discussed with the Kinyago and Kanuku villagers the video. After this, they went out into the field. This is what they saw as major environmental problems:
- The drainage was blocked by new structures built in the floodplain;
- Poor garbage disposal;
- Insufficient toilet facilities;
- Crowdedness increased;
- Lack of vegetation; and
- Inaccessibility for fire brigade and ambulance.

Even though, there were major improvements, environmental hygiene was still insufficient leading to high incidences of tuberculoses, diarrhoea, and cholera. Other issues that came up were related to lack of security of tenure, idleness, prostitution, abject poverty, criminality, and lack of land for income-generating activities.

The Green Town's participants observed an enormous willingness of the villagers to improve their direct living environment.
Kanuku and Kinyago Villages in the year 2000 - an interview with Kuria Gathuru

The planning exercise took a couple of weeks. However, the actual implementation process took many years. Things changed. Frederique Groenendijk interviewed Mr. Kuria Gathuru to find out what happened with the villages after we filmed them. It is June 2000 and Kuria looks back.

Mr. Kuria you worked with the Kanuku and Kinyago community from 1987 up to 1995. You left just after the Green Towns Project filmed the villages - how did you feel at that time?

I was very proud of the community and the work they had done. In particular the ‘agricultural’ and ‘artifacts’ women groups had done so well. These women no longer relied on Undugu Society. Actually, it were these women who pushed me to leave Undugu Society. They told me that they were very fine and that it was time that I started to think about myself.

Last year November 2000, you were asked to assess Undugu’s intervention in the villages. Could you please share with us some of your findings?

At first glance, it looked like that all efforts had vanished. The water tanks were no longer in use, because the rainwater is too polluted. The floodplain is built up and nearly every open space is taken up by shelters. The area is so congested that even the fire brigade cannot enter anymore. The area is again full of garbage, because the clean-up groups stopped.

But, at a second glance, the banana and other fruit trees planted in the early days still protect the floodplain from floods. Bananas are harvested. One woman protected her avocado tree with determination and now sells the fruits. The area is properly drained by six kilometres of drain. The floodplain became a safe place to settle, and thus (even though this was not the original intention) many shelters were constructed.

The women who started the vegetable gardens and the little market to sell their produce, now, go to the retail market to buy vegetables and trade them on their own market. Many other income-generating activities have come up. The villagers have money to pay school fees and improve their shelters. Many of the original residents are still living there. Many rent out one or two rooms. Some even want to apply for electricity and telephone connections.

Security of tenure has improved. The villagers are in the process of establishing a land trust. Occupation letters are issued. Neighbourhood guards protect the area against a small fee. Plans are made to organise garbage collection in a similar way. Kinyago and Kanuku villagers became respected Nairobians.”

Even though the outcome of the original environmental strategy changed, do you believe that Undugu’s initiative to address the immediate living environment was a worthwhile and valid activity?

Yes, I am absolutely convinced that the initiative triggered off a change for the better. The production of vegetables kept first hunger at bay and later provided a good income. The water tanks improved the health of the villagers. Many villagers modified the idea of the water tank into idea of having bathrooms (built on top of the drains). Some of these bathrooms changed into a paid public facility.

The clean-ups and the various recycling activities that followed created a community spirit. The agriculture and horticulture groups developed in small-credit and investment groups. As a result, many strong and independent women created a positive environment for their children to grow up. Currently, the residents are contemplating their own primary school while more and more people can afford secondary school fees. So, yes even though the first step was the provision of decent housing, the initiative to address the environmental issues on a village level was crucial to facilitate the growth of the individual residents and the village community.

I agree, not everything was implemented as originally was envisioned, other activities more important to the community were included, and the beautiful vegetable gardens in the floodplain disappeared again. But, please, do not forget that the environmental strategy gave suggestions to start up a process and stimulate a discussion. The environmental plan was never intended to be an end product. It was the process that counted most.

