Drivers in the future

Corinna Ravilious, UNEP-WCMC

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Pressures and threats: How do these relate to drivers?

When we have been talking of drivers we have mainly focused on **where are the drivers now** and **where forest cover change has already happened**.

What about **pressures** and **threats** on forests that may lead to deforestation or forest degradation in other areas in the future? i.e. **Drivers of future change.**

The word '**pressures**' is often used in a similar way to 'drivers'. '**Threats**' can be seen as a factor that may **change the future distribution of drivers.**

Pressures and threats: How do these relate to drivers?

To identify **locations for REDD+ interventions,** should we consider both location of **current drivers** AND **pressures and threats on forests** to help identify **where drivers** (i.e. the same drivers or new drivers) may expand to in the **future**.

For example:-

- for interventions under the REDD+ activity 'conservation of forest carbon stocks', areas that are under threat but not yet impacted by the driver need to be considered.

Drivers may be either direct and indirect

Examples of direct drivers include:

– Expansion of infrastructure

– Agricultural expansion

– Fire

– Mining activities

– Expansion of plantations e.g. rubber

Examples of indirect drivers include:

– Population size and density can indicate demand for land and resources

– Poverty levels can indicate direct dependence on natural resources

– Financial incentives (commodity prices, subsidies, etc.) make certain land-uses more desirable

– Cultural preferences may define how natural resources are used

– Political decisions determine how land-uses are distributed and controlled

Drivers of change in forest cover/quality may lead to changes in forest function, biodiversity, ecosystem services and livelihoods

1. Map current **direct and indirect pressures,** and examine their relationship with forest cover and forest cover change

2. Think about **how these may change in the future**

How can we identify and map future threats and drivers?

Examples:-

- Roads and infrastructure:
  - Is there a **relationship** between the **locations of past forest cover change** and the **distance to roads** and infrastructure? (*Which forests have previously been – and are – at risk?*)
  - Where do **planned** infrastructural developments **provide improved access to the existing forest cover**? (*where are forests most at risk from future development?*)
- Population density and poverty
  - Is there a **relationship** between the **locations of past forest cover change** and the **population density** in these areas?
  - How is the **population expected to change** (rate of change), and how may this **affect forest cover**?
- Local practices and political decisions (land-use plans)
  - How do the **locations of the current drivers of deforestation** relate to the **level of forest cover change** observed in an area?
  - How will a **proposed land-use plan** change the **extent to which a driver changes forest cover** in these areas?

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
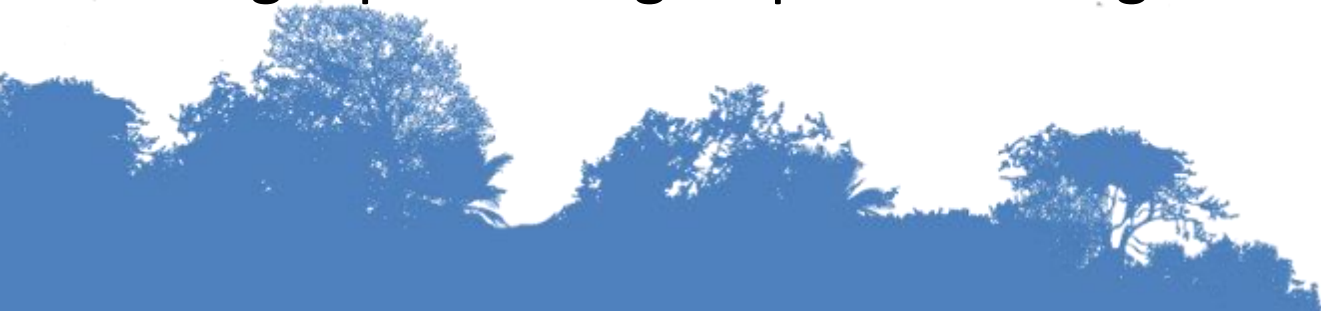
Two main steps

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
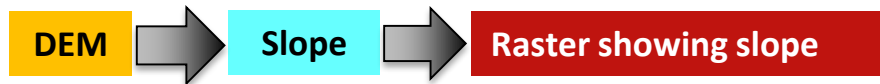   - Creates a model which combines many geoprocessing steps into a single or fewer step.

