Advancing agrobiodiversity
Why organisations of smallholders and Indigenous Peoples are vital

Duncan Macqueen
Advancing agrobiodiversity
Why organisations of smallholders and Indigenous Peoples are vital

Duncan Macqueen

Published by
International Institute for Environment and Development, London, 2024
Advancing Agrobiodiversity

Author
Duncan Macqueen
duncan.macqueen@iied.org

Published by IIED, January 2024

Macqueen, D (2024) Advancing agrobiodiversity: why organizations of smallholders and Indigenous Peoples are vital. IIED, London, UK.

Cover photos: Ms Ma Thi Ninh (director) and another member of the Yen Duong cooperative in Ba Be District of Bac Kan Province, Viet Nam, who produce diverse products for different markets © Duncan Macqueen; Natural biodiversity and agrobiodiversity managed by the Yen Duong Cooperative in Bac Kan Province of Viet Nam © Duncan Macqueen

www.iied.org/22251iied


International Institute for Environment and Development
44 Southampton Buildings, London WC2A 1AP, UK
Tel: +44 (0)20 3463 7399
www.iied.org
@iied
www.facebook.com/thelIED

Download more publications at iied.org/publications

IIED publications may be shared and republished in accordance with the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International Public License (CC BY-NC-ND 4.0). Under the terms of this licence, anyone can copy, distribute and display the material, providing that they credit the original source and don’t use it for commercial purposes or make derivatives. Different licences may apply to some illustrative elements, in which instance the licence will be displayed alongside. IIED is happy to discuss any aspect of further usage. Get more information via www.iied.org/Creative-Commons

IIED is a charity registered in England, Charity No.800066 and in Scotland, OSCR Reg No.SC039864 and a company limited by guarantee registered in England No.2188452.
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acronyms</strong></td>
<td>v</td>
</tr>
<tr>
<td><strong>Acknowledgements</strong></td>
<td>vii</td>
</tr>
<tr>
<td><strong>Summary</strong></td>
<td>ix</td>
</tr>
<tr>
<td><strong>1 The nature of agrobiodiversity, benefits and loss</strong></td>
<td>1</td>
</tr>
<tr>
<td>1.1 Nature and benefits of agrobiodiversity and agroecology</td>
<td>1</td>
</tr>
<tr>
<td>1.2 Why advancing agrobiodiversity matters</td>
<td>4</td>
</tr>
<tr>
<td>1.3 The loss of agrobiodiversity as agroecological approaches decline</td>
<td>6</td>
</tr>
<tr>
<td>1.4 The drivers and underlying causes of agrobiodiversity loss</td>
<td>9</td>
</tr>
<tr>
<td>1.5 Reconfiguring global food systems to reverse agrobiodiversity loss</td>
<td>14</td>
</tr>
<tr>
<td><strong>2 Smallholder farmers and Indigenous Peoples as custodians of</strong></td>
<td>17</td>
</tr>
<tr>
<td>agrobiodiversity</td>
<td></td>
</tr>
<tr>
<td>2.1 The role of smallholders and Indigenous Peoples in maintaining</td>
<td>17</td>
</tr>
<tr>
<td>agrobiodiversity</td>
<td></td>
</tr>
<tr>
<td>2.2 How organisations of smallholders and Indigenous Peoples manage</td>
<td>21</td>
</tr>
<tr>
<td>agrobiodiversity</td>
<td></td>
</tr>
<tr>
<td>2.3 How smallholder and Indigenous People's organisations can measure</td>
<td>26</td>
</tr>
<tr>
<td>and market agrobiodiversity</td>
<td></td>
</tr>
<tr>
<td>2.4 How global to national policies might support agrobiodiversity</td>
<td>36</td>
</tr>
<tr>
<td>management</td>
<td></td>
</tr>
<tr>
<td><strong>3 Case studies: how smallholders and Indigenous Peoples manage</strong></td>
<td>41</td>
</tr>
<tr>
<td>agrobiodiversity</td>
<td></td>
</tr>
<tr>
<td>3.1 Introducing the Forest and Farm Facility's case studies</td>
<td>41</td>
</tr>
<tr>
<td>3.2 Ecuador: Union of Peasant and Indigenous Organizations of</td>
<td>44</td>
</tr>
<tr>
<td>Cotacachi (UNORCAC)</td>
<td></td>
</tr>
<tr>
<td>3.3 Ghana: Abrono Organic Farmers Association (ABOFA)</td>
<td>47</td>
</tr>
<tr>
<td>3.4 Madagascar: ARFDDSA Analamanga</td>
<td>50</td>
</tr>
<tr>
<td>3.5 Nepal: Chabeli Farmers Group within the National Farmers Group</td>
<td>53</td>
</tr>
<tr>
<td>Federation (NFGF)</td>
<td></td>
</tr>
<tr>
<td>3.6 Tanzania: Network of Groups of Farmers and Breeders of Arusha</td>
<td>56</td>
</tr>
<tr>
<td>(MviwaArusha)</td>
<td></td>
</tr>
<tr>
<td>3.7 Zambia: Choma District Tree Nurseries Association (CDTNA)</td>
<td>59</td>
</tr>
</tbody>
</table>
4 Case study lessons: how organisations of smallholders and Indigenous Peoples advance agrobiodiversity

4.1 Promoting and marketing agrobiodiverse products 64
4.2 Cultivating agrobiodiverse crops: sharing knowledge and seed 66
4.3 Organising agrobiodiverse businesses: aggregating baskets of quality products 68
4.4 Reshaping investment models: mobilising internal finance to fund complexity 70
4.5 Bolstering political will and shaping enabling policies 72

5 Recommendations for upscaling agrobiodiversity conservation 75

5.1 Recognise FFPOs and IP and LC groups as stewards of agrobiodiversity 75
5.2 Get money for what matters to where it matters 78
5.3 Ensure FFPOs and IP and LC groups are represented in ODA decision-making and set targets for local disbursement 79

References 80

List of boxes, figures and tables

Box 1. FAO Plant Treaty: Article 9 on farmers’ rights 38

Figure 1. Agrobiodiversity as a subset of biodiversity 3
Figure 2. Agricultural biodiversity: global crop richness map 8
Figure 3. Global distribution of field size using crowd sourcing 8
Figure 4. The cycle of growing inequality underlying agrobiodiversity loss 11
Figure 5. How federated producer organisations shape flows of agrobiodiversity knowledge, seed and trade 19
Figure 6. Word cloud of responses: “What makes for a successful landscape?” 20

Table 1. The benefits of agrobiodiversity 5
Table 2. Drivers of the loss of agrobiodiversity 9
Table 3. Examples of useful manuals on agrobiodiversity and their intended purpose 28
Table 4. Examples of online tools to assess or promote agrobiodiversity 29
Table 5. Examples of emerging voluntary biocredit schemes and their market ‘claims’ 33
Table 6. Summary of the case studies of FFPO management of agrobiodiversity 43
Table 7. The interrelated dimensions of a more just, resilient and secure food system 77
Acronyms

ABDI Agrobiodiversity Index
ABOFA Abrono Organic Farmers Association, Ghana
ARFDDSA Analamanga Regional Branch of the National Platform for Women, Sustainable Development and Food Security, Madagascar
CBD Convention on Biological Diversity
CDTNA Choma District Tree Nurseries Association, Zambia
CIKOD Centre for Indigenous Knowledge and Organizational Development
CSBs Community seed banks
DATAR Diversity Assessment Tool for Agrobiodiversity and Resilience
FAO Food and Agriculture Organization of the United Nations
FFF Forest and Farm Facility
FFPOs Forest and farm producer organisations
FFS Farmer field schools
FGDs Focus group discussions
FLEGT Forest Law Enforcement, Governance and Trade
FOFIFA National Centre for Applied Research on Rural Development, Madagascar
GIAHS Globally Important Agricultural Heritage Systems
GMOs Genetically modified organisms
HHS Household surveys
IIED International Institute for Environment and Development
IPs and LCs Indigenous Peoples and local communities
IPRs Intellectual property rights
ITPGRFA International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN International Union for Conservation of Nature
KII Key Informant Interviews
MviwaArusha Mtiong wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha, Tanzania.
NARC National Agricultural Research Council, Nepal
NFGF National Farmers Group Federation, Nepal
NGO Non-governmental organisation
ODA Official development assistance
PACS Payment for agrobiodiversity conservation services
PBRs Plant breeders' rights
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>PES</td>
<td>Payment for ecosystem services</td>
</tr>
<tr>
<td>PGS</td>
<td>Participatory guarantee system</td>
</tr>
<tr>
<td>PNFDDSA</td>
<td>National Platform for Women, Sustainable Development and Food Security</td>
</tr>
<tr>
<td>PVR</td>
<td>Plant variety rights</td>
</tr>
<tr>
<td>SACCOS</td>
<td>Savings and credit cooperative societies</td>
</tr>
<tr>
<td>SNV</td>
<td>Netherlands Development Organisation</td>
</tr>
<tr>
<td>TRIPS</td>
<td>WTO Agreement on Trade-Related Aspects of Intellectual Property Rights</td>
</tr>
<tr>
<td>UNDRIP</td>
<td>United Nations Declaration on the Rights of Indigenous Peoples</td>
</tr>
<tr>
<td>UNDROP</td>
<td>United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas</td>
</tr>
<tr>
<td>UNORCAC</td>
<td>Union of Peasant and Indigenous Organizations of Cotacachi, Ecuador</td>
</tr>
<tr>
<td>UPOV</td>
<td>International Union for the Protection of New Varieties of Plants</td>
</tr>
<tr>
<td>VBC</td>
<td>Voluntary biodiversity credit</td>
</tr>
<tr>
<td>VSLAs</td>
<td>Village savings and loans associations</td>
</tr>
<tr>
<td>WTO</td>
<td>World Trade Organization</td>
</tr>
</tbody>
</table>
Acknowledgements

This report has been financed through the International Institute for Environment and Development's (IIED) frame funds from the governments of Sweden and Ireland in close collaboration with the co-management team of the Forest and Farm Facility (FFF). The paper also draws on six independent case studies that were financed by the FFF which is hosted by the Food and Agriculture Organization of the United Nations (FAO) and involves a co-management partnership of FAO, IIED, International Union for Conservation of Nature (IUCN) and AgriCord. FFF is funded by the governments of Finland, Germany, Holland, Norway and Sweden and by the FAO’s and European Union’s Forest Law Enforcement, Governance and Trade (FAO-EU FLEGT) programme, and Ikea.

The knowledge-generation process managed by IIED to produce this report for FFF was demand-driven and co-produced by forest and farm producer organisations (FFPOs) themselves. Knowledge-demand surveys with FFPOs pointed to agrobiodiversity as an area which FFPOs wanted to know more about. Six case studies were commissioned to document lessons from FFPOs that were known to be managing agrobiodiversity well. An academic literature on climate resilience was then blended with insights from the findings from six case studies in this short report.

Thanks to the members of the FFF co-management team for helping to shape the initiative and contribute thoughts to this paper, in alphabetical order: Luis Miguel Aparicio, Pauline Buffle, Valentina Carlino, Marguerite France-Lanord, Francesca Guarascio, Sophie Grouwels, Alistair Logan-Pang, Stephen Mwangi, Isabela Núñez del Prado Nieto, Noora Simola, Katja Vuori, Kata Wagner, Zoe Williamson and Jhony Zapata.

Thanks also to the FFF in-country facilitators who helped to discuss and identify suitable FFPO case studies that might be documented for this research, in country order: Boris Igor Fernández Arancibia (Bolivia), Virginia Beatriz Vallejo-Rojas (Ecuador), Kanimang Camara (Gambia), Elvis Kuudaar (Ghana), Philip Koskei Kisoyan (Kenya), Andry Rakoto Harivony and Herizo Rakotoniaina (Madagascar), Racchya Shah (Nepal), Geoffrey Bakanga (Tanzania), Aboudoumisamilou Issifou (Togo), Pham Tai Thang and Vu Le Y Voan (Vietnam) and Vincent Ziba (Zambia).

Special thanks to the authors of each of the case studies for their hard work in drawing together information from FFPOs across the world, in alphabetical order: Edena Andrianaivolala, Geoffrey Bakanga, Ernest Chingaibe, María Alegria Piñán Cajas, Canisius John Kayombo, Kedar Koirala, Richard Masandika, Ankita Nepal and Takyi Ezekiel Paul. Some of the analysis of the case studies, and especially the Tanzania case study, benefitted from early conceptual design work in the early implementation phase of a
project called Nature Nurture with support from the Global Centre on Biodiversity for Climate (GCBC). The GCBC is funded by the UK's Department for Environment, Food and Rural Affairs working in partnership with DAI Global as the Fund Manager Lead and the Royal Botanic Gardens, Kew as the Strategic Science Lead.

This publication has been reviewed according to IIED's peer review policy, which sets out a rigorous, documented and accountable process involving internal and external reviewers. The author expresses sincere appreciation to the internal reviewer Krystyna Swiderska (principal researcher in biocultural heritage at IIED) and the external reviewers Luis Miguel Aparicio (manager at FFF), Karine Peschard (associate research fellow at the Geneva Academy of International Humanitarian Law and Human Rights), and Noora Simola (climate and forestry expert, Food and Forest Development Finland).

Thanks to Alistair Logan-Pang (IIED) for overseeing the editing and production process, Holly Ashley Jones for copyediting, and to Judith Fisher for layout and design.
Summary

This report focuses on agrobiodiversity (or agricultural biodiversity) as the subset of biodiversity found within agricultural ecosystems: the full variability of animals, plants and microorganisms that make farms function, as well as any wild foods collected. Maintaining agrobiodiversity is an important ecological principle for sustainability, and therefore a central feature of agroecological approaches.

The primary audience for this report includes leaders of forest and farm producer organisations (FFPOs) and Indigenous Peoples' and local communities' (IP and LC) groups, plus their technical support partners. A secondary audience includes government decision makers in the agriculture, forestry and other land-use sectors and international resource partners in climate, nature or development finance. The objectives of the report are threefold:

- To build understanding of why and how FFPOs and IP and LC groups manage agrobiodiversity as its main stewards
- To understand the strategies and tactics FFPOs and IP and LC groups deploy to enhance agrobiodiversity management, and
- To provide recommendations based on the findings to government and international resource partners about how to upscale those efforts.

Maintaining diversity in what is grown on farms can enhance agricultural productivity, food security and livelihood resilience in the face of climate change and pest and disease outbreaks. It provides nutritional and health benefits as well as biomass energy and household materials. It also preserves biocultural heritage¹ and ecosystem services, including climate change mitigation and adaptation. In short, agrobiodiversity has many benefits.

Rapid ongoing loss of agrobiodiversity is therefore alarming. Of 6,190 breeds of mammal domesticated for food and agriculture, 559 have become extinct and 1,000 more are threatened. Of 7,000 plant species cultivated historically for food, just nine now contribute 66% of global crop production, while only three account for half of all plant-based calories (rice, maize and wheat).

¹ Biocultural heritage is the interlinked biodiversity and cultural heritage of Indigenous Peoples and local communities, including resilient traditional crops, traditional agroecological knowledge, and the cultural and spiritual values and landscapes that sustain them. See www.bioculturalheritage.org
Agrobiodiversity loss is the outcome of a cycle of growing inequality. That cycle is driven by agricultural policies, the promotion of monocultures by agricultural research and extension systems, the economic scale efficiencies of those monocultures, the advertising of cheap food, changing consumption patterns, and input subsidies and seed policies that favour commercial varieties. Agrobiodiverse systems are generally more productive per unit area than monoculture systems – but are less commercially profitable per unit area. In search of profit, largescale land acquisitions have concentrated land tenure. And as local people are swept aside, their knowledge of locally adapted landraces is lost and replaced by knowledge of fewer modern varieties. Higher profitability on larger farms means that incomes and labour costs rise. Technology for mechanisation to cut labour costs then becomes attractive, which reinforces the need for monoculture systems suited to mechanisation. This further increases profitability on larger farms which concentrates economic power in favour of further land acquisitions.

Most of the world’s remaining agrobiodiversity is therefore maintained by smallholder farmers and Indigenous Peoples. Smallholder farmers and Indigenous Peoples are agrobiodiversity’s stewards in part because they often rely on farms for subsistence as well as cash income. They also enjoy, personally, the benefits and reduced risks of diverse crops and livestock and wild foods for nutrition, energy, shelter, health, resilience, ecosystems services, cultural value and income generation. In smallholder group surveys conducted by the Forest and Farm Facility (FFF) of what makes for a successful forest-farm landscape in the 10 partner countries of FFF, biodiversity emerged as a key priority alongside other concepts such as productivity, sustainability, livelihoods and forest restoration.

To counter the growing inequalities leading to a loss of agrobiodiversity described above, smallholder farmers and Indigenous Peoples often work together in FFPOs or more territorially inclined IP and LC groups. They often work to secure tenure and rights to maintain their biocultural heritage, share traditional knowledge on appropriate varieties and agroecological cultivation practices, manage seed to grow and maintain genetic variation of those crops, and diversify their enterprises to incentivise the cultivation and sale of more crops. This reduces their dependence on external inputs such as commercial seed, fertilisers and pesticides.

As the work of those groups and their supporters has advanced, a range of useful manuals and online tools have been developed that help farmers and trainers to understand the benefits of agrobiodiversity, improve its practical management through cultivation and seed-management approaches, and measure its conservation and impacts. Some of these are listed and described within this report.
Payment schemes for agrobiodiversity conservation to reward smallholder farmers for this work are only under pilot development – but there is much to build on. Currently, emerging schemes such as 'biocredits' or biodiversity offsets only apply to the setting aside or conservation of natural areas of biodiversity (not on-farm agrobiodiversity). Innovations are emerging, however, in second-party certification schemes such as participatory guarantee systems (PGS) that might allow producers to make claims against on-farm diversity maintained.

Yet tensions remain over global and national policies that shape agrobiodiversity. On one side, there is legislation to protect commercial plant breeders' rights (PBRs) in the International Union for the Protection of New Varieties of Plants (UPOV), and in agreements on Trade-Related Aspects of Intellectual Property Rights (TRIPS) as part of the General Agreement on Tariffs and Trade (GATT) of the World Trade Organization (WTO). This legislation often favours the development and returns from largescale corporate monocultures.

On the other side, there is legislation that backs peasant seed systems. This includes the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA, also often called the Plant Treaty or International Seed Treaty) in harmony with the Convention on Biological Diversity (CBD), now backed by the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP). Such legislation obliges states to recognise farmers' rights to use, exchange and sell farm-saved seed as an integral part of the rights of peasants, to receive equitable benefits from their commercial use by others, to protect traditional knowledge and to participate in national decision-making, all of which are important to sustain agrobiodiverse seed and biocultural heritage systems.

As a contribution to understanding how FFPOs and IP and LC groups deal with such tensions and enhance agrobiodiversity conservation in practice, this report presents summaries of six country case studies (from Ecuador, Ghana, Madagascar, Nepal, Tanzania and Zambia). Each summary describes for a particular FFPO or IP and LC group the nature of agrobiodiversity managed, and how that organisation helps in the management of knowledge, seed, and enterprise strategies that incentivise agrobiodiversity conservation.

Analysis of those six case studies (and findings from broader support to FFPOs and IP and LC groups from the FFF) draws out lessons on the strategies that FFPOs and IP and LC groups themselves routinely deploy to enhance agrobiodiversity management.
Strategies and tactics for enhancing agrobiodiversity management include:

- **Promoting agrobiodiverse products – marketing nutritional and health benefits:**
  - Promoting nutritional diversity
  - Promoting natural medicines
  - Promoting organic and agroecological production systems
  - Reaching both rural and urban audiences

- **Cultivating agrobiodiverse crops – sharing knowledge and seed:**
  - Training farmers in agroecological methods
  - Encouraging crop diversification, tree planting and agroforestry
  - Organising seed fairs that allow peer-to-peer exchange
  - Managing community seed banks (CSBs)

- **Organising agrobiodiverse businesses – aggregating baskets of quality products:**
  - Organising market fairs that enhance sales of diverse products
  - Building collective businesses that reinforce cultural identity
  - Using established infrastructure to market diverse baskets of products
  - Developing shared labels

- **Reshaping investment models – mobilising internal finance to fund complexity:**
  - Normalising savings and loans groups
  - Evolving towards larger financial cooperatives
  - Attracting inward investment from nature-friendly partners

- **Bolstering political will – shaping enabling policies for the above:**
  - Promoting the benefits of agricultural heritage systems
  - Fighting for laws that support peasant seed systems and farmers' rights
  - Promoting tenure security and smallholder investment mechanisms.

