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IMPACTS FROM TAPPING OLEORESIN FROM *DIPTEROCARPUS ALATUS* ON TREES AND TIMBER VALUE IN LAO P.D.R.

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Ankarfjärd Renée (Department of Systems Ecology, Stockholm University, s-106 91 Stockholm, Sweden). IMPACTS FROM TAPPING OLEORESIN FROM *DIPTEROCARPUS ALATUS* ON TREES AND TIMBER VALUE IN LAO P.D.R.
In Laos *Dipterocarpus alatus* is both an important timber species as well as important for the oleoresin. Currently there is a ban on commercial tapping in Laos, due to a fear that tapping is unsustainable and environmentally destructive. This study assesses the impact of tapping on the physical condition of trees in a Lao village and also the effects of tapping on the timber from tapped trees. The tappers' skill is very important for the condition of the trees. Seven tappers out of 25 are responsible for 78% of the negatively affected trees. Old trees and trees with large tapping holes are in worse condition. Tapping does not influence the value of timber, but the wood from tapped trees is drier. It is therefore easier to handle at sawmills, but looses durability. With a good technique and a regulated outtake, it is probable that tapping can be a sustainable activity. Ways to reduce the risk of over-tapping and damage to trees are to learn from experienced tappers, to regulate the cutting of tapping holes and to relate the Lao sales quota system directly to the state of the resource.

L'IMPACT D'EXTRACTION D'OLÉORÉSIN DU *DIPTEROCARPUS ALATUS* SUR LES ARBRES ET LE VALEUR DU BOIS DANS LAO P.D.R. Au Laos *Dipterocarpus alatus* est une arbre importante pour son bois aussi que pour l'oléorésine. Actuellement il y a une interdiction d'exploitation commerciale d'oléorésine au Laos, à cause d'une crainte que l'extraction est insoutenable et destructive pour l'environnement. Cette étude évalue l'impact de l'extraction sur l'état physique des arbres dans un village du Laos et aussi les effets sur le bois. La compétence des extracteurs est très important pour l'état des arbres. Sept extracteurs d'un total de 25 sont responsables pour 78% des arbres endommagés. Les vieux arbres et les arbres avec des trous grands sont les plus affectés. L'extraction d'oléorésin n'influence pas la valeur du bois, mais le bois devient plus sec. Le bois est donc plus facile à travailler aux scierie, mais il perd de longévité. Avec une bonne technique et une exploitation reglée, il est probable que l'extraction puisse être une activité soutenable. Pour réduire le risque d'exploitation excessive et les dommages aux arbres, on devrait propager la téchnique des extracteurs expérimentés, régler le découpage des trous d'extraction et relier le système de quote-part de ventes du Lao directement avec l'état de la ressource.

Key Words: Dipterocarpaceae; *Dipterocarpus alatus*; oleoresin; non-timber forest product; Laos

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TAPPING AND USE OF OLEORESIN IN LAO P.D.R.

Tapping trees for resins has a long tradition in Southeast Asia. Several species of the family *Dipterocarpaceae* are used. The traditional tapping practice implies cutting a hole into the trunk and using fire to stimulate a continuing flow. This tapping method is described by

Gianno (1990) and in Ankarfjärd and Kegl (1998). In Laos the species used is *Dipterocarpus alatus* Roxb. ex G. Don, a large-growing tree found in Thailand, Laos, Burma, Cambodia and Vietnam (Smitinand 1989). *D. alatus* produces an oleoresin, i.e. a resin associated with an essential oil. Traditionally the oleoresin is used for lighting and for caulking boats and baskets. It is also used in paints, lacquers and varnishes (Foppes and Kethpanh 1997*). D. alatus* is also a species important for it's timber, which is mainly used for construction purposes and as railway sleepers (Collins et al. 1991). Timber represents an important part of Lao export value. In 1996 it amounted to 64.5 million US$ or 38% of total exports. The export value of non-timber forest products (NTFPs) the same year was 4.3 million US$ (Foppes and Kethpanh 1997). In Laos the forest and the timber is State owned, while local people have use rights (Mossberg 1990). The principle of "family economic necessity" exempt extraction of NTFPs from any regulation when it is motivated by economic need for subsistence (Enfield 1998).

