Women's Participation in Agro-biodiversity Management: A Case Study of Kaski District

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Abstract

The management of agro-biodiversity is integral to developing resilient and sustainable agricultural systems capable of addressing existing challenges. An investigation was carried out in Kaski district of Nepal during 2022 to explore the women's participation in agro-biodiversity management. Pretested semi-structured questionnaire was employed to gather primary data from 100 farm households. Further, Focus Group Discussion (FGD) and Key Informant Interview (KII) was used to gather primary data. Mean, frequency and other measures were used to present the findings. Results revealed that women play major role in collection and preservation of Non-Timber Forest products (NTFPs) in comparison to men. Involvement of women in drying, storage, marketing and value addition was also high in comparison to men. Women farmers' role in seed selection is predominant. Farmers are conserving traditional and exotic species of fodders, vegetables crops, and diversity on spices, cereals, oilseeds and legumes. From the above findings, it is suggested that the government and other development agencies should tailor policies and programs through the participation of women farmers for sustainability of conservation efforts. Moreover, involvement of stakeholders should be ensured in the implementation at the community level.

Key words: biodiversity, women, seed, community

Introduction

Agro-biodiversity constitutes a crucial subset of biological resources intricately intertwined with the agricultural production systems inherent to diverse farming cultures. It encompasses the array of crops, livestock, and the agro-ecological processes that collectively contribute to the richness of agro ecosystems. The physical manifestations of Agro-biodiversity emerge from the amalgamation of various farming practices and the dynamic interplay with distinct climates. In

essence, the intricate tapestry of agro ecosystems reflects the tangible embodiments of agro biodiversity, highlighting the interconnectedness of crops, livestock, farming traditions, and environmental factors within the agricultural landscape (Murray, 2002; Pratap & Sthapit, 1998). Modern agriculture relies heavily on a narrow range of high-yielding varieties, raising the risk of genetic erosion and threatening global food security (Begna, 2021). Crop breeders increasingly focus on a limited set of improved varieties, hindering efforts to broaden diversity. Homogeneous agriculture undermines the once reliable source of genetic diversity from farmers, especially endangering small-scale farmers who can't afford high-priced inputs (Busch, 1995). The formal research system's high-maintenance varieties, requiring costly fertilizers, often exclude millions of small farmers. Gender plays a crucial role in biodiversity's significance, shaping economic, political, social, and ecological opportunities. Recognizing women as primary land and resource managers is vital for successful biodiversity policies, given their substantial contribution to food production (Rocheleau, 1995). However, gender considerations often go unnoticed in decision-making regarding biodiversity resources. Hence, this study attempts to reveal the status of women's participation in agro biodiversity conservation at community level.

Methodology

Study area

The study was conducted in Pokhara metropolitan of Kaski district of western Nepal during 2022. It has nation's richest bio diversity in the form of wet land, greenery/parks, aquatic species, orchids, herbs, medicinal plants, wild rice varieties, orange, coffee etc. The main inhabitants of municipality are Brahmins, followed by Gurungs, Chetries, Dalits, Magars and Newars. It lies between 28º05'N to 28º 12' N latitude and 84º 02'E to 84º 08' E longitude. The maximum and minimum temperature lies between 40ºC to 5ºC and average rainfall is 3045 mm per annum. Altitude ranges from 407 to 1217 masl.

Sampling technique and sample size

Purposive and random sampling was used to select two wards (ward number 31 and 32) of Pokhara metropolitan. Total sample size was 100 (50 from each ward). Household survey was conducted using pretested semi-structured questionnaire, while Focus Group Discussion (FGD) and Key Informant Interview (KII) was carried out with selected individuals from farmers group,

government and non-governmental agencies. Secondary data was collected from published reports of governmental and non-governmental agencies and journal paper of several authors.

Data analysis and presentation

The primary data collected during the household survey using pre-tested interview schedule was entered and cleaned in MS-EXCEL. The data were analyzed through MS-EXCEL. Mean, frequency was calculated and presented appropriate table or figures.

