FUELWOOD IN NEPAL: RESOURCE MANAGEMENT PROBLEMS AND PROSPECTS

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Per capita energy consumption in Nepal was the lowest in the world in 1984 (The World Bank, 1986). This may be due to the fact that 90% of all energy consumed in Nepal is noncommercial (fuelwood, wastes, animal and human power). This is extremely high compared to India at 48% and even Bangladesh at 83% (Ghosh, 1984). High per capita use of biomass fuels in Nepal involves burning approximately 317 kilograms of firewood per year per household for cooking and warmth (Karan and Iijima, 1985), and rural collection and utilization of fuelwood for cooking and heating accounts for 95% of total energy consumption in Nepal (Bidwell, 1987). Wood has a high weight per unit of fuel value, so that as accessible resources are depleted, transport over long distances becomes commonplace, and fuelwood collection occupies a greater proportion of family time.

This study examines fuelwood use in the Khumbu region of Nepal, on the Tibetan border in the high Himalaya. The area provides an ideal spatial unit to examine the use of traditional energy supplies and consider long-term management relative to the economic and socio-cultural conditions of the Sherpa settlements in Khumbu.

Dwindling fuelwood supplies and increased overall demand with the advent of tourism have serious implications for the rural population of Khumbu. This high mountain area of Nepal, although isolated for centuries, is being integrated into a global economic scenario with the advent of tourism and increased access. Therefore not only the Sherpas and their relation to the land must be considered, but the changes brought about by tourist demand for services and resources that is slowly changing the region must also be taken into account. The infamous Lukla airstrip brings nearly 7000 climbers and trekkers a year to Khumbu, and tourism has replaced agriculture in the economic base.

Khumbu's forests, once widespread, have been traditionally used by the Sherpa community, who collect the blue pine, rhododendron, fir, birch, cedar, and juniper for cooking, heating, and house construction. Past

increases in local population heightened the demand for construction materials and fuelwood. Fortunately the Sherpa population of 3500 is not projected to increase as Nepals population soars (16.1 million in 1984 in a country of 141,000 square kilometers) (The World Bank, 1986, p. 180). The country of Nepal has seen 1/4 of all forests cut in the last decade due to this population growth. The Khumbu region in Nepal has seen little change in the past several decades, but the overall demand on the regional forests has outstripped local supplies. The advent of tourism compounds the problem with twice as many tourists as Sherpas. The resource base is slowly deteriorating with increased use of biomass fuels. Although the forests were never dense, deforestation of the slopes is a very long term trend, impacted by trekkers and climbers headed for the Everest massif, and Everest itself at 8848 meters.

A variety of resource management options for Khumbu are considered: regulated and reduced biomass fuel use; reforestation; and utilization of alternative resources including conversion technologies. It is apparent that fuelwood substitution provides an option, but not without socio-economic and environmental consequences. Improved end-use devices, cookstoves with flues, are also examined.

REGULATED AND REDUCED FUELWOOD USE

The Sagarmatha National Park (Chomolungma to the Sherpas) was established with New Zealand assistance in 1976. The boundaries incorporate Khumbu's 1243 square kilometers which include all the high mountains in the region, including Everest. The park was created to reduce the environmental impact of tourism in the Khumbu region and specify appropriate wood cutting areas for the Sherpas. It is managed by Nepalis, utilizing conservation techniques. The conservation management solution of reduced fuelwood use has been implemented in the national park through regulations which require all visitors to import kerosene for cooking. Sherpa cooks and visitor support staffs continue to cut wood for their own fires. Kerosene is too expensive for native use when transport costs to this area are considered. Nepal has a GNP per capita of $160, fourth lowest in the world (The World Bank, p. 180). Also the availability of kerosene is highly variable.