This report draws the conclusion that transforming global food systems to offer greater resilience and food security will require system-level changes across dimensions such as nutritional diversity, agrobiodiversity, social organisation, entrepreneurship and flexible finance. FFPOs and IP and LC groups are already pursuing many of the elements of such systemic change within an agroecological approach to food systems. Collectively, smallholders are already investing more than US$368 billion annually in climate adaptation – which typically involves efforts to diversify production.
This report recommends that government decision makers responsible for agriculture, forestry and other land-use sectors, and international resource partners in climate, nature and development finance could support:

- Greater recognition of the role of FFPOs and IP and LC groups as the stewards of agrobiodiversity – and their contribution to farming systems that provide long-term resilience and food security
- More effective efforts to get climate and nature finance to where it matters – to FFPOs and IP and LC groups who already invest more in climate adaptation than all climate finance combined
- Improved representation of FFPOs and IP and LC groups in national government or official development assistance (ODA) finance decision-making, to set targets for local disbursement towards a systemic transformation of the global food system.
Diverse agroforestry system in Southern Belize. Photo: Duncan Macqueen
1.1 Nature and benefits of agrobiodiversity and agroecology

Humans are dependent on a fragile layer of life that covers planet Earth. The health of that thin layer – and its capacity to survive human impacts – is therefore an important topic. It shapes global temperatures, sea levels, weather patterns, geochemical nutrient cycles, water supplies, food production, energy sources, construction materials and so much more. Forest biodiversity is crucial to our survival, and much has rightly been made of the need to conserve the remaining areas of natural forest, in part by entitling Indigenous Peoples as the guardians of those remaining forests. Yet agriculture is equally crucial. Agricultural productivity must expand to meet growing human needs for food in a fast-changing climate without causing further forest loss of which it is already the biggest driver (and in turn a major driver of climate change).
Doing things differently will require shifts in power to overcome the inertia of existing ways of doing agriculture (Hunter et al. 2017).

How agriculture is done matters. Of a total global land surface area of 149 million km², the total agricultural area stands at 48 million km² (46%) and now exceeds the area of remaining forests at 40 million km² (38%) (Potapov et al. 2022). Much of that agricultural area involves livestock (37 million km² or 77%). The geographical scale of livestock production, coupled with the inherent inefficiencies of converting solar energy into meat and dairy calories, is a good reason to pursue plant-based diets. Nevertheless, of the total agricultural area, cropland stands at 10.9 million km², and expanded 11.5% between 2000 and 2020 towards that new total (Potapov et al. 2022). And it is the degree to which agrobiodiversity is being maintained or lost in that expansion – putting humanities eggs in very few baskets – that concerns us here.

The primary audience for this report on agrobiodiversity includes leaders of forest and farm producer organisations (FFPOs) and Indigenous Peoples’ and local communities’ (IP and LC) groups, plus their technical support partners. The objectives of the report are threefold:

- To build understanding of why and how FFPOs and IP and LC groups manage agrobiodiversity as its main stewards
- To understand the strategies and tactics FFPOs and IP and LC groups deploy to enhance agrobiodiversity management, and
- To provide recommendations based on the findings to government and international resource partners about how to upscale those efforts.

For this reason, government decision makers in the agriculture, forestry and other land-use sectors and international resource partners in climate, nature or development finance are a secondary audience for this report – but for whom an associated policy brief has been prepared (Macqueen 2023). Before exploring these issues in more detail, this report offers some definitions.

1.1.1 Defining biodiversity

**Biodiversity** (biological diversity) is “the full variability among living organisms and the ecological complexes they compose” (UNCED 1992): in other words, life in all its diversity. The Convention on Biological Diversity (CBD) that was ratified in 1992 committed country signatories to the conservation of biodiversity, the sustainable use of its components, and the sharing of benefits arising from the use of genetic resources. It is important to understand that species diversity itself can be measured in several ways (Whittaker 1972) including: alpha diversity (the number of species in a habitat); beta diversity (the number of differences in species between two habitats) and gamma diversity (the combined
1.1.2 Defining agrobiodiversity

Agrobiodiversity (agricultural biodiversity) is “the subset of biodiversity found within agroecosystems (agricultural ecosystems), including the variety and variability of animals, plants, and microorganisms at the genetic, species, and ecosystem levels, which are necessary to sustain key functions of those agroecosystems” (see Parris 2001: 42). The CBD defines agricultural biodiversity as “a broad term that includes all components of biological diversity of relevance to food and agriculture, and all components of biological diversity that constitute the agricultural ecosystems, also named agro-ecosystems: the variety and variability of animals, plants and microorganisms, at the genetic, species and ecosystem levels, which are necessary to sustain key functions of the agro-ecosystem, its structure and processes”. Once again, this diversity could be measured in different ways such as the number of species on a particular farm (alpha diversity), the number of differences in species between different farms (beta diversity), or the combined total of species in a region comprising many farms (gamma diversity). Figure 1 shows the relationship between these two main concepts.

Figure 1. Agrobiodiversity as a subset of biodiversity
1.1.3 Defining agroecology

Agroecology is the application of ecological principles to agriculture (Altieri 1987). It is relevant to agrobiodiversity in that maintaining biodiversity is one of the ecological principles that must be applied to agriculture within an agroecological approach (Sinclair et al. 2019). It is vital to recognise that in agroecosystems, agrobiodiversity performs a variety of ecological services beyond the production of diverse products, including recycling of nutrients, regulation of microclimate and local hydrological processes, suppression of undesirable organisms and detoxification of noxious chemicals. A consensus view on the ecological principles that must be applied within an agroecological approach (FAO 2018a; Barrios et al. 2020) includes: biodiversity, co-creation and sharing of knowledge, synergies between system components, efficiency by using fewer external inputs, recycling, resilience, human and social values, culture and food traditions, land and natural resources governance, and a circular and solidarity economy. It can quickly be seen how the maintenance of agrobiodiversity underpins many of these other ecological principles.

1.2 Why advancing agrobiodiversity matters

Agrobiodiversity includes components that are planned, such as commercial or subsistence crop plants (see Henry 2017) and livestock (see Edwards et al. 2017), often including different types of trees (see Boshier et al. 2017), aquatic resources of different types (Bartley and Halwart 2017) and soil biodiversity. It also includes associated biodiversity made up of natural vegetation and wildlife on uncropped lands (for example, on steep slopes, watersheds and riverbanks) which maintains vital ecosystem services including pollination (see Ingram et al. 2017), as well as wild foods (such as forest products, fish and wildlife), medicinal plants and crop wild relatives. Traditional knowledge about how to access, use, manage, conserve, improve and commercialise different elements of this agrobiodiversity is distributed among smallholder farmers and Indigenous Peoples who inhabit these landscapes (see Labeyrie et al. 2021). This knowledge has led to new means of recognising them as Globally Important Agricultural Heritage Systems (GIAHS) (Agnoletti and Santoro 2022).

The benefits of agrobiodiversity are several, as listed in Table 1. In addition to food security and agricultural and livelihood resilience, these include benefits to nutrition and health, energy and household materials, the preservation of biocultural heritage and the maintenance of global ecosystem services (including climate change mitigation).

---

2 Established by the FAO in 2022, ‘Globally Important Agricultural Heritage Systems (GIAHS) are agroecosystems inhabited by communities that live in an intricate relationship with their territory.’ FAO's GIAHS programme has designated over 60 sites around the world. See www.fao.org/giahs/en
<table>
<thead>
<tr>
<th>Benefit of agrobiodiversity</th>
<th>Description</th>
<th>Recent references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food security and livelihood resilience</td>
<td>For farming communities, cultivating many different types of plant and animal for food reduces the risk of total failure due to threats to individual components from climate-related changes in temperature and rainfall, pests and diseases, political or market fluctuations, pandemics or other shocks.</td>
<td>Zimmerer and de Haan (2020); Kerr et al. (2021)</td>
</tr>
<tr>
<td>Nutritional and health benefits</td>
<td>Cultivating and consuming a wide range of local plants and animals (such as fruit and vegetables) supplemented by wild-harvested species ensures a healthy diet for both rural and urban populations, especially among poor rural families, due to a more balanced diet of carbohydrates, protein, fat, fibre, vitamins, minerals and water – alongside plants with known medicinal properties.</td>
<td>Fanzo et al. (2013); Remans et al. (2014); Zaccari et al. (2023); Harris et al. (2022)</td>
</tr>
<tr>
<td>Provision of biomass energy and household materials</td>
<td>Cultivating on-farm trees, palms and other fibrous plants or maintaining natural woody vegetation cover in diverse interplanting arrangements for fruit, spice, fodder, timber, thatch, wood energy and cosmetic or medicinal purposes can diversify livelihood incomes and/or improve access to livelihood essentials (such construction materials or fuelwood for the 2.4 billion people globally who use it to cook with).</td>
<td>Immerzeel et al. (2013); Subedi et al. (2020)</td>
</tr>
<tr>
<td>Preservation of biocultural heritage</td>
<td>Cultivating varieties of plants and animals that have co-evolved with human populations over generations is a central part of preserving the biocultural heritage and traditional knowledge of IPs and LCs. It enables the ongoing use and adaptation of those human, plant and animal ecosystems. These include Indigenous crops and livestock breeds and landraces that are often more resilient and nutrient-dense than their modern equivalents, and have important cultural and spiritual values, as well as resilient crop wild relatives used to domesticate and improve cultivated varieties.</td>
<td>Agnoletti and Santoro (2022); Swiderska et al. (2022)</td>
</tr>
<tr>
<td>Ecosystem services including climate change mitigation</td>
<td>Cultivating a wide variety of plants and animals while protecting associated biodiversity on uncropped land across landscapes controlled by multiple actors helps to maintain soil fertility, water cycles, carbon sequestration in soils and plant matter, maintenance of pollinators and seed dispersal agents, and control of pests and diseases.</td>
<td>Altieri (1999); Gerits et al. (2021); Drucker et al. (2022)</td>
</tr>
</tbody>
</table>
With the latter benefit in mind, there has been increasing interest in how to maximise ‘functional agrobiodiversity’ (FAB) which can be defined as “those elements of biodiversity within agricultural fields or landscapes, which provide ecosystem services that support sustainable agricultural production and can also deliver benefits to the regional and global environment and the public at large” (ELN-FAB 2012). In other words, how can forest and farm producers maintain clusters of elements (at the gene, species or habitat level) that provide the main desired ecosystem services or functions as described in the table above (Bàrberi 2013)?

1.3 The loss of agrobiodiversity as agroecological approaches decline

The history of agrobiodiversity can be considered as a series of transitions. These begin with the neolithic revolution from about 12,000 years ago as hunter-gatherers transitioned to sedentary farming with the domestication of species (Larson et al. 2014). As agriculture began to spread 7,000–4,000 years ago, it both drew on and created new agrobiodiversity, in what lately has been called the Anthropocene era (Smith and Zeder 2013). But as sedentary agricultural production spread, except in the case of wild harvesting of timber or non-timber forest products (NTFPs), it began to replace the full biodiversity of natural ecosystems with the more limited agrobiodiversity of different agroecosystems. The loss of biodiversity which this entails depends both on the extent to which natural biodiversity (genetic variation, species, and ecosystems) remain outside the cultivated area, and on the level of agrobiodiversity within the production systems – with some significant risks from pest and diseases in narrower clonal types of production (Matthews 2017). However, traditional farming landscapes can sustain high levels of biodiversity, both agricultural and wild (Fischer et al. 2014).

A second transition occurred as transport improved (especially shipping) so that agricultural plants could be exchanged between regions in what is known as the Columbian Exchange. Many crops such as potatoes, sweet potatoes, maize, cassava, coffee and rubber were introduced to new areas. New plantations of these crops went on to earn substantial revenues in areas free from each plant’s natural pests and diseases (Williams 2017). But narrow genetic diversity often resulted in the later rapid spread of pests and diseases – such as *Phytophthora infestans* in Europe that led to the Irish Potato Famine of the mid-19th century.

A third transition came about after the Industrial Revolution with the increasing use of industrial pesticides, fertilisers and irrigation systems alongside improved breeds. In the 1960s, large yield increases were achieved in what has been termed the Green
Revolution. Reductions in the numbers of crops and varieties cultivated was one side-effect as locally adapted ‘landraces’ were replaced with the high yielding ‘modern varieties’ of a few key species selected by scientific programmes. Ubiquitous monocultures of these more productive crops such as rice and maize crowded out the less productive but more nutritious millets and pulses in fertile areas of regions such as South Asia (Pingali 2017). With breeding and genetic modification now improving ‘resistant varieties’ in less favourable sites, a further reduction in landraces is expected.

The rate of loss of biodiversity is already tens to hundreds of times higher than it has averaged over the last 10 million years (IPBES 2019). The huge expansion in human populations, urbanisation, changing consumption patterns, and largescale monoculture production systems mean that an average of around 25% of species in assessed animal and plant groups are now threatened, suggesting that around 1 million species already face extinction, many within decades, unless action is taken to reduce the intensity of drivers of biodiversity loss (IPBES 2019). Climate change, economic and political turmoil exacerbate such losses.

The rate of loss of agrobiodiversity is also alarming. Of the 6,190 breeds of mammals domesticated historically for food and agriculture, 559 have become extinct (over 9%), and at least 1,000 more are threatened (IPBES 2019). Of 7,000 plant species cultivated historically for food, just 80 now make a major contribution to global food supply (Romanelli et al. 2015) and just nine contribute 66% of total global crop production (sugarcane, maize, rice, wheat, potatoes, soybeans, oil palm, sugar beet and cassava) (FAO 2019). Half of all plant-based calories come from only three species: rice, maize and wheat (Frison and IPES Food 2016). While less-well documented, the same may be true of other plant-based products such as construction materials, medicines and cosmetic products.

Figure 2 shows the number of harvested crops per hectare globally, combining data on 175 different crops. The close correlation between the remaining degree of agrobiodiversity (Figure 2) and the average farm size in hectares (Figure 3) leads Rist et al. (2020) to infer that smallholders are the remaining guardians of agrobiodiversity, an observation we return to below. It is certainly visually apparent that small field sizes tend to correlate with high agrobiodiversity. Agrobiodiversity is often highest on the lands of Indigenous and traditional peoples: many Indigenous territories overlap geographically with centres of origin and diversity of crops, known as Vavilov centres (Maxted et al. 2020).
Figure 2. Agricultural biodiversity: global crop richness map

Source: Data from Monfreda et al. (2008) produced in Gaisberger (2014).

Figure 3. Global distribution of field size using crowd sourcing

Source: Lesiv et al. (2018).
1.4 The drivers and underlying causes of agrobiodiversity loss

The loss of agrobiodiversity can be traced to a series of factors to do with developments in the way agriculture is practiced globally, following the three main transitions described above (see Table 2). These changes help to explain the visual correlations of figures 2 and 3.

Table 2. Drivers of the loss of agrobiodiversity

<table>
<thead>
<tr>
<th>Drivers of loss of agrobiodiversity</th>
<th>Description</th>
<th>Recent references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land tenure inequality</td>
<td>Largescale land acquisitions (which to date have included more than 30 million hectares within 1,560 concluded land deals, often involving largescale corporate investments in single-commodity crops such as oil palm, rubber, sugar cane) and that often displace agricultural smallholders.</td>
<td>Lay et al. (2021); Oliveira et al. (2021)</td>
</tr>
<tr>
<td>Changing sources of knowledge and pressure to adopt modern varieties</td>
<td>In addition to the loss of traditional knowledge as smallholder farmers are displaced, there is also pressure from globalised Western knowledge systems, urbanisation and changing consumer preferences, agricultural policies and research and extension systems for farmers to adopt modern varieties and join global value chains, often replacing traditional landraces with high-yielding varieties, often for very widely grown crops such as rice, maize and wheat: for example, during the Green Revolution of the 1960s and 1970s with support from the International Rice Research Institute (IRRI) and the International Maize and Wheat Improvement Centre (CIMMYT).</td>
<td>Ramankutty et al. (2018); Lusty et al. (2021)</td>
</tr>
<tr>
<td>Profitability of industrial-scale monocultures</td>
<td>Economic profitability per unit area (not the same as productivity per unit area) has seen a global expansion of input-intensive monoculture production around a small number of plant and animal species and varieties such as soybean and oil palm, often replacing much more diverse natural ecosystems or more diverse common land and agricultural smallholdings.</td>
<td>FAO (2010); Kröger (2022); Wagner et al. (2022)</td>
</tr>
</tbody>
</table>
### Drivers of loss of agrobiodiversity

<table>
<thead>
<tr>
<th>Drivers of loss of agrobiodiversity</th>
<th>Description</th>
<th>Recent references</th>
</tr>
</thead>
<tbody>
<tr>
<td>Technological advances that demand uniformity</td>
<td>As profitability and incomes rise, labour costs also rise, motivating further mechanisation that can improve labour efficiency. Highly mechanised production and processing plants require high levels of uniformity, often tied into aggressive advertising of limited product brands to ensure returns on investment.</td>
<td>Leite et al. (2022)</td>
</tr>
<tr>
<td>Power imbalances</td>
<td>Growing concentration of power in the agricultural seed, input and food distribution networks that tends to reduce agrobiodiversity by channelling investment into high yielding but high-risk production systems into which increasing numbers of smallholders are forced.</td>
<td>Chappell and LaValle (2011); Howard (2020); Clapp (2021)</td>
</tr>
<tr>
<td>Seed policies and intellectual property rights (IPRs)</td>
<td>Seed policies often support modern varieties that meet DUS criteria (distinctiveness, uniformity and stability), but not traditional varieties and informal seed systems. Seed-related IPRs often protect plant breeders' rights but not farmers' rights. Public agricultural research and extension agencies are increasingly acting as commercial breeders incentivised by IPRs, which can lead to the rapid spread of hybrids.</td>
<td>Sievers-Glotzbach et al. (2021); Swiderska et al. (2011)</td>
</tr>
</tbody>
</table>

Conventional wisdom has it that largescale monocultures are more productive – and that is why they flourish. But evidence points to the contrary. Smallholder farms (under two hectares) produce 30–34% of the world’s food supply on 24% of its gross agricultural area (Ricciardi et al. 2018). In other words, smallholders are more productive than largescale industrial agriculture, not less. This makes intuitive sense – and the scientific evidence appears to back this up (Ricciardi et al. 2021). On-farm productivity is based on the photosynthetic conversion of sunlight into plant material and on the health of soils. Careful spatial planting of root crops, cereals and fodder, and fruit, spice and timber trees (which is common in many multilayered smallholder agroforestry systems) is more likely than a single, industrial-level crop to capture and convert more of that sunlight into useful production. Additionally, agrobiodiversity contributes to the maintenance of ecosystem services such as nutrient cycles, water retention, pollination and so on that boost productivity.
So, if monocultures are not more productive, why do they proliferate to the detriment of agrobiodiversity? The answers given in Table 2 and Figure 4 suggest that beneath the drivers of the loss of agrobiodiversity lie inequalities in economic and political power. Larger, wealthier landowners have the power to consolidate their holdings and pursue corporatisation and monopolisation, and influence policies and agricultural research and extension systems towards those ends. The larger, wealthier and more powerful the landowner, the more industrial-scale mechanisation increases economic scale efficiency and per-area returns from almost any chosen crop component. Devoting effort to one uniform cash crop increases cost efficiencies for that crop, but at the expense of overall ecological production. Neighbouring smallholders cannot compete on price, falling back instead on their ecologically more-productive agrobiodiversity for subsistence, rather than commercial markets. This exacerbates inequalities in economic and political power, further excluding smallholders from commercial supply chains, as shown in Figure 4.

Figure 4. The cycle of growing inequality underlying agrobiodiversity loss
The driving forces behind this cycle of inequality not only include simple economic forces that shape profitability and access to finance, but also cultural values in which traditional knowledge is displaced by globalised Western knowledge systems. Four main drivers stand out:

- **Labour and production cost efficiencies** of uniform mechanised production over large areas (see Chaudhary et al. 2016) (although note that production cost efficiencies do not equate to greater production per unit area). These cost efficiencies are especially important in countries where the cost of forest and farm labour is high, and where mechanisation technology is readily available. Where forest and farm labour are cheap and technology inaccessible, the greater productivity of more diverse systems may give better returns.

- **Uniform product quality** that comes from a single species, variety or clone being grown over large areas under relatively uniform conditions. The challenge of mixing species is that this multiplies site-specific differences, which can in turn translate into product differences. This is perhaps most obviously seen in moving from a timber plantation towards timber trees within an agroforestry system, where very different stem forms can result from variable light and soil nutrition (Liu et al. 2018). Clever planting designs can allow for two, three, four or more species to be grown together without one species outcompeting the others. When they work, such systems can be more productive than monocultures – but the knowledge and skills required to manage such systems should not be underestimated (see below).

- **Lower knowledge requirements** that come from forest and farm producers having only to master the cultivation dynamics of a single crop. As noted above, the complex knowledge required to manage more productive and diverse multistorey agroforestry systems is an additional constraint beyond that of high labour costs, particularly where traditional knowledge has been lost. Additionally, much plant breeding has traditionally focused on monoculture yield – and different varieties might need to be bred to optimise intercropping compatibilities (see Bourke et al. 2021).

- **Simpler access to finance** that comes from bankers facing lower transaction costs of dealing with large volume, uniform, simpler-to-understand production systems. The complexity of small-volume, diverse and complex production systems is frequently documented as an impediment to smallholder access to finance (Macqueen et al. 2018).

