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Research Article

Participatory Rural Appraisal as a Tool for Documenting Indigenous Agricultural Practices and Environmental Stewardship in Bangladesh

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Abstract

The study was conducted in the villages of Mashok and Moumari, focusing on climate-resilient farming practices in two agroecological zones of Bangladesh from February to August 2018. Various tools and techniques of Farmer Participatory Research Appraisal (PRA) were employed to collect community knowledge about social behavior and management practices. Findings reveal that climatic variability, including erratic rainfall and elevated temperatures, is disrupting traditional farming calendars, leading to lower agricultural income and increasing dependence on non-farm employment. Homestead gardening has played a key role in empowering women and diversifying food sources for households. Biodiversity assessment revealed Mashok to have higher species richness, while Moumari exhibited greater evenness. Farmers demonstrated a strong knowledge of crop rotation and genetic flow, but have limited awareness of composting and fallow systems. Crop diversity, wild relatives and traditional weather forecasting collectively sustain resilient agroecosystems, aligning with the SDGs 2, 13, and 15 by ending hunger, promoting climate action, and protecting ecosystems. Acknowledgement of gender-sensitive participation in national environmental sustainability strategies is crucial for diversified rural livelihoods and ecological resilience.

Keywords: Biodiversity; Participatory Research Appraisal (PRA); Bangladesh

Introduction

In Bangladesh, homestead farms function as active ecological units, integrating subsistence needs with biodiversity conservation. These systems are closely linked with indigenous knowledge and are sustained through generations of adaptive practices. The country is endowed with over 5,000 plant species. This incredible biodiversity in this country is associated with resilience and flourishing agroecosystems. However, this diversity is increasingly at risk due to rapid genetic erosion caused by land-use changes and the intensification of conventional agriculture. The erosion of plant genetic resources threatens both ecological integrity and the cultural heritage associated with traditional agriculture. To address this challenge, institutional efforts such as the establishment of the Plant Genetic Resources Centre (PGRC) at the Bangladesh Agricultural Research Institute (BARI) have promoted germplasm conservation and sustainable use [1-3]. Yet, beyond formal conservation frameworks, farmers themselves act as stewards of biodiversity in traditional farming . They achieve this through context-specific cultivation methods and seed-saving practices, which are sustained and shared through a local network [4,5]. These decentralized, community-led approaches underscore the importance of integrating farmer knowledge into national strategies for climate-resilient agriculture. Acknowledging and valuing such contributions are necessary for developing inclusive policies that promote both environmental sustainability and rural livelihoods.

Focusing on this context, this study aims to document indigenous agricultural practices and environmental stewardship. It utilizes gender-sensitive Farmers Participatory Research Appraisal (PRA) with biodiversity metrics across contrasting agroecological zones, documenting community-led forecasting indicators. species prevalence and rankings. The dual-site comparison, combined with Simpson's Index and livelihood mapping, provides a replicable framework for capturing ecological resilience and cultural specificity. This framework underscores the significance of data-driven documentation of agroecological heritage. Moreover, this study documents the pivotal roles of women as stewards of the environment alongside traditional weather indicators, elevating the discourse on climate adaptation [6,7].

Materials and Methods

Selection of communities and study sites

The study spanned from February to August 2018 in two villages, Mashok and Moumari, representing ecologically distinct regions of Bangladesh. Mashok is located under Kapasia Upazila of Gazipur district at coordinates 24°02'-24°16'N, 90°30'–90°42'E at an elevation of 8 m. Positioned in central Bangladesh, it lies approximately 20 km north of the Bangladesh Agricultural Research Institute (BARI) headquarters, ensuring close institutional access. In contrast, Moumari falls under Debiganj Upazila of Panchagarh district at coordinates 26°00'–26°19'N, 88°39'-88°49'E with an elevation of 64 m. Situated in northern Bangladesh, Moumari is about 370 km from BARI headquarters but only 8 km from the BARI Seed Production Station (BSPS) Debiganj, reflecting both remoteness and local institutional linkage. These contrasting sites provided a representative framework for examining ecological and geographic variability across central and northern agro-ecological zones of Bangladesh. Plate 1 shows the sites of the locations, focusing their ecological and geographical distinctness, which is crucial for understanding regional variations in the study outcomes.

