# Spatial analysis to support provincial REDD+ action planning in Viet Nam

## Joint working session for the UN-REDD Viet Nam Phase II Programme

UN-REDD PROGRAMME

**Working Session Report**

*28 September - 3 October, Institute for Forest Ecology and Environment, Viet Nam Forestry University, Xuan Mai*

The joint working session covered in this report was organized by the Institute of Forest Ecology and Environment (IFEE) and the UN-REDD Viet Nam Phase II Programme.

The UN-REDD Programme is the United Nations Collaborative Initiative 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 the United Nations Environment Programme (UNEP). 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.

The UN-REDD Programme provided technical support from the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) for this workshop. UNEP-WCMC is the specialist biodiversity assessment centre of the United Nations Environment Programme (UNEP), the world's foremost intergovernmental environmental organisation. The Centre has been in operation for over 30 years, combining scientific research with practical policy advice.



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

| | |
|---|---|
| **CIP** | Co-Implementing Partner |
| **DEM** | Digital Elevation Model |
| **FIPI** | Forest Inventory and Planning Institute |
| **FREC** | Forest Resources and Environment Center |
| **EIA** | Environmental impact assessment |
| **ES** | Ecosystem services |
| **GIS** | Geographic Information System |
| **GIZ** | Deutsche Gesellschaft für Internationale Zusammenarbeit |
| **GPS** | Global Positioning System |
| **IFEE** | Institute for Forest Ecology and Environment |
| **IMHEN** | Institute for Meteorology, Hydrology and Environment |
| **IUCN** | International Union for Conservation of Nature |
| **KBA** | Key Biodiversity Area |
| **MONRE** | Ministry of Natural Resources and Environment |
| **MoU** | Memorandum of Understanding |
| **NGO** | Non-government organization |
| **NP** | National Park |
| **NTFPs** | Non-timber forest products |
| **PFES** | Payment for ecosystem services |
| **PRAPs** | Provincial REDD+ Action Plans |
| **REDD+** | Reducing Emissions from Deforestation and Forest Degradation; 'plus' Conservation of forest carbon stocks, sustainable management of forests; and enhancement of forest carbon stocks |
| **RF model** | Random Forest model |
| **SRTM** | Shuttle Radar Topography Mission |
| **Sub-FIPI HCM** | Sub Forest Inventory and Planning Institute for Ho Chi Minh City |
| **Sub-FIPI NW** | Sub Forest Inventory and Planning Institute for the North-West Region |
| **UNEP** | United Nations Environment Programme |
| **UNEP-WCMC** | United Nations Environment Programme World Conservation Monitoring Centre |
| **USGS** | Unisted States Geological Survey |
| **VFU** | Viet Nam Forestry University |
| **WDPA** | World Database on Protected Areas |

# Executive Summary

This report presents the outcomes of a joint technical working session on spatial analysis to support the development of Provincial REDD+ Action Plans (PRAPs) in pilot provinces of Viet Nam (see Box 1 below for more info on PRAPs). Aimed at providing technical support and guidance to the spatial analysis teams of the co-implementing partners (CIPs) that are assisting the pilot provinces to develop their PRAPs, the working session focused on the role of mapping in the PRAP process.

Within this process, spatial analysis is used to provide information on forest resources and status in the province, as well as particular drivers of deforestation and degradation and barriers to the 'plus' activities: conservation of forest carbon stocks; sustainable management of forest carbon stocks; and enhancement of forest carbon stocks. Mapping is also integrated into the PRAP workshops, where maps are used to inform discussion and participatory mapping is used to indicate locations where provincial planners and stakeholders consider drivers and barriers to be present, and areas of priority for REDD+ interventions.

***Box 1: Provincial REDD+ Action Plans (PRAPs)***

Approved in 2012, Viet Nam's National REDD+ Action Programme (NRAP) calls for provinces in the country to formulate and implement provincial REDD+ action plans, or PRAPs. These PRAPs will contribute to the achievement of the NRAP. Development of PRAPs utilizes a participatory and analytical process, involving people from multiple sectors and organizations to:

- Set out the status of forest resources in the province,
- Analyse the key drivers of deforestation and degradation, as well as barriers to the 'plus' activities*
- Develop, prioritize and plan in detail for interventions to address these drivers and barriers
- Formulate monitoring and evaluation plans

** The 'plus' activities of REDD+ refer to the conservation, sustainable management and enhancement of forest carbon stocks.*

The working session involved 12 participants (3 women, 9 men) from four CIPs: the Forest Resources and Environment Center FREC) of the Forest Inventory and Planning Institute (FIPI); the Sub-FIPI Office for Ho Chi Minh City; the Sub-FIPI Office for the North-West Region; and the Institute of Forest Ecology and Environment (IFEE) of the Viet Nam Forestry University (VFU) (a participants list is provided in Annex 1).

A key outcome of this working session was the discussion of, and agreement around, approaches to be used for the spatial components of PRAP development, particularly during the workshops. This led to the preparation of additional guidance on the mapping component of the PRAP workshops, based on the experiences so far and the issues raised (provided in Annex 2). Further, the session resulted in draft workflows for some maps, such as combining participatory mapping of hotspots for drivers with additional spatial analysis.

# 1. Introduction

## 1.1 Overview

This working session built on a first technical working session held by the Forest Resources and Environment Centre (FREC) and UNEP-WCMC in Ha Noi in June 2014. The initial working session introduced concepts and techniques for the use of spatial analysis to support REDD+ planning at the sub-national level. This second working session extended this technical support and capacity building to include all CIPs now working with the UN-REDD Viet Nam Phase II Programme pilot provinces in the development of their PRAPs, with a focus on the use of spatial analysis for use in the PRAP workshops and to support the overall planning process.

The participants learned from the experiences of the CIPs in the PRAP development process so far, and worked together to identify and elaborate appropriate techniques and workflows for preparing the spatial layers needed in the PRAP process. The session mainly used ArcGIS (MapInfo was also used for some analysis), with each CIP working with the provincial-level data they have collected. This session was designed to feed into a third proposed working session (planned for November 2015), which will aim to further build the capacity of participants to prepare maps prioritizing potential zones for REDD+ intervention packages.

## 1.2 Objectives

The working session had three main objectives:

a) To facilitate the exchange of knowledge and experiences between the CIPs involved in spatial analysis for PRAP development.
b) To provide technical support to CIPs in the preparation and use of spatial layers for the development of PRAPs.
c) To build the capacity of CIPs to take forward the spatial analysis work, with a focus on spatial layers needed for delivery of PRAP workshops and subsequent analysis.

# 2. Topics covered

The agenda for the session is provided in Annex 3; the main topics and issues covered during the working session are summarized below.

## 2.1 Introductory session

The session began with welcoming remarks from the Deputy Director of IFEE, Mr Le Sy Doanh. Mr Nguyen Thanh Phuong (UNEP UN-REDD) then provided an overview of the objectives of the session and the agenda for the coming week. This was followed by a round of introductions, during which the participants and facilitators arranged themselves according to their level of GIS experience.

Charlotte Hicks (UNEP-WCMC) then presented some background information on REDD+ and the project under the Viet Nam Phase II UN-REDD Programme. She outlined the role of spatial information in supporting REDD+ planning, and the steps in the PRAP process (see Annex 4 for copies of presentations).

*Photo 1: Introductions according to years of GIS experience*

This was followed by a recap of the first technical working session held in mid-2014, including the topics and tutorials it covered. Table 1 below shows the topics included in both working sessions. Thinking about the 2014 session and this session, the participants then created a parking lot of the key technical issues and questions that they would like to address.

*Table 1: Topics included in 2014 and 2015 working sessions*

| 2014 WORKING SESSION | 2015 WORKING SESSION |
|---|---|
| Introduction to mapping for REDD+ planning | Technical support on PRAP preparations so far: consultation, data collection, etc. |
| Mapping forest/land cover and natural forest | Mapping for Workshop 1: drivers and barriers |
| Mapping forest cover change | Combining participatory maps and GIS |
| Mapping carbon stocks | Mapping for Workshop 2: solutions / interventions |
| Mapping benefits and risks (e.g. biodiversity/species richness, soil erosion risk, poverty & population…..) | Mapping potential areas for interventions, including use of Model Builder |
| | Additional technical support *(short partner-to-partner session with each CIP team)* |

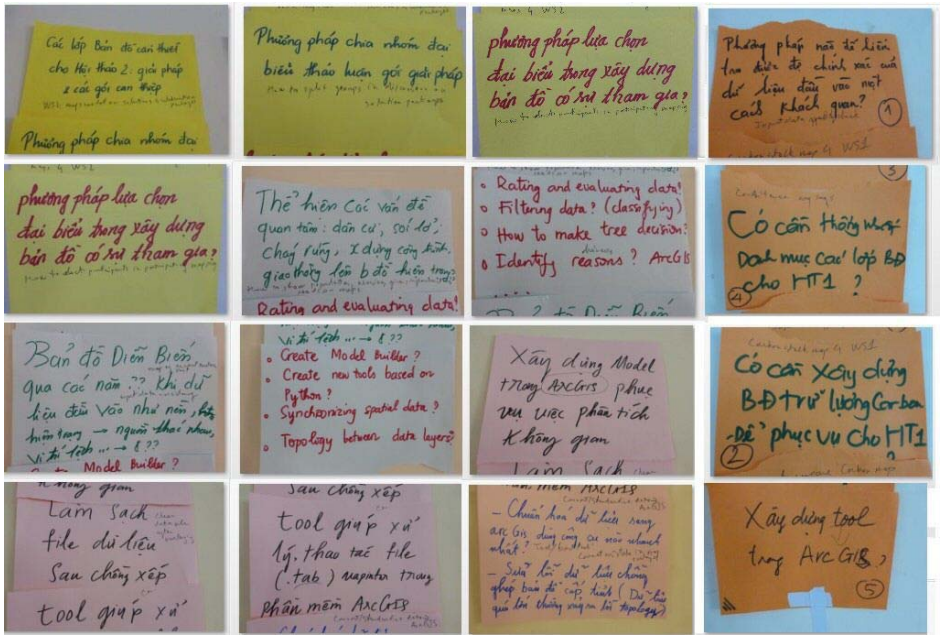



*Photo 2: Parking lot questions*

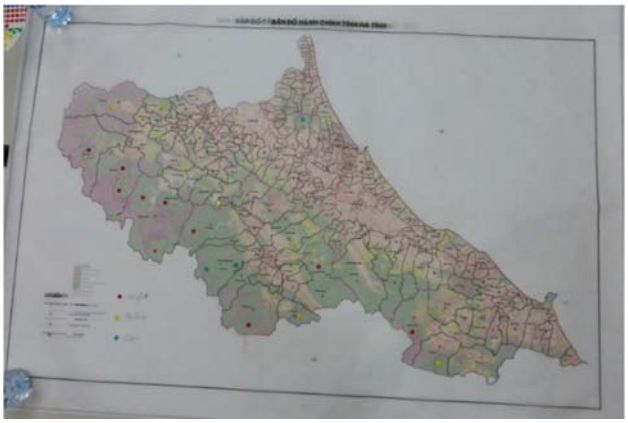
## 2.2 Preparing for the drivers/barriers workshop

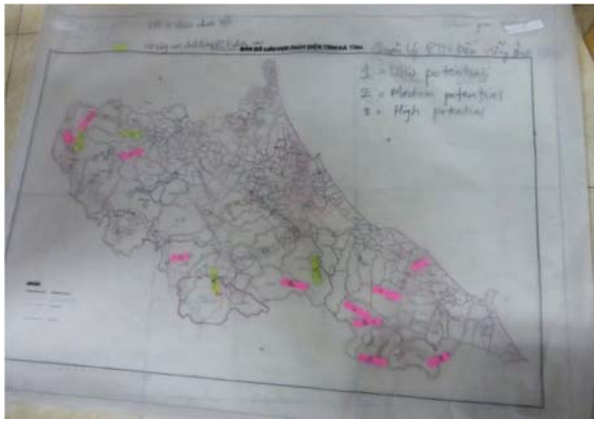
The next part of the session focused on prioritizing the map layers and other materials to be prepared for PRAP Workshop 1 on identifying drivers of deforestation and degradation and barriers, and how to further analyze drivers and barriers using spatial information.

The team from IFEE shared their experiences and results from Workshop 1 in Ha Tinh, held during September 2015, starting with a presentation by Mr Nguyen Van Thi. During this workshop, the Ha Tinh participants prioritized a series of drivers and barriers, and ranked communes in the province according to which are most affected. Key issues raised by the presentation and discussion included:

- It can be challenging to group the participants for the problem trees and mapping. This process needs to be facilitated, in order to get a good balance of expertise and viewpoints, and to prevent some participants from dominating the discussion.
- It can help to clearly define the role of each team member before the workshop and to practice the exercises/activities beforehand.
- Due to preconceptions about REDD+, people tend to focus on deforestation and degradation rather than the 'plus' activities, and on the forest sector rather than the role of other sectors.
- It was difficult to fit all the activities into the limited time available.

Following Mr Thi's presentation, the working session participants split into two groups to try for themselves two different approaches to participatory mapping, using the Ha Tinh workshop maps and overlays. One group ranked communes to identify those with forest areas potentially at risk of illegal logging, while the other group drew areas on the map where forests may be affected by/at risk of infrastructure development (see pictures 3-5 below). Both methods are useful for prioritizing areas, although drawing areas will provide the spatial analysis team with more information to develop maps later, i.e. maps showing the driver/barrier area (which may help for mapping priority areas for interventions).





*Photos 3- 5: Participatory mapping exercise and results of different approaches*

The participants then worked in their CIP pairs/groups to develop a list of maps and other materials that they plan to produce for the first workshop on drivers and barriers. This list showed the output map, the input layers needed to make it, and the presentation style (e.g. part of a poster, stand-alone map). After presenting these back for comments from the other CIPS, Charlotte gave a presentation on tips for making workshop maps (some of these tips are in Box 2 below; a full list is in the presentation in Annex 4).

The participants then started to work on some of the maps from their lists. Each CIP presented at least one draft map, and took questions and suggestions. Suggestions included simplifying the maps by removing unnecessary boundaries, roads, etc., and potentially including some areas of surrounding provinces, if the driver in question originates from external areas.

***Box 2: Some tips for making maps for workshops***

- Think carefully about how many maps you give to the participants - make sure that the participants are not overwhelmed or confused with lots of maps or information; focus on the most relevant maps and information.
- Make sure the participants understand clearly what each map is showing. Always give each map a title and a clear legend.
- Workshop 1 is about identifying drivers and barriers. Make sure that you have information that can be used for discussing barriers if needed.
- What scale should the maps be in? What level of detail will you need? Don't provide very detailed/complicated maps if they are not necessary.
- When using transparent maps for overlay exercises, think about how they will look if several of them are overlaid together. Make each transparent layer clear and simple.
- If the maps are even slightly different in size, they will not overlay properly. Check each of the overlays to make sure all the boundaries/graticules align.
- When all the maps are ready, practice the exercise you have planned for the workshop with some people in your team.

## 2.3 Mapping areas affected by/at risk of drivers

The next part of the session focused on how to use spatial analysis to explore how drivers of deforestation and degradation may evolve in the future. After a presentation by Corinna Ravilious (UNEP-WCMC), the participants chose a driver of interest in their province and started to develop a workflow for a simple map that could provide information about areas potentially at risk from that driver.

The participants then transferred these workflows into GIS, and presented the draft maps to the group for their comments and suggestions. Some of the issues and questions raised were:

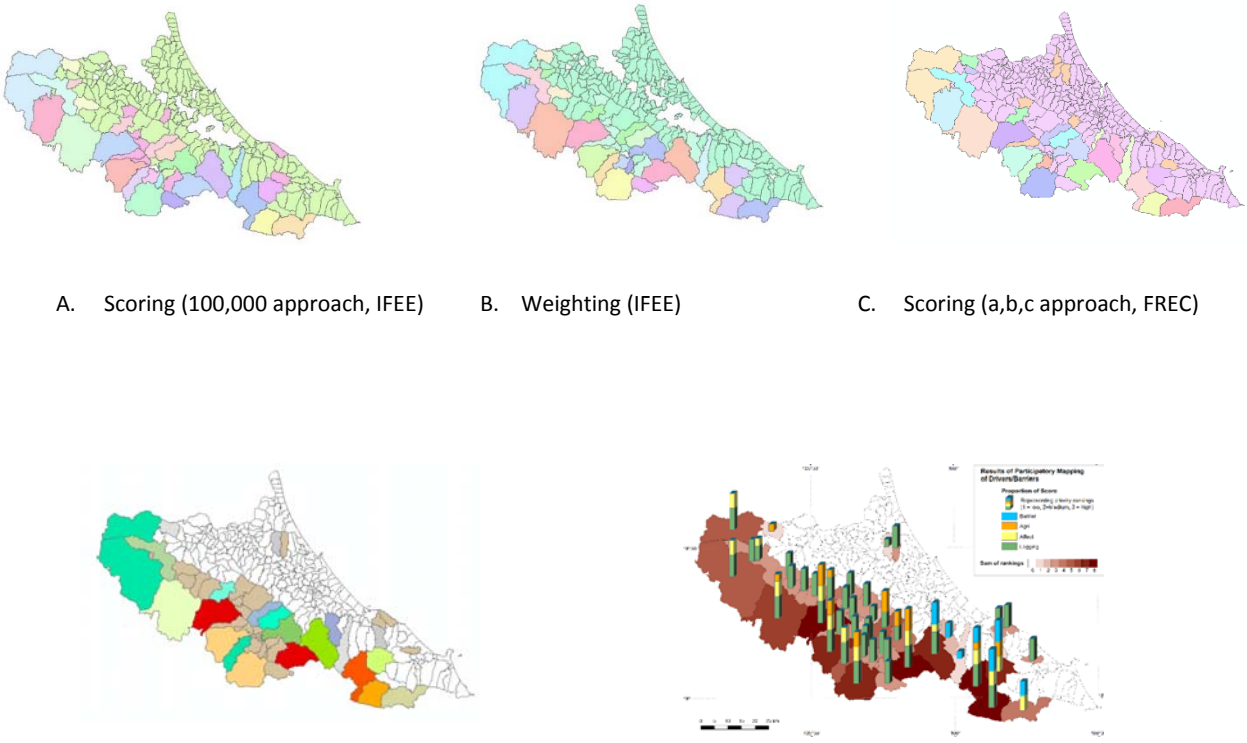
- Data should be standardized or 'cleaned' prior to combining it.
- There are a large number of data types and categories in the forest status dataset, and official guidelines that set out how these are defined and visualized. This makes it more challenging to simplify maps by combining classes/changing colours.
- Validation of maps on drivers/barriers can use a number of methods, such as spatial analysis, consultation and field checks. Some spatial analysis options include overlaying with relevant layers (e.g. forest cover change, future land use plan), as well as checking some areas against Google Earth or other satellite images.

*Photo 6: Presenting draft maps to the group*

## 2.4 Presenting the results of the drivers/barriers workshop

We also looked at options for processing and presenting the results of the participatory mapping conducted during Workshop 1. This included transferring the participatory maps for Ha Tinh into ArcGIS, as well as combining the participatory layers with other spatial information (in order to validate it and/or present more information about drivers/barriers). A georeferencing approach was used to transfer the drawn participatory maps into ArcGIS, while the ranking of communes was mapped by simply assigning attributes to the commune table.

However, the more complicated task was to combine the commune rankings for separate drivers/barriers into a single, combined drivers/barriers layer. The participants debated the pros and cons of different methods, and then each CIPs selected an approach to try. They compared the results of three different approaches for showing the combined results in Ha Tinh. These included two scoring/coefficient approaches, as well as a map that also showed which drivers were being ranked in bar graphs (see Figure 1 below).



A. Scoring (100,000 approach, IFEE) B. Weighting (IFEE) C. Scoring (a,b,c approach, FREC)

D. Summing (plus scoring aX,bX,cX,dX approach (Sub-FIPI HCM) E. Scoring + bar graphs

*Figure 1: Different approaches to combined ranking of communes by drivers/barriers*

Corinna briefly introduced another option – a flexible, Excel-based tool that uses tables to further explore the spatial data, showing statistics and rankings of administrative units according to different criteria. Mr Loi from Sub-FIPI Ho Chi Minh also showed the group another approach for displaying combined rankings, this time using a summing approach combined with 'a, b, c, d' to distinguish between driver/barrier combinations (Figure 1).

Following a presentation introducing multi-criteria analysis (MCA), the participants then created a map in ArcGIS combining the 'participatory mapping' results they had prepared earlier with other data layers, in order to:

a. help validate the participatory results; and
b. further analyse the areas affected by or at risk of a driver/barrier, by bringing in additional information.

For example, the map below (Figure 2) shows the 'participatory' map of areas that may be affected by road development, along with some further analysis, which calculates distance from current and planned roads. This could be used to validate whether the areas that the participants had drawn on the map were comparable to past deforestation and degradation around roads.

