九州大学学術情報リポジトリ
Kyushu University Institutional Repository

# Assessment of Cambodian forest concession management planning based on criteria and indicators of Montreal Process : a case study of CFC Company

Kao, Dana
Graduate School of Bioresource and Bioenvironmental Science, Kyushu University

飯田, 繁
九州大学大学院農学研究院

井上, 晋
九州大学大学院生物資源環境科学府

大賀, 祥治
九州大学大学院農学研究院

https://doi.org/10.15017/14857

出版情報：九州大学農学部演習林報告. 86, pp.69-84, 2005-03-27. 九州大学農学部附属演習林
バージョン：
権利関係：

KYUSHU UNIVERSITY

Original Ariticle

# Assessment of Cambodian forest concession management planning based on criteria and indicators of Montreal Process: a case study of CFC Company*

KAO Dana**,IIDA Shigeru***, INOUE Susum ** OHGAand Shoji***

## Abstract

Forest fragmentation results because the spatial scales of resource extraction do not match the scales of natural disturbance that shaped the evolution of the landscape. Tropical deforestation was still proceeding at 14.2 million hectares per annum in the 1990s, and only 5.5% of all forest in developing countries was under formal management plans in the year 2000. The Cambodian tropical forests contain partly continuous tropical forest in the world. However, it has suffered serious deforestation 0.6% annually since the last 30 years because of road-building, logging, mining, mismanagement-decision, and agricultural raising expansion. This paper aims at scaling and forecasting the problem in Cambodian forest concession management to fulfill the gape of sustainable forest management decision. To scale and forecast problems of forest management, we used data from CFC company in Cambodia to compare the modern forest management Montreal criteria. The work responds to the need to assess progress toward sustainable forest management as established by the Montreal Process of Criterion 2 and its Indicators. The focus is on a single criterion (commonly referred to as indicator 10 to 14), which addresses the "maintenance of the productive capacity of forest ecosystems" to compare with data of 25-year strategic sustainable forest concession management level. There were 33 sub-indicators of Criterion 2 in Montreal and only 52% equivalent to 17 sub-indicators were fulfilled. We found that 3 indicators (48%) of management indicators were not in the plan yet. We suggested that growing stock of plantation and non-timber forest products have made the forest management into terrible condition because the forest area in CFC Company was mainly studied only on the timber production. The CFC Company is not alone in facing the challenge of sustainable renewable resource management. The results of this study on assessment of forest concession in Cambodia are applicable for tropical forest management. The assessment was more accurate using a forest concession planning and the Montreal criteria and indicators. Because the sustainable forest management remedies are based on specific knowledge of criteria and indicators, our results may be useful for the future establishment and management of sustainable yields at tropical forests.

**Key words:** Cambodia, Sustainable forest management, Criteria and indicators, Scaling, Forest concession, Strategic management

---

* カオ・ダナ, 飯田 繁, 井上 晋, 大賀祥治：モントリオールプロセスを基準にしたカンボジアのコンセッション型林業経営の評価

** Laboratory of Forest Resource Management, Division of Forest Ecosphere Sciences and Management, Department of Forest and Forest Products Science, Graduate School of Bioresource and Bioenvironmental Science, Kyushu University

*** Laboratory of Forest Resource Management, Division of Forest Ecosphere Sciences and Management, Department of Forest and Forest Products Science, Faculty of Agriculture, Kyushu University 394, Tsubakuro, Sasaguri-Machi, Fukuoka Pref., Japan 811-2415

## 1. Introduction

Forest fragmentation results because the spatial scales of resource extraction do not match the scales of natural disturbance that shaped the evolution of the landscape (Hobbs, 2003). Tropical deforestation was still proceeding at 14.2 million hectares per annum in the 1990s, and only 5.5% of all forests in developing countries was under formal management plans in the year 2000 (FAO, 2001). Forest is the essential component for human life in term of economics and environment. There is a need to extend the findings from visual images and content analyses to a wider context and different types of media in order to further examine the role of forestry industry and organizations in the public sphere (Kohsaka and Flitner, 2004). As signatory nations negotiate the implementation of the Framework Convention on Climate Change (UNCED, 1992), the role of forestry-based options for mitigating carbon dioxide emissions continues to be debated (e.g. Kyoto Protocol).

Globally agreed-upon elements of criteria for sustainable forest management are extent of forest resources, biological diversity, forest health and vitality, productive functions of forests, protective functions of forests, socio-economic benefits and needs, legal and policy and institutional framework. Considerable international efforts also have focused in recent years on criteria for assessing forest issues. The United States signed the Santiago Agreement (Anonymous 1995) defining criteria and indicators for conserving and sustainably managing. Other efforts in Europe (Helsinki Process), tropical countries (Tarapoto Proposal), and Africa (Dry Zone Africa Initiative) are helping to develop a worldwide consensus on these topics. These criteria are now being used to develop the Global Forest Resource Assessment 2000 by the United Nations, and they served as the program theme for the 1997 World Forestry Congress in Antalya, Turkey (World Forestry Congress 1997). The Santiago Agreement identifies seven criteria for assessing sustainable forest management: (1) Conservation of biological diversity, (2) Maintenance of productive capacity of forest ecosystems, (3) Maintenance of forest ecosystem health and vitality, (4) Conservation and maintenance of soil and water resources, (5) Maintenance of forest contribution to global carbon cycles, (6) Maintenance and enhancement of long-term multiple, socioeconomic benefits to meet the needs of societies; and (7) Legal, institutional, and economic framework for forest conservation and sustainable management.

