



Inception Report

Project Kick-Off Workshop of RESTORE+: Addressing Landscape Restoration for Degraded Land in Indonesia and Brazil

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The RESTORE+ project is implemented by the International Institute for Applied Systems Analysis (IIASA), World Agroforestry Centre (ICRAF), Brazil National Space Research Agency (INPE), Brazil Institute for Applied Economic Research (IPEA), UN Environment-World Conservation Monitoring Centre (UNEP-WCMC), World Resources Institute (WRI) Indonesia, World Wildlife Fund (WWF) Indonesia, Mercator Research Institute on Global Commons and Climate Change (MCC), Environment Defense Fund (EDF), London School of Economics (LSE) Grantham Research Institute on Climate Change and the Environment and Landmapp.

The project is part of the International Climate Initiative (IKI). The German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB) supports this initiative on the basis of a decision adopted by the German Bundestag.

Executive Summary

- The RESTORE+ project is a five-year partnership that aims at addressing challenges surrounding the Food-Land-Energy nexus of restoration or utilization of degraded areas. The project will be implemented in Indonesia and Brazil, with limited activities in the Congo Basin.
- The project aims to inform key restoration-related policies in Indonesia (e.g., the National Mid-Term Development Plan 2020-2024, Nationally Determined Contributions (NDCs), the National Biodiversity Strategies and Action Plan (NBSAP) and in Brazil (e.g., ministry regulations and technical guidelines related to the implementation of Brazil's Forest Code to help achieve objectives such as those in its NDC and NBSAP).
- To achieve its goals the project will develop and apply approaches for identifying degraded areas and conducting multi-objective modelling and trade-off analysis. Moreover, the generic methodologies developed will be suitable for further application elsewhere, increasing the impact of the project.
- Landscape-level restoration involves complicated interactions of multiple measures. Questions may arise as to how these site-specific restoration outcomes contribute to the aspirational targets of national/global restoration efforts.
- A prerequisite of restoration is the identification of degraded areas. However, there is a strong disagreement regarding both the estimated amount—varying between 1 to 6 billion hectares globally—and the spatial distribution of degraded areas.
- Trying to come up with an agreed estimate of degraded areas may lead to lengthy debates that could potentially distract the project from its planned course. Therefore, identifying degraded land resources requires examination of various possible definitions of degradation. These definitions may feature biophysical characteristics that cannot be easily identified using conventional remote sensing measures or social characteristics that cannot be remotely sensed at all. RESTORE+ deploys innovative approaches (e.g., big earth observation data analysis and crowdsourcing) to capture information of such complexity.
- As restoration is a long-term process, *ex-ante* analyses are required to examine the implications of using different definitions of degradation as well as to assess the trade-offs of various restoration measures. RESTORE+ combines the biophysical and biodiversity aspects of degradation with social, policy and conservation dimensions. This is done through usage of enhanced datasets gained from innovative approaches mentioned above into biophysical modelling, economic land use modelling, spatial optimization of bioenergy commodities supply chains and biodiversity impact assessment.
- The project will also use relevant assessment results to examine the potential of scalable financing mechanisms such as sustainability certification or jurisdictional certification.

Table of Contents

Executive Summary.....	i
Table of Contents.....	ii
1 Background.....	3
2 The RESTORE+ project.....	4
2.1 Project goals.....	4
2.2 Project outputs.....	5
2.2.1 Indonesia.....	5
2.2.2 Brazil.....	6
2.2.3 Congo Basin.....	7
3 Methodology.....	8
3.1 Data enhancement to address degradation and restoration.....	8
3.1.1 Big Earth observation data analysis.....	8
3.1.2 Crowdsourcing.....	9
3.1.3 Participatory tools and grass-roots empowerment.....	10
3.2 Assessing environmental and social implications of degradation and restoration.....	10
3.2.1 Biophysical modelling.....	10
3.2.2 Economic land use modelling.....	11
3.2.3 Addressing biodiversity.....	12
3.2.4 Spatial optimisation of supply chain.....	13
3.2.5 Sustainability safeguard mechanisms to support restoration.....	13
4 Discussions for Implementation Plan.....	14
4.1 Overview of project activities.....	14
4.2 Adherence to proposal.....	17
4.2.1 Dealing with degradation.....	17
4.2.2 Contribution to Indonesia’s RPJMN 2020-2024.....	18
4.2.3 Needs for high resolution analysis of Forest and Landscape Restoration (FLR) in Brazil.....	18
4.2.4 Concerns over certification.....	18
4.3 Immediate actions and 2017 milestones.....	19
References.....	22
Annex 1: Kick-off Meeting Agenda.....	23
Annex 2: Participants.....	28

1 Background

The Bonn Challenge recently achieved a milestone of 150 million hectares of global restoration pledges, marking the increasing recognition of restoring deforested and degraded areas as an important means to enhance sustainability. The International Union for Conservation of Nature (IUCN 2012) estimated that realising this amount of restoration could generate 84 billion USD in economic benefits and 47 GtCO₂e in carbon sequestration. Restoration is also an important means of achieving the Convention on Biological Diversity (CBD) Aichi Target 15, the Rio+20 land degradation neutral goal and the United Nations Framework Convention on Climate Change (UNFCCC) Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) goal. IUCN promotes the approach of forest landscape restoration (FLR) which goes beyond forest areas. FLR is defined as the long-term process of regaining ecological functionality and enhancing human well-being across deforested or degraded forest landscapes. FLR entails balancing interdependent land uses in adjacent areas. These can be protected forests, plantations, production forests, ecological corridors etc.

Landscapes entail the presence of diverse and numerous stakeholders. Therefore, ensuring effective and sustainable results of FLR may require the application of multiple measures that suit the varying needs of stakeholders. An inclusive and participative process is clearly essential, since restoration strategies have to take into account specific needs of ecological functions, local rights and values, as well as other socio-ecological contexts. As landscape-level restoration involves complicated interactions of multiple measures and stakeholder participation, questions may arise as to how these site-specific restoration outcomes contribute to *ex-ante* targets of national/global restoration efforts.

More importantly, a prerequisite of restoration is the identification of degraded areas. Concerning the assessment of global, aggregated FLR outcomes, such a premise poses a significant risk. There is a strong disagreement regarding both estimated amount of land—varying between 1 to 6 billion hectares globally—as well as the spatial distribution of degraded areas (Gibbs and Salmon 2015). Moreover, identifying degraded areas also suffers from the lack of robust and operational definitions, which has meant that five global assessments on degraded land carried out between 1997 and 2003 refer to different measurable features of degradation, quality of datasets and spatial coverage (Safriel 2007).

Indonesia and Brazil both have significant potential for FLR and ambitious related policies in place. Indonesia's Climate Resilience Strategy mentions both reduction in forest degradation and utilization of degraded land for renewable energy as enhanced action priorities. At the same time, these measures are closely related to the land reform target of reallocating 9 million hectares to marginalised people. Indonesia also has a national target to rehabilitate 5.5 million hectares of degraded forests and land, and the newly established Peat Restoration Agency has the mandate to restore 2 million hectares of degraded peatlands by 2020. Brazil has made a commitment to the UNFCCC to restore 12 million hectares of deforested areas by 2030. Moreover, restoration—particularly through reforestation—is an important element of the Brazil's Forest Code, which consists of innovative policy instruments such as the Rural Environmental Cadastre.

2 The RESTORE+ project

The RESTORE+ project is a five-year partnership that aims at addressing challenges surrounding the Food-Land-Energy nexus that occurs during the restoration or utilization of degraded areas in Indonesia and Brazil. Activities in Indonesia comprise participatory mapping campaigns in combination with land-use and supply-chain modelling. The aim is to identify specific degraded areas with accompanying scenarios for restoration and sustainable utilization along with the implications for economic productivity, biodiversity, greenhouse gas (GHG) emissions and social impacts (e.g. land tenure rights). In Brazil, the project aims to enhance established land monitoring and modelling capabilities and support Brazil's contribution to meeting the "Bonn Challenge". The project will identify degraded areas, assess restoration options and explore trade-offs associated with the implementation of the Brazilian Forest Code.

