1 On-farm and \textit{in situ} conservation of tropical fruit tree diversity

Context and conceptual framework

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The origins of the book

Wild and cultivated tropical fruit tree diversity in Asia is threatened by rapid genetic erosion due to the destruction of natural ecosystems, commercialization, land use changes, global climate change and a variety of other socio-economic and cultural pressures. Despite these pressures, some farmers continue to successfully manage a range of tropical fruit tree diversity in different production systems, reaping benefits in terms of nutritional and food security, income-generating opportunities, ecosystem services or cultural identity. They identify, select, propagate, manage, use and promote fruit tree diversity through local social networks, market linkages, community rules and local customary practices. These unique management practices can serve as a valuable knowledge base for the sustainable management of tropical fruit tree genetic resources in other geographic areas with similar social, economic and ecological contexts today and in the future. This book aims to document these good practices for maintaining diversity so that farmers and other practitioners can fully and sustainably benefit from the unique diversity conserved in and near their lands. The identification of good practices can help researchers, government institutions and other farmer-support organizations to plan and conduct better informed and targeted interventions within their on-farm and \textit{in situ} conservation programmes and projects.

From 2009 to 2014, Bioversity International coordinated a research-for-development project supported by the Global Environment Facility (GEF) with implementation support from the United Nations Environment Programme (UNEP), ‘Conservation and sustainable use of cultivated and wild tropical fruit tree diversity: sustainable livelihoods, food security and ecosystem services’, abbreviated as the ‘TFTGR Project’. This project, implemented in India, Indonesia, Malaysia and Thailand, focused on livelihood and environment
benefits that people could derive from the conservation of species and varietal diversity of *Citrus*, *Garcinia*, *Mangifera* and *Nephelium*. These common tropical fruits include mandarin (*C. reticulata*), pomelo (*C. grandis*), mangosteen (*G. mangostana*), mango (*M. indica*) rambutan (*N. lappaceum*) and their edible wild relatives.

**Why a focus on conservation of tropical fruit trees?**

Tropical Asian countries are the centre of origin and diversity of many globally important tropical fruit tree species and their wild relatives. These species contribute to the well-being of human communities by providing a source of supplementary food, sustaining healthy diets and enhancing both household incomes and national revenues (Arora and Ramanatha Rao, 1998).

Fruit trees have recalcitrant seeds (i.e. they die if dried or frozen), which means that they cannot easily be maintained in genebanks. This makes it important to find solutions for their on-farm and *in situ* conservation. Natural reproduction of tropical fruit trees requires hot and humid conditions for germination and depends largely on their interaction with animal pollinators and fruit and seed dispersers. This unique reproduction system together with their perennial nature raises specific challenges (long investment period before initial fruiting, difficulty in propagation, limited breeding potential) and opportunities (long productive lifespan, low labour input crop, staggered harvest timings). It also determines their specific role in the agroecosystem as host and food source for pollinators, shade provider, conserver of soil organic matter, nutrient recycling enhancer, food for wild fauna and retainer of water.

Tropical fruit tree species have traditionally been selected to suit the specific hot and humid environments in which they have been cultivated or to satisfy the particular needs and preferences of local growers and consumers. Through natural selection processes, wild tropical fruit species found in this region have developed specific adaptive traits and qualities. Farmers’ varieties grown in fields and gardens are the products of domestication of wild trees taken from natural forest areas, then subjected to the historical process of farmers’ continued selection for preferred traits over several generations and for their sustainable management practices in traditional systems: agroecosystems (such as buffer zones surrounding villages, borders between farm fields or along paths), horticultural (semi-commercial or commercial orchards) or agri-silvicultural (home gardens or agroforestry). These management practices have been defined as on-farm conservation (Altieri and Merrick, 1987; Bellon, 1996; 2004; Maxted *et al.*., 2002). See Chapter 2 for a more detailed account of on-farm conservation. Planting materials of tropical fruit tree diversity tend to be sourced via social networks, where certain individuals with superior enthusiasm, skills and knowledge (‘custodian farmers’) play a key role (Sthapit *et al.*, 2013). See Chapter 4 for discussion of the concept of custodian farmer.

Despite their cultural and economic importance in Asia, there has been a lack of extensive research on the cultivation and management of these perennial
tropical fruit tree species. Global and national investment in tropical fruit tree research is meagre because of the high costs, length of time needed and the limited economic importance and critical research mass of these species in Western countries. In such a context, a cost effective and efficient method for research-for-development interventions is to identify ‘good practices’ from scientific research and from farmers’ innovation, which can be tested on site, strengthened and tried out in new sites (Figure 1.1).

