# Managing Protected Woodlands: Fuelwood Collection and Law Enforcement in Lake Malawi National Park

JOANNE I. O. ABBOT* AND RUTH MACE

Department of Anthropology, University College London, Gower Street, London WC1E 6BT, United Kingdom

**Abstract:** *We examined the decisions women make in their collection of fuelwood within a protected area in Malawi. We used law enforcement data and behavioral observations of fuelwood harvesting practices to examine the risk of detection and penalties posed by law enforcement activities. Our results indicate that, at their current levels, law enforcement patrols have little effect on wood collection practices. The low risk of detection and light penalties appear to favor illegal wood collection, which is practiced by the majority of women. Alternative strategies should be pursued to enhance the conservation of the woodland and its management as a fuelwood resource for local communities.*

Manejo de Areas Boscosas Protejidas: Colecta de Leña y Aplicación de la Ley en el Parque Nacional Lago Malawi

**Resumen:** *Examinamos la toma de decisiones por mujeres en la colecta de leña dentro de un área protegida de Malawi. Los datos de aplicación de la ley y las observaciones de conducta en las práticas de colecta de leña se usaron para examinar el riesgo de detección y las faltas detectadas durante actividades de aplicación de la ley. Nuestros resultados indican que, a los niveles actuales, las patrullas de aplicación de la ley tienen muy poco efecto en las prácticas de colecta de leña. El bajo riesgo de detección y la ligereza de las penas aparentemente favorecen la colecta ilegal de madera, la cual es practicada por la mayoría de las mujeres. Estrategias alternativas deben ser perseguidas con la finalidad de impulsar la conservación de áreas forestales y su manejo como una fuente proveedora de leña para las communidades locales.*

## Introduction

The conventional approach to conservation is characterized by state ownership of natural resources, establishment of protected areas, and development and enforcement of legislation (International Institute for Environment and Development 1994). Protected areas have made an important contribution to biodiversity conservation, but social, economic, and ecological conflicts are common in and around them such that the action of local people can undermine conservation goals (Pimbert & Pretty 1995; Milner-Gullard & Mace 1998). As a consequence, approaches to protected area management that integrate biodiversity conservation with social development are increasingly advocated and implemented (Western et al. 1994). These require an improved understanding of local patterns of resource use to enable conservation strategies to be better adapted to local livelihoods.

We explored local utilization of fuelwood in the protected woodlands of Lake Malawi National Park, which lies at the southern end of Lake Malawi. Fuelwood is an important resource in the developing world; in half the countries of Africa, wood is the source of more than 70% of energy consumed (Murray & de Montalembert 1992). In Malawi, fuelwood comprises over 90% of the primary energy supply (Energy Studies Unit 1984). Natu-

*Current address: International Institute for Environment and Development, 3 Endsleigh Street, London WCIH ODD, United Kingdom, email jo.abbot@iied.org

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ral woodlands and plantations cover approximately 38% of Malawi, yet rural people may have only restricted access to this resource because 55% of them are within designated national parks, game reserves, forest reserves, and protected hill slopes (Kayambazinthu 1988).

Although human populations are often displaced when national parks are created (Pimbert & Pretty 1995), five fishing villages enclosed by Lake Malawi National Park were not moved when the park was established in 1980, but restrictions were placed on their use of natural resources. One such restriction was that fuelwood collection from the park without a permit became an illegal activity. The Malawi Department of National Parks and Wildlife, which manages the protected area, organizes scout patrols to detect and penalize illegal wood collectors.

In determining how people respond to detection and punishment for illegal activity, economic theory predicts that the rate of detection is more important than the severity of penalties administered (Cook 1977). In the context of natural resources, Leader-Williams and Milner-Gulland (1993) suggest that the probability of detection is a "highly significant factor in the poacher's decision to hunt." Similarly, Sutinen and Gauvin (1989) show that the rate of violation of lobster fishermen in Massachusetts varied with perceived probability of detection and conviction.

Important in many rural communities is the subsistence harvesting of wild resources, such as fuelwood, plants, and small game (Scoones et al. 1992). Yet in Africa 134 million ha of land is protected in 700 sites, of which two-thirds prohibit the use of wild resources (World Conservation and Monitoring Centre 1992). Like commercial poachers, subsistence gatherers may be influenced by the risks imposed by law enforcement for illegal collection of wild resources from protected areas. We explored whether law enforcement influences fuelwood harvesting behavior in Lake Malawi National Park. This has important implications for two opposing strategies for the management of protected areas: preservation- and consumption-based models for conservation.

