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# On-farm conservation of tropical fruit tree diversity: roles and motivations of custodian farmers and emerging threats and challenges

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## Abstract

**Agricultural biodiversity is shrinking very fast. That said, there are still a few farmers who continue to maintain, innovate and disseminate fruit tree diversity in their home gardens and orchards. The study was conducted in 36 communities of India, Indonesia, Malaysia and Thailand to find out why some farmers do maintain rich fruit tree diversity whereas many do not. The study also aims to answer the following research questions: What conservation practices do farmers do and what are the motivations for their efforts? What are characteristics of such farmers and what are key challenges? Participatory four cell method was carried out amongst the potential custodian farmers, followed by key informant survey and field validation. We found that quite a few farmers maintain rich diversity with few rare and unique fruit tree species or varieties and are mainly driven by conservation ideology. The characteristics of such custodian farmers were identified and found to differ in their functions and motivations. Some functions of custodian farmers are critical for on-farm conservation of tropical fruit tree diversity. The paper also recommends how to consolidate their roles as conserver, innovator and promoter of local fruit tree diversity.**

**Keywords:** on-farm conservation, custodian farmers, agricultural biodiversity, tropical fruit tree diversity

## INTRODUCTION

The global economy's heavy reliance on a narrow diversity of crops puts future food and nutrition security at risk. Over the past century, more than 75% of plant genetic resources have been lost and one third of today's diversity could disappear by 2050 (FAO, 2011). Despite this trend, there are farmers who continue to actively maintain and employ agricultural biodiversity on-farm and who possess the knowledge for its use and cultivation. We recognize them as the "guardians" of diverse crop species and varieties. These farmers select crop varieties adapted to local conditions and preferences, and promote their use and conservation in familial and local networks.

We were interested why some farmers are keen to grow and save seeds of a rich number of crops and varieties, whereas other farmers are either uninterested or have opted to engage in specialized commercial farming. We conducted twenty case studies in India, Indonesia, Malaysia and Thailand to understand the motivations that exist of the custodian farmers to conserve, innovate and disseminate tropical fruit tree diversity. We also wanted to find ways to formally recognize such farmers and create mechanisms to support them to

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manage in situ local crop biodiversity.

Bioversity International, in collaboration with the Indian Council of Agricultural Research (ICAR), the Indonesian Centre for Horticultural Research and Development (ICHORD), the Malaysian Agricultural Research and Development (MARDI) and the Thai Department of Agriculture carried out field studies in thirty-six communities across four countries. The purposes of the study were to: 1) develop a deeper understanding of the roles of custodian farmers in the conservation, use and dissemination of agricultural biodiversity; 2) highlight their contribution to the national plant genetic resources system and sustainable agriculture development in general; and 3) raise their visibility and grant them recognition in the genetic resource management.

In February 2013, the “Workshop on Custodian Farmers of Agricultural Biodiversity: Policy support for their roles in use and conservation” was held by the Global Environment Facility (GEF), the United Nations Environment Programme (UNEP), and Bioversity International in collaboration with the Indian Council of Agricultural Research (ICAR), the National Bureau of Plant Genetic Resources (NBPGR) and the Protection of Plant Varieties and Farmers’ Rights Authority (PPVFRA). This innovative workshop brought global experts on agricultural biodiversity conservation together with twenty custodian farmers from South and South East Asia in order to their share expertise and experiences with one another.

### **Defining custodian farmers**

Custodian farmers are farmers (men and women) who actively maintain, adapt and promote agricultural biodiversity and related knowledge at farm and community levels over an extended period of time, and are recognized by community members for doing so. Often, custodian farmers do not act alone, but rather are actively supported in their efforts by family or household members (Sthapit et al., 2013).

