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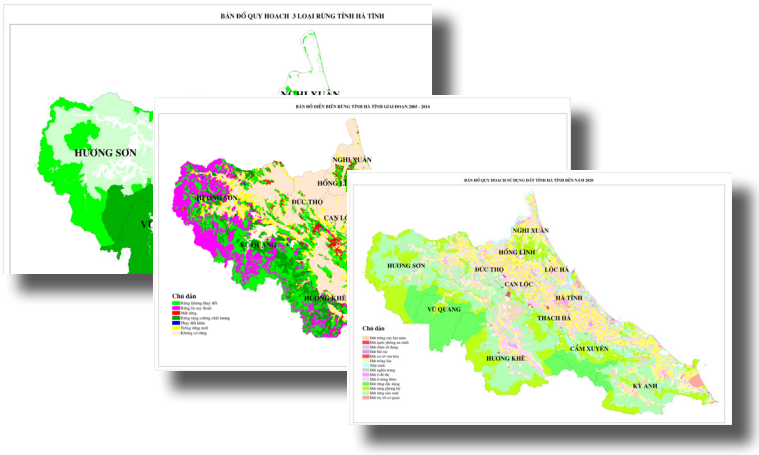
Integrated land-use planning for REDD+: lessons from combining spatial analysis and participatory approaches at the sub-national level in Viet Nam



Inside

This report is the product of a collaboration between the UN-REDD Viet Nam Phase II Programme and the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) on behalf of the UN-REDD Programme.

The UN-REDD Programme is the "United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation (REDD+) in Developing Countries". The Programme was launched in 2008 and builds on the convening role and technical expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and UN Environment. The UN-REDD Programme supports nationally led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including Indigenous Peoples and other forest-dependent communities, in national and international REDD+ implementation.

Phase II of the Viet Nam National Programme began implementation in 2013 building on the key achievements of the Phase I programme (2009-2012). It is designed to reduce emissions in six provinces, working with provincial, district and commune authorities, local communities and the private sector, with the objective to "enhance Viet Nam's ability to benefit from future results-based payments for REDD+ and undertake transformational changes in the forestry sector".

The UN-REDD Viet Nam Phase II Programme provided technical support from the UN Environment World Conservation Monitoring Centre (UNEP-WCMC) for this collaboration. UNEP-WCMC is the specialist biodiversity assessment centre of UN Environment, the world's foremost intergovernmental environmental organization. The Centre has been in operation for over 35 years, combining scientific research with practical policy advice.

Disclaimer

Should readers wish to comment on this document, they are encouraged to get in touch via:

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Suggested citation:

García-Rangel, S., Hicks, C., Ravilious, C., Williamson, A., and Nguyen, T.P. (2017) Integrated land-use planning for REDD+: lessons from combining spatial analysis and participatory approaches at the sub-national level in Viet Nam. UN-REDD Viet Nam Phase II Programme, Hanoi.

Acknowledgements:

With special thanks to the UN-REDD Viet Nam Phase II Programme Management Unit, the national partners in the provincial REDD+ planning process (Institute of Forest Ecology and Environment (IFEE), Forest Inventory and Planning sub-Institutes (Sub-FIPI) for the South and Northwest regions, and the Forest Resources and Environment Center (FREC)), and participants in joint working sessions for their contributions and input. We also acknowledge the support provided by Will Simonson (UNEP-WCMC), Lera Miles (UNEP-WCMC), Steven Swan (UN Environment), Akiko Inoguchi (FAO) and Bruno Hugel (UNDP) .

Cover photo: Vietnamese participants practice developing spatial analysis workflows, 2016 © UNEP-WCMC

UN environment WCMC

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Acronyms and abbreviations

CO_2	Carbon dioxide
FAO	Food and Agriculture Organization of the United Nations
FREC	Forest Resources and Environment Center
GHG	Greenhouse gas
GIS	Geographic Information Systems
GWP	Global warming potential
ICIMOD	International Centre for Integrated Mountain Development
IFEE	Institute of Forest Ecology and Environment
IPCC	Intergovernmental Panel on Climate Change
MARD	Ministry of Agriculture and Rural Development of Viet Nam
MRV	Measurement, Reporting and Verification
NRAP	National REDD+ Action Programme
PAMs	Policies and Measures
PRAP	Provincial REDD+ Action Plan
REDD+	Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks
Sub-FIPI	Forest Inventory and Planning sub-Institute
UNDP	United Nations Development Programme
UNEP-WCMC	UN Environment World Conservation Monitoring Centre
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD Programme	United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
VNFOREST	Viet Nam Administration of Forestry

Tra Su Forest, Tinh Bien, An Gang, Viet Nam © ePi.Lango
http://bit.ly/TraSuForest

Introduction

Deforestation and forest degradation play a crucial role in exacerbating climate change by making a significant contribution to anthropogenic carbon dioxide (CO_2) emissions. Parties to the United Nations Framework Convention on Climate Change (UNFCCC) are addressing this issue through REDD+, which stands for Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries. This global initiative aims to provide positive incentives (such as payments) to developing countries to contribute to climate change mitigation through activities in the forestry and land-use sectors.

A National REDD+ Strategy or Action Plan is required for a country to be able to receive results-based payments under the UNFCCC. This strategy should set out the actions, often referred to as "policies and measures" (PAMs), and governance arrangements to ensure the achievement of a country's REDD+ objectives. As factors driving deforestation and forest degradation are cross-sectoral in nature, REDD+ requires the involvement of a range of sectors. Depending on national circumstances, sub-national planning for REDD+ may complement and strengthen the national approach by tailoring the REDD+ actions to address locally specific drivers of deforestation and forest degradation, as well as the barriers to enhancement of forest carbon stocks, conservation and sustainable management of forests. Through participatory processes that engage local stakeholders, sub-national planning can increase the transparency, local ownership, and social and environmental sustainability of REDD+.

This document has been developed as a result of the collaboration between the UN-REDD Viet Nam Phase II Programme[1] and partners in developing provincial REDD+ action plans. These

[1] The UN-REDD Programme is the international United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (www.unredd.net).

Key messages

Combining spatial analysis and participatory approaches contributes to a successful integrated land-use planning process. Participatory processes are essential to capture knowledge, local priorities and perspectives of multiple stakeholders. Maps produced through spatial analysis can strengthen participation by prompting discussion, presenting relevant information in a compelling way, and gathering stakeholder feedback on the potential location and design of actions for implementation in a landscape.

The successful combination of these two approaches requires careful planning and a clear picture of how different analyses and techniques will be used together. Maps are a useful planning tool, but clarity is essential on the purpose of the maps, what they are communicating, data limitations, how they complement participatory processes, and how participants have used them.

Implementation plans for REDD+ or other initiatives should be 'owned' by the local constituencies. Strong local engagement needs to be incorporated into all steps and aspects of the planning process. This includes involvement in workshops, data collection, processing and analysis, and the provision of capacity building to local stakeholders to facilitate better cooperation and future contributions to implementation.

Capacity building is essential for a successful integration of spatial analysis and participatory processes. This may include building the capacity of technical staff to develop appropriate spatial analyses and good workshop maps, as well as the capacity of local stakeholders to provide inputs to the analyses and make best use of the maps. Sharing methods and exchanging experiences allows teams working in different locations to work together to define common methods, to promote consistency in approaches, to reduce workloads and to jointly overcome challenges encountered during the process.

The future use of implementation plans and the analyses that contributed to their development needs to be considered at an early stage. The role of spatial and other analyses used to develop the plans should be clearly defined. The types of analyses, their level of complexity and how they are verified can influence their suitability for future tasks, such as monitoring. Documenting the analyses carried out in the planning process facilitates understanding, replication and future review of the plan. A balance between the need for a simple plan and access to the technical information should be found.

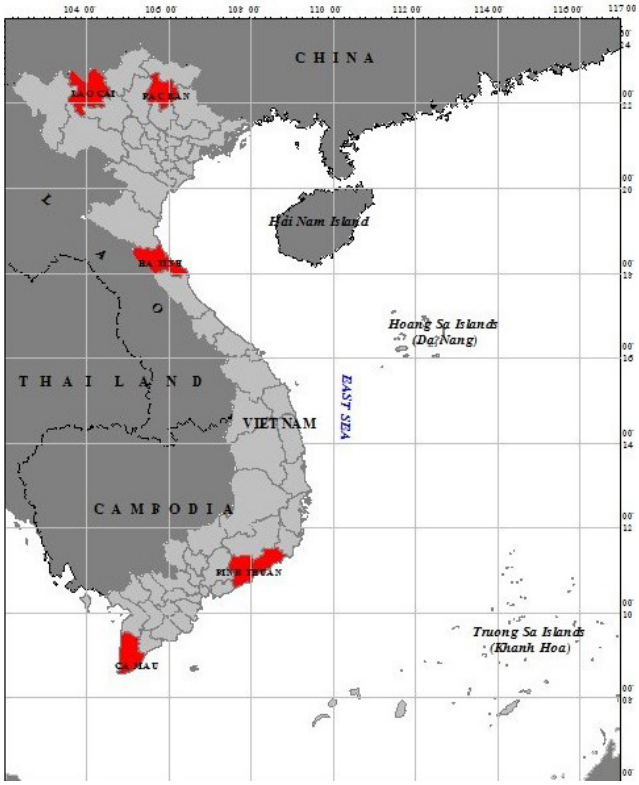


Figure 1: Location of the five pilot PRAP provinces

partners included the governments of five pilot provinces (Bac Kan, Binh Thuan, Ca Mau, Ha Tinh and Lao Cai, shown in Figure 1), and national institutes that worked with these provinces to develop the plans, including: the Institute of Forest Ecology and Environment (IFEE); the Forest Inventory and Planning sub-Institute for the Southern Region (South Sub-FIPI); the Forest Inventory and Planning sub-Institute for the Northwest Region (Sub-FIPI Northwest) and the Forest Resources and Environment Center (FREC).

Technical support was provided to partners in Viet Nam by the UN Environment World Conservation Monitoring Centre (UNEP-WCMC).

This document shares knowledge and experience on the use of integrated land-use planning approaches for REDD+ planning, focusing on the combination of spatial analysis and participatory approaches, and drawing on lessons from Viet Nam. It is part of a package of resources that have been developed by the UN-REDD Programme and its partners on this topic, including:

- A manual on sub-national REDD+ planning, setting out a framework, steps and tools setting out a framework, steps and tools for an overall sub-national REDD+ planning process, and highlighting experiences in Viet Nam and Nepal. The manual was developed by the UN-REDD Programme and the International Centre for Integrated Mountain Development (ICIMOD) (FAO 2017);
- A policy brief outlining the key issues and elements of sub-national REDD+ planning, also developed by the UN-REDD Programme and ICIMOD (UN-REDD Programme 2017a);
- A handbook on spatial analysis to support sub-

Case Study Part 1: Participatory sub-national planning for REDD+ in Viet Nam

Viet Nam provides a good example of a process for combining different types of planning approaches, including mapping and participatory approaches, which has been developed and piloted for REDD+. Viet Nam is engaged in REDD+ planning at the national and sub-national levels. In 2012, the Prime Minister approved a National REDD+ Action Programme: 2011-2020 (NRAP), which was reviewed in 2016 and is now in its second implementation phase (2016-2020). Identifying a need for "a comprehensive and participatory planning process at the provincial level", the UN-REDD Viet Nam Phase II Programme elaborated a methodology and piloted the development of Provincial REDD+ Action Plans (PRAPs) in five pilot provinces (Figure 2): Ca Mau, Binh Thuan, Ha Tinh, Bac Kan and Lao Cai (UN-REDD Viet Nam Phase II Programme 2016).

