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## HLPE-FSN Report #21

### Preserving, strengthening and promoting Indigenous Peoples' food and knowledge systems and traditional practices for sustainable food systems

A report by the High-Level Panel of Experts on Food Security and Nutrition (HLPE-FSN)

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## Foreword

The work of the High-Level Panel of Experts on Food Security and Nutrition (HLPE-FSN) is forward-looking by design and purpose. Its role is not only to examine individual challenges affecting food security and nutrition, but also to consider how different issues interact, how they are evolving, and what this means for policy and action in the years ahead.

It is in this context that the present report marks a crucial step in the evolution of the HLPE-FSN's work. It is the first HLPE-FSN report to focus specifically on Indigenous Peoples' food and knowledge systems. This focus brings both an important opportunity and a particular methodological responsibility.

Indigenous Peoples' food and knowledge systems are extraordinarily diverse, reflecting different histories, cultures, identities, environments, institutions and relationships with land and natural resources. At the same time, they embody knowledge and practices that can offer important insights into how we can build sustainable food systems that support resilience, biodiversity, nutrition and relationships between people, food, and ecosystems.

Understanding these systems, however, requires particular care. Much of the literature on Indigenous Peoples' food and knowledge systems has been produced by researchers and institutions that are not themselves actors, nor consumers, within those systems. This creates an inherent risk that analysis may be shaped by external perspectives and assumptions. The diversity of Indigenous Peoples and their food systems challenges the HLPE-FSN to identify common trends, principles and dynamics while keeping the specificity of different contexts. A further challenge concerns knowledge itself. The HLPE-FSN has always recognized the value of knowledge that extends beyond the peer-reviewed scientific literature, integrating, with rigour, grey literature and other relevant sources. The development of the report involved two public consultations, first on the scope of the report and later on the "V0" draft of the report. The report was also subject to peer review.

This process was not without challenges. The diversity of Indigenous Peoples and their food and knowledge systems was accompanied by the political sensitivity of the subject, significant differences in legal and institutional frameworks across countries, and different understandings and sensitivities surrounding terminology, rights, knowledge and representation. These dimensions required more exchanges, iterations and reflection than is usual for most HLPE-FSN reports.

Yet this complexity is also one of the report's greatest contributions. The lessons learned will be useful not only for future work on Indigenous Peoples, but more broadly for the panel's continued efforts to consider and address complex and interconnected food security and nutrition challenges.

Ultimately, this report is not intended to present Indigenous Peoples' food and knowledge systems as a universal model to be replicated, nor to treat them as relics of the past. Rather, it seeks to understand them as living, diverse and evolving systems, and to consider what they can teach us about the

opportunities and challenges of transforming food systems towards better nutrition and greater sustainability, resilience and equity.

In uncertain times and volatile environments, the knowledge and wisdom of Indigenous Peoples are essential if HLPE-FSN is to propose solutions to present challenges with a common purpose. As the CFS looks ahead to a changing global policy landscape, this ability to learn across different knowledge systems and experiences will be increasingly important. The HLPE-FSN will continue to contribute to that effort by providing independent, evidence-based and forward-looking analysis, while remaining attentive to the diversity of perspectives and forms of knowledges needed to understand food security and nutrition in all their complexity.

## Acknowledgements

The HLPE-FSN of the Committee on World Food Security (CFS) expresses its sincere gratitude to all those who contributed valuable inputs and thoughtful feedback during the two online public consultations. These contributions are key to better understand and address the diversity of perspectives and concerns of CFS members and participants.

The insights shared throughout the consultations were instrumental in supporting the integration of diverse forms of knowledge and expertise. Seventy-eight contributions were received at the first open consultation on the scope of the report. The second consultation, on the “V0” draft of the report, engaged 57 contributors from 18 countries, from across public and private sectors, bringing a wide range of perspectives. Many of these contributions resulted from collective reflection and engagement.

The HLPE FSN also expresses its gratitude to all the peer reviewers for their invaluable feedback on the “V1” draft of the report. The HLPE FSN peer reviewers are collectively listed in the HLPE-FSN website, at <https://www.fao.org/cfs/cfs-hlpe/en>.

The HLPE FSN also wishes to thank Christin Campbell for her meticulous editing of the English version, the FAO translation team for their work in translating the report into all official United Nations languages, Lorenzo Cintori for the graphic design and layout of the report and for his creative work on selected figures.

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## Acronyms

|          |                                                                                            |
|----------|--------------------------------------------------------------------------------------------|
| BaU      | Business as Usual                                                                          |
| CARE     | Collective Benefit, Authority to Control, Responsibility and Ethics                        |
| CBD      | Convention on Biological Diversity                                                         |
| CEDAW    | Committee of the Elimination of All Forms of Discrimination Against Women                  |
| CERD     | Committee on the Elimination of Racial Discrimination                                      |
| CFS      | Committee on World Food Security                                                           |
| CIAT     | Alliance of Bioversity International and the International Center for Tropical Agriculture |
| COP      | Conference of the Parties Rio Conventions                                                  |
| COPs     | communities of practice                                                                    |
| CRC      | Convention of the Rights of the Child                                                      |
| CSIPM    | Civil Society and Indigenous Peoples' Mechanism                                            |
| EMRIP    | Expert Mechanism on the Rights of Indigenous Peoples                                       |
| ETR      | Equitably Transformative Resilience                                                        |
| FAO      | Food and Agriculture Organization of the United Nations                                    |
| FPIC     | Free, Prior and Informed Consent                                                           |
| GCF      | Green Climate Fund                                                                         |
| GEF      | Global Environment Facility                                                                |
| HLPE-FSN | High Level Panel of Experts on Food Security and Nutrition                                 |
| ILO      | International Labour Organization                                                          |
| IPBES    | Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services           |
| IPFS     | Indigenous Peoples' food systems                                                           |
| IPRA     | Indigenous Peoples' Rights Act (Philippines)                                               |
| IUCN     | International Union for Conservation of Nature                                             |
| NAPs     | National Adaptation Plans                                                                  |
| NDCs     | Nationally Determined Contributions                                                        |
| NTFP     | Non-Timber Forest Products                                                                 |
| OCAP     | First Nation's Ownership, Control, Access and Possession                                   |
| PNGATI   | Brazil's National Policy for Territorial and Environmental Management of Indigenous Lands  |
| SDG      | Sustainable Development Goals                                                              |
| TEEB     | The Economics of Ecosystems and Biodiversity                                               |
| UN       | United Nations                                                                             |
| UNCCD    | United Nations Convention to Combat Desertification                                        |
| UNDRIP   | United Nations Declaration on the Rights of Indigenous Peoples                             |
| UNEP     | United Nations Economic Programme                                                          |
| UNESCO   | United Nations Educational, Scientific and Cultural Organization                           |

|        |                                                                                             |
|--------|---------------------------------------------------------------------------------------------|
| UNFCCC | United Nations Framework Convention on Climate Change Convention on Biological Diversity    |
| UNPFII | United Nations Permanent Forum on Indigenous Issues                                         |
| VGGT   | Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests |

### Context and rationale

Indigenous Peoples' food systems (IPFS) are complex networks of interrelationships between humans and nature that have developed over millennia and have contributed to shaping Indigenous ways of life. This report responds to the Committee on World Food Security's (CFS) request for a High Level Panel of Experts on Food Security and Nutrition (HLPE-FSN) report on preserving, strengthening and promoting Indigenous Peoples' food and knowledge systems and traditional practices for sustainable food systems.

Three objectives frame the report:

1. preserve and promote functioning Indigenous Peoples' food systems;
2. restore and strengthen systems under pressure or disruption; and
3. identify lessons that can inform the transformation of other food systems.

Indigenous Peoples are rights holders. They must be at the centre of food systems that are grounded in the right to food, the principles of free, prior and informed consent (FPIC), access and benefit-sharing (ABS), and the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). Foremost, the right to self-determination is fundamental and foundational, as it enables Indigenous Peoples to exercise their other individual and collective rights.

Transforming conventional agricultural and food systems is urgent. Global quantified hidden costs of agrifood systems have been estimated at 11.6 trillion 2020 purchase power parity [PPP] dollars. While commercial food production has increased food availability, it has not resolved inequities in food access and has generated substantial long-term health and environmental consequences. These include land degradation, water depletion and pollution, biodiversity loss, and climate change. Over a third of the world's fisheries are overfished, driven in part by industrial fishing, with consequences for Indigenous Peoples' and small-scale fisheries. More broadly, the expansion of conventional food systems has contributed to the marginalization of IPFS and the displacement of diverse traditional foods by increasingly processed and standardized diets. These changes have contributed to the growing triple burden of malnutrition: undernutrition, micronutrient deficiencies, overweight and obesity – a risk factor of non-communicable diseases.

While recognizing that there are major differences between industrial food production and small-scale farming systems, this report contends that IPFS offer lessons that can be applied to all food systems.

Indigenous Peoples' food systems (IPFS) are not only food production systems; they are systems of integration, where territorial rights, governance, knowledge, culture and food provisioning are inseparable. Colonialism systemically dismantled Indigenous governance, tenure systems and knowledge transmission structures, replacing them with extractive structures that continue to impact IPFS today. While many IPFS are deeply rooted in territory, displacement, migration and urbanization have altered access to these territories without severing these relationships. Indigenous Peoples continue to maintain, adapt and renew food-related connections to their territories, cultures and communities across distances.

This report follows the established HLPE-FSN methodology, drawing on published and grey literature and the expertise of the panel and drafting team. This process involved multiple rounds of public consultations. The HLPE-FSN views the report as a starting point for further consultations and discussion.

Our key message is that Indigenous Peoples' knowledge systems are independent of and complementary to scientific knowledge and other forms of evidence and should be recognized as valid in their own terms. They are built through generations of observation, experimentation, practice and adaptation, and continually tested through relationships

with land, water, animals and communities. They can therefore bring knowledge and dimensions that conventional scientific approaches may overlook or be poorly equipped to capture.

## **Indigenous Peoples' food systems: concepts and definitions**

Indigenous Peoples' food systems (IPFS) are premised on an Indigenous worldview where everything, tangible and intangible, is in a state of balance. As a simple example: When a food source is depleted, such as shellfish, Indigenous Peoples, such as the Māori, place a *rahui* (ban) over the area until the food source is replenished; then the ban is lifted. This philosophy achieves well-being, sustainability and respects biodiversity.

Indigenous Peoples' food systems are also dynamic, complex socioecological and biocultural systems that support both food generation (hunting, gathering, fishing) and food production (different farming systems, such as cultivation, shifting cultivation and animal husbandry). They integrate biodiversity management, Indigenous knowledge, cultural and spiritual values, customary governance, livelihoods and territorial relationships.

The report's core analysis pertains to Indigenous Peoples as recognized by UNDRIP and the Indigenous and Tribal Peoples Convention, 1989 (No.169). A working definition frames IPFS as dynamic, relational and communal systems grounded in Indigenous Peoples' territories, that include interrelated elements of nature, people, customary tenure and governance for the growing, harvesting, processing, preserving and consumption of food. Indigenous Peoples' food systems are underpinned by Indigenous Peoples' knowledge, cultural and spiritual values, and reciprocity, and guided by nature's seasons. They support livelihoods and well-being, deliver culturally appropriate, healthy and diverse diets, and generate socioeconomic, cultural and environmental outcomes that support the resilience of both people and food systems.

In line with the above definition, Indigenous food sovereignty here means the ability of Indigenous Peoples to control, manage, create and produce their own types of traditional foods, using their own practices and knowledge, to enhance their health and that of related production systems.

The preservation, protection, strengthening and promotion of IPFS can assist the wider transformation of food systems. This requires policies, careful legislation, recognition of Indigenous governance, and investment in solutions led by Indigenous Peoples.

Indigenous Peoples' food systems connect to the six dimensions of food security and nutrition (availability, access, utilization, stability, agency and sustainability), with relationality underpinning all six. Territorial access and agency enable individuals and communities to grow, harvest, process and sustainably manage culturally appropriate food.

Evidence shows that intact IPFS can deliver strong nutrition and health outcomes. Research on food species and nutritional values across nine countries shows that: Baffin Inuit (Nunavut) in Canada use 79 different plant and animal species, providing health beneficial omega-3 fatty acids and micronutrients; Awajun people in Peru use 223 species, many with high micronutrient content.

Indigenous Peoples' foods are largely absent from national food composition tables, making them statistically invisible and excluded from policies meant to address malnutrition. Generating Indigenous Peoples' food composition data under Indigenous governance is therefore a precondition for recognition of IPFS. This invisibility occurs within a broader marginalization of IPFS that contributes to the triple burden of malnutrition.

Indigenous Peoples' food systems require shifts towards future food production that is adapted to local ecosystems and focuses not only on quantity but also on nutritional quality to ensure food security and nutrition. These systems offer fundamental values: Food is the flow of life, not a commodity; food is to be treated with respect and gratitude; and food systems are holistic and part of nature. Legislation such as the Aotearoa (New Zealand) Hauraki Gulf/Tikapa

Moana Marine Protection Act shows how conservation and Indigenous food sovereignty can be reconciled. Diverse food systems support diverse economies, strengthening resilience to climatic and economic shocks.

### **Diversity, drivers of change, consequences and opportunities**

Indigenous Peoples' food systems are territorial systems of life in which food, governance, identity, spirituality and ecological stewardship are inseparable, embedded in land, water, forests, rangelands, wetlands, coastlines and sacred sites governed through customary institutions. They are best understood as biocultural systems anchored in ancestral territories, where territory is the material, social, political and spiritual basis through which food practices are organized and reproduced.

#### **Seven recurrent characteristics define functional Indigenous Peoples' food systems:**

- **territorial integrity:** secure relationship with the lands, waters, air and ecological spaces that sustain food systems;
- **biocultural food provisioning:** obtaining food through ecological knowledge and culturally meaningful practices;
- **reciprocity-based food exchange:** sharing food through kinship, mutual aid and ceremonies;
- **knowledge-grounded intergenerational transmission:** passing on food-related knowledge across generations;
- **community governance and self-determination:** authority to make decisions according to Indigenous Peoples' institutions;
- **moral-ecological stewardship:** caring for ecosystems and regulating extraction; and
- **relational values grounded in cosmology:** worldviews in which lands, waters, plants, animals and spiritual beings are living relations.

#### **A two-axis typology captures this diversity:**

- dominant socioecological livelihood configurations (forest-based mosaic, mobile herding and pastoral, water and fisheries-based, agrarian, and reconfigured food systems); and
- the current condition of functionality (territorially rooted, pressured, hybrid, fragmented, or externally dependent). These conditions are not necessarily sequential or mutually exclusive, and reconfiguration does not necessarily imply a loss of systemic coherence or autonomy.

Case studies – the Rio Negro forest-river mosaic in Brazil, Sámi reindeer pastoralism in the Arctic, Maasai pastoralism in East Africa, Sabetta agroforestry in Indonesia, Pacific Islands aquatic food systems, and the Bering Strait – show how territorial rootedness, governance and knowledge transmission interact with pressures such as climate change, land dispossession and market penetration. These cases show that IPFS are not static survivals of the past, but living systems shaped by adaptation and collective governance.

Indigenous Peoples' food systems are being reshaped by interacting socioeconomic, sociocultural, behavioural, climatic, political and environmental drivers. These include colonization, land dispossession, extractive industries, infrastructure expansion, market dependence and dietary transitions. Further, the structural drivers of racism and discrimination shape the conditions under which IPFS operate, limiting funding and policy support for Indigenous food sovereignty. These drivers interact and produce cascading and compounded effects.

Concrete examples highlight the magnitude of the change: Over 70 percent of Yucatec Maya farmers have adopted non-traditional technologies. These shifts often have negative consequences for food security, nutrition and health: lower access to traditional foods, higher dependence on ultra-processed foods, erosion of Indigenous knowledge, and

increasing rates of obesity, diabetes and other non-communicable diseases. Weakened IPFS also undermine biodiversity, ecosystem stewardship and customary governance across forests, rangelands, coasts and wetlands. Biodiversity loss on Indigenous Peoples' lands is driven by extractive practices such as overfishing, overhunting, overgrazing, shortened fallow periods and herd expansion due to insecure tenure, compounded by climate change.

Indigenous Peoples demonstrate resilience and adaptability to these pressures through cultural-ecological resilience, the ability of communities to sustain and regenerate their identities, knowledge systems and relationships with land through food practices. Examples include Sámi reindeer herders' seasonal mobility strategies, Kel Tamasheq grazing rotation and Tangkhul Naga seasonal calendars.

To strengthen IPFS, there is a need to protect territorial integrity and Indigenous Peoples' governance and self-determination. In addition, to support the transmission of knowledge and the co-creation with Indigenous Peoples climate and food-system policies that are adapted to local cultural, ecological and political contexts. Solutions must be context specific and led by Indigenous Peoples themselves.

### **Understanding the value of Indigenous Peoples' food systems**

The value of IPFS extends beyond production and market exchange, generating intertwined production, sociocultural, knowledge and well-being, and ecological values central to food security, nutrition, well-being, identity and ecological sustainability. Current valuation approaches, however, systematically marginalize these non-market and intangible contributions.

Global subsidies for fertilizers and pesticides are worth over USD 635 billion per year, but little comparable support exists for IPFS. Marketable values (crops, livestock, wild foods, medicines, value-added products and employment) are different from non-marketable values that support cultural continuity, food sovereignty and ecological integrity.

Functional IPFS support many social, cultural and ecological values including social cohesion, knowledge, food diversity and sovereignty, while provisioning several ecosystem services such as biodiversity and soil protection. Existing food production systems' related frameworks largely fail to capture such values which are pivotal and underpin Indigenous Peoples' well-being, identity and spiritual values.

Based on the Economics of Ecosystems and Biodiversity [TEEB]-Agrifood framework, an evaluation framework specific to Indigenous Peoples is proposed which focuses on production values, knowledge and well-being values, governance and relational values, and ecological values. The latter three dimensions of the proposed framework interact to generate production values while contributing to Indigenous Peoples' well-being and identity. The framework gives equal weight to cultural governance, knowledge and well-being, and ecological values. It addresses the six food security dimensions and adds "Peoples' well-being and identity" dimension. Importantly, not all dimensions of IPFS can or should be measured in economic terms. For example, social and ecological relationships – based on reciprocity, spirituality and kinship with nature – cannot be priced and monetised.

Recognizing the true value of IPFS can inform policy instruments, investment mechanisms and Indigenous Peoples-led programmes. It can also help deliver healthy diets, diversified food economies, enhanced resilience to climate shocks, biodiversity conservation, climate mitigation and culturally grounded well-being.

