P. ISSN: 0971-8184 II E. ISSN: 0976-1926
DOI: 10.61949/0976-1926.2024.v37i02.07

Indian Journal of Plant Genetic Resources

RESEARCH ARTICLE

Seeds of Harmony: Conservation of Landraces by Farmers, Communities and NGOs in the Western Ghats, a Case Study

G M Puneeth[1], Ravi Gowthami[2], Sanjay Patil[3], Kailash Chandra Bhatt[2], Ramesh Vasudeva[4] and Sunil Archak[2*]

Abstract

India is a megadiverse country and holds a vast diversity of different crops being conserved on-farm, including landraces. In the present study conducted in the Western Ghats region of the country, efforts were made to collect information from three different stakeholders, *viz*., individual custodian farmers, communities and non-governmental organizations (NGOs) working through different ways with a common aim to protect the indigenous cultivars. A custodian farmer named Mr. B K Deva Rao, one local community named *Kalsubai Parisar Biyanee Samvardhan Samajik Sanstha* and an NGO entitled Bharatiya Agro Industries Foundation (BAIF) were selected and the basic framework for the conservation of landraces was recorded. The roles played by all three stakeholders are interlinked and connected by supporting each other to save the seeds of the traditional cultivars. Additionally, the collaboration with government organizations promotes landrace utilization and sustainable management for crop improvement initiatives. The integration of formal and informal conservation approaches is essential for holistic plant genetic resource conservation, addressing both the scientific and socio-cultural aspects.

Keywords: Landraces, Custodian Farmers, Conservation, On-farm, Farmer Community.

[1]Division of Plant Genetic Resources, ICAR - Indian Agricultural Research Institute, Pusa Campus, New Delhi - 110 012, India.

[2]ICAR - National Bureau of Plant Genetic Resources, Pusa Campus, New Delhi - 110 012, India.

[3]BAIF Development Research Foundation, Warje, Pune - 411058, India.

[4]College of Forestry, University of Agricultural Sciences, Dharwad, Sirsi - 581 401, India.

***Author for correspondence:**

sunil.archak@icar.gov.in

Received: 11/03/2024 **Revised:** 31/05/2024

Accepted: 26/06/2024

How to cite this article: Puneeth GM, R Gowthami, S Patil, KC Bhatt, R Vasudeva and S Archak (2024) Seeds of Harmony: Conservation of Landraces by Farmers, Communities and NGOs in the Western Ghats, a Case Study. *Indian J. Plant Genet. Resour*. 37(2): 246-254.
DOI: 10.61949/0976-1926.2024.v37i02.07

Introduction

India is a country of villages and farmers, where more than 60 percent of its population lives in rural areas. Livelihood conditions differ considerably across the country. India has many agro-climatic regions and the Western Ghats are one of them. The Western Ghats are a chain of mountains lying along the western coast of peninsular India, covering Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu from the hills south of the Tapti River in the north to Kanyakumari in the south (Scaria, 2023). Meanwhile, the Western Ghats house vast genetic resources of different flora and fauna. People are dependent on them for their livelihood purposes. Historically, farmers around the world have been and continue to be the stewards of most of the resources, maintaining, refining and trading them to suit their needs. Thus, they are key actors in the conservation and enhancement of agro-biodiversity and their genetic resources.

Landraces serve as sources for the productivity, resilience and adaptability of agricultural systems. The conservation of this diversity is primarily facilitated through farmers' cultivation and selection methods. Local exchange and gene flow among landraces play a crucial role in promoting genetic variation, while continued cultivation fosters local adaptation (Bellon, 1996; Louette *et al*., 1997; Mercer and Perales, 2010).

Landrace conservation is a collaborative effort that often involves both formal and informal conservation through the

combined contributions of individual custodian farmers, local communities and government and non-governmental organizations (NGOs). Each of these stakeholders plays a unique and crucial role in safeguarding traditional crop varieties and preserving agricultural biodiversity (Joshi and Upadhya, 2019). For several generations, farmers or farming communities have been conserving and growing landraces (traditional crop varieties) that have been suited to the local environment. Thus, the paper discusses the importance and role played by a custodian farmer, a local farming community and an NGO in conserving, reviving, maintaining and cultivating the landrace diversity in the Western Ghats region as a case study.

