Other interested partners

A Green Economy Corridor in Kalimantan: Towards green growth based on innovative management of forest lands and natural resources

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Introduction

Indonesia has committed to realizing 7% GDP growth p.a. (by 2014) while achieving a 26-41% reduction in the emissions of GHG by 2020, and significantly and sustainably improving the well-being of its people whilst doing so. The natural resources sector, particularly forests and forestry, must play a significant role in the achievement of these targets.

In the words of H.E. Susilo Bambang Yudhoyono, President of the Republic of Indonesia:
"… We need solutions that will make economic growth and technology not the nemesis but the ALLY of our climate stability. And we need solutions that will serve the practical needs to slow, stop and reverse the process of climate change…
I believe Indonesia can implement green economy to achieve 7% economic growth and 26% reduction of greenhouse gas emissions from business as usual scenario in 2020.
To achieve those goals, Indonesia is seriously developing forest schemes to reduce greenhouse gases emanating from terrestrial sources; such as from forests and peat-lands…"

This concept note lays out how a consortium of partners convened by UNEP can support the REDD+ Task Force to achieve its mandate of *reducing forest based greenhouse gas emissions in Kalimantan, specifically Kalimantan Tengah, while at the same time generating multiple benefits for people's livelihoods, the economy and conservation*.

Recognising the urgency of the demands placed on the REDD+ Task Force, this proposal focuses on actions that can be achieved in the short term, i.e. the next six to twelve months, while recognizing that achieving green growth requires a longer, structured process of ensuring cutting-edge science and technology truly inform policy making and implementation.

Goal

REDD+ finance used to incentivize the transition towards a Green Economy in Kalimantan, in order to support Indonesia's targets of 7% GDP growth, food security, wise use of natural resources and contributions to poverty alleviation, and 41% carbon emission reduction by 2020 (of which 15% with international support), based on Kalimantan's valuable biodiversity, ecosystem services and contribution to CO2 emissions.

Objectives

In order to achieve this, a number of actions will be required, including:

1. REDD+: avoiding deforestation and forest degradation while identifying opportunities for forest restoration. Including but not limited to Norway's $ 1 billion REDD+ commitment.
2. Sustainable Palm Oil: increased use of degraded lands for sustainable palm oil and identifying sustainable opportunities for increased productivity and production
3. Agriculture: investment in ecologically friendly practices for smallholder farms, including sustainable intensification (especially in mixed rice systems), low tillage farming, multi-cropping, farm biomass, and additional lines including agroforestry and high-value crops
4. Forest management: investments in improved practices, NTFPs and 'trees on farms/outgrower schemes' around forested areas, to reduce pressure

5. Freshwater Management: improved freshwater and waterway management to support plantations, REDD+ afforestation along water ways, and transportation of mining output on waterways due to reduced siltation
6. Improved Fisheries Management
7. Better land-use and spatial planning & management, recognizing the importance of ecosystem services and biodiversity conservation and what they deliver towards community livelihoods, eco-tourism potential, soil and water conservation, and agricultural resilience against floods, drought, landslides etc caused by ecosystem losses
8. Energy and Mining: alternative energy sources, improved management of locations, reforestation & revegetation, etc.
9. Urban clusters: Identification of opportunities related to the importance of developing pools of human capital and especially nascent cities and agglomerations of human expertise pools as a means of delivering 7% growth, such as in information technology and services (finance, insurance etc.) related to the economic value of ecosystem services.

Key Outputs and Outcomes

Phase 1 - In the next three months:

Building on consultations with key stakeholders, develop and deliver

- a credible inclusive, innovative *economic scenario* for a 'Green Economic Corridor' in Kalimantan, using the "Threshold-21" model used by UNEP's Green Economy Report (Annex 2), which accounts for social, economic and environmental factors and demonstrates competitive social returns on investment and sustainable development. This will provide an alternative to the current 'business as usual' approach that does not fully take into account the sustainable, economic potential of ecosystem services and therefore delivers sub-optimal results in terms of development and GDP growth.
- *A proposal* that outlines a programme of work on developing an integrated investment package to urgently realize the Green Economic Corridor.
- *A mission* to explain outcomes and support the Government of Indonesia.

Details of Phase 1 are provided in Annex 1.

Phase 2 - In the following nine months (months 4-12):

- Develop a first draft of the integrated investment package and submit it to stakeholder consultations among key decision makers at national and provincial level and reviews at several scales.
- Carry out an initial ex-ante impact analysis of the anticipated investments on livelihoods, forests and economic systems, using a participatory process involving scenario analysis and stakeholder consultations
- Support capacities of key national and provincial governmental and non-governmental stakeholders to analyse implications of the emerging integrated investment package for policies and land-use planning
- Collate the results of broadbased stakeholder consultations at different scales
- Establish an institutional and organizational framework within which to anchor the envisaged work programme

- Support the development of a communications package on these achievements for Durban (December 2011) & Rio + 20 (June 2012)

Phase 3 - In the following 12-24 months (i.e. months 13 and beyond):
Continuing the work outlined above in order to support national and sub-national efforts to:

- *Deliver credible proposal(s) for integrated investment packages to international and national audiences*
- *Implement investment agreements that generate significant flows of investments into the Green Corridor*
- *Strengthen national organizational and institutional frameworks that can guide and further develop the process*
- *Convene an international support group that can be called upon to provide further capacity strengthening support as required*
- *Develop long term specific and dedicated capacity strengthening programs to support business and entrepreneurship related to realization of the investment plans as well as at all levels of government (across agencies) and communities*

As a result of which

- *Opportunities for additional green jobs, incomes and economic benefits will be identified,*
- *Access and Benefit Sharing systems (ABS) will be improved,*
- *Green House Gas emissions from forests will be decreased and*
- *Risk and threat levels to conservation of biodiversity will be lowered*

Details of Phases 2 & 3 will be submitted as part of the *proposal* developed in Phase 1.