A fundamental sustainable forest management increasingly debated in the past two decades has been the need for human actions that lead to sustainable development that meets the needs of the present without comprising the ability of future generations to meet their needs (WCED, 1987). This debate has broadened to include notions of sustainability as a normative concept reflecting the persistence over an indefinite future of certain necessary and desirable characteristics of both ecological and human parts of an ecosystem (modified from Hodge 1997).

Forest sustainability is a goal of many forestry organizations throughout the world. Managing forests sustainably involves recognizing interconnections among ecological, social, and economic systems to preserve options for future generations while meeting the needs of the present. Sustainability, like many concepts, is difficult to define in concrete terms. Many organizations are turning to criteria and indicators approach to help describe forest sustainability. Under this approach, criteria define broad categories of sustainability and indicators are specific measurements of each category (USDA, 2002). There are a host of efforts underway using criteria and indicators to describe forest sustainability. Notable among these is an effort commonly called the Montreal Process. This work is an outgrowth of the 1992 Earth Summit in Rio de Janeiro, Brazil. In 1995, the United States joined 11 other countries in signing a document establishing a set of 7 criteria and 67 indicators to track forest sustainability. Definition of the sustainable forest management criteria is a category of conditions or processes by which sustainable forest management may be assessed. Each criterion is characterized by a set of 9 to 20 indicators. An indicator is a qualitative or quantitative measure of an aspect of the criterion that can be observed periodically (Montreal Process Working Group, 1998).

In fiscal year 2003, the forest reformed program supported the Cambodia missions in conducting analyses and specific targeted interventions to mitigate conflicts over forest resources. These conflicts contribute to political destabilization and economic decline as well as environmental destruction ( USAID, 2004) . The Forest Administration ( FA, 2000) requires concession companies to set out in their sustainable forest management planning (SFMPs) clear objectives for "sustainable forest management over the concession area for the duration of the license through policy statement to which management and employees are committed. The FA can be congratulated for the thorough consideration of this topic in the planning process. The Planning Manual gives examples for the policy statement and several management objectives, which serve as guidance to the concessionaires.

The Cambodian forest of 2.1 million hectares (11%) was degraded from 1973 to 1997 (Fig.1). Cambodian tropical forests include the only partly continuous tropical forest in the world. However, it has annually suffered serious deforestation at 0.6% because of road building, mining and agricultural improvement expansion (Kim Phat et al, 2002, Kao, 2004) . A large deforestation area has affected the climate change, biological diversity, hydrological cycle, soil erosion and degradation (CTIA and Kao, 2004, Kim Phat et al, 2004, Top et al, 2004). In the past, logging was an integral part of the ecosystem in Cambodia, affecting wildlife habitats, forest stand dynamics, soil properties, and watershed hydrology. Therefore, assessment on the how concessions manage the forest needs to be studied for government and other concerned organizations to constrain forest harvesting and management. How do successional pathways differ throughout the region by site landform, and with susceptibility to

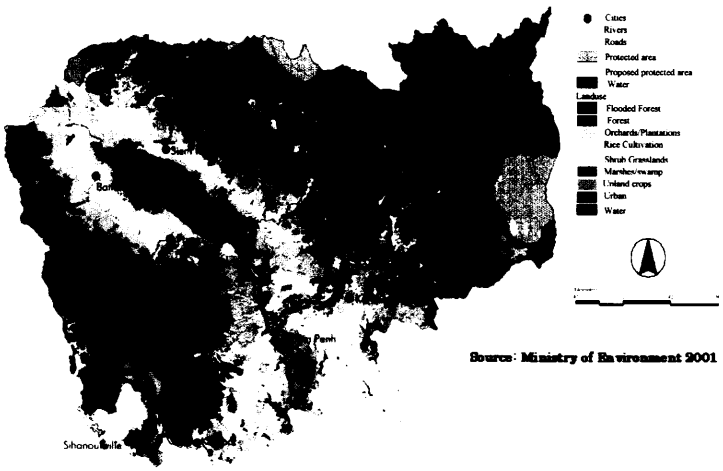


Fig.1. Cambodian Land use Map
Source: Cambodian forest statistics to 2002(FA, 2003)

disturbance?

