



**FOREST  
ECOSYSTEMS IN  
THE TRANSITION  
TO A GREEN  
ECONOMY AND  
THE ROLE OF  
REDD+ IN THE  
UNITED REPUBLIC  
OF TANZANIA**

**EXECUTIVE SUMMARY**





## Key messages

- **The main objective of this study is to assess whether there is an economic rationale for the reduction of deforestation in the United Republic of Tanzania, by calculating the economic costs and benefits based on current levels of deforestation.** The study is part of a range of activities offered by the UN-REDD Programme in support of the Tanzanian Government. REDD+<sup>1</sup> is a concept designed to reward developing countries for their verified reductions or removals of forest carbon emissions compared to a forest reference level or forest reference emission level that complies with the relevant safeguards.
- The Tanzanian mainland is estimated to have a total of 48 million hectares (ha) of forest, which is 51 per cent of the total area, with woodlands occupying about 90 per cent of the total forest area and the remainder being shared by mangrove forests, montane forests, small patches of coastal forests, and plantations of softwood and hardwood. Annual deforestation on the Tanzanian mainland is estimated by the National Forest Monitoring and Assessment (NAFORMA, 2014) at 372,816 ha between 1995 and 2010.
- **A cost-benefit analysis revealed that the present value of net economic losses from deforestation to the Tanzanian economy over the next 20 years (2013–2033) is TSh 273 billion (US\$ 171 million).** This analysis only included those provisioning forest ecosystem services that are captured by the system of national accounts and which can therefore be reflected in the gross domestic product (GDP). A discount rate of 5 per cent was used, which is the rate that the Bank of Tanzania uses in analysing long-term investments. This means that based on available data, it makes economic sense to reduce deforestation and implement policies and measures that tackle the direct and underlying drivers of deforestation<sup>2</sup>.
- A second scenario analysis using data from Catchment Forest Reserves took into account the economic effect of deforestation not only on timber resources, but also on other provisioning services, including non-timber forest products, regulating services such as water provisioning for domestic use and livestock, and supporting services

such as biodiversity. **The present value of net losses from deforestation to the Tanzanian economy in the period 2013–2033 amounts to TSh 5,588 billion (US\$ 3.5 billion).** This shows that the present value of net losses are an order of magnitude higher when taking into account the effect of deforestation on the full range of forest ecosystem services.

- Lastly, additional analysis also highlighted that **investments in the forestry sector lead to comparatively higher income for rural populations than the same investments in the sectors of agriculture and wood, paper and printing.** Hence, investments in the forestry sector could potentially also be beneficial from the perspective of poverty alleviation.
- These findings highlight that it is economically interesting for the United Republic of Tanzania to invest in conserving its forests, and therefore present a case for the Government to tackle the direct and underlying drivers of deforestation and transition, moving towards an economic model that stimulates sustainable use and conservation of forest ecosystems by implementing REDD+. In that sense, this report provides further rationale for efforts to accelerate the implementation of the REDD+ National Strategy and Action Plan.

## Introduction

The United Republic of Tanzania is one of the 60 partner countries of the UN-REDD Programme and one of the 21 countries with a national programme (as of May 2015). The United Republic of Tanzania has made progress in a range of areas that are part of the Warsaw Framework for REDD+, or the so-called “REDD+ Rulebook”. The valuation of the country’s forest ecosystems and their contribution to its economy was one of the activities that continued after its national programme closed in 2013 as part of the UN-REDD support for national actions.

The country is highly biodiverse and is renowned for the richness of its wildlife. Approximately 38 per cent of the country’s mainland is set aside in protected areas for conservation. The Tanzanian mainland is estimated to have a total of 48 million ha of forest, which is 51 per cent of the total area, with woodlands occupying about 90 per cent of the total forest area and the remainder being shared by mangrove forests, montane forests, small patches of coastal forests, and plantations of softwood and hardwood (NAFORMA, 2014).

