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# Recovery of anuran community from logging disturbance

**Anthropogenic disturbances, such as logging, can affect ecosystems dramatically. Depending on the intensity of the impact and the resilience of the ecosystem with its biological communities, the ecosystem may recover. For anurans, which are very habitat-dependent species, little is known about their long term recovery from logging disturbances. Funded by Tropenbos International (TBI) Suriname, Gwen Landburg studied the recovery of the anuran community of the Tonka experimental research site within the Kabo Forest Concession in order to investigate if the effects of the recurring disturbances regime of the CELOS Management System (CMS) are still visible, approximately 30 years after the last disturbance. Environmental conditions, anuran diversity and species composition of control and "logged with refinements" plots were compared with each other to identify how the CMS has affected the anuran community.**

## History of the research site

The Tonka experimental site (1000 ha) was established in 1980 to investigate vegetation distribution patterns, the effects of logging and refinement on the forest and the efficiency of the system in terms of revenues by using selective logging according to the CMS. The CMS exposes the forest to different selective logging regimes in one rotation period of 20-25 years. The logging activities of the system include a first harvesting of all economic valuable species above a certain diameter (year 0), followed by refinement (year 2) in which all the undesirable tree species above a certain diameter are eliminated by arboricide-girdling. A second refinement is done (year 10) to eliminate the commercial species from the competition of undesirable species and lianas after which the commercial species have 10-15 years to grow before the new harvesting cycle starts. The plots selected for this study were only exposed to the first felling and the first refinement (Jonkers, 1987).
One year after the first felling, Jonkers started a factorial block experiment with two factors, in which logging and silvicultural treatments have been studied at three levels. A set of 3 replication blocks was made, each consisting of 9 plots of 150 x 150 m each. Apart from these blocks, three plots with virgin forest were set up as control plots (figure 1).

## Methods

For this study the plots selected had a logging intensity of 46 $m^3$/ha and a silvicultural treatment in which all non commercial species with a diameter of 20 cm and above were removed (hatched plots in figure 1: 16, 24 and 39). For the control plots, the already established undisturbed plots were used (dark gray plots in figure 1: 41, 42, 43). In each of the selected plots a 100 x 100 m rectangular transect was set up in which anurans abundance and species composition were studied and also their habitat was characterized. This was done by measuring environmental variables in sub plots which reflect their habitat and the impact of the logging experiments. The variables selected were canopy openness, cover of the vegetation in all strata, counts of trees in different diameter at 1.3 m breast height (dbh) classes, presence of logs and snags and presence of palms. Surveys were done in the short rainy season (January-March 2010).

## Findings in relation to logging impact

To identify the effect of the logging experiments a comparison of the measured environmental

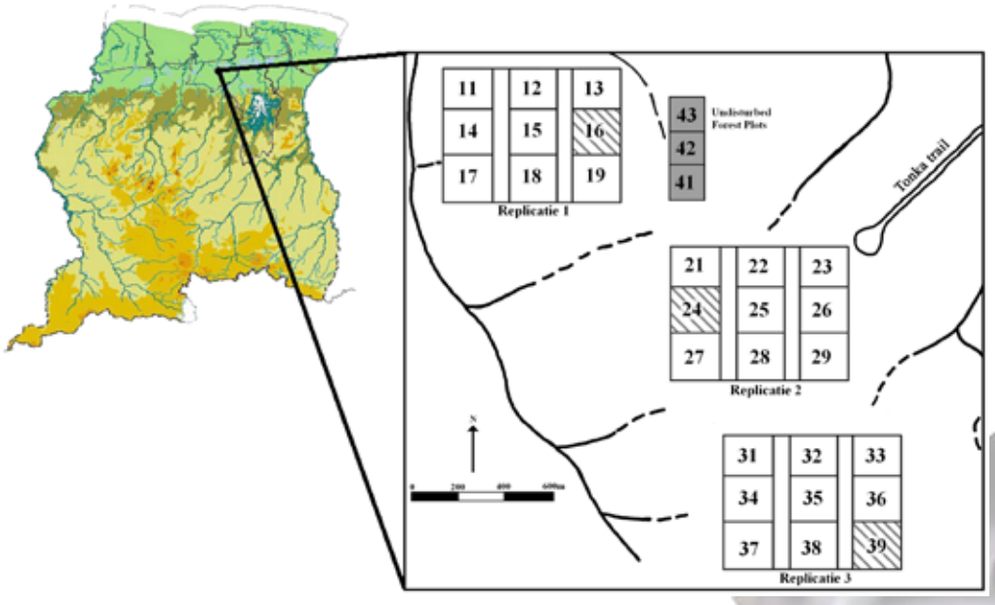


*Figure 1. Overview of the Tonka experimental site (Kabo, Suriname) and the selected plots for the study; hatched plots = experimental plots; dark-gray plots = control plots.*

variables, the anuran abundance and species composition was made between the two types of plots. The comparison of the environmental variables revealed that the control and the experimental plots only differed in the litter cover on the ground and the lower tree cover. This could be due to the presence of palm patches in the control plots. These palm patches result in a scarce litter cover but a closed lower tree cover in these plots.

For the experimental plots this is the other way around. During the refinement activities, in which all undesirable non commercial trees are being removed, the palm patches are also being removed enabling other (non) palm species to grow. In these plots a litter layer established itself, while the lower tree cover was more open. Despite these differences in the forest structure between the two types of plots, the other measured environmental variables did not differ, which implies that the experimental plots may have recovered from the logging disturbance.

There was no difference found in anuran diversity, but some differences were found in species composition. These differences may be due to under-sampling of the plots because abundance curves and calculated expected species richness showed that additional sampling might be needed to get an overview of the total anuran community. Still this needs further research because studies on the impact of logging on amphibians revealed differences in species composition. These studies showed that only certain species can adapt to the disturbed conditions. It has been found in other studies that litter species of the families Bufonidae, Dendrobatidae and Leptodactylidae were found to be in higher abundance in disturbed sites. These species are expected to have different biological characteristics, for example a drier skin, which enables them to have a broad physiological range so they can tolerate drier conditions in disturbed forests. Their reproductive mode also enables them to reproduce successfully and have high abundance under drier conditions. Except for two species, (*Synapturanus mirandariebeiroi* and *Ctenophryne geayi*), all terrestrial species found during this study are also found in other disturbed sites that have a certain degree of canopy cover. These species were found in both control and experimental plots which implies that the logging experiments were not the major cause for this species composition.

**Long term recovery**

This study reveals that it is possible that after 28 years, forest conditions can recover from logging disturbances and that also the anuran community may recover. During this research the effect of only two interventions, first logging (year 0) and first refinement (year 2), of the CMS were studied. It is important to also investigate the effect of the second refinement (year 10) on the anuran community, as shorter recovery time between the interventions may result in greater loss of habitat and even extinction of anuran species.



This information is derived from:
Gwendolyn Landburg, 2010. *Long Term Recovery of Anurans from Selective Logging Disturbance.* MSc thesis, Wageningen University, the Netherlands (WUR).

**For more information:**
Tropenbos International Suriname, PO Box 4194 - Paramaribo South, Suriname
Leysweg - CELOS building Phone: +597-532001
E-mail: tropenbossuriname@yahoo.com

Photos: Gwen Landburg, Astra Singh and Rutger de Wolf

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