



# Summary Report

Rwanda : From Post-Conflict to  
Environmentally Sustainable Development

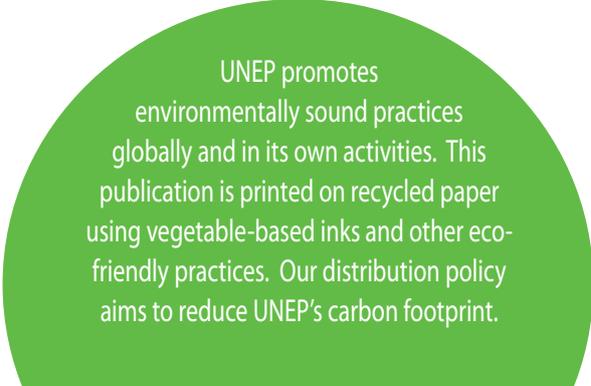
United Nations Environment Programme

The basis for this *Summary Report* is the full report *Rwanda: From Post-conflict to Environmentally Sustainable Development* and is meant as a synthesis of its key findings. The report has been subject to extensive review within UNEP as well as by the Government of Rwanda and other stakeholders.

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# Summary Report

Rwanda : From Post-Conflict to  
Environmentally Sustainable Development



## Acronyms and abbreviations

<b>CASM</b>	Communities and Small-Scale Mining
<b>CBFP</b>	Congo Basin Forest Partnership
<b>CBO</b>	community-based organisation
<b>CDM</b>	Clean Development Mechanism
<b>CFL</b>	compact fluorescent lamp
<b>CGIS</b>	Centre for Geographic Information Systems and Remote Sensing
<b>CITES</b>	Convention on International Trade in Endangered Species of Wild Fauna and Flora
<b>CNG</b>	compressed natural gas
<b>DMU</b>	Disaster Management Unit
<b>EAC</b>	East African Community
<b>EDPRS</b>	Economic Development and Poverty Reduction Strategy
<b>EIA</b>	environmental impact assessment
<b>ENRSSP</b>	Environment and Natural Resources Sector Strategic Plan
<b>EWB</b>	Energy and Water Board
<b>FAO</b>	Food and Agriculture Organization
<b>GDP</b>	gross domestic product
<b>GIS</b>	Geographic Information System
<b>GoR</b>	Government of Rwanda
<b>IPCC</b>	Intergovernmental Panel on Climate Change
<b>IWRM</b>	Integrated Water Resources Management
<b>LPG</b>	liquefied petroleum gas
<b>MDG</b>	Millennium Development Goal
<b>MINICOM</b>	Ministry of Trade and Industry
<b>MININFRA</b>	Ministry of Infrastructure
<b>MININTER</b>	Ministry of Internal Security
<b>MINIRENA</b>	Ministry of Natural Resources
<b>NAFA</b>	Rwanda National Forest Authority
<b>NAPA</b>	National Adaptation Programme of Action
<b>NBI</b>	Nile Basin Initiative
<b>NCPC</b>	National Cleaner Production Centre
<b>NELSAP</b>	Nile Equatorial Lakes Subsidiary Action Program
<b>NGO</b>	non-governmental organisation
<b>NUR</b>	National University of Rwanda
<b>ORTPN</b>	Rwanda Office of Tourism and National Parks
<b>PCEA</b>	post-conflict environmental assessment
<b>PES</b>	Payment for Ecosystem Services
<b>RDB</b>	Rwanda Development Board
<b>REIN</b>	Rwandan Environment Information Network
<b>REMA</b>	Rwanda Environment Management Authority
<b>RMS</b>	Rwanda Meteorological Service
<b>SEA</b>	strategic environmental assessment
<b>SHS</b>	solar home systems
<b>SWAp</b>	sector-wide approach
<b>SWG</b>	Sector Working Group
<b>SWM</b>	solid waste management
<b>UN</b>	United Nations
<b>UNDAF</b>	United Nations Development Assistance Framework
<b>USD</b>	United States dollar
<b>WHO</b>	World Health Organization
<b>cm</b>	centimetre
<b>ha</b>	hectare
<b>m</b>	metre
<b>MW</b>	megawatt
<b>°</b>	degree
<b>°C</b>	degrees Centigrade

# Summary Report

## 1. Introduction

Fifteen years after the 1994 genocide, Rwanda is today a resurgent nation that is stable, pursuing innovative reconciliation efforts and radiating with ambitious determination. This remarkable turnaround from a devastated, war-torn country into a promising showcase of African development is an exceptional story.

Vision 2020 is Rwanda's long-term national development plan, prioritising rapid economic growth and poverty alleviation that is broadly aligned to the Millennium Development Goals (MDGs). Its overriding aspiration is to catapult Rwanda within one generation from a least developed into a middle-income country by 2020. The groundwork for good governance is now well in place. Completion of debt reduction programmes in 2005 further marked a symbolic turning point in the country's evolution from the recovery phase to a solid development track.

It is within the context of finding an environmentally sustainable path to Vision 2020 that the Government of Rwanda (GoR) requested UNEP to carry out a countrywide post-conflict environmental assessment (PCEA). Although 16 years have elapsed since the end of the conflict in 1994, its environmental consequences continue

to pose significant challenges. What this multi-disciplinary assessment aims to offer is an independent, critical analysis of the most pressing environmental issues facing Rwanda. With due consideration to its post-conflict context, the assessment assumes a forward-looking approach and suggests scientifically-based and practical recommendations to tackle concrete problems.

This report is a summary of the full assessment study, *Rwanda: From Post-conflict to Environmentally Sustainable Development*, to which readers should refer for more detailed analysis as well as statistical data and illustrations. Addressed primarily to national decision makers and international development partners, this summary begins by highlighting the priority areas for intervention together with an implementation strategy. It then outlines the assessment's overall messages and elaborates on theme and sector-specific findings, which constitute the basis for the report's technical recommendations.

While this assessment should assist Rwanda chart an environmentally sustainable course to its national development goals, it is not prescriptive. Implementation of Rwanda's recently adopted Environment and Natural Resources Sector Strategic Plan (ENRSSP) is to be implemented by Rwandan stakeholders in collaboration with development partners based on a sector-wide approach (SWAp). In moving this process forward, strategic action planning should consider this assessment's findings and recommendations amongst other sources.



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*Underlying Rwanda's verdant landscapes and abundant water supplies are serious environmental pressures*

Map 1. Great Lakes and Eastern Africa



REGIONAL MAP

- ★ National capital
- Cities with more than 250,000 inhabitants
- Cities with less than 250,000 inhabitants
- ++++ Railway
- International boundary



Datum: WGS84  
Geographic projection.

Sources:  
ETOPO1, VMap0,  
ESRI Data & Maps 9.3.

The boundaries and names shown and the designations used on this map do not imply official endorsement by the United Nations.

## 2. Assessment process

This PCEA is the product of a consultative process involving the GoR, academic and research institutions, United Nations (UN) and international agencies, donors, civil society organisations and private sector representatives. UNEP's national counterpart in this process was the Rwanda Environment Management Authority (REMA), working under the overall leadership of the Ministry of Environment and Lands (MINELA).

The assessment process was carried out between March 2008 and April 2009. Following an initial scoping study identifying priority themes, UNEP commissioned 12 national experts to prepare a comprehensive desk study, which was completed in June 2008. The desk study served to advise the fieldwork phase of the assessment and was also subsequently used by REMA as an input for preparing the government's national State of Environment Report.

Fieldwork was primarily conducted over a two-week period in August 2008 by a multi-disciplinary UNEP team of ten scientific experts. It involved site reconnaissance visits, extensive stakeholder interviews and field documentation. Soil and water samples were collected for site-specific snapshots of land contamination, water quality and soil sedimentation rates, and analysed both in the field and at international laboratories. Extensive mapping and satellite image analysis was conducted in collaboration with the Centre for Geographic Information Systems and Remote Sensing (CGIS) of the National University of Rwanda (NUR), including national-scale Geographic Information System (GIS)-based modelling of soil erosion. Draft reports were

subject to national review at two major workshops (August 2008 and March 2009) to elicit feedback and input from stakeholders. While the array of perspectives expressed in these consultations are by and large reflected in the final text, this assessment report remains, however, first and foremost an independent UNEP study.

## 3. Priority areas and implementation

As it strives to make up for lost time during the conflict years, Rwanda is pushing for fast-track economic growth that is imperative to lift the majority of its population out of poverty and improve their quality of life. Inspired largely by the experience of the 'Asian Tigers', the government aims to maintain high economic growth and transform Rwanda from a subsistence agrarian economy into a regional service and knowledge-based hub. This accelerated development process will most likely create profound social and environmental change, with sustainability dependent on the country's ecosystems' continuous delivery of economic and social benefits. The challenge is to unlock the environmental degradation trap of "rapid population growth, resource over-exploitation and scarcity" that has caused the poor to "mine" the environment and has stymied Rwanda's potential for decades.

This assessment identifies three priority areas for intervention that should help decision makers pursue an environmentally sustainable course towards Vision 2020. These core priority areas were in turn used to categorise individual recommendations per issue and sector into a more structured and costed plan that is tabulated in Annex 1 of this report.

Table 1. Total number of recommendations under the three priority areas and their corresponding costs

Priority area	Total number of recommendations	Total estimated cost (USD millions)
Ecosystem conservation and rehabilitation to combat poverty	35	92.15
Capacity-building to strengthen environmental governance	47	47.90
Enhance and promote regional environmental cooperation	7	7.30
<b>Total</b>	<b>89</b>	<b>147.35</b>



*Conservation agriculture combines stabilising the ground with hedges and agroforestry as shown above, with mulching and a mineral fertiliser supplement to keep soil erosion at an acceptable level while ensuring good yields*

Each chapter of the main report proposes lead agencies as well as a tentative duration for implementing recommendations within a five-year time period. The total cost estimate of the proposed 89 technical recommendations is USD 147.35 million (see Table 1 and Annex 1). It should be noted that although projected costs are derived from broad calculations that require validation with national partners during the project development phase, it does, however, provide a reliable indication of the investment scale needed to address the priority environmental challenges facing the country.

### **3.1 Priority areas for intervention**

#### **Ecosystem conservation and rehabilitation to combat poverty**

Achieving the targets of Vision 2020 and improving the quality of life of Rwandans depend, either directly or indirectly, on the continuous supply of goods and services by the country's ecosystems.

Natural forests and wetlands, particularly in the Congo-Nile and Byumba highlands comprise Rwanda's strategic ecosystems. They provide the major source of renewable freshwater and energy generation, improve erosion control as well as regulate regional climate and natural hazards. Fully conserving the existing natural forest and wetlands resource base as well as rehabilitating degraded forest, wetland and rangeland ecosystems can greatly contribute to Rwanda's fight against poverty through job creation, income generation and provision of alternative livelihoods. Communities need to be mobilised around the rehabilitation and sustainable management of ecosystems in a manner that provides demonstrable benefits at the village and household levels. Targeted environmental rehabilitation interventions could help improve the quality of growth by delivering immediate benefits to the poorest segments of society. Restoring ecosystem integrity would also help build the coping capacity of the very poor in view of Rwanda's high vulnerability to climate change and disasters.

### **Capacity-building to strengthen environmental governance**

Rwanda has made substantial progress in establishing the policy, legal and institutional frameworks to address environmental issues in the country. However, considerable investment in capacity-building efforts is still required to ensure adequate compliance and enforcement, support the ongoing decentralisation process and bolster environmental governance within key economic sectors. Priority areas include: (i) technical assistance in natural resource management; (ii) environmental monitoring, scientific data collection and information management; (iii) environmental policy and law, including development of implementing regulations; (iv) strategic environmental assessments (SEAs) and environmental impact assessments (EIAs) to ensure integration of environmental considerations in national policymaking and development projects; (v) environmental education and awareness raising; and (vi) promoting public-private partnerships and strengthening the role of environmental non-governmental organisations (NGOs) and media. Recent endorsement of an Environment and Natural Resources strategy should contribute towards a coherent and long-term environmental vision and consolidation of the current project approach to environmental management. Support for the development of the environment Sector Working Group (SWG) and a SWAp is critical for effective prioritisation and planning in the sector and alignment of donor funding.