Monocultures have significant advantages for economic profitability and growth. But economic profitability and growth that threaten planetary sustainability is clearly calamitous. The negative impacts of agrobiodiversity loss go far beyond the loss of iconic species (Roe 2019). They threaten the future adaptability of food systems under climate change and go beyond the realm of food and agriculture, to include impacts on economic
opportunity, rights and political power. Negative impacts follow this cycle of inequality, driven by conventional economic forces, pushing rural producers towards monocultures, or even off the land and into urban settlements.

Just as agrobiodiversity was found to have many benefits (Table 1) so its loss will have the opposite impacts: food insecurity and livelihood vulnerability, malnutritional and illness, and deficits in energy provision and shelter. But it is the broader loss of biocultural heritage, food security and political power among vulnerable groups that is most worrying. This erodes smallholder farmer and Indigenous Peoples’ capacity to secure their territories and maintain their diverse ecosystem services, including the capacity of smallholder farming systems to contribute to climate change adaptation, mitigation and resilience. This latter point is important because smallholder producers often bear the brunt of climate impacts and make up the main labour force for climate action.
Climate change and climate extremes are already visible threats with impacts particularly acute for smallholders in risk-prone areas. Yet for local forest and farm producers, resilience to climate change is founded on diversification across a range of ecological, economic, social and physical/technological options (Macqueen 2021). Agrobiodiversity underpins many of those options for resilience (Renard and Tilman 2019; Dainese et al. 2019), which is explored further in the following sections.

1.5 Reconfiguring global food systems to reverse agrobiodiversity loss

With so many negative environmental impacts associated with the industrial monoculture agriculture model, practitioners have begun to suggest that simply searching for environmental solutions within the current global food system is futile. Instead, some are advocating for a much more profound change based on agroecological symbiosis (AES) reconfiguring the primary production of food in agriculture, the processing of food, and developing a food community to work toward system-level sustainability based on agrobiodiversity (Helenius et al. 2020).

A transformation of the global food system will rely on planned agrobiodiversity intentionally managed by farmers and on the associated biodiversity that spontaneously colonises the agroecosystem. For this to happen, there will have to be a considerable strengthening of the social networks that organise farmers towards that endeavour – and there is a big gap in the knowledge about such networks or organisations (Labeyrie et al. 2021). This report is partly written to address that knowledge gap and show how such FFPOs and IP and LC groups are indeed mobilising large numbers of farmers towards a much more diverse and distributed global food system.

One critical element of a more diverse and distributed global food system will be the degree to which it genuinely delivers local agroecological food systems (LAEFS) that achieve five outcomes (Sanz-Cañada et al. 2023):

- Achieving a compromise at the local level between agrifood and market specialisation on the one hand and greater cultivated biodiversity and a more diversified economic structure on the other
- Geographically and commercially shortening food channels to the fullest extent – to ensure that the largest possible number of crops are grown locally to supply local need
- Developing new organisational innovations in logistics, distribution and public procurement for the aggregation and scaling up of sustainable food from multiple producers
● Establishing participatory, bottom-up, multistakeholder and multilevel territorial governance that can create an enabling environment for the above, and
● Enriching the collective understanding of these more-resilient food systems by reorganising rural–urban linkages.

There is a territoriality to such diverse and resilient systems that needs investment and support. Once again, the territorial nature of many FFPOs and IP and LC groups offers exactly the right sort of trajectory for this transformation.

This nature of the change that must be contemplated requires a systems perspective. This must reject agricultural technologies being developed with a logic focused solely on a single field or individual plant population – the promotion of monoculture, the reliance on fossil fuels and agrochemicals, the dependence on genetically modified plants – which together are responsible for the current system’s vulnerability and social inequity (Tittonell 2023). Agroecological approaches not only foster greater agrobiodiversity, but they also foster distributive justice, ecosystem restoration and food sovereignty and can only be implemented by embracing whole landscape and food-systems approaches. As we shall see in the following sections, this reconfiguration towards a systems-based approach is already taking place in the FFPOs and IP and LC groups that represent smallholders and Indigenous Peoples worldwide.
Agrobiodiverse agroforestry system in Java, Indonesia. Photo: Duncan Macqueen
2.1 The role of smallholders and Indigenous Peoples in maintaining agrobiodiversity

In contrast to largescale industrial monocultures, smallholder farmers’ and Indigenous Peoples’ landscapes foster high agrobiodiversity. The congruence between maps of agrobiodiversity and average farm size has already been noted (see figures 2 and 3) and is backed by statistical evidence.
that links smaller farm size to greater agrobiodiversity (Rist et al. 2020). In addition, it is important to recognise that many of the world's centres of crop domestication and diversity are located on Indigenous Peoples' territories, which contain rich ancestral gene pools and crop wild relatives (Maxted et al. 2020; Swiderska and Argumedo 2022).

Greater smallholder agrobiodiversity is partly due to the range of items that local people need and therefore plant for subsistence. Smallholders often mix multiple subsistence annuals, perennials and tree crops with any other crops that are established for the purposes of generating cash income (Jarvis et al. 2008). This mix helps smallholders secure income, food, energy, shelter, health, cultural knowledge and ecosystems services (Kahane et al. 2013). Cultural and spiritual values also play an important role in sustaining agrobiodiversity for use in rituals and festivals and by promoting seed sharing and reciprocity (Swiderska and Argumedo 2022).

Together, smallholders produce market products with a gross annual value of between US$ 0.87 and 1.3 trillion (Verdonne 2018). They are also the most populous, comprising 1.5 billion smallholders that make up about 85% of the world's farms. Farms under 2ha globally produce 30–34% of food supply on 24% of gross agricultural area suggesting greater aggregate productivity per unit area (Ricciardi et al. 2018). Smaller-scale farms orient more of their production towards food with farms of less than 5ha producing 70% of the calories in the regions where they predominate (Samberg et al. 2016). Smallholders are also the unsung giants of climate and nature investment, collectively investing US$368 billion annually on necessary climate adaptation which includes diversifying the species and varieties planted (Hou Jones and Sorsby 2023).

Often isolated from each other, markets, service providers and decision-makers, smallholder farmers and Indigenous Peoples frequently choose to work together in different forms of FFPOs or IP and LC groups to overcome that isolation. For smallholder farmers, these groups are often federated into different tiers:

- Local (first-tier) groups generate income from primary production of sufficient quantities and qualities of product to access markets.
- Regional (second-tier) associations generate income by aggregating, processing, packaging and marketing product (value addition) and by providing services to their members.
- Apex-level national (third-tier) federations generate income by representing members in national decision-making processes for which they usually require membership fees (see Figure 5).
- In turn, these third-tier federations may be affiliated to regional or global (fourth-tier) alliances that fight to shape global agendas.
The exact nature of these FFPOs and IP and LC groups and their networks, whether informal and distributed, or formal and centralised, will vary by country. But whatever their nature, their importance in shaping agrobiodiversity should not be underestimated. For example, IP and LC groups play a key role in conserving agrobiodiversity, including in centres of origin and diversity of food crops, such as the Potato Park in Peru. The park acts as an evolving gene bank, testing and improving seeds and supplying surrounding communities with resilient seeds from its collection of about 1,400 native potato varieties (Swiderska and Argumedo 2022).

FFPOs and IP and LC groups and their networks play a key role in shaping agrobiodiversity, including conservation and improvement, with Indigenous women and elders often leading these efforts (Labeyrie et al. 2021). They play a key role in each of the four main areas that typify current research on agrobiodiversity: how agricultural ecologies evolve; how knowledge, seed and enterprise are governed; how food, nutrition, health and resilience are enhanced and impacted; and how global environmental and socioeconomic changes affect the above (see Zimmerer et al. 2019). To this might be added the research area of how agrobiodiversity is conserved, sustainably used, improved, categorised and measured.

Figure 5. How federated producer organisations shape flows of agrobiodiversity knowledge, seed and trade

FFPOs and IP and LC groups often play key roles in the management of agrobiodiversity as it relates to land tenure, knowledge and values, seeds and enterprise. These four areas overlap. For example, secure land tenure in Indigenous Peoples’ territories has allowed knowledge and cultural values to develop around different varieties of crop over
Advancing Agrobiodiversity

millennia. Similarly, knowledge of agrobiodiversity may be used to establish seedbanks, planted field gene banks or seed orchards and protected natural areas, and to select and breed varieties for particular traits. Sometimes FFPOs turn seed production, or seedling production, into an enterprise (Vernooy et al. 2022). The organisations of government and non-governmental agencies, agricultural research agencies and private-sector organisations also shape these flows – and so partnerships, or collaborative governance, are often seen as a preferred way forward (McGuire and Sperling 2016).

In a recent unpublished FFF survey, undertaken by the author, of the perception of 26 FFPOs and IP and LC groups from seven countries as to what makes for a ‘successful landscape’, agrobiodiversity featured strongly. Agrobiodiversity was expressed as a desirable trait using words and phrases such as biodiversity, conservation, trees, integration, reforestation, climate-smart, restoration, regeneration and so on. Figure 6 shows a word cloud of single words or phrases given by the survey respondents in answer to the question “What makes for a successful landscape?”. The same survey saw contrasting words and phrases used to describe a ‘failing landscape’ such as monocultures, fragmentation, degradation, neglect, soil erosion and infertility. When asked what their organisation contributed towards ‘improving’ the landscape, they included words or phrases such as agroforestry, conservation-agriculture, living fences, organic production/fertilisers, reforestation, respect for nature, environmental conservation, resilience, tree planting, assisted regeneration, agroecology, climate-smart agriculture, integration, regeneration/rehabilitation and so on. Clearly, FFPOs and IP and LC groups play an important role in managing, conserving and enhancing agrobiodiversity and the benefits associated with it.

Figure 6. Word cloud of responses: “What makes for a successful landscape?”
Managing agrobiodiversity can be complicated, however. This stems in part from the difficulty of managing complexity when there are a high number of stakeholders across highly variable ecosystems. There is often also a mismatch between the spatial extent of biophysical ecosystems (an area or landscape) and the social, political and institutional boundaries that exist. Sometimes in Indigenous Peoples’ territories, there are distinct cultural landscapes that embrace similar cultural values and beliefs and diverse human interactions with the natural environment under a single customary governance structure. Sometimes, however, the tenure, knowledge, seeds and livelihood strategies are patchy, fragmented, poorly documented or lacking.

What processes for securing tenure, knowledge, seed and enterprise development might FFPOs and IP and LC groups use to manage, sustain or even enhance agrobiodiversity? These are the questions that shaped this report and the case studies within it – focusing on contexts where FFPOs have developed clear approaches to biodiversity management and where agrobiodiversity is notably rich (see Section 3).

2.2 How organisations of smallholders and Indigenous Peoples manage agrobiodiversity

Smallholder farmers and Indigenous Peoples each have some degree of tenure, knowledge, seed and enterprise that shape the agrobiodiversity on their land. But often, they choose to work together to secure tenure, share knowledge, exchange seed, and develop joint enterprises which aggregate enough volume to improve their access to markets.

The organisational priorities which result from collective action will have an important impact on how agrobiodiversity is managed. They may pursue knowledge of high-yield varieties, displace the seed of native landraces, and foster single-product enterprises that spread monocultures. Alternatively, they may promote traditional knowledge of local landraces, conserve and distribute their seed, and try to aggregate and sell baskets of diverse products in such a way as to incentivise the use of agrobiodiversity. Very different outcomes can be achieved depending on the outlook taken. Aggregation of products from the landscape is always vital for market access, but organisations can try to compete in highly competitive commodity markets or distinguish themselves with specific quality traits of products and production systems – the latter route potentially offering better longer-term prospects for premium prices.
2.2.1 Securing tenure and rights

If organisations choose to conserve and manage agrobiodiversity, the empowerment that comes from collective action can be important in securing land tenure and use rights. As noted previously, agrobiodiversity loss often results from inequalities in finance and power driven by conventional economic forces that concentrate land into industrial-scale monocultures (see Figure 4). An appropriate starting point for FFPOs or IP and LC groups is to reclaim political and economic power. This is possible because of the ‘strength in numbers’ that comes from FFPO membership or from sizeable territorial claims – which can improve on the one hand market power (by FFPOs aggregating substantial volumes of product and finance) and on the other hand political power (by marshalling substantial numbers of voters or sizeable Indigenous Peoples’ territorial areas). For example, the Global Alliance of Territorial Communities (GATC) has conducted a very effective campaign to assert tenure rights for its members through engagement at global political conferences of the United Nations on climate change and biodiversity (Currey and Sofa 2021).

Farming transitions that favour agroecological approaches and agrobiodiversity cannot happen solely on farm and in landscapes. They demand mutually supportive transformations, not just in agriculture, but also in the political systems governing rights and economies, and in education systems training tomorrow’s producers, such that agroecology and agrobiodiversity are underpinned by politics, rights and educational support for solidarity economics and localised democracy (Pimbert 2021).

FFPOs and IP and LC groups must often fight to empower their members in those political and economic systems through social innovations that create inclusive and safe spaces for peoples’ deliberation and action. They can strengthen local organisations, horizontal networks and federations that enhance people’s capacity for voice and agency (including gender and intersectional equity). The stronger and more numerous these organisations become, the greater the strength of their linked federations and confederations, and the greater their potential to democratise and decentralise the governance of food systems towards agroecology that enriches agrobiodiversity (Pimbert 2021).

Building on powerful international precedents such as the 2007 UN Declaration on the Rights of Indigenous People (UNDRIP) and the 2018 United Nations Declaration on the Rights of Peasants and Other People Working in Rural Areas (UNDROP), local FFPOs can advance concepts such as food sovereignty and peasant seed systems. Food sovereignty has been defined as “the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems” (Nyéléni 2007).
Recent research on how to move away from industrial scale monocultures towards more resilient and agrobiodiverse systems stresses the importance of addressing underlying property norms that drive land-access regimes, especially where property is controlled by the ruling elites (Calo et al. 2021; Sampson et al. 2021). Due to their strong voter constituency, FFPOs are well placed to fight for more secure property rights, alongside other public services and infrastructure (Pasiecznik et al. 2015).

2.2.2 Sharing knowledge

Biocultural heritage systems often include elders and women with a deep and significant repository of knowledge on agrobiodiversity and how to store, plant, sustainably use and improve it. In a survey of Indigenous farmers in four countries (China, Kenya, India and Peru) research found more than 500 biocultural innovations in China alone that enhance food security, resilience, livelihoods and biodiversity (Swiderska et al. 2018). This rich source of knowledge can be combined with new insights from outside in equitable processes of co-production (Utter et al. 2021).

FFPOs including IP and LC groups can help to develop and spread useful innovations that enhance agrobiodiversity governance. Empowering farmers to tap into such innovations in a more structured way can be achieved using farmer-to-farmer knowledge-exchange methodologies such as through farmer field schools (FFS) and community seed banks (CSBs) (Oxfam et al. 2017) and through the establishment of collectively governed biocultural heritage territories for agrobiodiversity conservation (Swiderska et al. 2020). Climate change variabilities alongside political and economic shocks (such as the war in Ukraine) make diversification towards agroecological resilience a key strategy for local producers (Macqueen 2021). Farmer field school approaches are very useful in helping people manage this transition because they help farmers to experiment with diverse crops and planting arrangements, produce knowledge and innovate independently, drawing on both traditional knowledge and science (Bakker et al. 2022a).

In a survey review of 65 FFS projects (see van den Berg et al. 2020), there was substantial evidence showing that peer-to-peer FFS approaches had led to improvements in natural capital (better field practices, food production, agricultural diversification and food security), with some limited evidence also of improvements to human capital (greater critical thinking, innovation, confidence and quality of life), social capital (greater mutual trust, bonding, collective action, networking and emancipation), and financial capital (greater income and profits, savings and loans schemes). These positive results have led to manuals that guide practitioners in how FFS can help manage agroecological transitions (Bakker et al. 2022b).

The sustainability of techniques such as FFS to enhance agroecological approaches that enrich agrobiodiversity are found to be greatly improved by embedding FFS within FFPOs (IFAD 2022). This is primarily because FFPOs have strong institutional structures and
governance that are necessary for income generation and so can serve as a basis for the sustainability of FFS practice and the quality and duration of training of FFS facilitators (van den Berg et al. 2020). For IP and LC groups, FFS may be sustained beyond projects when centred on sharing traditional knowledge and designed by communities (Swiderska and Stenner 2020).

2.2.3 Managing seed

Farmers the world over manage seed to grow their crops. IP and LC groups frequently treat seed both as biological entities and as part of sacred cultural knowledge systems. Indigenous seed systems help to maintain the human connection to nature (Swiderska and Argumedo 2022). Knowledge about traditional varieties and their seed is often highest in older generations – and there is constant erosion of that knowledge and extinction of locally adapted varieties where gaps between the generations or gender groups are strong (Chaudhary et al. 2020). FFPOs and IP and LC groups can play a key role in managing seedbanks of key locally adapted varieties.

Community-level seed-saving initiatives have emerged over the last 30 years to preserve, restore or improve local systems of seed conservation – especially around local landraces (Vernooy et al. 2015). Often called community seed banks (CSBs), these include a variety of local institutions that contribute to seed conservation – many of which would fall under the definition of FFPO cited above – but are usually set up with support from non-governmental organisations (NGOs). While often established to conserve endangered landraces, they have frequently evolved to multiply and distribute seed, foster food sovereignty, and even generate income from the sale of seed. This has often involved the registration of the institution as a cooperative or company. As numbers have increased, networking between them has helped share learning about best practices.

The functions performed by a CSB might span education and awareness about agrobiodiversity or agroecology (building on traditional knowledge described previously), seed collection or production, storage and distribution on-farm or in some form of storage facility, genetic improvement processes, sale of seed or seedlings or associated technologies, and advocacy (Vernooy et al. 2015). Management is often a challenge, as is financial sustainability, and so there may be significant advantages to embedding these CSB structures within FFPOs that are themselves both managed and income generating, or establishing Indigenous community seed enterprises. Alternative private-sector approaches have struggled, despite the development of climate-resilient varieties, because they have failed to understand the importance smallholders afford to local control over seed and the exchange and experimentation that this allows (Shilomboleni et al. 2022; Vansant et al. 2022).

The importance of producer-managed seed-production systems is found in estimates that West Africa farmers access 90–98% of their seed from farmer seed systems, and for the
rest of Africa, it is 70–95% (Vernooy et al. 2020a). But the formalisation of farmer seed-production systems requires significant investment of traditional knowledge and local finance (Vernooy et al. 2022). It has been possible to develop farmer field school curricula that spread understanding of how best to manage farm seed production, including within local groups or FFPOs (for example see Morrone et al. 2018).

2.2.4 Diversifying enterprise

Often overlooked in the transition towards a more agroecological approach that enhances agrobiodiversity is the enterprise dimension. Who will buy the diverse products emerging from such systems? How can FFPOs sell baskets of products in various markets to reward and thereby incentivise those who are sustaining or adopting more agrobiodiverse land use?

As noted in Section 2.1, some of the agrobiodiversity that is prevalent on smallholder farms is a function of subsistence systems: people planting a wide diversity of things that they themselves need for healthy nutrition, traditional medicines, energy, household construction and furnishings, and for cultural purposes. As opportunities emerge to join the market economy, economic forces may entice farmers towards production uniformity in search of profit, and cost and scale efficiencies. Extension services may encourage farmers to adopt high-yielding varieties (see Section 1.3), replacing a diverse number of traditional species and varieties with a few high-yielding profitable ones (Pascual and Perrings 2007). This may work for farmers' short-term incomes – but it also increases input costs and erodes agrobiodiversity. It may also threaten longer-term smallholder resilience by building dependency on single commodity crops and markets that can suffer economic downturns and climate-related failures. Are agrobiodiversity and poverty inextricably linked or is it possible to increase incomes while conserving agrobiodiversity?

One route towards poverty reduction is through enterprise. There are two main things that can be sold from rural smallholdings: products and services (ecosystem services that provide public goods and ecotourism in Indigenous landscapes). To maintain agrobiodiversity while also reducing poverty (de Boef et al. 2013), FFPOs might pursue combinations of a number of strategies:

- **Installing broader enterprise aims than short-term profit** by using group enterprise development processes to build in social inclusion and environmental sustainability objectives that will ensure longer-term social and environmental sustainability of those enterprises.

- **Considering economic risk and long-term productivity** by broadening the understanding farmer-group businesses have of the agroecological and climate-resilience benefits of maintaining diversity and soil fertility that may counterbalance short-term economic incentives of switching to few improved varieties.
Advancing Agrobiodiversity

- **Targeting local markets** and broadening diverse local sales by promoting customary nutritional diversity and capitalising on local dietary or cultural product preferences to generate value from as many products as possible.

- **Aggregating for scale across multiple products** by capitalising on the strength in numbers of member-based organisations to aggregate and sell efficiently volumes of those diverse products from the same landscape so as to improve market access for different markets (often with some of the same products as the two preceding options).