Materials and Methods

Study Area

The entire Western Ghats biogeographic region is a major genetic estate with an enormous biodiversity of ancient lineages (Daniels, 2003). The Western Ghats form one of the 34 biodiversity hotspots in the world (Myers, 2000). It consists of 6% of the total land area of India, but has >30% of the biodiversity of India. Nearly 5800 species of flowering plants occur here, of which 56 genera and 2100 species are endemic. In addition to diverse flora and fauna, the Western Ghats are also home to diverse social, religious, cultural and linguistic groups. The Western Ghats consist of a rich diversity of crops and their wild relatives, *viz.,* rice, sorghum, finger millet, foxtail millet, little millet, green gram, horse gram, pigeon pea, *Dolichos* bean, rice bean, taro, yams, banana, mango, jackfruit, ginger, turmeric, chili, sugarcane, coconut, cotton and many more (Arora, 1988; Rohini *et al.,* 2015).

Data Collection

Initially, a comprehensive review of the literature was done concerning the conservation efforts carried out on-farm by individual custodian farmers, communities and NGOs. This information was obtained from the Bioversity International regional station (NASC complex, New Delhi), ICAR-National Bureau of Plant Genetic Resources (NBPGR) regional station (Akola, Maharashtra), the crop-based research institute (ICAR-Directorate of Cashew Research, Puttur, Karnataka), NGOs (*Sahaja Samruddha*, Bengaluru, Karnataka and BAIF, Pune, Maharashtra), communities (*Siddharudha Savayava Krushikara Balaga*, Khanapur, Karnataka) and co-operatives (*Savayava Krishi Pariwara*, Thirthahalli, Karnataka).

Based on the preliminary information gathered, a custodian farmer, one local community and an NGO were chosen to comprehend their respective roles and efforts in relation to on-farm conservation of landraces (Fig. 1). A detailed amount of information was collected from these entities on various aspects, from basic details to marketing aspects, including landrace diversity, livelihood options, etc.

Fig. 1: Details of the different stakeholders under study

Results and Discussion

Seed is the soul of agriculture. It has taken many years of dedicated efforts by the farmers to develop and conserve crop races suitable for local agro-climatic conditions. However, in recent years, agriculture has been practiced in a high external input mode with hybrids every season and surely farmers will have to go back to the market to buy the seeds. Over time, custodian farmers have assumed a crucial role in preserving agro-biodiversity, particularly traditional varieties and landraces, whether through direct or indirect conservation methods. Additionally, some farming and tribal communities, with the help of a few NGOs, have preserved many indigenous seeds.

Individual Farmer-led Conservation

The present study gathered detailed insights from Mr. B.K. Deva Rao, a custodian farmer residing in Belthangady, Dakshina Kannada, Karnataka, India, who has been actively engaged in on-farm conservation of landraces for the past few decades. B.K. Deva Rao's dedication to on-farm conservation has inspired his son, Mr. Parameshwara Rao (54 years old) and daughter-in-law, Mrs. Vasanthalaxmi (42 years old), to adopt similar practices on approximately 30 acres of land in the remote village of Mithabagilu in the foothills of the Western Ghats near the coastal plains of Karnataka (Figs 2a-b). For the past 50 years, Mr. B.K. Deva Rao has been deeply immersed in on-farm conservation efforts aimed at preserving agrobiodiversity alongside various other farming activities, including livestock management (Figs 2c-f).

To ensure sustainable income, Mr. Parameshwara Rao initiated an innovative venture known as "*Swasti Farms Kukkavu*," a local visiting farm, a few years ago. Through these activities, they aim to promote traditional knowledge, local cuisines and farming methods. Mr. Parameshwara Rao, as a farmer breeder, selected and developed a rice variety called "*Swasti*" with high yield potential, adaptability to local climatic conditions and resistance to pests and diseases (Figs 3a). They actively engage in seed exchanges with farmers from various regions to increase and preserve diversity for future generations. They are focusing on a diverse array of rice landraces (>140), along with cucumber (> 10), cowpea (6), brinjal (3), ivy gourd (3), jackfruit (> 50), mango (80) and various root crops (10). Locally grown varieties such as *Raja Kayime, Kutti Kayime* and *Suggi Kayime* hold

Fig. 2: Custodian farmer (a-b) B.K. Deva Rao with his son Mr. Parameshwara Rao; (c-f) PGR and livestock activities

special importance for them, passed down through many generations and sourced from different farmers (Figs 3b-d) (Table 1).