### **Enhance and promote regional environmental cooperation**

This assessment underscores the importance of regional environmental cooperation in sustainably managing the resource demands of Rwanda's rapidly growing population across core development sectors. Key areas include promoting joint investments in the energy and water sectors, sustainable trade in forest resources, transboundary management of protected areas and regional level initiatives in responding to the challenges posed by disasters, climate change and food security. Drawing on the experiences and successes of neighbouring countries in the sustainable management of natural resources through regional knowledge networks that act as conduits for technical cooperation, information exchange and technology transfer would help save precious time and resources. Cumulatively, the confluence of transboundary and

regional environmental activities could substantially advance interstate dialogue and confidence-building as well as reinforce regional integration and long-term peace.

## **3.2 Implementation approach and financing**

It is critical that this report's findings are nationally owned and implementation of its recommendations is nationally driven. This can be done by using its analysis and results to support the implementation of the five-year ENRSSP (2009-2013) recently developed under MINIRENA's leadership.

Furthermore, to promote national buy-in, prioritisation of this report's recommendations should be made by all national stakeholders through a transparent and participatory manner. This process should be facilitated through a SWG using a SWAp as called for under the Environment and Natural Resources strategy. Both UNEP and the UN Country Team through the United Nations Development Assistance Framework (UNDAF) Environmental Theme Group are ready to assist the government in taking this proposal forward.

As the government has a limited revenue stream, resources to implement the recommendations will need to be mobilised from development partners in the short to medium term. At the same time, for sustainability purposes, the government should, to the extent possible, cover project operational costs. Other means for raising capital should also be explored, including public-private partnerships and market-based financing.

A National Environment Fund, sanctioned by law though not yet activated, provides a suitable financial mechanism to coordinate the proposed investments. Another complementary financing option is through the newly established One UN Fund, particularly for those projects where it may offer a comparative advantage for implementation.

## **4. Key messages**

Underlying key messages have been drawn out from this assessment, highlighting the magnitude and complexity of the environmental challenges that need to be tackled. Emphasis is placed on



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*Conflict-induced population displacement in 1994 created massive environmental damage as more than three million people moved in and out of the country. Repercussions of ensuing deforestation and encroachment on national parks and wetlands will continue for many years in the future*

seizing the numerous opportunities available to reduce serious environmental risks and augment the sustainability of the transition towards a Vision 2020 society.

**1) The 1990-1994 conflict and genocide caused significant environmental impacts with implications that are felt to this day and will extend many years into the future.**

The main damage has been caused by massive population displacement and resettlement of returnees leading to potentially irreversible losses, including considerable reductions in the surface area of national parks, forests and other vegetation cover as well as encroachment on wetlands. The initial breakdown in natural resource governance and the loss of long-term environmental data sets, collapse of research and monitoring programmes as well as the shortfall in human expertise are enduring impacts of the conflict.

**2) Rwanda's extensively altered environment is under multiple, severe and mutually reinforcing pressures driven by high**

**population growth, declining resources and poverty.**

Major human-induced stressors are long-standing problems largely caused by natural resource over-exploitation and include land degradation and deforestation as well as wetland and biodiversity loss. Resulting environmental degradation and population expansion over and above projected growth rates can potentially suppress development gains and undercut progress towards the goals of Vision 2020. It is, therefore, important that environmental considerations are integrated into policies that aim to reduce population growth rates and promote off-farm rural income-generation sources. Furthermore, environmental conservation and rehabilitation can positively contribute to national reconciliation and peacebuilding initiatives.

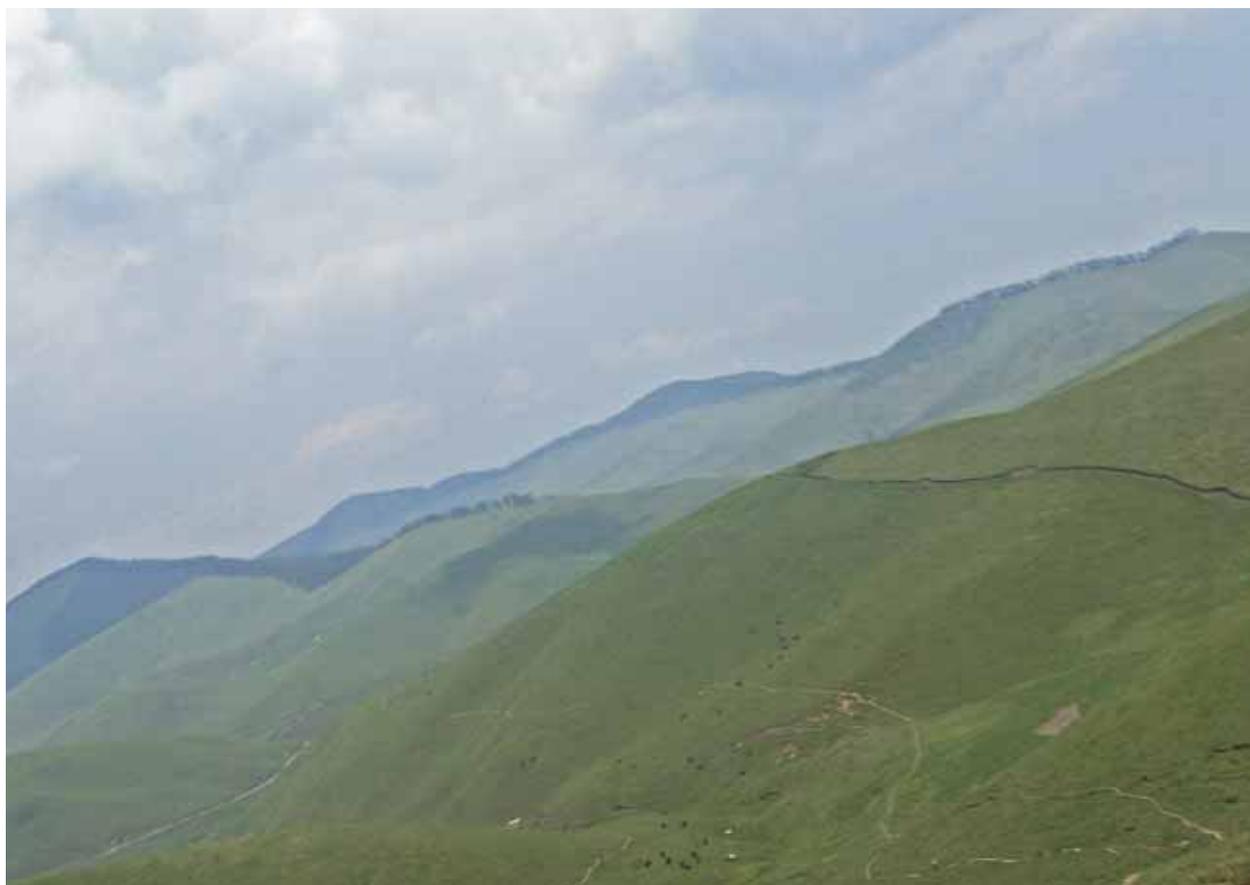
**3) An enabling environmental governance framework has been created at the institutional, policy and legal levels that needs to be strengthened with sustained capacity-building and technical and financial assistance.**

Environmentally sustainable development, including ecosystem rehabilitation, enjoys strong and high-level government support. Environmental considerations are well embedded in national development plans. The ongoing decentralisation process provides a unique opportunity to promote community-based environmental management at the local level, which has been weak. At the same time, environmental governance structures, including at the local level, need to be reinforced through the implementation of the ENRSSP, resource mobilisation and capacity-building to ensure compliance and enforcement.

- 4) **Major environmental data and research gaps are seriously hampering environmental governance.** Environmental monitoring systems across key sectors are inadequate to support informed decision making, including the development of indicators to assess progress towards Vision 2020 and the MDGs. Most notable is the destruction of the hydrological

and meteorological networks, absence of standard water quality and soil erosion monitoring programmes, lack of harmonised forestry inventories and inadequate research on several vital topics such as household use of wood and non-wood forest products at the household level, renewable energy sources and national-scale climate change assessments. Furthermore, where detailed data exist, they are often inaccessible due to the lack of a universal information management structure.

- 5) **The poorest segment of society is disproportionately vulnerable to rapid social change and is at risk of crossing biophysical thresholds beyond which there is sudden and potentially irreversible environmental collapse.** While Rwanda has made substantial gains in improving human well-being and combating poverty, the benefits are not distributed equally. There is a growing income gap between the top and bottom 20 percent of the population. The fast-track towards Vision 2020 risks creating profound



*Conversion of the forest area bordering Arusha village into pastureland occurred in the 1980s under a development project*

social transformation and places new pressures on the country's environmental capital. The poorest – including the 35.2 percent female-headed households, the 30 percent of farmers cultivating less than 0.2 ha of land, those living on steep and fragile landscapes as well as vulnerable groups such as child-headed households – are in danger of being locked out of this fast-tracked development process and further entrapped in the downward cycle of resource over-exploitation, environmental degradation and poverty. Targeted pro-poor environmental interventions should be strengthened to raise their coping capacity and improve livelihoods.

- 6) **Poor soil conservation practices are driving land degradation, including soil erosion and depletion of soil nutrients.** Frequent soil tillage, particularly on steep slopes, has led to very high erosion rates, validated by field measurements of sedimentation rates and preliminary results from GIS-based soil erosion modelling. Overcultivation without an appropriate mix of organic and chemical inputs has depleted soil fertility and led to very low productivity levels. While planned agricultural intensification is necessary to raise yields, it will likely increase nutrient and pesticide pollution in freshwater, substantially increase water withdrawals for irrigation and reduce agricultural biodiversity. A comprehensive package based on 'conservation agriculture' as well as promotion of off-farm alternative livelihoods needs to be developed, with a special focus on the poorest farmers, to alleviate pressure on land resources.
- 7) **Positive but qualified progress in forestry and protected area management.** Although reforestation efforts have raised forest cover to around 20 percent of Rwanda, most of this consists of exotic tree plantations that provide a more limited range of ecosystem services and biodiversity value compared to the 5.3 percent of land under natural forest. A significant economic potential exists from the harvesting of mature tree plantations that are at risk of being damaged by natural hazards. At the same time, this asset offers a good opportunity for improving local community engagement in forest management. Similarly, while the formally designated national park area has more than doubled in the post-conflict period and specific successes have been achieved such as the conservation of the endangered gorilla, these trends mask the substantial downsizing of the overall protected area network and significant decline in wildlife populations. A more concerted effort is needed to improve the management of nature reserves and protected areas.
- 8) **Per capita freshwater availability is below the limit of water scarcity, and biologically contaminated water remains a leading cause of sickness and death.** A more than five-fold expansion in water use is projected by 2020, which could further reduce per capita water availability. It is important to emphasise, however, that growing water scarcity is not absolute and can be remedied with an appropriate combination of governance, technological, ecosystem restoration and market-based responses. Furthermore, low-cost investments in safe drinking water and sanitation would significantly improve the health and economic productivity of the majority of Rwandans.
- 9) **Wetlands are targeted for heavy exploitation, putting at risk key ecosystem services, including their role as major sources for renewable freshwater supplies.** Around 60 percent of Rwanda's wetlands has already been converted for agriculture, while a substantial proportion of the remaining wetlands is threatened with reclamation under the drive for agricultural intensification as well as peat mining. Furthermore, inefficient implementation of existing policies and legislation have created loopholes that may undermine critical wetland services, including water replenishment and purification, flood control and drought mitigation as well as their role in food production and as wildlife habitat. Ongoing development of a wetlands master plan should help establish guidelines on their management and use. Applying EIAs on proposed development projects should safeguard sustainable use of this critical resource.
- 10) **A persistent fuelwood energy crisis prevails and associated indoor house pollution poses a serious health hazard, particularly for women**

**and children.** About 96 percent of households is dependent on wood and charcoal for cooking. The growing firewood demand is a significant but not the leading driver of deforestation. Lack of accurate data on the role of agroforestry in firewood supply is an important constraint on planning activities. Augmenting tree plantation supplies, accelerating the agroforestry and biogas programmes, and more-efficient stove programmes equipped with smoke hoods would help ease firewood demand and reduce indoor air pollution. Decentralised renewable energy sources offer a good opportunity to provide the majority of the Rwandan population with clean lighting electricity.

