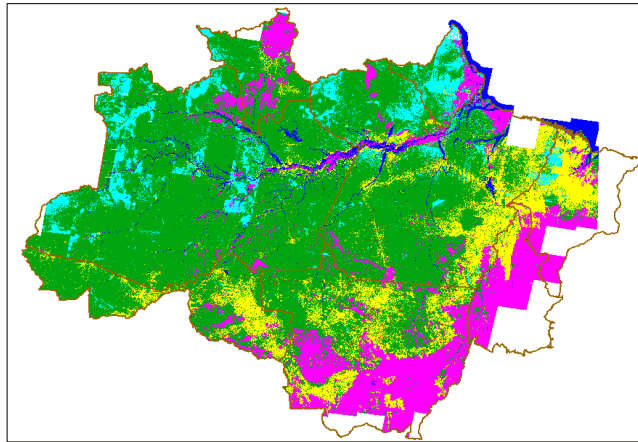


## Environmental Modeling Exercise IV: Deforestation



The objective of this exercise is to calibrate the model to study deforestation in the Brazilian Amazonia. The model tries to reproduce the spatial distribution of deforestation using at most four proximate factors: distance to roads, distance to ports, average deforestation of the neighbors, and percentage of protected areas. Three potential submodels use different factors, and the idea is to change the parameters of each submodel related to the importance of such factors to find the best allocation of change. Execute the following steps:

- 1) Change the demand of “deforestation.lua” to take into account the real deforestation from 2002 to 2011. Use the PRODES data as yearly demand (see the output of “total-prodes.lua”). Note that the original model supposes a constant demand for each year, but PRODES data changes from year to year.
- 2) Compute the real deforestation in 2011 by summing up the deforestation data in 2001 (file “amazonia.mdb”) with the yearly PRODES increments until 2011 (file “prodes.mdb”). You can use the function forEachCellPair to traverse two cellular spaces at the same time. You will need this data at the end of the simulations to compute the goodness-of-fit of the results.
- 3) Calibrate the different potential strategies by changing the weights manually in order to increase the goodness-of-fit of the results. For example, you can manually change the values -0.450, +0.260, -0.140 and +5.313 from the expected potential given the source code below to try to achieve better results:

```
expected = - 0.450 * math.log(cell.distRoads)
           + 0.260 * 1 / cell.distPorts
           - 0.140 * cell.protectedArea
           + 5.313
```

Use the multi-resolution metric to measure the goodness-of-fit between the real deforestation and the result of the simulations for 2011. See an example of computing the goodness-of-fit in “check-fit.lua”, where the result of the method fit() (the last value printed on the screen when this

script is executed) is the error to be minimized. Note that the potential based only on the neighborhood cannot be calibrated because it does not use any weights.

Deliver the source code that allows one to reproduce the results you have achieved and a small report with the spatial distribution of the real deforestation in 2011, the final allocation according to the three potential strategies, and a discussion of the different results using the three potential strategies.