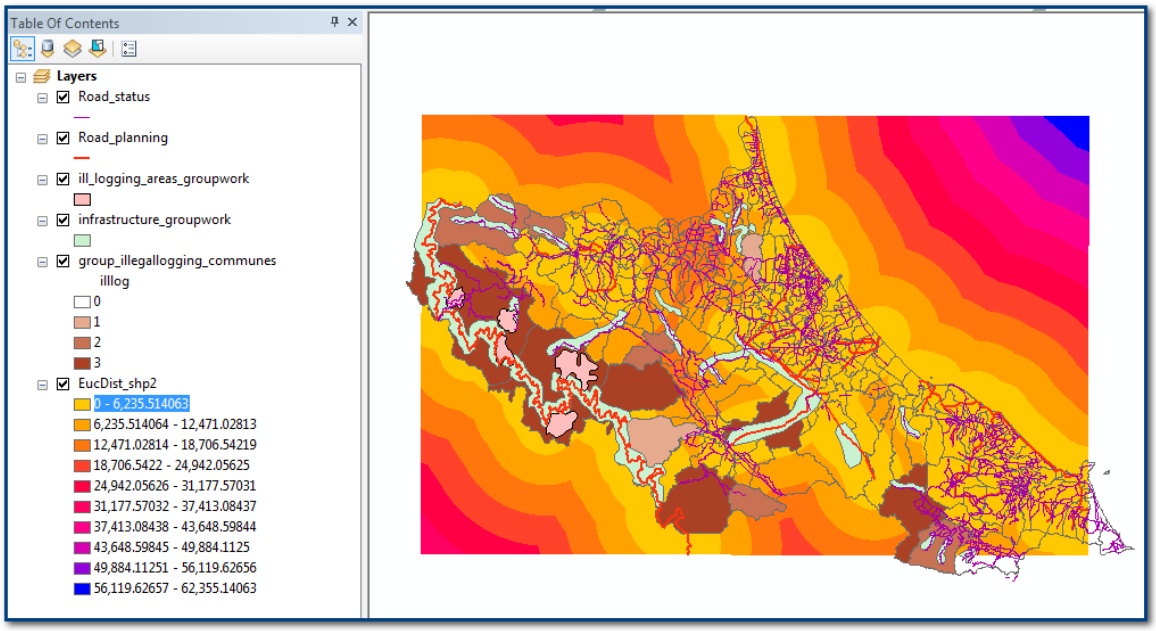



*Figure 2: Working session map showing participatory mapping of areas potentially affected by road development and distance from roads*

## 2.5 Preparing for the solutions workshop

The participants then discussed Workshop 2 on 'solutions', including the workshop activities and materials that will be needed. The participants noted that the purpose of Workshop 2 is to find solutions to drivers, and ways to reduce or remove barriers, as well as identify priority areas for interventions. Drawing on the 'step-by-step workshop guideline', this discussion highlighted the following:

| Activity | Materials |
|---|---|
| Develop solution trees in groups | o Results of WS1, including problem trees and maps<br>o Materials for developing solution trees |
| Exchange/present between groups | |
| Rank/prioritize solutions, develop intervention packages | |
| Participatory mapping for locations of interventions | o Maps showing driver/barrier areas and/or rankings<br>o Simple maps for participatory mapping |
| Museum visit between groups | |
| Risks and benefits analysis | o Information/maps to support risks and benefits analysis |

Based on this discussion, the CIPs also drafted a list of the materials, including maps that they would prepare for Workshop 2.

## 2.6 Developing workflows for the mapping of intervention areas

Charlotte gave a presentation on REDD+ interventions and outlined factors to consider when trying to prioritize locations for interventions. In a group discussion, we brainstormed an intervention to address the driver 'expansion of rubber plantations in degraded forest areas leading to deforestation', which was to 'increase incentives to zone natural forest for regeneration'. We then identified factors that may help us to prioritize or identify suitable locations: geophysical factors, feasibility factors, and potential benefits and risks.

To continue the exercise, the participants then split into two groups. One group was given a driver (illegal logging of natural forest), and one a barrier (to enhancement of natural forest), and both came up with a possible intervention to address them, as well as some geophysical factors, feasibility factors, potential benefits and potential risks that may influence where the intervention could be implemented (see Table 2 below). The two groups then discussed the workflows that they would use to develop a map showing areas suitable for their interventions. In smaller groups, the participants then developed spatial workflows for the two example interventions.

*Table 2: Results of exercise to identify factors relevant to intervention areas*

| **Driver** | **Intervention** | **Geophysical Factors** | **Feasibility** | **Benefits** | **Risks** |
|---|---|---|---|---|---|
| Barrier to enhancement of natural forest | Strengthen and create new PFES areas | Existing PFES area; Degraded forest area; Close to community | Livelihoods need to be supported; Who will pay for the PFES? | Improve biodiversity; Livelihood improvement; Increase carbon stocks | Conflict among recipients of payments/over land |
| Illegal logging of natural forest | Increase number of forest management stations; Increase resources/ capacity building | Natural forest area; Accessibility for stations (roads); Close to border | Needs to be accessible; Spacing of stations | Improve forest monitoring overall; Improve forest quality | Budget / capacity to implement; Conflicts (over livelihoods) |

An example workflow produced by one of the groups for the intervention "Strengthen and create new PFES areas" to address the "Barrier to enhancement of Natural Forest" is shown in Figure 3:

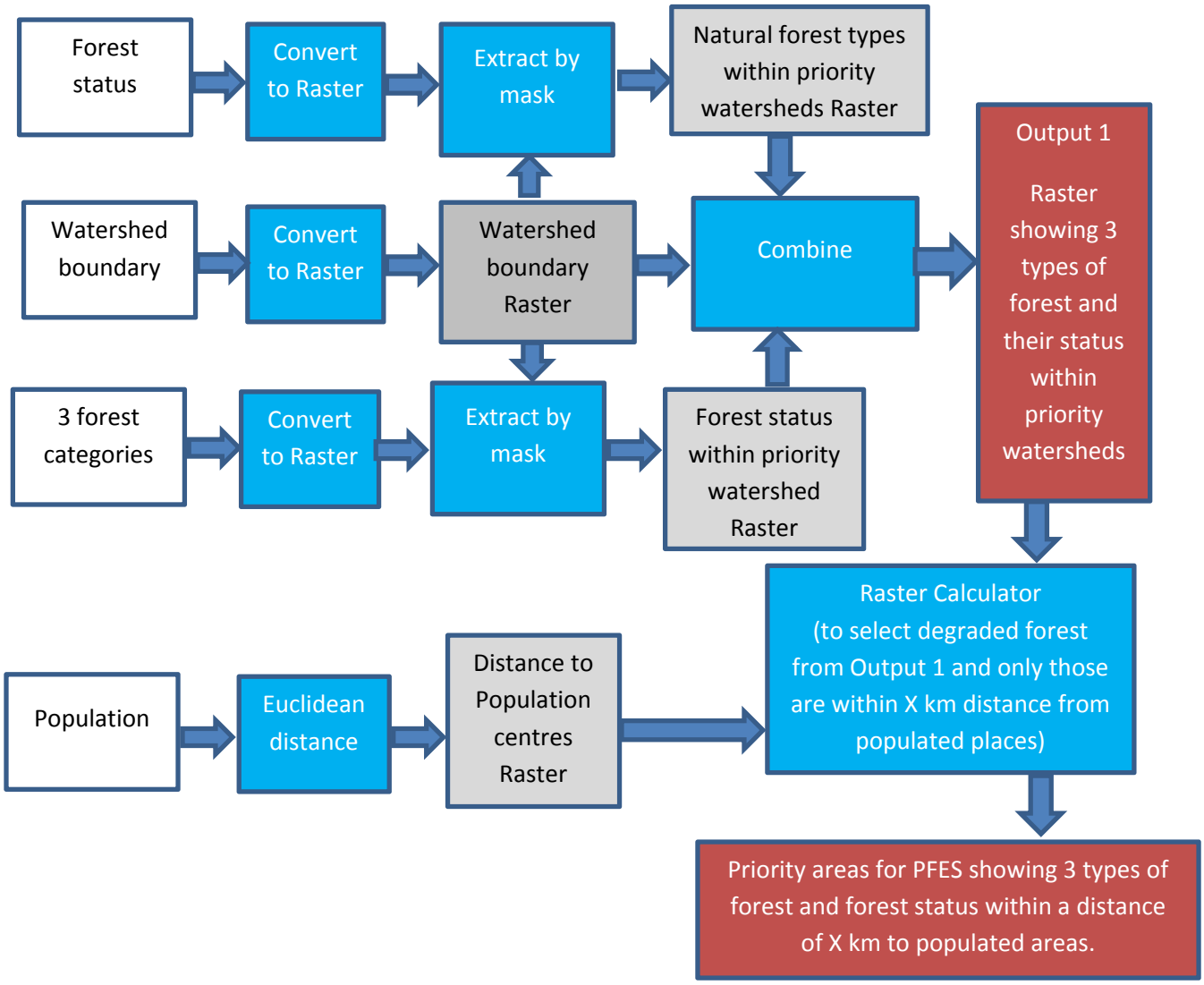



*Figure 3: Example workflow for indicating areas suitable to address deforestation from small-scale cassava production through community forestry*

The workflow extracts natural forest from the forest status dataset and overlays it with the three forest categories (protection, special use, production) and watersheds, in order to show the three categories of forest within priority watersheds. A distance raster shows distance from population centres to identify priority areas for PFES close to populated areas (i.e. where local people could be involved and where there was potential to improve local livelihoods). This was an example workflow only and could be improved by specifying more clearly the criteria to select areas and making an additional selection for degraded forest areas (as the intervention aims to incentivize regeneration of degraded forest). There are also some assumptions that need to be made transparent. For example, how are priority watersheds identified? And are all population centres important for the intervention or should some be prioritized?

Another example workflow that was produced is for the intervention "Increase number of forest management stations" to address the driver of illegal logging in natural forest areas (Figure 4 below).

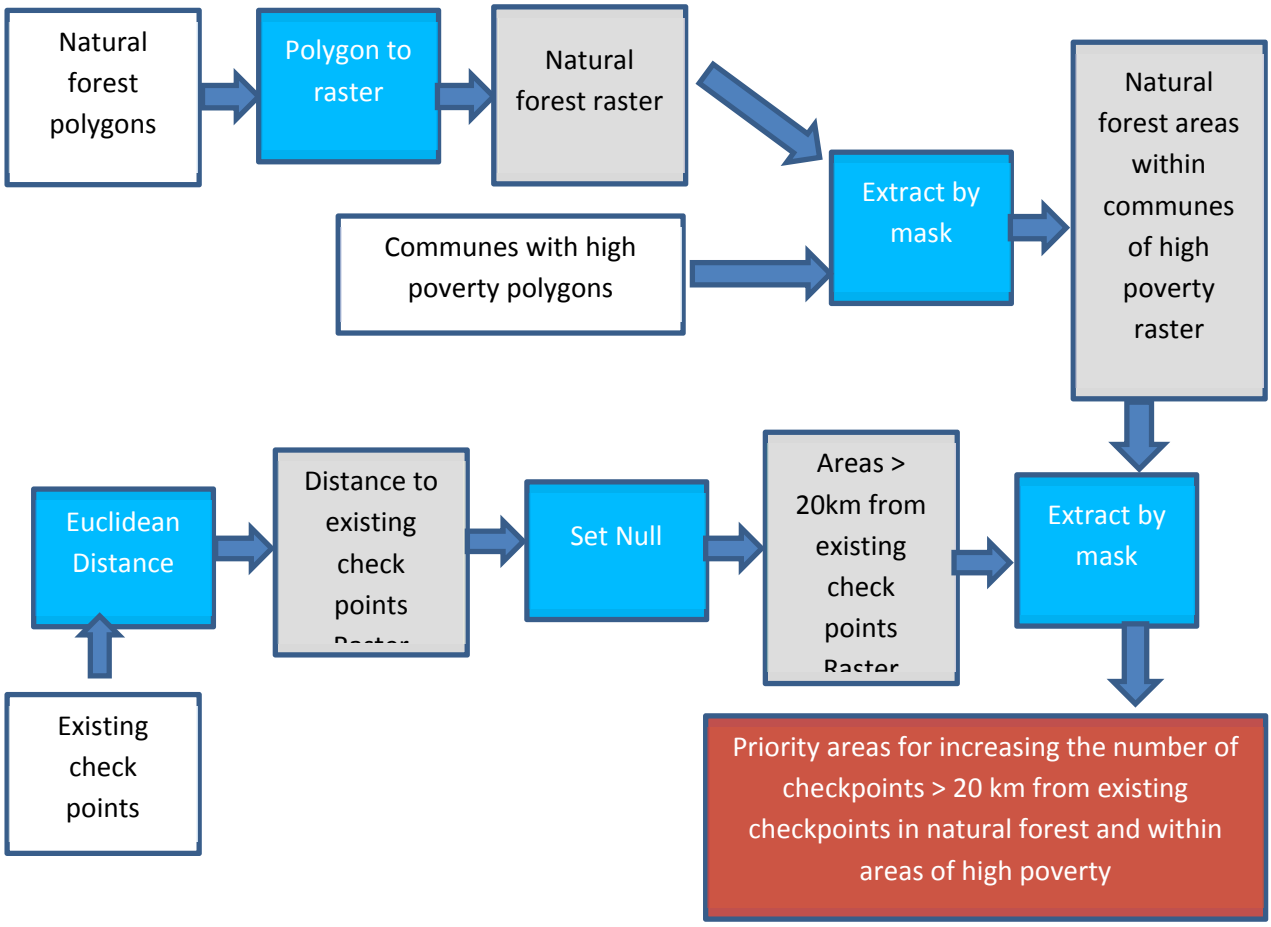



*Figure 4: Example workflow for mapping areas for increasing the number of forest protection checkpoints*

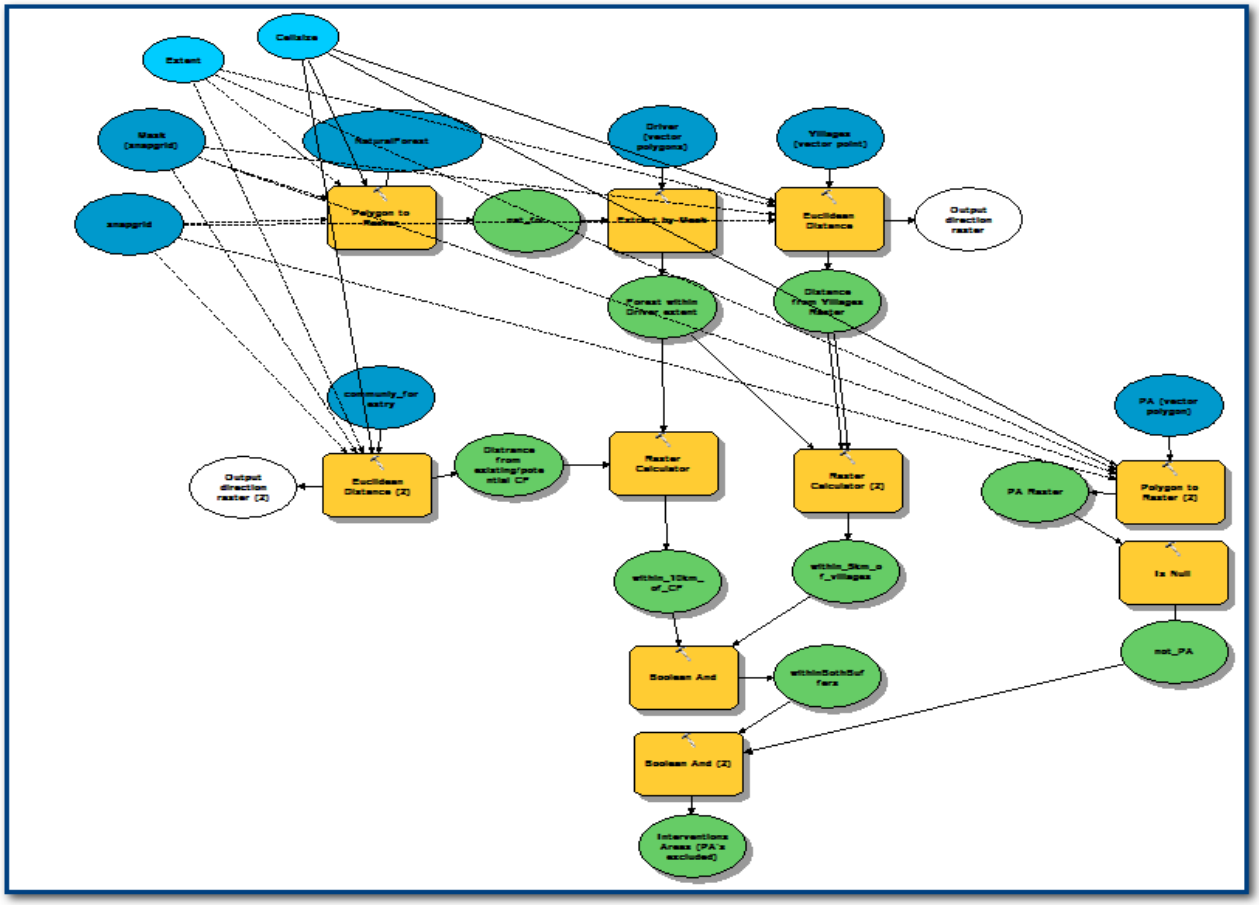
In this workflow, natural forest classes are selected from the forest status map and converted to raster. Then communes with high poverty are selected and used to extract areas of natural forest located in communes with high poverty. Next, a distance raster is generated to show distance from existing checkpoints. The *Set Null* tool is used to create a raster layer from the distance raster, where values <= 20 km are set to No Data and values > 20 km set to 1 (i.e. the output raster from this step is the areas outside coverage by existing checkpoint stations). This is used to extract areas were natural forests within high poverty communes are in areas > 20km away from existing checkpoints. The distance of 20 km was assumed to be the radius covered by each checkpoint, but should be verified with local stakeholders/experts.


*Photos 7 and 8: Discussing workflows for mapping areas suitable for example interventions*

## 2.7 Using ArcGIS Model Builder

After a brief presentation on putting workflows into ArcGIS, the participants learned about using Model Builder to develop a spatial workflow (see Figure 5 below) for conducting a piece of analysis. Corinna used a follow-along exercise to show how to create a model to prioritize areas for a hypothetical intervention (community forestry) to address a driver (cassava expansion). Everyone successfully completed the example model, and Corinna later presented the results in a demonstration to show what outputs were produced at each stage of the workflow.

*Figure 5: Example workflow in Model Builder*




The participants then took the workflows they developed the day before in groups and transferred them into the ArcGIS Model Builder. Two participants presented back the model that they created, along with the outputs. These included FREC's model to show priority for regenerating forest areas within watersheds, and IFEE's model to select areas of natural forest for the establishment of new checkpoints or stations.

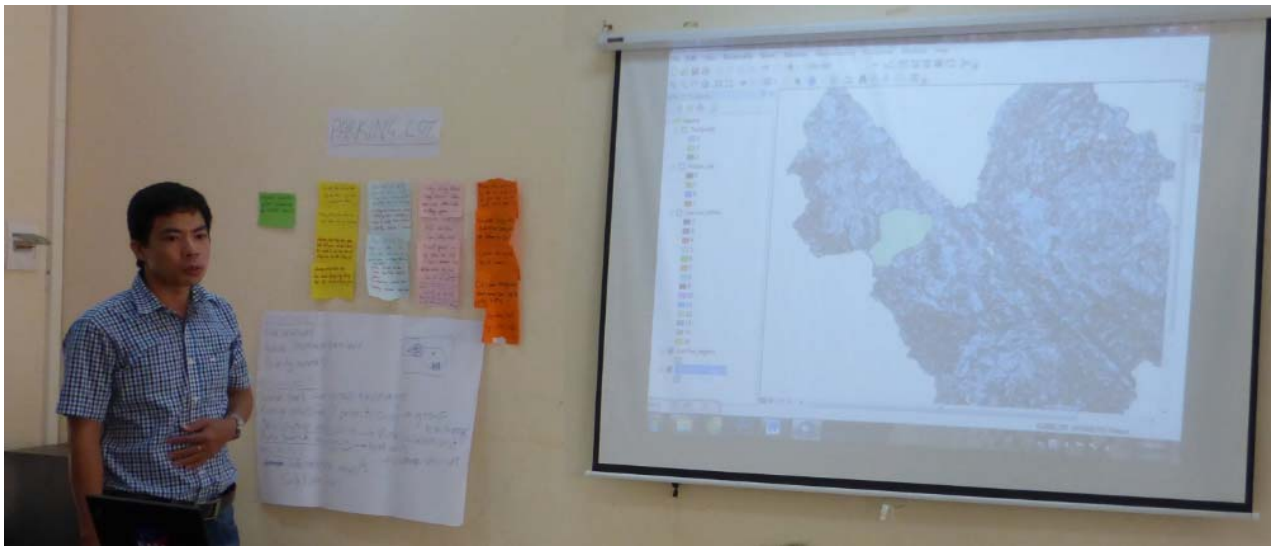
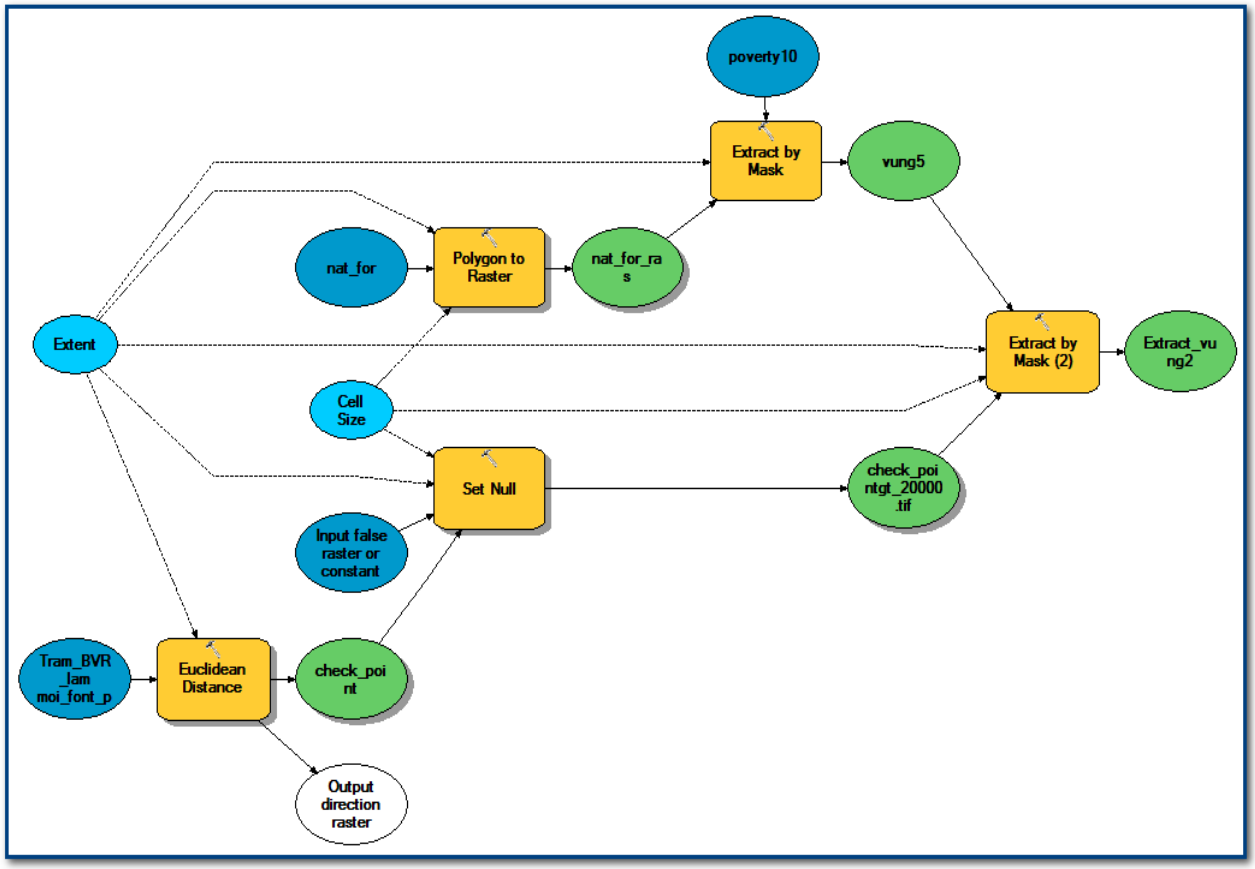


*Photo: FREC participant presents their model*

IFEE's example of an ArcGIS model to select areas of natural forest for the establishment of new checkpoints is presented below along with model inputs, intermediate steps and final output maps.



