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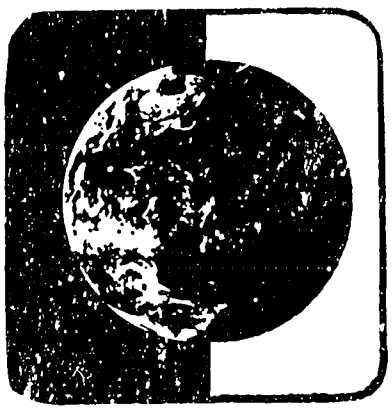
WOMEN AND RESOURCE CONSERVATION AND UTILIZATION IN NEPAL — II



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OCCASIONAL PAPER SERIES:

Women in Development
Volume II

WOMEN AND RESOURCE CONSERVATION AND UTILIZATION IN NEPAL - II

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Preface

The South-East Consortium for International Development (SECID) is a non-profit organization composed of thirty-four research and academic institutions located in the southern and eastern United States. SECID provides research, training, and technical assistance to developing countries. In 1980, SECID established the Center for Women in Development with funding from the Office of Women in Development at the Agency for International Development. The Center's primary objective is to ensure that women, as agents and beneficiaries, are included in all phases of SECID's development initiatives. This has included working with SECID member institutions to identify and utilize qualified women faculty and with SECID's overseas projects on design and implementation.

In 1981, the Center established the International Fellowship Program in Technical Assistance. This program was designed to respond to several critical needs in the area of women in development by: 1) increasing opportunities for women to gain international experience; 2) advancing important WID issues via a balanced approach of research and direct participation in community development activities; and 3) integrating WID approaches and issues into existing SECID projects.

In 1984 Holly Reid and Sally Sontheimer, both graduate students at Duke University in the Department of Environmental Management, undertook gender-specific work in Nepal. In conjunction with the Resource Conservation and Utilization Project, and building on earlier SECID/CWID work in the area, they spent six months in Nepal, where Reid evaluated the efficiency of improved cookstoves, and the health impact of smoke from both traditional and improved cookstoves, while Sontheimer worked with the first two classes of women to enroll in the Institute of Renewable and Natural Resources. Their reports and recommendations are presented here.

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AN EVALUATION OF RCUP'S IMPROVED COOKSTOVE PROGRAM WITH SPECIAL EMPHASIS ON INDOOR AIR POLLUTION SAMPLING

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This project was funded through the Office of Women in Development of the United States Agency for International Development (USAID) and administered by the Center for Women in Development (CWID) of the South-East Consortium for International Development (SECID). From 1981-1982 USAID supported fourteen Technical Assistants in nine countries for short-term consultancy work on specified sub-projects in human and natural resource related fields. This cookstove and smoke exposure evaluation is one of three assistantships hosted by the Resource Conservation and Utilization Project (RCUP) in Nepal during 1984-1985. Sincere gratitude is owed to both USAID and SECID, and especially Ellen Fenoglio as project manager of this assistantship program. Their active participation in Women in Development issues provides a unique opportunity for graduate students and junior faculty members of SECID institutions to assume an influential role in bringing recognition to women's roles and responsibilities as the main laborers and managers in rural community development activities of many developing countries.

I want to express my deepest appreciation to my closest companion, and cultural, lingual and social interpreter, Bageshwari Sherchand, for her unending energy, commitment to seeking truth, and ability to provide comic relief when most needed. I would also like to recognize RCUP's stove and energy technicians, Dina Nath Koirala, Bal Bahadur Pun, and Prem Tulachan, without whom this field evaluation would have taken twice as long and been twice as difficult. Gerry Richards, Bill Hart, Ann Lewis, Shanta Pandey, Prajwol Pradhan, and Yam Malla were also invaluable as my very practical and experienced advisors during the many uncertain hours of certain confusion.

Much thanks is also extended to Kirk R. Smith, Coordinator of the Biomass Fuels and Development Project at the East-West Center in Hawaii, for providing the equipment and the incentive to work on the serious problem of Third World cooks' exposures to indoor air pollution, and to his project support staff, Nazrul Islam, Premlata Menon, Jamuna Ramakrishna, and Allen Jelich, for my training and frequent conversations about post-field and data analysis. Appreciation also goes to Air Quality Research Labs in California for supplying some of the first passive NO2 and HCHO monitors for research on domestic air pollution in a LDC. Deepak Bajracharya, also of East-West Center, is responsible for my very rewarding introduction to rural energy development in Nepal. I thank him and his entire family for always welcoming me into their Kathmandu homes. Also, many smiles to Sally Saunter Sontheimer and Shawzer for their editorship and constant kindness.

Most importantly, my work companions and I offer a respectful greeting "Namaskar" to all the cooks and families who generously welcomed us into their mountain homes to learn a little bit about their lives.

INTRODUCTION

This is an evaluation of the Resource Conservation and Utilization Project's (RCUP) improved cookstove program. The study provides a more complete report of the improved cookstove's performance, user acceptance, and preference, along with data on women's exposure to indoor air pollution from cookstoves with and without flues. The original objective of the evaluation was to visit at least sixty households in the three RCUP districts (thirty households with traditional, no-flue cookstoves and thirty households with improved cookstoves) (see map I) to compare old and new stoves by both subjective and objective criteria.

The study combined a qualitative survey (a sixty-six item questionnaire, Appendix B) with quantitative measurements of cookstove fuel efficiency and cooks' exposures to domestic air pollution. However, due to time limitations, previous field work completed on cookstove efficiency, and the absence of any data collected in Nepal on womens' exposures to smoke, the quantitative portion of this study was focused exclusively on indoor air pollutant measurements. Section I describes a brief history of the cookstove program and the parameters and limitations of this 1984 evaluation. Sections II and III explain the methods and results of the quantitative smoke sampling and the qualitative questionnaire sampling, respectively. Section IV addresses cookstove program obstacles in the climatically and socially varied district of Mustang. Section V offers cookstove program conclusions and recommendations, and finishes with the relevance of this study as a Women in Development project.

Summary of Findings

* Indoor air pollution measurements of smoke from domestic cooking fires have revealed alarmingly high concentrations of harmful gases and other substances, including carbon monoxide, formaldehyde, nitrogen dioxide, suspended particulates, and a carcinogenic hydrocarbon known as benzo (a) pyrene.

* Comparisons of pollutant measurements between households with improved cookstoves and those with traditional cookstoves clearly demonstrate that the use of a flue significantly reduces the cook's exposure to harmful pollution by venting an otherwise confined cooking environment.

* Emissions data from both traditional (flue-less) and improved (flue) cookstoves, collected for this study are conservative estimates of annual exposure rates, because (1) measurements were conducted during the driest part of the year, and (2) sampling sites were concentrated in more populated bazaar areas where "modern" architecture (with more windows and higher ceilings) influenced the ventilation of the cooking areas. Bazaar homes were considered unrepresentative of the traditional, rural Nepali lifestyles.

* Domestic indoor air pollution is likely to be an important contributor to the high prevalence of chronic obstructive lung disease in rural Nepali adults, particularly women, and an important risk factor for the high mortality and morbidity from acute respiratory infections in rural infants and children. The flue is presently the most effective method of decreasing domestic indoor air pollution, and therefore is likely the most effective means of reducing lung and eye disorders in Nepal.

* Health benefits of flues should be a greater consideration in the justification of cookstove programs, even for development organizations that do not actively work in the field of public health.

* Decreased exposure to smoke was the first priority of most cooks, and the reason most often given for wanting or using the improved cookstove.

* Although the improved cookstove generally took a longer time to cook meals than the traditional mud chulo (but less time than the one-pot agena), the majority of cooks responded that the improved stove decreased their overall work load, or work time.

* A "Kitchen Behavior Test" indicated that Nepali cooks spend about ninety-three percent of the cooking period at or within six feet of the cookstove. Users of both improved and traditional stoves spend approximately five hours per day cooking meals and snacks (this includes approximately two hours each morning and evening, and approximately one hour in the afternoon).

* This Women in Development (WID) sponsored project did improve communications between RCUP personnel and the district villagers, and did specifically solicit the native wisdom of the rural women to identify and address sex-segregated issues. This study employed a woman interpreter and a woman Technical Assistant which resulted in uninhibited rapport and dialogue with predominantly female, household cooks. This procedure was a reflection of: (1) sensitive policy changes introduced by USAID/WID to respect and work within traditional Nepali customs and beliefs on sex segregation, and (2) practical recommendations made by other field technicians who found that their male personnel had great difficulty soliciting the frank opinions of rural women. Women talking with women made a very practical difference in the quantity and quality of information exchange.

I. COOKSTOVE BACKGROUND AND EVALUATION CRITERIA

"We had a land named after the dense forest that grew there called 'salyani gairo' (pine tree gorge). Now, it is called 'rato gairo' (red gorge) because it is naked and all you see is the red soil sliding down the mountain."

Yoga Nana Regmi, Bansbot, Myagdi

"In mother's day, there used to be forests. Now we have all eaten them up."

Lal Kumari Malla, Rakhu Piple, Myagdi

A. RCUP Cookstove History

The RCUP improved cookstove program was initiated in 1980 as a basic means of decreasing household fuelwood consumption and, subsequently, the rapid rate of forest destruction within two watershed catchments in Nepal. Since the first cookstove installations in the Gorkha district in 1981, RCUP's energy division has experimented with at least five different designs, including: double wall, terri, insert, mud, in situ-built, and single wall magan. Most improved cookstove designs consist of a pre-fabricated ceramic frame which includes a fuel-efficient feature, such as a baffle in the firebox, and a flue[1] of either ceramic or tin. Improved cookstoves are intended to replace or significantly reduce the use of the traditional Nepali one-pot, open flame "agenas", and two-pot, enclosed flame "mud chulas", referred to as the "old stoves". Table 1 shows the types, location, and number of improved stoves that RCUP has installed since 1981, while Maps II and III show their distribution. Beginning in January of 1984, the UNICEF single wall magan chulo, referred to as the "new stove," was introduced to the Gorkha and Myagdi districts. Satisfactory user-assessment and ease of installation have encouraged the promulgation of this UNICEF model as RCUP's long-term choice of design.

TABLE 1

Distribution of RCUP Improved Stoves

	Installations (as of)					
	FY 81	FY 82	FY 83	6/84	FY 84 9/84	Target
Stove Type	In-situ Built	Double-Wall	Double-Wall	UNICEF Magan Single-Wall		
District						
Gorkha	140	74	130	98	150	300
Myagdi	7	20	68	74	74	74
Mustang	7	3	9	--	--	26
Total	154	97	207	174	224	400

The Mustang district, however, requires an entirely different cookstove for its cooler climate and Tibetan cultural influence. The UNICEF cookstove does not radiate sufficient heat for households in this region. For this reason, the RCUP cookstove program is neither well defined nor active in Mustang. Stove installers have had little success with the pre-fabricated ceramic frames, which are designed to fit the needs of warmer, more southern areas, so they are currently experimenting with new materials. For example, cast iron rings permit the use of different sized pots, and corrigated tin sheets allow more radiation of heat from the fire-box and flue during the cooking period (see Map IV).

To minimize variability, this project evaluates only one type of improved cookstove: the UNICEF single wall magan chulo. Sampling sites were restricted to the Gorkha and Myagdi districts where the magan chulo is used. The fledging Mustang cookstove program is evaluated here only briefly due to the few observations conducted during an abbreviated field visit to this region (see Section IV).

Three evaluations of RCUP's cookstove program were conducted prior to introducing the magan chulo to the Gorkha district: in July 1983 by K. Roesing (sixty households); in February 1983 by H. M. Shrestha (fifty households); and in December 1982 by D. N. Koirala (sixty households). All evaluations involved at least a portion of a forty-six item questionnaire developed by the Community Forestry Afforestation Division (CFAD) of FAO. Only one quantitative sampling, a fuel-efficiency test, was attempted in the field. This was done by S. K. Acharya in 1983. Unfortunately, the equipment used for the Water Boiling Test (a standard test of fuel efficiency established by the Volunteers in Technical Assistance (VITA))

proved inaccurate. Systematic field tests of the fuel efficiency of many improved stove designs have been completed by development organizations other than RCUP. The UNICEF magan chulo, however, has been omitted in this testing (Campbell, 1984b). To compare its efficiency with that of other improved stoves, the UNICEF model must be tested further. This study did not include fuel efficiency measurements of the UNICEF magan in the fields. It is assumed here that its efficiency is comparable to that of cookstoves of similar design, (see Table II). Advocates of improved stoves say they can achieve an overall efficiency of between twenty and thirty percent (Islam et al., 1984).

TABLE II

Field Tests of Cookstove Efficiencies

Stove Type	To Boil 2 Liters H20	Efficiency
Double Wall	12 - 17 min.	25 - 29%
Insert	14 - 18	18 - 26
Traditional	13 - 25	15 - 22

(RECAST, 1982) and (Bhattarai, 1983)

RCUP's method for distributing the single wall magan began with RCUP's Energy Specialist identifying the panchayats* with the greatest fuel scarcity. The two district headquarters presented prime targets because of high population density, taxed forests, and ease of access. At first, the improved stoves did not meet with great consumer demand. In Gorkha stove installers had to recruit recipients with slide shows and exhibition. Later, advertising by word-of-mouth caught on until today, the stove installation cannot keep up with the demand. In Gorkha and Myagdi there is a waiting list of applications. Households apply for the stove at RCUP headquarters, and are later interviewed in their homes to match the compatability of their family size and the intended uses of the new stove with new stove limitations. This screenig process directly influences stove acceptance rates by encouraging stove distribution to the most appropriate households.

RCUP stove recipients are not required to pay for stove materials. They are, however, responsible for transporting stove materials to their homes and for assisting RCUP's stove technician with mud, bricks, and labor during installation. For the Gorkha District, the magan chulo is made by potters in the Kathmandu Valley and transported by truck to Gorkha district headquarters in Gorkha Bazaar. Gorkha's energy specialist and stove technicians report that ten

* A panchayat is an area of nine wards which is governed by a local council.

percent of ceramic stove parts are broken upon arrival due to poor packing (Shrestha, H.M., 1984). For the Myagdi District, the magan ceramic set is made by potters in the same district, and transported by porter to district headquarters in Beni for distribution. Magan is not suited for use in Mustang, and therefore, the RCUP cookstove program is not very active in Mustang.

B. Sampling Conditions

Household visits for this evaluation were conducted during the month of September in Gorkha, October in Mustang, and November in Myagdi. Nepal's distinct seasons affect sampling results: the summer monsoon season runs approximately from May to August; the winter monsoon, December to January; and the spring windy season, February to April. All field tests were conducted during the autumn when conditions were said to be the driest and least windy of the year. This means that wood moisture content, and the associated smoke production, were at their lowest annual levels. With the improved cookstoves, lower wind conditions contribute to good ventilation as smoke is not forced back down flues, a reportedly common occurrence during the strong winds of spring. On the other hand, very low wind conditions can cause higher pollution levels when stagnant non-circulating air does not draw smoke out from windows and doors to ventilate the cooking area. In the opinion of most participant cooks, this study's indoor air pollution measurements should reflect the best (or least suffocating) cooking environments that Nepali women experience during the year.

Due to RCUP's relatively recent introduction of the magan chulo (January, 1984), this study's choice of household participation was limited to two central locations. Until September 1984, RCUP installed most of its stoves in the two district headquarters of Gorkha and Beni. Both are large bazaars on major trading/trekking routes, affording RCUP an opportunity to monitor the status of many new stoves within easy access. Both bazaars have been influenced by the influx of modern conveniences, including a less traditional architectural style. Selection of households without prior reconnaisance sometimes resulted in the sampling of more "modern" homes with very high ceilings, large windows and tin roofs. Most Nepalese, however, live in traditional rural homes, that are characterized by very small windows and doors, thatched roofs and low ceilings. For air pollution monitoring, the height of ceilings directly affected ventilation and the amount of smoke in the cook's breathing zone. Exposure to smoke in a "modern" house with traditional, flue-less stoves would likely be lower than a cook's normal exposure to smoke from the same stove in a traditional low-ceiling, almost window-less rural village home. In the opinion of the surveyors, monitoring these non-traditional homes, therefore, placed a conservative bias on traditional stove exposure results.

C. Household Selection

Household selection was not based on random sampling due to the recent date of stove installations, access inconveniences, and the influence of recent changes in home design. Critics of past cookstove evaluations have noted the short period of cookstove use between installation and evaluation. To avoid examining the performance of very young stoves, this study limited household selection to those homes with the earliest installations, i.e. before June of 1984. The average age of improved stoves sampled was 5.7 months. In Gorkha this criterion decreased the potential number of participants to ninety-eight. A few households were rejected because of distance or non-traditional home design. (Home design became a more important factor in household selection as more household visits revealed the difference between "modern" and traditional architecture. Hence, both types of architecture are included in the study, although the non-traditional influence was discouraged as selection progressed).

The primary consideration for household selection was to establish an equal representation of households of high, medium, and low economic status. Caste status was originally planned as an indicator of economic status. It was soon recognized, however, that one did not necessarily reflect the other. In order to include a wide cross-section of participants, RCUP stove installers instead helped to cross-identify households according to both criteria. Using the technician's unwritten definitions, "high" economic status indicated households with surplus food, land, and much livestock, "medium" referred to those with just sufficient food, sufficient land to produce the food, and one or several water buffalos, while "low" indicated those with insufficient food, no land, and usually no livestock. "High" caste status included Brahman, Chetri, and Thakuri groups; "medium" included the Newari, Thakali, and Magar; "low" included the Untouchables and/or all those of occupational employment such as blacksmiths, tailors, and musicians. Once designated, households were distributed into a three by three matrix of caste and economic distinction (see Table III). Selection of households from these matrices occurred one day prior to sampling. The same methodology was also used for households with traditional stoves.

TABLE III

Household Selection
Matrix of Equal Representation

		Economic Status			
		High	Medium	Low	Total
Caste Status	High	3	1 or 2	-------	5
	Medium	1	3	1	5
	Low	-------	1 or 2	3	5
		Total no. of households randomly selected from the matrix to represent one stove type			15

As of September 1984, many improved stoves in Gorkha had been distributed, but not installed. The homes that had been given stoves parts but still awaited installation, were ideal candidates for traditional stove tests because they were already participants in the RCUP cookstove program, and were, therefore, approachable. In Myagdi, on the other hand, all improved stoves distributed were also installed, which necessitated the participation of old stove households not already affiliated with RCUP.

Nepali women cook two main meals each day, at approximately 9:00 a.m. and 6:00 p.m. For this reason, two 1 1/2- to 2-hour sampling sessions were planned for each day. Households were selected randomly from the caste/status matrices, and visited one day prior to testing. The RCUP stove installer, interpreter, and Technical Assistant visited the cooks to gain their trust, to determine their desire to participate, and to set up the next day's time of return. In the two cases where a household declined to participate, for religious reasons or inconvenience, another household on the matrix was chosen and visited in turn. In this manner thirty-five households, twenty with new stoves and fifteen with old stoves, were sampled in Gorkha. Thirty-one households were sampled in Myagdi, fifteen with new stoves and sixteen with old stoves. Only four stoves, those of caste iron ring and metal construction, were sampled in Mustang.

D. Selection Limitations

The greatest difficulty during selection was finding enough low economic and caste status households with improved stoves to sample. In Gorkha, only three households of low economic status had improved stoves installed by RCUP as of September 1984. Initially, there was concern that RCUP was showing a serious lack of concern for the needs of the most destitute. RCUP stove technicians, however, have described specific reasons for the improved stoves' failure to fit into the traditional low-income lifestyle. They explained that the poorest of Nepal scavenge for firewood. They do not buy firewood at the bazaar as do the other castes and, therefore, do not have an incentive to save cash by decreasing their fuel consumption. On the other hand, fuel efficiency is the highest stated priority of the poor who did want the new stove (see Section III). These few respondents wanted to change their traditional stove-use customs to save the time that is lost scavenging for firewood at increasing distances each year. Based on these considerations, new stove dissemination among lower income groups may be hampered partially because promotion efforts do not emphasize the time saved through less frequent fuel collection. Furthermore, critics argue that some improved stoves are not necessarily fuel efficient with scavenged fuel - small twigs, dung, and crop residues - which is the fuel of the poor. Instead, they are usually designed for wood combustion (Tinker, 1985).

The majority of Nepal's poor use the least efficient of cookstoves, the tripod pot support, or agena. Introducing a mud-enclosed firebox and flue into their lives requires that the women learn a completely new way of cooking. In addition, the poor usually have large families, while the improved stoves are specifically designed for limited family size. Large pots and large quantities of food are inefficiently heated and allow smoke to escape between the pots and pot mouths.

Although there are impediments for improved stove promotion with poorer Nepalese, RCUP has achieved progress in the adoption of the new stove in their ranks. Poor Nepalese who have dared to try an improved stove (sometimes a large deviation from a dictated low caste lifestyle) first note the large reduction in their fuel needs. In the case of one low-income home, the change from an open to an enclosed fire decreased fuel use, and therefore, scavenging time, by eighty percent (Shrestha, D.M., 1984). Of secondary importance, new stoves symbolize a higher standard of living and a cleaner, more attractive living environment for those of low-income and low castes. Regardless, a change in cooking style seems to affect most profoundly those who can least afford experimentation in their lives.

II. QUANTITATIVE SAMPLING

"When too windy outside with wet wood and smoke inside, I would like to stay hungry rather than cook."

Shariya Prakash Baniya, Beni, Myagdi
(Owner of a traditional stove)

"In developing nations, exposure to smoke from biomass fuels is probably the single most important occupational health hazard of women."

(De Koning, Smith, and Last, 1984)

A. Domestic Air Pollution

Air pollution sampling took a giant leap forward with the introduction of personal air monitoring equipment. Air sampling is "personal" when the subject wears the equipment. Equipment portability allows for a more accurate measurement of a person's exposure to a pollutant much more accurately than measurements from a stationary, middle-of-the-room air sampler. Therefore, personal air monitors sample the air in the subject's ever-changing breathing zone. This enables analysts to quantify the harmful particulates suspended at the nose and mouth of the respiratory system, rather than waiting to examine the lungs of the victims of respiratory disease.