Proposed Process

A phased process is proposed, that would follow the time line above. Towards the end of each Phase decision makers would be required to make a decision to either:

1. accept the course of action proposed for the next phase and therefore continue, or
2. not accept the course of action proposed, in which case a further decision would be required:
    a. whether to reflect, revise and resubmit the proposals
    b. whether to close the program at that stage

This is designed as a collaborative programme with different organizations collaborating, with different sources of funding and addressing different parts of the challenge, to collectively realize the goal of helping to create a Green Economy Corridor. Management and governance structures will reflect this 'open tent' approach.

Overall leadership would be placed within the Indonesian Government. UNEP sees its role as helping to convene international partners, expertise and capacities, and helping to catalyse the process based on its technical competencies in the arena of Green Economy and REDD+. For this purpose UNEP would draw on the support of the UN System, especially those parts that are engaged with REDD+ and the Green Economy, as well as its extensive networks among other types of partners.

Following Minister Kuntoro's letter to UNEP's Executive Director (Annex 3), it is clear that phase 1 should commence immediately. A workshop to further refine this concept note, scope the scenario and develop an outline for the proposal will take place on August 12&13 in Jakarta Partners listed in Annex 1 have agreed to support the project as described above, however the nature of this will still need to be worked out in the workshop described in the point above.

Annex 1: **Details of outputs and activities proposed during Phase 1**

1. A scenario (report), based on modeling analysis that clearly articulates how a reduction of different amounts of carbon emissions can go alongside with different growth rates, poverty reduction and job creation rates, while maintaining essential ecosystem functions and biological diversity. The report will be based on the Threshold-21 family of models which will be fully customized to the objectives of the project and the local issues to be analyzed. The model will account for social, economy and environmental factors and will be fully integrated across these sectors. Key underlying mechanisms o the modeling methodology proposed include the explicit representation of causal relations, feedback, non-linearity and delays – allowing for the generation of dynamic medium to longer term scenarios for policy formulation and evaluation in "what if" framework. The initial report – and model – will be based on existing data and knowledge, so as to speed up the process and will be uniquely customized to the area and issues to be analyzed. The simulations (or scenarios) will be aligned to the goals of the government, and economic performance (as well as emissions, to name one indicator) will be driven by the combination of social, economic and environmental indicators.

The goal for the initial modeling work would be to show potential synergies and bottlenecks within and across sectors, resulting from policies and interventions simulated. It would also identify the broad potential of the Green Corridor and provide an indication of the nature of investments required. This of course would be done using a truly integrated approach (going beyond a mere economic analysis that assumes many externalities, which will instead be internalized and estimated).

The model will be developed to include, among others population, education, public infrastructure and provision of social services (in the social sector), as well as government and households accounts, balance of payment, etc. (in the economic sector), and land allocation, resource-based production (fishery and forestry among others), energy demand, production and consumption, air emissions, water demand and supply (in the environment sector). In other words, the report and the model/analysis will be expected to stand criticism from conventional economists and at the same time gain support from social and environmental experts. Subsequently the model can be refined with additional data, if necessary. This T21-Kalimantan model will be developed as an integrator of knowledge generated at the sectoral level, as well as a catalyst for more detailed studies and research projects in the future. It can be made spatially explicit through use of GIS data at different resolutions. Some of the data and information required to run the model is not available in the public domain. However as the Govt. of Indonesia is to be an integral partner in this undertaking, it is expected that such data will be available, with the assurance that such data will only be used in confidence and as agreed.

2. A proposal and work programme on how the opportunities identified in the report above could be realized through a detailed work programme that identifies work streams related to:

- Identifying and developing an integrated investment package to support the green corridor, including due diligence on the benefits expected
- Assessing and managing the potential impacts of the investment package using a process of stakeholder engagement and scenario analysis to simulate and 'test' the impacts of proposed investments

- Developing policies and measures to safeguard benefits and investments
- Supporting the institutional and organizational frameworks required for the work programme, including management of partnerships and resource mobilization
- Stakeholder engagement, communications and outreach related to the programme
- Data, related to economic, ecological and social aspects required to bridge information and knowledge gaps

3. A mission, led by Mr. Pavan Sukhdev, consisting of eminent experts and representatives of the partnership involved that would present the outputs mentioned above and consult with the Government of Indonesia on the way forward. The Mission will discuss results/options with key Ministers and, if deemed necessary, the President. The output of the high level mission will be a "roadmap for transformation": process, timeline, budget, roles and milestones. The roadmap would lead to realizing the transformation investment package, with pledges, institutional arrangements and capacity to deliver.