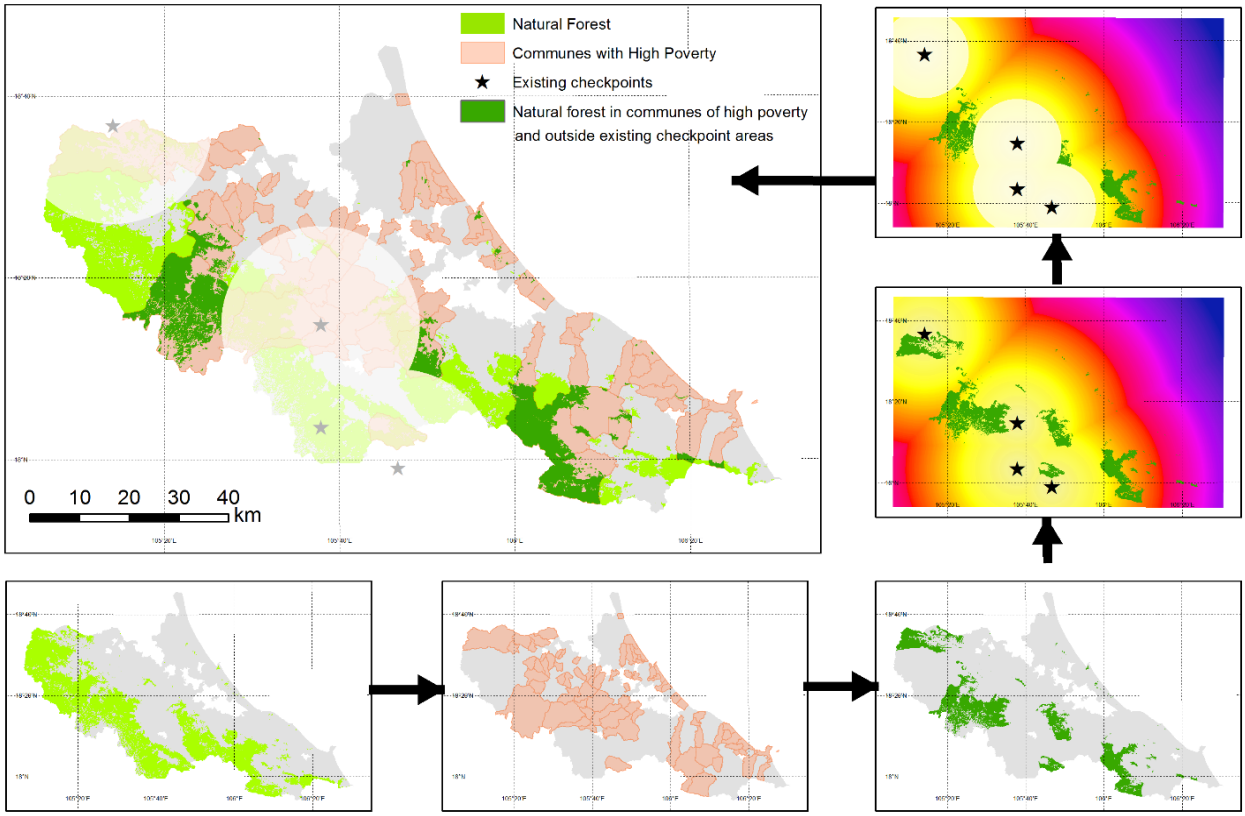



*Figure 6: Workflow in Model Builder, intermediate steps and final output maps from IFEE model*

The draft models were run successfully by the participants; however, there are a number of factors that still need to be considered:

- The workflow should address those areas at risk from the driver. Therefore the results from the participatory driver map (preferably the validated version of this map) should be included.
- The workflows presented in this report are examples only and are the starting points for building final workflows after other steps in the PRAP process have been carried out, i.e. the solutions workshop, field verification, risks and benefits analysis, etc. These steps will provide additional information that may need to be incorporated into the final workflows.

### 2.8 Closing of session

To close the session, Corinna went through the questions in the "parking lot", and provided additional materials to participants on the USB sticks to address some of the technical questions. Charlotte checked that others had been covered in enough detail throughout the working session. As many of the participants were not very familiar with ArcGIS Model Builder and raster analysis tools, Corinna agreed to prepare and provide additional guidance materials on both these topics to assist participants in creating and implementing workflows after the working session. After some final discussion, each partner also prioritized topics to discuss in the short partner-to-partner sessions over the following week, and the certificates of participation were presented.

## 3. Partner-to-partner sessions

Each CIP had a half day to cover any topics related to the PRAP process and preparing for the participatory or technical support questions for the spatial analysis.

### 3.1 Sub-FIPI Ho Chi Minh (HCM) Office

The following topics were covered in the session:

**1. Methods for showing population**

We discussed where to obtain current population data:-

- Current land use map
- Population by commune from statistical yearbook
- Some village locations (do they have population figures associated with them?)

There may be some challenges if looking at populations in remote areas. We talked about participatory methods for identifying locations of populations. Corinna showed an international dataset http://www.worldpop.org.uk/

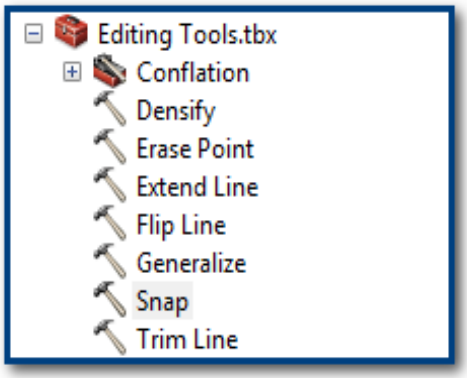
For Viet Nam, WorldPop uses census data from 1999 and 2009 plus satellite imagery for mapping settlements to predict the number of people per ~100 m pixel, using the random forest (RF) model as described in Stevens, et al. (2015). For full source information see: http://www.worldpop.org.uk/data/WorldPop_data/AllContinents/VNM-POP_metadata.html

**2. Data to develop carbon map**

Charlotte described the method of applying carbon values to the different forest types within the forest status map. The official carbon values are not yet available but we can provide these once they have been approved.

### 3. Processing data when overlaying to manage shifts/inconsistencies

- **Projections questions:** Loi highlighted some of the problems occurring due to differences between WGS84 and VN2000 and how this problem may cause issues for PRAP maps if the transformations were not done correctly. This topic came up with most of the partners. Advice on map projections and transformations between WGS84 and VN2000 is provided in Box 3 below.
- **Inconsistent map layers from different years:** Corinna showed how to snap boundaries in ArcGIS but highlighted the need to be careful with the snapping tolerance so that data are not wrongly changed. If the data have been collected at different scales, then fixing inconsistencies is difficult.




- For line features such as a province boundary the ArcGIS **Snap** tool in the **Editing Tools** toolbox can be used quite successfully.

- We discussed an example of two forest cover datasets generated for different years and at different scales. Corinna indicated that the snapping method will work for polygons too, but it may not work well for this example as the datasets are very different. Therefore it will be important to test to see if it can fix any of the inconsistencies as it may not be able to distinguish lines which are supposed to be identical and lines which are different because of change. In the example, shown from Binh Thuan the datasets looked very different and in order to compare datasets between years it is better that they are mapped at the same scale using the same methodology.
- The **Conflation** Toolset contains additional **Rubber sheeting** tools which can help to adjust the lines in one dataset to the lines in another. Again caution needs to be taken, particularly with datasets generated at very different scales and from different years. Rubber sheeting tools can take a long time to run.

### 4. Analysing drivers from outside the province

This issue was discussed in relation to Binh Thuan where there is deforestation along border with Lam Dong and in hillslope areas where there are no communities but outsiders come in.

When looking at poverty and education factors, local people may be blamed when in fact the main actors are from outside. We highlighted how participatory mapping is very important for this topic. In order to capture this information, you need to get more info from participants during the workshops regarding who is behind the driver, especially if indicated in a remote location. Forest cover change data from neighbouring provinces may also help to see if contiguous problem is happening there.

### 5. Soil erosion in coastal areas

Coastal erosion a big problem in southern provinces. For Ca Mau, they currently have map of mangroves, or coastal forest, for 2007 and 2014, and Spot images which they have used to show changes in the coastline. However this doesn't show interaction with tidal aspects, or future risk. This is an important driver and will change in the future with climate change.

The 3 forest categories mapping theoretically includes soil erosion risk mapping but they haven't seen a soil erosion risk map for Ca Mau. The Institute of Marine Science also have an activity to interpret Spot images.

Charlotte agreed to provide some follow-up advice regarding data on coastal erosion and climate change impacts. There are projects which have generated such data and so we should try to use that data, rather than try to repeat a complex analysis. The best option may be to request projected climate change impacts layers (e.g. for coastal erosion) from MONRE. If these are not available at the local level, then you can also try IMHEN (Institute for Meteorology, Hydrology and Environment). Another option is to contact the GIZ climate change project in Ca Mau.

**6. Deforestation from shrimp farming**

Sub-FIPI HCM is not sure where to obtain data on these, but need to confirm whether this driver is having a big or small impact. They will use the drivers' workshop to try to confirm; if it is an issue, then they will need to find way to get more information, e.g. from the Sub-Institute of Aquaculture or the GIZ project.

**7. Exchange of data among sectors**

There are still some difficulties in Ca Mau in getting data from other sectors. It was asked if UN-REDD could help facilitate data requests. They have not contacted GIZ yet so Charlotte will try to follow up contacting the GIZ project for Ca Mau.

Also mentioned were other difficulties in data collection. For Ca Mau they have many layers of forest cover change but lack past land use and the future land use plan (e.g. only have the transportation plan (2020) as a diagram/PDF). For the past data they can process through satellite imagery but it is not official.

## 3.2 Sub-FIPI Northwest (NW)

Data collection has been smooth for Bac Kan, as they have a working group to facilitate this. For land use data and future land use plan, there are some inconsistencies between DARD and DONRE, so they have to reach agreement to produce the final data. For Workshop 1, they have a clear idea of the mapping and methods to use, having learnt from IFEE. They plan to use both commune rankings and area selections.

**1. Using additional data, e.g. satellite, for drivers analysis**

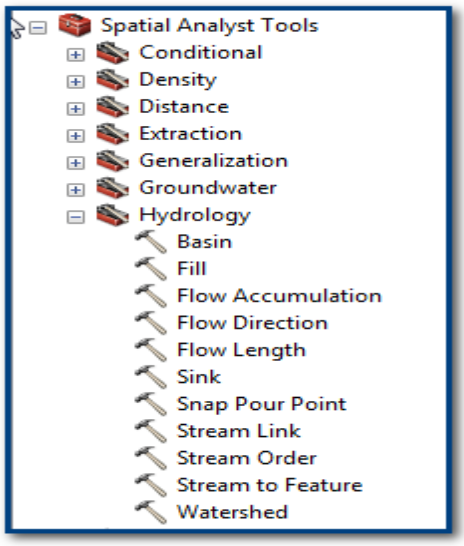
Sub-FIPI NW were already aware of sources of free satellite imagery from the Landsat archive but asked if there were any free/low cost Spot or Quickbird images. Unfortunately there are no sites that we are aware of that provide higher resolution satellite images for free or at low cost. As a general rule, sub-30m resolution imagery is in the commercial domain and has to be purchased.

However, the EU/ESA Sentinel-2 imagery (an improvement on Landsat) is already online for free, though with limited global coverage, and some spectral bands are at 20m. Access is via the Sentinel Scientific data hub: https://scihub.esa.int/. For DEM 30m resolution, SRTM data is available from USGS at http://earthexplorer.usgs.gov/.

**2. Creating watershed maps by DEM model**

We highlighted two international sources:

- HydroSHEDS - includes river networks, watershed boundaries, drainage directions, and flow accumulations. Available at http://hydrosheds.cr.usgs.gov/index.php




- Hydrobasins - using the HydroSHEDS database at 15 arc-second resolution, watersheds are delineated in a consistent manner and hierarchically nested sub-basins at different scales supported by a coding scheme that allows for analysis of watershed topology, such as up- and downstream connectivity. Available at http://hydrosheds.org/page/hydrobasins

There was a question regarding using data from international websites and how to correct differences, e.g. shifts between layers of 10m differences.

If resolution really is not suitable you can generate your own using tools in ArcGIS in the **Spatial Analyst** toolbox >>**Hydrology** toolset. A tutorial is provided from UNEP-WCMC on the USB stick: **2c_Annex 2 Soil erosion risk ArcGIS_VN.docx,** in the **2014 tutorials** folder, which shows how to generate catchments of dams using these tools. For more complex analysis consider installing the **ArcHydro** module which can be freely downloaded from http://resources.arcgis.com/en/communities/hydro/01vn00000010000000.htm

### 3. Projections

There was a quick discussion about checking projections in ArcGIS. This was common to all partners (see Box 3 for more details).

### 4. Checking the formulae/models or functions in ArcGIS

This question related to both checking whether a formula/expression is correct (i.e. the correct syntax) and whether the result it produces is correct. Corinna pointed to the **ArcGIS Help,** which provides good guidance on raster analysis syntax and using Google to search online forums to find similar expressions. It is important to carefully check results at each step in a workflow, after each function has run. Is the result what you expect? It may be helpful to check the input and output for a few sample polygons. Corinna will provide some additional guidance materials on the use of Model Builder and Raster analysis in ArcGIS following the session.

### 5. Connecting/combining imported MS office data with ArcGIS

We worked through an example provided by Huong to take an MS Office table and join it to spatial data in ArcGIS. The first step was to ensure that there was a common unique field in both the spatial data and the MS office table. The column in the MS Office table that you will join must have unique entries (i.e. no duplicates), otherwise ArcGIS will just pick the first row it comes across.

### 6. Using biodiversity data for PRAPs

We discussed currently available data, e.g. based on locations with rare/endemic species. They could get some information from local knowledge/surveys, as well as the IUCN Red List data (http://www.redlist.org/)[1]. In addition, a protected areas layer could be used. They already have data on Protected Forest and Special Use Forest and we asked whether all protected areas fell under these

[1] This could also be complemented by GBIF point data (http://www.gbif.org/country/VN/about), though please note that sampling is ad hoc – GBIF observation richness may reflect sampling effort rather than biodiversity.

categories. We provided a copy of the WDPA data but highlighted that this was based on the 2003/2004 update from the Government of Viet Nam; they may check with the relevant ministries if there is more recent data (WDPA can be accessed here http://www.protectedplanet.net/).

**7. Centre point of shapes**

If we change a shape, shouldn't the centre change too? How to maintain attributes of old polygon when overlaid with new polygons? Corinna highlighted that this was a difference between MapInfo and ArcGIS; in ArcGIS there was no label point and therefore the attributes will be maintained automatically.

**8. Copying toolboxes**

You can attach a toolbox in the same way as you would attach a document to email. (Note: It won't attach data, this would needs to be zipped and attached separately). Full instructions will be provided in the model builder guidance to be prepared by Corinna.

**9. Connecting between R-studio and ArcGIS**

Download toolbox from R-studio site:
http://www.arcgis.com/home/item.html?id=a5736544d97a4544aa47d06baf910f6d

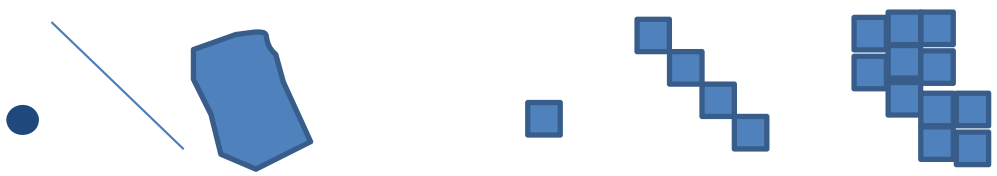
## 3.3 Forest Resources and Environment Center (FREC)

**1. Coordination transformation**

We discussed conversion between VN2000 and WGS84, including understanding what the projection should be and how to define it correctly in ArcGIS. Corinna showed two ways ArcGIS deals with projections a) projecting on-the-fly (where data are stored in one coordinate system but displayed in another) and b) physically projecting the data, so the data are stored in a new coordinate system. She also showed where we can find some of the projection tools in ArcGIS toolbox (see details in Box 3).

**2. Fitting boundaries when converting between vector and raster**

Raster cell boundaries are unlikely to exactly match the original vector data due to the fundamental differences in how the data are stored - i.e. vector data as points, with lines and polygons defining the boundary or location of an object; and raster being made up of cells (square pixels) of a certain size (see illustration below). The smaller the cell size of the raster data, the closer it will match with the vector data.



Vector Raster

When converting from raster to vector, the cells are converted to follow the step-like appearance of the raster cell and thus lines can be altered. You can choose to generalise on conversion to smooth out the step-like appearance but this will still not match exactly with the vector data. If it is necessary for an output to be identical, then it is best to explore:

a) if the analysis is possible in a vector approach and thus avoid raster;

b) if raster is necessary, then choose your cell size carefully so that the result matches as closely as possible with the original data; and

c) if the raster data matches with the vector data in terms of the boundaries between classes, then the raster attributes can be applied to the original vector polygons by converting the raster data to point and doing a spatial join with the vector data. However, if during the raster processing the data now contains more detailed classes within the original vector polygons, you cannot simply do a spatial joining.

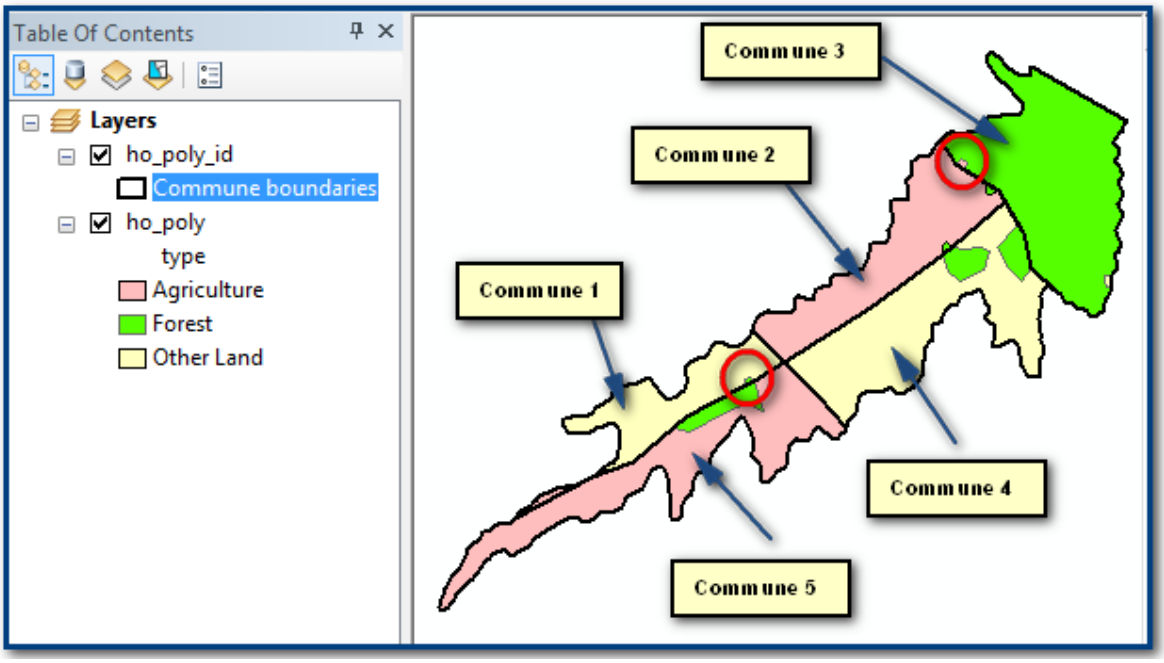
e) If you have a dataset that has already been converted from raster to vector and you no longer have the raster version, you may wish to see if ArcGIS tools such as **Snap** in the **Editing Tools** toolbox, can help readjust the data back towards the original line.

