

# Fellowship report

## ***The impact of logging damage on tropical rainforests, their recovery and regeneration***

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**Damaging cut:** Logging operations in Ghana can impact forest flora and fauna. *Photo: K.O. Afriyie*

This paper summarizes the results of work carried out under an ITTO Fellowship that was recently completed. The objective of the Fellowship was to publish a book<sup>1</sup> on the impact of logging damage on forest mortality and regeneration in the high forest zones of Ghana. The book (an annotated bibliography) was based on information generated by a DFID/FRP project (R6716 – *Impact of harvesting on forest mortality and regeneration in the high forest zones of Ghana*). The aims of the project were to improve knowledge of the negative impacts of logging in tropical rainforests and to recommend improvements in the logging system. The total number of references in the annotated bibliography is 1327. Most of the papers focus on four broad areas, namely: (1) logging damage; (2) recovery after logging; (3) regeneration after logging; and (4) biodiversity of the residual forest.

### **Logging damage**

Papers addressing the impact of logging damage cover both forest flora and fauna. Many papers have used GIS and remote sensing techniques, field assessment of logging activities and models to assess logging damage on forest flora. Several papers report on tree fall gaps, logging in forest coupes, and damage to residual stands.

The book highlights that literature addressing the impact of timber harvesting methods and operations on animal taxa is biased towards birds and primates. For birds, authors have variously reported: significant decreases in bird species richness and diversity; only slight differences in species diversity; and similarity in bird richness,

but with important changes in species abundance and composition after logging. Primate responses to logging are also variable. Some primate species are highly dependent on undisturbed forest (specialists like *Hylobates* spp., *Cercopithecus* spp. and *Chiropotes* spp.), while others prefer disturbed habitats and will be more likely to survive in disrupted areas (generalists like *Macaca* spp., *Colobus* spp. and *Cebus* spp.). After logging, the intensity of hunting increases primarily because of easier access to remote forests by new roads and of the greater human presence in the area, and this impact is an important component of the impact of logging.

### **Recovery after logging**

Many studies focus on structural measures of logged forest recovery, such as basal area, aboveground biomass, tree height and stem density. Other studies examine changes in canopy structure, the frequency and size of canopy gaps, and light availability during forest recovery. Forest recovery was also measured in terms of the abundance and richness of species used for non-timber products.

The impact of logging on soil nutrients and cycling has been an important area of research. Disturbance that impacts soils as well as aboveground vegetation, such as the use of bulldozers and skidders during logging operations, can significantly slow down the rate of forest structural recovery and can have long-lasting effects on species composition. The recovery of soil fertility is closely linked with the recovery of aboveground biomass.

### **Regeneration after logging**

Several of the papers included in the bibliography highlight that the natural regeneration of many species

<sup>1</sup> Hawthorne, W.D., Marshall, C.A.M., Abu Juam, M. and Agyeman, V. 2011. The impact of logging damage on tropical rainforests, their recovery and regeneration: an annotated bibliography. OFI, U.K.

is gap size dependent and that the sizes of gaps created determine the type of species which regenerate and the extent of natural regeneration. Medium-sized openings resulting from felling gaps and skid trails favor the natural regeneration of most of the economic timber tree species, many of which are non-pioneer light demanders, compared to other gaps. Small (branch or small tree fall) and large (multiple tree fall, haulage roads and loading bays) gaps result in reduced regeneration and a decline in the economic value of the tropical high forests. Timber harvesting affects the forest micro-environment and also stimulates the growth and regeneration of tree species.

The book highlights that tropical forest tree species differ markedly in their tolerance of shade and their ability to respond to changes in irradiance. Responses of species to variation in irradiance have been studied by growth analysis using shade houses, gaps created in the forest or light response curves. It was also shown that proximity of disturbed areas to remnant forest patches with 'seed trees' promotes more rapid recovery, particularly in species composition.

## Biodiversity of residual forest

Many papers report that logging activities may result in the disappearance of species, thus reducing species diversity. Uncontrolled logging has considerable impact on biodiversity conservation, forest structure and species composition and may lead to the loss and fragmentation of forests. The removal of seed trees reduces the potential of the forest to regenerate after logging.

The impact of logging on forest fauna is similar to that on flora and depends on the ecology of particular species or group of species. Logging alters the habitat of wildlife by changing or destroying nesting, feeding and breeding sites. Since different silvicultural systems produce forest stands with different forest structures, their impacts on animals varies depending on animal habitat requirements and the ability to recolonize logged forest.

## The way forward

Analysis of the current status and trends has led to the identification of themes that are likely to be important in determining the future of tropical timber harvesting in Ghana and elsewhere. These include:

- i. *Pressures for sustainable management will continue to gather force.* While some progress has been made in this direction, more is needed to satisfy the principles of sustainable forest management. In particular, efforts should be made in reducing harvesting and processing waste.

- ii. *Demand for social equity will increase.* Although there is general recognition of the roles of forests in local people's livelihoods, in practice the social aspects of forestry are often neglected or sacrificed in pursuit of financial expediency. It is expected that demands for greater participation and responsibilities and benefits will intensify in the face of dwindling resources.
- iii. *Increasing restrictions on access to forests through physical and regulatory constraints.* With a global deforestation rate of 1.3% and overall forest quality decline, it seems evident that the future holds greater physical resource constraints.
- iv. *Timber trade will remain important.* In spite of (i) to (iii) above, trade in timber products will continue to be important through its contributions to foreign exchange earnings and GDP. Wood demand in the domestic market will also increase due to population growth and other factors.

Against the general policy background and factors that are likely to shape the future of timber harvesting in the tropics, the following options have been proposed:

- i. *Improve efficiency in forest harvesting and wood processing.* Significant economic gains could be made if the current rates of product recovery (now about 50% for harvesting and about 30% - 45% for log processing) could be improved. Improvements in processing efficiency could help to diminish the pressure on the forests by reducing the volume of logs required to manufacture the same volume of products.
- ii. *Increase production from forest plantations, particularly on degraded forests lands.* A relatively new prospect for encouraging investment in plantations is to provide measures for sequestering carbon in exchange for pollution rights under climate change agreements. While details are still to be agreed, the Kyoto Protocol lays a foundation for a potential vast new investment in forest plantations. Ghana, for example, needs to negotiate for investment in this area in support of its plantation development and the Forestry Development Master Plan.

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*Limited copies of the annotated bibliography produced under this Fellowship are available on request (aoki@itto.int).*