LA·FORE·T

LANDSCAPE FORESTRY IN THE TROPICS

Towards policy approaches for improving livelihoods, sustainable forest management and conservation

Ecosystems Research and Development Bureau

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LaForeT – Landscape Forestry in the Tropics is a four year project, launched in 2015. It explores the impact of policy instruments on deforestation and reforestation processes as well as land-use dynamics in a landscape context.
The project will be carried out with partners in the Philippines, in Ecuador and in Zambia.

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Ecuador:

Universidad Estatal Amazònica (UEA)
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Introduction

Between 2010 and 2015, 8 million hectares of forest were lost annually, mainly in the tropics. Especially the tropical regions of our planet are characterized by high poverty and by complex ecosystems with high biodiversity. Many people are directly or indirectly dependent from forest ecosystems.

Ongoing deforestation often results in dramatic impacts on livelihoods and ecosystem services including biodiversity. Promising policy approaches like REDD+, payments for ecosystem services, good-governance or FLEGT – among others - have been developed but their effectiveness to counteract the causes of deforestation is not explored yet adequately in most countries (GRAINGER 2010).

The causes of deforestation are depending from geographical, biological and socio-economic conditions (GEIST ET AL. 2001; HOSONUMA ET AL.2012, KISSINGER ET AL. 2012; KÖTHKE ET AL. 2013). Problems, caused by deforestation emerge on different scale levels. On the land user level, poverty and subsistence need to be studied. Consequences of reduced ecosystem services are usually related to higher spatial scales, e.g. the use of water resources or avoidance of erosion on the water catchment level. The loss of cultural services for biodiversity and the consequences of climate change are related to the global scale level (FREMIER ET AL. 2013).

In order to tackle these challenges, it appears essential to apply an approach integrating different scale levels for the analysis of the deforestation drivers as well as giving recommendations for an effective allocation of appropriate policy instruments (GÜNTER ET AL. 2013). Beyond strategies and policy approaches for the avoidance of deforestation, it is also necessary to initiate reforestation activities and to impede simultaneously perverse incentives or unwanted leakage effects. The development of strategies for sustainable forest management depends on sustainable land-use concepts on the landscape level. In addition to the valuation of wood and alternative utilization potentials sustainable forest management requires a perspective beyond the forest margins – towards a landscape approach which adequately integrates forestry and agroforestry systems as well as non-forest related land-use systems (KNOKE ET AL.2013).

It is essential that the interrelationship between stakeholders is analysed and optimized by policy instruments so that the livelihoods of the local population can be improved by simultaneously safeguarding the provision of ecosystem services on the landscape level (FROST ET AL. 2006, PERSHAET AL. 2011). Landscape and silvicultural potentials need to be combined in order to meet the demands of the local population (SAYER ET AL. 2013).

As governance structures and decision processes are often inefficient and unclear in many developing countries, official land-use decisions (*de jure*) are often not adequately implemented (*de facto*) (SAMNDONG, VATN 2012).

Therefore, sustainable land-use requires a deeper understanding of decision processes, which are based on legal and traditional rules for the utilization of natural resources. In the context of this project, two essential policy instruments with a potential for promoting sustainable forest management will be explored: financial incentive systems and regulative instruments.

The core objective of the project is highlighting the impact of policy instruments on deforestation and reforestation processes as well as land-use dynamics and sustainability in a landscape context (Fig. 1).