Their knowledge of the traditional practices that enhance the cultivation of various crops on the farm was unmatchable. They were well aware of the benefits of the landraces, like nutritional value, medicinal value and cultural value, which they promoted among the fellow farmers. They themselves pray for the gods during festivals by offering a variety of products and dishes made by the native varieties (*Suggi Kayime, Ibbudla, Kashi Gumbala* and *Virupa Kayime*). They greet the guests in a traditional way by offering well water along with pieces of jaggery. Thus, maintaining the traditional practices associated with the landraces enhances their conservation as well. They also reap the medicinal benefits offered by the native varieties, which enhance their lives (healthy diet) and livelihoods (more price for the native varieties products, such as red rice, brown rice, pickles, etc.).

They grow the landraces of different crops with scientific and traditional knowledge that they got from their forefathers. They have different varieties for both the *rabi* and *kharif* seasons, which sustains the cultivation throughout the year. They know the unique traits and value of each and every variety they grow. Despite their dedication, they acknowledge the loss of several landraces from their farm due to natural occurrences such as landslides, as well as challenges posed by wildlife like monkeys and wild boars during harvesting seasons and crop stand periods. Recognizing his outstanding achievements in agriculture, Mr. B.K. Deva Rao has been honoured with the *Karnataka Rajyotsava* Award by the Karnataka Government. Recently,

Fig. 3: (a) *Swasti*, a farmer rice variety by Mr. Parameshwara Rao; (b-d) Representative images of landraces conserved by the family

Table 1: Representative landrace diversity conserved by Mr. B.K. Deva Rao

Crop	*Landraces*
Cucumber	*Mullu Southe, Sanna Southe, Dodda Mullu Southe, Aanemottu/Hegge Southe, Aati Southe, Oddu Southe, Garbeeja, Ibbudla*
Cowpea	*Kempu Halasande, Bannada Halasande, Gidda Halasande, Bijada Halasande, Bagade*
Brinjal	*Mottu Gulla, Musuku Badane, Keddasa*
Lab-Lab bean	*Kathi Avare, Chaturbuja Avare*
Jackfruit	*Nar Thuluva, Thuluva, Barikke, Aati Variety, Rudrakshi, Happala Sonte, Uppada Pacheeru*
Mango	*Battala Mavu, Neeru Kuku, Sanna Mavu, Dodmane Mavu, Nekkare Mavu*
Banana	*Avande Baale, Kadhali Baale, Sakkare Baale, Boodu Baale, Kallu Baale*
Ridge gourd	*Pundi Heere, Daare Illada Heere, Neera Peere*
Ladies finger	*Bahuvarshika Bhendi, Thoora Uda/Ane Kombu Bhendi, Bili Bhendi*
Ash gourd	*Kashi Gumbala, Dodda Gumbala, Sanna Gumbala*
Rice	*Raja Kayime, Kutti Kayime, Suggi Kayime, Neerambade, Virupa Kayime, Ajippa, Swasti, Jeerige Sanna, Mysuru Mallige, Padma Rekha, Soma Saale*

in 2023, Mr. B.K. Deva Rao received the Protection of Plant Varieties and Farmers' Rights Authority's 'Plant Genome Saviour Farmers Reward, 2020–21' in New Delhi.

Custodian farmers play a critical role in conserving the genetic diversity and adaptability of landraces, ensuring their availability for future generations. Custodian farmers are often recognized and respected for their knowledge and expertise and they are also recognized by the local communities for their immense contribution towards

Fig. 4: (a-c) Farmers of the community in their respective *rabi* crop field; (d) Seed marketing from farmers to market; (e, f) Seed storage systems of different farmers of the community; (g) Community seed gene bank, *Kalsubai Parisar Biyane Samvardhan Samajik Sanstha*, Khirvire, Akole, Ahmednagar, Maharashtra

landrace conservation. These findings resonate with the conclusions drawn by Gajanana *et al*. (2015) regarding mango landrace conservation in different regions of India. Additionally, Puneeth *et al*. (2024) survey on custodian farmers in the Western Ghats of Karnataka reveals the same results. Furthermore, Sthapit *et al*. (2013) documented various case studies across India, Malaysia, Indonesia and Nepal, shedding light on the role, motivations, methods of seed dissemination and connections with formal seed systems in landrace conservation efforts.