The development of PRAPs by the five pilot provinces during 2015-2016 was based on the widely used 'theory of change' approach and guided by a PRAP manual (now reproduced as a sub-national REDD+ planning manual, FAO 2017). The methodology emphasized complementarity between qualitative and participatory approaches and more technical planning methods, such as spatial analysis. Indeed, the use of maps – generated mainly through spatial analysis but also through participatory mapping – has played an integral role in the PRAP process.

The theory of change approach places a strong emphasis on cause-and-effect analysis through the use of 'problem trees' and 'solution trees' (together these are also known as 'results chains') (UN-REDD 2017a). The PRAP process involved two main participatory workshops:

1) To develop problem trees to identify the drivers of deforestation and forest degradation, and the


Hà Giang Sunrise, Viet Nam © Gavin White http://bit.ly/HaGangSunrise

national REDD+ planning, providing in-depth guidance on conducting the spatial analyses used to support sub-national REDD+ planning in Viet Nam. This was developed by the UN-REDD Viet Nam Phase II Programme and Institute of Forest Ecology and Environment (IFEE) (IFEE 2017).

This document is aimed at readers involved in REDD+ planning or broader land-use planning processes at the sub-national level. The focus is on technical aspects of the planning process, and strengths and challenges in combining spatial analysis and participatory approaches for REDD+ planning are explored. A seven-step approach to integrating spatial analysis and participatory planning processes is illustrated by examples from the case study – the development of provincial REDD+ action plans in Viet Nam – starting with Case Study Part 1 below.

Key messages and lessons learned are presented, drawing on recommendations from the Vietnamese experiences. A glossary and table of useful resources and tools related to spatial analysis and participatory REDD+ planning are provided in the annexes.

barriers to enhancement activities such as afforestation, reforestation, forest restoration, improved management of natural forests, and improved management of plantation forests;

2) To develop solution trees to identify and prioritize actions to address the drivers and barriers. Field validation was also undertaken and the potential risks and benefits of proposed REDD+ actions analyzed.

Each team produced a series of maps for their province, to serve a number of purposes:

- Provide background information informing the workshops
- Aid participatory identification of priority issues and areas for REDD+
- Complement the participatory outputs, and to form part of the final action plans.

The PRAPs of these five pilot provinces were approved by their respective Provincial Peoples' Committees and officially launched in 2016. The PRAP concept has now been incorporated into most initiatives supporting REDD+ readiness in Viet Nam. This approach chosen by Viet Nam aims to provide a more detailed and reasoned understanding of where to implement REDD+ actions. It also aims to give ownership of the plans to the provinces, which will be responsible for implementing them. The combined participatory and analytical approach built capacity for REDD+ planning and implementation in the provinces, and provided a greater understanding of the methods used to arrive at the final PRAPs, and greater confidence in the results.

For more information on REDD+ in Viet Nam: http://vietnam-redd.org


Community discussions during PRAP process, Lao Cai, Viet Nam © UN REDD Viet Nam Programme

Combining mapping and participatory approaches: strengths and challenges

Maps are valuable tools for communicating information and range from basic, hand drawn maps to those depicting the results of spatial analysis carried out using a Geographic Information System (GIS). In this digital age, GIS is used by many government and non-government organizations to store and analyze spatial data, covering national, provincial and even local scales. Data stored in a GIS may come from a wide range of sources, including those collected in the field, or obtained from satellite imagery. GIS provides an opportunity to undertake relevant spatial analysis and combine different datasets more quickly and at a greater depth than was previously possible. Thus, a well-designed spatial analysis can be used to help answer planning questions simply and efficiently.

Maps play a vital role in integrated land-use planning, and as such are a valuable tool for informing decision-making and participatory planning processes. An integrated land-use planning approach tries to engage stakeholders from various sectors, taking into account different objectives and activities in the landscape and any decisions relating to them. It aims to enable sectors, individually or together, to achieve their goals with a minimum of conflicts and enhanced benefits for society, the economy and the environment. From a REDD+ perspective, spatial analyses can provide essential information on **planning factors relevant to REDD+ actions**, such as the distribution of forest types, patterns of deforestation and forest degradation over time, and the estimated carbon stocks in a landscape. The same rationale applies to other activities that aim to influence land-use so that these lessons learned from REDD+ are of interest to planning in a range of sectors.

Spatial analyses can also contribute to understanding the **potential environmental and social benefits and risks of actions** in a given landscape. REDD+ has the potential to deliver multiple benefits, including a wide range of social and environmental goods and services in addition to climate change mitigation. The same is true of other initiatives that may take place in a landscape. Depending on how REDD+ or other actions are implemented, they can also carry potential risks. A programme that delivers multiple benefits and avoids risks can contribute to policy goals beyond climate change mitigation, while being more desirable to stakeholders and so more sustainable in the long-term. Mapping the distribution of these potential benefits and risks can help to incorporate these factors into land-use planning. This can be done at the sub-national level, helping to understand and negotiate trade-offs among relevant stakeholders.

Planning where and how to implement REDD+ or other actions, using an integrated land-use planning approach, often involves decisions on trade-offs between competing land uses, such as for the protection or enhancement of carbon stocks and other ecosystem services, supporting livelihoods, biodiversity conservation and economic development. Spatial analyses can be used to combine a wide range of factors influencing planning, to **identify priority areas for REDD+ implementation** based on information about deforestation and forest degradation risk, current and potential carbon stocks, future land-use demands and likely benefits. However, the results on their own cannot provide a complete picture of the context, priorities and local knowledge of stakeholders.

Combining participatory processes with mapping and spatial analysis for land-use planning increases the value of the resulting plans. Participatory approaches aim to involve relevant stakeholders, especially those affected by or influencing a process or situation, in planning, implementing and evaluating programmes or initiatives. There are numerous participatory approaches, such as passive participation or receiving information, consultation, and interactive participation in analysis, planning

and decision-making (Chatty *et al.* 2003). Capturing the knowledge of experts, community members and stakeholders from different sectors through participatory approaches helps to ensure the results of any analyses are compatible with other multi-sectoral plans and priorities. In the case of planning for REDD+, the knowledge captured can provide key information on emerging drivers of deforestation and forest degradation, barriers to REDD+ implementation and considerations about the social, economic and environmental context. Maps can be used to strengthen participation by prompting discussion among stakeholders, presenting relevant information in an accessible and compelling way, and gathering feedback and proposals for the location and design of actions. Mapping exercises can also provide a means to record the knowledge held by different stakeholders.

In turn, the participatory process can strengthen the design of the spatial analysis, as it can be tailored to the priorities, criteria and/or parameters identified by stakeholders. The participatory process can help to validate patterns of deforestation and forest degradation, the location of key drivers of change (e.g. agricultural expansion or infrastructure development) and priority areas for actions identified through spatial analysis. Participatory approaches may also uncover further information or data sources that are missing from or under-represented in an initial spatial analysis. The knowledge recorded in a participatory process is especially important if the available map data are of poor quality, limited in availability, or do not accurately reflect the situation on the ground. The use of maps in a participatory setting may promote agreement or disagreement between stakeholders, and provide insight into elements of the analysis that might need further validation.

An iterative process, where spatial analyses and other analytical techniques are combined, with strong participation by stakeholders, contributes to a better planning process. It provides a more robust method to ensure reliable inputs and a clearly thought-out methodology that is guided by experts and stakeholders. Spatial analysis and participatory approaches combined can, therefore, contribute to a better-informed planning process that has buy-in across multiple sectors and strong local ownership.

Using integrated approaches, however, **is challenging and requires careful planning and timing**. Coordination can be demanding and ordering of individual tasks and outputs needs consideration. Spatial analyses can both speed up and slow down the planning process. For example, large quantities of data can be processed quickly and efficiently in a GIS system and complex information presented simply on a map. However, unforeseen problems in data access or processing can cause delays. The quality of the analysis will also be limited by the technical knowledge or experience of the technical staff involved and, therefore, an element of capacity development may be required as part of this process. It is essential that technical staff are competent in spatial analysis so that the methods used and mapped outputs are of a high quality and fit for purpose.

Maps can be valuable tools in participatory workshops, but it can be challenging to determine what sort of information is required and how data should be presented to the stakeholders involved (Ravilious *et al.* 2016; FAO 2017). Good facilitation is critical to ensure that information is communicated effectively, that different groups are working towards the same aim and that a consistent method is used for recording results. Combining the results from both mapping and participatory processes is also challenging, especially where there is disagreement between the results from the different approaches. Resolving such conflicts may require additional validation, adding to time and budgetary pressures. It is important to be able to present the combined final results transparently and document how conflicts were resolved.


Spatial analysis capacity building session © UNEP-WCMC

Combining mapping and participatory approaches: a stepwise method to support planning

This section will introduce seven key steps to combine spatial analysis and participatory approaches to support sub-national land-use planning. Each step will be illustrated with examples and lessons from the experience in supporting sub-national REDD+ planning in Viet Nam.

1 Capacity building for spatial analysis to support planning

The combination of spatial analysis and participatory planning processes requires skills in creating maps, as well as using them in workshops and in other participatory settings. It is critical to invest time and resources at an early stage in building capacity not only to create the necessary maps - e.g. using GIS software - but also strengthening the ability of facilitators and participants to use maps in a meaningful way.

Consider the following to help define capacity building needs:

- **Decide who will make the maps needed for the process**. Think about whether there are skills at the local level, and if there is a need to train staff to carry out spatial analysis. Some maps may be easy to obtain from other organizations or free data sources, or to create through participatory mapping exercises, while others will require more advanced spatial analyses.
- **Aim to involve local technical staff in developing and preparing maps**. This helps to ensure that local knowledge is incorporated and that maps are not created in a 'black box', i.e. without sharing knowledge on the steps and parameters used that would allow the map to be re-created or updated. GIS software, tools and guidance are available to help build capacity in conducting spatial analyses useful for integrated land-use planning – for example, for REDD+ planning this includes, maps showing changes in forest cover, estimated carbon stocks, and locations of key biodiversity areas.

Box 1: UN-REDD multiple benefits mapping tool box and tutorials

The UN-REDD Programme has developed a range of GIS training materials and tools for use in planning REDD+ activities. These resources are designed to assist technical staff undertaking spatial analyses to identify areas suitable for specific REDD+ actions, and which areas are likely to yield multiple benefits. Materials have been developed for both QGIS (open-source) and ArcGIS software, according to the needs of individual partner countries. The materials continue to be developed and tested with country partners, with tutorial versions in various languages. A customized ArcGIS toolbox has also been developed at UNEP-WCMC for REDD+ multiple benefits analyses – it is known as the Exploring Multiple Benefits Mapping Toolbox. The toolbox provides raster and vector analysis tools to help identify, map and understand the spatial relationship between carbon stocks, other ecosystem services, biodiversity conservation, land use and pressures on natural resources.

http://bit.ly/GIStools-redd

Facilitators practice using maps during a capacity building exercise © UNEP-WCMC

Case Study Part 2: Building mapping capacity in Viet Nam

The process to develop PRAPs in Viet Nam builds upon several years of work on REDD+ readiness and awareness raising in the country. However, capacity building was still required for partners and participants in the PRAP process.