Partner contributions

Presidential Unit for Monitoring and Oversight of Development
Overall guidance and steering of the project

Pavan Sukhdev & GIST Advisory
Advisors to the programme, and participants in scoping the economic analyses and inputs to Threshold-21 to make it fit for use at provincial level and in an economy focused on use and optimization of natural capital

UNEP
Overall strategic direction, convening international partners, funding support, technical support to identification of investment package (including background research) as well as impact studies through use of participatory scenario analysis, support to stakeholder engagement, and communication. Mapping and spatial analysis of multiple benefits of forests under REDD+, including in relation to conservation areas.

WWF
Overall lead in stakeholder engagement processes and support in providing necessary available data, information and knowledge. This includes scenarios, data and information used for biodiversity and ecosystem services assessment as well as outputs of InVEST models and other geospatial analyses, relevant spatial plans (including the Heart of Borneo Strategic National Area). WWF Indonesia has extensive on the ground experience and projects who can play a significant role in the medium to long term.
This includes Heart of Borneo partner organizations:

- Price Waterhouse Coopers
- Witteveen & Bos
- PT Hatfield

All of whom may taken on their own roles as the initiative develops (see subsequent section), to provide guidance and inputs during scoping workshop in the first phase.

Millennium Institute:

Creation of a Threshold 21 model adapted to deliver the T-21 Kalimantan model, simulation and scenario analysis. The MI team will provide guidance on, and support data collection, consistency check of the available information and the integration of this information into a unique framework of analysis already applied to sustainable development issues, green economy and climate analysis is over 40 countries over the last 28 years. The MI team will also support the preparation of the final report, using inputs and contributions on the analysis of the results from the whole project team.

UNDP
Technical and administrative support to the project, based on their role within the UN-REDD Programme, TACC etc.

Prof Mubariq Ahmad
Economic and policy expertise and advice related to development approaches based on sustainable use of ecosystem services and the green economy.

Annex 2 Threshold 21 Model – exemplary Outputs

The Green Economy Report, excerpt to illustrate the use of the T21 modeling approach to analyze options and opportunities of the green corridor in Kalimantan.

The simulation of future scenarios with an integrated cross sectoral model highlights the characteristics of the green economy approach and allows the reader to assess the broad impact of both brown and green investments. These impacts are summarized below.

The brown investment scenarios (BAU1 and BAU2), projected to increase GDP and employment, following BAU trends of resource efficiency and carbon intensity, show a growing depletion of natural resources. More specifically, water stress will worsen, impacting population growth, agriculture and industrial production. A larger number of vessels in the fishery sector will allow fish catch to rise in the short term but fall in the medium to longer term, limited by a considerable decline of fish stock in the next forty years. The increased use of chemical fertilizers is projected to increase yields in the agriculture sector in the short term at the expenses of a longer-term decline of soil quality. This will require more land -converted from forest area to farmland- to feed the growing population. Moreover, the increasing use of fossil fuels projected in the brown scenarios will further jeopardize energy security and curb economic growth, especially through higher energy (especially oil) prices. As a consequence of high fossil fuel dependency and deforestation, CO_2 emissions are projected to grow beyond BAU over the forty-year period. As a consequence, while GDP will still grow, its dependency on natural resources will increase, pushing our ecological footprint to over two times the available biocapacity by 2050.

In the green economy scenarios one observes significant efficiency improvements, resource conservation and carbon mitigation, which contribute to a stronger and more resilient economic growth in the medium and long term. The sustainable management of natural resources, resulting from a reduction in fishing capacity, a decline in deforestation, promotion of organic fertilizer and cutback on fossil fuel use, will allow the restoration of stocks of key natural resources, or greatly mitigate their depletion. For example, fish stocks, forestland and soil quality are estimated to increase by 64-106%, 21% and 21-27% relative to BAU by 2050, which will benefit the production of these sectors. In addition, the efficiency improvement of water and energy use in a number of sectors will considerably curb the consumption of these resources (below BAU by 34-50% for fossil fuels and 24-19% for water in 2050) and avoid negative consequences arising from their depletion. With increased carbon sequestration from forests, the potential sequestration from conservation agriculture (still to be estimated in details), and the substitution of traditional energy resources with low-carbon alternatives, CO_2 and GHG emissions will be considerably lower than BAU over the next forty years.

More and more decoupled from consumption of natural resources, GDP growth is expected to be slower than BAU and brown scenarios in the short-term, but to surpass

them in the medium to long term, as annual GDP is projected to be 6-11% and 16-32% above the baseline scenario over the next twenty and forty years in the G1 and G2 cases respectively, with an average annual growth rate of 2.4-2.8% throughout 2050. Worth noting, while BAU investments show a higher return on investment (ROI) in the short and medium term, green investments indicate higher economic ROI in the longer term, outperforming BAU investments by over 25% throughout 2050 –yielding, on average by 2050 over $3 for each dollar invested. Also, both investments yield positive economic returns after about 9-11 years in the green cases and 7-9 years in BAU scenarios. Taking into account the improved maintenance of natural capital in the G1 and G2 scenarios, an adjusted and more holistic measure of economic growth would probably perform even more favorably relative to the brown scenarios (see text box). Driven primarily by green investments and the subsequent push to economic development, total net direct employment in the sectors analyzed in this chapter is projected to be lower than brown cases in the short term, and to then rise above both brown and BAU scenarios in the medium to long run (2-3% above brown scenarios and 8-14% above BAU in 2050). When total employment is considered, the green scenarios are expected to converge to the corresponding brown cases in the longer term, and exceed BAU by 3-5% in forty years. These results point to the need for policies that recognize and manage the transition costs involved in moving towards a green economy, with a focus on an equitable distribution of costs and benefits that emerge from new opportunities.