Results and discussion

Demographic study of the study site

The age of the respondents ranged from 17 years to 72 years with the mean of 45.74± 1.47. Out of 100 respondents, 68 percent were female whereas rest 32 percent were male. Household members in the study sites were involved in both on farm and off farm activities as a means of their livelihood. Majority of the respondents have agriculture as their principal occupation in the study area. The study showed that 66 percent respondents had agriculture as their main occupation whereas rests 34 percent were found to involve in both farming and off farmbusiness.The percentage of women engaged in off farm activity was considerably high while it was very less in off farm activity. Male members engaged in off farm activities, e.g. business, job in office, migration etc. was relatively high. The process of urbanization has changed the types of family and its social values. In this study, although the sample size was smaller, nuclear family was predominant. Out of total sampled household only 26 percent were respondents who live in joint family. The education level of the respondents was divided into four categories as illiterate (who cannot read and write at all), schooling (1-10 class), higher secondary (12 class pass) and college (higher level). The proportion of male who has attained higher education (higher education, college) and schooling was comparatively higher than females and the reverse was the case in the illiterate category implying a wider gender gap. Landholding plays an important role in securing food or nutritional security and livelihood of the farm house hold. An attempt was made to categorize the sample household based on the access to crop lands. The data gathered in the course of interview revealed that most of the HH had control over1-5 ropani (44%) to 5.1 – 10 ropani (30%). In the sample size only (1%) household had 20.1-25 ropani of land. Among the

respondents, 87 percent used to farm on their own land, while 9 percent used to cultivate the land taken in share basis.

Animal husbandry

Table1 shows that women are mostly involve in forage and fodder collection (72%), animal shed management (60%) and milking (57.44%) activities whereas mostly men (more than 50%) do the marketing activities. Here comes the important issue in terms of distribution of benefits in the farm households. Because of the marketing is such activity of farming which converts the production efforts into cash, and such activities are not undertaken by women, economic empowerment of women thus becomes insufficient in contrary to the development objectives envisaged by the development plans.

Table 1. Farmer's involvement in livestock production in family in study area

Activities	**Male**	**Female**	**Both**	**Total**
Forage & Fodder collection	8	72	20	100
Animal shed management	16	60	24	100
Milking	6 (6.38)	54 (57.44)	34 (36.17)	94
Selling/marketing of milk	30 (50)	14 (23.33)	16 (26.66)	60

Source: Field survey (2022)

Note: A figure in parenthesis indicates percentage.

Non timber forest products diversity

The study sites were found rich in the plant diversity for non- timber forest products (NTFPs). Most of the NTFPs listed by the farmers were medicinal and aromatic plants and other products that have markets inside and outside the districts. Respondents of the study sites collect NTFPs for their own purpose and for commercial purpose too. They have been conserving many of these plant species by domesticating or managing the community forest jointly. The major NTFPs that had been used by the farmers of the study sites are listed below:

Table 2. Most common NTFPs in Study Sites

Nepalese name	Common name	Scientific name	Family
Amala	Amala	*Phyllanthus emblica*	Euphorbiaceae
Barro	Bastard myrobalan	*Terminalia bellirica*	Combretaceae
Bojho	Sweet flag	*Acorus calamus*	Acoraceae
Harro	Haritaki	*Terminalia chebula*	Zingiberaceae
Tulasi	Sacred basil	*Ocium sanctum*	Labiatae
Sikari lahara		*Peripoca calophylla*	Apocynaceae
Gaikhure			

Source: Field survey (2022)

Women's involvement in collection of NTFPs.

In this study it was found that children were not involved in the collection of NTFPs while women played most important role in collection, and preservation of NTFPs in comparison to men in the study area.

Women's participation in decision making process in agro biodiversity conservation

It is well known that women play an important role in the traditional seed conservation and production system in Nepal. According to Acharya and Bennett (1981), 30 percent of the decisions on what crop to plant are made by women alone. In the study sites women were found actively engaged in various on- farm activities like crop production right from land preparation to planting, intercultural operations, harvesting to value addition and marketing.

Table 3. Farmer's involvement in decision making in different cropping activities

Activities	Men (%)	Women (%)	Both (%)
Seed selection	20	30	50
Intercultural activities	0	72	28
Harvesting	0	64	36
Drying and storage	22	65	13
Value addition	16	44	40
Marketing	20	42	38

Source: Field survey (2022)

Only women were involved in seed selection in 30 percent of the HHs while 72 percent respondents told that in the intercultural activities only women were involved whereas male alone do not take part in harvesting the crops. In some household involvement of the male was also found along with women. Involvement of women in drying and storage and marketing and value addition such as, *Maseura* (product of taro and black gram), *Tandre, gava* (products of taro) was also high in comparison to male.