Community-led Conservation

The conservation of landraces by local communities represents a critical and sustainable approach to preserving traditional crop varieties and agricultural practices. In the present study, a survey was conducted to gather insights into the functioning and management of the *Kalsubai Parisar Biyanee Samvardhan Samajik Sanstha* in Akole, Ahmednagar district, Maharashtra, focusing on on-farm conservation of landraces. The study revealed that the community maintains a register to record germplasm collection site details, indigenous knowledge associated with these landraces and their on-farm maintenance (Patil *et al.,* 2015). This community was also working in 20 tribal villages in the Akole block of the Ahmednagar district of Maharashtra for the conservation and promotion of indigenous crop cultivars (landraces) in different crops in the region. They engage in seed selection, adaptation and exchange, ensuring the continuous availability of diverse varieties (Brush, 2000; Subedi *et al.,* 2003).

Since June 2016, the community has been involved in seed production for rice, hyacinth bean, little millet, horse gram, green gram and other crops. A total of 615 individual members, including 155 men and 460 women, are engaged in seed production, highlighting the active participation of women in seed production and conservation efforts. The motivation to start seed production stemmed from the establishment of *in situ* conservation centers through the Bharatiya Agro Industries Foundation (BAIF) program (Fig. 4a). Through field visits by knowledgeable farmers, including women and elders, unique crop cultivars were identified for promotion through participatory varietal selection. This process generated significant interest among farmers in selecting crop cultivars in the field itself at the maturity stage. For promotion of on-farm conservation of vegetable landraces, the community started a campaign for an indigenous vegetable cultivar nutrition garden, from which 10,000 families benefited (Figs 4b-d).

In the present study, farmers have identified superior landraces in different crops that are well-adapted to specific agro-ecological conditions and used in large-scale seed production for marketing purposes (Supplementary Table 1). The community in the present study has a seed bank

with 95 accessions of different crops (rice-13, horse gram-4, cowpea-5, hyacinth bean-18 and other pulses), oil seeds and local vegetables. The conservation of all these crop cultivars is done in ten *in situ* conservation centers in 20 villages, through kitchen gardens and through storage in the community seed bank (Figs 4e–g). Local communities establish and manage community seed banks, preserving landraces and ensuring their availability during times of need (Witcombe *et al.,* 1996).

Local communities ensure the survival of rare and unique traits that might be lost in modern agricultural systems (Perales and Golicher, 2014). Communities contribute to the improvement of landraces through participatory plant breeding programs, combining traditional knowledge with modern breeding techniques. Several successful examples of landrace conservation by local communities exist worldwide. One such initiative is the "Territorial Seeds" project in Peru, where indigenous communities in the Andes have been safeguarding traditional crop varieties like quinoa and potatoes for generations (Pimbert, 2009). This project highlights the importance of collective action and community-driven efforts in preserving agrobiodiversity. In the same way, the Seed Savers Group community in the Jawhar block of Maharashtra is working on the conservation of indigenous crop varieties of different fruit crops (Chothe *et al.,* 2014).

The members of this community were also conferred with several awards and recognitions for their immense contribution (Table 2). The community also participated in different events, workshops and trainings and shared crop cultivars of rice, hyacinth bean, millets and vegetables. Exposure visits by farmers, students and NGOs to the seed bank and *in situ* conservation and demonstration centers reached more than 3500 farmers, students, NGO representatives, etc.

Non-government organization (NGO)-led conservation

By engaging with local communities, farmers and various stakeholders, NGOs undertake the crucial task of safeguarding and promoting the cultivation of invaluable landrace genetic resources. Their endeavours encompass a wide range of activities, including research, guidance, capacity building and the implementation of conservation techniques aimed at empowering communities and conserving agricultural biodiversity. Through their interventions, NGOs facilitate the sustainable utilization and management of landraces, ensuring the preservation of unique local crop varieties, their continued cultivation and their integration into modern agricultural practices.

The present study sought insights from the Bharatiya Agro Industries Foundation (BAIF) Development Research Foundation, Pune, Maharashtra, regarding the role and significance of NGOs in on-farm conservation. Established in 1967 by the late Dr. Manibhai Desai, a follower of Gandhi, the BAIF Development Research Foundation has been dedicated to promoting sustainable livelihoods and enhancing the quality of life for tribal and rural communities (Table 3).