Figure 1: *Trends in GDP growth rate, historical data (WDI, 2009) and projections in BAU, BAU2 and G2 scenarios*

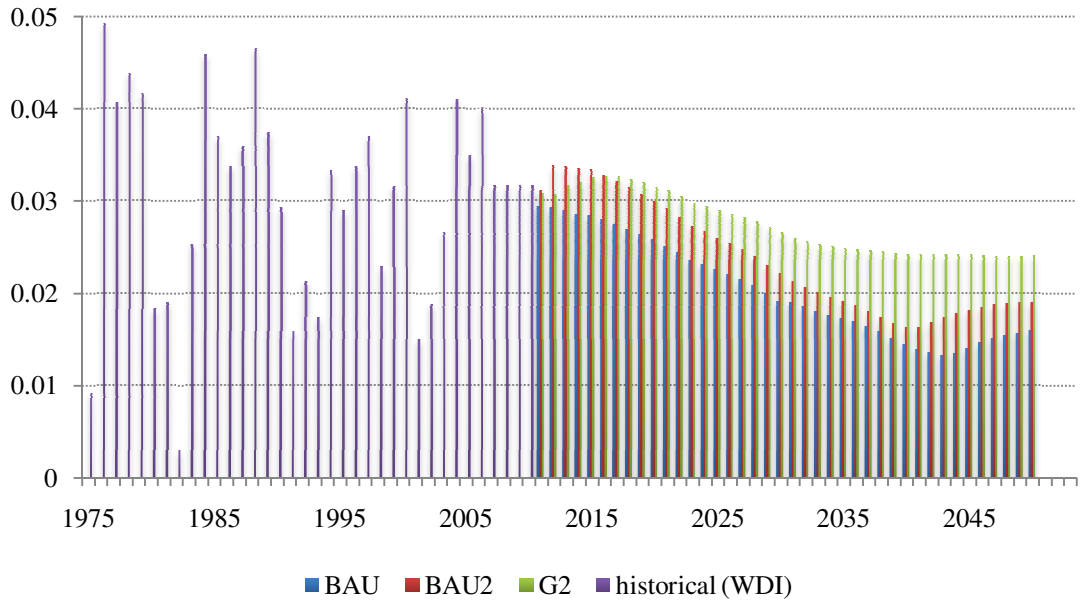


Figure 2: *Trends in GDP growth rate (secondary axis) and stocks of natural resources (primary axis: oil discovered reserves, fish stock and forest stock, relative to 1970 levels), in the BAU and G2 cases. Stocks are better managed and saved for future generations in G2, while supporting GDP growth already in the medium and longer term.*

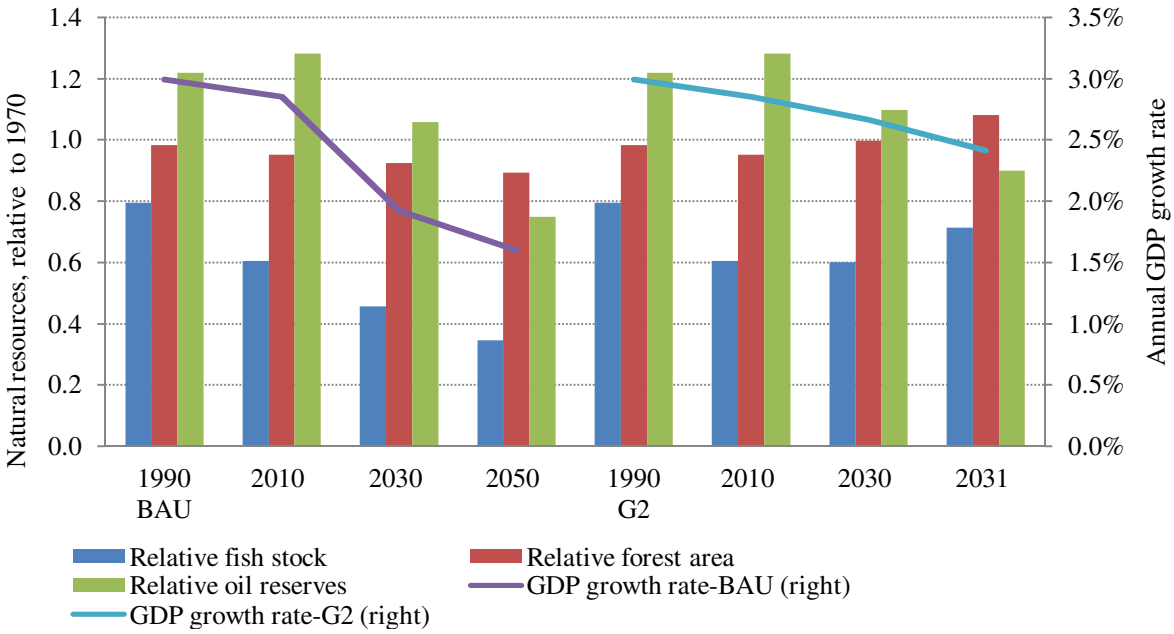


Figure 3: *Results of the G2 scenario in 2015, 2030 and 2050 relative to BAU2 (%). Selected indicators: real GPD, employment, poverty (population below poverty line), nutrition, water stress, footprint-biocapacity ratio.*