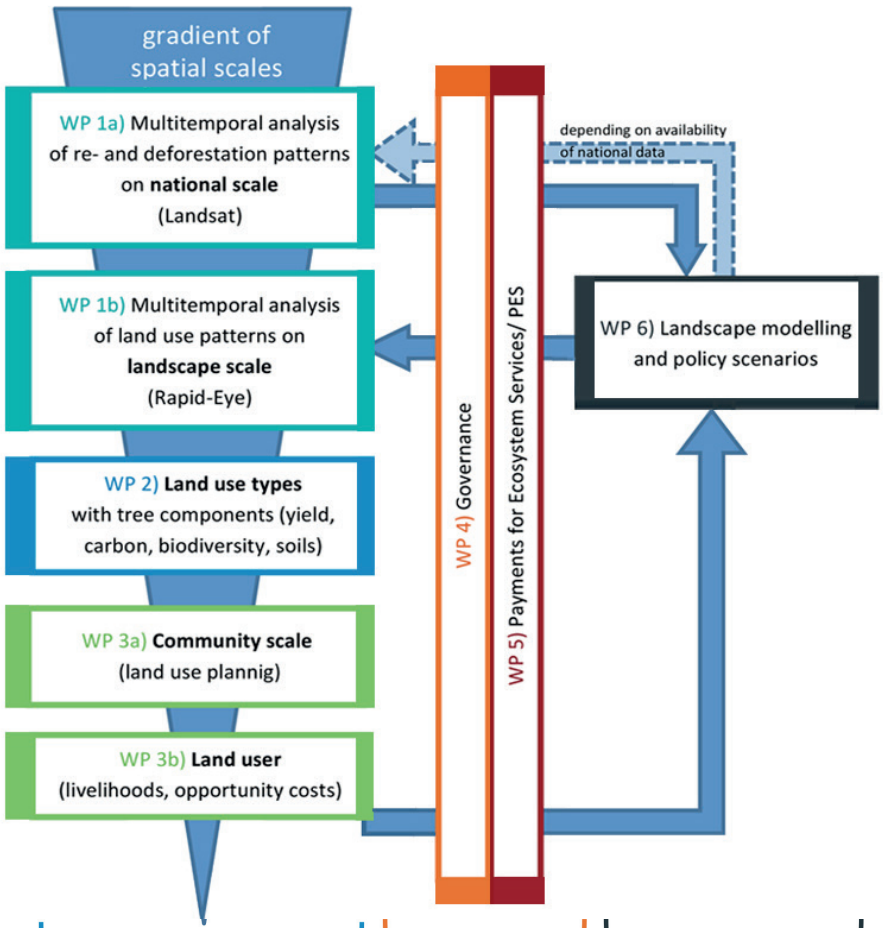
Special attention will be put on the following aspects:

- **Work Package 1**- Drivers of deforestation and reforestation on transnational to local scale
- **Work Package 2** - Sustainable forestry and agroforestry land-use
- **Work Package 3** - Subsistence- and market-oriented livelihoods of local populations
- **Work Package 4** - Governance structures as potential barriers or facilitators for sustainability
- **Work Package 5** - Ecosystem services and payments for ecosystem services (PES), especially carbon/REDD+
- **Work Package 6** - Modelling the consequences of incentive systems and controlling tools on forests, landscapes and livelihoods of local populations

Fig. 1:

The conceptual project approach is based on three components and six work packages:

- analysis of land use systems and drivers of land use change on different spatial scales (left, WP1-3)
- comprehensive analysis of governance structures, environmental valuation and payments for ecosystem services „PES“ (middle, WP 4-5)
- as well as landscape simulation and scenario modelling (right, WP 6)



Work Package 1:

„Drivers of de- and reforestation“

Reliable data on deforestation patterns and their spatial and temporal variability are of highest importance as basis for the development of efficient and precise counter-measures for affected regions and countries. In this context, revealing direct and underlying causes of deforestation are a fundamental prerequisite for the implementation of REDD+. While the development of reference scenarios for deforestation is currently pushed by several countries, there is still enormous need for revealing causes of deforestation on subnational and local level in relation to current and historical land use and related socio-economic and institutional stakeholders (LAMBIN et al. 2001). Further on, many countries with net-deforestation on national level frequently exhibit strata with increasing forest cover on subnational levels, which have to be considered in integrated and effective policy-approaches. The project contributes improving efficiency of global and national forest related policies and helps identifying potential leakage-effects. For this purpose, we aim at combining historical time series of satellite images of lower spatial resolution with recent high resolution images, in order to distinguish the most important forestry, agroforestry and agricultural land-use types within their landscape context.