At the present, Cambodia has 26 forest concessions, who manage the natural forest. By early 2003, 2 companies had been cancelled, 1 dropped out and 2 missed the deadline; of the remaining 9 concessions. Twelve forest concessions were required to revise and resubmit their plans, for further review ( Table 1) . As a result, 6 concessions have been provisionally approved for advancement to the compartment level (5-year) planning stage: Cambodia Cherndar Plywood Manufacturing Co. Ltd, Everbright CIG Wood Co. Ltd., Colexim Enterprise, TPP Cambodia Timber Product Pte. Ltd., Timas Resources Ltd. and Samrong Wood Industry Pte. Ltd.

The focus on problem of concession management is the subject of this paper. Specifically, the purpose of this paper is to evaluate the accomplishment of CFC forest Concession Company to assess sustainable timber production and adaptability in the context of the Montreal Process of Criterion 2 and Indicators number 10, 11, 12, 13 and 14 for sustainable forest management (Montreal Process Working Group 1998).

## 2. Materials and Methods

There are 5 indicators of criterion 2, which deals with maintenance of the productive capacity of forest ecosystems. The focus is on a single Criterion (commonly referred to as indicators 10 to 14), which addresses the "maintenance of the productive capacity of forest ecosystems". Data of 25-year strategic sustainable forest concession management level of CFC Company were selected for tabulation. For a more accurate evaluation of the CFC Company, the sections, which related to

Table 1: Valid forest concession area in Cambodia

| No | Name | Provinces/Municipality | Approved Date | Area (ha) |
|---|---|---|---|---|
| 1 | Cambodia Cherndar Plywood Mfg.Co., Ltd. | Preah Vihear | 3/2/1996 | 103,300 |
| 2 | Casotim Enterprise | Kratie | 9/4/1996 | 131,380 |
| 3 | Colexim Enterprise | Kampong Thom, Preah Vihear | 12/2/1996 | 147,187 |
| 4 | Everbright CIG Wood Co., Ltd. | Kratie, Stung Treng | 8/8/1996 | 136,376 |
| 5 | King Wood Industry Pte. Co., Ltd. | Krotie, Stung Treng, Modul Kiri | 15/1/1998 | 301,200 |
| 6 | Mieng Ly Heng Investment Co., Ltd. | Kampong Thom, Kampong Cham, Preah Vihear | 27/2/1996 | 198,500 |
| 7 | Pheapimex Fuchang Cambodia Co., Ltd.(1) | Krotie, Kampong Thom | 15/3/1996 | 137,475 |
| | Pheapimex Fuchang Cambodia Co., Ltd.(2) | Stung Treng | 15/3/1996 | 221,250 |
| | Pheapimex Fuchang Cambodia Co., Ltd.(3) | Stung Treng, Ratanak Kiri | 8/4/1998 | 350,000 |
| 8 | Samrong Wood Industry Pte., Ltd. | Siem Reap, Otdor Meang Chey | 22/8/1996 | 200,050 |
| 9 | Silveroad Wood Products Ltd.(1) | Koh Kong, Pursat | 8/3/1998 | 215,460 |
| | Silveroad Wood Products Ltd.(2) | Koh Kong | 8/4/1998 | 100,000 |
| 10 | Timas Resources Ltd. | Kampong Cham, Kratie, Preah Vihear | 14/4/1996 | 161,450 |
| 11 | TPP Cambodia Timber Product Pte., Ltd. | Siem Reap, Preah Vihear, Pursat, Koh Kong | 3/4/1998 | 395,900 |
| 12 | Yourysaco Company | Pursat, Battambang | 2/3/1998 | 214,000 |
| Total | | | | 3,874,028 |

Source: Cambodian forest statistics to 2002 (FA, 2003)

criterion 2, were sorted.

### 2.1 Data sources

Most of the data in CFC Company and in the Montreal process were collected based on the question "what is each indicator and why it is important?" and "What does the indicator show?" Standard protocols for each indicator of Criterion 2 are available at www.fs.fed.us/research. Each of the selected indicators was assessed based on the results of the publication from the United States department of agriculture, European forest certification, ITTO report and FAO report and the result of acceptable indicator of Criterion 2 of the Montreal, existing records in the World Wide Web.

In Cambodia, data were collected through a combination of individual and key informant interviews from the forest concessionaire in Cambodia, focus group (professor, FA officers, forest manager and the executive staff of CFC company), direct observation, and measurement of sheet 25-year strategic sustainable forest management plan of CFC Company, analysis of methodology work, result analyses and literature reviews. There are 8 criteria in 25-year sustainable forest management

plan of CFC Company. Criteria number 4, 5 and 6 of the CFC Company were collected because of this relevance to Criterion 2 of Montreal process 1998 (Table 2).