The rest of this chapter will (1) provide a conceptual framework for what constitutes a ‘good practice’ in the context of on-farm and *in situ* conservation of tropical fruit tree diversity; (2) outline the steps taken to identify good practices for diversity management of tropical fruit trees; and (3) outline the main findings about categories, types and contexts of good practices as an analytical tool. Then in Chapter 2 more detail is given on key concepts used in this book; in Chapter 3 the characteristics of Community Biodiversity Management (CBM) are discussed, an approach whose principles underpin this research; and in Chapter 4 one of the major findings of this research, the existence and role of ‘custodian farmers’, is considered. Part 2 consists of six chapters from experts from countries outside the project countries to expand the scope of the book and to give the current status and examples of good practices found elsewhere. In Part 3 we present 19 case studies (that were selected from 33 original case studies), each documenting, under four different

![Figure 1.1](image-url) **Figure 1.1** Impact pathway for enhanced community well-being and conservation of tropical fruit tree diversity.
categories, different good practices for diversity identified and tested during the project. Finally, in Part 4 we share reflections on identifying, documenting, piloting and mainstreaming good practices for diversity management and offer principles for identifying and using good practices for diversity as a combined livelihood and conservation tool, based on the lessons learned during the project.

Good practices

‘Good practice’ and ‘best practice’ are widely used terms in agriculture, manufacturing and the processing of products. Often they refer to a farm or production technique that can be adopted by farmers or companies to improve harvest yields or ensure the standardized quality of products. They are often measurable practices that include certification schemes to ensure compliance towards agreed standards. In the context of biodiversity conservation and poverty alleviation, good practices are considered by the Convention on Biological Diversity (CBD) to be an effective way to document and share tools, instruments and methods (CBD, undated; Gemmill, 2001). Sometimes the term ‘best practice’ is also used, but we consider ‘good practice’ more acceptable due to the complexity of on-farm conservation practices and the inability to measure or compare practices (GEF, 2001).

Practices are considered ‘good’ when they effectively work towards the achievement of certain objectives under a given set of conditions or contexts. A practice can be a technique, a method, a process, an institutional arrangement or any combination of these. Good practices should follow some criteria, as they should be practical, cost-efficient, sustainable, and have the potential for scaling up to wider geographical, institutional and socio-cultural spheres (Sthapit et al., 2003).

A good practice for diversity management is defined as a system, organization or process that over time and space maintains, enhances and creates crop genetic diversity and ensures its availability to and from farmers and other actors for improved livelihoods on a sustainable basis. It is abbreviated as GPD (Sthapit et al., 2003).

The argument for a focus on good practices is that it constitutes a low-cost approach for on-farm and in situ conservation. Instead of starting from scratch, it allows the practitioner (whether a farmer, an extension agent or a researcher) first to recognize and understand existing practices and then to build further on these. A wealth of documented case studies exist about the functions and values of agricultural biodiversity (Frankel and Soule, 1981; Brush, 2000; Maxted et al., 2002; Bellon, 2004; Smale et al., 2004; Heywood and Dulloo, 2005; Jarvis et al., 2007; 2011); however, limited research has focused on what could be successful intervention strategies for on-farm and in situ conservation, how to strengthen or promote agricultural biodiversity efficiently and effectively on the ground, and what approaches can be systematically replicated that government agencies can support. This book strives to fill this gap by exploring
the concept of good practice as a means to understand and improve on-farm and in situ conservation efforts of farmers, communities and researchers around the world. In particular, it looks at the good practices involved in managing and conserving tropical fruit tree diversity.

As many farmers’ livelihoods depend on the success of their crops in any given year, good practices are key for perpetuating a long-term cycle of sustainable development and livelihood improvement. GPDs combine the achievement of both improved livelihoods and conservation in a given context. Most GPDs stem from traditional agricultural practices. In agricultural research, large-scale monocropping and modern agricultural practices have tended to be the main interventions considered for improving the livelihoods of farmers, thus contributing to loss of varietal and species diversity as well as traditional agricultural practices. Our contention is that these interventions are not the most appropriate in all contexts. Biological diversity and traditional systems can help many a poor smallholder farmer to improve their livelihood as they are better adapted to local socio-economic and environmental conditions and give farmers a range of options to manage climate or market risks. These risks are especially apparent in regions that can be characterized as remote, marginal and with limited market infrastructure, the areas where agricultural biodiversity is mostly still found and where high input-oriented monocropping systems often have had limited positive impacts on livelihoods. Farmers make their livelihood decisions based on multiple types of benefits in which home use and social and cultural factors play a major role besides private economic gains. What we see on the ground is that farmers often combine modern and traditional farming practices (and seed materials) that best suit their own interests and support their individual instinct for innovation and survival. In Chapters 3 and 4 we elaborate more on how conservation practices are embedded within sustainable livelihoods, and in Chapter 22 on the contribution of markets to conservation practices.