Mr. Kuria, I thank you for your collaboration. I do know that you gave more than 100 per cent of your energy to the development of Kanuku and Kinyago Villages. The process was slow and tedious and sometimes even depressing. The problems, such as commercial sex, youth criminality, fresh influx of desperate people, sometimes seemed insurmountable. The newly planted trees died because men were ‘urinating’ them. New environmental problems propped up – air pollution made it impossible to harvest the rainwater and industrial groundwater pollution jeopardised the growing of vegetables. Nevertheless, you never gave up and helped to improve the lives of many children, women and men.
Intermezzo – Some Planning History

The previous case study illustrated partnership between government and the community, the need for discussion, and flexible and open-ended planning. Implementation and planning were intertwined. ‘Change’ might have been the only constant factor. During the period 1983/1984 up to 1999/2000, the population of Nairobi increased from about 1.25 or 1.5 million to 2.5 or 3 million. In about 17 years the population doubled – imagine two times as many mouths to feed, two times as much solid and liquid waste, shelter for two times as many people etc etc. The traditional (in Kenya basically British) planning methods can no longer succeed. In the Kinyago-Kanuku case study, a much more flexible, process oriented approach was introduced. The plan was an expression of an overall vision. Kuria, then, was the advocate and spent about eight years in discussing, planning and assisting the community. Planning and implementation went hand-in-hand. And another six years later, things have changed again. How does the planning method that was followed here fit with what happens elsewhere in the world?

In the 100 years of physical and urban planning history, planning approaches continuously changed in an effort to meet real world’s problems. Among others, we saw planning change from:

- Philanthropy (1900) to rational planning based on scientific data collection (1950) back to social commitment and learning,
- Blue-print planning to open-ended strategic planning,
- Believe in human power to (re)create the world to a more modest step-by-step problem solving approaches,
- Neutral advising discipline to a facilitating or advocating profession,
- One man’s show to interdisciplinary teamwork to community involvement and mobilisation, and
- Substantial and philosophical to procedural ‘red tape’ hampering planning flexibility and change.

Physical planning originated from the concern with the dilapidated living conditions of the urban poor at the end of the 19th century. Philanthropic movements helped to improve the situation, while the government developed housing standards, adopted physical planning acts and introduced by-laws to regulate land use in the inner cities. Large-scale demolition and sub-urbanisation were among the ways to improve the physical environment of the poor. Meanwhile, planning methods became more sophisticated. Surveys, analytic methods, designs of one or more plans were presented to the implementers, basically the government. After the World War II, these methods no longer corresponded to the reality. Changes in the real world, among others, because of an unexpected growth of the population and economy, made it necessary to view cities as complex systems and planning as a continuous process. A more cyclic planning method based on environmental scanning, goal formulation, development of alternative plans or models, evaluation of the alternatives, all the way to implementation and review of the results, emerged. The planners and decision-makers still believed in a ‘makable’ world. The plans, therefore, were detailed

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and had a distinct blueprint character. In the late 1960's, the planning came under critique. It was said that the planning methods failed to include the political context of decision-making, norms and values of the citizens, and other irrational elements, such as, experience and intuition. Others started to doubt human capacities to create comprehensive environments or predict the future. As a reaction, more participatory planning methods developed. In some cases, the planning was partial and experimental, only working on problems as they arose. This required a decision-making and planning processes based on incremental and strategic choices. Planners changed roles from advisors to the government to advocates, co-ordinators, catalysts, or decision-making facilitators for government and citizens. Planning approaches have become more flexible and incorporated more and more social learning and social mobilisation.

Environmental planning, a purposeful intervention in man-nature relations' is the title of this chapter. You saw earlier that nature and society have their own driving forces. You learnt that if these forces work in different directions, the relations between man and environment become disturbed. Nature is largely self-organising, but human beings can make choices, decisions, and conscious changes. Human beings have the choice to decide to respect nature and carefully mould and form nature into an environment that serves its human purposes. Or human beings can decide to take the maximum out of the natural system and leave the environment spoiled and wasted, useless for any other who will live after him/her. Nature itself cannot make such choices - nature just follows its own natural laws.

Environmental planners work within these natural and social forces. The Kanuku/Kinyago case study shows that environmental care will benefit the individual and the community. Through offering choices the environmental planner guided the community in their decision making. They chose to care for their direct living environment because it gave them a better life. Nature did what it always did – it produced vegetables and fruits, provided shade and protected against floods.

We learned from the Kanuku/Kinyago experience that in an extremely poor society, where the existence of tomorrow is unsure, and where changes are fast, planning should be:

- Based on nature’s forces expressed in landscape ecological processes,
- Based on local knowledge,
- Respectful of local needs and restrictions,
- (Incremental) problem solving that is addressing individual human needs while integrating community environmental requirements,
- Action oriented,
- Aggregating actions within an overall environmental development framework,
- Extremely fast and flexible, and
- A cyclic planning process inter-linked with implementation.

Within a situation whereby the government has very limited say over private land, no manpower or money to implement and maintain environmental plans, it is the community who ultimately manages its own environment. Environmental planning therefore must include the community in all levels of decision making. This makes the environmental planner also an educator, facilitator, community worker, and an advocate. He or she somehow forms a bridge between the local community and the local and central government.