Indoor pollution measurements are just beginning to gain popularity in more developed countries (MDCs), where gas/wood stove, furniture, and insulation emissions often exceed allowable standards set by government health protection agencies. Unfortunately, very little attention has been directed towards much greater pollutant levels in rural village homes in lesser developed countries (LDCs), where one-half of the world's households are cooking two to three times daily with biomass fuels such as wood, crop residues, or dung (Smith, 1986).

This is the first study in Nepal in which personal air monitoring equipment was used. The purpose of the air monitoring was to document Nepali women's exposure to pollutants produced from the combustion of biomass fuels. More specifically, the data were used to compare the difference in pollutant levels between indoor cooking environments with traditional, no-flue cookstoves and those with improved cookstoves with flues. In Nepal, it is suspected that womens' exposures to smoke are exceptionally high because they cook in confined kitchen environments, under low ceilings, with few windows, and at high altitudes.

B. Sampling Procedure

Smoke consists of the products of incomplete fuel combustion in the form of suspended particulates, droplets, and gases. In wood smoke, for example, several hundred compounds have been identified, several dozen of which are known to be toxic in one way or another. In this study, five types of sampling tests were performed to monitor some of the more harmful constituents of smoke which are produced during the combustion of biomass fuels, including suspended particulates, carbon monoxide, nitrogen, dioxide, formaldehyde, and benzo(a)pyrene. All equipment (see Equipment List, Appendix A) and training for smoke sampling was provided by Dr. Kirk R. Smith, coordinator of the Biomass Fuels and Development Project of the East-West Center in Hawaii and his associates. The following describes the method used for each of the separate smoke sampling tests.

As mentioned earlier, personal air sampling measures the cook's exposure to Total Suspended Particulates (TSP) in the breathing zone. The battery pack/air pump is clipped to the hip and a plastic tube runs from the pump to the shoulder where the cassette containing the filter is located. The pump simply draws in air through the filter and collects particles down to 0.1 microns. TSP includes particulates as large as fifteen microns in diameter. However, it is the smallest particle sizes that pass into the nose and mouth, causing respiratory problems. Because nearly all material in wood smoke is less than three microns in diameter (Smith and Apte et al. 1984), all of it may be considered to be RSP (Respirable Suspended Particulates) capable of penetrating the deep lung. The pump indicates the rate of air flow in liters per minute, which is multiplied by minutes sampled and particulate weight to yield quantity per volume. To insure consistency of flow rate, the air pump was periodically calibrated with a bubble meter and timer.

The second type of data collection employed a carbon monoxide (CO) continuous diffusion monitor. This CO monitor was originally intended for use in industrial, occupational settings where it was attached to the worker's hip belt. The monitor has an electrochemical cell that senses the presence of carbon monoxide, and instantaneously displays the amount, in parts per million, on a small digital panel display. The monitor has a built-in alarm, usually set at fifty ppm, which sounds when the worker is in an area of high concentration. For our purposes, the alarm (a beeping signal) was set at the highest possible limit, 197 ppm, and the second signal (continuous alarm) at 500 ppm, because very high CO levels were expected.

The CO monitor was designed to be worn on a belt at hip height. However, because nose/mouth height was the correct sampling zone for this study and because the cooks were already inconvenienced by the particulate air sampler, the CO monitor was placed in a stationary spot on a box or shelf at the cook's head height at the cookstove. Most cooks squatted on the floor in front of their cookstove, so

the monitor was positioned between two and three feet from the floor and within a three-foot horizontal distance from the cook's most common squatting position at the stove.

Because instantaneous concentrations in such conditions vary dramatically from one minute to the next, the CO monitor was modified to permit an averaging of the instantaneous readings over the total sampling period. The monitor held a gold memory cell that periodically recorded instantaneous readings during the hour of testing. After sampling was completed, an accessory instrument, called a dosimeter, read what was stored on the cell, and calculated the time-weighted average in ppm/hrs. A small tank of carbon monoxide, in the form of certified 190 ppm span gas, was carried to the field in order to calibrate the monitor on a weekly basis.

The nitrogen dioxide (NO2) and formaldehyde (HCHO) monitors consisted of chemically impregnated filters designed for passive exposure to the air. Unlike the particulate and CO monitors discussed above, these passive monitors require no pumps, batteries, or electronics. They were supplied by Air Quality Research Labs in California and were designed principally for NO2 and HCHO detection in MDC homes where principal sources would be gas stoves and insulation respectively. They had never before been used to sample smoke from cooking fires in rural LDC homes. With the active monitors, only one hour of the cooking period was sampled. The passive NO2 and HCHO monitors, however, were placed in homes for a one or two week duration to measure a family's total exposure. Thus, these monitors average cooking and non-cooking periods together.

The filters, located at the bottom of small glass test tubes, were hung from wood beam rafters at standing height in both cooking and sleeping areas. Although the sample size was small (n=36, total; n=18, NO2; n=18, HCHO; plus further subdivisions), the results gave a useful indication of differences in NO2 and HCHO exposures from both old and new cookstoves, and in both cooking and sleeping areas.

The fifth and final test involved a chemical analysis of the air sampling filters for quantification of a polycyclic aromatic hydrocarbon called benzo (a)pyrene (BaP). BaP is a carcinogenic substance found in the tar of cigarette tobacco, and is also a product of the combustion of other biomass fuels. The analysis (gas chromatography) was conducted by Prema Menom, a doctoral student at the Biomass Fuels and Development Project at the East-West Center in Honolulu, Hawaii.

C. Sampling Results

Table IV compares sampling results of the improved stove with those of two types of traditional stoves (the mud chulo and agena) as compared to different national exposure standards. The TSP and CO results are compared to one-hour public safety standards because the sampling time was for only one hour of cooking period. The one-hour standard is logically higher than longer-term standards,

because it reflects a human's capacity for safe exposure to a higher concentration for a very short period of time.

This comparison is misleading, however, because Nepali women are not exposed to these pollutants for only one hour, but for an average of five hours every day. One could argue that the preparation of food requires so many hours each day that a Nepali woman spends nearly an entire "work day" by the stove. This reasoning suggests that it makes more sense to compare TSP and CO exposures to eight-hour occupational safety standards, which are much higher than one hour public, or ambient, exposures. For example, the United States Environmental Protection Agency's air quality standard for exposure to particulate matter during an eight-hour work day is 5,000 ug/m^3. This study's results would then indicate that a Nepali cook's exposure to improved stove emissions are 4.4 times less than these occupational standards prescribed for workers exposed to TSP and MDCs. Exposure to traditional stove emissions, however, would bear a dangerously close resemblance to this high occupational limit, being only 1.6 times less.

On the other hand, the NO2 and HCHO results are compared to longer-term standards because the sampling time was longer (one or two weeks). Long-term standards are lower because they reflect a person's total exposure averaged over all cooking and non-cooking hours. To demonstrate the spatial differences and possible exposure of other family members to pollutants, NO2 and HCHO results are also subdivided between cooking (k) and sleeping (b) area exposures.

The BaP results are compared to a proposed USSR standard here only because no other countries have even suggested allowable exposures to this carcinogen.

Table IV

Pollutant Exposures of Nepali Women Using Improved versus Traditional Cookstoves

P = P-test for comparison of the means (improved versus combined cookstoves)
n = sample size
x = mean
s = standard deviation
cov = coefficient of variation
k = kitchen (cooking area)
b = bedroom (sleeping area)

POLLUTANT	STANDARD (country, averaging time)	IMPROVED	TRADITIONAL MUD CHULO	TRADITIONAL AGENA	COMB. TRAD	P
TSP (ug/m^3)						
n		27	13	9	22	
x	200	1130	2610	3915	1340	<0.5%
s	(Japanese-	700	3050	2050	2710	
cov	one hour)	0.62	1.17	0.52	0.86	
CO (ppm)						
n		26	15	12	27	
x	35	65	240	375	300	<0.1%
s	(USEPA-	112	200	187	203	
cov	one hour)	1.67	0.84	0.50	0.68	

		Improved (k)	Improved (b)	Combined Trad. (k)	Combined Trad. (b)	(k)	(k+b)
n		5	4	5	4		
x	0.05	0.04	0.04	0.26	0.02	<0.1%	<2.5%
s	(USEPA-	0.04	0.03	0.14	0.01		
cov	one year)	0.89	0.67	0.55	0.57		
HCHO (ppm)							
n		5	4	5	4		
x	0.1	0.20	0.13	0.33	0.04	>40%	>50%
s	(Canada-	0.19	0.18	0.18	0.02		
cov	one week)	0.97	1.43	0.55	.54		
BaP (ng/m^3)							
n		4		5		>50%	
x	0.1	454		393			
s	(USSR-	466		171			
cov	proposed annual)	1.0		0.4			

The total suspended particulate (TSP) results demonstrate the large difference between the smoke emitted indoors from improved and old stoves. In this case a flue is effective in eliminating approximately two-thirds of the smoke from the indoor environment, from a particulate concentration of 3,140 ug/m^3 to 1,130 ug/m^3. Using a Japanese safety standard for acceptable exposure to TSP for a one hour period of 200 ug/m^3, we see that even the improved stove results are 5.6 times greater than this allowable level. However, the old stove results exceed the improved stove emissions by a factor of three, or sixteen times greater than the allowable levels.

It is important to differentiate between two types of traditional stoves, the mud chulo and the tripod agena. Because of their designs, TSP measurements are significantly different between them. Mud chulo TSP quantities averaged 1,600 ug/m^3. The tripod agena produced the highest monitoring of TSP in all sampled households, averaging 3,900 ug/m^3, or almost twenty times higher than the Japanese one-hour standard. The tripod agena proved itself as the most inefficient method of burning fuel in Nepal, i.e., emitting the most amount of uncombused particulate matter into the cooking environment.

Carbon monoxide results were hampered somewhat at exceptionally high concentrations of smoke. At lower concentrations of 0 to 200 ppm, occasional observations of the instantaneous display coincided well with the average readout from the dosimeter. However, at high levels when the alarm was sounding, observations of the displayed readings during the test were considerably lower (approximately 500 ppm) than the dosimeter's post-average (up to 7,500 ppm). Interference of other gases has been dismissed as a possible reason for the high averages because the gases that are known to distort readings from the CO monitor cannot be present when biomass fuels are combusted (Islam, 1985). To adjust for this occurrence, all dosimeter readings over 500 ppm were decreased to that amount. The adjustment only affects old stove measurements and is very conservative procedure designed to take into account the inconsistent readings above 500 ppm. The result is that the reported CO concentrations for old stoves are lower than the true values.

Improved cookstove flues performed well in venting carbon monoxide. Exposures averaged at sixty-five ppm, or only two times more than the WHO standard for one hour, and 7.5 times their standard for eight hours. Even after adjustment, old stove CO readings <u>still</u> averaged at 300 ppm, or 8.5 times and thirty-three times the one and eight hour WHO standards respectively. Distinguishing between traditional stove types, CO measurements resulting from exposure to cooking with the tripod agena were higher than the mud chulo. The agena exposure levels averaged at a dangerously high level of 375 ppm, and the mud chulo, slightly lower but still of great concern, at 240 ppm. The open fire, tripod style of cooking maintains its distinction as the most inefficient burning and efficient polluting style of cooking with the highest concentrations of carbon monoxide and particulate matter emitted into the cook's breathing zone.

Nitrogen dioxide and formaldehyde tests also indicated a difference in exposures between traditional and improved cookstove use. Overall, a statistical comparison of the means demonstrates that the difference between the cooks' mean exposures to NO2 produced from new and old stoves is greater (probability (P) of less than 2.5%) than their mean exposure differences to HCHO between the two stove types (P > 50.0%). In other words, there is greater statistical confidence that cooks are exposed to higher levels of NO2 rather than higher levels of HCHO when comparing the use of traditional stoves to that of improved stoves. Nevertheless, both tests show significant improvements in exposure reduction with the new stove.

As mentioned previously, NO2 and HCHO sampling was conducted for longer periods (one or two weeks) than that of CO or TSP (one hour during mean preparation). For this reason, results reflect the cooks' overall exposure to these pollutants, including periods of zero pollution production when cookstoves were not in use (assuming there were no other sources of the pollutants). These data are compared to long-term standards which are set for public, not occupational, settings. For example, NO2 results are compared to an annual USEPA standard of 0.05 ppm. Cooks' exposures to the No2 produced by traditional cookstoves exceeded these standards, whereas results with the improved stove did not. HCHO results, in turn, were compared to a Canadian standard of 0.1 ppm. In this case, both new and old stove results exceeded this standard, the old stove by a greater factor (3X) than the new (2X).

In addition to sampling in the cooking area, NO2 and HCHO tests were also conducted in sleeping areas. A hypothesis is that smoke rises through stairwells and gets trapped on the second floor to add a second area of exposure for Nepalese retiring soon after their evening meals. As expected the cooking area exposures, shown here on the left, exceeded sleeping area exposures, on the right:

0.04 ppm	(new stove, NO2 exposure)	0.04 (new stove, NO2 exposure)
0.26	(old, NO2)	0.02 (old, NO2)
0.20	(new, HCHO)	0.13 (new, HCHO)
0.33	(old, HCHO	0.03 (old, HCHO)

However, none of the tests of sleeping areas exceeded the long-term standards set for safe exposure. Sleeping areas of homes with old stoves averaged lower quantities of the two gases than the same areas in homes with new stoves. This may mean that smoke is vented effectively from the first floor indoor cooking area by the flues, but re-enters through second floor windows contaminating the bedroom areas. This observation was noted by a few cooks whose second floor had open windows at both ends to encourage a cross-draft. In general, Nepalese family members sleep on both ground and upper floors. It is, therefore, important to consider the impact of pollutants on the not only the cook, but on other family members as well.

Benzo(a)pyrene (BaP) analysis of the TSP filters was only completed with nine households. The four homes with the new stoves averaged slightly higher (454 ng/m^3) than the five homes with the old stoves (393 ng/m^3). New stove results are unreliable: a high standard deviation (466 ppm) includes two data points of zero and two high readings of 760 and 1,056 (the highest of which can be attributed to the smallest (4 m^3) cooking area sampled). Overall, however, it is important to recognize that all of the results are high, about 4,000 times the proposed annual standard set by the USSR of 0.1 ng/m^3. These indications call for more data collection in this area. Fortunately, the recent introduction of BaP personal monitors, in the form of badges easily worn on the cook's shirt, will make information gathering more exact.

D. Flue and Pot Fit Micro-Experiments

In two tests with improved stoves, sampling was repeated during a second cooking period because ventilation performance of the flue seemed exceptionally poor. This presented a perfect opportunity to do a micro-experiment with two "before and after" tests.

In the first case, a woman in the town of Bansbot, Myagdi complained that we had come at the wrong time, harvest time, when she had to feed more than her own family members. For the month of November she was compelled to use larger rice containers which were not the pots for which the stove was designed. This situation resulted in much smoke escaping between the large pot and the smaller, supportive pot-mouths.

Limited pot use is a common complaint with he improved stoves. It is a limitation that must be well advertised before stove dissemination. In this case the cook did not mind the inconvenience during one part of the year, because the greatly improved ventilation for most of the year was well worth the tradeoff. Our test results for use with the ill-fitting pots was TSP = 4,908 ug/m^3 and CO = 550 ppm. The next morning we repeated the test, asking the cook to use her normal pots (the same used to mold pot-mouth size during installation). The difference in the amount of smoke in the cooking area was remarkable: TSP = 1,100 ug/m^3 and CO = 30.6 ppm. Poor pot fit accounted for 4.4 times the amount of particulates and sixteen times the carbon monoxide trapped indoors.

A second opportunity for before and after sampling occurred in Gorkha where a woman and her daughter admitted to never having cleaned the flue of their improved stove since its installation six months prior. During the first evening that we tested, the smoke noticeably backed down the flue and we recorded a TSP measurement of 1,740 ug/m^3 and a CO measurement of 500 ppm. On the following day the RCUP Energy Specialist, Gyani Shakya, helped the cooks remove 1.5 liters of soot from their flue. That evening we returned to do an after test, but unfortunately, our air pump's battery discharged and a follow-up TSP measurement was not completed. The after test for CO, however, showed a nine times reduction of the household's exposure to the harmful gas, at 56.1 ppm.

This second example demonstrates the importance of maintaining the improved stove's flue. Flue cleaning is another new stove disadvantage pointed out by users. This is in part due to the new stove flue being a completely alien technology for rural Nepali homes, and therefore, a completely alien responsibility. Understandably, flue disassembling takes a little practice. In this case the mother and daughter were still convinced of the new stove's advantages, even when the flue was clogged. They represented a majority of cooks who claimed that they had forgotten, did not understand, or were never taught how to clear soot from the flue. Because the stoves are installed by technicians, RCUP's social scientist postulates that the cooks also expect the technicians to return to maintain the stove by periodically cleaning the flue (Pandy, 1985).

E. Two Smoke Sources Micro-Experiment

During six smoke sampling tests, the cook used a second cookstove. In every case a tripod agena was the second type of stove brought into use, either for making alcohol, tea, livestock feed, or to help ignite the main cookstove fire. The second fires were in use for approximately thirty minutes, or half of the sampling period. The use of both an improved and traditional tripod cookstove (n=3) resulted in TSP measurements of 1,510 ug/m^3 and CO measurements of 183 ppm. The use of two types of traditional stoves (n=3), a mud chulo and a tripod agena, produced the expected higher results of TSP of 3,910 ug/m^3 and CO of 447 ppm.

As was mentioned earlier, two-source exposure is not an unusual situation in Nepali homes. Many households with domesticated livestock and/or alcohol producing practices regularly use a second stove because improved stoves cannot support or heat the larger pots needed for cooking large quantities of feed, food, or brew. In fact second sources of smoke, especially from large fires, may contribute more emissions to the cooking area than worse-case agena cookstoves. More attention must be directed toward distinguishing between cookstove emissions depending upon the number of sources, such as the auxillary use of agenas for warmth as a major and continuous source of smoke during colder, winter months.

F. Morning and Evening Exposures

Pollutant measurements for TSP and CO were subdivided into morning and evening cooking periods to determine possible influence of outside conditions. The following table displays the obvious differences between the two times of day. All mean evening exposures exceed mean morning exposures.

Table V

Differences in AM/PM Exposures

	MORNING			EVENING		
TSP (ug/m^3)						
	mean	std. dev.	sample	mean	std. dev.	sample
new	1,110	580	14	1,440	1,190	15
old	1,580	1,680	15	3,490	3,190	13
all stoves	1,470	1,400	35	2,380	2,430	32
CO (ppm)						
new	36	22	14	168	230	13
old	286	212	14	313	183	13
all stoves	173	193	34	230	209	31

A discrepancy between morning and evening particulate exposures was also reported in a 1981 study in India by Smith, Aggarwal, and Dave (1983). This study concluded that ground-level inversions and calm air affect Indian villages in the evening and probably caused decreased air flow through homes. The same reasoning is also likely to be behind the consistently higher exposure levels found in the evenings for this study. Given that Nepalese cooks use the same fuel and same food for morning and evening meals, it would seem that local valley inversions (rapidly cooling, evening air trapping ground-level firesmoke and preventing it from rising) would be the most logical contributors to this consistently recorded occurrence.

G. Health Implications

"I believe the smoke is really bad for my health. It is the root of all my sickness."

R.K. Shahi, Rakhu Piple, Myagdi

"The most prevalent disease I've seen among the cooking people are asthma, coughing, eye pains, eye weakness, and sight diminishing early. And many complain of severe headaches."

B.P. Regmi, Beni Bazaar, Myagdi

"Links between wood burning and respiratory and eye diseases are clear to any rural cook, but have not been scientifically established."

(Cecelski, 1984)

Few studies have been conducted in LDCs on health problems associated with heavy exposures to indoor air pollutants. Particulates, carbon monoxide, formaldehyde, nitrogen dioxide, and benzo(a)pyrene have been examined from the perspective of MDCs: urban outdoor exposure and exposures of men in occupational settings. These latter studies have been used to set national standards for allowable exposure to air pollutants in MDCs. Ironically, there are no air pollution standards to protect the health of half of the world's households who cook with biomass fuels, and are, therefore, chronically exposed to high levels of indoor air pollutants.

This study provides information about Nepali cooks' exposures to air pollutants along with their perceptions of the health problems associated with that exposure. Unfortunately, lung and eye disorders were not diagnosed during this study for want of a qualified rural health doctor. Although a direct correlation between health problems and smoke exposure cannot yet be established quantitatively, interviewee perceptions of smoke-related ailments are a useful contribution. Table VI describes the symptoms commonly cited by the cooks during this study as being attributable to daily exposure to the smoke produced from their cookstoves. These observations may be compared with the known health impacts of some of the individual constituents of biomass smoke shown in Table VII.

Table VI

Symptons of Smoke Exposure

Respiratory Problems	Eye Problems
- chest pains	- constant tearing
- coughing up black mucus	- headaches from eye pains
- difficulty breathing	- mucus formation on eye lids
- asthma	- eye itch
- general lethargy	- squinting/reddening of eyes
- prone to catch colds and sore throats	- poor eyesight
- exhaustion	- drying of eyeball lubrication
- excessive expectoration	- blindness
- heat suffocation	

Table VII

Health Problems Associated with Exposure to Specific Air Pollutants

Respirable Suspended Particulates (RSP)
- bronchial hypersecretion
- air flow obstruction

Carbon Monoxide
- headache
- nausea
- vomiting
- dizziness
- drowziness
- collapse

Formaldehyde
- asthma attacks
- fatigue
- insomnia
- diarrhea
- chest pains
- eye, nose, and throat irritation
- nausea and dizziness
- rashes

Nitrogen Dioxide
- reduced resistance to respiratory infection
- eye irritation
- pulmonary edema

Benzo(a)pyrene
- lung cancer
- skin cancer

The exact health implications of chronic exposures to wood smoke have not yet been addressed systematically. Although few, the studies in LDCs are fairly consistent in their suggestion of the causative agent of high prevalences of respiratory diseases: cooking indoors on open fires in unventilated homes (Cleary and Blackburn, 1968 and Kossov, 1982). Full comprehension of the specific health impairments caused by specific constituents of smoke requires extensive, systematic medical research of household health in collaboration with air pollution monitoring of household exposure (EWC, 1985).