Forests provide a range of ecosystem services, of which some can be reflected in market prices, such as timber and derivative products like paper. Other services that are also important for the economy, such as the ability of forest soils

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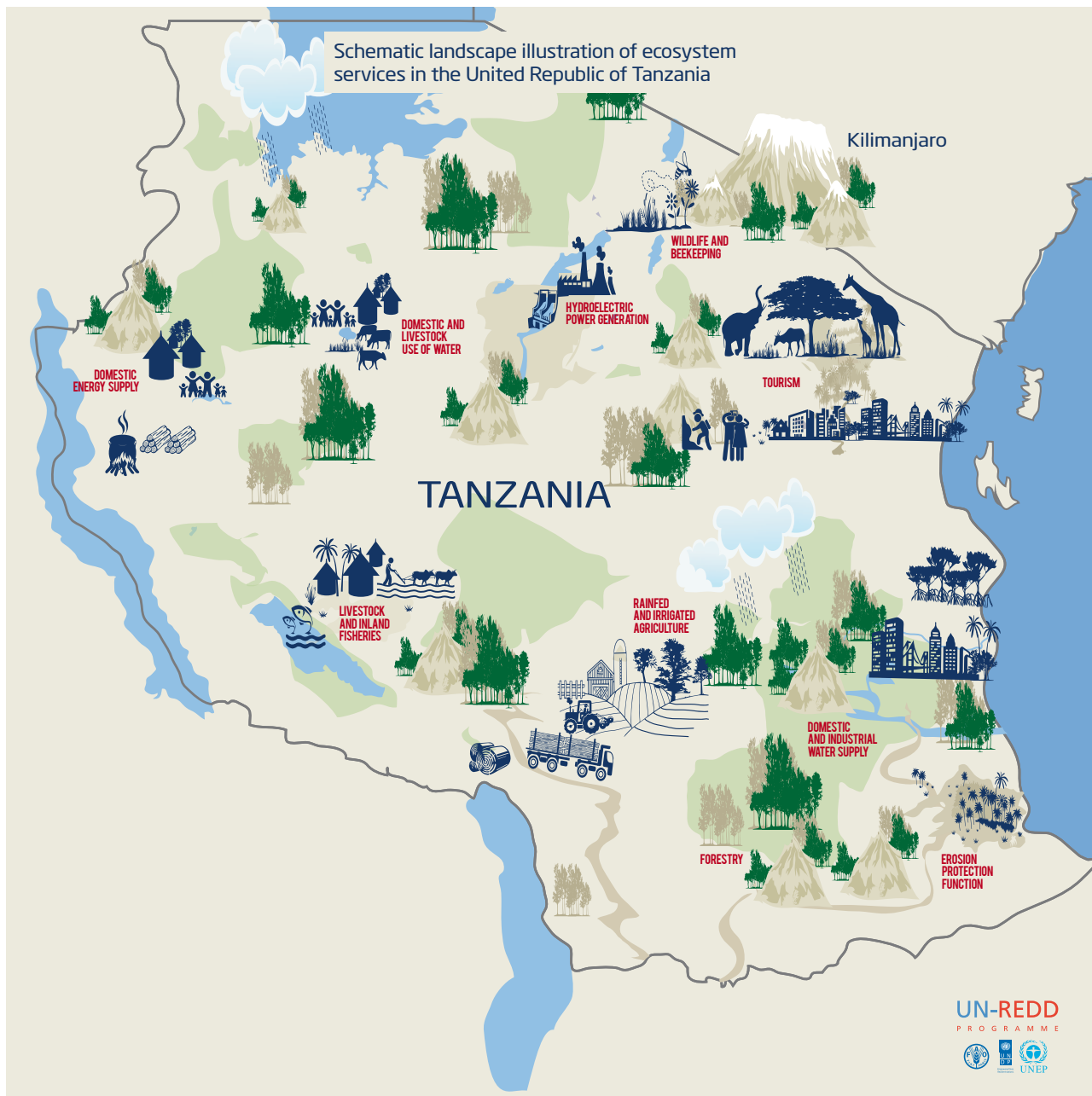
1. “REDD” and “REDD+” refer to the mechanism called “Reducing emissions from deforestation and forest degradation in developing countries”, which emerged in 2008, building in the roles of conservation and sustainable management of forests, forest restoration and reforestation. REDD+ is an enhanced version of the mechanism.  
2. It should be noted however, that the cost-benefit analysis does not take into consideration the potential alternative income from activities after land is deforested (e.g. agriculture)

to purify water for domestic and industrial use, regulate run-off to support hydroelectric power generation, sequester carbon, etc., are usually quantified using shadow prices as opposed to market prices (see figure 1 for an overview of some ecosystem services that forests provide to the Tanzanian economy and society). The current contribution of the forestry sector to the country's gross domestic product (GDP)<sup>3</sup> is 3 per cent (National Bureau of Statistics, Ministry of Finance 2013).