2.1 Project goals

The objective of the project is to provide decision makers in the tropical region with lasting capacity, technical recommendations and enhanced datasets to inform the restoration of degraded and marginal areas. This calls for a comprehensive assessment of degradation and restoration, which requires the identification of degraded areas, multi-objective modelling and trade-off analysis. It provides the opportunity to develop a generic methodology that can be applied to other regions in order to maximise the impact of the results. To this end, while focusing on detailed assessment activities in Indonesia and Brazil, the project also covers the Congo Basin, to conduct dissemination and research outreach activities in this area.

Specifically, the project aims to generate information, tools and understanding on: 1) the extent and distribution of degraded land, 2) the socio-economic and environmental (e.g., GHG emissions and biodiversity) implications of varying definitions, and related uses, of degraded land, and 3) the options and trade-offs for ecosystem restoration or sustainable food/energy crop production on degraded lands.

In **Indonesia**, RESTORE+ aims to use the above to inform key national and sub-national policies. Relevant national policies that are targeted to utilize such information include the medium-term economic development plan (or RPJMN¹), nationally determined contribution (NDC), climate resilience strategy, and national biodiversity strategies and action plan (NBSAP).

Other than results, the project will also deliver modelling tools that can be used for further analyses or other related inquiries in the broader land use context. As model development and modelling assessment requires joint capacity building and close collaboration with local stakeholders, enhanced capacity in modelling and analysing results is also a crucial outcome of the RESTORE+ project.

¹ National Medium Term Economic Development Plan is popularly abbreviated as RPJMN from its Indonesian terminology of *Rencana Pembangunan Jangka Menengah Nasional*

In **Brazil**, the RESTORE+ project benefits from the successful results of the preceding IKI-funded REDD-PAC² project. Other than generating important technical assessments that are used as the basis of Brazil's NDC, REDD-PAC also resulted in the GLOBIOM-Brazil model (G. Câmara et al. 2015) and local modelling capacities that will further contribute to the RESTORE+ project. At this stage, RESTORE+ aims to inform official national documents (e.g., ministry regulations, technical guidelines, policy guidelines) that contribute to the implementation or enhancement of Brazil's Forest Code to help achieve objectives such as those in its NDC and NBSAP.

In the **Congo Basin**, activities are dedicated to gaining endorsement from stakeholders of the region (e.g., Ministries of Forest/Environment, COMIFAC, CN-REDD offices, Ministries of Agriculture) on the potential contribution of RESTORE+ project results to policy formulation or relevant activities of the stakeholders. Selected training activities will also be identified and conducted throughout the project which will result in enhanced capacities.

2.2 Project outputs

2.2.1 Indonesia

Tools, platform and participatory mapping campaigns (output I)

Since definitions and spatial assessment of degradation currently contribute uncertainty to the assessment of restoration potential, RESTORE+ will conduct innovative mapping and participatory campaigns that utilizes crowdsourcing measures to address these uncertainties. **Tools (e.g., mobile applications)** and **web-based platforms** will be developed and utilized to facilitate **crowdsourcing campaigns**. These campaigns will: 1) identify key ecological functions that characterise degradation, 2) collect biophysical and/or social information that is required in the assessment of degradation and restoration, and 3) generate **detailed maps** that are required as input data for multi-objective modelling and scenario analysis of degradation and restoration.

Due to technical and resource limitations, the project will focus on the provinces of South Sumatera and East Kalimantan when conducting detailed crowdsourcing campaigns for mapping degradation. Nevertheless, the developed tools and platform together with generated datasets will be made available to the public to allow application of the approach to other areas in Indonesia and beyond.

Technical assessment of degradation and restoration (output II & III)

A national assessment of degradation and restoration will be conducted to examine:

- the implications of using different definitions of degraded and marginal land for production, biodiversity and wider land use related issues,
- national scenarios on general land use impact related to land resource carrying capacity of key economic development activities (e.g., agriculture, transport infrastructure development, and industrial development),

² See www.redd-pac.org for more information.

- national scenarios of restoration and sustainable food/energy crop production on degraded areas, and
- scenarios for sustainable bioenergy production in Indonesia with detailed land resource identification and supply chain arrangements/policies.

The technical assessment will rely on processing relevant datasets, modelling the economics of land use change as well as supply chain optimization modelling. The assessments will generate **scenario impact maps, datasets of scenario analysis** and **reports** that will inform policy makers and other stakeholders in Indonesia. Extensive stakeholder engagement and joint capacity building to allow meaningful interaction are crucial elements throughout the modelling process. Therefore, the project will result in **operational models, accessible decision support tools** as well as **local capacity** that is capable of maintaining and further developing the tools.

Restoration and sustainability certification mechanisms (output IV)

Ultimately, the results of the technical assessment need to be translated into actual implementation of restoration activities. Sustainability certification and standards are important means that can mobilise private funds to this end. Using the results of the technical assessment, RESTORE+ will examine how restoration can be included into these existing demand-side measures. The project aims at generating **recommendations** and **disseminating** them to policy makers and certification bodies in order to ensure that other project outputs are delivered in a relevant manner.

2.2.2 Brazil

Enhanced maps of degradation (output V)

In Brazil, the RESTORE+ project focuses on tropical forest degradation. The project will utilize big data analysis methods to generate **yearly country map datasets** for the period of 2000-2020. These datasets will be made accessible to the public.

Technical assessment of degradation and restoration (output V & VI)

A national assessment will be conducted to examine:

1. implications of using different definitions of degraded land on production, biodiversity and wider land use in Brazil, and
2. national scenarios of restoration and sustainable food/energy crop production on degraded lands.

The technical assessment will utilize the GLOBIOM-Brazil model to **explore different scenarios, and generate associated maps, datasets and reports** that will inform policy makers and other stakeholders in Brazil. Specifically, the assessment will cover:

1. technical recommendations on the definition of the legal framework that will regulate the environmental reserve quotas market which is foreseen in Brazil's Forest Code;

2. technical recommendations on the formulation of Brazil's national policies for forest protection (including Amazon Region Protected Areas (ARPA)) and forest restoration considering the Forest Code (including Rural Environmental Cadastre) and international REDD+ arrangements to which Brazil has agreed to take part; and
3. identification of the target areas for forest restoration in Brazil, considering socio-economic costs and benefits, biophysical constraints, and national environmental policies for forest regrowth after deforestation and degradation, to support Brazil's contribution to the Bonn challenge.

Datasets from the technical assessment will be disseminated to the wider public through a **web-based analytical and visualisation tool** which will also be useful for national and local planners in Brazil.