Capacity building on spatial analysis was provided for national partners supporting the process, in addition to training on the PRAP methodology. After an initial introduction to spatial analysis techniques, national partners met twice during the PRAP process

Box 1 provides information on UN-REDD Programme resources to support spatial analysis, while Annex 2 includes a table of other useful tools.

- **Ensure technical staff and facilitators guiding the planning process are well informed.** Understanding how maps have been created, the assumptions underlying them, and the data sources used will help technical staff and facilitators to answer questions from participants and to get the most out of map-based exercises. Consider designing the map-based excercises together with the technical staff and facilitators, or testing the exercises with them.
- **Design exercises to help familiarize participants with the process and the use of maps.** Working with maps in a participatory process is familiar and intuitive only to some people. Exercises can be used to introduce and practice using maps to support participatory planning. For instance, transparent overlays can be used by participants to answer particular planning questions and to understand different factors that can influence planning. Such exercises can also help participants to prioritize important information and to learn about potential trade-offs and synergies between different land-uses and objectives.

Provincial technical staff practice using GPS equipment to update maps during a training session, Ho Chi Minh City, 2016 © UNEP-WCMC

to participate in 'working sessions'. These sessions took them step-by-step through the production of priority spatial layers or maps, supported the integration of this process with participatory approaches, provided technical support in addressing key challenges, and helped to provide consistency in methods across the provinces.

According to the national partners, a key success of the working sessions was the opportunity to learn from and exchange experiences among the partners. A lesson learned from this process was the need to provide more capacity building at the local level, so that provincial staff and participants could be more deeply involved in the production of the maps and could take ownership of the analyses and databases produced.

Once the PRAPs were finalized, the UN-REDD Viet Nam Phase II Programme acted on this recommendation and provided additional training at the provincial level, led by the national partners themselves. This covered basic GIS functions, mapping layers useful for REDD+ planning and monitoring, and the structure of the databases created through the PRAP process.

For more information on the working sessions, including the materials used and reports produced. Visit: http://bit.ly/mbs-redd

2 Collecting, prioritizing and processing data for planning

Determining the right amount of data to use to support integrated land-use planning is a central step in the process. Clearly, some datasets are needed to develop an accurate and credible plan, and to cross-check and validate the participatory process against other sources. With insufficient data, there will be limitations on the information available and the analyses that can be done outside of the participatory process. However, too much data can also be a problem: the process may become cumbersome and overwhelming for technical staff and participants. Collecting, prioritizing and processing data is thus a vital step:

- **Identify the data and data sources that will most likely be needed for the planning process**. In addition to commonly required datasets – such as land or forest cover, and patterns of land or forest cover change and infrastructure – there are other datasets that are valuable inputs to a planning process. Stakeholder and expert advice can be useful at this stage, indicating what topics and types of data are considered important in the local context.
- **Assess what data are available.** Consider whether spatial data or other types of data exist for the topics relevant to the planning process, and whether these datasets are credible and cover useful time periods. For example, good spatial data for forest cover in the most recent period may exist, but comparable data from an earlier period may be lacking. In some cases, data are held by organizations that cannot, or are reluctant, to share them. Higher level requests or authorization may be needed to access some data.
- **Prioritize what is needed for a robust planning process.** Whether there are plenty of data or data access is difficult, prioritizing the most useful data for the planning context helps to focus the analysis and the participatory process on the most relevant questions – such as the highest priority drivers of deforestation and degradation, or on those potential environmental and social benefits and risks that are viewed as most important. (Case Study Part 3 provides an example of a simple approach used in Viet Nam to prioritize spatial data).
- **Recognize that not all information needs to be presented through maps**. Some data that are important in a planning process may not be available or useful in a spatial form. Statistics, narrative accounts, stories and case studies from the people involved can also inform planning processes. For example, gender considerations, such as differences in how men and women use natural resources, can be very influential over the design of natural resource management actions, but are less likely to require mapping.


Data workshop, Bac Kan Province, Viet Nam © Sub-FIPI NorthWest

- **Allow flexibility in data collection.** It can be difficult to predict exactly which data will be needed in a planning process. Data that seemed unimportant at the start of the process may become vital if stakeholders deem them necessary, or if the situation changes. One approach is to list and collect potentially useful data, but only spend time processing the data that are later agreed to be important.
- **Check the requirements for accessing data.** Accessing spatial, statistical and other types of official data can be difficult and time-consuming. Ensure that the requirements for data access are known in advance – for example, permission to collect data or an official request for data may be needed from authorities, or in some cases, payment for data licenses may be expected.
- **Ensure that time and resources are available for processing data**. Depending on the size and complexity of the spatial datasets, processing can take substantial time and resources. It involves tasks such as: ensuring datasets use similar classes or categories so they can be compared; ensuring that the same geographical projections are used; rearranging other types of data, such as statistics, so that they can be added to maps; tracking down metadata; and 'cleaning' datasets, i.e. checking for errors and fixing them.
- **Storing data and metadata.** Make sure that data collected for the planning process is carefully stored and available to the people who will need it. Metadata summarize basic information about data, such as date of creation, owner, file size, and can make working with and locating datasets easier. Knowing these metadata is necessary for understanding how the data can be used, whether they can be shared, and how they can be cited.

Case Study Part 3: Getting useful data for provincial REDD+ planning in Viet Nam

The teams developing PRAPs in Viet Nam faced numerous challenges related to data collection, prioritization and processing. Although some datasets are very rich in Viet Nam – such as data from the country's forest management information system – other data are absent or difficult to access, such as data on biodiversity.

The teams began with a suggested list of datasets for collection (Table 1). These were categorized as 'basic data', considered fundamental for the planning process and understanding the feasibility of implementing REDD+ in an area, and 'additional data' to be used in prioritising among areas, considered useful but likely to vary across provinces. Official letters requested other departments and agencies to cooperate in the provision of data. It was a requirement to record metadata on all collected datasets; teams that neglected this task had to track down this information at a later stage.

Some of the key challenges related to data for the PRAPs included: the use of different definitions and categories in forest data over different periods of time; the complex and detailed nature of data on forest resources; the discovery of differences between mapped information and the reality on ground, or the perceptions of stakeholders; and difficulties in accessing some data held by departments outside of the forest sector.

The teams came up with a number of ways to deal with these challenges, including:

- Working with provincial departments to reach consensus on which datasets to use and how
- Using more recent satellite imagery or other data from forest departments to complement the existing spatial data, especially in cases where there were inconsistencies or doubts about the data
- Discussing with other teams on how to best work with the large, complicated forest resources datasets

Table 1: Example of datasets prioritized during the Viet Nam provincial REDD+ planning process

SUGGESTED DATASETS	FOR USE IN: UNDERSTANDING FEASIBILITY	PRIORITISING LOCATIONS
BASIC DATASETS		
FOREST/LAND COVER	X	
CARBON (ABOVE- AND BELOW-GROUND)	X	X
FOREST CLASSES/CATEGORIES	X	X
POVERTY		X
POPULATION DENSITY		X
CURRENT Land-use	X	X
FUTURE Land-use PLAN (2020)		X
CURRENT MINING AND HYDROPOWER	X	X
FUTURE MINING AND HYDROPOWER		X
PROTECTED AREAS/PROTECTED ZONES	X	X
ROAD NETWORK	X	X
ADDITIONAL DATASETS		
WATERSHEDS & WATER BODIES		X
SOIL EROSION RISK/INPUT LAYERS FROM FOREST FUNCTION MAPPING		X
SPECIES RICHNESS		X
KEY BIODIVERSITY AREAS		X
FOREST SECTOR VALUE/EMPLOYMENT		X
FIRE OCCURRENCE/RISK/INTENSITY		X
DIGITAL ELEVATION MODEL (SLOPE, ASPECT, ELEVATION)		X
PRECIPITATION	X	X
FOREST OWNERS/FOREST MANAGEMENT UNITS	X	X
FOREST LAW VIOLATIONS		X

❸ Making maps for workshops and other participatory activities

Maps for workshops or other participatory activities are different in style to those created for more formal documents. They should be designed to suit the intended purposes of a workshop and should provide clear, easy to digest and relevant information. These maps should help participants understand the spatial distribution of different types of information (e.g. poverty rates in a landscape), promote discussion and allow annotation or recording of information from the participatory process. To make appropriate workshop maps and prepare for their use in a workshop setting, consider the following (and see Box 2 for cartographic tips):

- **Focus on the most relevant information.** Before preparing the maps, think carefully about how many maps can be easily managed in a workshop. Focus on what is needed for the exercise at hand. Decide on which maps are the priority maps for the participants, and which are lower priority and may be kept as additional or reserve map layers**.**
- **Determine the best materials for printing, displaying and using the maps.** Some maps will be best printed on paper as a solid base map and others can be printed on transparent sheets for participants to overlay. When using transparent overlays, check each map to make sure all the boundaries and graticules align. Maps with even a slight difference will not overlay properly. If additional maps and information are required, it may helpful to use a different format, e.g. on a poster with other contextual text, images and statistics. Think about what participants will need to use the maps effectively. Print spare copies in case participants make mistakes or ask to start again. Make sure there are clips to hold the maps and stickers to identify features. Consider what pens and pencils should be used; it may be better if any drawn areas can be easily erased or changed, but permanent pens are useful for final annotations once participants have reached a decision.
- **Make sure the participants understand what each map is showing.** Information about the map and what it shows should always be presented clearly and concisely, reflecting the limited time available to digest the information in a workshop. Give each map a clear title and legend, describing its purpose and content. Be prepared to answer any questions participants may have. They may want to know the sources of information shown in the map, so make sure that this is recorded with the map, as well as any information on the quality and accuracy of the data.
- **Think about how to maximize the usefulness of the maps and their effective contribution to the overall process.** Make sure that the maps are integrated into planning activities and discussions, and that clear instructions are given to facilitators and participants on how to use them. These instructions need to be consistent, especially if participants are split into groups to carry out the same activity, or if there are multiple workshops covering the same topic.

Think carefully about what information you need to gather from the participants and how they will record it during the session.

- **Test the use of the maps.** Practice using the maps before the workshop to ensure that facilitators are fully briefed about how the maps will be used. Holding a practice session also helps to check if the maps are fit for purpose, identify potential issues or problems that may arise and highlight any additional information that might be required. Make sure at least one member of the spatial analysis team attends the workshop if they are not already a facilitator.

Box 2: Cartographic tips for good workshop maps

Registration marks: Including a graticule, grid or tic points allows the scanning/digitizing of participatory maps later on. A minimum of four tic points is required, preferably located towards the extremities of each map.

Simple and effective classifications: Think about what level of detail is required to present the information clearly and achieve the expected outcome. Complicated maps can cause confusion rather than add value, while harmonizing data into a simpler classification with less detail may provide more clarity. It may make sense to combine some features (e.g. reducing the number of land cover classes to provide a more interpretable map).

Presentation of features: How a feature – like an area, water body or road – is presented on a map differs depending on whether a paper basemap or a transparent overlay is being developed. Think about whether to use solid colours or patterns, the thickness of lines and size of points. Choose colours and symbols carefully, and consider the colours used within a single map and between maps. For example, on a large A0 or A1 map, features with similar colours, thin lines and small points may be very hard to see. A series of maps that use different colours to represent the same feature (e.g. protected areas) may confuse people. Also, remember to test the final maps for colour blindness compatibility.