Table 2: Summary of criteria and indicators of CFC Company

| Criteria | Indicators |
|---|---|
| 4. Environmental and social | |
| 4.1. ESIA[a] | Conclusion of the ESIA document |
| 4.2. Evaluation of impacts and mitigation measures | Table of the principal investigation and mitigation measures appropriate to forest concessions |
| 4.3. Special management areas | Guidelines for special management areas |
| 4.4. Environmental monitoring | Monitoring measures tables |
| 5. Forest function zonation | Zoning according to the manual :<br>- Production areas<br>- Protection areas (>5%)<br>- Local traditional use areas (>5%)<br>Tables with non operable area and net operable working forest by major type<br>Forest function zonation: production areas, sacred forests, protection, special management areas. |
| 6. Resource and Yield calculation | |
| 6.1. Area information | Forest types area tables<br>Operable forest types<br>Maps (1:100 000)<br>Document verification undertaken - sources |
| 6.2. Concession level inventory | Description of the methodology of the inventory<br>Tables, data available and correct with precision <20 $m^3$/ha<br>Data verified on the field by the DFW[b] |
| 6.3. Growth and yield information | Guidelines will be developed by the DFW in the next months |
| 6.4. Estimated Available Annual Yield | Calculation available and based on the main group of species (Group I, II and III) by forest types updated after Cambodia |
| 6.5. Plans | |
| Compartment level | Maps (1:50 000) showing compartment layout based on a EAAY[c] production for a five years period<br>5 to 6 compartments according to contract between concessionaires and DFW<br>Tables showing areas by forest types and estimated volumes in each compartment updated after Cambodia |
| Arterial road network | Proposal of an arterial road network<br>Maps (1:50 000)<br>Schedule of road construction per year |

Source: 25-year strategic sustainable forest management plan (CFC, 2003)
[a] Environmental and social impact assessment
[b] Department of Forestry and Wildlife
[c] Estimate of annual allowable yield

### 2.2 Data analysis

To evaluate the different indicators between CFC Company and Montreal, we first answered the question "What does the indicator show?" and summarized them, and

interpreted the indicators of Montreal. Then, we matched each indicator of CFC Company and Montreal indicators. Indicators with negative or fluctuating trends were scored "0", while indicators with positive trends were rated "1". To evaluate the value of sustainable forest management of CFC Company, we finally graded each indicator of CFC based on the data collection, methodology and its objective.

The analysis of indicators data goes beyond the direct measurement of grade by scaling the sub-indicators in each indicator as mentioned in Table 3. In this study, we assessed the grade of each sub-indicator at four different ranks "A" is high, "B" is medium, "C" is low and "D" is poor in each sub-indicator or indicator, respectively. To examine the effect of CFC's sub-indicators, we sorted the sub-indicator descriptions of the data collection, the data analysis and the SFM objectives in each indicator for tabulation. The sub- indicator, which did not fulfill one of the three activities of accomplishment, was graded as "C". The sub- indicator, which fulfilled the three activities of the data collection, the data analysis and the SFM objective, was graded as "A". The sub-indicator, which fulfilled two of the three activities i.e., fulfilling of the data collection and the data analysis but without the SFM objective, was graded as "B".

For the forest area estimation activity, we graded this sub-indicator by "A" if there was information or "D" if there was no information in the CFC's sustainable forest management plan. The CFC's area estimation source generally used Geographic Information System (3.01) from the Forest Administration Office in Cambodia based on the imagery in the year 2000. Therefore, it was accurate enough for planning the sustainable forest management.

Table 3: Summary of sustainable forest management sub-indicator data and rating

| CFC's sub-indicators | Grade | Ranking |
|---|---|---|
| 1 Available a | "C" | Low |
| 2 Available | "B" | Medium |
| 3 Available | "A" | High |
| Area estimation by GIS | "A" | High |
| No information on area estimation | "D" | Poor |

[a] Assessment on the available data from CFC Company on sub-indicator (1) Data collection, (2) Data analysis or (3) Sustainable Forest Management (SFM) objective

## 3. Results and Discussion

Indicator 10: Area of Forest Land and Net Area of Forest Land Available for Timber Production. This indicator provides information fundamental to calculating the timber productive capacity of existing forests and shows how much forest is potentially available for timber production, compared with total forest area. Knowledge of the availability and capability of forest land to provide desired goods and services is a critical indicator of the balance of forest ecosystems relative to

potential end uses. The comparison between Montreal's and CFC's sub-indicators showed that CFC's company fulfilled the forest land available for timber production in indicator 10 about 11 of 13 sub-indicators (Table 4). The community and conservation area estimation were not fulfill. Whereas, the other 11 sub-indicators were realized with the grade A because the area estimation used Geographic Information System (GIS) in the year 2000, which may provide the accurate area identification. Therefore, average of annual allowable cut and stock forests would be accurate because this plan has enough information for forest operation (Table 4).