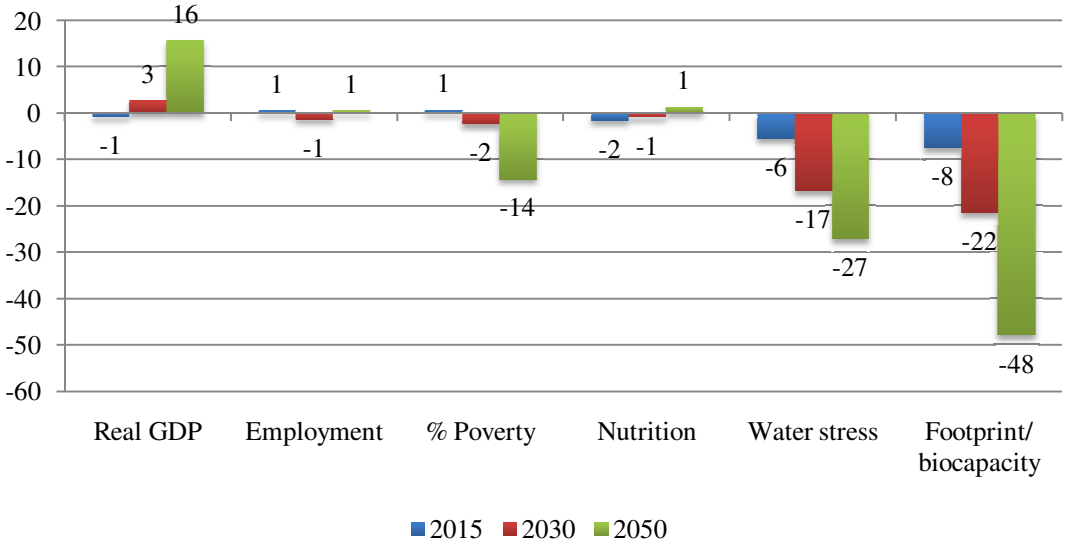
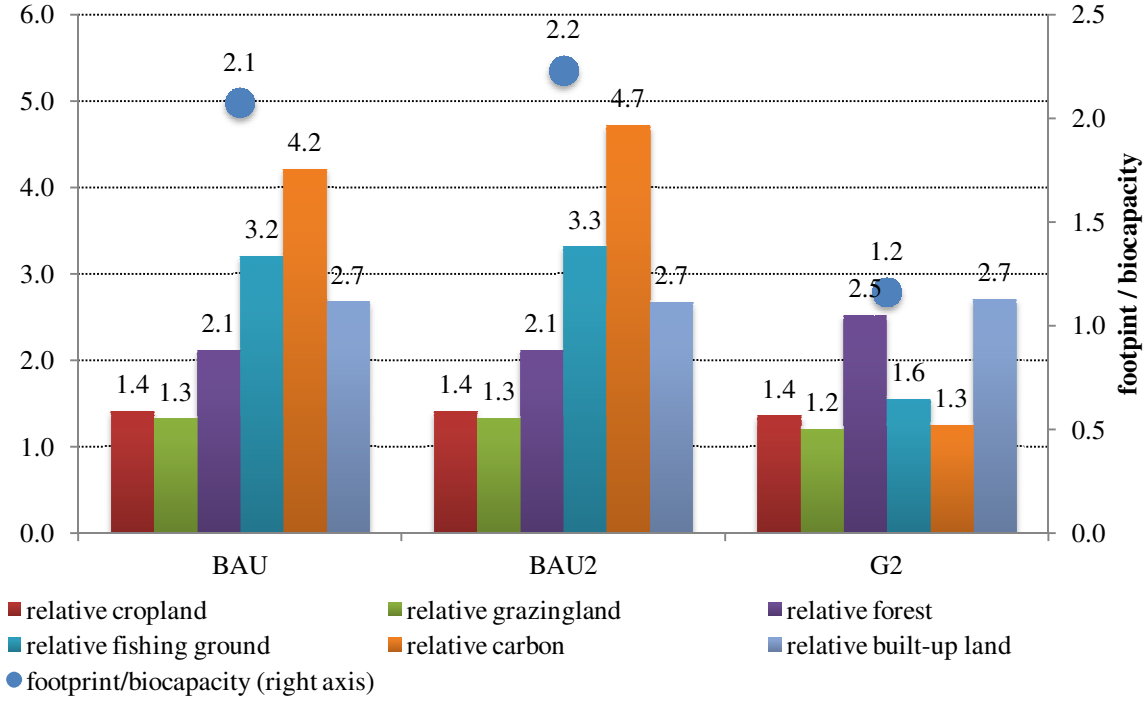


Figure 4: *Composition of ecological footprint in 2050 in various scenarios, relative to 1970 value (primary axis), and indication of the projected footprint-biocapacity ratio in 2050 (secondary axis)*



Text Box 1: Changes in natural capital stocks

Conventional economic indicators, such as GDP, provide a distorted lens on economic performance particularly since such measures fail to reflect the extent to which production and consumption activities may be drawing down natural capital. By either depleting natural resources, or degrading the ability of ecosystems to deliver economic benefits, in terms of provision, regulating or cultural services, economic activity may be based on the depreciation of natural capital. Various alternative approaches to adjusting the system of national accounts and aggregate economic indicators are being refined and discussed at the international level (e.g. Integrated Environmental and Economic Accounting – SEEA[1]).