Optimum amounts of information: Maps should not be cluttered with information. For example, try not to repeat information (e.g. administrative boundaries and names) on all of the maps during a transparent map exercise. When many maps are overlaid, it can start to look crowded and messy, and important information may be obscured. In particular, make sure each transparent layer is clear and simple.

Check before you print multiple sets. Test print the final maps to ensure that colours and designs have printed clearly, and that overlays align correctly.

PRAP workshop, Bac Kan Province, Viet Nam © UNEP-WCMC


Ke Bang Forest, Quang Binh, Viet Nam © Tinker & Rove http://bit.ly/KeBangForest

Case Study Part 4: Lessons on making good workshop maps from complex data in Viet Nam

Although a wealth of mapped data already existed in Viet Nam, PRAP teams faced a number of data challenges when preparing mapped inputs for the participatory workshops. The first workshops in the provinces, for example, required the preparation of maps and statistics on forest cover change and posters to highlight drivers of deforestation and forest degradation. Challenges included:

- Changes in land cover classifications over the time periods involved;
- Differences in data collection methodologies;
- The existence of formal rules that set out how forest classes are defined and visualized on maps, making it harder for the teams to simplify the maps in a way that can be easily understood by participants in a workshop environment, but are still consistent with practice in Viet Nam.

The teams addressed these challenges in a number of ways. They harmonized land cover classes into fewer classes, creating simpler maps, and sought formal approval to present the data in fewer classes (see Figure 2). They chose to compare time periods for which data were available and collected with a consistent methodology. They cross-checked data to ensure that forest cover change analysis was only capturing actual change in forest cover and not differences due to data errors (e.g. that may arise to due to misalignment of data, see Step 7).

The main lessons learnt on making good workshop maps from complex datasets from the Vietnamese experience are:

- Develop tools to help with data cleaning; standardization can help to speed up the process and to reduce errors.
- Understand that not all differences in data can be resolved by cleaning and harmonization of classes. Some data collected using different collection methodologies and at different scales are simply not comparable.
- Be aware of any rules that exist on how spatial data should be presented, and seek permission for an exception if needed to allow maps to be usable during workshops.
- Be transparent and highlight any known issues in data quality for the datasets used for preparing the maps and statistics, and check the results with local stakeholders.
- Minimize unnecessary, additional information on the maps, such as names of administrative areas and sites, which may obscure the main information you are trying to present.

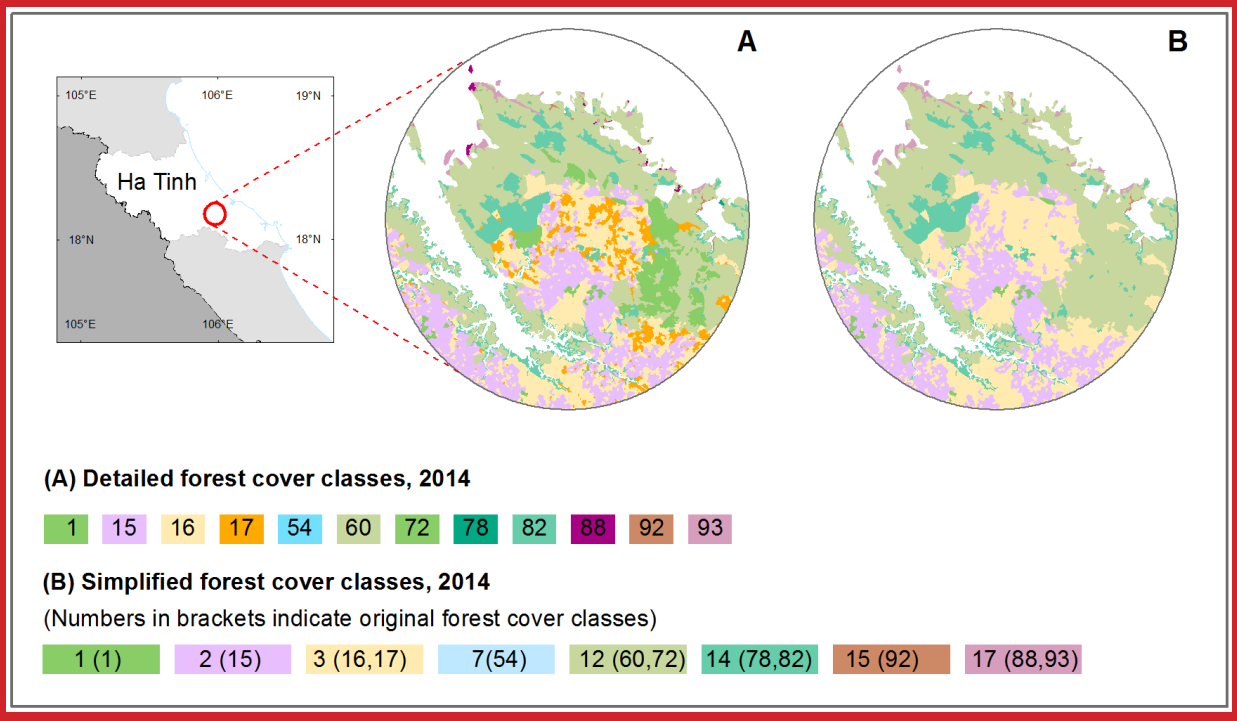


Figure 2: Comparison of initial, unsimplified analysis of forest cover change (left) and simplified forest cover change analysis (right) (numbers represent particular forest classes in Viet Nam) (prepared by IFEE, 2017).

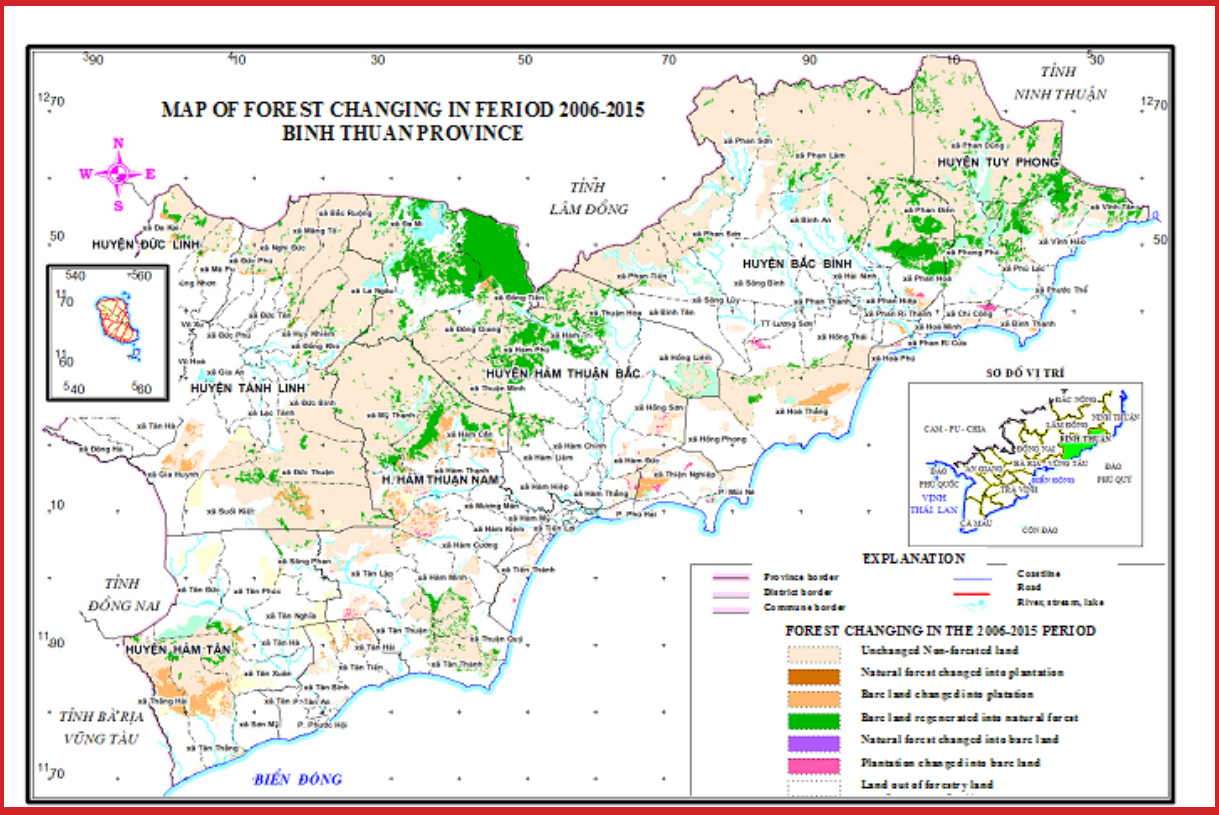


Figure 3: Map of forest cover change 2006-2015 for Binh Thuan Province (prepared by Sub-FIPI South, 2016)

4 Participatory mapping and the prioritization of areas and drivers of change

Spatial analysis of forest and land cover datasets and other thematic datasets collected over multiple time periods can show how forest and other types of land cover has changed over time. A basic analysis of land cover change prior to a participatory workshop can highlight dominant trends (e.g. in forest regeneration, deforestation and degradation, from a REDD+ perspective). Analysis of data on past and planned developments or trends from other sectors may also highlight the role of particular drivers of forest cover change and pressures on forests. The following are some key considerations in preparing maps of forest cover change and pressures on forests for use in integrated land-use planning processes:

- **The data being compared must be collected and mapped using a consistent methodology**. This is necessary for the resulting map to show where and how much forest cover has been lost or gained with some degree of accuracy. For instance, the definitions of key concepts such as forest and forest degradation will need consistency so that the data from the different periods are comparable.
- **The analysis will be constrained by the level of detail in the dataset.** Many datasets may only allow an analysis showing a simple change from forest to non-forest. Understanding the type of change, i.e. from its original state and what it has been converted to (e.g. from primary forest to agricultural land), may require a more detailed dataset or other information. In the most comprehensive datasets on forests, it may be possible to map information on forest degradation and regeneration, i.e. where forest has changed from high to low biomass or vice-versa.
- **Forest cover change analysis does not provide a complete picture on its own.** It can provide some indication of where deforestation and forest degradation has happened in the past and the potential drivers of the change. However, additional information (including from local stakeholders) can provide a better understanding

Data workshop, 2014, Bihn Thuan, Viet Nam
© Nguyen Minh Khoa

Box 3: Spatial analysis workflows

Maps for integrated land-use planning require **a clear logic** that can be justified and explained to policy-makers and other stakeholders, including those with technical and non-technical backgrounds. Although spatial analysis and participatory approaches complement each other and add value to the planning process, combining the two approaches also adds complexity.

Clearly **identifying and documenting** each step in the analyses is vital, in order to ensure a sound methodology and coherence between the approaches used to develop different maps. Before undertaking any spatial analysis, the question that the analysis will try to answer needs to be clearly formulated and in sufficient detail for the spatial analysis team to develop a map. This involves identifying the sequence of appropriate analytical steps, the input requirements (in terms of data and any criteria) and the expected output from the analysis. Defining a robust spatial logic (a series of technical GIS processing steps) and working out the sequence of those steps into a **spatial analysis workflow** will save time and ensure the analysis is appropriate for the question.