In Laos quotas given by the Provincial Forestry Departments to export companies regulate trade in NTFPs. In theory the quotas are based on the state of the resource and on experience obtained from local people. In practice this knowledge does not appear to be used however and information on the decision process is difficult to obtain (Enfield 1998). Tapping oleoresin for commercial purposes, is currently prohibited in Laos due to governmental concern that tapping is unsustainable and damaging to the trees. It is not clear on which facts this decision was based (Foppes pers. com.). Literature related to tapping oleoresin unanimously claim that it can go on for a very long time (50-80 years) without killing the trees (Crevost 1926, Enfield 1998, Foppes and Kethpanh 1997, Gianno 1990, Smitinand 1989). They all seem to rely on information obtained from local people. Lao oleoresin has been exported mainly to Thailand. The export volume increased between 1994 and 1996, despite the 1996 quota restrictions. This is explained by the import of oleoresin from Cambodia, which is re-exported to Thailand (Enfield 1998).

The tapping of dipterocarp trees for oleoresin has not received much attention in the research community despite its commonness in Southeast Asia. Only a handful of references have been found describing this activity (Crevost 1926, Gianno 1990, Howes 1949, Smitinand et al. 1990). One important aspect of tapping, the sustainability, has so far been absent in the available literature. In this study I assess the impact of tapping on the physical condition of tapped trees in a Lao village and also the effects of tapping on the timber from tapped trees.

MATERIALS AND METHODS

Site description

Fieldwork was carried out in Savannaketh province in Lao P.D.R. during November through March 1993/94 and in April-May 1998. Tree-measurements were made in Dong Kapho State Production Forest, Phin District, near Ban Nathong village (105°30'84"E, 16°40'36"N, 200 m a.s.l.). Interviews were made in Ban Nathong and at eight sawmills in Savannaketh Province.

The area has a tropical monsoon climate with distinct wet (May-September) and dry (October-April) seasons. The forest is mainly mixed deciduous with elements of dry evergreen forest. In Dong Kapho tapping of oleoresin from *D. alatus* used to be a common practice and an important source of cash income for many villagers (Anonymous 1993, Ankarfjärd and Kegl 1998). Savannaketh town is the second largest town in Laos with 124,000 inhabitants. The location on the banks of the Mekong River just opposite the Thai city Mukhdahan, makes it an important trading point for products to and from Thailand. There are currently six sawmills operating in the town. Before the oleoresin ban there used to be five export-companies buying oleoresin from intermediaries for export to Thailand (Houmpheng pers.comm.).

Interviews

In 1993/94 interviews were made with 25 tappers in Ban Nathong. These were randomly selected within different economic levels based on a survey of the wealth of all families in the village, measured as self-sufficiency in rice. The initial work in Ban Nathong focused on three main topics, the importance of oleoresin in the family economy, tapping techniques and the tenure system. The results are presented in Ankarfjärd and Kegl (1998). In 1998 a new set of interviews were made with 18 of the 25 selected families. Eight families owning 38 trees were absent from the village and could not be interviewed.

In 1998 owners and/or employees at eight sawmills in Savannaketh Province were interviewed concerning their experiences of timber from tapped trees. Aspects covered were quality, value and losses due to tapping. All interviews were semi-structured and open-ended.

Data on trees

In 1993/94 every tapped tree owned by the 25 selected families was measured (N=312), with respect to diameter at breast height (DBH) and the volume (dm^3) of the tapping holes was calculated. For the analysis the trees are divided into 20-percentile DBH-classes. The distribution is 45-67cm, 67-84cm, 85-98cm, 98-127cm and 127-223cm. The physical condition of the trees was classified according to the following criteria; wood and bark fairly intact above tapping hole (1), bark burnt above tapping hole but wood intact (2), dead branches and/or wood severely burnt above tapping hole (3), tree dying (4). Growth rings were analyzed on sawn logs from tapped *D. alatus* trees at the sawmills and at a deposit close to Ban Nathong.

EFFECTS OF TAPPING: RESULTS AND DISCUSSION

Physical condition of tapped trees

The most obvious injuries suffered by the trees are the tapping holes. When a hole ceases to yield oleoresin a new hole is cut and the old one is abandoned. The examined trees had one to five holes with only one being actively tapped. Old holes slowly heal. Large tapped trees usually have a higher number of holes, as well as larger ones, compared to smaller tapped trees (Fig.1). This is a natural consequence of the fact that they start tapping the trees at a DBH of around 50 cm and continue to tap them for several decades. Through repeated burning the active holes get successively larger.