In 1984 the World Health Organization declared that the leading cause of death in lesser developed countries was respiratory disease (WHO, 1984). Among the most commonly occuring respiratory diseases in LDCs are acute respiratory infections (ARI) in children, and chronic obstructive lung disease (COLD) in adults. It is estimated that 666,000 infants die each year from ARI (Chretien et al., 1984). Table VIII identifies the causative agents most associated with ARI morbidity (incidence of disease) and mortality (number of deaths). In Nepal

Dr. Mrigendra Raj Pandy of Bir Hospital found an alarming three hundred thirty ARI deaths per thousand births in the high-altitude village of Jumla (Pandey et al., 1983 and Pandey, et al., 1984).

Table VIII

Causative Factors of ARI Morbidity and Mortality

Morbidity	Mortality
1. Air Pollution (including tobacco smoke)	1. Malnutrition
2. Crowding	2. Previous Morbidity of Moderate or Severe ARI
3. Lack of Immunization	3. Lack of Access to Curative Health Services
4. Lack of Personal Hygiene	
5. Presence of Causative Organisms	

(Smith and Kunstader, 1985)

Dr. Pandey's extensive work in the Kathmandu valley region on the prevalence of chronic bronchitis (CB) in men and women tobacco smokers and non-smokers has lead him to the conclusion that time spent near the fire is statistically correlated with CB (Pandey, 1984). Both male and female smokers were shown to have a similar prevalence of CB of about eighteen percent. However, male non-smokers only had a three percent chance of having CB, whereas female non-smokers had a seventeen percent chance. This verified the fact that women were being exposed to another source of air pollutant -- domestic cooking fires. Dr. Pandey also demonstrated that as hours spent near a fire increased, so did the prevalence of chronic bronchitis (Pandey, 1984).

Recognizing that Dr. Pandey has demonstrated the relationship between exposure to cooking fires and a respiratory disease, then it is only reasonable to suggest that improved cookstove flues can, in fact, decrease the prevalence of chronic bronchitis and other smoke-related respiratory diseases in Nepal.

III. QUALITATIVE SAMPLING

"My life is so difficult I would do anything to make it easier, like have a new stove."

Balmati Biswakarma, Beni, Myagdi
Traditional Stove Owner of the
Untouchable Caste

"...rural Nepalese respondents think, talk and behave in terms of their own social organization, beliefs, fears, values, and ways of categorizing and interpreting the world, which the research designers do not necessarily even know about (let alone control for) beforehand."

(Campbell et al., 1983)

A. Questionnaire

Sixty-six questions constituted the interview format for this study (see Sample Questionnaire, Appendix B). This questionnaire was a compilation of several improved-stove surveys from the Indoor Air Pollution, Biomass Fuels and Health Project of the East-West Center in Hawaii and other resource management development organizations in Kathmandu. The first three pages of the questionnaire were taken directly from the Community Forestry and Afforestation Division's (CFAD) Survey of New Stoves, which included queries about household characteristics, stove use, installation, and users' perceptions of fuel use. The fourth through sixth pages asked questions about perceptions of smoke exposure, women's workload changes, the advantages and disadvantages of the improved stove, and surveyor observations. The seventh page made room for sketches of the stove, room, window and door, and general household dimensions. The last page was a Kitchen Behavior Test of the cook's usual location and activity during the sampling period.

Most important to the question-preparation process was an understanding of the question-presentation process. Experienced social scientists warned that formal questions would produce formal answers, long and complex questions would lead to misunderstandings and frustration, and the interviewer's attitude and interest would dictate sincerity of response. Several advisors, including J. Gabriel Campbell (1984b) of CFAD and Shanta Pandey of RCUP, specifically noted the importance of making the interview simulate an informal conversation to increase dialogue and gain the trust of the interviewee. Indispensible advice, such as this, helped both the interpreter and the Technical Assistant to be sensitive and effective during questionnaire sessions.

The next eight sections of this chapter present, in part, the results of the sixty-six item questionnaire. Some results are abbreviated or not discussed if they were felt to present no new information.

B. Household Information

All tests were conducted between the altitudes of 855 and 1,530 meters (2,800-5,000 feet) with the exception of four tests in Mustang at 2,560 meters (8,400 feet). Most stoves were located on the ground floor and had been installed about one-half year previously. The sampling sessions were divided evenly between morning and evening cooking periods. Of the seven ethnic groups represented in the study, the most common households were Newari (40%), Brahmin (17%), and Magar (15%). More importantly, the three economic groups were evenly represented (see Table X). Within the old stove category, more tripod stove owners were characterized as poor (61%) than those with mud chulas (20%). Few households of high economic status had an old stove that was a tripod agena (8%); most had mud chulas (40%).

All homes averaged about six household members with between one and two children under the age of ten years. Most cooks started cooking "on a regular basis" at sixteen, although this age ranged from four to fifty-six. Men (or women) beginning to cook at a much older age did so because their spouse had died, daughter had married, or servant had been dismissed. The average age of all cooks at the time of sampling was thirty-four years, and ranged between ten and seventy-five years. Only those cooks using a tripod agena were, at an average of forty-three years, older than most cooks in the survey.

Seventy households were sampled in the three districts. The breakdown of the sampled stove types are shown in Table IX.

Table IX

Sampled Stove Types

Sample Size	Cookstove Name
n = 28	Improved UNICEF "New"
n = 28	Traditional Stoves "Old"
n = 15	Mud Chulas
n = 12	Tripod Agenas
n = 1	3 Stove Support
n = 4	Mustang District
n = 6	Two Sources of Smoke
n = 4	Experimental
n = 70	TOTAL

When the improved stove was installed, it most often (89%) took the place of a mud chulo, rather than a tripod agena (11%). Most replaced stoves were actually removed or broken (78%), although fifteen percent were kept to be used "sometimes". All mud chulas sampled were used for all cooking, except livestock feed. A majority (61%) of the sampled tripod agenas were used to cook everything (meals, feed, alcohol, etc.). These differences in stove use are expected because agenas can support and heat any sized container, whereas mud chulas are usually built too close to the wall to accommodate an animal feed pot, or alcohol container.

Many Nepalese believe that a fire used to cook rice, corn, or cereals is contaminated and needs to be red-washed with clay after use. Likewise, Nepalese of higher caste groups forbid using the same fire for human and animal food preparation (S. Pandey, 1985). For these reasons, the improved stove was exclusively used for meal and tea-making in most cases (77%), and least frequently (7%) for all cooking. Recipients of improved stoves usually (59%) kept an agena present to supplement their cooking options, although a significant portion (41%) maintained no other stove. Most households with mud chulas also kept agenas as second cookstoves (80%), while most agena households did not have a second cookstove (54%). No homes employed two mud chulas as their primary and secondary cookstoves, though a few homes maintained a pair of agenas of different sizes. In all cases, secondary cookstoves were limited to specific functions for alcohol, livestock feed, or tea-making. These observations all support the conclusion that stove type and number is an indicator of economic status. In general, Nepalis of higher economic status will own both a mud chulo and an agena. Table X shows the percentages and types of households sampled in the two districts of Gorkha and Myagdi, according to ethnic group and economic status.

Table X

Percents of Household Sampled

		Improved (n = 27)	Combined Trad. (n = 28)	Mud Chulo (n = 15)	Agena (n = 13)
ETHNIC GROUP	Brahmin	22%	11%	13%	8%
	Thakuri	4	14	0	31
	Chetri	15	4	6.5	0
	Magar	11	18	13	23
	Thakali	0	0	0	0
	Newari	44	39	60	15
	Occupational*	4	14	6.5	23

* (Lowest Hindu caste grouped by occupation such as tailors, blacksmiths, and leather goods makers.)

ECONOMIC STATUS	High	37%	25%	40%	8%
	Medium	33	36	40	31
	Low	30	39	20	61

C. Improved Stove Inspection

At the start of sampling sessions, the accompanying RCUP stove technician performed a systematic inspection of the condition of the stove. When the technician was not available, the Technical Assistant followed the same procedure. A flashlight and probe were the only equipment necessary to perform inspections. The only difficult point of the inspection was determining the ash content collected inside the flue, because the answer had to be induced by stated flue performance instead of observed build-up of soot and ash.

Stove parts infrequently were broken, and only occasionally cracked. This is easily attributed to the newness of the stoves and that most cooks handled the stove carefully, sometimes for fear of its fragility and the unavailability of replacement parts.

The "damper" feature noticeably went totally unused (36%), or frequently unused (55%). Dampers are used to regulate the airflow through the stove to control the speed of combustion and unwanted backdrafts during windy days. Very few cooks responded that they understood the function of the damper after complaining of smoke backing down the pipe.

Seventy-two percent of the cooks with new stoves had attempted to clean the flue since installation. The median number of times that soot and ash were removed (which requires some dismantling of the pipes) was three times, or once every two months. Tea shop and hotel owners cleaned most frequently, between once or twice a week. Flue cleaning was probably the most unpopular responsibility associated with the new stove, which was demonstrated by the number of times that ash was found in the connecting pipe (59%), and soot or ash reported to clog the flue (83%).

About forty-four percent of the cooks indicated that their pots fit the molded pot mouths "good" or "fair". This result does not seem to be a fair description of pot fit because cooks commonly complained of smoke escaping from between pots and pot mouths. Poor pot-fit concerns stove technicians because it so easily defeats flue ventilation advantages. RCUP technicians consciously try to accommodate several pot sizes by 1) placing extra mud in a funnel-shape at the pot mouth, and 2) encouraging the use of tin plates with an inner section removed to support, for example, very small tea pots.

D. Fuel Savings

Improved stove users perceived that they saved approximately thirty-eight percent of the fuel over their replaced, traditional stove. Cooks were asked how many big "bharis" of fuel that they consume per month. (A "bhari" is a headload of collected, stacked wood; small bharis weigh from fifteen to thirty-five kilograms and big bharis vary from thirty-five to sixty kilograms.) Perceptions obviously differ on fuel use and bhari size and recall questions have yielded quite inaccurate guesses, consistently on the side of over-exaggeration (Fox,1982). Nonetheless, the average perceived fuel use for improved stove users was 3.9

bharis per month. This is 1.7 times or forty-two percent less than the reported use of 6.7 with their original stove, which differs some from perceived fuel use of 8.0 by old stove owners. With old stoves, fuel use per month was 7.8 bharis for mud chulas and 8.4 bharis for agenas. This reflects the greater fuel use by the open fire agenas.

At the time of the survey, one bhari cost about 28.5 rupees in bazaar areas; the range is between twenty to forty rupees. Although these results are only perceived savings, not measured fuel savings, one could conjecture that new stove owners could save about eighty rupees per month (28.5 x 6.7 - 28.5 x 3.9 = 79.8) due to the improved stove fuel efficiency characteristic.

E. Smoke Exposure

All but one owner of improved-stoves (ninety-six percent) were delighted with the new stove's ability to reduce the smoke in the cooking area. An important consideration for both smoke exposure and workload information is the average time the cook spends near the fire. This question was asked from two perspectives to check the consistency of responses: 1) cooking hours per day; and 2) hours spent near any fire. Answers from the first question revealed that owners of new stoves spend about 5.2 hours per day "cooking", versus 5.1 spent by owners of old stoves. By the second method, owners of new stoves spent 1.9 hours per meal by a fire and another 1.3 per tea/tiffen/alcohol/livestock feed heating, for a total of 5.3 hours per day (when multiplied by two meals/day plus tea/etc.). Owners of old stoves spent 2.1 hours per meal and 1.1 for tea/etc., for a total of 5.4 hours per day. According to both perspectives, then, the time spent around either stove is a little over five hours per day. However, among old stoves, there is discrepancy. Mud chulas cook faster than agenas because two pots can be heated simultaneously and the mud enclosure acts to re-radiate the heat. Cooks spend between 4.8 to 5.1 hours around mud chulas, and between 5.3 and 5.6 hours with the tripod agena. Therefore, differences in exposures to smoke between mud chulas and agenas is related to time (i.e., hours spent by the fire), whereas differences between new and old stoves, in general, is related to exposure control (i.e., the flue).

The percentage of health problems associated with smoke exposure to the different stoves was very significant. Cooks using the improved stove stated that: 1) they had no eye problems in the last month (65%); 2) they had no cough in the last month (63%); and 3) it was easy to breathe when they cooked (89%). In contrast, most cooks using the old stoves stated that: 1) they had eye problems in the last month (74%); 2) they had a cough in the last month (71%); and 3) it was not easy to breathe when they cooked (67%). Both new and old cookstove owners stated that their eyes teared when they cooked (85 to 89%). New stove owners probably experienced eye tearing because the flue did not rid the indoor environment of all smoke (see Section II).

More owners of old stoves smoked cigarettes (eleven of twenty-eight) than owners of new stoves (five of twenty-five). All except one of the owners of an old stove who smoked used an agena. These ten agena cooks smoked an average 10.2 cigarettes per day, whereas the one cook of low income status with a mud chulo smoked thirty cigarettes in a day. Six of the ten agena cooks were in the lowest economic status. This may suggest that more poor Nepalese smoke cigarettes than those of medium or high economic status. The average number of other family members complaining of breathing or eye problems was 2.2 for old stoves, and 1.2 for new stoves.

Overall, cooks' consciousness of health problems associated with breathing excessive quantities of smoke varied widely. The survey did note, however, that owners of new stoves mentioned ills and hazards of smoke inhalation more frequently than did owners of old stoves. When asked about breathing or eye problems, old stove owners did not necessarily equate health problems directly with smoke.

In general, greater health awareness, better education, and higher economic status characterize owners of new stoves more than owners of old stoves. On the other hand, this conjecture is limited, based on observing cooks and families living in two large villages, rather than constituting an even representation of rural households to which the stove program is presently expanding.

F. Women's Workloads

> "At subsistence levels, women are the major providers and consumers of energy."
>
> (Irene Tinker, 1980)

This portion of the questionnaire was included to bring a Women in Development perspective to the study. Originally, the questions were centered around a family history of time spent collecting firewood. First of all, however, the younger generation of cooks sampled rarely collect fuelwood themselves. For those of high and medium economic status, bazaar life means buying fuelwood in the marketplace. Seventy-two percent of new stove owners buy their own fuel, in contrast to only forty-six percent of old stove owners. Within old stoves, however, most mud chulo stove owners (seventy-three percent) buy their own wood, whereas most agena owners (eighty-five percent) collect their own. Those who do scavenge for fuel collect (by permit) brush or crop residues in a government protected forest or on their own land, or they claim driftwood. On the days they collected fuelwood, approximately twenty percent of new stove owners and fifty percent of old stove owners spend between two and twelve hours away from their household chores.

Second, few cooks could recall the hours spent by grandparents on the collection of fuelwood. Therefore, the focus of the questions were redirected towards work-time related to cooking. Most cooks (seventy-nine percent) declared that they spend less time working with the improved stove than they had with their old stove. Also, despite most preconceptions of the new stove's slowness in cooking,

there was no consensus. New stove owners were clearly divided over the change in time spent cooking with the new as compared to the old stove: thirty-five percent decreased their time; twenty-seven percent spent the same amount of time; and thirty-eight percent increased the time spent. These responses coincide with reported hours spent near the fire, averaging approximately five hours for both new (5.2) and old stoves (4.8 - mud chulo, and 5.3 - agena). Every new stove owner agreed that the improved stove was more convenient than their old one. This further indicates that although cooking time does not decrease with the new stove, work time does.

Nineteen of twenty-seven (seventy percent) new stove owners stated that they are able to perform other activities while they cook with the new stove. Some of these activities include: other household "work," visiting other people, knitting or weaving (loom), preparing other food, relaxing, fetching water, reading, or selling medicine (response of a local doctor). In general, these cooks had to learn to shift the pots between pot holes, but otherwise the improved stove required less fire-tending, less attention to cooking, and, therefore, less work. Outside of the cooking period, new stove owners also felt their work time was greatly decreased by the flue venting dirty soot that used to require daily washing of stove walls, pots, clothes, and body. This is explained more thoroughly below.

G. Stove Advantages and Disadvantages

Findings of this evaluation coincide with other studies done in Nepal (Bajracharya, 1984) concerning the cook's highest priority for wanting an improved stove. Decreased domestic air pollution is the major selling point of the improved stove for potential recipients, and the most appreciated attribute for present owners. These results have a greater impact when considered together with the third most stated priority: cleaner homes. "Less smoke" as a first priority is associated with increased comfort and better health. A "cleaner home" is also a direct benefit of less smoke: for example, less particulate fall-out on clothes and hair, and less charring of walls adjacent to the stove and pot bottoms. The first and third priorities together emphasize the dominant influence of smoke in a Nepali cook's life, and the great significance a flue portends in improving that lifestyle.

Tables XI A to D list reasons that: a) owners of new stoves liked or disliked their new stoves; b) owners of old stoves wanted a new stove; and c) owners of old stoves liked or disliked their old stove.

Table XI-A

New Stove Owners
Reasons for Liking New Stove: Prioritized

Priority	Reason	
1	Less smoke - better health - less discomfort	
2	Less fuel consumed	
3	Cleaner homes (Better Control of Soot) - less red-washing walls and stove - less pot washing - less clothes washing - less hair and body washing	(LESS WORK)

Other advantages most often offered (in order of frequency of response):

Less tending/blowing of fire
Less heat emanated directly on body associated with better health (especially in summer heat)
Stove stays warmer longer
- keeps food heated, or also able to make tea
Fewer pains and aches
- fewer or no eyepains, headaches, nausea, dizziness, tearing
More safety
- children safe from falling in fire
- hands safe from open flame when cooking
More attractive stove
- higher standard of living, cleaner home
Easier to patch/repair/maintain stove
- no chipping
No ashes fly when blowing in stove mouth
Able to use second floor
- no complaints from children, guests, or lodgers
Less chance of burning food
Rice tastes better
Stove leaves more coal
- less ash (a possible disadvantage because villages need ash for laundry and dish washing)
Covered and controlled flame - less time needed to tend fire

Table XI-B

New Stove Owners
Reasons for Disliking New Stove: Prioritized

Priority	Reason
1	Longer cooking time
2	Difficult to clean flue
3	More wood splitting required; wood must be straight and dry

Other disadvantages enumerated:

Pots don't fit well
- cannot interchange pots
- not good for cooking for many people (limits guests)
- need tin overlay or extra mud to adjust for pot size

Smoke backs down flue when outlet pipe faces into strong winds
Frame too fragile
No warmth in winter
- ceramic pipes vent, rather than radiate heat
- cold high altitude climates (Mustang) need warmth

Hard to ignite
Small mouth for feeding in wood
No regulation of flame

The first reason that owners of new stoves disliked those stoves -- "longer cooking time" -- is misleading. Most new stove owners replaced a mud chulo with the new stove. Mud chulas take less time for cooking because there is a hot flame under both pot holes. Agena owners, however, compliment the new stove's quickness because they are used to cooking with one pot at a time. Thus, the improved stove involves longer cooking time for those of higher economic status who traditionally use the mud chulas. Lower income Nepalese (not as well represented here) see the new stove as adding a second pot to the burner, and requiring less overall cooking time. Ironically, longer cooking hours were also viewed as an advantage, leaving more "free" time for other activities or work.

The next portion describes the expectations of those about to receive a new stove.

Table XI-C

Old Stove Owners
Reasons for Wanting New Stove: Prioritized

Priority	Reason
1	Less smoke
2	Less fuel
3	Cleaner home

Other expectations of the new stove included:

Less work
Greater attractiveness of stove
Time to do other work
Less chipping
Less pains and aches
Free from illnesses
Safe from burns
Food keeps warm longer

Owners of old stoves generally also selected "less smoke" as their primary reason for wanting the new stove. However, with further examination of old stove users' responses, tripod agena owners more frequently chose fuel efficiency as their most important requisite. Agenas are the most fuel-inefficient Nepali cook-stoves. It makes sense that the poor, who use them exclusively, would feel the pressure to collect fuel more strongly than the "inconveniences" of poor health and increased cleaning time.

Finally, the last portion lists old stove characteristics that their owners liked or disliked.

Table XI-D

Old Stove Owners
Reasons for Liking or Disliking Old Stoves

Liked	Disliked
- cooks for many	- always dirty
- no wood splitting	- high fuel use
- warmth in winter	- much work to clean
	- no free time
	- frequent repair
	- always feel sick
	- cooks "late" or slowly
	- always bending over
	- great discomfort

The final notes include: 1) the disadvantage of the new stove not providing warmth in the winter would likely have been a more frequent response if the survey had been were conducted during that season, and 2) the tradition of squatting and cooking on the ground may be a commmon adaptation to domestic smoke pollution based on the observation that many owners of old stoves noted the inconvenience of "always having to bend" to keep their heads out of the smoke. Several young women stated their preference for a higher improved stove. To them, a flue meant that they would be able to sit or stand (instead of squatting) while cooking, because the smoke would no longer fill the upper portion of the room.

H. Surveyor's Observations

The following observations were noted by the Technical Assistant during sampling sessions.

1. The average number of people eating meals in homes with new stoves was six, compared to seven in homes with old stoves.

2. Only one or two other members were usually present in cooking area during cooking periods.

3. Three quarters of all the cooks agreed that the fuelwood was "dry"; usual only for autumn and spring seasons.

4. Except a few homes in remote areas that burned with corn husks, all cooks used wood for fuel.

5. Most new stove owners (seventy-five percent) used "small" sized fuel, whereas all of the old stove owners (one hundred percent) used "large" wood pieces.