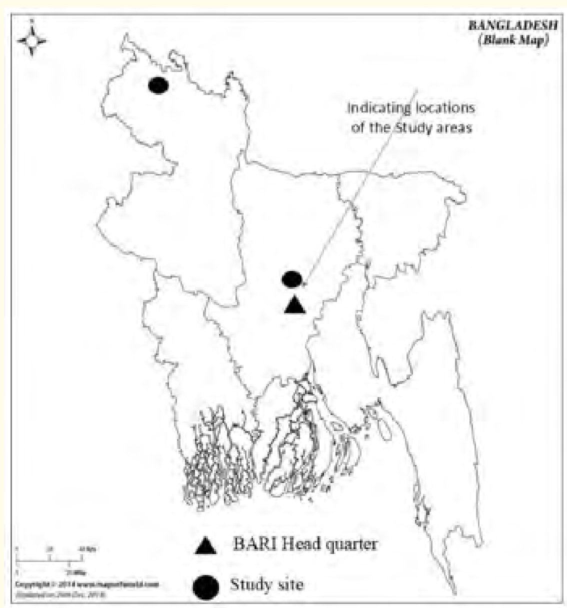

Plate 1: Geographical location of Mashok (Gazipur) and Moumari (Debiganj) study sites, highlighting ecological and agro-edaphic contrasts.

along with their wild and weedy relatives.

Arrangement of participatory meeting

Participatory Rural Appraisal (PRA) was applied to document traditional practices and indigenous knowledge (IK) related to homestead farming, aiming to support conservation and sustainable agricultural development. PRA offers an interactive approach that draws on local insights to assess rural conditions [8]. A multidisciplinary team comprising horticulturists, entomologists, plant pathologists, extension experts and agricultural economists was trained to facilitate engagement and collect data effectively [9]. Farmers were informed three days in advance to ensure preparedness. Participants ranged from 15 to 70 years of age, allowing for broad representation. On the day of the session, facilitators outlined the objectives and procedures, encouraging active involvement. To promote inclusivity, men and women participated in separate discussion groups. Male participants were divided into two teams, each guided by at least two scientists, while female scientists and extension workers conducted sessions with women in their homes. Separate group discussions facilitated by multidisciplinary teams, enabled inclusive dialogue on traditional farming practices, ecological knowledge, and community priorities for sustainable agriculture. By using matrix-based tools in their PRA sessions, farmers were able to identify resource flows, ecological hotspots, and vulnerable areas. These maps merged local knowledge with ecological observations, giving a swift spatial assessment of what matters to the community and how land is being utilized.

Data recording

Data were collected on the demographic characteristics of the communities, agro-edaphic features and socioeconomic variables to explore how these factors influence pattern of resource utilization. Participatory discussions, enable participants to articulate their perceptions of ecosystem services and changes in the supply of services across the landscapes in which they live. Participatory mapping tools following the framework outlined by Braslow., *et al*. (2016) were applied to document and visualize ecosystem services and their variations in supply across the agricultural landscapes [10]. In collaboration with local communities the research team developed a comprehensive list of plant species linked to crops, along with their wild and weedy relatives.

Plate 2: Participatory Rural Appraisal (PRA) sessions in Mashok and Moumari villages, showing inclusive engagement of male and female participants facilitated by multidisciplinary teams.

Data analysis Biodiversity assessment

Species diversity was quantified using the Simpson Diversity Index and Shannon Diversity Index. The Simpson Index was calculated as:

$$D = 1 - \sum_{i=1}^{s} \left(\frac{ni}{N}\right)^2$$

Where *ni* is the number of individuals of species *i*, *N* is the total number of individuals, and S is the total number of species (Simpson, 1949) [11]. The Shannon Index was calculated as:

$$H' = - \sum_{i=1}^{s} pi\ln(pi)$$

Where *pi* is the proportional abundance of i species [12]. These indices provide complementary measures of diversity, with Simpson emphasizing dominance and Shannon emphasizing richness and evenness. We used the ranking-based formula for Relative Prevalence (PR) following the method outlined by Millat-e-Mustafa, (1997) [13]: PR = Species population per homestead × percentage of homesteads containing the species.

Weather forecasting and themes analysis

The community discussion was analyzed to identify recurring ideas, topics, and core messages related to traditional weather forecasting. A thematic analysis approach was used to highlight common issues and main themes as described by Baxter and Jack (2008) [14]. The findings were synthesized through matrices developed during PRA sessions with local stakeholders. This method facilitated the documentation of intra-community differences based on gender, age, livelihood strategies, and resource access. The matrix-based tools align with established PRA methodologies, emphasizing structured, participatory analysis of community dynamics [15]. Overall, this approach provided a comprehensive understanding of community perceptions and behaviors related to traditional weather forecasting, ensuring that diverse perspectives within the community were systematically captured and analyzed.

