

Using GIS to develop indicators of deforestation in Mozambique

Problem Statement – deforestation for charcoal

For much of the world's population, sourcing fuel supplies for cooking and heating is a fundamental problem. In the absence of more sophisticated power supplies, the use of fuelwood is a common solution to this problem, but one which can result in widespread deforestation.

This is certainly true of central Mozambique, where a long-running civil war prevented the civilian population from collecting firewood on a large scale for many years. However, with the advent of peace in 1992 and the subsequent clearance of land-mines, large areas of Mozambique's indigenous *miombo* woodland are being cleared to service a growing demand for charcoal in nearby urban areas such as the port of Beira. Merchants in urban areas pay intermediaries to fell trees for charcoal. Once trees have been cleared, bags of charcoal are transported from the rural areas by bicycle or truck to the cities.

The deforestation resulting from charcoal burning is spreading further and further inland, with the result that environmentally important areas such as Gorongosa National Park are now being threatened.

As a response to this threat, the park authorities have been encouraging villagers living around the park to cultivate crops under trees through an agro-forestry project. Almost a hundred villagers have now signed up to this scheme and it is hoped that these villagers will act as a 'buffer' against the activities of the charcoal burners. For a description of this agro-forestry project, see the web site for EnviroTrade, the company who run the project:

http://www.envirotrade.co.uk/Pages/mozambique_sustdevel.htm

Data:

Landcover_2000.txt: An ESRI ASCII raster format grid of land cover for the study area, based on classified Landsat ETM satellite imagery. To reduce the size of the data files used, this land cover map is provided for a small portion of the overall study area. There are 8 land cover classes on this map, each represented by a different number:

code	1 : water
code	2 : forest
code	3 : forest/grass1
code	4 : forest/grass2
code	5 : grass patch edge
code	6 : agriculture/grass

code 7 : sand/bare earth
code 8 : vlel (riverine grass)

Park_bnd: the boundary of Gorongosa National Park

fields: the locations of farmers' fields, which have signed up for the proposed agro-forestry scheme

Population_by_village: the population of different villages across Mozambique, based on the 1997 population census. In the attribute table for this data set, the **pop2000** field for each village indicates the total population there in 1997.

Note on data sources: the Mozambiquan population data are derived from this web site:

<http://www.sahims.net/gis/>

The land cover map was produced by Dr. Jim Wright of University of Southampton, whilst the agro-forestry scheme data are fictitious, but comparable to a 'real world' data set for this park.

Note that the **Population_by_village** map layer covers the whole of Mozambique and is intended to show the Gorongosa study area in relation to the whole of Mozambique. The remaining three map layers cover a much smaller area, namely the national park and the area immediately west of it. All map layers share the same geographic reference system and do not require any change of reference system.

Task:

You will need to import the ASCII format raster data before proceeding further. To do this, within the ArcToolBox, click on *conversion tools* and choose *To raster*, then choose *ASCII to raster*. Select the land cover file described under 'data' above as your *input ASCII raster file* and type in a suitable name for the *output raster*. Leave the *output data type* set to *integer* (an integer is a whole number with no decimal places, so this option means that each raster grid cell will contain a whole number. The other option here, *float*, means that the numbers stored in each grid cell will contain a fractional part with decimal places).

Part 1: Review the available data sets using your GIS software. Choose what you would consider to be appropriate pressure, state and response indicators for handling the management problem of deforestation.

[When you have considered which data you would choose for which indicator, turn the page and view the answers at the back of this handout]

Part 2: Post a brief message of a paragraph or two to the course web site, considering:

(a) What you consider to be the advantages of using GIS in this particular case study;

- (b) What you consider to be the disadvantages of using GIS in this particular case study;
- (c) Ultimately, whether you think the GIS technology is useful in helping manage the deforestation problem in Mozambique

Answers to Part 1:

- In the absence of any further data, a Pressure indicator might be population density, as described by the Population_by_village map layer. This assumes that demand for fuelwood and charcoal is proportional to population and that no alternative sources of fuel are available.
- An appropriate state indicator might be the percentage of land under the various forested land cover types.
- An appropriate response variable might be the total number of fields (or area of land) signed up to the agro-forestry scheme.