### **Land, water and territorial rights**

***Four interconnected pathways link territorial rights to IPFS:*** governance and self-determination; ecosystem stewardship; knowledge systems; and food and nutrition security, connecting governance and ecological processes to concrete food and nutrition outcomes. Territorial rights extend across water and marine environments, yet these

are often far less recognized than land rights. Territorial rights are the upstream structural foundation of nutrition and health. Effective recognition and implementation of collective, seasonal and overlapping tenure rights are therefore essential to improve indigenous Peoples' food security and nutrition.

Territorial dispossession always undermines governance, ecological stewardship and food security, including diverse, culturally appropriate traditional diets, such as the Sawhoyamaya ruling in Paraguay, the Baka and Bakola forest dispossession in Cameroon and the Ogiek legal victory in Kenya demonstrate. In Kenya, the Ogiek of Mau Forest were evicted for conservation and logging, disrupting resource use and undermining knowledge. In 2017, the African C on Human and People' rights found Kenya had violated the rights of the Ogiek to property, culture, natural resources and development.

Territorial rights also ground essential knowledge, since place-based knowledge of soils, seeds, fisheries, water systems and seasonal indicators depends on continued access to and responsibility for specific lands and waters. Territorial rights are therefore a knowledge infrastructure that allows Indigenous Peoples to maintain and pass on ecological knowledge.

Colonial legal regimes, large-scale land acquisitions, financialization of ecosystems and climate change continue to undermine territorial governance. These outcomes are influenced by gender, youth and equity dimensions: Women are often custodians of seed banks and food knowledge but are disproportionately burdened by land encroachment. Some countries have moved forward: Canada's 2021 Fisheries Resources Reconciliation Agreement, Aotearoa's (New Zealand) Te Awa Tupua Act recognizing the Whanganui River as a legal entity and Mexico's 2024 constitutional reform recognizing Indigenous Peoples as "subjects of public law." This kind of recognition matters, not just on paper.

Indigenous Peoples who are displaced from their territories or living in urban and peri-urban contexts often maintain linkages with their food systems through rural–urban food networks, remittances, cultural gatherings and seasonal return. However, such adaptations cannot substitute for restored territorial rights. Territorial rights need to evolve to be applicable in these circumstances. For example, they can be exercised as rights of return, seasonal harvesting or co-management and benefit-sharing over ancestral territories, applying FPIC and ABS mechanisms. Closing the gap between formal legal recognition and effective implementation requires binding FPIC, legal protection of customary tenure, cross-sectoral policy coherence, Indigenous data sovereignty, and redirected financial flows towards Indigenous Peoples-led conservation and food systems.

## **Co-creation of knowledge**

Co-creation of knowledge can support the transformation of disrupted food systems by bringing scientists and Indigenous Peoples' knowledge holders into meaningful dialogue. Indigenous Peoples' food systems (IPFS) draw on knowledge developed, tested and adapted over generations through close relationships with territories, waters, plants, animals and communities, including through periods of profound disruption. They contain rigorous concepts, methods, analysis and synthesis, expressed through storytelling, oral histories, ceremonies, land-based observation, and community-guided research. Co-creation does not require merging knowledge systems or validating Indigenous knowledge through scientific standards. It requires conditions for respectful and reciprocal engagement: Indigenous knowledge holders must choose whether and how to participate; Indigenous Peoples' rights, governance and ownership of knowledge must be protected; different knowledge systems must be respected on their own terms; and the process must be inclusive, consensual and transparent, with no obligation to co-create or to cede governance.

A shift is needed from a narrow science-policy interface to a broader knowledge-policy interface – one that recognizes Indigenous Peoples' knowledge as a legitimate basis for public policy that is in addition to conventional scientific evidence. Indigenous Peoples must participate as rights holders and knowledge holders, not simply as stakeholders or informants. They are the primary interlocutors and the only ones authorized to assert their voice and knowledge

before third parties, without external intermediaries. Co-creation depends on self-determination, FPIC, knowledge safeguarding, equitable benefit-sharing and governance arrangements that address colonial power asymmetries.

### **Critical requirements underpin effective co-creation**

Co-creation of knowledge that is applicable to agricultural and food systems requires an enabling policy and governance interface that is based on common principles, values of mutual respect, reciprocity, transparency, trust, plural evidence and shared benefits, and a methodologically sound process for bridging science with Indigenous Peoples' ways of knowing.

Such a methodology connects Indigenous Peoples' knowledge systems and scientific approaches around four shared pillars – concepts, methods, analysis and synthesis – without subordinating one to another. Establishing conditions for the validity of Indigenous Peoples' knowledge systems is a power that belongs exclusively to Indigenous Peoples.

Co-creation of knowledge can transform disrupted food systems only if territorial rights, cultural protocols, language, spirituality and Indigenous knowledge governance are respected throughout. Strengthening Indigenous-led knowledge systems requires secure territorial rights and public policies that recognize Indigenous Peoples' knowledge on its own terms. It also requires the conditions for such knowledge systems to remain living and dynamic: opportunities for knowledge holders to practice, transmit and renew their knowledge, and for younger generations to learn through relationships with territories, communities and other knowledge holders. The erosion of intergenerational transmission threatens not only the continuity of Indigenous knowledge, but also the knowledge that Indigenous Peoples can choose to bring into dialogue with the formal scientific community. Supporting knowledge holders and intergenerational learning is therefore urgent, irrespective of whether such knowledge ultimately enters processes of co-creation.

### **Future pathways for Indigenous Peoples' food systems**

A forward-looking outlook for IPFS illustrates how present governance choices and interacting polycrises may either deepen disruption or enable transformation.

#### ***Two trajectories frame this outlook***

A business-as-usual (BAU) trajectory envisages that existing systemic risks (territorial fragmentation, climate change, biodiversity loss, extractive expansion, land grabbing, policy incoherence and weak recognition of Indigenous governance) result in IPFS becoming increasingly constrained, hybridized and externally governed.

A transformative trajectory envisages that unequal power, rights, resources and capabilities are redressed through restoration of territorial rights, collective governance, secure land and water access, effective FPIC, knowledge co-creation and recognition of Indigenous Peoples' decision-making authority. This leads to greater climate resilience, democratized governance, territorial reconstitution and biocultural regeneration.

Case studies show that shifts from BAU to transformative pathways are possible when structural conditions change, depending on four interconnected processes: securing territorial rights, supporting biocultural food systems and territorial economies, enabling Indigenous Peoples-led knowledge systems through co-creation and shared governance, and aligning global food-system transformation agendas with Indigenous Peoples' priorities.

Institutional change matters too. Brazil's Comissão de Alimentos Tradicionais dos Povos [Commission for Traditional Foods of Indigenous Peoples] (CATRAPOVOS) and Aotearoa's (New Zealand) Ka Ora, Ka Ako [When you are well, you can learn] show how school-feeding programmes can be reshaped to fit IPFS – through governance, procurement rules, food safety standards, quality criteria and knowledge integration.

The analysis identifies four mutually reinforcing conditions for transformation: secure territorial rights and Indigenous governance; support for biocultural food systems and territorial economies; protection and transmission of Indigenous Peoples' knowledge; and alignment of national and global policies with Indigenous Peoples' priorities. These conditions provide a framework for the recommendations.

## **Conclusions and recommendations**

Strengthening IPFS is both a rights-based obligation and a pathway for broader food-system transformation. Indigenous Peoples' food systems (IPFS) range from intact to fragmented, reconfigured, urbanized or disrupted systems. External factors have eroded Indigenous Peoples' rights, governance, territories and knowledge. Restoring and protecting IPFS is critical for Indigenous food sovereignty, nutrition, well-being and cultural survival, and for states seeking to meet the SDGs. Governments and other institutions should recognize Indigenous Peoples' food systems as living socioecological systems – not vulnerable remnants – whose governance, knowledge and practices can help shape more just and sustainable food futures.

### ***The report presents ten clusters of recommendations***

The recommendations derive from the scenario analysis in Chapter 6 and other chapters, which identifies the structural conditions needed for transformative pathways, and are aligned with existing international commitments (UNDRIP, Convention on Biological Diversity [CBD], SDG 2, Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests [VGGT], Paris Agreement, Convention on the Elimination of All Forms of Discrimination against Women [CEDAW], among others) and realistic policy timeframes (2030, 2035 and the Committee on World Food Security Multi-Year Programme of Work [CFS MYPOW] 2028–2031).

1. Recognize the value of Indigenous Peoples' food and knowledge systems.
2. Improve Indigenous Peoples' food security and nutrition outcomes.
3. Secure Indigenous Peoples' collective territorial rights and governance authority.
4. Support Indigenous Peoples' food systems and territorial economies.
5. Enable Indigenous Peoples-led knowledge systems.
6. Align food system transformation agendas with Indigenous Peoples' priorities and rights.
7. Address gender, youth and intergenerational justice.
8. Ensure data and knowledge sovereignty and governance.
9. Prevent and respond to climate impacts.
10. Design and implement fair standards and inclusive regulation.

Central to all recommendations is the recognition that Indigenous Peoples' knowledge systems must be recognized on their own terms without subordination or externally imposed validation. Indigenous Peoples are rights holders and their knowledge systems are independent of conventional scientific knowledge.

The CFS should establish a biennial, Indigenous-led IPFS assessment process, supported by a baseline assessment completed by 2027 and a midterm review in 2030. Reporting should track legal recognition, implementation, direct financing, and participation in decision-making, food security and nutrition outcomes. Indicators, data governance arrangements and review procedures must be jointly defined with Indigenous Peoples and respect their data sovereignty.

For these recommendations to be implemented, funding must reach Indigenous organizations directly, political will must be sustained, and the United Nations agencies must coordinate their efforts. Conditional funding, private

interests, weak accountability, and continued loss of Indigenous territories and rights undermine political will. These challenges are compounded by limited understanding among many policymakers, scientists and the broader public of Indigenous Peoples' histories, their long struggles for rights and self-determination, and the gains achieved – and sometimes subsequently lost – through these struggles. Addressing this historical and political knowledge gap is essential to avoid treating Indigenous rights as recent claims rather than rights grounded in long histories of resistance, negotiation and recognition. These risks must be tracked and mitigated through transparent reporting and the full participation of Indigenous Peoples in all reviews.

Incremental change is no longer sufficient. These recommendations and targets set out a clear path to recognize, protect and strengthen Indigenous Peoples' food systems. Their implementation is essential to the continuity of Indigenous cultures and knowledge systems, while contributing to global food security and nutrition, as well as planetary health.

Key messages:

- Indigenous Peoples' food systems (IPFS) are premised on, and derived from, their Indigenous worldview or cosmology where everything, tangible and intangible, is interconnected as a web of relationships in a state of balance, where nature, humans and the sacred form an inseparable whole.
- Indigenous Peoples' food systems are dynamic, complex socioecological and biocultural systems that support both food generation (hunting, gathering, fishing) and food production (shifting cultivation, cultivation, livestock).
- Key international instruments such as the United Nations (UN) Declaration on the Rights of Indigenous Peoples articulate fundamental rights for Indigenous Peoples including the key right of selfdetermination that embodies additional rights such as free, prior and informed consent (FPIC) and rights to land, territories and resources.
- The proposed working definition of IPFS emphasizes their dynamic, relational, and communal character and their role in sustaining healthy diets, livelihoods, and well-being, their spiritual dimension as well as intergenerational responsibilities, social cohesion and cultural benefits.
- Indigenous Peoples' food systems (IPFS) consider food as relational rather than merely a commodity, prioritizing reciprocity, sustainability, and nutrition. While recognizing that there are major differences between industrial food production and small-scale farming systems, this report contends that IPFS offer lessons that can be applied to all food systems.
- Indigenous Peoples' knowledge systems are independent of and complementary to scientific knowledge and other forms of evidence and should be recognized as valid in their own terms
- The preservation, protection, strengthening, and promotion of IPFS can help in food-system transformation. This requires policies and, in some instances, careful legislation.
- Ensuring IPFS are preserved, protected, strengthened and promoted requires the recognition of Indigenous Peoples' governance and investment in Indigenous Peoples-led solutions.

## 1.1 Introduction

This report is in response to the Committee on World Food Security's (CFS) call for a High Level Panel of Experts (HLPE-FSN) report entitled *Preserving, strengthening and promoting Indigenous Peoples' food and knowledge systems and traditional practices for sustainable food systems*<sup>1</sup>. The status quo in global food systems is no longer sustainable, threatening human health, environmental stability and economic security. The challenge is no longer simply to produce more food but to ensure that food systems provide nutritious, culturally appropriate, and climate-resilient foods while sustaining biodiversity, ecosystems and human well-being. Indigenous Peoples' food systems (IPFS) offer important lessons for this transformation, seeing food not simply as a commodity but as a source of life embedded in relationships among people, culture, land and nature. Accordingly, understanding IPFS systems and how they can be enhanced, promoted, protected and restored to achieve sustainable, diverse, nutritious, and healthy food systems is the main aim of this report. Three objectives frame the report:

1. preserve, protect and promote functioning Indigenous Peoples' food systems;
2. restore and strengthen systems under pressure or disruption; and
3. identify lessons that can inform the transformation of other food systems.

Critical to an IPFS is the understanding of Indigenous Peoples' worldviews. A perspective from the HLPE-FSN Steering Committee was that a reframing to better situate and highlight the importance of Indigenous Peoples' worldviews is crucial in addition to the importance of the meaningful application of the fundamental rights articulated in the United Nations Declaration on the Rights of Indigenous Peoples.

Professor Leroy Little Bear defines a worldview as “a set of beliefs and values that are honoured, where the person or group interacts with the world around them, including land, animals, and people, passing on their worldview to ensure continuity” (Little Bear, as quoted in GTEC Canada Reader, 2022. Teaching Treaties in the Classroom, 2002, p. 31). Centred on creation stories and principles of reciprocity and relatedness, the aim of Indigenous Peoples' worldview is balance. A simple example: When a food source is depleted, such as shellfish, Indigenous Peoples, such as the Māori, place a *rahui* (ban or restriction) over the area until the food source is replenished and balance reestablished, then the ban is lifted. This philosophy promotes well-being, sustainability and respects biodiversity (Teaching Treaties in the Classroom, 2002).

Colonialism was not simply an external shock, but it systematically dismantled Indigenous Peoples' worldviews, governance, tenure systems and knowledge creation, innovations and transmission, replacing them with extractive legal and economic structures that continue to impact IPFS today (Rotz, Rück and LeBlanc, 2025). State subsidies for industrial agriculture and fisheries further distorted land use and markets, often to the direct detriment of IPFS (FAO, 2021).

Industrialized intensive fishing has led to the overfishing of over a third of the global fisheries, affecting Indigenous and small-scale fisheries for food, livelihoods and overall aquatic and marine health (Sharma *et al.*, 2025; Farquhar *et al.*, 2024). While recognizing that there are major differences between industrial food production and small-scale farming systems, IPFS, which have been increasingly marginalized to date, can offer lessons that can be applied to all food systems.

There is an urgency to preserve, protect and strengthen IPFS to sustain and advance customary agroecological practices and knowledge systems; to provide real-world case studies for food systems including agriculture, fisheries and aquaculture, to learn from these local, diverse, sustainable, eco-friendly systems and to adapt to current unpredictable climatic situations; and to take policy actions for the sustainability and support of IPFS and other food systems.

Indigenous Peoples have been documented to protect biodiversity, reduce environmental degradation, and supply healthy and nutritious foods sustainably to their communities, valuing and respecting and limiting food wastage (Knorr and Augustin 2025). Based on principles of reciprocity and ecological stewardship, IPFS offer a pathway to such change (Braun *et al.*, 2021; Vijayan *et al.*, 2022; Knorr and Augustin, 2025). Examples such as Heifer International's support to milpa systems (Heifer International, 2025) and the work on traditional varieties of the Global Alliance for the Future of Food (Global Alliance for the Future of Food, 2022) illustrate the potential of these approaches.

This report offers ground-up evidence from studies on the importance of IPFS where IPFS are not only food production systems but are systems of integration, where the land, governance, knowledge, culture and food provisioning are related and inseparable.

While most IPFS are territorially based, this report recognizes that displacement, migration and urbanization have created new realities for Indigenous Peoples, who maintain food connections across distances. The future of IPFS depends critically on the Indigenous knowledge keepers and youth, who are the continuity of food and knowledge systems, yet face added challenges of knowledge and language erosion.

The HLPE-FSN acknowledges not only the diversity of IPFS but also that IPFS share key principles rooted in Indigenous Peoples' values towards their food systems, including relationality, spirituality and sacredness of food, sustainable practices, and treating food with gratitude rather than as a commodity, which can inform the broad stream of food-related and production-related approaches.

## 1.2 Scope and structure of this report

The core principle informing the report is having Indigenous Peoples at the center as rights holders; rights that are recognized by, and firmly anchored, in the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP, 2007). Key rights include self-determination, free prior and informed consent, rights to their lands, territories and resources and the right of Indigenous Peoples to govern, collect, own, interpret and use data regarding their food systems (EMRIP, 2021). Without an Indigenous Peoples' right of self-determination, none of the other fundamental rights can be fully exercised (EMRIP, 2021).

The report recognizes that Indigenous Peoples have an intrinsic relationship with their land, territories (including aquatic and marine areas) and resources. This relationship is underscored by Indigenous Peoples worldviews, and concepts of sustainability, well-being, biodiversity and resilience are achieved in this relationship reflecting and guiding IPFS. While acknowledging that IPFS are dynamic, they can be fragmented or displaced or reconfigured states due to multiple historical, economic, institutional and political factors that have impacted them over time and/or continue to impact them to date. One major factor is colonialism, which has had and continues to have a widespread impact by systematically dismantling the social, cultural, ecological, and governance of relationships between people, territories, and their food systems. The legacy of colonialism exists through land dispossession, forced displacement, ongoing cultural disruptions, and restrictions on customary harvesting, hunting, fishing, and farming practices. These disruptions, compounded by market and economic pressures, have resulted in the loss of traditional practices and Indigenous Peoples' knowledge. To date, a number of IPFS are in a dire state characterized by alienation from their territories, eroded knowledge systems and declining access to traditional foods, demanding urgent restoration, protection and preservation for Indigenous food sovereignty, health, identity and resilience, which are foundational to the socioeconomic livelihoods and well-being of Indigenous Peoples.

The report also acknowledges the diversity among Indigenous cultures and that Indigenous Peoples' practices are diverse, context specific, and continually evolving. A selection of case studies is presented to show the issues that IPFS are facing in different contexts. The report emphasizes that functional IPFS demonstrate characteristics aligned to an Indigenous Peoples' world view.

A global perspective, drawing on case studies and evidence from various regions, informs this report. While it recognizes the particular histories of settler colonialism in countries such as Canada, Australia, New Zealand and the United States of America, the scope of the report extends beyond these contexts. The recommendations in this report are intended to be relevant across these diverse contexts while also emphasizing the importance of adapting them to local contexts and needs.