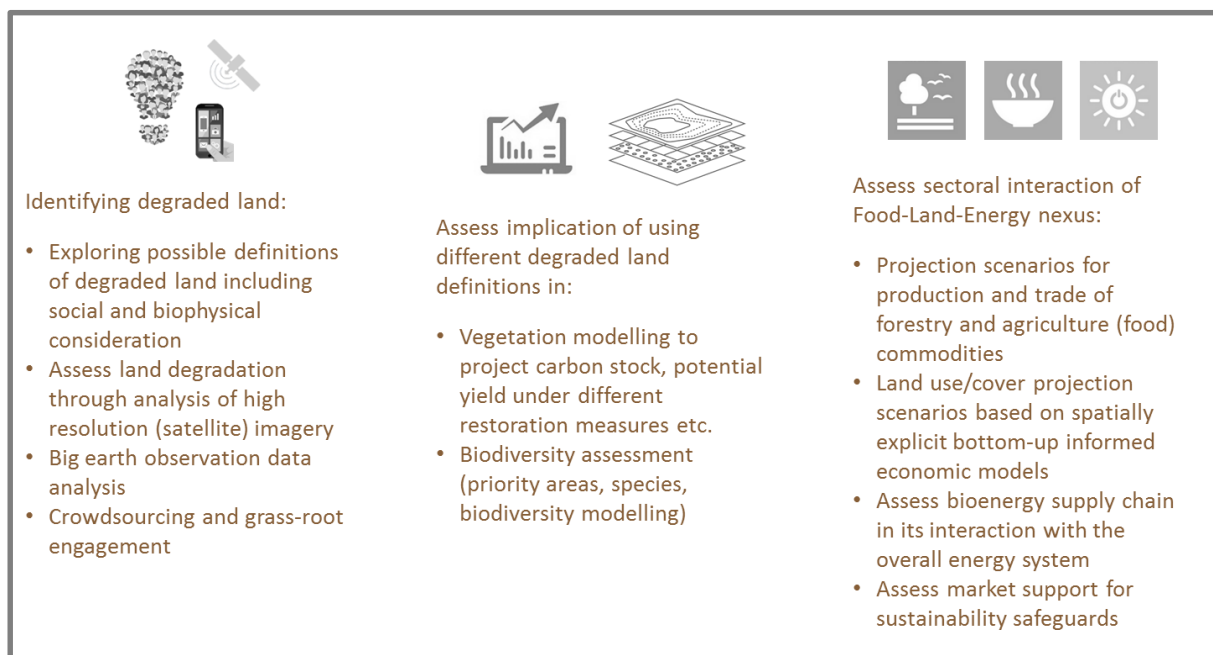
2.2.3 Congo Basin

Technical assessment of degradation and restoration (output VII)

Building on land use change projections for the Congo Basin region that were generated by the REDD-PAC project, RESTORE+ will incorporate newly available datasets on degraded areas to continue modelling activities and generate **technical recommendations** to relevant policy makers in the region.

3 Methodology

The RESTORE+ project activities comprise three main approaches (as illustrated in Box 1). Identification of degraded areas is combined with biophysical modelling and biodiversity assessment to examine the implications of utilizing different scenarios for defining degradation and implementing restoration options.



Box 1 Three main areas of RESTORE+ approach

3.1 Data enhancement to address degradation and restoration

Identifying degraded land resources requires examination of the various possible definitions of degradation. These definitions may feature biophysical characteristics that cannot be easily identified using conventional remote sensing measures or social characteristics that cannot be remotely sensed at all. RESTORE+ deploys innovative approaches to capture information of such a complexity.

3.1.1 Big Earth observation data analysis

Remote sensing based forest area change assessments often rely on comparing satellite images between of two dates (Hansen et al. 2013). However, such an approach is not capable of identifying differences among types of forest. For example, a natural forest may have been removed and replaced with a planted forest during the observed timeline. In such a situation, the persistence of forest cover may result in no identification of forest loss. This can be problematic as natural forest and planted forest have different implications for ecosystem services or biodiversity. Therefore, remote sensing information needs to provide detailed temporal evolution of forest and land cover (as illustrated in Figure 1) to capture detailed indicators of degradation (e.g., net primary productivity, biomass, soil quality).

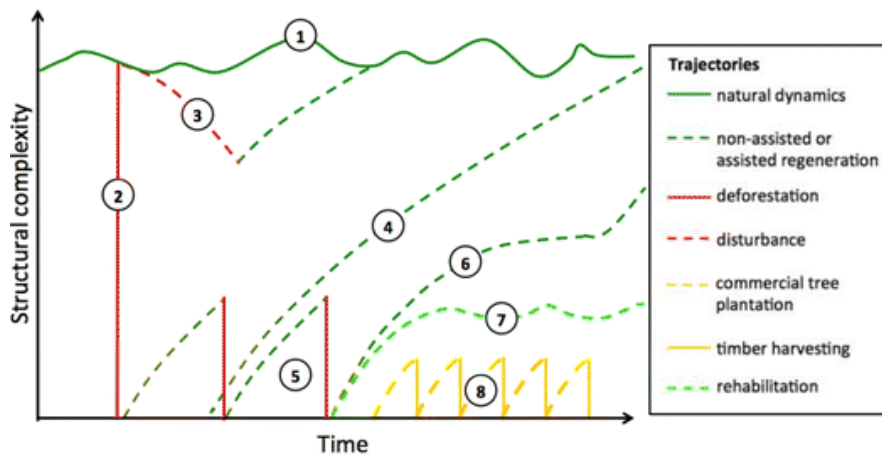


Figure 1 Temporal evolution of forest areas (Chazdon et al. 2016)

In RESTORE+, INPE will employ a time-series multi-dimensional stack of spatially aligned pixels, known as data cube, to analyse temporal evolution of forest areas. The approach takes into account historical evolution (see Figure 2) instead of just two-point states, thus providing detailed information for analysing degradation and identifying restoration options.

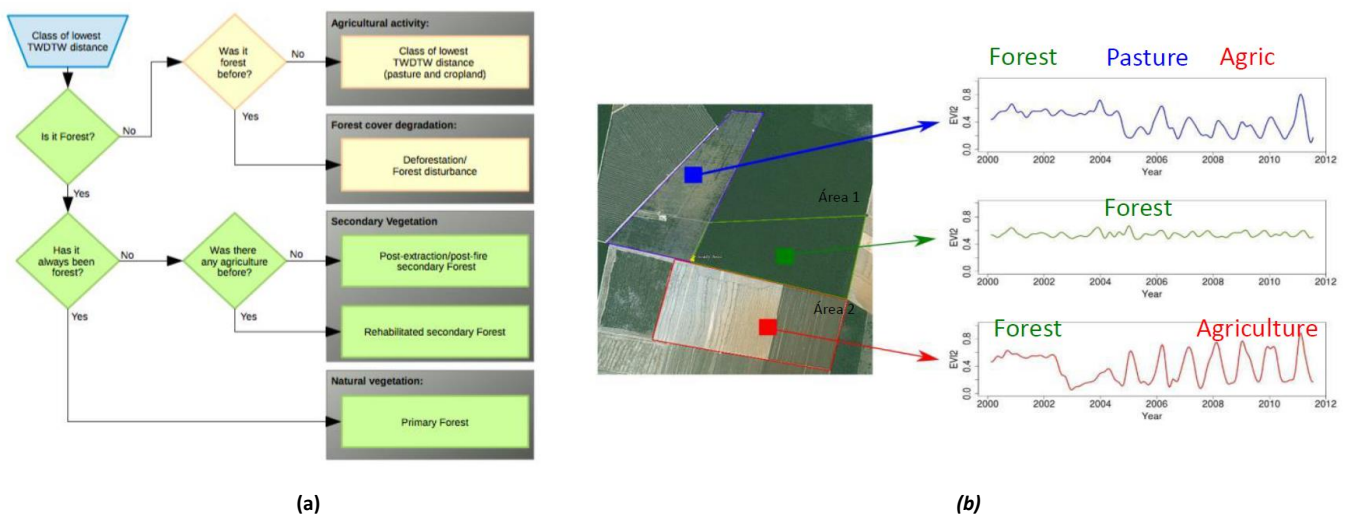


Figure 2 (a) rules for forest evolution and (b) illustration of land trajectories (Gilberto Câmara and Maus 2017)

3.1.2 Crowdsourcing

Crowdsourcing is capable of generating an incredible amount of data in a relatively short period. Crowdsourced datasets and crowd-empowered analysis can be utilized to calibrate or validate satellite images in order to improve classification algorithms as well as the accuracy of land-cover products (See, Fritz, and McCallum 2014). In RESTORE+, IIASA will deploy its Geo-Wiki approach, which is a crowdsourcing platform with the aim of : 1) increasing the amount of in-situ land cover data available for training, calibration and validation, and 2) creating hybrid land cover maps that provide more accurate land cover information than any current individual product.