Deforestation in the United Republic of Tanzania is driven by the expansion of agricultural activities, including through shifting cultivation, wildfires, lack of clearly defined

boundaries, illegal logging, livestock grazing, unsustainable charcoal production for domestic and industrial use, lack of systematic management, introduction of alien and invasive species, etc. These driving forces are depreciating the country's natural capital or stock of forest ecosystem assets, because, as forests disappear, so may the benefits that these provide in terms of regulating water run-off, reducing soil erosion, capturing and sequestering carbon, etc. Deforestation rates range from 130,000 to 500,000 ha per annum (FRA, 2010), with different sources setting the rate at 142,720 ha in 2013 (GFW, 2015) and 372,816 ha per annum between 1995 and 2010 (NAFORMA, 2014). The NAFORMA figure has been used for the analysis in this study.

Figure 1: Schematic landscape illustration of ecosystem services in the United Republic of Tanzania



3. The contribution was 3.10 per cent at 1992 prices and 2.70 per cent at 2001 prices.





The primary goal of this study is to provide an insight into the economic costs and benefits of deforestation in the United Republic of Tanzania. The analysis focuses both on the specific effect of deforestation on the GDP of the forestry sector, and also on the impact of deforestation on the broader economy. One way to look at this is as follows: If deforestation affects the water cycle it will have a negative impact on the value added of the hydropower or energy sector if energy generation is impaired. In a similar fashion, agriculture can be affected if deforestation increases soil erosion or impairs the irrigation system. This can lead to higher costs (e.g. additional fertilizers) or lower yields (due to poorer soil quality). In that way, this analysis provides a broader perspective of deforestation on the economy. The System of National Accounts (SNA) is used by governments around the world for macroeconomic policy making and defines how GDP is calculated.

As a second step, the report gives policy makers in the Tanzanian Forest Service (TFS), the National Bureau of Statistics (NBS), the Ministry of Finance and Economic Affairs, the Ministry of Natural Resources and Tourism and other public and private stakeholders in the United Republic of Tanzania more visibility about the important roles that the forest sector plays in supporting the welfare of households across the country and its direct and indirect contribution to the economy in terms of added value through interlinkages with other sectors. In doing so, the study provides the rationale for the United Republic of Tanzania to move ahead with the implementation of REDD+ through actions, policies and measures that could generate results-based payments.

## Costs and benefits of deforestation for the Tanzanian economy

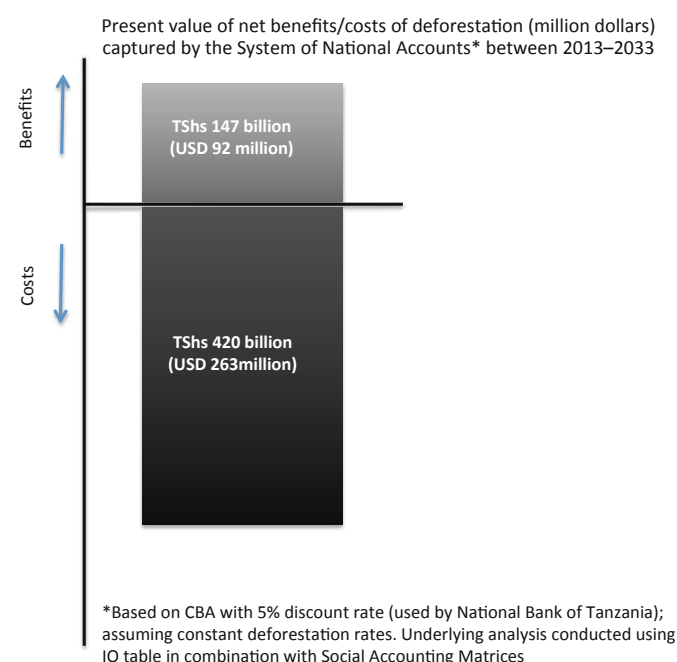
### 1. Monetary costs and benefits of deforestation captured by the System of National Accounts

The first scenario analysed how the monetary benefits that society obtains from cutting down forests (in terms of obtaining useful provisioning services such as timber) compare to the monetary costs to the economy of the lost value added of the forestry sector. In doing so the interlinkages that the forestry sector has with other sectors were taken into account by using an input-output analysis and social accounting matrices. The social accounting matrix is an extension of an input-output table, which, in addition to income and expenditure flows of industries and their outputs which are captured by input-output tables, contains detailed information that captures all transfers and real transactions between industries and institutions in

the economy. The values presented below can be directly captured by the SNA<sup>4</sup>.

