



## Planning of the Sustainable Slash-and-Burn Cultivation Programme in Koli National Park, Finland

### 1. Preface

The ancient slash-and-burn cultivation has played a very important role in the history of human life and the human impact on forest ecosystems in Finland. According to pollen analysis, slash-and-burn agriculture started in eastern Finland about 2000 years ago. About 4,000,000 hectares of forest land had been estimated to be affected by the slash-and-burn agriculture by the end of 20<sup>th</sup> century (Heikinheimo 1915).

Although the slash-and-burn agriculture diminished at the end of 19<sup>th</sup> century and stopped totally during the 1940s, many signs of the slash-and-burn activities can still be found in Finland's forests. Eastern Finland was one of the last relict areas where the slash-and-burn agriculture was kept alive in Europe. In Koli National Park, there are still many deciduous mixed forests and slash-and-burn meadows (in Finnish: *aho*) which are standing on previously burned sites. In addition, there are stone constructions related to slash-and-burn culture still visible in the old slash-and-burn sites.



**Figure 1.** Study area: Koli National Park in eastern Finland.

Koli National Park was established in 1991. At that time, the restoration of slash-and-burn culture and landscapes created by the slash-and-burn agriculture was identified as one of the main tasks of the national park. This mission was designated by the Finnish parliament in the form of law. Since the year 1994, every year a small area ranging from 0.3 to 2.5 ha of forest has been cut down and burned and cultivated according to the traditional methods. So far more than 5 hectares have been managed by the slash-and-burn practices. In the future, the slash-and-burn activities will be extended in the national park to up to 150 hectares.

### 2. Objectives of the study

The objective of the study is to analyse the dimensions of sustainability in the slash-and-burn agriculture and to produce information for making long term strategic decisions on the slash-and-burn

cultivation. The aim of the study is also to identify possible criteria for the social sustainability approach in connection to the slash-and-burn agriculture and the interest of different groups of stakeholders of the national park. The operative outcome of the study will be a plan including sustainable slash-and-burn programmes for two heritage farms in the park for the next 50 years.

### **3. Methods**

#### **3.1 Introduction**

Information on the detailed goals for the slash-and-burn programme and the economical, ecological and social impacts of the management is insufficient at the beginning of the project. However, more information would be gained during the project by data analyses and goal surveys. Consequently, a heuristic dynamic planning approach is used in this study. The basic principles of the planning method are: holistic thinking, openness for changes, selection of the forests suitable for slash-and-burn agriculture according to the biological, social and economical criteria in co-operation with the interest groups, the simulation of development of forests for the whole management cycle during the planning process and stepwise selection of the forests which will be managed by the slash-and-burn activities operatively every year.

#### **3.2 Steps of the planning method**

##### **3.2.1 Goal surveys**

A master plan for the next ten years has been prepared by a steering committee in Koli National Park. The steering committee is represented by all important interest groups of the national park. At the beginning of developing the project master plan opinions and objectives concerning slash-and-burn management were identified by a questionnaire.

##### **3.2.2 Identification of the borders of slash-and-burn zones**

The steering committee defined two special land use management zones; the natural zone and the cultural zone. The slash-and-burn activities will be done mainly inside the borders of the cultural zone. The potential sites for slash and burn were defined on the basis of information concerning the land-use history, soil properties, the location of special key biotopes and old-growth forests and the location of old heritage farms, which will act as information and education centres for the local back-forest peasant heritage.

##### **3.2.3 Selection of forests suitable for slash-and-burn cultivation**

During the 19<sup>th</sup> century (actual slash-and-burn time) the slash-and-burn sites were selected according to their distance to the dwellings and their capacity to produce crops. In addition, it was important to consider the properties of the forest, which affected to the workload needed for the slash-and-burn activities.

Today the motives are totally different. The crops are not most important products of the slash-and-burn cultivation anymore. Today it is more important to produce heritage in landscape, environment for endangered fire- and meadows-oriented species, and information on cultural heritage for pupils, students and tourists, for instance. This is why the steering committee evaluated different qualities of forests in order to find the best selection for the forests for slash-and-burn cultivation. The qualities were related to slash-and-burn history (gained from past inventories), topography, soil, age of the forests, and location in relation to heritage dwellings and lakes. At this step the costs of the slash-and-burn activities or the volume of the forest timber were not yet involved in the planning.