Workflows usually take the form of **a diagram, setting out the inputs, GIS processing steps, criteria and outputs.** They document how the maps have been generated and can record how information from the participatory process and spatial analysis have been combined. A workflow can be used to guide a technician manually through the analysis steps or, if the GIS technician chooses, the sequence of steps can be strung together and run repeatedly (e.g. using tools such as ArcGIS model-builder).

A documented workflow also makes it easier to review and modify analysis (e.g. if new information becomes available) and allows the steps to be shared between technicians and teams. An example workflow developed during the working sessions with the PRAP teams in Viet Nam is provided in Box 4, step 6 of this document.

of why the change is happening and where it will likely happen in the future.

- **Data from other sectors can help to provide an indication of the role of past, current or future pressures on forests**. Data from sectors other than forestry can also often be mapped and may highlight particular pressures on forests. For example, useful datasets may include those showing planned land concessions for agriculture and plantations, infrastructure development plans, current and/or projected population density, and timber harvesting areas. However, remember that these datasets will often be based on different methodologies, classifications and time periods, and thus may be difficult to compare with each other.
- **Maps require a clear logic that can be explained to stakeholders.** Documentation of how the maps have been created, and how the datasets have been used, is essential to explaining the results and replicating analyses in the future. Box 3 introduces spatial analysis workflows as a way to guide and document the process for developing maps.

Participatory approaches, including participatory mapping, can be effective ways to complement forest cover change analysis by:

- **Identifying the need for further validation**. The analyses of forest cover change or pressures on forests may require further work and validation if stakeholder information disagrees with the findings of the spatial analysis. Step 7 provides more information on cross-checking maps and the outputs of participatory processes.
- **Helping to identify and prioritize areas affected by or at risk from drivers of change.** The maps and statistics generated from the spatial analysis will aid discussion with stakeholders from different sectors, organizations and communities. They can prompt people to contribute local knowledge and discuss the accuracy of the trends presented in the maps. The maps can also help people to prioritize areas considered the most affected by, or at risk of, drivers of forest cover change, and which pressures or drivers of change merit the closest attention in the planning process.
- **Promote exchange of knowledge across sectors.** The maps can aid examination of impacts of particular sectors on forest cover, and how these may change in the future; for example, planned deforestation due to the proposed development of infrastructure or changes to land-use designations.
- **Providing input into the design of further analyses**. Stakeholder and expert opinion can help to guide the development of further spatial analyses. For example, spatial analysis to identify areas most likely at risk from future deforestation can be areas or drivers which the participatory process has highlighted. Stakeholders can also provide valuable guidance on criteria or parameters for further analyses; for example, that the forest areas at most risk of conversion to small-scale agriculture are those of a particular management category within a particular distance from existing agricultural fields.

Field verification of interventions, Tanh Linh District, Binh Thuan, Viet Nam © Nguyen Dai Tien

Case Study Part 5: Prioritizing drivers and affected locations in Viet Nam

In the Viet Nam PRAP process, prioritization of drivers of deforestation and forest degradation and barriers to enhancement, conservation and sustainable management, as well as identification of hotspot areas, was primarily driven by the participatory workshops. However, spatial analysis was integrated throughout the whole process, with technical teams providing maps and statistical inputs to the workshops, conducting subsequent spatial analysis using the participatory results, and conducting additional spatial analyses after workshops to help cross-check the spatial and participatory results.

A multi-stakeholder workshop was held in each pilot province for prioritizing drivers and barriers. Participants were presented with information for their province on trends in deforestation and forest degradation and on direct and indirect drivers and barriers. They ranked priority drivers and barriers, considering the future risk as well as past patterns, and developed problem trees to identify the different components and issues associated with each priority driver/barrier. The participants used maps to then rank particular areas, usually at the scale of communes, as high, medium, or low in terms of the importance and impact of particular drivers/barriers.

The teams further analyzed the results of the participatory mapping following the workshop by incorporating the results of the workshop into GIS, conducting additional analysis to complement the participatory maps and refine the areas affected by or at risk from the driver/barriers, and in some cases undertaking field visits to further check the results and seek more information. Validated maps of the priority areas in each province for drivers/ barriers were prepared, and fed into the next stage of the planning process, including participatory workshops to develop 'solutions'.

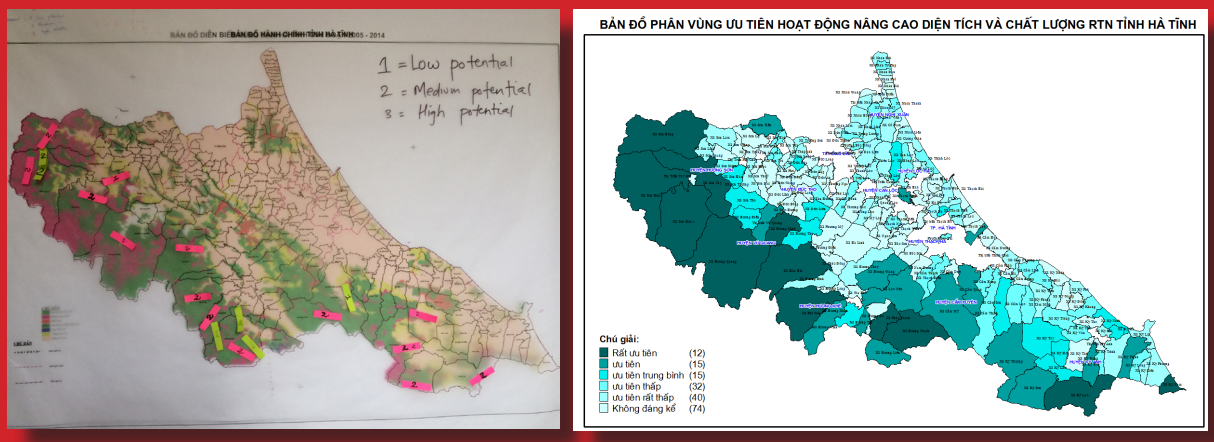


Figure 4: Participatory map ranking communes in Ha Tinh Province according to potential for forest enhancement (left); and final GIS map showing all communes ranked according to key drivers and barriers (right) (prepared by IFEE, 2016)

The main challenges faced in Viet Nam during this stage of the planning process were:

- Ensuring appropriate facilitation of mapping exercises, and that each group answered the same questions and used the same method for prioritizing the areas for drivers/ barriers.
- Recording as much information as possible from participants to understand why they chose certain areas/communes or exactly what kind of problems and barriers they were discussing.
- Allocating enough time during workshops for discussion and the participatory mapping exercises.

5 Incorporating multiple benefits and risks

REDD+ and other initiatives to optimize land-use have the potential to deliver **multiple benefits**, including a wide range of social and environmental goods and services. For example, social benefits from REDD+ implementation can include enhanced forest governance and increased participation in local decision-making on land use and natural resources. Environmental benefits from securing the many ecological functions of forests can include improved biodiversity conservation and provision of ecosystem services on which people depend.

Depending on how actions in landscapes are implemented, they also carry **potential risks**. For example, in the REDD+ context, pressures on forests could be displaced from one area to another, or local communities' access rights to forests may be reduced. A set of safeguards, known as the **Cancun safeguards**, were specifically developed by the Parties to the UNFCCC to address such potential risks of REDD+ and encourage its benefits, and are summarized in the table below. The UNFCCC requests countries to promote and support these safeguards throughout the implementation of REDD+ activities. Other initiatives may also be subject to safeguard requirements, for example from donors and development banks.

Summary of the Cancun safeguards[2]:

Table 2: Summary of Cancun Safeguards

(A) Consistency with national objectives and international agreements
(B) Transparent, effective forest governance and sovereignty
(C) Respect for knowledge and rights of indigenous peoples and members of local communities
(D) Full and effective participation of stakeholders
(E) Natural forest, biological diversity and enhancement of benefits
(F) Address the risks of reversals
(G) Reduce the displacement of emissions

Well-planned and integrated REDD+ implementation should therefore enhance potential environmental and social benefits and reduce potential risks. When planning for REDD+ at the sub-national level, including identifying suitable or priority locations for the implementation of REDD+ actions (see Step 6 for more discussion on REDD+ actions), the potential risks and benefits, and the compliance of the actions with the safeguards, should also be considered. This includes considering these factors in related spatial analyses.

Field validation of conversion of forest to agricultural land, Ha Tinh Province, Viet Nam, 2016 © IFEE

Just as other criteria for planning can be considered spatially, so can certain environmental and social benefits and risks. When mapping priority locations for actions, in addition to considering biophysical features, forest management categories, and so on, **spatial analysis criteria** could therefore include the following:

- Location of natural ecosystems (in order to avoid the risk of converting natural ecosystems to another use)
- Location of poor households or communities (in order to target certain actions in poor communities where potential socio-economic benefits may be higher)
- Location of areas providing non-timber forest products (in order to reduce the risk that certain actions may lead to people losing access to forest products on which they depend for livelihoods and well-being)
- Areas with higher risks of soil erosion (in order to enhance a potential benefit from actions like forest restoration or reduced deforestation, i.e. reducing soil erosion)
- Areas with high conservation value or biodiversity (in order to enhance the potential benefit of actions for biodiversity conservation)

There are numerous examples of criteria and corresponding spatial layers that can be used to explore the distribution of potential environmental and social benefits and risks across a landscape. However, not all information can be mapped – understanding risks and benefits, and the compliance of REDD+ actions with the Cancun safeguards, also needs consultation with stakeholders and other types of analysis. For example, this can include participatory analysis using tools such as the UN-REDD Programme's Benefits and Risks Tool (BeRT), focus group discussions and field visits to better understand potential risks and benefits.

[2] For more information on the Cancun safeguards: http://www.unredd.net/knowledge/redd-plus-technical-issues/safeguards.html

Case Study Part 6: How were benefits and risks considered in Viet Nam's PRAPs?

The planning process in Viet Nam's pilot provinces included the participatory analysis of potential benefits and risks of the proposed REDD+ actions by workshop participants. Participants assessed the potential social and environmental benefits and risks of the proposed interventions (Table 3). They also considered the feasibility or implementation risks (i.e. potential obstacles to effective implementation).

The analysis involved group work, and in some cases focus-group discussions. In addition to identifying the potential benefits and risks, the participants assessed the probability and size of impact of each benefit/risk, and discussed possible risk mitigation and benefit enhancement measures. The feasibility, benefits and risks of REDD+ actions were also discussed with local stakeholders during field visits to sites in the provinces.

Table 3: Examples of risks from proposed REDD+ actions identified in Binh Thuan Province's PRAP process (UN-REDD 2017a)

Intervention package (action)	Environmental risk	Probability	Impact	Measures to mitigate risks
Issuing legislation on forest encroachment	Leakage: deforestation in neighbouring provinces and weaknesses in forest governance	Medium	Medium	Improve coordination with neighbouring provinces
Intervention package	**Social risk**	**Probability**	**Impact**	**Measures to mitigate risks**
Issuing legislation on forest encroachment	Loss of income from forest products (especially for poor households)	High	Medium	Benefit-sharing mechanisms between forest owners and communities

In some cases, the potential benefits and risks were also analyzed spatially. For example, including the distribution of soil erosion risk in a landscape in the mapping of priority areas for forest restoration actions. However, a lesson from the Vietnamese experience is that the analysis of benefits and risks through the participatory process should be more formally integrated into the mapping process. Ensuring strong feedback on benefits and risks between participatory approaches and other analyses requires that clear guidance is provided to participants and planning teams.