### **METHODOLOGY**

The preliminary selection of custodian farmers does not always take their key functions (such as maintenance, selection/adaptation, promotion and continuity) into consideration. In many cases, at least initially, there is a tendency to identify a village leader or farmer who uses modern varieties and technologies, or to pinpoint a wealthier farmer who has firmer institutional connections. In order to avoid this inherent bias, the following simple guide for selection was provided to national partners:

- Discuss the definition and characteristics of custodian farmers among the implementing partners.
- Identify potential custodian farmers using secondary sources of information.
- Use focus group discussions with the community to further clarify the definition and characteristics of the custodian farmer before gathering information on potential candidates.
- Shortlist five to six potential custodian farmers in each community based on focus group opinions.
- Validate candidates with personal field visits and informal interviews to match the profile and characteristics of a custodian farmer.
- Utilize Four Cell Analysis (a participatory method used to assess the richness level of diversity) (Sthapit et al., 2006) for individual farmers to identify the unique traits or characteristics of the genetic resources they maintain, adapt or promote.
- Most importantly, understand and document the rationale and motivations of the shortlisted farmers by identifying triggers or driving factors that prompted them to assume their conservational practices.

### **RESULTS AND DISCUSSION**

Based on the above-refined definition as well as the representation of custodian farmers present at the workshop, we identified four broad types of custodian farmers within agricultural communities (see Figure 1):

- 1) Farmers who maintain a rich and unique portfolio of species and varieties.
- 2) Farmers who maintain and promote a portfolio of species and varieties.
- 3) Farmers who maintain and adapt a portfolio of species and varieties.
- 4) Farmers who actively maintain, adapt and promote their portfolio of species and varieties.

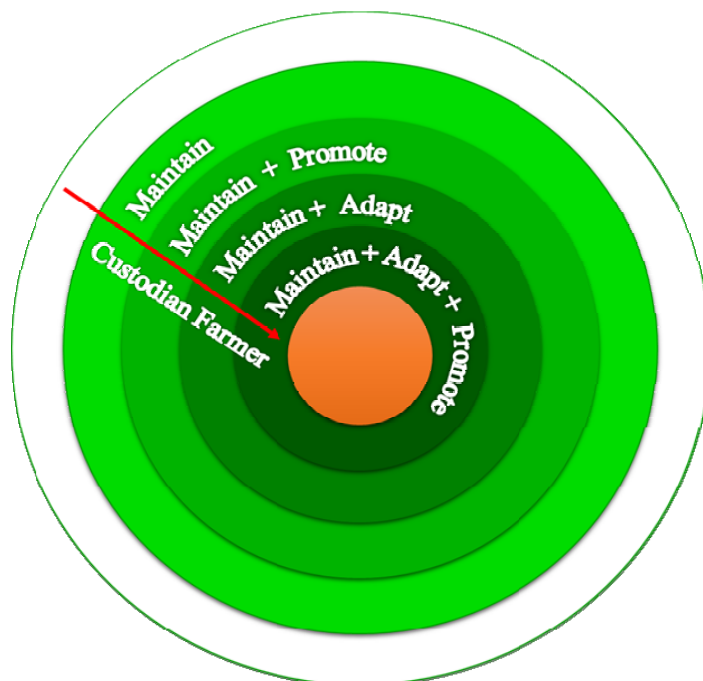


Figure 1. Typology of custodian farmers (Sthapit et al., 2013).

Discussions and case studies suggest that the boundaries distinguishing the different types of custodian farmer may be blurred depending on a given local context due to factors such as crop type, local culture, exposure to new knowledge and settings, and environmental conditions. Therefore, the purpose of this categorization is simply to highlight the diversity of custodian farmers one may expect to encounter in the field.

### Characterization of the custodian farmers

Both the term and concept of a “custodian farmer” are relatively new to the field of in situ and on-farm agricultural biodiversity conservation. Recognized for over a decade now, Subedi et al. (2003) coined them as “nodal farmers” of social seed networks. That said, the general characteristics of custodian farmers observed in our study were: they i) are usually located in diverse agro-ecosystems, ii) maintain rich species and varietal diversity, iii) are driven by a conservation ideology, iv) are rich in eco-agricultural knowledge and varieties with unique traits, and v) are usually willing to share their knowledge and materials with others.

### Sources of motivation

The above-mentioned twenty case studies reveal that the sources of custodian farmer motivation can be diverse: personal, social, economic, cultural, and environmental and policy/legal factors; all, in varying degrees, drive their approach to farming (Table 1 for selected profiles). Nonetheless, such a wide array of motivating factors is only to be expected given the diversity of local conditions, customs, and pre-existing practices.