The report is organized as follows:

Chapter 1 introduces the report, including clarification on the scope and a working definition of IPFS.

Chapter 2 describes what IPFS look like in the contemporary world and what their key characteristics are. This chapter shows the diversity and uniqueness of IPFS and knowledge systems worldwide by offering case studies, including their multifunctional purposes and outcomes. Further, it highlights the drivers causing unwanted changes in IPFS and their impacts.

Chapter 3 focuses on how to understand and assess the value of IPFS. By value, the report intends both the marketable (tangible) and non-marketable (intangible) values, considering that failing to consider the latter is a reason for underrating IPFS's contribution. This chapter proposes an interlinked, systems framework, entailing both marketable and non-marketable components of food systems, i.e. natural, social, human and production values, and metrics on how to appropriately assess the importance of IPFS and support them to preserve, restore and promote them for the present and future generations.

Chapter 4 focuses on the critical issues of rights-based approaches, Indigenous Peoples' rights and territories, by conceptualizing land, water, and territorial rights as structural determinants shaping IPFS while linking governance, resource access, and food system outcomes. It analyses how these rights are enabled or constrained by sociopolitical processes and identifies key policy gaps and potential pathways to strengthen equitable, sustainable, and resilient Indigenous food systems. Further, it discusses the diversity of tenure systems globally and related issues.

Chapter 5 focuses on the co-creation of sustainable IPFS and related knowledge systems. It proposes processes and a model on how best to build bridges between science and Indigenous Peoples' knowledge systems, and to contribute to the design of public policies, aiming at transforming food systems.

Chapter 6 builds upon earlier chapters and focuses on envisioning how IPFS systems can improve and help transform mainstream food systems. This chapter uses examples of successful case studies to show that positive change is possible and that the right set of policy instruments can help instigate this much needed change.

Chapter 7 presents conclusions and recommendations.

### 1.3 Methodology

This report is based primarily on a comprehensive desktop analysis synthesizing existing evidence on IPFS from published and grey literature. The review draws upon peer-reviewed journal articles, books, reports from international organizations, , government publications, and Indigenous-led research, case studies, and other relevant literature from diverse geographical regions. Literature was found through systematic searches of major databases and institutional repositories using combinations of keywords related to Indigenous Peoples, food systems, traditional ecological knowledge, biodiversity, livelihoods, nutrition, governance, culture, sustainability, and related concepts depending on the focus of the different chapters. Our analysis looked to capture the diversity of IPFS across ecological, cultural, and socioeconomic contexts while recognizing their complexity.

This report recognizes Indigenous knowledge systems as valid in their own terms, independent of and complementary to scientific knowledge and other forms of evidence, rather than as sources that require external validation.

#### 1.4 Defining Indigenous Peoples for the purpose of this report

James Anaya (1996, p. 3) identified key commonalities to provide a loose definition of what it is to be Indigenous

The living descendants of pre-invasion inhabitants of lands now dominated by others... They are indigenous because their ancestral roots are imbedded in the lands in which they live, or would like to live, much more deeply than the roots of more powerful sectors of society living on the same lands or in close proximity. Furthermore, they are peoples to the extent they comprise distinct communities with a continuity of existence and identity that links them to communities, tribes or nations of their ancestral past.

The definition of Indigenous Peoples was highlighted during the drafting of the UNDRIP where both Indigenous Peoples and Member States eventually reached an agreement that there would be no formal definition of Indigenous (Gilbert, 2022). Despite this, the commonly accepted definition was developed by José Martínez Cobo, the UN Special Rapporteur of the Sub-Commission on Prevention of Discrimination and Protection of Minorities. He defined the term “Indigenous” in his seminal work, the *Study of the Problem of Discrimination Against Indigenous Populations*. Within his study, the definition of “Indigenous” pivots on colonization history, ancestry, and the ability of “self-identification” (based on 37 countries at the time) (Martínez Cobo, 1987). Drawing on these debates, and for the purpose of this report, the following working definition is proposed:

Indigenous Peoples communities are those which, having a historical continuity with their territories, including with pre-invasion and pre-colonial societies, consider themselves distinct from other sectors of the societies now prevailing on those territories, or parts of them. They generally form at present non-dominant sectors of society and are determined to preserve, develop and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as Peoples, in accordance with their own cultural patterns, social institutions and legal systems.

On an individual basis, an Indigenous person is one who belongs to these Indigenous populations through self-identification as Indigenous (group consciousness) and is recognized and accepted by the group as one of its members (Martínez Cobo, 1987). This definition preserves for these Peoples the sovereign right and power to decide who belongs to them, without external interference. The United Nations Permanent Forum on Indigenous Issues (UNPFII) applies the criteria of self-identification, historical continuity, a strong link to territories, and distinct social, language, and worldviews (UN Permanent Forum, 2025).

Indigenous Peoples from every region share commonalities, including forming the non-dominant sector of society and remaining determined to maintain their culture and connection with their lands and territories, despite having endured invasion and colonization. While some regions’ experiences differ, these commonalities remain.

The UNDRIP may not provide a definition of what it is to be Indigenous, but reliance can be placed on the preamble and key articles within the UNDRIP, together with the working definition above to provide an understanding of what it is to be Indigenous. Through a legal lens, to be Indigenous confers rights and obligations: rights to traditional resources and obligations on states to negotiate with Indigenous Peoples for

access to these resources. Deferring to, and consistent with, the key right within the UNDRIP of self-determination, the notion of self-identification and recognition by the community as Indigenous, as included as part of the working definition above, clearly aligns with the pivotal right of self-determination.

The Indigenous and Tribal Convention, 1989 (No. 169) (ILO, 1989, Art. 1a, p. 7) that revised the earlier Indigenous and Tribal populations convention, 1957 (No. 107) applies to Tribal Peoples as well:

Whose social, cultural and economic conditions distinguish them from other sections of the national community, and whose status is regulated wholly or partially by their own life systems or traditions or by special laws or regulations.

and to Peoples regarded as Indigenous on account of their descent from populations that inhabit the country at the time of conquest/colonization or the establishment of present state boundaries (ILO, 1989). Consistent with these International instruments, this report focuses on Indigenous Peoples as defined by the key UN texts referenced above. Importantly, among the criteria mentioned above, food systems are an integral part of Indigenous Peoples' customs, practices, languages, and worldviews and support the right of Indigenous Peoples to their land, territories and resources

The extent to which international instruments on Indigenous Peoples' rights have been reflected in national legislation varies greatly from country to country, and many Indigenous Peoples are not afforded legal recognition by their states. However, the relevance of this report extends beyond formal legal recognition as its findings and recommendations are meant to inform policies, practices and food system transformations that can improve the situation of Indigenous Peoples.

### 1.5 Defining Indigenous Peoples' food systems

Indigenous Peoples' food systems (IPFS) are diverse and continuously changing in response to internal and external dynamics. IPFS are "systems" that have been derived from and premised on an Indigenous Peoples' worldview, comprising of nature, people, food, the economy, knowledge and related governance and institutional systems, as well as the multifaceted interlinkages among them.

This report adopts the following working definition, which builds on the analysis of existing definitions and approaches as well as on the lived experiences of authors. The proposed working definition of IPFS is by no means exclusive and is intended as a working definition to inform this report and to inspire adaptation according to Indigenous Peoples' contexts. It is primarily intended to serve as a baseline/reference point for practitioners, policy decision makers, and others to aspire for desirable functional food systems, which are neither pristine nor ideal. Guided by Indigenous Peoples' ways of knowing, cultural values, and relationality, and UNDRIP and other global legal frameworks and informed by a review of the literature, IPFS can be defined as follows:

*Indigenous Peoples' food systems (IPFS) are premised on an Indigenous Peoples' worldview. IPFS are "systems" representing the web of relationships between nature, people food and spirituality, that seeks balance. IPFS are guided by Indigenous Peoples' knowledge, cultural and spiritual values, and reciprocity. IPFS support people's livelihoods and well-being, and deliver culturally appropriate, healthy, and diverse diets, and generate socioeconomic, cultural, and environmental outcomes that support the resilience and sustainability of both people and food systems.*

In line with the above working definition, Indigenous food sovereignty here means the ability of Indigenous Peoples to control, manage, create and produce their own traditional foods, using their own practices, to enhance their health and wellbeing.

## 1.6 The importance of IPFS

There is increasing consensus on the importance of IPFS food systems, and the resilience, diversity, and stability of these systems (Sangha *et al.* 2026; Knorr *et al.* 2025; FAO and Alliance of Bioversity International and CIAT 2023; Vijayan *et al.* 2022; FAO, 2021; HLPE 2017, 2020; Kuhnlein and Receveur 1996). These systems recognize an Indigenous worldview and are embedded in nature, draw on intimate human connections to local ecosystems, and are centred on reciprocity, centuries-old practices, and plural knowledge systems.

Common features of IPFS are that food is not considered a commodity, and it is often considered almost sacred as it represents a holistic and reciprocal relationship with territories and natural resources. At the societal level, this means diverse economies, governance systems, capabilities (skills and knowledge), languages, cosmologies, and forms of food expression offer a multifaceted socioeconomic system. At the ecological level, such a system entails the diversity of species and ecosystems, thereby bringing about diverse ecological functions and provision of their services at landscape scales, making these systems sustainable and resilient over the long term (FAO 2021a; Rights and Resources Initiative, 2023).

A premise that guides this report is that self-determination, sovereignty and the well-being of Indigenous Peoples are fundamental to IPFS. This report shows that IPFS are not only important for Indigenous Peoples but also provide vital lessons for wider food system transformation: IPFS principles of diversity, reciprocity, relationality and working with natural cycles offer alternatives to conventional food systems and fisheries (HLPE, 2017; FAO, 2021a).

These lessons are not prescriptive blueprints but rather sources of inspiration to rethink food systems in ways that are ecologically sustainable and socially just (see Chapter 6). This is particularly relevant in the context of polycrises such as climate change, economic and sociopolitical conflicts which are disproportionately affecting vulnerable, marginal Indigenous Peoples at local, regional, and global scales (UNEP, 2025).

Globally, colonization has widely disrupted, destroyed, marginalized and displaced Indigenous Peoples' ways of life and consequently their food systems, with deep, multifaceted ongoing repercussions. With the ongoing impacts of colonization, including institutional structures and policy settings, and over the last few decades with neoliberalization and the strengthening of corporate sectors, the focus of food systems has largely been on tangible economic outcomes (TEEB for Agriculture and Food, 2018). For example, food is largely treated and measured as a commodity, yet it is one of the essential life elements for humans, along with water and air to which Indigenous Peoples assign special values (Vivero-Pol *et al.*, 2018). Diversity of food and its nutritional value, people's values and ways of producing food while working in harmony with nature – key features of IPFS – without an extractive mindset are rarely accounted for (TEEB for Agriculture and Food, 2018).

This report presents the current state of the IPFS and offers policy recommendations for their restoration and support. It also identifies current key states of IPFS as either intact, fragmented, or disturbed based on their functionality, while recognizing that most of these systems are not intact. The report also recognizes that by nature, IPFS are dynamic and continue to evolve over time (Chapter 2).

However, the report uses the desirable functional/intact IPFS as a reference point to restore fragmented and disturbed systems. The revival and strengthening of IPFS is an essential and urgent step, as once these systems, related values and knowledge are lost, there is no going back for humanity to learn about the diversity of food, the agroecological principles, practices and values with which food is cultivated/gathered/hunted, including the various production and preparation processes that are founded on centuries-old values embracing cultural and spiritual rituals, ceremonies and traditions.

The resilience of IPFS depends on multiple interconnected domains that are examined throughout this report: climate change adaptation, seed conservation, water governance, land management and ocean stewardship (see Chapters 2, 4, and 6). These domains are not separate from food systems but integral to them, reflecting the holistic nature of Indigenous Peoples' relationships with their territories. Indigenous Peoples' food systems are guided by the principle that food is not a commodity; food is to be treated with respect and gratitude; and food systems are holistic and part of nature.

### 1.7 Links between Indigenous Peoples' food systems and food security and nutrition

Following the most widely accepted definition, food security is when all people, at all times, always have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life (FAO, 2001). Most of these aspects are covered under four dimensions: access, availability, stability and utilization. In 2020, the HLPE-FSN broadened the understanding of food security with the dimensions of agency and sustainability, thus considering six dimensions in total, i.e. availability, access, utilization, stability, agency and sustainability (HLPE 2020; Clapp *et al.* 2022), an understanding which is now increasingly integrated in policy and analysis (Clapp *et al.* 2025).

Analysing each of these dimensions from an Indigenous Peoples' perspective, this report underscores that achieving food security in culturally appropriate ways depends on a fundamental aspect of IPFS, i.e. "relationality". Relationality is a key characteristic of IPFS and includes people's values, identity, spirituality and rights linked to IPFS and related Indigenous Peoples' territories. Relationality denotes the reciprocal obligations between people, food, and other living beings and territory where food is understood as a blessing and responsibility rather than a resource or commodity. Thus, it is the relational structure that distinguishes IPFS from other food systems. Relationality is essential and foundational to understanding how Indigenous Peoples relate to their food systems and how IPFS are organized (see Figure 1.1; details in Chapters 2 and 3).

All six dimensions of food security can be achieved if people are enabled to produce and source (grow/harvest/hunt), access, and utilize the type of food that meets their needs in the short and long term, while maintaining the sustainability of cultural, social, and natural systems and related knowledges and skills and governance arrangements that enable people to produce, process and consume healthy and safe food. All those dimensions are interconnected and do not operate in isolation to contribute to food sufficiency, sovereignty and security. For example, the agency of Indigenous Peoples, understood not only as individual choice but as collective agency exercised by families, communities and Nations, determines what type of food they want (agency and access), when to grow/hunt/harvest (availability), how to prepare, preserve and utilize it over time (utilization, stability and sustainability). Political, social, economic and institutional systems, from local to global, further shape agency in many ways. Yet agency is not just about choosing what to eat; it is about the collective

power of Indigenous Peoples to make decisions over their food systems, for example, to govern their territories and resources, and to influence the rules that affect them.

A positive change in one dimension of food security often generates cascading benefits across others. For instance, strengthening customary governance and territorial access enables Indigenous Peoples to maintain culturally appropriate diets, supports livelihood stability, and reinforces the sustainable management of IPFS. This suggests that targeted investment in IPFS can yield multiple long-term benefits.

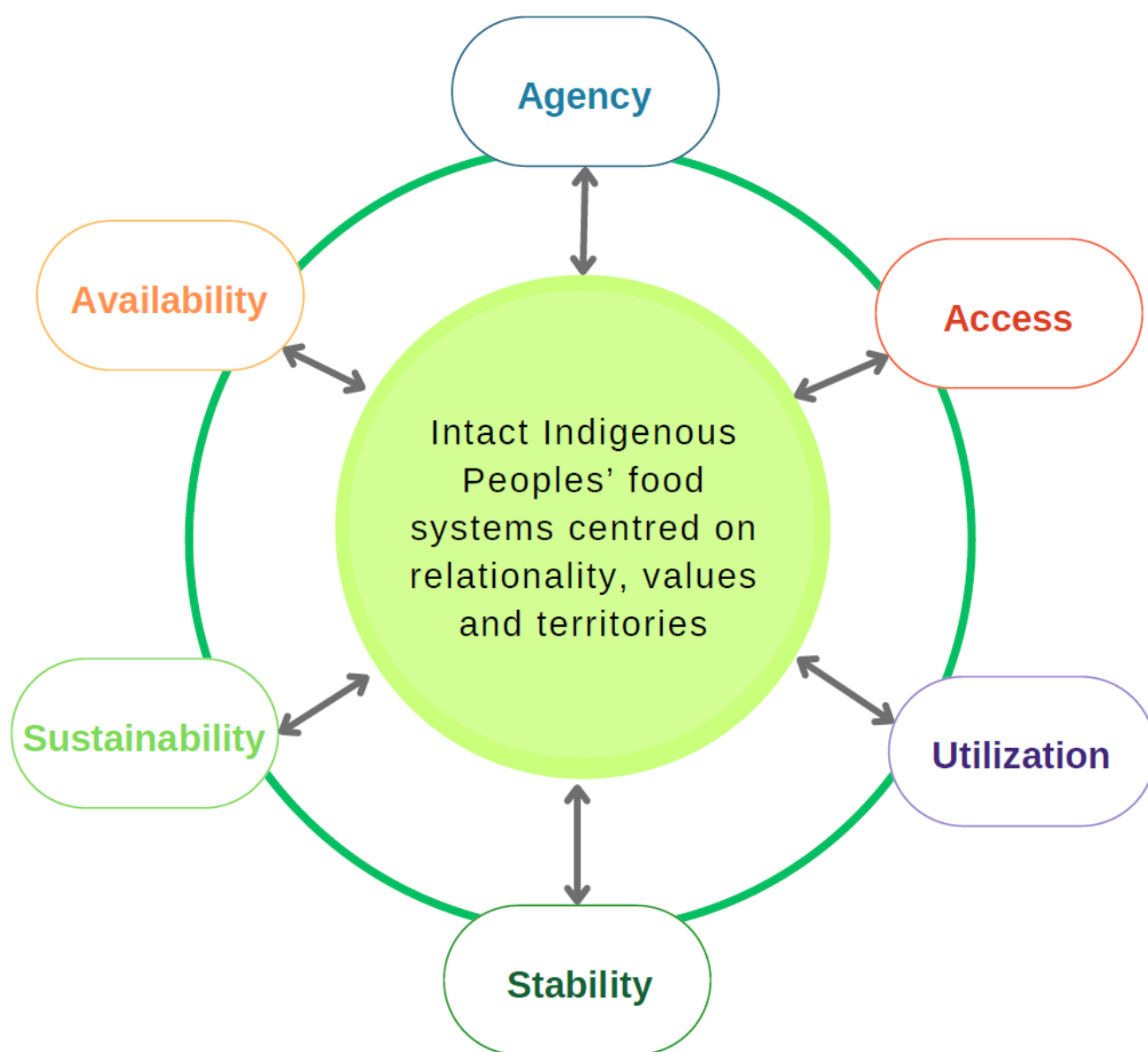


Figure 1. 1. Intact, functioning IPFS (circle in the middle) contributes to each of the six dimensions of food security and nutrition, with “relationality” forming the foundation of IPFS. To support the functioning of IPFS and Indigenous Peoples’ relationships to their territories requires rights-based approaches. Each dimension of food security interacts with other dimensions as well as with people’s relationships to their territories.

Source: Authors' own elaboration.