In 2008, BAIF initiated a community-led conservation and management program for indigenous crop cultivars and forest food resources in Maharashtra. The primary objective was to conserve and revive crop diversity along with associated knowledge. The program involved scientific studies focusing on morphological and nutritional aspects, the establishment of community seed banks and community-level seed production (Figs 5a-d). Starting in Jawahar (Palghar), the program has received the support of the government of Maharashtra in expanding its reach to other blocks in Ahmednagar, Pune, Nandurbar, Gadchiroli and Sindhudurg districts of Maharashtra. This program has also been scaled up since July 2021 with its implementation at Champawat (Uttarakhand), Dangs (Gujarat) and Sambalpur (Odisha).

The Maharashtra Gene Bank project was conceptualized and implemented across various agro-climatic zones of the state, with a focus on conserving and managing bio-resources with active community participation. Under this initiative, BAIF's program emphasized participatory *in situ* and *ex situ* conservation, management of local bio-resources, including crop cultivars, livestock breeds and forestry species, as well as habitat eco-restoration in eight clusters spanning diverse agro-climatic zones and covering 94 villages in Maharashtra. BAIF also established a women-led enterprise for the production and sale of vegetable crop cultivars for kitchen gardens, with 10,000 packets prepared, each containing 12 different vegetable crops. The importance of farmers and NGOs in seed exchange with an aim to conserve rice landraces was also reported by Muralikrishnan et al. (2021). ICAR-NBPGR has a Memorandum of Undertaking with BAIF for landrace collection, conservation and characterization. They also facilitate the exchange of seeds among farmers, helping to prevent the erosion of genetic diversity. Established *ex situ* gene bank at BAIF Central Research Station, Urulikanchan (Pune), Maharashtra (Figs 5e-i). Another notable example is the "*Navdanya*" movement in India, started by environmentalist Dr. Vandana Shiva to promote native seed-saving practices, thereby conserving numerous landraces and promoting sustainable agriculture (Vandana, 1991).

Deciphering Conservation Dynamics: Farmer, Community and NGO-Led conservation

From the present study, it is evident that individual custodian farmers, communities and NGOs have a common goal, *i.e.,* "protection of indigenous cultivars for future generations," but are working in different ways to achieve this goal

Table 2: Members of the community conferred with recognitions or awards

S. No.	*Name of Recognition/Reward*	*Year*	*Name of the awardee*
1	*Narishakti* Award (2018) by the Ministry of Women and Child Development, Government of India, from the President of India.	2019	Srimati Rahibai Popere
2	Felicitation by the Honourable Governor of Himachal Pradesh during the National Seed Conference.	2019	Kalsubai Parisar Biyane Savardhan Samajik Sanstha
3	Vasundhara Kirloskar Award	2018	Srimati Raibai Popere
4	Felicitation by the Department of Animal Husbandry, Government of Maharashtra, at Jalna, Maharashtra	2018	Kalsubai Parisar Biyane Savardhan Samajik Sanstha
5	BAIF's Innovative Farmer Award	2016	Srimati Mamtabai Bhangre
6	BAIF's Innovative Farmer Award	2017	Srimati Rahibai Popere
7	SRISTI SANMAN Award 2017 by SRISTI, Honey Bee Network and NIF, Ahmedabad	2017	Srimati Rahibai Popere
8	Padmashree Award	2021	Srimati Rahibai Popere

Table 3: Details of the Non-Government Organization (BAIF)

Name of the NGO	*Bharatiya Agro Industries Foundation (BAIF) Development Research Foundation, Pune, Maharashtra.*
Location	Jawhar (Palghar), Akole (Ahmednagar), Junner (Pune), Dhadgaon (Nandurbar), Etapalli (Gadchiroli), Kudal (Sindudurg) blocks of Maharashtra also in Champawat (Uttarakhand), Dangs (Gujarat) and Sambalpur (Odisha).
Activities	Documentation of crop diversity and associated knowledge in diverse agro-climatic zones. Germplasm collection, characterization, evaluation and participatory seed production. *In situ* conservation with the active involvement of the local community. Community-level processes include networking, establishing community seed banks and participatory events.
Focused crops	Local cultivars of paddy, millets (foxtail, finger, little and barnyard millet), beans, pulses, maize, sorghum, wild vegetables and tuber crops.