**11) Massive post-conflict urbanisation has caused significant environmental stress.**

The overwhelming majority of urban residents live in informal and unplanned settlements. Poorly planned urban development raises significant challenges to human well-being, including inadequate and inequitable access to safe drinking water, sanitation and solid waste management (SWM) services. Efforts to develop urban master plans need to be reinforced to mitigate and reduce environmental stress from rapid urbanisation. Problems associated with industrial pollution loadings are relatively small and localised, but are growing as the industrial sector expands.

**12) Climate change is very likely happening in Rwanda and, together with more frequent weather-related disasters, is projected to affect – directly and indirectly – all economic sectors and long-term development goals.**

While many of the potential problems associated with climate change are presently not clearly separable from short-term variations, they are likely to have important implications on food security, water and energy supplies and critical infrastructure. The poor, particularly women, are most vulnerable due to their dependence on climate-sensitive livelihoods. Strengthening of Rwanda’s adaptive and disaster risk reduction capacities is seriously curtailed by the lack of an accurate national-scale climate change assessment.

**13) Regional environmental cooperation offers a promising strategy to sustainably manage**

**Rwanda’s growing resource demands and reinforce environmental conservation.**

Compared to many of its neighbours, land-locked Rwanda has limited natural resources to drive its development. Transboundary cooperation to tap into the resource endowments of the Great Lakes region on a sustainable basis would significantly contribute to meeting increasing resource demands. Positive steps under way include the Nile Equatorial Lakes Subsidiary Action Program (NELSAP) as well as cooperation on the Virunga parks. There is a need, however, to expand and scale up environmental cooperation into a consolidated programme that would include sustainable trade in raw and value-added natural resources (timber, charcoal, minerals), harnessing the energy potential of shared rivers and the vast methane deposits in Lake Kivu, and management of transboundary parks. Engaging in regional knowledge networks to learn about and share successful experiences on natural resources management is equally important.

**5. Assessment findings**

This section provides a summary of this assessment’s main findings. It covers three cross-cutting issues and eight sectors. As many environmental problems and threats have multiple causes and are closely interlinked, overlaps are bound to occur. The identified gaps and weaknesses highlight key areas for action, which are formulated as practical recommendations in the summary table in Annex 1.

Cross-cutting issues
– Conflict, peacebuilding and the environment
– Population displacement, resettlement and the environment
– Disasters and climate change
Sectoral issues
– Agriculture and land degradation
– Forest resources
– Water resources
– Wildlife and protected area management
– Energy and the environment
– Urban environment and health issues
– Industry and mining
– Environmental governance

## 5.1 Conflict, peacebuilding and the environment: Capitalising on environmental opportunities

### Significant environmental impacts

- The direct military impacts of the 1990-1994 conflict were marginal and appear to have been largely remedied. The foremost legacy is that of **landmine and unexploded ordnance (UXO)**, which until 2006 contaminated 900,000 m<sup>2</sup> or 3.5 percent of Rwanda's surface area. Since then, there has been remarkable progress and Rwanda has been declared the first landmine-free country in the world. While the environmental impacts of landmines and UXO are minor, their main impact has been to further diminish, for an interval period of time, Rwanda's already limited land base. Mine clearance has played an important role in removing obstacles for accessing fertile lands and revitalising the agricultural sector, particularly the tea industry.
- The most significant environmental effects of the 1990-1994 conflict are **indirect and secondary impacts**, mainly occurring in the post-conflict emergency period from 1994 to 1998. These relate to the movement and resettlement of hundreds of thousands of returnees and displaced persons into national parks as well as extensive deforestation and wetland encroachment. Ensuing reduction in vegetation cover and cultivation on steep slopes and marginal lands have further amplified Rwanda's chronic soil erosion problem. Rapid and unplanned post-1994 urbanisation, particularly in Kigali, due largely to the influx of returnees, has aggravated sanitation and public health problems. Finally, the disruption of environmental monitoring systems and research programmes as well as the loss of qualified personnel and long-term data sets have had serious implications on environmental governance and decision making.

### The environment's role in national reconciliation and peacebuilding initiatives

- **Four key areas through which the environment can contribute to peacebuilding and reconciliation** have been identified: (i) ecosystem rehabilitation to improve livelihoods; (ii) land tenure reform to encourage resource conservation; (iii)



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*Rwanda has been declared the first landmine-free country in the world*

- investing in climate change adaptation and disaster risk reduction; and (iv) improving living conditions in refugee camps.
- While the government is highly motivated to fast track development, it is important that its ongoing efforts to create **safety nets for the poorest segment of society** include the promotion of environmentally sustainable livelihood options. This should prevent the poorest from crossing biophysical tipping points and help strengthen reconciliation efforts.
- Rwanda's **environmental recovery plans** can substantively reinforce ongoing national reconciliation efforts. Practical interventions are identified in the relevant sections of this assessment and, if incrementally applied, constitute important steps towards social cohesion and peace. Such measures include: (i) devolving authority over resources to communities through the current decentralisation process; (ii) creating environment-friendly off-farm sources of income generation for imidugudu residents; (iii) rehabilitation of montane forests; (iv) promoting conservation agriculture and agroforestry; and (v) strengthening adaptive environmental governance.
- **Regional environmental cooperation** can help provide the framework for tapping into the major resource endowments of the Great Lakes region. It would not only help improve standards of living and assist in meeting the demographic and climate challenges of the future, but also support regional integration processes and peacebuilding.



*Gihembe is Rwanda's largest refugee camp in Rwanda and hosts nationals from the eastern DR Congo. The Great Lakes region has witnessed massive refugee flows across borders in the past decades*

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## 5.2 Population displacement, resettlement and the environment: Extensive post-conflict impacts

### Multiple causes and impacts of displacement

- The **most significant environmental impacts of the 1990-1994 conflict** and genocide stem from massive population displacement and resettlement of returnees. The main damage sustained is the considerable reduction in the surface area of national parks, forests and other vegetation cover, including encroachment on wetlands.
- Since the mid-twentieth century, **conflict has been the main driver of large-scale population displacement** in Rwanda. The other two main causes are: (i) disasters mainly due to flooding, landslides and droughts; and (ii) loss of livelihoods stemming from the vicious cycle of population growth, poverty and environmental degradation.
- There are **three main types of conflict-related displaced persons** in Rwanda, each having a different level of environmental impact: (i) the two to three million people who fled Rwanda following the end of the conflict in 1994 and who mostly returned in 1996/1997 (referred to as new caseload); (ii) the 812,000 returnees who fled the country since 1959 and returned mainly in 1994/1995 (referred to as old caseload); and (iii) the approximately 54,750 foreign refugees from the Democratic Republic of the Congo (DR Congo) and Burundi.
- It is difficult to gauge the environmental consequences of the **two to three million people displaced** following the 1994 conflict, as they mostly fled outside of Rwanda's borders and many eventually regained their former homes in 1996/1997. Overall, it may be qualified as one of short duration, high local impact and a medium-to long-term recovery period.
- Although the **environmental footprint of the few remaining refugee camps is low**, it remains locally significant. The principal problem relates to deforestation around the camps from uncontrolled fuelwood collection.
- Given the severe land scarcity problem in Rwanda, **the most enduring impacts have been caused**

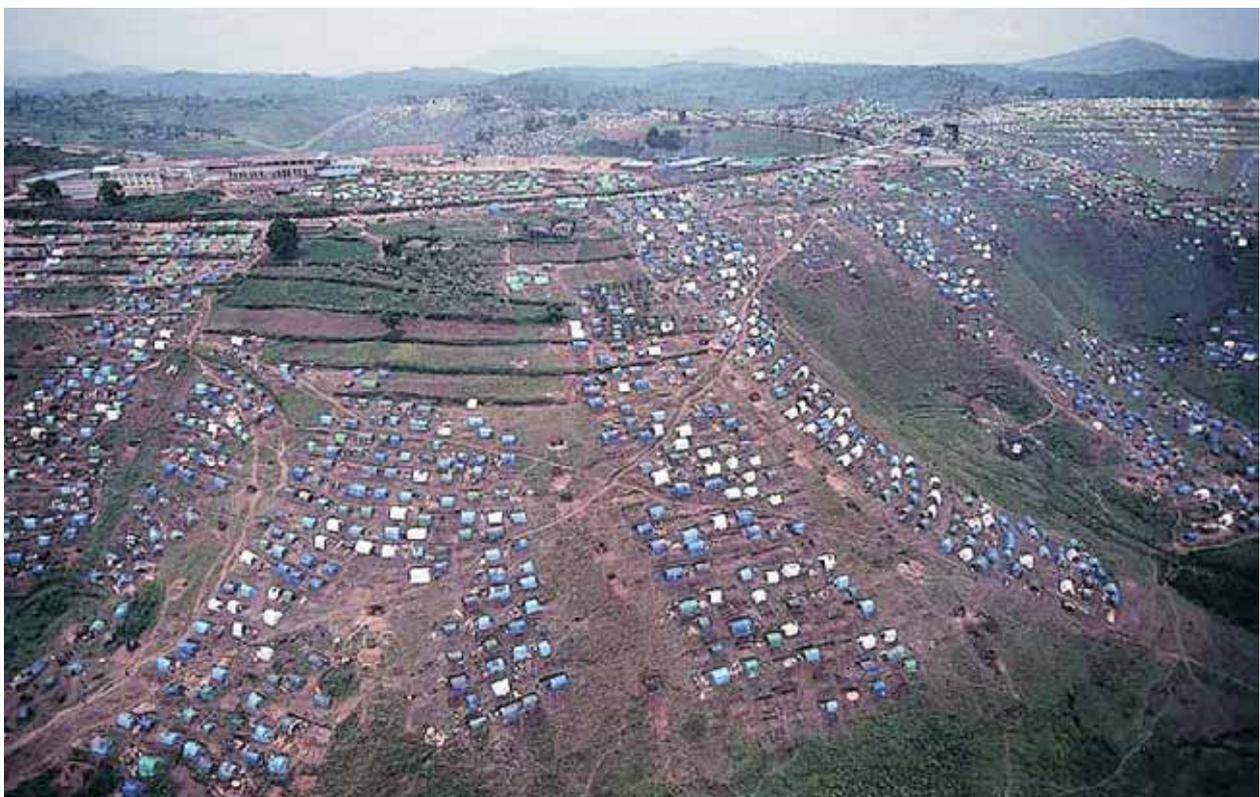
by the resettlement of primarily old caseload returnees in protected areas and forest reserves as well as on fragile lands and steep slopes. As a result, some critical ecosystems were impacted in the eastern savanna landscape and Afro-montane forests in the Congo-Nile highlands. Specifically, the whole of the Mutara Game Reserve and 63 percent of the Akagera National Park were degazetted for resettlement, while 93 percent and 43 percent of Gishwati and Mukura forests, respectively, were cleared mainly by returnees.

**A major resettlement programme with significant environmental impacts**

- To deal with the enormous task of accommodating the returnees, the government sought to regroup them in settlements known as *imidugudu*. The ***imidugudu* approach** was subsequently scaled up under the National Human Settlement Policy into a full villagisation programme with the intention of replacing the traditional scattered settlement pattern with planned settlements. By 2007, an estimated two million people, or 20 percent of the rural population, were living in 5,486 such new settlements. The objective is that 45 percent and 70 percent of the rural

population will reside in *imidugudu* by 2011 and 2020, respectively.