People's agency and access to their territories that deliver food are fundamental for the success of IPFS (Fig. 1.1), enabling people to maintain and nurture their relationships with their lands and waters, following their cultural governance. Agency and access are also important for practicing and passing on their value and knowledge systems related to growing, harvesting, hunting, processing, and preparing of food. With people practicing their cultural food systems, the utilization of native foods can deliver better health outcomes (Lopes *et al.*, 2023; Dissanayake *et al.*, 2025). An important point to note is that integral IPFS also deliver stability and sustainability not just of food systems but also of associated social, cultural and natural systems.

By highlighting how intact IPFS can help address all six dimensions of food security and nutrition, this report aims to provide a policy-oriented reframing to achieve food security and nutrition at local, regional and global scales. Additionally, functioning IPFS are relevant for the achievement of various Sustainable Development Goals (SDGs): SDG 1 No Poverty, SDG 2 Zero Hunger, SDG 3 Good Health and Well-being as well as the ecological goals SDG 12 (Responsible Consumption and Production) SDGs 13 Climate Action, SDG 14 Life below Water, SDG 15 Life on Land, and SDG 17 Partnerships for the Goals that impact the wider public (Chapters 2, 3, 4 and 6; Gautam *et al.*, 2022; FAO and the Alliance Bioversity International and CIAT 2023; Kuhnlein and Chotiboriboon, 2022; FAO 2021a). This report highlights how IPFS can contribute to food security and nutrition as well as alleviating hunger (SDG 2) by suggesting policy action-oriented approaches.

Functional IPFS can provide nutritious and healthy food to people (Kuhnlein *et al.*, 2009, 2013). The landmark FAO report by Kuhnlein *et al.* (2009) provides a comprehensive source of information on the diversity and nutritional value of Indigenous Peoples' foods, using 12 case studies from nine countries worldwide and documenting food species and the percentages of energy and nutrients in local foods. The report particularly underscores the fact that IPFS provide many nutritional benefits and are an important foundation of food security for Indigenous Peoples in their locales. For example, the Baffin Inuit (Nunavut) people in Canada use 79 different plant and animal species for food, which provide a rich source of antioxidants, omega-3 fatty acids and micronutrients; the Awajun people in Peru use 223 species of food, many with high micronutrient content; the Ainu people in Japan use 20 varieties of food containing high amounts of potassium, phosphorus and iron; and tribal people in Andhra Pradesh, India use 137 varieties of food, rich in micronutrients, vitamin C, carotenes, and other nutrients. In Australia, Indigenous Peoples' foods are reported to offer high nutrient density (fibre, protein, micronutrients) while being low in sugar and are reported to reduce diabetes and other health issues (Thornburn *et al.*, 1987; Brand Miller *et al.*, 1998). To date, there are few case studies but no global or regional detailed studies on the diversity and nutritional values of food produced through IPFS. Indigenous Peoples' foods are largely absent from national food composition tables, with the implication that these foods are not taken into account in dietary assessments, national dietary guidelines, food-based nutrition programmes or public procurement, thus perpetuating cultural and policy marginalization. Nutritionally rich Indigenous Peoples' food becomes statistically invisible and systematically excluded from policies meant to address malnutrition.

## 1.8 Envisioning Indigenous Peoples' food systems into the future

There is now increasing agreement on the importance of producing high quality, nutritious, and culturally and climatically appropriate foods to enhance people's health and well-being. Indigenous Peoples' food systems offers core principles: Food is more than a commodity; food is to be treated with respect and gratitude (and it is

often considered sacred), and food systems need to be understood as holistic. Indigenous Peoples' food systems should be celebrated for their diversity, cultural expressions, ecological balance, biodiversity, and resilience.

Legislation, such as the Aotearoa (New Zealand) Hauraki Gulf/Tikapa Moana Marine Protection Act offers a pathway towards reconciling environmental conservation with Indigenous food sovereignty that could serve as a model for the protection of Indigenous Peoples' food systems across Small Island Developing States and low-lying coastal regions, where rising seas and resource depletion threaten food and nutrition security, biodiversity and livelihoods (Burlingame, Toki and Iese, 2026). Although countries may not have specific legislation covering IPFS, often the recognition of specific IPFS is integrated into broader constitutional and human rights frameworks that focus on territorial rights, food sovereignty, rights of self-determination and regulatory governance rights to ensure the continuity of specific IPFS.

Diverse food systems reflect diversified economies which can offer resilience to climatic and economic disasters affecting food security and nutrition (HLPE, 2025). Diverse food systems also require a varied range of skills and knowledge sets which can lead to a myriad of innovative opportunities and economies.

An aspirational policy goal is to support a world in which diverse IPFS are recognized, supported, promoted, and strengthened. In this context, diverse, resilient, and healthy food economies can emerge, contributing to sustainable livelihoods and improved food security and nutrition outcomes. This report aims to inform policy dialogue in this direction. Realizing this vision, however, requires concrete governance pathways and implementation strategies. These are developed in Chapter 7, which outlines policy recommendations and institutional mechanisms to support the preservation, strengthening, and promotion of IPFS.

## Chapter 2. Indigenous Peoples' food systems context, drivers of change, consequences and opportunities

### Key messages:

- Indigenous Peoples' food systems are territorial systems of life in which food, governance, identity, spirituality and ecological stewardship are inseparable, embedded in land, water, forests, rangelands, wetlands, coastlines and sacred sites governed through customary institutions. They are best understood as biocultural systems anchored in ancestral territories, where territory is the material, social, political, and spiritual basis through which food practices are organized and reproduced.
- The primary cause of the disruption to Indigenous Peoples' food systems stems from the way global food systems are structured and the political and economic marginalization of Indigenous Peoples, which trace back to their separation from their territories imposed by colonial powers.
- Presently, these food systems are progressively influenced by a complex interaction of socio, economic, sociocultural, behavioural, climatic, political, and environmental factors, with negative food security, nutrition and health outcomes. These include diminished access to traditional foods, greater dependence on imported and ultra-processed foods, loss of territories, institutions, knowledge and practices, and increased health risks.
- The weakening of IPFS also affects planetary health by undermining biodiversity, ecosystem stewardship, mobility, customary governance and the ecological relationships that sustain food systems across forests, rangelands, coasts, oceans, wetlands and other territories.
- Indigenous Peoples have demonstrated resilience and capacity to respond and adapt through community connectedness, intergenerational knowledge, nature-based practices and culturally grounded climate adaptation pathways.
- Strengthening IPFS requires protecting territorial integrity, Indigenous Peoples' governance and self-determination – in alignment with UNDRIP – and promoting climate and food-system policies which are led by Indigenous Peoples.

### 2.1 Introduction

This chapter aims to describe the state, diversity, drivers of disruption and uniqueness of IPFS and Indigenous Peoples' knowledge systems together with the consequences of disruption and how IPFS respond and adapt to change.

### 2.2 Description of Indigenous Peoples' food systems

Indigenous Peoples' food systems are not simply methods of producing food. They are territorial systems of life in which food, governance, identity, spirituality, and ecological stewardship are inseparable. In Indigenous Peoples' contexts, food systems are embedded in territory-land, air, water, sky, including forests, rangelands, wetlands, coastlines, oceans and sacred sites which are governed through customary institutions that allow access, use, reciprocity, and collective responsibility. They are best understood as biocultural systems anchored

in ancestral territories. The following characteristics represent recurrent structural features expressed in diverse ways across territories, histories, and contemporary conditions.

- **Territorial integrity** refers to the secure relationship between Indigenous Peoples and the lands, waters, forests, coasts, rivers, grazing routes and ecological spaces that sustain their food systems. In IPFS, territory is often the material, social, political and spiritual basis through which food practices are organized and reproduced. Meaningful food access includes the real capacity to inhabit, use, protect and maintain links with food-producing environments, even under conditions of mobility, displacement or partial dispossession.
- **Biocultural food provisioning** refers to the diverse ways Indigenous Peoples obtain food through ecological knowledge, biodiversity management and culturally meaningful practices, including cultivation, agroforestry, gathering, hunting, fishing, pastoralism, seed stewardship and seasonal mobility. Biological and cultural diversity are mutually reinforcing, as food species, landscapes and diets are maintained through institutions, rituals, culinary preferences and collective labour.
- **Reciprocity-based food exchange** refers to the social relationships through which food is shared, exchanged and redistributed through kinship, mutual aid, collective labour, ceremonies and obligations of care. Many IPFS rely on networks of giving and receiving that strengthen solidarity, belonging and resilience during periods of food scarcity or crisis.
- **Knowledge-grounded intergenerational transmission** refers to the processes through which food-related knowledge, skills, values and practices are learned, renewed and transmitted across generations. This includes knowledge of seasons, soils, tides, animal behaviour, seed selection, food processing, preservation, storage, cooking practices, medicinal foods and respectful relations with ecosystems. Such practices and knowledge systems are dynamic, place based and continuously adapted to a changing environment.
- **Community governance and self-determination** refers to the authority of Indigenous Peoples to make decisions about their food systems according to their own institutions, norms and priorities. This includes decisions over territories, harvesting rules, production systems, benefit sharing and responses to external pressures. Self-determination refers to the right and practical capacity to shape food futures rather than depending entirely on markets, state programmes or humanitarian systems designed by others.
- **Moral-ecological stewardship** refers to the ethical norms and practical arrangements through which Indigenous Peoples care for ecosystems, regulate extraction and maintain the regenerative capacity of food-producing environments over time. This may include seasonal closures, rotational use, fallow cycles, selective harvesting, habitat care and responsibilities towards future generations.
- **Relational values grounded in cosmology** refers to worldviews in which lands, waters, plants, animals, ancestors and spiritual beings are understood as living relations. These values often shape practices of respect, gratitude, reciprocity, ceremonial obligations and care towards nature reciprocity, human-environment balance and co-existing worlds, helping guide behaviour, cultural identity, well-being and long-term ecological balance.

The seven characteristics presented above describe recurrent features of IPFS, acknowledging that these systems take diverse forms across territories, ecological contexts, and historical conditions.

### 2.3 Drivers shaping and disrupting Indigenous Peoples' food systems

Drivers impacting and disrupting IPFS can be biophysical, political, economic, technological, demographic, environmental or cultural. Main drivers include climate change, urbanization, global trade policies, technological innovation, population growth, market demand, and shifting consumer preferences, as well as power asymmetries in the global food system (FAO, 2023). Colonization has driven changes in IPFS by disconnecting Indigenous Peoples from ownership of and access to their territories. Direct, cascading, and compound impacts of drivers contribute to socioeconomic, sociocultural, and behavioural changes disrupting IPFS. Drivers may operate directly or through cascading and compound pathways, producing changes in livelihoods, mobility, sociocultural practices and behaviours that reshape the characteristics and functionality of IPFS.

#### **Systemic barriers: structural racism and discrimination drivers**

Colonization, racism and unequal power relations constitute structural drivers that shape the conditions under which Indigenous Peoples' food systems operate. Colonization and land dispossession have disconnected Indigenous Peoples from ownership of and access to territories that are important for their food systems, actively contributing to the break in intergenerational knowledge transmission through colonial institutions such as residential schools and the organized religion of the colonizer (Haynes *et al.*, 2024; Diko, 2025), while ethnocentric and Eurocentric policies have privileged conventional knowledge and development models over Indigenous knowledge and governance. These processes can also limit access to funding and policy support for Indigenous Peoples' food sovereignty initiatives (FAO, 2021; Food Rights Initiative, 2021; Rotz *et al.*, 2023).

Through territorial dispossession, exclusion from decision-making, erosion of Indigenous governance and marginalization of Indigenous knowledge, these drivers weaken territorial relations, governance, knowledge transmission and access to traditional food resources. They can also increase reliance on purchased foods and external food systems.

Racism and discrimination are strongly linked to the limited (and sometimes non-existent) consideration of IPFS. Policies have been shaped by ethnocentric and Eurocentric views, the idea that western knowledge is superior and Indigenous knowledge is somehow less valid. In this way Indigenous governance has been undermined, and outside models of development have been pushed onto communities without their consent. Racial inequalities are a root cause of food insecurity; Crawford O'Brien and Wogahn (2023) and d'Angelo and Zoubek (2021) demonstrate that the issue is not just a question of environmental hazards or justice but also about who makes decisions about the food systems, and who is excluded from decision-making. The Food Rights Initiative (2021) points out that racism and colonial structures deny Indigenous Peoples and rural women their right to food. In Canada, Rotz *et al.* (2023) found that Indigenous applicants are effectively excluded from funding for their own food projects because government programmes impose definitions of success incompatible with Indigenous Peoples' food sovereignty. Ek *et al.* (2025) examine racism through a public health perspective, synthesizing evidence that recurrent experiences of racial discrimination among Indigenous populations are associated with higher allostatic load, elevated inflammatory biomarkers and poorer health outcomes, thereby showing how structural racism becomes biologically embodied and reinforces food insecurity and health disparities. In Canada and the United States community-based partnerships and collaboration that combine transmission of knowledge, cultural connectedness through cultivation practices, and preparation and consumption of traditional foods are common elements of successful Indigenous food sovereignty initiatives (Gutierrez *et al.*, 2023).

## **Territorial, environmental, and climate-related drivers**

Climate change, environmental degradation, extractive industries and land-use pressures are major drivers affecting the availability, accessibility and sustainability of Indigenous Peoples' food resources. Indigenous Peoples' close relationships with their territories provide food, medicine and livelihoods, but extractive development and conflict have displaced many communities from their ancestral lands, increasing their vulnerability to climate change impacts (Roy *et al.*, 2024; Kuhnlein and Chotiboriboon, 2022; Lansbury *et al.*, 2025).

Climate impacts vary according to the diversity of food systems and geographic location (Brubacher *et al.*, 2024; FAO and Alliance of Biodiversity International and CIAT, 2021; Roy *et al.*, 2024; Amato-Ali *et al.*, 2025; Cappa *et al.*, 2024). Climate change and environmental pressures alter food availability, species composition, seasonal accessibility, mobility, reducing the productivity of hunting, fishing, pastoralism, and farming. In Arctic and sub-Arctic regions, for example, changes in temperature, snow and ice conditions affect reindeer access to lichen and alter fish populations, while environmental degradation and infrastructure development further restrict access to traditional hunting and grazing territories (Kukkurainen and Sonneveld, 2025; Spring *et al.*, 2025; Prieto *et al.*, 2026; Marquardt *et al.*, 2024; Harkoma and Forbes, 2020; Turunen *et al.*, 2016; Molinos *et al.*, 2024). For pastoralists, drought reduces livestock numbers, milk production and food availability, while on small Pacific islands, sea-level rise, droughts and tropical cyclones affect traditional crops and increase food loss (Mekuyie and Mulu, 2021; Msimanga and Mukwada, 2022; Matsa, 2021; Tui and Fakhrudin, 2022; Iese *et al.*, 2021, 2025).

These drivers weaken provisioning practices and territorial relationships and increase reliance on purchased and ultra-processed foods. Climate-related relocation further disrupts access to traditional food sources and shifts food provisioning towards markets (Kuhnlein and Chotiboriboon, 2022). The relocation of Vunidogoloa Village in Fiji, for example, provided housing security but disrupted access to traditional food sources and increased exposure to market-based foods (Link *et al.*, 2025; McMichael *et al.*, 2025; McMichael and Powell, 2021).

## **Socioeconomic and demographic drivers**

Market integration, monetization, wage labour, urbanization, migration, population growth and infrastructure development have reshaped Indigenous Peoples' livelihoods and food provisioning. These processes are closely interconnected: Changes in economic opportunities and labour arrangements can encourage mobility and urbanization, while population growth, improved infrastructure and increased market access can accelerate the transition from subsistence-based economies towards cash-based systems. Colonization, land dispossession, extractive industries and conservation policies have contributed to these transitions, reducing reliance on hunting, fishing, pastoralism and low-input production while increasing dependence on purchased foods (FAO, 2021c). For example, in the Solomon Islands, missionary activity contributed to the transition from a self-sufficient system towards a monetized economy, while improved road infrastructure increased the need for cash income among the Baka in Cameroon (FAO and University of Wollongong, 2023; FAO, Alliance of Biodiversity International and CIAT, 2021). In the Brazilian Amazon, for example, Indigenous Peoples' territories and livelihoods are also increasingly affected by in-and out-migration, urbanization, extractive industries, commercial agricultural expansion and changing preferences among younger generations (Infoamazonia, 2021).

Urbanization and migration can alter access to territories, labour, food-producing environments and community-based provisioning arrangements, while population growth and changing family structures may reduce opportunities for communal food preparation, sharing and collective labour. Mobility can also be constrained by

property rights and commercial uses of land within Indigenous Peoples' territories, leading to shifts in food production and diets (FAO, 2021c).

These processes affect territorial relations, provisioning practices, food availability, resource-sharing systems, and food autonomy. In remote communities, limited infrastructure for transport, storage, and local markets can increase food prices and reduce access to affordable and nutritious foods. In the Northern Territory in 2023, the average cost of a healthy food basket in remote Aboriginal and Torres Strait Islander community stores was 40 percent higher than in district-centre supermarkets, and similarly. In Pacific Small Island States remoteness increased food costs through shipping and transportation costs (van Burgel et al., 2026; Brewer et al., 2023). Over time, these processes may produce hybrid IPFS, where Indigenous provisioning continues alongside purchased foods and external markets.

### **Interacting, cascading and compound drivers**

These drivers rarely act in isolation; on the contrary, they often interact and produce cascading and compound effects on IPFS. Several characteristics can be affected simultaneously, such as territorial relations, provisioning practices, governance, knowledge transmission, and food-sharing systems. Final outcomes depend on the intensity and combination of drivers and on Indigenous Peoples' capacities to adapt, maintain or recover their food systems.

Polycrises such as climate change, biodiversity loss and pollution further increase the urgency of transformative change towards food systems that are more equitable and ecologically sustainable (UNEP, 2021, 2026; Ahmed, 2022). At the same time, the increasing recognition of IPFS in international fora such as the Conference of the Parties of Rio Conventions (COP), the International Union for Conservation of Nature (IUCN) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) highlights their role in sustaining biodiversity while producing food. Evidence gaps remain regarding how disasters and slow-onset climate impacts shift IPFS and diets before, during and after shocks, as well as the diversity and effectiveness of Indigenous Peoples' coping and adaptation strategies (Kooloth and Rupe, 2026; FAO, Alliance of Bioversity International, and CIAT, 2021).

### **Pathways of impacts**

The drivers presented above affect IPFS through pathways of impacts, presented in this report as the processes through which broader structural, environmental, economic, and demographic pressures translate into changes in IPFS characteristics.