Table 1. Selected profiles of custodian farmers from South and Southeast Asia.

Country	Custodian farmer	Richness (varieties/species)	Description
Sirsi, India	Dattatreya Hedge	52 mango varieties and 4 <i>Garcinia indica</i>	Cultural and personal hobby driven by passion of local diversity. He is a custodian of 12 unique “appe” mango of the Western Ghats, India. Major source of income is commercial orchard of arecanut, banana, cardamom and pepper but also fruits nursery.
Sirsi, India	Vishweshwar Ganapati Hedge “Eshanna”	25 mango including 14 “appe” mango	The master grafting expert and barefoot breeder of local “appe” mango varieties. Personal zeal to look for best scion of good pickle making varieties from wild as his wife is known expert for pickle making. He also maintains unique <i>Varate Giduga</i> mango variety.
Chittoor, India	K. Ravindranath	24 mango including 4 naati (local)	Sentimental attachment of ancestor’s orchard, source of income, different varieties of fruits and risk avoidance are main drivers of maintaining rich diversity. He also maintains unique varieties such as <i>Lababa</i> , <i>Atimadhuram</i> and <i>Gaddemar</i> .
Chittoor, India	M. Gunashekhar Reddy	15 mango including 4 naati (local)	Inherited orchard from his father; main source of income and livelihood for family well-being. He maintains one of the rarest and unique <i>Peddarasam</i> (sucking type as large as 1 kg fruit with excellent taste and flavour) and <i>Kalepadu</i> (excellent fruit for home consumption).
Malihabad, India	Chhote Lal Kashyap	135 mango varieties including seedling types	Limited resources and poor sandy soils led farmers to search and test portfolio of seedling and grafted mango varieties resulting in highest number of mango varieties in his 2 ha orchard. <i>Tukmi Heera</i> , <i>Deshi Lambui</i> and <i>Tukmi Surkha</i> are unique types.
Malihabad, India	Nawab Hasan	51 mango varieties	A family flair of appreciating and collecting diversity of mango varieties is main driver. His family maintains a range of unique mango varieties such as <i>Matkagola</i> , <i>Paudagaj</i> , <i>Surkha</i> , <i>Nazirpasand</i> , <i>Paan</i> , <i>Navras</i> , <i>Improved Dashehari</i> and <i>Deshi Bombay</i> .
South Kalimantan, Indonesia	Ahmad Kusasi	6 <i>Mangifera</i> spp. with <i>Kasturi</i> , <i>Rawa-rawa</i> , <i>Kuini</i> and <i>Hambawang</i> are unique types	Custodian of six species of <i>Mangifera</i> : <i>casturi</i> , <i>griffithi</i> , <i>odorata</i> ; <i>aplantat</i> , <i>foetida</i> and <i>indica</i> ; 3 varieties of <i>M. foetida</i> ( <i>Hambawang</i> ) in his orchards in Telaga Langsat, South Kalimantan, Indonesia.
East Java, Indonesia	Pak Sudarman	10 varieties of pummelo and other citrus species	Leader and custodian of “Javanese Pummelo” and was motivated to cultivate pummelo from the neighbouring village Sukomoro as source of income and livelihood.
Papar, Malaysia	Palin Along	16 species of tropical fruits; 2 varieties Aroi–Aroi ( <i>Garcinia forbesii</i> )	Despite small size of orchards, he is custodian of underutilized tropical fruit species as personal hobby. He learned to appreciate diversity from his farther. He maintains unique Aroi-Aroi ( <i>Garcinia forbesii</i> ) which has thick skin and used for local cuisine.
Bukit Gantang, Malaysia	Razali Yahya	4 cv. <i>Garcinia atroviridis</i> ( <i>Asamgelugor</i> ), 1 mangosteen and 3 cv of rambutan with 6 other species	He maintains 9 species of tropical fruits in his orchards and known guardian of <i>Asam gelugor</i> . He domesticated planting of wild <i>Garcinia atroviridis</i> ( <i>Asam gelugor</i> ) in agroforestry systems and promoted in the village.
Chiang Mai, Thailand	Suradech Tapuan	21 varieties of mango and 4 wild relatives	A champion of side grafting and custodian of unique mango diversity. He developed unique side grating technique suitable for rainfed conditions. He has passion to graft and cultivate multiple varieties of mango in a single tree.