Table 4: Area of forest land and net area of forest land available for timber production

| Sub-indicators | Title of sub-Indicator 10 | Montreal's ref.[a] | CFC's ref.[b] | Quality Grade[c] |
|---|---|---|---|---|
| In.10.1[d] | Area of forest land and its changed by forest, class and year type | 1 | 1 | A |
| Subin.10.1.1[e] | Unlogged evergreen forest | 1 | 1 | A |
| Subin.10.1.2 | Unlogged mix evergreen forest | 1 | 1 | A |
| Subin.10.1.3 | Unlogged deciduous forest | 1 | 1 | A |
| Subin.10.1.4 | Logged over evergreen forest | 1 | 1 | A |
| Subin.10.1.5 | Logged over mix evergreen forest | 1 | 1 | A |
| Subin.10.1.6 | Logged over deciduous forest | 1 | 1 | A |
| Subin.10.1.7 | Biodiversity forest | 1 | 1 | A |
| Subin.10.1.8 | Community forest | 1 | 0 | D |
| Subin.10.1.9 | Conservation forest | 1 | 1 | D |
| In.10.2 | Timber land area, by management class and region | 1 | 1 | A |
| Subin.10.2.1 | Gross area by forest type and management level (Strategic, compartment and annual) | 1 | 1 | A |
| Subin.10.2.2 | Net operable area by forest types and management level | 1 | 1 | A |
| Total | | 13 | 11 | 11A, 2D |

Source: Indicator number 10 of Montreal Process Working Group 1998
[a] Montreal's reference
[b] CFC's reference
[c] This assessment was graded based on area estimation by GIS
[d] Indicator number 10.1
[e] Sub-indicator number 10.1.1

Indicator 11: Total Growing Stock of both Merchantable and Non-merchantable Tree Species on Forest Land Available for Timber Production. Growing stock is a fundamental element in determining the productive capacity of the area identified as forest available for timber production. Knowledge of growing stock of the various species that make up the forest and how growing stock changes over time is central to considerations of a sustainable supply of wood for products and the sustainability of the ecosystems that provide them. The comparison between Montreal's and CFC's sub-indicators showed that CFC's company fulfilled the total growing stock of both merchantable and non-merchantable tree species in indicator 11 about 2 of 7 sub-

indicators (Table 5). Of the 2 sub-indicators, sub-indicator 11.1 was graded as A and sub-indicator 11.2 was graded as B because only data collection and data analysis were fulfilled and the objective of SFM is not mentioned. However, the other 5 sub-indicators were realized with the grade D because in the CFC's master plan, there was no information mentioned (Table 5).

Table 5: Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production

| Sub indicators | Title of sub-Indicator 11 | Montreal's ref. | CFC's ref. | Quality Grade[a] |
|---|---|---|---|---|
| Subin.11.1 | Merchantable volume by forest type and year | 1 | 1 | A |
| Subin.11.2 | Non merchantable volume by forest types and year | 1 | 1 | B |
| Subin.11.3 | Percentage for comparison by forest types and year | 1 | 0 | D |
| Subin.11.4 | Compare the evolution for decision making | 1 | 0 | D |
| Subin.11.5 | Trend of growing stock by year by region | 1 | 0 | D |
| Subin.11.6 | Growing stock volume on timber land by region and species group | 1 | 0 | D |
| Subin.11.7 | Growing stock volume per hectare on timber land by region | 1 | 0 | D |
| Total | | 7 | 2 | 1A,1B, 5D |

Source: Indicator number 11 of Montreal Process Working Group 1998
[a] This assessment was graded based on the three activities of (1) Data collection, (2) Data analysis or (3) Sustainable Forest Management (SFM) objective

Indicator 12: Area and Growing Stock of Plantations of Native and Exotic Species. This indicator is a measure of the degree to which forest plantations are being established in response to increasing demand for forest products and competing non-timber uses for forest land. The provision of forest products from intensively managed plantations can enhance the potential range and quantity of goods and services available from the remaining forest. The comparison between Montreal's and CFC's sub-indicators showed that CFC's company did not fulfill the area and growing stock of plantations of native and exotic species in indicator 11 (Table 5). Therefore, the whole indicator in this area should be restudied by CFC Company (Table 6).

Table 6: The area and growing stock of plantations of native and exotic species

| Sub-indicators | Title of sub-Indicator 12 | Montreal's ref. | CFC's ref. | Quality Grade[a] |
|---|---|---|---|---|
| Subin.12.1 | Area of forest planting by forest type and species | 1 | 0 | D |
| Subin.12.2 | Area of tree planting by major geographic region (Specific period) | 1 | 0 | D |
| Subin.12.3 | Area of timber land plantations | 1 | 0 | D |
| Subin.12.4 | Area of timber planting by major geographic region (Specific period) | 1 | 0 | D |
| Total | | 4 | 0 | 4D |

Source: Indicator number 12 of Montreal Process Working Group 1998
[a] This assessment was graded based on area estimation by GIS