Women's engagement in compost/FYM application

Compost or farm yard manure (FYM) application is one of the most important activities to replenish the soil nutrient taken up by the field crops. All of the respondents of the study area use to apply FYM in their fields. In the course of field observation, it was found that the amount and type (fully decomposed or partially decomposed) of FYM applied on crops varied widely across HHs depending upon the HHs capacity to rear animals and their perception of the need to supply for particular crop with FYM.

Table 4. Gender variation in involvement of FYM use**.**

	Involvement			
Activity	**Men (%)**	**Women (%)**	**Both (%)**	**Total (%)**
Decision making about the dose of manure	8	56	36	100
Decision making about the time of application	8	60	32	100
Transportation (carrying compost from pit to field)	-	100	-	100

Source: Field survey (2022)

It was found that carrying the compost/ FYM from the pit to the crop land was completely done by women. During focus group discussion, it was reported that women it was women responsibility to carry manure from pit to field, which is hard labor task. This fact shows that women's

engagement in heavy farm activity is based on gender discrimination. Though they involved totally in transportation of FYM, but in taking the decision about rate/amount of manure (56%) and at the time of application of the FYM, (60%) there was involvement of male also.

Gender variation in chemical fertilizer use

In this study, distinct variation was observed in the use of chemical fertilizer. The involvement of women is higher in the decision-making process in use of chemical fertilizer. The involvement of male is higher than women in procurement and transportation of the chemical fertilizer. Women also actively involved in deciding the rate of fertilizer and time of application.

Table 5. Gender variation in chemical fertilizer use

Activity	**Involvement**		
	Men	**Women**	**Both**
Decision making about the fertilizer dose	16(26)	24(40)	20(33)
Decision making about application	14(23)	24(40)	22(37)
Buying / transportation	28(47)	20(33)	12(20)

Source: Field survey (2022)

Note: A figure in parenthesis indicates percentage.

Role of women in conservation and management bio diversity in study area

Study area is highly diversified. The diversity of crops, vegetables, fruits, fodders and forages have been managed by the women. Women have been taking care of overall management, harvesting, marketing of the fruits, vegetables, cereals and NTFPs. Women's participation an all most agricultural activities is more than in the study sites.

Women of the study area had conserved more than 35 endangered species of orchids, which are going to extinct. This is managed by women's group named Demonstration and Management Block of Orchids Diversity.

Farming system

Mixed farming system is common practice in the study area. There was a symbiotic relationship between crops and livestock production on the farm. Using the crop residues in animal husbandry and manure for crop production is the aged old practice for each farming house hold.

Mixed cropping system helps in the conservation and management of biodiversity rather than mono cropping. Many farmers in the study area are aware of need and value of agro bio diversity so they are adopting the mixed farming system.

Use of hybrid seed

Hybrid seeds are not common to the farming system in Nepal but it is rapidly increasing now a day in the most of the villages of Nepal. In the study area 48 percent of the respondents use hybrid seed and rest 52 percent do not use the hybrid seed. Generally, hybrids seed of vegetables, maize and rice are commonly use in the study area.

The common belief on the issue is that hybrid seed will replace the old ones and reduce the diversity, and increases the farmer's dependency towards the outer sources for their seed. At present hybrid seed and traditional varieties are seen in the farmer's fields. Women in the study area are actively participating in conservation and value addition of the traditional varieties in cooperation with LIBIRD. But awareness on the importance of local landraces and their conservation are mandatory for maintenance of diversity in study area.

Fruits diversity

Study site was rich in fruit diversity. Generally sub-tropical types of fruits such as banana, orange, lemon, Guava, litchi, mango, lime etc are found here. Begnas site is famous for orange also grown in commercial scale. Others fruits were generally grown in the homestead and used only for family consumption. Women have been taking care of overall management, harvesting and marketing of the fruits in the study area.

Diversity on fodder and forages

The study site was rich in fodder and forage diversity. Forages are small grasses mostly seasonal in growth habit and are important source of animal diet. Local forages species generally contribute most of the animal feed at the time of monsoon. Mostly there was active participation of women in collection of forages and feeding of animals. Farmers had collected fodder either from community forest or from their own land for feeding the animals. Generally, farmers used fodder

in the lean season. Now a day's farmers cultivated forages like Napier, stylo, Berseem, oat, Ipil-Ipil, Bakino etc. in their field.