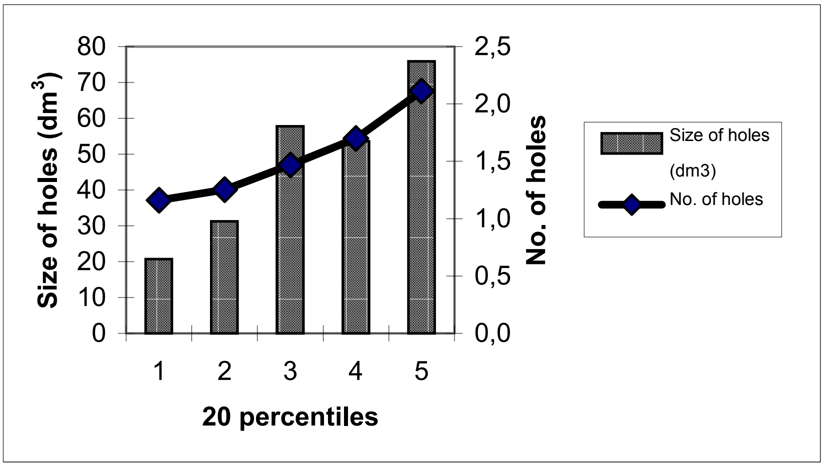

Fig. 1. Average size of tapping holes, dm^3 (bars) and average number of tapping holes (line) in relation to size-classes.

When looking at the physical condition of the tapped trees (Fig. 2), there is a decreasing number of unaffected individuals with increasing size, while the number of affected trees instead increases among the larger trees. Trees in bad condition (3) are very few (N=6) in all size classes. Only one tapped tree was considered dying.

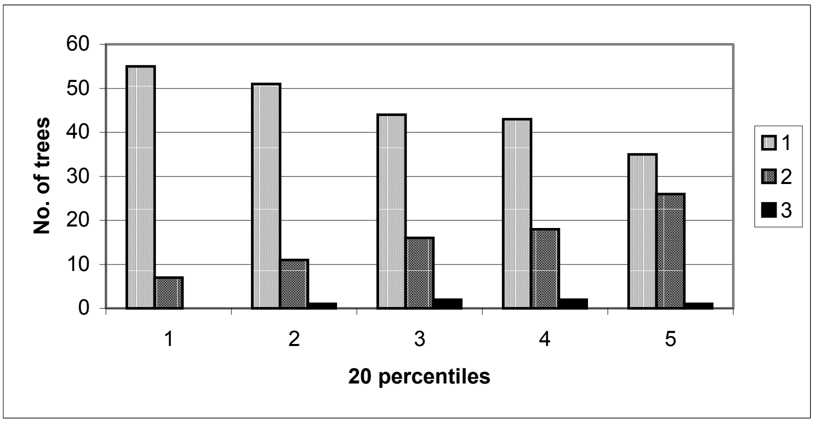

Fig. 2. Distribution of trees according to physical condition (1, 2, 3) in different size-classes.

To what extent the decreasing vigor can be blamed on tapping is difficult to say, since no untapped reference group could be studied. If the condition is compared within each size group the results are similar (Fig. 3).

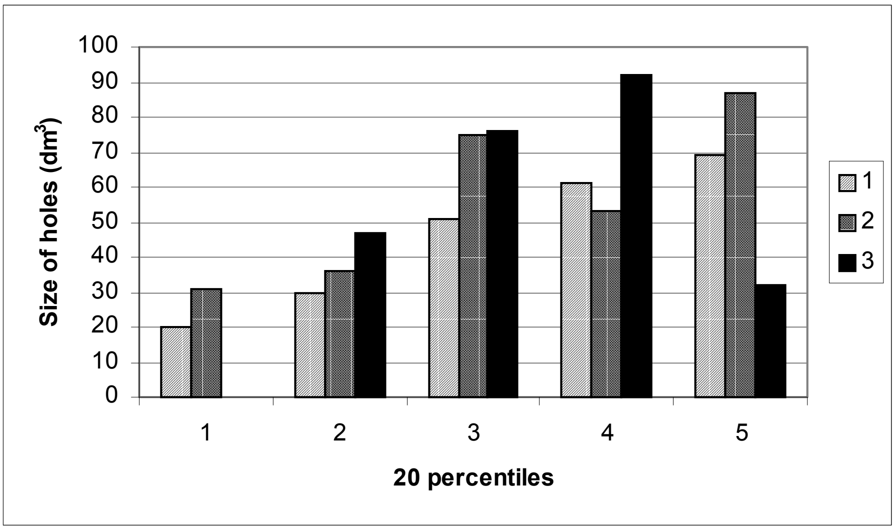

Fig. 3. Condition of trees (1, 2, 3) in relation to size of holes (bars) within size classes.