6. The relative "smokiness", "blackness", and ventilation of cooking areas (see Table XII below) was determined exclusively by the Technical Assistant's opinion of comparison.

7. Roof material on all the homes surveyed was most often wood beam and occasionally thatch or tin. Room volumes ranged between four and 150 cubic meters and averaged twenty-four cubic meters for all households.

8. Cooking areas usually had only one window, and one or two doors. Estimated free wall space (ventilation from windows and doors) did differ slightly between new stove households (fourteen percent) and old stove households (eleven percent).

Table XII

Perceptions of Smoke

		New Stove	Mud Chulo	Agena
Smokiness of Cooking Area	None	68% (n=28)	27% (n=15)	23% (n=13)
	Little	29	60	15
	Much	3	13	62
Blackness of Cooking Area	None	36 (n=28)	23 (n=13)	0 (n=13)
	Little	39	31	8
	Much	25	46	92
Ventilation	Good	83 (n=28)	40 (n=15)	23 (n=13)
	Fair	14	53	23
	Poor	3	7	54

The three indicators on the left clearly show the impacts of decreased exposure control; most new stove owners reported good ventilation and no smokiness in the cooking area. The agena stove not only demonstrated the most smoky and black indoor conditions, but also the poorest ventilation. This observation about agenas was also noted by Joseph et al. (1984) in "A Preliminary Investigation Into Impact on Pollution Levels in Nepali Households by the Introduction of Stoves," where poor ventiliation and poor installation are also associated with low economic status.

In general, rural Nepalese architecture does not include windows; concern over warmth, theft, and demons discourage any open spaces in walls. Poorer homes are usually smaller, crowded next to other homes, and not well ventilated. In these homes, all family members live in one room that also serves as the cooking area. Higher income homes, especially in bazaars, have larger rooms, higher ceilings, and a separate area for cooking.

I. Kitchen Behavior Test

To supplement this study's questionnaire, J. Gabriel Campbell (1984b) of the Community Forestry Afforestation Division, FAO, suggested a behavior test to monitor the cooks' location and activities during the cooking period. The behavior test, also known as the "monkey test" because it was first used to monitor the behavior of monkeys, checks the subject's activity every five minutes during the hour. The percentage of totaled observations (represented by a tally mark by different activities and locations) are averaged and multiplied by sixty minutes to estimate the average portion of the hour the cook spends in a specific position, and the portion of the hour she spends doing a specific task. The difficulty encountered during the test was adjusting for the influence of the investigators' presence on the cook. The cook was always asked to follow her normal pattern of cooking. However, dialogue sometimes required her to be in close proximity to the surveyors who were usually seated in the cooking area.

The following results combine the behaviors of cooks using both new and old stoves:

Table XIII-A

Estimated Time Spent by Cooks in a Specified Location
(minutes per hour)

At Stove	6 ft.	Other Part of Room	Another Room	Outside
47	8	2	2	1

Table XIII-B

Estimated Time Spent by Cook Doing a Specified Activity
(minutes per hour)

Cooking	Preparing	Feeding Fire	Setting/Talking (by Fire)	Arranging Pots	Fetching Water
21	8	12	13	3	3

Assuming that the hour sampling session represented a normal cooking hour, this behavior test indicates fairly well the approximate number of minutes in each hour that the cook actually spends by the cookstove. Looking at the behavior of both new and old stove owners, the cooks spend about fifty-five minutes of each hour within six feet of the cookstove. Multiplied by the average 5.3 hour cooking period for new stove owners (see Women's Workloads Section), this suggests that the new stove users spend 292 minutes or over 4.75 hours every day in very close proximity to the cookstove. For mud chulo owners (average 4.8 hours cooking period), this translates to just less than 4.5 hours, and nearly 5 hours for agena owners (average 5.3 hour cooking period). This, of course, does not include time spent near the fire when space heating. As Bhattarai (1983) reported, percentages of overall fire use are:

- 72% for cooking and tea,
- 17% for livestock feed/alcohol/other, and
- 11% for space heating.

Another thirty minutes (eleven percent of five hours) of daily exposure may be added for extra exposure during winter months.

IV. MUSTANG

"One of my great uncles brought the first tin stove to the Thak Khola region from India a generation ago. Tin flues and stoves are not a new introduction in Mustang."

(B. Sherchand, 1984)

A. Background

Within its mandate to work on natural resource management in the two major watershed of Nepal, RCUP took on a very diversified project. Briefly, Myagdi and Gorkha can be described as having predominately Hindu ethnic groups. Although they are located in two separate river basins, these two districts have similar social and cultural conditions, and therefore, similar applications for RCUP. On the other hand, the Mustang District, containing an upper portion of the Kali Gandaki River, has a distinctly different character than its lower, warmer neighbors. Bordering Tibet, Mustang has a Tibetan-Buddhist influence from years of cultural exchange along this busy trade route through the Himalayan range. A particular ethnic group, known for its business savvy, established itself in this northern region. Their merchant skills have brought foreign goods and modern influence to communities along the trade route. As a result, the area has been characterized as more commerically advanced than most districts of Nepal.

Most of Mustang is located in the rain shadow of the great Dhaulagiri and Annapurna ranges (26,000 ft.). Therefore, the region is a cold, high-altitude desert for most of the year. As would be expected, Mustang's social and climatic differences from other areas prescribe an entirely separate subset of resource management investigations and solutions for RCUP.

RCUP reassessed its Mustang program in order to match cookstove design with this region's cooking habits. Mustang women and men are known for building very sophisticated and attractive stoves. When surveyed, Myagdi cooks often remarked on the perfect, angular shapes of Mustang stoves that are frequently constructed at standing height instead of on the floor. Whereas the pre-fabricated ceramic mud chulo and flue seemed to address the Myagdi and Gorkha situations fairly well, the same cookstove in the Mustang District understandably was a failure.

Between 1981 and 1983 RCUP energy specialists tried introducing ten experimental double wall and insert chulas with ceramic flues in the villages of Jharkot and Muktinath in Mustang. In brief, Mustang's energy technician later assessed the trial stoves as "useless." Because mud was used as the construction material,

it completely eliminated that improved design as a viable option for the cold climate of Mustang; a ceramic flue cannot radiate heat to provide warmth.

Our discussion with one double wall stove owner verified some of the energy technician's observations. She complained of its small mouth which prevented her from stuffing large pieces of wood into the stove. She also disliked the insufficient amount of heat emitted from the flue, causing her to limit her stove use to the few warmer summer months when no heat was needed. On the other hand, she praised the stove because it did ventilate the smoke, it was very fuel efficient, and the enclosed fire prevented her small children from getting burned.

RCUP had not intended that the improved cookstove be used for only a few summer months. This modified use was encouraging and informative. However, it was also clear that the Mustang cookstove program needed to experiment with a dual-function stove for cooking and heating during most of the cold months. Fortunately, RCUP recognized this concern and proceeded very cautiously.

Energy personnel also understood that this was not a new problem for Mustang households. Industrious Thak Khalis imported the first tin into Mustang from India at least a generation ago to make tin heaters (S. Sherchand, 1984). Although the tin comprised both the firebox and flue to radiate maximum heat, the stove consumed much fuelwood. Today, many Thak Khalis have tin flues on both heaters and tin stoves. RCUP's Mustang Energy Technician is profitting from these advanced ideas by experimenting with a combination heater and stove, and adding cast iron rings to accommodate different sized pots. The combination stove has a baffle to increase fuel efficiency and large cast iron rings built into the stove mouth for structural support. A household in Larjung volunteered to try the new stove during winter 1984-85.

In 1984, Kalopani, Mustang received enough galvanized iron sheets and cast iron rings for twenty-seven stoves. As of November 1984, only two had been installed because potential recipients were fully occupied by the busy harvest season. The Energy Technician wanted to determine acceptance rates before encouraging more dissemination.

Some cookstove practices hamper the promotion of new cookstoves. Villagers of Kalopani, Mustang are traditionally concerned with wood beam preservation because the Valley's wetter climate contributes to wood rot. Eliminating smoke via a flue means losing beam preservation benefits. The Energy Technician understands that he must convince cookstove recipients that a tin flue does not limit their smoking practices because the cookstove pot mouths can be left uncovered for fumigation purposes.

On the other hand, the tin flue and cast iron rings are easily promoted because of perceived advantages. The unpopular task of required soot removal and flue cleaning is simply performed by knocking on the pipe periodically to loosen soot or ash build-up on the inside walls. The concentric rings are placed one

inside the other to fit different sized pot mouths for a variety of cooking containers. The rings are very popular. In fact, guesthouse and teashop owners in the southern Myagdi District are asking about ring availability. Unfortunately, the rings are both heavy and expensive.

Stove technicians advocate the use of tin-plate overlays (with a hole in middle for a pot) to place over mud pot mouths as an inexpensive substitute for the cast iron rings. Many households, teashops, and lodges are willing to use the cast iron rings even without the improved cookstove body or flue.

B. Quantitative and Qualitative Sampling

Only four households were sampled for indoor air pollutants in Mustang. Monitoring results from this region were not included with other district data because these stoves were not pre-fabricated, or of same design. Despite the small size (n=2), there again appears to be a noteworthy difference in TSP and CO readings between the "new stoves" with 920 ug/m^3 and 41 ppm, respectively, and the "old stoves" with 1,750 ug/m^3 and 64 ppm. In these cases the "new stove" was defined as the traditional mud chulo of Mustang retrofitted with: 1) a hand-made baffle, 2) cast iron rings, and 3) a tin flue. The "old stoves" did not have baffles or tin flues, but had cast iron rings in anticipation of subsequent baffle and flue installation.

It is important to note that these Mustang homes were, overall, much better ventilated than Myagdi and Gorkha homes. The average volume of cooking rooms in Mustang was forty-three cubic meters, versus twenty-five cubic meters for other districts. Architecture also differed very noticeably within this region. Homes of the middle and high economic status were characterized by their large rooms, and large windows (with and without glass panes). They also have high ceilings with a four-foot square hole above old stoves without flues. These ceiling "sky lights" provide light, and effective ventilation when high winds do not prevent the smoke from escaping. No homes of the lower economic status were visited. A resident stated that fewer poor people live in Mustang and, therefore, do not represent the living conditions of a large majority as in the other districts (Tulachan, 1984).

The two "new stove" owners also claimed fuel savings over their "old stoves" of twenty and fifty percent. Fuel use and cooking time were much greater (twenty to forty bharis per month and nine hours per day) in these few examples because three of the four households offered lodgings and meals to tourists and traders.

For two owners of old stoves the primary reason for wanting a new stove was for smoke reduction. The two owners of new stoves also cited this as a primary advantage. Health impairments most associated with heavy smoke exposure included susceptibility to sore throats and colds, headaches, and "weak" eyes.

C. Recommendations for Mustang's Cookstove Program

RCUP's cookstove program in Mustang is proceeding at a deliberately slow pace. It has the chance to develop carefully and with great sensitivity to tradition and new ideas. The Energy Technician is experimenting with new designs using iron and tin. Once these experimentations are perfected, the stoves will likely find rapid acceptance because the largest user group of the region is known for its general adaptability and ingenuity in marketing. The market potential for the tin stoves appears to be large even with the expense of importing metal stove parts.

Little evaluation can be made about Mustang's cookstove program while there have been so few installations. However, a few suggestions may be offered on expansion. RCUP will want to examine the participation of lower economic status households. Are the poorer offered the same opportunity for improved stove ownership? RCUP is realizing difficulty in Mustang, as it is in its other two districts, of matching this "advanced" stove with the simple needs of its most needy beneficiaries. New design experimentation must be sensitive to the most user groups and the most practical uses.

RCUP may be especially interested in assessing the impact of cookstove fuel efficiency in this dry, cold region of slow vegetative growth and exacerbated fuelwood scarcity. People of Jomosom, Mustang stated that the distance they must travel to collect fuel has increased in one generation to a two-day walk each way. Logically, the effects of decreased fuelwood consumption would be the greatest concern of Mustang residents. Nonetheless, it is remarkable that smoke reduction was selected over fuelwood savings by all four respondents as the first priority for cookstove acquisition.

RCUP may want to experiment with other development organization cookstove programs that have succeeded in cold, high altitude environments. A suggestion for combined heating and cooking technology for Mustang has been tried in eastern Nepal, in Nepmache Bazaar (Coburn, 1984). "Backboilers," or cookstoves equipped with water tanks near the flue pipe, provide heated water during cooking hours. Guesthouses with high water demands found the backboilers particularly simple and useful.

Finally, RCUP may want to sponsor a health impact study of the peculiar effects of altitude on cooks and chronic smoke exposure. High altitudes with their lower oxygen levels compound respiration and cardiovascular illnesses. For example, carbon monoxide (CO) from fuel combustion is known to bind with hemoglobin (the oxygen carrier in the blood) and tie up sites on hemoglobin protein normally held by oxygen. Cooking at high altitudes with biomass fuels puts much CO into the indoor air environment where already "thin air" exists. Mustang cooks may have better ventilated kitchens, but their village elevations put them at greater risk for CO poisoning than their lower altitude neighbors. In addition, women

have a greater susceptibility to CO poisoning than men, due to: 1) naturally lower reserves of hemoglobin; 2) malnutrition and anemia, or lower iron levels (less heme to bind with oxygen); and 3) pregnancy, which naturally causes increased CO levels produced by the body (Smith, 1986). These effects result in a twenty to thirty percent decrease in oxygen-carrying capacity of hemoglobin levels in women, and lowered birthweight in children.

Slow distribution of new cookstoves and careful monitoring of experimental designs is the most important prescription for Mustang's cookstove program. If the expense of metal cookstove materials decidedly exceeds the investment made by RCUP for ceramic stove components in Gorkha and Myagdi, then selling metal parts should be seriously considered before abandonment of the program. The great interest shown in cast iron rings and metal flues suggests that RCUP could provide a popular service, generating revenues to sustain that service while encouraging the use of cookstoves that produce less smoke and have greater fuel efficiency.

V. CONCLUSION AND RECOMMENDATIONS

"Our old stove left no time but to cook. Now we can read newspapers, books, and talk while cooking, besides cutting vegetables and bringing water. This is more relaxing and very good for small families. Also, since the new stove consumes less fuel, the forests will be saved. So the same wood can be used to increase industries like paper and furniture making, thereby providing employment to our people."

B. P. Regmi, Beni, Myagdi

"We do not need to remind ourselves to look at the bigger picture. Any improved stove that can help to reduce fuelwood dependency and, even better, to also alleviate at least some of the hardship of living and working in a smoky home will make a very large difference in a rural cook's life."

Gyani Shakya, RCUP Energy Specialist

A. Resources and/or Health

A natural resource management project does not have health or human resource management as one of its mandates. Energy conservation does not seem to relate directly to preventative medicine, and logically, the Resource Conservation and Utilization Project does not have any responsibilities in the health field. The fact that the Project promotes a particular cookstove which is primarily resource-efficient, and only secondarily protective of health is clearly understandable.

Without information on the comparative health impacts between traditional and improved cookstove emissions, little accusation can be made of projects that decide to discontinue funding of improved stove flues when fuel efficiency is their primary concern. In contrast, however, most projects have supported the often expensive and problematic flue, despite the lack of evidence on their specific health benefits. Before dissemination of RCUP cookstoves, preliminary surveys (Bajracharya, 1984) demonstrated the overwhelming preference of Nepali cooks in several villages for a cookstove that included a means of ventilating their cooking environments in addition to the basic fuel-efficient feature. User preference and common sense lead most cookstove programs to encourage the promulgation of improved cookstoves with flues. Ridding the indoor air environment of at least some unquantifiable, though recognizable, portion of smoke has to be worthwhile.

B. Flue Versus Flueless

A critic of improved stoves with flues focuses on a resource conservation project's larger objective of easing rates of forest consumption. French (1983) measures an improved stove's success by its actual, minuscule fuel savings on a national scale, while a proponent of new stoves (Manibog, 1983), emphasizes the population actually served and the translation of small national fuelwood savings into thousands of hectares of plantations and millions of retrieved donor-agency investments in reforestation efforts.

In Nepal, Darrow (1984) of the Resource Centre of Applied Science and Technology (RECAST), specifically targets the inclusion of the flue in all stove programs as a serious threat in keeping overall stove adoption, and slowed deforestation rates, at a relatively insignificant level. His argument underlines the high costs to manufacture, transport, install, and maintain the flues. He points out that reductions in total household smoke exposure from flues is less dramatic when one considers smoke from: 1) noncooking sources (for heating); 2) auxiliary traditional stove use (for alcohol, buffalo feed, etc.); and 3) smoke emitted by fuel efficient stoves with flues. Darrow also reiterates that household smoke is only one of several factors contributing to health problems associated with smoke inhalation.

When considering RCUP's main objective of decreasing natural resource degradation, Darrow's (1984) ideas on an alternative strategy for more rapid and easier dissemination of fuel efficient cookstoves (without flues) are very important. Especially in remote regions of Nepal, where distribution, installation and maintenance of cookstoves with flues would be prohibitive, the simple one-piece, flueless cookstove becomes a practical alternative. Although at high altitudes, where the loss of forests are the greatest and where the supposed highest levels of respiratory and eye diseases are found, the flueless stove offers no greater benefits than stoves with ceramic flues.

Campbell (1984a), however, disagrees with Darrow's promotion of flueless stoves, arguing that none have proven socially acceptable in Nepal. He notes that a flue reduces: 1) smoke pollution from forty to sixty percent over reductions already received from improved efficiency; and 2) smoke inhalation from the equivalent of sixteen cigarette packs a day to six or eight packs a day. Campbell believes there is merit in exploring the possibility of introducing flueless stoves, but that improved stoves should aim to provide the maximum benefits per household.

The RCUP stove program ought to heed both Darrow's and Campbell's arguments, and perhaps consider offering both flue and flueless stoves in the future. The program will need to address difficulties in access and transportation costs as it expands towards more remote areas. However, RCUP's present program has evolved properly, with a slow and steady growth in interest, acceptance, and use. Its ceramic and tin stove parts are popular primarily due to the benefits of the flue. Many Nepali cooks in the RCUP districts are finally recognizing that their kitchens do not have to be "suffocating chambers of pungent smoke" (Raju, 1953)

twice daily, and that a simple flue can alleviate significant hardship from their traditional responsibility of cooking.

This study shows that the inclusion of the flue as part of RCUP's fuel efficient cookstove program provides benefits of greater significance than the RCUP Energy Sector had hoped or expected. The cooks in the RCUP districts have received and maintained properly their improved cookstoves with flues. They consistently will verify the far-reaching importance that decreased indoor air pollution has had on their lives. The responses of seventy cooks in the three RCUP districts of Myagdi, Gorkha, and Mustang in the Fall of 1984, along with clear results of indoor pollution monitoring, supports further dissemination of improved cookstoves with flues by the host of development organizations concerned with resource management and/or health in Nepal.

Recommendation: The success of RCUP's stove program is in large part due to the benefits of the flue, which needs to be a greater consideration in the evaluation and promotion of all improved cookstove programs.

C. Pollutant and Health Monitoring

Fortunately, attention has been directed recently directed toward cooking and its hazardous health effects, which are understood to affect many households in lesser developed countries. The harmful levels of toxic air pollutants are a health problem of much greater proportion than anticipated. The scant research conducted in LDCs that have identified and quantified these pollutants demonstrates that the levels are frequently of magnitudes higher than those of any measurements performed in MDCs (Smith and Ramakrishna, 1984). The only episodes of comparison in MDCs are situations of infrequent, emergency, acute exposures. Half of the world's households are chronically exposed, every day and at least twice a day, to airborne gases and particulate matter that are seemingly significant factors in the development of respiratory diseases as the leading cause of death in LDCs. Domestic air pollution is and long has had a great effect on the health of LDC households.

The conclusions of this study must be used as a pilot study for future research that employs both air pollution monitors and rural health workers to diagnose respiratory, optical, and cardiovascular diseases (EWC, 1985). Clearly, the greatest significance of smoke sampling is its direct relation to health impairments. The extensive research of Dr. Mrigendra Raj Pandey on chronic bronchitis and acute respiratory infection of thousands of Kathmandu Valley residents must be supplemented with exact measurements of smoke exposures, specifically differentiating between tobacco smoking, heating, and cooking. This invaluable information would enable researchers to correlate specific exposure levels and durations to specific health problems. The cost of including flues and fuel-efficient stoves in energy programs may be justified by documented health benefits associated with lower pollution levels.

Recommendation: Future research should combine the expertise of pulmonary physicians and environmental scientists to establish the exact relationship between changes in pollutant exposures and changes in health.

D. Making Cookstoves a Concern of HMG

For RCUP's interest in particular, it has been strongly suggested that the improved cookstove program should be "institutionalized" into one of His Majesty's Government (HMG) ministries (Malla, 1984). At present, RCUP administers the cookstove program without an improved cookstove program counterpart within HMG. The obvious importance of this suggestion centers around the concern over the eventual cessation of the RCUP project after its grant date completion. Without institutionalization of the cookstove program into a department of the government, proper continuation and follow-up of the program after RCUP departs will not be possible.

Recommendation: A HMG ministry should assume the oversight/development of RCUP's improved stove program, and help to coordinate information flow and collaboration between all donor agencies with improved stove interests.

E. Expansion

The RCUP cookstove program is successful. It is enjoying much popularity in the villages that it has serviced so far. After four years the improved stoves are proving to promote themselves and installation cannot keep up with distribution. The needs of the specific user groups and their environments seem to be well met by the different cookstove designs, with the possible exception of households of low economic or caste status. With interests in expansion, RCUP's Energy Sector must be careful to continue its dissemination with attention to the selection of needy and responsible recipients. RCUP stove technicians are aware that their programs are working because they are careful about how it is carried out. For it to continue in this way, potential cookstove recipients must continue to satisfy specific criteria prior to installation, and cookstove distribution must continue to depend on household size, pot size and user intention. Very large families needing large pots for meal preparation will be dissatisfied with cookstove performance; on the other hand, cooks with smaller families who have a clear understanding of the maintenance responsibilities involved with the improved stove should be encouraged to participate. Screening interviews to determine these factors are extremely important to maintaining user satisfaction.