## Study Area and Methods

We studied fuelwood harvesting by residents from Chembe, which is the largest village in Lake Malawi National Park, with a population of over 3000 people. Fuelwood is the main source of energy for cooking and heating, and Lake Malawi National Park woodlands provide the only local supply (Abbot 1996). Fuelwood permits cost 0.30 Malawi Kwacha (MK; US$0.03) and enable women, who are primarily responsible for domestic fuelwood collection, to gather one headload of wood. The annual average income for smallholder households is low, estimated at MK170 (US$18.80, United Nations in Malawi and Government of Malawi [UN/GOM] 1993). Women tend not to control household resources, particularly cash transactions (UN/GOM 1993), but if detected by scout patrols, illegal wood collectors risk penalties, which include warnings, the forced purchase of permits, fines, and the confiscation or burning of fuelwood bundles.

We used focal group sampling (Altmann 1974) to examine the risk to wood collectors from Chembe of detection by law enforcement patrols. Women collect fuelwood in groups of around six individuals ($\bar{x}$ = 5.71, range 2–17, Abbot 1996). Between October 1993 and May 1994, we accompanied 42 groups of women as they collected fuelwood and recorded their routes and encounters with scout patrols.

Patrol reports recorded over the same time period were also analyzed. Using a 1:50,000 map of the national park, the area was divided into 1-km$^2$ grid squares. For each patrol, scouts recorded their route, indicating the grid squares patrolled, and encounters with wood collectors. Using methods outlined by Bell (1986), patrolling effort was estimated from the frequency with which grid squares were patrolled per unit of time. The small size of grid squares ensured that patrols detected illegal activity across the entire grid square. The same grid squares were used to determine the routes taken by the domestic wood collectors that we tracked.

## Results

Of the 42 wood collection groups tracked, scouts were encountered on only five occasions. These data suggest that women have an approximately 12% chance of being caught by scout patrols. The penalties imposed by the scouts were not analyzed because they may have been influenced by the presence of the researchers.

Data from patrol reports (Table 1) reveal that, on average, only 6.7 patrol days are undertaken each month by each of the two scout groups that patrol the woodland. The rate of encounter of patrols with wood collecting groups is also low, averaging one encounter per patrol.

**Table 1. A summary of woodland law enforcement activities, October 1993–May 1994.**

| *Patrol data* | *Mean* |
|---|---|
| Effective patrol days per patrol group per month* | 6.6 |
| Wood collectors encountered per month | 48.8 |
| Wood collectors harvesting fuelwood illegally (%) | 64.3 |
| Wood collection groups encountered per month | 13.4 |
| Wood collection groups encountered per effective patrol day | 1.1 |

** "Effective patrol time" is defined by Bell (1986) as when staff are on active patrol on foot in the bush. There are two patrol groups that patrol different areas of the park.*

Data from patrols and tracking of wood collectors provide differing estimates of the proportion of women that collect fuelwood illegally. Data from tracking wood collectors suggest that 83.5% of women collect illegally (only 29 of the 176 women tracked claimed to have a permit). The patrol data (Table 1), however, suggest that only 64.3% of women collect fuelwood illegally. This may reflect the higher probability that legal wood collectors will be detected by scout patrols because illegal wood collectors are likely to try to avoid encounters.

Various penalties are imposed by the park scouts for illegal wood collection. Analysis of the 76 encounters between groups of illegal wood collectors and scout patrols showed that most wood collectors received a warning (61%) and that just over a quarter (28%) purchased a permit from the scouts. More severe penalties were issued much less frequently. For example, 8% of illegal wood collectors had their fuelwood burnt, 1% were taken to the village chief, 1% paid a fine, and 1% were prosecuted. This may reflect a recent policy toward more lenient penalties for illegal wood collectors to improve the relations between park management and local communities.

Law enforcement may influence patterns of wood collection. A comparison of scout patrol routes with the sites where groups of collectors gather fuelwood shows that, rather than selecting low-risk areas, wood collection groups frequent the areas with the highest patrolling effort (Fig. 1). Such risk-prone behavior seems counterintuitive, given that most women collect illegally and are subject to penalties if caught. One interpretation of these results is that the scout patrols are efficient at targeting areas that are most frequently used for fuelwood collection. The most frequently patrolled grid square, however, was visited only 15 times during the 8-month study period (less than two patrols per month). Given that women collect fuelwood every 4 days (Abbot 1996), the risk of detection when collecting fuelwood illegally is low, even in the high-risk areas. Data from tracking wood collectors and from patrol reports (Table 1) support this hypothesis.