(Table 4). The synergy between NGOs, local communities and custodian farmers strengthens landrace conservation efforts. Though NGOs are integrating both community and custodian farmers together to achieve on-farm conservation, there is a need to integrate with government organizations. By combining scientific research, external support and traditional wisdom, these stakeholders collectively contribute to the sustainable management of agricultural biodiversity. The involvement of all entities fosters community ownership, cultural preservation and a sense of responsibility towards safeguarding landraces, ultimately leading to more resilient and diverse agricultural systems in the face of global challenges such as climate change and food security.

Conclusion

Throughout the history of agriculture, landrace conservation has been practiced both in formal and informal ways. The farmers conserve and exchange landraces to meet diverse requirements such as sustenance, animal feed, energy, textiles and medicinal purposes. From the present study, it is evident that landrace conservation is being practiced at different levels among farmers, communities and NGOs towards a common goal of conserving landraces for present and future sustainability. However, many farmers and communities are engaged with relative organizations in conservation and promotional activities. Due poor

Fig. 5: (a-d) Seed production in farmers' fields; (e-i) community seed bank at Jawhar block of Palghar, Maharashtra

Table 4: Comparison of custodian farmer, community and NGO towards on-farm conservation of landraces

Features	*Individual farmer-led conservation*	*Community-led conservation*	*NGO led conservation*
Conservation	Mostly short-term	Medium to long-term	Medium to long-term
Shared responsibility towards landraces conservation	Low	High	High
Landraces seed exchange	Low	High	High
Landraces cultivation scale	Small to medium	Medium to large	Medium to large
Knowledge sharing	Inherent sharing of knowledge with future generations of the family. Often with other members of the community.	Knowledge sharing among the members of the community	Knowledge sharing among the members of the community
Safety duplication	Very rare	The same landraces were conserved by different farmers in the community	The same landraces were conserved by several communities
Connection with NPGRS	Only few custodian farmers connected with NPGRS	Few communities linked with NPGRS	Mostly connected with NPGRS
Scientific support	Rare	Often	Most of the time
Funding	Very rare or nil	Few have that opportunity	NGOs get funding from government and other agencies
Landrace crop diversity	Few crops	More crops	More crops
Purpose of conservation	Hobby, reputation and social recognition, conservation (few)	Community benefit, conservation	Conservation, financial benefit

identification and insufficient documentation, the role of these stakeholders go unnoticed. Thus, there is a need for the integration of all the guardians of landraces with government organizations and institutions. It supports to bridge the gap by fostering collaboration and knowledge exchange among researchers, policymakers, farmers and other stakeholders in conserving the vast traditional knowledge of the native varieties.

Acknowledgement

The authors thank ICAR-NBPGR for the facilities. GMP was supported by the ICAR-IARI Fellowship and SA was supported by the ICAR-National Fellowship. The authors are highly indebted to the information provided by BAIF Research Foundation, Pune and to the custodian farmers for their invaluable knowledge and resource conservation.

Author Contribution

SA and GMP designed the study. GMP carried out the study with the assistance of SP and SA. GMP and RG wrote the manuscript. SA, SP and RV edited and corrected the manuscript. All authors reviewed the manuscript.

Data Availability

The data that were generated during the study as well as those that support the findings are included in the paper.

Statements and Declarations

The authors declare no competing interest

References

Arora RK (1988) The Indian gene centre - priorities and prospects for collection. In: RS Paroda, RK Arora and KPS Chandel (ed) *Plant genetic resources: Indian perspective.* NBPGR, New Delhi, India, pp 66-75.

Bellon MR (1996) The dynamics of crop infra-specific diversity: a conceptual framework at the farmer level. *Econ. Bot.* 50: 26-39.

Brush SB (2000) Issues of *in situ* conservation of crop genetic resources. In Genes in the field: On-farm conservation of crop diversity. IDRC, Ottawa, ON, CA.

Chothe A, S Patil and DK Kulkarni (2014) Unconventional wild fruits and processing in tribal area of Jawhar, Thane District. *Biosci. Discov.* 5(1): 19-23.

Daniels RR (2003) Biodiversity of the Western Ghats: An overview. Wildlife and Protected Areas, Conservation of Rainforests in India, 4: 25-40.

Gajanana TM, MR Dinesh, S Rajan, R Vasudeva, SK Singh, HAH Lamers, VA Parthasarathy, B Sthapit and RV Rao (2015) Motivation for On-farm Conservation of Mango (*Mangifera indica*) Diversity in India–A Case Study. *Indian J. Plant Genet. Resour.* 28(1): 1-6.