- **Developing multiple market niches** by capitalising on peculiar geographical/varietal characteristics, quality and origin in marketing and labelling to differentiate products in ways that might improve access to broader (such as export) commodity markets or domestic ecological and tourist markets (often with the same products).

- **Developing value-added farm and wild-harvested products** based on traditional knowledge, which can increase profit margins and reduce production intensity, such as speciality foods, herbal teas, crafts or personal care products.

- **Developing revenue from ecotourism and educational tourism** through for example restaurants that sell traditional foods, trekking and homestays in Indigenous territories rich in agrobiodiversity and biocultural heritage.

- **Including add-in environmental service schemes** to learn to measure, manage and market agrobiodiversity as an ecosystem service or public good in emerging schemes (see also Section 2.3).

- **Using collective saving and investment funds to incentivise diversity** by reinvesting some income generation into savings and credit cooperative societies (SACCOS) that make loans conditional on agrobiodiversity conservation to ensure longer-term revenue flows.

In the transition from subsistence to engagement with markets, well-organised FFPOs and IP and LC groups can put in place a number of these measures to try and decouple poverty reduction from agrobiodiversity loss.

### 2.3 How smallholder and Indigenous People’s organisations can measure and market agrobiodiversity

Since agrobiodiversity contributes to the public good as noted in Section 1, it should be possible for metrics of agrobiodiversity to act as a promotional tool for products marketed from agrobiodiverse systems.
From the outset, it is important to note that if a key aim is biodiversity conservation, the very best way to conserve biodiversity is to protect natural ecosystems embedded within forest and farm landscapes (Sacco et al. 2021). No amount of agrobiodiversity, even when it includes wild foods, is likely to compensate for the loss of natural ecosystems. This is especially true for the tropics, where the numbers of vascular plant species in a typical forest range from over 8,000 in the Congo Basin, to more than 19,000 in Indonesia to as much as 34,000 in the Brazilian Amazon (Mongabay). Even the more agrobiodiverse farm landscapes in the case studies in Section 3 only manage a few hundred species at most: so the importance of maintaining natural vegetation is immediately apparent.

2.3.1 Useful manuals and online tools on agrobiodiversity

Even though agrobiodiversity is only a small subset of overall biodiversity, however, it still has many distinct benefits for the forest and farm producers who maintain it (see Section 1). These benefits to food security, livelihood resilience, nutrition, provision of biomass energy and household materials, as well as the preservation of biocultural heritage and ecosystem services, are public goods in their own right. Farmers often have detailed understanding of the crops under their care in traditional classification systems (ethnotaxonomies), seasonal calendars and management practices, and beliefs about values and uses. Measuring agrobiodiversity can be done in several participatory ways (see PAR 2018 for a thorough treatment). These include household surveys (HHS), focus groups discussions (FGDs) and key informant interviews (KIIs), complemented by other methods such as participatory transect walks or four cell analysis (FCA) in which the numbers of people planting a crop or variety (few, many) and the scale at which they plant it (small or large areas) can quickly assess varieties that may be under threat (PAR 2018). Together, these approaches can generate data about the numbers of species and varieties (and their local and scientific names) and the extent of use.

Because of this, a range of tools now exists to help farmers take a more proactive approach to measuring and managing agrobiodiversity. A number of useful introductory manuals have been developed that can equip FFPOs with practical approaches to this (see Table 3). Additionally, there are now several more sophisticated online tools to help different audiences improve their agrobiodiversity management. Table 4 provides examples of some prominent online tools that help farmers or support workers to assess or promote agrobiodiversity with a view to enhanced management.
### Table 3. Examples of useful manuals on agrobiodiversity and their intended purpose

<table>
<thead>
<tr>
<th>Name of manual</th>
<th>Purpose</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agrobiodiversity – a training manual for farmer groups in East Africa</td>
<td>To help farmers understand the benefits of agrobiodiversity (such as nutritional benefits and food security) with guidance on how to integrate different elements of crops, cover crops, trees, livestock and aquatic production systems.</td>
<td>FAO (2018b)</td>
</tr>
<tr>
<td>Agrobiodiversity conservation and sustainable use in enhancing food security</td>
<td>To equip practitioners or trainers in understanding various elements of agrobiodiversity conservation and use, for their subsequent work with communities.</td>
<td>Mungai (2011)</td>
</tr>
<tr>
<td>Biodiversity and agricultural production practices toolkit</td>
<td>To introduce farmers to production practices that improve (wild) biodiversity or reduce the negative impacts on biodiversity of producing crops and livestock.</td>
<td>Ecoagriculture (2017)</td>
</tr>
<tr>
<td>Building on gender, agrobiodiversity and local knowledge – a training manual</td>
<td>To help trainers introduce to communities issues of gender and local knowledge which are important elements for agrobiodiversity management and food security.</td>
<td>FAO (2005)</td>
</tr>
<tr>
<td>Community seed banks: concept and practice. Facilitator handbook</td>
<td>To help farming communities understand why and how to set up and run a CSB to conserve agrobiodiversity.</td>
<td>Vernooy et al. (2020b)</td>
</tr>
<tr>
<td>Improving nutrition with agricultural biodiversity</td>
<td>To help farmers use agrobiodiversity to improve community nutrition.</td>
<td>Fanzo et al. (2011)</td>
</tr>
<tr>
<td>Manuals and protocols for conservation and sustainable use of agrobiodiversity</td>
<td>To point practitioners to a range of tools in participatory agrobiodiversity diagnosis, crop improvement, action research on neglected and underutilised crops, CSBs, seed systems analysis and improvement and enterprise.</td>
<td>Vernooy (2023)</td>
</tr>
<tr>
<td>Measuring agrobiodiversity: a compendium of methods</td>
<td>To equip practitioners with the ability to measure agrobiodiversity.</td>
<td>PAR (2018)</td>
</tr>
<tr>
<td>Rapid Agrobiodiversity Assessment (RABA)</td>
<td>To offer guidance on the important things that should be noticed in an attempt to advocate conservation of agrobiodiversity in the context of payments for environmental services.</td>
<td>Kuncoro et al. (2004)</td>
</tr>
<tr>
<td>Teaching agrobiodiversity: a curriculum guide for higher education</td>
<td>To equip teachers with a curriculum guide on agrobiodiversity for higher-education students.</td>
<td>Rudebjer et al. (2011)</td>
</tr>
</tbody>
</table>
Table 4. Examples of online tools to assess or promote agrobiodiversity

<table>
<thead>
<tr>
<th>Name of tool</th>
<th>Description</th>
<th>Treatment of agrobiodiversity</th>
<th>Intended users and reference</th>
</tr>
</thead>
</table>
| Agrobiodiversity Diet Diagnosis Interventions Toolkit (ADD-IT) | ADD-IT is an application developed to improve nutrition in the African region. | ADD-IT uses a food frequency questionnaire as a nutrition survey method to quickly assess people's nutrition in the region and provide immediate feedback on nutrition and vegetables. | Aimed at local health workers and community health volunteers.  
| Agrobiodiversity Index (ABDI)                     | ABDI is a tool to measure agrobiodiversity and identify concrete actions to achieve diverse and sustainable food systems. | The tool focuses on sustainability through three pillars that also represent three measurement categories:  
1. Healthy diets (how users contribute to improving food biodiversity for healthy diets).  
2. Sustainable agriculture (how users contribute to improving biodiversity for sustainable agricultural production).  
3. Current and future use options (how users contribute to improving the management of agrobiodiversity genetic resources for current and future options). | Aimed at a range of customers including countries, companies and projects.  
CGIAR (2019) |
| Cool Farm Tool                                    | The Cool Farm Tool allows for a quantitative scoring of whole farm management in order to assess the scale of contribution to biodiversity protection (alongside greenhouse gas emissions and water management). | The tool involves a questionnaire for a participating farm with answers linked to quantitative algorithms built into the tool that create scores on four dials for: (1) Farmed products, (2) Farming practices, (3) Small habitats, and (4) Large habitats. | Aimed at farm managers (mainly in the temperate region but with tropical capabilities under development).  
Cool Farm Alliance, https://coolfarm.org |
**Diversity Assessment Tool for Agrobiodiversity and Resilience (DATAR)**

DATAR is an open-source pilot software platform with a web interface (the DATAR Web Portal) and an Android App that allows communities to:
- Set agrobiodiversity goals
- Make participatory assessments
- Identify constraints, plan interventions and assess progress
- Cross diverse crop varieties, livestock breeds, and aquatic farmed types 

The tool uses participatory methods and data input from FGDs, HHS and KIIs to populate the app with information about crop varieties, livestock breeds, and aquatic farmed types and their functional traits – as well as identifying and describing genetic material providers who supply crop seeds, animal breeds and aquatic farmed types: from local communities to public and private companies.

**Intended users**

Aimed at farming communities (mainly in the tropics) who wish to proactively manage their agrobiodiversity.

**PAR, Platform for Agrobiodiversity Research, www.datar-par.org**


Community registers of agrobiodiversity and traditional knowledge can also provide tools to assess agrobiodiversity levels and protect farmers’ rights in the event of unauthorised commercial use (such as through secure community databases). IPs and LCs can also develop their own tailored tools that reflect traditional ways of organising landscapes and traditional taxonomies. For example, Quechua communities in the Chalakuy Maize Park in Peru and the NGO Asociación ANDES (Association for Nature and Sustainable Development) have developed a smartphone app to collect information about wild foods, including Global Positioning System (GPS) coordinates, and traditional and scientific names and traditional uses, which allows users to enter the information directly into a community database for sustainable use and monitoring (Swiderska and Stenner 2020).

### 2.3.2 Payment schemes for agrobiodiversity conservation services

FFPOs and IP and LC groups are very much the custodians of agrobiodiversity (as will be illustrated in Section 3). In part this is because subsistence farming systems sustain rich agrobiodiversity linked to nutrition, medicines and construction materials.

The challenge is to maintain the agrobiodiversity and cultural values while eliminating income poverty through careful engagement with the market and the promotion of mixed
subsistence and market economies. It is not just diverse products that can be marketed. An alternative lies in finding ways to develop markets for agrobiodiversity itself as an ecosystem service or public good. Once FFPOs are familiar with tools to measure and manage agrobiodiversity, the possibility might open up to explore such markets.

The means of doing this is to link a credible ‘measurement’ of agrobiodiversity to a ‘claim’ within some form of payment for ecosystem services (PES), biodiversity offsets or biodiversity credit (biocredit) certification scheme. In recent years, several such schemes have emerged to help value the conservation of agrobiodiversity.

The PES-type arrangements are often now called payments for agrobiodiversity conservation services (PACS) and early examples include those from Bolivia, Ecuador, Guatemala and Peru which covered payments for the protection of 130 threatened varieties across a number of major food crops, and involved over 100 farming communities and 1,100 farmers. How they work is that a conservation ‘buyer’ rewards groups of farmers (each of whom submits a competitive tender bid) for growing threatened genetic resources of high public-good value (the choice of which is determined in a participatory way). The competitive tender processes yielded farmer bids with high heterogeneity, varying between US$675/ha to 10 times as much – and the selection processes involved both cost considerations and social considerations (Drucker and Ramirez 2020).

At the moment, the coverage and impacts of such schemes are limited. But it could become a vital element of agrobiodiversity conservation if a strategy were developed to:

- Map and identify hotspots where poverty and agrobiodiversity overlap
- Provide decision support to channel PACS towards effective intervention areas
- Set up a monitoring scheme to assess impacts on both agrobiodiversity conservation and poverty reduction, and
- Promote willingness to pay through ecolabel development, public procurement, and public or private programme partnerships (Drucker 2011).

However, some Indigenous groups have been critical of PES schemes and other Western market-based approaches which do not give sufficient attention to Indigenous Peoples’ worldviews, values, institutions and economies and thus contribute to their erosion. In some cases, IP and LC groups have instead developed low-impact ecotourism services (such as traditional restaurants, homestays, trekking) that can generate revenue from agrobiodiverse landscapes while supporting biocultural values (Swiderska et al. 2020).
2.3.3 Biodiversity offsets

Biodiversity offsets have also emerged as schemes where biodiversity loss in one area is supposedly ‘compensated' by payments for biodiversity conservation in another area. Assessments of such schemes cast considerable doubt on their efficacy (zu Ermgassen et al. 2019), since the assumption of ‘equivalence' (that harm in one location is comparable to reparations elsewhere) rarely holds. Some have even argued that biodiversity offsets legitimise, rather than prevent, damage to biodiversity since technical and financial limitations in measuring nature often fail to allow certainty in measuring equivalence or ensuring that offsets are truly providing a net gain (Ducros and Steele 2022). As a result, even when a biodiversity offset scheme targets a net zero impact, there is still the likelihood of damaging biodiversity. This forms part of an uncomfortable relationship between business and biodiversity that is well discussed in the literature (see Panwar et al. 2022).

2.3.4 Voluntary biocredits

Also under development are a series of schemes that try to quantify and sell biodiversity management credits or ‘biocredits’ without any loss of biodiversity elsewhere. The main schemes that have emerged to date focus on the protection, restoration and management of ‘wild' biodiversity rather than agrobiodiversity (see Table 5, based on Ducros and Steele 2022). As many as 11 biocredit developers are now entering this space (Zynobia et al. 2023). Biocredits are being applied broadly in three ways:

- To avoid habitat conversion and resultant biodiversity loss
- To measure improvements in biodiversity through some form of restoration, or
- To reward successful management of pristine sites (Ducros and Steele 2022).

In agricultural settings, it is probably the first two that merit consideration, as both rely on some form of measurement against a reference level – which could be a reference level for agrobiodiversity, not just wild biodiversity.
Table 5. Examples of emerging voluntary biocredit schemes and their market ‘claims’

<table>
<thead>
<tr>
<th>Name of scheme</th>
<th>Description</th>
<th>Treatment of biodiversity to make market claim</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Terrasos</td>
<td>Terrasos is a company based in Colombia that designs financial instruments for biodiversity conservation in Colombia – including pioneering a ‘habitat banking model’ – as a solution for delivering high-quality biodiversity offsets and biocredits for the voluntary market, with 60 voluntary biodiversity credits (VBCs) sold by 2022 in Cesar, Antioquia, and Meta departments of Colombia.</td>
<td>A voluntary biodiversity credit (VBC) is a transactional unit representing positive contributions to biodiversity in an area of at least 10m², within a preserved and/or restored ecosystem, that is managed technically, financially and legally, for at least 20 years, achieving measurable results in terms of biodiversity. Terrasos quantifies the VBC from four factors that are given scores and include: 1. IUCN risk category of the ecosystem (higher risk equals higher score), 2. Preservation versus restoration (restoration scores higher), 3. Permanence (longer is better from 20-year minimum), 4. Ecological connectivity (higher if restoration also increases habitat connectivity).</td>
<td><a href="http://www.terrasos.co">www.terrasos.co</a> Terrasos (2023); Ducros and Steele (2022)</td>
</tr>
<tr>
<td>ValueNature</td>
<td>ValueNature is a new company that is currently raising funds to accelerate the protection and recognise the value of nature by providing a platform that uses technology to efficiently measure, value and trade biocredits. It works with Conserve Global to identify priority African conservation land that lies outside of parks, and with Hedera Hashgraph, that provides a digital ledger technology platform for its digital certificates.</td>
<td>A ValueNature Score (VNS) is a transactional unit for one hectare of land protected from degradation for 10 years with a minimum permanence of 30 years. A VNS is measured by a composite biodiversity metric made up of equal parts of: 1. Flora intactness (measured using remote sensing such as normalised difference vegetation index (NDVI) of satellite imagery), 2. Fauna intactness (measured using camera traps and bioacoustics sensors deployed locally), 3. The IUCN Species Threat Abatement and Restoration (STAR) metric (which scores the potential benefit for threatened species of habitat restoration), and 4. Carbon stocks (measured from above-ground and soil carbon assessed remotely).</td>
<td><a href="https://valuenature.earth/">https://valuenature.earth/</a> ValueNature; Ducros and Steele (2022)</td>
</tr>
<tr>
<td>Name of scheme</td>
<td>Description</td>
<td>Treatment of biodiversity to make market claim</td>
<td>Reference</td>
</tr>
<tr>
<td>---------------</td>
<td>-------------</td>
<td>-----------------------------------------------</td>
<td>-----------</td>
</tr>
</tbody>
</table>
| Wallacea Trust | Wallacea Trust is a biodiversity and climate research organisation. Working with a wide range of partners, it has developed an open methodology that defines a ‘biocredit’ or unit of biodiversity as a 1% increase or avoided loss in the median value of a basket of metrics (per hectare). This can be validated and verified by a third-party certification body such as Gold Standard or Plan Vivo who issue the credits upon successful review. Entities such as rePLANET and the Biodiversity Credit Company develop the projects. | A Wallacea Trust biocredit is defined as a 1% restoration or avoided loss per hectare in the median value of a basket of a minimum of at least five biodiversity metrics that reflect conservation objectives for the region of the submitted site over a 25-year period. Those five metrics usually monitor species richness (weighted by IUCN-listed species) with abundance on a five-point logarithmic scale – for functional tax such as breeding birds, soil invertebrates etc. Metrics are typically evaluated every five years (or shorter) and three types of biocredit serve different sites, such as: 1. Ex-ante biodiversity uplift credits (for new site-management approaches that compare metrics with those of a reference site), 2. Ex-post biodiversity uplift credits (for sites that submit metrics periodically over time), and 3. Ex-post avoided biodiversity loss credits (for sites where developments have been avoided and can be quantified from sites that were developed). | https://wallaceatrust.org
Wallacea Trust (2023); Ducros and Steele (2022) |

It may be that smallholder farmers can make landscape claims for ‘wild’ biodiversity conservation using such schemes – but they are not yet readily applicable to the direct promotion of agrobiodiversity. For that reason, it may be fruitful to explore other ways of rewarding agrobiodiversity conservation in the market – through for example participatory guarantee systems (PGS) or other biocultural labelling schemes which support cultural values.
2.3.5 Certification to reward agrobiodiversity claims

Certification schemes with set standards and third-party audit processes in the agricultural space include for example organic certification and Fairtrade certification, and – in the forest space – certification for sustainable forest management. In the latter schemes, there are some indicators on managing ecosystem services and high conservation-value forest: Principles 6 and 9 of the Forest Stewardship Council. But none of the existing schemes currently quantify or reward agrobiodiversity as a direct aim. Moreover, most third-party certification schemes fail adequately to address the inherent disadvantages of scale in covering third-party audit costs – which work against smallholders who might stand to benefit most from schemes to certify agrobiodiversity.

In response, many smallholder groups have been exploring how to develop less costly shared labels. Chief among these have been the emergence of second-party certification schemes under the banner of the International Federation of Organic Agriculture Movements (IFOAM), called participatory guarantee systems (PGS). Innovators of PGS originally set out to make claims about the sustainable (often organic) nature of their agricultural production using internally developed standards and agreed peer-to-peer audit systems to assure compliance (Loconto et al. 2016). Guides as to how to do this are now widely available (see IFOAM 2019).

As the popularity of these schemes has expanded, there have been innovations in the nature of what is claimed by smallholder producers. So for example, there have been developments in PGS systems that make claims for the sustainability of charcoal, cocoa, coffee, fruit, honey, rattan and textiles (see Wagner 2022). Slow Food International has helped Indigenous Peoples develop PGS labels to defend and promote their food heritage, through its Presidia Label and Narratives Label which promote recognition of agrobiodiversity conservation. These PGS developments are part of broader sustainable food-systems innovations that are reshaping how longer-term sustainability can be forged (see Loconto et al. 2020). Recent research has looked in more detail at how producers are making claims about farming systems in Europe that promote ‘agroecology’ (Loconto et al. 2023). The study finds that labels are communicating a diversity of ideas about agroecology with messages that are more complex than only ‘no agrochemicals’. More formal labels built around ‘organic’ production are also strongly associated with diversity while less formal labels are associated with notions of ‘local products’ and ‘social’ values. It will be interesting to track whether sharper messaging on agrobiodiversity can gain traction in the market through these more flexible PGS-type schemes.

In looking at how these new PGS shared labels are developing, it is clear that they can counterbalance pressures towards commoditisation and provide a useful way of

---

3 See https://adria-balkan.fsc.org/en/forest-management/fsc-principles-and-criteria
4 See www.ifoam.bio/our-work/how/standards-certification/participatory-guarantee-systems
5 See www.slowfood.com
differentiating products: in this case, by highlighting agrobiodiversity within the forest and farm production system perhaps within particular traditions of biocultural heritage (Wagner 2022). There appears to be market demand for such labels both in the global North and markets serving the middle classes of the global South. There also appears to be strong supply-side motivation, especially in territories where maintaining agrobiodiverse production is integrally linked to preserving biocultural heritage, with examples of new shared labels attracting price premiums, preferential market position and new and better market linkages (Wagner 2022). The key going forward will be to develop credible metrics for agrobiodiversity that are developed by local smallholder farmers or Indigenous Peoples and can be factored into such labels.