- Benefits of deforestation:** The benefits are one-off financial benefits from provisioning services (mainly timber). These are TSh 29,233 per hectare per year (2013). Based on deforestation levels of 372,816 ha per year, **the discounted benefits over the period 2013–2033 are estimated at TSh 147 billion (US\$ 92 million).**
- Costs of deforestation:** There are two types of costs. First, once a hectare of forest has been cut down that same hectare does not contribute any more to the value added of the forestry sector the following year. Second, there are multiplier effects as investments in the forestry sector contribute to the value added of other sectors in the country. In other words, deforestation will reduce this positive indirect effect on other sectors. Combining these two costs results in total costs of TSh 83,771 per hectare per year (2013). Based on deforestation rates of 372,816 ha per year, **the discounted costs for the period 2013 to 2033 amount to a total cost of TSh 420 billion (US\$ 263 million).**

Figure 2: Present value of net benefits and costs of deforestation captured by the System of National Accounts (SNA) between 2013 and 2033



4. The analysis assumed that deforestation levels, which on average were 372,816 ha per year between 1995 and 2010 (NAFORMA, 2014), would remain constant for the next 20 years: 2013–2033. A discount rate of 5 per cent was used, which is the rate that the Bank of Tanzania uses in analysing long-term investments (see Sanga and Mungatana, forthcoming).

In conclusion, the present value of net losses from deforestation to the Tanzanian economy amounts to TSh 273 billion (US\$ 171 million), as shown in figure 1. This means that deforestation is economically unattractive purely from the perspective of the forestry sector-related contribution to GDP (see boxes 1 and 2).

**Box 1: Brief note of clarification on the cost-benefit analysis**

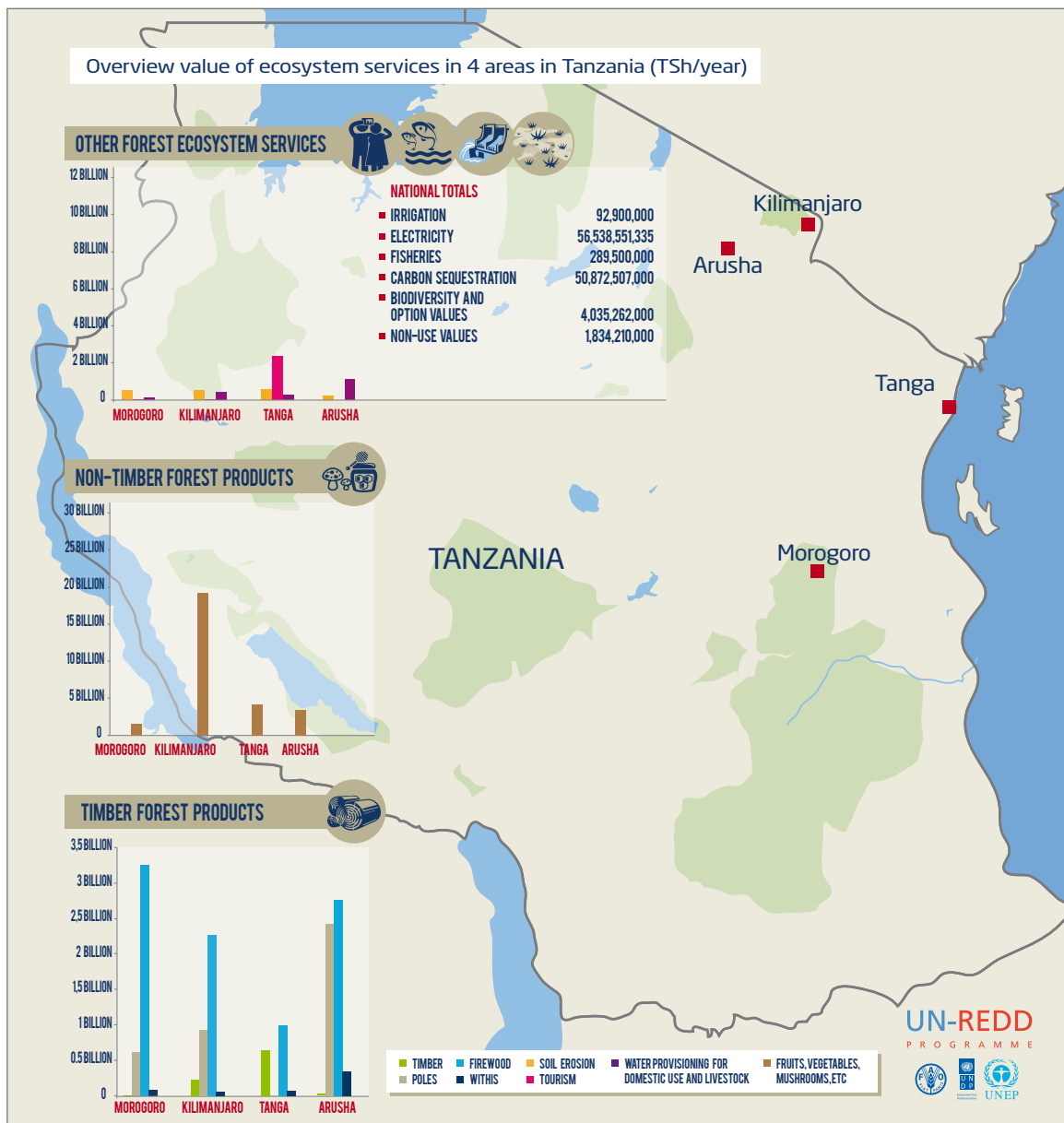
In this analysis the amount of land that is removed from forestry and transferred to an alternative use, such as agriculture, does not enter as a sector in the input-output matrix. Additional policy-scenario analysis can be carried out to assess this marginal income impact generated from deforested land through alternative land use. This exercise is beyond the scope of the present report.

