

In most of the areas, salinity of surface soil can be reduced through leaching with natural rainwater for at least one year and land can be initially used for cultivation of salt-tolerant rice varieties and other crops, viz. rice: CSR-13, TRY 1, TRY(R) 2, Co 43, Co 47, ADT 43 and ADT 36; ragi: TRY 1; sunflower: CO4; groundnut: VRI 2; green gram: K 851; brinjal: PLR 1 and AU 1; clusterbean: Pusa Navbahar; jack: Palur 1; pomegranate: Ganesh; sapota: PKM 1; cashew: VRI 2 and 3; amla: BSR 1, and tamarind: PKM 1.

Since in saline soils, young seedlings are sensitive to salinity, only aged seedlings (one week more than normal age) may be planted with higher number (4–6) of seedlings per hill. In case of fertilizer application, 25% extra N as basal dose should be added along with zinc sulphate @ 25–35 kg ha⁻¹. Phosphorus should be applied on the basis of soil test or 15 kg ha⁻¹ as maintainer dose. In case of delayed supply of canal water or rainwater, sowing of sprouted seeds should be resorted to.

Major emphasis should be given to the management of the seafront of the land so as to protect the lands for agricultural production and inhabitation. A natural shelter belt and eco-friendly approach can be made by the creation of a bio-wall growing mangrove trees, coconut (*Cocos nucifera*), casuarinas (*Casurina equisetifolia*), pungam (*Pongamia pinnata*), punnai (*Calophyllum inophyllum*), palmyrah (*Borassus flabelliformis*), poovarasu (*Thespesia populnea*), etc. along the coastal line. This will dissipate the energy of the sea waves and thus diminish their damaging force (Figure 4). It will act as sanctuary for fishes and other sea flora, which can be economically exploited. It will also prevent soil erosion and act as a sink for atmospheric carbon dioxide.

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ACKNOWLEDGEMENTS. We thank Dr P. K. Ghosh, Director, CSMCRI, Bhubaneswar for his keen interest in work.

Received 22 December 2005; revised accepted 9 March 2006

Gender in the management of indigenous knowledge: reflections from Indian Central Himalaya

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In the Indian Central Himalaya, indigenous knowledge is an important natural resource that has enormous potential to facilitate the development process in cost-effective and sustainable ways. It governs almost all important productive resource sectors and revolves around traditional values of resource use. In this study, covering nineteen settlements and as many as 500 respondents drawn equally from both sexes, an effort was made to understand the indigenous knowledge of both sexes through documentation of indigenous system of medicine and health-care practices. The study revealed that women are the real custodians of the indigenous knowledge system, as 52% of them have knowledge on thirty practices against that of 26% for males.

Keywords: Gender, conservation, Indian Central Himalaya, indigenous knowledge, resource.

THE Indian Central Himalaya (ICH), spreading over a geographical area of 53,485 km², supports 8,479,562 persons who constitute about 0.83 and 21.40% of the total population of the Indian Republic and Indian Himalayan Region (IHR) respectively. The region is synonymous with the newly constituted Himalayan state of Uttarakhand. The geographical area of the region is dispersed within an altitudinal variation ranging from 200 m to more than 8000 m amsl. It is composed of five lithotectonically and physiographically distinct subdivisions, namely the Outer Himalaya comprising the Tarai and Bhabhar, Sub-Himalayan belt of the Siwalik, the Lesser Himalaya, the Great Himalaya and the Trans-Himalaya or Tethys¹. The climate and consequently the biological communities vary considerably along the gradients of this mountain ecosystem, giving a heterogeneous dispersion of biodiversity elements in the region². Conservative estimates indicate that the region harbours more than 700 species of medicinal plants out of the 1748 and 2500 species reported in the IHR and India respectively³. It also supports remarkable cultural and ethnic diversity, and human habitation is found up to an altitude of 3500 m amsl.