Thus, good practices can be farmers’ own innovations or can be developed by formal research and development agencies and later adapted by farming communities in a variety of local contexts. In this book we focus first on farmer-innovated practices, as these tend to be overlooked by the research and government sectors. We also provide, however, examples of contexts where farmer-innovated practices did not exist and where the adoption of practices developed by the formal sector has allowed farmers to create livelihood gains and improve the management of plant genetic diversity on farm. Additionally we invited external experts to share their own experiences and perceptions of good practice to expand the scope of the book. See Table 1.1 for a summary.

**Process of identifying good practices**

The process used for identifying good practices for the conservation and sustainable use of tropical fruit tree diversity included the following steps:
1. A literature review to attain a better conceptual understanding of GPDs within the wider context of (a) on-farm and *in situ* conservation, (b) sustainable livelihoods, (c) Community Biodiversity Management (CBM) and (d) the specific context of cultivated and wild tropical fruit tree species.

2. A workshop with experts and partner institutions to understand and agree on the definition, types, evaluation criteria and methodology for the identification and promotion of good practices. Through discussions at this workshop, four broad topic areas were identified by which good practices maintain and enhance tropical fruit tree diversity:
   - propagation and planting material management
   - production and crop management
   - commercialization and home use
   - collective action and social networking

3. Inventory of potential good practices. Multiple sources of information and collection methods were used to inventory good practices: (1) review of scientific and popular literature, (2) review of case studies as encountered in the field, (3) formulation of additional case studies based on interviews and direct field observations with specific individuals and (4) experimental learning and innovation based on ongoing projects and case studies.

4. Development and refinement of evaluation criteria. A set of descriptors for good practices was developed from the good practice definition that served as a starting point for describing, characterizing and rapidly screening good practices to shortlist selected good practices for further research (Box 1.1).

5. Further development of conceptual framework. Given the multiple desired outcomes of livelihood and conservation benefits, it was agreed to use a sustainable livelihood framework when piloting and assessing good practices for diversity (Sajise, 2005; Sajise and Keizer, 2005). The sustainable livelihood framework recognizes five different forms of capital or assets of a household – human, social, natural, financial and physical – and explains how they are deployed by household members in livelihood activities to achieve certain livelihood goals and to deal with external shocks, uncertainties or policies (DFID, 1999). See Chapter 2 for more details on this framework. In the sustainable livelihood framework, agricultural biodiversity is embedded within the asset of natural capital – the seeds or tree crops that the farming households possess – but it is also part of the external environment in which the household lives, through the provision of ecosystem services such as lower pest and disease pressure, shade or the retention of water, which they enjoy from the direct local environment. Despite rich bio-wealth and traditional knowledge, poor and smallholder farmers often feel helpless when dealing with their current situations and, therefore, empowering such farmers to develop self-confidence through social capital building and livelihood enhancement is one essential part of good practice interventions.
6. Analysis of selected good practices to identify ways to strengthen the good practice on site and how to replicate it elsewhere. National partners were requested to follow a specific outline (3–5 pages long) and provide a few key tables to describe the good practices. Every good practice proposed was described and analyzed using the five assets of the sustainable livelihood framework to understand how the practice affects livelihoods and could be improved and implemented. In addition, all practices were analyzed by describing the driving forces and barriers favouring or hindering success.

7. Exploration of ways to strengthen existing good practices. The project used a CBM approach, which is a participatory methodology supporting community empowerment through diversified use of biodiversity resources. Many research-for-development tools have been developed in

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**Box 1.1 Descriptors for screening good practices for diversity (GPD) derived from the good practice definition**

1. GPD in action over time and space  
   Description: GPD that has been in use for more than one year and in more than one location  
   0 = not sure, 1 = no, 2 = yes

2. GPD crop genetic diversity  
   Description: Describe the GPD impact on crop genetic diversity  
   –1 = reduces, 0 = no impact or not sure, 1 = maintains, 2 = enhances, 3 = creates

3. Genetic diversity availability to and from farmers  
   Description: Indicate whether the crop genetic diversity used for implementing the practice is available to farmers and others  
   0 = not available or not sure, 1 = available to farmers, 2 = derived from farmer knowledge, 3 = available to and derived from farmer knowledge

4. GPD improving livelihoods  
   Description: Indicate if the GPD has any impact on improving the livelihoods of farmers  
   0 = not sure, 1 = no, 2 = yes

5. GPD is economically sustainable  
   0 = not sure, 1 = no, 2 = yes
the context of the CBM approach (e.g. Four Cell Analysis, Diversity Fairs, Diversity Kits, Participatory Diversity Selection, CBM fund), with the aim of strengthening and facilitating existing processes. This methodology and tools are described in more detail in Chapter 3.

