Working Session 1:

Introduction to spatial analysis for REDD+ planning at the provincial level in Viet Nam

Ha Noi, 16 – 27 June 2014

Working Session technical session plans

PART 2: Identifying potential zones for a REDD+ action - Maintaining existing forests (continued)

Now that the carbon layer is ready to use and the analysis extent constrained to cover the maximum area possible for the REDD+ action **maintaining existing forests,** and we have discussed inputs for additional benefits and pressure layers, the additional factors can be brought into the analysis.

2E: Create overlays of carbon stocks in natural forests, other benefits and pressures

Presentation on multi-criteria analysis

Discussion on how to represent data in a multicriteria analysis in different ways

We will be using multi-criteria analysis techniques to build up combined layers of pressures and multiple benefits, and exploring how best to present these on a map or maps. We are not at this stage creating a single workflow that takes in input data and produces a map of potential zones for REDD+ actions, although that might be an ultimate goal.

When a combined map is produced it should be clearly presented along with its constituent parts so that policy makers can understand why particular areas are important.

Before we can undertake the technical activities, we therefore need to decide on which data layers we will include in the combined additional benefits and combined pressures layers, and if there are any pre-processing steps that need to be undertaken before including them in the analysis (e.g. buffering of roads and areas of recent deforestation before including in Approach 1).

Technical activities

Approach 1 objective: Produce two data layers 1) showing areas of potential importance for additional multiple benefits and 2) showing areas of potential multiple pressures (using a threshold approach)

*For the **purpose of this training only** thresholds will be defined based on discussion and/or thresholds in continuous data will be defined by displaying data in quantile class breaks and picking the threshold for the top quantile.*

Approach 2 objective: Produce a data layer of potential importance for additional multiple benefits and a data layer showing areas of potential multiple pressures (using a normalization approach to spread values between 0 and 1)

Objective 3: Produce a map with a matrix style legend to display two raster datasets at once

Examples of maps that could be produced using such a legend include:

- carbon vs species richness
- additional benefits vs pressures in and outside of forest areas
- additional benefits vs pressures in areas of high carbon
- carbon within and outside of natural and other forest highlighting those areas with > 2 additional benefits
- carbon within and outside of natural and other forest highlighting those areas with > 2 additional benefits and with > 2 pressures

For this exercise we will be using the following datasets. Please remember that the input maps that you use in the future may change, depending on the priorities and conditions in particular provinces.

Initial input datasets/base layers:
Forest/land cover;
Natural forest;
Carbon stocks;
Forest management categories

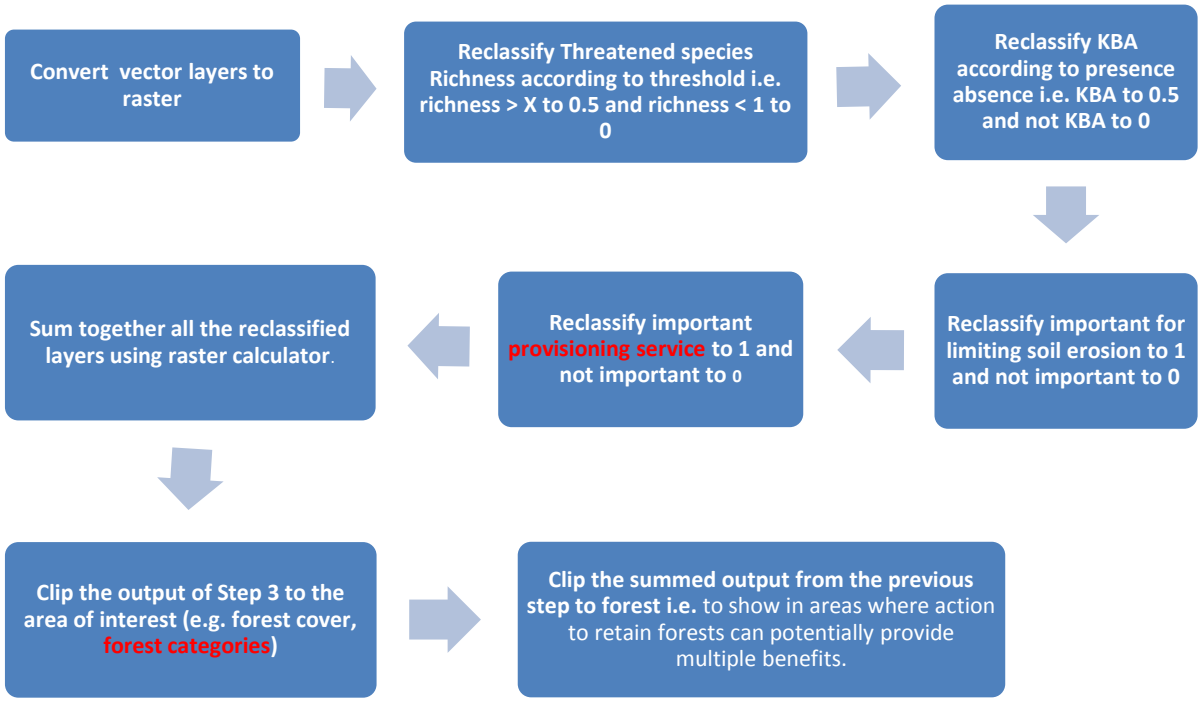
For additional benefits map:
Threatened species richness,
Key biodiversity areas,
Areas important for soil erosion risk,
Areas important for a provisioning service
Input datasets for pressures:
Fire,
Road network,
Population,
Poverty,
Forest cover change

