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Illegal rum production threatens health of lemur populations at Tsinjoarivo, eastern central Madagascar: Brief report and request for information

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Introduction

Many of the pressures faced by lemur populations are global issues affecting primates worldwide. All human societies, to varying degrees, are converting land from natural states to modified food-producing states. This conversion of primary forest threatens biodiversity in rural populations throughout the world. The hunger of the developed world for tropical hardwood lumber has also reached across all continents, and this commercial logging continues to impact tropical forest ecosystems. Even hunting is relatively global, although mediated by differing cultural beliefs and practices, hunting is a major threat in at least certain parts of all tropical continents.

In contrast, other human activities threatening forests are of a more local character and for this reason are more difficult to predict or detect. However, these locally unique threats can be equally or more detrimental than more commonly-recognized threats.

Rum is a very important part of Malagasy rural and urban culture. Although commercially-produced rum ("toaka") is available, most consumers buy the illegal "toaka gasy" produced by individuals in rural areas. Toaka gasy is produced to various degrees throughout the island but eastern central Madagascar is known as an area of very high production (Irwin 2000 et al.; S. Lehman pers. comm.), and rum from this region has a strong reputation for good quality and taste. Similar larger-scale production is known from the Masoala peninsula (Vasey 1997, pers. comm.).

At Tsinjoarivo, very little of the locally-produced rum is consumed locally; large quantities of toaka gasy are sold to wholesalers who transport it to Antananarivo and other urban centres for sale. Entering the commercial scale of production is potentially dangerous in that any ecological and environmental impacts of this activity will be amplified. Here we provide a preliminary report of the effects of illegal rum production on the rainforest community at Tsinjoarivo, eastern Central Madagascar. Our results suggest that this activity constitutes a serious, but previously unrecognized, threat to the forest ecosystem.

Materials and Methods

MTI conducted botanical inventories and lemur censuses at Tsinjoarivo between June and October 2001, and studied the behavior and ecology of one lemur species, *Propithecus diadema*, from December 2002 to December 2003. HVR conducted socioeconomic surveys in several local villages in Tsinjoarivo commune during February and May 2003.

The Tsinjoarivo region (19°41' S, 47°48' E; 1400-1650 m asl) contains central domain high-altitude rainforest (Humbert and Cours-Darne 1965; DuPuy and Moat 1996). Although land-cover maps from the 1960's indicate nearly continuous forest cover (FTM 1972), a satellite image from April 2000 shows that considerable deforestation and fragmentation has taken place, mostly in the western half of the forest corridor. In this area, forest exists as isolated and semi-isolated fragments surrounded by cultivated land, villages, and secondary vegetation dominated by two small woody shrubs: Dingadingambavy (Asteraceae: *Psiadia altissima*) and Rambiazina (Asteraceae: *Helichrysum bracteiferum*).

Results

Socioeconomics of rum production

Rum production is arguably the single most lucrative activity in the Tsinjoarivo region. Villagers cultivate rice, potatoes, sweet potatoes, corn, beans and taro, and keep relatively small numbers of cattle, pigs, chickens and ducks. However, the soils and local conditions are only marginally suited to agriculture, and failed rice harvests are common. We believe that many settlements would be unsustainable economically without the cash infusion that rum provides. From the villagers' point of view, rum provides a "fallback" source of income that is more reliable than farming. The demand is constant, and rum producers from a radius of more than 15 km gather weekly at the "Toby Toaka" (rum market) in Tsinjoarivo, where wholesalers buy the rum in 20-litre "jerry cans".

The prices vary between 300 and 800 Ariary (approx. $0.25 to $0.67 USD) per litre. The minimum yearly production we encountered for one person was 40 l, and the maximum was 2790 l. This signifies an annual income supplement (assuming an average price of 550 Ariary per litre) of between 22,000 and 1,534,500 Ariary (approx. $18 to $1280 USD) per producer. This is a considerable amount given that Madagascar's per capita GDP is estimated at $800 USD (CIA World Factbook 2004), and the average in rural areas is likely much lower.

Impact of rum production on forests

The impact of rum production on the forests at Tsinjoarivo is threefold. First, the cultivation of sugarcane leads to increased per capita demand for land conversion. Second, the distillation process requires large amounts of firewood, thus increasing the per capita demand for this limited resource. Finally, the distillation process requires the addition of "laro" (tree bark from particular species). It is unclear whether this bark is a necessary component of fermentation, as the producers contend, or whether it simply adds a desired flavor.

We found that only 5 species, all within the genus *Syzygium* (Myrtaceae), are used as laro at Tsinjoarivo. However, our botanical transects found that these trees were heavily exploited, and that this exploitation has caused a considerable loss of forest biomass. Within 61 botanical transects (10 x 100 m) at the fragmented forest site of Mahatsinjo, we found an average value of 108 dead *Syzygium* trees per hectare. Here we count both trees that are stripped but still standing (this "girdling" leads to tree death) and trees that are cut and stripped (these have the potential to regrow, but regrowth has not yet been observed). These dead *Syzygium* trees accounted for, on average, 1.54 m^2 per hectare of basal area (counting stems > 5 cm dbh), or more than 5% of the living total. Laro extraction therefore: (1) alters the physical structure of the forest, creating light gaps which promote changes in local temperature and humidity, and (2) alter the forest's species composition by selectively removing *Syzygium* species.

Behavioral studies are revealing that the trees being lost are in fact important food resources for lemurs. Wild sifakas (*Propithecus diadema*) at Tsinjoarivo eat leaves of all five *Syzygium* species, and were also observed to eat the fruit or seeds of the two *Syzygium* species observed to fruit during 2003 (Irwin, unpublished data). This genus is also known to be eaten by sifakas at other sites (Mantadia: Powzyk & Mowry 2003; Ranomafana: Hemingway 1995, P. Wright pers. comm.), as well as by *Eulemur fulvus rufus* and *Eulemur rubriventer* at Ranomafana (Overdorff 1993), and by *Varecia variegata variegata* at Manombo (Ratsimbazafy 2002), Ranomafana (Balko 1998) and Nosy Mangabe (Simons Morland 1991).

None of the 37 forest fragments from which our botanical data were collected host all nine local lemur species: species richness varies from 0 to 7, and both *Eulemur fulvus* and *E. rubriventer* were absent from all surveyed fragments (Irwin unpub. data). Along with fragmentation effects, and low-level extraction of other tree species, we hypothesize that rum-related extraction has contributed to these local extinctions.

Discussion

In light of the data presented here, it is important to realize that Malagasy forests which are otherwise protected or relatively undisturbed may suffer disproportionately in areas where large-scale rum production exists. Rum-related extraction greatly alters the forest's structure and composition, and removes species known to be lemur food resources. Unfortunately, conservation efforts in Madagascar cannot "write off" forests close to human habitation, as natural forests sufficiently remote from human settlement are too few. We must be able to protect lemur populations within walking distance of villages, by identifying and mediating the effects of culturally-based practices such as rum production. Rum production and consumption are so deeply ingrained in Malagasy culture that any attempts to remove them will likely fail. Instead, we recommend investigating alternative production methods designed to have lessened ecological impacts.

In order to begin assembling a broader geographic perspective of this problem for a manuscript currently in preparation, we invite any researchers who have encountered illegal rum production in other areas of Madagascar to kindly contact one of us. In particular, the following information would be most useful: (1) sugar source (e.g. sugar cane), (2) plant species used for "laro", (3) some estimate of the volume of production (i.e. for local consumption vs. for export), and (4) any botanical data or counts measuring the impact on forest structure and composition.

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