The Gorkha stove technician was concerned that rapid expansion of the successful program might inhibit the installer's opportunity for personal contact with the many households needing frequent instructions on the use of this "appropriate", but nevertheless, new technology. He feared that the numbers of installations would become more important than maintenance review in homes that had already received a new stove. The technician argued for careful program expansion; he did not want to install more stoves without making sure that previously installed stoves were functioning properly. Otherwise, abandonment rates might

eventually equal installment rates, (Koirala, 1984). Both the Myagdi and Gorkha district installers hoped that if expansion were to occur, it would double in size and include the hiring of one other trained installer. Screening recipients and advertising the limitations of the improved stove, such as maintenance responsibilities, are integral to the continued success of the program.

A related recommendation from RCUP Energy field personnel included the establishment of a Maintenance and Repair program. Neglect or misunderstanding about soot removal from the flue or mud enforcement responsibilities, for example, can cause abandonment of the stove and poor relations with RCUP.

It is suggested that the advertisement of fuel-saving practices be included in a Maintenance and Repair program. Some literature states that the management of cooking fires, utensil, and food preparation can save more fuel than the improved stove itself (Cecelski, 1984). Ideas such as putting out embers, reclaiming charcoal, and careful tending can supplement techniques already employed by fire-conscious cooks. The use of round-bottom and/or aluminum pots and tight fitting lids increase fuel efficiency. Placing rocks on top of pot covers can increase pressure and reduce cooking times. Food preparations, such as soaking beans, parboiling rice, finely chopping meat and vegetables and cracking wheat are traditional methods of fuel conservation in many countries. All these techniques should be advocated as part of the Maintenance program for a more holistic perspective on saving fuel.

Recommendation: RCUP should continue to stress acceptance of improved stoves before accelerating distribution. Toward these ends RCUP should establish a Maintenance and Repair program to aid recipient households to maximize their fuel efficiency and minimize their smoke exposure.

F. Women in Development

> "With old stove, it used to be very smoky. So husband never used to come in the kitchen. He would come home late or stay out until the smoke had settled. So now, with the new stove, we have more family life."
>
> Heem Kumari Shrestha, Beni, Myagdi

> "To accumulate data about household energy, it is necessary to reach women themselves."
>
> (Tinker, 1980)

Most development organizations now understand fully that directing attention towards women's activities brings more attention to the entire family. Women's roles in the community define the essence of participation. Women are already the organizers, managers, and unifiers of a microcommunity: the home and family. In fact, involving women in appropriate changes and acceptable improvements in

village life can be argued as being more effective than involving men. However, the exclusion of either women or men is obviously wrong for building any community or development activity. Community development, after all, is principally defined by all-inclusive participation.

This evaluation of RCUP's cookstove program depends upon user assessment. Those users are necessarily cooks; cooks are inevitably women. Common sense dictates that assessing a person once-removed from the activity of cooking, such as men or children, would have offered erroneous or at least incomplete information on the success or failure of the program.

An essential component of soliciting useful, and accurate first-hand information is the presentation and approach of the surveyors during the questionnaire process. In an effort to prevent biasing participant responses and to decrease the formality of the survey, the investigators (myself, the Technical Assistant, and Bageshwari Sherchand, my interpreter/Research Assistant) underemphasized our roles as RCUP representatives or official program evaluators, and allowed time for informal discussion (i.e., "small talk"). The fact that we were two females, one Nepali, certainly facilitated our access to homes, promoted discussion, and increased informaton flow. Rapport was greatly facilitated because women were communicating with other women about cooking, a very sex-seggregated issue in Nepali society.

Two Nepali women-surveyors would be the best combination for an evaluation team. Hoskins (1982) suggests that at least thirty percent of all RCUP energy personnel be women to ensure their participation in the modification of energy technologies, and to strengthen their leadership positions. The success of any program depends upon participation and representation, so Nepali women continually must be encouraged to voice their experiences in Panchayat Committee meetings, as well as in field and administrative posts. The support and training of Nepali women in resource management issues will enhance communication, and help all HMG ministries and donor agencies make more representative decisions about issues of greatest priority for the future of Nepal.

Women in Development (WID) projects are necessary to bring more attention to the wealth of information, or "native wisdom", that Nepali women share. The data that this one WID-sponsored project has gathered signifies the importance of active solicitation of Nepali women's views.

Recommendation: Assign Nepali women to more field positions (such as stove installation, energy-technology assessment, and program monitoring) to improve rapport with a neglected portion of Nepal's great resource base, rural Nepali women. Encourage frequent and informal dialogue between foreigh WID assistants and Nepali WID representatives.

It is hoped that future WID issues will not have to be treated separately or as separate entities within certain ministries, but eventually will be absorbed as an obvious and necessary component of all donor-agency and HMG work in natural resource management, as well as in all other fields. Women represent half of Nepal's potential development-force; they must not be neglected.

APPENDIX A

Equipment List
Indoor Air Pollution Sampling

TSP (Total Suspended Particulates)	Manufacturer
- personal air sampler - aerosol filter pump with 3 batteries (6 volt)	Gilian Corporation Wayne, NJ
- teflon-coated glass-fiber filters	Pallflex Corporation Putnam, Conn.
- cassettes, tubing, boss filters	
- inverted burette, detergent, stop watch	
- solar cells, invertor, charger	
- polybags, labels, tape	
Carbon Monoxide	
- continuous CO diffusion monitor with flow adapter and batters (1.5 volt)	Gastech Inc. Newark, CA
- gold-plated memory cells	Dupont Corporation Wilmington, DE
- audio read-out dosimeter with batteries (9 volt)	Dupont Corporation Wilmington, DE
- CO pure span gas, nozzle, regulator	
Formaldehyde and Nitrogen Dioxide	
- HCHO passive monitors	AQRI, Inc.
- NO2 passive monitors	AQRI, Inc. Berkeley, CA
- ribbon, thumb tacks	

APPENDIX B

Sample Questionnaire
RCUP ENERGY SUB-PROJECT
DHOBIDHAT AND PATAN

	HOUSEHOLD CHARACTERISTICS:	CODE		
		V.#	Name	Value
1.	District:	01		
2.	Panchayat: _____ Village:	02		
3.	Household name: _____ S.No: _____ Surveyer: _____ Date (Roman): _____ / _____ / 1983 Main Cook's name:	03	HH#	/ / / /
4.	New stove type: 1 Insert 2 Double wall 3 Modified Magan Chulo	04	NSTO	/ /
5.	Months installed:	05	AGE	/ / /
6.	Floor installed: 1 Ground 2 1st Floor 3 2nd Floor 4 3rd Floor	06	FLOR	/ /
7.	Installer: #	07	INST	/ / /
8.	Ethnic group / caste (see code):	08	ETH	/ / /
9.	Regular number of household members:	09	HPOR	/ / /
10.	Number less than 10 years old:	10	CPOP	/ / /
11.	Previous traditional mud stove type 1 There was no traditional mud st ve 0	11	STO1	/ / /
12.	Present use of traditional mud stove: Removed 0 Still have but not used 1 Have and used 2	12	ST_1U	/ /
13.	Traditional Tripod stove type 2	13	STO2	/ / /
14.	Present use of traditional Tripod stove: Removed 0 Still have but not used 1 Have and used 2	14	ST_2U	/ /

Stove Use:

		CODE		
		V.#	Name	Value
15.	Stove temperature: warm: 0 cold: 1	15	TEMP	/ /
16.	New stove use: (see code)	16	NUSE	/ /
17	Old stove use: (see code)	17	OUSE	/ /

Condition of New Stove:

18.	Firebox: 0: not cracked 1: cracked 2: broken	13	FIRE	/ /
19.	Mouth Piece: 0: not cracked 1: cracked 2: broken	19	ARCH	/ /
20.	Baffle and Damper: 0: not cracked 1: cracked 2: broken	20	BAF	/ /
21.	Chimney: 0: not cracked 1: cracked 2 broken	21	CHIM	/ /
22.	Repaired: 0: not required 1: not repaired 2: partially 3: completely	22	REP	
23.	Inside Chimney: 0: clean 1: soot accumulated 2: ash accumulated 3: both ash and soot accumulated	23	ASHC	/ /
24.	Is there ash in firebox or back connecting pipe 0: no 1: yes	24	ASHP	/ /
25.	Number of times chimney cleaned	25	CLEN	/ /

Stove Installation:

26.	Measurements: 0: within tolerance limits 1: slightly exceeds limits 2: greatly exceeds limits	26	MEAS	/ /
27.	Chimney installation: 0: good 1: minor problems 2: major problems (note separately)	27	CHIM	/ /
28. 28a.	Pot hole spacing: 0: good 1: bad 2" sufficient	28	POTS	/ /
29.	Stove and chimney location: 0: good 1: bad	29	LOCA	/ /
30.	Frequently used pots fit holes: 0: good 1: fair 2: poor	30	PFIT	/ /

Users Perceptions and Fuel Use:

31. Estimated percentage fuelwood saving:

32. Amount of fuelwood used before new stove:

33. Amount of fuelwood used at present:

34. Present price of fuelwood per kg:

35. Average amount purchased:

36. Straw/agricultural residue used before - in kg:

37. Straw/agricultural residue used at present:

38. Dung burnt before:

39. Dung burnt at present:

40. Meal cooking time: 0: Decreased 1: Same 2: Increased

41. Comparative convenience: 0: Better 1: Same/mixed 2: Worse

Smoke and Health - Perceptions of Exposure

42. Change in amount of smoke with new stove:

43. Average time per meal spent near a fire:

44. Have you had any eye problems in the last month:

45. Have you had a cough in the last month:

46. Do your eyes tear when you cook:

47. Is it easy to breath when you cook:

48. Do you smoke cigarettes:

49. How many in a day:

50. Does any one else (in family) complain of breathing or eye problems:

Name	Age	Smoker	Problem

Women's Workloads - Perceptions of Change

51. How long does it take to collect firewood/day and distance:
How long did it take your mother:
How long did it take your grandmother:

52. Does the new stove make more or less work:
Does it change the schedule of your day:

53. Does the new stove take more or less time to cook:

54. Did the new stove change your way of cooking, or what you cooked:
How:

55. What do you like and dislike about the new stove:

Like	Dislike
Less smoke Less wood to burn Preserves forests Cleaner house More attractive stove	Longer to cook More wood splitting Less light (children to study by) (lose fire spirit) (lose warmth) Hard to clean

56. Do you think the new stove improves life in your village:

Sampling Session

57. Who usually does cooking:

58. At what age did she begin cooking:

59. How many hours/day spent cooking:
    Space heating:

60. Do you use the same cooking space all year:

61. What is being cooked:

62. For how many people:

63. Is this a typical meal:

64. What type of fuel is being used:

65. Where is it stored and for how long:

66. Who else is in the room when you cook:

Measurements

Fuel Type:

Last Calibration:

Weight of Fuel Before:
After:

Weight of Food before:
After:

Moisture content of wood:

Size of wood used:

During cooking - Filter #:
Pump #:

Time - start cooking (lighting fire):
end of cooking (extinguishing fire):

Time - begin air sampling:
end air sampling:

Readings - Rotometer - begin:
end:
- CO begin:
end:
- Dosimeter - average:

Surveyor's Observations

Location of sampler and movement:
Time near stove:

Location of monitor and movement:
Time near stove:

Who else was in the vicinity of stove:

How smokey was the room:

How black was the kitchen:
Nearby rooms:

Ventilation - where did smoke go:

What is roof made of:

Other sources of smoke:

Conditions outside:

Comments:

Sketches

a) Stove including dimensions (also agena if present)

b) Location within "kitchen"

c) General house plan

d) Number of windows and doors, and approximate percentage of kitchen wall that can be considered as windows or doors.

KITCHEN BEHAVIOR DURING MEAL

WHERE COOK IS LOCATED:

	AT STOVE	CLOSE VICINITY	OTHER PART OF ROOM	ANOTHER ROOM	OUTSIDE		OTHER
:05							
:10							
:15							
:20							
:25							
:30							
:35							
:40							
:45							
:50							
:55							
:60							

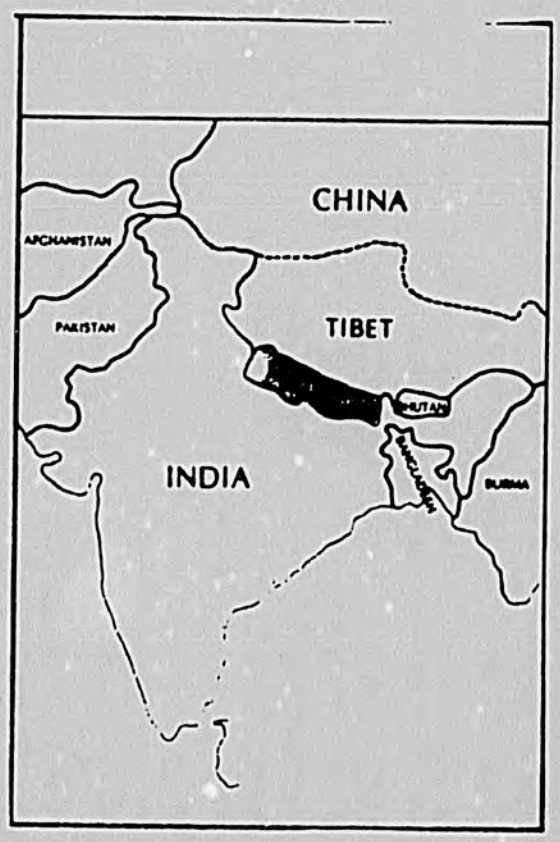
WHAT COOK IS DOING:

	COOKING	PREPARING	FEEDING FIRE	TALKING	ARRANGING POTS		OTHER
:05							
:10							
:15							
:20							
:25							
:30							
:35							
40							
45							
50							
55							
60							

NEPAL

26 - Myagdi District
27 - Mustang District
38 - Gorkha District

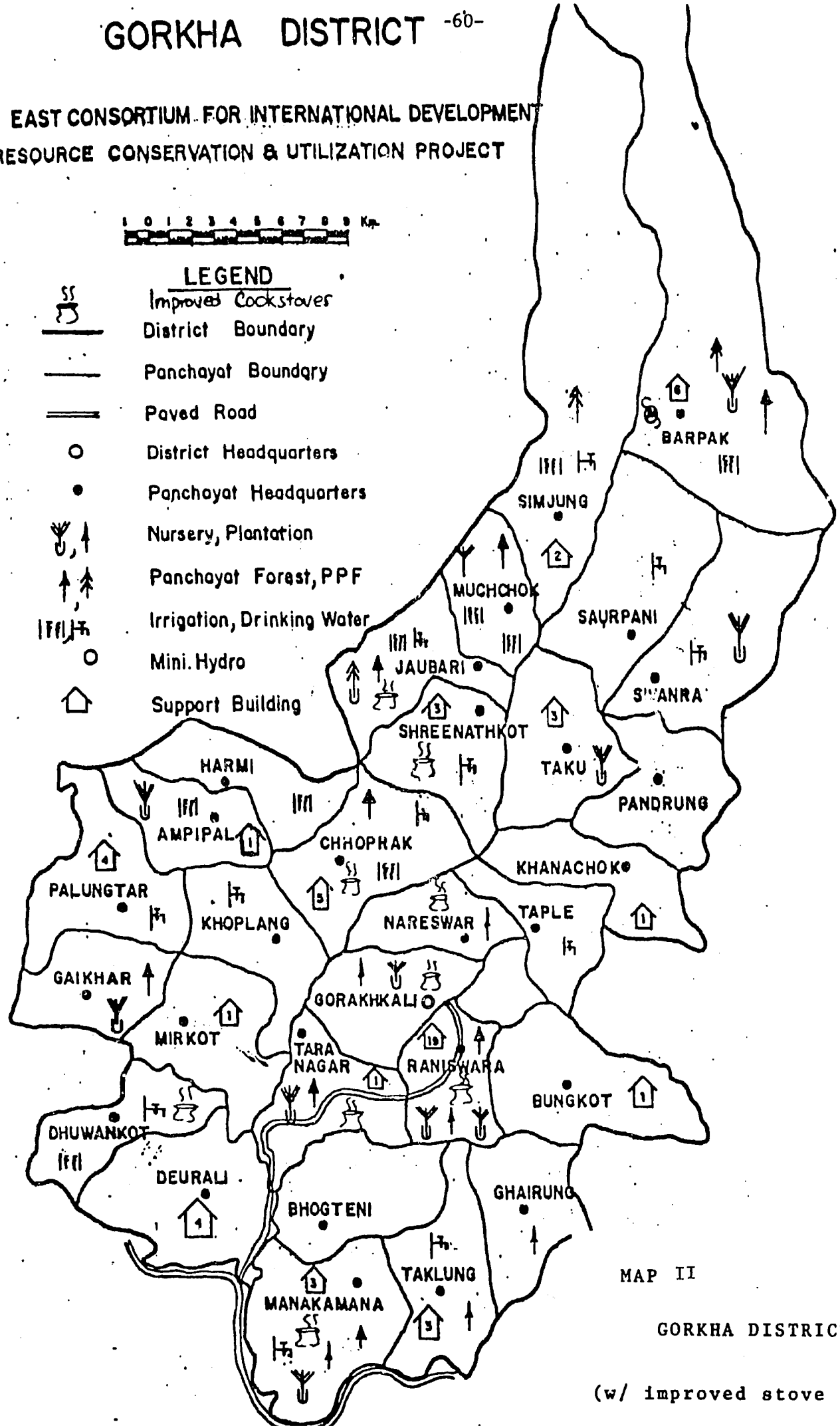
(Karan et al., 1983)



Map I

GORKHA DISTRICT

SOUTH EAST CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
RESOURCE CONSERVATION & UTILIZATION PROJECT



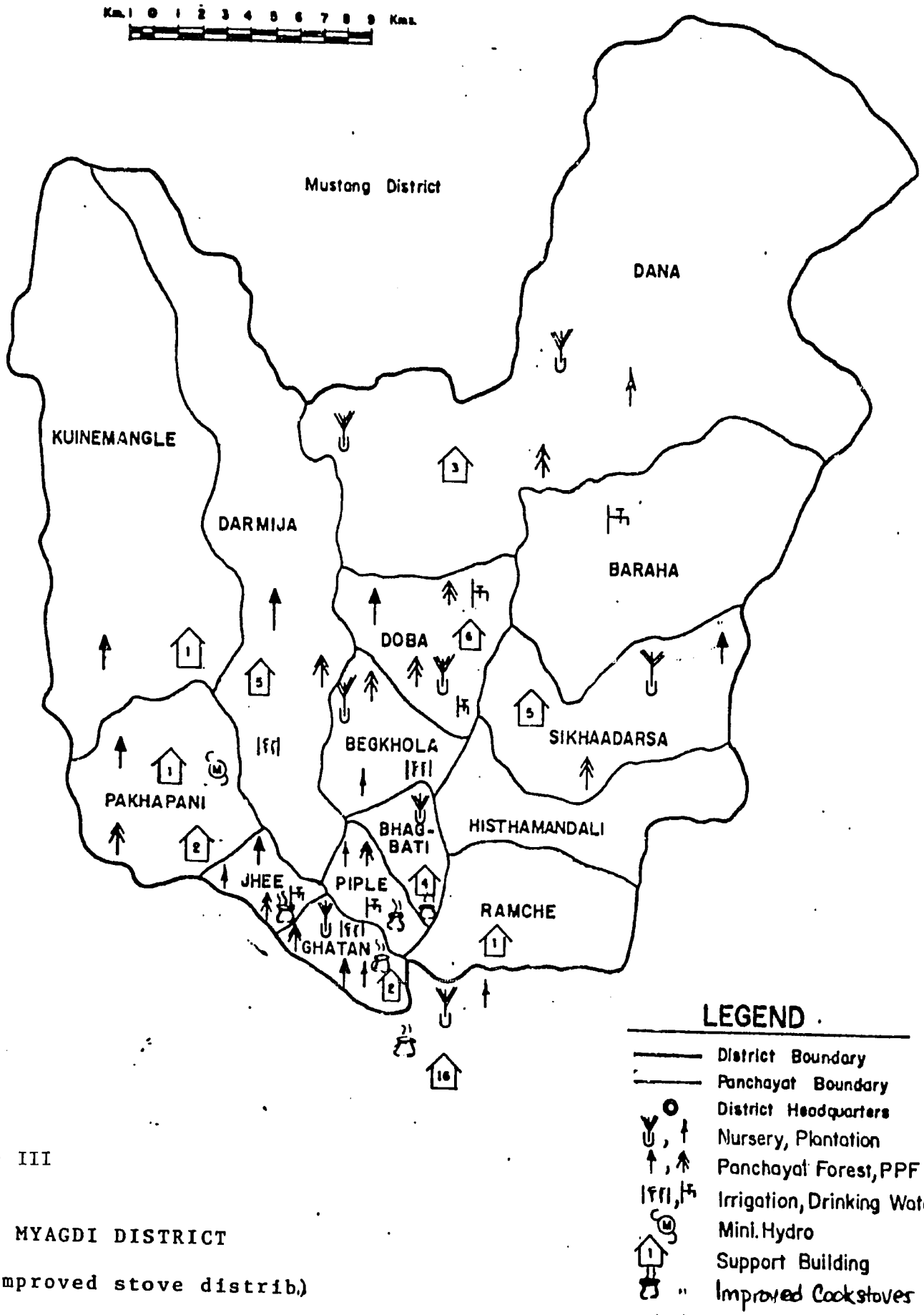
MAP II

GORKHA DISTRICT

(w/ improved stove distrib)