The T21 model tracks the evolution of various natural resource stocks over time as highlighted in Figure 12 and in more detail in Appendix VI. The green economy scenarios are characterized by investment in and recovery of these stocks, providing a basis for sustained income gains over the medium to longer term.

It is insightful to undertake some additional calculations, using relatively simplistic assumptions, to generate some sense of the potential economic magnitude of the improved management of natural capital. The table below presents changes in the value of three resource stocks – fossil fuels, forests and fisheries – over the short and medium term in both absolute terms and relative to GDP. The change in physical values for fossil fuels and fish is valued using estimates of the economic value (unit rent), and for forests, using estimates from TEEB. Following the methodology employed by the World Bank (2006), these estimates of depreciation (or appreciation – where changes below are positive), these amounts can be seen as reflecting additional components of a measure of negative net savings in global wealth (as could be represented in asset accounts following system of national accounts).

According to these calculations, annual drawing down fossil fuel stocks is equivalent to 1.8% of current GDP. Under BAU, this remains roughly the same in the short term and then rises in the medium to longer term. The G1 and G2 scenarios reverse this trend with this depreciation, as a ratio to GDP, declining over the period 2010-2050, reaching 0.5% of GDP by 2050 under G2, reflecting the marked reduction in fossil fuel dependence of the global economy in this scenario.

Lower and upper bound values of the value of the depreciation of natural capital in the form of forest land are presented due to the wider range of uncertainty concerning global reference values (see Appendix VI which makes use of results from TEEB research). Current depreciation of forestland is thus estimated at between USD 2.8 billion and USD 2,609 billion – spanning three orders of magnitude – which is between 0.01% and 5.4% as a proportion of GDP. Note that the higher range estimates are comparable to, and indeed well above, those for fossil fuels. The green scenarios considerably reduce this loss within the short term and turn it around into modest positive growth – or appreciation instead of depreciation – by 2050.

Similar improvements can be seen in fish stocks. The current estimate of depletion of this natural asset is valued at USD 116 billion per year, which is -0.24% when expressed as a ratio to GDP. The green scenarios succeed in reducing this lost and over the medium to longer term, stabilizing it or turning into a net appreciation.

Although a range of results is only presented for forest resources, due to the wide range of existing measures, the estimates for fossil fuels and fish could also be developed into ranges. These would however probably not have the same degree of variability as those for forests.

It is important to bear in mind that even though the results are presented in a way that makes comparison between the estimated depreciation of the different assets comparable, this should be done and interpreted with care. In particular, the three assets are not substitutes for each other. Fossil fuels are a source of energy. Forests, including how they are valued here, provided a range of provisioning and regulating services, both locally but also much more widely, including even globally. Fisheries provide a major source of protein and employment to a substantial proportion of the world's population

Forestry (modeling chapter)

In the green economy scenarios, green investment in the forestry sector, totaling $40 Bn per year on average between 2010 and 2050, is allocated to both deforestation reduction and reforestation. The average annual deforestation rate of natural forests in the green scenarios is projected to be 50% lower than BAU between 2010 and 2030 (See Figure 5 and Figure 6). With the deforestation rate declining to 6.7 M ha per year from 2030 in the green cases, an estimated 283 M Ha (or 8%) of natural forest area is saved. Additional green investments will considerably increase reforestation (planted forest) to 19 M Ha per year in 2050. Thus, planted forests will be 497 M Ha (or 143%) more than BAU by then, providing sufficient resources for forestry production to exceed baseline projections in the longer term (after 2015). In accordance with the forestry production growth in green cases, forestry employment will be reach 30 M in 2050, which is 20% above BAU. As a result of the enhanced reforestation and avoided deforestation efforts, total forestland is projected to reach 4.5 Bn Ha over the forty-year period, outperforming the BAU case by 21%. This will allow 502 Gt of carbon stored in the forest ecosystem in 2050, which is 71 Gt tons above BAU and 21 Gt lower than current level. Also, higher forestland improves soil quality and often increases water availability, two factors that positively impact agriculture production (Pretty et al., 2006). In the short term, however, the efforts of reforestation (2.5 and 3 times of BAU) and avoided deforestation (60% and 46% above BAU) due to green investment do not lead to immediate impacts on the environment due to delays especially in increasing planted forests. The total forest area (around 4 Bn Ha) is projected to be 1% and 3% higher than BAU in 2015 and 2020. Forestry production will start seeing benefits around 2020, reaching $840 Bn of value added in 2020, which is 12.5% higher than baseline, creating 3 M additional jobs.

Forests are very important for many countries, where both their harvesting and preservation are important economic drivers. In certain cases waste land could be converted to forests over time, without negative impacts on agriculture and settlements. Simultaneously, better control measures would reduce the rate of deforestation, limiting fast depletion of forestland and natural resources.