In some cases, Indigenous Peoples have developed informal collective labels that apply to all products and services from a particular territory, with criteria and rules defined by Indigenous Peoples that recognise and support cultural values and customary laws. The Potato Park label in Peru, for example, applies to all products and services from the Potato Park biocultural territory, and 10% of revenues derived from its use are invested into a communal fund and shared equitably (Swiderska et al. 2019). The Maori experience in New Zealand shows that Indigenous Peoples’ own labelling and self-certification can be effective for generating revenue in both domestic and international markets, while promoting environmental and cultural goals (Mattei et al. 2020). These labels seek to strengthen Indigenous values that underpin agrobiodiversity conservation.

2.4 How global to national policies might support agrobiodiversity management

Food security is increasingly threatened by both climate change and the distributive inefficiencies of the industrial food system. Against that backdrop, the maintenance and enhancement of agrobiodiversity by communities typically happens alongside the more formal breeding of new commercial plant varieties with temporarily improved performance, such as tolerance of new conditions until those conditions change, or resistance to pests and diseases until the pest and diseases circumvent that resistance. While free circulation of plant varieties and knowledge about them has in the past been considered in the public interest, new agreements to incentivise plant breeding and create the conditions for expansion of the corporate breeding sector have not taken the same view – and this has detrimental impacts on smallholder management and improvement of agrobiodiversity, as is explained in the next sections.
2.4.1 International agreements on plant breeders’ rights

Incentivising plant breeding might require compensating plant breeders for their efforts (whether they are local farmers or multinational corporations). For this reason, an International Convention for the Protection of New Varieties of Plants (the UPOV Convention) was negotiated as the 1978 Act that allowed signatories to establish a list of plant varieties eligible for plant breeders’ rights (PBRs). PBRs protect the commercial interests of formal plant breeders. A simple summary of the 1978 Act is that it protects commercial production and sale of seed or vegetative material of nationally listed plant varieties for 15 years.

The UPOV Convention was altered in 1991 and expanded coverage to include all new, distinct, uniform and stable (NDUS) plant varieties – again, excluding local farmer varieties (always evolving and genetically diverse). It also restricts the use and non-commercial exchange of protected varieties. As of 2021, 75 countries were members of UPOV, with 60 signing the 1991 Act (Peschard 2021).

Relatedly, the 1995 WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) has introduced obligatory protection of plant variety rights (PVRs). The TRIPS Agreement, driven primarily by industrialised nations, establishes minimum standards for the regulation by national governments of different forms of intellectual property (IP) and includes the obligatory protection of plant varieties. In practice, however, there is considerable leeway under TRIPS for countries either to use patents, PVRs or to develop their own unique (sui generis) legislative protection of IP requirements to suit their own needs and interests.

Industrialised countries, whose corporate seed industries stand to benefit from strong PBRs, have pressured countries in the global South to join UPOV and ratify the 1991 Act, often by making broader trade agreements conditional on them joining UPOV to meet TRIPS requirements. However, industrialised corporate profits from plant breeding and the sale of commercial varieties (which cannot be freely saved and exchanged) does not contribute to food security in a rapidly changing climate. Despite such concerns, many countries have adopted UPOV to access trade agreements, in some cases adopting national legislation that effectively criminalises the local sale of seed (see La Via Campesina 2015).

In comparison with industrialised countries, agriculture in the global South often accounts for a substantial share of gross domestic product (GDP) and involves a substantial sector of smallholders and traditional agriculturalists, for whom rigid application of the UPOV Convention as a means of meeting TRIPS requirements may be highly contentious (Antons 2016). Indeed, recent analysis of a decade of application of the UPOV Convention in West Africa has demonstrated a high degree of dysfunction and negative side effects (Coulibaly and Brac de la Perrière 2019).
2.4.2 International agreements on farmers’ rights to use, exchange and sell farm-saved seed

The 1993 Convention on Biological Diversity is one of the most widely ratified international instruments (192 nations). The CBD sets out an agreement to conserve biological diversity, to sustainably use the components of biological diversity, and to ensure fair and equitable sharing of the benefits of that diversity. This introduced the idea of genetic resources of agriculture as a common heritage of humankind subject to the sovereign rights of nation states – but also recognising customary rights (Santilli 2017).

Partly in response to the concerns around PBRs raised in the previous section, a further agreement was reached in 2001 (in force by 2004): the legally binding International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA), often called the Plant Treaty or International Seed Treaty (see Box 1). The Plant Treaty aimed to be a comprehensive international agreement in harmony with the CBD, to guarantee food security through the conservation, exchange and sustainable use of the world’s plant genetic resources for food and agriculture, the fair and equitable benefit sharing arising from its use, as well as the recognition of farmers’ rights. The landmark introduction of farmers’ rights in Article 9 could be seen as a counterbalance to the protection of plant varieties under the UPOV Convention and WTO TRIPS Agreement (Golay et al. 2022).

But despite being legally binding, implementation of Article 9 was weakened by the fact that its interpretation is “subject to national legislation”. While many countries have enshrined PBRs in national law, farmer-managed seed systems are largely neglected in national policies and legislation, thus creating an imbalance which can undermine the seed systems of smallholders and Indigenous Peoples and their incentives to conserve them (Andersen 2023).

Box 1. FAO Plant Treaty: Article 9 on farmers’ rights

The International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) – also often called the Plant Treaty – recognises the enormous contribution of farmers worldwide in conserving and developing crop genetic resources. Measures to implement farmers’ rights may include (Article 9):

- The protection of traditional knowledge relevant to crop genetic resources
- The right to participate in equitable benefit sharing arising from the utilisation of crop genetic resources
- The right to participate in making decisions, at the national level, on matters related to crop genetic resources, and
- Rights that farmers have to save, use, exchange and sell farm-saved seed/propagating material, subject to national law.

Source: Golay et al. (2022)
Complementing this binding text with clearer guidance, anchored to human rights legislation, UNDRIP of 2007 lays out in Article 31 Indigenous Peoples’ rights to maintain, control, protect and develop their seeds and ownership of seeds (United Nations 2007). These rights were further elaborated in UNDROP in 2018. Article 19 of UNDROP explicitly obliges States to recognise farmer’s rights to use, exchange and sell farm-saved seed as an integral part of the rights of peasants – and also obliges States to support peasant seed systems, and promote the use of peasant seeds and agrobiodiversity (UN Human Rights Council 2018). It further obliges states to ensure that seed policies, plant variety protection and other IP laws, certification schemes and seed marketing laws respect and take into account the rights, needs and realities of peasants (Peschard et al. 2023a; 2023b).

2.4.3 The way forward for greater protection of peasant seed systems

The rights and protections afforded to peasant seed systems are still highly contested in many countries. This is not a small issue, as estimates put farmer-managed seed systems in Africa as responsible for 80–90% of what is planted each season. In Asia and Latin America, they account for 70–80% (La Via Campersina 2015). For too long, peasant seed systems have been either neglected or marginalised by laws geared primarily towards the commercial interests of the corporate sector. The adoption of UNDROP clarifies for nation states that the human right to seed must take precedence over other private or commercial rights (such as those relating to plant breeding, plant variety protection, intellectual property, marketing and trade).

As nation states grapple with these issues, compliance with international human rights in the area of food sovereignty requires the recognition of the intrinsic value of peasant seed systems, and the central role they play in preserving agrobiodiversity (Peschard et al. 2023). Smallholder farmers must be able to rely on, save, exchange and sell their own seeds of choice, at times suited to them. Ancestral and innovative practices that have allowed agricultural production to adapt and meet local needs, and which comprise traditional knowledge, must be acknowledged, respected and protected in law. Exceptions in domestic patent law must allow peasants to save, use, exchange and sell farm-saved seeds and propagation materials from plants covered by patents. Smallholders and Indigenous Peoples, through their representative bodies (such as FFPOs and IP and LC groups), must be involved in the development of any laws that impinge on those rights.

There are good reasons for moving sharply in this direction – not least to maintain food security from collectively the largest agricultural production sector. But protecting peasant and Indigenous seed systems also ensures ongoing adaptation to climate change – as well as the maintenance of high levels of agrobiodiversity that give resilience in the face of climate change.
Agrobiodiverse agroforestry system in Nepal. Photo: Duncan Macqueen
3

Case studies: how smallholders and Indigenous Peoples manage agrobiodiversity

3.1 Introducing the Forest and Farm Facility’s case studies

Co-production of knowledge is a key means of effective learning on sustainability (Norström et al. 2020). As a partnership that aims to strengthen FFPOs and IP and LC groups as the most significant change agents for delivering climate-resilient landscapes and improved livelihoods, the Forest and Farm Facility (FFF) co-produces knowledge with
the FFPOs and IP and LC groups it supports. Typically, this involves a series of steps (see Covey et al. 2021), that in this case have included:

- Identifying with FFPOs and IP and LC groups an area of mutual interest – agrobiodiversity management – that emerged in collaborative exchanges with FFPOs and IP and LC groups in Viet Nam during the 2022 conference Saving our Future: Investing in Locally Led Diversification for Food Security and Climate Resilience. During the conference, there was interest to learn more about how to manage the diversity necessary for resilience.

- Co-committing to the topic through field discussions at the conference of the best organisations and sites from which to learn

- A researcher-led literature search to frame the topic: the analysis presented in the earlier sections led to the design template for the case studies

- Commissioning case studies documented by FFPOs or IP and LC groups (which are summarised in the following sections)

- Organising a co-learning event to exchange and integrate findings (currently scheduled for April 2024)

- Producing initial knowledge products, including the case studies already online

- Testing any knowledge products or guidance to improve FFPO agrobiodiversity management, and

- Organising final co-learning events to implement training or refine knowledge products prior to alternative means of dissemination.

The six case studies selected for inclusion here emerged out of that process. Each of the summaries are based on the longer case studies referenced in Table 6. The idea was to substantiate theories gleaned from the academic literature about how agrobiodiversity might be managed with some glimpses of how FFPOs and IP and LC groups were actually doing it in practice. Each of the case studies was chosen because FFF facilitators felt that those particular groups were managing agrobiodiversity well and using at least some deliberate proactive management strategies from which other FFPOs and IP and LC groups could learn.

---

6 See Forest and Farm Facility (2022).
<table>
<thead>
<tr>
<th>#</th>
<th>Country</th>
<th>FFPO name</th>
<th>Description of agrobiodiversity</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ecuador</td>
<td>Union of Peasant and Indigenous Organizations of Cotacachi (UNORCAC)</td>
<td>Within the mosaic smallholdings of Cotacachi canton, UNORCAC members manage an estimated 172 on-farm species, of which 97 are detailed in the case study.</td>
<td>Piñán Cajas (2023)</td>
</tr>
<tr>
<td>2</td>
<td>Ghana</td>
<td>Abrono Organic Farmers Association (ABOFA)</td>
<td>Based in Forikrom in Bono East Region, ABOFA supports its 6,000 members to manage more than 30 different crops, nine species of livestock and a wide range of medicinal herbs on their small 1 hectare plots.</td>
<td>Paul (2023)</td>
</tr>
<tr>
<td>3</td>
<td>Madagascar</td>
<td>Analamanga Regional Branch of the National Platform for Women, Sustainable Development and Food Security (ARFDDSA Analamanga).</td>
<td>In Ambohidratrimo district, some 40km from Antananarivo, ARFDDSA Analamanga helps its members manage more than 34 types of crops: 24 agricultural and 10 fruit crops (composed of 80 varieties) while also keeping 13 different types of livestock.</td>
<td>Andrianaivolala (2023)</td>
</tr>
<tr>
<td>4</td>
<td>Nepal</td>
<td>Chabeli Farmers Group within the National Farmers Group Federation (NFGF)</td>
<td>In the hilly Bhimphedi municipality, Chabeli Farmer Group members manage of 56 species of cereal, vegetable crops, fruit, forage and fodder species – with as many as 99 different varieties across those species – alongside 10 types of livestock.</td>
<td>Nepal and Koirala (2023)</td>
</tr>
<tr>
<td>5</td>
<td>Tanzania</td>
<td>Mtandao wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha (MviwaArusha)</td>
<td>In rolling hills of the Karatu and Monduli districts, the 12,500 smallholder members of MviwaArusha manage more than 20 commercial crops and 10 types of livestock (including bees). They also collect a wider range of vegetables, fruit and medicinal plants from forest and farm patches.</td>
<td>Kayombo et al. (2023)</td>
</tr>
<tr>
<td>6</td>
<td>Zambia</td>
<td>Choma District Tree Nurseries Association (CDTNA).</td>
<td>This atypical case described the work of CDNTA's 111 nursery grower members to supply 338,000 assorted seedlings from 48 tree species per year to restoration programmes, government agencies, NGOs, schools, colleges, fellow farmers and individuals.</td>
<td>Chingaipe (2023)</td>
</tr>
</tbody>
</table>
In the sections that follow, the case-study summaries introduce each FFPO, highlight the agrobiodiversity their members manage and how knowledge about it is managed, how seed and animal offspring are procured, and how enterprise strategies incentivise its maintenance. Particular attention is paid to the role that the FFPOs play in those processes.

3.2 Ecuador: Union of Peasant and Indigenous Organizations of Cotacachi (UNORCAC)

3.2.1 About UNORCAC and the agrobiodiversity its members manage

UNORCAC is a second-tier association of 45 grassroots community and smallholder producer organisations in the Cotacachi canton of Ecuador, comprising approximately 3,500 households. It emerged out of discrimination, social inequality and poverty to pursue for its members ali kawsay – or ‘good life’ – with a strong cultural and territorial identity anchored in an economic model based on respect for Pachamama: ‘mother earth’ and reciprocity.

Through its commitment to preserve ancestral knowledge, UNORCAC has played a fundamental role in the conservation of agrobiodiversity in the forest and agricultural landscapes of the Indigenous communities that live between 2,200–3,400m elevation in the Andes.

Almost 70% of the household members of UNORCAC have title deeds to their chakras (smallholder plots) while 20% lease land and 10% share land by a process known as ‘division’ with the landowners. A total of 172 plant crops have been recorded on these smallholder plots including 72 species used for food. During interviews with 10 male and 10 female farmers there were found nine main grain crops, eight different tubers, 20 different fruit trees, 17 vegetables and a wide range of living hedge species, fodder crops and medicinal plants, alongside many different types of livestock. Many wild timbers, grasses and fruit are also collected from the páramo (high zone) on the slopes of the volcano Mama Cotacachi, in the parishes of El Sagrario, San Francisco, Quiroga and Imantag. Of the main agricultural crops, 80% is destined for home consumption and 20% for sale in local fairs.

The agricultural systems managed by the Indigenous communities stand out for their high biodiversity and for the agroecological approaches and traditional knowledge they use, recently qualifying as a GIAHS. The people strive for soil and water conservation, visibly shaping a colourful mosaic landscape (in contrast to the wealthy haciendas which are
characterised by largescale monoculture crops based on biochemical and technological land-use packages that degrade the soil and water).

3.2.2 How UNORCAC members manage their agrobiodiversity knowledge

Agriculture for Indigenous communities is a matter of survival and resilience. Their strategy is rooted in notions of territory renewed by solidarity and shared practices in the face of unfavourable social and economic conditions. These include regular agricultural festivals such as Pawkar Raymi (21 March) to celebrate flowering and the harvesting of tender grains, Inti Raymi (21 June) to celebrate the corn harvest, Koya Raymi (21 September), a celebration of femininity and fertility at land-preparation time, and Kapak Raymi (21 December), a festival of seedlings and weeding.

There are also biocultural practices such as minga (providing shared labour for community welfare), bartering (exchanging surplus goods and products between communities and different altitudinal zones for nutrition) and pampa mesa (communal meals) that allow exchanges of seed and knowledge to the benefit of agrobiodiversity. Traditional knowledge and cultural and spiritual values have enabled farmers to maintain high levels of agrobiodiversity in the chakra: the term used to describe this agricultural or food-production system that integrates communities and territories in economic, social, cultural and environmental development.

The role of UNORCAC is bolstered by its Women's Central Committee – an organisation established to address the specific problems faced by women Andean farmers in the Cotacachi area. Women play a particularly important role as conservationists and custodians of knowledge about seed, agriculinary practices, medicinal uses of plants, agricultural cycles, lunar cycles and the agricultural festive calendar. Through organisational networks at the canton level, women in the subtropical zone also exchange products with other women producers from the lowlands. Women are critical to territorial management of agricultural systems and are included on the board of directors of the Women's Central Committee. The Women's Central Committee maintains agroecological plots and native varieties that have both cultural relevance and are at risk of genetic erosion, and promotes biocultural heritage through the use of different varieties to improve the diets of families. It runs a number of combined knowledge- and seed-related activities as described in Section 3.2.3.

In addition, UNORCAC and the Women's Central Committee have tried to shape supportive public policies at the local level, with ordinances now favouring their views on the conservation of the agrobiodiverse heritage in the canton of Cotacachi, and on water, land, seeds and Indigenous justice. The state has shown little interest in supporting peasant family farming, which is why the local organisations have sought funding from international cooperation agencies. These experiences show how important it is to have
a strengthened organisational structure, with coordination between the whole community, UNORCAC and the Women's Central Committee to take ownership and face the challenges that arise together.

3.2.3 How UNORCAC members manage seed and agrobiodiversity

UNORCAC and the Women's Central Committee facilitate a number of spaces for the transfer of both knowledge and seed, including:

- The Bioknowledge Centre, a demonstration and educational site for visitors on ancestral health practices, and through the restitution of seeds to farmers in the communities through its community seed bank
- The Muyu Raymi seed fair (meaning ‘seed festival’) for the exchange of germplasm between producers, knowledge about ancestral medicine, and culinary knowledge
- The La Pachamama Nos Alimenta weekly community fair which allows farmers to sell the surplus of their agroecological products
- Gastronomic festivals such as the chicha de jora (a traditional soft drink), the preparation of fanesca (a traditional soup) and others, and
- Community exchange tours and training workshops on issues such as agroecology, the introduction and management of fruit trees, native crops and small livestock management, biological fertilisers, the conservation of agrobiodiversity, and culinary traditions.

These are important spaces that build on the human capital and ancestral wisdom of the communities themselves, working with previously trained and qualified community members who understand the traditional knowledge and who then replicate training workshops for the producers.

3.2.4 How UNORCAC fosters pro-agrobiodiversity enterprise strategies

Beyond subsistence food security, UNORCAC also helps its members to develop market opportunities. Surplus produce is used to generate income through marketing at rural fairs, by supplying school food programmes, selling and delivering baskets of fresh produce directly to homes (a strategy used especially during the COVID-19 pandemic lockdowns), selling produce to tourists, and supplying restaurants. UNORCAC has also helped to develop several value-added enterprises such as its food-supplier company Sumak Mikuy (meaning ‘excellent food’). Sumak Mikuy adds value to underutilised crops such as the cape gooseberry, the spicy rocoto pepper (aji rocoto) and wild fruits such as mortiño. It produces dried fruit, has a defined national market and exports abroad. Its main
suppliers are producers organised around the cultivation of cape gooseberry and pepper, or mortiños in the páramo neotropical high-mountain biome.

Another microenterprise initiative developed by UNORCAC’s Women’s Central Committee is the Sara Mama enterprise and brand. Sara Mama produces the soft drink chicha de jora, which is based on germinated maize and is representative of the four Andean world celebrations and other family and religious celebrations. These strategies broaden the sales options from the use and conservation of native and local varieties and have in no way displaced other varieties.

In response to community demand for territorial development, UNORCAC has also incubated a community agrotourism enterprise. Runa Tupari Native Travel promotes agricultural practices that go hand in hand with the promotion of local food, medicine and Indigenous rituals/clothing. The company offers homestay tourism and has both national and international clientele whose money incentivises families to maintain their biocultural practices.

### 3.3 Ghana: Abrono Organic Farmers Association (ABOFA)

#### 3.3.1 About ABOFA and the agrobiodiversity its members manage

The Abrono Organic Farmers Association (ABOFA) – formerly the Abrono Organic Farming Project – is a first-tier association of smallholder producers based in Forikrom in the Bono East region of Ghana. It was established in 1992 and has been supporting its approximately 6,000 members to manage agrobiodiversity through agroecological farming methods over an area in excess of 5,000 hectares. The original aims of the association were to help its members and other rural farmers acquire techniques to improve farming systems that would ensure greater food sufficiency and food sovereignty – focusing especially on organic agriculture and on Indigenous agricultural extension services. ABOFA also focuses on income-generating activities through marketing and technical support.

ABOFA’s members cultivate relatively small plots of about 1 hectare each but grow many different crops in those small areas, including a mix of root crops, cereals and fruit trees in agroforestry systems. Smallholder farmers in this region are born into families that automatically own family land through both maternal and/or paternal inheritance. However, approximately 15% of the total membership involves farmers who have migrated into the area from the Savannah zone and northern part of Tamale. These latter farmers often rent the land on which they farm, although some have now managed to buy their
own land. Some landowners also rent out their land once they have harvested a crop so as to share the land for part of the cropping season.