Joshi BK and D Upadhya (2019) On-farm conservation approaches for agricultural biodiversity in Nepal. *J. Agri. Nat. Resour.* 2(1): 14-35.

Louette D, A Charrier and J Berthaud (1997) *In situ* conservation of maize in Mexico: genetic diversity and maize seed

management in a traditional community. *Econ. Bot.* 51: 20-38.
Mercer KL and HR Perales (2010) Evolutionary response of landraces to climate change in centres of crop diversity. *Evol. Appl.* 3: 480-493.
Muralikrishnan L, RN Padaria, A Dass, AK Choudhary, B Kakade, S Shokralla, TK El-Abedin, KF Almutairi and HO Elansary (2021) Elucidating traditional rice varieties for consilient biotic and abiotic stress management under changing climate with landscape-level rice biodiversity. *Land.* 10(10): 1058.
Myers N, RA Mittermeier, CG Mittermeier, GAB Da Fonseca and J Kent (2000) "Biodiversity hotspots for conservation priorities". *Nature.* 403(6772): 853-858.
Patil S, KS Patil, P Sawarkar and DK Kulkarni (2015) Germplasm conservation of Maize, Sorghum, Millets and vegetables from Dhadgaon and Akkalkuwa tribal block of Nandurbar district, Maharashtra State. *Sci. Res. Rep.* 5(2): 137-146.
Perales H and D Golicher (2014) Mapping the diversity of maize races in Mexico. *PloS one.* 9(12): e114657.
Pimbert M (2009) Towards Food Sovereignty: Reclaiming Autonomous Food Systems. The International Institute for Environment and Development (IIED), pp 1-20
Puneeth GM, R Gowthami, A Katral, KM Laxmisha, R Vasudeva, GP Singh and S Archak (2024) On-farm crop diversity, conservation, importance and value: a case study of landraces from Western Ghats of Karnataka, India. *Sci. Rep.* 14(1): 10712.
Rohini J, ND Mandar and AS Upadhye (2015) Wild Relatives of Crop Plants from Northern Western Ghats of Maharashtra: Diversity and Distribution. *Advances in Plant Sciences and Biotechnology*. Goa University Publisher, India, pp 17-27.
Scaria R (2023) Origin and Evolution of Peninsular India, Western Ghats, and its Diverse Life Forms. In: Aguilar, C.N., Abdulhameed, S., Rodriguez-Herrera, R., Sugathan, S. (eds) Microbial Biodiversity, Biotechnology and Ecosystem Sustainability. *Springer*, Singapore, pp 43-56.
Sthapit B, H Lamers and RV Rao (2013) Custodian farmers of agricultural biodiversity: Selected Profiles from South and South East Asia. Proceedings of Workshop on Custodian Farmers of Agricultural Biodiversity, New Delhi, India.
Subedi A, P Chaudhary, BK Baniya, RB Rana, RK Tiwari, DK Rijal, BR Sthapit and DI Jarvis (2003) Who Maintains Crop Genetic Diversity and How? Implications for On-farm Conservation and Utilization. *Culture Agri.* 25(2): 41-50.
Vandana S (1991) The Violence of the Green Revolution: Ecological Degradation and Political Conflict in Punjab. Zed Books.
Witcombe JR, A Joshi, KD Joshi and BR Sthapit (1996) Farmer participatory crop improvement. Varietal selection and breeding methods and their impact on biodiversity. *Exp. Agri.* 32(4): 445-460.

Supplementary Table 1: Selected crop cultivars under seed production by the community