The tappers themselves claim trees loose their health rather because of old age than because of tapping, which could explain why trees in bad condition have the smallest holes in the last percentile. Still one must remember that only six trees represent this category. It can however be seen that trees may have quite large holes and still be in good vigor. It is clear that tapping skills differ among the tappers. The six most damaged trees belonged to two of the tappers and 78% of the slightly affected trees were owned by seven of the 25 families. Careless handling of fire caused most injuries. This could easily be avoided by a better technique.

In 1989 businessmen wanting to buy oleoresin approached the village. This initiated more villagers to tapping trees. Also tappers increased their number of trees. Only one third of the examined trees that were currently tapped in 1994 were tapped before 1989. I had suspected that new tappers might not be as skilled in tapping as the more experienced ones, but this was only slightly confirmed by the results (Table. 1). One limitation that could influence the results is that the tappers could only account for how many years their own family had used the tree. In many cases trees had formerly been tapped by others and then been abandoned.

TABLE.1 DBH, NUMBER OF HOLES AND CONDITION OF TREES TAPPED BY PRESENT TAPPER < AND > 5 YRS (SD = STANDARD DEVIATION).

No. of years tapped	**DBH (SD)**	**No. of holes (SD)**	**Condition (SD)**
< 5 years (N=210)	88.6 (±27.9)	1.3 (±0.6)	1.2 (±0.4)
> 5 years (N=100)	114.4 (±35.4)	1.9 (±0.6)	1.4 (±0.6)

Growth rate

In tropical moist forests trees do not usually have growth rings, but in areas with a pronounced annual dry season, like in Savannakhet Province, trees have such rings (Killmann and Hong 1995). For *D. alatus* in Phin District distinct rings were visible on fresh cuts. On cuts that were not fresh a whitish coat covered the surface, possibly of resinous origin. According to these rings the following relationship between DBH and age was found; 135 cm - 124 years, 170 cm -165 years and 75 cm – 65 years. Thus the average growth of tapped *D. alatus* in this area is 1.10 cm per year. No differences in ring thickness could be detected before and after the tapping was initiated. No logs from untapped trees were available here, but comparing to growth estimates made in different studies for untapped *D. alatus* trees in northern Thailand all but one are 1-4% higher than for the tapped trees in Phin. The following estimates were obtained; 0.80 cm (plantation), 1.44 cm (plantation), 1.35 cm (plantation), 1.57 cm (arboretum) and 1.24 cm (along a road in Chiangmai) (Table 11. in Pooma 1996). However, the differences in climate between these places and Phin are probably too large to allow any conclusions about the impact of tapping on growth. For example the total annual rainfall in Phin is nearly twice that in Chiangmai. Also the difference between wet and dry seasons is not as pronounced in Chiangmai as in Phin (Anonymous 1993, Pooma 1996). In Phin trees are under water stress for several months which could explain a slightly lower growth-rate.

Other possible effects of oleoresin tapping

Breaking by wind - During the five years that passed between my visits to Ban Nathong, 1993-1998, 16 tapped trees had died, which gives a mortality rate for adult trees of about 1% annually, which is not particularly alarming. The causes for death mentioned by the tappers were breaking by wind or old age. It seems reasonable that tapping-holes can cause a reduced strength in the trunk against the wind. The question is to what extent. It is not only the physical holes that need consideration here, but also if tapping oleoresin also makes the wood brittle.

Insect attacks - Oleoresin has insect repelling properties (Howes 1949). As tapping makes the wood drier it might also reduce the tree's resistance to insects. Pooma (1996) found that termites were responsible for the majority of insect attacks on D. alatus in Chiang Mai. One of the sawmill owners in Savannketh stated that the tapping holes do open up the wood for termites. Resins have the potential to function as a physical barrier to possible pathogen infections and also to function as a chemical defense (Guarigata and Gilbert 1996). Terpenoids from dipterocarps have been shown to act as a defense against termites (Messer et al. 1990).