A quick survey of 20 farmers (10 male and 10 female) showed that farmers always cultivate at least two main cash crops and sometimes as many as six or more. But the number varies between farmers so that the total number of crops cultivated is much higher – and from a 20-farmer sample, this included 16 crops for men and 15 for women. Additionally, the men kept nine different types of livestock, while the women kept three. There is little distinction between commercial crops (sold to local markets) and subsistence crops (eaten at home). But farmers did record a number of additional crops that were regularly used for food in times of hunger, for medicinal and religious purposes, and for leather and manure. And both men and women collect a variety of wild plants and animals for various subsistence purposes.

### 3.3.2 How ABOFA members manage their agrobiodiversity knowledge

As noted above, agriculture in the region is a mix of subsistence farming but also with some commercial sales both in the local community market and externally. In fact, most of the crops produced (an estimated 65%) are commercially sold. Farmers typically use traditional knowledge from their ancestors or neighbours to manage complex mixes of crops.

ABOFA has supported this diverse agroecological cropping system by offering a series of trainings on agroforestry and tree planting, and promoting the use of Indigenous species to support local farming systems and help build resilience to climate change. ABOFA has experienced some challenges in promoting these new approaches. But by using the farmer field school approach, trainers have been able to offer guidance to around 120 community volunteer trainers on issues such as soil testing, land preparation, organic vegetable farming, compost preparation, rainwater harvesting, nursery practices (including for fruit and agroforestry trees), beekeeping, grafting and recordkeeping. This has expanded the farmers’ knowledge on how to use farming practices that support local agrobiodiversity.

ABOFA also collaborates with the Ministry of Food and Agriculture to bring in agricultural extension agents, and with the Forestry Commission, which has provided 6,000 tree seedlings as part of Green Ghana Day. It works also with national and international NGOs such as the Adventist Development and Relief Agency (ADRA), the World Cocoa Foundation’s African Cocoa Initiative, and the German Agency for International Cooperation (GIZ) for training in farm business. It has established a women’s wing where women leaders champion women’s issues in sustainable agriculture through radio shows, and lead campaigns against the use of hybrid seeds and seed from genetically modified organisms (GMOs).
3.3.3 How ABOFA members manage seed and agrobiodiversity

Farmers mostly multiply and keep their own seeds or obtain them from their neighbours using traditional forms of barter. However, some newer crops that were not historically cultivated in the region have had to be bought or supplied by government services. ABOFA has partnered with a wide range of organisations such as Grassroots International, the United Nations Development Programme, Association Cambiste Internationale, CARE International, the Centre for Indigenous Knowledge and Organizational Development (CIKOD), and FAO and its partners in the FFF. Through such support, it has helped its members to establish a CSB funded by membership fees with support also from the Agroecology Fund (a multidonor trust fund that supports just and sustainable food systems).

ABOFA aims to expand its seed coverage within its CSB from the current 31 crop varieties. It aims to expand its stocks of these seeds (which are provided by member farmers who can borrow seed on condition they replace the seed after harvest with a slight increase in weight). It also aims to increase the reach of its CSB activities to farmers in different areas. ABOFA estimates that 90% of farmers in its membership have now been trained in seed-preservation techniques. The CSB serves as a centre that promotes sharing and learning about different crop varieties and encourages the storage, loan and then replacement of seed of those varieties. During COVID-19, the nutritional benefits of maintaining diverse crops (especially local herb varieties) became apparent, compared with communities without a CSB, and this further motivates the members of the association.

3.3.4 How ABOFA fosters pro-agrobiodiversity enterprise strategies

ABOFA has also helped to make more profitable use of agrobiodiversity by helping farmers to add value to new agroforestry crops such as cashew, mango and cocoa or products such as honey. For example, ABOFA helped 60 farmers to acquire 200 beehives to initiate honey production in the region. ABOFA has also been providing technical support for livestock rearing, which – alongside organic composting – is seen as a way to enhance organic fertiliser production in the face of shortages of inorganic fertiliser due to Russia's war in Ukraine.

Some of these newer crops have struggled for initial acceptance. For example, cashew was deemed to take up too much valuable land and compete with core crops such as yams, beans and cassava. But with more careful attention to intercropping arrangements, some of this resistance has disappeared.
ABOFA also helps marketing by aggregating products such as maize, beans, onions and other vegetables to improve market access and get better sales prices. Farmers have learnt that working in a group can improve negotiating power with buyers and now aggregate mangos, for example, with a newly established Yilo Krobo Mango Farmers Association. By enhancing marketing options, ABOFA members believe they can aggregate many different crops from their farms and upscale the planting of Indigenous trees and seeds – thereby maintaining agrobiodiversity which will maintain climate resilience.

3.4 Madagascar: ARFDDSA Analamanga

3.4.1 About ARFDDSA Analamanga and the agrobiodiversity its members manage

ARFDDSA Analamanga is a regional branch of the National Platform for Women, Sustainable Development and Food Security (PNFDDSA) in Madagascar. PNFDDSA was established in March 2013 in the city of Mahajanga. The platform started with about 40 members, with the objectives of mobilising women for sustainable development and food security by strengthening sustainable value chains and entrepreneurship. In formalising the association in 2016, each region was to be represented by regional branches which were to be managed and operate autonomously but are considered part of the overall national structure.

This case study describes the experiences of the Analamanga Regional Branch of the PNFDDSA (ARFDDSA Analamanga), which is located approximately 40km outside the capital city of Antananarivo. It comprises 30 farmer leaders who each oversee groups of approximately 10 farming households. ARFDDSA Analamanga operates in an area dominated by extensively cultivated hills, interspersed with rice-growing valleys and lowlands. There is almost no natural vegetation remaining in the region. Typical farms comprise an average of 0.45 hectares of rainfed crops on upland hills and 0.3 hectares of lowland rice fields.

A quick survey of 20 farmers (10 male and 10 female) in the region showed that farms are diversified, planting on average nine different types of crop and keeping three different types of livestock, alongside several fruit or cash crops. There is a dominance of annual crops, driven by market demand from the neighbouring urban centre. In total, the 20 ARFDDSA Analamanga members interviewed for this case study grow more than 34 types of crops: 24 agricultural and 10 fruit crops (composed of 80 varieties) and keep 13 types of livestock. Despite this agrobiodiversity, the natural vegetation is severely reduced and is under heavy pressure from annual agricultural cycles.
3.4.2 How ARFDDSA Analamanga members manage their agrobiodiversity knowledge

The most common forms of knowledge transfer on these many species and varieties of crops are exchanged between generations from parents to children, and through local community exchanges (such as sharing learning between neighbours) and self-experimentation. Parents pass on to young people their knowledge of managing the ‘old’ types of crops and livestock that have been practised for generations: the production of rice, maize, tubers, beans, groundnuts, pigs and chickens. Some new crops and varieties have been introduced by seed suppliers over time.

ARFDDSA Analamanga has helped to promote agrobiodiversity within a broad agroecological approach through a number of approaches. Firstly, ARFDDSA Analamanga has implemented a series of training courses through lead farmers in topics such as the challenge of climate change, agroforestry (using fruit or other useful trees), nursery stock production and tree-growing techniques, organic composting techniques, organic farming (including natural pest and disease management techniques), and agroecological techniques such as crop rotation, cover crops and soil moisture management. ARFDDSA Analamanga has relied on local structures and mechanisms for the transfer of farmer-to-farmer knowledge – such as the use of farmer leaders to train their local farmer organisations – and through the regular use of reference sites and demonstration plots.

In interviewing the farmers, a number of trends were revealed. Firstly, there had been a progressive integration of agroforestry in recent years under the guidance of ARFDDSA Analamanga, with an increase in the number of trees planted and the widespread adoption of organic fertilisation using leaf-composting techniques. For example, the gradual adoption of agroforestry using trees such as orange, avocado and eucalyptus is currently beginning to restore the landscape of the targeted farms in the study area. This has been accompanied by a significant reduction in the use of chemical inputs and the progressive adoption of biological pest control methods.

3.4.3 How ARFDDSA Analamanga members manage seed and agrobiodiversity

In terms of seed management, self-provisioning is by far the most frequent practice (keeping seed from the previous year’s crops). Nevertheless, there is also a steady input of commercial seed from research centres and specialist suppliers. ARFDDSA Analamanga has contributed in its push towards a more agroecological approach that fosters greater agrobiodiversity by providing regular local support during crop innovation phases, such as the adoption of new crops or planting techniques.

ARFDDSA Analamanga does not deal directly in seed or negotiate directly with suppliers or buyers, but it has built the capacity of its members, especially the farmer leaders,
to study and seize opportunities. For example, ARFDDSA Analamanga has promoted access to information on seed through different channels such as social networks and websites (specifically Evokatra, a specialist farming platform), and by supporting farmers to participate in fairs such as the International Fair of Agriculture, Livestock and Fishing in September 2022.

ARFDDSA Analamanga has also mobilised the specialised National Centre for Applied Research on Rural Development (FOFIFA) to train farmer leaders in seed-production techniques for rice and dry grains (beans, groundnuts). This strengthens the capacity for local seed multiplication and management within the farms themselves. Links such as this open up new seed suppliers. For example, through research done by the organisation Norwegian Malagasy Farming (FIFAMANOR), fodder seeds have been recommended and secured to improve the productivity of dairy farming.

### 3.4.4 How ARFDDSA Analamanga fosters pro-agrobiodiversity enterprise strategies

In this part of Madagascar, with such high demand for agricultural land, access to diverse remunerative and regular markets is key to maintaining agrobiodiversity in rural agricultural landscapes. ARFDDSA Analamanga does not directly market products for its members, but has played a key role in market research to improve the market prospects for tree-based products, the development of which will further expand the uptake of agroforestry and other agroecological techniques among its members. ARFDDSA Analamanga is also intensifying the promotion of agricultural entrepreneurship among its members, with the aim of ensuring that farms are profitable and income generating, able to meet the food and nutritional needs of the household, sustainable (integrating environmental sustainability and resilience to hazards), and inclusive of active and committed women.

The combined effect of entrepreneurial, agroecological and nutritional advice promoted by ARFDDSA Analamanga in parallel with the evolution of urban demand for healthy nutrition, (the farmers’ main market) has seen a diversification of agricultural and livestock production businesses materialising at the farm level. However, the strong pressure to plant annual food crops may limit the future development of agroforestry and arboriculture in the long term. To prevent this, ARFDDSA Analamanga is promoting organic farming with higher added value (including fruit trees), exploring and acquiring profitable markets for crops together with research institutions (such as certified essential oils from trees and crops, organic fruit and honey production), strengthening advocacy for the allocation of new agroforestry land to farmers, and helping to structure farmer organisations into functional value chain businesses.
3.5 Nepal: Chabeli Farmers Group within the National Farmers Group Federation (NFGF)

3.5.1 About the Chabeli Farmers Group and the agrobiodiversity its members manage

The Chabeli Farmers Group was established in 2012 and is located in Bhimphedi rural municipality, which is located 300–1,800m above sea level in Makawanpur district in the Middle Hills of Nepal. It comprises 40 smallholder farmers (32 women) from four different castes and ethnicities: eight Brahman and Chhetri members, 22 Adivasi Janjati Indigenous People, seven Dalit members and three members from other castes and ethnicities. Together, they have established a group to sustain their production system and make it more resilient. The group is a member of the Shiva Shakti Savings and Credit Cooperative which trades its organic products and also belongs to the community forest-user group Batuk Bhairab. The Chabeli Farmers Group is affiliated to the National Farmers Group Federation (NFGF) of Nepal which was established to promote economic empowerment through the production of healthy and agroecological products to bring transformative changes to the lives and livelihoods of farmer producers.

Farmers within the Chabeli Farmers Group generate their productive income mainly from agriculture (78%). But they also manage some agroforestry (including for fodder) in the 498ha collective area of the community forest-user group (11%) and some livestock (11%). Farmland is divided between marginal farmers (0.01–0.5 hectares) and smallholder farmers (0.5–0.8 hectares), farming predominantly terraced fields. Some 80% of farmland is controlled by farmers, with the rest being used for commercial agricultural production including poultry and cash crops. Some farmers lease land to grow additional commercial production of vegetable crops and fruits. Marginal farmers earn 20% of their revenues from planned agriculture (including crop production) and 80% from the associated forest ecosystem, whereas smallholder farmers earn 50% of revenues from planned agriculture and 50% from the associated forest ecosystem.

The 20 farmers surveyed for this case study (10 male and 10 female) were growing 56 species of cereals, vegetables, fruit, forage and fodder, with as many as 99 different varieties across those main species. Livestock reared included chickens, cows, buffalo and goats, as well as other species. A significant integration of agrobiodiversity into livelihood strategies has been maintained in the farming system, with both male and female farmers growing crops and livestock for both commercial sales and household subsistence needs. The high levels of agrobiodiversity were felt to result from the mix of commercial and
household needs, the abundant natural resources, and the home gardening management systems and practices used by culturally diverse peoples.

3.5.2 How the Chabeli Farmers Group members manage their agrobiodiversity knowledge

Farmers in the region have strong biocultural heritage and have passed from parents to children the knowledge of how to manage different species for different purposes. Traditional and local knowledge includes species selection, land preparation, soil fertility management (by using local biological resources extracted from the forest and khar bari or grasslands), pest and disease management, post-harvest and storage practices, seed selection, and agroforestry practices. For example, the Adivasi Janjati Indigenous People retain dependence on forests for wild mushrooms, bamboo shoots, wild ferns, berries and medicinal herbs, and Newari members celebrate different rituals and festivals in which local wine is made from traditional cereals (rice, millet, sorghum) called chhyang.

The Chabeli Farmers Group plays an active role in encouraging knowledge transfer through farmer field school techniques. For example, the process of creating biofertiliser is demonstrated at a demonstration site supported by the NFGF. The incorporation of tree species in degraded, unproductive and abandoned agricultural land is also an important new intervention. The Chabeli Farmers Group has set up a demonstration garden showcasing agrobiodiverse organic methods, incorporating various crops and vegetables of both local and improved varieties. Each member of the group is expected to learn at the centre and then replicate the practice on their land.

As a member of the NFGF, the Chabeli Farmers Group is also part of a knowledge network which has helped them develop technical knowledge of organic production, updated practices of soil fertility management, how to establish and run a participatory guarantee system (PGS), and how to improve climate resilience. Farmers are helped to access and use different sources of information such as publications and broadcasted information from the National Agricultural Research Council (NARC) (including a weekly agri-bulletin, radio programmes), and information disseminated by local government and civil society organisations, to complement local and traditional knowledge.

3.5.3 How the Chabeli Farmers Group members manage seed and agrobiodiversity

Farmers use traditional practices to manage seeds, collecting and storing locally adapted plants (including traditional and heirloom varieties) in containers known as bhakari that are made of bamboo and mud and are usually one chambered but occasionally double chambered, where grains in the lower chamber are used first while grains in the upper chamber are used during monsoon season. Farmers label and organise seeds in packets with the plant name, variety and any other relevant information and maintain detailed
records of the seeds collected and stored, including information about the date of
collection, location and any relevant notes about the plant. Collected seeds are sold at
local markets, where farmers also purchase seeds from seed producers.

In addition, the Chabeli Farmers Group helps to manage seeds from diverse crops and
trees through group nurseries. It also runs a demonstration stand showcasing their
basket of produce at a nutrition fair organised by schools and local government. The aim
is to interest young people in agriculture and the importance of nutritional values. NFGF
organises regular fairs and exchanges to encourage the exchange of seed between
farming communities, and community members also participate in a community seed
fair organised by seed producers in the Bhimphedi municipality market, where local
unique varieties of seeds are demonstrated. NFGF has also introduced two mobile apps,
the Krishipath app and the Krishi Guru app. These online platforms provide farmers
with a range of features including information on different crops and their varieties,
the availability of seeds, market prices, crop-production guidelines, crop insurance, and
information on government schemes and programmes.

3.5.4 How the Chabeli Farmers Group fosters pro-
agrobiodiversity enterprise strategies

The Chabeli Farmers Group has consolidated the basket of products that its members
produce to collectively approach the market. To certify their products as safe and organic
produced without application of pesticides and agrichemicals), the group has collaborated
with the local government to initiate a PGS system to improve the marketing of their
organic produce. The commercial production of leafy greens, tomatoes, cereal crops and
legumes are the main products sold.

By providing training on organic and agroecological practices, the Chabeli Farmers Group
is attempting to reduce the risks of organic vegetable production. However, expanding
their markets for black tomato, strawberries, kiwi and avocado may displace traditional
local crops and their varieties in the future. In addition, the growing use of polybags and
plastics in tunnels and mulching, of machinery and fossil fuels, and the corresponding
decrease in sustainable traditional practices such as intercropping, crop rotations, and
zero tillage will have unknown effects on resilience and sustainability.
3.6 Tanzania: Network of Groups of Farmers and Breeders of Arusha (MviwaArusha)

3.6.1 About MviwaArusha and the agrobiodiversity its members manage

Mtandao wa Vikundi vya Wakulima na Wafugaji Mkoa wa Arusha (Network of Groups of Farmers and Breeders of Arusha or MviwaArusha) was founded in 2011 in Monduli district. It is now organised as 446 local groups, including 46 ward-level networks and six district-level networks, headquartered in Arusha in Northern Tanzania. Much of its members agricultural land lies 1,000–2,000m above sea level and some borders conservation areas such as the Ngorongoro Conservation Authority Area (NCAA), which is a totally protected area. Members possess varied farm sizes ranging from 1.5–5ha of land and most sell around half of their crops with the rest kept for household consumption.

MviwaArusha’s vision is to balance care for human rights alongside achieving sustainability and quality in production, while creating a strong, rights-based network of socioeconomically empowered farmers and pastoralists achieving sustainable livelihoods. MviwaArusha aims to become a knowledge hub with a mission to strengthen collective voices and actions, sustainable high-agroforestry productivity, reliable markets and financial sustainability. Five strategic goals aim to strengthen the farmers’ network, improve advocacy, build agroecological approaches, develop effective marketing and finance, and mobilise and manage the networks’ resources.

Agrobiodiversity is promoted under the third strategic goal of promoting agroecological approaches. The smallholder farmers’ development success through MviwaArusha is rooted in its members’ solidarity. Most are involved in agriculture and rearing livestock, with a focus on the rehabilitation and restoration of degraded natural resources, protecting intact natural vegetation and enriching agroforestry systems with trees on farms. Retained trees and woodlots within the homesteads of smallholder farmers offer fruit, lumber, poles, firewood, windbreaks, shade, livestock fodder and soil erosion control. The men and women smallholder farmers interviewed for this case study plant, sell and consume more than 20 commercial crops and 10 types of livestock (including bees) and extract a much wider range of less-common vegetables, fruit and medicinal plants for regular use from the patchwork of forests and farms.
3.6.2 How MviwaArusha members manage their agrobiodiversity knowledge

Knowledge management is key to maintaining that agrobiodiversity. MviwaArusha draws heavily on its members’ Indigenous knowledge of plant and animal cultivation – augmented by outside knowledge – and fosters this knowledge through projects, partnerships and practical farmer field school-type exchanges that enhance collective understanding of cultural practices and ecological sustainability.

MviwaArusha has expanded its members’ knowledge and experience in several key ways. It has strengthened its 446 local groups and 46 ward-level networks that encourage peer-to-peer learning and participation in market shows. It has written proposals and attracted external support and knowledge from projects. It has a deliberate strategy of developing staff capability and trainers-of-trainers in topics such as entrepreneurship, agroforestry, tree nurseries and tree planting, community seed banks, poultry rearing, and the use of livestock waste to make biogas. It has enhanced local communication through radio, television and social media. Finally, it has helped local groups to develop microcredit facilities and larger finance groups that offer members the scope to develop many different income-generating ideas through community savings and loans schemes – which itself allows for experimentation in how to make profitable use of agrobiodiversity.

Smallholder farming families play an important role in producing food for households and market demand in Tanzania. Tapping into community-centred Indigenous knowledge of agriculture, animal domestication and ecological sustainability provides a high level of agrobiodiversity protection compared with more industrial agricultural models. The MviwaArusha leadership and committees serve to extend local community farmers’ networks to help spread an agroforestry vision that integrates crops, trees, livestock, manure and compost, rainwater harvesting, enterprise development and finance. It also promotes the transfer of intergenerational knowledge, as most knowledge about plant and animal cultivation and management is transmitted from grandparents, parents and neighbours to their children.

3.6.3 How MviwaArusha members manage seed and agrobiodiversity

Seed production – especially local climate-resistant varieties of crops and medicinal plants as well as local and exotic trees – has also been crucial to agrobiodiversity conservation. More than 60% of seed/animal offspring is sourced from informal social networks of neighbouring farmers and MviwaArusha members regularly share information among themselves about available agricultural crops or animal resources.