Results and Discussion

Agro-edaphic and socio-economic characteristics of the study sites

During the participatory discussions, the participants were able to perceive that crops, livestock, fresh water, timber, and medicinal plants, pollination, nutrient cycling, soil formation, habitats are tangible products of the ecosystem. As the discussion progressed, community interactions revealed that environmental services are not isolated functions but closely interlinked with biodiversity. They clearly identified and recorded where resources are located and how the changes in supply are impacting their livelihoods and the management of each resource in question. Table 1 illustrates the unique agro-edaphic and socio-economic characteristics of the study sites. Mashok, may have a smaller land area; nevertheless, it is home to a rich ecological diversity that encompasses uplands, valleys, forests, and loamy soils, as visualized in Plate 3 (a). The rice-based cropping system is complemented by abundant winter and summer vegetables with fruit trees dominating homestead plantations. Climatic variability, including erratic rainfall and elevated temperatures, is disrupting traditional farming calendars [16]. Villagers are more involved in service industries and less in agriculture. Further, the village is distinguished by the presence of governmental and non-governmental educational institutions, religious organizations, and orphanages, all of which contribute to strengthening the resilience of the communities. In contrast, Moumari, is comparatively less fertile, a condition depicted in Plate 3 (b). The cropping pattern in Moumari primarily revolves around rice, with a mix of maize, wheat, oilseeds, pulses and seasonal vegetables. In addition, people of Moumari cultivate fruits and timber species alongside their croplands and annual fruit crops in their homesteads. Despite this diversity, the community in Moumari experiences heightened vulnerability due to a higher number of marginal households and a shortage of educational institutions.

Character		Mashok	Moumari
a)	Land area (ha)	: 200	: 309
b)	Number of households	: 300	:400
c)	Land type (%)		
High		: 20	: nil
Medium-high (Floodplain		: 30	: 75
Medium low		: 20	: 20
Low		: 10	: 5
Very low		: 20	: 0
d)	Soil type	: Loamy, high organic matter content	: Sandy loam, low organic matter content
e)	Climate	: Mild to hot summer, heavy rainfall in the rainy season.	: Hot summer temperatures, cold winter, low rainfall
f)	Landscape and topography	: Level upland, deep, or shallow broad valleys, forest on uplands with many useful herbs and shrubs, and plenty of seasonal water bodies including rivers	: Plain land with huge cropland, scattered village groves with wild edible species, and plenty of seasonal water bodies, including rivers
g)	Major crops	: Rice, fruits/vegetables,	: Rice, maize, wheat, seasonal fruits, vegetables
h)	Homestead farm size (%)		

(i) Large (land operating >2.0 ha)	:05	: 02
(ii) Medium (land operating 1.0-2.0 ha)	: 10	:05
(iii) Small (land 0.5-1.0 ha)	: 60	: 60
(iv) Marginal (land 0.21-0.5 ha)	: 20	: 30
(v) Landless (homestead only)	:03	:03
i) Public and local institute/ NGO		
Primary school	: 01	: 01
High school	: 01	: 01
Madrasa (private)	: 02 (1 non-govt.)	: Nil
Private school	: 02 (1 non-govt.)	: Nil
Temple	: Nil	: 01
Church	:1	: Nil
Orphanage	: 01	: 01

Table 1: Agro-edaphic and socio-economic characteristics of Mashok (Gazipur) and Moumari (Debiganj) villages based on PRA survey and Upazila Krishi Office data.

a) Ecological diversity of Mashok uplands and valleys

b) Cropland-dominated plain landscape of Moumari

Plate 3: Topographic and land use characteristics of Mashok and Moumari landscapes, illustrating ecological diversity and distribution of agricultural resources.

Demographic and socio-economic characteristics of the study sites

As detailed in Table 2, the communities of Mashok and Moumari exhibit diverse demographic and socio-economic profiles. Although agriculture remains the primary livelihood, households are increasingly finding new income sources. They are relying on remittances, small businesses, wage labor, and informal work, reflecting the limited sustainability of the farming system. This trend toward non-farm activities is more evident among landless and marginalized groups. Many depend on rivers and seasonal water bodies for fishing while others turn to fallow or uncultivated lands for supplemental food production. Plate 4 effectively visualizes how agroecological practices contribute to wellbeing in rural environments, including income diversification, gender empowerment, and nutritional well-being. Notably, home gardens empower women by allowing them to retain earnings from produce sales while income from natural water bodies augments family income and resilience.

