

UN-REDD

R E P O R T



Agricultural Expansion and Deforestation

This UN-REDD Report explores the linkage between deforestation and the agricultural sector and suggests ways forward for consolidating the global agendas of curbing climate change and ensuring food security for all.

By:

Linda Rosengren, *UN-REDD Programme*

Christina Seeberg-Elverfeldt, *Natural Resources Management and Environment Department, FAO*

Forests are crucial for the world's carbon cycle, but tropical forests also contain at least two thirds of the world's terrestrial biodiversity and maintain a range of ecosystem services hard to evaluate in monetary terms (Gardner et al, 2009). There is moreover strong evidence that forests, and trees outside forests, play a crucial role in supporting livelihoods and promoting food security. An estimated 1.6 billion people, more than 25 per cent of the world's population, rely on forest resources for their livelihoods, and of these almost 1.2 billion live in extreme poverty (World Bank, 2001).

An agreement on the mechanism, referred to as reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries (REDD+), was endorsed at the UNFCCC's COP16 meeting in Cancun in December 2010. REDD+ provides a unique opportunity to give a monetary value

to the carbon stored in standing forests. Until now, income from the forestry sector was mainly derived by extracting timber and non-timber forest products and from converting the land to other uses such as pasture for cattle ranching or crop cultivation. The agents who drive deforestation differ; there are small and large-scale farmers who contribute to land conversion through their agricultural activities, but with different motives. For any REDD+ scheme to be successful, the different drivers of deforestation must be understood and addressed.

Drivers of deforestation

Deforestation drivers can be divided into so-called "immediate" and "underpinning" drivers. The underpinning drivers are (Geist and Lambin, 2002) (see Figure 1):

- **Demographic factors:** population growth and density, urbanization and migration
- **Economic factors:** changes in relative prices, economic structures, shifts in demand for commodities, infrastructure development
- **Technological factors:** technological progress to increase agricultural production



UN-REDD
PROGRAMME



- **Policy and institutional factors:** macro-economic policies, tenure rights, corruption, access to loans, education
- **Cultural factors:** public and individual attitudes and values, lack of concern about forests, rent-seeking, frontier mentality

Actual cutting of trees is due to “immediate” deforestation drivers and agricultural expansion is one of the most important immediate deforestation drivers (Geist and Lambin, 2002). This can be observed by looking at the correlation between the expansion of the agricultural sector in a country and the country’s loss in forested area. The publication “State of the World’s Forests” (FAO, 2003) shows that in two-thirds of countries where agricultural land was expanding, forest area was decreasing. Gibbs et al. (2010) estimate that during the ‘80s and ‘90s, more than 80 per cent of new agricultural land in the tropics came from intact, natural forests. However, official figures often miss the additions to forest land through fallow land becoming managed, as well as many trees outside forests (FAO, 2003). Often, a sequence can be observed of first infrastructure development, followed by wood extraction, and finally agricultural expansion occurring. Nevertheless, strong regional differences exist, making general conclusions difficult.

Agriculture as a driver for deforestation

In Africa, deforestation is caused mainly by small-scale farming and fuel wood collection, while in Latin America it is driven more by large-scale agriculture, especially extensive cattle production. In the

Box 1: In the **Brazilian Amazon**, large-scale agriculture contributes to deforestation through the conversion of forests to cropland, which began with small-scale timber extraction and subsistence agriculture. The mechanization of forest clearing led to the expansion of the road networks deep into the forests. Larger farms followed suit first with cattle ranching and later with large scale soybean cultivation. Since 1970, approximately 70 per cent of forest clearing has been due to medium and large-scale ranches (Fearnside, 2005). The profit from beef cattle was an important motivation. However, recently the expansion of large-scale mechanized agriculture at the forest frontier has been caused by an increase in soybean cultivation. For the Brazilian state of Mato Grosso, Morton et al. (2006) found a significant correlation between deforestation and the price of soybeans and they attributed 17 per cent of the forest loss to large scale cropland expansion. There is a clear correlation between deforestation and the prices of soybean. In this case, agriculture is the main immediate driver of deforestation, which is influenced by underlying factors, such as the expansion of the road network, the proximity to previous clearings, high population densities, and climatic factors such as low annual rainfall, and long dry seasons (Kirby et al 2006).

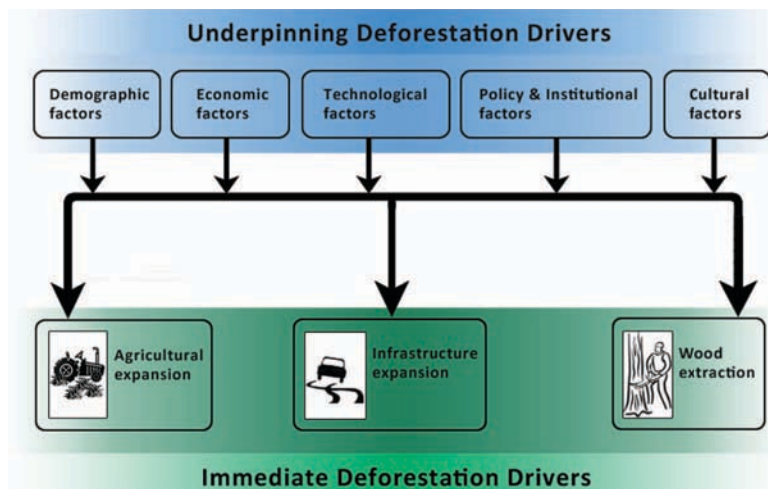


Figure 1. Interaction between two levels of deforestation drivers (Geist and Lambin, 2002- modified)

Asia-Pacific region, deforestation drivers are more diverse but the agricultural sector is still the most important (FAO, 2001) (see Figure 2).