Indicator 13: Annual Removal of Wood Products Compared to the Volume Determined To Be Sustainable. This indicator compares net growth of growing stock with wood harvest (removals) of products on timber land. This method is frequently used to assess whether wood harvesting is reducing the total volume of trees on forest available for timber production. Growth is the net annual increase in the volume of growing stock between inventories after accounting for effects of mortality and before accounting for the effects of harvest. Removals measure the average annual volume of living trees harvested between inventories. Timber land is the subset of forest land on which some level of harvesting is potentially allowed. The volume of trees on timber land is considered sustainable as long as growth (net of mortality) exceeds removals. The comparison between Montreal's and CFC's sub-indicators showed that CFC's company fulfilled the annual removal of wood products compared to the volume determined to be sustainable in the indicator number 13 approximately 4 of 5 sub-indicators (Table 7). For the sub-indicator number 13.4 the grade D (Table 7) was evaluated base on data rating in table 3. There were two A graded in the sub-indicator number 13.1 and 13.5 because the growing stock by species group class and current removal by forest types were studied with the clear objectives (Table 7). Sub-indicators number 13.2 and 13.3 was graded as B because there are only two activities were studied (Table 7).

Table 7: Annual removal of wood products compared to the volume determined to be sustainable

| Sub-indicators | Title of sub-Indicator 13 | Montreal's ref. | CFC's ref. | Quality Grade[a] |
|---|---|---|---|---|
| Subin.13.1 | Historic growth and removals of growing stock by group class, dbh and species | 1 | 1 | A |
| Subin.13.2 | Net growth and removals of each forest type by year | 1 | 1 | B |
| Subin.13.3 | Potential Growth by forest type | 1 | 1 | B |
| Subin.13.4 | Current growth by forest type | 1 | 0 | D |
| Subin.13.5 | Current removals by forest type | 1 | 1 | A |
| Total | | 5 | 4 | 2A,2B,1D |

Source: Indicator number 13 of Montreal Process Working Group 1998
[a] This assessment was graded based on the three activities of (1) Data collection, (2) Data analysis or (3) Sustainable Forest Management (SFM) objective

Indicator 14: Annual Removal of Non-timber Forest Products Compared to the level determined to be sustainable. This indicator shows removal of non-timber forest products (NTFPs). As demand for these products grows, it becomes more important to monitor the products' flow and the effect of their removal on the viability of current and future forest ecosystems. Information is not currently available to compare the growth and removals of NTFPs to evaluate sustainable levels. The comparison between Montreal's and CFC's sub-indicators showed that CFC's company did not fulfilled the annual removal of non-timber forest products (NTFPs)

in indicator 14 (Table 8). Therefore, the whole indicator in this area should be restudied by CFC Company (Table 8).

Table 8: Annual removal of non-timber forest products (NTFPs)

| Sub-indicators | Title of sub-Indicator 14 | Montreal's ref. | CFC's ref. | Quality Gradea |
|---|---|---|---|---|
| Subin.14.1 | Popular use of medicinal plants, food and forage species | 1 | 0 | D |
| Subin.14.2 | Floral and horticultural species, resins and oils, | 1 | 0 | D |
| Subin.14.3 | Materials used for arts and crafts, and game animals and fur bearers. | 1 | 0 | D |
| Subin.14.4 | Annual periodic harvest of NTFPs | 1 | 0 | D |
| Total | | 4 | 0 | 4D |

Source: Indicator number 14 of Montreal Process Working Group 1998

[a] This assessment was graded based on the three activities of (1) Data collection, (2) Data analysis or (3) Sustainable Forest Management (SFM) objective

Table 9 summaries the comparison between Montreal's and CFC's 5 indicators in the whole Criterion 2. We found that CFC's plan accomplished only 3 indicators 85%, 29% and 80% in table 4, 5 and 6, respectively. Indicator 12 and 13 were remaining blank (Table 9). There were 14 sub-indicator graded as A, 3 sub-indicator were graded as B and 16 sub-indicators were graded as D (Table 9). There were 33 sub-indicators of Criterion 2 in Montreal and only 52% equivalents amount of 17 sub-indicators were fulfilled (Table 9).

Table 9: Summary of Criterion 2 of maintenance of the productive capacity of forest ecosystems

| Indicator number | Title of indicators | Montreal's | CFC's | CFC's (%) | Quality Grade |
|---|---|---|---|---|---|
| 10 | Area of forest land and net area of forest land available for timber production | 13 | 11 | 85 | 11 A, 2D |
| 11 | Total growing stock of both merchantable and non-merchantable tree species on forest land available for timber production | 7 | 2 | 29 | 1A,1B, 5D |
| 12 | The area and growing stock of plantations of native and exotic species | 4 | 0 | 0 | 4D |
| 13 | Annual removal of wood products compared to the volume determined to be sustainable | 5 | 4 | 80 | 2A, 2B, 1D |
| 14 | Annual Removal of Non-timber Forest Products (NTFPs) | 4 | 0 | 0 | 4D |
| Total Fulfillments | | 33 | 17 | 52 | 14A, 3B, 16D |

Source: Criterion number 2 of Montreal Process Working Group 1998

The Montreal Process provides little guidance for defining annul allowable cut although the information that is available largely addresses sustainable forest management. The various technical notes on the subject refer to biodiversity generically. They stress the need to assess using quantitative and qualitative

information of the trends on the status of maintenance of the productive capacity of forest ecosystems. Little guidance is available for which scales need to be considered other than general direction to deal with national, regional, and local concerns. No guidance is provided for how to scale annual allowable cut information upward to broader spatial scales.