Character	Mashok (Gazipur)	Moumari (Debiganj)
a) Household size		
Member/family (Nos.)	: 4 (3.18)	: 5 (4.3)
Babies and children up to 15 years	: 1	: 2
Workable members (16-50 years)	: 2	: 3
50 years and above	: 1	:1
Male-female ratio	: 1:1	: 1:1
Earning person	: Husband	: Husband
Family head	: Husband	: Husband
Family decision taken	: Men, occasionally discuss with their wives	: Men and women jointly
Role of workable member	: Share crop production activities; off-farm income activities, and tending livestock and poultry	: Share crop production activities, help in off-farm income; livestock/poultry rearing
b) Role of women in Family	: Prepare food for family : Manage home garden, post-harvest processing of crops, seed storing, picking vegetables, collecting firewood, tending livestock/poultry	: Prepare food for family : Help with post-harvest processing, seed storing, managing home gardens/natural harvest, collecting firewood, tending livestock/poultry
c) Religious (%)		
Muslim	: 88	: 90
Christian	: 8	: 1
Hindu	: 4	: 9
d) Education status (%)		
Basic literacy (reading and writing)	: 20	: 32
Primary level (up to class V)	: 45	: 35
Secondary level (SSC)	: 20	: 20
Higher secondary level (HSC)	:12	: 12
Bachelor's and above	:3	: 1
e) Major income source (crops, fishing, and livestock)	Agriculture	Agriculture
f) Others (non-farm)	g) Remittance h) Petty business i) Self-employment) j) Rickshaw pulling k) Tailoring l) Grocery store m) ICT n) Band party o) Priest p) Working at local factory	a) Remittance on farm products b) Petty business c) Daily labor d) rickshaw pulling e) Priest

Sharing of household income (%)		
a) Agriculture	: 35	: 45
b) Government service	: 15	: 5
c) Private or company Job	: 20	: 15
d) Other (non-farm)	: 30	: 35

Table 2: Demographic and socio-economic profiles of Mashok and Moumari communities derived from PRA matrices.

	
a) Home gardens fostering women's empowerment through produce sales and diversified income streams	b) Reliance on seasonal water bodies as a source of household nutrition from natural food diversity

Plate 4: Agroecological practices in study sites, demonstrating contributions to rural wellbeing through income diversification, gender empowerment, and nutritional security.

Analysis of household income

The data from Table 3 highlight a significant shift in rural household income sources between 2000 and 2018, with agriculture experiencing a marked decline. While agricultural income fell from 80% to 60%, the service sector doubled its share from 5% to 10%, and other sectors such as commerce, transport, and non-agricultural labor increased from 15% to 30%. Hill and Genoni *et al*. (2016) in their report also stated a pronounced increase in non-farm income in rural Bangladesh between 2010 and 2016 [17]. As labor and capital shift away from farming, biodiversity-rich practices may be overlooked, leading to reduced crop diversity, soil degradation, and weakened ecosystem services.

Issue	**Year of incidence (%)**		**Trends**	**Participants' reaction to the change**
	2000	**2018**		
A. Income source				
Agriculture	80	60	Decreasing (20%)	Symbiosis between industries and agriculture Socially looked down upon agriculture Farming as a laborious job Soil health degradation Inadequate marketing facilities Outbreaks of pests and diseases Male-dominated gender inequality

Service	5	10	Increasing (05%)	Social status improved Income opportunity for unemployed family members Education status improved Gender equity improved The natural environment changed
Others (commerce, transport and communication, non-agriculture labor)	15	30	Increasing (15%)	Farming is risky Income opportunities in the agricultural supply chain Low agro-biodiversity Indigenous knowledge is extinct Loss of arable land Degradation of environmental health
Total	100	100		

Table 3: Trends in household income sources (2000 to 2018) and community perceptions of agricultural transitions compiled from pooled PRA matrices and community discussions.

Farming practices and community awareness of ecological impacts

Table 4 presents farming practices and ecological awareness in Mashok and Moumari. High awareness of practicing crop rotation and green manuring indicates strong community recognition of their role in enhancing soil fertility, resource use efficiency and crop resiliency. This is evidenced by the 80% awareness of weather forecasting methods and the cultivation of traditional crops in Mashok (50% in Moumari); similarly, traditional knowledge systems remain influential in ecological impacts. Conversely, notably lower awareness is recorded for ecologically beneficial practices like the use of organic inputs, fallow systems and home gardens despite their contributions to soil health, biodiversity, and erosion control. These findings resonate with the objectives of the Bangladesh Biological Diversity Act (2017), which emphasizes public awareness and community participation in biodiversity conservation. Farmers' strong knowledge of crop rotation and genetic resource flow aligns with policy goals of sustainable resource use, while limited awareness of composting and fallow systems reveals gaps that national extension programs must address. Thus, PRA documentation provides actionable insights for bridging policy frameworks with grassroots realities [18].