Diversity in vegetables crops

Diversity on vegetables crops reported during the study period is presented in table. Potato, cabbage, cauliflower, brinjal, carrot, gourds, yam, taro etc were grown in small-scale in-home garden largely for home consumption. Both exotic and traditional species were cultivated in home garden. Women have been taking care of overall management, harvesting and marketing of the vegetable in the study area. The involvement of women in the storage of vegetable, marketing and value addition is higher than male.

Diversity on cereals

Rice is the most important crop in the agriculture system of the study area. Farmers cultivated cereals crop either in their own land or share- in land for food security at household level. Rice was the major food crops followed by maize, wheat, millet grown across the visited area. Women have been taking care of overall management, harvesting and marketing of the cereals in the study area. All most all women participate in processing and value addition of the cereals.

Legumes

Grain legumes are an integral part of Nepalese farming system and therefore occupy a vital position in the agriculture and economy of the study sites. Animal proteins are expensive and cannot be afforded by majority of the population in their daily diets; hence grain legumes contributed towards overcoming this deficiency. Beans, black gram, soybean, cowpea etc are Commonly grown legumes in study area. The involvement of women in the storage of legumes crops, marketing and value addition is higher than male. Women have been taking care of overall management, harvesting and marketing of the legumes in the study area

Oil seeds

Farmers in the study area mostly use mustard and tori for the extraction of oil either for their home use or for marketing. Generally, almost all women participate in processing and marketing of oil seeds. The commonly found oil seed in the study area are listed below:

Seed storage practices

Farmers, from the time immemorial, have been preserving and selecting their crops and crop varieties, saving and maintaining the seeds for next season as experimenting with new seed exchanged with neighbors and relatives. These activities constitute in situ conservation. Farmers

of the study sites have been storing the local seed of cereals (rice, wheat, maize, and millet), legumes (black gram, lentil, soybean etc.) oil seed (mustard).

Women farmers' engagement in seed selection, drying and storage was predominant. They select good seed for the next season, and mix them with different locally available preserving materials (ash, hers, oils) frequently drying them in the sun first, and preserve them using different methods of storage. The participants of FGD have reported about this univocally.

The method and storage structures for various crops are given below:

Table 6. Methods and storage of seeds

S.N.	Crops		Seed storage method (after harvesting)	Seed storage structure	Place
1	Cereals	Rice	• Threshing manually • Winnowing • Removal of unwanted materials • Sun drying for 2-3 days.	Bhakari with covering it air tight	Warm and dry place inside room.
		Wheat	• Threshing manually • Winnowing • Removal of unwanted materials • Sun drying for 2-3 days.	Ghyampo/ earthen pots	Cool and dry places inside the house.

		Millet	• Threshing manually • Winnowing • Removal of unwanted materials • Sun drying for 2-3 days.	Kothi	Cool and dry places.
		Maize	• Sun drying for 2-3 days • Making jholi • Sun drying for 1-2 days	Suli	Outside the house
2	Legumes	Black gram, lentil, soyabean	• Threshing manually • Winnowing • Removal of unwanted materials • Sun drying for 2-3 days	Ghyampo/ghainto, Jute sack. Tin box (by mixing with ash)	Warm and dry places
		Cow pea	• Threshing manually • Sun drying for 2-3 days • Making small bundles	Bamboo basket, small earthen pot, plastic bag	
3	Oil seeds	Mustard	Similar to rice	Kothi	Warm and dry place

					inside house
4	Vegetables	Taro/pidalu	• Removal of unwanted materials • Sun drying for 2-3 days	Khor	In raised pillar with roof outside house
		Sponge gourd/ghiraulo	Whole fruits kept hanging by its stalk	None	Veranda
		Chilly	Sun drying for 3-5 days	Small earthern pot Plastic bag	In warm place inside house

Source: Field survey (2022)

Knowledge and seed storage techniques

Among the 100 respondents all of the farmers practice storing well dried seeds in cool and dry places. All the farmers responded that storing in air tight bhakari/seed bin is suitable for seed storage.