In the ICH, the qualitative relationship of the people with its immediate environs and natural resources has evolved through strenuous experiences of difficult survival⁴. These experiences help evolve tools, technologies and

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practices for sustenance of the production systems in balance with social heritage, economic conditions and ecological specificities^{5,6}. These eco-culturally evolved ecosystem-specific tools, technologies and practices constitute integral parts of appropriate innovative strategies, otherwise called the indigenous knowledge system that effectively conserves resources and also allows options for their optimal use⁷⁻¹⁰. It revolves around traditional values of resource use that include subsistence values (food, clothing, housing, medicine, energy), socio-cultural values (ritual, spiritual, aesthetic, educational, psychological), economic-commercial values (agricultural, industrial, pharmaceutical, tourism), and traditional practices of resource use (agri-diversity, wild edibles, medicinal plants and ethnomedicine, forest and grasslands, ethnoveterinary, etc.). The indigenous knowledge in this ecosystem, therefore, serves as a cultural and natural capital¹¹, assisting the native societies to 'live in harmony with nature'¹². This knowledge is passed on from generation to generation, in which the women in the region have a major role to play in view of their responsibility in resource management, particularly the production system.

Women, constituting about 49.1% of the total population of the region, are the life and blood of the economic structure¹³. The agricultural system is heavily dependent on women as except for ploughing, which is done by men, all other activities are largely done by women. Large-scale migration of men from this region to lower plains has attenuated their socio-economic responsibility, enforcing women to be heavily involved in food production. Probably, because of this reason, despite a high literacy rate (the male and female literacy in the ICH was 84.01 and 60.26% respectively, against 75.84 and 54.16% for India), women in the region generally work more than 15–18 h a day¹⁴, attending to cattle, collecting fuel, fodder and water in addition to performing normal duties at home, apart from managing agriculture (Table 1). This responsibility of food production has endured women to rationally use, promote and conserve the scarce and finite natural resources of this mountain region with the help of indigenous knowledge system. It is pertinent to note that though the replication of modern technologies developed elsewhere is restricted in this ecosystem because of

mountain specificities, viz. inaccessibility, fragility, marginality, diversity (heterogeneity), niche (natural suitability) and adaptability (human adaptation)¹⁵, women have effectively used indigenous knowledge in optimally managing agriculture and other resources for their sustainable living. Also, the knowledge and practices of utilization and conservation of medicinal plants, ethno-medicinal and ethno-veterinary treatments by women of the region are vast¹⁶. With these in background, the present study is aimed at determining the role of women in the indigenous knowledge system through documentation of indigenous medicine and health-care practices.

Nineteen sample villages (Table 2), located within altitudinal variation of 800–2000 m asl in two districts, viz. Almora and Nainital in Uttaranchal which is synonymous with the ICH (Figure 1) were selected for the study. The villages were purposely selected keeping in view the biophysical diversities, i.e. forest cover, altitudinal location, distance from (i) block headquarters, (ii) market/growth centres, (iii) road and bus points, and cultural diversities, i.e. multi-caste composition of the village, so that they were best representatives of other villages in the region. Data on indigenous health-care practices were collected through interviewing the villagers using open-ended interviews and guided dialogue techniques. As many as 500 respondents, half of them women, were interviewed independently in their villages by an interdisciplinary team of researchers to document the prevalent human diseases and disorders, their diagnostic knowledge for curing such diseases and disorders, and medicinal plants and other raw material used in the treatments. The local names of the diseases and disorders and plants with medicinal value were recorded from the respondents while interviewing them. Later, the plants with medicinal value were identified with the help of the respondents and taxonomists. In order to quantify the gender division of indigenous knowledge base in health-care practices, 250 respondents each from both the sexes were interviewed.

The ICH is served inadequately by the state-sponsored medical system. Primary Health Centre (PHC) is the key unit of health-care delivery. The size of the population stipulated to be covered by each PHC is 20,000 in the hills and tribal areas¹⁷. Each PHC, supposedly equipped

Table 1. Women's contribution to various activities in Indian Central Himalaya

Activity	Women's contribution (%)
Agriculture	85.7
Cattle care	83.5
Fuel-wood collection	90.6
Fodder collection	94.7
Water collection	90.8
Cooking	96.9
Child care	95.0

Source: P. K. Samal, unpublished report, 2002.