Analysis of intervention packages, Phan Thiet City, Binh Thuan Province, 2015 © Nguyen Minh Khoa

Using maps of priority communes to develop 'solutions' during a workshop in Bac Kan Province, Viet Nam ©UNEP-WCMC

6 Mapping priority areas for implementing actions

Selecting and designing effective, locally appropriate actions to address particular problems and to achieve certain objectives is a key goal of sub-national planning. In the REDD+ context, addressing drivers of deforestation and forest degradation and barriers to conservation, sustainable management and forest enhancement is an essential element of developing sub-national REDD+ plans. REDD+ actions, often also referred to as 'policies and measures' (PAMs) or 'interventions', refer to the specific measures to be taken to implement REDD+. Some examples are shown in Table 4.

The prioritization and mapping of areas for proposed actions to be included in a sub-national plan can also benefit from combined participatory and spatial analysis approaches, and an integrated land-use planning framework that includes multiple sectors. For example, broad areas (e.g. administrative units) or specific areas (e.g. in a particular forest or community) for particular actions can be identified in the participatory workshops and recorded through participatory mapping. The participatory process may also collect other information about where an action can be implemented; for example, stakeholders may recommend to focus an action in areas with a particular quality or function (e.g. natural forests, poor communities).

Additional spatial analyses can be used to then further confirm or refine these priority areas. They can also be used to identify other areas based on criteria identified in the participatory process. For example, if participants have identified some broad areas, spatial analysis could help to exclude areas where that action would not be possible, or it could prioritize areas where the action may be most suitable or beneficial.

As discussed in Step 4, spatial analysis workflows are especially valuable in carrying out this kind of multi-criteria analysis. Defining a logical workflow for the spatial analysis helps to ensure that: a) areas appropriate for the specified action are selected, i.e. information collected from the participatory sessions is used; and b) appropriate spatial analysis methods are used. An example workflow is presented in Figure 6.

Table 4: Examples of REDD+ actions

Five REDD+ activities	Example actions
Reducing emissions from deforestation	Reduce conversion pressure through improved land-use planning
Reducing emissions from forest degradation	Provide alternatives to fuelwood from natural forests
Conservation of forest carbon stocks	Improve management of existing protected areas
Sustainable management of forest	Promote reduced impact logging practices
Enhancement of forest carbon stocks	Rehabilitate degraded forests using enrichment planting

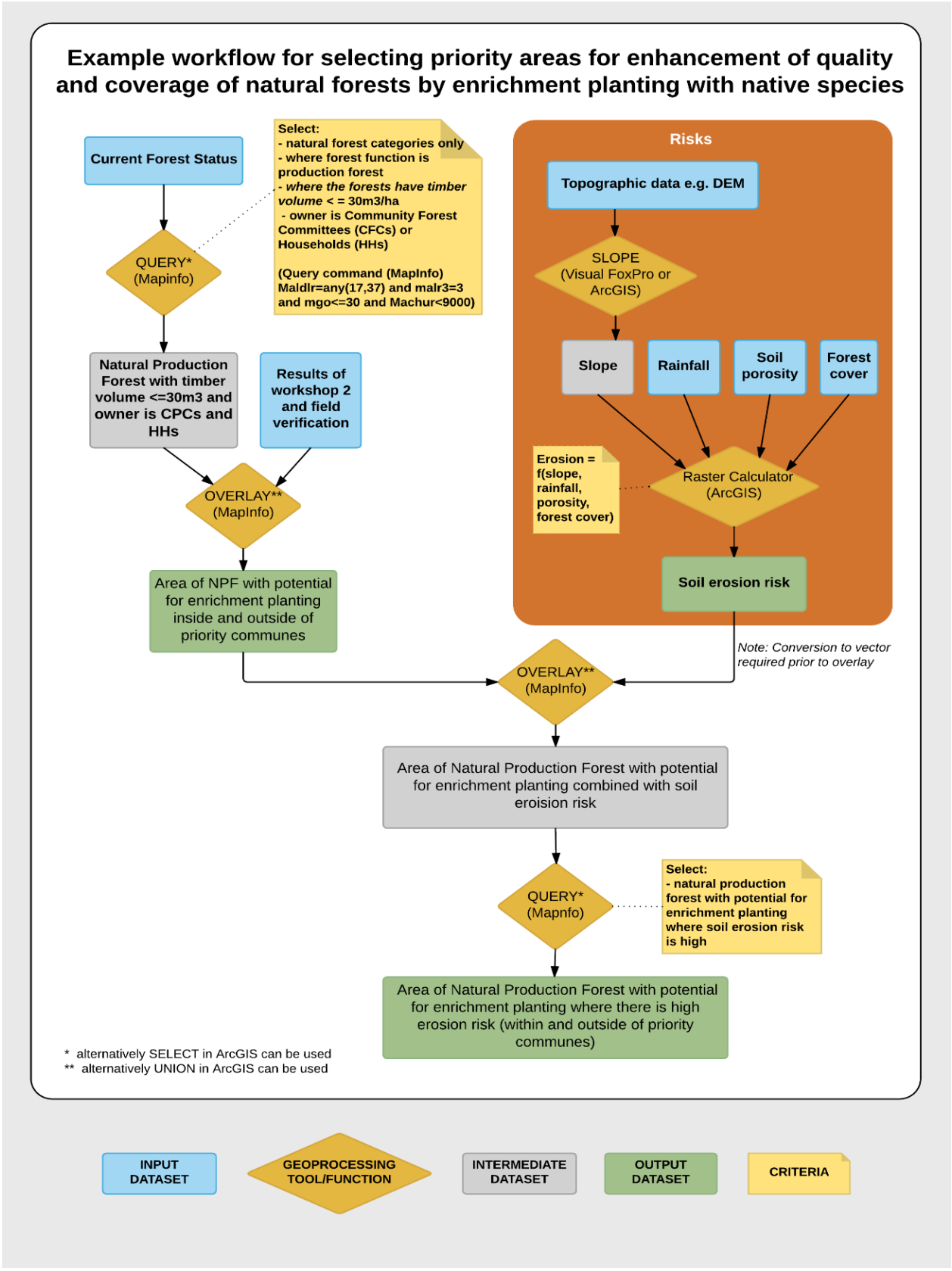


Figure 5: Example workflow for selecting priority areas for a REDD+ action

The following questions can help to clarify the logic, data and steps required for mapping priority areas for the implementation of actions[3]:

- **Where are the areas affected by/at risk from the target problems, drivers or barriers?** The location of actions should be informed by the location of the drivers of change or barriers that the action is to address. This may be based on previous maps developed to show drivers and barriers, or on other knowledge about which areas are affected.
- **What physical aspects, if any, will affect the implementation of the intervention?** For example, the degree of slope, soil type, forest type or local climate may be influential over the suitability of an area for implementation of a particular action.
- **What other aspects may affect the action's feasibility?** For example, factors such as the accessibility of sites, estimated carbon stocks, the forest condition (e.g. degree of degradation), or risks to implementation (e.g. flood risk) may also need to be considered.
- **What is the potential to enhance social and environmental benefits from the action?** For example, can the action contribute to poverty reduction, biodiversity conservation, or ecosystem services provision? Will some areas increase the potential to provide these benefits compared to others?
- **What social and environmental risks are associated with the action?** What is the potential to reduce risks, for example to prevent the conversion of natural forests to plantations or reduce the risk of conflict over land? In the case of REDD+, this contributes to assessing whether the intervention is consistent with the safeguards.

Maps setting out areas of land, forest or administrative areas, suitable for particular actions, are thus the result of bringing together the previous analyses and participatory outputs, combining a number of different sources of data and processes. These will likely include: participant priorities and information from multi-stakeholder workshops; existing layers of spatial and statistical information; the results of field visits; analysis of risks and benefits; more detailed implementation plans or designs for actions; and finally inputs from stakeholders during validation processes (see Step 7). GIS tools such as ArcGIS Model Builder may be used to help implement the workflows, particularly for the more complicated multi-criteria analyses (Box 4).

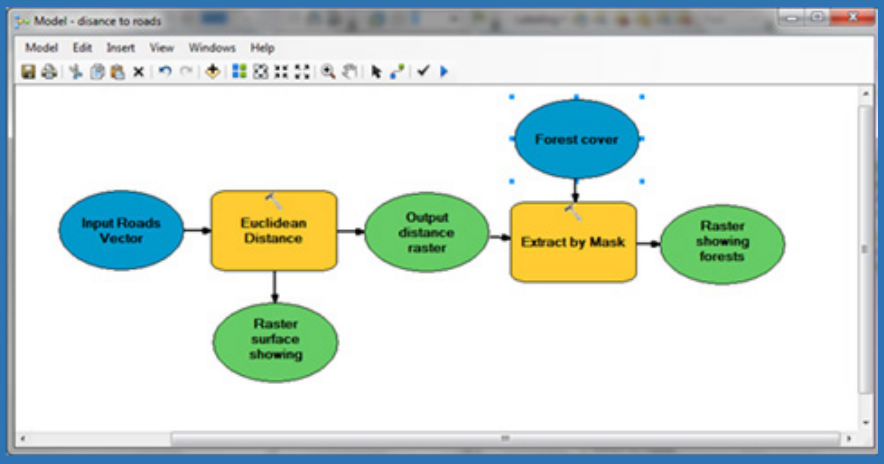
[3] Adapted from Ravilious *et al.* 2016

Box 4: Model Builder

Model Builder is an application that you can use to create, edit, and manage models. Models in ArcGIS are workflows that string together sequences of geoprocessing tools, feeding the output of one tool into the next. Benefits of using Model Builder include better organization for improved workflows and faster analysis. By standardizing processes in this way, any future repeat analysis is also made much easier. A simple example may only contain one or two steps and ArcGIS geoprocessing tools. For example, the model below classifies forest according to distance from roads.

In QGIS, Graphical Modeller is a similar tool. Tutorials for both are availale at

http://bit.ly/GIStools-redd.