Research questions

- **How are patterns of de- and reforestation spatially distributed?**
- **Is there a relationship between de- and reforestation patterns, governance-structures, land use systems and price variability of important agricultural products?**
- **Are there different causes for deforestation on global, national and landscape-level? Which conclusions can be derived for the development of strategies for conservation and sustainable management of forests?**
- **Can de- or reforestation patterns be attributed to specific land-use types, or are interactions with biogeographical, infrastructural, ethnic or socioeconomic parameters playing a more important role?**

Methods

Landsat-images (and NDVI or others) will be analyzed on national level in high temporal resolution, in order to determine spatially delimited strata of de- and reforestation for the subsequent work steps (WP 2-6) and to verify if global drivers of deforestation patterns can be detected also on national and subnational levels. The strata will serve as analytical units for cross-checking relationships with governance structures (WP 4) and regional price variability of agricultural products (WP 1a). In a next step (WP 1b) several landscape sections will be selected randomly within defined strata of typical de- and reforestation patterns and will be analyzed with images of high spatial resolution (e.g. Quickbird, Rapid Eye). Calibration and ground truthing in the field will be carried out in combination with inventory teams of WP 2. Derived land use maps will be combined with information on drivers of de- and reforestation as basis for land-use models and the implementation of policy scenarios of WP 6.

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Work Package 2:

„Land use types“

In WP 2 we will assess the impact of land use on forest area and forest structure. This is carried out on the basis of selected landscape cutouts and satellite images from WP 1. Data on carbon storage, biodiversity, tree composition, increment of commercial timber species and land use history will be collected. Primary and secondary forests, forest plantations and agroforestry plots will be assessed. These data will allow concluding to which extent previous utilization was sustainable and is matching with economic, ecological and socio-economic requirements. We will analyze, whether today's forest condition is the result of sustainable or unsustainable management and if agroforestry systems may be a viable option as alternative to agrarian and forest monocultures.

From these analyses we will derive recommendations for sustainable forest management and multifunctional forest landscapes. This will contribute to international forest policy issues which aim at forest protection through sustainable utilization of forest resources.

Research questions

- **What was the influence of different land use systems on forest distribution in the past? (in combination with WP 1 and 3)**
- **Was the forest utilization sustainable so far? Are future carbon sequestration and tree diversity safeguarded?**
- **Which revenues are/were obtained from different land use systems? (in combination with WP 3)**
- **How to improve the sustainability of existing land use types?**
- **What are the revenues from improved land use forms? At which costs are these produced?**

Methods

A stratification of satellite images according to four forest strata (primary, secondary forest, forest plantation, agroforestry) will be implemented. Further stratification will be applied for

Primary forest:
low versus high utilization intensity
Secondary forest:
low versus high utilization intensity
Plantation forests:
low versus high management intensity
Agroforestry:
simple versus complex systems

Field data collection will take place in a standardized sample plot procedure as described by SYNNOTT (1979). Plot size will be 25 x 25 m. One quarter of all sample plots will be established as permanent plots (size 100 x 100 m) where the increment of all trees (> 25 cm dbh) will be measured by increment tapes. A re-measurement after 3 years will allow the calculation of increment and a comparison with the average annual cut. The sample plots in forest plantations and agroforestry systems will be smaller (10 x 10 m).

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Work Package 3:

„Livelihoods und opportunity costs“

Land use decisions are de facto implemented by different land users (e.g. subsistence-oriented, market-oriented). These are differing across countries and regions. To politically influence land use decisions, an analysis of the relevant land uses, involved land users and their decisions is essential. Market-oriented land users are expected to be influenced by monetary incentives and market structures. Their decisions on forest maintenance versus alternative land uses may among others be guided by price incentives. Mainly subsistence-oriented land users are expected to build their livelihoods on diversified human, social, natural, physical and financial resources („sustainable livelihood capitals“) to assure resilience (CHAMBERS, CONWAY, 1991). Here, different livelihood resources substitute merely monetary ones. At the same time, all land users are affected by national and sub-national laws and probably also by traditional norms.

The main influencing parameters for policy design can be deduced from the knowledge of drivers of land use decisions. Monetary policy instruments (e.g. incentive and compensation payments from PES or REDD+) can be effective if a land user is acting according to financial influences. In this case, the adequate amount for compensation payments needs to be assessed. Subsistence-oriented land users, however, will be guided mainly by securing the nutritional basis and other existential resources.