Crop and landrace	*Specific Traits*
Hyacinth Bean	
Kadu Wal	Growth period 7-8 months, short height, bushy, season-*rabi*, grows on residual soil moisture, resistant to pests and diseases, water stress tolerant, round shaped seed, good market value
God Wal	Growth period 5-6 months, bushy, short height, grows well in shallow soil, pest and disease resistant, good for *dal* preparation
Gavati Ghevda	Climber type, perennial landraces (3-4 years), pod yield- 30-40 kg/plant in season, good market value, water stress tolerant
Butka Ghevda	Perennial, 25-30 kg/plant/year, bush type, pods are small and bold, grain dried and used in food scarcity period in tribal areas, good storage value, good market value
Lal Ghevda	Perennial, grain colour-blackish purple, used for *dal* purpose, good keeping quality, pods for short bold, grows on residual moisture
Sharavan Ghevda	Early maturity, season-*kharif*, short height, bushy, grows well in shallow soil, immature pods used as vegetable purpose, good yielding, long pod
Patadya Ghevda	*Patadya* means more width of pod, young pods used as fresh vegetable, dried seed grains used for curry and also eaten after boiling, perennial (at least 3 years), cultivated in upland, pest and disease resistant, yield about 60-70 kg per plant
Vatana Ghevda	Pod size is small, seeds are as like green pea, good taste, used as fresh vegetable, dried grains for curry preparation, perennial (at least 3 years),cultivated in dry and upland area, yield-20-25 kg per plant
Val Ghevda	Perennial, outer kernel is thick, used as fresh vegetable, curry, *dal* preparation, dry upland land type
Black gram	
Udadi	Dark black coloured seeds, small grain size, dry upland, low water requirement, tasty and nutritious, yield- 2-3 quintal/acre
Udid	Bigger grain size compared to udadi, used for dal, papad, plant height-1 to 1.5 ft, dry upland, grain yield-3-3.5 quintal/acre, crop period-4 months
Cow pea	

Garvi Chavali	Late maturing, reddish coloured grains, crop period-8 months
Halki Chavali	White coloured grains, large pod size, good storage life, maturity period-4 months
Niger	
Gavati Khusani	Dry upland, oil used for facture recovery, pest and disease resistant oil used for daily cooking, cultivated on farm bunds, cake used as feed to animals, grain yield-2-3 quintals/acre
Groundnut	
Khandwa	Growth period - 3-4 months, nut size is bigger, grain colour is deep pink, cultivated in dry upland, grows well in shallow soil, grows in upward direction, more oil percent
Ghungrya-Early	Early maturity (3 months and 15 days), mature nuts sounds well, small nut size, seeds are small, seed colour-white, highest market value, good for taste
Ghungrya-Late	Late maturing (4 months), reddish coloured grains, good for oil purpose, nut size-big, seed size-bold
Gavati Pundya	Late maturity (4 months), spreading habit, less oily, good for direct consumption
Rice	
Kolpi (Early)	Growth period 90-100 days, tall, short fine rice, good for fodder yield and fodder quality, grows well in shallow soil, lodging landrace, non-scented
Kolpi (Late)	Growth period 110-120 days, tall, medium fine rice, non-scented, grows well in shallow soil, good fodder quality, good market value
Ambe Mohor	Growth period 110-120 days, scented, short fine rice, responds well on organic inputs, medium yielding, high market value
Manur	Growth period 90-100 days, short panicle, scented, tall growing, good fodder quality, small fine rice
Raibhog	Growth period 110-120 days, tall, long fine rice, scented, grows well in shallow soil, good fodder quality, good market value, seed colour -brownish
Kalbhat	Growth period 100-110 days, scented, stickiness, long and medium bold, seed colour- blackish violet, good market value, long panicle
Dhavul	Growth period 90-100 days, seed colour-red, grain colour-short panicle, scented, tall growing, good fodder quality, small fine rice
Finger millet	
Nachani (Early) Red	Growth period - 3.5 months, panicle is close shape, grain colour-red, medium height, grows well in shallow and sloppy land, dwarf landrace
Nachnai (Early) white	Growth period - 3.5 months, panicle is close shape, grain colour-white, medium height, grows well in shallow and sloppy land, dwarf landrace
Nachani (Late) Red	Growth period - 4-4.5 months, panicle is open, medium tall, grain colour-red
Green pea	
Kala Vatana	Growth period - 3.5-4 months, *rabi*, grain size-small, round shape, grain colour-blackish, dwarf, grows well on residual moisture, small pods
Gavati Safed Vatana	Growth period - 3.5 months, *rabi*, grain size-small, round shape, small pods, grain colour-white, grows on shallow and poor soil
Horse gram	
Lal Hulga	Growth period - 4 months, kharif season, grain colour-light red, good taste, end use- *vada*, spicy *jelabi*, sprouts as vegetable, shallow soil, Rainfed crop
Safed Hulga (Early)	Growth period - 3.5 months, *kharif* season, grain colour white, medium light soil, Rainfed crop
Gabra Hulga	Growth period - 3.5 months, grain-bold, *kharif* season, grain colour-light black, medium light soil, Rainfed crop