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# Availability and use status of plant genetic diversities from forests for food, nutrition and livelihood security

## A case from Chepang tribal communities of Nepal

Bed Prasad Khatiwada
*ActionAid International, Kathmandu, Nepal*
Bhim Chaulgain
*SECARD Nepal, Kathmandu, Nepal, and*
Surendra Osti
*University of Florida, Quincy, Florida, USA*

**Abstract**

**Purpose** – The purpose of this paper is to explore the availability and use status of plant species and their genetic diversities from local forests and uncultivated lands in the context of three different Chepang ethnic communities of Nepal. In the current context of increased threats upon the natural resources to meet increased food demand, unsustainable harvest is also practised, leading to unavailability of the diversities, thus conservation and sustainable harvest were compared along with contribution of those neglected and underutilized species for food, nutrition and livelihood security of the local dwellers.

**Design/methodology/approach** – This research was done by using multi-stage random sampling of 15 households from each village development committee (VDC), namely Shaktikhor, Kaule and Siddhi of Chitwan district of Nepal. The farmers' participation in this study was ensured through participatory research methods, including group discussions (GD) and other Participatory Rural Appraisal (PRA) tools. In addition, field observations, household interviews and consultation with experts were used in this study.

**Findings** – The Chepang community was found to possess immense knowledge on forest products and crop landraces and utilize the various plants for food and medicine. The underutilized species were used by the local people in different forms (food, vegetables, medicine, and for cultural and economical reasons). The uses of 46 underutilized plant species were documented, including 25 species with multiple functions as food, vegetables, and medicines. The overall contribution was about 2.7 months a year, with a significant difference between Siddhi (3.8months), Shaktikhor (2.4 months) and Kaule (1.9 months).

**Research limitations/implications** – This research was an exploratory action research covering only 45 households from three VDCs and is not an adequate sample size considering population size. Due to differences in the altitude, farm and family size, level of education, the number of species availability and uses may differ and this research needs to be replicated covering different seasons, years and more respondents.

**Originality/value** – This piece of research is original and conducted by three researchers working with different institutions. This strongly showed a gradual loss of the plant genetic diversities due to inability of the state, through its policy and programs, to recognize the contribution of those species in food, nutrition and livelihood security of vulnerable populations. The state should emphasize on research, education and technology development for those undermined crops, despite their huge contribution to the livelihood system.

**Keywords** Nepal, Plants, Forests, Nutrition, Ethnic minorities, Food, Livelihoods, Food security, Underutilized species, Chepang community

**Paper type** Research paper

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## Introduction and background

Nepal is a least developed country and ranks 142 out of 177 countries on the Human Development Index (United Nations Development Programme (UNDP), 2009). Nepal's poverty is the result of many factors among which, low agricultural productivity is one that has great impact being two-third of population of Nepal is dependent upon agriculture for their livelihood security. Food security is of great concern and is an over burning issue in context of recent increase in world food prices and impacts of climate change on smallholders agriculture. Nepal is rich in genetic biodiversity due to its extreme variation in altitude, ecology, farming system and varied sociocultural settings. Nepal comprised only 0.09 percent of global land areas; the country possesses a large diversity of flora and fauna at the genetic, species and ecosystem level (Nepal Biodiversity Strategy (NBS), 2002). Plant species used in food and agriculture can play a crucial role in the national economy of agro-based country Nepal. This fact lures the attention of the research community to the conservation and sustainable use of Nepal's biological diversity. During the past three decades, however, government or non-government sectors focus in raising livelihood status and food security are focussed on exotic technologies and inputs, which are high external input based. These development efforts centered not in analyzing local opportunities of livelihood based on local crop species rather orienting the farmers as if high-input agriculture system is inevitable for uplifting their livelihoods. Due to extensive range of climatic variability, varying from tropical to alpine temperatures, thousands of indigenous varieties of cereals, fruits and vegetables are found growing wild in Nepal. Some of these were identified and selected by local people for growing in kitchen garden or even as a main crop. Many are still growing in the wild such as Fern (*Diplazium stoliczkae*), wild edible yam (*Dioscoreas* spp.), nettle vine (*Urtica dioica*) and so on. The local people collect them for home consumption only if other alternatives sources of vegetable are not available and rarely sell in the market.