### 3. Conversion of MapInfo TAB format to use in ArcGIS

Corinna demonstrated the **data interoperability extension** in ArcGIS. She explained that ArcGIS can pick up and read MapInfo TAB files directly using this extension, but not edit the TAB file without conversion into shapefile format. There is also commercial software called FME (Feature Manipulation Engine), which is designed specifically for converting between datasets in different formats. The ArcGIS Data Interoperability extension is a subset of the full FME software. https://www.safe.com/fme/fme-desktop/ http://www.esri.com/software/arcgis/extensions/datainteroperability

### 4. How to clean data after overlaying

Ho demonstrated a problem related to cleaning data (in the example below the size of the polygons to be eliminated is exaggerated for demonstration)



We built a workflow in ArcGIS Model Builder to undertake the cleaning task more efficiently, which is needed in situations when tiny polygons (below a certain area) need to be eliminated as a result of overlay with commune boundaries. The standard ArcGIS tool will choose which polygon to merge the eliminated feature into and does not let the user specify to always keep the commune boundary line. This cleaning model inputs the dataset to be cleaned, splits it into separate files by commune and cleans each of these individually before merging back into a single file at the end of the cleaning process.

As other partners also raised data cleaning issues, Corinna has provided additional documentation on this tool (will be sent out separately to partners).

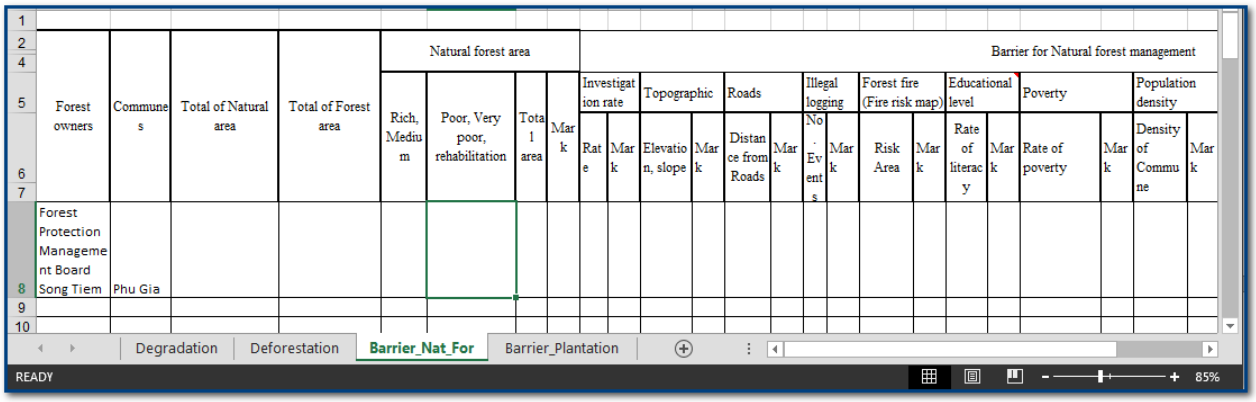
### 5. Other materials on REDD+ and workshops for PRAPs

We also discussed some non-GIS aspects of PRAP development, including:

- Differences between drivers and barriers to REDD+, and how to communicate with stakeholders about barriers
- The differences between 'stakeholders' and 'institutions', and how to present on the stakeholder and institutional analysis for Workshop 1
- The differences between solutions (e.g. solutions to address a driver/reduce a barrier) and interventions (e.g. packages of interventions that together form a solution to a driver/barrier)
- Charlotte will share links to additional material on REDD+ from the UN-REDD Programme

## 3.4 Institute of Forest Ecology and Environment (IFEE)

Discussion in this session focused on how to identify areas relevant to barriers using the forest status map, three forest type and some additional research in from legal documents. IFEE stated with their present knowledge, they did not have any technical issues related to spatial analysis and were more interested in discussing how to use current data for identifying priority areas in Ha Tinh.



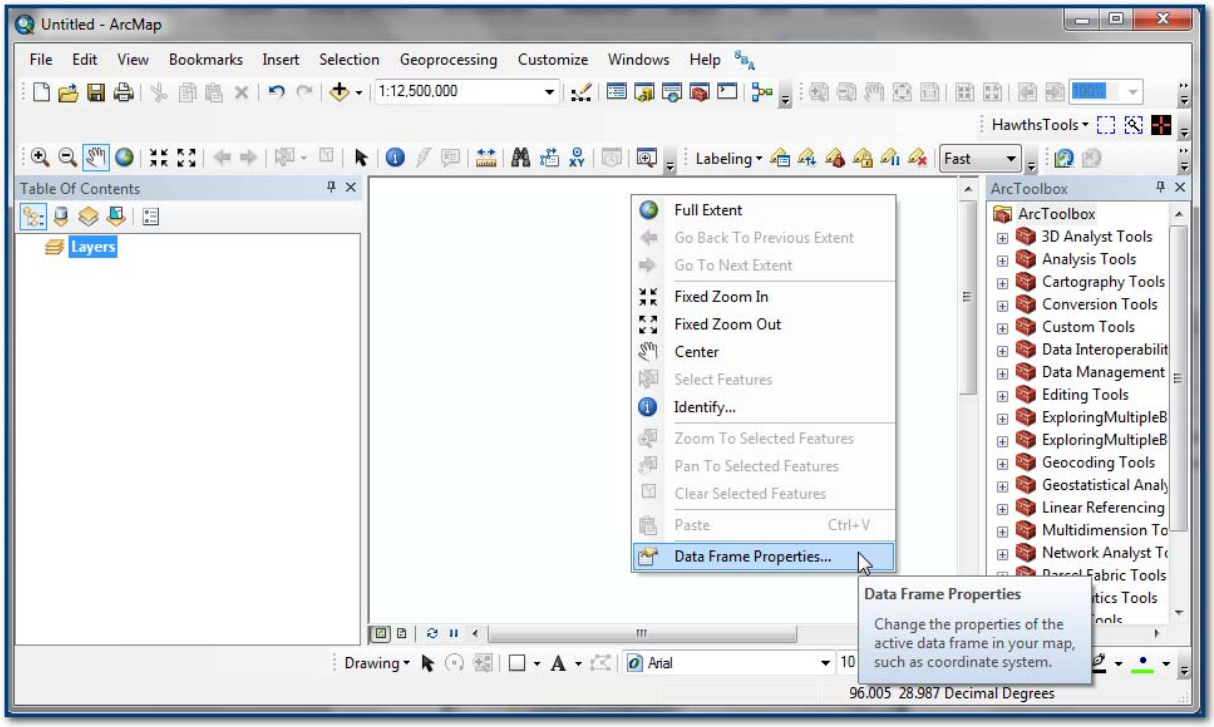

IFEE presented a draft matrix for the drivers and barriers related to REDD+ in Ha Tinh, as identified in Workshop 1. These were ranked by low, medium, and high, according to each of commune/forest owner. IFEE sought feedback on the criteria they planned to use in the matrix (example above). The purpose of the matrix is to complement/validate the participatory results and will accompany a report going into specifics about the drivers/barriers affecting each commune.

We discussed some of the criteria in detail, noting some difficult questions about how the workshop participants had been ranking barriers, e.g. were communes ranked based on the seriousness of the barrier to restoration? Or on the potential for regeneration? The approach taken in the matrix should match that used in the participatory mapping.

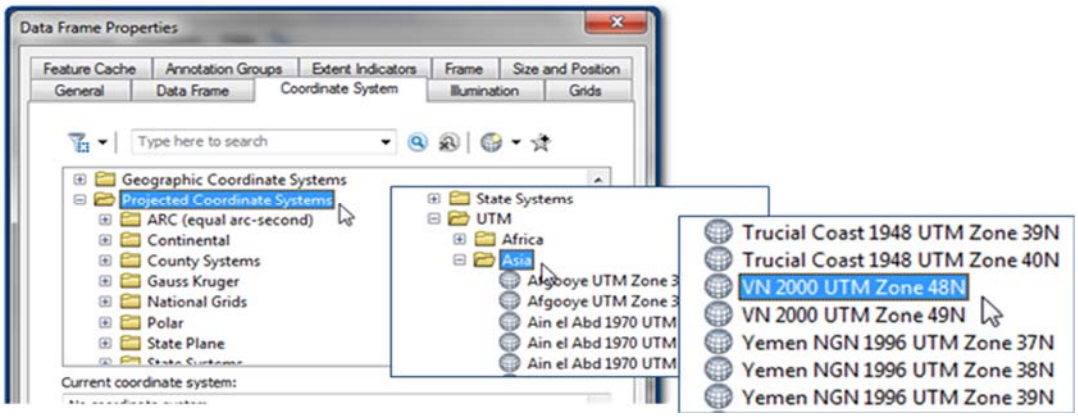
We all discussed the need for better analysis using the data within the forest status map, combined with data on the three forest categories, forest owners', and from legal documents. It is necessary to have a good understanding on what aspects of REDD+ have the greatest potential in the province, to help guide participants in Workshop 1.It is also important to clearly describe the results of Workshop 1 and further analysis during Workshop 2, so that potential areas for interventions are well-linked to areas identified in Workshop 1. An important question for further analysis in Ha Tinh is how significant the drivers really are, compared to potential for '+' activities.

**Box 3: Projection advice associated with VN 2000 projection**

To **project on-the-fly** you right click on the data frame in ArcMap, click **Data Frame Properties** and then choose the projection in which to display any data that is added to that ArcMap project**.**

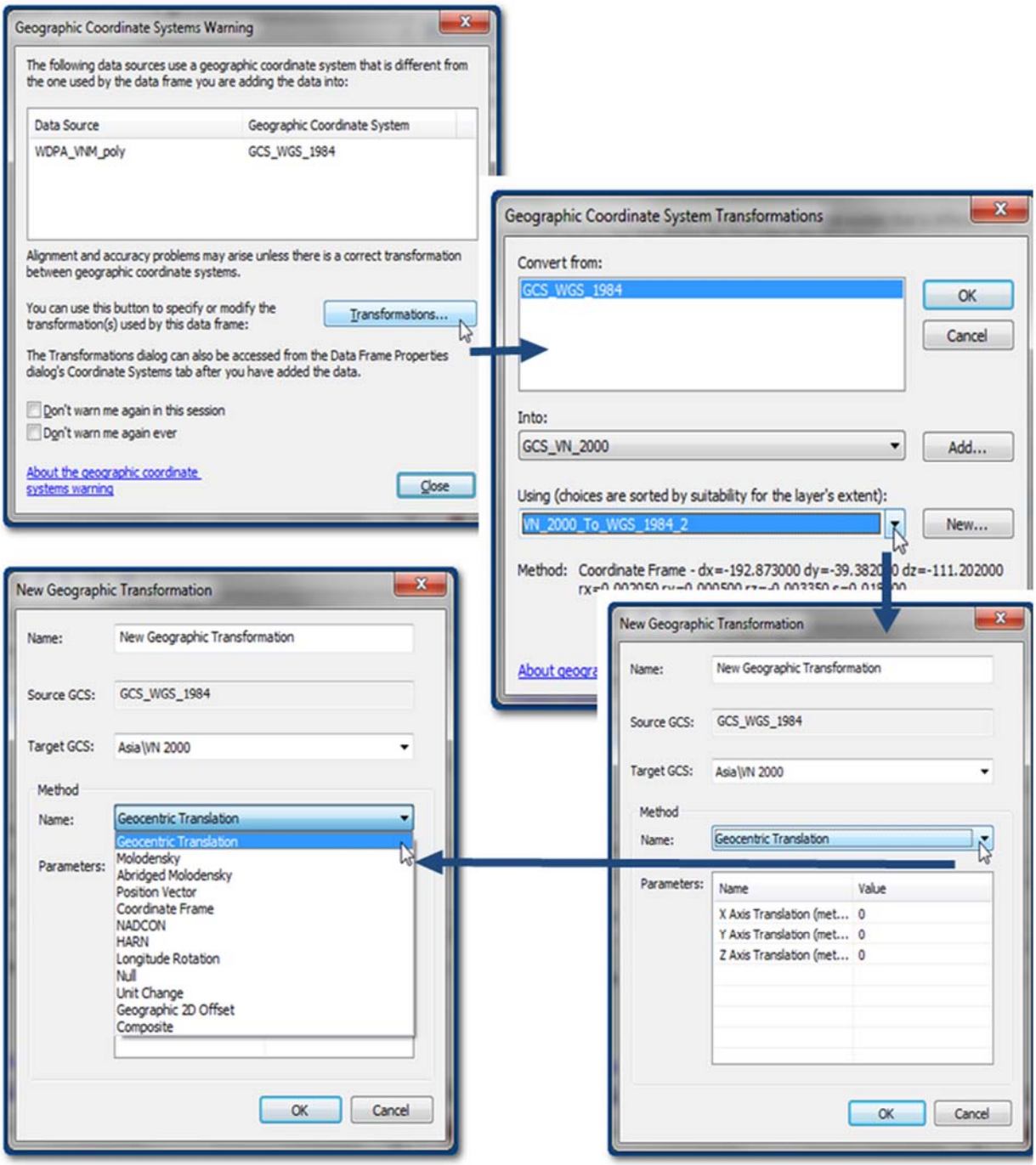



There are two VN 2000 projections which are located in **projected coordinate system>>Asia VN2000 UTM Zone 48N** and **VN2000 UTM Zone 49N.** Data added to the ArcGIS project that have a different coordinate system to the data frame, are projected on-the-fly to e.g. **VN 2000 UTM Zone 48N**. A **Geographic Coordinate Systems Warning** window appears and the **user must select the correct transformation** for ArcGIS to project the data **on-the-fly** in the correct way i.e. that the transformation from VN2000 to WGS84 Datum uses the correct method.



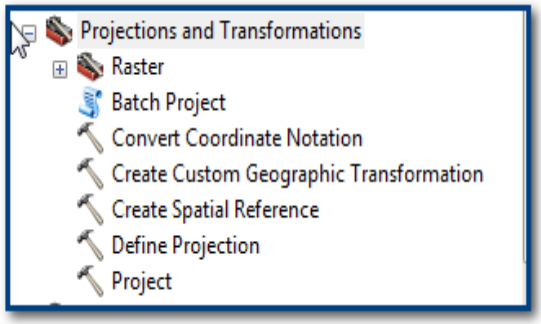

ArcGIS has one Transformation method for the VN2000 coordinate system but if this is not appropriate /correct, i.e. if it differs from local VN 2000 parameters used, the user can click new and define a custom transformation method. Some additional help on the VN 2000 coordinate system transformation is discussed here **http://forums.esri.com/Thread.asp?c=93&f=984&t=267736**

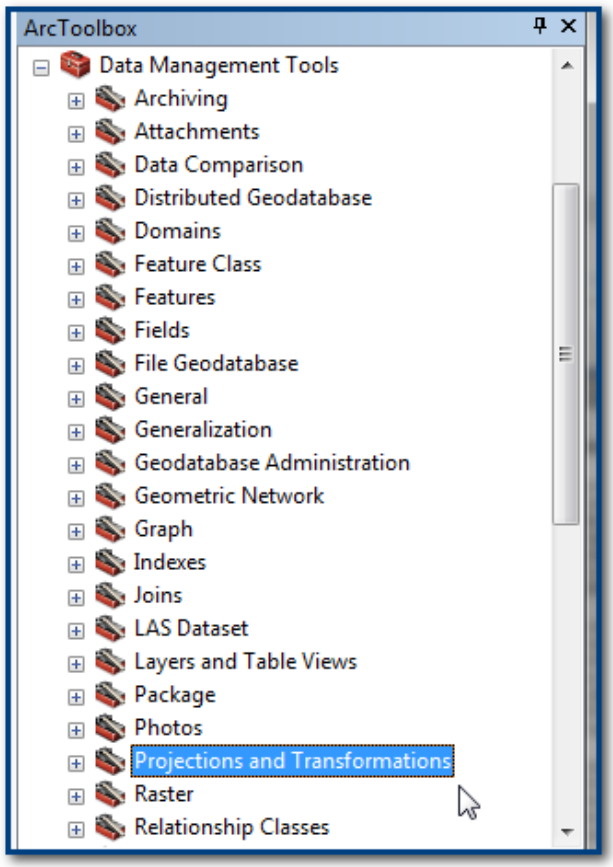
**Box 3, cont.**


Geographic Coordinate Systems Warning
The following data sources use a geographic coordinate system that is different from the one used by the data frame you are adding the data into:
Data Source
Geographic Coordinate System
WDPA_VNM_poly
GCS_WGS_1984
Alignment and accuracy problems may arise unless there is a correct transformation between geographic coordinate systems.
You can use this button to specify or modify the transformation(s) used by this data frame:
Transformations...
The Transformations dialog can also be accessed from the Data Frame Properties dialog's Coordinate Systems tab after you have added the data.
Don't warn me again in this session
Don't warn me again ever
About the geographic coordinate systems warning
Close
Geographic Coordinate System Transformations
Convert from:
GCS_WGS_1984
OK
Cancel
Into:
GCS_VN_2000
Add...
Using (choices are sorted by suitability for the layer's extent):
VN_2000_To_WGS_1984_2
New...
Method: Coordinate Frame - dx=-192.873000 dy=-39.382000 dz=-111.202000
New Geographic Transformation
Name:
New Geographic Transformation
Source GCS:
GCS_WGS_1984
Target GCS:
Asia\VN 2000
Method
Name:
Geocentric Translation
Parameters:
Geocentric Translation
Molodensky
Abridged Molodensky
Position Vector
Coordinate Frame
NADCON
HARN
Longitude Rotation
Null
Unit Change
Geographic 2D Offset
Composite
OK
Cancel
New Geographic Transformation
Name:
New Geographic Transformation
Source GCS:
GCS_WGS_1984
Target GCS:
Asia\VN 2000
Method
Name:
Geocentric Translation
Parameters:
Name
Value
X Axis Translation (met... 0
Y Axis Translation (met... 0
Z Axis Translation (met... 0
OK
Cancel

**Box 3, cont.**

To physically project data from one coordinate system to another so that the data are stored in a new projection. The tools are found in the **Data Management Tools>>Projections and Transformations** toolset.




When you add data to ArcMap that requires projecting on-the fly with a custom transformation or physically project data to store in a new projection, you need to define the transformation methods. Rather than manually defining the methods each time, the **Create Custom Geographic Transformation** will create and store your user defined transformation within ArcGIS. The three other most useful tools are:-

- The **Project tool** is used to project vector data from one coordinate system to another
- The **Raster>>Project Raster Tool** is used to project raster data from one coordinate system to another

The **Define Projection** tool is used to add missing projection information to a vector or raster dataset (you need to know what coordinate system the data are in in order to correctly define the projection. This does not transform the data in any way, it just tells ArcGIS that this dataset is stored in this projection).