- In the initial emergency phase, environmental considerations including site selection were inadequately addressed in resettlement planning. The **main environmental problems** with *imidugudu* are deficient water and sanitation services, land degradation, fuelwood supply shortages and inadequate access to agricultural land. Nevertheless, regrouping of people in settlements has helped improve living conditions by facilitating the provision of services and infrastructure and offering the potential to emerge as growth poles for local development. Moreover, environmental standards for new resettlement design have recently been developed, although technical assistance and capacity development are needed to ensure effective implementation, particularly at the district level.
- To reduce environmental stress and given the land shortage problem, it is crucial that alternative **environment-friendly off-farm sources of income generation** are developed as an integral part of the *imidugudu* resettlement package.



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*Inappropriate campsite selection such as on steep slopes can significantly accentuate land degradation*

## Environmental migrants

- **Complex interlinkages between disasters, persistent environmental degradation and climate change** are a growing driver of population movements in Rwanda. Recurrent drought in the east and south of the country (e.g. Bugesera) has forced people to migrate from these regions. Landslides and flooding due in part to extensive deforestation has also led to displacement, as experienced in Gishwati in 2007. It is difficult to make an accurate assessment of the trends and patterns in environmentally induced population movements and to propose management measures, as this issue is poorly studied.

### 5.3 Disasters and climate change: An emerging threat to long-term development

#### High vulnerability to disasters and climate change

- Climate change and more frequent disaster events represent a **substantial threat** to the impressive achievements made by Rwanda during the recovery phase and may undermine its ongoing development drive towards Vision 2020 targets and the MDGs. Priority areas at risk are food security, water and energy supply, and critical infrastructure. The poor, particularly women, will be hardest hit given their dependence on climate-sensitive livelihoods. Awareness of the

potential impacts of climate change is low and needs to be bolstered, including at the highest levels of government.

- The underlying factors behind **Rwanda's significant vulnerability** to disasters and climate change include its having one of the highest population densities in the world, mountainous terrain, elevated poverty levels, dependence on rain-fed agriculture practised on erosion-prone steep hillsides and other forms of unsustainable land use pressures.
- The **principal disasters** affecting Rwanda are droughts, floods, landslides, earthquakes and volcanic activity. Of the recorded seven major floods since 1963, five occurred in the past decade (1998-2008). Floods and associated landslides are likely to increase, as one of the anticipated effects of climate change is more extreme rainfall events. The northwestern part of the Congo-Nile highlands, especially deforested Gishwati, is particularly vulnerable to landslides and floods. Savanna landscapes in the east and southeast are more prone to drought, which is likely to worsen since prolonged periods without rain is another expected outcome of climate change. Nevertheless, it is feasible to adapt to such drought events, especially as they are relatively less severe compared to similar prevailing situations in other sub-Saharan African countries.



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*Climate change projections indicate that most parts of the country will experience increased but irregular rainfall, raising the risk of flooding events*



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*Terracing hillsides helps reduce vulnerability to flash floods*

- Despite Rwanda's limited climatological records, they provide some evidence that **climate change is happening** with important implications on agricultural production. During the past 36 years (1971-2007), the average annual temperature has gradually increased by 0.9 °C. From 2000 to 2006, the total average annual rainfall dropped by 10 percent compared with the mean for 1961-1990. In addition, rainfall patterns have steadily changed with less weather predictability for farmers as a result. While there is contradictory information on whether a trend towards a shortening of the rainy season is occurring, observations recorded provide grounds for concern.

#### **Limited knowledge base and adaptive capacity**

- Rwanda's **meteorological services are operating at a bare minimum** and require substantial capacity-building and rehabilitation of the monitoring network devastated during the 1990-1994 genocide. This is essential to create the requisite knowledge base for developing robust climate change projections, early warning systems as well as adaptation measures.
- **No specific national-scale climate change assessment** has been undertaken for Rwanda. The most recent regional climate change projection is found in the Intergovernmental Panel on Climate Change's (IPCC) fourth assessment report (2007). It predicts that East Africa, including Rwanda, will experience a 3 °C rise in average temperature and a 7 percent increase in annual rainfall, with more intense high-rainfall events expected by the end of this century. The limitations of these coarse climate projections, however, should be recognised. Hence, there is an urgent need for improved Rwanda-specific climate analysis, particularly of crop yield projections given the importance of agriculture to the majority of the population.
- Rwanda's adaptive capacity to disasters and climate change is limited. It is critical to **expand and build on practical environmental measures** in order to raise environmental resilience and reduce vulnerabilities to disaster and climate change impacts. Positive ecosystem management interventions, which are gradually being implemented, include: (i) better integrated watershed management to mitigate flood risk; (ii) lake and riverbank protection, including the injunction prohibiting cultivation within 50 metres; and (iii) sustainable management of wetlands and lakes to enhance drought coping capacity. Furthermore, there is a need to develop climate change-proof construction guidelines for critical infrastructure and integrate disaster considerations in spatial planning.



*The main challenge for the agricultural sector is to ensure food security for a heavily populated country without degrading a highly vulnerable tropical mountain environment*

#### Nascent cross-sectoral coordination

- The recent transfer of the Disaster Management Unit (DMU) to the Ministry of Internal Security (MININTER – under the Rwanda police), which is well equipped to handle disaster interventions, promises to enhance response capacity in Rwanda. At the same time, similar efforts to strengthen **disaster risk reduction capacities** through prevention and preparedness should also be considered, particularly through more active engagement with national and sectoral agencies dealing with core development issues.
- Rwanda's recently completed **National Adaptation Programme of Action (NAPA 2006)** to climate change provides a solid basis for decision makers to prioritise action areas and enhance adaptive capacity. This will require improved cross-sectoral coordination on climate change and disasters to ensure the incorporation of adaptation measures in national, sectoral and local development plans.

#### 5.4 Agriculture and land degradation: Reinforcing the poorest farmers to ensure broad-based development

##### A key sector slowly emerging from post-conflict rehabilitation

- Agriculture is the **mainstay of Rwanda's economy** contributing around 32.6 percent of gross domestic product (GDP) and employs 80 percent of the working population. Growth in this sector in the post-conflict period has until recently been sluggish, resulting in low growth of per capita income levels. In 2008, however, the sector registered a major boost in the growth rate of 15 percent. Export crops (coffee, tea) are one of the main foreign exchange earners for the country.
- Farming is mainly of a low-input, low-yield subsistence type, almost entirely rain-fed and practised on very small landholdings. More than 60 percent of households cultivate less

than 0.7 ha. The principal constraint on agricultural growth is **severe land scarcity, land degradation and low productivity**, leading to overcultivation (up to 2-3 times per year) and depletion of soil fertility.

- The agricultural sector was **devastated by the 1990-1994 genocide** and has not yet recovered to pre-conflict levels. The main impacts were: (i) loss and displacement of skilled farmers and agricultural professionals; (ii) a high level of female- and child-headed households with minimum production means; (iii) loss and damage to long-term data sets as well as monitoring and research facilities; and (iv) agricultural expansion by the large numbers of exiled returnees into forest reserves, national parks, steep slopes, wetlands and other marginal areas with serious implications on land degradation.

#### Unsustainable land use

- **Land degradation**, including soil erosion and nutrient depletion, is Rwanda's major long-standing environmental problem. The country's fragile soils, steep topography, low natural vegetation cover and high rainfall signify that it naturally experiences very high erosion rates, which are considerably augmented by intensive farming and overgrazing. Frequent soil tillage with no organic or chemical input depletes soil fertility. Tillage on very steep slopes exposes soil to rapid wash erosion.
- GIS modelling results clearly illustrates the **extreme gravity of the soil erosion problem**, with 47 percent and 34 percent of the country experiencing soil erosion rates of between 50 and 100 tonnes per hectare per annum, respectively. The magnitude of the soil erosion problem is further illustrated by UNEP measurements of sedimentation rates in selected lake/reservoir sinks across the country, revealing high soil loss rates. For example, radioactive dating showed that in excess of 54 cm of sediment had been deposited in Lake Karago at the sample point in under one year. High sediment loads in the country's turbid rivers are another visible sign of the problem that was validated by UNEP sampling.
- Deforestation and farming on very steep slopes have resulted in **catastrophic erosion and**

**slope failure**, particularly in the northwest of the country. For example, in the former Gishwati forest reserve, UNEP observed slopes greater than 60° being regularly and deeply tilled with limited signs of soil conservation measures. As a result, huge sediment inputs carried by the Nyamukongoru River that drains this area have reduced by a quarter the surface area of downstream Lake Karago.

#### Inadequate erosion control

- Despite the government's strong commitment to address soil erosion as a national priority, **practical measures are insufficiently implemented on the ground**. The focus has been on capital-intensive erosion control projects, particularly radical terracing. A complementary approach focusing on the promotion of high-quality soil management (conservation agriculture) is also needed. A detailed field survey in 2005 found that 35.7 percent of farmers do not use any soil control measures. Multiple barriers to farmer adoption of soil conservation prevail. More suitable incentives – such as the government's ongoing land registration programme that should improve tenure security – are, therefore, needed to give farmers a direct stake and encourage better soil management.
- **In principle, cultivation on steep and fragile slopes greater than 40° should be restricted** to perennial crops (coffee, tea, jatropha) that provide permanent vegetation cover. Given the difficulties in implementing such measures, priority should be given to prohibiting tillage cultivation on slopes greater than 55°.
- Poor road construction, particularly of secondary unsurfaced roads, was also frequently observed to be important hotspots of soil erosion.

#### Overgrazing pressures

- Despite government efforts to reduce the size of cattle herds with a reported reduction of over 400,000 head from 2003-2006, **overgrazing remains a serious problem** throughout the country. The most heavily degraded areas are in the Eastern Province. Government needs to reinforce efforts to control herd size, promote zero-graze systems and improve the cattle breeding system.



*Cultivation on steep slopes should be restricted to perennial crops that maintain permanent vegetation cover*

#### **Integrating new approaches to improve farmer livelihoods**

- An **integrated conservation agriculture approach** is needed to address intense demands on land resources and raise yields, while minimising environmental damage. The focus here is on synergistic application of conservation techniques by smallholder farmers aiming to minimise soil disturbance, maintain permanent cover and practise crop rotations. Of specific importance is raising soil fertility through simultaneous use of animal manure and chemical fertilisers. Promising agroforestry trial results, a key component of conservation agriculture, show up to 90 percent reduction in soil losses. These need to be combined with biological nutrient cycling, including incorporation of legumes into the cropping system and improved fallows.
- One integrated farming system that has good potential, but is not widespread in Rwanda, is **agro-sylvopastoralism**, which aims to integrate on-farm tree cultivation and animal husbandry. The government's One Cow per Household Programme provides a good opportunity for promoting an integrated agro-sylvopastoral package. There are many valuable examples from neighbouring countries that could provide useful models.

#### **Low investment in research and data collection is hampering effective planning**

- The aforementioned post-conflict institutional memory failure is compounded by the lack of reliable baseline data necessary to assess the effectiveness of anti-erosion control strategies. Simple **erosion pins** provide a cheap and easy-to-use method for national-scale monitoring of soil erosion and could significantly increase the accuracy of GIS modelling results.
- The country **lacks applied research programmes** of the size and scope needed to meet the country's planning requirements and to provide locally specific information for extension work and early warning on emerging threats, including food security issues, climate change and disease outbreaks. Furthermore, there are critical technical capacity shortfalls that need to be strengthened.