Martin Holdgate in his book ‘From Care to Action’ quotes on page 121 the one founding principle for all others. It is:

Respect and Care for the Community of Life. This principle reflects the duty of care for other people and other forms of life, now and in the future. It means that development should not be at the expense of other groups or later generations.
Environmental Planning Process

We asked the Green Towns participants on the basis of the lessons learnt in this theoretical section, to identify important planning steps. We give you the slightly modified results. The planning steps are not always as logical as listed down here. Steps might be swapped, steps maybe jumped, certain steps may have to be revisited many times before an environmental development strategy plus possible actions will be produced.

The participants mentioned two critical areas. According to them, the most dominant feature of modern planning should be a community based character. Second, environmental planning should be process oriented. The process was seen as more important than the result.

The following planning steps were identified:

**Step 1** Get to know the area! What are the unique landscape characteristics? Can you identify specific landscape units? What are the dominant natural processes? Who lives there? What are their habits, norms and values?

**Step 2** Jointly (planner and community) identify problems, their causes and effects;

**Step 3** Establish individual and community needs.

**Step 4** Assist the community in establishing a vision for the future and the overall objectives.

**Step 5** Jointly prepare an environmental development plan, strategy, or spatial concept. This concept shows how to create the envisioned future.

**Step 6** Stimulate the community to come up with realistic and detailed actions to build their 'ideal' environment. Sometimes it is required to collect detailed and additional information to solve the problems or to implement an idea. Also identify who is responsible for implementation.

**Step 7** On the basis of the outcome of step 6, adjust if necessary the strategy or concept to fit the reality.

**Step 8** Implement and monitor. The evaluations will stimulate to go back to any of the planning steps at any time.

Epilogue

In this Section I, we learned to respect nature. We saw how nature and human drives can be harmoniously brought together. Environmental planning is seen as one of the ways to do so. Environmental planning can thus be defined as a discipline that works from an understanding of landscape dynamics through a design process towards balanced land uses, safeguarding natural resources on the long term while providing the population with their basic needs on the short term. A (theoretical) step by step approach to (participatory) environmental planning was set out. In Section 2, the planning approach used by the Green Town project is elaborated and put into practice.

Compare the changes in international planning methods with the planning approaches used in Kanuku and Kinyago. Identify the main requirements for successful environmental planning.
Introduction

Environmental planning for 'real' is an exercise in applying the theory presented to you in Section 1. Reading is not enough – you have to do it!

This section on environmental planning starts with an elaboration of the environmental planning method, which was introduced in the previous section. Then, you will apply the various planning steps guided by an example case in Webuye town.

We will pay ample attention to community participation in the environmental planning process in Section 3.

Teaching Techniques

- Theoretical key note
- Critical video watching
- Field assignments

Learning Objectives

After studying this section and practising the assignments, you should be able to:
- Design an environmental development plan in line with your vision
- Come up with creative solutions fitting short-term social and economic needs of the community and long-term ecological strategy of your environmental development plan
- Propose realistic environmental actions

Contents

- Green Town's environmental planning method
- Planning for Real - A field course in Webuye
Introduction
A Green Town's method evolved from an environmental planning and design method developed at Wageningen University and its application in several Kenyan case studies. In this method, there are three distinct clusters of planning activities. We discuss the method cluster by cluster.

Teaching Techniques
- Theoretical key note

Learning Objectives
After studying this chapter, you will be familiar with:
- The environmental planning method that forms the foundation of the Green Town's approach.

Cluster 1
- Action plans
- Pilot projects
- Implementation
- Monitoring & evaluation

Cluster 2
- Detailed studies
- Detailed designs
- Environment development plan

Cluster 3
- Vision
- Landscape analysis
- Problems
- Objectives and goals
- Constraints
- Strategy
- Concept

Contents
- Green Town's Environmental Planning Method
Section 1 provided you with a philosophical and theoretical foundation on environmental planning. In this section 2 we will show you how to practically apply this theoretical foundation. We will follow an environmental planning and design method that was developed by Wageningen University at the Department of Environmental Science. The method evolved from applications in Kenya, such as the South-West Kano and the Undugu case studies presented to you earlier as well as from cases elsewhere. The method is described in several articles\(^1\) and 2 and the 'Manual on Environment and Urban Development'\(^3\).

We will guide you step-by-step through the method.

In the theoretical background and philosophy explained in Section 1 – Man and Nature, the forces working on the environment were taken apart. The ultimate objective of this section is to creatively bring the forces together with the aim to come to harmonious development.