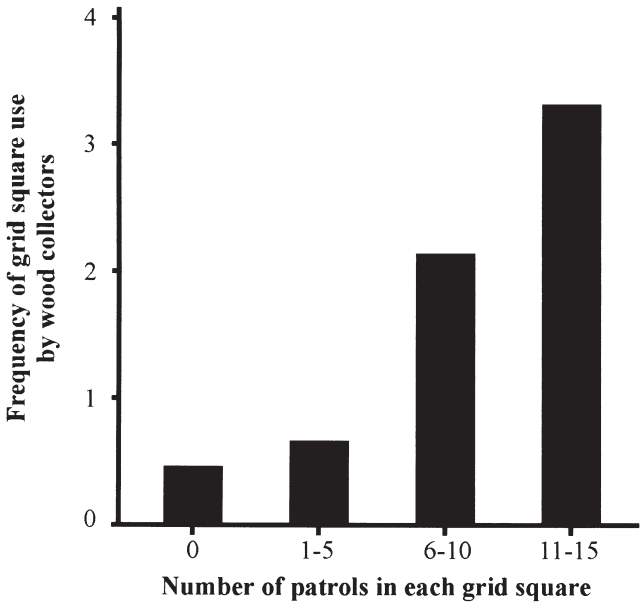


*Figure 1. Comparison of the grid squares frequented by women for fuelwood collection and scouts during patrols (October 1993–May 1994).*

By analyzing the monetary penalties delivered to illegal wood collectors, it is possible to contrast the financial cost of fuelwood collection for women who collect legally and illegally. This analysis assumes 96 fuelwood collection trips per year, an average fine for illegal wood collection of MK3 (US$0.30), and an opportunity cost of MK5 (US$0.55) when fuelwood is burnt by scout patrols, which is the cost of purchasing a replacement bundle of fuelwood in Chembe village. A woman who collects legally and purchases a permit for each wood collection trip would pay MK28.80 (US$3.20) annually for wood collection. A woman who collects illegally and is detected on 12% of wood collection trips would incur annual costs of MK6.17 (US$0.68). Thus, women who collect fuelwood illegally and incur the penalties imposed if detected pay less than one-quarter of the costs incurred by women who regularly buy permits. Women claim to be unable to afford permits, but it appears that it is not in their financial interest to purchase them prior to fuelwood collection. Further analysis of the law enforcement data suggests that the detection rate for wood collectors would have to increase to 58% for the costs of illegal wood collection to equal those of legal wood collectors.

## Discussion

An understanding of the factors that influence resource harvesting decisions can improve the management of natural resources. Our analysis suggests that, if maintained at current levels, law enforcement practices appear to favor illegal wood collection; indeed, this is practiced by the majority of women.

One option for park management is to increase patrolling effort in the park, but regulation is expensive (Milner-Gulland & Leader-Williams 1992), and our study suggests that the patrolling effort would have to be increased substantially for women to be encouraged to purchase permits. Our results also suggest that law enforcement is inefficient because the number of effective patrol days is low compared with the potential number of scout working days (Bell 1986).

Another option for park management is for the price of permits to be increased and more severe penalties to be administered. This would reverse the park's recent

trend toward a more lenient approach to domestic wood collectors in an attempt to increase local support for the protected area; scout patrols are a point of contention between villagers and the Malawi Department of National Parks and Wildlife.

The objective of law enforcement is to regulate woodland use and thereby conserve the resource base. But law enforcement seems inappropriate for regulating the harvesting of fuelwood, which is a basic element of subsistence for resident households. The park woodlands are the only local source of fuelwood for the five villages. Since the permit system was introduced in 1980, the population of the fishing villages has increased by more than 50% (Abbot 1996). This means that even with increased patrolling effort or more severe penalties, law enforcement policies alone are unlikely to protect the woodlands because they fail to provide alternative supplies of fuelwood for resident households.

The long-term survival of the fishing communities and the park woodlands may require fuelwood, or other sources of energy, to be supplied to the villagers. This could be funded through revenue generated by the national park. There is extensive experience in Africa of developing revenue-sharing approaches to conservation in an attempt to protect biodiversity and support rural livelihoods in and around protected areas (Western et al. 1994; Matzke & Nabane 1996). Revenue sharing enables local communities, who bear some of the costs of the protected area (through restrictions on resource harvesting), to also partake of its benefits. This is likely to have a more beneficial impact on woodland conservation than imposing penalties on wood collectors for illegal collection of an essential element of subsistence.

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