#### **Environmental risks of agricultural intensification**

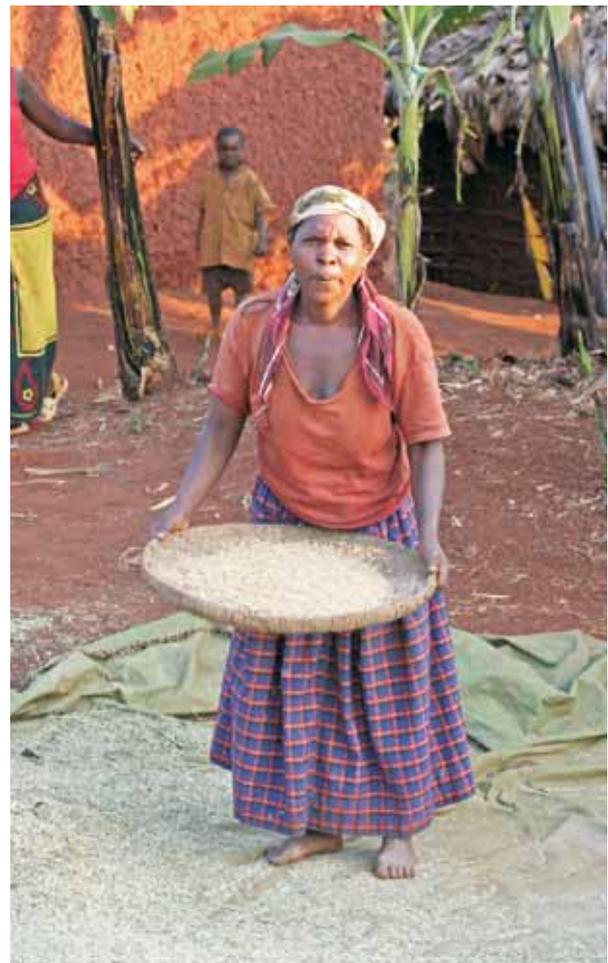
- The government considers agriculture to be a crucial driver of national economic growth and its policy aims to transform the sector from one that is primarily subsistence based to commercial production through **intensive cash crop farming**.

The objective is to increase the proportion of the country farmed under modern agricultural methods from 3 percent to 50 percent by 2020.

- Given the rapid pace of population growth and urbanisation, **it is critical that Rwanda increases agricultural productivity through intensification** to prevent food shortages and avoid falling into an inflationary trap of rising food prices. However, care should be taken that the transformation to intensification does not compromise environmental sustainability.
- A **considerable increase in fertiliser use** is expected following the World Bank's lifting of its moratorium on importation subsidies. There is a real danger of fertiliser overuse, however, potentially polluting streams and groundwater, which requires rigorous environmental assessment and monitoring. Extension services will also need to provide crop-specific guidance and training to farmers, emphasising fertiliser use as part of an integrated conservation agriculture approach.
- Consolidation of cropping into regionally specific types is a key component of the agricultural intensification process. The greatest risk of this plan is that the resulting loss of on-farm crop diversity **reduces the resilience of subsistence agriculture**, thereby increasing food insecurity in the face of climate variability and extreme events.
- Although the focus of agricultural intensification is on cash crops, it is important to recognise that **food staples** (bananas, potatoes and sweet potatoes) are the largest subsector and have the greatest poverty reduction potential. Supporting subsistence agriculture and promoting marketing opportunities for food crops is, therefore, critical for food security and broad-based development. Staple crops also have the potential to develop into non-traditional export crops, especially within the region, as witnessed in neighbouring countries.
- **Wetlands** are a major target for agricultural expansion, particularly rice cultivation. Although a master plan for marshlands has been developed identifying those that can be converted to agriculture with relatively limited environmental consequences, uncontrolled wetland reclamation continues to occur.

### High vulnerability of the poorest farmers

- The poorest and most vulnerable farmers, including **female- and child-headed households and the 17 percent of the population cultivating less than 0.25 ha of land**, have a limited capacity to transition from subsistence to commercial agriculture and reap the full benefits of agricultural intensification. At the same time, it is these poorest farmers who live on the most environmentally sensitive parts of the landscape – the over 18 percent of the cultivated land with a slope greater than 45° and with the most fragile soils – where environmental remediation measures are most necessary. Targeted pro-poor interventions, therefore, need to be reinforced to build their resilience, increase their income stream and prevent the cycle of environmental degradation and poverty from undermining long-term development.



*Female headed households have a limited capacity to transition from subsistence to commercial agriculture*

## 5.5 Forest resources: A critical asset for pro-poor development

### Major forest loss and rehabilitation opportunities

- Historically, about 70 percent of Rwanda has been covered with natural closed forest. A **drastic 60 percent reduction in the natural forest area** has occurred since independence, mainly driven by the needs of a growing population for agricultural land, timber and firewood. Today, natural forests, which are located almost entirely in protected areas, account for only 5.3 percent of the land area. Deforestation has been exacerbated during the post-conflict period, with a 25 percent reduction in montane rainforests and gallery forests and with the loss of two-thirds of the protected savanna landscape between 1990 and 2002. This underlines the importance of fully conserving all existing natural forests.
- There has been a **considerable increase in the area under tree plantations** (mainly eucalyptus and pines) from 1 percent of the land area in 1960 to 12.4 percent in 2002 – or 17 percent

in 2005 according to the Food and Agriculture Organization (FAO). As a result, around 20 percent of Rwanda is today covered by forests, which the government plans to increase to 30 percent by 2020. However, these tree plantations offer a more limited range of ecosystem services and biodiversity value compared to natural forests. Moreover, only 0.1 ha of forest area per capita remain today, illustrating the high human pressure on forest resources (compared with 0.7 ha per capita average for Africa).

- Despite significant ongoing efforts, **rehabilitation of degraded montane forest ecosystems** in the Congo-Nile highland area needs to be reinforced and multiplied. Forest watershed management services will become more important in the future given the increasing incidence of disasters that are likely to be accentuated by climate change.

### Good agroforestry potential

- **Trees and shrubs outside of protected areas and plantations**, which are not reflected in the above statistics, are an important source



*Harvesting of mature plantations can significantly contribute to the national economy*



*There has been a considerable increase in the area under tree plantations*

of forest products for the majority of the rural population. Although the role of agroforestry in firewood supply has not been quantified, it is considered to be substantial. This fact is not sufficiently appreciated by policymakers and decision makers, with significant implications on planning activities aiming to address the forestry and energy needs of a growing population.

- **Agroforestry** has considerable potential to respond to the needs of poor rural communities, not only for timber and firewood but also for a diverse range of products (medicinal plants, fruits, honey, etc.). Although coverage of agroforestry systems is expected to increase to 85 percent of the cultivated area by 2020, progress to date has been slow and should be reinforced in the upcoming revision of the National Forestry Plan.

#### **A major data constraint**

- Outdated data, information gaps as well as discrepancies between various forest inventories represent a planning handicap. It is, therefore, essential to harmonise forest inventories and obtain **a single accurate baseline for planning purposes**. Moreover, there are no reliable data on the use of wood and non-wood forest products at the household level, total wood volume in forest plantations, tree and shrub cover outside of natural forests and large plantations as well as the regional forestry trade. Mobilisation of resources to fill these data gaps is critical for sustainable forest management.

#### **An undervalued economic potential**

- The importance of the forestry sector to **national development and poverty reduction** is underestimated. Although forestry's contribution to GDP was officially reported at 0.6 percent in 1997, this low figure ignores the wide range of forestry products that are not traded on the market. For example, the value of firewood and charcoal alone was estimated to represent 5 percent of GDP in 2007.
- A **significant economic potential** exists from the harvesting of at least 20,000 ha of mature pine plantations estimated to be worth USD 36 million. This major asset, however, is at risk of being damaged from natural hazards such as windstorms, fires and disease outbreak. Harvest operations need careful management to avoid glutting the market and represent an ideal opportunity to involve local communities in forest management. Participatory forest management is a new approach in Rwanda that is particularly relevant within the current context of decentralising natural resource governance.

### Transboundary forestry cooperation

- There is a major opportunity for transboundary cooperation between Rwanda and neighbouring countries to develop large-scale regulated and **sustainable trade in forest products**, particularly for charcoal and high-value timber. The Congo Basin Forest Partnership (CBFP) can provide the forum for this dialogue.

## 5.6 Water resources: Strengthening governance at national and local levels

### Abundant supplies, limited access

- As a headwater country, Rwanda **enjoys both ample and good quality freshwater resources**. While water use is projected to expand more than five-fold by 2020, it would still account for less than 5 percent of national renewable water resources. Although UNEP's snapshot field analysis needs to be supplemented by long-term water resources monitoring, it confirmed that the quality of Rwanda's waters are overall within pristine range conditions.

- Despite abundant water resources, wide fluctuations in rainfall over space and time mean that the main challenge is matching water demand to accessible supply. Significant regional variations exist with the east and southeast savanna landscapes being particularly vulnerable to droughts and water shortages. **Per capita water availability (610 m<sup>3</sup>/year in 2005) is below the limit of water scarcity (1,000 m<sup>3</sup>/year) and could decline further** due to increasing water demands and the potential impacts of climate change. It is noteworthy to emphasise, however, that growing water scarcity is not absolute. An appropriate combination of governance, technological, ecosystem restoration and market-based responses would effectively tackle this issue.

### Drinking water and sanitation issues

- **An estimated 71 percent of the Rwandan population has access to a safe drinking water supply, while only 10 percent of household sanitation facilities is within required norms.** The gap in access to safe drinking water between rural (68%) and urban areas (76%)



*The main challenge facing Rwanda's water sector is a shortage of investment in human capacity building and infrastructure*

has significantly reduced. The government's bold goal of providing full access to potable water and improved sanitation by 2020 is commendable, but poses a major challenge. While water supply and improved sanitation coverage has been expanding, investments need to be significantly increased, particularly to meet per capita water consumption requirements and for sanitation, to attain set targets within such short-time scales. **Rainwater harvesting** represents an underutilised opportunity to increase supply accessibility at household and community levels.

- **Waterborne diseases due to bacteriological contamination are one of the leading causes of human death and illness** in Rwanda, particularly amongst children under the age of five. In view of the general absence of domestic wastewater treatment, it is not surprising that 90 percent of random samples collected by UNEP were biologically contaminated, of which at least 47 percent were pathogenic. Infrastructure investments in common sewage treatment plants as well as improved modern latrines are needed, particularly in Kigali. More importantly, however, low-cost measures to protect springs and wells on which the majority of Rwandans are dependent for their water supply would significantly improve human health and economic productivity.

#### **Land-cover changes and severe suspended sediment pollution**

- Extensive land-cover and land use changes exacerbated by population displacement in the post-conflict period, particularly deforestation in the Congo-Nile highlands and cultivation on steep slopes, have profoundly impacted the water regime, water quality and ecosystem integrity. The most important consequence has been the **elevated levels of suspended sediment**, visible in Rwanda's highly turbid and muddy streams and rivers. The problem of high sediment loads, validated by UNEP laboratory measurements, is intimately tied to excessive soil erosion from human activity.
- **High levels of suspended sediments degrade water quality** by acting as carriers of pathogens and other pollutants, increase the cost of drinking water treatment and adversely impact aquatic life. They have also led to considerable economic losses due to siltation of rivers, lakes and reservoirs that generate almost half of Rwanda's electricity. Managing this diffuse pollution source requires an integrated catchment approach, including rehabilitation of Congo-Nile highland forest and wetland ecosystems that are source areas for Rwanda's renewable freshwater supply.

#### **Emerging threats from agricultural intensification and hydropower projects**

- Agriculture accounts for 93 percent of total water consumption and demand in the sector is **estimated to increase by over seven-fold** due to expansion of irrigation schemes. Agriculture is, therefore, a logical target for water savings and demand management, including improving yields of subsistence rain-fed agriculture, use of more efficient irrigation techniques and cultivation of less water-demanding and drought resistant crops.
- Almost 60 percent of Rwanda's wetlands have been converted to farming. **A substantial part of the remaining wetlands are targeted for reclamation under the drive for agricultural intensification.** This development if not carefully managed will considerably compromise critical wetland ecosystem services, including water replenishment and purification, flood and drought mitigation as well as their role in food production and as wildlife habitat. It is, therefore, essential that all wetland reclamation schemes be subject to prior EIAs. In addition, the government should explore the feasibility of developing market mechanisms, such as Payment for Ecosystem Services (PES) to promote wetland conservation and restoration.
- **Fertiliser use** is expected to increase, with potentially serious impacts on both surface and groundwater quality as a result of nutrient loadings (mainly nitrogen) in agricultural runoff. UNEP random sampling showed relatively elevated levels of nitrates signalling some grounds for concern. Environmental assessment and monitoring of fertiliser use are needed to alert decision makers about potential problems, while farmers should be trained on fertiliser application methods to ensure adherence to technical guidelines.