Table 2. Particulars of studied villages

Total villages sampled	19
Altitudinal variation of location of villages	800–2000 m
Proximity variation of villages from nearest road	0.0–5.0 km
Location of villages from nearby forest cover	0.5–8.0 km
Nature of composition of villages	Multi-caste
Total households covered	777
Total human population of sample villages	5567
Average number of people in a household	7
Per capita availability of cultivated land	0.07 ha
Percentage of irrigated land to total cultivated land	25.3

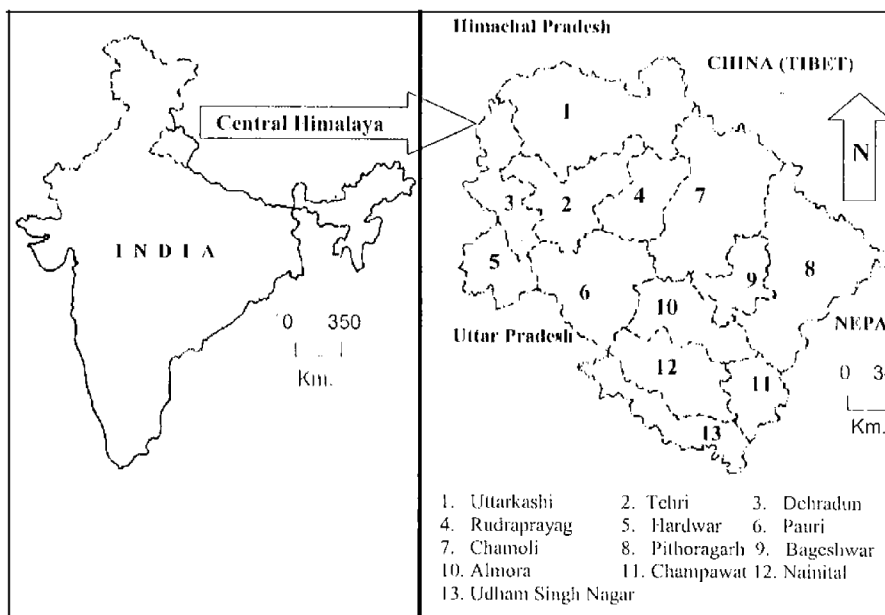


Figure 1. Location map of Indian Central Himalaya.

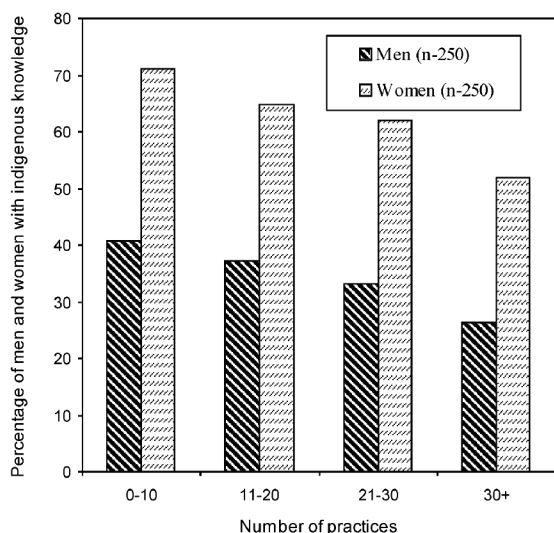


Figure 2. Status of knowledge of men and women on indigenous health-care practices.

with four to eight beds for inpatients, is envisaged to be managed by two doctors, one male and one female, besides a team of para-medical and supporting staff. In this region, however, each PHC caters to more than 31,000 people against the stipulated norm of 20,000. Despite this inadequacy, people have access to the state-sponsored and other forms of modern health care and medicines. But what was worth documenting was the fact that the indigenous knowledge system of medicine in this region has been existing as a super structure, effectively serving the people for many generations. Further, the indigenous practices are easily administrable, cheaper and effective. As found

from this study, about 53 indigenous treatments are being practised by locals in healing a number of diseases/disorders, using as many as 42 plant species of medicinal value (Table 3).