### **Searching, selecting and maintaining tropical fruit tree diversity**

The study confirmed that custodian farmers exist in all of the countries examined and play a distinct and important role in the agricultural systems thereof. They maintain and conserve a wide range of tropical fruit tree species and varieties based on their own interests and local context. Often nodal points for the informal exchange of seed and plant material among farmers, they are also important providers of materials and related knowledge to breeders and seed distribution programs. Custodian farmers provide the key function of linking traditional and modern seed systems, and through their efforts contribute to the evolutionary process of crop adaptation in a dynamic and competitive arena. However, though their roles as conserver, innovator and promoter are well appreciated in local communities, in reality their rights and contributions go unnoticed or unrecognized at the national and global policy levels.

### **Continuity**

Although in some farm families custodianship will be passed on to the next generation, this method of transmission is by no means guaranteed. In light of increasing rural migration and higher education rates, the new generation of custodian farmers is by no means unanimously keen on continuing their parents' work. That said, a proposed mechanism that will work to maintain custodianship is the establishment of a network in which the "tenure" of one custodian farmer can be taken over or shared by other partnered farmers when they are no longer capable of continuing their efforts. Potential manifestations of this mechanism include community gardens or seed banks that will help to preserve current information while linking it to young and future farmers.

### **Challenges**

The important role custodian farmers play in conservation, innovation and development is often underestimated, undervalued and unrecognized. This can be attributed to the relative rarity of such farmers combined with their lack of connection to mainstream research and development networks. One current challenge is to develop mechanisms that establish connections between custodian farmers, the larger network of regional farmers, and both national and international genetic resource systems.

Identification and selection of the best fruit trees from farmer-managed genetic resources can provide immediate benefits to communities. Sthapit and Rao (2009) have proposed a simple process by which custodian farmers' unique/rare/elite varieties could be formally registered and thus enter into the commercial multiplication and distribution system. That said, policy barriers could present a challenge to the wider recognition of materials developed by custodian farmers. One potential method of addressing this obstacle would be to require prior informed consent in order to provide access to benefit sharing mechanisms the farmer's develop.

Further development of the framework of responsibilities and rights of custodian farmers in those countries is essential where a relevant policy is not in place. This includes the right to participate in national decision making processes and benefit-sharing policies as well as international agreements. This will only become possible if we advocate for the formal recognition of custodian farmers, similar to the special recognition already afforded to outstanding progressive farmers or genebank curators as stewards of the world's food and nutritional security.

### **Recommendations**

- Assess the importance of custodian farmers for on-farm/in situ conservation of local crop diversity and consolidate their roles as conserver, innovator and promoter of local fruit tree diversity.
- Establish custodian farmers' networks as an integral part of national and international conservation strategies and link them directly to agricultural biodiversity conservation institutions (e.g. genebanks to document diversity and involve custodian farmers in research programs).

- Use a community-based approach to improve the capacities of custodian farmers on: i) the protection of traditional knowledge of Plant Genetic Resources for Food and Agriculture (PGRFA), through documentation, use and conservation of traditional knowledge (e.g. community fruit catalogue, community biodiversity register etc.), ii) the right to save, use, exchange and self-farm saved seed/planting material (e.g. community seed bank, and participatory crop improvement), iii) the right to participate in decision making at the national level on matters of conservation and the use of PGRFA, as well as overall community development (e.g. community biodiversity management, establishing community biodiversity management (CBM) fund, etc.), iv) the right to equitably participate in benefit sharing arising from the utilization of PGRFA by creating economic and nutritional benefits (e.g. product development, marketing and home processing).
- Support locally-driven CBM funds that can directly maintain the multiplication and exchange of rare and unique materials at the local level.

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