The Geo-Wiki approach has been mainly utilized to enhance remote sensing based maps. However, a broader application of the approach to capture the complexity of degradation and restoration is also

possible. Work on identification of spatially explicit non-biophysical information will benefit from GeoWiki's experience in allowing crowd participation through, among others, gamification (see Figure 3).



Figure 3 Gamification in Geo-Wiki (See 2017)

3.1.3 Participatory tools and grass-roots empowerment

RESTORE+ also benefits from the experience of its partners in providing tools and services that allow broader stakeholder/crowd participation and grass-roots engagement. WRI's Global Forest Watch (GFW) tools are renowned for enabling users to have high accessibility to near real time and high resolution forest data. GFW tools provide an information platform that is user friendly, transparent and accessible in displaying technically complicated forest data. Such an approach allows broader participation and is highly effective in raising awareness. Further development of the GFW platform includes linking with mobile tools that can mobilize the public to obtain *in-situ* data to monitor forests. Landmapp provides landholders with affordable and accessible land documentation services on a large scale, unlocking the value of land. Its activities require close interaction with local stakeholders in combination with affordable mapping technologies.

3.2 Assessing environmental and social implications of degradation and restoration

As restoration is a long-term process, *ex-ante* analyses are required to examine implications of using different definitions of degradation as well as assessing various restoration measures.

3.2.1 Biophysical modelling

Understanding the interactions between potential vegetation, biogeochemical, hydrological and climatic elements is necessary when assessing the biophysical implications of restoration options. Biophysical modelling is therefore necessary to provide various *ex-ante* analyses with detailed information on the productivity of degraded land resources. In RESTORE+, IIASA will conduct biophysical modelling activities based on its in-house models, that is, the Environmental Policy

Integrated Model (EPIC), the Global Forest Model (G4M) and BioGeoChemistry Management Model (BGC-MAN).

EPIC is used to compare land and forest management systems and their effects on environmental indicators like water availability; nitrogen and phosphorous levels in soil; and GHG emissions. EPIC can analyze several crop types and their management under different weather, topographical, and soil conditions. It investigates the trade-offs between plant growth and yield on the one hand, and environmental impacts and sustainability on the other.

G4M models forest growth by parametrizing a dynamic net primary production (NPP) model to show how growth rates are affected by changes in temperature, precipitation, radiation, or CO₂ concentrations. G4M can estimate the amount of net income from forests by calculating the amount and value of wood produced minus the harvesting costs (i.e., logging and timber extraction). It also assesses the potential income derived from carbon sequestration and storage in forests.

BGC-MAN uses daily weather data and site information to calculate the cycles of carbon, nitrogen, water and energy within a given ecosystem. Up to 50 parameters describe the ecophysiology, phenology, growth and allocation structure, as well as intrinsic and externally driven biomass mortality of single species, assemblies of species, plant traits, plant functional types or biomes. Distinct parameter sets exist for the major species of temperate and boreal forests; temperate and boreal grasslands; and for distinct tropical forest ecosystems, tropical savannahs and tropical woodlands.

3.2.2 Economic land use modelling

Degraded land cannot be analysed in isolation from the broader land use and land use change context. IIASA utilizes its Global Biosphere Management Model (GLOBIOM) to analyse the competition for land use between agriculture, forestry, and bioenergy, over varying land resources that may have some degree of degradation (e.g., natural forest, logged forest, and cropland). GLOBIOM is a partial equilibrium model that is global and recursively dynamic. It integrates the agricultural, bioenergy, and forestry sectors and draws on comprehensive socio-economic and geospatial data. GLOBIOM incorporates spatially explicit productivity or natural vegetation restoration potential estimated from biophysical models. Therefore, GLOBIOM is capable of predicting forest gains/losses while considering the full range of land use complexity. GLOBIOM can also assess restoration options in terms of land use change and its impact on GHG emissions (see Figure 4), the production of food and other commodities, and biodiversity indicators.

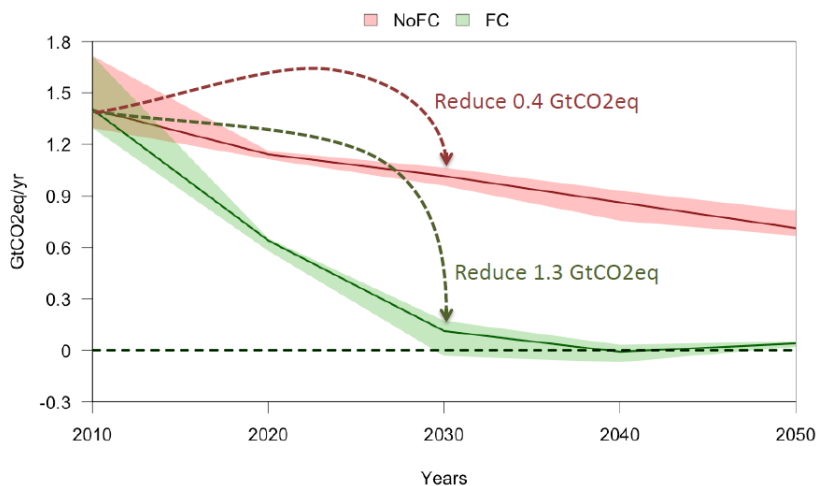


Figure 4 GHG emission projections of Brazil land use change scenario assessed by the REDD-PAC project. FC indicates the implementation of Brazil's Forest Code while NoFC represents baseline situation of no Forest Code implementation. (Soterroni 2017)

In addition to GLOBIOM, econometric analyses will be conducted to understand the implications of detailed policy scenarios in Brazil. The Environmental Reserve Quota (CRA) is an innovative policy tool within the new Brazilian Forest Code. The policy allows landowners to have a 'cap and trade' mechanism on their legal quota to conserve or restore forest areas within their land. To examine this mechanism, EDF and IPEA will conduct econometric analysis of the historical relationship between observed land use decisions and differences in estimated profitability. The analysis will also be integrated into the GLOBIOM modelling structure in order to explore scenarios of varying degrees of CRA implementation.

3.2.3 Addressing biodiversity

Biodiversity is an important element that needs to be considered in discussions concerning degradation and restoration. Key options for linking biodiversity analysis with other RESTORE+ activities include impact and process modelling (García-Rangel et al. 2017). Impact modelling (e.g., the PREDICTS database) projects the responses of ecological diversity (e.g., biodiversity abundance, species richness, biodiversity intactness index) in changing terrestrial ecosystems (see Figure 5).

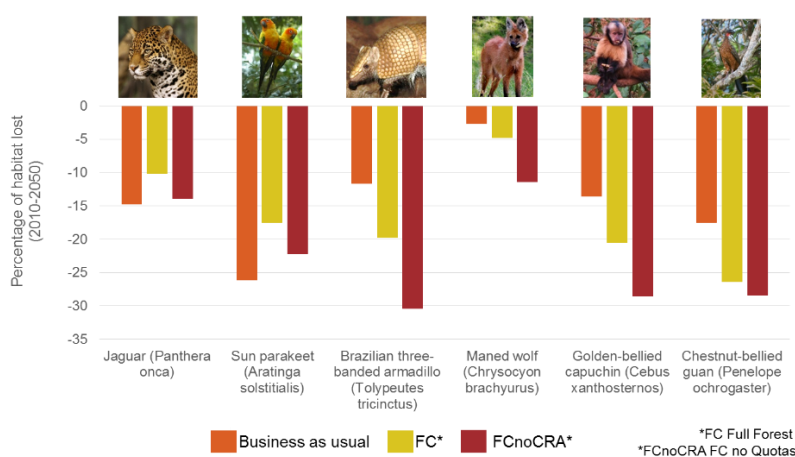


Figure 5 Assessment on impacts of Brazil land use policies coming from the Forest Code on species (García-Rangel et al. 2017)

Process modelling (e.g., the Madingley model) is based on NPP and interactions between trophic levels. Process modelling can help to investigate the impacts of decisions on biodiversity and ecosystem services and trajectories of biodiversity change under scenarios of human development.