Knowledge-wise data of the respondents revealed that six formulations are practised to treat vomiting followed by five formulations for treating joint pain and four for toothache. However, it needs to be mentioned here that this documentation is not exclusive. Knowledge-wise data of the respondents also revealed that *Curcuma domestica* (haldi) is used in as many as nine formulations in healing diseases like common cold, cough, fever, sore throat, strain, cuts, bone fracture, internal injuries and joint pain. *Brassica campestris* (sarshon) was used in six formulations, followed by *Punica granatum* (darim), *Terminalia chebula* (harar), *Ocimum sanctum* (tulsi) and *Zingiber officinale* (adrak), which are used in five formulations each.

From the documentation, it was apparent that women possess more knowledge of the indigenous practices, as more than 52% of them have knowledge on 30 practices against 26.4% for men (Figure 2). Since the practices are largely dependent on the locally available bioresources¹⁸, women have also aptly used the indigenous knowledge in the strategic management of bio-genetic resources in accordance with environmental conditions and diverse nutritional and social needs. Apart from possessing indigenous knowledge on medicinal health-care practices, they also possess indigenous knowledge in order to face the vagaries of changing weather, keep their homes free from germs, and store and preserve food grains, vegetables and food items (P. K. Samal, unpublished report, 2002). Their knowledge of rainfed agriculture with associated practices like mixed cropping, maintenance of soil fertility, etc. is

Table 3. Plants of medicinal value and their parts used in diseases/disorders

Botanical name/local name	Disease/disorder	Part of the plant used
<i>Allium cepa</i> (Pyaj)	Vomiting, toothache	Bulb
<i>Allium sativum</i> (Lahsun)	Joint pain, ear ache, muscle pain	Bulb
<i>Angelica glauca</i> (Gandrani)	Vomiting	Root
<i>Asparagus curillus</i> (Keru)	Urinary infection	Root
<i>Azadirachta indica</i> (Neem)	Skin infection	Leaf
<i>Berberis asiatica</i> (Kilmaru)	Eye infection	Stem
<i>Brassica campestris</i> (Sarshon)	Joint pain, sprain, dog bite, tooth ache, skin burn, jaundice	Oil of seed
<i>Callicarpa macrophylla</i> (Dayya)	Mouth ulcer	Fruit
<i>Capsicum annuum</i> (Lal Mirch)	Dog bite	Oil
<i>Carum carvii</i> (Kala Jeera)	Vomiting	Seed
<i>Carum copticum</i> (Ajvien)	Common cold, cough, sore throat and fever, abdominal pain	Seed
<i>Citrus histrus</i> (Jamir)	Vomiting	Root or stem
<i>Citrus limon</i> (Neebu)	Vomiting	Fruit
<i>Coriandrum sativum</i> (Dhaniya)	Vomiting	Seed
<i>Curcuma domestica</i> (Haldi)	Common cold, cough, fever and sore throat, strain, cuts, bone fracture, internal injury, joint pain	Rhizome
<i>Cucumis sativus</i> (Kakri)	Abdominal pain	Seed
	Urinary infection	Seed
<i>Cynodon dactylon</i> (Doob grass)	Jaundice	Leaf
<i>Dolichos biflorus</i> (Gahat)	Kidney stone	Pulse (seed)
<i>Elettaria cardamomum</i> (Ilaichi)	Fever	Root
<i>Eleusine coracana</i> (Madua)	Minor eye injury	Flour of grain
<i>Emblica officinalis</i> (Amla)	Vomiting	Fruit
<i>Euphorbia hispida</i> (Syun)	Ear ache	Stem
<i>Ficus auriculata</i> Lour (Timul)	Indigestion	Fruit
<i>Glycyrrhiza glabra</i> (Mulethi)	Sore throat, dry cough	Root
<i>Grewia optiva</i> (Bheemal)	Skin burns	Leaf
<i>Lannea coromandelica</i> (Jhingan)	Cuts	Root
<i>Mentha piperata</i> (Pudina)	Vomiting	Leaf
<i>Ocimum sanctum</i> (Tulsi)	Sore throat, cough, itching	Leaf
<i>Oryza sativa</i> (Dhan)	Dysentery, jaundice	Grain
<i>Phaseolus moonga</i> (Urad)	Fever	Pulse (seed)
<i>Pinus roxburghii</i> (Chir)	Joint pain	Oil of pine wood
<i>Piper nigrum</i> (Kali mirch)	Indigestion, abdominal pain, urinary infection	Seed
<i>Punica granatum</i> (Darim)	Common cold, cough, sore throat and fever, mouth ulcer, vomiting	Outer layer of dry fruit
<i>Raphanus sativus</i> (Mulli)	Jaundice	Leaf
<i>Ricinus communis</i> (Rendy)	Slip disc	Leaf
<i>Solanum tuberosum</i> (Alu)	Burns	Tuber
<i>Syzygium aromaticum</i> (Loung)	Toothache	Bud, oil
<i>Terminalia chebula</i> (Harar)	Common cold, cough, sore throat and fever, tooth ache	Pulse (seed)
<i>Trigonella foenum-graecum</i> (Methi)	Diabetes	Seed
<i>Triticum aestivum</i> (Gehun)	Burns	Flour of grain
<i>Urtica dioica</i> (Sisun or Bichhu)	Joint and muscular pain	Leaf
<i>Zingiber officinale</i> (Adrak)	Common cold, cough, sore throat and fever	Rhizome