#### ***Political insecurity, conflict and territorial violence***

Conflict, organized crime, territorial insecurity and land grabbing can directly disrupt Indigenous Peoples' food systems. In the Amazon, criminal networks involved in illegal logging, mining, and coca production have contributed to river contamination, destruction of food sources, and forced displacement. Similar processes have affected Indigenous Peoples' territories in Peru, Mexico and West Papua, where illegal mining, agricultural expansion, land grabbing and organized crime have undermined territorial security and displaced Indigenous Peoples (Amazon Watch, 2025; Hoetmer, 2025; Merino, 2020; Pérez, 2025; Urrieta and Landeros, 2024; Velásquez Nimatuj, 2023; Navarro López, 2026; Csevar and Rugarli, 2025).

Territorial violence, environmental contamination, land grabbing and forced displacement restrict access to food-producing territories, disrupt mobility and undermine Indigenous governance and knowledge of place. They can destroy or reduce traditional food sources and interrupt social relationships through which food is produced,

exchanged, and shared. These processes may rapidly shift an IPFS from a territorially rooted or pressured condition towards fragmentation, while forced displacement and the loss of local provisioning capacities can increase external dependence.

### ***Sociocultural transitions and dietary change***

Socio, cultural and behavioural changes are understood primarily as pathways through which broader drivers reshape IPFS. Language loss, changing family structures and shifting preferences among younger generations can weaken the transmission of ecological and food knowledge, food, related identities, ceremonies and seasonal food practices (FAO, 2021; FAO, Alliance of Bioversity International, and CIAT, 2021). The erosion of knowledge transmission, changes in food preparation and sharing, reduced physical activity associated with hunting, gathering and farming, and increasing consumption of processed and convenience foods can weaken the cultural and knowledge foundations of IPFS. The Baka increasingly depend on cultivated crops and anticipate reduced engagement of younger generations in forest foraging, while the Kel Tamasheq in Mali obtain approximately 35 percent of their food from markets, indicating engagement with external food systems (FAO, 2021c). Shifting preferences, time constraints associated with wage labour and schooling can further increase reliance on purchased food (Guell *et al.*, 2021; FAO, 2023). Market engagement can play a positive role for knowledge transmission, food security and incentives.

These changes and transitions can occur within otherwise functioning IPFS and therefore do not necessarily imply fragmentation, because they may contribute to hybridization and reconfiguration when Indigenous practices remain operative alongside new food practices. When knowledge transmission, food practices, resource-sharing systems and territorial relationships become substantially weakened, they can contribute to increasing external dependence of IPFS (Maudrie *et al.*, 2021). However, through activities that promote the transmission of cultural knowledge, such as gardening and harvesting, IPFS are resilient.

### **2.4 Diversity of Indigenous Peoples' food systems'-case studies**

The case studies presented in this section illustrate the ecological diversity, institutional complexity, and contemporary transformations of IPFS across regions. Although not exhaustive, they provide examples of how the seven characteristics identified in this report are expressed under different socioecological conditions and political realities. Together, they represent forest-based mosaic systems, aquatic systems, mobile herding and pastoral systems, and customary agroforestry systems, while also showing varying contemporary conditions ranging from territorial rootedness to hybrid reconfiguration and sustained pressure. These case studies demonstrate that IPFS are not static survivals of the past but living systems shaped by adaptation, knowledge transmission, collective governance and changing relations with markets, states and ecosystems (FAO, 2009; FAO, Alliance of Bioversity International, and CIAT, 2021).

The traditional agricultural system of the Rio Negro in northwestern Brazilian Amazonia is practiced by more than twenty Indigenous Peoples. It is organized through a forest-river mosaic in which swidden fields, fallows, forests and aquatic environments are integrated into a highly diversified food system centred on bitter cassava, fisheries, fruits and forest resources. Managed primarily by women (*donas de roça*), its resilience is grounded in matrilineal exchange networks of structured plant "collections", reciprocal labour (*ajuri*), and detailed ecological knowledge of soils, floods and successional cycles. This Indigenous system extends into urban and peri-urban margins where family networks and the continuous circulation of plant material connect forest-based and town communities. Recognition as Brazilian Cultural Heritage reflects the system's importance for food security, closely linked to cultural continuity, biodiversity conservation and Indigenous governance. At the same time,

infrastructure expansion, extractive pressures, and climatic variability create growing pressures on its long-term reproduction (IPHAN, 2019).

The Sámi reindeer herders' case illustrates Indigenous Peoples' food systems in Arctic and sub-Arctic environments, where food provisioning has historically depended on mobile reindeer herding, fishing, hunting and gathering across extensive seasonal territories (Oskal *et al.*, 2024). In this context, food systems are inseparable from mobility rights, snow and pasture knowledge, herd management practices and customary institutions regulating access and collective use (Eira *et al.*, 2025). The Sámi case highlights how climate change is directly affecting Indigenous Peoples' food systems through altered snow conditions, pasture instability and ecological shifts, while extractive industries, infrastructure development and regulatory regimes further constrain territorial continuity (Mathiesen, 2023). Despite these pressures, Sámi food systems continue to adapt through livelihood diversification, institutional advocacy and the maintenance of traditional knowledge through strong cultural relations with land and herds (Burgess *et al.*, 2018; FAO, Alliance of Bioversity International, and CIAT, 2021).

The Maasai case represents mobile herding and pastoral food systems in the drylands of East Africa. Historically based on livestock mobility, reciprocal exchange and communal rangeland governance, Maasai food systems have long depended on the strategic management of climatic variability through herd movement, species diversification and social cooperation. However, contemporary transformations including land fragmentation, privatization, sedentarization, conservation enclosures, and increased market dependence have significantly altered food access and nutritional outcomes. Research shows that while households increasingly combine pastoralism with cultivation, wage labour and purchased foods, pastoralism remains central to identity, social organization and resilience. The Maasai case therefore shows both the adaptability of IPFS and the risks generated when territorial mobility and commons governance are undermined (Kuhnlein *et al.*, 2009; Galvin *et al.*, 2015; Lind and Flintan, 2025).

The Sibetan Bali Aga case from eastern Indonesia illustrates a customary agroforestry food system in which livelihoods are organized around multilayered salak cultivation integrated with trees, water management, ritual institutions and community cooperation. Food provisioning and income generation are linked to a landscape that simultaneously supports biodiversity, soil conservation, and cultural practices. The system is shaped by Balinese cosmological principles, customary governance and farmers' organizations that regulate production and resource use. At the same time, tourism expansion, commercialization, dietary change and generational transitions are reconfiguring local food relations. This case demonstrates how some IPFS combine strong territorial rootedness and ecological stewardship with selective engagement in markets, producing hybrid but still culturally grounded food systems (Government of Indonesia, 2023).

The case example of the Pacific Islands proves that the consumption of aquatic foods is essential for the food and cultural security of Pacific Island communities. Annual average intake by coastal rural populations ranges from 30 to 118 kg per person in Melanesia, 62 to 115 kg in Micronesia, and 50 to 146 kg in Polynesia (FAO, 2014). In rural areas, aquatic foods provide 50 to 90 percent of dietary animal protein (Bell *et al.*, 2009). Although consumption in urban centres is lower than in rural areas, it generally remains above the global average of approximately 20 kg per person per year (Farmery *et al.*, 2020). Pacific Island countries are predominantly Indigenous, and the application of cultural governance alongside community-based, locally managed marine areas is vital for enhancing the health of aquatic resources (Aisea *et al.*, 2026; Vave *et al.*, 2024; Robertson *et al.*, 2020). Co-management and co-governance between Indigenous Peoples and governments are fundamental to achieving success (Robertson *et al.*, 2020; Burlingame *et al.*, 2026).

**Table: 2.3 Selected case studies according to the Indigenous Peoples' food systems' typology**

| Case study                             | System type                 | Current condition                 | Key features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|----------------------------------------|-----------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Rio Negro (Brazil)</b>              | Forest-based mosaic         | Territorial rooted / hybrid       | <ul style="list-style-type: none"> <li>• Practised by &gt; 20 Indigenous Peoples' groups</li> <li>• Forest-river mosaic integrating swidden fields, fallows, forests and aquatic environments</li> <li>• Centred on bitter cassava, fisheries, fruits and forest resources</li> <li>• Managed primarily by women (<i>donas de roça</i>)</li> <li>• Matrilineal exchange networks and reciprocal labour (<i>ajuri</i>)</li> <li>• Recognized as Brazilian Cultural Heritage</li> <li>• Pressures from infrastructure, extractive activities and climate variability<sup>i</sup></li> </ul> |
| <b>Sámi Reindeer Herders (Finland)</b> | Mobile herding and pastoral | Pressured / fragmented / hybrid   | <ul style="list-style-type: none"> <li>• Arctic/sub-Arctic system based on reindeer herding, fishing, hunting and gathering</li> <li>• Food systems inseparable from mobility rights and customary institutions</li> <li>• Climate change affecting snow conditions and pasture stability</li> <li>• Extractive industries and infrastructure constraining territorial continuity</li> <li>• Adapting through livelihood diversification and institutional advocacy<sup>ii</sup></li> </ul>                                                                                               |
| <b>Maasai (Kenya/Tanzania)</b>         | Mobile herding and pastoral | Reconfigured hybrid               | <ul style="list-style-type: none"> <li>• Pastoral system in East African drylands</li> <li>• Historically based on livestock mobility and communal rangeland governance</li> <li>• Strategic management of climatic variability through herd movement</li> <li>• Land fragmentation, privatization and conservation enclosures altering food access</li> <li>• Pastoralism remains central to identity and resilience<sup>iii</sup></li> </ul>                                                                                                                                            |
| <b>Sibetan Bali Aga (Indonesia)</b>    | Agrarian / reconfigured     | Hybrid                            | <ul style="list-style-type: none"> <li>• Customary agroforestry system</li> <li>• Multilayered salak cultivation integrated with trees and water management</li> <li>• Shaped by Balinese cosmological principles and customary governance</li> <li>• Tourism expansion and commercialization reconfiguring food relations</li> <li>• Combines territorial rootedness with selective market engagement<sup>iv</sup></li> </ul>                                                                                                                                                            |
| <b>Pacific Islands</b>                 | Water and fisheries-based   | Territorial rooted / reconfigured | <ul style="list-style-type: none"> <li>• Aquatic foods essential for food and cultural security</li> <li>• Annual intake: 30–118 kg/person (Melanesia), 62–115 kg (Micronesia), 50–146 kg (Polynesia)</li> <li>• Provides 50–90 percent of dietary animal protein in rural areas</li> <li>• Cultural governance and community-based marine management vital</li> <li>• Co-management fundamental to success<sup>v</sup></li> </ul>                                                                                                                                                        |

Sources: <sup>i</sup> IPHAN. 2019.; <sup>ii</sup> Oskal *et al.*, 2024; Eira *et al.*, 2025; Mathiesen, 2023; Burgess *et al.*, 2018; FAO, Alliance of Bioversity International, and CIAT, 2021; <sup>iii</sup> Kuhnlein *et al.*, 2009; Galvin *et al.*, 2015; Lind and Flintan, 2025; <sup>iv</sup> Government of Indonesia, 2023; <sup>v</sup> FAO, 2014; Bell *et al.*, 2009; Farmery *et al.*, 2020; Robertson *et al.*, 2020; Burlingame, Toki and Iese, 2026

These case studies show that IPFS are diverse socioecological systems whose current conditions depend on the extent to which territorial integrity, Indigenous Peoples' governance, knowledge transmission, reciprocal exchange and moral-ecological stewardship remain operative. Pressures such as climate change, land dispossession, market penetration, and state regulation affect IPFS differently according to ecological configuration and historical context. Comparative analysis of such cases therefore provides a grounded basis for the typology proposed in this chapter and for finding pathways to strengthen Indigenous Peoples' food security, resilience and self-determination

## 2.5 Consequences of disrupted Indigenous Peoples' food systems

Indigenous Peoples' food and knowledge systems have been, and continue to be, rapidly disrupted. For example, over 70 percent of Yucatec Maya farmers are now adopting other technologies in their food systems, using less

knowledge, and fewer resources and techniques from their traditional ancient ways of farming (Rosado-May *et al.*, 2025).

The disruption of IPFS can be traced back to different and interconnected drivers: disconnecting from traditional food systems via colonization (Malli *et al.*, 2023), climate change (Demi and Ahmed, 2025); and trends in urbanization and demographic shifts influencing lifestyles.

### Impacts on people's health

In the 2025 *Lancet* series devoted to ultraprocessed foods and human health, health is defined as the collective capacity of populations to maintain dietary patterns that promote well-being and prevent disease within food systems (Monteiro *et al.*, 2025; Baker *et al.*, 2025; Scrinis *et al.*, 2025). According to more than 100 prospective and mechanistic studies, the replacement of traditional foods with ultraprocessed foods may contribute to rising rates of diet-related diseases, including diabetes, obesity, cardiovascular diseases and non-communicable diseases. Such a shift affects traditional food systems, particularly those of indigenous peoples (FAO, 2021c), due to a decline in traditional food-related skills, such as fishing, seed saving and food preservation (see Box 2.2 for examples).

#### **Box 2.2 Food security and nutrition outcomes of disrupted Indigenous Peoples' food systems**

There are several documented examples of how disrupted IPFS negatively impact the food security and nutrition outcomes of Indigenous Peoples. For instance, the shift in diets of the Melanesians of the Solomon Islands has contributed to poor health outcomes such as high blood pressure, high blood glucose, and increasing rates of overweight and obesity. The Maya Ch'orti' people in Chiquimula, Guatemala are eating a less diversified diet because of a decrease of animal-sourced foods (bushmeat, molluscs and crustaceans, insects). Similarly, the Anwal and Bhotia people in Uttarakhand, India have reduced access to wild edibles imposed by national conservation laws (FAO, 2021c). Land fragmentation has reduced the Sámi reindeer herders' access to traditional grazing areas, negatively affecting the health and mobility of reindeer herds (Eira *et al.*, 2025). These changes may also affect herders' diets by reducing access to traditional reindeer foods. Together with regulatory structures that restrict access to foods such as blood and offal (Sara *et al.*, 2022), these pressures may alter traditional dietary patterns and affect Sámi food security and nutrition (Kukkurainen and Sonneveld, 2025). This ecological disruption also impacts herders' diets, as diminished herd productivity increases reliance on market foods, particularly processed meat, thereby altering traditional dietary patterns and potentially undermining nutritional health. The Greenland Inuit's experience of the transition to western diets is associated with nutrient deficiencies, reduced microbial diversity, and increased risk of chronic disease. Traditionally harvested and minimally processed Inuit foods contain diverse environmental microbes that may contribute to gut microbiome diversity and potential health benefits (Hauptmann, 2024; Hauptmann *et al.*, 2020).

### **Sustainability of Indigenous Peoples' food systems**

From the Amazon rainforest and the Arctic taiga of Sámi to the forests of Cameroon and the Himalayan highlands, a growing territorial insecurity is undermining the sustainability and resilience of IPFS (FAO, 2021c)). In the Baka food system, approximately 81 percent of food is sourced directly from the local territory, while only 19 percent comes from markets, demonstrating a strong reliance on surrounding ecosystems rather than external supply chains. Since the 1990s, rising urban demand and road access have shifted bushmeat hunting from subsistence to commercial exploitation. Traders supplied hunting tools, intensifying extraction and contributing to wildlife decline and the "empty forest" syndrome. Although the Baka argue that animals have moved deeper into the forest, market pressures have undermined sustainable resource use.

In contrast, the Khasi food system is more diversified and market integrated, with approximately 45 percent of food derived from livestock and cultivation, 10 percent from wild resources, and 45 percent from market purchases. This comparison highlights clear differences in ecological dependence and market integration between the two systems. Among the Khasi, the loss of dense forest since the 1980s has been accompanied by the disappearance of large wildlife species once commonly hunted, such as deer and Chinese pangolin. As a result, community members have reduced hunting and gathering activities, further increasing reliance on cultivated and market-based foods (FAO, 2021c).

## 2.6 Responding and adapting to changes

Indigenous Peoples' food systems embody multiple dimensions of resilience, extending beyond food provision to encompass livelihoods, cultural identity, health, and traditional medicine. Their strength lies in intergenerational knowledge transmission, adaptive practices, and close relationships with local ecosystems. Examples of solutions and responses by Indigenous Peoples to enhance and adapt their food and knowledge systems to changing drivers are context specific and necessitate the full participation, ownership, and leadership of Indigenous Peoples.

### **Building resilience**

The HLPE-FSN (2025) has stressed the importance of a food systems resilience which is both equitable and transformative to guide the transformation of food systems. Doran (2024) through the lens of cultural-ecological resilience, defines food system resilience as a dynamic and culturally grounded capacity to sustain ecological relationships and community autonomy through sovereign food practices. This is the ability of communities to maintain and regenerate their cultural identities, knowledge systems, and relationships with land through food practices, while adapting to environmental and sociopolitical change. According to Kuhnlein and Chotiboriboon (2022) many Indigenous Peoples' cultures understand health as encompassing four interconnected dimensions, physical, social, mental, and spiritual well-being. These dimensions are closely intertwined with cultural food system practices, in which biodiversity plays a foundational role in sustaining resilience. Indigenous Peoples' sustainable management of terrestrial and marine resources strengthens ecosystem resilience (Sanchez *et al.*, 2023). Their stewardship is grounded in longstanding traditional practices and responsibilities through which they have managed, conserved, and protected their environments. This approach is rooted in deep cultural, spiritual, and historical connections to the lands and waters they have inhabited across generations (Knorr and Augustin, 2025).

### **Improving livelihoods**

To improve the livelihoods of Indigenous Peoples and their food systems, a prerequisite is strengthening the economic, social, and ecological foundations that enable Indigenous Peoples, individually and collectively, to secure sustainable and dignified ways of living. In Indigenous contexts, this often includes supporting land rights, enhancing sustainable resource management, revitalizing traditional knowledge systems, and increasing access to markets, education, and healthcare while ensuring that development efforts reinforce, rather than undermine, cultural and ecological integrity.

For example, enabling Sámi reindeer herders to apply their own food knowledge in production systems could strengthen income generation and overall livelihoods. Policy makers should therefore support family-based livelihoods, such as reindeer pastoralism, by prioritizing Indigenous Peoples' knowledge and governance in food-

system decision-making. Such an approach would enhance long-term sustainability, reinforce cultural continuity, and promote self-determination (Oskal *et al.*, 2024).

### **Remaining connected**

*Community connectedness* is defined as people's subjective sense of belonging and relatedness to their local community, their emotional and social bonds to others that again influence eating behaviours, reinforce local food traditions, and support collective actions that promote sustainability (Lenzi *et al.*, 2025)

In Indigenous Peoples' food systems, knowledge and governance connectedness is visible through ecological, social and cultural links between land, water, biodiversity and seasonal cycles where food systems are naturally a part of the ecosystem. Knowledge connectedness involves multigenerational knowledge transmission, which is the core that connects practices, seasonal cycles and stewardship, while social, cultural and governance links involve rituals, reciprocity, solidarity, customary institutions, and access to territories and resources.