Case Study Part 7: Mapping 'intervention areas' in Viet Nam

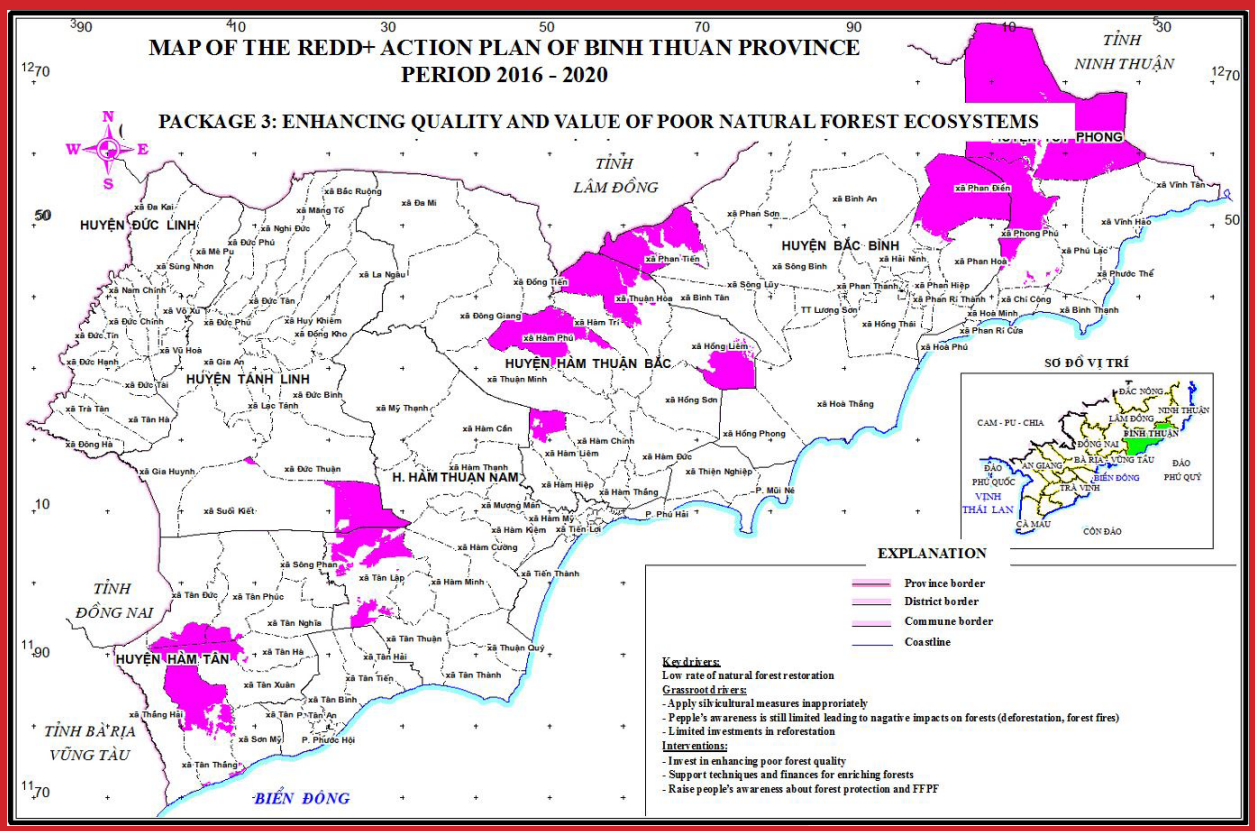
In the Viet Nam provincial REDD+ planning process, REDD+ actions are referred to as 'interventions'. Through the participatory workshops and analyses, each province came up with a set of 'intervention packages', which included a series of individual interventions. The teams then had the task of defining priority areas for these interventions on maps.

The first question was at what level should the interventions be mapped? Most provinces chose to map priority areas for intervention packages, rather than individual measures within those packages. The teams then prepared draft maps of areas for REDD+ implementation. These maps varied among the provinces in the way that areas were shown. Most highlighted priority communes (an administrative area that was used by participants during the workshops), while some highlighted forest management units or forest areas.

In all cases, these maps were the product of a number of inputs and processes including: areas prioritized by workshop participants for REDD+ actions; results of additional analysis and field visits; analysis of feasibility, risks and benefits; and the final design features of the intervention packages.

The final maps for the intervention areas are more detailed and nuanced than those that have previously been prepared for REDD+ planning in Viet Nam, and the process boosted technical capacity for the national partners in this area. There were some challenges in integrating the work into the relatively short action plans that resulted, such as in recording technical details of how the interventions were designed and mapped, and in how to provide templates or detailed guidance for the final maps when circumstances differ across provinces.

Figure 6: Example of final PRAP map for Binh Thuan Province showing potential areas for undertaking a REDD+ intervention package to enhance forests (prepared by Sub-FIPI Southern Region, 2016)



7 Validating maps and participatory planning processes

Checking and validation should be undertaken throughout the sub-national planning process, and applied to maps, other analyses, and the results of participatory approaches. Participatory processes can be used to cross-check spatial analyses and vice-versa. For example, participants in workshops can highlight whether maps look accurate based on their local knowledge, and spatial analyses can confirm how widely trends identified by participants are occurring across the landscape. Cross-checking the outputs of spatial analysis (e.g. on land cover change, key drivers of deforestation and forest degradation, and priority areas for implementation of actions) can be done in numerous ways:

- **Field checks.** Visiting hotspots of land cover change, e.g. deforestation and/or forest degradation, and priority areas for implementation shown on the maps helps to confirm whether the analysis and the participatory findings are accurate, and can provide valuable information for the planning process (e.g. on the severity of the target problem, such as forest loss, on the feasibility and local appropriateness of proposed actions, and potential benefits and risks). However, field visits can also be time and resource intensive, and sometimes difficult to organize.
- **Additional analysis.** Beyond using spatial analysis and participatory approaches, the results of different stages of the planning process can also be cross-checked using other types of information. For instance, statistical data may confirm the degree of poverty or population growth in particular areas, or the intensity of enforcement actions against illegal forest activities. Satellite images, and services such as Google Earth, may provide a cost-effective way to cross-check reports of environmental change or other developments in an area, depending on data availability. Overlaying future spatial land-use or sectoral development plans may help to confirm why participants have prioritized certain areas or drivers of change.
- **Expert review**. The results of spatial analysis and participatory approaches will also benefit from review by experts, e.g. to quality check the locations in the participatory maps. This is particularly important when spatial datasets and participatory maps contradict each other. Where the planning process is led by government, the results will also generally require review and approval by the relevant authorities. If an expert or official review process is to be undertaken, make sure to account for this in the timeline to develop the plan.
- **Participatory review and validation**. This is often a late or final step in the preparation of analyses or the development of a plan. However, feedback from stakeholders should be sought throughout the planning process, as it can help to highlight inaccuracies and refine the maps. It is also essential for ensuring local acceptance and ownership of the results.

Discussions with local communities on proposed interventions, Tanh Linh District, Binh Thuan Province © Nguyen Dai Tien (Sub-FIPI South)

Case Study Part 8: Validating maps for Viet Nam's PRAPs

The overall approach used to develop the provincial REDD+ action plans in Viet Nam encouraged regular feedback between the participatory and analysis components. Each output developed through a workshop or analysis was then fed into another workshop or analysis, until the maps had been finalized.

The maps developed for the action plans were validated in a number of ways, including presentation and annotation of maps during workshops, field visits and expert review. The final content of the plans was also presented in provincial workshops for stakeholder review, and the plans themselves were approved by the Provincial People's Committees.

Challenges were encountered in this process, such as lack of confidence among stakeholders in the data being used or the results of analyses, and a lack of confidence in participatory results among technical staff. However, the combination of the two approaches strengthened the outputs, and increased stakeholder ownership and transparency in the REDD+ planning process.

Lessons learned

In integrated land-use planning, stakeholders and decision-makers consider a range of economic, environmental and social development goals and land-use activities, aiming to reconcile targets for different sectors and simultaneously meet a number of objectives in a landscape. Combining spatial analysis and participatory approaches can make a valuable contribution to integrated land-use planning. The experiences in sub-national REDD+ planning in Viet Nam have shown that maps are valuable tools for communicating information, both helping to answer REDD+ planning questions and informing participatory processes. Key lessons for those undertaking integrated land-use planning at a sub-national level using combined spatial analysis and participatory approaches include the following:

Implementation plans should be 'owned' by local level constituencies, with strong provincial and local-level involvement in the process. This refers not just to the workshops but also to data collection, processing and analysis. To ensure better cooperation with local staff and allow them to contribute further to the implementation of the plan in the future, capacity building and training at the sub-national level is needed, for example on GIS as well as on the planning process more broadly.

Final plans need to include clear explanations of the analysis that was carried out and how the conclusions of the plan were reached. This includes documenting and storing the technical workflows used for each final map, with the option to share simplified versions of workflows with decision-makers and non-technical audiences. This facilitates understanding, potential for replication and adjustment of the analyses, and future review of the plan. To this end, a balance between the need for a simple, readable plan and for access to the technical information should be found. For those maps and other analyses generated during the planning process but not included in the final plan, these can be included in an annex or supplementary materials document.

Technical oversight and knowledge-sharing on methods and workflows. Depending on the resources available, this could be a central repository of methods and analyses, or delegation of responsibility to an organization for collating these which also provides technical oversight/advice. This would assist sub-national teams undertaking similar analyses in the future, help to provide a degree of consistency across sub-national units, and contribute to sharing the technical approaches beyond technical staff and other actors involved in specific planning processes.

Shared methods and exchanges of experiences between teams. Encouraging teams working across a number of locations to work together to define common methods and to share their experiences

is highly beneficial. It promotes consistency (e.g. in spatial analysis methods and validation of outputs), reduces the need to develop new methods, and helps to jointly overcome challenges encountered during the process.

Maps are valuable when integrated with a participatory planning process, but a clear understanding of them is essential. Maps can help to communicate information, encourage discussion and feedback from participants, and serve as a planning tool. However, clarity is important on the purpose of the map, what it is communicating, and what the participants are being asked to map or prioritize.

There should be strong integration between different workstreams and activities in developing the sub-national plans. More formal and comprehensive integration between the various workstreams or components of the planning process is beneficial. For example, the process should explicitly link the design and mapping of locations for actions to the analysis of benefits and risks, and thus to any safeguards considerations.

Clear and detailed guidance is helpful and allows more consistency between sub-national planning areas, but differences between areas also need recognition. Although detailed guidance and instructions for developing a plan is generally preferred by planning teams, including what maps to produce and how to produce them, this is challenging to provide when the context and needs within a country differ substantially. For example, the spatial analysis needed for understanding drivers of change may vary considerably, the land classes that need aggregation may differ, and stakeholders may prefer different scales and levels of detail in their maps. Thus, there still needs to be some flexibility and creativity in preparing maps appropriate to different contexts. Capacity building on how to interpret any official guidance, how to deal with different contexts, and how to use datasets in different ways is also needed.

A clear position on role of spatial analysis in future steps is needed. The type of maps produced during the planning process, their technical complexity and the scrutiny and verification processes applied to them depends on several factors. These factors not only include how the maps will be used in the planning process (e.g. suitability for workshop use) but also whether there will be a future expectation to use the maps (or spatial data) in subsequent work, such as monitoring, site-based and sectoral plans. These expectations need to be carefully considered and made clear at an early stage in the process. If maps are to be used for future tasks such as monitoring or MRV, more guidance for the consultant teams will be needed.

