

LINKAGES BETWEEN KENYA'S FOREST REGULATING SERVICES AND THE REST OF THE ECONOMY

7 February 2012



Preamble

This Report evaluates the importance of montane forest dependent regulating ecosystem services to the economy of Kenya.

The Report forms part of a larger study that builds upon the 2009 UNEP report on the forest related regulating ecosystem services of Kenya, through valuation of the priority regulating services.

The key objectives of the larger study are:

1. To link regulating services associated with the montane forests of Kenya, to the economy of Kenya;
2. To construct hybrid physical and monetary Input-Output models that will feed into the activities below as part of the process to build resource accounts for Kenya;
3. To estimate the value of the regulating services of the montane forests of Kenya;
4. To construct resulting monetary resource accounts;
5. To strengthen national institutional capacities ; and
6. To write a paper to make a case for montane forests in Kenya's linkages and contribution to the UN-REDD Programme Global Framework Document 2011-2015 and its work area 6 "Green economy transformation processes catalyzed as a result of REDD+ strategies and investment".

This Report addresses objectives 1, 3 and 6 above.

The outputs of this report are to be incorporated into the Input-Output models in order to assess the economy-wide effects of deforestation in Kenya.

The first six chapters portray the essence of the report. More detailed literature reviews and analyses on each aspect of the report are presented in the appendices from which large sections were also used in the main report. This may appear as repetition, but serves the purpose of completeness.

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Executive Summary

Kenyan economic growth is intrinsically linked to three highly variable economic characteristics. Firstly, Kenya is poorly endowed with energy resources, and thus the economy is sensitive to increases in international crude oil prices. Secondly, the economy is vulnerable to inflationary pressures when the Kenya Shilling weakens against the currencies of its major trading partners. Thirdly, inflationary pressure arises during periods of drought when the water dependent economic sectors come under pressure.

Kenya's water is highly dependent on Kenya's five Water Towers, which together encompass more than a million hectares of montane forests. The total water yield from the Water Towers could be more than 15,800 million m³ /yr, which is more than 75% of the renewable surface water resources of Kenya.

Kenya's Water Towers are highly vulnerable to deforestation (DRSRS 2004, DRSRS 2006). Timber, fuelwood and charcoal harvested thus harvested provides poor people with immediate and significant cash incomes, as well as productive land. These constitute significant economic incentives favouring deforestation.

However, deforestation also incurs severe economic costs on the economy of Kenya. Not only does it adversely affect Kenya's water yield and thus water dependent sectors, but it also affects a range of other economic sectors. These sectors are the *Agriculture, forestry and fishing* sectors, the *Electricity and water* sectors, the *Hotels and accommodation* sector and the *Public administration and defense* sector.

Deforestation in the Water Towers affects the economy through a set of ecosystem services defined by the Millennium Ecosystems Assessment (MEA, 2005) as regulating services. In 2005, the United Nations-led Millennium Ecosystem Assessment (MA) proposed a radical new framework for the analysis of the interface between ecosystems and the economy, and thus provided a framework to structure the quantification of the value of ecosystem services from natural assets to the economy. The MA defines four categories of ecosystem services: provisioning services, cultural services, regulating services, and supporting services.

Provisioning services cover the renewable resources that are mostly directly consumed and that generally have well-defined property rights. Cultural services capture many of the non-use (or passive use) values of ecological resources such as spiritual, religious, aesthetic, and inspirational wellbeing. In Kenya irrigation agriculture, forestry, fishing, hydropower, and tourism are economic sectors that depend upon ecosystem services such as fresh water, forest products, fish stocks and the aesthetic appeal of the Kenyan landscape. These are examples of provisioning and cultural services. These services are highly tangible and their economic importance is easily recognizable.

Regulating services are indirect services that determine the capacity of ecosystems both to regulate the impact of external shocks, and to respond to changes in environmental conditions without losing functionality. Regulating services are a special category of ecosystem services which are intermediate to the production of the provisioning and cultural services. They are not directly consumed in the economy but rather, their value is determined by the value of the final consumption services they protect. Regulating services reduce risk to the economy and thus provide an insurance value to the economy. This insurance value is important, not only to maintain economic resilience to

seasonal environmental and economic changes, but also to long term economic hazards, such as climate change. It is therefore important that the country manages its natural assets with a view to increasing the country's economic resilience.

Kenya can manage the supply of its regulating services by carefully managing its natural assets. Hazards that put natural assets and regulating services at risk include severe population pressure, poor farming methods, water pollution and deforestation. These hazards may result in changes in water runoff, flash flooding, reduced water infiltration into soil, soil erosion, siltation and loss of biodiversity, which in turn negatively affects the economic sectors discussed above.

This report focuses on the role that Kenya's indigenous montane forests play in producing regulating services, and on their input into the economy of Kenya. The montane indigenous forests of Kenya that fall within Kenya's five Water Towers, produce several regulating services of importance. These include local climate regulation, water flow regulation, erosion regulation, and water purification and waste treatment. These services are further closely associated with other regulating services including disease regulation and natural hazard regulation.

The regulating services of Kenya's montane forest ecosystems are thus important production factors to the *Agriculture, forest and fishing* sectors, the *Electricity and water* sectors, the *Hotels and accommodation* sector, and the *Public administration and defense* sector. These sectors, together, contributed between 33-39 % to GDP between 2000-2010. In addition, these sectors have a very significant multiplier effect on the rest of the economy's GDP.