Participatory mapping of ecosystem services and farming practices

The participatory mapping effectively visualizes these interactions and guides land use decisions, underscoring the significance of local knowledge in promoting resilient, community-led agricultural transitions. In a previous report by Braslow., *et al*. (2016), participatory mapping similarly was highlighted as a rapid spatial assessment tool for ecosystem services in multiuse agricultural landscapes [10]. Consistent with this framework, Plate 5 demonstrates how community knowledge visualizes farming practices and ecological impacts, guiding resilient and sustainable landuse decisions.

SL No.	Management option	Ecological Benefits	Community awareness about the impact (%)	
			Mashok	Moumari
1	Green maturing, crop residues, crop rotation, crop association	Improve soil organic matter, resource use efficiency, nitrogen use efficiency.	100	100
2	Use of manures, compost, and bio-pesticides	Reduce production costs. Improve soil health Enhance environmental health and biodiversity.	30	20
3	Cultivating traditional crops, different varieties of the same crops	As a part of heritage Planting materials/seeds available Low production costs Meet family needs Low insect pest attacks Less or no irrigation Source of fodder and fuel	80	50
4	The flow of genetic materials	Replace poor-quality seeds Grow better cultivars Test new cultivars Plant diseases and pests	100	100
5	Fallow system of cultivation; home garden	Source of uncultivated harvest for household consumption Promote wild crops, wildlife, and other species Enhance homestead biodiversity Stop soil erosion	30	30
6	Input use (Irrigation, fertilizers, chemicals)	Water pollution, biodiversity loss	60	60
7.	Weather forecasting	Rely on traditional methods	80	80

Table 4: Farming practices and community awareness of ecological impacts in study sites (PRA matrices).

Weather forecasting

Rural communities rely heavily on environmental cues such as cloud formations, animal behavior, plant phenology, and celestial patterns to predict seasonal changes, as summarized in Table 5. These traditional indicators, developed through generations of observation, are crucial for agricultural planning and climate adaptation, especially in low-resource settings where formal forecasting tools are limited. The socioeconomic relevance has been highlighted in previous studies while their cultural specificity has also been well established [19,20]. Comparative evidence from Zimbabwe and China demonstrates that indigenous seasonal calendars enhance resilience by improving local climate understanding. Integrating such indicators into scientific forecasting frameworks can improve contextual relevance, strengthen adaptive capacity, and reinforce agricultural resilience across diverse agroecological zones (Table 5).

Crop-associated bio-diversity, their wild and weedy relatives

Table 6 presents the depth and diversity of plant biodiversity highlighting species prevalence across the study sites. Mashok

Indicator	Phenomena	Anticipation
Cloud	Cumulus clouds in the north/northwest in April-May	A storm (northwestern) with hail
	A long parallel band of feathery clouds appears	A storm
	Red sky at sunrise	Upcoming rain
	Night and day warm during monsoon	Sign of approaching rain,
	Clouds in the north, northwest in early summer with flying king stork	Sing strong storm
	Clouds form in the east and the south in July-August.	Bad weather and rain
	Spading-type clouds and blue sky in between during the month of July	Chance of rain in early summer
	A foggy winter morning near the new moon	Chance of rain in mid-April
	Winter morning of December with a foggy sky	Chance of rain in mid-April
Moon	Ring form around the moon	Uncertain climate in near future
	Upright moon.	Chance of uniform rain
	A crescent moon's "horns" point to the side (i.e., horizontally).	Potential for rain or precipitation
	Tilted position of the crescent moon (south-facing).	Linked to drought in summer
Wind	The Southwest monsoon wind	Leading to heavy rainfall.
	An east wind over Everest	Can carry cold, dry air from over
Bird Chirping	Jacobin cuckoo (*Clamator jacobinus*) chirping in April	
	Chirping of greater coucal (*Centropus sinensis*).	
	Change in the voice of the kite bird (*Milvus migrans*) in March -April.	Sign of prolonged drought
Frog and toad	Louder and more frequent calling	Sign of the rainy season approaching
	Alter the calls of toads and frogs	Linked to drought
Bumper crops of certain plants	Bumper production of mango	Chances of a successful harvest of Aus rice
	Abundant harvest of tamarind	Indicator of potential floods
	Bumper production of Jackfruit	High possibility of floods that year