## Annex 1: Participants list

| STT | Họ tên / Name | Chức vụ Position | Cơ quan (CIP Name) | Chuyên môn Profession background | Tel | Email | Địa chỉ Address | PRAP | Đợt tháng 6/2014 | Ghi chú Remarks |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Trần Thị Thanh Hương | Phó giám đốc Trung tâm Bản đồ và Cơ sở dữ liệu | Phân Viện Điều tra quy hoạch rừng Nam bộ - FIPI | Viễn thám GIS | 097 668 4404 | thanhhuong81185@gmail.com | 197 Bành Văn Trân, Quận Tân Bình, thành phố Hồ Chí Minh | Ca Mau | x | Trưởng nhóm |
| 2 | Nguyễn Minh Khoa | Cán bộ kỹ thuật | Phân Viện Điều tra quy hoạch rừng Nam bộ - FIPI | Viễn thám GIS | 0902 899864 | nguyenminhkhoa1987@gmail.com | 197 Bành Văn Trân, Quận Tân Bình, thành phố Hồ Chí Minh | Binh Thuan | | |
| 3 | Nguyễn Vĩnh Lợi | Cán bộ kỹ thuật | Phân Viện Điều tra quy hoạch rừng Nam bộ - FIPI | Viễn thám GIS | 0986 423 857 | vinhloi.gisk26@gmail.com | 197 Bành Văn Trân, Quận Tân Bình, thành phố Hồ Chí Minh | Ca Mau | | |
| 4 | Phạm Đức Cường | Trưởng phòng GIS | Trung tâm Tài nguyên và môi trường lâm nghiệp (thay HQ) | Viễn thám GIS | | cuongfipi@gmail.com | Vĩnh Quỳnh, Thanh Trì, Hà Nội | Lao Cai | x | có thể tham gia không đầy đủ |
| 5 | Phạm Mạnh Hà | Chuyên viên | Trung tâm Tài nguyên và môi trường lâm nghiệp | Viễn thám GIS | 0977 044166 | hafrec@gmail.com | Vĩnh Quỳnh, Thanh Trì, Hà Nội | Lao Cai | | |
| 6 | Trần Văn Hổ | Cán bộ kỹ thuật | Trung tâm Tài nguyên và môi trường lâm nghiệp | Viễn thám GIS | 098 1617640 | tranhofipi@gmail.com | Vĩnh Quỳnh, Thanh Trì, Hà Nội | Lao Cai | | |
| 7 | Nguyễn Trường Chinh | Cán bộ kỹ thuật | Phân Viện Điều tra quy hoạch rừng Tây bắc bộ - FIPI | Viễn thám GIS | 0979 034 686 | truongchinh.1368@gmail.com | Vĩnh Quỳnh, Thanh Trì, Hà Nội | Bac Kan | | |
| 8 | Đoàn Thùy Dương | Cán bộ kỹ thuật | Phân Viện Điều tra quy hoạch rừng Tây bắc bộ - FIPI | Viễn thám GIS | | | Vĩnh Quỳnh, Thanh Trì, Hà Nội | Bac Kan | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9 | Nguyễn Bá Quyền | Cán bộ kỹ thuật | Phân Viện Điều tra quy hoạch rừng Tây bắc bộ - FIPI (thay HQ) | | 0914 916 016 | quyengb@gmail.com | Vĩnh Quỳnh, Thanh Trì, Hà Nội | Bac Kan | | contact person của FIPI Tây Bắc |
| 10 | Nguyễn Văn Thị | Trưởng phòng GIS | Viện Sinh thái và Môi trường rừng - Đại học Lâm nghiệp (IFEE) | Viễn thám GIS | 0915. 686.1 27 | nguyenvanthi@ifee.edu.vn | Xuân Mai, Hà Nội | Ha Tinh | | |
| 11 | Vũ Thị Kim Oanh | Cán bộ kỹ thuật | Viện Sinh thái và Môi trường rừng - Đại học Lâm nghiệp | Viễn thám GIS | 0982. 840.7 03 | vuthikimoanh@ifee.edu.vn | Xuân Mai, Hà Nội | Ha Tinh | | |
| 12 | Kiều Đăng Anh | Cán bộ kỹ thuật | Viện Sinh thái và Môi trường rừng - Đại học Lâm nghiệp | Viễn thám GIS | 0936. 468.3 42 | kieudanganh@gmial.com | Xuân Mai, Hà Nội | Ha Tinh | | (bổ sung) |
| 13 | Nguyễn Quang Huy | Cán bộ kỹ thuật | Viện Sinh thái và Môi trường rừng - Đại học Lâm nghiệp | Viễn thám GIS | 098 684 5526 | huy.khmt@gmail.com | Xuân Mai, Hà Nội | Ha Tinh | | tham gia xử lý bản đồ cho Hội thảo phân tích nguyên nhân (có thể tham gia từ đầu tháng 10) |

## Annex 2: Draft additional guidance on mapping tasks for PRAP development

| Product | Purpose | Presentation suggestions/options |
|---|---|---|
| **Workshop 1 – Drivers & Barriers** | | |
| Posters:<br>- Drivers<br>- Barriers<br>- Stakeholders & institutions analysis | To provide participants with relevant information and promote discussion | - Information should be clear and concise<br>- Use text, charts/diagrams and images<br>- Conduct basic analysis of forest cover change prior to workshop to try and see what the dominant trends in the province are (e.g. regeneration, deforestation, degradation).<br>- Include maps if it adds value to the poster; these could be in the poster or displayed separately to provide more detail.<br>- Maps may include additional information or spatial analysis of particular drivers/barriers that you know will be considered important in the province.<br>- Allow participants to comment, correct and add to the information on the posters. |
| Maps/layers to use for participatory mapping exercise | To help the participants prioritize communes or specific areas affected by drivers and barriers | - Prioritize and provide only the most important layers for use in participatory mapping. Make sure you have maps to facilitate discussion of barriers as well as drivers.<br>- These may include: forest status map; forest cover change map; land use map; forest owners; forest categories; future land use plan; and a selection of transparent layers related to specific drivers/barriers that are relevant in the province.<br>- Different groups may choose to use a different base map, or different layers, depending on which driver or barrier they are analysing.<br>- Choose a participatory mapping approach (e.g. by commune, by area, by both) in advance.<br>- Classifications and colours should be suited to the participatory task: it should be easy to distinguish the colours and lines. Maps should include registration marks (graticule or tic points) to help with input of the participatory data after the workshop.<br>- Make sure the results are clear and that you have a record of them; get as much information as possible from participants as to why they chose certain areas/communes or what kind of barriers they are discussing. Ensuring the problem trees are more detailed will help with this too.<br>- Allocate enough time for discussion and participatory mapping. |
| **Processing WS1 results** | | |
| Commune rankings for drivers/barriers | To transfer participatory results from WS1 into GIS for use in further analysis and to show in WS2 | Where a commune ranking has been done:<br>- Prepare maps showing the results for each driver/barrier discussed during the participatory mapping exercise.<br>- Depending on the approach you use in WS1, this may be:<br>o a simple ranking of communes for a single driver/barrier (e.g. high, medium, low);<br>o a combination of both rank and area. |
| Combined commune rankings | To visualize the overall ranking of communes by driver/barrier, in | - Select an approach to sum the results of the commune rankings. This approach should allow to distinguish between different combinations of H, M, L rankings (e.g. coefficient approach). |

| | | |
|---|---|---|
| | order to see which may be most affected | - Select an approach that allows you to see additional information about which drivers/barriers have been included for which communes (e.g. matrix or charts). Three approaches were demonstrated by the CIPS in the working session. |
| Participants' drawn areas for drivers/barriers | To transfer participatory results from WS1 into GIS for use in further analysis and to show in WS2 | Where an area selection has been done:<br>- Prepare maps showing the results for each driver/barrier discussed during the participatory mapping exercise.<br>- Depending on the approach you use in WS1, this may be:<br>o an area drawn on the map for a single driver/barrier;<br>o a combination of both rank and area. |
| Maps combining participants results with further analysis | To try to validate the areas/rankings given by the participants, as well as further analyse the areas affected by or potentially at risk of drivers/barriers | - Use the layers developed to show the results of participatory mapping for each driver/barrier.<br>- Combine these with additional layers in order to (a) try to validate the areas/rankings (e.g. checking whether forest cover change has occurred in those areas)<br>- Combine these areas with additional layers in order to (b) further analyse areas potentially affected by or at risk of the driver/barrier; this may result in different or additional areas been included as driver/barrier areas.<br>- Additional analyse may include generating statistics, e.g. the amount of deforestation or degradation that has occurred in a polygon, or the amount of certain forest types affected or at risk, or the carbon stocks affected, etc. |
| **Workshop 2 – Solutions** | | |
| Participatory results from WS1<br>- Problem trees<br>- Participatory maps on single drivers/barriers<br>- Combined rankings | Provide the results from WS1 to share with the participants and to remind them of their outputs/decisions | - Decide how to display the results of WS1 during WS2. For example:<br>o Original problem trees/large size printed photos/diagrams of the problem trees<br>o Large printed participatory maps results<br>o Large printed map or poster of the combined rankings |
| Maps on drivers/barriers, combining participatory results and further analysis | Provide more information to the WS2 participants about areas affected by or at risk or drivers/barriers | - Prepare a combined map (WS1 participatory results + further analysis) to use in WS2.<br>- Consider how you will display the areas affected by or at risk of a driver/barrier:<br>o The factors used to create this map should be clear to the participants (and any thresholds should be transparent);<br>o The participatory results should be included and clear as well.<br>o Allow the participants to use their own knowledge; do not imply that these areas are completely accurate and inflexible. |
| Map/s to use for participatory mapping exercise | Map/s to use for the participatory exercise of prioritizing areas for interventions | - The participants will need a map on which to locate areas for interventions, as well as maps/materials to refer to in this exercise.<br>- Choose an approach for this in advance; e.g. will the draw areas on a map? Use pins or other markers? Or select priority communes/forest areas? |

| | | |
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| | | - For example, they will most likely need to refer to the problem tree and solution tree related to their intervention.<br>- Then they may need to see the map showing areas affected by and at risk of driver, or areas affected by barriers/with potential for '+' activities. If this map is quite complicated, you may wish to provide another simplified/basic maps for them to use to mark intervention areas on.<br>- For certain types of interventions, other types of information may be valuable to the group, e.g. forest owners, three forest categories, protected areas, etc.<br>- It is not recommended to prepare many additional layers. You may prioritize several important layers to produce as transparencies, and have the option to project or display on screen other layers that the participants request or need.<br>- Make sure the results are clear and that you have a record of them; get as much information as possible from participants as to why they chose certain areas/communes. |
| Risks and benefits analysis:<br>- Risks and obstacles identification<br>- Rapid feasibility assessment<br>- Social risks and benefits assessment<br>- Environmental safeguards and risks brainstorming | - To help groups identify risks or obstacles related to the intervention packages, feasibility and potential benefits from the interventions | - The groups analysing risks, obstacles, feasibility and social risks & benefits should refer to the materials used by each group in WS2: problem tree, driver/barrier map, solution tree and map of suggested intervention areas to examine potential risks/obstacles.<br>- Additional layers may be provided showing social risks & benefits information, e.g.: poverty, population, ethnic minorities or other relevant aspects. And environmental risks & benefits information, e.g.: natural forest, areas important for biodiversity; important non-forest ecosystems. Additional layers could be prepared as transparent layers or just projected digitally.<br>- If maps are marked with any further information related to risks and benefits, this should be recorded. For example, workshop participants may provide useful information about the location of ethnic minority communities, or important non-forest ecosystems like wetlands. |
| **Processing WS2 results** | | |
| Participants areas for interventions (from participatory mapping) | To transfer participatory results from WS2 into GIS for use in further analysis and to share with stakeholders | - Prepare maps showing the results for each intervention package discussed during the participatory mapping exercise.<br>- Depending on the participatory mapping approach you use in WS2, this may be:<br>o an area drawn on the map for an intervention package;<br>o a point on the map indicating likely area or commune<br>o a combination of priority commune and area. |
| Maps for priority areas for interventions (combining participatory maps and further analysis) | Draft maps of potential areas for proposed intervention packages | - Take the results of the participatory mapping of areas for intervention packages, and combine these with additional layers in order to analyse areas suitable or of priority for the intervention in question.<br>- Consider creating a model that will help to define areas suitable or of priority for a particular intervention, based on important factors influencing the location. For example: |

| | | |
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| | | o Geophysical factors<br>o Factors influencing feasibility<br>o Additional benefits<br>o Risks<br>- The feasibility, risks and benefits analysis conducted during WS2 can contribute some of this information.<br>- First draft maps will be used, validated and revised further during subsequent consultations, e.g. interventions design workshop |
| Any additional participatory mapping done (e.g. from risks & benefits analysis) | To transfer participatory results from WS2 into GIS for use in further analysis and to share with stakeholders | - During risks and benefits analysis, the participants may provide additional useful information, e.g. the locations of ethnic minority groups or areas important for NTFPs collection.<br>- This information may be useful for the further analysis of areas for interventions; in which case, transfer the participatory results so that you have a shapefile that could be used in further GIS analysis. |
| **Environmental impacts analysis & key informants workshop** | | |
| Environmental impacts analysis (by consultant) | To further analyse potential environmental impacts of proposed interventions | - The consultant will need to refer to the results of WS2, including maps of areas for interventions (PM results and additional analysis) and risks and benefits analysis conducted by WS2 participants.<br>- They may need to use spatial data related to the environment that has been collected and prepared for the province, such layers showing natural forest, protected areas and key biodiversity areas (KBAs), species richness, provision of ecosystem services, location of important non-forest ecosystems, etc.<br>- The consultant may prepare additional layers showing areas important for environmental impacts (risks and benefits) associated with interventions. |
| Key informants workshop | To discuss and verify results of environmental impacts assessment | - The participants in this workshop should be provided with the results of the consultant's analysis, as well as any relevant environmental impacts maps prepared. |
| **Intervention package design key informant workshop** | | |
| Provincial REDD+ Working Group workshop | To review and confirm interventions from WS2, including more detailed implementation plans | - Participants in this workshop will need to refer to the results of Workshop 2 and the environmental impact assessment.<br>- They should also be provided with the maps prepared by CIPs showing areas suitable or prioritized for interventions (i.e. based on PM results and additional analysis). |

## Annex 3: Working session agenda

| Time | Topic | Responsible |
|---|---|---|
| **Day 1 – 28 Sept.** | | |
| 08:30 – 09:00 | • Welcome (5-10 mins)<br>• Run through agenda<br>• Introductions | IFEE/PMU |
| 09:00 – 09:30 | • Ice-breaker quiz: what do we know about REDD+ and forests in Viet Nam? | Phuong/ Charlotte |
| 09:30 – 10:30 | Session 1: Role of spatial analysis in PRAP development<br>• Presentation on spatial analysis and PRAPs<br>• Exercise: on a timeline of PRAP process, each CIP shows what stage their province is in<br>• Discussion: any questions about PRAP process? | Charlotte |
| 10:30 – 11:00 | Tea break | |
| 11:30 – 12:00 | Session 2: Set up, checking software, data, permissions | Corinna |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 1:30 | Set up, cont. | |
| 1:30 – 2:00 | Session 3: Recap of 2014 session:<br>• Topics covered<br>• Provide tutorials | Charlotte |
| 2:00 – 2:30 | Session 3, cont.<br>Parking lot: issues/tasks for technical support | Charlotte |
| 2:30 – 3:30 | Session 4: Drivers workshop preparation<br>4.1 IFEE to present experience from Ha Tinh drivers workshop:<br>4.2 Group exercise: participatory mapping approaches | IFEE |
| 3:30 – 4:00 | Tea break | |
| 4:00 – 5:00 | Session 4, cont.<br>4.3 Draft list of maps/materials for drivers analysis workshop: | |
| 5:00 – 5:15 | Recap/questions | |
| **Day 2 – 29 Sept.** | | |
| 08:30 – 08:45 | Recap of previous day | |
| 08:45 – 10:00 | Session 4, cont.<br>4.4 Preparing draft maps for the drivers workshop<br>• Initial guidance/tips<br>• Map preparation | Charlotte/ Corinna |
| 10:00 – 10:30 | Tea break | |
| 10:30 – 12:00 | Session 4, cont.<br>• CIPs continue working on maps & present one draft | |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 3:00 | • Session 5: Drivers in the future - Mapping threats or future pressures on forests:<br>• Presentation on options and pros & cons of mapping potential pressures<br>• Template of input layers and simple workflow<br>• Prepare draft maps | Corinna |
| 3:00 – 3:30 | Tea break | |
| 3:30 – 5:00 | Session 5, cont.<br>• Continue work on maps and then present to group for feedback | |
| 5:00 – 5:15 | Recap and questions | |
| 08:30 – 08:45 | Recap of previous day | |
| 08:45-10:00 | Session 6: Post-workshop drivers/barriers mapping<br>6.1 Combining participatory mapping and GIS<br>OUTPUT: 4 driver/barrier maps ranking affected communes | Corinna/ Charlotte |
| 10:00 – 10:30 | Tea break | |
| 10:30 – 12:00 | 6.1, continued. | Corinna |

| | | |
|---|---|---|
| | • Presentation on multicriteria analysis (MCA)<br>• How to combine information on commune rankings into one overlay?<br>OUTPUT: One layer showing communes ranked by no. drivers/barriers present | |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 3:00 | Session 6, post-workshop mapping cont.<br>• 6.2 Exercise: each CIP take a participatory map from exercise 4.2 and transfer into GIS<br>• Validation: how do the areas identified compare with other relevant data (e.g. FCC layer, layers related to driver) and with commune rankings? | |
| 3:00 – 3:30 | Tea break | |
| 3:30 – 5:00 | Session 7: Preparing for the 'solutions' workshop<br>7.1 Identifying interventions:<br>• Presentation: What are REDD+ interventions?<br>• How will REDD+ interventions be identified? What will happen during Workshop 2? | Charlotte |
| 5:00 – 5:15 | Recap/questions | |
| 08:30 – 08:45 | Recap of previous day | |
| 08:45 – 9:30 | 7.2: Workshop plans<br>- Group discussion & report-back | Charlotte |
| 09:30 – 10:00 | 7.2, cont.<br>• Draft list of maps/materials for use in solutions workshop (with input layers, etc, using table template) | Charlotte/ Corinna |
| 10:0 – 10:30 | Tea break | |
| 10:30 – 12:00 | Session 8: Mapping potential areas for interventions<br>8.1 Exercise: each CIP identifies a hypothetical intervention to address the driver/barrier they mapped in session 4. | Charlotte & Corinna |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 2:00 | Exercise 8.1, cont. | |
| 2:00 – 3:00 | 8.2 Developing a workflow to map potential intervention areas<br>• In 2 groups, develop workflow for their interventions. | |
| 3:00 – 3:30 | Tea break | |
| 3:30 – 5:00 | Session 8, cont.<br>8.3 Options for introducing workflows into ArcGIS:<br>• Presentation introducing spatial workflows in Arc | Corinna/ Charlotte |
| 5:00 – 5:15 | Recap/questions | |
| **Day 5 – 2 Oct** | | |
| 08:30 – 08:45 | Recap of previous day | |
| 08:45 – 10:00 | 8. 3 continued, group work on workflow templates<br>• Demonstration of an example workflow that has been put into Arc | Corinna |
| 10:00 – 10:30 | Tea break | |
| 10:30 – 12:00 | 8.3, cont. groups put workflows into Arc.<br>• Each group creates the workflow in ArcGIS to identify areas where the intervention could be undertaken<br>OUTPUT: map showing driver area in one colour and the intervention area in another | |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 3:00 | 8.3 Workflows, continued<br>• Groups present their workflows and output map and - get feedback from group | |
| 3:00 – 3:30 | Tea break | |
| 3:30 – 5:00 | Groups finish maps, present and provide Corinna with copy of ArcGIS workflow and data | |
| 5:00 - 5:15 | Recap/questions | |

| | | |
|---|---|---|
| 06:00 ---- | Group dinner | |
| **Day 6 – 3 October** | | |
| 09:00 – 10:30 | Session 8, cont.<br>8.4 Mapping another intervention: swap | |
| 10:30 – 11:00 | Tea break | |
| 11:00 – 11:30 | Session 8, cont.<br>8.5 Discussion:<br>• Would the workflow created for this intervention address this driver/barrier in your province?<br>• Are there any steps in the workflow you would change?<br>• Would the input layers be the same, or different for your province?<br>• Are the risks and benefits the same or should they be changed for your province? | |
| 11:30 – 12:00 | 8.6: Revisiting the solutions workshop: | |
| 12:00 – 1:00 | Lunch | |
| 1:00 – 1:30 | • Evaluation forms<br>• Closing remarks | |

# Annex 4: Presentations

## 4.1 The role of spatial analysis in provincial REDD+ planning, Charlotte Hicks, UNEP-WCMC

UN-REDD PROGRAMME

The role of spatial analysis in provincial REDD+ planning

Charlotte Hicks, UNEP-WCMC

Ha Noi, September 2015

### Outline

This presentation will provide an overview of the role of spatial analysis in supporting provincial REDD+ planning in Viet Nam, and the steps involved the PRAP process:

1. Background
2. Using spatial information to support provincial REDD+ planning
3. Steps in the PRAP process

### 1. Background

### REDD+

REDD+

= Reducing emissions from Deforestation and forest Degradation

+

Conservation of forest carbon stocks
Sustainable management of forests
Enhancement of forest carbon stocks

- REDD+ is an international initiative to combat climate change by changing the ways in which forests are used and managed, so that emissions of GHG from forests are reduced and carbon sequestration is increased.
- REDD+ may require different actions, such as protecting forests from fire or illegal logging or rehabilitating degraded forest areas.