Analysis map projection: VN-2000 / UTM zone 48N

PROJCS["VN-2000 / UTM zone 48N",GEOGCS["VN-2000",DATUM["D_",SPHEROID["WGS_1984",6378137,298.257223563]],PRIMEM["Greenwich",0],UNIT["Degree",0.01745329251994329 5]],PROJECTION["Transverse_Mercator"],PARAMETER["latitude_of_origin",0],PARAMETER["central_meridian",105],PARAMETER["scale_factor",0.9996],PARAMETER["false_easting",500000],PARAMETER["false_northing",0],UNIT["Meter",1]]

Approach 1 objective: Produce two data layers 1) showing areas of potential importance for additional multiple benefits and 2) showing areas of potential multiple pressures (using a threshold approach)

General workflow for the creation of the combined additional benefits layer for Approach 1, using example datasets. In this example, there are two biodiversity layers. So that each type of benefit has an equal weight, a positive value in either of the biodiversity layers is assigned a value of 0.5 rather than 1 as for the other layers:



General workflow for the creation of the combined additional pressures layer for Approach 1.

The workflow for the combined pressures will be the same as in the creation of the combined additional benefits layer, however when converting from vector to raster there may be some additional processes required; e.g. buffering of roads to a certain distance, selecting out points from the fire dataset that relate to high intensity or fire season.

Step 1: Which datasets are important for mapping areas of importance for multiple benefits?

First, the environmental and/or social benefits to be included in a combined map should be chosen. Select benefits which are important to consider for the province (e.g. based on provincial priorities identified by REDD+ planners and stakeholders) and for which spatial data are available.

Some of the data may be in raster format and some are vector. The analysis will be undertaken as a raster analysis so any vector layers will need to be converted into raster format prior to Step 2.

Step 2: Reclassify the selected layers

In order to combine the layers into a single potential importance layer it is necessary to simplify the information. For each layer, think about what high importance means. For example, for those layers

where the thematic data cover the whole map (e.g. species richness, decide upon the threshold level that will determine the areas of highest importance. Symbolising the data into class-breaks by quantiles can help assign these thresholds, if there are no clear quantitative criteria. For other layers, presence or absence may determine importance, where all areas are of equal importance (i.e. if an area has been defined as a Key biodiversity Area or not).

Once importance has been determined, each layer will need to be reclassified accordingly to "0" for less important and "1" for highly important (see example processes below).

If any of the input layers have any areas of "no data" these should be assigned a value of "0" unless these areas are to be excluded from the whole analysis. The tools that are used for undertaking the overlay analysis will otherwise exclude these pixels even if data are present there in some of the other datasets.

Step 3: Sum the reclassified layers to create a combined benefits layer

Next, add together all the reclassified layers using raster calculator. This will produce a resulting layer where the scale will be from 0 – 4 and will demonstrate where areas which contain all 4 chosen benefits coincide.

Step 4: Clip the output of Step 3 to the area of interest (e.g. forest cover, forest category) i.e. to show areas where action to retain forests can potentially provide multiple benefits.