For example, the Maya Ch'orti's social connectedness is based on seasonal rituals and collective labour, while the Kel Tamaseq share grazing rights and intercommunity cooperation within their community. The Melanesians coastal and forest ecosystems are ecologically connected through fishing, gardening, and forest gardening, and the reindeer herding Sámi are reliant on seasonal cycles of reindeer herding, fishing, and wild foods. The Baka people's ecological connections are linked to forest biodiversity through hunting, gathering, and wild foods, while the Bhotia's and Anwal's to shifting cultivation and multispecies harvesting across Himalayan terrains.

### **Adapting to climate change**

Adaptation of agriculture and food systems to climate change does not happen in a vacuum, rather it exists in local contexts of Indigenous Peoples (Wilson *et al.*, 2019; Tolera and Senbeta, 2020; Nunn *et al.*, 2024). Therefore, including knowledge systems in adaptation planning, implementation and evaluation is critical for success (Tolera and Senbeta, 2020; Wilson *et al.*, 2019; Price *et al.*, 2022; Molinos *et al.*, 2024). These knowledge systems enable them to observe changes and cope and adapt to environmental changes and climate change.

Adaptation by Indigenous Peoples is diverse depending on their location and food systems, but it is mostly incremental in nature. Although Indigenous Peoples are some of the most vulnerable, they have a wealth of knowledge of their environment, seasons and cultural diversity in the ingenuity of food systems that are adaptive to climate change (Kuhnlein and Chotiboriboon, 2022; Lansbury *et al.*, 2025; Kukkurainen and Sonneveld, 2025). In Manipur, India, the Tangkhul Naga Indigenous seasonal calendars integrate weather observation, agriculture timing and socioeconomic timing into a single forecasting system that enables them to anticipate and plan around seasonal variability. Nonetheless, this Indigenous knowledge is disappearing rapidly due to cultural assimilation, loss of habitat, and observed seasonal changes. This case showcases the adaptive benefits of Indigenous Peoples' knowledge systems and the need to document them before they are lost irretrievably. Solutions should be sustainable, co-created with Indigenous Peoples and attuned to cultural, geographic, environmental and political contexts (Galappaththi *et al.*, 2021; Price *et al.*, 2022; Lamalice *et al.*, 2018; Ford *et al.*, 2015; Iese *et al.*, 2020).

## Chapter 3. Understanding the value of Indigenous Peoples' food systems

### Key messages:

- This chapter reframes the value of IPFS beyond production and market exchange, demonstrating that IPFS generates sociocultural well-being and ecological values that are central to people's food security and nutrition.
- The meaningful inclusion of the right of Free Prior and Informed Consent is required as it can be a bridge (or a shield) between IPFS and external markets or commercial interests to, for example, protect IP biodiversity and unique seed bank.
- Current valuation approaches and agrifood policies do not recognize the intangible contributions of IPFS, including Indigenous Peoples' knowledge, social cohesion, cultural and spiritual values, biodiversity stewardship, soil and water conservation, and ecosystem resilience.
- The chapter proposes a valuation framework that integrates production, socio-cultural, knowledge and wellbeing and ecological values, explicitly recognizing Indigenous Peoples' wellbeing, identity, cultural governance, territorial relations and policy contexts.
- A better understanding of the value of IPFS can inform policy instruments and investment mechanisms to support healthy diets, diversified food economies, biodiversity conservation, climate mitigation, reduced disaster risks and culturally grounded well-being initiative.

### 3.1 Introduction

This chapter discusses the value of IPFS, covering ecological, governance, relational, social, knowledge and production dimensions. It emphasizes the importance of non-market, intangible values, the “invisible economy” and proposes a framework and metrics to assess IPFS contributions to well-being, food security, nutrition, ecological health and societal well-being. Recognizing the importance of the right of free, prior and informed consent (FPIC) for Indigenous Peoples is pivotal when understanding the value of IPFS. Valuing IPFS is not merely an academic exercise; it is a policy issue with direct implications for funding allocations, institutional support, legal recognition, and the design of programmes that can either strengthen or undermine Indigenous Peoples' food systems.

Typically, the value of food systems is measured by production, mainly yield and input and output costs (FAO 2024a), and marketable, tangible measures reflected in the current market system. Such an approach neglects the underpinning aspect of food production systems: that they are fundamentally rooted in natural and social systems.

A complex web of ecological functions, coupled with social and human inputs in the form of knowledge, agency, cultural governance, labour, and demand for specific foods in their regional and climate settings, supports the performance and diversity of food systems. In addition, monoculture food systems in the Global North have caused negative externalities such as biodiversity loss, and land and ocean degradation (FAO, 2025; The Economics of Ecosystems and Biodiversity, Agrifood [TEEB-Agrifood], 2018; Thiagrajan and Devrajan, 2025). None of these losses is reflected in current market systems; hence, these are called non-market or intangible costs. In contrast, diverse, eco-friendly, functional IPFS deliver many social, cultural and ecological benefits,

such as preserving soil and biodiversity, and contributing to better health and well-being of people (Sangha *et al.*, 2026; Das *et al.*, 2023). Accounting for and understanding the role of natural and social systems in production systems is critical for sustaining food production into the future as well as for food security and better human health and nutrition outcomes.

FAO (2024) revealed that the global hidden costs of agrifood systems amount to \$11.6 trillion per annum (in PPP dollars, 2020), primarily due to hidden health, environmental and social costs which involve a range of drivers (Figure 3.1). This indicates the limits of the “business-as-usual” model (FAO, 2024; 2025; TEEB-Agrifood, 2018; IFPRI, 2020, 2024). There can be lessons from IPFS in the future transformation of food systems.

This chapter proposes an IP-focused framework for assessing the value of IPFS, building on concepts mentioned in chapters 1 and 2. The underlining principle is the relationality in Indigenous peoples’ connections with their food systems. In particular, the importance of cultural governance and relationships, people’s knowledge, and natural/ecological dimensions, are emphasised as critical to the production values of IPFS. Cultural and spiritual factors shape and sustain these systems, which further contribute to people’s socio, economic, physical and mental well-being.

Indigenous Peoples’ food systems are characterized by complex interactions among natural (ecological), social (governance and relationships), cultural (customary rituals/ceremonies), and knowledge systems as part of the woven food systems, forming the foundation of functional IPFS (FAO, 2021a). Yet policy and decision-makers often ignore the value of these intangible dimensions due to a lack of the proper yardsticks and tools to date. Therefore, governments fail to adequately support IPFS the way they support conventional food systems (Ley *et al.*, 2024).

All these interactions evolve over time to shape IPFS in culturally proper settings, which directly contribute to people’s well-being. Indigenous Peoples’ food systems treat food production (quantity) as just one part among other social, cultural, and knowledge dimensions (FAO, 2021a). The value of IPFS here encompasses both marketable (tangible) and non-marketable (intangible) contributions of food systems to people’s well-being and to the sustainability of natural systems (following Zhang *et al.*, 2018). For this report, the marketable contributions are related to production and non-marketable to governance and relationships (social and cultural values), knowledge (context-specific skills and knowledge of IPFS), and natural and ecological dimensions of food systems.

| Categories     | Hidden cost drivers         | Environmental impacts | Social impacts | Economic impacts | Health impacts | Identity and culture impacts |
|----------------|-----------------------------|-----------------------|----------------|------------------|----------------|------------------------------|
| Environmental  | Air pollution               |                       |                |                  |                |                              |
|                | Antibiotic resistance       |                       |                |                  |                |                              |
|                | Overuse of resources        |                       |                |                  |                |                              |
|                | Water pollution             |                       |                |                  |                |                              |
|                | Blue water scarcity         |                       |                |                  |                |                              |
|                | Loss of ecosystem services  |                       |                |                  |                |                              |
|                | Loss of genetic resources   |                       |                |                  |                |                              |
|                | Land dispossession          |                       |                |                  |                |                              |
|                | Pesticide use               |                       |                |                  |                |                              |
| Socio-economic | Displacement and migration  |                       |                |                  |                |                              |
|                | Loss of knowledge           |                       |                |                  |                |                              |
|                | Time poverty                |                       |                |                  |                |                              |
|                | Child and forced labour     |                       |                |                  |                |                              |
|                | Gender wage gap             |                       |                |                  |                |                              |
|                | Occupational hazards        |                       |                |                  |                |                              |
|                | Food losses and waste       |                       |                |                  |                |                              |
|                | Working poverty             |                       |                |                  |                |                              |
|                | Dependence on markets       |                       |                |                  |                |                              |
| Health         | Undernutrition              |                       |                |                  |                |                              |
|                | Overweight and obesity      |                       |                |                  |                |                              |
|                | Unbalanced/simplified diets |                       |                |                  |                |                              |
|                | Unsafe food                 |                       |                |                  |                |                              |

Figure 3.1 Hidden cost drivers and impacts

Governance and relational dimensions, including caring for resources and sharing of produce, are often intertwined with context-specific knowledge of the ecological systems. For example, the Aboriginal people of Arnhem Land in northern Australia (Bininj) hunt together for ceremonies and social gatherings, applying a particular technique called “the kangaroo drive”, in which elders guide hunters in planning and using fire as a hunting tool. The hunters drive kangaroos and other macropods, such as emus, in a particular direction for

simultaneous spear strikes. In preparation, hunters collectively sharpen their spears and perform ceremonies before hunting (Advancing Australia, n.d.).<http://advancingaustralia.com/our-innovators/dr-otto-campion-bulmaniya/> This collective exercise helps effectively and efficiently hunt animals, puts less pressure individual efforts, enables youth to learn hunting techniques, maintains ongoing ceremonies to show gratitude to nature, and maintains harvesting and ecological balance.

### 3.2 Market and non-market values of Indigenous Peoples' food systems

Economics is both about marketable and non-marketable values, and this section explores to what extent and how the value of IPFS can be assessed and measured. For many Indigenous Peoples, land, food and water are sacred and are not objects to be priced or traded. This report acknowledges that some dimensions of IPFS cannot be valued in economic terms, and attempts to do so should be applied cautiously as they should be culturally appropriate and suiting Indigenous worldviews (Wilson and Inkster 2018; Damoah *et al.*, 2024). This report also recognizes that not all dimensions of IPFS can be measured in economic (market) terms. For example, social and ecological relationships – based on reciprocity, spirituality and kinship with nature – cannot be priced and monetized. However, there are methodological techniques available in the ecological economics discipline to reflect the value and/importance of such dimensions towards supporting people's livelihoods and wellbeing. This recognition thus suggests care-taking in the methods used to value IPFS.

IPFS values considered in here include:

1. Production values: a tangible outcome that can be measured and reflected in the market to a limited extent.
2. Governance and relational values—part of broader social and cultural values: the IPFS deliver a range of intangible benefits to Indigenous Peoples, forming the basis for cultural governance, relationships with the territories including spiritual, and ritual ceremonies, organizations, and the sacredness of food.
3. Knowledge values: IPFS enhance human capability to learn, update, and practice their language and knowledge to cultivate/harvest and consume food in their own ways contributing to people's wellbeing
4. Ecological values: intact/functional IPFS contribute to protecting and preserving land and water systems and biodiversity, while sequestering carbon, mitigating climate change, delivering a range of ecosystem services and maintaining natural assets, collectively referred to here as natural or ecological values.

Any valuation framework must be clear about what it measures, what it does not, and why. Indigenous Peoples themselves should lead valuation processes, with their own criteria and priorities.

This section focuses on cultural governance and relational values while acknowledging a wide range of social and cultural benefits of IPFS. Current approaches measure the quantity of food produced, which represents only a small proportion of IPFS benefits. In contrast, the social, cultural, knowledge and ecological benefits of IPFS contribute significantly to people's well-being but remain underestimated as market approaches do not capture them (FAO, 2024a).

### 3.3 Marketable and non-marketable values of Indigenous Peoples' food systems

Marketable values are typically reported primarily for food crops, livestock, non-timber forest products (NTFP), medicinal products, value-added products, and employment while diverse ecological, social and-cultural benefits are mentioned in multiple studies (FAO and Alliance of Bioversity and CIAT, 2022).

Social cohesion and food sovereignty are recurrent in the literature on IPFS, while governance and empowerment dimensions are less frequently articulated, suggesting potential gaps in policy recognition rather

than the absence of value. The existing research highlights a strong imbalance between the richness of non-market values generated by IPFS and their limited representation in formal economic and policy frameworks (Cunningham, 2013, in Kuhnlein et al., 2013; FAO, 2021b).

The displacement of traditional foods from IPFS has measurable impacts on nutrition and health. Among Inuit adults in northern Canada, restricted access to caribou, a key traditional food, would increase anaemia prevalence by 6 percent, and up to 35 percent if caribou were substituted with other country foods. Further, daily caribou consumption was positively associated with higher haemoglobin levels (Kenny *et al.*, 2019). Beyond nutrition, the substitution of traditional foods with lower-quality market foods generates additional costs for health systems (Kenny *et al.*, 2018; Hu *et al.*, 2018). These findings underscore the need to consider both the nutritional value and the health system costs when assessing the true value of IPFS.

It should be noted that the examples presented in this report come from different places and represent diverse realities. In many cases they share common patterns, such as the role of social cohesion or the transmission of knowledge, but the experiences of Indigenous Peoples vary according to their location, the ecosystems they inhabit, their territorial governance, and their degree of market integration. Gender also plays a role: women are often the ones who process and preserve food, while men have more say in cultivating, herding and hunting of food. Likewise, benefits and burdens are not always distributed equitably. These differences matter, and they imply that valuation and policy must be adapted to each context, rather than based on one-size-fits-all approaches.

### 3.4 How to measure the value of Indigenous People's food systems

[The FAO Agroecology Knowledge Hub](#) proposes a framework for embracing cultural and ecological values; however, it misses production values which are equally important and can help compare IPFS with other production systems. Bockstaller *et al.* (1997) also propose a list of agroecological indicators, primarily focused on nutrient and pesticide inputs, along with soil organic matter, crop diversity, and ecological structures, but with little inclusion of social aspects.

According to the analysis of these and several other frameworks (Meuwissen *et al.*, 2019 on resilience, and so forth), the core values of IPFS that shape these systems are Indigenous Peoples' knowledge, well-being and identity, cultural and religious or spiritual values for food, the societal ways of working together, and sharing knowledge, all of which are practically absent from all existing key analysed frameworks. The only exception is the Economics of Ecosystems and Biodiversity (TEEB)-agrifood systems framework (Zhang *et al.*, 2018), which is broader and includes the four dimensions of: i) production capital: crop inputs and outputs; ii) human capital: labour and knowledge; iii) social capital: social networks, land tenure and cultural knowledge; and iv) natural capital: land and water resources and biodiversity. TEEB labels these four dimensions as forms of capital. This report proposes an alternative terminology based on Indigenous perspectives: production value, knowledge and well-being value, governance and relational value, and ecological value.

While FAO and many national ministries refer to agriculture as broadly including crop cultivation, animal production, forestry, fisheries and aquaculture IPFS refer to food as being "generated through a combination of techniques, such as fishing, hunting, shifting cultivation, harvesting and gathering" (FAO, 2024b, p. 4). As IPFS are rooted in holistic approaches that diverge from conventional economic standards (e.g. biocultural and ecological reciprocal considerations). Therefore, in line with FAO's precept, this report uses the TEEB framework as a basis for moving towards a more inclusive structure based on the working definition of IPFS.

However, there are critics of the TEEB framework. MacDonald and Corson (2012) argue that the valuation of ecosystems in economic terms involves the removal of nature from its social and ecological context and the reduction of complex ecological dynamics to categories that can be incorporated into economic models. They see this as part of a larger project of making markets work to make nature conform to an abstract notion of “natural capital”. This criticism, although based on understanding that economic valuation is about marketable values, is important for IPFS because these systems are based on relationships, reciprocity and Indigenous governance, not on commodification. The TEEB-AgriFood framework (UN Environment, 2018) claims to offer a holistic view of “eco-agri-food systems”, but it was not designed with Indigenous worldviews in mind. The TEEB-AgriFood Mexico initiative (2019) has since acknowledged the social, cultural and economic values of biodiversity, which opens the door to non-monetary approaches. The framework proposed here builds on these insights but deliberately moves away from the language of “capital” and towards a way of understanding “value” that is rooted in Indigenous perspectives.

Indigenous Peoples have different conceptions of value, well-being and sustainability than those set forth by neoclassical economic models. For many Indigenous Peoples, well-being is not about income or material wealth, but about the health of the land, the strength of social relations and the continuity of cultural practices. Therefore, there is a need for innovative plural metric systems that include Indigenous criteria as well as economic indicators and that allow for both qualitative and quantitative measurements (Paul *et. al.*, 2023).

### 3.5 Towards proposing an Indigenous Peoples’-specific food systems framework

Building on the TEEB-agrifood framework, this report proposes an Indigenous Peoples’ specific food systems framework. While production value is important, the framework gives equal weight to three further dimensions shown earlier, i.e. cultural governance and relational value, knowledge and well-being, and ecological values, which together contribute to people’s well-being and identity.

A combination of cultural governance and relational values, knowledge and ecological values, interact in an integrated and cohesive manner to generate production values (which include the amount and variety of crops produced, or collected through wild harvesting, the amount of meat sourced through hunting and their contribution to nutrition). All four types of values contribute to Indigenous Peoples’ well-being and identity. Cultural norms, aspirations, and responsibilities, as well as socio and ecological principles, play a significant role in the governance and management of IPFS.

External issues such as political, economic, institutional, and governance systems play a key role in the functioning and performance of IPFS. These policy settings include government regulations, including land access, tenure, and what and when to grow/harvest. Additionally, there are different tiers of policy settings. All these play a vital role in how IPFS perform and are considered, supported and promoted. Particularly important are the key dimensions of food diversity and nutrition which are not reflected in typical mainstream frameworks. By linking production values for including food diversity and nutrition with people’s well-being and identity, this important aspect of IPFS can be brought to the limelight.

### 3.6 Metrics to evaluate IPFS

Based on the above framework, a set of guiding criteria (and some general indicators) are identified to evaluate IPFS, which can vary depending on local context. Using a combination of quantitative and qualitative measures (e.g. wild food, quantity and diversity of food), the aggregated outcome can be used to evaluate the state of IPFS.

The most important point is that from the interactions of different elements of cultural governance and relationships, knowledge, and ecological dimensions, Indigenous Peoples’ well-being and identities are derived.

Well-being measures could be diverse and vary from one locality to another, depending on people’s needs and aspirations.