### UN-REDD Programme

- UN-REDD = United Nations collaborative initiative on Reducing Emissions from Deforestation and forest Degradation (REDD) in developing countries.
- Started in 2008; joint programme of UNDP, FAO, UNEP
- Supports national REDD+ readiness efforts in more than 60 partner countries
- Viet Nam started its UN-REDD National Programme in 2009; currently implementing Viet Nam UN-REDD Phase II Programme
- Viet Nam National REDD+ Action Plan approved in 2012; currently developing PRAPs for pilot provinces

### Introduction to UNEP-WCMC

- United Nations Environment Programme World Conservation Monitoring Centre
- Provide support to UN-REDD partner countries on Safeguards & Multiple Benefits:
  - Planning for REDD+ that achieves multiple benefits, including using mapping and other tools, e.g. economic analyses
  - Developing country approaches to safeguards
- Close collaboration with in-country partners, FAO & UNDP; focus on capacity building & participatory approaches

## UNEP-WCMC – Viet Nam REDD+ collaboration

- Previous work on:
  - Ecosystem services from new & restored forests (2010)
  - Mapping potential of REDD+ to provide biodiversity co-benefits (2010)
- In 2014, began providing technical support on spatial analysis to inform development of PRAPs
- Upcoming technical support on design of Safeguards Information System

## 2. Using spatial information to support provincial REDD+ planning

## Decision-support tools and analyses

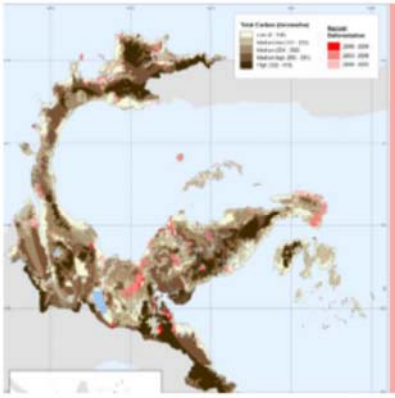
Numerous tools, analyses and studies support planning for REDD+. For example:

- Analysis of drivers of deforestation and forest degradation
- Valuation studies
- Spatial analysis / mapping
- Stakeholder consultations and participatory approaches
- Costs-benefits analysis

## Maps as decision-support

- Map-making is not itself a planning process
- Maps can and should be used together with other tools and approaches
- Maps can help REDD+ planners and stakeholders to:

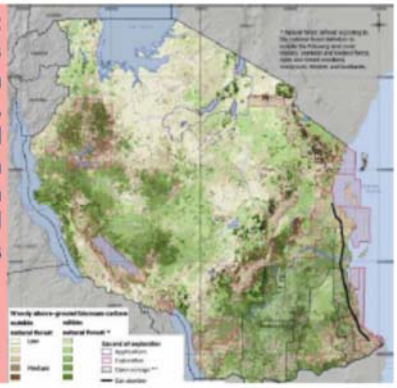
## 1. Understand context for REDD+ planning



For example: Carbon stocks and areas of recent deforestation (2000-2009) in Central Sulawesi

## 2. Understand past/current/future drivers of deforestation/ degradation

For example: Current oil and gas exploration licenses, applications and open acreage in Tanzania, with carbon and natural forests



### 3. Help to identify potential benefits and risks of REDD+

**For example: Important wildlife corridors, protected areas, natural forest and woody biomass carbon in Tanzania**

### Additional benefits of REDD+

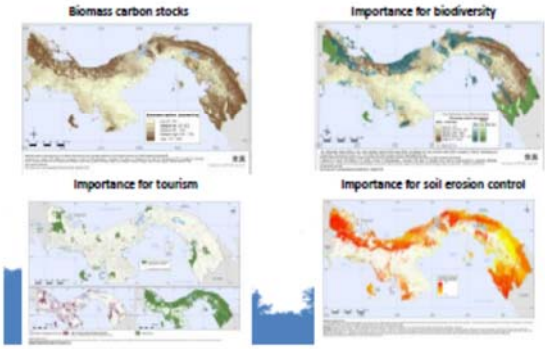
- While main aim of REDD+ is to reduce GHG emissions and increase $CO_2$ sequestration from the atmosphere, it has the potential to deliver additional benefits
- Additional benefits of REDD+ are all of these other benefits – social and environmental – that may result from the implementation of REDD+. For example:
  - Enhancement of ecosystem services
  - Biodiversity conservation
  - Livelihoods and social benefits
  - Clarified tenure and improved governance of natural resources

### Potential risks of REDD+

- REDD+ also carries potential risks, which depend on specific actions, as well as national and local contexts:
  - Environmental risks could include:
    - Conversion of degraded natural forest or other ecosystems to plantations
    - Displacement of pressures to areas important for biodiversity or ecosystem services
  - Social risks could include:
    - Reduced access to resources for forest users
    - Inequitable sharing of REDD+ benefits
    - Conflicts over land
    - Displacement of forest dependent communities

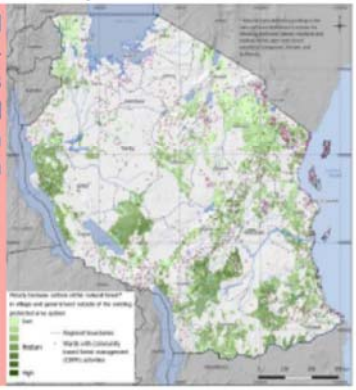
### Benefits & risks vary geographically

**For example: individual benefits of forests in Panama**



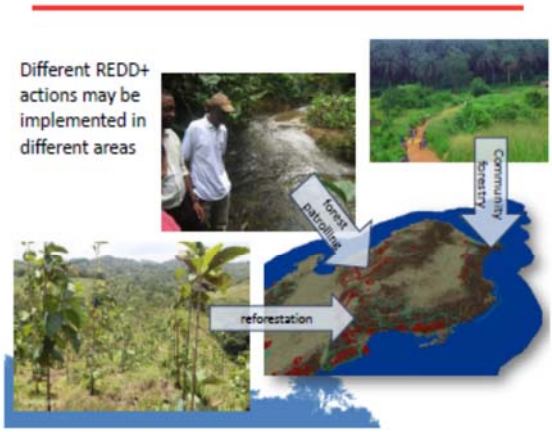

### 4. Analyze suitability of different areas for different types of REDD+ actions (interventions)

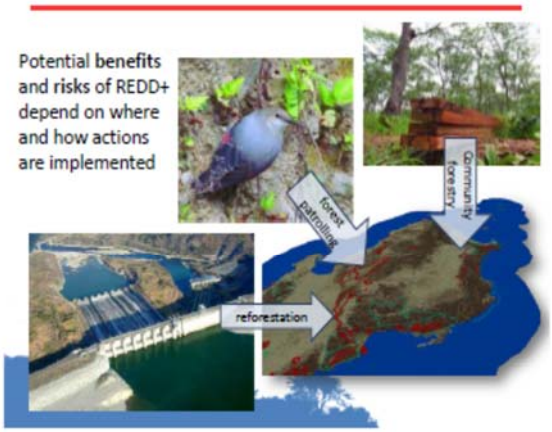
**For example: Potential zones for REDD+ actions to extend areas community-based forest management in Tanzania**

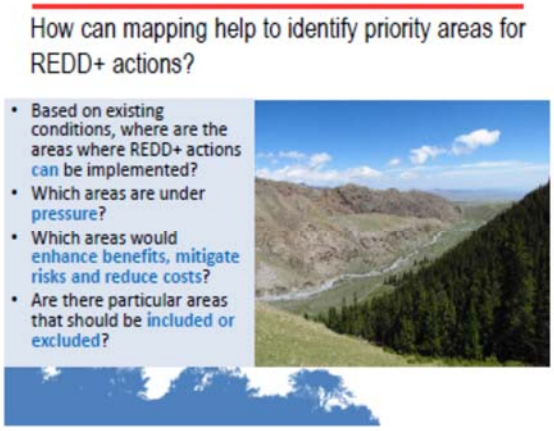


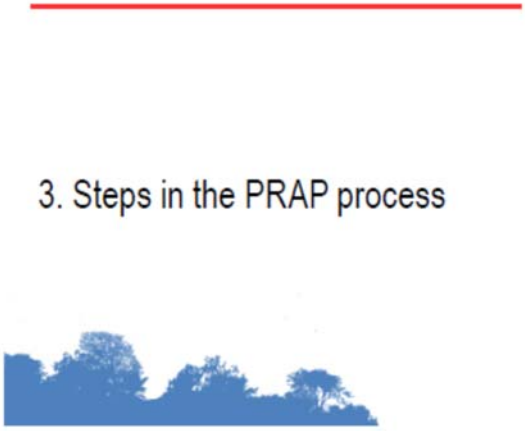
### REDD+ actions? (In Viet Nam = interventions)

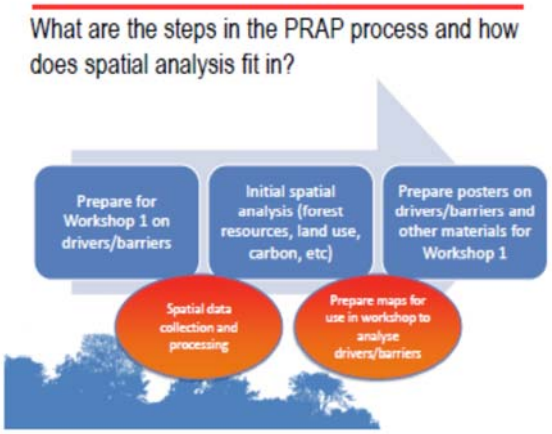
| Activity | Example interventions |
|---|---|
| Reducing emissions from deforestation | Eg: reduce conversion pressure through improved land-use planning |
| Reducing emissions from forest degradation | Eg: improve sustainability of NTFPs harvesting/production; fuelwood alternatives/efficient cookstoves |
| Conservation of forest carbon stocks | Eg: improve management of existing protected areas |
| Sustainable management of forest | Eg: reduced impact logging; community forestry |
| Enhancement of forest carbon stocks | Eg: forest rehabilitation; afforestation |

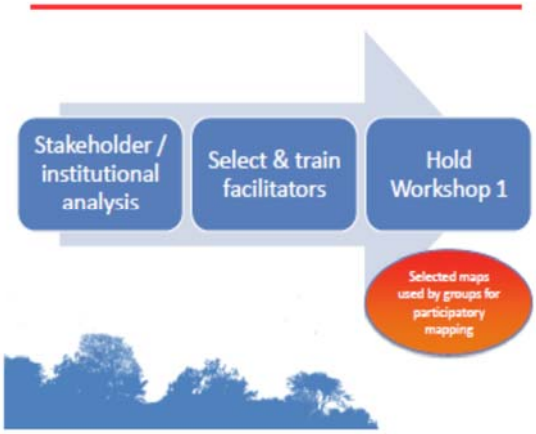

Different REDD+ actions may be implemented in different areas
forest patrolling
Community forestry
reforestation

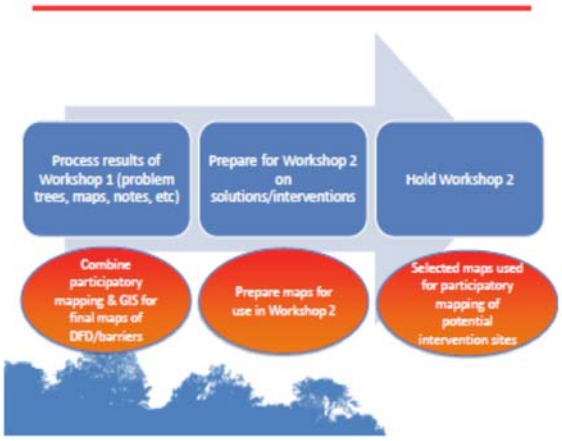

Potential benefits and risks of REDD+ depend on where and how actions are implemented
forest patrolling
Community forestry
reforestation

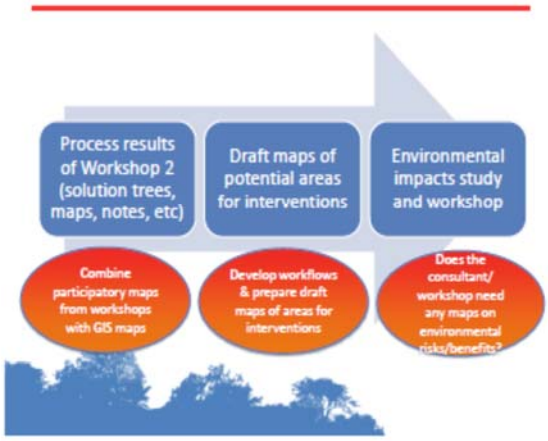

How can mapping help to identify priority areas for REDD+ actions?
Based on existing conditions, where are the areas where REDD+ actions can be implemented?
Which areas are under pressure?
Which areas would enhance benefits, mitigate risks and reduce costs?
Are there particular areas that should be included or excluded?

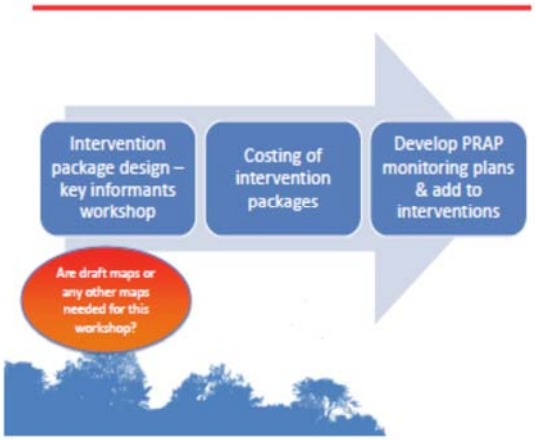

3. Steps in the PRAP process

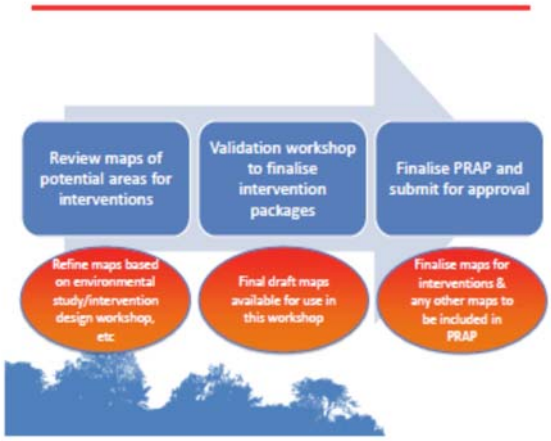

What are the steps in the PRAP process and how does spatial analysis fit in?
Prepare for Workshop 1 on drivers/barriers
Initial spatial analysis (forest resources, land use, carbon, etc)
Prepare posters on drivers/barriers and other materials for Workshop 1
Spatial data collection and processing
Prepare maps for use in workshop to analyse drivers/barriers

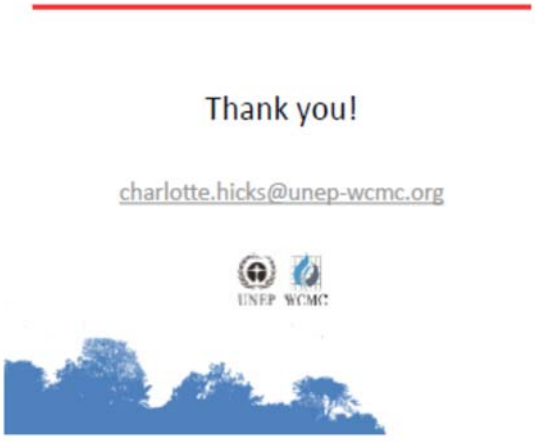

Stakeholder / institutional analysis
Select & train facilitators
Hold Workshop 1
Selected maps used by groups for participatory mapping


Process results of Workshop 1 (problem trees, maps, notes, etc)
Prepare for Workshop 2 on solutions/interventions
Hold Workshop 2
Combine participatory mapping & GIS for final maps of DFD/barriers
Prepare maps for use in Workshop 2
Selected maps used for participatory mapping of potential intervention sites

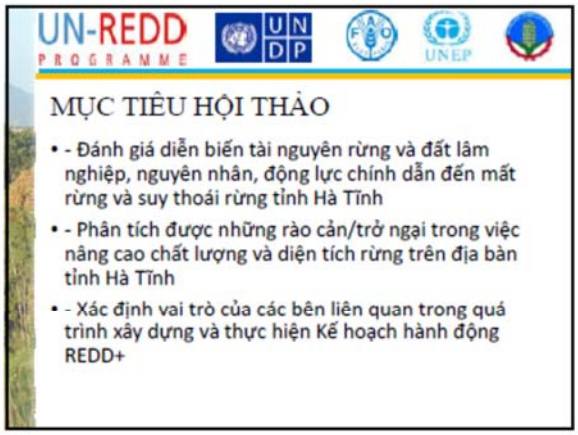

Process results of Workshop 2 (solution trees, maps, notes, etc)
Draft maps of potential areas for interventions
Environmental impacts study and workshop
Combine participatory maps from workshops with GIS maps
Develop workflows & prepare draft maps of areas for interventions
Does the consultant/ workshop need any maps on environmental risks/benefits?


Intervention package design – key informants workshop
Costing of intervention packages
Develop PRAP monitoring plans & add to interventions
Are draft maps or any other maps needed for this workshop?


Review maps of potential areas for interventions
Validation workshop to finalise intervention packages
Finalise PRAP and submit for approval
Refine maps based on environmental study/intervention design workshop, etc
Final draft maps available for use in this workshop
Finalise maps for interventions & any other maps to be included in PRAP


Thank you!
charlotte.hicks@unep-wcmc.org
UNEP WCMC

### 4.2 Workshop 1 in Ha Tinh, Mr Nguyen Van Thi, IFEE





Poster về các bên liên quan

KẾT QUẢ ĐẠT ĐƯỢC CỦA HỘI THẢO LẦN 1

- Đã xác định được các nguyên nhân chính gây mất rừng và suy thoái rừng, các rào cản chính của các hoạt động tăng cường trữ lượng các-bon từ rừng trên bản đồ tỉnh Hà Tĩnh
- Đã xác định được các điểm nóng về mất rừng, suy thoái rừng và rào cản của các hoạt động tăng cường trữ lượng các-bon từ rừng trên bản đồ tỉnh Hà Tĩnh

Xếp hạng ưu tiên

Lập ưu tiên cho các nguyên nhân và rào cản

Thảo luận xây dựng cây vấn đề

Cây vấn đề 1 – Xâm lấn đất rừng để SXNN

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Cây vấn đề 2 – Khai thác rừng trái phép

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Cây vấn đề 3 – Quản lý rừng TN chưa HQ

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Cây vấn đề 4 – Mở rộng DT rừng trồng KT

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Trình bày cây vấn đề

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Xác định các điểm nóng trên bản đồ

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Kết quả xác định điểm nóng trên bản đồ

## 4.3 Recap: 2014 Working Session - Introduction to spatial analysis for REDD+ planning at the provincial level in Viet Nam, Charlotte Hicks, UNEP-WCMC

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Recap:
*Introduction to spatial analysis for REDD+ planning at the provincial level in Viet Nam*
Charlotte Hicks, UNEP-WCMC
September 2015

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**Basics**

- Took place in Ha Noi, 16-27 June 2014
- Week 1: 12 national level participants from FREC, sub-FIPIs, NIAPP, VAFS, CFIC.
- Week 2: 13 provincial level participants from UN-REDD pilot provinces

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**Objectives**

- To build capacity among technical staff in spatial analyses to inform the development of PRAPs and for provincial-level mapping related to REDD+ actions;
- To develop approaches for support on spatial planning for REDD+ to UN-REDD pilot provinces;
- To provide partners with knowledge and tools to work with technical staff and stakeholders in the pilot provinces.

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**Content:**

1. REDD+ planning and PRAPs:
   - Introductory presentations
   - Interactive exercises
2. Natural forest:
   - Definition
   - Mapping
3. Carbon map
   - Introduction to method & values
   - Mapping
4. Introduction to ArcGIS REDD+ planning/multiple benefits toolbox (UN-REDD product)

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**Content, cont:**

5. Multiple benefits of REDD+
   - Biodiversity conservation layers: species richness and Key Biodiversity Areas
   - Ecosystem services: discussion of forest function mapping criteria in Vietnam; introduction to Waterworld online modelling tool
6. Pressures related to REDD+ planning:
   - Forest cover change mapping; discussion of limitations in data
   - Roads, fire intensity, population, etc

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**Content, cont:**

7. Discussion and group work: available datasets for mapping basic information, benefits and pressures, and how to prioritise these
8. Multi-criteria analysis approaches (MCA)
9. Group work using Lao Cai map layers:
   1: Base layers and quality control (prepare natural forest, carbon, FCC)
   2: Biodiversity benefits (prepare species richness & KBAs)
   3: Ecosystem services (Waterworld outputs & provisioning ES)
   4: Pressures (prepare roads, fire, population, poverty)

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Content, cont:

- Overlay approach: presenting two layers with matrix legend (carbon + species richness)
- Wrap-up session: combined benefits and pressures to prioritise locations for REDD+ actions

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GIS tutorials available (en, vn)

- Exercise introduction: using transparencies
- Natural forest
- Carbon stocks
- Species richness
- Soil erosion risk
- Matrix-style legend map
- Workflows on additional benefits and pressures
- Multi-criteria analysis
- Multiple Benefits Toolbox and instructions

| 2014 WORKING SESSION | THIS WORKING SESSION |
|---|---|
| Introduction to mapping for REDD+ planning | Technical support on PRAP preparations so far: consultation, data collection, etc |
| Mapping forest/land cover and natural forest | Mapping for Workshop 1: drivers and barriers |
| Mapping forest cover change | Combining participatory maps and GIS |
| Mapping carbon stocks | Mapping for Workshop 2: solutions / intervention packages |
| Mapping benefits and risks (e.g. biodiversity/species richness, soil erosion risk, poverty & population.....) | Mapping potential areas for intervention packages |
| Including topics from 2014 and/or this session.... | Additional technical support (short session with each CIP teams on Saturday) |

## 4.4 REDD+ interventions, Charlotte Hicks, UNEP-WCMC

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# REDD+ interventions

Charlotte Hicks, UNEP-WCMC

Ha Noi, September 2015

## Outline

This presentation will examine REDD+ interventions and their place in the PRAP process:

1. What are REDD+ interventions?
2. REDD+ interventions in PRAPs
2. Spatial analysis related to interventions

## REDD+

- REDD+ is an international initiative, negotiated under the United Nations Framework Convention on Climate Change (UNFCCC)
- It aims to create positive incentives for developing countries to reduce emissions from forested lands, by providing financial value for carbon stored in forests
- Key idea: results-based payments to be derived from verified carbon emission reductions or removals
- To achieve emission reductions/removals, REDD+ involves 5 activities; may utilise a range of different actions or interventions to implement these.

## REDD+ activities and interventions

| Activity | Example interventions |
|---|---|
| Reducing emissions from deforestation | Eg: reduce conversion pressure through improved land-use planning |
| Reducing emissions from forest degradation | Eg: improving sustainability of NTFPs harvesting/production; fuelwood alternatives/efficient cookstoves |
| Conservation of forest carbon stocks | Eg: improving management of existing protected areas |
| Sustainable management of forest | Eg: reduced impact logging; community forestry |
| Enhancement of forest carbon stocks | Eg: forest rehabilitation; afforestation |

## 1. Reducing Emissions from Deforestation

- Deforestation is the human-induced conversion of forest to non-forested land
- Deforestation converts carbon stored in forests into carbon dioxide released into the atmosphere

Interventions to reduce deforestation?
- Sustainable agricultural intensification
- Reform of lending criteria
- Improved land use planning
- _____

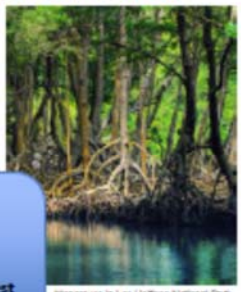
## 2. Reducing Emissions from Forest Degradation

- Forest degradation is the human-caused loss of carbon stocks on forest land that remains forest land
- It can lead to forest thinning and lower carbon stocks

Interventions to reduce degradation?
- Improved fire management
- Alternatives to fuelwood harvesting
- _____

### 3. Conservation of Forest Carbon Stocks

- Preserves existing forests, and so can be considered as actively maintaining a carbon stock



Mangroves in Los Haitises National Park, Dominican Republic

**Interventions to conserve forest carbon stocks?**
- Improve protected area management
- Establish community-based forest management areas
- ……

### 4. Sustainable Management of Forests

- When the rate of extraction from forests does not exceed the rate of natural growth, the forest can be said to be sustainably managed

**Interventions for SMF?**
- Reduced impact logging
- Promotion of forest certification
- Sustainable community forestry
- ……

### 5. Enhancement of forest carbon stocks

Enhancing carbon stocks can include:

(i) Restoring forests on previously forested land, or rehabilitating degraded forests.