The center of Sherpa and tourist activity is Namche Bazar at 3400 m, placed on the shoulder of a plateau in the Y between the Dudh Kosi and the Bote Kosi. It is a prosperous traditional market town with a high standard of living, and has an extremely high biomass use density. New downtown lodges are being built to service trekkers and climbers, and, although one would assume that park regulations for kerosene would encompass lodge activities, the Sherpas use fuelwood in these instances. Doko after doko of wood is collected and carried to the lodges for cooking and heating. Further depletion of the forest could lead to extensive soil erosion, loss of biomass productivity, reduced water retention capacity, and increased flooding (deLucia et al., 1982). There is minimal charcoal use, although it is a cleaner burning fuel with half the weight and twice the caloric value of wood. Charcoal can be transported over greater distances, but results in further deforestation.

REFORESTATION

Field observation and recent research indicates that the solutions to deforestation involve both short and long-term conservation management concepts. Even reduced fuelwood use can not offset the necessity for longterm reforestation. Reforestation attempts began in 1978 with national park demonstration plots near Namche, protected by stone enclosures from the animals that graze already deforested areas and severely limit regeneration. The reforestation nursery has blue pine and silver fir seedlings. These are traditional Sherpa fuels, both economically and socially. Although history documents that developing countries usually change from traditional to commercial fuels, Nepal may not experience this shift. The transition may never be completed. It is probable that Nepal will retain a heavy reliance on traditional fuels in absolute quantity even if not percentage (deLucia et al., 1982).

ALTERNATIVE RESOURCES

Utilization of alternative resources for fuel provides another management option, but not without socio-economic consequences. The yaks and zopcho crossbreeds provide more than transport. The dung patties can be dried and burned. Dung has a high caloric value per unit weight, but its use means a reduction of recycled nutrients and soil conditioners to

the potato and barley fields. This loss of organic material is a loss of vital calories, already less than daily requirements, and will also reduce the soil water holding capacity. Additionally, any increase in pastoral activities may result in increased impact of stock use on vegetation with more terracette formation and potential erosion.

CONVERSION TECHNOLOGIES

Another alternative is to develop Conversion Technologies. The solar power alternative is utilized passively by the Sherpas to dry clothes in Namche and for space heating via south facing new glass windows.Although solar hot water heaters had been reported at both Namche and Tyangboche lodges, the only evidence of active collection was a small panel on the Park police station. Since Sherpa villages are located between 3400-5100 meters, the high altitude and predominantly clear dry winter days would make solar power a viable energy option. Silicon cells could produce up to 1 KW of electric power in decentralized locations (Grathwohl, 1982). Panel cost, transport and installation would remain problems.

Decentralized small hydropower developments are multiplying now in Nepal, where only 5% of the total population has electricity but where small hydro potential could provide as much as 800 megawatts (Flavin, 1987). A small experiment with hydroelectricity now provides each house in Namche with 1 light bulb that is operational for a few hours each evening. The local use of water power is usually more practical, however, such as softening yak skins or turning prayer wheels, at least more practical given recent events. In late 1985, a catastrophic flood occurred with the sudden release of water from a glacier-dammed lake. When the Langmoche Glacier dammed lake spilled over its moraine dam after an avalanche shortly before our visit to Khumbu, the impulse wave sent 5 million cubic meters of water down the Bhote Kosi valley at 1,600 cubic meters per second discharge for a distance of 40 kilometers (Vuichard and Zimmermann, 1987). A scar represents all that is left of the 95% complete $10 million Austrian HEP project in Thame. The project was designed to supply 132,000 KW hours of electricity for cooking, heating and light for Namche, which would have meant a hotplate in every village house.

Assessment of such flood hazards in a mountainous environment is crucial to energy resource planning in Khumbu. This event illustrates the

problem of too much reliance on technological solutions. The HEP project was built for peak annual discharge, not the 100 year flood (by a country where HEP represents 2/3 of all commercial energy produced), despite the fact that a similar flood occurred off Ama Dablam in 1977 and there had been four or five such floods in residents' memory. There is not enough consideration of natural hazards in development project planning.

Although alternative energy resources could be available to meet future demand, potential energy development obviously is extremely difficult in this physical environment around Mt. Everest. Also the beauty of the area dictates that impacts of any development should be minimized.