**2. Visualizing the economic costs and benefits of deforestation on the broader economy**

The second scenario assessed how the one-time monetary benefits that society obtained from deforestation compared to the monetary costs of lost provisioning, regulating and supporting ecosystem services. The analysis is based on data from catchment forest reserves (CFRs) issued by the Ministry of Natural Resources and Tourism (MNRT, 2003). The CFRs in the survey covered 677,203 ha and are found in Morogoro, Tanga, Kilimanjaro and Arusha. The survey includes services produced by the forestry sector that supports value added in other sectors (e.g. agriculture, tourism, energy) such as:

- Provisioning services (timber-related): timber, poles, firewood, withies

Figure 3: Overview value of ecosystem services in 4 areas in Tanzania (TSh/year)





- Provisioning services (non-timber forest products): wild fruits, traditional medicines, wild vegetables, bushmeat, mushrooms, ropes
- Other provisioning, cultural and regulating (intermediate) services: water provisioning for domestic use and livestock, water for irrigation, water for electricity generation (hydropower), fisheries, prevention of soil erosion and tourism.

The benefits of managing CFRs on a sustainable basis, extracting timber resources, non-timber forest products, and intermediate services, amount to TSh 1 million per hectare per year. The decision to cut down a hectare of forest in the CFRs has costs and benefits. There are ‘one-off’ benefits in terms of the economic value of timber forest products of about TSh 102,993 per hectare. The costs can be computed as lost timber (after a hectare is cut down it does not deliver any timber-related products from the next year onwards), non-timber forest products and regulating and supporting services, which on an aggregate basis are TSh 1 million per hectare. Discounting the costs and benefits for the next 20 years leads to net benefits of TSh 38 billion (US\$ 24 million) and net costs of TSh 5,627 billion (US\$ 3.5 billion), see figure 4. This shows that when taking into account the full range of forest ecosystem services, it is even more economically unattractive to continue current deforestation rates. Please note some of the costs are compatible with the SNA and reflected in GDP through lower value added of other sectors such as agriculture, tourism and energy. For example, more irregular water availability due to deforestation can impact agricultural output, or lead to higher costs for hydro-electric utilities. The UN-REDD Programme has also emphasized the importance of recognizing the multiple benefits that forest ecosystems provide (UNEP, 2014). Other costs such

as effects on biodiversity, carbon sequestration and other non-use values are not compatible with the SNA and hence not reflected in the GDP.