8. Further analyses. Papers presented by the national partners and international experts were reviewed to draw lessons and principles from the key areas of research identified. Some of these are outlined in Part 4.

What we found

Contexts of good practice

Tropical fruit tree genetic resources were found to be traditionally managed in two overarching contexts:

- in communities interacting with natural forests or protected areas, mostly in remote hilly to mountainous landscapes with limited access to services and support systems including markets
- in on-farm or home garden systems or orchards in which communities are engaged in intensive horticultural practices in flat agricultural landscapes with good access to markets by substantial physical infrastructure such as power, roads and communications.

Context 1: Natural forests and protected areas

The majority of wild fruit tree species cannot be conserved *ex situ* in plantations or field genebanks because of biological, technical and resource limitations. Most so-called field genebanks for fruit tree species actually do not conserve genetic diversity but only elite materials (i.e. trees have undergone at least one cycle of selection at the time of sample collection) for fruit tree improvement researchers. Conserving a wide range of tropical tree species such as mango, durian, rambutan, breadfruit and jackfruits is practical in natural forests and protected areas as the size and canopy of trees is too large in home gardens and orchards. Therefore, the conservation of tropical fruit genetic resources relies heavily on *in situ* conservation efforts in public or semi-public lands (see Chapters 2 and 5 for more on *in situ* conservation). Guidelines for tree and forest genetic resource conservation and management *in situ* in managed natural forests and protected areas are already published jointly by FAO, DFSC and IPGRI (2001), but they do not recognize the role of human intervention in natural ecosystems. The roles farmers and communities play in managing wild tropical fruit tree species diversity are increasingly recognized but still limited and, as a result, traditional ecological knowledge and good practices for such management systems are eroding fast. Community roles in *in situ* conservation in buffer zones, community forests, sacred groves and religious forests require supportive national and local level policies, which are often lacking, weak or
threatened because development-oriented land use policies usually ignore farmers’ long-term needs.

**Context 2: Home gardens, orchards and nurseries**

Home gardens are plots located adjacent or in close proximity to a given homestead, in which a range of crops and trees are maintained for numerous culinary, medicinal and cultural purposes. Home gardens are a time-tested traditional practice throughout tropical countries, where combinations of trees, crops and animal and aquatic biodiversity are managed by family members for household food supply, income and well-being (Soemarwoto, 1987; Eyzaguirre and Linares, 2004; Kumar and Nair, 2006; Gautam et al., 2009). Although the effective population size of target fruit trees in a single home garden can be limited for on-farm conservation, a landscape of home gardens tends to maintain a wide range of high-value, unique and rare fruit trees. These landscapes have been found to be a place for blending traditional knowledge with scientific knowledge through farmers’ experimentation and innovations. Most of the custodian farmers identified (Sthapit et al., 2013 and Chapter 4) have well-tended home gardens that harbour a rich diversity of tropical fruits. Networks of such home gardens might represent a bigger population size for maintaining reproductive biology of taxa. Home garden systems play an important role in the preservation of indigenous traditional knowledge, as they are often organized and defined by a set of traditional management mechanisms that do not always translate into large-scale or commercialized configurations such as orchards and nurseries.

Semi-commercial orchards and nurseries are two additional contexts in which innovative propagation and management techniques are displayed for using diversity. These settings differ from home gardens in several respects, though the main contrast is that they are often less diverse, focusing on commercial species and varieties that offer more direct economic incentives and benefits to the farmers who own them. Chapter 18 describes how varietal diversity is used by commercial farmers to minimize risk and improve yields, and how it is used to increase incomes through sales.

**Categories of good practice**

*Propagation and planting material management*

In many communities, a major constraining factor farmers face when attempting to expand the diversity and overall size of their seed portfolios is a lack of access to adequate planting materials. As such, developing and implementing good practices for propagation at the nursery level is key to encouraging the cultivation of a diverse seed portfolio.

Responsibly using naturally occurring wild fruit diversity and domesticating economically important fruit diversity from forests, combined with sharing
knowledge and skills relating to propagation and management with local communities, plays an important role in tropical fruit tree conservation efforts. One example of this is seen in India, where communities in the proximity of natural or community forests harvest wild mango varieties such as Appemidi and Jeerige for pickle making, which contributes significant income to the livelihoods of local people. Farmers were able to collectively identify the large number of varieties of pickle mangoes that exist in the forest. They verified the best trees and standardized grafting techniques. Expert grafters now graft pickle mangoes in their friends’ and families’ home gardens or orchards (see Chapters 11 and 28).