This report presents a valuation of the regulating services produced by the Water Towers of Kenya. It is thus a step towards integrating regulating services into the national accounting framework. In 2009, Kenya Forest Services (KFS) and Kenya National Bureau of Statistics (KNBS), in collaboration and Miti Mingi Maisha Bora, developed an Environmental Economic Account for Forestry in Kenya (KFS 2009). This account focused on the provisioning services, the timber and non-timber forest products, produced by the forests of Kenya. Thereafter, the United Nations Environmental Programme (UNEP) produced a preliminary report on the role of forest-related regulating services (UNEP, 2009). This report is a continuation of the 2009 work by KFS, KNBS and UNEP.

The World Bank's WAVES¹ initiative intends to address the matter of accounting for regulating services. It identifies accounting for the regulating services as a challenge. This is because regulating services' value derives indirectly from their use as inputs to production process. Thus, most often, there are no markets for these services and their value is already included, implicitly, in the value of other assets for which markets exist (Lange 2011, World Bank 2011). In addition, regulating services is of value because they ensure the delivery of final consumption services over a range of environmental conditions (Perrings, 2006). Thus, regulating services reduce risk to the economy, which is why it has an insurance value.

In order to estimate the value of the montane forest regulating services of Kenya, this study develops a case study of the effects of deforestation that occurred between 2000 and 2010 on the Kenyan economy, for the 2010 fiscal year. The case study is evidence-based and makes use of official economic data, environmental indicators, experimental results and peer reviewed publications to

¹ Wealth Accounting and the Valuation of Ecosystem Services

develop a bio-economic model for the regulating services of Kenya. In a subsequent phase of the study, these effects will be incorporated into the national accounts of Kenya.

In the 10 year period, 2000-2010, deforestation in Kenya's Water Towers amounted to an estimated 28,427 ha. By 2010 such deforestation of montane forests yielded a timber and fuelwood volume of 210 m³/ha with a cash value of 272,000 KSh/ha. At an estimated deforestation rate of 2,762 ha in 2010, this was equivalent to a revenue of KSh 796 million in 2010. This is a considerable economic incentive for illegal loggers.

However, the indirect costs of deforestation are borne by sectors and households elsewhere in the economy, through the reduction in the value of regulating services. Whereas the cash value of timber and fuelwood has a once-off value, the consequences of deforestation in preceding years continue to be felt in the economy in every subsequent year. By 2010, the cumulative negative effect of deforestation on the economy through reduction in regulating services was an estimated KSh 2,231 million/yr.

The largest component of this was attributable to changes in river flows in the form of a reduction in dry season river flows, which reduced the assurance of water supply to irrigation agriculture. This reduced irrigation area by 5,287ha and reduced agriculture output by KSh 1,499 million in 2010. Reduced river flows also reduced hydropower generation by KSh 8 million. Although this is relatively not a very high value, the multiplier effect of hydropower on the rest of the economy is considerable.

Reduction in water quality due to siltation and elevated nutrient levels running off degraded land into fresh water systems reduced inland fish catch by KSh 86 million and increased the cost of water treatment for potable use by KSh 192 million.

Deforestation increases malarial disease prevalence. Incidence of malaria under an exposed population of approximately 150,000 people is estimated to have been KSh 237 million by 2010. This is in the form of additional health costs to the Government of Kenya, and through losses in labour productivity.

Forest loss is also detrimental to the global carbon cycle. The above-ground carbon storage value forgone through deforestation was estimated at KSh 210 million in 2010.

Thus, in 2010, the total net cumulative effect of deforestation on the economy of Kenya was a loss of KSh 1,435 million. This loss in output has a considerable multiplier effect on the rest of the Kenyan economy.

Whereas the immediate cash benefit of deforestation through timber and fuelwood sales is KSh 272,000/ha, the total effect of regulating services lost is estimated to be KSh 763,283/ha. The cumulative loss to the economy in 2010 outweighed the cash benefits by at least 2.8 times. This ratio will increase into the future as the cumulative effect of deforestation endures.

Of particular interest is the implication for the UN's REDD+ initiative. A carbon value of US\$ 6/ton provides insufficient economic incentive (KSh 71,768/ha) to compensate for deforestation (KSh 272,000/ha). However, this analysis shows that the total ecosystem service value of the montane forests far exceeds the carbon storage value. Carbon, as a proxy for regulating ecosystem services, has a regulating service multiplier effect of 10.6. In practice this means that for every KSh1 that

illegal loggers earn through deforestation, various sectors in the rest of the economy, by 2010, lost USD 2.81 in terms of total output per sector.

The key policy implications for the Government of Kenya lies in (1) sustainable use of the forest resources (mainly timber and wood) through selective thinning regimes, instead of clear-felling of large areas; (2) the protection of the forests against uncontrolled settlement; (3) adequate allocation and policing of water withdrawals; (4) improved management of degraded land. This can be achieved through:

- proper road and path planning, design, and maintenance;
- establishment of crop systems that protect the soil and create microclimatic conditions resembling forest conditions as close as possible (shamba-system for example);
- terracing on steep upstream cropped areas to reduce surface runoff and increase infiltration;
- mulching bare areas to protect the soil, avoid weed growth to reduce soil water loss through evaporation from the soil and through transpiration by weeds;
- tied ridges are very effective in controlling surface runoff and improving soil moisture conditions;
- payments for ecosystem services schemes related to the REDD+ initiative.

The cost of these mitigation measures is expected to be far less than the value of regulating services lost.

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