MYAGDI DISTRICT

SOUTH EAST CONSORTIUM FOR INTERNATIONAL DEVELOPMENT
RESOURCE CONSERVATION & UTILIZATION PROJECT



MAP III

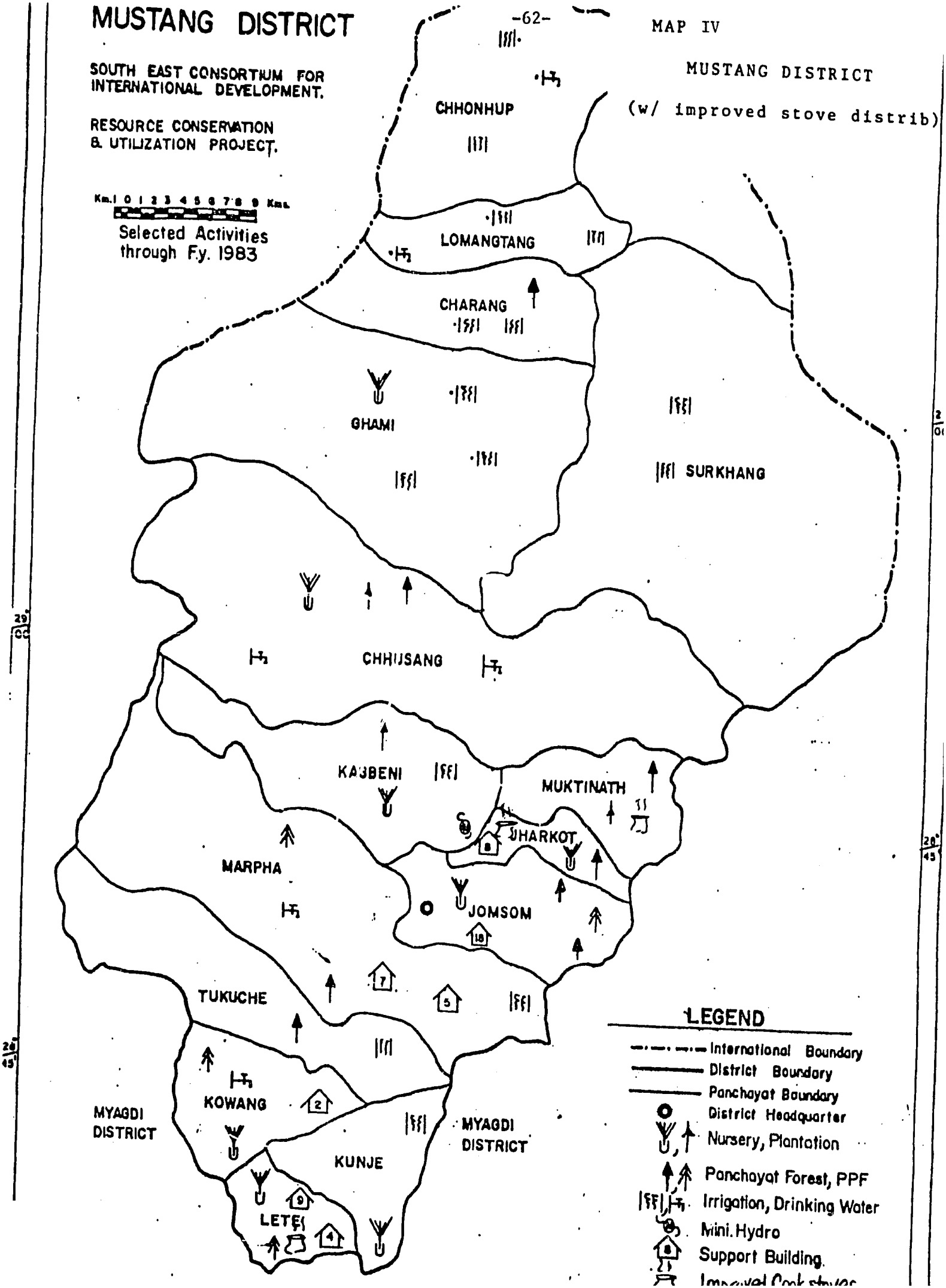
MYAGDI DISTRICT

(w/ improved stove distrib.)

MAP IV

MUSTANG DISTRICT

(w/ improved stove distrib)



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TRAINING WOMEN AT THE INSTITUTE OF RENEWABLE NATURAL RESOURCES: RECRUITMENT, FINANCIAL SUPPORT, EMPLOYMENT

Sally Ann Sontheimer
Duke University

INTRODUCTION

Nepal is one of the few countries in the developing world where women are being trained professionally in forestry and renewable natural resource management. In the fall of 1983, seven young women were admitted to the Institute of Forestry/Institute of Renewable Natural Resources (IOF/IRNR), Nepal's official post-secondary school for the study of forestry, soil and water conservation, and wildlife management. Their admittance at the Institute (commonly known as IRNR) was significant in introducing the first women into a formerly male-dominated profession in Nepal. It as such, marked a commitment on the part of the Nepalese government to involve more women in forestry-related activities.

I spent the summer and fall of 1984 in Nepal on a fellowship sponsored by the South-East Consortium for International Development with funding from the Women in Development Office of the United States Agency for International Development (USAID). I worked in the capacity of technical assistant to the Resource Conservation and Utilization Project (RCUP) which is a cooperative project between the Government of Nepal (GON) and USAID/Nepal designed to improve soil, water, and forest resources in the two major watershed catchment areas of the central hills of Nepal -- the Daraundi River in Gorkha District, and the Upper Kali Gandaki River in Myagdi and Mustang Districts. Project activities focused on an integrated approach to renewable natural resource management, and includes attention to: 1) improved fuel-efficient wood stoves; 2) livestock management; 3) community-managed forests; 4) improved agricultural and forestry skills and technologies; 5) training and extension; and 6) institutional development at the Institute of Forestry/Institute of Renewable Natural Resources.

The major objective of my work was to investigate certain problems concerning the women students studying at the IRNR. Those problems included: integration of women at the Institute; suitable employment for the women once they graduated; and recruitment and continued financial support for women studying at IRNR. All of these problems are discussed in subsequent sections of this report.

The methodology I employed in my investigation was quite simple. With an invitation from the RCUP, I moved to Hetauda, Nepal where the school is located, and became an invited participant in IRNR activities. At the Institute, I worked very closely with the Program-in-Charge (a position similar to that of Assistant Dean), Madhav Karki, who was very helpful in my endeavors to understand the situation at IRNR and to further the women's interests. Shanta Pandey, the RCUP social scientist, introduced me to the female students, establishing me as their spokesperson, resource person, friend, and greatest supporter. I also spent time in RCUP's project districts observing first hand the project's activities and visiting three female students from IRNR in their homes. Throughout my stay, I benefited from the support of the Nepali and expatriot staff of the RCUP and IRNR in Hetauda and Kathmandu.

This report is based on information gathered in interviews, through surveys, and literature written by former RCUP personnel (notably Marilyn Hoskins, Debra Davidson Skinner, Carol Cooper, and Donald Messerschmidt). It is also based on my own observations and close participation in IRNR and RCUP activities. The report is divided into sections, the first giving a brief history of the introduction and involvement of women at the IRNR, with subsequent sections dealing with the problem issues of recruitment, employment and financial support for women at the IRNR.

II. THE HISTORY OF WOMEN AT IRNR

Training for foresters and other renewable natural resource personnel is one important component of Nepal's community forestry program. Begun in the 1970's, the nationwide community forestry program in Nepal is designed to involve rural people in efforts to preserve and develop Nepal's forest resources. Because community forestry involves a people-oriented approach to natural resource management, Nepal recognized the need to train a new type of forester who whould be sensitive to village people's needs and knowledgeable about integrated approaches to solve the deforestation, soil erosion and agricultural problems especially evident in the heavily populated hill regions of Nepal.

Nepal's growing need for more foresters, soil and water conservation personnel, and other environmental managers is now being met by training at the Institute of Renewable Natural Resources (IRNR). With funding from the U.S. Agency for International Development (USAID), the Resource Conservation and Utilization Project (RCUP) is supporting a project to help build the institutional capabilities of the school. The project's principal objective is to provide the Government of Nepal (GON) with middle-level personnel to implement planned development activities in the forestry sector. Part of the project's special emphasis is on enrolling and training more women and students from remote areas of Nepal.

The Need to Target Women for Renewable Natural Resource Development

The idea for training women in renewable natural resource management originated with the realization that women play an important role in forestry-related activities in Nepal. It is the responsibility of rural women to collect firewood for cooking and green fodder for feeding livestock (Skinner and Cooper, 1983). Because women cut the forest and feel most directly the problems of scarcity, they also have the greatest stake in saving the forest or developing new forest land for future use. Thus, there are two good reasons to focus renewable natural rsource development efforts at women: first, to ease the burden of work for the women themselves; and second, to target programs involving forestry development at the persons most involved in forest use and destruction.

Why Train Women?

There is also another important reason to train women in forestry and renewable natural resource managment. Part of the community forestry methodology involves teaching rural Nepalese about natural resource problems and then supporting them in efforts to improve and develop local forest, soil, and water resources. Social norms governing conduct make communication between the sexes difficult in rural Nepal. Thus, women extension workers are needed to forge the communication link with rural women. In the past, even if women were seen as the

logical group to involve in forestry development and protection programs, they were ignored because outreach was conducted by men for men (Skinner and Cooper, 1983). Training women with the intention of using them to reach rural women is the most viable way to reverse this trend.

Women at the Institute of Renewable Natural Resources

In response to the need to train women in forestry, the RCUP developed a program to sponsor women at the IRNR. The RCUP also actively recruited women from villages in RCUP's hill districts as candidates for training and helped negotiate their admittance at the Institute. The young women had passed their School Leaving Certificate (SLC) exams and thus were eligible for entry into a university level school. After a year of delays over the negotiations for their admission, these women and three others were admitted to the Institute in the fall of 1983. Six of the women began studies at the Proficiency Certificate level which provides training in preparation for positions as junior technicians and forest rangers. One women began studies at the Diploma (Bachelor of Science) level which is the more advanced degree offered by IRNR as training for government posts as District Officers and other mid-level positions.

Integrating Women into the IRNR

When the first female students arrived at IRNR, they faced a number of immediate difficulties which stemmed from the fact that women had never before been enrolled at the Institute. Although their financial support had been assured by the RCUP, the Institute had failed to provide housing or a house warden for the women. There were also some difficulties in completing the admission process for the women since special arrangements had been made for their entry. Both of these difficulties were eventually worked out by the IRNR and RCUP staff. A hostel was found for the women off-campus and after the first few difficult weeks the women settled down to a life dictated by study and classes. Throughout the year, the women participated in the normal functions of the school such as making field trips and doing the compulsory physical training and games.

By the time I arrived, at the beginning of their second year, the women expressed to me their own sense of belonging at the Institute. The Institute had made small adjustments to accommodate them such as planning hostel facilities for women on the new campus under construction in Pokhara, providing separate tents or sleeping quarters for the women during field trips, and establishing security measures to met Nepali standards for the appropriate treatment of women. The women seemed at ease in their situation, communicated freely with their male colleagues, and appeared to be an accepted part of campus life. The second group of women students which entered in the fall of 1984 met a far more accepting and encouraging atmosphere on campus and avoided the difficulties the first group encountered upon arrival.

However, the problem of integrating women into forestry and other renewable natural resource activities is not merely a simple matter of accepting female students at the IRNR. There are also the larger problems of integrating women into the broad scheme of forestry activities in Nepal and the implication that increased female involvement will have upon that sector. Major questions still remain concerning how female IRNR graduates will be employed, who will continue to support training for women, and how more women can be recruited for that training. A discussion of these unresolved issues and some recommendations for possible solutions follows in the next two sections.

III. ATTRACTING WOMEN AND REMOTE AREA STUDENTS TO THE IRNR

One of the goals of the IRNR is to increase the enrollment of women and students from remote areas. At the same time, the greatest personnel needs in forestry are in the remote areas of Nepal. Students recruited from cities and the Terai districts are reluctant to take posts in outlying areas in the middle-hills or mountains districts. However, students recruited from remote areas are far more inclined to return to those areas to work, especially if they are near their homes (USAID, 1984).

The IRNR faces a number of difficulties in meeting its mandate of increasing the number of women and remote area students enrolled at the Institute. There are three obstacles that make it very difficult for students from hill and remote areas to both apply and be accepted at the IRNR. These are: (1) lack of awareness of educational opportunities available at IRNR; (2) the difficulties of applying for admission; and (3) poor academic standing due to the lack of schools in remote areas. This section is an analysis of these problems and a list of recommendations useful to IRNR to increase the number of female and remote area students. Three important issues - advertising, reserve seats, and financial constraints - are discussed at the end of this section.

IRNR Application and Selection Process

Although the significant increase in the number of applications submitted to the IRNR by women was a great success for the program, many of the fifty-one applications received at the Institute were from women whose homes are on the Terai. Admission at IRNR is determined by the ranking of School Leaving Certificate (SLC) scores. The eleven women admitted to the Institute were almost all from the Terai where school systems are better than in the more rural areas. Thus, the women from Terai outranked women from remote or hill areas. The results of last year's admission process indicate a general trend favoring admission of women from Terai or urban areas. This contradicts the program's objective to enroll more female students from remote or hill areas. This admission basis at IRNR affects remote area students, both male and female and merits careful analysis if the IRNR is to meet its goal of increasing the enrollment of students from remote areas.

The application procedure for admission to IRNR is a major obstacle to increasing the number of remote area students at IRNR. According to the rules of Tribhuvan University (TU) of which IRNR is a part, a student wishing to apply to any of its schools must make a direct application either in the Kathmandu office or in the Dean's office of the school itself. For a remote area student, this is a hardship. It means that they must walk from their home to a place where they can get public transportation to either Kathmandu or Hetauda. Because there are no public systems of communication outside the Kathmandu Valley, once students have applied to IRNR they must then wait in Hetauda to hear the results of the selection process. This wait could be up to two weeks long. This system of application involves both travel expenses and time lost from work. The system is

especially prejudiced against women, a group with less freedom to travel about the country, whether alone or accompanied. In the past, most of IRNR applications from remote areas have been from those students who received special help in the application procedure.

Some of the difficulty in applying to IRNR will be eased when the campus moves to new facilities in Pokhara. Pokhara is located in the middle hills region of central Nepal and as such will be much more assessible to students from hill regions. However, considering the geography of Nepal, a student from far-eastern or far-western regions still must travel a great distance in order to apply. For them, the situation does not improve with the move to Pokhara.

Past Efforts to Recruit Women to IRNR

Recruitment by RCUP for women to attend IRNR was based on the discovery of their interest. The four women RCUP eventually recruited lived in villages where RCUP was active. Thus, they were familiar with the project personnel. The women had all passed their SLC exams, an unusual accomplishment for village women in a country where ninety-five percent of the female population is illiterate (Acharya, 1979). In addition to these four women, two women from Hetauda and another from Bakhtapur in the Kathmandu Valley began studies for the 1983-1984 academic year.

Women entering for the 1984-1985 academic year were recruited in a different manner. Part of the first-year Certificate students' work-study assignment involved recruiting female high school students from the Hetauda area where the Institute is located. The IRNR women students visited high schools in Hetauda where they gave information to eligible women on educational opportunities at IRNR. Partly as a result of these recruitment efforts, IRNR received a large number of applications from women in Terai regions, especially from the Hetauda bazaar area. The Institute received fifty-one applications from females, which was a significant improvement over the year before. Out of the eleven women admitted to the Certificate program, five came from Hetauda, four from other Terai regions, one from Gorkha in the middle hills region of Nepal, and one from Kathmandu. One women from the Terai was also admitted to the B.Sc. (diploma) program.

Parallel Problems at the Institute of Agriculture and Animal Science

The Institute of Agriculture and Animal Science (IAAS) has a program similar to IRNR's, with the goal of training more women and remote area students. Both the IRNR and the IAAS are technical institutes belonging to the Tribhuvan University (TU) system and thus both fall under the same set of rules regarding application procedures. The IAAS is located in Rampur, also in the flat Terai region of southern Nepal and equally far removed from students in remote regions. Because of the smilarities in procedures and location of the two institutes, remote area and female students wishing to attend IAAS experience the same problems as those wishing to attend IRNR.

One of the obvious answers to the problems for both schools is to simplify the procedure for applying to technical schools of the TU system.
the ongoing reorganization of the TU system provides an opportune time to lobby the TU congress for changes applicable to technical institutes.

Knowledge of Educational Opportunities at IRNR

Initially a general lack of awareness about educational opportunities at IRNR hinders the recruitment of female and remote area students. While the Institute is well-known to people who live in the Terai because it is situated near their homes, it is less well-known to people in the hills. Information passes slowly into the hill regions due to geographical barriers and the difficulties of communication and transport. Thus, IRNR receives fewer applications from students who live in hill regions simply because they are unaware that IRNR is an educational opportunity open to them.

Lack of Schools in Remote Areas

Outside of the Terai region, Nepal is seriously lacking in secondary schools. In remote areas, this means that students have less opportunity for formal study and preparation for post-secondary education. In the selection process, students are ranked according to their SLC scores with preference given to those students who have performed well in math, science and English. Without a high school, remote area students must study for the SLC examinations on their own. This means that remote area students generally score far lower on tests than their peers from the Terai or the Kathmandu Valley.

The situation is even more difficult for women students. In rural Nepalese society, women generally are not encouraged to continue studies beyond the first few grades of school. A daughter's labor is important to the economy of the household and girls generally stay at home to work while sons are sent to school (Davidson ad Cooper, 1983). The evidence of this tradition is a female literacy rate of approximately five percent. Thus, in general, girls perform less well than boys on SLC examinations due to a lack of educational opportunity. In an open selection process at IRNR they would have less chance of being accepted on academic merit. Therefore, it is necessary to reserve seats for them.

Advertising

Advertising is necessary to inform students in hill regions about the educational opportunities that exist at IRNR. Distribution is the major difficulty in advertising in the hill regions. The most effective form of distribution involves the cooperation of people who work in those regions and have access to students. With this in mind, the following efforts were made to develop and implement an advertising campaign for IRNR.

1) At the suggestion of the IRNR administration, I developed and wrote a comprehensive school prospectus detailing academic information about IRNR. This school bulletin was printed and distributed throughout Nepal to various government agencies. However, the bulletin is written in English and therefore has limited use as an advertisement to the majority of the Nepalese people.

2) The RCUP also published a small pamphlet which I wrote entitled, "Educational Opportunities for Women and Remote Area Students at the Institute of Renewable Natural Resources." The pamphlet has been translated and printed in Nepali for distribution to school teachers, field technicians, and government officials who are posted in hill areas and have access to high school students. A program is being implemented to distribute these pamphlets through Peace Corps Volunteers who are high school math/science teachers working in the middle hills regions of Nepal.

3) The RCUP is training three "Women Development Officers (WDOs) to be posted in each of RCUP's three districts. As part of their duties, WDOs will help to recruit women for training at IRNR from RCUP's districts, distribute information regarding the program, and generally act as a resource person and promoter for students wishing to attend IRNR.

The following are recommendations to further the advertising efforts started by the RCUP:

1) The RCUP should explore the options for a more widespread distribution of the small pamphlet written in Nepali. Cooperation could be sought from other donor-agency funded renewable natural resource projects, from the Women's Development Service of GON, from the Ministry of Forests and Soil Conservation, the Ministry of Education and Tribhuvan University.

2) The pamphlet should be made available in all District Education Offices, District Forest Offices and District Conservation Offices. In this way, the pamphlet could be used to inform not only prospective students but also those people who are responsible for informing others about educational opportunities.

3) The IRNR fund radio time on "Radio Nepal" should be used for advertising announcements. Radio Nepal is widely listened to all over Nepal and often serves as an official medium of spreading information into hill and remote regions.

Reserved Seats

As outlined above, remote area students and women generally score lower on SLC examinations than students from more urbanized areas and the Terai. Female students generally score lower than their male counterparts. In order to offset these disadvantages and assure representation of both these groups of students, the IRNR has a reserved seats policy for females and remote area students. However, the present system of reserved seats needs to be expanded to assure a more diverse representation of studnets from hill areas of IRNR.

The following are recommendations to revise the reserved seat policies concerning females and remote area students:

1) That the problem of reserved seats for women be clarified since there has long been disagreement on the policy which reserves ten percent of the seats in every new class (i.e., 110) per year for women. In 1984, IRNR admitted eleven women to the Certificate program which exactly met the ten percent requirement. However, some of these women had SLC scores high enough for them to have been admitted on the basis of academic merit alone. Some argued that these women should have been admitted to the Institute without their being considered as part of the ten percent requirement. If IRNR had followed this policy, more than eleven women would have been admitted to the Institute in 1984. In the future, IRNR will be accepting many more groups of students under a reserved seat policy and should clarify its position on this question to avoid further disputes.

2) That the reserved seat policy for Certificate level students be revised to assure that in the future the Pokhara campus will have a diverse representation of students, both male and female, from hill areas. The following is a suggestion for a new seat policy addressing this need:

(1) Females: twenty total reserved seats to include (a) two seats for women from each of RCUP's districts, i.e., Myagdi, Mustang, and Gorkha, (b) three seats for women from the Far-western Development Region, (c) three seats for women from the Mid-western Development Region, (d) three seats for women from the Eastern-Development Region and (e) five additional seats for women from any region of Nepal not making admission in open competition by academic merit.

(2) Males: Fifteen total reserved seats to include (a) two seats for men from each of RCUP's districts, (b) three seats for men from the Far-western Development Region, (c) three seats for men from the Mid-western Development Region, and three seats for men from the Eastern Development Region.

Financial Incentives and Continued Financial Support

Women at the IRNR presently are supported by the RCUP as part of its institutional development project at IRNR. Those studying at the Certificate level receive two thousand Nepali rupees (NRs) per year, distributed over a ten month period. In addition, the Certificate level women receive one hundred NRs per month on a special work-study program sponsored by RCUP. Thus, women at the Certificate level receive a total of three hundred rupees per month (approximately $17 based on exchange rates in late 1984). Women studying at the diploma (B.Sc.) level receive four thousand rupees per year from the RCUP. They are eligible for a Tribhuvan University scholarship but this is given to only one woman each year at the Diploma level based on academic standing.