A number of the case studies in this book relate to propagation and planting material management techniques for home garden systems. For instance, Chapters 11, 16 and 19 depict the manner in which home gardens in Indonesia, India and Malaysia integrate a variety of plant and animal species in an intensive farming arrangement as a way to conserve and enhance mango and citrus varietal diversity while generating an additional source of household income, all the while minimizing waste and providing a valuable set of ecosystem services. Farmers have developed context-specific propagation methods, for example, side grafting in dry areas of Thailand (Chapter 15) and marcotting of citrus in swampy peat land conditions in South Kalimantan (Chapter 14). Chapter 12 illustrates traditional practices of planting seedling mango as a thick boundary fence and assessing potential best varieties as a source of diversity.

Semi-commercial orchards and nurseries tend to be hotspots of innovative propagation techniques. For instance, Chapter 13 discusses maintenance of mother block seed production used by orchard owners in India that strengthens the local seed system, supplies healthy saplings, increases the yield and quality of fruit and improves overall orchard health and life span estimates. Similarly, Chapter 11 describes how a farmer has experimented with grafting methods to be able to introduce wild species into his semi-commercial orchard and Chapter 28 describes how a network of farmers with excellent propagation skills provide grafting services to their fellow villagers with home gardens and orchards. Sets of such practices help maintain diversity and increase crop productivity.

Production and crop management

Another broad topic this book emphasizes is good production and crop management practices for home gardens, orchards and other settings. Once a sustainable source of seed and planting material has been established, farmers must optimize their use of these resources when confronted with limited spatial, financial and technical inputs.

The greater land area and more direct economic connections of orchards and nurseries make them ideal sites for experimenting with and implementing distinctive management and production practices. Chapter 12 presents a study of historic heritage orchards in Malihabad, India, some of which contain as
many as 135 different varieties of mango that are managed using unique, time-tested techniques passed down from generation to generation of farmers. Systems such as this often house a startling array of diversity due to a combination of social, cultural and economic interests, all of which tend to intersect in semi-commercial institutions like orchards and nurseries. One low-cost and efficient strategy is to identify the best trees available in the community, characterize and evaluate them and further multiply them for community benefits (Dinesh et al., 2015). Chapter 17 shows how the needs of a traditional Hindu festival ensure the maintenance of a range of fruit species and in particular a genetically highly variable population of pomelo in home gardens in Bihar, India. Chapter 18 describes how varietal diversity is used in commercial orchards in Chittoor, India to lengthen harvest seasons, manage risk, avoid the glut season and improve productivity and pollination services. Chapter 20, from Thailand, demonstrates sustainable use of Garcinia fusca by holistic production and management practices, whereas Chapter 21 showcases the example of successful post-harvest management practices to support the livelihoods of aroi aroi (G. forbesii) farmers and genetic resources in home gardens and orchards in Subah, Malaysia.

Commercialization and home use

Several chapters in this book focus on how farmers establish market linkages and use commercialization of local biodiversity as a means to improve livelihoods. While historically the commercialization of agricultural systems had a negative impact on local agricultural biodiversity (see Chapter 22), a number of the good practices recorded in this book showcase different ways in which local communities have constructively engaged with markets in such a way as to support and promote the maintenance and enhancement of tropical fruit tree diversity by providing income, among other livelihood benefits in order to ensure a win–win situation of conservation and income generation. The nearly ubiquitous presence of markets in agriculture, even in remote, biodiverse regions, and the importance of providing economic incentives and benefits to farmers make it important to find ways to sustainably use and commercialize native biodiversity. Three primary strategies by which markets can contribute to the commercialization and conservation of tropical fruit tree diversity demonstrated in this book are: (1) by making the local agroecosystem and diversity an economically competitive good through community-based agrotourism (Chapters 22, 23 and 24); (2) by product development in conjunction with the creation of market links based on unique native fruit tree species and landraces (Chapters 24 and 25); and (c) by premiums or rewards paid by consumers or companies for conservation services conducted by local communities (Chapters 21 and 24 on the contribution of markets and Chapter 20 on G. fusca in Thailand).

Chapter 23 describes the establishment of a fruit diversity garden and trekking route for tourists in Sarawak, Malaysia. Chapter 25 summarizes how...
a self-empowered women’s group in Thailand successfully commercialized a unique local dish that uses a local species, *G. cowa*, for its particular flavour. Another example of how local agricultural biodiversity can contribute to the creation of added-value products is showcased in Chapter 28, describing the development of mango pickle made from carefully selected varieties of a unique aromatic type of mango found only in the Western Ghats of India. The establishment of several commercial activities at a community level, as presented in Chapter 24 by the community groups of Kiriwong village in Thailand, is a prime example of a practice that combines the strategies described above. This case study shows how several groups could organize themselves and sell a range of products from *Garcinia* species, along with using their protected local natural landscape to attract tourists. This type of value chain development often entails the provision of external support to local communities in the form of training in processing, financial loans or grants and help with economic and marketing expertise.