3.2.4 Spatial optimisation of supply chain

Sectoral policies for commodities that are either affected or generated by restoration activities can strongly influence restoration itself. For example, generating bioenergy from degraded land is considered a potential option where the conflict of food versus energy in climate change mitigation can be bridged. In Indonesia, RESTORE+ aims to look into the energy system to assess the potential contribution of bioenergy generated from degraded land resources. To conduct such an assessment, IASA will deploy the BeWhere model, which is a techno-economic engineering model for renewable energy systems optimization. The model is based on mixed integer linear programming. BeWhere identifies the implications of resource availability and demand projection to optimize the localization, size and technology of the renewable energy system that should be applied in a specific region.

3.2.5 Sustainability safeguard mechanisms to support restoration

Commercial agricultural commodities are responsible for 40% of total deforestation in the tropics and sub-tropics (FAO 2016). Sustainability initiatives such as the zero-deforestation supply chain pledge has emerged to address the negative impacts that commodity supply chains pose to forest resources. Standards and certifications (e.g., RSPO/ISPO, UTZ, and Rainforest Alliance) are important means to allow the private sector to achieve the goals of such sustainability initiatives. Within RESTORE+, MCC will lead a study to systematically review the compatibility of these standards in addressing the needs of restoration activities. Such a review includes the assessment of policies and the broader enabling environment, such as taxation and subsidies. The study will also benefit from an uncertainty analysis of land use returns conducted by LSE. The uncertainty analysis uses real options theory to study how upfront costs and uncertainty in land use returns over time can influence the decision of whether to restore degraded areas. Such an analysis will inform both financial and non-financial requirements of market-based sustainability safeguard mechanisms to support restoration.

4 Discussions for Implementation Plan

The kick-off workshop of the RESTORE+ project was held at IIASA in Laxenburg, Austria, on 18-20 April 2017. The event was attended by partnering institutions, international organizations, government representatives and funding agencies. The objective of the workshop was to: 1) introduce the RESTORE+ project approach, planned activities and expected results; 2) discuss concerns over restoration of degraded land with a broad range of stakeholders; and 3) gather feedback and input for internal consolidation on planned activities and detailed work plan. The main conclusions of the discussions that took place throughout the workshop are documented in this chapter as a point of reference in formulating immediate next steps and implementing the project proposal.



Figure 6 Public event of the RESTORE+ kick-off workshop

4.1 Overview of project activities

RESTORE+ activities are grouped into seven work packages. These work packages correspond with project outputs that are mentioned in section 2.2. Work packages I-IV comprise activities in Indonesia while work packages V-VI and work package VII cover activities in Brazil and the Congo Basin respectively. RESTORE+ starts by exploring possible definitions of degradation which are conducted collectively for both Indonesia and Brazil. Afterwards, country and regional analyses are conducted separately while exchanges of findings are done annually in coordination meetings. Such an approach will allow for methodological consistency, ensuring that an integrated methodology based on the country activities can be generated by the end of the project. Figure 7 displays the overview of activities within the work packages throughout the project lifetime. Figure 8 shows the flow of information indicating how the individual activities are interconnected.