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*Water demand in the agricultural sector is projected to increase by over seven fold by 2020*

- In addition to several large dam projects such as Rusumo Falls and Kakono undertaken in consortium with neighbouring countries, Rwanda presently has 20 small and micro-hydropower plants in the pipeline and around 300 potential sites are under study. Even though environmental impacts from small hydropower plants are generally individually low, they may be cumulatively significant. While development of the hydropower subsector is essential to meet Rwanda's growing energy needs, it is important that **the projected increase in hydropower projects** does not compromise the sustainability of inland water systems through fragmentation, habitat destruction and loss of biodiversity.

#### **New reforms in water governance**

- Rwanda has embarked on important water policy reforms incorporating a **progressive ecosystem-based approach known as Integrated Water Resources Management (IWRM)**. Widening the scope of the water agenda should help coordinate and balance the diverse demands of drinking water, agriculture, energy and environment stakeholders. However, institutional arrangements, legislative instruments and the technical capacity to support cross-sectoral consultations within an IWRM framework are nascent and need to be supported. Pilot projects at the catchment

level should be undertaken to help develop a Rwanda-specific IWRM approach; the Rugezi wetlands provide a useful case.

- **Decentralisation offers a valuable opportunity to apply IWRM** at the catchment level and promote decision making and ownership by local communities, particularly women, in water resources management and conservation. Developing human resource capacity at the local level to coordinate and manage the interests of all water stakeholders, maintaining infrastructure and collecting data for decision making are critical for the benefits of IWRM to materialise on the ground.
- Sustainable water resources management continues to be **impeded by the destruction of the hydrological monitoring network and loss of long-term data sets** during the 1990-1994 conflict. Although the installation of a new water surface station network is under way, the state of Rwanda's water resources remains inadequately monitored. A comprehensive water monitoring programme needs to be developed covering surface and groundwater, standard water quality surveillance and freshwater biological indicators.
- Similar to other countries implementing IWRM in the region, **Rwanda should endeavour to mobilise international partner support for its water sector, which is presently minimal**. Development partners could support capacity-building activities, establishment of a monitoring programme and pilot projects, while operational costs are borne by the government to promote sustainability.

#### **Promising regional cooperation**

- **Rwanda is positively engaged in regional dialogue and cooperation** on transboundary waters, particularly through Nile Basin Initiative (NBI) and NELSAP, which includes economic investments such as joint hydropower projects. There is a need to activate similar cooperation on the Congo Basin for which a framework agreement was set up in 1999. National water policies and laws can be strengthened through harmonisation with those of the East African Community (EAC) and the application of IWRM principles on shared basins.

## 5.7 Wildlife and protected area management: Positive trends requiring reinforcement

### Encouraging steps to protect a depleted resource

- Rwanda boasts a remarkable variety of wildlife including flagship species such as the iconic mountain gorilla, whose conservation despite the conflict has been a major success story. The country, however, has witnessed a **major decline in wildlife populations** in recent decades (e.g. ranging from 50 to over 90 percent in Akagera National Park) due mainly to habitat loss as well as cross-border poaching and wildlife trade. Rwanda harbours at least 17 species that are globally threatened with extinction. In addition, wetland reclamation represents a significant threat to the country's impressive list of 670 bird species.
- The formally designated national park area **has more than doubled** in the post-conflict period from 3.9 percent of the country in 1990 to 8.4 percent in 2008. This expansion is mainly due to the upgrading of Nyungwe's status from a forest reserve to a national park in 2005. However, this increase masks the fact that the Akagera National Park experienced a substantial 55 percent downsizing, while the Mutara Game Reserve was entirely degazetted, mainly to accommodate returnees in the post-conflict period. Conversely, while the national park area has increased, the national territory under protection has actually declined. High population density and growth rates resulting in acute land scarcity have rendered the national parks to resemble 'fortresses under siege'.

### A growing source of national income

- Government policies have recognised the significant contribution of **wildlife tourism** to national economic development and poverty reduction. In this regard, the government has taken positive steps to promote ecologically friendly tourism and private sector investment, and re-channel tourism revenues to local communities and protected area management. Robust economic valuation of the full range of ecosystem goods and services provided by protected areas is needed to better guide policy planning.

- **Community participation** in wildlife conservation and protected area management is a novel approach in Rwanda that needs to be promoted and strengthened. Priority issues include: (i) development of viable income generation options for communities living around protected areas; and (ii) community-based management of the buffer zone pine plantations around national parks. To this end, Rwanda has an opportunity to draw on the substantial experience of neighbouring countries.

### Strengthening wildlife and protected area governance

- The ongoing development of a **protected area policy and wildlife framework law** should address the following key issues: (i) institutional arrangements for wildlife and protected area management, including the recent placement of the Rwanda Office of Tourism and National Parks (ORTPN) under a development agency – the Rwanda Development Board (RDB); (ii) the existing institutional gap in the management of wildlife outside of protected areas, particularly in wetlands and lakes; and (iii) fair compensation to local communities for losses caused by wildlife.

### Emerging threats

- An emerging concern in Nyungwe National Park is the widespread opening of the forest canopy (due mainly to deforestation but worsened by fires in 1997 and 2005), which has encouraged the spread of an **invasive indigenous liana** (*Sericostachys scandens*) and inhibited tree regeneration. Some experts advocate examining the reintroduction of liana feeding elephants and buffaloes as a potential option to reduce the spread of this highly invasive plant.
- **Forest fires** are a constant threat to protected areas. Their incidence and severity are likely to be exacerbated due to anticipated droughts induced by climate change, particularly in the Afro-montane zone. An early warning system for forest fires needs to be developed and fire preparedness and response capacity strengthened, including promoting involvement of local communities in protected area buffer zones.



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*Protected areas under siege: the Volcanoes National Park lies in striking contrast with the surrounding densely populated farmland*



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*The emergence of mountain gorilla tourism into a key contributor to Rwanda's national economy in the aftermath of the 1994 conflict has been a major conservation success story*

### Regional wildlife cooperation

- **Transboundary cooperation** is critical for the successful management of Rwanda's national parks as they are all adjoined to protected areas in neighbouring countries. There is already an established history of cooperation with the DR Congo and Uganda on the Virunga parks, which needs technical assistance to support implementation of existing instruments and promote joint investment in infrastructure projects. Similar efforts need to be reinforced between Nyungwe National Park and Kibira National Park in Burundi. Establishment of a wildlife corridor between Akagera National Park and Burigi Game Reserve in the United Republic of Tanzania should also be explored.
- **Illegal trade in wildlife species and products**, including ivory, is an issue warranting forceful control by the relevant Rwandan authorities as prescribed by the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). The recent establishment of an environmental crime unit under the police

department could help address this problem. Regional cooperation is equally necessary to ensure that a regulated wildlife trade regime sustainably contributes to economic development.

## 5.8 Energy and the environment: A complex predicament

### A fuelwood energy crisis

- Rwanda faces a **triple energy crisis** comprising: (i) domestic cooking energy; (ii) major electricity deficit; and (iii) rising fuel costs. While these challenges are difficult, they are not insurmountable given Rwanda's assets and the high potential for drawing on regional energy resources.
- Rwanda is **heavily dependent on biomass energy**, mainly wood and charcoal, which accounts for 86 percent of its total primary energy supply. At the household level, 96 percent are dependent on wood and charcoal, essentially for cooking. Although significant, fuelwood demand is not the main driver of deforestation; rather, the leading causes are agricultural clearance and human settlement.

- **A 50 percent reduction in household biomass use is targeted for 2020.** As the feasibility of switching to alternate fuels is low due to cost and access issues, the focus should be on the following three key areas: (i) sustainable wood supply measures by augmenting tree plantation yields that reportedly can be increased by two to four times; (ii) accelerating the agroforestry and biogas programmes; and (iii) improving efficiency of existing cooking stove programmes at marginal cost.
- To moderate fuelwood demand, Rwanda has embarked on an **improved stove programme**. Considering that the efficiency of the improved stove is only 25 percent more than the traditional three-stone stoves, there is scope for further efficiency improvement including partnering with international companies to promote highly efficient third generation models. Moreover, initial government inspections found improved stove adoption to be significantly lower than reported. It is critical that the Ministry of Infrastructure's (MININFRA) planned evaluation of the improved stove programme is carried out to provide targeted recommendations on corrective actions.
- Exposure to **indoor house pollution** is a major health hazard facing most Rwandan households, primarily due to their dependence on biomass for cooking and kerosene for lighting. As access to cleaner fuels – e.g. electricity, liquefied petroleum gas (LPG) – is beyond the reach of the majority of the population, the focus should be on: (i) promoting use of smoke hoods or chimneys under the improved stove programme; (ii) expanding the biogas programme by reducing the comparatively high installation costs; and (iii) promoting the shift to charcoal, which although not entirely clean is nevertheless less polluting than fuelwood.

#### Major electricity deficit

- Despite substantial improvement since 2000, **only 5 percent of the population has access to electricity**, of which over 99 percent are urban residents. No substantial investment has been made in the electricity sector since the early 1980s, and the limited existing hydropower facilities were adversely affected by the conflict.



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*Exploring solutions to its energy crisis, Rwanda launched a pilot plant to exploit methane gas in Lake Kivu in 2009. The lake's enormous gas reserves have the potential of satisfying Rwanda's electricity needs and also supplying the wider region over the longer term*



*Indoor house pollution from traditional biomass fuel for cooking poses particular health risks to women and children*

- Rwanda has challenging targets of **increasing electricity access to 16 per cent by 2012 and 35 percent by 2020**. This represents a seven-fold increase from the current coverage rate of 5%. The principal beneficiaries of this coverage expansion will be urban residents; the majority of the rural population would likely remain without electricity access. A bolder plan is, therefore, needed to provide electricity to the majority of the population.
- Decentralised **renewable energy sources** offer a good opportunity to provide the majority of the Rwandan population with lighting electricity, particularly for households distant from the main grid. Presently, development of renewable energy is entirely dependent on donor support. Considering its importance, the government must be more proactive in this field and focus on: (i) solar energy; and (ii) agrofuels to power local grids in rural areas. Although Rwanda has embarked on promising renewable initiatives such as building Africa's largest solar plant, the present tax on solar equipment is an obstacle to growth that should be reviewed.
- Pilot development of the **vast deposit of methane gas** under Lake Kivu is presently under way. It is estimated that this resource may eventually generate up to 700 MW of electricity, of which Rwanda has a roughly 50 percent share with the DR Congo. While methane is a promising energy source that may also be converted to clean liquid fuel for domestic purposes, requisite EIAs and safeguards are needed.
- The government responded proactively to the hydropower generation crisis of 2004 by prohibiting cultivation on lakeshores and reservoirs and protecting critical wetlands. **Watershed management activities** to control siltation and secure hydropower generation should be continued and expanded.

#### **Soaring fuel bill**

- Petroleum products accounted for **40 percent of the import bill in 2002**, which is likely to have increased with rising fuel prices. To cut costs, the use of heavy fuels and diesel in electricity generation needs to be systematically reduced. Adoption of energy efficient technologies, such as a World Bank-supported project to promote more efficient compact fluorescent lamps (CFLs), should be pursued.

- Appropriate policy and financing measures should be taken to **ensure efficient growth in the transportation sector**, which consumes 70 percent of petroleum products. This includes barring importation of inefficient second-hand vehicles, promoting public transport, accelerating plans to establish rail links and oil pipelines to Indian Ocean ports, and exploring cleaner alternatives such as compressed natural gas (CNG) from Lake Kivu methane. Such measures would also help address the growing air pollution problem in Kigali.

#### Energy governance

- A specialised **sustainable energy department** under MININFRA needs to be established to deal with: (i) renewable energy; (ii) energy efficiency and management; and (iii) rural electrification. The establishment of an Energy and Water Board (EWB) in 2009 is a positive step that should help promote these objectives but which will require support to make it operational.
- Despite the favourable energy governance framework in place, special effort should be made to **promote foreign private investment** as exemplified in the development of Lake Kivu methane gas. This should help address the existing 60 percent financing gap in infrastructure investment and mobilise efficient and environmentally friendly technologies for power production. Energy price reform, including tariffs on LPG and solar, would help attract investment in the energy sector.
- Proposals to exploit **peat and papyrus** need to be cautiously examined considering the potential impacts on critical wetland services. Moreover, the economic viability and energy contribution from these sources is of minor consequence to the overall energy balance.