Chepangs are the socially and economically marginalized communities, living on a marginal resource base, and in isolated condition. Chepangs are in Nepal living mostly in the Mahabharat mountain ranges of Makwanpur, Chitwan, Gorkha, Tanahu and Dhading districts characterized by high mortality rate, low literacy percentage and poor entrepreneurship skill. Their total population is about 40,000 (SEACOW and SNV, 1996). Very few of these hunting tribal people started deriving subsistence from agriculture. Otherwise hunting, wood collection, etc. have been their foremost living subsistence. Though they are economically backward, the rich biological diversity of area has enriched them and only the way of food security. But these rich biological diversities are still underexplored and processed. Chepang community possesses an immense knowledge on forest products and crop landraces and utilizes the various plants for food, medicine to cope with environments.

## Statement of the problem

Food security issues in Nepal are bound up with the fact of extreme topographical variation and poor connectivity despite wide ecological, agricultural and economic diversity. Rural dwellers of 16 hill districts of Nepal are facing recurring food insecurity despite ample opportunities to meet food security in their context. Efforts are centered not to identify local solution to combat food insecurity problem rather to orient farmers in providing high external input agriculture options for increasing productivity, where latter is not feasible as rate of adoption of technology and investing power of farmers is quite low. Chepang communities are living in extreme food

insecurity where there collection and/or production is sufficient only to less than four months a year and in rest of the months, they are either compelled to reduce the meal specially by women or forced to hard labor. The increases in the population of Chepang, made underutilized species in the vulnerable existence. The living conditions of Chepangs are aggravated by food deficit, poor health, malnutrition, wide spread ignorance and illiteracy. They have been living in or near by forest since ages and exploit plant resources to fulfill their basic needs. They possess an immense knowledge on forest products and utilization of various underutilized plant species for food, medicine and to cope with environments.

## Justification of the study

Mountains and hills of Nepal are facing chronic food insecurity as a trend rather than shocks since last decade. Approximately 27 percent of rural households are food insecure as defined by their very poor or poor food consumption patterns. A total of 16 percent of rural households have very poor food consumption patterns. Development intervention related to agriculture, in most cases focussed on introduction of modern technologies that are high input based, thus are not sustainable and adoptable by rural poor. Besides, heavy emphasis was laid since four decades in distributing the foods which are lifted by air with government subsidies at 10 kg/family/month. The supported rice is not only sufficient enough for two days for a hungry family but also changes attitudes of farmers to search for local alternatives. Numerous underutilized and underexplored species are there in midhills of Chitwan district that can be explored for income generation, family nutrition availability and long-term sustainability. All development initiatives centered in providing rice in insufficient amount and which ultimately make farmers as if rice is inevitable for life. That, as side effects of development, introduces a mentality of neglecting local alternatives of rice like potato and Taro, Colocasia, etc. that are grown since long with special adaptation to that ecosystem. As traditional crops that are primarily undervalued and underutilized have come into existence down the ages through vigorous natural selection process, they are adaptable to the native agro-ecological conditions and have natural resistance to many disease, pests and adverse climatic conditions. Such food crops are also low-input crops and can produce desirable yields by adjusting the appropriate low-input technology, specifically with reference to irrigation, fertilizers and plant protection chemicals, which are the main constraints in the hilly mountain areas. Underutilized food species can therefore play an important role in remote areas where improved inputs cannot be accessed due to lack of road networks, low purchasing power and unsuitable climate and sloppy hills with low soil productivity. In context of poor road connection, priorities of research and development should be shifted for exploring the local opportunities and identify constraints for exploiting the undervalued species through social and economic analysis. Social analysis is required to identify social barrier that hinders the exploration of such species while economic analysis is required to assess the public vs private value, observed vs potential value and temporal and spatial dimension of undervalued species.

## Nature, scope and objectives of the research

### *Nature and scope*

The research is based on the survey of the rural Chepang communities living in the midhills of Chitwan district who are presently facing the problem of recurrent food insecurity. This will help to know the current scope and status of livelihood of Chepang

communities of midhills of Chitwan. This research project has very wide scope because most of the hills and mountains are facing food deficit problems and is relevant to devise a viable local resource-based food security options for rural poor of Nepal.