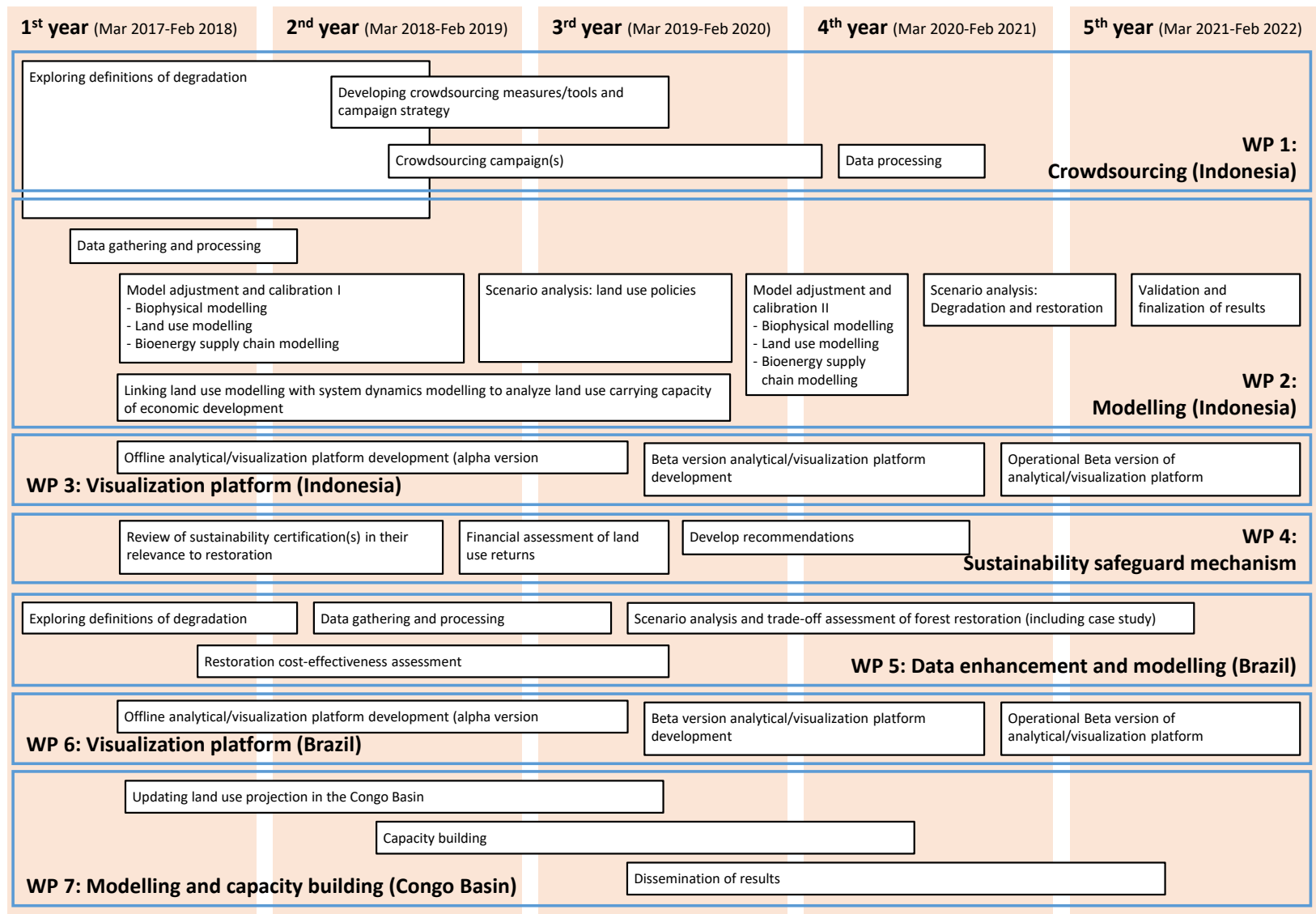


Figure 7 Overview of RESTORE+ activities

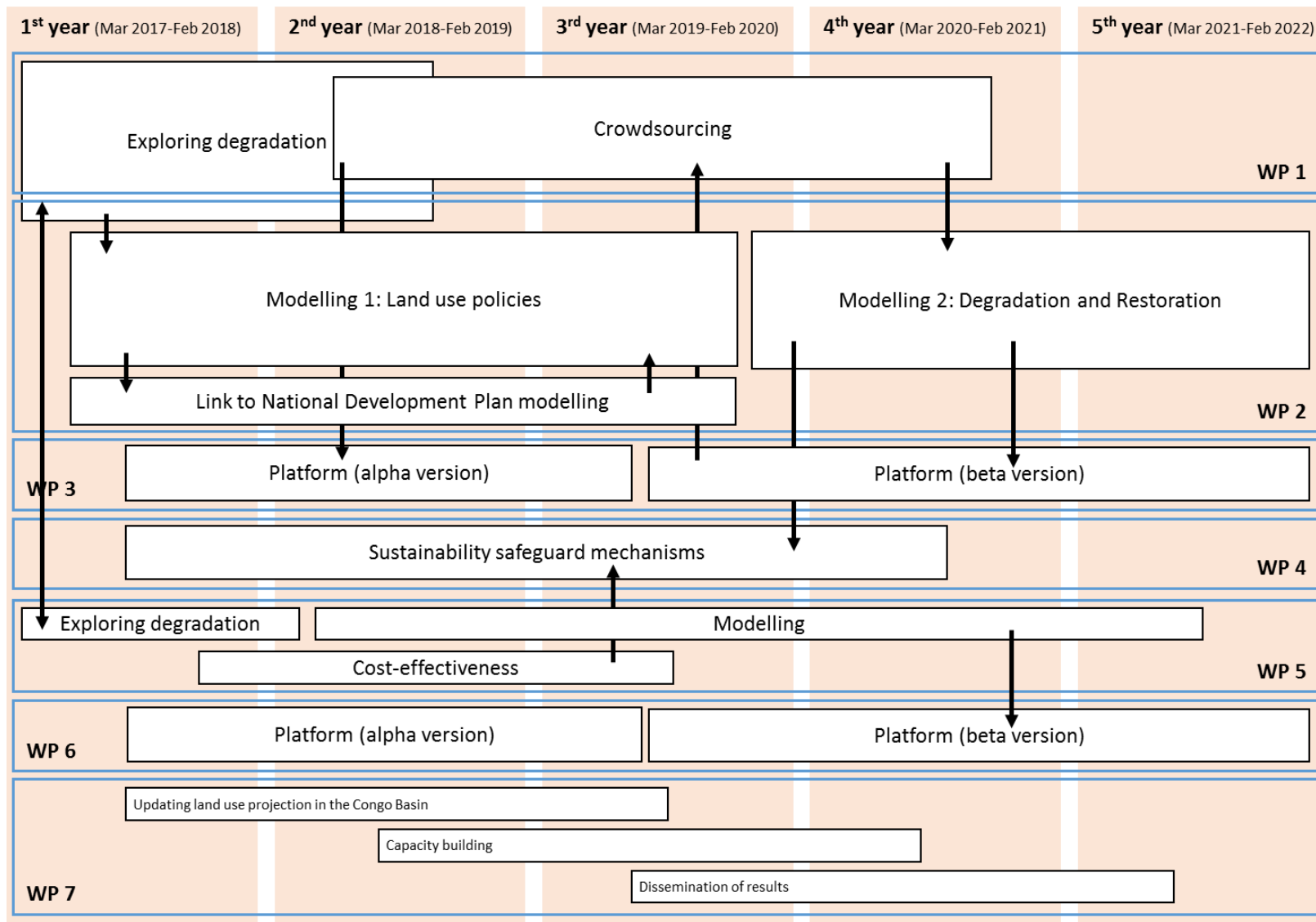


Figure 8 Interconnectedness between different RESTORE+ activities

4.2 Adherence to proposal

The discussions between project partners, RESTORE+ advisory board members and the BMUB-IKI representative helped identify necessary minor modifications to the planned activities. Whilst not representing major deviations from the initial plans, these modifications are important in ensuring project goals are achieved.

4.2.1 Dealing with degradation

Trying to come up with an agreed definition of degraded areas may lead to never-ending debates that could significantly distract the project from its planned course. Therefore, changing the direction to formulating restoration measures—that may cover degraded areas or even beyond—can be considered a useful approach. At the same time, the actual situation on the ground requires a multi-dimensional perspective in understanding degradation dynamics and formulating the corresponding restoration requirements. Beyond the biophysical and biodiversity aspects of degradation that were envisioned in the initial project plan, the following elements are considered important in exploring and assessing the implications of degradation and restoration:

1. Multidimensional perspective

Social issues (e.g., land rights, social equity, and well-being of surrounding communities) are important elements that are often decisive in ensuring the effectiveness and long-term sustainability of restoration. Stakeholder engagement is an important process that will bridge top-down analysis with bottom-up information. Such a process will allow the identification of restoration objectives that accurately reflect the type of degradation that is taking place.

2. Policy dimension

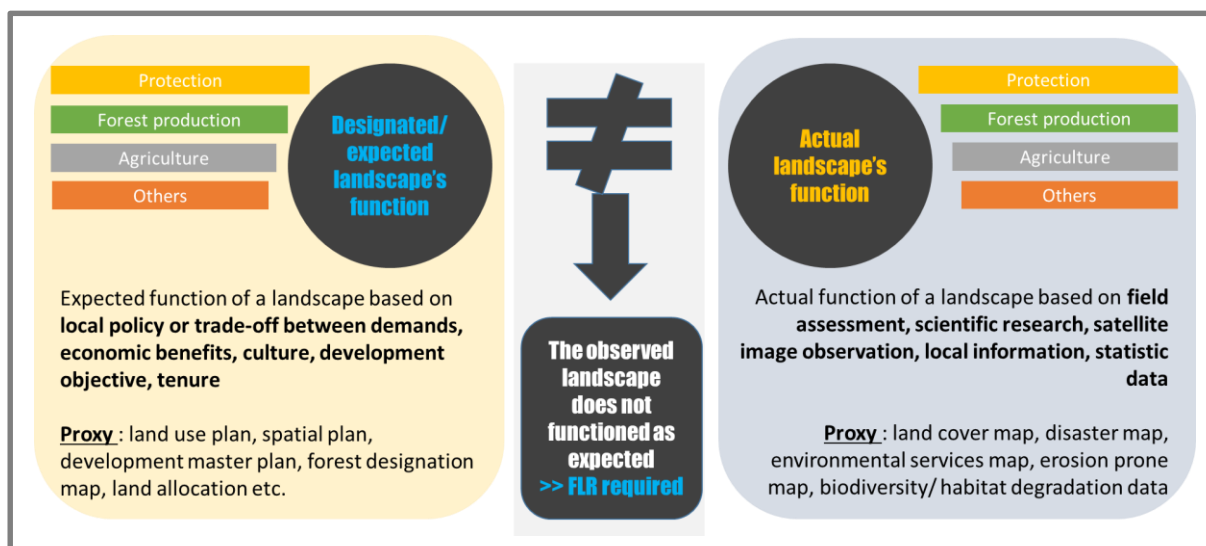
National and sub-national land use related policies are also important in defining the range of possible indicators that define degradation. Varying policies that might not explicitly address degradation but are highly relevant may be present (e.g., ‘critical land’ in Indonesia or degraded forest in Brazil). These policies should be considered in the wider assessment of restoration potential. Moreover, policies regarding, for example, production or conservation areas can also indicate degradation if inconsistency occurs between the policies and their implementation on the ground.

3. Restoration and conservation

It is important to highlight that restoration should not undermine conservation efforts. When degradation is identified, the best restoration measures may well be natural regrowth (passive restoration) instead of those requiring human intervention (active restoration), particularly as the latter also has the potential to accelerate or expand degradation instead of reversing it. More importantly, a focus on restoration should not undermine the effort of identifying and addressing the drivers of degradation. It is important to note that restoration should be seen as a trajectory, not an end goal or one-off intervention.

The above elements are also consistent with a function-based approach to identifying degradation and restoration needs. This approach has been implemented by ICRAF and WRI in South Sumatra. Such an approach assesses the gap between the designated or expected function of a landscape and the actual function of the landscape (see Box 2). Ideally, the expected function is based on ecological

characteristics as well as expected social benefits, while the actual function reflects current environmental issues and their drivers.