Since the slash-and-burn cultivation requires a lot of resources, it was clear that only small part of the national park can be managed by using this activity. Thus, only the areas inside the cultural zone and some man-made forests on the natural zone were selected to the further planning.

The answers of the steering committee were guiding the planning process; the unfavourable sites, like high priority old growth forests and mixed forests with high biodiversity, were excluded completely from the further planning process. Further, a special rank-value for every site was calculated according to the goals and their importance expressed by the steering committee. The ranking scale was between

0 to 12. All stands which had better value than 5 were selected to the next step of the planning process, which gave up about 200 hectares more or less favourable sites for management.



**Figure 2.** Fire in a slash-and-burn in Koli National Park in 1994. Photo: Metla – Ismo Hyttinen



**Figure 3.** Rye grows in the ash and humus mixture of boreal spruce (*Picea abies*) forest after slash and burn in Koli National Park in 1999. Photo: Metla – Lasse Loven.



### **3.2.4 Planning of the sustainable slash-and-burn programme**

The slash-and-burn agriculture requires a lot of work and other resources. The market value of timber and labour can be taken into account when calculating the total financial consequences of the slash-and-burn programme and the optimal schedule for management activities.

The goal of Koli National Park management is to develop a slash-and-burn programme which will not have any negative consequences for national park's biodiversity (ecological sustainability). Another goal was to make it possible to practise different slash-and-burn methods continuously in co-operation with the local people (social sustainability). Under these restrictions, the slash-and-burn programme should be financially as cost-effective as possible.

In order to analyse the economical results of different slash-and-burn programmes, a special calculation system was created. The name of the systems is KALA and it is based on the Excel programme. The KALA calculates the year when the forest can be technically and economically burned. The forest must contain a certain amount of biomass (about 60-80 m<sup>3</sup>/ha) to produce ash in fire until it is ripe to be burned. The system produces also a suggestion on the method which could be used on slash-and-burn of a certain forest. In addition, the system calculates how much timber could be taken out from the slash-and-burn site for some other economical use. Finally KALA calculates the margin profit and the net present value of the slash-and-burn programme.

### **3.3 Preliminary results**

The aim of the study was to create a slash-and-burn programme for Koli National Park for the next 50 years with 5 sub-periods in 10 years intervals. The selection of the stands was made in the middle of each sub-period. The development of the forests was simulated to the middle of each sub-period by a forest stand simulator called METKA. After simulations, the simulated data was transformed into KALA-system. The final selection of sites, which had ecologically and socially equal and favourable potential for slash-and-burn, was made on basis of the margin profit (positive or negative) criteria.

The KALA-system calculates different parameters concerning the management programmes. They include area of the slash-and-burn programme, volume of the stands, costs and incomes of the programme, net present value of the programme etc. By comparison of two separate programmes it is possible to draw conclusion about the facts which affect the profitability of the programme, for instance. In addition, the slash-and-burn programmes will be visually analysed by using the MapInfo 6.0 programme. Finally, the areas which will be under continuous slash-and-burn rotation and the areas which will only once be burned will be identified.

## **4. Discussion**

The planning of sustainable slash-and-burn programme is very challenging planning problem. The national parks have many tasks, some of which are exclusive. The method used in this study can not create a fully optimal comprehensive management programmes, but it offers many advantages. First, the programme created by this method takes into account the goals and objectives of the most important interest groups of the national park. Second, it pays attention both the ecological, economical and social dimensions of sustainability. The ecological aspects are playing most important role, since the most of the forests were excluded from the programme due to ecological reasons. Participatory planning was part of social sustainability. The economical aspects were taken into account when choosing the final program after the ecological and social criteria were fulfilled.

The sustainable slash-and-burn plan shall be tested in the practical operations in Koli National Park during next 50 years. The environmental effects of the management, like the impact on flora, insects, fungi and soil shall be monitored and reported. The ancient swidden fires have returned as a living heritage to the boreal forests-hill landscape of in Koli National Park, Finland.

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