#### Sourcing cheaper electricity through regional cooperation

- In the long term, the key to securing Rwanda's electricity requirements will be through joint development of the Great Lakes **considerable regional energy potential**. Positive steps in this direction have been made under NELSAP.

These efforts, including joint hydropower projects and a system for expanding electricity grid interconnections in the EAC, should be intensified while applying the necessary environmental precautions.

## 5.9 Urban environment: Mounting public health problems

### Massive unplanned growth in the post-conflict period

- Rwanda has experienced significant environmental stress from rapid post-conflict urbanisation, which at 12 percent per annum is **the highest in Africa**. In terms of scale, urban environmental problems are most acute in Kigali. While other urban centres registered even higher growth rates (up to 20 percent), the smaller concentrations of population do not cause the same magnitude of environmental impacts as seen in the capital.
- The overwhelming majority of urban residents live in **informal and unplanned settlements**. In Kigali, 83 percent of the population lives in informal settlements. In spite of rapid urbanisation, land development schemes are expected to provide only 10 percent of urban housing demand. As a result, slums have been growing, with almost nine out of ten urban residents living in unplanned settlements.

### Critical environmental health risks

- Within this context of unplanned urban development, the most pressing environmental problems with significant implications on public health are:
  - i) **Inadequate and unsafe drinking water:** Half of the urban poor collect drinking water from unprotected sources and a significant portion receive only 50-80 percent of their water requirements. In terms of water quality, the main problem is biological contamination detected in 90 percent of random samples tested by UNEP, of which at least 47 percent were pathogenic. In Rwanda, where 80 percent of diseases are waterborne, access to safe drinking water is critical to protecting environmental health.

- ii) In addition to bacterial contamination, evidence of increasing concentration of heavy metals was found in some drinking water collection points tested by UNEP. While all concentrations were below World Health Organization (WHO) drinking water quality standards, there is sufficient cause to believe groundwater sources are at risk from current land uses and activities in the Kigali urban area.
- iii) **Poor sanitation conditions:** Slightly more than half (56%) of the urban population has access to improved sanitation. Only 15 percent of households are serviced with wastewater treatment facilities, with the rest dependent on pit latrines. This significantly raises the risk of bacteriological and nutrient contamination of groundwater. Moreover, waste from septic tanks is typically dumped openly in the environment.
- iv) **Solid waste disposal hazards:** Although improvement in SWM at the collection level has been impressive, there still remains a major problem with open waste disposal as all urban centres in the country lack engineered

sanitary landfill facilities. The most pressing problem observed by UNEP is in Kigali, where solid waste leachate is impacting on groundwater that is the only drinking water source for downstream communities.

- v) **Construction in inappropriate and hazardous areas:** Urban sprawl, particularly on slopes greater than 10°, has significantly increased vulnerability to disasters (landslides, floods, erosion).

### Inadequate investment in urban planning and environmental health infrastructure

- With government plans to increase urban population from 18.7 percent to 30 percent by 2020, the need for **investment in urban planning and water and sanitation infrastructure** cannot be overemphasised. Although an important positive step has been made with the development of the Kigali City master plan, there is a commensurate need to develop capacity and mobilise resources to implement it. A national urban strategy is needed to help address environmental issues in other urban centres, particularly in the context of ongoing decentralisation.



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*Rwanda's rapid post-conflict urbanisation is one of the highest in Africa. As most of this growth has been unplanned, it has created a range of environmental problems*



*Predicted growth in the industrial and mining sectors requires better regulation to address potential environmental impacts*

## 5.10 Industry and mining: A growing sector in need of environmental regulation

### A small but emerging economic base

- Given limited industrial and mining development in Rwanda to date, environmental damage as a whole is minor and localised. However, as Vision 2020 aims to **increase the industrial sector's contribution to GDP from 8 percent to 26.5 percent**, urgent measures are required to mitigate potential impacts, including preparedness for potential industrial accidents. Already, between 1999 and 2004, 45 percent of Rwanda's increase in export growth originated from mining activities, and export revenue from high value minerals is expected to grow by 250 percent by 2012.

### Key pollution hotspots

- The foremost industrial hot spot is **Gikondo wetland valley** in Kigali. The main problem is that there are inadequate facilities to treat industrial wastewater, which is discharged directly into the environment. Based on UNEP's

snapshot analysis, some evidence indicates that environmental pollution is occurring. However, to assess the magnitude of the problem requires more detailed monitoring focusing on several heavy metals, hydrocarbons and some industrial chemicals. UNEP observed that the efforts in promoting cleaner production made by the Ministry of Trade and Industry (MINICOM), supported by REMA, are a positive step for some manufacturing facilities.

- The **wastewater load from coffee washing stations**, which the government intends to double to more than 250, may have potential negative impacts on streams and wetlands throughout the country. Development and enforcement of pollution standards for coffee wastewater effluent, therefore, will be necessary to prevent or minimise potential damage to the environment.
- On the whole, the **environmental impacts of mining activities are localised but can be severe**. Child labour and women working under conditions of substandard occupational safety is an issue of concern.

### Major gaps in industry and mining governance

- With respect to governance, the focus should be on **developing specific environmental regulations and standards and strengthening enforcement and compliance capacities** in both the industry and mining sectors.
- The government's strategy to develop dedicated **industrial parks**, which include relocating outside of Gikondo, is the right way to proceed. However, this process is expensive and progress has been slow. Meanwhile, industries have little motivation to invest in waste treatment and curtail poor disposal practices. To promote resource and cost efficiency, it is important that new industrial zones be planned to treat their wastewater, solid waste and energy requirements in a collective rather than individual basis.
- At this time, there has been **no environmental regulation of the mining sector**, including both artisanal and large-scale operations. Promulgating the new mining law, which enshrines EIA, is an encouraging step. At the same time, environmental management plans (EMPs) should be applied to all existing Large Scale Mining (LSM) mining operations.
- While recognising that **artisanal and community mining** is a complex issue within the context of prevailing poverty and limited livelihood options, there is a need to develop creative policies to address it. This includes establishing clear regulatory and policy processes that encourage livelihood options within the framework of national ownership of the mineral resource. Assisting community mining cooperatives to develop environmental management practices needs to be greatly improved.

### 5.11 Environmental governance: Vision, coherence and strengthening capacities

#### Initial post-conflict vacuum followed by creation of an effective governance framework

- Environmental governance in twentieth century Rwanda was generally characterised by “resource mining” rather than “resource management”. Severe state failure following the 1990-1994 genocide resulted in the **collapse of natural resource administration**, and substantial

environmental degradation ensued, including major losses to protected areas, forests and wetlands and rapid slum growth. Moreover, environmental concerns were largely overlooked during the post-conflict emergency phase (1994-1998).

- Alarmed by the growing environmental crisis, the government **established a new legal and institutional framework for environmental management** during the recovery period (1998-2005). Landmark instruments include the National Environment Policy (2003) and Organic Law (2005) on environment, which led to creating REMA in 2006 under the auspices of MINIRENA. Integration of environmental considerations in the Economic Development and Poverty Reduction Strategy (EDPRS) (2008-2012) is also an important milestone.

#### Pursuing an integrated environmental vision

- There is strong and high-level government support for environmentally sustainable development in Rwanda, which has been significantly reinforced with the creation of REMA. Environmental interventions, however, are **heavily dependent on projects supported from multiple funding sources**.
- The adoption of a five-year ENRSSP in 2009 provides a solid basis to work towards a common vision. The critical next step is **establishment of a SWG** to implement the strategy through action plans, based on prioritised projects including those proposed under this report's recommendations.
- While considerable work is underway to streamline environmental policies and legislation, there is a need to **raise awareness on institutional mandates and responsibilities**, particularly with regard to wildlife management issues outside of protected areas.

#### Decentralisation of natural resource governance

- Decentralisation provides, for the first time, the possibility to recruit environment officers and establish environment committees at the sub-national level. While this should **significantly improve environmental planning and coordination at the local level**, sufficient investment in building capacities is needed to make them operational and effective.

- As participatory environmental management is a new approach in Rwanda, decentralisation reform offers positive leverage to widen governance beyond local authorities and **engage communities in decision making**, including what and how resources should be used. For this to be meaningful, development of community skills and capacities to competently manage ecosystems is required.
- **Environmental civil society is nascent** with limited capacity to mobilise funds and design effective interventions. Nevertheless, NGOs have a proven track record in many other African countries as efficient implementation partners and as critical intermediaries between local communities and state institutions. However, substantial support, including seed funding, is required to build their technical and organisational skills. It is also important that government proactively engages the private sector in delivering environmental solutions through public-private partnerships to promote financial sustainability, appropriate technology transfer, innovation and best practice.

#### Capacity development and national investment needs

- In early 2009, the **Environmental Impact Assessment function of REMA was transferred to the Rwanda Development Board (RDB)**. While this is a novel approach that could help integrate environmental considerations into decision making, given the RDB's mandate to 'fast track development' and promote foreign investment, it will be important to strengthen this new institutional arrangement to ensure its technical rigour and effectiveness.
- In the post-conflict period, financing of environmental management has **almost entirely relied on donor resources**. While donor support is critical, it is often guided by the international environmental agenda and not necessarily by national priority issues. It is, therefore, important that predictable and sustainable sources of financing are secured, including through the establishment of the National Environment Fund, which is sanctioned by law but is not yet operational.

#### Environmental sensitisation and access to information

- While environmental awareness is progressing, it tends to be event based and associated with specific projects. There is a need to **widen the scope of environmental education and awareness** into a comprehensive national programme that also draws on the special role of the media.
- **Management of environmental information**, both horizontally at the sector level and vertically across administrative units, is a major challenge to sound environmental decision making in Rwanda. A promising start was made to develop a knowledge coordination mechanism known as the Spatial Data Infrastructure in 2006, but this needs to be reactivated. Rapid developments in Rwanda's information and communication technology infrastructure can help improve access to environmental information.

#### Environmental cooperation

- Rwanda is actively participating in many international environmental conventions as well as regional initiatives, which appear to be proceeding well. There are **multiple opportunities to undertake transboundary projects as well as technical cooperation** with neighbouring countries particularly on wildlife and protected areas, forestry, energy and climate change. This should not only significantly contribute to Rwanda's development, but also promote greater integration and stability in the Great Lakes and East Africa regions.

## 6. Going forward

At the national level, the most important step now is to implement the recently adopted Environment and Natural Resources Sector Strategic Plan under the leadership of MINIRENA. Transforming the plan's strategic priorities into an actionable road map should also draw on this assessment's findings and prioritise its 89 recommendations in an open and participatory process through the environment Sector Working Group. The full participation



*Typical agroforestry system in the Congo-Nile highlands*

of line ministries and agencies, civil society organisations as well as UN and development partners to marshal national buy-in and implement the prioritised recommendations cannot be overemphasised.

Notwithstanding the importance of raising domestic investment and the environment sector's share of the national budget for sustainability purposes, Rwanda's limited ability to raise additional revenue means that the funding gap will need to be largely met by development partners in the short to medium term. UNEP and the UN Country Team will assist the GoR in mobilising resources to implement the suggested recommendations. Resources should be primarily channelled through the proposed National Environment Fund. In consultation with national and UN partners, and should funds allow, UNEP intends to develop a country programme that could include a number of the

listed recommendations where it has a clear comparative advantage.

Equally important is the need to ameliorate the quality and delivery of international environmental assistance by improving the coordination of donor projects, which have mostly been stand-alone initiatives. This would require up scaling current projects into mutually reinforcing and coherent programmes that better respond to national priorities and needs.

Finally, as part of the One UN reform process, it is crucial that UN agencies consolidate their fragmented environmental projects into a consistent and effective programme at the country level. UNEP will assume a lead role in taking this process forward as part of its environmental advisory support to the UN system in Rwanda and help ensure that environmental issues are adequately integrated across its programme of work.