Box 2 Formulating FLR needs based on the function-based approach (Ekadinata et al. 2017)

4.2.2 Contribution to Indonesia's RPJMN 2020-2024

The formulation of Indonesia's RPJMN 2020-2024 follows a tight schedule. Technical assessments need to be finalized by the end of 2018 in order to contribute to formulation of the plan—which will include administrative and political processes—in 2019. Therefore, RESTORE+ has a tight two-year timeline to generate downscaled modelling analysis and establish consistency with other analyses that support RPJMN formulation.

4.2.3 Needs for high resolution analysis of Forest and Landscape Restoration (FLR) in Brazil

The Brazilian government has made high spatial resolution land cadastre datasets publicly available. The datasets open up challenges as well as opportunities, as technical assessments aspiring to inform the detailed restoration mechanisms in the Brazil's Forest Code can now be examined at a higher level of detail. Discussions were raised in exploring the possibility of developing a high spatial resolution (1 km x 1 km) model to inform FLR activity in Brazil.

4.2.4 Concerns over certification

Discussions during the kick-off event pointed out recent developments in private sector commitment to restoration (e.g., palm oil, pulp and paper industry) as well as financing mechanisms that can mobilize funds beyond sustainability certification and standards. Therefore the need to broaden planned activities regarding certification mechanisms was identified, along with covering innovative ideas (e.g., jurisdiction certification, bundling options). Such an approach will also reduce the potential political sensitivity that surrounds sustainable certification by providing more options and different ways to involve the private sector.

4.3 Immediate actions and 2017 milestones

Partners that are mainly concerned with activities in Indonesia (i.e., IIASA, ICRAF, WRI and WWF) agree that detailed planning—informed with technical details of RESTORE+ assessment activities—is required to address the concerns of a tight schedule and the needs of close coordination and synchronisation with RPJMN formulation as mentioned in 4.2.2. Similarly, IIASA together with MCC, EDF and LSE will also review how to incorporate the concerns over certification in section 4.2.4 into the modified plan of activities.

Moreover, the project partners decided that forming taskforces is necessary in order to implement planned RESTORE+ activities as well as to incorporate the modifications mentioned in section 4.2.

Task Force 1: Brazil Forest and Landscape Restoration (FLR) Model

Tasks:

- Exploring the feasibility of developing a high spatial resolution (1 x 1 km) FLR model for Brazil within the project's planned activities and available resources
- Such a model should consider the data from the rural environmental cadastre (CAR) and available information on biodiversity values and economic trade-offs
- Identifying resources beyond the RESTORE+ project that can be utilized in synergy with RESTORE+ project activities
- Formulating proposal for the action plan that is well coordinated and works in synergy with the RESTORE+ project planned activities to be reviewed by the RESTORE+ coordinating team and the Principal Investigator for activities in Brazil

Members: Gilberto Câmara (PIC), Pedro Andrade, Hugo Valin, Florian Kraxner (coordinating team)

Task force to deliver: the proposal for action plan by end of **September 2017**

Task Force 2: Usage, sharing and management of data and intellectual property

Tasks:

- Developing agreed usage and sharing protocols for models, data, tools or other intellectual property that are utilized and/or generated by the RESTORE+ project
- Such a protocol should also address authorship of scientific publications within the RESTORE+ project and for future publications that utilize intellectual property generated by the project
- Facilitating inclusive discussion among project partners and relevant stakeholders (e.g., external data owner) in the formulation of the protocol
- Reviewing and updating the protocol according to new developments and emerging needs

Members: Petr Havlik (PIC), Gilberto Câmara/Fernando Ramos, Hugo Valin, Jasmine Puteri (coordinating team)

Task force to deliver: Protocol to be agreed by end of **November 2017**

Task Force 3: Stakeholder engagement

Tasks:

- Developing an overarching stakeholder engagement strategy considering the needs for integration and interaction between various sectors and stakeholders in the RESTORE+ project
- Ensuring consistency and information exchange between stakeholder engagement activities in specific regions (i.e., Indonesia, Brazil and Congo Basin)

Members: Shaenandhoa Garcia Rangel (PIC), Sonya Dewi, Alexandre Ywata, Ping Yowargana (coordinating team)

Task force to deliver: Stakeholder engagement strategy by end of **September 2017**

Task Force 4: Communication strategy

Tasks:

- Developing strategies and protocols for communicating RESTORE+ activities, outputs and scientific results/findings considering varying stakeholders and target audiences
- Suggesting platforms for disseminating RESTORE+ project activities and results
- Advising the coordinating team in developing communication tools and materials

Members: Johannes Pirker (PIC), Shaenandhoa Garcia Rangel, Nirarta Samadhi, Ping Yowargana (coordinating team)

Task force to deliver: Stakeholder engagement strategy by end of **September 2017**

Task Force 5: Biodiversity

Tasks:

- Developing an approach to assessing the 'biodiversity value' per different definitions of degraded land and modelling the impact on biodiversity of policy options that use those different definitions and consequent restoration trajectories/land-use change
- Reviewing available biodiversity datasets and selecting appropriate biodiversity indicators and modelling approaches, drawing on crowd-sourced data (Indonesia) and big data analysis (Brazil)
- Sharing information on status and progress of integrating biodiversity assessment in all RESTORE+ activities
- Updating and/or providing feedback to the biodiversity assessment based on new developments and emerging needs

Members: Will Simonson (PIC), Aline Soterroni, David Leclere, Stephan Pietsch, Zulfira Warta, Florian Kraxner (coordinating team)

Task force to deliver: Agreed approach to assess and model biodiversity value, aiming for a provisional plan by the end of **November 2017**

Task Force 6: Impact of industrial activities

Tasks:

- Setting the scope of industrial activities to be included in the RESTORE+ activities
- Developing an approach to assess the impacts of industrial activities on degradation and restoration

Members: Aline Mosnier (PIC), Ping Yowargana (coordinating team)

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Annex 1: Kick-off Meeting Agenda

Tuesday, 18 April 2017 (public event)

Time	Session
09.30 – 10.00	Registration (and coffee)
10.00 – 11.00	<p>Opening session:</p> <ul style="list-style-type: none"> • Welcoming remarks, Pavel Kabat (Director General/CEO of IIASA) • Remarks from the Brazilian Embassy, H. E. Ricardo Neiva Tavares (Ambassador of Brazil for Austria) • Remarks from the Ministry of National Development Planning of Indonesia, Gellwynn Jusuf (Deputy Minister for Maritime and Natural Resources) • Remarks from German Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Ruth Irlen (Policy Officer for Forest Conservation and Sustainable Forest Management)
11.00 – 11.20	Introduction of the RESTORE+ Project: Addressing landscape restoration of degraded land in Indonesia and Brazil, Florian Kraxner (IIASA)
11.20 – 12.00	<p>Panel Discussion: What is degraded land? How much degraded land do we have? What should we do with degraded land? (Chair: Florian Kraxner, IIASA)</p> <ul style="list-style-type: none"> • Sonya Dewi, World Agroforestry Center (ICRAF) • Fernando Ramos, National Institute for Space Research (INPE) • Valerie Kapos, UN Environment-World Conservation Monitoring Centre (UNEP-WCMC)
12.00 – 13.00	Sandwich lunch
13.00 – 13.50	<p>Afternoon session 1: Restoration and land use complexity (Chair: Ping Yowargana, IIASA)</p> <ul style="list-style-type: none"> • Aline Mosnier, IIASA, “Assessing restoration opportunities in the tropical region” • Shaenandhoa Garcia Rangel, UNEP-WCMC, “Assessing biodiversity impacts of land-use policies in Brazil and Congo Basin” • Zulfira Warta, WWF Indonesia, “Lessons from forest and landscape restoration activities in Indonesia”
13.50 – 15.00	Afternoon session 2: Understanding land use implications at different levels (Chair: Will Simonson , UNEP-WCMC)