However, this study found that only 52% of Criterion number 2 was accomplished. We found that 48% of management indicators were not in the plan yet. Whenever the CFC's master plan will be approved, this estimation forecasted that indicator number 11, 12 and 14 will be endangered to the forest area of CFC Company. We suggested that growing stock of plantation and NTFPs have made the forest management into terrible condition because the forest area in CFC Company was mainly studied on the timber production.

## 4. Conclusion

The analysis of trade data goes beyond direct measurement of Montreal Criterion number 2 and each sub-indicator of indicator number 10, 11, 12, 13 and 14. It is difficult to assess whether a 25-year sustainable forest management plan will fully support sustainable forest management if measures such as the conserved forest, annual growth rate and NTFPs are not provided. Many of the current analytical approaches are designed to reflect, forest area and annual allowable cut on aggregate levels. 5 Indicators attempt to address the links among land management, the flow of growing stock, and plantation. In that sense it reflects the current scientific thinking of forest growth and harvesting rate. This study recommends to not approving this company to proceed to cut forest because the growth rate of this area is not studied yet.

Sustainability is a human value, not a fixed, independent state of social, economic, and ecological affairs. As such it is not an 'absolute' because it is dependent on social values and involves multiple dimensions and scales, including those of time and space. At the concession scale, a concession's concept of sustainability may be influenced by broad scale perspectives such as general trends in concessionaire's environmental conditions, concession social or institutional issues or the balance with other national priorities. At the concession scale, the criteria and indicators will focus on eco-regional conditions, provincial economies and program effectiveness. At the concession scale, conceptions of sustainability will vary from stakeholder to stakeholder and will vary with unique forest conditions, the importance of forest in the traditions and economies of the area, and the nature and type of land ownership. While at each scale and for each property owner or manager the land management objectives may vary, collectively their individual actions contribute to sustainability. For instance, the indicator number 14, which is mainly about the NTFPs,

concessionaires may not need to use this information in their plan because of economic conditions. Regardless of the scale at which they are applied, however, Montreal criteria and indicator frameworks must be flexible and adaptable over time. As society's values around sustainability change over time, criteria and indicators frameworks will need periodic revision to ensure that they continue to accurately and efficiently report on progress towards concession sustainable forest management for timber production. For the indicator number 12, which is mainly about the growing stock of plantation of native and exotic species, concessionaires may need this in the plan when the commercial forest area is not enough for the current production.

Montreal criteria and indicators programs represent complementary tools that can be used to show progress towards sustainability and there is no information regard to monitoring. Each tool helps answer a set of questions unique to that scale and provides feedback for different kinds of purposes and decisions at other scales. Monitoring on illegal logging and reduce impact logging should be mentioned in the standard criteria and indicator in order for the manager to conduct and follow. Managing for sustainability requires thinking across all indicators of criterion 2, but monitoring and assessing sustainability must be based on the recognition that different questions and different methods are appropriate for different indicator. There is clear philosophical overlap and interdependence between the concession and Montreal indicators sustainability monitoring initiatives although the purposes, tools, and approaches are by intent different and therefore not easily translated one to the other.

The CFC Company is not alone in facing the challenge of sustainable renewable resource management. Problems such as illegal logging by arm group, population growth, conflicting resource uses and subdivision of open spaces confront most of the other concessions that are employing criteria and indicators. Using criteria and indicators to assess and monitor forest conditions can aid in addressing these problems, but further action is necessary to effectively influence policies and decisions to achieve sustainable management of renewable resources. Cambodia must also integrate the information derived from the use of criteria and indicators into the development and implementation of the national forest programs.

The policy statement should include an overall company goal and the willingness to : maintain long term productivity, maintain environmental and social- economic quality, sustain economic returns, work in compliance with laws and internationally recognized criteria for sustainable forest management, conduct regular monitoring, match downstream processing and forest production and formulate detailed management objectives derived from the policy statement. Defining management objectives is a key element of strategic planning.

The results of this study on assessment of forest concession in Cambodia are applicable for tropical forest management. The assessment was more accurate using

a forest concession planning and the Montreal. Because the sustainable forest management remedies are based on specific knowledge of criteria and indicators, our results may be useful for the future establishment and management of sustainable yields in tropical forests.

## 5. Acknowledgements

We thank anonymous reviewers and editor for their readable comments and suggestions. This work was supported by a Japan International Cooperation Agency (JICA) JDS No: 0385507. This work is in partial fulfillment for advanced forest management research from Kyushu University, Japan.