IMPROVED END-USE DEVICES

Sherpas are proud of their homes and villages, and cultural values are very important. Whereas men frequently are now involved in trekking and climbing activities, the women spend the greatest amount of the total family time in collecting fuel, processing food, and in domestic activities. In the Khumbu region there are unique energy use patterns, and the women's role is central. Stove use for cooking and heating averages almost 12 hours/day, often with continuous daylight burning and sometimes 24 hours a day burning. The stoves are made of dried mud with front opening and no chimneys, although some homes have a small roof hole for limited ventilation. Actual cooking requires nearly 5 hours per day, with women in close attendance. Women begin to cook at around 16 years old (Reid et al., 1986). In such high altitude rural areas, the cold temperatures mean that a large proportion of time is spent indoors with high human exposure to the fires that burn over long periods. The hearth is sacred, but also is a contributor to excessive indoor air pollution. Indoor air pollution research indicates unacceptable levels of total suspended particulates, carbon monoxide, dioxide, methane, and nonmethane hydrocarbons (Davidson, 1986). Complaints about coughing and eye irritation are symptomatic of the chronic bronchitis, emphysema, and TB that serve to keep life expectancy at 46 for women and 47 for men (The World Bank, 1986). Indoor fuelwood combustion also degrades the outdoor environment. There are high levels of potassium and methyl chloride (Davidson, 1986), with populated villages exhibiting visible haze and even

trekkers' lodges exhibiting traditional smoke. Respiratory disease is also a prime factor in infant mortality.

The final management option to consider would be to change these end-use devices - the traditional stoves. Experiments have been completed in the middle hills of Nepal using improved cookstoves with a flu. They reduce the cooks' exposure to TSP by 2/3 and carbon monoxide by 3/4 (Reid et al., 1986). The benefits of improving the stove efficiency include lower smoke and fuel savings, but more women need to be educated to the latter conservation benefits. The disadvantages of change include extra maintenance for a clean flu, new pots, increased time spent cooking, and more wood splitting for smaller pieces (Reid et al., 1986). Many world agencies are involved in stove programs in the developing world, and there is potential for fuelwood conservation if both smokelessness and stove efficiency are considered in stove improvements. The women of the region will provide the primary means of disseminating these changes as they become educated in stove and fuel use, since they are the principle decision-makers regarding usage.

SOCIAL, RELIGIOUS, AND ECONOMIC INTERRELATIONSHIPS

Foreign aid and associated geopolitics may run counter to nature, as with the Namche small hydro project, and the Sherpas know when their mountain gods are not pleased. The Khumbu Yul-Lha, the valley's god and protector, must be treated with seriousness (Bjonness, 1986). The Sherpas concept of Buddhism also influences their environmental perception. The view is complex, but ties nature and humans together since each person is a part of nature. Thus the Lamas also have a role to play. Tyangboche monastery has already taken an active part in attempting to reduce the brain drain of educated young men from Khumbu, so a resource management role might also evolve. In the past the Lamas have taken active steps to forbid tree cutting for religious reasons in certain locations such as Tyangboche monastery. Vestiges of high altitude juniper forests surround the oldest gompa in Khumbu, Pangboche monastery. Over 300 years ago, when Buddhism was introduced into Khumbu, legend says that the old Lama tore out his hair and cast it around. Black junipers sprouted from that hair and were forbidden to be cut. Today the fringe of forest remains around Pangboche, untouched, next to denuded slopes.

Involvement of many different groups in forest management will be crucial, and the women play a far more active role in economic decision making than usually assumed (Karen and Iijima, 1985). Unfortunately, they have limited access to information on conservation techniques. Women should be educated, informed, and involved in resource decision-making.

The Sherpas are not truly poor and illiterate. They are an adaptable, intelligent people who live in a fragile environment. The natural and aesthetic resources of the mountain environment need to be conserved in order to preserve the Sherpas' quality of life. Major resource development projects in this high mountain area may not be appropriate. Demand for food, fodder, and fuel resources will increase in the future, so both short and long run conservation management will be necessary. Solar and biomass resources will be best for small, decentralized energy sources. For new management policies on reduced cutting, improved stoves, and small scale renewable resource use to be effective, there must be more involvement of local people. All changes will have to mesh with the social, religious, and economic activities in Khumbu. The Sherpas have very rich but vulnerable traditions in this land of extremes.

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