Limitations of this methodology and further considerations:

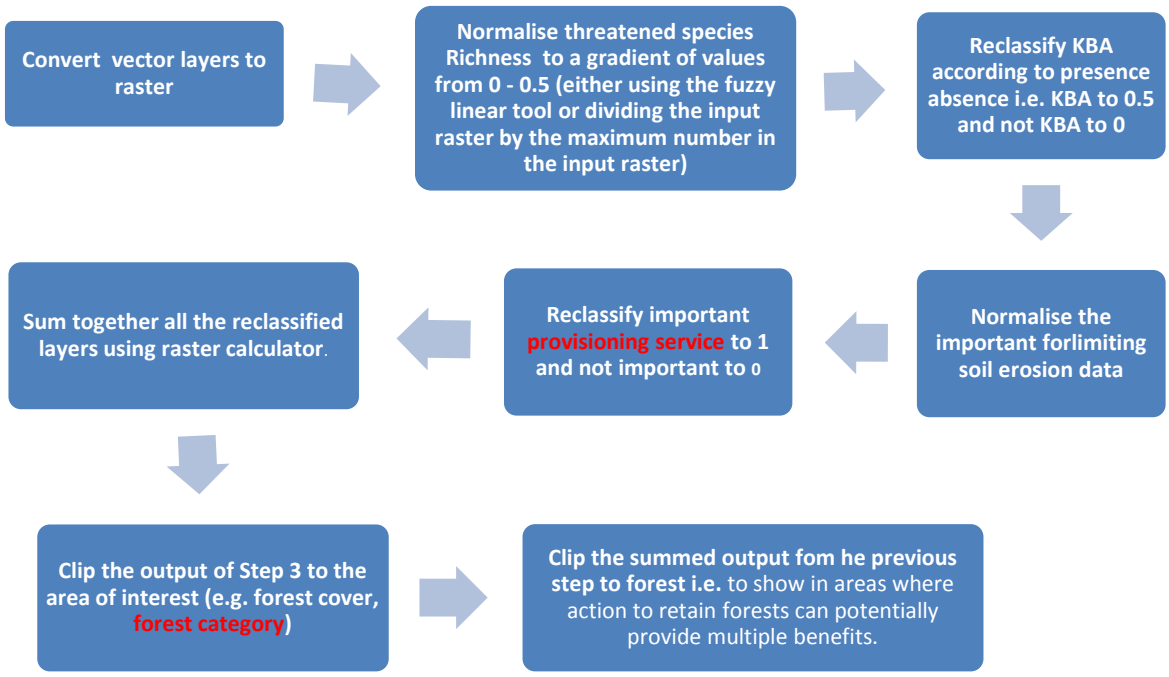
Whilst showing data in this way can provide an idea of certain areas that may be particularly valuable to retain, combining layers in this way will also mask some of the detail in the data. An area could be important for 2 or 3 of all benefits chosen, but you cannot see which of these benefits it is important for. If it is particularly important that the types of benefits in an area are explicitly visible, another approach may be needed.

Carbon can also be included as a benefit (i.e. in a map of multiple benefits rather than benefits additional to carbon) but then it will become equated with the other benefits, unless it is weighted differently. It is probably more meaningful to use carbon value as a filter on whether REDD+ is feasible in a location, rather than one of multiple criteria to determine whether it would yield multiple benefits.

The resulting map is dependent on the thresholds chosen in the initial steps. Careful consideration of these thresholds in the country context from the outset is therefore important and further verification of whether these are appropriate may enhance the map and its potential usefulness.

Approach 2 objective: Produce two data layers 1) showing areas of potential importance for additional multiple benefits and 2) showing areas of potential multiple pressures (using a normalised approach to spread values)

General workflow for the creation of the combined additional benefits layer for Approach 2



The workflows for the approach two remain the same, but the difference is how the data are transformed. In this example, for continuous data, rather than chose a threshold, we are placing the data on a sliding scale from 0 (low) to 1 (high) with the rest of the values distributed in between. The example uses a linear normalisation process but it may be also useful to explore the other tools 'fuzzy' normalisation tools which will alter the distribution of values between 0 and 1.

General workflow for the creation of the combined pressures layer for Approach 2:

For the transformation of vector layers such as roads rather than buffering the data the 'Euclidean distance' too in ArcGIS can create a continuous raster showing distance from roads which can then be normalised from 0 to 1.

The advantage of approach two is that all information contributes to the result but its disadvantage is that it requires some additional explanation as to meaning of units and therefore in communicate the results to decision makers.

Display and compare the results obtained from the two approaches

Objective 3: Produce a map with a matrix style legend showing carbon vs species richness

Refer to: STEP-BY-STEP TUTORIAL: HOW TO PRODUCE A MATRIX STYLE LEGEND WITH RASTER DATA USING ARCGIS 10