Putting things back together again in a sensible way is not an easy task. As you recall from the 'Kleefmann' model, it requires the integration of socio-economic, cultural, political, and ecological aspects. As was well illustrated in the Kinyago and Kanuku case study, purposeful planning also demands the bridging between individual daily needs and longer-term ecological objectives. The process of building these bridges can be described as an organised process of trial and error in a search for the best fit. The method we will describe to you can be seen as a guide to your search. The method heavily builds on visualising the present and the future in maps, sketches, cross-sections and the like. We believe that this opens the way to maximum discussion, revelation of issues, and optimum stimulation of creativity.

The method identifies three groups of related activities. Cluster 1 covers activities as the establishment of goals and objectives, analyses of the environment, problem identification and the development of a concept for a sustainable future. In Cluster 2 detailed studies and designs further explore the potentials of the concept. A more realistic environmental development plan is the result. Cluster 3 includes actual implementation and evaluation. Illustration 12 gives a graphical interpretation of the environmental planning process. The various circles can be seen as the gears of a gearbox. The changing of gears then symbolises the changing from more abstract thinking to concrete doing or from analysing to creating and the other way around.

**Cluster 1 - A Vision**

The basic objective of this first cluster is to arrive at a joint vision among residents, decision-makers, non-governmental organisations, churches and other community groups. To arrive at such a vision, cluster 1 is built around 7 activities (see Illustration 13), as follows:

- **Philosophy** is based on your starting points regarding nature-man relations. Section 1 gives the basic starting points for this handbook. The questions and assignments may have assisted to form your own philosophy. Without a basic philosophy, you will have difficulties to develop a consistent vision and an environmental development plan and strategy.

- **Environmental analysis**, the environment as we see it around us is the tangible reflection of the

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workings of nature and the use people make of it. The physical environment, therefore, can to a large extent be seen as a mirror of the use of land. ‘Reading’ and ‘understanding’ this environment provides an enormous amount of information. We have seen a good example of this ‘understanding’ in the South-West Kano case study.

- **Socio-cultural and political analysis**, the environmental analysis may already have revealed much of how the people relate to the environment. More information may be required. Focused individual face-to-face and group discussions, field walks, and secondary research can provide most of your information. Most likely, you will continue to make discoveries as you go through the planning process. For example, when pilot projects are implemented, certain restrictions related to cultural taboos may come up.

- **Problem analysis/statement** should reflect the problems experienced by the people as well as related to the ecology of the area.

- **Objectives and goals** should be realistic and obtainable.

- **Constraints**, can be identified in the natural environment as well as in the intervening socio-cultural, economic or political environment. Examples of constraints can be found among others in the Kinyago and Kanuku case study.

- **Environmental development concept and strategy**, this is the first rough idea of how a harmonious future can look. The concept can be presented as a schematic impression or a map, but somehow locational factors must feature. You could say, that the concept is a graphic expression of a development vision for a unique location while respecting unique natural and societal opportunities and restrictions.

The activities do not always follow each other in the presented order. Illustration X gives only one of the possible routes. To keep the diagram simple, the linkages with the two other clusters are not included.

Cluster 2 is a group of the following activities:

- **Detailed studies**, it may be necessary to further analyse an issue identified in cluster 1. For example, in an area near to Machakos, the erosion of the farmland slopes was getting more and more serious. The mapping out of the erosion pattern, revealed that the excellently maintained, beautifully swept compounds were one of the main causes. The rainwater ran off from the compound’s compacted surface into the soft soil of the shamba and then gradually caused deep gulies. In order to avoid future problems, the solution was simply to protect the boundary between the compound and the shamba. Without, the detailed study, it would have been quite unlikely that this unintended but basic cause for the soil erosion problem would have been found.

- **Detailed designs**, the environmental development concept includes many suggestions for environmental improvement, such as spring protection,
tree planting in and around public spaces. It is in this cluster 2 that the how of these suggestions has to be sorted out. Questions like 'How can river slopes be protected while most of land is formally or informally occupied' must also be answered. Land users have to be challenged to use more environment protective land uses. (Urban) agroforestry techniques could be a useful tool. A detailed design for a relatively small area with suggestions for conservation measures while boosting the agricultural production may be a starting point to discuss environmental enhancement and conservation with the residents.

- **Environmental Development Plan**, the outcome of the detailed studies and detailed designs will have to be fed back to the concept. The resulting more detailed overall plan is called the environmental development plan.

**Cluster 3 - Implementation**
The environment development plan sufficiently checked on its reality and affordability gives a framework for small projects and development programmes.

