15 Prospects for the CELOS Management System

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The central question of this publication is: can the CELOS Management System (CMS) contribute to an improved management of tropical rainforests? Obviously, this book would not have been published if the answer to this question had been NO. But the answer is not a simple YES either.

The CMS was formulated in the 1980s, after many years of research in Suriname (see Chapter 2). It included a Reduced Impact Logging (RIL) method and silvicultural interventions (see Chapter 3), which are referred to as the CELOS Harvesting System (CHS) and the CELOS Silvicultural System (CSS). The CMS should result in a yield of approximately 20 $m^3.ha^{-1}$ once every 25 years. The research findings obtained show that the growth of commercial timber species after logging and the best performing CSS treatment is such that this sustained yield should indeed be possible (see Chapter 4). The CSS treatment consists of killing large lianas and all non-commercial trees larger than 20 cm dbh. In most cases, one silvicultural intervention will be sufficient, although three were originally foreseen. In Suriname, forest management without silvicultural treatment will seldom result in such a sustained yield, but this does not necessarily apply to other countries (see e.g. Section 9.3.3).

Considerable efforts were made to investigate the environmental and ecological impact of the CMS. It is obvious that CMS interventions are intended to change the tree species composition, but the studies conducted did not show unacceptable effects on the plant biodiversity, fauna, and biomass and nutrients (see Chapters 4, 5, 6 and 7). This does not imply, however, that undesirable ecological side-effects are negligible and that there is no need for additional corrective measures (see Section 15.1).

Since the 1980s, technical innovations and new concepts of sustainability have emerged, which were not incorporated in the CMS. Furthermore, the risk of overexploitation has increased as the timber market accepts more species and trees of smaller dimensions than in the 1980s. Hence, the CMS techniques need to be updated and the CMS concept needs an upgrade. This in itself is an example of how forest management continuously needs to adapt to changing conditions to ensure sustainability of use.

Sustainable forest management requires an enabling legal environment. Existing legislation in many tropical countries seldom makes sustainable forest management attractive, as is illustrated clearly in the cases presented (e.g. Ghana and Costa Rica, Chapters 12 and 14). For instance, logging companies often are made responsible for the management of their concessions, while a major part of the return on investments becomes available during the second logging cycle, that is, after their licences have expired. As these companies do not profit from the long-term benefits of sustainable forest management, they will be inclined to minimize all forest management expenditures which are not profitable in the short term. This is an important constraint for the introduction of sustainable forest management in general, and of the CMS in particular, and requires more attention than it has been given so far.

15.1 Suggestions for technical modifications

The CHS has served as a basis for RIL methods developed in countries such as Brazil, Bolivia, Costa Rica, Guyana and Cameroon (see Chapters 9, 10, 11, 12 and 13). The experiences obtained in these countries can be used to further develop the CHS. Simply copying a complete RIL method from elsewhere is not a good strategy, however, as terrain conditions and forest composition determine the optimal method to a large extent. An important innovation is the introduction of Geographical Information System (GIS) as a mapping tool. This makes mapping easier, less costly and more accurate. Furthermore, it is recommended to carry out liana cutting during the pre-felling inventory rather than after logging, thus incorporating it in the CHS. This modification is likely to reduce logging damage and to facilitate directional felling.

In many countries, including Brazil, Belize and Guyana, RIL has been expanded with additional measures for environmental protection and sustained yield, cast into so-called Codes of Practice for Timber Harvesting. These codes evolved out of the 1996 FAO Model Code of Forest Harvesting Practice (Dykstra & Heinrich 1996). Suriname is currently developing such a Code of Practice based on the Guyana Code of Practice and current harvesting regulations, such as the concession conditions and guidelines for exploitation plans.

The draft Code of Practice for Suriname includes measures to protect rare timber species and vulnerable sites, such as steep slopes and riparian fringes, and presents detailed requirements with regard to pre-harvest forest inventory; planning and construction of roads, bridges, culverts, roadside landings and skid trails; directional felling; controlled winching and skidding; administrative/registration requirements; post-harvest requirements; operational hygiene and occupational health and safety.