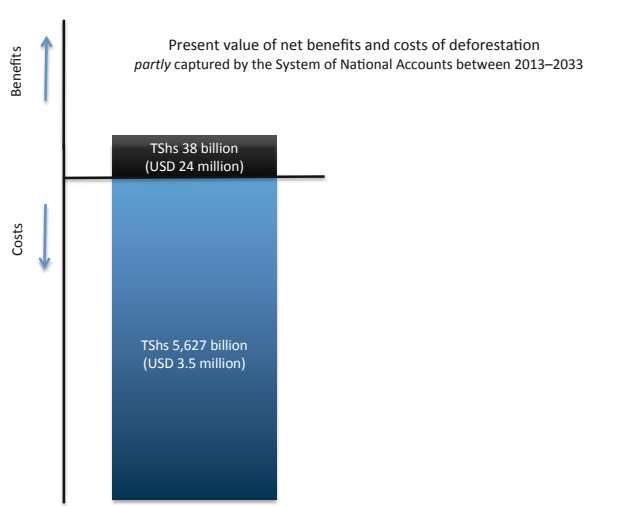
### Policy implications

Following these results, the Tanzanian economy would benefit from reducing deforestation and increasing the conservation and sustainable use of forest ecosystem services. Suggestions are provided for different government ministries and agencies, regarding how they could strengthen the integration of forest ecosystem services in their policies and decision-making procedures.

**Suggestions for the Natural Bureau of Statistics (NBS) and the Ministry of Finance and Economic Affairs:** The marketable outputs provided by forests are captured by the SNA and reflected in the GDP, whereas the majority of non-marketable outputs are not captured at all. However, restricting the attention of decision-makers exclusively to the share of the forests’ contribution to the country’s GDP presents a skewed picture of its true contribution. Given that the present value of the marketable forest goods and services shows a net loss for the Tanzanian economy, a recommendation for the NBS and the Ministry of Finance and Economic Affairs could be to start assessing how the value of the country’s natural capital can be linked to its national accounts, for example by developing an inclusive wealth account that includes the value of the natural capital in addition to social, manufactured and other types of capital. In that way changes in the forest stock and other natural capital assets can be tracked on a periodic basis.

The use of forests in many developing countries is usually undervalued (e.g. Roe and Elliot, 2010). In addition, the income from forests to households is typically stated as income, which is likely to understate the true income because of the prevalence of informal markets. In the United Republic of Tanzania for example, forests are a source of income for a significant number of households or consumed as a complement to other goods. For instance, in order to prepare food in many communities, wood provides the cooking energy. However, data on these activities are typically not available at the national level. This results in undervaluing the contribution of the forestry sector to the economy. The study by Agrawal et al. (2012) highlights that in many developing countries non-industrial economic contributions of forests are typically unavailable and in many cases are three to ten times higher than that collected in national accounts. The analysis presented in this study, however, shows that indeed the net non-market benefits and losses of forest ecosystems are ten times as large as the marketed losses.

Figure 4: Present value of net benefits and costs of deforestation in CFRs between 2013 and 2033



Please note that part of the costs are compatible with the SNA and hence reflected in GDP, but not in the forestry sector but in other sectors. This concerns effects of deforestation on providing water for domestic use and livestock, preventing soil erosion, etc. If deforestation affects these services this can lead to lower value added of sectors such as agriculture, tourism and energy. Other forest ecosystem services that are affected because of deforestation, such as biodiversity and non-use values, are not compatible with the SNA and hence not reflected in GDP.

A natural capital account that is part of a country's inclusive wealth account and which is linked to its existing system of national accounts can inform the Ministry of Finance and Economic Affairs and the NBS when it develops or adapts policies to stimulate economic growth. The United Nations system of environmental-economic accounting and experimental ecosystem accounting (UN SEEAEEA, 2013) provides three ways in which ecosystem accounting information may be used to augment the economic accounts of the SNA:

- A. The compilation of balance sheets that compare the values of ecosystem assets with value of produced assets, financial assets (and liabilities), and other economic assets. This approach also brings into consideration an approach described in the literature as wealth accounting;
- B. The compilation of a sequence of economic accounts taking into account ecosystem services and other ecosystem flows, especially ecosystem degradation;
- C. The derivation of aggregate measures of economic activity, such as income and saving, that are adjusted for ecosystem degradation.