In addition to these practices, MviwaArusha has also developed five community seed banks (CSBs) across its networks. Members provide small demonstration pots of
seedlings for display at their local CSBs with a record of their contribution. The CSBs also maintain larger seed selections of key crops that can be purchased either by members or external buyers. Members can use seed from the seed bank, provided they replace the same quantity from that year's harvest. These CSBs therefore collect and store traditional landraces in a centralised location, with records of which farmers are planting and can supply seed of those agricultural crop varieties.

MviwaArusha has also helped members to set up (and furnished them with plastic potting bags) a host of commercial local tree nurseries that help farmers to maintain access to and sell tree components of their farming systems. MviwaArusha promotes the role of both men and women in such ventures, working towards sustainable social, economic and ecological improvement.

3.6.4 How MviwaArusha fosters pro-agrobiodiversity enterprise strategies

Enterprise development that supports agrobiodiversity is being built through MviwaArusha trainings in entrepreneurship. MviwaArusha has supported members’ enterprises through better access to finance by setting up village savings and loans associations (VSLAs) that are now almost ubiquitous across its local groups. At the network level, several of these VSLAs are combined in banked SACCOS that can offer larger loans to groups based against the full financial capital in the combined VSLAs.

Market research and support for processing and packaging is emerging in key areas such as the production of sunflower oil, pigeon peas, honey and potentially coffee and other crops. These products are developed from agroforestry systems that maintain agroecological functions to be climate resilient. MviwaArusha is actively building on traditional agroforestry practices while also introducing innovations to strengthen agroforestry production. For example, it promotes the use of livestock waste to make biogas and slurry, encourages tree seedling nurseries as an income-generating option, develops diverse processing, packaging and marketing of different products, and establishes finance schemes to fund its members’ necessary investments. Yet it is perhaps the organisational solidarity within farmer groups and networks that offers the greatest source of innovation in conserving agrobiodiversity that will best sustain its members in the future.
3.7 Zambia: Choma District Tree Nurseries Association (CDTNA)

3.7.1 About CDTNA and the agrobiodiversity its members manage

Choma District Tree Nurseries Association (CDTNA) first formed in 2017 to promote the economic, social, cultural and environmental needs and aspirations of its members and their communities within and around Choma district. Its stated mission is to promote forest cover by raising tree seedlings for woodlot establishment in nurseries in Choma district. It is an affiliate member of the Farm Forestry Smallholder Producers Association of Kenya (FF-SPAK) and is helping its smallholder members to improve and maintain agrobiodiversity in their local forest and farm landscape.

The association now boasts 111 nursery grower members and group members and is unusual in that it focuses on the supply of inputs (planting materials) for agroforestry, rather than managing forest and farm agrobiodiversity itself. While CDTNA does not use the term ‘agrobiodiversity’ in its objectives, the association is a key player in promoting, supplying and sharing planting materials and knowledge to support on-farm agrobiodiversity.

CDTNA’s membership maintains a set of nurseries within the premises of the Choma district’s Forestry Department timber yard, where they grow 48 different trees species and supply more than 338,000 assorted seedlings per year for sale to programmes, government agencies, NGOs, schools, colleges, fellow farmers and individuals. Many species have several uses and the species that are grown reflect the needs of the main customers:

- Fruit and nut species such as cashew, mango and avocado
- Agroforestry species such as leucaena, gliricidia and moringa
- Timber species such as eucalyptus, khaya and pine
- Firewood species such as acacia, trichilea and gmelina
- Medicinal species such as neem, sombo and aloe, and
- Ornamental species such as candle tree, flamboyant and jacaranda.

While there are several large institutional buyers – notably the Netherlands Development Organisation (SNV), local schools, the Plant a Million programme and church groups – local buyers include Zambian farmers, who are primarily subsistence smallholders with less than 5ha and primarily dependent on family labour, using traditional farming technology, purchasing and using very few farming inputs, and consuming most of their
produce. For them, trees that produce fruit or other saleable products or which enhance agricultural productivity are in high demand. But the complete list of end uses is large and includes firewood, fruit, fruit juice, timber, poles, fodder, soil improvement through nitrogen fixation, charcoal, ornamental purposes, medicine, pesticides, bee forage, string, windbreaks, land stabilisation, tannins, cosmetics and fencing.

### 3.7.2 How CDTNA members manage their agrobiodiversity knowledge

Many nursery growers live traditional lives on smallholder farms. That lifestyle allows regular interactions where the older generation (grandparents, parents, uncles and aunts) teach the younger generation about important crops and trees and how to use them. Traditional knowledge and practices, for example, include ensuring trees around homesteads are protected and not removed. Medicinal trees, nitrogen-fixing trees and fruit trees are often treated as sacred because of myths and folklore and are therefore protected.

Through its organisation and networks, CDTNA has facilitated capacity development for and among its members on how to develop nursery techniques and grow different species. CDTNA is also involved in various networks to support its work. For example, technical knowledge has been shared by experts from the Choma Forestry Department, the Cotton Association of Zambia (CAZ), the Zambia National Farmers Union, SNV Forestry, and various other environmental NGOs. Western technical knowledge (such as tree parent-stock identification, seed collection and storage, pot filling, sowing and climate-smart agriculture) has been shared by experts from the forestry, agricultural and environmental sectors, to complement Indigenous knowledge. This has resulted in growers ensuring that local seed is collected from healthy parent trees, and that seed is good quality and has a very high germination potential. Information on storage, pre-treatment and sowing protocols have also been shared by the Forestry Department.

Farmer-to-farmer education programmes, field exchanges and field tours have also facilitated the transfer of skills and knowledge between members. FAO (through its FFF programme) also networks these farmers into its food and energy security programme, where farmers are trained to raise and maintain forest stock for many different purposes.

### 3.7.3 How CDTNA members manage seed and agrobiodiversity

Seed is primarily collected locally from the farms and homesteads of local members. Nursery members tend to gauge the type and numbers of seedlings they need to sow based on their estimates of what buyers would prefer. The purchase of and bartering for some seed and seedlings also occurs, especially fruit trees. For example, bartering for oranges was observed. Instead of sowing oranges, nursery tree farmers start the process
by raising lemon trees instead, onto which oranges are then grafted. Orange fruit scions are bought through a barter system.

CDTNA assists its members with locating suitable sources of seed, but does not yet offer any onsite storage facilities for seed. Indigenous tree species are sourced from Nyimba district and are bought as fruit at the Choma market. Fruit tree seeds of both citrus and Indigenous fruits are bought from the open market as fruit. After the fruit is eaten, the seeds are prepared and sown. High-value exotic seeds such as pine are bought from named farmer-suppliers or from the Forestry Department. Seed from nitrogen-fixing and ornamental trees are collected from either the nursery site itself, from houses around the nursery, and/or in and near smallholdings. Unlike newer members, older members are experienced nursery tree growers and are very particular about the type and quality of seed they source.

3.7.4 How CDTNA fosters pro-agrobiodiversity enterprise strategies

CDTNA is a collective business entity and therefore operates its tree nursery entirely as a commercial venture. All crops raised are sold for profit and not to be distributed for free. It was very clear from the respondents that all seedlings are raised to be sold, apart from seedlings that are too overgrown to sell (in which case they can be given away to individuals and neighbouring farmers). In terms of commercial seedling sales, nursery producers are often grouped into enterprises that make their own sales, but often in coordination with the CDTNA leadership when there are large orders to fulfil. CDTNA uses a single commercial price list to harmonise sales between the different internal groupings and members sign up for the use of this price list.

CDTNA shows how the establishment of an association can transform scattered individual nursery producers into a much larger and more commercially successful enterprise development model with increased membership, varying skill sets and by promoting the inclusion of both men and women. A membership mix of newer and older members also creates a competitive environment for growth because it provides inspiration, interest, drive and motivation for new members to do better. CDTNA has also helped to transform some individual growers into smallholder group enterprises, creating new employment opportunities for youth and single parents, and helping groups to develop and take advantage of opportunities and networks.
Agrobiodiverse coffee agroforestry system in Tanzania. Photo: Duncan Macqueen
Case study lessons: how organisations of smallholders and Indigenous Peoples advance agrobiodiversity

Loss of agrobiodiversity decreases the options to ensure food security, nutritional health, resilience in the face of climate change, agroecological production systems and the provision of diverse products and services. FFPOs and IP and LC groups are on the frontline of negative climate impacts and recent global surveys suggest that collectively, smallholders
are already investing approximately US$368 billion annually in measures to adapt to climate change – typically built around diversification (Hou Jones and Sorsby 2023).

As noted in Figure 4 in Section 1, the underlying drivers of agrobiodiversity loss follow a self-reinforcing cycle – which will have planetary consequences if left unchecked. While smallholder forest and farm landscapes have fostered higher levels of agrobiodiversity than industrial-scale agriculture, there is no guarantee that they will continue to do so if the prevailing strategy is to link them ever more tightly to industrial-scale monoculture systems via outgrower arrangements that appeal solely to their (and corporate) profit motives. Alternative strategies are needed that enable smallholders and Indigenous Peoples to derive revenue from a basket of products and services, while maintaining the cultural and spiritual values that underpin agrobiodiversity-rich subsistence practices and local seed systems.

Solutions to reversing the cycle of agrobiodiversity loss lie in organisational innovations that are visible in each of the case studies described above. These organisational innovations lie in five interrelated areas: promoting agrobiodiverse products, cultivating agrobiodiverse crops, organising agrobiodiverse businesses, reshaping investment models and bolstering political will. These five areas are discussed in the following sections, illustrated by one or two examples from the case studies described in Section 3 and broader observations of FFPO and IP and LC group dynamics. Lessons on the strategic approaches used by FFPOs and IP and LC groups to enhance agrobiodiversity are only included below where there was felt to be widespread adoption of similar strategies beyond the limited case studies presented here.

4.1 Promoting and marketing agrobiodiverse products

Smallholders grow what they can use and sell. So, the promotion of diverse nutritional, health and other natural products is a necessary starting point for reducing agrobiodiversity loss. For many of the groups surveyed in the case studies, subsistence production goes hand in hand with commercial sales, and there is often a useful interconnection between the promotion of traditional gastronomic and health customs, and the marketing and sale of products that draw on biocultural heritage in marketing and labelling. Academic studies document evidence of the link between agrobiodiversity, nutritional diversity and health (Remans et al. 2014; Jones 2017). Thus, the traditional knowledge of FFPOs and IP and LC groups and the scientific consensus are fully aligned. The real question is how to promote nutritional diversity and health to incentivise and reward smallholder producers who maintain agrobiodiverse forest and farm landscapes.
4.1.1 Agrobiodiversity: promoting nutritional diversity and cultural use

For many IP and LC groups, promoting nutritional diversity and the cultural use of agrobiodiversity is a core part of their biocultural heritage. For example, the Union of Peasant and Indigenous Organizations of Cotocachi (UNORCAC) in Ecuador maintain and promote their own traditional gastronomic and health practices. They do this through a series of seasonal gastronomic fairs such as Pawkar Raymi (21 March), Inti Raymi (21 June), Koya Raymi (21 September) and Kapak Raymi (21 December), and through La Pachamama Nos Alimenta community product fair that complements other family and religious ceremonies in celebrating and promoting 172 traditional food and medicine crop species (Piñán Cajas 2023). The Indigenous People within the Chabeli Farmers Group in Nepal also maintain and promote traditional nutrition that supports their cultivation of 56 species of cereals, vegetables, fruit, forage and fodder, with as many as 99 different varieties across those main species. Newari members celebrate different rituals and festivals in which local wine is made from cereals (rice, millet, sorghum) called chhyang (Nepal and Koirala 2023). These examples from Ecuador and Nepal also show the importance of cultural and spiritual values, festivals and beliefs in sustaining agrobiodiversity. The emphasis on promoting nutritional diversity is widespread in FFPOs and IP and LC groups – for example, in the prominent contributions by regional and national apex FFPOs and IP and LC groups in the Agroecology Coalition.7

4.1.2 Promoting natural medicines

Promoting natural medicines is also a key activity of many IP and LC groups and also some FFPOs. For example, in the Chabeli Farmers Group, the Adivasi Janjati Indigenous People maintain traditional healing practices based on medicinal herbs that they collect alongside other wild foods (Nepal and Koirala 2023). UNORCAC in Ecuador have also set up a Bioknowledge Centre to display and promote a wide range of traditional medicines, linked to the Hambi Warmikuna (women healers) ancestral health group (Piñán Cajas 2023). In Zambia, the CDTNA grows seedlings of a wide range of different trees, including some that are specifically grown for their medicinal properties (Chingaipe 2023).

4.1.3 Promoting organic and agroecological production systems

Promoting organic and agroecological production systems is key for smallholder FFPOs, for whom future sustainability and resilience is key to their survival and is often embedded in the cultural values of Indigenous Peoples. It features prominently for example in the literature and approaches of groups such as ABOFA in Ghana, ARFDDSA Analamanga in

7 See https://agroecology-coalition.org/members
Advancing Agrobiodiversity

Madagascar, or MviwaArusha in Tanzania. ABOFA was set up to promote food sufficiency and food sovereignty through organic agriculture (Paul 2023). ARFDDSA Analamanga provides nutritional advice as part of its promotion of agroecological approaches (Andrianaivolala 2023). MviwaArusha in Tanzania runs demonstrations of traditional cooking, alongside seed and market fairs (Kayombo et al. 2023). In the more specialised groups such as the Choma District Tree Nurseries Association (CDTNA), a diversity of tree species is deliberately promoted to augment farmers’ food and nutrition (fruit and nut trees), productivity (agroforestry trees), construction options (timber trees), energy supplies (fuelwood trees), health (medicinal trees) and landscaping (ornamental trees) (Chingaipe 2023). In Nepal, the Chabeli Farmers Group have established a demonstration garden showcasing agrobiodiverse organic methods, incorporating various crops and vegetables of both local and improved varieties (Nepal and Koirala 2023).

4.1.4 Reaching rural and urban audiences

Reaching both rural and urban audiences is vital. Marketing nutritional diversity, natural health products, and organic and agroecological production methods is not just a rural issue. More than one half of humanity currently lives in urban areas, and by 2050 this figure is projected to grow to 68% (UN Habitat 2022). So how health from nutritional diversity is presented in urban contexts is likely to have bidirectional linkages to rural agrobiodiversity (Zimmerer et al. 2021). UNORCAC in Ecuador have developed a food supply company called Sumak Mikuy (‘excellent food’) that markets the health benefits of underutilised crops such as cape gooseberries, spicy rocoto peppers and mortiño fruits both in national and export markets. In FFF’s work in Vietnam, several cooperatives have made excellent progress in marketing traditional foods such as sticky rice and dried fruits to national markets (Bui and Thang 2022). Many FFPOs support their members to participate in and showcase their unique products in urban agricultural fairs and markets, such as MviwaArusha in Tanzania (Kayombo et al. 2023) or ARDDSA Analamanga in Madagascar (Andrianaivolala 2023).

4.2 Cultivating agrobiodiverse crops: sharing knowledge and seed

Smallholders can only grow what they have knowledge and seed of. As noted above, in the global South most farmers (75–90%) get seed primarily from informal local seed systems (Heindorf et al. 2021). This figure is slightly higher in Africa (80–90%) than in Asia and Latin America (70–80%) (La Via Campesina 2015). What to plant and how, and where to get hold of seed, are therefore primarily local issues. Structured interventions by local FFPOs and IP and LC groups to improve knowledge about and access to different crop and tree varieties can therefore play a decisive role in maintaining agrobiodiversity.
4.2.1 Providing agroecological training for farmers

Training farmers in agroecological methods is one option that is frequently employed by FFPOs and IP and LC groups such as those in the case studies described in this report. For example, in Tanzania, MviwaArusha trains its members in agroecological techniques, runs peer-to-peer learning within and between its local groups and networks, and supports seed and market fairs to broaden people’s understanding of different crop options (Kayombo et al. 2023). In Ghana, ABOFA uses the farmer field school approach to train its members in agroecological farming methods (Paul 2023). UNORCAC from Ecuador runs training workshops in a wide variety of topics that include the importance of agrobiodiversity, agroecological production methods, management of fruit trees, native crops and livestock breeds, and the preparation and use of biological inputs. They also run community experience-exchange tours that cover many of those different elements and a weekly community fair (La Pachamama Nos Alimenta) that promotes agroecological methods. Trainings often draw on both traditional knowledge and Western science.

4.2.2 Encouraging crop diversification, tree planting and agroforestry

Encouraging crop diversification, tree planting and agroforestry is a frequent priority for FFPOs and IP and LC groups as they seek to diversify production while strengthening environmental service provision. For example, in Zambia, CDTNA was established as an association of nurseries precisely to meet the growing demand for trees, both from farmers but also in anticipation of sales to major agroforestry and landscape restoration programmes such as those of SNV and Plant a Million, explaining why the greatest number of trees raised were leguminous (in line with the agroforestry programmes of those buyers). In Madagascar, ARFDDSA Analamanga have been promoting diversification of income sources, partly through fruit-tree planting and the adoption of agroforestry, alongside the abandonment of the use of chemical inputs with the aim of restoring farming landscapes (Andrianaivolala 2023). In Ghana, ABOFA has worked with the Forestry Commission under the Ministry of Food and Agriculture to train farmer members and distribute tree seedlings during Green Ghana Day (Paul 2023). In Tanzania, MviwaArusha has provided training in agroforestry alongside how to set up and run tree nurseries as a business (Kayombo et al. 2023). In Nepal, the Chabeli Farmers Group have been promoting the incorporation of tree species in degraded, unproductive and abandoned agricultural land as a strategy to upgrade land use for agroforestry. With support from the National Farmers Group Federation (NFGF) they have also introduced two mobile apps – the Krishipath and Krishi Guru apps – as online platforms that provide information on different crops and their varieties, the availability of seeds, market prices, crop production guidelines, crop insurance, and information on government schemes and programmes (Nepal and Koirala 2023).
4.2.3 Organising seed fairs

Organising seed fairs is another way FFPOs and IP and LC groups build knowledge of the diversity of what can be planted. For example, UNORCAC in Ecuador has helped organise for 20 years the Muyu Raymi Seed Fair that creates space for local producers to learn about and access seed of native varieties (Piñán Cajas 2023). The fair involves about 400 seed conservationists of grains tubers and tree seedlings who voluntarily contribute their expertise to participating producers. MviwaArusha also runs seed fairs in Tanzania alongside helping farmers to develop tree nurseries and sell tree species commercially (Kayombo et al. 2023).

4.2.4 Managing community seed banks

Managing community seed banks (CSBs) is a further way FFPOs and IP and LC groups help to share seeds and knowledge of agrobiodiverse crops. For example, in Ghana, ABOFA has worked with CIKOD to support farmers in Forikrom and the surrounding communities to establish a CSB to preserve 31 different varieties of Indigenous seed. Producers of those varieties set aside seed for display and share seed within the CSB. People wanting to access and try the varieties can use some of the seed, contingent on replacing it at the end of harvest (Paul 2023). The Bioknowledge Centre of UNORCAC in Ecuador also involves a CSB that enables the promotion and multiplication of different varieties of crop (for example, with 12 native varieties of maize and 39 varieties of beans). In this case, a partnership with the National Institute of Agricultural Research (INIAP) allows multiplication of preferred varieties before redistribution to community producers (Piñán Cajas 2023). Partnerships of this sort are also seen in Madagascar where ARFDDSA Analamanga has mobilised the specialised FOFIFA to train farmer leaders in seed-production techniques for rice and dry grains (beans, groundnuts) which has strengthened the capacity for local seed multiplication and management within the farms themselves (Andrianaivolala 2023).

4.3 Organising agrobiodiverse businesses: aggregating baskets of quality products

The great advantage of working together in FFPOs and IP and LC groups is that many products from multiple smallholdings can be aggregated in sufficient volumes to improve market access and price negotiation. Baskets of products can be developed that allow smallholder farmers to trade more than one item: protecting them from shocks that might come from market volatility or climate change. Organisational innovations can enhance quality standards, aggregation volumes and added-value processing and packaging of multiple products from many diverse smallholdings into reliable market offers.
4.3.1 Organising market fairs

Organising market fairs that enhance sales can enhance business opportunities for members of FFPOs or IP and LC groups – even if those business opportunities are developed individually rather than through collective enterprises. For example, in Madagascar, ARFDSDA Analamanga supported women farmer leaders to participate in the International Fair of Agriculture, Livestock and Fishing in September 2022, which resulted in an increase and diversification of sales by the farmers’ group (Andrianaivolala 2023). In Tanzania, MviwaArusha supported local groups to participate in the farm show component of a larger Nane Nane agricultural show in Arusha where their products could be promoted and sold (Kayombo et al. 2023).

4.3.2 Building collective businesses

Building collective businesses that reinforce cultural identity is one strategy used by several FFPOs and IP and LC groups. Working together to aggregate product from many members can improve market access and negotiating power. Building a strong cultural brand can both cement membership and attract customers. For example, in Ecuador, the UNORCAC Women’s Central Committee also runs a Sara Mama processing plant and business for a traditional chica de jora drink made of maize (Piñán Cajas 2023). In Tanzania, MviwaArusha has been developing businesses for honey from miombo woodlands and sunflower oil, and developing new labelling to improve marketing prospects (Kayombo et al. 2023).