The CSS uses a list of species to be cut in the second harvest, which is foreseen after 25 years. For Suriname, the present CELOS list of commercial tree species (CELOS 2002; see also Annex 1), which is based solely on timber characteristics, provides a good basis for updating the list used previously in the CELOS silvicultural experiments. However, timber quality is not the only criterion to be used for such a silvicultural list: the size which a species can attain and its growth rate are other characteristics to be considered (see Annex 1). Furthermore, adding species to the list does not necessarily result in more profitable future yields. More species on the list means that more trees are retained and that there is more competition in silviculturally treated stands. This results in slower growth rates of the established commercial species. In other words, the implication of adding species with an uncertain commercial potential to the list is a decrease in production of more valuable timber species. The optimal list may vary from forest to forest and it is therefore recommendable to work with a flexible list, which includes currently preferred species and a selection of potentially commercial species where appropriate. The decision to expand or reduce such a list should be based on yield prediction (see Section 15.2).

Refinement techniques should be improved as more information on specious behaviour becomes available, for instance through field trials. In Brazil, Precious Woods has employed a modified CSS, where elimination of unwanted trees is restricted to the immediate vicinity of commercial trees. This has advantages: it may lead to a reduction in costs and it better preserves those parts of the forest where commercial timber species are rare or absent. However, trees also endure considerable competition from other trees that are not their immediate neighbours, and this will negatively affect the growth response of the commercial trees (see Chapters 4 and 5). Another modification is the use of an adapted chainsaw to double ring-bark trees to be killed (see Photo 10.5). This technique has less impact on the environment than poison-girdling, but it may be less effective in eliminating unwanted trees. It may also be less cost-efficient. As the effects of these modifications have not yet been analyzed, it is too early to advocate or discourage their application.

Any forest management plan should include an approach to deal with undesirable ecological effects. Ecological monitoring and measures to prevent poaching and illegal felling should be part of this approach. As part of biodiversity conservation targets it may be desirable to leave representative parts of the forest completely and permanently untouched to preserve flora and fauna, as recommended by many authors (e.g. Van Bodegom & De Graaf 1991) and required by certification schemes. One may also consider to adjust the sequence in which forest compartments are logged and treated silviculturally in such a way that each compartment where forestry operations are in progress is adjacent to compartments which have been and will be left untouched for a prolonged period of time. Thus, management compartments may be arranged in a chessboard-like pattern, where the "black compartments" are logged and treated during the first half of the cutting cycle and the "white compartments" in the years thereafter. The "white compartments" will then serve as temporary buffer zones for the "black compartments" and vice versa. Furthermore, it is obvious that vulnerable sites, where logging is not allowed according to the Code of Practice for Harvesting Operations, are left untouched during silvicultural interventions.

15.2 Suggestions for upgrading forest management

After the CMS was formulated in the 1980s, forest management, deforestation and forest degradation gradually became significant topics on the international political agenda as a result of a growing concern about issues such as dwindling timber resources, biodiversity loss, climate change and the livelihoods of forest dwelling people. This led to a range of initiatives aimed at stimulating sustainable forest management. One of the first was the development of criteria and indicators for the certification of forest management. The extent to which the CMS meets these standards is discussed in Chapter 8. It is obvious that many modules of current certification schemes are not covered by the CMS: the CMS is a set of methods to grow and harvest timber on a sustainable basis rather than a complete management system for a forestry enterprise. Nevertheless, the CMS provides methods for harvesting and stand treatment that lie at the heart of sustainable forest management. The system will need to be upgraded when certification standards are to be met (see Chapter 8 for details). The example of Precious Woods, where the CHS and the CSS are incorporated in a certified management system, shows that this is feasible (see Chapter 10).

More recent international initiatives related to forest certification and sustainable forest management are the European Union's FLEGT (Forest Law Enforcement, Governance and Trade) Action Plan, the United Nations' REDD (Reducing Emissions from Deforestation and forest Degradation) Programme and other REDD initiatives, and a number of financing schemes directed mainly at nature conservation or forest management by local communities. The FLEGT Action Plan[1] intends to increase the capacity of developing and emerging market countries to control illegal logging, while reducing trade in illegal timber products between these countries and the European Union. Sustainably managed forest operations have more costs than illegal producers, who pay less fees and taxes and do not invest in forest management. As illegal logging is widespread, this competitive disadvantage is a major constraint for the implementation of sustainable forest management. Therefore, FLEGT promotes sustainable forest management in an indirect way by curbing the activities of illegal logging operators and by impeding their access to the European market.

