LEAD Livestock, Environment And Development Initiative

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Highlights...   Neotropics

Predicting land use dynamics in the neotropics: The role of livestock in the deforestation process

Land used for extensive grazing in the Neotropics has increased continuously over the past decades and most of this increase has been at the expense of forests. Ranching-induced deforestation is one of the main causes of loss of some unique plant and animal species in the tropical rainforests of Central America and South America as well as carbon release in the atmosphere. Although the driving forces changed, this process is known to be still ongoing, while more and more evidence is becoming available on the often unsustainable use this represents. With time productivity declines and severe degradation problems occur.

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From this standpoint, it is urgent that alternatives to extensive livestock production in Latin America are found. To be able to address this need, a first prerequisite is to know the location of the problem areas: Statistics from different sources demonstrate the evolution of livestock production and deforestation at the nation level, but their relation is known to be highly location dependant. To help decision-making address the problem it is therefore essential to dispose of a spatially specific information on the relation between different land uses, as well as its evolution. The LEAD programme therefore seeks to identify "grazing induced degradation hot spots", i.e. areas where unsustainable exploitation leads to degradation of ecological, environmental and productive quality. The current mapping effort focuses on deforestation hot spots, which are considered more critical and urgent to deal with than pasture degradation. Livestock related deforestation hot spots are defined as large forested areas that will be replaced by pasture in the near future. On the basis of data, literature and expert knowledge, the objective of the spatial modelling approach is to explain spatial correlation between various processes, and predict where they will take place in the near future. The focus is here on spatial extent and location (at regional scale), which is a clearly contrasting and complementary approach with respect to the large body of literature analysing causes of deforestation (at local scale).

Approach: The spatial modelling framework

Of all the factors that have been reported to influence the location of the deforestation process (and thereby the other land uses!), we need to know where they have a significant influence and what their relative weight is. We then can spatially distribute quantitative change projections. This information is obtained through a statistical systematic modelling approach. We selected the Conversion of Land Use and its Effects (CLUE) modelling framework, prepared by Veldkamp and Verburg at the Wageningen University.
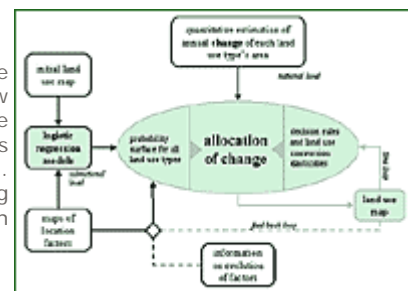
Results

Distinct patterns of deforestation are found within and between countries, pointing to different types of land use change processes. Looking at the region as a whole, lowland deforestation frontiers clearly account for the bulk of deforestation. Forest in these frontiers is mainly converted to pasture, except for a few cropland expansion areas. National and local policies are important determinants to the deforestation process and its location. Although not explicitly included in the location factors, they are taken into account in the analysis as the land use change demand at country level integrates the effects of policies on the aggregated land use changes, and the regressions are calculated at a sub national level, assessing how current policies are translated into current land use patterns. If policies do not change in the near future, we assume that the land use change should follow the same "rules" as it has done in the near past. As a decision support exercise, sensitivity analysis and scenarios assessment would also allow to test future trends if policies are changed.

Conclusions

Without stating that livestock production causes deforestation, one can surely say it is associated with this process, being the main land use replacing forest after clearing. Indeed, the results produced estimate that the expansion of pasture into forest is greater than that of crop land, and above all they show where each of these processes are

expected to dominate.

The results allow distinguishing different spatial patterns of change. The presented hotspot maps indicate the main contiguous areas at risk. In addition large areas with a far more diffuse land use change pattern, but that may deserve attention too, were delineated. While hotspots may serve as political and scientific focal points of attention, the model results also help to increase the awareness that a large part of agricultural expansion into forest may well take place outside hotspots.

Land use change modelling, especially if done in a spatially-explicit, integrated and multi-scale manner, is an important technique for the projection of alternative pathways into the future. This work, and the regional insights provide, sufficiently detailed to constitute a decision support tool for decision makers. The spatial information as such may serve to target policies and focus activities (i.e. conservation, payment for eco-services, incentives for sylvopastoralism, adapt land tenure regulations). To this end it will be particularly interesting to cross the results with other policy information as biological corridors, protected areas, conservation programmes, etc. The model and its input themselves also constitute an interesting decision support tool, allowing to evaluate the impact of different scenarios of change. This role can be achieved through testing aggregated land use demand scenarios or through modifying location factors (e.g. new human settlement, new transport infrastructure).

From a research perspective, the results provide a framework to the local case-studies on the land use change realised in the recent past, filling the gap between such studies and national quantitative estimates of change. We also hope our work will support the identification of further detailed studies, by giving insights as to the factors to be considered (the location factors of our study) and the identification of dynamic frontiers (hotspots) and diffuse deforestation areas.

Raw model outputs, hotspot maps as well as baseline land use input are available in GIS format through the Geonetwork at the following URL: **http://www.fao.org/geonetwork** .

More information of this study can be obtained from the Neotropics Portal URL. Please **click here** to visit the portal online.

Acknowledgements

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