## Annex I – Summary of Recommendations

A detailed description of the recommendations is provided in the relevant chapters of the main report

Table 1. Summary of recommendations

Ecosystem conservation and rehabilitation to combat poverty		Estimated cost (USD millions)	Tentative duration (years)
<b>Population displacement, resettlement and the environment</b>			
R5.1	Promote biogas plants and other renewable energy options in <i>imidugudu</i> .	5	3
R5.2	Implement “cash-for-environment” projects.	3	3
R5.3	Provide alternative, environment-friendly income-generation opportunities for <i>imidugudu</i> residents.	5	3
R5.4	Develop pilot projects for rainwater harvesting in <i>imidugudu</i> .	2	2
R5.7	Promote biogas plants and other renewable energy options in refugee camps.	0.5	1
<b>Disasters and climate change</b>			
R6.4	Pilot micro-finance projects targeting disaster affected areas.	1.5	5
R6.5	Establish Clean Development Mechanism (CDM) projects based on run-of-the-river hydropower plants in rural areas.	10	5
<b>Agriculture and land degradation</b>			
R7.1	Promote integrated conservation agriculture.	5	5
R7.3	Establish national-scale monitoring of soil erosion.	1.5	5
R7.5	Phase out tillage cultivation on steep slopes.	1.25	5
R7.6	Monitor the environmental impact of accelerating fertiliser use.	0.15	Continuous
R7.7	Promote the conservation of agricultural biodiversity.	0.5	2
R7.8	Reduce the prevalence of livestock disease and improve pasture quality.	2.5	5
<b>Forest resources</b>			
R8.1	Promote participatory forest management.	1	2
R8.2	Increase the extent of agroforestry, including small private woodlots.	3	3
R8.4	Rehabilitation of the Mukura montane rainforest.	0.5	3
R8.5	Restoration of gallery forests.	1	2
R8.9	Establish a biodiversity inventory of the Sanza relict forest and possibly other unknown relict forests.	1	2
<b>Water resources</b>			
R9.3	Develop a national wetlands programme.	2	2
R9.5	Scale-up rainwater harvesting projects at household and community levels to improve water supply.	2	3
<b>Wildlife and protected area management</b>			
R10.4	Develop alternative and sustainable income-generating activities for communities living around protected areas.	1	2
R10.5	Promote national parks as important leisure areas for the growing middle class in order to increase domestic tourism.	1.5	3
R10.7	Fully quantify and recognise the contribution of protected areas and wildlife to the national economy.	0.5	2
<b>Energy and the environment</b>			
R11.1	Sustainably manage wood and non-wood biomass energy supplies.	3	3-4
R11.2	Upgrade the current Improved Stove Programme.	2.5	3
R11.9	Accelerate the biogas programme.	10	4
R11.10	Explore the feasibility and long-term viability of using agrofuel oils to generate electricity.	2	3
<b>Urban environment and health issues</b>			
R12.1	Development of urban land use master plans.	5	5
R12.2	Develop a programme for liquid waste management to minimise the exposure of the urban population to contaminated groundwater.	5	3-5
R12.5	Assess the feasibility of various waste disposal interventions including land filling and installation of municipal solid waste incinerators.	0.25	0.5
R12.6	Undertake a detailed site contamination and risk assessment of Nyanza dumpsite, including implementation of mitigating actions.	1	3-5
R12.7	Develop and implement a water quality control and monitoring programme.	1	1
R12.8	Undertake a comprehensive review of community-based organisations (CBOs) involved in solid waste collection services.	0.5	1-1.5
<b>Industry and mining</b>			
R13a.2	Undertake environmental rehabilitation of the Gikondo wetland area.	10	3-5
R13b.2	Assess the major social and environmental impacts associated with Communities and Small-Scale Mining (CASM).	0.5	1-1.5
<b>Total estimated cost for ecosystem conservation and rehabilitation to combat poverty</b>		<b>92.15</b>	

Table 1. Summary of recommendations (continued)

Capacity-building to strengthen environmental governance		Estimated cost (USD million)	Tentative duration (years)
<b>Conflict, Peacebuilding and the Environment</b>			
R4.1	Improve public awareness of land tenure reform arrangements, including processes of distributing and demarcating land.	1	5
R4.2	Implement an environmental and technical assistance project in the four refugee camps.	0.5	2
<b>Population displacement, resettlement and the environment</b>			
R5.5	Develop an environmental management master plan for <i>imidugudu</i> .	0.5	1
R5.6	Strengthen environmental planning capacities of designated authorities for resettlement schemes.	2	2
R5.8	Pilot the use of constructed wetlands for wastewater treatment in urban <i>imidugudu</i> .	3	2
<b>Disasters and climate change</b>			
R6.1	Strengthen governance capacities and establish institutional mechanisms for cross-sectoral coordination on climate change and disaster reduction.	5	3
R6.2	Strengthen the institutional and technical capacities of the Rwanda Meteorological Service (RMS).	1.5	2
<b>Agriculture and land degradation</b>			
R7.2	Improve agricultural research and data collection systems and capacity.	3	3
R7.4	Increase investment in agricultural extension services.	3	3
<b>Forest resources</b>			
R8.3	Assessment of the extent of trees and shrubs outside forest areas.	0.5	1
R8.6	Assessment of the wood market.	0.2	1
R8.7	Strengthen the capacity of forest guards to protect relict forests and control logging operations in tree plantations.	1	2
R8.8	Establish a central forestry data bank under the Rwanda National Forest Authority (NAFA).	1	2
<b>Water resources</b>			
R9.1	Develop a national Integrated Water Resource Management (IWRM) plan.	1	2
R9.2	Pilot IWRM projects at the catchment level.	1	2
R9.4	Support the re-establishment of a national water monitoring programme.	3.5	3
<b>Wildlife and protected area management</b>			
R10.1	Review institutional arrangements for wildlife and protected area management.	0.05	1
R10.2	Resolve human-wildlife conflicts through community awareness programmes.	0.15	2
R10.3	Reinforce the protected area network.	1	3
<b>Energy and the environment</b>			
R11.4	Develop an energy pricing reform strategy.	0.1	1
R11.5	Promote solar home systems (SHS) to provide lighting to households in areas where other electricity sources are not feasible.	2	3
R11.6	Operationalise the Energy and Water Board (EWB) and strengthen its capacities to ensure efficient and sustainable development of the energy sector.	1	2
R11.7	Promote the use of compressed natural gas (CNG) in the transportation sector.	5	3
R11.8	Mobilise foreign and national private investment to increase electricity supply.	0.2	1
<b>Urban environment and health issues</b>			
R12.3	Develop a solid waste management policy that aims to put environmental controls on waste and its management.	0.25	1
R12.4	Build capacities of government and the private sector to undertake environmentally sustainable urban planning and development.	1	2
R12.9	Develop an environmental programme to protect the sustainability of urban water resources.	1.5	3-5
R12.10	Develop guidelines on management of urban wetlands and wastewater treatment.	0.25	1-1.5
R12.11	Undertake a feasibility assessment for the development of constructed wetlands in the urban environment of Kigali.	0.25	1-1.5
R12.12	Prepare an air quality monitoring programme for Kigali and develop appropriate policy responses to alleviate air pollution problems.	0.25	1 (continuing)

Table 1. Summary of recommendations (continued)

<b>Capacity-building to strengthen environmental governance</b>		<b>Estimated cost (USD million)</b>	<b>Tentative duration (years)</b>
<b>Industry and mining</b>			
<b>Industry</b>			
R13a.1	Undertake an extensive review of industrial facilities located in the Gikondo area with the aim of providing technical guidelines and mobilising financial support for future relocation.	0.5	0.1-0.3
R13a.3	Develop planning codes for proposed industrial parks.	0.1	1
R13a.4	Undertake an EIA on proposed industrial land use zones.	0.25	2
R13a.5	Establish common facilities in industrial parks to promote cleaner production and resource efficiency.	3	3
R13a.6	Strengthen and build the capacity of the National Cleaner Production Centre (NCPC).	1	3-5
R13a.7	Develop regulations and standards under the Environmental Law for industry.	0.1	1-3
R13a.8	Develop environmental management guidelines and regulations that minimise the adverse impacts of small- and medium-scale business.	0.05	1
<b>Mining</b>			
R13b.1	Develop environmental guidelines and appropriate technologies to improve management of mining and quarrying activities.	0.25	1-1.5
R13b.3	Subject all LSM activities – current and future – to EIA in accordance with the Environment Law and the draft mining law once approved.	0.25	2
<b>Environmental governance</b>			
R14.1	Support the implementation of the ENRSSP.	0.35	1
R14.2	Ensure implementation of SEAs and EIAs.	0.25	2
R14.3	Strengthen the decentralisation of environmental management in the country.	0.3	3
R14.4	Establish a sustainable and predictable mechanism for financing environmental programmes and activities.	Multi-million	Multi-year
R14.5	Support the development of a Rwandan Environment Information Network (REIN).	0.25	2
R14.6	Develop and implement a comprehensive environmental education programme at the national level.	0.25	3
R14.7	Reinforce coordination between institutions dealing with natural resources, protected areas and nature reserves and harmonise relevant policies and laws.	0.05	0.5
R14.8	Strengthen technical and organisational capacities of the recently established environmental NGO forum.	0.25	3
<b>Total estimated cost for capacity-building to strengthen environmental governance</b>		<b>47.90</b>	

<b>Enhance and promote regional environmental cooperation</b>		<b>Estimated cost (USD million)</b>	<b>Tentative duration (years)</b>
<b>Disasters and climate change</b>			
R6.3	Strengthen national and regional volcanological and seismic monitoring in the countries of the Albertine Rift Valley.	1.5	3
<b>Agriculture and land degradation</b>			
R7.9	Engage in regional and international agricultural research.	1	3
<b>Forest resources</b>			
R8.10	Initiation of sustainable and regulated trade in forest products with neighboring countries.	1	2
<b>Water resources</b>			
R9.6	Develop a strategy to promote water management cooperation in the Congo Basin.	0.05	1
<b>Wildlife and protected area management</b>			
R10.6	Strengthen intercountry cooperation in the management of transboundary protected areas.	3	4
R10.8	Promote regulated and sustainable trade in wildlife and wildlife products.	0.5	4
<b>Energy and the environment</b>			
R11.3	Promote regional energy cooperation to facilitate increased supply and distribution.	0.25	1
<b>Total estimated cost to enhance and promote regional environmental cooperation</b>		<b>7.30</b>	

Table 2. Summary and total cost of recommendations (USD millions)

Issue and sector	Number of recommendations	Ecosystem conservation and rehabilitation to combat poverty	Capacity-building to strengthen environmental governance	Enhance and promote regional environmental cooperation	Total cost
Conflict, peace-building and the environment	2	-	1.50	-	1.50
Displacement and resettlement	8	15.50	5.50	-	21.00
Disasters and climate change	5	11.50	6.50	1.50	19.50
Agriculture and land degradation	9	10.90	6.00	1.00	17.90
Forest resources	10	6.50	2.70	1.00	10.20
Water resources	6	4.00	5.50	0.05	9.55
Wildlife and protected areas	8	3.00	1.20	3.50	6.70
Energy	10	17.50	8.30	0.25	26.05
Urban environment	12	12.75	3.50	-	16.25
Industry and mining	11	10.50	5.50	-	6.00
Environmental governance	8	-	1.70	-	2.15
<b>Total</b>	<b>89</b>	<b>92.15</b>	<b>47.90</b>	<b>7.30</b>	<b>147.35</b>

Note:

– Indicates data not applicable.



## **Further information**

UNEP has an online bookstore at: **<http://www.earthprint.com>**

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[www.unep.org](http://www.unep.org)

United Nations Environment Programme  
P.O. Box 30552 Nairobi, Kenya  
Tel: +254 (0)20 762 1234  
Fax: +254 (0)20 762 3927  
Email: [unepubb@unep.org](mailto:unepubb@unep.org)