Table 5: Traditional weather forecasting indicators documented from PRA sessions in Mashok (Gazipur) and Moumari (Debiganj) villages compiled from pooled community matrices and thematic discussions.

exhibits a rich diversity with 70 species across nine crop categories, especially in fruit trees and vegetables, with 27 and 19 species, respectively. Moumari has 55 species, notably 12 medicinal plants, reflecting traditional healthcare practices. The higher species richness of Mashok (70 species, Simpson's D = 0.22; Shannon H′ = 0.82) suggests a broader genetic pool that enhances adaptive capacity under climatic stress. In contrast, the greater evenness of Moumari (55 species, Simpson's D = 0.20; Shannon H′ = 0.78) reflects balanced resource distribution, which stabilizes yields but may limit adaptive flexibility. The wild edible species found in Mashok provide alternative food options and help families bounce back from unexpected challenges. On the other hand, the limited range of wild edibles in Moumari could hinder adaptive strategies, leaving households more reliant on cultivated crops and outside markets, though its richer medicinal plant diversity enhances health resilience. These complementary resilience pathways highlight the importance of tailoring interventions to site-specific ecological contexts [21,22].

Crop/Plant group Mashok		Number species	
		Moumari	
1	Fruit tree	27	16
2	Annual fruit *	2	2
3	Timber	7	2
4	Vegetables	19	15
5	Spices	5	4
6	Cash crop	3	3
7	Medicinal	4	12
8	Edible wild	4	1
9	Wild or domestic shrub	3	-
	Total species= Moumari	70	55
	Simpson's index (D)	0.22	0.20
	Species diversity index (H ©)	0.82	0.78

Table 6: Plant biodiversity across crop groups in Mashok and Moumari villages with species richness and ecological roles compiled from PRA survey data and community resource inventories.

Table 7 further highlights the relative prevalence of key fruit species in Mashok, where jackfruit (*Artocarpus heterophyllus*), banana (*Musa spp.),* and monkey jack (*Artocarpus lacucha*) dominate homestead orchards, reinforcing their agroforestry and nutritional value. Primary fruits of Moumari include jackfruit, banana, monkey jack and litchi (*Litchi chinensis*) (Table 8). A diverge range of trees is a guarantee of year round food supply and support a richer mix of wildlife. By linking various trophic levels and enhancing physical conditions fruit trees reinforce overall ecosystem resilience.

Sl. Nos.	Fruit Species	Botanical name	Species size/ homestead	Households containing the species (%)	Relative prevalence	Ranking
1	Coconut	*Cocos nucifera*	2	30	60	10
2	Mango	*Mangifera indica*	5	100	500	5
3	Jackfruit	*Artocarpus heterophyllus*	16	100	1600	1
4	Litchi	*Litchi chinensis*	7	80	560	4
5	Banana	*Musa spp*	10	100	1000	2
6	Papaya	Carica papaya	5	100	500	5
7	Jujube	*Ziziphus mauritiana*	2	30	60	10
8	Monkey Jack	Artocarpus lacucha (*Buch)*	10	80	800	3
9	Amloki	*Phyllanthus emblica Lin*	5	20	100	9
10	Guava	*Psidium guajava*	3	50	150	7
11	Hog plum	*Spondias dulcis*	1	10	10	16
12	Pomelo	*Citrus grandis (L)*	2	25	50	11

13	Olive	*Elaeocarpus floribundus*	1	30	30	13
14	Blackberry	*Syzygium cumini (L)*	2	50	100	9
15	Chapalish	*Artocarpus chama*	1	2	2	19
16	Date palm	*Phoenix dactylifera*	3	45	135	8
17	Karambola	*Averrhoa carambola*	1	40	40	12
18	Pomegranate	*Punita granatum*	1	5	5	17
19	River ebony	*Diospyros peregrina*	1	3	5	17
20	Palmira palm	*Borassus flabellifera L.*	2	2	4	18
21	Wax Jambo	*Syzygium samarangense*	1	20	15	15
22	Rose apple	*Syzigium jambos*	1	2	2	19
23	Bullock heart	*Annona reticulate*	1	20	20	14
24	Lime/Lemon	*Citrus limon*	2	80	40	12
25	Stone apple	*Aegle marmelos*	1	30	30	13
26	Wood apple	Limonia acidissima	3	60	180	6
27	Phalsa	Grewia asiatica	1	10	10	16

Table 7: Relative prevalence of major fruit species in Mashok homesteadorchards compiled from PRA survey data and community resource inventories.