Generating workflows and using ArcGIS model builder

Advantages of using Model builder rather than running each ArcGIS tool individually:
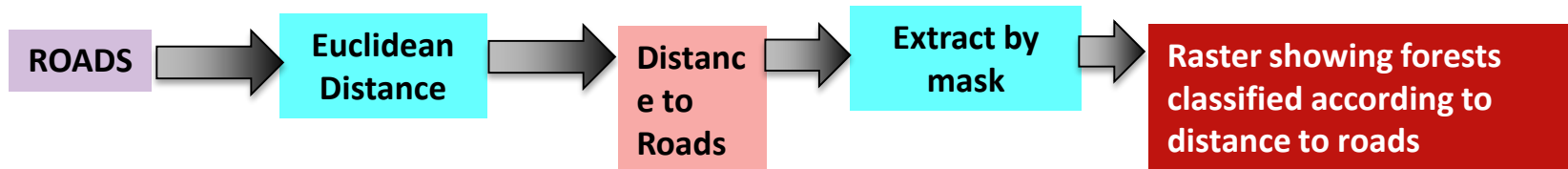
- Provides a documentation of the analysis you are doing
- If you have made a mistake it is easier to modify and rerun rather than starting from scratch
- You can share with colleagues (useful for sharing methods between CIPS)
- Can reduce the number of geoprocessing steps by combining tools into a single 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

| DEM | → | Slope | → | Raster showing slope |

Example layer 2

| ROADS | → | Euclidean Distance | → | Distance to Roads | → | Extract by mask | → | Raster showing forests classified according to distance to roads |

| Input Vectors | Input Rasters | Input Values (numbers or text) |
| Output Vectors | Output Rasters | Geoprocessing | FINAL OUTPUT |