The REDD Programme[2] is part of the global effort to reduce climate change. Its objective is to create a financial value for the carbon stored in forests, offering incentives for developing countries to reduce emissions from forested lands and invest in low-carbon paths to sustainable development. The upgraded version of REDD, "REDD+", goes beyond deforestation and forest degradation, and includes the role of conservation, sustainable management of forests and enhancement of forest carbon stocks (see Global Canopy Foundation 2008). At the time of writing, the programme is still under development. It is predicted that financial flows for reductions in greenhouse gas emission from REDD+ could reach up to US$ 30 billion a year.

1 http://www.euflegt.efi.int
2 http://www.un-redd.org

Although the estimated REDD financial flow may be somewhat optimistic, as it was calculated before the 2008 financial crisis, and although this sum has to be shared by a vast number of beneficiaries, it may contribute substantially to the future financial benefits of sustainable forest management, in spite of additional costs involved. Guyana, for instance, may receive up to US$ 250 million until 2015 from Norway to finance its national REDD+ programme[3].
Of course, carbon stocks and their fluctuation in time have to be quantified in order to qualify for participation in this scheme. As this is tightly linked to tree biomass, tree growth models are helpful to achieve this. The estimates for living and dead biomass given in Chapter 6 and the growth and mortality data in Chapter 4 provide an input for such assessments in Suriname. In other regions, local data should be used for carbon assessments.

Growth models are not only needed for assessing carbon sequestration, but also for the regulation of timber yields. When the CMS was formulated there was no need for yield regulation other than specifying minimum diameter limits for trees to be felled, as harvest intensities were low. The risk of overexploitation has increased since, not only because more species and smaller logs are accepted by the timber market, but also because more and more concessions are issued for forests which have been logged at least once before and have not fully recovered from previous exploitation. Various yield regulation models have been developed in the last decades, among others in Cameroon (see Chapter 13) and in various South American countries (e.g. Van Gardingen et al. 2006; Gourlet-Fleury et al. 2005; Alder 2002; Alder et al. 2002; Phillips et al. 2002), but recommended maximum harvest levels (expressed as Annual Allowable Cut) are not always enforced. Such yield regulation models should be implemented to define sustainable harvest levels and can at the same time be expanded to estimate carbon storage and carbon sequestration associated with these harvest levels. The Brazilian model, for instance, estimates volume growth of both commercial and non-commercial species. Such estimates can be converted into biomass growth estimates, and subsequently to the amount of carbon sequestration in living trees. Such an adapted model has been used to estimate the impact of RIL on carbon sequestration in Malaysia (see Putz et al. 2008).

15.3 A future for the CELOS Management System

In 1996, Schmidt & Hendrison stated: "The CELOS Management System (CMS) has special features which make it suitable for the sustainable management of tropical rain forests. Being one of the few management systems based on relatively long-term research and tested in semi-practical operations, it deals with ecological, silvicultural and operational aspects. The system is sufficiently developed to control commercial logging operations, to reduce logging damage, and to lead to regeneration of the remaining forest, thus fitting in with current perceptions of natural resource management and sustainable development. It offers promising prospects for Suriname and other tropical countries, where lowland rain forests are subjected to exploitation [...]. Apparently, the first stage of the development of the CELOS forest management system can be considered

3 http://www.regjeringen.no/en/dep/md/Selected-topics/climate/the-government-of-norways-international-/guyana-norwaypartnership

successfully accomplished. The introduction of the CMS on a larger scale should be promoted by establishing a Model Forest Management Unit." It seems appropriate to conclude that this statement is still valid.

So, the question "can the CELOS Management System contribute to an improved management of tropical rain forests?" can be answered with YES, but the system needs to be adjusted and expanded and is not necessarily applicable in all rainforests. Some suggestions for improvements are given above, but it is left to the users of this book to further develop the system and to adapt it to local conditions, new insights and opportunities and the requirements of future generations.

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The work is done, now some rest! (Photo P. Schmidt)