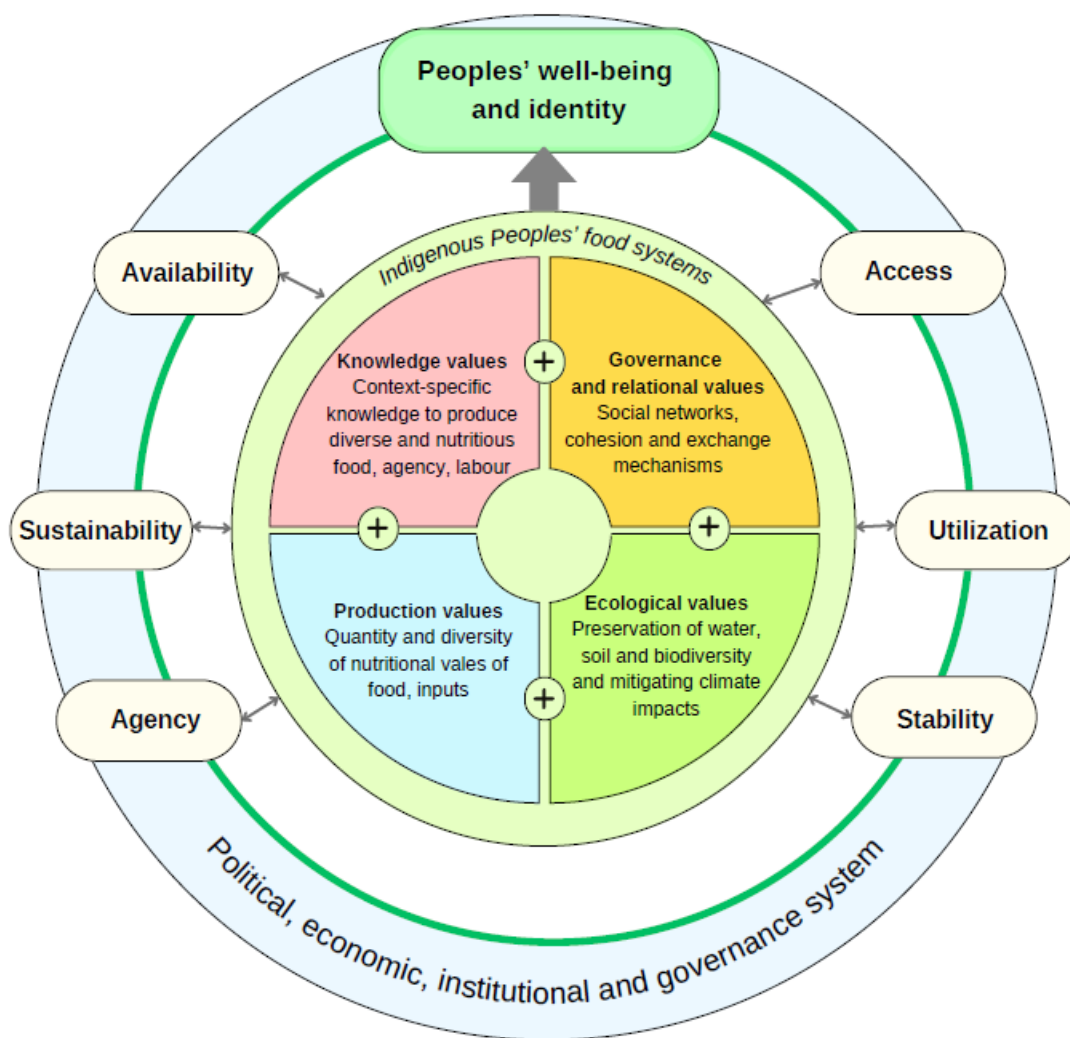


Figure 3.2 Areas for evaluation of IPFS

To support operational use, indicators should be accompanied by guidance on data sources and methods. For example, data on access to traditional hunting, fishing and farming grounds can be collected through community-based monitoring, participatory mapping and household surveys (O'Connor *et al.*, 2022). Gender equity indicators can be measured through disaggregated data on resource control, decision-making participation, and workload distribution (Beale, 2024). Specific attention should be given to youth, including indicators on intergenerational knowledge transmission and youth access to traditional grounds (O'Connor *et al.*, 2022).

### 3.7 Conclusions

Understanding the complex values of IPFS matters for policymakers, particularly as several of these values flow beyond current market systems and hence remain unrecognized. The intertwined nature of IPFS, food values, diversity and nutrition, linking to people’s well-being and identities makes IPFS distinctive. The human–nature relationships, not production, are at the centre of IPFS.

It is important to note that the purpose of including intangible values of IPFS along with produced values is to inform decision makers. This does not necessarily mean that such values need to be monetized, which can depend on the purpose for valuation. The importance of these intangible and non-marketable values can be understood both in monetary and/or non-monetary terms using qualitative tools. The proposed framework offers a tool to put those critical values together with production values to be considered for decision-making. Most importantly, the word “value” does not mean market value as in the common usage of the term. There are several ways in which intangible values can also inform decision makers such as understanding their role in people’s well-being (see Costanza *et al.* 2014; Sangha *et al.*, 2021; Costanza, 2024).

Indigenous Peoples’ food systems are facing many prevalent issues and challenges. To support, strengthen, and promote IPFS, the review of case studies highlights that strengthening institutional and governance arrangements, developing coherent policies, and promoting inclusive participation and ownership are vital. Community participation and control in local governance and food sovereignty have been recognized as key factors in the success of IPFS. Funding has also been recognized to play an important role in the success of IPFS.

To underscore the value of IPFS, the proposed framework connects cultural governance and relational values, knowledge and well-being, and ecological and production dimensions of food systems. This framework directly addresses the six dimensions of food security proposed by HLPE-FSN (Clapp *et al.*, 2022), underlining that well-being and identity are interlinked to these dimensions. Typically, food systems are related to people’s livelihoods. This report argues that people’s well-being is more than their livelihoods and includes the concept of identity (Sangha and Russell-Smith, 2017). Government policies and programmes that aim to support IPs focus primarily on livelihoods (Sangha *et al.*, 2025, 2026; Failler *et al.*, 2025). Often, the focus remains on creating alternative livelihood opportunities to integrate IPs into the mainstream economy (IPBES, 2024; UNEP, 2025), which needs to shift towards improving people’s well-being.

In contrast, well-being, following Sen (1999a), is much more than just livelihoods for enabling people to lead their lives the way they want to live.

Recently, nature-based solutions and economies have been recommended as feasible options to preserve biodiversity and mitigate climate change (IPBES, 2024; Nexus and IPBES, 2025). Developing such incentivized mechanisms, if targeted to support IPFS, can help address three targets at once: 1. producing food that is healthy and nutritious; 2. generating employment for IPs; and 3. managing ecological crises (climate change, biodiversity loss, and land degradation).

The valuation of IPFS has direct policy implications for funding and institutional reform. Firstly, a key policy recommendation based on this chapter is to understand the full value of IPFS by including cultural governance and relational values, knowledge, and ecological values that contribute to people’s well-being. Secondly, financial mechanisms through which funding for environment, biodiversity and climate is provided, must be re-oriented to support Indigenous-led valuation processes (Bertilsson and Soneryd, 2023; UNPFII, 2024). Thirdly, institutional reforms are vital to embed Indigenous criteria and priorities into policy decisions on land, food and resource governance (UNPFII, 2024). Fourthly, there must be public investment to enable Indigenous Peoples to decide for their own food systems, so that they can identify and track their own indicators of well-being and sustainability (Mercer *et al.*, 2023). Fifth, underscoring this understanding is the importance of the right of FPIC when assessing the value of IPFS. Such a holistic approach can help comprehend the multifaceted role of IPFS beyond the current market measures, and to develop programmes at the local, regional and global level to support IPFS.

## Chapter 4. Land, water, and territorial rights as the foundation of Indigenous Peoples' food systems

### Key messages:

- Land, water and territorial rights are foundational for IPFS, shaping governance authority, resource access, ecological stewardship, knowledge transmission, food security, nutrition and well-being. Indigenous Peoples' territorial relationships differ fundamentally from conventional property models: Territories are not only productive assets, but material, cultural, spiritual, political and intergenerational foundations for food-system continuity.
- Land, water and territorial rights are essential for territorial practices such as seasonal mobility, selective harvesting, cultural burning, customary fisheries management, and other customary practices, and for place-based knowledge systems which sustain food availability, cultural identity, ecological integrity and adaptive capacity, and governance over and responsibility for specific lands and waters.
- Secure access to biodiverse territories supports dietary diversity, culturally appropriate foods, clean water, mental and cultural well-being, enabling resilience to nutrition transitions and non-communicable diseases.
- Insecure tenure, territorial dispossession, restrictive conservation policies, and extractive industries, disrupt IPFS.
- Rights-based legal frameworks including UNDRIP, International Labour Organization (ILO) Convention No. 169, the right to food, the Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (VGGT) and FPIC provide important foundations. However, major implementation gaps exist where national laws, sectoral policies or investment decisions often fail to recognize Indigenous Peoples' tenure systems.
- Strengthening IPFS requires moving beyond official recognition to the effective implementation of territorial rights.

### 4.1 Conceptualizing territorial rights as structural determinants

This chapter conceptualizes land, water and territorial rights in terrestrial, freshwater, coastal and marine environments as structural determinants shaping Indigenous Peoples' Food Systems (IPFS) (CSDH, 2008). These structures, social, political, economic, and legal, shape the distribution of power, resources and decision-making, and therefore have a profound impact on IPFS. The chapter analyses the nexus of governance, resources and food outcomes, and assesses how sociopolitical processes enable or constrain the realization of Indigenous Peoples' rights. It identifies policy gaps and pathways for strengthening equitable, sustainable, and resilient IPFS.

Territorial rights influence IPFS through four interrelated pathways: governance and self-determination, ecosystem stewardship, knowledge systems, and food and nutrition security. These pathways illustrate how territorial rights impact IPFS by linking governance and ecological processes to concrete food and nutrition outcomes. The distinction between formal legal recognition and de facto access and control is maintained, as the disparity between the two is also a structural determinant of system outcomes.

Territorial rights extend beyond property ownership as for Indigenous Peoples they are the basis of identity, sustenance and well-being. These structural determinants influence the distribution of power and the access to resources for survival and differentiate Indigenous ontologies from models of property based on markets (Coté,

2016; UN DESA 2021; United Nations, 2007). For coastal and island Peoples, territory includes reefs, fishing grounds and sea ice as well as land.

**Table 4.1. The Indigenous vs market-based property paradigm**

| Feature      | Indigenous ontologies                                    | Market-based property model                                                            |
|--------------|----------------------------------------------------------|----------------------------------------------------------------------------------------|
| Core value   | Ancestry, sustenance, identity, and spiritual foundation | Capital assets or means of production                                                  |
| Relationship | Intergenerational responsibility and reciprocity         | Legal ownership and extraction rights (in market economies); state ownership in others |
| Governance   | Collective well-being and customary law.                 | Individual rights and state-led regulations                                            |
| Food role    | Territory constitutes survival.                          | Market-dependent supply chains (where markets exist); state-distributed in others      |

Property models often lead to territorial dispossession, affecting IPFS. The loss of land in the case of the Sawhoyamaxa (Inter-American Court of Human Rights, 2006) was associated with food insecurity and violations of the right to life and property. In Canada, the draining of the Sumas Lake in the 1920s destroyed Stó:lō food resources, and in the wake of the 2021 flood, the Stó:lō are calling for its restoration (Joseph and Turner, 2020; Finn *et al.*, 2024). The Lhaka Honhat court decision in Argentina recognized restricted Indigenous access to territory to be a violation of the right to food (Inter American Court of Human Rights, 2020), the first case in which the court found autonomous violations of Article 26 of the American Convention on Human Rights in respect of the rights to adequate food, water, a healthy environment and cultural identity. In the Sahel, commercial land transactions inhibit pastoral mobility and disrupt established food systems (FAO, 2018a).

**Table 4.2. Indigenous People’s food systems as a manifestation of territorial relationships**

| Aspect                   | Description and manifestation                                                                                                                                               | Key functions                                                                                                             |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| Material basis           | Indigenous Peoples’ food systems (IPFS) are “territorially constituted and place-based,” relying on long-term relationships with land, water, and ecosystems”. <sup>i</sup> | Growing, accessing, and preparing food; ensuring survival                                                                 |
| Institutional governance | Food is governed within boundaries and rules established by Indigenous Peoples themselves. <sup>ii</sup>                                                                    | Community planning, decision-making, and self-governance. Sustainable natural resource use and biodiversity conservation. |
| Routine activities       |                                                                                                                                                                             |                                                                                                                           |

|                                |                                                                                                     |                                                                              |
|--------------------------------|-----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
|                                | Daily practices such as planting, fishing, hunting, and foraging <sup>iii</sup>                     | Indicators of system dynamism, resilience, and self-renewal                  |
| <b>Cultural and spiritual</b>  | Shaping identities and conducting spiritual practices through food-related activities <sup>iv</sup> | Maintaining collective identity and spiritual health                         |
| <b>Knowledge transfer</b>      | Passing down ecological and practical knowledge to younger generations <sup>v</sup>                 | Intergenerational transmission of food-system wisdom and cultural continuity |
| <b>Foundational principles</b> | Systems are built on reciprocity, respect, interdependence, and sustainability. <sup>vi</sup>       | Ensuring ecological integrity and long-term sustainability                   |

Sources: <sup>i</sup> FAO, Alliance and CIAT, 2021; <sup>ii</sup> Morrison, 2011; FAO, Alliance and CIAT, 2021; <sup>iii</sup> FAO, Alliance and CIAT, 2021; Kuhnlein and Chotiboriboon, 2022; <sup>iv</sup> FAO, Alliance and CIAT, 2021; <sup>v</sup> FAO, Alliance and CIAT, 2021; <sup>vi</sup> Morrison, 2011

Conservation efforts that limit or exclude human presence often drive Indigenous Peoples off their land, limiting access to ancestral lands (RRI and ELI, 2020). In Cameroon, the Baka and Bakola lost access to their ancestral forests which were taken without their consent and designated as conservation parks, disrupting transmission of knowledge and traditional food systems (FAO, 2021; UN DESA, 2021). In Kenya, the Ogiek of the Mau Forest went through a legal struggle from 1997 to 2022, as they and were evicted for conservation and logging, disrupting resource use and eroding knowledge. In 2017, the African Court on Human and Peoples' Rights ruled that Kenya had violated the Ogiek's rights to property, culture, natural resources and development and in 2022 it ordered the reparations and restitution of Ogiek ancestral land. In India, the Adivasi, including the Jenu Kuruba, were similarly displaced from protected areas, changing livelihoods to wage labour (Mahanty, 2002; Demps *et al.*, 2012). Among the Boran and Gabra pastoralists of Ethiopia and Kenya, infrastructure development and land privatization restricted the migratory routes on which seasonal livestock grazing depends, leading to livestock losses and heavier dependence on food aid (Dominguez and Luoma, 2020; FAO, 2018a).

The cases show how territorial dispossession disrupts governance, weakens stewardship and undermines food security, and they demonstrate the structural importance of territorial rights to Indigenous Peoples' food systems. Food sovereignty scholars advocate for "resurgence", the rebuilding of Indigenous Peoples' governance and land-based practices from within and "re-connection" to ancestral territories, food, and political systems. Territory is where Indigenous Peoples exercise governance, sustain culture, and maintain identity (Coté, 2016; Pictou, 2018; Poirier and Neufeld, 2023). Kenyan pastoralists such as the Maasai and Samburu experience the disruption of food systems caused by loss of access to land; constraints on the mobility of livestock from commercial ranching, conservancies, and private titling reduce productivity and food security (Galvin, 2009; Homewood, Kristjanson and Trench, 2009).

International land rights frameworks emphasize that secure access to land, fisheries and forests is essential to the right to food (FAO, 2012), particularly for Indigenous Peoples with spiritual ties to their lands (FAO, 2010). The UN Declaration on the Rights of Indigenous Peoples (UNDRIP) affirms the rights of Indigenous Peoples to maintain their connection to their land and resources and to decide how their territories are developed.

Territorial rights include water systems that support fisheries, wetlands, and floodplain agriculture and pastoralism. Comparative legal evidence shows that water rights are often connected to community land rights; where customary land rights are recognized, this often leads to the formal recognition of community water resource rights (Jackson, 2018).

Legislation, government policies and third-party users can undermine Indigenous water rights and associated resources, threatening downstream ecosystems and food security (Gupta, Hildering and Misiedjan, 2014). An example is the Omo River-Lake Turkana system; completion of the Gibe III dam altered the river flow and seasonal flooding on which fish reproduction and flood plain agriculture depend, affecting Turkana access to water, food security, and the traditional knowledge systems associated with them (Avery, 2013). In North America, changes in land ownership, capitalist development, and sociocultural changes following colonization drove Indigenous Peoples away from their traditional food systems (Malli *et al.*, 2023).

Conservation programmes can be essential for conserving habitat and biodiversity, however if they are based on exclusion rather than co-management of protected areas, they can be detrimental to Indigenous food systems, livelihoods and nutrition (Vasquez and Sunderland, 2023). The loss of land and access to resources undermines the ability to provision, including customary institutions, knowledge systems, and intergenerational transmission (Joseph and Turner, 2020). The Sámi reindeer herding food system is approaching critical thresholds due to industrial pressures on grazing lands (Oskal *et al.*, 2024; van Rooij *et al.*, 2023). Indigenous Peoples' food systems are home to a high level of both cultivated and wild biodiversity that is linked to health and cultural identity; having secure land rights is key to their sustainable development (Swiderska *et al.*, 2022). Insecure land rights leave land vulnerable to mining, infrastructure and industrial agriculture, risking permanent loss and threatening Indigenous food systems (Garnett *et al.*, 2018).

Secure recognition of Indigenous territories is essential to the continuation of land-water relationships, self-governance and ecological integrity. The Mëbêngôkre-Kayapó of the Brazilian Amazon have secure access to and traditional knowledge of large areas of rainforest, rivers and *cerrado (tropical savannah)* landscapes, which provide diverse types of food, nutrition, and the intergenerational transmission of culture and livelihoods. Their Territorial and Environmental Management Plan aims to preserve the territory for health, medicine, food and future generations. They define the principles of territorial management as “the path to care for the land, the forest, the rivers and the people” (Associação, Floresta Protegida *et al.*, 2024, p. 30). However, illegal mining, cattle expansion, highways, logging and infrastructure projects threaten their forests, biodiversity, food systems and culture, leading to strong territorial defence.