(ii) Converting non-forested land into forested land;

**Interventions to enhance forest carbon stocks?**
- Restoration of degraded protected forest
- Reforestation with valuable species (e.g. timber, NTFPs)
- ……

### REDD+ interventions in PRAP process

- Identification and design of effective REDD+ intervention packages suited to situation in province is central to PRAPs
- After identification and prioritisation of drivers of deforestation & forest degradation, and barriers to enhancement, workshop participants will develop problem trees:

Example problem tree, rubber plantations, Binh Thuan, 2014

### REDD+ interventions in PRAPs

- Solution trees then developed to outline intervention packages: groups of interventions that address the driver/barrier:

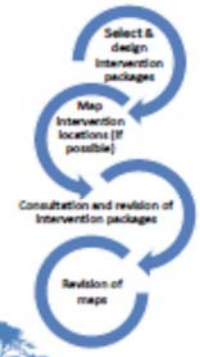
- Within intervention packages, there will be different types of interventions, e.g: policy measures, capacity building, on-the-ground interventions.

### Spatial analysis related to REDD+ interventions

- Not all interventions can be mapped; e.g. regulatory reform
- Maps will be needed for solutions workshop (e.g. drivers maps, forest cover maps)
- Problem trees, solutions trees and participatory mapping undertaken by participants → result in initial suggested locations for interventions

## Spatial analysis related to REDD+ interventions, cont

- Spatial analysis will involve combining workshop results (participatory maps) with other layers in GIS to show areas in province suitable for certain interventions.
- Further analysis and design of interventions, and then consultation → likely revise interventions themselves and the maps for interventions




## So how to map potential areas for interventions?

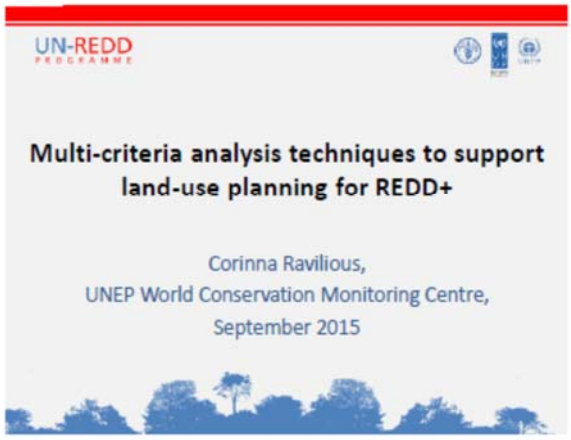
Points to consider:

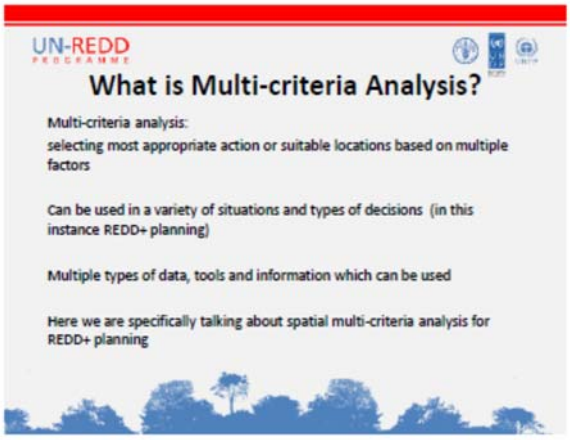
- Location of interventions should be informed by location of drivers/barriers
- Geophysical aspects, e.g. slope, soil, forest type
- Feasibility, e.g. access, carbon stocks, forest condition, risks
- Potential to enhance benefits, e.g. poverty reduction, biodiversity conservation, ecosystem services provision
- Potential to reduce risks and support safeguards, e.g. conversion of natural forest, leakage

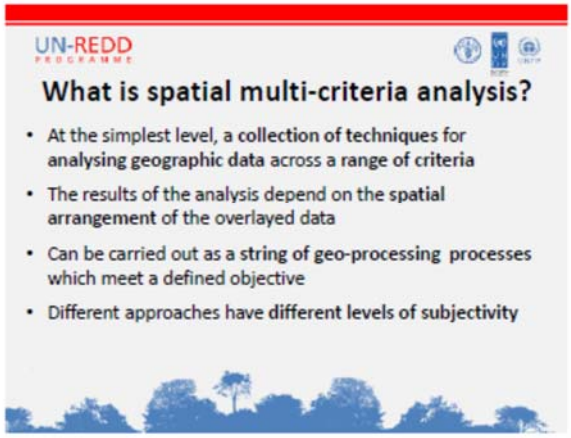
## Thank you!

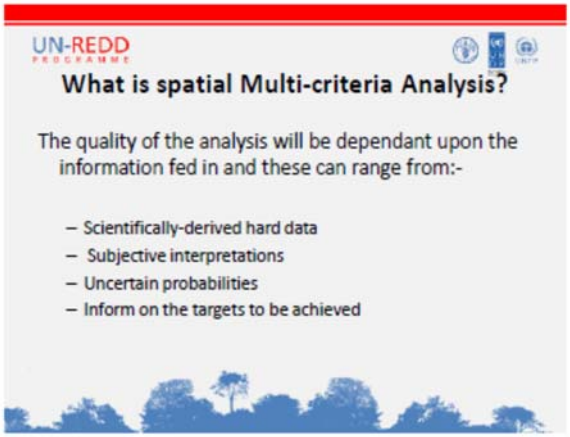
charlotte.hicks@unep-wcmc.org

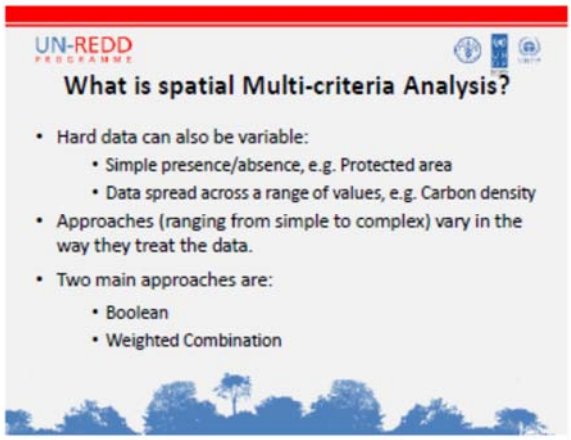
## 4.5 Multi-criteria analysis techniques to support land-use planning for REDD+, Corinna Ravilious, UNEP-WCMC

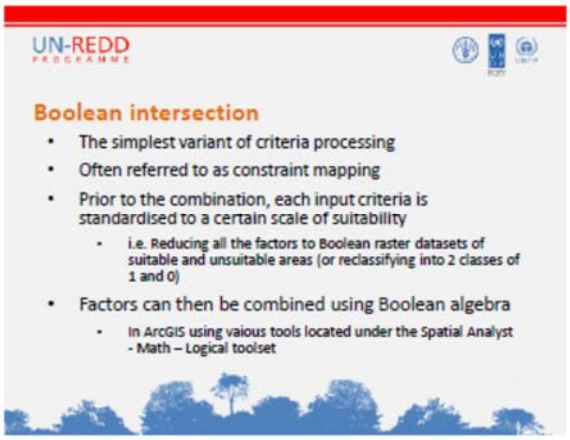


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## Fuzzy Overlay

- Fuzzy overlay results in degree of membership, whereas boolean or weighted overlay either belong or don't belong
- The combining analysis step in Fuzzy Overlay analysis quantifies each location's possibility of belonging to specified sets from various input rasters.

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## Fuzzy membership tools

- In ArcGIS there are various tools which can be used to normalise the data to a range between 0 – 1.
- Different tools can be used to **spread** the data i.e. determines **how the fuzzy membership values relate to the true value.**

  *The simplest of these is a linear relationship which divides the values in the continuous raster by the maximum number*

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## Weighted Combination

- Gives varying levels of 'importance' or weight to the different input layers
- Additive overlay analysis
  - Weighted overlays
  - Weighted sums

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## Weighted Overlays

- **Input rasters** have to be **integers**
- Continuous data need to be **reclassified prior to analysis**
- Scales the input data on defined scale (the default being 1 to 9) with the most favourable locations for each input data being given the maximum value e.g. 9.
- Each input layer is assigned a weight (relative percentage) and all weights must sum to 100 percent
- Each input layer is then multiplied by the appropriate weight and all of the resulting values are added together for each cell.
- Weighted Overlay makes more favourable factors have the higher values in the output raster, therefore identifying these locations as being the **priority**.

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## Weighted Sum

- Similar to weighed overlay but allows continuous data.
- Does not automatically scale input data
- Also unlike weighted overlay, weights assigned to the input rasters can be any value and do not need to add to a specific sum
- Output values are a direct result of the summation of the multiplication of each value by the weights.
- Maintains the attribute resolution of the values entered in the model (unlike Weighted Overlay, values are not rescaled back to a defined scale)

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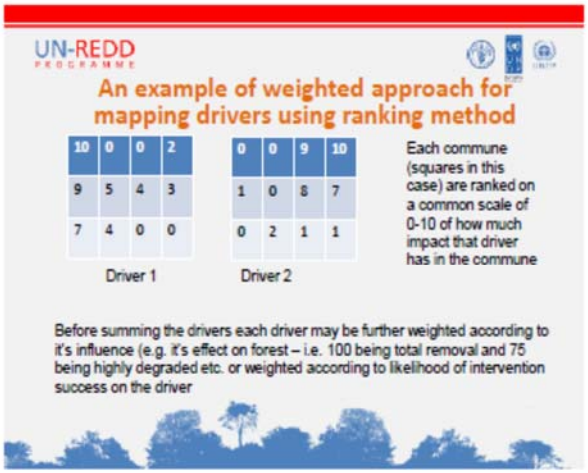
## Reclassifying data

- Need to identify thresholds for suitability in input layer to Boolean analysis and for class breaks in inputs to overlay analysis
- Try to reduce subjectivity by choosing appropriate thresholds informed by literature, policy or expert consultation.
- Understand the data and ensure that the values chosen are appropriate for the data being used.
- Do the values make sense for the question you are trying to answer? How do they inform questions about REDD+ planning?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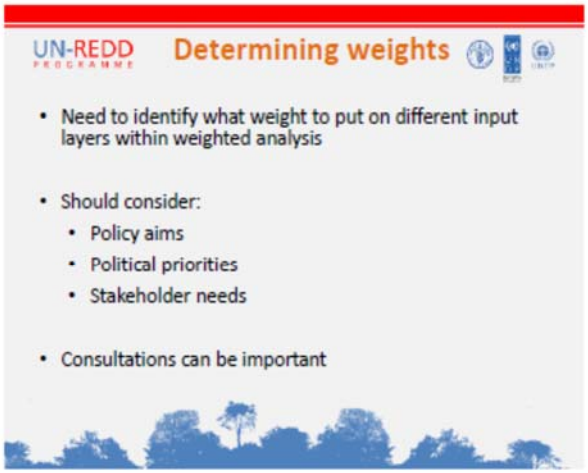
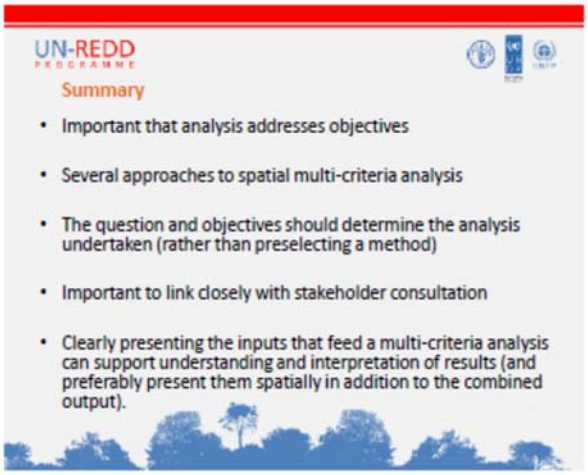
An example of weighted approach for mapping drivers using ranking method
10 0 0 2
9 5 4 3
7 4 0 0
Driver 1
0 0 9 10
1 0 8 7
0 2 1 1
Driver 2
Each commune (squares in this case) are ranked on a common scale of 0-10 of how much impact that driver has in the commune
Before summing the drivers each driver may be further weighted according to it's influence (e.g. it's effect on forest – i.e. 100 being total removal and 75 being highly degraded etc. or weighted according to likelihood of intervention success on the driver


UN-REDD PROGRAMME
Determining weights
Need to identify what weight to put on different input layers within weighted analysis
Should consider:
Policy aims
Political priorities
Stakeholder needs
Consultations can be important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Summary
Important that analysis addresses objectives
Several approaches to spatial multi-criteria analysis
The question and objectives should determine the analysis undertaken (rather than preselecting a method)
Important to link closely with stakeholder consultation
Clearly presenting the inputs that feed a multi-criteria analysis can support understanding and interpretation of results (and preferably present them spatially in addition to the combined output).


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Thank You!
Corinna Ravilious
Corinna.Ravilious@unep-wcmc.org
Website: http://www.un-redd.org

## 4.6 Workflows for mapping REDD+ interventions, Corinna Ravilious, UNEP-WCMC

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**Workflows for mapping REDD+ interventions**

Corinna Ravilious, UNEP-WCMC

Hanoi, September 2015

**Workflows for mapping REDD+ interventions**

Defining workflows help us think about how we are going to undertake a piece of analysis: the spatial logic, GIS processes, and sequence

Now, we are defining workflows to help identify potential locations for a particular REDD+ intervention, combining factors, so that we:

- Include areas suitable for the intervention
- Exclude areas where it could not be undertaken.

**Activity: Create a workflow for your REDD+ intervention**

In your groups for your intervention define the spatial workflow to address your driver/barrier.

- Driver/Barrier
  - Is anything further needed other than the participatory mapping layer? e.g. if the PM shows current areas at risk, are any other geoprocessing tasks needed to identify potential areas at future risk from that driver?
- Intervention:-
  - Where can't the REDD+ intervention be undertaken?
    *i.e. exclude areas where that REDD+ intervention would not be possible. List the reasons why you are excluding certain areas*
  - Where can the REDD+ intervention be undertaken?
    *i.e. which areas should be included. List the reasons why you are highlighting certain areas*
  - What data you will use to make those exclusions/inclusions?
  - What geoprocessing tools might you use in ArcGIS?

**Transferring spatial workflows in ArcGIS**

- A simple model may only contain one or two steps and ArcGIS geoprocessing tools

E.g. generating a layer that shows forest classified according to distance from roads

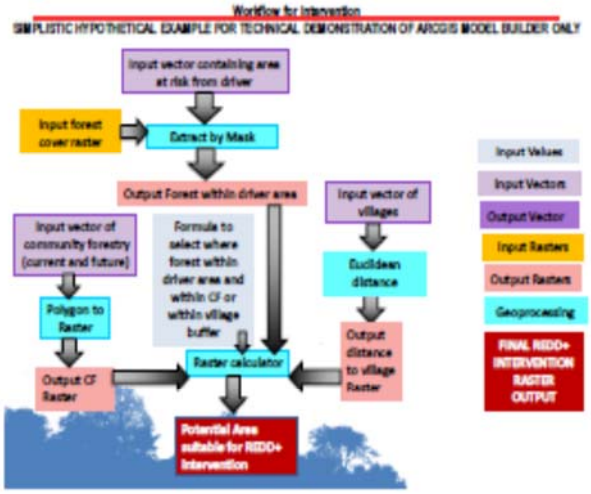
**Transferring an example workflow into ArcGIS**

To develop a REDD+ intervention layer for **community-based sustainable forestry** to address the **driver small-scale conversion to cassava**, we may consider:

- Where are the areas at risk from small-scale cassava expansion (now or in future)?
- Where can community-based sustainable forestry occur?
- Which forest area designations should be included?
  - Natural forest and planted forest?
  - Existing community forestry areas or broader?

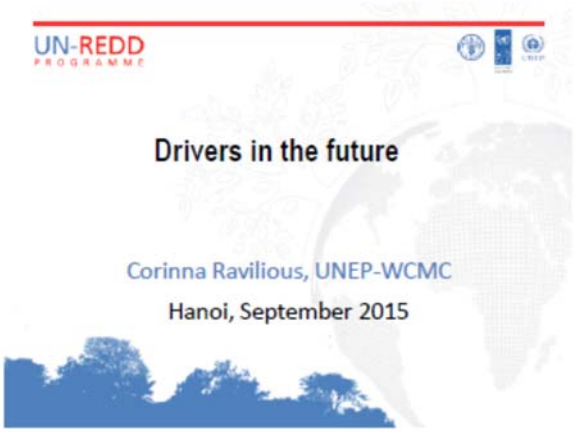
*The GIS analysis would then exclude areas not at risk from the driver and areas where it is not possible to undertake that particular action.*

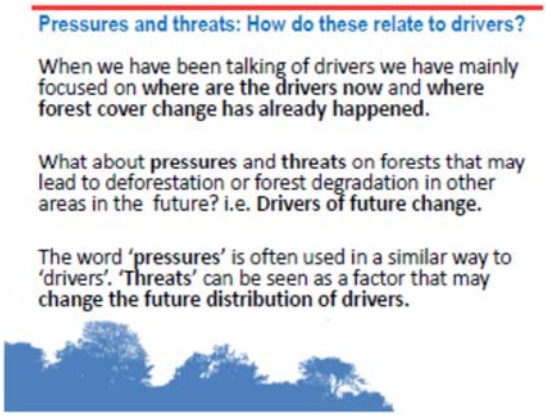
| INTERVENTION: community forestry to reduce conversion to cassava | |
|---|---|
| Input layer/data | How to use |
| Forest cover | Forest area available for action |
| Village locations | Areas near villages with likely demand for cassava production and/or CF activities |
| Potential community forests | Category of forest; areas that have already been identified as likely CF sites |
| Future land use plan | Identify areas designated for crops or forest |
| Protected Areas | Exclude strictly protected areas |
| Extent of driver | Area affected by / likely to be affected by driver (conversion to cassava) |

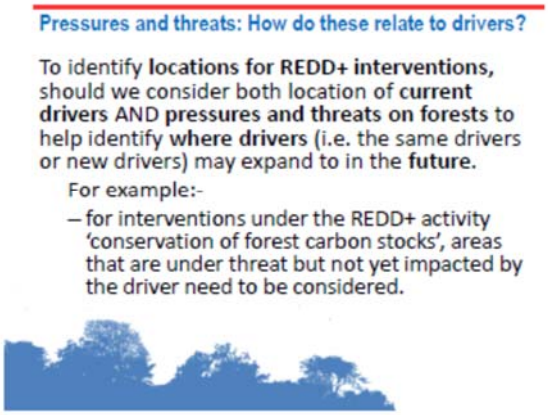

Workflow for Intervention
SIMPLISTIC HYPOTHETICAL EXAMPLE FOR TECHNICAL DEMONSTRATION OF ARCGIS MODEL BUILDER ONLY
Input vector containing area at risk from driver
Input forest cover raster
Extract by Mask
Output Forest within driver area
Input vector of villages
Input vector of community forestry (current and future)
Formula to select where forest within driver area and within CF or within village buffer
Euclidean distance
Polygon to Raster
Output distance to village Raster
Output CF Raster
Raster calculator
Potential Area suitable for REDD+ Intervention
Input Values
Input Vectors
Output Vector
Input Rasters
Output Rasters
Geoprocessing
FINAL REDD+ INTERVENTION RASTER OUTPUT


DEMONSTRATION
Putting workflow into ArcGIS

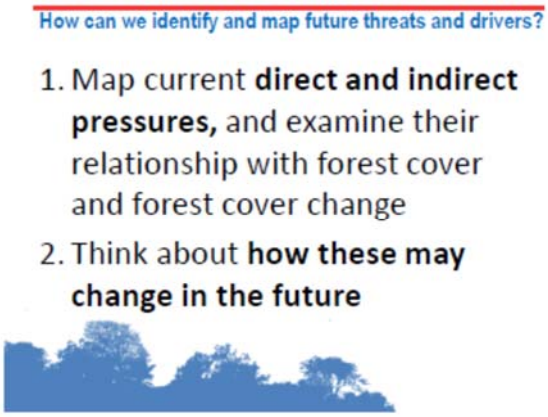
## 4.7 Drivers in the future, Corinna Ravilious, UNEP-WCMC

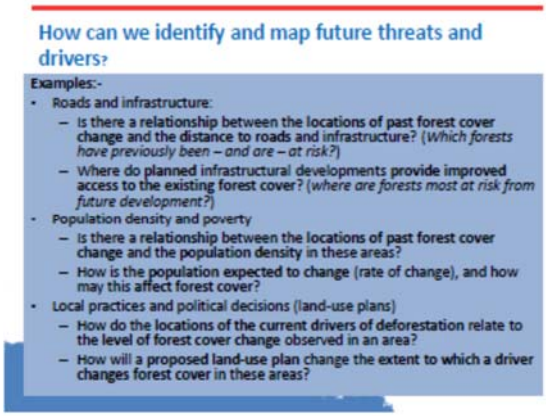






## Two approaches for mapping future drivers

**Option 1** – Simple overlays of pressures/future threats are provided to participatory session

Possible outputs from this method:

- Information presented as single maps e.g. maps showing
  - Forest shown according to distance to roads and distance future roads
  - Population density across the province
  - Slope
  - Elevation
  - Poverty
  - Future land use plan
  - Forests show according to distance from recent forest cover change

## Two approaches for mapping future drivers

**Option 2** – Maps are created showing areas selected based on pre-defined criteria

Possible outputs from this method:

- Map showing locations of future pressure/threats based on a number of inputs (using specified criteria and thresholds)
- Maps showing possible future extent of a particular driver based on user defined workflow
- Maps showing the individual input layers and thresholds used
- Combined map showing number of possible future threats/pressures/drivers

## Two approaches for mapping future drivers

**Option 1** – Simple overlays of pressures/future threats

**Pros**

- Participants can identify areas they feel are most at risk
- Transparent
- May encourage selections based on local knowledge

**Cons**

- Areas of potential future drivers are NOT identified
- More difficult to identify specific areas
- Subjective in terms of locations chosen

**Option 2** – Maps showing areas selected based on certain criteria

**Pros**

- Areas of potential future drivers are identified based on input criteria
- Can be useful if presented transparently with a well documented workflow and maps showing the input layers

**Cons**

- Assumptions more hidden
- Thresholds need to be decided and fed into model
- Model selects areas
- Subjective in terms of the criteria and thresholds selected (would need to be validated by expert knowledge)
- If expert knowledge to define workflow lacking - can lead to misinformed presentation of data

## Generating workflows and using ArcGIS model builder

Two main steps

1. Defining spatial logic (workflow)
   - How are you going to produce the map
     - What are your input datasets?
     - What geoprocessing tools will your need?
     - What are the outputs you want to produce?
2. Putting the workflow into ArcGIS model builder ArcGIS
   - Creates a model which combines many geoprocessing steps into a single or fewer step.