**Collective action and social networks**

The last theme this book covers relates to how good farmer practices form working modalities with a range of actors hailing from local, political and commercial spheres. Part of creating market linkages and providing livelihood benefits to rural and impoverished communities relies on the institutional and personal relationships they have with others capable of providing much needed capital assistance. As the case studies presented in this volume demonstrate, this social capital support can come in a number of different forms, from rallying political influence for policy ends to harnessing social and human capital in the form of collective action initiatives. Diversity fairs, CBM funds and income generation activities organized by farmers’ self-help groups are good practices for social capital building (Chapters 3, 20, 24, 25 and 29). One manifestation of this theme can be observed in Chapter 23, a case study relating to the establishment of a tropical fruit tree agrotourism park in Malaysia. It illustrates the manner in which tapping a wide collection of sources for technical and material support can lead to a sustainable mechanism for preserving and expanding tropical fruit tree biodiversity in conjunction with a host of livelihood benefits. We observed that empowering farming communities and their local institutions for self-directed conservation and development goals by capitalizing tropical fruit tree diversity is challenging and a long-term investment. Developing skills and knowledge, raising awareness of the potential values of local biodiversity resources, exploring market linkages and setting up a CBO (community-based organization) do not require a long time, but institutionalizing practices and being able to work in a self-sustaining way require at least 8–10 years. Often external agencies, such as funding partners, have little patience for this persistent effort. Chapters 24 and 25 show examples where collective action has been formed in the villages of Kiriwong and Trok Nong, Thailand, with a view to facilitating this kind of institutional, transformative
change, but it is early to assess whether the changes will be long lasting. We also noticed emerging collective action and leadership by the farmer organization in India called the Society for Conservation of Mango Diversity (SCMD) (Chapters 12 and 29) in a time frame of four to five years of social capital building.

Typology of good practices

Since a good practice can be a process, a method, a technique, an institutional arrangement or any combination of these, a typology was developed to better understand good practices in the context of a sustainable livelihood framework. Three key questions – what? (Techniques), how? (Processes) and in what ways? (Methods) – are posed to gain a conceptual grasp of good practices and how they can be better documented, so that piloting and scaling up of good practices can be practical, cost-effective and simple to implement.