	<ul style="list-style-type: none"> • Aline Soterroni, INPE, “Addressing LUC complexity in the tropics: the GLOBIOM Brazil experience” • Andree Ekadinata, ICRAF, “Grassroot level multi-stakeholders land use planning tools” • Stephan Pietsch and Juraj Balkovic, IIASA, “Dynamic vegetation modelling in the tropics” • Piera Patrizio, IIASA, “Spatial optimization for land use sustainability– a case for renewable energy”
15.00 – 15.30	Coffee break
15.30 – 16.40	<p>Afternoon session 3: Enhancing efficiency and governance through participation (Chair: Gilberto Câmara, INPE)</p> <ul style="list-style-type: none"> • Linda See, IIASA, “GeoWiki as citizen science platform” • Arief Wijaya, WRI Indonesia, “Global Forest Watch experience in Indonesia” • Victor Maus and Gilberto Câmara, INPE, “Big earth observation data analysis and INPE/IPEA Open Data Services” • Simon Ulvund, Landmapp, “Affordable and accessible land documentation in rural communities – experiences from Ghana”
16.40 – 17.30	<p>Afternoon session 4: Enabling market support as environmental safeguards (Chair: Sonya Dewi, ICRAF)</p> <ul style="list-style-type: none"> • Luca Taschini, LSE, “Implication of uncertainty in land returns” • Sabine Fuss, Mercator Research Institute on Global Commons and Climate Change (MCC), “Degraded land and sustainability certifications” • Ruben Lubowski, Environmental Defense Fund (EDF), “Assessing cost effectivity of forest restoration measures” • Alexandre Ywata, Institute of Applied Economics Research (IPEA), “ Environmental reserve quotas in Brazil’s new forest legislation”
17.30 – 18.10	Panel Discussion with the RESTORE+ advisory board: The way forward for RESTORE+ (Chair: Valerie Kapos , UNEP-WCMC)

Wednesday, 19 April 2017 (consortium event, open for guests to participate)

Time	Session
09.00 – 12.00	<p>Session 1: Overview of work plan (Chair: Florian Kraxner; Gvishiani room)</p> <p>Expected outcome: Shared understanding of planned project activities and expected outputs/deliverables on:</p> <ul style="list-style-type: none"> • cohesiveness of planned activities • sequence and interdependency of activities and outputs • tasks and contributions of partners

09.00 – 09.15	Presentation on general administration issues by Susanna Kupi (discussion to be scheduled individually)
09.15 – 10.00	Presentation and Q&A (only for clarification questions) on “Overview of RESTORE+ project activities” by Ping Yowargana
10.00 – 10.15	Coffee break
10.15 – 11.15	Break-out discussion: <ul style="list-style-type: none"> • potential issues of the current plan • how to address the issues within the framework of the project proposal
11.15 – 12.00	Reporting results of break-out discussions and compilation
12.00 – 13.00	Lunch
13.00 – 17.00	<p>Session 2A: GIS input data acquisition and processing activities (Chair: Linda See, Gvishiani room)</p> <p>Expected outcome: Shared understanding of the various mapping, earth observation data analysis, crowdsourcing and other spatially explicit data collection approaches that will/can be conducted throughout the project</p> <p>Envisaged participants: IIASA, ICRAF, INPE, IPEA, WCMC, WRI, WWF, Landmapp</p>
13.00 – 15.10	Technical discussion, 40 minutes each (presentation and discussion): <ul style="list-style-type: none"> • IIASA on GeoWiki approaches • Mapping/crowd participation activities of WRI Indonesia • INPE on big earth observation data analysis and Open Data Services • Landmapp
15.15 – 15.30	Coffee break
15.30 – 16.30	Discussion on regional application of approaches (Gvishiani and Raiffa rooms are available if break-out discussion is needed)
16.30 – 17.00	Plenary reporting together with session 2B
13.00 – 17.00	<p>Session 2B: Analytical activities (Chair: Aline Mosnier, Wodak room)</p> <p>Expected outcome:</p> <ul style="list-style-type: none"> • Shared understanding of various models or modelling techniques that will/can be deployed throughout the project • Shared understanding of planned modelling activities and expected results: <ul style="list-style-type: none"> - Objective of modelling activities - sequence and interdependency of activities and outputs <p>Envisaged participants: IIASA, ICRAF, INPE, IPEA, WCMC, WRI, MCC, LSE, EDF</p>
13.00 – 14.45	Technical discussion, 30 minutes each (presentation and discussion): <ul style="list-style-type: none"> • Dynamic vegetation modelling for the tropics (IIASA, 45 minutes)

	<ul style="list-style-type: none"> • GLOBIOM Brazil • Bioenergy supply chain optimization (IIASA, BeWhere modelling)
14.45 – 15.00	Coffee break
15.00 – 16.30	<p>Technical discussion, 30 minutes each (presentation and discussion):</p> <ul style="list-style-type: none"> • Indonesia INDC model (BAPPENAS) • Biodiversity (WCMC) • Sustainability standards and certifications (MCC)
16.30 – 17.00	Plenary reporting together with session 2B (in Gvishiani room)

Thursday, 20 April 2017 (consortium event, open for guests to participate)

Time	Session
09.00 – 12.00	<p>Session 3A: Activities in Indonesia (Chair: Sonya Dewi; Gvishiani room)</p> <p>Expected outcome: Feasible work plan substantiated with implementation details (including on stakeholder consultation) on activities related to:</p> <ul style="list-style-type: none"> • Land use modelling to assess degraded/marginal land availability and restoration/utilization options • Identification of degraded/marginal land through mapping and crowdsourcing activities • Integrating biodiversity component • Supply chain modelling to assess bioenergy utilization of degraded/marginal land • Contribution on land use related insights to Indonesia's National Midterm National Development Plan (RPJMN) 2020-2024 • Sustainability certification to support restoration/utilization • Analytical and visualization platform <p>Envisaged participants: IIASA, ICRAF, WCMC, WRI, WWF, Landmapp, MCC, LSE</p>
09.00 – 12.00	Substantiation of work plan overview (Gvishiani and Raiffa rooms are available if break-out discussion is needed)
09.00 – 12.00	<p>Session 3B: Activities in Brazil (Chair: Fernando Ramos; Wodak room)</p> <p>Expected outcome: Feasible work plan substantiated with implementation details (including on stakeholder consultation) on activities related to:</p> <ul style="list-style-type: none"> • Land use modelling to assess <ul style="list-style-type: none"> - definitions in the legal framework of environmental reserve quotas market - forest protection and forest restoration considering the Forest Code (including Rural Environmental Cadastre) and international REDD+ arrangements - target areas for forest restoration in Brazil

	<ul style="list-style-type: none"> • Identification of degraded/marginal land through mapping activities • Integrating biodiversity component • Analytical and visualization platform <p>Envisaged participants: IIASA, INPE, IPEA, WCMC, EDF</p>
09.00 – 12.00	Substantiation of work plan overview (Wodak and S46 rooms are available if break-out discussion is needed)
12.00 – 13.00	Lunch
13.00 – 14.30	<p>Session 4: Immediate next steps (Chair: Florian Kraxner; Gvishiani room)</p> <p>Expected outcome: Agreed next steps on collaborative activities (especially related to national stakeholder engagement) activities in 2017</p>
13.00 – 14.00	Reporting from session “Activities in Brazil” and “Activities in Indonesia” (30 minutes presentation each)
14.00 – 14.30	Discussing next steps
14.30 – 14.45	Coffee break
14.45 – 16.15	<p>Session 5: R+ methodology and outreach (Chair: Florian Kraxner; Gvishiani room)</p> <p>Expected outcome:</p> <ul style="list-style-type: none"> • Agreed steps to allow the project approach to become a methodology that can be applied in other regions • List of relevant projects, initiatives and contacts to be included in R+ activities
14.45 – 15.45	Extending the discussion in session “Overview of work plan”
15.45 – 16.15	Filling the outreach table

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