*Broad objectives*

To explore the underutilized species that may have significant contribution to food security among Chepang community of Chitwan.

*Specific objectives*

The specific objectives are:

- to document underutilized species (vegetables, cereals, fruits, non-timber forest products) prevalent in the region;
- to know the role of underutilized species in household food security of the Chepang community;
- to assess the social barriers to exploitation of the underutilized species; and
- to analyze the relationship between use of uncultivated foods and food security.

## Literature review

Nepal is a geographically diversified nation with varied climate, topography and ecology. There is an increasing interest in neglected and underutilized crop species both for export and for the domestic market. Such interest stems from a variety of factors including their contribution of agriculture diversification and better use of land, their economic potential and the opportunities they provide for dietary diversification. Most importantly, local population for centuries frequently views underutilized crop species as new species although they have been in use. Traditional food crops offer many benefits to farmers practicing the various farming system. They provide food for home consumption, make productive use of marginal land and also play crucial role in food security of the rural households residing in countryside. The increased production and consumption of some selected underexploited food plants in Nepal can substitute in part for cereal food requirements and thus assist in solving the food deficit problem. These species persist because they are still useful to local people, occupying special niches in the agro-ecology and semi-subsistence production system. Some demonstrate an agronomic advantage in terms of adaptability to low-input agriculture and marginal lands (Padulosi *et al.*, 2002), environmental services or restoration of degraded lands. Recent publications have underscored their importance in the livelihoods of the poor though ethnobotanists and anthropologists have long recognized their role in rural life. Some species are gathered as a source of food or cash, especially during lean periods in the agricultural cycle. Others supply diversity, essential nutrients, vitamins or mineral in diets that would otherwise consist primarily of carbohydrates (Johns, 2004; Johns and Sthapit, 2004). Often, they reflect cultural values too (Johns and Eyzaguirre, 2002). Traditional knowledge is typically associated with the use of these species, while scientific knowledge is emerging, but limited. Since the beginning of the twentieth century, people have relied increasingly on a few selected plants for their food supply, with about half of the world's calorie intake coming from just three crops: rice, wheat and maize (Prescott-Allen and Prescott-Allen, 1990; Gruere *et al.*, 2006). For many centuries, farmers in Nepal had been growing several species of food plants including many varieties of millet, barley and buckwheat. During the past three decades,

however, the public sector sponsored agricultural programs has been promoting the use of improved exotic varieties of major cereal crops, which is forcing the landraces and underutilized crops out of the picture. In marginal environments of developing agricultural economies, ethnobotanic surveys have documented that many less well-known species continue to be grown, managed and collected (International Plant Genetic Resources Institute (IPGRI), 2002; Gruere *et al.*, 2006). Research studies were focussed on identifying role of home gardens and their roles in domestication of wild or uncultivated species and linking dietary diversity to biodiversity conservation. Wild or uncultivated plants provide a "green social security" to hundreds of millions of people in the form of food, materials for clothes and shelter throughout the world (Cunningham, 2001). These plants add diversity to local food systems, reinforce culture and contribute with diversity to farming systems, and traditions and are important for household food security, health and nutrition and income generation (Machakaire, 2001; Warinwa, 1995). Between 60 and 70 percent of populations in developing countries dwell in the interface between agriculture and forest land areas collect various parts of uncultivated plants like roots, leaves, fruits and nuts (FAO, 1999; Hladik and Dounias, 1993).

## Methodology

This research was done by using multi-stage random sampling of 15 households from each village development committee (VDC) namely Shaktikhor, Kaule and Siddhi of Chitwan district of Nepal. The farmer's participation in this study was ensured through participatory research methods, including group discussions (GD) and other participatory rural appraisal (PRA) tools. In addition, methods like field observations, household interviews and consultation with experts were used in this study.

### *Study population, sample size and sampling techniques*

The selection of study areas was based on settlement or political division, i.e. VDCs, which is the smallest local authority for planning of rural development activities. The study was conducted in multi-stage random sampling of 15 households each from Shaktikhor, Kaule and Siddhi VDC of Chitwan district. District-based agencies, institutions and individuals were consulted for the identification of potential sites for the study. District Forest Offices and District Agriculture Development Offices (particularly from Chitwan), Nepal Chepang Sangh were consulted for identification of potential sites for the study. A visit was made to both of sites in early March 2009. The purpose of the visit was to brief the community people about the proposed study. Discussions were held with the community members and farmers suggested villages in the VDC suitable for data collection. The same meeting identified local motivators from the community people that later were involved in the study. They were mainly responsible for arrangement of meetings and identification of individual households during the survey.