Workflow example Option 2: Driver:- small-scale cassava expansion (HYPOHETICAL EXAMPLE FOR DEMONSTRATION ONLY)
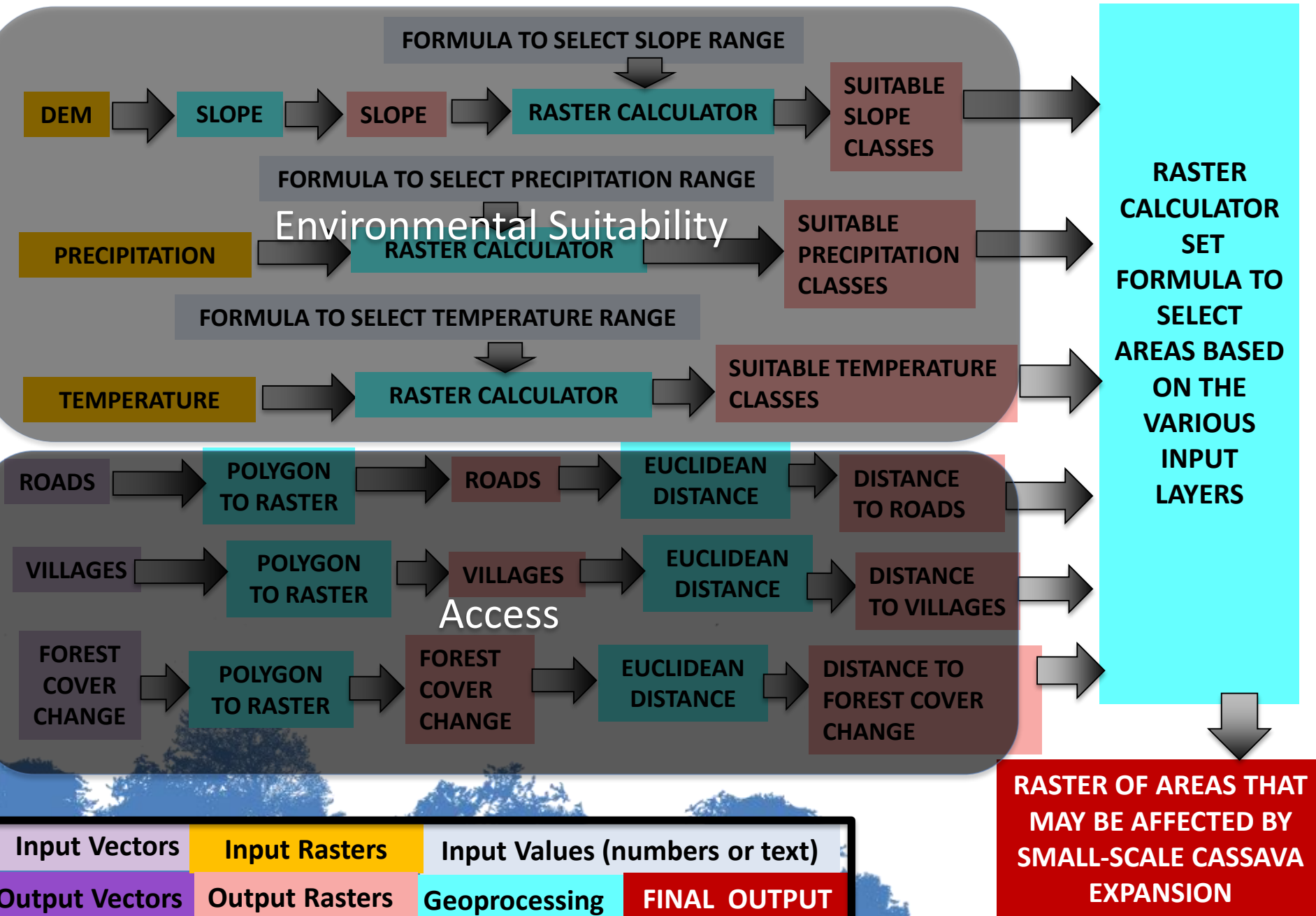
Environmental Suitability

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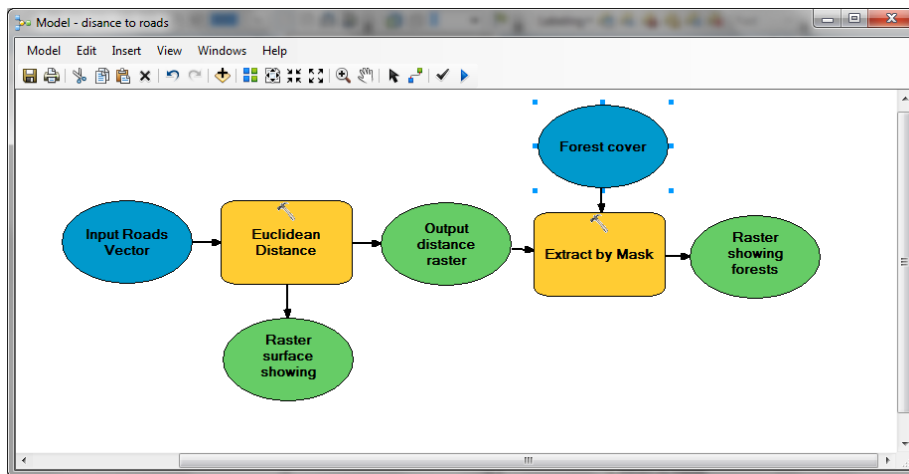
E.g. generating a layer that shows forest classified according to distance from roads

Thank you!

Corinna.Ravilious@unep-wcmc.org