## References

**Anonymous (1995)**: Sustaining the world's forests: the Santiago Agreement. Journal of Forestry. **93**: 18-21

**CFC ( 2004)** : 25- year strategic sustainable forest management plan. Forest Administration, Phnom Penh, Cambodia. 235pp

**Cambodia Timber Industrial Association (CTIA). Kao D. (2004)**: Consolidated Environmental and Social Impact Assessment as Integral Part of the Strategic Forest Management Plan for Preah Vihear Forest Concession of Cambodia Cherndar Plywood Mfg. Co., Ltd., Forest Administration, MAFF and MoE, Phnom Penh, Cambodia 150pp

**FA (2000)**: Forest Concession Management Planning Manual. Forest Administration, Phnom Penh, Cambodia

**FA (2003)**: Cambodian forest statistics to 2002. Forest Administration, Phnom Penh, Cambodia

**FAO (2001)**: Forest Resources Assessment 2000. FAO Forestry Paper No. 140. UN Food and Agriculture Organization, Rome.

**Hobbs R.J. (2003)**: Challenges and opportunities in integrating ecological knowledge across scales. Forest Ecology and Management **181**: 223-238

**Hodge T. (1997)**: Toward a conceptual framework for assessing progress toward sustainability. Social Indicators Research. **40:** 5-98

**Kao D. (2004)**: Current situation of forest concession management in Cambodia. Annual report for Kyushu University of Forests 2004, 41-44

**Kim Phat N. Ouk S. Uozumi Y. and Ueki T. (2002)**: Management of mix forest in Cambodia- - A case study in Sandan District, Kampong Thom. J. Fac. Agriculture. 38, 45-54.

**Kim Phat N. Knorr W. and Kim S. (2004)**: Appropriate measures for conservation of terrestrial carbon stocks-Analysis of trends of forest management in Southeast Asia. Forest Ecology and Management **191**: 283-299.

**Kohsaka R. and Flitner M. (2004)**: Exploring forest aesthetics using forestry photo contests: case studies examining Japanese and German public preferences, Forest Policy and Economics **6**: 289-299

**Montreal Process Working Group (1998)**: The Montreal Process. http://www.mpci.org. (January 9, 2002)

**Top N. Mizoue N. Kai S. (2004)**: Estimating forest biomass increment based on permanent sample plots in relation to woodfuel consumption: A case study in Kampong Thom Province, Cambodia. Journal of Forest Research 9, 117-123

**UNCED ( 1992)** : Framework Convention on Climate Change. United Nations, Washington, DC.

**United States Agency for International Development- USAID (2004)**: Foreign Assistance act section 118 report: Tropical Forests. USAID report to congress fiscal year 2003. United States Agency for International Development Washington, D.C. 2052

**USDA (2002)**: Source book on Criteria and Indicators of Forest Sustainability in the northeastern areas. USDA Forest Service Northeastern Area State and Private Forestry. 11 Campus Boulevard, Suite 200 Newtown Square, PA 19073. NA-TP-03-02. 39pp

**World Commission on Environment and Development -WCED (1987)**: Our common future report of the World Commission on Environment and Development. London: Oxford University Press

## モントリオールプロセスを基準にしたカンボジアのコンセッション型林業経営の評価

Kao Dana、飯田　繁，井上　晋，大賀祥治

## 要　旨

森林伐採が生態系の回復過程とマッチしない規模であるため，森林の破壊・細分化がもたらされている．熱帯林は1990年代においても毎年1,420万haの規模で減少が続いており，発展途上国では2000年の場合，森林のわずか5.5%しか計画的な管理が実施されていない．カンボジアの森林は，世界の熱帯林の一部を構成しているが，道路建設，木材生産，鉱業生産，農業開発などで過去30年間にわたり毎年0.6%の割合で森林が減少してきた．そこで本稿では，カンボジアにおけるコンセッション経営の問題点を明らかにする．

問題点は，CFC林業会社から得たデータとモントリオールプロセスで示された基準との比較によって明らかにされ，評価される．評価基準は同プロセスの基準２（指標10～14: 森林生産力の維持）であり，評価対象は，カンボジアのコンセッション型林業経営で実施している輪伐期25年の管理基準である．モントリオールプロセスの基準２は33の指標に分かれているが，コンセッションでは，その内17指標についてのみ記録されている．３指標についてはコンセッションの管理計画にも入っていない．また，今回の調査では植林木の成長状況や非木質林産物についての調査が欠けているという問題もあった．

今回の調査結果は，カンボジアにおける熱帯林の管理に有益であり，コンセッションの林業計画やモントリオールプロセスの評価基準や指標の改善に有益である．

**キーワード**：カンボジア，持続的森林経営，基準と指標，規模，コンセッション

(Recievel to December 2004 ; Acceptecl 25 Fenruary 2005)