ecologically practicable and economically viable. Women know which plant species to use for what purpose, how much to harvest from a specific plant species and when. More significantly, while collecting fuel wood, fodder, edible or medicinal materials, they ensure that something is left for the future needs as also for other women from the neighbouring village, who have to make a living as well. In addition to this knowledge of how to process and nurture the natural resources, they understand the signs of nature and prepare themselves accordingly. Women are capable of predicting the climate based on their inherited knowledge. For example, if a red cloud appear in the evening, it means the weather will be clear; when wild

animals suddenly run in pastureland, it may rain; if rainfall starts either at the beginning or at the end of the month rainfall will continue for a longer period; if rainfall starts on Tuesday, there will be continued rainfall for a longer period; when birds such as 'gyar' and 'simtola' are found near a water source it may rain, etc.

Women, by virtue of being repositories of indigenous knowledge, innovations and practices (I-KIP) in sustainable resource management, need to be empowered to exercise more control over resource management and generate income in equitable ways, in conformity with the existing social and cultural norms of the society, through interventions that aim at reversing the eco-deterioration and com-

bat poverty. Therefore, interventions with conservation in focus must keep three things in forefront as follows:

1. They need to be careful in not isolating indigenous women from management practices and need to strengthen their I-KIP by value addition, so as to enable and empower them to assert larger control over resources and their management. The value addition of the I-KIP needs to be given due gender considerations without prejudicing women's right to own and benefit from their own knowledge, innovation and practices.
2. The I-KIP should be integrated with formal research system. This will help in developing appropriate technologies, as indigenous knowledge system has the potential for developing ecologically sound, environment-friendly, economically feasible and location-specific technologies¹⁹.
3. It is necessary to internalize various externalities that currently pose serious threats to the existence I-KIP.

The above concerns could be addressed when proposed interventions accord due respect to Article 10(C) of the Convention on Biological Diversity²⁰: 'protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements'. Further, a culturally sensitive and pluralist model of education will ensure survival of cultural diversity in addition to promoting women's awareness to their own rights, rights in particular to possess and benefit from the value addition of their knowledge, innovation and practices.

In the mountain ecosystem of the ICH, apart from being the backbone of the economy of the region, women are the real custodians of I-KIP. It appears that mountain specificities coupled with seasonal male migration under economic compulsions from this region to lower plains, have necessitated women to possess and preserve this knowledge base. Addressing the issues of sustainable resource use and conservation in the ICH demands a complete understanding of the indigenous knowledge system and gender participation in its management, as it facilitates the process of resource conservation. Therefore, faithful documentation of I-KIP, their possible value addition and integration with formal research system will help in confidence-building of the women, promote economy and help in the process of conservation. The documentation may also help in understanding the autonomous nature of the I-KIP and the opportunities they offer to serve as repository of knowledge base for future use, their contribution to the economy of the native societies and gender empowerment and their potential to conserve resources.

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ACKNOWLEDGEMENTS. The paper has emanated from findings of a research project funded by ICSSR, New Delhi. Financial support from ICSSR is acknowledged. We thank the Director, GBPIHED for support and facilities and Dr S. S. Samant for taxonomic identification.

Received 7 March 2005; revised accepted 11 May 2005