**Suggestions for the TFS:** Deforestation has a net negative impact on the economy from the perspective of the forestry sector and fails to take into account potential alternative income from other sectors (see box 1). These results could therefore be used to advocate the provision of additional domestic resources to tackle the driving forces behind deforestation. In addition, this study looked at how deforestation affects the revenues of the TFS itself. Monetary benefits for the TFS from managing forests can include receipts, licences and other miscellaneous payments such as forestry royalties and fees. The costs are expenditures for forest management. At current prices, the present

value of net losses for the TFS from deforestation between 2013 and 2033 are estimated at TSh 2,063 million (US\$ 1.3 million). This means that, from the point of view of the TFS deforestation has a negative effect on its net income.

### Suggestions for the Ministry of Natural Resources and Tourism and the Planning Commission

The project also measured the effect on household income assuming a scenario whereby a plan would be implemented to increase output in the following sectors by 10 per cent within five years due to increased demand<sup>5</sup>: first, forests and hunting; second, agriculture; and third, wood, paper and printing. Four types of households were identified: first, rural poor; second, rural non-poor; third, urban poor; and fourth, urban non-poor. The effect of this simulation was measured both in terms of direct effects on household income if the Government decided to invest in the forestry, agriculture or wood, paper and printing sectors, but also the indirect effect. The indirect impact considers the relationship with other sectors of the economy, for example, increasing the output of the agricultural sector will have an impact on all sectors that have an economic relationship with it (seed supply, fertilizer supply, irrigation water supply, transportation, etc). Increased demand will spur economic growth in the interdependent sectors, which will ultimately be reflected in the welfare of households.

The analysis revealed that such an equal increase in output in these three sectors increased household welfare for both the rural poor and non-poor more in the forestry sector, than in agriculture and wood paper printing (see table 1 and figure 8).

This provides a rationale for the Ministry of Natural Resources and Tourism (MNRT) to stimulate output of the forestry and hunting sector in the interest of poverty

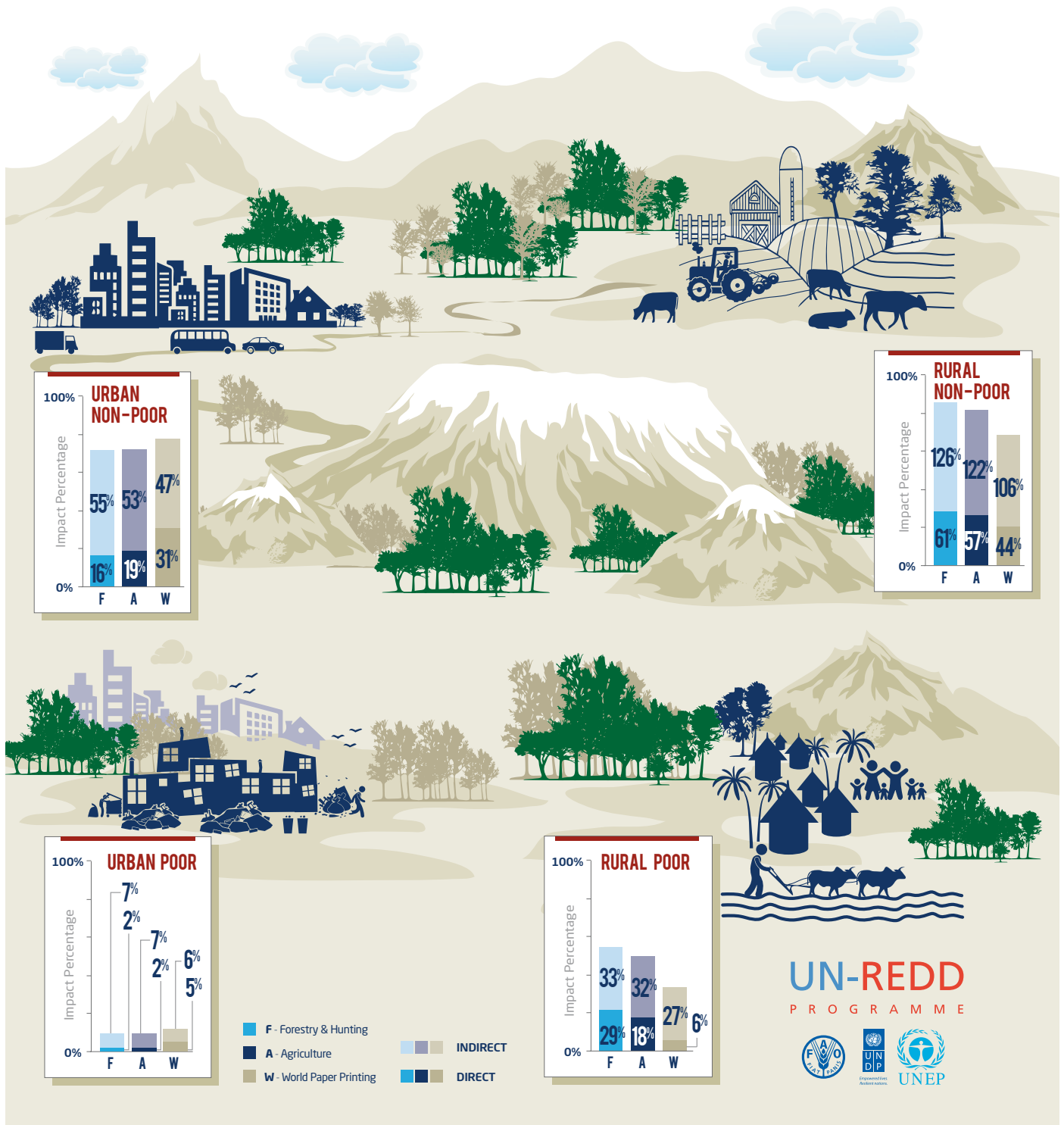
Table 1: Effect on household income from a targeted 10 per cent increase in supply of the forestry, agriculture and wood paper printing sectors over the next five years