Field validation of conversion of forest to plantations, Ha Tinh Province, Viet Nam, 2016 © IFEE

Annex 1: Glossary

Term	Definition	Source
Addressing safeguards	Ensuring that a coherent body of policies, laws and regulations (PLRs), and associated institutional arrangements, are in place to deal with the potential benefits and risks associated with REDD+ actions, and in doing so, enabling the application of the Cancun safeguards in the country context and meeting country safeguard goals.	Adapted from: UN-REDD Programme 2016a; UN-REDD Programme 2015a.
Anthropogenic emissions	The term used to distinguish naturally occurring greenhouse gas emissions from ones that result from human activity. (It is also referred as human induced).	Barnsley 2009
Barriers	Constraints to implementing "+" activities of REDD+, i.e. barriers to the enhancement and conservation of carbon stocks and sustainable management of forests. These are similar to barriers to investments related to sustainable forest management and the drivers of deforestation, e.g. fiscal incentives.	UN-REDD Programme 2015b
Carbon dioxide (CO_2)	A naturally occurring gas, also a by-product of: burning fossil fuels from fossil carbon deposits, such as oil, gas and coal, burning biomass, land-use changes and industrial processes (e.g., cement production). It is the principal anthropogenic greenhouse gas (GHG) that affects the earth's radiative balance. It is the reference gas against which other GHGs are measured and therefore has a Global Warming Potential (GWP) of 1.	Intergovernmental Panel on Climate Change (IPCC) 2014
Cartography	The art and science of expressing graphically, usually through maps, the natural and social features of the Earth.	Esri 2017
Dataset	Any collection of related data, usually grouped or stored together.	Esri 2017
Deforestation	The direct human-induced conversion of forested land to non-forested land.	IPCC 2000
Drivers of deforestation and forest degradation	In the context of REDD+, 'drivers' are actions and processes that result in deforestation and forest degradation. Drivers can be separated into: • 'Direct drivers' (also called 'proximate causes'), i.e. human activities or immediate actions that directly impact forest cover and loss of carbon; •'Indirect drivers' (also called 'underlying causes' or 'driving forces'), i.e. complex interactions of fundamental social, economic, political, cultural and technological processes.	UN-REDD Programme 2015b
Ecosystem services	The benefits people obtain from the environment. Ecosystem services are the transformation of natural assets including soil, plants and animals, air and water, into things that we value. They can be viewed as provisioning (e.g. food and water); regulating (e.g. flood and disease control); cultural (e.g. spiritual, recreational, and cultural benefits); or supporting (e.g. nutrient cycling), which maintain the conditions for life on Earth.	UN-REDD Programme 2015c
Enhancement of forest carbon stocks	A component of a REDD+ strategy that could include both the restoration/ improvement of existing but degraded forests and the increase of forest cover through environmentally appropriate afforestation and reforestation.	World Bank 2012
Enrichment planting	The process by which trees are planted in a degraded forest to increase the density of existing tree species or increase tree species richness by adding tree species.	Forest Restoration Research Unit/Chiang Mai University 2008
Forest degradation	The term used to describe the condition of a forest that has been reduced below its natural capacity, but not below the threshold percentage of crown cover that qualifies as deforestation.	IPCC 2000

Geographic Information System (GIS)	An integrated collection of computer software and data used to view and manage information about geographic places, analyze spatial relationships, and model spatial processes.	WikiGIS 2011
Geoprocessing	A GIS operation used to manipulate spatial data. A typical geoprocessing operation takes an input dataset, performs an operation on that dataset, and returns the result of the operation as an output dataset. Common geoprocessing operations include geographic feature overlay, feature selection and analysis, topology processing, raster processing, and data conversion. Geoprocessing allows for definition, management, and analysis of information used to inform decisions.	Esri 2017
Graticule	A network of longitude and latitude lines on a map or chart that relates points on a map to their true locations on the Earth.	Esri 2017
Integrated land-use planning	Integrated land-use planning is used to promote the sustainable management and development of land resources. It seeks to meet this objective by a better balancing of all relevant aspects (biophysical, technical, socio-economic, legal, institutional and social) in land-use planning. In particular, it stresses: the importance of engaging stakeholders and recognizing their different objectives through a platform for negotiation; outlining an enabling institutional and policy environment at local, sub-national, and national levels; ensuring an accessible knowledge base; and providing a set of planning procedures.	Ministry of Agriculture and Co-operatives (The Kingdom of Swaziland), FAO, and UN Environment 1998.
Model Builder	The interface used to build and edit geoprocessing models in ArcGIS.	Esri 2017
Policies and Measures (PAMs)	A frequently used phrase – sometimes abbreviated as PAMs – referring to the actions taken – or to be taken – by countries to reduce greenhouse-gas emissions under the UNFCCC and the Kyoto Protocol. Some possible policies and measures are listed in the Protocol and could offer opportunities for intergovernmental cooperation.	United Nations Framework Convention on Climate Change (UNFCCC) 2014
REDD+	Reducing emissions from deforestation and forest degradation is a mechanism developed by Parties to the UNFCCC. It creates a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. REDD+ goes beyond simply deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks.	UN-REDD Programme 2016b.
REDD+ actions	Specific interventions, within the five REDD+ activity categories agreed under the UNFCCC, aimed at tackling underlying drivers of deforestation and forest degradation, or to support more effective/ extensive “plus” activities	UN-REDD Programme 2015c
REDD+ activities	The five REDD+ activity categories agreed under the UNFCCC: reduction of emissions from deforestation and forest degradation, conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks	UN-REDD Programme 2015b
REDD+ benefits	Potential benefits or positive impacts arising from REDD+ implementation. These can also be referred to as ‘multiple benefits of REDD+’.	UN-REDD Programme 2017b
REDD+ risks	Potential risks or negative impacts arising from REDD+ implementation	UN-REDD Programme 2017b
Spatial analysis	The process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge. Spatial analysis extracts or creates new information from spatial data.	Esri 2017
Sub-national	An administrative division, administrative unit, administrative entity or country subdivision (or, sometimes, geopolitical division or sub-national entity) that is a portion of a country or other region delineated for the purpose of administration.	The REDD Desk 2017
Workflow	A set of tasks or steps carried out in a certain order to achieve a goal.	Esri 2017

Annex 2: Examples of tools

This table provides some examples of tools that can be used to support spatial and other types of analysis in sub-national integrated land-use planning.

Title	Web link	REDD+ relevance	Platform		
			Land-use	Valuation	
Exploring Multiple Benefits Mapping	http://bit.ly/GIStools-redd	This is a GIS toolbox, for use in ESRI's spatial analysis software. The outputs can support REDD+ decision making.	X		ArcGIS
InVEST: Integrated Valuation of Ecosystem Services and Tradeoffs	http://www.naturalcapitalproject.org/invest	A family of tools to map and value the goods and services from nature.		X	Stand alone or ArcGIS
NatureServe Vista	http://www.natureserve.org/conservation-tools/natureserve-vista	A spatial decision-support framework that helps users bring together conservation objectives with land-use and resource planning.	X	X	ArcGIS
Ecosystem Management Decision Support (EDMS) system	http://www.spatial.redlands.edu/emds/	An application framework for knowledge-based decision-support for ecological assessments at any geographic scale.	X		ArcGIS
Engaging Plans	http://engagingplans.com/	Enables planners to launch and maintain interactive, place-based, public involvement websites for gathering stakeholder feedback and sharing updates to the community.	X		Stand alone. Desktop-based
Zonation	https://ebmtoolsdatabase.org/tool/zonation	A framework for large-scale conservation planning.	X		Stand alone. Desktop-based
Co$ting Nature	http://www.policysupport.org/costingnature	Web-based tool for natural capital accounting. Typical applications include ecosystem service assessment, prioritization of areas for conservation, analysis of co-benefits (e.g. for REDD+), and impacts of pressures and threats.		X	Stand alone. Desktop-based
SOLVES	http://solves.cr.usgs.gov/	SolVES 3.0 is a public-domain tool to help evaluate the social values of ecosystem services and to facilitate discussions among diverse stakeholders regarding the tradeoffs among ecosystem services		X	ArcGIS
TESSA	http://tessa.tools/	Site-based toolkit, with guidance on low-cost methods for evaluating ecosystem services at particular sites.	X		Stand-alone. Web-based.
WaterWorld	http://www.policysupport.org/waterworld http://www.climateplanning.org/tools/waterworld	WaterWorld is a spatial tool for testing the impacts of land- and water-related policies on water services.	X		Stand alone. Web-based

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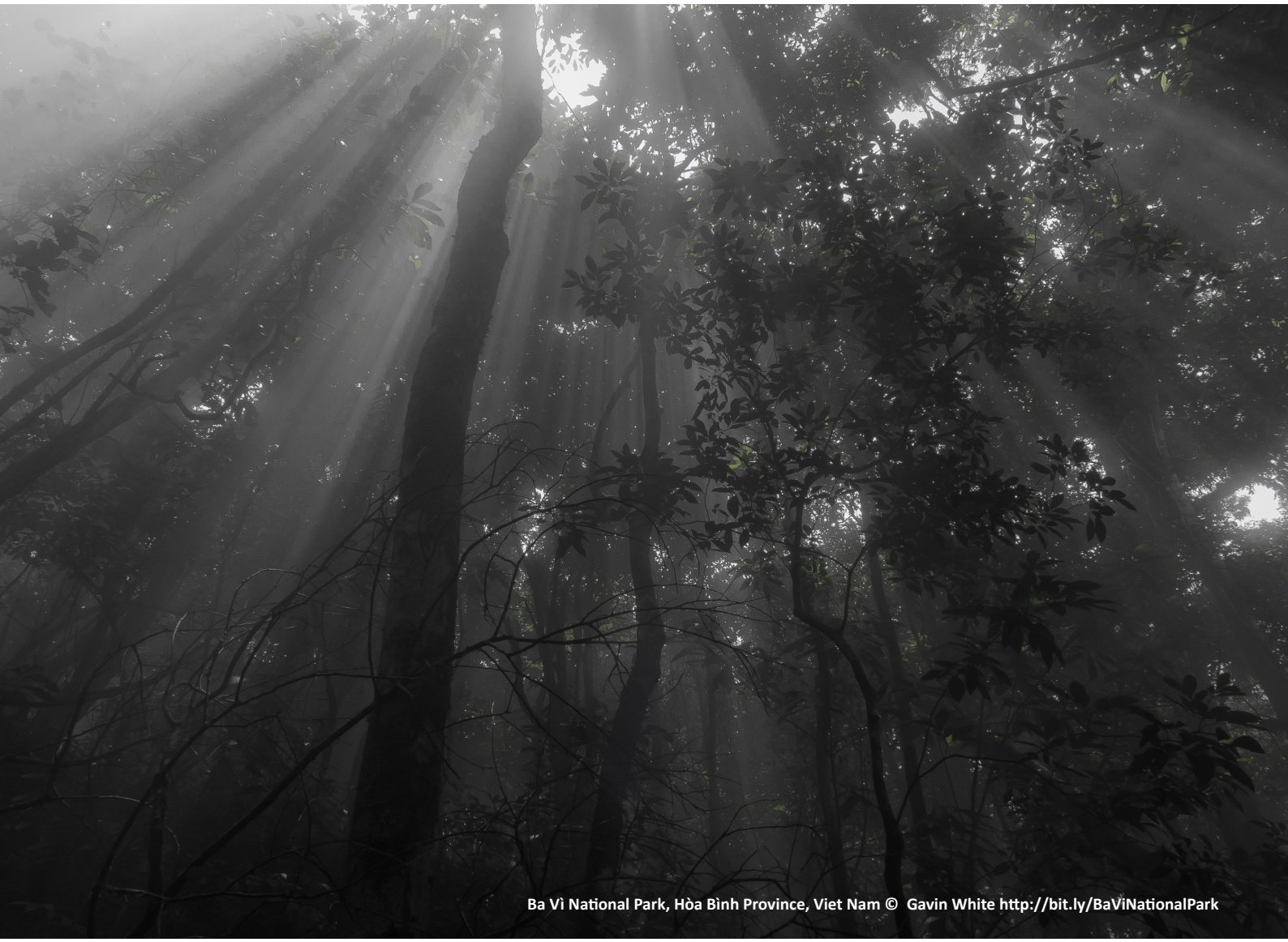
UN-REDD PROGRAMME VIET NAM

Food and Agriculture Organization of the United Nations

UNDP UNEP



Ba Vì National Park, Hòa Bình Province, Viet Nam © Gavin White http://bit.ly/BaViNationalPark

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