Agricultural expansion is a complex issue and has many underpinning drivers. Populations are growing and need more food; rising incomes in many countries enhance the demand for meat and animal feed as well as other cash crops; urbanization creates new consumption patterns; and rising prices for fossil fuels increase fuelwood and charcoal consumption as well as biofuel production. Low productivity of smallholder agriculture in many parts of the developing world also leads to agricultural land expansion. Usually there is a different combination of agents and drivers at play depending on the area, and it is therefore important to observe on a case-by-case basis why and how agriculture contributes to deforestation.

The example of Brazil (Box 1) illustrates the variety of factors leading to deforestation, which in the Brazil case is mainly caused by large-scale farming.

The situation is somewhat different in the case of smallholders, whose main goal is to secure livelihoods and improve the economic situation of their families. The following circumstances can push small-scale farmers to move into forests:

- Low productivity of the already cultivated land leads to food insecurity and forces farmers to open up new land
- Lack of alternative fuel sources results in heavy reliance on wood and/or charcoal, and where demand exceeds the limits of sustainable production, degradation of forests results

- Lack of alternative income sources leaves people with no option other than to plough up new farm land on forested areas

In many areas, population pressure in combination with a transition from subsistence to market-oriented livelihoods prompts expansion of cultivated area and reduction of fallow periods, which makes slash and burn agriculture unsustainable. Deforestation drivers in a smallholder context in Indonesia illustrate the variety of linked factors (Box 2).

A way forward

Successful REDD+ policies require tackling different deforestation drivers, both at the forestry as well as the agricultural sector level. Agriculture and forestry are closely linked, as agricultural policy decisions have an impact beyond agriculture. When designing national REDD+ strategies, policies, laws and action plans, it is necessary to consider agricultural and rural development goals and use an integrated landscape approach. This approach takes into account all land uses in a holistic way and ensures that mitigation objectives among sectors do not compete with each other. An opportunity is provided by using the “middle ground” between forests and fields through practices like evergreen agriculture, where multipurpose trees are introduced, serving the multiple goals of agricultural production, food, income, energy and protection of the environment. If policies are designed only at the forestry sector level, ignoring the different drivers of agricultural expansion, REDD+ policies will not be successful.

To protect natural forests from unsustainable use requires the combination of a sound regulatory framework, law enforcement and involvement of stakeholders. In some circumstances it may be necessary to establish conservation areas. In such cases, local communities should be consulted for their free, prior and informed consent and receive fair compensation, for which REDD+ payments can be used.

The imperative for food and energy security and the need to increase food production will remain the highest priority for national governments and people alike. To reduce deforestation, the low productivity of agriculture must be tackled. Increased support for research, technological development, extension services and capacity building to sustainably increase yields per hectare is needed. Furthermore, adoption of sustainable farming practices such as improved water management, conservation agriculture, agroforestry practices, improved sustainable rice production, integrated rice-livestock systems, regeneration of

Box 2: *An example in the surroundings of the Lore Lindu National Park in Central Sulawesi, Indonesia illustrates the encroachment and deforestation at the forest margin. The majority of households in the region are farmers and rice is the most important staple food, whereas coffee and cacao are the predominant cash crops (Maertens et al. 2006). During the last 20 years, the agricultural area has expanded by 20 per cent, the perennial crop plantations area has tripled and spread into former forest areas and logging is observed. Cacao cultivation takes place in a range of management systems from shaded agroforestry systems to open large-scale monocultures. The expansion of cacao cultivation has been triggered not only by favorable producer prices for cacao, but also through the introduction of intensified cacao farming techniques by migrants (Steffan-Dewenter et al 2007). Cultural influences of migrant households have introduced technological changes shifting the dominant livelihood strategy from a “food-first” strategy based mainly on irrigated rice to a “cash-crop” first strategy, thereby increasing the pressure for forest conversion and intensification of cacao cultivation. The overall impact of immigration is, however, less clear, because it enhances welfare, which in turn over the years reduces deforestation rates. Other major factors fostering deforestation are infrastructure development and the introduction of labour-saving technologies. Labour-demanding technologies, like the establishment of irrigated rice plots, have a negative influence on forest clearing (Klasen et al 2010).*