These funds are insufficient for the living expenses of women studying at the Certificate level. This problem was the most common complaint I heard. Actual student expenses for an academic year are estimated at five thousand rupees (five hundred rupees for ten months). Yet the female students receive only three hundred rupees per month, two hundred fifty are needed for food alone. The fifty rupees left each month is grossly inadequate to cover the remaining expenes for books, materials, travel, clothes and medical needs.

In response to these financial difficulties, the RCUP volunteered funds to increase stipends for all the students it supports at IRNR, including the women. The IRNR administration declined the offer with the argument that 1) it is unfair to raise stipends while faculty salaries have seen no increase and 2) it is unfair to students whose families finance their education.

Financial incentives such as scholarships and stipends are crucial to attract women to IRNR. However, the financial support provided should be adequate to cover living expenses, since women generally cannot expect additional financial support from their families. In explaining their financial difficulties to me, the women stated that male students generally receive money from home to help cover expenses whereas they, as women, received no money from home. Thus, the women's realistic chance of attending IRNR hinges on whether they can meet all of their living expenses with the stipend they are given. The experience of women at IRNR is evidence that the present stipend program is inadequate and should be revised.

The following recommendations are offered concerning financial constriants:

1) That IRNR implement a supplementary scholarship program modeled on the "Equal Access Scholarship Program" of the IAAS, which provides four thousand rupees ($250) annually paid out over ten months to women and remote area students. Coordinating efforts could help to standardize procedures for all technical institutes of TU with regard to financial support for remote area and female students.

Stipends for women at IRNR are presently funded by the RCUP. However, once the RCUP has reached the end of its contract in the next few years, financial support for women at IRNR must come from other sources.

2) That all future support for women at IRNR should come through scholarships sponsored by Tribhuvan University. In order to assure that training for women at IRNR continues, support for the program must be internalized within the government of Nepal. Stress should be laid upon the need to change Tribhuvan University regulations to provide adequate financial support rather than relying on the short-term measures such as foreign aid.

Observations from the Field

During a field trip into two of RCUP's districts, Myagdi and Mustang, I observed how women had been assisted in the application procedure. Several women IRNR students from the area told me they had been assisted in the procedure, either by someone attached to the RCU Project, or by a district officer (District Forest Officer (DFO), District Conservation Officer (DCO), District Education Officer (DEO), or by some combination of both. These people were instrumental in distributing application forms and seeing that the forms were then sent to Hetauda. None of the students had made the trip to Hetauda. Thus, without assistance, many of the students could not have applied at all.

I also saw evidence of a growing interest among high school students, both male and female, in studing at the IRNR. All along my route, I met with students who found out that I represented the IRNR and were interested in asking me questions and seeking advice. In most of their discussions about IRNR, I recognized a deep concern over the deforestation, the soil erosion, and the fuelwood and fodder scarcity that they saw in their communities. One male student also told me that he wanted to go to IRNR because he thought that forestry was a good prospect for a career.

The few women students with whom I talked had unusually high SLC scores for women from remote areas. The scores were all second division, SLC pass, ranging from fifty-two to fifty-six percent. Such scores represent medium levels of achievement on SLC exams. It seemed apparent from my brief visit to RCUP's districts that there may be more women in remote areas who have passed their SLC's than is currently assumed. It was also apparent that the relatively small amount of advertising that RCUP did by word-of-mouth was paying off in terms of increased interest among high school students about IRNR.

Recommendations

The following recommendations were developed in collaboration with both the IRNR and RCUP staffs for changes in the admission procedure at IRNR. These recommendations are designed to help IRNR in its efforts to attract more remote area and women students. Because so many of the issues are similar, some of the recommendations presented here are based on solutions already being implemented at the IAAS (IAAS, 1984). If IAAS solutions are adopted by the IRNR, they could help to establish a set of standardized procedures that could be used by TU's technical institutes to fcilitate the application process for all students.

The recommendations are as follows:

1) That IRNR and IAAS cooperate in lobbying efforts to change the standard application procedures to facilitate the entry of women and remote area students into the program.

2) That the helping hands process which is evident in RCUP's districts be institutionalized as an interim measure to facilitate the application process for students applying from remote areas. The Dean of IRNR has the discretionary power to authorize district officials to provide application forms and to help process them by sending them to IRNR before the deadlines. Among those available to carry out this procedure are:

a) Peace Corps Volunteers (PCVs). The Program Director for the Peace Math/Science teachers program has already volunteered the services of PCVs to distribute and help process applications. The Math/Science teachers are placed in the middle hills regions to teach classes in the upper grades and thus have excellent access to students who would be good candidates for IRNR.

b) District Education Officers (DEOs). All questions of education are under the jusrisdiction of DEOs in their districts and thus IRNR should seek their cooperation on this matter. Applications forms could be made available through these officers and students could rely on the DEO to send their application to IRNR before the deadlines.

c) District Forest and Conservation Officers (DFOs and DCOs). Considering the help that DFOs and DCOs have contributed in the past, their support should again be enlisted to identify and aid students who wish to apply to IRNR. It is especially important that DFOs and DCOs outside of RCUP's districts be notified of educational opportunities at IRNR as they are less likely to be informed and therefore helpful.

3) That IRNR fund radio time to announce the names of selected applicants in remote districts in order to notify them of their acceptance. This process will save remote area students the necessity of being present at the Institute when the acceptance list comes out. Announcing the names of accepted students over the radio is especially important since it is hard to predict exactly when the list of accepted students would appear. The radio announcement should be timed well in advance so that students have sufficient time to travel to campus to accept their seat.

4) That the Women's Development Service (WDS) of the GON's Ministry of Panchayat and Local Development increase their involvement in the recruitment and support of women at both the IRNR and IAAS. Although the WDS is already overburdened with the massive job of overseeing all of the GON women-oriented projects, support for involving more women in study at the IRNR and IAAS could be strengthened if backed by the WDS.

5) That cooperation on recruitment efforts be sought with women's organizations and other organizations in Nepal that reach village women. This has been accomplished in part by the RCUP's staff members' (and my own) participation in the Women in Development (WID) organization in Kathmandu. Participants in the WID's monthly meetings were informed of the recruitment and other problems for women at IRNR. I also made a presentation to the group in December of 1984 asking for their help in recruiting women for study at IRNR. Informing women involved or employed by GON ministries, large donor organizations and other organizations working in Nepal is an excellent way to spread information concerning women throughout the country.

IV. EMPLOYMENT PROSPECTS FOR FEMALE IRNR GRADUATES

Women are trained at IRNR to provide a cadre of professional women who can facilitate communication between rural women and renewable natural resource development schemes. To fulfill that objective, the female graduates of IRNR must be placed in positions where they can be involved in or run programs that target rural women as beneficiaries. Like all other IRNR students, these women are being trained for middle-level positions within various departments of the Ministry of Forests and Soil Conservation. However, it is feared that female IRNR graduates will be placed in Ministry positions where they will not be given the opportunity to use their professional skills.

This section explains the problems surrounding this issue and offers some recommendations for actions to assure that the training of women at IRNR meets the original mandate of the program.

Putting Women in the Field

Most of the debate over the employment of female graduates stems from the question of whether women are capable of performing the duties required of the profession, especially in field situations. Many government officials feel women cannot function as well as men in field situations due to the rigors of the profession (NRA, 1984). They also expressd a concern that problems would arise for women placed in the field due to certain Nepali customs regarding security for women. For example, women generally do not travel alone, live alone, nor associate freely with men. This attitude on the part of officials within the Ministry of Forests could have major implications for female forestry personnel, resulting in their being excluded from posts in rural areas and contact with the population they were intended to help. Not allowing women to take field positions creates a placement policy. These women could be most effective as extension agents in close contact with rural people, especially women.

National Seminar on the Employment of Female IOF (IRNR) Graduates

In an effort to discuss and further investigate the issue of employment, the National Seminar on the Employment of Female IOF (IRNR) Graduates was held in Kathmandu, May 16-18, 1984, and sponsored by the IRNR, the RCUP, Tribhuvan University, the Department of Soil Conservation and Watershed Management, the U.S. Agency for International Development and the South-East Consortium for International Development. Participating in the seminar were the major employing government agencies of renewable natural resource personnel (i.e., departments within the Ministry of Forests and Soil Conservation) and organizations and individuals concerned over the issue of IRNR female graduates' employment prospects.

The seminar served two major functions. First, it brought to light the fact that there are many vacant posts for natural resource personnel within the Ministry. In the Department of Forests alone, there are more than six hundred vacant positions for rangers and junior technical assistants. An equal number of positions is also vacant in the Department of Soil Conservation and Watershed Management (NRA, 1984). Second, the seminar helped to raise awareness among employing agencies of the need to employ the female graduates of IRNR in positions that utilize their specific skills and abilities as resource managers. The seminar concluded with recommendations to investigate in greater depth the opportunities and problems associated with employment of female IRNR graduates.

Female Student's Job Preferences

To address these problems, it was first essential to ask the women students what they wanted in terms of employment. Among the students at IRNR, it is assumed that most of them will enter government service, first as rangers or junior technical assistants for students completing the Certificate level training, and later as gazetted officers in mid-level positions upon completion of the Diploma program. The women students expected to follow this rather standardized career pattern.

In response to survey questions concerning their preferences (see Appendix 1), women students all expressed interest in doing nursery management, extension work, or research, in that order of preference. A typical response came from Raj Kumari Malla, a second-year female student from Myagdi, who answered, "When I finish my studies I would like to go to the village and tell the poeple how to stop deforestation, why fuelwood is scarce and why soil erosion is happening. I could do any job but I prefer to do extension work so that I can teach my brothers and sisters in the villages to stop these things from happening."

The story of Pratima Tiwari is an example of how the status quo works to keep women out of field posts. Before the IRNR program was implemented, Ms. Tiwari was sponsored by the RCUP at the All India Forestry College (AIDC) in Dehredun, India. Ms. Tiwari graduated from Dehredun with the same credentials and training as a District Forestry Officer (DFO) and wished to be placed in a position as a DFO. However, she was placed in the Department of Forest's Remote Sensing Institute because it was thought that a research-oriented position was a more suitable job for a female (Pradhan, personal communication, 1984). RCUP staff felt that this young woman could have been the dynamic example of how well women can work in the field given her own particular capabilities and her desire to work with rural people, but she was not given the opportunity to do so.

Despite these obstacles, the women had a very positive and defined view of what they would like to do. This vision focused heavily on their role as extension agents and teachers in rural posts. Their comments also reflected a strong, patriotic commitment to solving the environmental problems so evident in Nepal. They also seemed confident of their abilities to work in the field as is evident in the following response from Bijaya Laxmi Lama: "As I have been taught in IRNR to work for my country and my people, I have no reservations about working for HMG (His Majesty's Government). I have been taught the same things as the boys so there will be no difficulties for me to work even though I am a woman."

Survey of Major Donor and Other Organizations

There are many organizations operating programs in Nepal aimed at developing renewable natural resources. I developed a survey based on the possibility that organizations such as FAO, UNDP, UNICEF and many others could offer an alternative employment option to the female graduates of IRNR (see Appendix 2 for sample). The purpose of the survey was to gauge the interest of organizations in employing Nepali women trained in renewable natural resource management. The main questions the survey asked were: (1) whether the organization would find it useful to hire a female IRNR graduate; (2) whether there were actual job openings within the organization which the women could fill; and (3) whether they foresaw any difficulties in terms of social inhibitions or security problems associated with hiring a Nepali woman (See Appendix 4).

All but one orgaization out of twenty-one surveyed responded very favorably to the first question by saying that they would find it very useful and desirable to hire a Nepali woman for their staff. Many responses spoke of getting more women involved in their projects, particularly at the village level. The answers also stressed the idea that professionally trained women would be able to empathize with other women and be especially helpful to the organization in the areas of extension, fuel-efficient chulo stove installment and other projects which involve increasing the participation of rural women.

In response to the second queston about actual positions, it became evidient that the majority of the organizations cannot directly hire Nepali staff. Most development projects in Nepal are collaborative efforts between the donor organization and the Government of Nepal (GON) where the Nepali staff is provided by GON. Thus most of the Nepali personnel working on collaborative development projects funded by organizations such as FAO, USAID, UNDP are attached to a department within the Ministry of Forests and Soil Conservation. Although many organizations expressed a desire to have more women on their staffs, they rely on GON to provide them with personnel. If there are no women available through GON Ministries, then women cannot be hired.

Non-governmental organizations (NGOs), however, can hire Nepali staff directly. All of the NGOs surveyed were very interested in the idea of hiring a Nepali woman to help with their more grass-roots oriented approach to renewable natural resource management. CARE/Nepal stated that they had immediate openings for staff

which they hoped to fill with a female graduate of IRNR.

Answers were mixed with regard to the difficulties of employing a Nepali woman on their staff. Most organizations recognized that there may be problems in sending Nepali women into field situations but expressed a willingness to give it a try. Other answers expressed a spirit of compromise to any cultural or security problems which might arise for women in the field. George Axinn, the FAO Country Representative for Nepal noted, "The biggest problem is getting the first few employed. After several have been successful, it will be easier. Social arrangements will have to be made so that both female staff members' families and the local people are satisfied."

Employment Outlook

The findings in the above paragraphs are highlighted by these central points:

(1) The Ministry of Forests and Soil Conservation has many vacant posts to fill which should give them a great amount of leeway to place women in jobs they prefer and will meet the mandate of the training program for women.

(2) Women studying at IRNR have stated that they would most prefer jobs in nursery management and extension. They have also expressed a strong commitment to solving renewable natural resource problems, especially in the hills areas.

(3) There is an expressed desire for female personnel to work with donor organization-GON collaborative projects with activities directed to women.

These findings clearly indicate that there are opportunities for the female graduates of IRNR to fill a new role in the forestry sector focusing on extension and other renewable natural resource development efforts directed at rural women. The greater question of women's capabilities must be answered in the future. But in order for those capabilities to be judged fairly, women must be placed in positions that will allow them to express their unique skills and commitments.

Recommendations

It is extremely important to the success of the training program for women at IRNR that the first group of female graduates be allowed to work in positions where they can prove their abilities as professional foresters and resource managers, as well as focusing their efforts on reaching the rural women of Nepal to increase their activity in the forestry sector. Placement of the first graduates is especially significant since it is likely to set a precedent for placement of future graduates. For the IRNR Women's Training Program to meet its

goals, it is recommended:

1) That GON make a policy of placing female graduates of IRNR in positions that enable them to work on projects directed at increasing the involvement of rural women in renewable natural resource schemes. One viable option for such placement is to attach women to donor organization-GON collaborative projects such as RCUP, the Nepali-Australia Forestry Project and FAO's Community Forestry Programme, where there is an expressed need for female extension and outreach personnel.

2) That GON create new positions for female personnel to work on developing or implementing such needed projects as women in extension, women in nursery management, women in livestock management and fodder production, and women in fuel-efficient chulo stove use.

3) That RCUP employ at least the four women that were recruited from RCUP's districts in the capacity of nursery managers, extension agents, or chulo stove technicians. Not only does this recognize the women's job preferences but it also sets a precedent for placing women in field posts near their homes.

4) That the female graduates themselves be their own most forceful lobbyists. It is ultimately the responsibility of the female graduates to seek the sort of work they prefer. They must make every effort to find support and backing from RCUP and IRNR to help them negotiate with the Ministry of Forests and Soil Conservation for preferred postings.

5) That women consider seeking employment outside GON with non-government organizations involved in more grass-roots level work. Employment outside of GON should be considered as only a stop-gap measure which recognizes women students' job preferences and can help redefine the role of women in forestry by placing women in visible positions which focus on community forestry activities and extension work.

6) That female graduates at the Diploma level be given positions as DFOs or DCOs if they so desire. Women must eventually be represented in positions of authority within the Ministry of Forests and Soil Conservation in order to influence perceptions and policy from within the government system. Placing a woman in a position such as DFO would be a positive move in this direction.

V. SUMMARY AND RECOMMENDATIONS FOR FUTURE ACTIONS

The training of women at the Institute of Renewable Natural Resources has the potential to have great impact on renewable natural resource use by targeting women as participants in forestry sector development efforts. This report has addressed ways in which the training program for women at IRNR can be improved to assure that it meets its original manadate.

Among the suggestions offered were two major recommendations; (1) that the government of Nepal place female graduates in positions which will allow women the opportunity to prove their abilities, match their own job preferences and meet the program's primary objective of providing a link between rural women and government sponsored renewable natural resource development schemes; and (2) that IRNR offer further financial incentives to attract women to IRNR, remove barriers to their admission such as exclusionary application procedures, and assure their continued entry with an expanded reserved seats policy.

Future Actions

Followup to some of the recommendations and questions raised in this report will be necessary to answer some future questions and problems concerning the training of women at the IRNR. The following are some questions for further study and other efforts to assure continued support and attention for women in Nepali forestry.

1) Impact of women working in the forestry sector: Once women have been employed by GON or other organizations, another study will be needed to evaluate the overall impact of women working in the forestry sector. The question of how women are being employed by GON is crucial, considering the present debate on this issue.

2) Coordination on training programs for women: There is great potential for a more coordinated effort for training programs involving women in the agricultural and forestry sectors. Many of the problems and solutions to those problems are similar for the women studying at both the IAAS and the IRNR. Future concern should focus on the problems at both institutes and the bigger question of the impact such training programs have throughout Nepal.

3) Para-professional training programs: The issue of para-professional training also deserves future attention. The program to involve more women in Nepali forestry through training could be greatly expanded to include para-professional education and training programs. The RCUP has a history of conducting such training programs for village women. One example is the recent effort targeting women for training in the production and harvesting of Daphne, a bushy tree which is used for paper making in Nepal. However, more such training programs are

needed to reach a greater number of village women throughout Nepal.

4) Female literacy: There is also a need to put more effort and coordination behind female literacy programs due to the link between the issue of female education and a woman's ability to attend training programs such as at IRNR.

5) Role Models: One final issue not discussed in this report is the need for women attending training programs such as IRNR and IAAS to have role models. Employing female faculty or staff persons could greatly facilitate communication between the female students and the administration. It could also provide an advisor to the women who boost their moral and encourage their confidence.

APPENDIX 1

Survey of Female IRNR Student's Opinions on Employment*

This survey is designed to gauge the opinion of the female students at IRNR who have now completed one year of study. This survey will offer information which should increase the understanding between the women, the school administration and employing agencies. You can help facilitate this understanding by answering the following questions as thoroughly as possible.

(1) What sort of forestry-related work do you want to do whey you finish your studies at IRNR?

(2) After completing your studies, what do you think would be your most useful contribution to the renewable natural resource problems which Nepal is now facing?

(3) Who do you wish to work for?

(4) Do you have any reservations about working for HMG? Do you think there will be difficulties or discrimination because you are a woman?

(5) Are you interested in working for private organizations which conduct more grass-roots oriented projects in Nepal?

* This survey was translated into Nepali by my interpreter Sushila Nepali. It was also explained verbally to the women students. Although I was most interested in responses from the second-year women, the new group of women also completed the survey, giving answers strikingly similar to the second-year women. It is my opinion that all the women consulted with each other to some degree on their answers. As a result, the answers were very homogeneous and easy to translate into generalizations about the women's desires for employment.

APPENDIX 2

Survey of Job Opportunities for Female IOF(IRNR) Graduates Among Major Donor Agencies and Private Organizations in Nepal

Survey Questions:

(1) Would your organization find it useful or desirable to hire a female graduate of the IRNR trained in renewable natural resource management. If yes, explain why.

(2) Are there actual positions available for natural resource managers within your organization?

(3) Would there be difficulties for your organization to hire a Nepali woman?

(4) Please use this space for other comments.

List of Organizations Surveyed

- Care, Inc.
- Save the Children Federation, Inc. (USA)
- Save the Children Federation, (U.K)
- United Mission to Nepal
- International Center for Integrated Mountain Development (ICIMOD)
- World Neighbors
- Swiss Association for Technical Assistance (SATA)
- Food and Agricultural Organization of the UN (FAO)
- United Nations Children Fund
- Nepal-Australia Forestry Project
- World Bank
- National Research Associates (NRA)
- Integrated Development Systems (IDS)
- Agricultural Development Council
- Agricultural Projects Service Center
- New Era
- United States Agency for International Development (USAID)
- Nepal/United Kingdom Silvicultural Research Project
- Koshi Hill Area Rural Development Project (U.K.)

APPENDIX 3

Educational Opportunities for Women and Remote-Area Students at the Institute of Renewable Natural Resources*

Introductory Note:

The Institute of Forestry/Institute of Renewable Natural Resources (IOF/IRNR), presently located in Hetauda, offers training to young men and women in the fields of Forestry, Soil and Water Conservation, and Wildlife Management. The purpose of this bulletin is to explain admission requirements and the availability of scholarships and stipends to encourage students, especially those from the hill regions of Nepal, to consider an education in natural resource management.

Background:

In August of 1983, IOF/IRNR admitted its first female students. Six young women began their first year of Certificate level studies and one began her first year of study for a Bachelor of Science (B.Sc.) in Forestry. Under assistance from the South-East Consortium for International Development, the Resource Conservation and Utilization Project (RCUP) provides funds for scholarships and stipends to all female students who attend IOF/IRNR. There is also a provision that a minimum of ten percent of the seats are reserved for females. In August of 1984, IOF/IRNR met that goal by selecting eleven females candidates from the fifty-one total females who applied.

The IOF/IRNR also reserves seats for students from remote areas of Nepal and actively encourages their application and admission.