Reproductive capacity and stress - Another possible effect of tapping, is that the reproductive capacity might be negatively affected**.** Both fire and enhanced oleoresin flow ought to be stressful for the trees, but how this is manifested is not clear.

Timber value

The price paid at sawmills for *D. alatus* logs was between 50 and 150 US $ per cubic meter in 1998, depending on quality (A, B and C). No sawmill owner or worker perceived tapping as a problem regarding the quality of the timber. Instead it has the positive effect that the wood is drier and therefore easier to process. On the negative side tapping reduces the durability of the timber, so that it needs coating when used for outdoor purposes. Another consequence is that logs need to be taken to the sawmills not too long after logging. When stored in open air the natural durability of the timber from *D. alatus* is 1-10 years, with an average of 4.3 years (Wing-Chong 1990). If tapped, the logs have to be processed within a few months up to a year. The conclusion is that tapping does not affect the price since the customers cannot tell the difference between tapped and untapped wood.

Two of the owners mentioned that insect attacks were more of a problem, which they related to the elapse of time between logging and processing, rather than tapping. One owner told that the most serious and costly problem he had, was metal pieces from bombs felled during the Vietnam War. These had destroyed the saw several times.

Losses of timber

Normally around 70% of the logs can be sawn into planks. Only one sawmill owner told that an additional 10% of the logs from tapped trees are wasted. None of the 15-20 logs from tapped trees we examined had any internal wood damages like signs of decay or rot. All the injuries were confined solely to the tapping hole. The location of the holes influences the possible outtake of planks. The initial hole is usually placed at about one meter above ground, a convenient height for collecting the oleoresin (Ankarfjärd and Kegl 1998). Since the cutting of the trees occurs at the same level (if made by hand as in Ban Nathong) the timber loss is limited. However, because additional holes often are cut higher up and/or at the opposite side of the trunk more of the timber is damaged. One could avoid cutting more than one hole or place all holes on the same side of the trunk or on the opposite side but below one meter.

CONCLUSIONS

The future of oleoresin tapping in Laos depends upon three things, the timber market, the market for oleoresin and whether tapping proves to be a sustainable activity or not. Assessing prospects for marketing is beyond the scope of this study, but research in this area is essential. Many facts speak in favor of the traditional way of tapping; the good physical condition of tapped trees, evidence of continued growth after tapping has been initiated, the great number of statements that tapping can go on for a very long time and that it is possible to make use of the timber even after many years of tapping. One conclusion that remains from Ankarfjärd and Kegl (1998) is that the handling of fire needs to be controlled in a better way by some tappers. The concentration of affected trees to specific tappers indicates differences in tapping technique, which could be helped by improving tapping skills. Still the majority of tappers are good tappers possessing knowledge that is of use in managing this resource. Regarding the use of the timber from tapped trees the location of holes could be regulated in order to minimize possible wastes of wood. A regulation of the cutting of holes could also help in limiting risks of damaging trees.

Ending commercial tapping might not have the desired effect of avoiding unsustainable use of trees. It is very important to consider what the consequences are. As long as the *D. alatus* trees have a value as oleoresin producers and source of long-term cash income to local people there is an incentive to keep them. If this opportunity is taken away people will look for other opportunities to replace this source of cash income. There is a possible risk that there will be an increase of illegal activities like hunting and marketing of endangered wildlife and illegal logging. There are indications that this is already taking place (Ryberg and Skagerfält pers. comm.). It is important that analysis of possible consequences precede decisions that to a large extent affect the livelihood of forest depending people, in order to avoid unexpected negative effects.

One step towards avoiding overexploitation of oleoresin would be to modify the quota system, to be directly related to the state of the resource. An idea is to give quotas to villages rather than to export companies. This “village-quota” should be based on the density of *D. alatus* in the village forest and an annual production rate of 20L/tree (Ankarfjärd and Kegl 1998). A continued utilization of 60-70% of the trees with a DBH over 50 cm could be maintained at least until the effects of tapping on regeneration is known. Village-quotas would also put tappers in a better bargaining position.

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