### *Survey design and methods of data collections*

Surveys of individual households, key informant interviews of community members as well as personnel from relevant institutions/organizations, GD, field observations, were all employed as methods of data collection.

*KIS and GD.* Household survey questionnaires were not sufficient for collecting the required information, so key informant interviews and GD were carried out in those sites. Key informants were selected from the farmer's level (two from each site).

Key informants were interviewed about their perceptions, experience and their opinion about the role of underutilized foods in conservation and sustainable livelihood for the benefit of the local people. During repeated visits to each site further GD were held with old-aged key informants. A checklist was used for KIS and general discussion points for GD.

*The household survey*. The household survey (a questionnaire used during an interview) was designed to get data on existing farming practices, livelihood dependency, use of underutilized plants and their management, role of gender in decision making as well as personal demographic features. The questionnaire consisted of demographic and socio-economic information from the household, including variables such as sex, age, education, household size, major occupation, food sufficiency and household income. Furthermore it was devoted to information regarding the shifting cultivation farming practices, underutilized plant species. Finally, information regarding the conservation and management of underutilized plant species were dealt with.

*Field observation*. Areas where the respondents collected the underutilized species were visited with the local motivators, and some key informants, to see the species and their habitat. During the visit the team also noted the availability of uncultivated species found in that particular season. During the visit, harvesting methods, parts used, harvest quantity as well as treatment and storage of different species for future use was discussed.

*Data analysis*. Both qualitative and quantitative data were collected from primary and secondary sources. The primary data were collected in the study areas, while secondary data were derived from available statistics in District Development Committees, Nepal Census Indicators 2001 and Trends, Central Bureau of Statistics. Also other relevant governmental and non-governmental institutions were consulted and visited for collection of information for this study. The qualitative data were obtained from GD, PRA and KIS. The quantitative data mainly obtained from household surveys were analyzed using SPSS computer software package.

## Result and discussion

### *Socio-economic status*

Farmers in the selected areas live under different socio-economic conditions in terms of education, income sources, food sufficiency levels, family size, age and occupation. Overall the number of interviewed respondent, only women (5.4 percent) and men (94.6 percent) were household head. There was a great significant difference in terms of sex as household head among three different VDC. The mean age of all respondents was 51 years, and 42, 53 and 54 years in Siddhi, Shaktikhor and Kaule, respectively. A total of 68 percent of the respondents were between 15 and 59 years, 32 percent were more than 59 years and none of the respondents were of age $<15$ years because older members of the household were selected for the household survey, due to expected knowledge about underutilized species (Table I).

The average household size (number of people) in Siddhi (5.933), Shaktikhor (5.80) and Kaule (6.06), which shows Kaule has higher population density. In general the level of literacy in the study sites was low. Respondents with graduation in the study site are only one which shows the region is beyond of higher education. More than 75 percent of the total respondents were illiterate. Comparatively, illiterate respondents were more common in Kaule (28.9 percent) than in Siddhi and Shaktikhor (22.2 percent).

| Categories | Siddhi | Shaktikhor | Kaule |
|---|---|---|---|
| *Sex* | | | |
| Male | 13(28.9) | 11(24.4) | 10(22.2) |
| Female | 2(4.4) | 4(8.9) | 5(11.1) |
| *Age group (years)* | | | |
| 15-59 | 13(28.9) | 10(22.2) | 12(26.7) |
| >59 | 2(4.4) | 5(11.1) | 3(6.7) |
| *Education group* | | | |
| Non-educated | 10(22.2) | 10(22.2) | 13(28.9) |
| Primary | 2(4.4) | 3(6.7) | 2(4.4) |
| Lower secondary | 3(6.7) | 1(2.2) | 0 |
| Graduate | 0 | 1(2.2) | 0 |
| Average household size | 5.933 | 5.80 | 6.06 |