Research questions

- **Which land user types are the most relevant actors in the landscape context/ the country? (Quantitative importance?)**
- **Which influence do land users have on the de facto land use type and practice and what drives their decisions? (Differentiation of subsistence- and marked-oriented land users)**
- **How can land use decisions be managed politically? Will monetary incentives or the provision of livelihood commodities be effective? Which roles do traditional norms play?**
- **Which revenues can be generated from alternative land use forms in comparison to forestry? What are the opportunity costs of avoided deforestation?**

Methods

Samples of relevant land users in each country will be surveyed systematically, to gather information on their livelihood resources, land use practices and influences. Therefore, about 400 land users per country and stratum will be interviewed (KREJCIE, MORGAN, 1970). The needs of the subsistence-oriented land users and their influence on deforestation and forest degradation will be analysed according to the „Sustainable Rural Livelihoods Framework“ (SCOONES, 1998) (based on the survey of 5 „livelihood capitals“). Approaches for policy design can be deduced from the findings, which combine the preservation and sustainable management of forests and the securing of livelihood needs. Opportunity costs of avoided deforestation can be calculated from the investigation of net revenues (yields, prices, market opportunities) from the relevant alternative land use forms to forestry (KÖTHKE, 2014). Spatial differentiation and monetary quantification is achieved by combining those results with the information on spatial heterogeneity within the landscape stratum and country.

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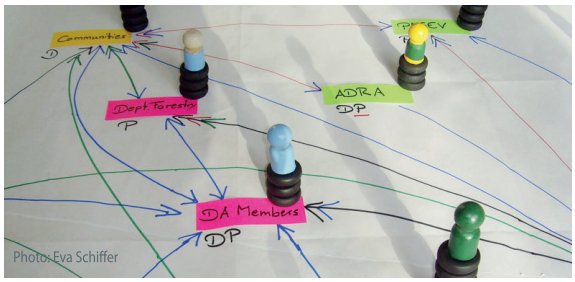
Work Package 4:

"Governance"

Forest Governance is regarded as key topic for reducing deforestation and degradation in the tropics. International forest policy processes support the concept. Forest Governance is perceived as broad and comprehensive approach, including (i) legislation and institutions (ii) tenure and use-rights (iii) land use planning, as well as (iv) benefit sharing and incentives. In many countries promising frameworks have *de jure* been created during the last decades. However, the *de facto* situation on the ground is often challenging. Specifically institutional structures are ineffective or missing and



law enforcement is limited. This creates a weak basis for the development of sustainable policy approaches.

Research questions

- **Can areas with promising *de jure* structures (legal framework, responsibilities, institutions, formal tenure rights) be identified and distinguished from those requiring more development?**
- **What are the *de facto* differences to these formally defined structures? How can governance be spatially defined and described?**
- **Which are facilitators, barriers and constraints for development and implementation of forest governance at different scales?**
- **Which governance indicators are applicable at different institutions? What relevance does participation play? How to support stakeholder participation?**
- **Does 'good governance' affect forest condition and the socio-economic environment of local land users (in combination with WP 2 and 3)?**

Methods

The project combines quantitative and qualitative approaches. On one hand, it relies on indicator systems developed under the auspices of the Worldbank (KISHOR, KENNETH 2012) or by the World Resources Institute (DAVIS ET AL. 2013).
On the other hand qualitative methods and expert judgment are indispensable (e.g. WERTZ-KANOUNNIKOFF, MCNEILL 2012).
The *de jure* situation is documented and analyzed based on literature studies; additional information is assessed in the countries at different scales (national, regional, local, households). *De facto* governance is assessed through expert interviews and participating observation. On national and community level decision makers are identified and asked for interviews. On community level workshops will provide a basis for participatory rural appraisals. Household interviews are used for triangulation and acquisition of detail information. Governance information is thus spatially explicitly expressed and assigned to institutions. Within WP 6 this provides the basis for simulating effects of good governance on land use types and efficiency of land use systems (WP2) as well as on the socio-economic environment of land users.

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Work Package 5:

"Payments for Ecosystem Services"