Scaling up and out

There are challenges in adopting a GPD in a new context and place. During the piloting and implementation period, several workshops at various levels and cross-site visits by farmers, development workers and researchers were carried out in anticipation of mainstreaming some of the GPDs. Experience showed that GPDs cannot simply be ‘copied and pasted’ but instead need to be de-packaged by researchers or farmers and re-packaged to suit their own local context. For example, farmers and researchers from Sirsi in India saw a household-level cottage industry of soap, candle and shampoo preparation from G. mangostana and oilpalm among woman farmer entrepreneurs in Kuching, Sarawak but adapted the practice to produce candles made of kokum (G. indica). In Malaysia and Thailand, nursery owners display colour pictures of fruit along with young saplings in order to provide varietal information and facilitate customers in their purchase decisions. This idea was picked up by practitioners from the Sirsi site, who are now using information from the community fruit catalogues for marketing purposes. A side-grafting idea from Thailand has been tried for grafting multiple scions in the Malihabad site in India, while the multivarietal orchards idea from India was transferred as labelling diversity blocks in natural private land or community home gardens in East Java. The Thai packaging skills for value added products are well appreciated by all other countries, but it has been found difficult to transfer this skill set to other country contexts. Even within the same country, we cannot assume that good practices will be transferred without facilitation. Farmers and researchers from Sisaket, Thailand, learned tie dye fabric dyeing using natural dyes extracted from the by-products of tropical fruits from the Kiriwong community also in Thailand, through project activities (Chapters 20 and 24). This kind of social learning and local innovation can be created using a CBM approach. It is enhanced by organizing opportunities for farmer-to-farmer knowledge sharing and exchange visits.
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<th>Chapter</th>
<th>Practice</th>
<th>Focus: (a) propagation and planting material management, (b) production and crop management, (c) commercialization and home use, (d) collective action and social networking</th>
<th>Context (i.e. wild or home garden, orchard)</th>
<th>Type (i.e. system, technique, process, method, institution)</th>
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<td>Overarching, holistic</td>
<td>On farm and home gardens</td>
<td>Method</td>
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<td>Good practices for conservation and sustainable use of crop wild relatives of tropical fruit tree diversity</td>
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<td>Exotic and indigenous fruit tree diversity on farm and the conservation of tree genetic resources: Case studies from sub-Saharan Africa</td>
<td>(a) Propagation and planting material (b) Production and crop management</td>
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<td>Method</td>
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<td>Good practice: Using intraspecific crop diversity to manage pests and pathogens in China</td>
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<td>Method</td>
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<td>Kandyan home gardens: A time-tested good practice from Sri Lanka for conserving tropical fruit tree diversity</td>
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<td>Farmer ++</td>
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<tr>
<td>11</td>
<td>A suite of propagation and management techniques for <em>Garcinia</em> in the central Western Ghats region of Karnataka, India</td>
<td>(a) Propagation and planting material</td>
<td>Forest Technique</td>
<td>Farmer ++</td>
<td></td>
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<tr>
<td>12</td>
<td>A set of interconnected practices which enhances and conserves mango diversity in Malihabad, India</td>
<td>(a) Propagation and planting material (b) Production and crop management</td>
<td>Home gardens, orchard</td>
<td>Farmer ++</td>
<td></td>
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<tr>
<td>13</td>
<td>Maintenance of mother blocks of <em>Citrus</em> rootstocks by farmers and nurseries for production of quality planting materials</td>
<td>(a) Propagation and planting material (b) Production and crop management (d) Collective action and social networking</td>
<td>On-farm mother block nurseries System with technique</td>
<td>Farmer +++</td>
<td></td>
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<tr>
<td>14</td>
<td>Marcotting as good practice in community nursery of citrus for maintaining diversity in south Kalimantan, Indonesia</td>
<td>(a) Propagation and planting material (b) Production and crop management</td>
<td>Home gardens, orchards</td>
<td>Farmer ++</td>
<td></td>
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<tr>
<td>15</td>
<td>Combination of side-grafting technique and informal germplasm exchange system in non-irrigated mango orchards in Thailand</td>
<td>(a) Propagation and planting material (b) Production and crop management</td>
<td>Home gardens, orchards, commercial orchards</td>
<td>Farmer +++</td>
<td></td>
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<tr>
<td>16</td>
<td>Propagation technique and pruning techniques of <em>Garcinia atroviridis</em> (asam gelugor) in Bukit Gantang, Perak, Malaysia</td>
<td>(a) Propagation and planting material (b) Production and crop management</td>
<td>Home gardens, orchards</td>
<td>Farmer +++</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chapter</td>
<td>Practice</td>
<td>Focus: (a) propagation and planting material management, (b) production and crop management, (c) commercialization and home use, (d) collective action and social networking</td>
<td>Context (i.e. wild or home garden, orchard)</td>
<td>Type (i.e. system, technique, process, method, institution)</td>
<td>Farmer or formally innovated</td>
<td>Scope for scaling up and out (+ little, ++ moderate, +++ high)</td>
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<tr>
<td>17</td>
<td>The role of a traditional festival, Chhath Puja, in the conservation and sustainable use of tropical fruits</td>
<td>(b) Production and crop management (d) Collective action and social networking</td>
<td>Home gardens</td>
<td>System</td>
<td>Farmer, culture</td>
<td>++</td>
</tr>
<tr>
<td>18</td>
<td>Multivarietal orchards – an age old conservation practice in mango mango</td>
<td>(b) Production and crop management</td>
<td>Home gardens and orchards</td>
<td>System</td>
<td>Farmer</td>
<td>+++</td>
</tr>
<tr>
<td>19</td>
<td>Integrated home gardens for maintaining diversity of mango and citrus, and for family well-being in East Java</td>
<td>All four categories</td>
<td>Home gardens</td>
<td>System</td>
<td>Farmer</td>
<td>+++</td>
</tr>
<tr>
<td>20</td>
<td>Management of <em>Garcinia fusca</em> for sustainable use</td>
<td>(a) Propagation and planting material (b) Production and crop management (d) Collective action and social networking</td>
<td>Wild and home gardens</td>
<td>System</td>
<td>Blended</td>
<td>++</td>
</tr>
<tr>
<td>21</td>
<td>Production and management of an underutilized fruit: aroi aroi <em>Garcinia forbesii</em> King in home gardens or orchards</td>
<td>(b) Production and crop management</td>
<td>Home gardens, orchards</td>
<td>Technique</td>
<td>Formal</td>
<td>++</td>
</tr>
<tr>
<td>23</td>
<td>Agrotourism in Kampung Kakeng, Serian: Development and challenges</td>
<td>All four categories</td>
<td>Natural forest and home gardens</td>
<td>Combination of system, method, technique, institution</td>
<td>Formal</td>
<td>++</td>
</tr>
<tr>
<td>No.</td>
<td>Description</td>
<td>Categories</td>
<td>All and Community</td>
<td>Formal</td>
<td>Blended</td>
<td>++</td>
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<tr>
<td>24</td>
<td>Conserving tropical fruit tree diversity by using their products and promoting agrotourism: Lessons from an empowered community in Southern Thailand</td>
<td>All four categories</td>
<td>Home gardens, Combined gardens, agroforestry, technique, institution</td>
<td>++</td>
<td>+++</td>
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<tr>
<td>25</td>
<td>Value addition of a local food through collective actions and marketing by women’s groups</td>
<td>All four categories</td>
<td>Home gardens, Combined gardens, commercial orchards</td>
<td>++</td>
<td>+++</td>
<td></td>
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<tr>
<td>26</td>
<td>Value creation for <em>Garcinia gummi-gutta</em> and <em>Garcinia indica</em> through energy-efficient dryers and product differentiation in central Western Ghats region of Karnataka, India</td>
<td>(c) Commercialization and home use; (d) Collective action and social networking</td>
<td>Wild and home gardens</td>
<td>++</td>
<td></td>
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<tr>
<td>27</td>
<td>Community forests: Utilization and informal regulation for tropical fruit tree conservation</td>
<td>(d) Collective action and social networking</td>
<td>Community forests</td>
<td>+</td>
<td></td>
<td></td>
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<tr>
<td>28</td>
<td>An informal network of grafting experts to help communities conserve and use wild pickle mango (<em>Mangifera indica</em>) diversity in the central Western Ghats region of Karnataka, India</td>
<td>(a) Propagation and planting material; (d) Collective action and social networking</td>
<td>Community forests, Home gardens, on farm</td>
<td>+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Social capital building for tropical fruit tree diversity management</td>
<td>(d) Collective action and social networking</td>
<td>On farm, agroforestry, home gardens</td>
<td>+++</td>
<td></td>
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</tbody>
</table>
Table 1.1 summarizes all the case studies in terms of focus, context, types, origin and potential for scale up and scale out. Potential for scale out is based on subjective assessment of context, crops, categories, source of innovation, quality of participation amongst stakeholders and partners and authors' experiences of interventions.