**Note:** Proportions in different categories are presented within brackets

**Table I.**
Socio-economic features of the respondents (number of respondents) in the three study areas (Siddhi, Shaktikhor and Kaule)

*Livelihood features*

*Occupation and income*. Agriculture was the main source of livelihood for majority of the households in the study areas. Overall, 95 percent of the total respondents were found engaged in agriculture as their major occupation. However, agriculture was not sufficient to sustain their livelihood throughout the year, and about 90 percent of the respondents in Kaule, 87 percent in Siddhi and Shaktikhor ranked wage labor as the second most important occupation. Selling of homemade liquor, handicrafts, vegetables, etc. (local business) was a source for cash income for 60 percent of the households although its contribution to overall income was very low.

*Food sufficiency levels*. In all the study sites, food surplus was negligible and most of the people had to purchase food. Only 20 percent respondents' households in Shaktikhor and 13.33 percent in Kaule were enjoying food sufficiency from their own production. However, no respondent's household in Siddhi were found enjoying food sufficiency for more than ten months a year.

For 66.6 percent of the households in Siddhi, 46.66 percent in Shaktikhor and Kaule their own production was sufficient for less than six months a year (Figure 1).

During the food deficit months, these households adopted different strategies to meet their food demands (Table II). Wage labor, share cropping, selling of livestock, collection of wild foods, exchange and selling of products were major strategies adopted by the people in order to survive food scarcity periods. A majority of the households in Siddhi (40.6 percent), Shaktikhor (37.5 percent) and Kaule (21.9 percent) depended heavily on wage labor to earn living. Over 38.7 percent of the household in Siddhi and Shaktikhor were engaged in collecting wild and uncultivated foods to supplement their food during food deficit months, which was a significantly higher proportion than the 22.6 percent in Kaule.

*Abundance of underutilized species and their status*. A total of 46 underutilized plant species have been documented. The greatest richness of the underutilized species was found from the forest environments. These resources have been used by Chepang ethnic groups for various purposes provided their multi-functionality in the study sites (Table III).

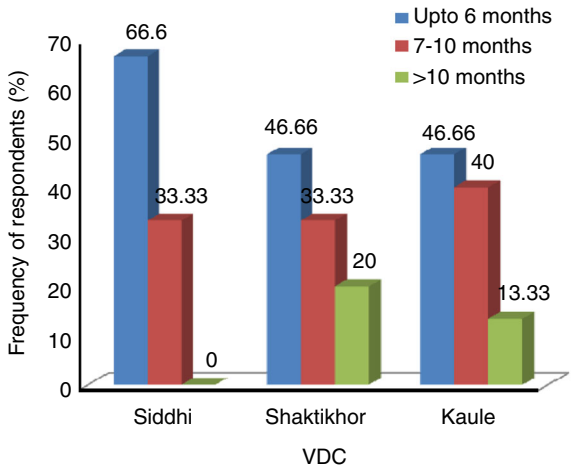


**Figure 1.**
Food sufficiency levels (number of months) of the households in Siddhi, Shaktikhor and Kaule

**Table II.**
Frequency of different strategies (and proportion of respondents within brackets) adopted during food deficit months in Siddhi, Shaktikhor and Kaule

| VDC | Wage labor | Collection in forests | Share cropping | Exchange | Buying |
|---|---|---|---|---|---|
| Siddhi | 13(40.6) | 12(38.7) | 0 | 11(30.6) | 11(30.6) |
| Shaktikhor | 12(37.5) | 12(38.7) | 0 | 11(30.6) | 11(30.6) |
| Kaule | 7(21.9) | 7(22.6) | 0 | 14(38.9) | 14(38.9) |