The IOF/IRNR is divided into two campuses, one in Hetauda and a new campus under construction in Pokhara. When construction is completed, the Diploma (B.Sc.) program as well as a new Certificate level program will move to Pokhara campus from its present site in Hetauda. Hetauda campus will continue to teach a Certificate level program in Forestry. Students applying to IOF/IRNR for Certificate training may choose to apply to either campus.

Scholarships and Stipends:

All students of the Pokhara campus in good academic standing who are not receiving any other financial support will receive a stipend or scholarship provided by funds from RCUP. Students at the Certificate level will receive 2000 NRs. per academic year to cover living expenses. All female students at IOF/IRNR receive the above stipend plus an allowance for suitable clothing for field work. Work-study grants are also available to female students which provide an additional 100 NRs. per month.

*Translated into Nepali and printed in small pamphlet formate for distribution. 3,000 copies funed by RCUP.

In addition to these stipends, ten percent of the students in each year's Certificate and Diploma programs will receive scholarships based on academic excellence. One scholarship will be provided to an outstanding female and one to an outstanding remote-area student in each yer of each program. For the first year of the Diploma (B.Sc.) program, two scholarships for outstanding females and two for outstanding remote-area students will be awarded.

How to Apply:

Students generally make their application to IRNR in person, presenting their documents directly to the Dean's office in Hetauda. After completion of the Pokhara campus in January 1986, applications can also be made to the Dean's office in Pokhara.

Students from remote areas who are unable to make the trip to Hetauda (or Pokhara) should contact District Education Offices (DEO's), District Forest Offices (DFO's), District Conservation Office (DCO's) or Women Development Officers nearest their home for assistance in applying to IRNR.

Applications are due one month before classes begin. For the Certificate program, the application deadline falls during the month of August. For the Diploma program, applications are accepted twice per year, in June for those aplying with a B.Sc. in General Science and in October for those entering with a Certificate and three years field experience.

Appendix 4

BULLETIN OF THE INSTITUTE OF FORESTRY/INSTITUTE OF RENEWABLE NATURAL RESOURCES ACADEMIC YEAR 2042-2043 (1985-1986)

HISTORY

The Institute of Forestry (IOF) was established under His Majesty's Government (HMG), Department of Forests in 2004 B.S. (1941 A.D.) to provide a training program for rangers and foresters within Nepal. With the assistance of the Indian Co-operation Mission, a campus was constructed in Hetauda in 2028 B.S. (1965) which today still houses the Proficiency Certificate training program. In 1973, the Institute of Forestry was incorporated along with other technical institutes under the Tribhuvan University system.

DEVELOPMENT

In response to the growing challenge of managing Nepal's diverse natural resources, the Institute has recently undertaken a program of expansion and development. To mark this growth and to project modern concepts a proposal was made to change the name of the Institute of Forestry to the Institute of Renewable Natural Resources (IRNR). With funding from the World Bank and the United States Agency for International Development (USAID), IRNR began classes in temporary facilities at Pokhara in 1981. A new Pokhara Campus is presently under construction, with an expected completion date in early 1986. Although both campuses are temporarily housed at (IOF) Hetauda, when construction is completed the Diploma (B.Sc.) program as well as a new Proficiency Certificate level program will move into the new Pokhara facilities. The Hetauda campus will continue to teach a Proficiency Certificate level program in Forestry.

The Pokhara Campus was established to meet the growing demands for trained natural resource managers in Nepal. The curriculum at the Pokhara campus focuses on an integrated approach to natural resource management with a special concern for the growing problems of fuelwood and fodder scarcity in Nepal's hill regions. Pokhara was chosen for the new campus site because of its location in the Middle Hills region of Central Nepal and its greater accessibility to students from remote regions. In addition to its B.Sc. and Certificate programs, the Pokhara campus will also offer short-term training to natural resource managers presently employed by various HMG conservation agencies to keep them informed of current developments in social forestry and other management practices.

FACILITIES

The Hetauda campus facilities include administrative and classroom buildings enclosed in a park-like compound of 90 hectares of forested land. Men's housing facilities are located on-campus while the women's hostel is within close walking distance to the campus. Also located on-campus are a large sports field for physical training and various research stations including a small nursery.

Upon its completion in early 1986, the Pokhara campus will consist of administrative and classroom buildings, a library, a student center, laboratories and workshops. There will also be male and female hostels with a capacity for housing 400 students. Faculty housing will also be located on-campus.

RESEARCH ACTIVITIES

The Institute of Forestry at Hetauda has been conducting research on the relevant areas of forestry and soil and water conservation for many years. The major facilities to carry out research activities are located at (a) Khairani Tar, Tanahu District, (b) Nibuwatar, Makwanpur District, and (c) Tamagarhi, Bara District representing middle hills, inner Terai and Terai ecosystems respectively. Research programs have concentrated on:

1. Watershed Reforestation Techniques.
2. Erosion and Gully Control, and
3. Agro-forestry Techniques.

The Institute of Forestry has recently begun research on Farm Forestry activities under a grant from the Canadian based International Development and Research Center. The main objective of the Farm Forestry program is to develop sound techniques of extending forestry practices onto private farmland in a manner appropriate to Nepal. The research sites under this project are located at (a) Karmaiya, Sarlahi District, (b) Parwanipur, Parsa District, (c) Khairani, Chitwan District, (d) Rampur, IAAS plots, (e) Taranagar, Gorkha District, and (f) the IRNR site in Pokhara.

FINANCIAL AID

With funds from the USAID-Resource Conservation and Utilization Project, (RCUP) the Pokhara program provides scholarships and stipends as incentives to recruit high quality students, to increase the percentage of females admitted, to encourage students from remote areas of Nepal to seek admission, and to promote academic excellence.

All students of IRNR Pokhara campus in good academic standing who are not receiving a stipend or scholarhip from any other source, and who are not receiving a departmental salary, educational leave pay or other financal support, may receive a stipend. Students at the Certificate level will usually receive 2000 NRs per academic year while B.Sc. students will generally receive 4000 NRs per academic year.

In addition, 10% of the students in each year of each Certificate and B.Sc. Diploma class will receive scholarships awarded for academic excellence. Scholarships will also be provided to encourage applications and academic excellence from females and students from remote areas.

The Hetauda campus offers stipends to 25% of its Certificate level students. These stipends are awarded based on superior academic performance. Two students from remote areas and one student without financial resources are awarded stipends from within the total 25% selected. In addition, tuition and fee waivers, or Freeships, are awarded to 14 students based on financial need plus academic merit.

WOMEN AND REMOTE AREA STUDENTS

One of the goals of the Pokhara program is to attract students from remote areas and females for training in renewable natural resource management. To meet this goal, the Pokhara program reserves seats for both remote area and female students and actively encourages them to apply. As special incentive, the Pokhara program offers scholarships to these students, based on academic merit.

In 2040 (1983), IRNR enrolled its first female students in both the Certificate and Bachelor of Science in Forestry programs. By Bhadra, 2041 (August 1984) it had met its goal of filling 10% of the available seats with female candidates.

ACADEMIC INFORMATION

IRNR offers two programs of study, Proficiency Certificate training in Natural Resource Management or Forestry and the more advanced Diploma (B Sc.) program in Forestry, Soil and Water Conservation or Wildlife Management. The Hetauda campus offers a 2 year Certificate level program in Forestry accepting 110 students per year.

The Pokhara campus presently offers a 3 year B.Sc. course of study for those students who have completed the Proficiency Certificate program and three years of work experience. Students entering with a B.Sc in General Science may complete the course in two years. The Pokhara campus will also offer a new Proficiency Certificate program in natural resource management for 110 students per year when construction of the new campus is completed. Students applying to IRNR for Certificate training may choose to attend either campus.

CERTIFICATE PROGRAM IN RENEWABLE NATURAL RESOURCES

The Certificate course has been designed primarily to provide training for young men and women who wish to work in the Ministry of Forests initially at a junior supervisory level (foresters and soil and water conservation technicians). The course is completed in two academic years. The first year's study focuses on basic education and introduction to natural resource management. The second year provides extensive field experience for a practical grounding in natural resource conservation. Although all students undertake the same course of study, there are opportunities both during field experience and in the 2nd year for individual project work.

Course Schedule

Year One
Nepali
English
Mathematics and Calculation
Basic Silviculture and Forest Conservation
Soil and Water Conservation
Introduction to Renewable Natural Resource Management
Practice of Renewable Natural Resource Management
Introduction to Biology and Plant Identification
Introduction to Extension Work in Natural Resource Management
Surveying and Engineering
Regular Field Works, Part I
Physical Training and Games, Part I

Year Two
Nepal Parichaya
Law and Administration Related to Natural Resources
Wildlife Conservation in Nepal
Agriculture and Rural Sociology/Village Crop and Livestock
Harvesting and Logging
Basic Forest Protection
Personnel Management and Accounting
Work Practice, Hand Tools, Efficiency and Maintenance
Timber Utilization and Intermediate Technology
First Aid, Health and Hygiene
Physical Training and Games, Part II
Regular Field Works, Part II
Attachment to Project Evaluation

Certificate Courses:

Nepali: Nepali Grammer, general knowledge of the language, expression and presentations.

English: Outline of basic English language terminology related to renewable natural resource conservation, practice in effective communication in written and spoken English.

Mathematics and Calculation: Mathematic methods and techniques applicable to the field of forestry, statistics and elementary forest mensuration.

Basic Silviculture and Forest Conservation: Classification of forests; concepts of succession, basic management objectives, silviculture of selected species. Concepts and techniques of forest conservation.

Soil and Water Conservation: Basic metecrology, introduction to hydrology and physical properties of soils; effect of different land use practices on soil and water conservation, causes and control of erosion.

Introduction to Renewable Natural Resources Management:
Covers geology, physiography and climate of Nepal; basic concepts of plant and animal ecology, development and use of forest products; government and private organizations concerned with natural resources in Nepal.

Practice of Renewable Natural Resource Conservation:
Basic forest nursery techniques; establishment of tree and cover crops across the range of site types in Nepal, maintenance of forest cover crops.

Introduction to Biology and Plant Identification:
Overview of the structure of plant and animal kingdoms, identification of important forest fungi, insects, birds and mammals, study of animal and plant life cycles.

Introduction to Extension Work in Natural Resource Management:
Training, demonstration and instructional techniques; review of communication and organizational skills necessary for effective extension programs.

Surveying and Engineering: Techniques of surveying; use of chain, compass and plane table survey; work of a surveyor in the field and office.

Regular Field Works:

Part I Field trip of a week duration in the mountains as well as the Terai regions.

Part II Field trip of 20 days duration to observe different forests, forestry practices, forest based industries, and forest-related activities.

Physical Training and Games: Physical excercises to maintain student's fitness; drills, jogging, and other athletic activities

Nepal Parichaya: The geographic, historical, administrative, economic, social, linguistic and literary disciplines of Nepal from ancient to modern times, overview of arts and foreign policy of Nepal from ancient to modern times.

Law and Administration Related to Natural Resources:
Introduction to policy and implementation of Nepal's Forest Laws, overview of rules and regulations which apply to forest use and wildlife conservation in Nepal.

Wildlife Conservation in Nepal:
Review of the major wildlife species in Nepal, their habits and prefered habitats; conservation practices related to wildlife; related regulations and laws governing protection.

Agriculture and Rural Sociology/Village Crop and Livestock:
Social structure of rural communities in Nepal, the working of village economies; aspects of natural resource conservation in local community development; impact of farming systems on land use, major crop and livestock types used in farming in Nepal

Harvesting and Logging:
Harvesting techniques, grading, storage and protection of felled timber

Basic Forest Protection:
Factors causing damage to trees and plants; life cycle of important biotic agents, basic fire protection; remedial and control actions against forest pests.

Personnel Management and Accounting:
Responsibilities of the supervisor; basic human relations, basics of accounting and bookkeeping.

Work Practice, Hand Tools, Efficiency and Maintenance:
Correct and incorrect procedures in basic work tools; safe work practices, routine maintenance procedures.

Timber Utilisation and Intermediate Technology:
Structure and quality of hardwoods and softwoods; conversion of wood into sawn timber and other products; main uses for wood.

First Aid, Health and Hygiene:
Fundamental aspects of human anatomy and physiology, instruction in correct first aid procedures; basic principles of good health and hygiene in rural areas.

Attachment to Project Evaluation: Field stay of 10 days on each site

Gorkha: RCUP works, surveying, demonstration, trail improvement, trekking, fencing.

Saurahe: Chitwan national parks, jungle survival exercise.

Chautara: Community Forestry project works, nursery and plantations practices, trekking.

Sagarnath Sagarnath forestry project works, Terai plantations, nursery works, logging,felling, charcoal production works.

B.Sc.(DIPLOMA) PROGRAM IN RENEWABLE NATURAL RESOURCES:

The diploma course runs for three years and prepares students to become Forest Officers and Soil and Water Conservation Officers under the Ministry of Forests. Training is also provided in Wildlife Management. The first two semesters concentrate heavily on the basic sciences. In the second year the basic applied sciences of forestry and soil and water conservation are covered. In the final year students take several specialized courses which are taught within their discipline.

The following abbreviations are used to indicate courses offered only to students within the stated discipline. F = Forestry, S = Soil and Water Conservation, W = Wildlife Management

Course Schedule

	Full Marks
Year One*	
English	100
Algebra and Trigonometry	100
Calculus and Introduction to Coordinate Geometry	100
Introductory Botany	100
Introductory Zoology	100
Introductory Chemistry	100
Introductory Physics	100
Year Two	
Hydrology	50
Introduction to Soil Science and Geology	100
Introductory Statistics	50
Human Resource Management	50
Surveying, Mapping and Draftsmanship	50
Accounts and Procedures	50
Resource Economics	100
Ecology	105
Animal Physiology (W)	50
Soil and Water Conservation Engineering (S)	50
Forest Mensuration (F,W)	50
Plant Physiology (F,S)	50
Year Three	
Silviculture	100
Forest Engineering (F,W)	50
Harvesting, Logging and Utilization of Forest Products (F)	100
Remote Sensing	50
Seminar in Forest Management (F), Soil and Water Conservation (S) and Wildlife Management (W)	25
Soil Genesis, Morphology and Classification (S)	50
Forest Protection (F)	50

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* Students entering with a B Sc. in General Science begin their studies at IRNR with a capsule course introduction to natural resource management. They then proceed directly to the second year of course work.

Soil Fertility and Plant Nutrition (S)	50
Irrigation and Drainage (S)	50
Watershed Management (S)	100
Habitat Improvement and Wildlife Conservation (W)	100
Wildlife Management Techniques (W)	50
Wildlife Biology (W)	50
National Park Administration and Management (W)	50
Ornithology and Mammology (W)	75
Statistical Methods and Experimental Design	50
Agricultural and Range Management (F,S)	75
Elective	50

English:

Definitions of tehnical terms and comprehension of typical scientific literature; report, essay and letter writing, use of the library

Algebra and Trigonometry:

Calculus of areas, volumes, and quantities used in soil engineering, forestry, construction and land surveying; trigonometrical functions in the volumetric mensuration of individual trees, forest stands and felled timber.

Calculus and Introduction to Coordinate Geometry:

Co-ordinate geometry and graphical methods, advanced calculus.

Introductory Botany:

Taxonomy, the origin and evolution of domestic plants, biological site responses of some important species.

Introductory Zoology:

Classification and phylogeny of the animal kingdom ; study of internal structure and organization of important representatives. Origin and evolution of domestic and other important animals.

Introductory Chemistry:

Principles of inorganic and organic chemistry, bio-chemistry, chemical structure and reactions; laboratory exercises.

Introductory Physics:

Physical principles underlying the properties of living organisms, physical features of the earth's surface and mechanisms.

Hydrology:

Basic concepts of meteorology and hydrology, measurement and estimation of factors in the hydrologic cycle; evaluation of meteorologic and hydrologic factors in relation to foresty and soil conservation management planning

Introductory Geology and Soil Science:

Process and formation of minerals and rocks, geological formations, geologic history and major geologic formations of Nepal, nature and properties of soils, soil management for natural resource utilization and conservation.

Introductory Statistics:

Basic concepts and limitations of standard statistical procedures, descriptive statistics and sampling; hypothesis testing.

Human Resource Management:

Study of traditional values, human resources and various interactions among human communities; human resources planning and motivation.

Surveying, Mapping and Draftsmanship:

Principles of land surveying and draftsmanship; mapping in Nepal; mapping as related to land use management.

Accounts and Procedures:

Principles of bookkeeping, accounts, costing and estimating; particular attention given to economic theory, land as capital and simple accounting for an enterprise

Resource Economics:

Economics of natural resource management and policy analysis, cost-benefit analysis, special economic problems of natural resource use in Nepal

Ecology:

Physical, chemical and biotic factors of the environment, structure and classification of ecosystems, plant and animal communities in Nepal; effects of various management practices on the ecosystem

Animal Physiology (W)

The biology of organisms, physiological processes of animals and their adaptation to their environment.

Soil and Water Conservation Engineering:

Design, layout and construction of terrace systems, grassed water-ways, holding basins, drop control structures, ponds, dams, and other structures used for water conservation, erosion and flood control

Forest Mensuration (F,W):

Inventory, measurements and sampling of felled or standing timber, advantages and limitations of various volume calculations

Plant Physiology (F,S):

Elementary cell biology; the physiological processes of higher plants in relation to their environment; the biology of micro - organisms and fungi

Silviculture:

Principles and practice of silviculture and its application to Nepal, silvicultural systems, methods of planting and maintenance of young forest crops.

Forest Engineering (F,W):

Simple and indigenous techniques for building construction, bridges, forest trail improvements and construction of roads and fire lanes

Harvesting, Logging and Utilization of Forest Products (F):

Covers the range of economically feasible methods of forest harvesting now in use and their application in Nepal.

Remote Sensing:

Aerial photography and satellite imagery, preparation of maps from aerial photographs; evaluating and monitoring the environment through the use of aerial photography

Seminar in Forest, Watershed or Wildlife Management:

Special topics, critical reviews and discussions of pertinent literature throughout a wide range of subject areas in forestry watershed and wildlife management; student presentations.

Soil Genesis, Morphology and Classification (S):

Factors of soil formation, principles of soil classification, model classification systems and their application to Nepal, soil mapping; field and laboratory exercises relevant to soil genesis and classification

Forest Protection (F):

Pests and deseases of trees and higher plants, control and salvage operations in forest protection, fire fighting

Soil Fertility and Plant Nutrition (S):

Relaticinships between soil nutrition and plant growth, nutrient chemistry of soils in Nepal; nutrient cycles and their relevance to crop production in Nepal

Irrigation and Drainage (S):

Design, implementation and control of irrigation and drainage systems for agriculture and forestry in Nepal.

Watershed Management (S):

Physical, biological institution and social considerations of watershed management in Nepal, principles of watershed management

Habitat Improvement for Wildlife Conservation (W):

Methods to improve habitats for specific groups of wildlife; relationship of natural resource use to habitat destruction; range management, including wetlands and grasslands.

Wildlife Biology (W):

Outline of wildlife distribution in Nepal, ecological and historical factors of wildlife management; population dynamics and manipulation.

Parks Administration and Management (W):

Concepts and objectives of National Park management, evaluation of social and economic impacts of National Parks in Nepal.

Ornithology and Mammology (W):

Biology of birds; behavior and ecology of common birds of Nepal; techniques of research, classification and time ranges of mammals; common mammals of Nepal.

Statistical Methods and Experimental Design:

Overview of statistical designs for biological research; analytical techniques in statistics; problems of reearch in renewable natural rescurce conservation in Nepal; computer application of statistics.

Agriculture and Range Management (F,S):

Farming systems and agricultural production practices in Nepal, management of livestock; range management and improvement, combination forest, fodder and food crop production systems

Wildlife Management Techniques (W):

Techniques used in protection and research procedures in wildlife science Maintenance of wild animals, identification, ageing and trapping animals

Elective

Individual research for preparation of a paper in the students' area of interest

ADMISSION REQUIREMENT:

All Certificate level candidates are required to have passed the School Leaving Certificate (SLC) examination. Students with higher scores in English, Mathematics, and Science are given preference.

Admission requirements for B.Sc. candidates are as follows:

1. A B Sc. or Diploma in General Science (Physics, Chemistry, Math, Zoology or Botany) or

2. Certificate from (IOF-IRNR) plus 3 years practical field experience in Natural Resource Management (forestry, watershed management and wildlife conservation works).

HOW TO APPLY.

Application forms for both Certificate and B Sc. programs are available from the Dean's office at the Hetauda and Pokhara campuses, both presently located in Hetauda

Applications are due in early Srawan (August) or at least one month before classes begin for Certificate and B Sc. (Forestry) programs

For application to the B Sc course, students with a Certificate in Renewable Natural Resources Management may apply in Ashwin (October) and those with a Diploma in General Science may submit applications in Ashar (June).

Remote area students should contact District Education and District Forest and Soil Conservation Officers nearest their home for aid in applying to IFNR Students may also seek aid in applying from Women Development Officers in their panchayat.

REFERENCES

Personal Communications

(1) Madhav Karki, Program-in-Charge, IRNR
(2) Bimal Koirala, IRNR Faculty
(3) Prashwal Pradhan, Training Officer, RCUP
(4) Yam Malla, Training Officer, RCUP

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(2) Davidson, Debra and Cooper, Carol, 1983. Women and Resource Conservation and Utilization in Nepal. Occasional Paper Series: Women in Development. South-East Consortium for International Development.

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(6) National Research Associates, 1984. Proceedings of the National Seminar on Employment of Female IOF(IRNR) Graduates. RCUP/IRNR, Kathmandu, Nepal.

(7) Pandey, Shanta, 1984. Women in Natural Resource Management. From Panchayat Darpan, A Journal of Local Development: Special Issues on Women's Development. Publication 46, 1984-85, No. 1. HMG/MPLD Training Material Production Center, Kathmandu.

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(9) USAID/Nepal, 1984. Project Paper: Institute of Agricultural and Animal Science - II (367-0148). Unclassified paper. USAID, Kathmandu.