Conclusions

The intention of this introduction is to clarify the conceptual understanding of the term ‘good practice’ for tropical fruit tree diversity (inter- and intraspecific diversity), maintenance and enhancement in the context of a sustainable livelihood framework. The rationale for identifying good practices is to build upon existing interests, activities and social structures while providing a range of options that farmers can experiment with and ultimately implement, which not only support dynamic on-farm and in situ conservation of tropical fruit tree species diversity but also confer social, economic and environmental benefits on the rural communities that actualize them. It is anticipated that this methodology and compendium of good practices can be used by research and academic institutions across South and Southeast Asia and the broader global community to identify, strengthen and promote locally available good practices. Additionally, the methodology could help national level on-farm and in situ conservation programmes to increase understanding and subsequently improve the effectiveness, efficiency and sustainability of their activities.

Experience suggests that ‘good practices’ are very context-specific and hence a better understanding of the particular circumstances and corresponding drivers that result in positive outcomes is required. Because of this context specificity, we have tried, rather than using a blueprint approach to replicate good practices, to focus on the identification of key principles that are embedded within a good practice of in situ and on-farm conservation of tropical fruit tree diversity. These principles are further explained and defined in Part 4, where we also discuss the challenges and lessons learned during the process of conceptual understanding, identifying, piloting and scaling up of good practices for diversity management. Using principles allows the easier application of the concept of good practices to other species and geographic locations. The concept of GPD is still new; there is a great need for more work in other locations and countries so that the methodology can be further refined through an experiential learning process. We hope that the case studies presented in this book will stimulate action by other interested multidisciplinary researchers.

It should be noted that the parameters and contours of what constitutes a good practice and the criteria by which it is evaluated are continuously evolving. Though a preliminary foundation such as that laid out above is necessary for orienting the following case studies within the confines of a broader field of study, experiential learning from these studies and those to follow is indispensable to refining the concept of good practices and how they relate to a diverse array of local contexts. The hope is that books and studies
such as this will encourage the scientific community to grapple with these issues on a more universal scale, thus facilitating the global exchange of knowledge, data and lessons learned. Such a movement of ideas and research has the potential not only to make sustained progress in ongoing efforts towards conserving biodiversity, but also towards improving the quality of life for rural and impoverished communities worldwide.

References


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