**Note:** Strategies adopted by them

**Table III.**
List of underutilized species that has been documented

| SN | Nepali name | Chepang name | English name | Scientific name | Growth habit |
|---|---|---|---|---|---|
| 1 | Ainselu | Lyangsai | Raspberry | *Rubus ellipticus Sm. Rosaceae* | P |
| 2 | Amaro | Pakmaru | Golden apple | *Spondias cytherea Sonn. Anacardiaceae* | P |
| 3 | Amrisho | Phek | Broom grass | *Thysanolaena maxima (Roxb.) Kuntze Poaceae* | P |
| 4 | Ban kera | Ban maisai | Banana | *Musa balbisiana Colla. Musaceae* | P |
| 5 | Ban tarul | Brangoi | Wild yam | *Dioscorea bulbifera L. Dioscoreaceae* | P |
| 6 | Bankakri | Banaisai | – | *Solena heterophylla Lour. Cucurbitaceae* | A |
| 7 | Bans | Chyas | Bamboo | *Bambusa nepalensis Stapleton Poaceae* | P |
| 8 | Bel | Bel | Wood apple | *Aegle marmelos (L.) Correâ Rutaceae* | A |
| 9 | Bethe sag | Bethu | Lamb's quarter | *Chenopodium album L. Chenopodiaceae* | A |
| 10 | Bhakyamlo | Rusai | Nepalese sumac | *Rhus javanica L. Anacardiaceae* | P |
| 11 | Bhimsen pati | Goihomro | Butterfly bush | *Buddleja asiatica Lour. Scrophulariaceae* | P |

(*continued*)

| SN | Nepali name | Chepang name | English name | Scientific name | Growth habit |
|---|---|---|---|---|---|
| 12 | Bhorla | Maklo | Camel's foot climber | *Bauhinia vahlii Wight* and *Am. Fabaceae* | A |
| 13 | Bhyakur | Pass | Cush-cush yam | *Dioscorea deltoidea Wall. ex Griseb. Dioscoreaceae* | A, P |
| 14 | Camuna | Camuna | – | *Syzygium cerasoides (Roxb.) Raizada Myrtaceae* | P |
| 15 | Chilaune | Kyangsi | Needle wood | *Schima wallichii (DC.) Korth. Theaceae* | P |
| 16 | Chiuri | Yosai | Butter tree | *Diploknema butyracea (Roxb.) H.J. Lam Sapotaceae* | P |
| 17 | Dumri | Dumri | Cluster fig | *Ficus racemosa L. Moraceae* | P |
| 18 | Githa | Lak | Air potato | *Dioscorea bulbifera L. Dioscoreaceae* | A |
| 19 | Jaluko | Fyaksa | – | *Remusatia vivipara (Roxb.) Schott Araceae* | A |
| 20 | Jamun | - | Black plum | *Eugenia formosa Wall. Myrtaceae.* | P |
| 21 | Jangali aanp | Bantaksai | Wild mango | *Mangifera indica L. Anacardiaceae* | P |
| 22 | Jaringo | - | Poker weed | *Phytolacca acinosa Roxb.Phytolaccaceae* | A, P |
| 23 | Kabro | Kabra | Elephant fig | *Ficus lacor Buch.-Ham. Moraceae* | P |
| 24 | Kaphal | Kaphal | Box myrtle | *Myrica esculenta Buch.-Ham. ex D. Don Myrtcaceae* | A |
| 25 | Katus | Ekai | Chestnut | *Castanopsis indica (Roxb. ex Lindl.) A. DC. Fagaceae* | P |
| 26 | Khaniyo (Rai) | Koksai | – | *Ficus semicordata Buch.-Ham.ex Sm. Moraceae* | P |
| 27 | Khole sag | Simsag | Brooklime | *Veronica beccabunga L. Scrophulariaceae* | A |
| 28 | Koiralo | Rimsi | – | *Bauhinia purpurea L. Fabaceae* | P |
| 29 | Kurilo | Jyordum | Wild asparagus | *Asparagus racemosus Willd. Asparagaceae* | A, P |
| 30 | Kutilkosa | Nakatisai | Clover vetch | *Vicia angustifolia L. ex Reichard Fabaceae* | A |
| 31 | Latte sag | Dakhinsag | Amaranth | *Amaranthus spinosus L. Amaranthaceae* | A |
| 32 | Lunde | Armulya | Pigweed | *Amaranthus viridis L. Amaranthaceae* | A |
| 33 | Nigalo | Monyanro | Himalayan bamboo | *Arundinaria falcata Nees Poaceae* | P |
| 34 | Nimaro | Nemsi | Eve's | *Ficus auriculata Lour.* | P |
| 35 | Niuro | Niuro | Edible fern | *Dryopteris cochleata (D. Don) C. Chr. Dryopteridaceae* | A |
| 36 | Pakhanbed | Pakhanbed | Rock foil | *Bergenia ciliata (Haw.) Sternb. Saxifragaceae* | P |
| 37 | Pandel | Yausi | – | *Ziziphus incurva Roxb. Rhamnaceae* | P |
| 38 | Raikhanyu | Koksi | Nepal fodder fig | *Ficus semicordata Buch.-Ham. ex Sm. Moraceae* | P |
| 39 | Shiplican | Dyoyaisag | Garlic pear | *Crataeva unilocularis Buch.-Ham. Capparaceae* | P |