Sl. Nos	Species	Botanical name	Species size	Abundance*	Relative prevalence	Ranking
1	Coconut	*Cocos nucifera*	2	20	40	8
2	Mango	*Mangifera indica*	5	100	500	2
3	Jackfruit	*Artocarpus heterophyllus*	3	40	120	5
4	Litchi	*Litchi chinensis*	3	50	150	4
5	Jujube	*Ziziphus mauritiana(Lam)*	2	50	100	6
6	Banana	*Musa spp*	8	70	560	1
7	Guava	*Psidium guajava*	1	30	30	9
8	Pomelo	*Citrus gradis (L)*	1	10	10	11
9	Blackberry	*Syzygium cumini (L)*	1	10	10	11
10	Pomegranate	*Punica granatum*	1	5	5	12
11	Rose apple	*Syzigium jambos*	1	2	2	13
12	Bullock heart	*Annona reticulate*	1	20	20	10
13	Line/Lemon	*Citrus limon*	2	80	40	8
14	Stone apple	*Aegle marmelos*	1	30	30	9
15	Wood apple	Limonia acidissima	2	30	60	7
16	Papaya	Carica papaya	5	50	250	3

Table 8: Relative prevalence of major fruit species in Moumari homestead orchards, documented through PRA matrices and household orchard assessments.

Abundance = % of household containing the species.

Farmers' experiences with crop and variety changes over time

The chronological account of farmers' experiences from 2000 to 2015 reveals a gradual transition in agricultural practices, marked by declining crop diversity, rising input dependency, and erosion of traditional knowledge (Table 9). During 2000-2004, farmers faced yield and price uncertainty of the produce, alongside the expansion of poultry farming and pesticide use. These changes led to reduced agrobiodiversity and increased production costs, prompting labor migration and a gradual disengagement from farming. In 2005–2009, community reported a notable shift in agriculture with the introduction of high-yielding fruit and vegetable varieties like mango and litchi. Yet, the profit-oriented cropping diminish the farmers' control over production systems. The 2010–2015 period saw the disappearance of landraces and traditional crop varieties coinciding with food insecurity, hidden hunger and malnutrition. These transitions mirrored broader pressures on smallholder systems under market pressure, where external inputs replace local resilience [23,24]. The data underscore the need to revalue indigenous crop diversity and farmer-led innovation to support sustainable, inclusive agricultural development.

Year of events	Relating events	Farmers' reaction to the event and social perspectives
2000-2004	Reduction of the number of crops Social inequality, change in land use practices Expansion of poultry farming Evolving new pesticides Uncertainty of crop yield High price of fertilizers Uncertainty in price of products	Agro-biodiversity reduced Production cost increased Unchecked growth of plague insect Migration of farming labor to off-farm activities Abandoning agriculture as profession The production system was controlled by farmers
2005-2009	Introduction and expansion of modern varieties of mango, litchi and vegetables Expansion of poultry farming continuing Incidence of new insect-pests and diseases Lower price of paddy and higher price of rice	The profit-oriented changes in cropping patterns crop agriculture provides limited opportunities for meaningful family participation. Eliminating farmers' control over production system
2010-2015	Disappearing local crops and traditional varieties Ups and downs of agricultural production Incidence of new pests and diseases Increased use of external inputs in farming Reduction in fertilizer price (subsidized rate) Introduction of new crops and new varieties Involvement of young and women in farming	Disappearing of landraces Food security threatened Hidden hunger, malnutrition Disappearing of traditional crops/varieties High-value crops other than rice for higher productivity

Table 9: Chronology of crop and variety changes from 2000 to 2015.

Limitations and scope

Participatory approaches to conserving and utilizing plant genetic resources in Bangladesh are still emerging, with limited availability of skilled facilitators. As a result, some data, such as descriptions of women's roles in rice harvesting, may appear narrative in nature, which could potentially reduce reader engagement. This exercise enables participants to gain deeper insights through hands-on experience with PRA methodologies.