- **Development programme**, Each project or programme contributes to the creation of the ideal envisioned future.
- **Pilot projects** could further test the implementation strategy and the validity of the environmental development plan resulting from the Cluster 2 activities.
- **Implementation**, the lessons learned from the pilot projects will help to further improve the implementation strategy and ultimately to assess the environmental planning approach as described in Cluster 1.
- **Monitoring and evaluation** will assist in reacting on changes in, for example, the planning environment and help to further improve the planning approach. Monitoring and evaluation helps to find answers on the question 'Are we still on the right track?' Illustration 15 gives the activities and their inter-linkages of cluster 3.

As mentioned earlier, the planning steps as presented to you give an indication of a certain order in the planning process. Community involvement can be realised at various moments, which you will see in Section 3. Not everybody will follow through the whole process – you might be involved in the process of conceptualisation of Cluster 1, but not in the actual implementation. Or you might be involved in a first round of planning, design and implementation, but not in a second round.

However, we do like to note that the 'real-life' experience of implementing pilot cases as we did in the Green Town's project taught us a million lessons. These lessons were incorporated in this handbook as well as in the development of the 3-Day Participatory Training Programme. And so did, for example, the following through of the Kinyago and Kanuku case study. If you have the opportunity to follow a full cycle, we can only advise you to take such a chance with both hands.

In the coming chapter, we follow certain planning steps in much greater detail. We hope that with the help of the illustrative video material and the Webuye case that you can undertake 'real-life' exercises in your own direct living environment.
Introduction
After introducing you in the previous chapter to the environmental planning method, we invite you to apply the method in an area of your choice. For a successful application, all your newly acquired knowledge of the previous sections will be needed. As a guide, we invite you to watch the Green Town’s video ‘Make Your Town a Green Town’. This video shows what the people of Webuye did when they prepared their environmental development plan.

Teaching Techniques
- Field assignments
- Video watching

Learning Objectives
After applying the assignments in this chapter, you will have designed your own:
- Environmental development plan
- Creative solutions for short-term social and economic needs fitting your long-term ecological strategy for your environmental development plan
- Realistic environmental actions

Contents
- Webuye Green Town experiences
- Development of an environmental development and action plan in detail
The experience with the planning method in Webuye is filmed. The resulting video “Make Your Town a Green Town” forms a handy part in explaining the process to you. Ol Kalou, Malindi, Nyeri, Webuye, Nanyuki and Migori are all field course towns were the Green Towns trainees practised with the planning method. All exercises resulted in a Green Town’s Environmental Development Plan for the town. Even though there are local differences, each of them would equally well illustrate the environmental planning process. If you would like to know more about them, we refer you to the reports.

In the Green Town’s field courses, the trainees worked for about 14 days with 5 to 8 representatives of the town community. Although, there were separate workshops to inform the larger community, the emphasis in the field courses is on the learning process of the Green Town’s trainees (the future facilitators). The Green Town’s 3-Day Participatory Environmental Planning (PEP) workshop has its emphasis on the learning process of the urban community. How to facilitate the latter process is addressed in Section 3.

The main objective of the field course exercise is that you will be able to apply the theoretical knowledge presented to you. Understanding the theory does not automatically mean that you also can apply your knowledge. It is one thing to understand the ideas behind the identification of the landscape units, but quite another thing to actual recognise the various units in the field. The development of an environmental plan that is affordable and achievable is partly a rational and logical process and partly a creative and at times not-so-logical process. It forces you to think outside the normal way of doing things and come up with some unique ideas.

The integration of information and knowledge is yet another area of great importance that requires specific attention. One of my educational teachers once mentioned to me: ‘People store their information in small little drawers. One drawer contains knowledge in the area of ecology, one with sociology, one with planning theories and so on. These drawers are not connected with each other. Integrating, combining, or looking for aggregated solutions requires that you have to build connections between your drawers’. This was far before computer time – now you could say the computer stores information in files. The files might be combined in folders – but inter-linkages are not existing unless you create them. And even when they are linked – you might be able to print a series of files in a certain order or you may insert an Excel file in a Word document, but there is no creative spark that brings out a completely new aggregate.

In the field course, we try to make you ‘spark’. We would like you to make bridges in between your little ‘drawers’ of knowledge. This is normally done in an intensive ‘master – student’ interaction. Here, we will take you along in the process by inviting you to carry out field assignments by showing you the Green Town’s training videos and photographs. As a form of introduction, we invite you now to first watch the Green Town’s video ‘Make Your Town a Green Town!’

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