4.3.3 Using established marketing infrastructure

Using established infrastructure to market diverse baskets of product is another way of rewarding those committed to agrobiodiverse production. For example, in Nepal, the Chabeli Farmers Group produce and sell a wide range of legumes and organic vegetables in commercial markets and also produce a diverse local basket of products targeting niche markets, which helps farmers to maintain agrobiodiversity on their farms (Nepal and Koirala 2023). The UNORCAC Sumak Mikuy company aggregates, processes and promotes several underutilised traditional crops such as cape gooseberry, rocoto pepper and mortiño fruit (Piñán Cajas 2023).

4.3.4 Developing shared labels

Developing shared labels is an additional way to promote the benefits of agroecological production. For example, in Nepal, the Chabeli Farmers Group has helped its members to develop a basket of products based on organic practices that are sold in commercial markets using a participatory guarantee system (PGS) that allows neighbouring groups of farmers to agree to a set of organic standards and then make a claim of organic origin in the market (Nepal and Koirala 2023). Similar PGS schemes have been developed by
Advancing Agrobiodiversity

FFPOs and IP and LC groups for a wide range of products and market contexts, with detailed case studies documented from Bolivia, Ecuador, Indonesia, Nepal, Vietnam and Zambia (Wagner 2022).

4.4 Reshaping investment models: mobilising internal finance to fund complexity

Conventional investment models baulk at diversity. The complexity of multiple income streams from multiple markets and business strategies is treated as risk. Rationalising in a business plan the financial dynamics of potentially hundreds of income streams would be beyond most FFPOs or IP and LC groups. Yet their smallholder members routinely manage trade and transactions at that level of complexity. FFPOs and IP and LC groups frequently develop locally controlled investment funds that make socially networked and trust-based investments to members who wish to experiment with new crops and production advancements. Capacity to repay loans is assessed against a portfolio and track records of diverse aggregated income streams, not against exhaustive financial analysis and linear business planning for a single production component for which the loan is given. Some communities with exceptionally high levels of agrobiodiversity, such as the Potato Park in Peru, have set up communal funds which redistribute a share of the profits from collective microenterprises fairly amongst communities, according to customary law principles for a solidarity economy (Swiderska et al. 2020).

4.4.1 Normalising savings and loans groups

Normalising savings and loans groups is the first step in mobilising flexible finance that can be used by members of an FFPO or IP and LC group to diversify their production. For example, in Tanzania, MwiwaArusha has invested heavily to ensure that each of its 446 local groups develop a VSLA. These form the basis for small loans to individual members to help them overcome the startup costs of initiating new on-farm production activities (Kayombo et al. 2023). In Ecuador, UNORCAC has also developed a 21-year history of managing a savings and loan group (now the Santa Anita Savings and Credit Cooperative – see Section 4.4.2).

4.4.2 Evolving towards larger financial cooperatives

Evolving towards larger financial cooperatives is a second-phase activity that can increase the scale of finance available to local FFPOs and IP and LC groups. For example, in Tanzania, MwiwaArusha has helped local groups with savings and loans systems to pool resources into or SACCOS or finance Circle Management Groups (CMGs) which pool
the financial resources of several local groups in order to be able to extend larger loans to members belonging to those groups. The combined financial resources of the several groups therefore increase the loan funds available (Kayombo et al. 2023). In Ghana, the Jwa Ngwaane Community Cooperative Credit Union was established by the Kassena Nankana Baobab Cooperative Union (KANBAOCU) through the mobilisation of 96 VSLAs. The main purpose of the credit union is to enable KANBAOCU’s members to save and have access to low-interest credit at fair and competitive rates (Adagenera and Kuudaar 2023). Similarly, in 2001 in Ecuador, UNORCAC established the Santa Anita Savings and Credit Cooperative. The cooperative offers microcredit loans to its rural members and (to maintain liquidity) to members in better-off urban centres. For over two decades, it has evolved and now raises funds from savings and fixed-term deposits, cooperation funds, international banks, second-tier banks and government funds so that it can channel credit to its clients in the rural sector (Carrera Rueda and Vallejo Rodas 2023).

4.4.3 Attracting inward investment from nature-friendly partners

Attracting inward investment is a frequent result of FFPO and IP and LC group efforts to professionalise their own financial accounting practices, savings and loans services. For example, in Vietnam, the Cinnamon and Star Anise Cooperative mobilised four collective groups into a registered cooperative with sound finances, that then attracted a private-sector investor (Vinasamex) to develop a spice-processing factory (Thoan et al. 2020). Similarly, in Ecuador, another FFPO known as the Artisanal Producers Association of Agricultural and Livestock Goods of Napo (KALLARI) has managed to attract inward investment to develop a range of chocolate products, using many flavours from within the agroforestry cocoa groves, that are sold on international markets (Poso 2020). In Bolivia, attention to quality and financial management attracted interest for the Association of Wild Cocoa Collectors Yuracaré (ARCASY) chocolate producers from the Breick chocolate industry that negotiated a deal directly benefiting 130 cocoa-picking families (Aro 2020). In Nepal, the Chabeli Farmers Group noted the inevitable tension between upscaling commercial production of one or two products, potentially at the expense of a more diverse range of traditional crops (Nepal and Koirala 2023).
4.5 Bolstering political will and shaping enabling policies

There are growing inequalities in rights and financial power that will overrun such innovations unless policies and laws redistribute rights and finance. As noted in Section 2, policy support for peasant seed systems is highly variable and is undermined by corporate interests seeking to generate income from PBRs. There is a role for FFPOs and IP and LC groups to champion the benefits of peasant and Indigenous seed systems.

4.5.1 Promoting the benefits of agricultural and biocultural heritage systems

Promoting the benefits of agricultural and biocultural heritage systems is one strategy used by FFPOs and IP and LC groups. For example, UNORCAC staff have worked with grassroots communities to describe, table and have recognised the Andean chakra system. The wider promotion, marketing and labelling of their traditional chakra system of the Kichwa communities of Cotacachi has also resulted in FAO recognition of it as a Globally Important Agricultural Heritage System (GIAHS) (Piñán Cajas 2023). In Vietnam, similar work and labelling systems are helping to promote Indigenous cultural values and products in mountainous areas (Bui and Thang 2022). In Peru, the Potato Park biocultural heritage territory has been legally recognised as an Agrobiodiversity Zone (Amazon Conservation 2021).

4.5.2 Supporting and protecting farmer seed systems and rights

Fighting for laws that support peasant seed systems and protect farmers’ rights often falls to FFPOs and IP and LC groups. For example, in Ghana, the women’s wing of ABOFA have been broadcasting radio and advocacy dialogues about the Plant Variety Protection Act 2020 which establishes a framework to protect PBRs. The women have been campaigning against the act and the use of hybrid seed and GMO food and seed (Paul 2023). The representatives of MwiwaArusha in Tanzania have been challenging the 2014 Tanzania Plant Breeders Rights Act, which followed Tanzania becoming the first Least Developed Country signing the UPOV 1991 agreement, pressured by the condition that without doing so they could not receive development assistance through the New Alliance for Food Security and Nutrition (NAFSN). MwiwaArusha have been advocating for the recognition of farm-managed seed systems for health and sustainable food production (Kayombo et al. 2023).
4.5.3 Promoting tenure security and smallholder investment mechanisms

Promoting tenure security and smallholder investment mechanisms is a frequent priority for FFPOs and IP and LC groups. For many IP and LC groups, the struggle for tenure rights that allow them to maintain their agrobiodiverse traditional cultivation systems is a key concern. For example, UNORCAC in Ecuador mobilised from a struggle against discrimination, racism and the marked social inequality and poverty found in the Indigenous communities of Cotacachi – and its very existence in the territory is seen locally as a vindication of the rights of the Indigenous peasant people (Piñán Cajas 2023). In Bolivia, the local affiliation of the Federation of Agroecological Producers and Collectors of Cocoa in Cochabamba (FEDPRACAO CCBA) to the National Federation of Cocoa Producers and Collectors of Bolivia (COPRACAO) – and umbrella association of many regional cocoa producing cooperatives – has led to a strengthening of a Technical Roundtable of Cocoa, in turn catalysing the emergence of the multi-million Programme for Strengthening Cocoa Production in Bolivia 2020–2024 (Aro 2020). Many IP and LC and FFPO groups are currently involved in campaigns for a more effective channelling of climate and nature finance through their own organisations, resulting in major pledges of support at the 2021 United Nations Climate Change Conference in Glasgow (COP26) (FTFG 2022).
Agrobiodiverse agroforestry system with beehives in Sulawesi, Indonesia. Photo: Duncan Macqueen
5
Recommendations for upscaling agrobiodiversity conservation

5.1 Recognise FFPOs and IP and LC groups as stewards of agrobiodiversity

Maintaining the global benefits of agrobiodiversity cannot be achieved without FFPOs and IP and LC groups. Their smallholdings and territories are the repositories of global agrobiodiversity – which their members continually improve and adapt through selection, crossbreeding and domestication as the basis for their future survival. This dependence creates strong practical motivations to manage agrobiodiversity which can be seen in strategies to secure tenure, share knowledge, exchange seed and develop joint enterprises which aggregate volumes and qualities from multiple products sufficient to improve market access. This report has presented the empirical evidence for the link between FFPOs and IP and LC groups and agrobiodiversity conservation, the causes of
agrobiodiversity loss which lie outside of those groups, the strategies they use to enhance agrobiodiversity, and practical examples of each of these strategies as documented in a set of international case studies.

Recognition of the importance of FFPOs and IP and LC groups in agrobiodiversity conservation and enhancement is a vital first step in planning actions to upscale that conservation. Support must work with and through the right groups. But these groups must not be treated as recipients of external largesse: they are the frontline experts in this field. It is especially important to recognise the contribution of FFPOs and IP and LC groups to fostering an alternative global food system that is built around nutritional diversity and agrobiodiversity, the flourishing of smallholder organisations and social networks that help them thrive in complex environments, and an economic balance of local to global market provision, backed by flexible financing that maintains resilience and food security. This involves reconceptualising food systems as a series of interrelated dimensions that span the nutritional, ecological, social, entrepreneurial and investment dimensions as shown in Table 7.

What is clear from the examples in this report is that FFPOs and IP and LC groups do not just support the management of agrobiodiversity. They also manage knowledge, seed, enterprise, finance and political engagement in pursuit of a broader transformation of food systems. This makes them key allies in building future resilience and food security.
### Table 7. The interrelated dimensions of a more just, resilient and secure food system

<table>
<thead>
<tr>
<th>Dimensions of a just and resilient food system</th>
<th>Food and nutritional diversity</th>
<th>Agrobiodiversity (and supporting wild diversity)</th>
<th>Social organisations and networks</th>
<th>Interlinked entrepreneurial options</th>
<th>Flexible finance and investment</th>
<th>Enabling laws and policies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual level</td>
<td>Different varieties of a single type of food with varying properties</td>
<td>Genetic diversity (within and between populations of single species and their wild relatives)</td>
<td>Farmers with traditional knowledge and seed of crop, tree and animal species</td>
<td>Individual subsistence consumption or local sale of crop, tree and animal products</td>
<td>Re-investment of individual savings from product sales</td>
<td>Secure rights to individual or communal agricultural lands</td>
</tr>
<tr>
<td>Local level</td>
<td>Different types of food providing different nutrient compositions</td>
<td>Species diversity within (alpha) or between (beta) farms and any supporting ecosystems</td>
<td>Local groups that share knowledge and seed of multiple species between farmers</td>
<td>Collective aggregation and sale of crop, tree and animal products to local and distant markets</td>
<td>Collective savings and credit cooperative organisations offering flexible loans to members</td>
<td>Devolved authority and support for collective action from farm to market</td>
</tr>
<tr>
<td>Landscape level</td>
<td>Different markets at which different combinations of food can be purchased</td>
<td>Ecosystem (habitat) diversity at landscape level (gamma diversity) across many farms and intervening land or water bodies</td>
<td>Umbrella organisations that organise knowledge and seed exchanges between different local producers</td>
<td>Healthy competition between several crop, tree and animal product-aggregator enterprises</td>
<td>Federations of financial cooperatives offering varied financial products</td>
<td>Enabling national laws and policies that encourage collective action and prevent concentration of money and power</td>
</tr>
</tbody>
</table>
5.2 Get money for what matters to where it matters

Given the centrality of FFPOs and IP and LC groups to agrobiodiversity conservation — including the endogenous motivations for that conservation that are not always shared by external parties — it makes sense to get money where it matters. Climate and nature finance must be channelled to and through those groups if it is to result in agrobiodiversity conservation. The purpose of such funding could draw on the strategies that FFPOs and IP and LC groups themselves routinely deploy to enhance agrobiodiversity management (see Section 4) but in summary this could involve finance for:

- Promoting agrobiodiverse products: marketing nutritional, health and cultural values
  - Promoting nutritional diversity and cultural use
  - Promoting natural medicines
  - Promoting organic and agroecological production systems
  - Reaching both rural and urban audiences
- Cultivating agrobiodiverse crops: sharing knowledge and seed
  - Training farmers in agroecological methods
  - Encouraging crop diversification, tree planting and agroforestry
  - Organising seed fairs that allow peer-to-peer exchange
  - Managing community seed banks (CSBs)
- Organising agrobiodiverse businesses: aggregating baskets of quality products
  - Organising market fairs that enhance sales of diverse products
  - Building collective businesses that reinforce cultural identity
  - Using established infrastructure to market diverse baskets of product
  - Developing shared labels
- Reshaping investment models: mobilising internal finance to fund complexity
  - Normalising savings and loans groups
  - Evolving towards larger financial cooperatives
  - Attracting inward investment from nature-friendly partners
- Bolstering political will: shaping enabling policies for the above
  - Promoting the benefits of agricultural and biocultural heritage systems
  - Fighting for laws that support peasant seed systems and farmers' rights
  - Promoting tenure security and smallholder investment mechanisms.

Programmes based on that agenda, carried out by the huge strength in numbers that FFPOs and IP and LC groups provide, would provide effective fast action towards biodiversity conservation, climate mitigation, adaptation and resilience, and the reversal
of land degradation (see Hou Jones and Macqueen 2019). It should also be noted that smallholder farmers and Indigenous Peoples globally already invest annually a hundred times more in climate adaptation than all climate adaptation finance combined. It is a case of better supporting the huge investments and innovations already undertaken by these groups, and not at all a case of trying to stimulate adaptation within a reluctant stakeholder group.

5.3 Ensure FFPOs and IP and LC groups are represented in ODA decision-making and set targets for local disbursement

Much of what is stated in this report is not new. As noted in Section 1, there are powerful countervailing forces of economic concentration and power driving the current cycle of inequality and biodiversity loss in the global food system. Those countervailing forces are not restricted to the concentration of wealth and power in the private sector. They also and increasingly involve concentrations of power and influence in government decision-making and in the multilateral and non-governmental organisations that manage official development assistance (ODA). The scale of local exclusion from financial decision-making has been much documented (Holland et al. 2022).

To shift from rhetoric and pledges to real change in who does what, perhaps the most immediate need is for better representation of FFPOs and IP and LC groups in ODA decision-making. Tokenism cold then be avoided as most such groups have elected representation with formal mandates and accountability mechanisms. One approach might be to promote national-level representatives of farmer organisations or Indigenous Peoples into national aid agencies. Another approach might be to ensure that major climate and development funds such as the Green Climate Fund (GCF), Global Environmental Facility (GEF), Adaptation Fund (AF) and others have steering committees where FFPOs and IP and LC groups comprise majority representation, and these funds should increase funding for agrobiodiversity.

Metrics must be introduced that track how much funding reaches local FFPOs and IP and LC groups from the vast sums committed to ODA – with hard targets for what percentage must reach what sort of group. And this will likely involve a proliferation of funding channels rather than the current concentration of ever-greater funding quantities ending up in ever fewer hands. But diffusion of resources and power, rather than its concentration, is exactly what is needed to reverse the current cycle of inequality that fuels biodiversity and agrobiodiversity loss. It is also what is needed to transform the current monocultural and concentrated global food system into a global food system that offers true resilience and food security and justice for the long term.
References

Adagenera, CA and Kuudaar, E (2023) Mobilising internal finance within a forest and farm producer organisation: a case study of the Jwa Ngwaane Community Cooperative Credit Union. Jwa Ngwaane Community Cooperative Credit Union, Ghana and IIED, London. www.iied.org/21406g


Andrianaivolala, E (2023) Enhancing agrobiodiversity in smallholder agroforestry systems in Madagascar. PNFDDSA and IIED, Edinburgh. www.iied.org/21476g


Aro, RM (2020) Cocoa from peasant and indigenous families – a way to fight climate change. FEDPRACAO CBBA, Bolivia and IIED, London. www.iied.org/16679iied


Carrera Rueda, H and Vallejo Rojas, V (2023) Mobilising internal finance within a forest and farm producer organisation: a case study of the Santa Anita Savings and Credit Cooperative. UNORCAC, Cotacachi and IIED, London. www.iied.org/21451g

CGIAR (2019) Agrobiodiversity Index, tool to measure agrobiodiversity and identify concrete actions to achieve diverse and sustainable food systems. https://hdl.handle.net/10568/122833


Chingaipe, E (2023) How tree seedling nurseries are furnishing landscape agrobiodiversity in Zambia. CDTNA, Zambia and IIED, Edinburgh. www.iied.org/21441g


Forest and Farm Facility (2022) Saving our future: investing in locally led diversification for climate resilience and food security. Conference highlights. www.iied.org/21211g


Holland, E, Patel, S, Roe, D and Shakya, C (2022) Money where it matters for people, nature and climate: driving change through support for local level decision making over resources and finance. IIED, London. www.iied.org/20966iied


Hou Jones, X and Sorsby, N (2023) The unsung giants of climate and nature investment: Insights from an international survey of local climate and nature action by smallholder forest and farm producers. IIED. www.iied.org/21976IIED


Kayombo, CJ, Bakanga, G and Masandika, R (2023) Successful smallholder management of agrobiodiversity in Northern Tanzania. MVIWAARUSHA and IIED, Edinburgh. www.iied.org/21421g


Macqueen, D (2023) Agrobiodiversity — the way to save earth’s skin. IIED, London. www.iied.org/21626iied


Mongabay, Countries with the highest biodiversity, Total number of amphibian, bird, fish, mammal, reptile, and vascular plant species, by country. https://rainforests.mongabay.com/03highest_biodiversity.htm


PAR, Welcome to DATAR, The Diversity Assessment Tool for Agrobiodiversity and Resilience to feed and restore our planet. www.datar-par.org


Paul, TE (2023) Advancing agrobiodiversity through the promotion of agroecology, seed management and enterprise development in Ghana. ABOFA and IIED, Edinburgh. www.iied.org/21391g


Piñán Cajas, MA (2023) Managing agrobiodiversity in successful smallholder landscapes in Ecuador. UNORCAC, Ecuador and IIED, Edinburgh. www.iied.org/21386g


Poso, C (2020) Climate change resilience via production that preserves biocultural heritage. KALLARI, Ecuador and IIED, London. www.iied.org/13617iied


Terrasos (2023) ClimateTrade and Terrasos will jointly promote Voluntary Biodiversity Credits to boost Habitat Banks and promote the effective conservation of biodiversity. https://bit.ly/3T6FPme


ValueNature, Transparent, quantifiable return on investment through tangible environmental and social improvements. https://valuenature.earth/#vision


Agrobiodiversity is the subset of biodiversity found within agricultural ecosystems. It feeds us with nutrients vital to our health. It fuels and furnishes our homes. It underpins cultural traditions. It sustains farm productivity in the face of climate change. But agrobiodiversity is rapidly being lost. Just three crops account for half of all plant-based calories (rice, maize and wheat). Most of the world’s remaining agrobiodiversity is now conserved by 1.3 billion smallholder farmers and Indigenous Peoples. But the march of cheap, industrial-scale, monoculture food systems displaces these smallholders and Indigenous Peoples – with dire prospects for global resilience and food security. Food system transformation is required. This report documents 5 innovative system-wide strategies and 18 tactics emerging among smallholder farmer and Indigenous People’s organizations to deliver just that:

- Promoting nutritional and medicinal health;
- Sharing knowledge and seed to cultivate complexity;
- Diversifying enterprises that aggregate multiple products;
- Self-mobilizing flexible finance;
- Bolstering political will for system change.

Government and donor decision-makers need to recognise the centrality of this work, improve efforts to get climate and nature finance to these local groups, and improve their representation in farm system transformation processes.

IIED is a policy and action research organisation. We promote sustainable development to improve livelihoods and protect the environments on which these livelihoods are built. We specialise in linking local priorities to global challenges. IIED is based in London and works in Africa, Asia, Latin America, the Middle East and the Pacific, with some of the world's most vulnerable people. We work with them to strengthen their voice in the decision-making arenas that affect them — from village councils to international conventions.