## Generating workflows and using ArcGIS model builder

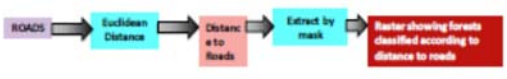
Advantages of using Model builder rather than running each ArcGIS tool individually:

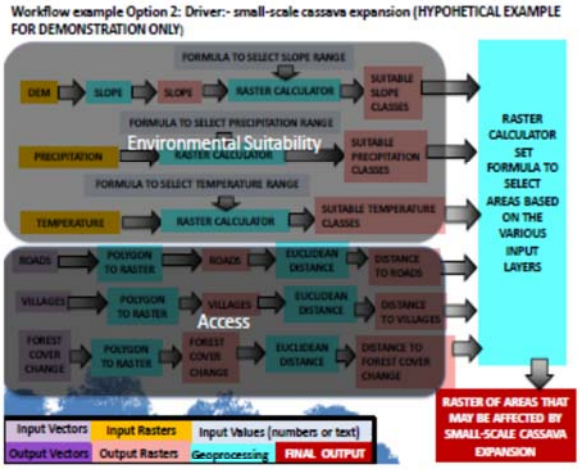
- Provides a documentation of the analysis you are doing
- If you have made a mistake it is easier to modify and rerun rather than starting from scratch
- You can share with colleagues (useful for sharing methods between CIPS)
- Can reduce the number of geoprocessing steps by combining tools into a single workflow
- Reduces time
- Repeat process as new data becomes available
- Allow people with limited GIS knowledge to run a sequence of processes so not reliant on the person who created the model.
- Can be used to iterate through a number of datasets to speed up manual tasks

**Workflow Example for Option 1: (HYPOHETICAL EXAMPLES FOR DEMONSTRATION ONLY)**

Example layer 1


Example layer 2




## Environmental Suitability

Environmental suitability modelling can be complex and time consuming and often requires expert knowledge. Statistical approaches such as regression are often used to generate such layers:

- Where possible try to use data that has already been modelled by experts in that field e.g. if you are looking at expansion of different crops are there and suitability maps?
- You may want to keep it simple and be transparent about what factors and thresholds have been included and why.
- Present assumptions and limitations.
- Check the result against current crop distributions to make sure it makes sense.

## Transferring spatial workflows in ArcGIS

- A simple model may only contain one or two steps and ArcGIS geoprocessing tools

E.g. generating a layer that shows forest classified according to distance from roads

## Thank you!

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UNEP WCMC

## 4.8 Tips for workshop maps, Charlotte Hicks, UNEP-WCMC

# Tips for workshop maps

### 1. Preparing the maps

- Think carefully about how many maps you give to the participants - make sure that the participants are not overwhelmed or confused with lots of maps or information; **focus on the most relevant maps and information.**
- Which maps are the **priority maps** to give participants? Other, lower priority maps may be kept as **additional or reserve layers.**
- Make sure the participants **understand clearly what each map is showing.** Always give each map **a title**. Make sure the map has a **clear legend**.

- Be **prepared to answer any questions** they may have. Maintain information which records the source of each dataset.
- Workshop 1 is about identifying **drivers and barriers**. Make sure that you also have information that can be used for discussing barriers if needed.
- What **scale** should the maps be in? What level of **detail** will you need? Don't provide very detailed/complicated maps if they are not necessary. It may make sense to combine some features, for example.

- How will you **use the maps after the workshop**? To enable you to scan/digitize the participatory maps later on, you need to **include graticule/grids** with at least 4 tic points available, preferably located towards the extremities of the map.
- When using **transparent maps**, it's important to think about how they will look if several of them are overlaid together. Make each transparent layer **clear and simple**. For example, do not use green for non-forest areas.
- Also, thin lines, small points and similar colours will be very **hard to see**. Use hatched lines in different orientations / thicknesses / separations, as well as colours, if several layers need to be overlaid.

- Do not **repeat information** (e.g. district names) on all of the maps; if overlaid, it will start to look crowded and messy. These names may only need to be on the base map and/or the administrative boundaries map.
- If the maps are even slightly different in **size**, they will not overlay properly. Check each of the overlays to make sure all the boundaries/graticules align.
- When printing the transparent maps, print one first as a test before sending all to print.

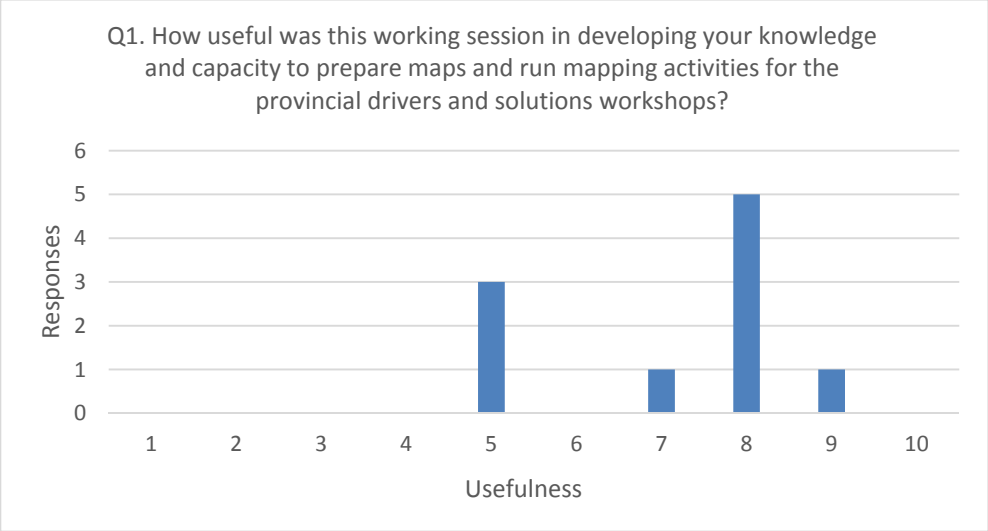
### 2. Preparing and running the exercise

- When all the maps are ready, **practice** using them, and the exercise you have planned for the workshop with some people in your team.
- Brief the **workshop facilitator** about the exercise and how the maps will be used.
- Make sure at least **one member of the spatial analysis team** attends the workshop.

- Take a couple of extra layers/spare copies for the participants to draw on, in case they make mistakes, or ask to start again.
- Take bulldog clips/strong paper clips to help the participants hold the overlaid maps together.
- Consider what pens/pencils should be used in the exercise and check. Ideally you would want any drawn features to be able to be erased / changed as required, but they should not be so easy to remove that they smudge as soon as they are touched.

## Annex 5: Participants' feedback

In order to gather feedback from the participants about the utility of the working session and suggestions for the future, a feedback questionnaire was distributed on the last day. The results of the questionnaire are summarized below.

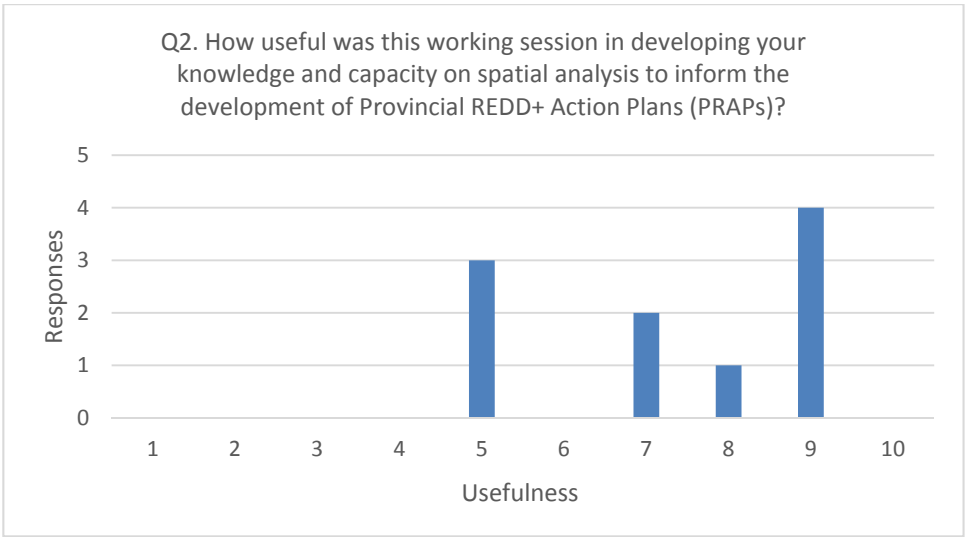



Some comments included:

*"In the past, our work required merely MapInfo data, in which spatial analysis received inadequate attention and most of activities implemented manually. With ArcGIS, model development provide important contributions to identify methods appropriate in spatial analysis"*

*"It is definitely necessary for PRAP development process and forest resource monitoring"*

*"This session provided with quite sufficient useful information for the driver workshop in the future"*

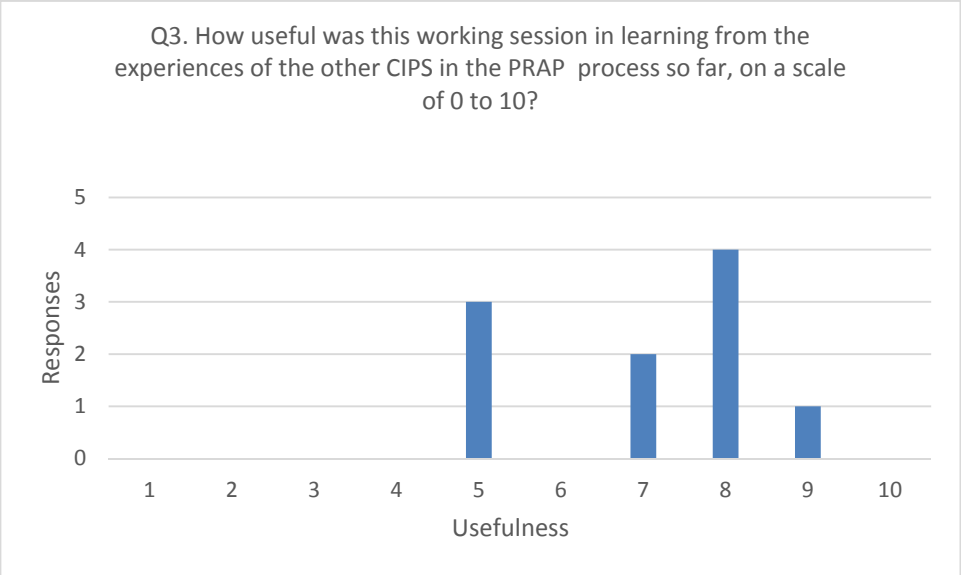


Comments were for example:

*"This session is aimed at sharing information and knowledge among CIPs. Together we worked and addressed problems and bottle-necks faced by CIPs"*

*"Joining the working session, we understood more about creation of the workflow and overlap input layers so as to come up with results".*

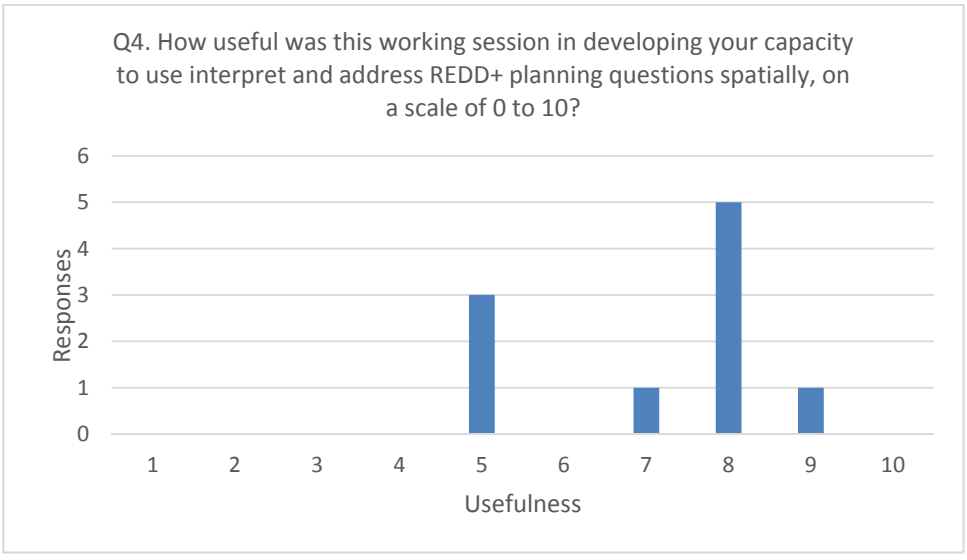
*"Learn about various ways to see the relationship among information layers (provided by stakeholders and map analysis) to get the best results"*




Most participants found the experiences of the other CIPS in the PRAP process useful or very useful, with comments such as:

*"CIPs have good opportunities to meet and share information and experience, especially workshop preparations"*

*"Learn much about experience from other CIPs such as facilitation skills and presentation of maps in workshop"*



Regarding the development of the participants' capacity to use, interpret and address REDD+ planning questions spatially, 3 out of 10 participants found the working session useful and 7 participants found it very useful:

*"Spatial analysis shows clearly benefits and risks, which will help to come up with better solutions or appropriate plan adjustments for mitigation of risks".*

*"Be more confident as having found out various solutions towards REDD+ planning difficulties and issues"*

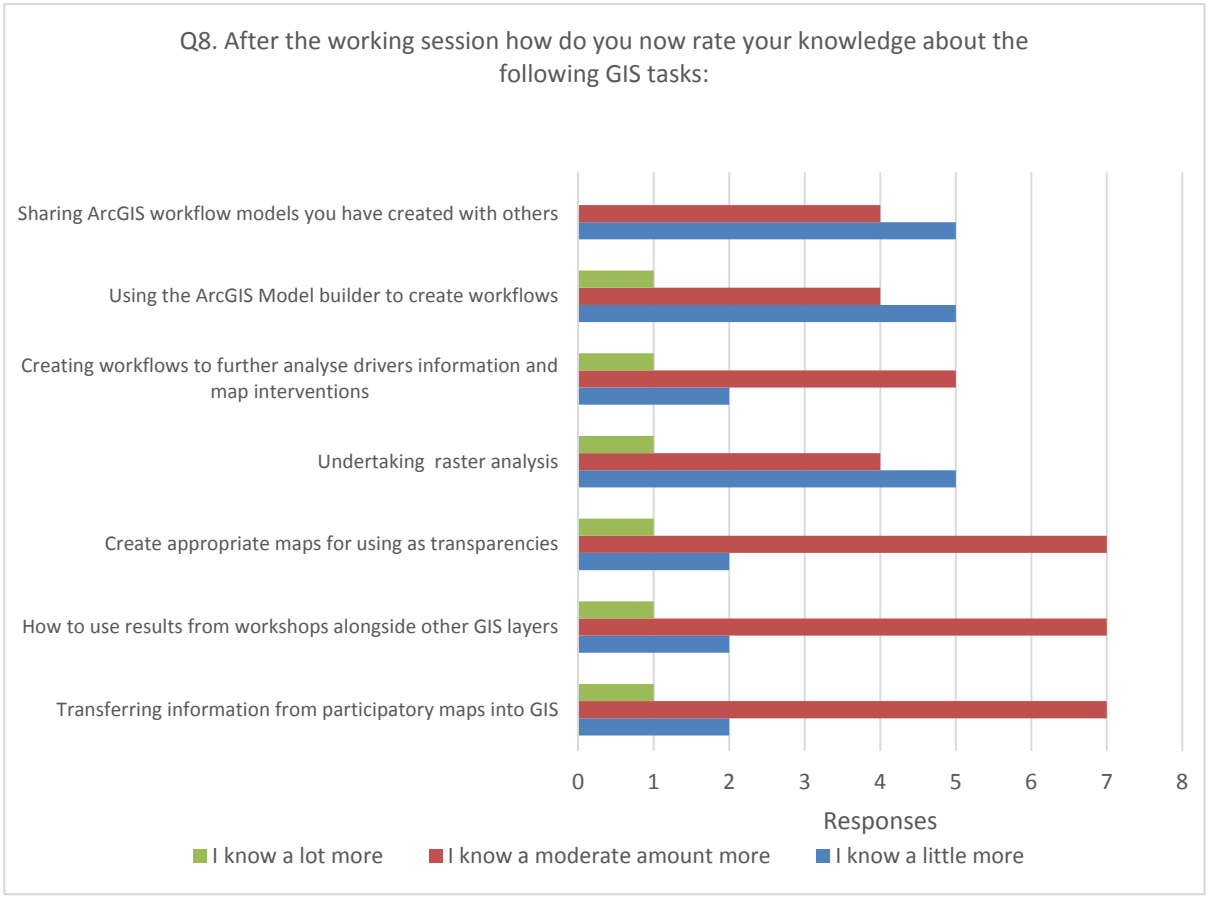
*"Understand basic methods on development of workflows in ArcGIS"*

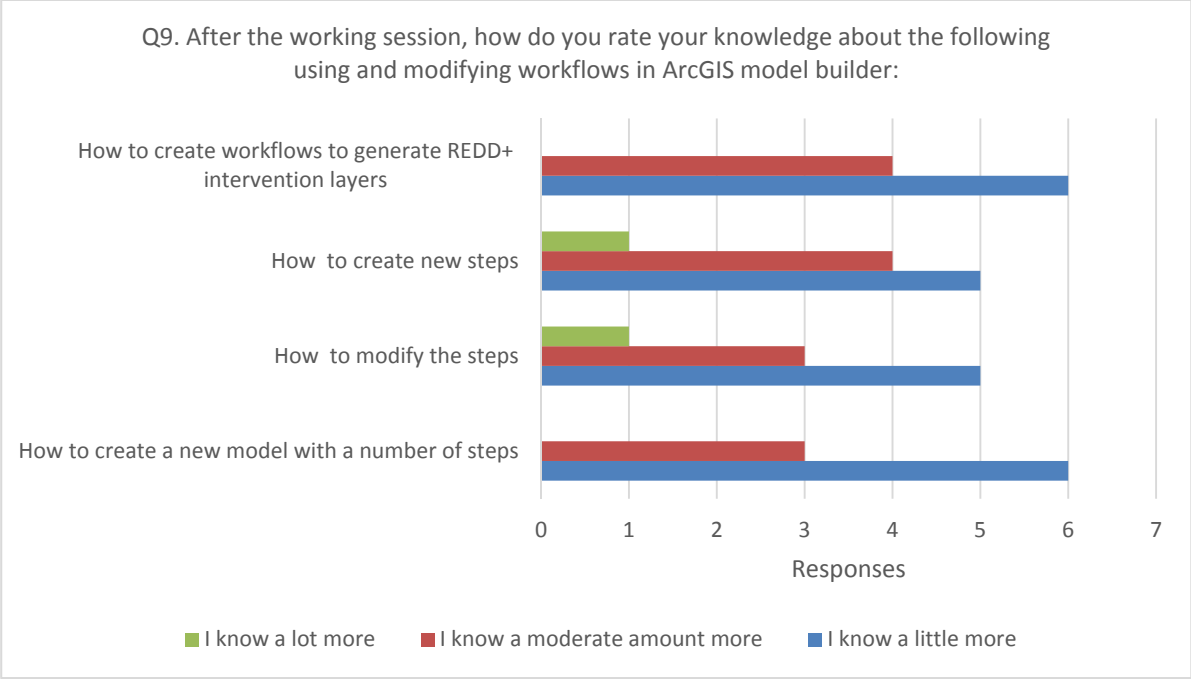
*"Understanding PRAP; Learning about related issues; Learning about spatial analysis techniques"*

Regarding the **most useful topics or tools**, five participants highlighted the Model Builder and two participants found the Raster Calculator especially useful. Analysing input map layers, the PRAP development process and the creation of various tools in ArcGIS were also mentioned.

In terms of **less useful topics** all participants responded that they found all contents helpful.

The charts below shows how participants rated their knowledge about different GIS tasks and their knowledge about using and modifying workflows in ArcGIS model builder after the working sessions:






Among the additional technical (GIS) knowledge that would be helpful to undertake work on spatial planning for REDD+ were the model builder (5 responses) and the raster calculator (3 responses):

*"Workflow development with ArcGIS model builder"*

*"Overlaying helps to identify potential areas on the basis of different input layers"*

*"Analyzing image data helps to come quickly up with results"*

*"Establishing workflows to identify priority areas for intervention packages"*

*"Model builder; Euclidean distance; Raster calculator"*

Most participants found **the working sessions organisation** good (8 responses) or suitable (2 responses).

Some other **comments or suggestions** included covered logistical arrangements and interest in more training:

*"Arrangement of vehicles to pick up participants from hotel to VFU and vice versa".*

*"There should be more training courses organized on spatial analysis and application so as to share information with local communities relating to REDD+ - related benefits through various solutions".*

*"More detailed guidance on workflows in ArcGIS used in REDD+ spatial analysis".*

*"More details on Model builder, especially tools often used in spatial analysis".*