Figure 5: *Land allocation in 2050 in BAU and G2 Scenario, in Billion Ha and as a share of total land*

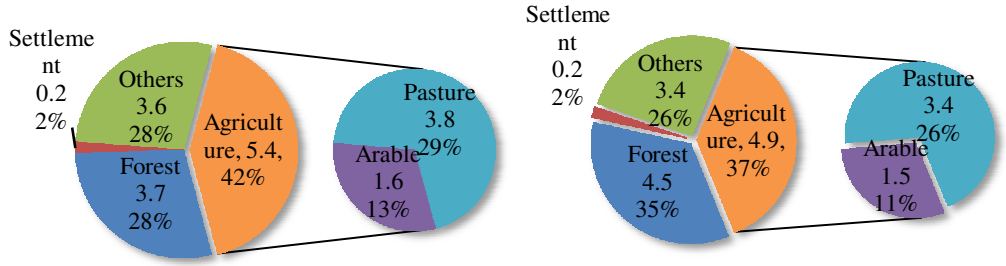
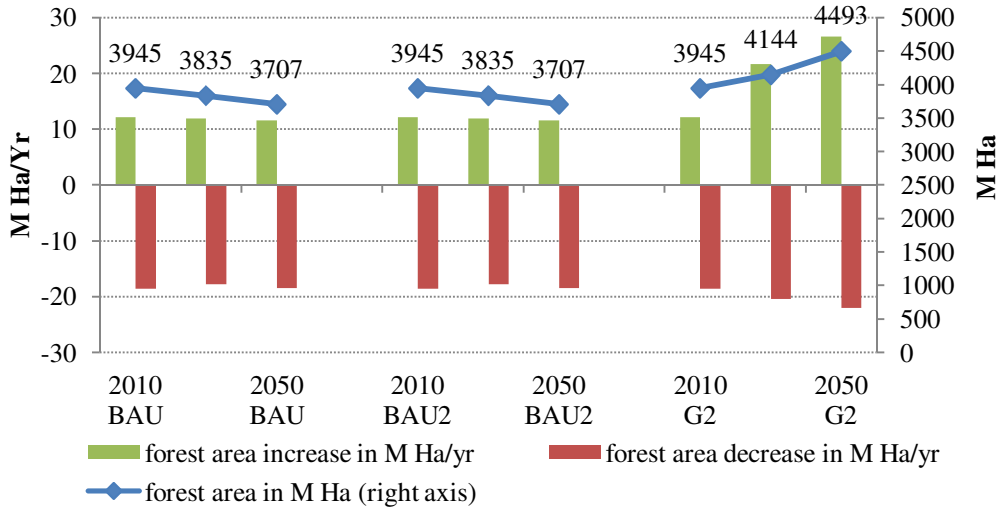


Figure 6: *Total forest stocks (secondary axis), and flows of deforestation and reforestation (primary axis) in BAU, BAU2 and G2 scenarios*



4. Modelling green investment in forests (GER forestry chapter)

In this section the impacts at a global level of increasing investment in two of the actions discussed in the previous section are examined. We focus on private investment in reforestation and public investment in payments to avoid deforestation. This is because both of these actions are highly likely to play a role in climate change mitigation and will form part of a post 2012 international climate agreement.

4.1 The green investment scenarios

These scenarios assume that 0.034% of global GDP is allocated for reforestation and incentives for avoiding deforestation/forest protection and reforestation between 2011 and 2050. This equates to US$40 billion – in constant US$2010– per year on average, with 54% or US$22 billion going to reforestation and 46% or US$18 billion per year to avoided deforestation.

This is similar in order of magnitude to estimates made in the 1990s of the amount of investment needed for sustainable forest management in production forests of US$33 billion per year (Tomaselli 2006) and the estimates made in recent years for the cost of avoiding deforestation which range from US$5 billion to US$15 billion per year (Stern 2007; Grieg-Gran 2006) to US$17-28 billion (Kinderman *et al.* 2008)). The amount indicated for avoiding deforestation also compares well with the estimate of US$12-17 billion per year made in Section 3.2 of the investment needed for effective management of protected forests (based on Balmford *et al.* 2002).

4.2 The baseline scenario

In the modelling conducted for the Green Economy Report, the baseline scenario for the forest sector replicates history over the period 1970-2009 and assumes no fundamental changes in policy or external conditions going forward to 2050. The baseline scenario projects a continuing decrease in forest area from 3.9 billion ha in 2010 to 3.7 billion ha by 2050. Due to continuing deforestation and forest degradation, carbon storage in

forests will decline from 523 Gt in 2009 to 431 GT in 2050. The contribution of the forest sector to GDP and employment is projected to grow at 0.3% per year between 2010 and 2050 to reach US$0.9 trillion and 25 million jobs by 2050. This is in line with growth rates in the sector between 1990 and 2006 (FAO 2009).

4.3 Investing to reduce deforestation

The cost of avoiding deforestation is assumed to start at US$1,800 per ha increasing to US$2,240 by 2050. This is based on the global average value added per hectare of crop production plus the value added of forest products per hectare (measured in constant 2010 US$) which is taken to represent the opportunity cost if forests are conserved with no extraction of forest products or clearing. This approach to estimating opportunity cost is somewhat different from that taken in a number of studies on this topic (e.g, Grieg-Gran 2006; Börner *et al.* 2010) which add together the present value of agricultural revenues net of cost discounted over several years and the stumpage fees for timber but the result is within the range of most such estimates[1]. It can be considered a generous estimate of the opportunity cost as in many locations the returns to converting forests to smallholder agriculture, subsistence and cash crops and to cattle ranching are considerably lower than US$1,800 per ha. This figure is more representative of higher value land uses such as oil palm (see Grieg-Gran 2006, Chomitz *et al.* 2006; Börner *et al.* 2010).