Payments for ecosystem services (PES) aim at the valorization of ecosystem services, thus generating additional sources of income for local land users. This can provide incentives to maintain forest eco-systems. Ecosystem services (ES) include provisioning services (e.g. wood, non-timber forest products, medicinal plants…etc.), regulating services (e.g. water quality, carbon sequestration) and cultural services (e.g. eco-tourism).
Even though there are a number of positive examples (PAGIOLA 2008; WUNDER & ALBÁN 2008), the broad implementation of such PES systems currently lags behind expectations (PATTANAYAK et al. 2010; ARRIAGADA et al. 2012). User driven systems have been shown to be more efficient compared to state organized ones (WUNDER et al. 2008; PATTANAYAK et al. 2010). However, high transaction costs are often a limiting factor (FERRARO 2008; VATN 2010). A well balanced mix of PES is advocated by many authors. Therefore it is necessary, first, to determine potential services at the appropriate spatial scale (local, regional, global), and second, to identify potential payers. In addition, legal and institutional frameworks need to be analyzed in different countries and cultural contexts. The risk of losing specific ecosystem services needs to be considered and costs for providing these need to be analyzed (WÜNSCHER et al. 2008; ROBERT & STENGER 2013).The WP in general informs policy makers on the suitability of PES as an instrument for forest protection and provides know-how on necessary preconditions. At the same time it detects ecosystem services that have the potential to be included in PES schemes and identifies countries and regions where PES schemes might successfully contribute to forest conservation.

Research questions

- **Which ES have the potential for being marketed and thus might contribute to the protection and conservation of tropical forests? What are the necessary local and regional preconditions?**
- **Which is the corresponding scale of demand (local, regional, global), and how large are the respective benefits for the consumers?**
- **Which institutional conditions (legal, markets, enforcement) need to be sustained, created or changed for the marketing of ES?**
- **How can prices and other marketing conditions be determined and designed in a way that maximizes effectivity and efficiency of payments for ES, minimizes financial, social and environmental costs, and thus contributes substantially to forest conservation?**

Methods

Based at the CICES-classification (HAINES-YOUNG UND POTSCHIN 2013), surveys will be conducted at local and national level as well as in selected additional countries worldwide in order to determine local, national and worldwide monetary benefits of promising ecosystem services. The resulting information will be aggregated to demand curves which are the basis for determining the maximum potential that can be marketed for each ecosystem service considered. A second step will analyze how much of the theoretically marketable potential can be actually realized. On this basis, situation-adapted proposals for PES schemes will be elaborated, taking into account institutional aspects (like market access, property rights, customary rights) as well as technical questions (transport, information barriers).

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Work Package 6:

"Landscape modelling and policy scenarios"

Models for landscape and land-use dynamics are effective decision-support instruments and can be used for manifold practical purposes. They are spatially explicit and can serve as basis for scenario analysis (LAMBIN, GEIST 2006). In this project we aim at defining scenarios of potential implementation of policy instruments, for example PES for conservation or reforestation or estimating potential consequences of opportunity costs (WP 3) on land use-dynamics. The potential effect of regulative instruments or future infrastructural investments (e.g. roads) is additionally subject of this work package. Thus, potential land use conflicts can be identified based on predicted deforestation areas in relation to protected areas or topographical positions with specific protective functions. Conclusions on potential conflicts between wood

production as result from reforestation activities versus food security from agricultural land will be derived. For best precision and efficiency of the models we envisage a careful definition of the scenarios under participation and in cooperation with national and international stakeholders and decision makers.

Research questions

- **How will de- and reforestation patterns develop under stable conditions? Where are hotspots of de- and reforestation today and in future? Which conclusions on potential land use conflicts can be derived?**
- **How will de- and reforestation patterns perform under consideration of defined regulative scenarios or under scenarios for PES? Which ecological and economic consequences can be derived? Which recommendations for mitigation of potential land use conflicts can be derived, for example for the establishment of protected areas?**
- **Which user types and which modifications of land-use systems can provide highest efficiency for increased forest cover and avoided deforestation?**

Methods

Data from WP 2-5 will be combined with spatially explicit data from WP 1 and integrated into landscape simulation models such as Dinamica Ego, Clue-S or others. In a first step, "business as usual scenarios" will be developed by extrapolating current and historic drivers of land use-change. In a second step two packages of scenarios for potential policy instruments will be defined in cooperation with local stakeholders (e.g. ministries, communities and NGOs) and later incorporated as restrictions and functions into the model. The first package includes more regulative instruments (protected areas, protected forests, critical distances to rivers, slopes, etc.), the second one is focusing on incentives for avoided deforestation and reforestation including estimates about efficiency in relationship with opportunity costs of alternative land uses. This way, the potential impact of different policy approaches on land-use patterns can be simulated, and effects on forest configuration, ecosystem services and livelihoods be deduced.

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For more detailed information please visit our project website:

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