Conclusion

The study has built awareness among participating communities about the environmental benefits in which they live. The findings from the PRA reveal that protecting biodiversity, preserving crop variety and utilizing traditional weather forecasting techniques enhance our resilience to climate variability. The active involvement of women in homestead gardening, seed preservation and ecological management underscore their active role in food security and adaptation to these variations. By prioritizing community-driven approaches and policies on gender-sensitive participation can be effectively aligned with national strategies. This approach not only promotes environmental sustainability but also diversifies rural livelihoods and empowers marginalized groups. Aligning these initiatives with SDG 2 (Zero Hunger), SDG 13 (Climate Action), and SDG 15 (Life on Land) paves the way for a transformative pathway toward resilient, equitable, and sustainable rural development in Bangladesh.

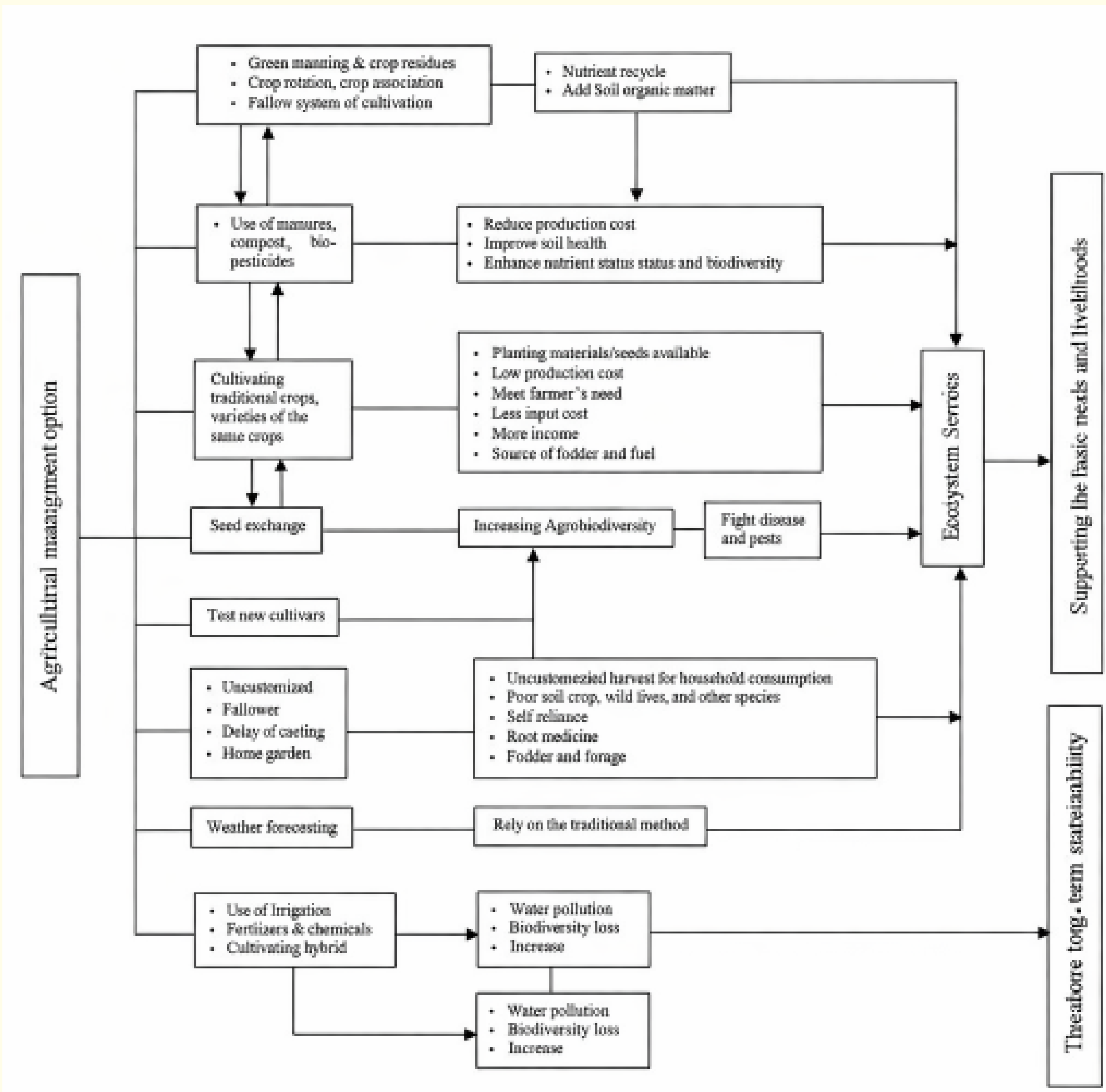

Plate 5: Participatory mapping of farming practices and ecological impacts, visualizing community knowledge for resilient, sustainable land use decisions.

Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this paper

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