Institutional settings and access to technology, information and services

Participation in groups

Many types of groups were found in the study sites. Most of the respondents were affiliated with farmers group, community forest users' group, women groups, cooperative etc. out of total sampled about 84 percent respondents are the member of at least one group or community-based organization.

Participation in trainings

Training is one of the modes of disseminating the knowledge and skills to the community in order to enhance their capacities. The results about 52percent of the respondents reported to have received agricultural training. The proportion of respondents receiving agricultural training was higher in female in comparison to the male. This may be due to various women empowerment program implemented in the past. Some of the trainings that farmers had participated are such as

coffee cultivation training, off season vegetable production, bee keeping, animal health, goat farming, local resource management, bio diversity conservation etc.

Some of the community-based organizations that are found in the study sites are

1. Parma culture group.
2. Partigya cooperative
3. Fish cooperative
4. Chaur mothers' group
5. Unatsil mothers' group
6. Environmental protection group etc.

Participation in exposure visit

Some of the farmers from study sites reported to have visited different places of Nepal. Only 42 percent of the respondents were found to have exposure to other places and organization. The member of the house hold participated in such tours or a visit was mostly female.

Knowledge about bio diversity

It was found that farming communities in the study sites received information about the agro bio diversity conservation and utilization through different means. About 75 percent respondents of the study site are aware of bio diversity conservation and their utilization. Most of the respondents have get information about agro bio diversity conservation from non-government organization i.e., LI-BIRD which is working in the field of community bio diversity management from a long period in this area. And some of the respondents have get information from neighbors, radio, TV, etc.

Sources of cash income

The house hold members in the study area were engaged in different on- farm and off – farm activities to support their diverse household needs. Sale of agricultural and livestock products, wage laboring, remittance (working out side of the country), service in the country and pension were the major source of cash income of the households in the study area. Remittance was the major source of income. Mostly young generation migrates for employment.

Table no: **7** Distribution of respondents by gender on various training

Respondents Types	**General Agriculture**	**Commercial fish Farming**	**Brood fish hatching**	**Off season vegetable**	**Commercial Training**	
					Poultry	Goat farming
Male	12 (13)	47 (52)	0 (0)	3 (3)	3 (3)	0 (0)
Female	20 (22)	27 (30)	0 (0)	12 (13)	3 (3)	5 (6)
Both	50 (56)	8 (9)	4 (4)	0 (0)	0 (0)	0 (0)
None	8 (9)	8 (9)	86 (96)	75 (83)	83 (92)	85 (94)

Source: Field survey (2022)

Note: figures in parenthesis indicates percentage.

Of the total respondents, number of males and females from the same house taking training on agriculture is found to be 56% followed by female only by 22% and male only 13%. While in commercial fish farming, male only participated by 52% followed by female only by 30%. In hatchery management of brood fish only 4% farmers (both males and females) participated in the training. In off-season vegetable farming mostly, women involved by 13% followed by male (3%) and 83% of the total farmers did not took any training. In commercial poultry and goat farming very less farmers i.e., 3% male and 3% female have taken training in poultry. Similarly, in goat 6% female have taken training while majority of farmers both in poultry and goat i.e., 92% and 94% respectively have not been found taking any training on these enterprises.

Conclusion

The strong linkage between gender, agriculture and biodiversity conservation plays important role in biodiversity conservation. Women are a major working force in agriculture activities and play a great role in conserving agricultural diversity. They participate in land preparation, seed selection, crop management, harvesting and storing as well as livestock management. The marketing is such activity of farming which converts the production efforts into cash, and such activities are not undertaken by women. Economic empowerment of women thus becomes insufficient in contrary to the development objectives envisaged by the development plans. NTFP

is the important source of medicine, pesticides, spices and fruits but NTFPs have also been used for generating income. Farmers have been conserving many of these plant species by domesticating or managing the community forest jointly. So, in one hand the NTFP diversity is being conserved and in other hand they are being the part of livelihood generation of the farming community. Women in the study area are actively participating in conservation and value addition of the traditional varieties in cooperation with non-government organization but lacks awareness on importance of local landraces. Farmers are conserving traditional and exotic species of fodders, vegetables crops, and diversity on spices, cereals, oilseeds and legumes. Bio diversity is an important component of ecosystem. Obviously, its conservation and use should be done in sustainable way to ensure the ecosystem function and services in favors of local marginalized communities and particularly women. This should be properly addressed by the government through appropriate policy and programs.

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