(*continued*)

**Table III.**

| SN | Nepali name | Chepang name | English name | Scientific name | Growth habit |
|---|---|---|---|---|---|
| 40 | Simali | Glausigoi | Orange jasmine | *Murraya paniculata (L.) Jack Rutaceae* | P |
| 41 | Sisno | Nelau | Nettle | *Urtica dioica L. Urticaceae* | P |
| 42 | Siundi | Kituki | – | *Euphorbia sp. Euphorbiaceae* | P |
| 43 | Tanki | Saga | Pink bauhinia | *Bauhinia purpurea L. Fabaceae* | P |
| 44 | Timoor | Umpur | Nepal pepper | *Zanthoxylum armatum DC. Rutaceae* | P |
| 45 | Tindu | Tindu | Tindu | *Diospyros malabarica (Desr.) Kostel. Ebenaceae* | A |
| 46 | Tyaguna | – | – | *Dioscorea pentaphylla L. Dioscoreaceae* | A |

**Table III.**

**Note:** A, annual; P, perennial

## Conclusion and recommendations

This study has revealed that underutilized plant species are used for consumption at times of food shortage, which has the potential to become valuable staple foods and important alternatives to the usual food crops cultivated by farmers. The option to improve food production through exploiting the potential of underutilized food plants might be a sustainable, cheap and local alternative for decreasing the food shortage problem. At the same time, development of use of underutilized food plants might contribute to biodiversity. There is a need of integrated research and development programs for forest dwelling communities like Chepang, Tharu, Darai, Bote, Majhi in Nepal (with food sufficiency problems), where underutilized foods provide key supplements to the main diet and are of great medicinal and cultural importance. Without the understanding of the importance of both staple crop foods and underutilized foods, agricultural planning will have no major focus and exclude the diverse and important underutilized food resources with major focus on few staple food crops. The contribution of underutilized plants needs to be taken into account in planning and investment in the development of these resources will make a major contribution to the alleviation of poverty. However, additional investigations on the use and availability of underutilized plants in different regions and countries are needed. One of the greatest difficulties for including underutilized plant species in agricultural research and development is because of lack of basic information regarding the underutilized species. So there is little appreciation by planners, policy makers and developers. Emphasis must therefore be placed on national and local actions to develop a standardized inventory of use values of these resources. The underutilized plants are important sources of food and nutritional security to the thousands of people especially in the rural areas, so there is a need of integrated research and development activities. A number of species are being gradually eroded so, conservation of these resources should be initiated by the government and research institutions with participation of local community people. In the same time, the traditional knowledge, skills regarding utilization and management of underutilized resources should be documented and protected.

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**About the authors**

Bed Prasad Khatiwada, a qualified horticulturist, has been working in the sustainable agriculture sector since 2003, in various parts of Nepal. He has conducted various action researches in agriculture and natural resource management issues and has presented papers in international and national conferences and published articles on relevant issues in different local, national and international journals, newspapers and magazines. He is currently pursuing his PhD from Central Queensland University, Australia, with focus on post-harvest horticulture research. Bed Prasad Khatiwada is the corresponding author and can be contacted at: bedkhatiwada@gmail.com

Bhim Chaulagain is a government official working under the Department of Agriculture in Nepal. He is a qualified Plant Pathologist and involved in characterization of different wheat genotypes in regard to yellow rust. He is also a Visiting Fellow at the Himalayan College of Science and Technology, Purbanchal University, Nepal.

Surendra Osti is a young researcher with strong academic background in agriculture science. He got involved in different field-based research and gained knowledge in working with poor farming communities. He has delivered his services through rural plant clinics in different parts of Nepal and also through training on technology transfer in agriculture science. Currently he is studying at Louisiana State University.