On the other hand, the cost of designing and administering a payment scheme, the so-called transaction costs, can be considerable particularly in developing countries and in remote forest areas. While existing national level PES schemes in Costa Rica and Mexico have administration costs of well below 10% of the overall amount spent, analysis of the Bolsa Floresta scheme in Amazonas state in Brazil indicates a much higher percentage, around 40% (Viana *et al.* 2009). The cost figure used in this model is high enough to incorporate some provision for transaction costs.

The investment would enable payments to be made to forest landholders over a steadily expanding area, with the yearly increase reaching 6.76 million ha by 2030 and then decreasing to 6.66 million ha by? 2050, in effect reducing the annual rate of deforestation by just over 50%. This is consistent with a number of studies which have examined the costs of avoided deforestation, which have predominantly estimated the cost of reducing deforestation by 50% (Stern 2006; Eliasch 2008; Kinderman *et al.* 2008).

4.4 Investing in planted forest

The cost of planting forests is assumed to be US$1,630 per hectare based on the costs of reforestation in the Costa Rica national PES scheme which pays farmers US$980 per hectare (Robalino et al. 2010) to cover 60% of the costs of establishment (Miranda *et al.* 2003). This is within the range of costs estimated for production planted forests which is the type of reforestation under consideration here. The modelling examines the full cost to a landowner of establishing a planted forest rather than the incentive payment that

[1] It is equivalent to the cost of purchasing the land or the cost of making annual payments (as in PES schemes) to compensate for forgone annual returns to land over an appropriate time period (30 -50 years) discounted at an appropriate rate.

might make such a land use competitive. On average, the investment allocated will cover the cost of reforesting an additional 9.6 million hectares per year or 386 million hectares over the 40 year period.

4.5 Impacts of investment in reducing deforestation and in planted forest

The economic and environmental impact of these green investments have been modelled by the Millennium Institute (Bassi *et al.* 2010) and results are shown in Table 8. In the short term the reduction in deforestation leads to a decrease in the value added of the forest sector (wood, wood processing and pulp and paper) so that it is 1.7% below the baseline in 2013. Similarly, employment is 2% below the baseline level in 2013. But this does not take account of the economic impacts on other sectors such as tourism which may benefit from the reduction in deforestation and also the economic value of the carbon emission reductions. In the longer term as the area of planted forest increases, value added in the conventional forest-based industries increases to US$ 10.4 trillion, some 19% above the baseline scenario. The increase in forest industry value added is accompanied by an increase in employment from 25 million to 30 million worldwide, or 20% above the baseline scenario.

The main environmental impacts are the effect on the area of natural forest which in 2050 is 8% higher in the green investment scenario than in the baseline scenario, and on the total area of forest (natural and planted) which in the green investment scenario is 21% higher in 2050 than in the baseline scenario and 14% higher than the current forest area. This in turn has positive implications for biodiversity and carbon storage and results in reduced greenhouse gas emissions. The increase in the forest area is made possible by the investments in improved productivity in the agriculture sector (see Chapter on Agriculture). This means that demand for agricultural production can be met from a smaller area of land, freeing up land for reforestation or afforestation. It also means that there is less pressure on natural forest.

Table 8 Comparison of baseline[2] and green investment scenario

Key forest sector indicators in 2050	Baseline	Green Investment 2
Natural forest area	3.36 billion ha	3.64 billion ha
Deforestation rate ha/year	14.9 million ha	6.66 million ha
Planted forest area	347 million ha	850 million ha
Total forest area	3.71 billion ha	4.49 billion ha
Carbon storage in forests	431 billion tonnes	502 billion tonnes
Gross value added	0.9 trillion	US$1.4 trillion

[2] In the case of the forestry sector, there is no significant difference between the BAU scenario and the BAU2 scenario, in which an additional 2 per cent of global GDP is invested following existing business-as-usual trends (see the Modelling chapter for more explanation of the scenarios). Hence the green investment scenario, in which 2 per cent of global GDP is allocated to a green transformation of key sectors can be compared to the BAU, here termed "Baseline", which also represents the model's projections of future trends on a business as usual path.

Employment	25 million	30 million

These projections indicate the potential of increasing green investment in the forest sector. But much depends on how the investment is made and in what policy and institutional context. As discussed in Section 3, reforestation programmes do not always work financially, socially or environmentally, and the small amount of investment in avoiding deforestation so far, mainly in the national PES schemes in Costa Rica and Mexico, has struggled to demonstrate cost-effectiveness. Large investment programmes on the scale modelled here will be more challenging although they can draw lessons from the existing experience. Global aggregate projections of this nature cannot, due to limitations of their design, capture the differences in response between tropical countries and non-tropical countries, or between countries with high forest cover and low forest cover, or between high income and low income countries. They do, however, indicate what can be achieved at a global level in the appropriate policy and institutional conditions.

Annex 3: Letter from Minister Kuntoro Mangkusubroto, Head Presidential Unit for Monitoring and Oversight of Development, Chair National REDD+ Taskforce to Mr. Achim Steiner, Executive Director of UNEP (*not attached here***)**