Christina Seeborg-Elverfeldt

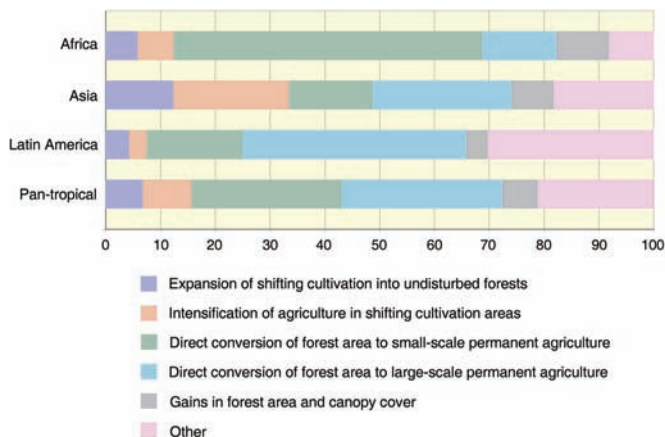


Figure 2. Transition of forest between 1980 and 2000 to other land uses and other land uses to forest due to different causes expressed in percentage (FAO, 2001)

degraded pasturelands and silvo-pastoral systems, is crucial. By adopting these practices, which increase productivity and resilience towards climate change impacts, and reduce emissions and sequester carbon, incomes can be increased, livelihoods enhanced, and possibly opportunities for carbon payments for agriculture will emerge. To address climate change and to improve food security and livelihoods, sound agricultural and rural development policies are needed with increased investments into productive and climate-smart farming systems, agricultural extension services and rural financial markets. Tenure rights, corruption, policy and law enforcement will also need to be addressed.

UN-REDD PROGRAMME

The United Nations Collaborative Programme
on Reducing Emissions from Deforestation and
Forest Degradation in Developing Countries



www.un-redd.org
un-redd@un-redd.org
unredd.wordpress.com



References:

- FAO. 2001. Global Forest Resources Assessment 2000. FAO.
- FAO. 2003. The State of the World's Forests. FAO
- Fearnside, P.M. 2005. Deforestation in Brazilian Amazonia: history, rates and consequences. *Conservation Biology* 19: 680–688.
- Gardner, T., Barlow, J., Chazdon, R.L., Ewers, R., Harvey, C.A. and Sodhi, N.S. 2009. Prospects for tropical forest biodiversity in a human-modified world. *Ecology Letters*, 12: 561-582.
- Geist, H.J. and Lambin E.F. 2002. Proximate Causes and Underlying Driving Forces of Tropical Deforestation. *BioScience*. Vol. 52 No 2. Pp. 143-150
- Gibbs, H.K., Ruesch, A.S., Achard, F., Clayton, M.K., Holmgren, P., Ramankutty, N., Foley, J.A., and 1990s. PNAS Early Edition
- IPCC. 2007. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. IPCC, Geneva, Switzerland.
- Kirby, K.R., W.F. Laurance, A.K. Albernaz, G. Schroth, P.M. Fearnside, S. Bergen, E.M. Venticinque and C. da Costa. 2006. The future of deforestation in the Brazilian Amazon. *Futures* 38: 432-453
- Klasen, S., Faust, H., Grimm, M., Schwarze, S. (2010): Demography, Development, and Deforestation at the Rainforest Margin in Indonesia. In: Tschardtke, T., C. Leuschner, E. Veldkamp, H. Faust, E. Guhardja, A. Bidin (eds.). *Tropical Rainforests and Agroforests under Global Change*. Springer-Verlag, Berlin, pp. 213-238. ISBN: 978-3-642-00492-6
- Maertens, M., M. Zeller, and R. Birner. 2006. Sustainable agricultural intensification in forest frontier areas. *Agricultural Economics* 34 (2): 197-206.
- Morton D.C., DeFries R.S., Shimabukuro Y.E., Anderson L.O., Arai E, Espirito-Santo F.D.B, Freitas R, Morissette J. 2006. Cropland expansion changes deforestation dynamics in the southern Brazilian Amazon. *PNAS*. USA. 103, 14, 637–14,641.
- Steffan-Dewenter I, Kessler M, Barkmann J, Bos MM, Buchori D, Erasmi S, Faust H, Gerold G, Glenk K, Gradstein SR, Guhardja E, Hartevelde M, Hertel D, Hohn P, Kappas M, Kohler S, Leuschner C, Maertens M, Marggraf R, Migge-Klein S, Mogeja J, Pitopang R, Schaefer M, Schwarze S, Sporn SG, Steingrebe A, Tjitrosoedirdjo SS, Tjitrosoemito S, Twele A, Weber R, Woltmann L, Zeller M, and Tschardtke T. (2007). Tradeoffs between income, biodiversity, and ecosystem functioning during tropical rainforest conversion and agroforestry intensification. *PNAS* 104(12): 4973–4978
- World Bank. 2001. A revised forestry strategy for the World Bank Group. Washington DC. USA, World Bank.

Acknowledgements:

Bruce Campbell, CGIAR

David Duthie, Convention of Biological Diversity

Stefan Schwarze, University of Göttingen