		Forestry and hunting	Agriculture	Wood paper printing
Rural poor	Direct	19%	18%	6%
	Indirect	33%	32%	27%
	<b>Total</b>	<b>52%</b>	<b>50%</b>	<b>33%</b>
Rural non-poor	Direct	61%	57%	44%
	Indirect	126%	122%	106%
	<b>Total</b>	<b>187%</b>	<b>179%</b>	<b>150%</b>

5. Both direct (final demand) and indirect effects (supporting production activities in other sectors) were taken into account.

Figure 5: Effect on household income from a targeted 10 per cent increase in supply of the forestry, agriculture and wood paper printing sectors over the next five years

## Effect on household income from a targeted 10 per cent increase in supply of the forestry, agriculture and wood paper printing sectors over the next 5 years







alleviation. This is because investments in the forestry sector leads to comparatively higher income for rural populations than equal investments in the agricultural and wood paper printing sectors.

Taking all analyses into account, this report provides motivations for the Government of Tanzania to accelerate REDD+ readiness and move towards implementation of the National REDD+ Strategy (2013). In doing so, Tanzania would take an important step to transition to a Green Economy

*This summary was produced by Ivo Mulder (UNEP) with support from Beth Mbote, Paulo Nunes (UNEP) and Suzannah Goss, based on a report written by Babatunde Abidoye, Eric Mungatana, Linda Mahlalela, Thabo Sacolo and Folaranmi Babalola (The Centre for Environmental Economics and Policy in Africa, CEEPA, University of Pretoria).*

*The study was executed by UNEP's Ecosystem Services Economics Unit, Division of Environmental Policy Implementation.*

### **Box 2: Use of the Computable General Equilibrium (CGE) model for the United Republic of Tanzania**

CGE models are a standard tool of empirical analysis, and are widely used to analyse the aggregate welfare and distributional impacts of policies whose effects may be transmitted through multiple markets, or contain menus of different tax, subsidy, quota or transfer instruments.

The social accounting matrix for the United Republic of Tanzania was developed by the International Food Policy Research Institute following the framework presented in the study by Lofgren et al., 2002. Both the single-country static and dynamic versions of the Partnership for Economic Policy standard CGE models were designed for country-level studies adapted to the Tanzanian national economy. The model is implemented in the General Algebraic Modelling System (GAMS) and is solved using the continuous optimization solver CONOPT.



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Printing: UNON, Publishing Services Section, Nairobi, ISO 14001:2004-certified.  
D1 No.: 14-03776/250 copies

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