Indigenous Peoples manage or hold tenure rights over one quarter of the world's surface, including 37 percent of natural lands and 40 percent of terrestrial protected areas (Garnett *et al.*, 2018; IPBES, 2024). Modern treaty settlements in Canada, such as the Mi'gmaq First Nations fisheries agreements, operationalize treaty rights and provide access to commercial fisheries (DFO, 2021a, 2021b; Stiegman and Pictou, 2024). Recognition of Indigenous hunting and wildlife management rights in Australia supports customary harvesting, increasing game availability and securing totemic species (Wilson, Edwards and Smits, 2010). Alliances among Brazil's Kayapo protect forests, helping to stave off deforestation while conserving biodiversity and helping maintain fish, game and crop diversity (Garcia *et al.*, 2024). Territorial rights are foundational to governance, sustainability, knowledge systems, and food security.

#### 4.2 Territorial practices and food system functions

Indigenous Peoples' food systems depend on diverse landscapes and waterscapes, including farmland, forest, hunting grounds, fishing waters, grazing routes, wetlands, rivers, reefs and migratory corridors. Control of these

lands allows food provisioning, traditional management of resources and intergenerational knowledge transfer (FAO, Alliance and CIAT, 2021; Treacle and Krell, 2014). These are rights over territories that configure governance in concrete actions for food security, ecological sustainability, and cultural survival. The following paragraphs illustrate how territorial practices sustain food provisioning, ecological stewardship, and intergenerational continuity.

Diverse territorial practices underpin food provisioning, ecological stewardship, and intergenerational continuity. Seasonal rounds and spatial continuity facilitate timely harvesting, distributing pressures and providing a steady food supply (Joseph and Turner, 2020; Poirier and Neufeld, 2023). Mobility enables nomadic herders, fishers and agropastoralists to adapt to environmental variability and maintain ecological connectivity and adaptive resource use (FAO, 2018a). Rotational use, fallowing and intercropping regenerate soils, restore biodiversity and maintain productivity (Altieri, 2018; FAO, 2012, 2018b). Selective harvesting, seasonal restrictions and cultural burning support sustainable resource use and ecological integrity under customary governance (FAO, Alliance and CIAT, 2021; Joseph and Turner, 2020). Territories also serve as learning spaces for the transmission of seasonal knowledge, species identification and cultural protocols, ensuring the preservation of traditional ecological knowledge and food practices (Kuhnlein *et al.*, 2013; Poirier and Neufeld, 2023; Joseph and Turner, 2020). Secure territorial rights underpin the continuation of traditional and hybrid food systems, and facilitate food sovereignty, intergenerational stewardship and cultural continuity (Grey and Patel, 2015; FAO, 2012).

Such practices show how territorial rights through quotidian practices contribute to maintaining ecological integrity, ensuring food security, and transmitting knowledge. Indigenous Peoples' food systems are based on active management of environments and not passive access.

#### 4.3 Territorial rights and Indigenous Peoples' knowledge systems

Indigenous Peoples' knowledge systems for food are highly place based and connected to a particular environment. They are developed, validated and transmitted through ongoing interaction with specific landscapes, and are shaped and guided by traditional tenure and Indigenous People's management rules (Treacle and Krell, 2014). Territorial rights enable Indigenous Peoples to observe, experiment, transmit, share and adapt their ecological knowledge on food practices over generations.

Territorial rights safeguard these knowledge systems and enable their continued production, which require regular interaction with land and ecosystems. Community systems define harvesting norms, seasonal restrictions, species protection and habitat management (Kuhnlein *et al.*, 2013; FAO, Alliance and CIAT, 2021; Treacle and Krell, 2014). This knowledge contributes to biodiversity conservation, intergenerational transmission, and adaptive responses to climate change.

Factors that undermine knowledge construction include displacement, fragmentation, market integration, cultural assimilation, language loss, and restrictions on or criminalization of access to territory, leading to the loss of traditional ecological knowledge and capacity for sustainable biodiversity management (Joseph and Turner, 2020; Malli *et al.*, 2023; Treacle and Krell, 2014). While the Convention on Biological Diversity and the Nagoya Protocol recognize traditional knowledge, they do not on their own provide legal protection (Convention on Biological Diversity, 2011). Without recognized rights and secure tenure, Indigenous Peoples cannot control external access to their knowledge or ensure fair benefit sharing.

By contrast, secure territorial rights grant Indigenous Peoples the permission to observe, experiment with, and adaptively manage resources. Governance based on customary and cultural laws supports the ever-changing

nature of Indigenous food systems (FAO, 2012; Grey and Patel, 2015). Territorial rights are therefore a knowledge infrastructure that allows Indigenous Peoples to maintain, adapt, and pass on critical ecological knowledge for resilient food systems. Governance knowledge, including Indigenous data sovereignty and co-creation protocols, is explored in Chapter 5.

#### 4.4 Historical and political roots of territorial dispossession

Territorial dispossession has roots in colonization. Colonial governments declared the land *terra nullius*, or empty land, imposed private property, criminalized Indigenous land use and seasonal movement and disrupted food systems and stewardship (McNai, 2019; Harris, 2004). However, Indigenous Peoples were managing these territories and resources through different practices (Denevan, 1992; Fletcher *et al.*, 2021). Courts now recognize the harm done through dispossession, as in the case of *Sawhoyamaya v. Paraguay*, where land loss was associated with malnutrition and death (Inter-American Court of Human Rights, 2006). But recognition is not action. Post colonial development continues to restrict Indigenous Peoples' practices while enforcement of existing protective laws is still weak (FAO 2021).

Dispossession threatens health and well-being as land and food are linked to identity and spirituality. In some countries, loss of land can result in loss of nutrition, mental health and culture (Kuhnlein *et al.*, 2013; Acharibasam *et al.*, 2024). Lower rates of deforestation are found where Indigenous Peoples have secured land rights or tenure, across deforestation hotspots in Latin America (Ceddia, Gunter and Corriveau-Bourque, 2015).

In some parts of Latin America, violence is high and several indigenous environmental defenders have been killed. In such areas, criminal networks dominate agriculture and block Indigenous Peoples from gaining territorial rights and protecting food systems (Global Witness, 2024). The tenure statutes today remain a legacy of colonial legal doctrines. Decolonizing tenure law is a precondition for Indigenous food system recovery.

#### 4.5 Rights-based legal foundations for land, water, and territorial rights

International human rights frameworks (Box 4.1) recognize the collective rights of Indigenous Peoples to lands, waters, territories and resources which are vital for food, health, culture and self-determination. States' obligations in relation to the right to food include reference to reform of agrarian system (ICESCR Article 11) and access to ancestral lands as essential to food security for indigenous peoples (ICESCR General Comment 12 (1999)) and the right to land and territory (ICESCR General Comment 26 (2022)). However there are several implementation gaps to these provisions, due to power imbalances, lack of enforcement or competing economic interests.

Customary tenure can be recognized alongside state law through constitutional legal pluralism (Bolivia, 2009), statutory titling of ancestral domains subject to customary law (Philippines, 1997), co-governance statutes providing for shared Indigenous Peoples' and state governance (New Zealand, 2017), and participatory territorial management (Brazil, 2012). These models treat customary law as a source of law. In 2024 Mexico adopted a constitutional reform recognizing Indigenous Peoples as "subjects of public law" having legal personality, patrimony, self, determination, autonomy and consultation rights over land and resource issues (DOF, 2024).

#### **Box 4.1. Key international legal frameworks for Indigenous Peoples' territorial rights and food systems**

International human rights frameworks recognize Indigenous Peoples' collective rights to lands, waters, territories and natural resources. These include the following:

- UNDRIP (United Nations, 2007) and the Indigenous and Tribal Peoples Convention, 1989 (No. 169) (ILO, 1989) affirm Indigenous Peoples' rights to self, determination, territorial governance and FPIC.

- The Committee on the Elimination of Racial Discrimination (CERD) General Recommendation No. 23 calls on States to recognize and protect Indigenous Peoples' rights to own, develop and use their communal lands, and to provide restitution where lands were taken without consent (CERD, 1997).
- General Recommendation No. 39 of the Committee of the Elimination of All Forms of Discrimination against Women (CEDAW) recognizes the rights of Indigenous women and girls to land, territories and food systems (CEDAW, 2022).
- The Convention of the Rights of the Child (CRC) General Comment No. 11 links the rights of Indigenous children to culture, health and adequate food (CRC, 2009). The right to adequate food under Article 11 of the International Covenant on Economic, Social and Cultural Rights (United Nations, 1966) and General Comment No. 12 set out the right to food that is culturally appropriate and nutritionally adequate and call for States to acknowledge Indigenous Peoples' access to traditional lands (CESCR, 1999).
- Voluntary Guidelines on the Responsible Governance of Tenure of Land, Fisheries and Forests (VGGT) recognize customary tenure, prohibit forced evictions and highlight the significance of land and resource management for food security (FAO, 2012).
- The Nagoya Protocol (adopted 2010, entered into force in 2014) on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization to the Convention on Biological Diversity, with a view to development of a fair and equitable regime, and noting the interrelationship of traditional knowledge (Convention on Biological Diversity, 2011).

However, implementation gaps remain. Free, prior and informed consent (FPIC) often ends up as a procedural formality rather than a substantive right. State override of customary governance erodes control over water and aquatic food systems.

Implementation of Indigenous Peoples' rights is taking place in some countries. In New Zealand, the Te Awa Tupua (Whanganui River) Act 2017 gives the river legal entity status with rights as a living being and establishes Te Pou Tupua, an office whose two members are nominated by Whanganui iwi and the Crown, with a joint group called Te Kopuka na Te Awa Tupua developing strategy for the river. This is a good example of legal systems working together, but the effect on fishing and food practices has not been evaluated yet (Cribb, Macpherson and Borchgrevink, 2024; New Zealand, 2017). The Hauraki Gulf/Tikapa Moana Marine Protection Act 2025 was developed in collaboration with Māori iwi and recognizes Māori customary rights in the new marine protected areas. It does not create a co-governance body like the river law, and its impact on traditional fishing has not been researched (New Zealand, 2025). In Brazil, the National Policy for Territorial and Environmental Management of Indigenous Lands (PNGATI) (Box 4.2) promotes participatory territorial planning and recognizes Indigenous governance. In Mexico, the 2024 constitutional reform recognizes the Indigenous Peoples as "subjects of public law" with legal personality to determine their own development. Recognition takes place at different levels. The Bolivian Constitution recognizes Indigenous autonomies and communal territories (Bolivia, 2009). The Philippines' Indigenous Peoples' Rights Act of 1997 (IPRA) recognizes ancestral domains (Philippines, 1997). In India, Article 371A (1963) protects Naga customary law from parliamentary override. Article 371A is an unusually strong constitutional guarantee by comparative standards: No Act of Parliament in respect of Naga religious or social practices, Naga customary law and procedure, land ownership and transfer, and civil and criminal justice under Naga custom applies to Nagaland unless the Legislative Assembly by resolution provides otherwise (India, 1950). In the United States, Washington State co-manages treaty fishing rights, and California's policy directs agencies to co-manage and return land (RRI and ELI, 2020). In Northeast

India, the Khasi Hills Autonomous District Council has legislative power over land, with community land (Ri Raid) distinguished from private clan land (Ri Kynti) (India, 1950).

#### 4.6 Diversity of Indigenous Peoples' territories and tenure systems

Indigenous Peoples live in diverse ecological regions, and their land tenure systems reflect those differences through collective custodianship, overlapping rights, seasonal use and stewardship responsibilities (FAO, 2012; IPBES, 2019). These systems shape food access, management and distribution through Indigenous Peoples' governance. Despite this diversity, IPFS are based on collective custodianship, adaptive management, and governance based on ecological knowledge.

**Table 4.3. Key aspects of Indigenous Peoples' ecological governance**

| Dimension / issue                                  | Governance aspect, with illustrative examples                                                                                                                                                                                                                                                                             | Implications for food security and ecological resilience                                                                               |
|----------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Collective custodianship and layered rights        | Clan or lineage-based stewardship systems with overlapping rights regulate access to hunting, rotational fields, grazing, and fisheries. These systems embed stewardship responsibilities and social networks for ecological governance. <sup>i</sup>                                                                     | Promotes sustainable resource use, strengthens social cohesion, protects biodiversity, and ensures equitable access to food resources. |
| Pastoral, forest, and shifting cultivation systems | Pastoralism requires flexible grazing lands and water points; forest and shifting cultivation depend on rotational crop lands and sacred forests. Secure tenure allows fallow periods and resource regeneration. Restricted movement or shortened fallow periods disrupt ecological balance and resilience. <sup>ii</sup> | Maintains ecological productivity, supports livestock and crop yields, preserves forest resources, and sustains livelihoods.           |
| Coastal and marine tenure systems                  | Customary marine tenure includes fishing bans, seasonal closures, and regulated access based on mutual obligations. Industrial fishing, tourism, and blue economy projects often displace Indigenous Peoples' fishers. Legal protection of customary marine tenure is critical. <sup>iii</sup>                            | Supports aquatic food security, preserves coastal biodiversity, and ensures small-scale fishers' livelihoods and cultural practices.   |
| Arctic, riverine, and wetland systems              | Indigenous Peoples' territories include ice, sea, coastal waters, and land areas. Seasonal and hydrological dynamics influence                                                                                                                                                                                            | Maintains ecosystem connectivity, supports multispecies management, ensures sustainable food and water                                 |

|                            |                                                                                                                                                                                                                                                             |                                                                                                                                                              |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            | agriculture, fisheries, and livelihoods. Fragmentation by borders or infrastructure disrupts ecosystems and Indigenous management. <sup>iv</sup>                                                                                                            | access, and protects cultural and ecological knowledge.                                                                                                      |
| National policy challenges | National statutes emphasizing private ownership often criminalize Indigenous Peoples' tenure, reduce access, and alter boundaries. Recognition of collective tenure and incorporation of Indigenous Peoples' governance systems are necessary. <sup>v</sup> | Secures land rights, preserves ecological integrity, protects cultural practices, and supports sustainable food systems across diverse territorial contexts. |

Sources: <sup>i</sup>FAO, 2012; IPBES, 2019; Alden Wily *et al.*, 2017; <sup>ii</sup>FAO, 2012; <sup>iii</sup>FAO, 2015; <sup>iv</sup>FAO, 2012; <sup>v</sup>Dawson *et al.*, 2021; FAO, 2012; Alden Wily *et al.*, 2017.

Indigenous Peoples' territorial systems demonstrate the capacity to adapt and manage land, water and food systems. Support policies cannot be one-size-fits-all but must be adapted to local contexts. Legal recognition of customary tenure, such as the Indigenous Peoples' Rights Act (IPRA) in the Philippines, which recognizes and supports fisheries and agroforestry with ancestral domain titles (Philippines, 1997), and traditional marine rules in Vanuatu that regulate reef closures and fishing seasons, contributing to the security of aquatic food supply (Johannes, 1998), show how such recognition supports sustainable resource management by Indigenous Peoples, strengthens food systems and enhances community resilience.

#### Box 4.2. Brazil's National Policy for Territorial and Environmental Management of Indigenous Lands (PNGATI)

Territorial governance in Brazil's PNGATI (Decree No. 7.747/2012) is a way to reinforce IPFS. The policy understands that Indigenous Peoples' well-being, food security, biodiversity and cultural continuity are linked to secure territorial rights, autonomous governance and sustainable land management. Brazil's National Policy recognizes Indigenous territories as integrated socioecological systems providing food, livelihoods and intergenerational knowledge, based on the constitutional recognition of Indigenous territorial rights. It also addresses the pressures of agricultural expansion, infrastructure, illegal extraction and biodiversity loss, while protecting water sources and ecosystems critical for resilient food systems (Brazil, 2012).

Three features of PNGATI are particularly relevant for IPFS:

- 1. Participatory governance:** The policy was developed through an extensive consultation process involving Indigenous organizations from across Brazil, strengthening Indigenous leadership in decision-making.
- 2. Recognition of Indigenous governance:** PNGATI recognizes Indigenous governance institutions, customary knowledge, self-determination and the right to free, prior and informed consent.

**3. Participatory territorial planning:** The policy promotes ethnomapping, ethnozoning and Territorial and Environmental Management Plans (*Planos de Gestão Territorial e Ambiental*/PGTAs), which support sustainable resource management and strengthen dialogue with public institutions (FUNAI, 2013)

#### **Key policy lessons for strengthening Indigenous Peoples' food systems**

- Secure territorial rights are fundamental for food security and cultural continuity.
- Biodiversity conservation and Indigenous food systems are mutually reinforcing.
- Indigenous governance institutions are central to territorial management, while participatory planning can strengthen coordination across land, environmental and food policies.

Despite its innovative design, PNGATI has faced implementation challenges, including limited financing, weak institutional coordination and continued external pressures on Indigenous territories. These constraints highlight the need for sustained political commitment and adequate public investment to translate legal recognition into effective territorial governance.

#### **References:**

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FUNAI. 2013. *Planos de gestão territorial e ambiental de terras indígenas: orientações para elaboração* [Territorial and environmental management plans for Indigenous lands: guidance for preparation]. Brasília, FUNAI

#### **4.7 Territorial rights as determinants of nutrition and health**

Territorial rights can be measured through indicators such as tenure security, access to biodiversity, and mobility (HLPE, 2023). Secure tenure is associated with less deforestation (Ceddia, Guntur and Corriveau-Bourque, 2015). Territorial rights influence nutrition through conservation of biodiversity, access to culturally appropriate foods, and conservation of the ecological systems that support production.

#### **4.8 Key factors affecting Indigenous Peoples' food systems and territorial rights**

**Biodiversity, land access, and diet quality.** IPFS provide diverse, nutrient-rich foods. When land access is lost, diets can worsen. Secure access improves nutrition (Kuhnlein *et al.*, 2013; HLPE, 2023; Vasquez and Sunderland, 2023).

**Ecological integrity, climate resilience, and food security.** Recognizing Indigenous rights supports traditional land governance, helps prevent deforestation, and protects ecosystem services (Ceddia *et al.*, 2015; Ding *et al.*, 2016).

**Water rights, food safety, and public health.** Clean water is essential for food and health, linked to territory, culture, and spirituality. Customary governance protects water sources, and marine rights sustain aquatic foods (Wilson, 2014; Jackson, 2018; Errico and Feiring, 2021).

**Territorial well-being and health.** Well-being depends on healthy ecosystems and land relationships. Access to territories reinforces identity and knowledge of transmission (Stephens, Parkes and Chang, 2007).

**Territorial rights as upstream determinants.** Territorial rights shape diet quality, food access and health through ecosystems and governance, something that nutrition programmes alone cannot fix.

#### 4.9 Impact of global economic trends and climate change on Indigenous Peoples' territories

Large-scale agriculture, infrastructure, overfishing, land grabbing and extractive activities threaten Indigenous Peoples' self-governance and land (IPBES, 2024). For example, large-scale land acquisition affected about 2.5 million hectares in five African countries between 2004 and 2009 (Cotula *et al.*, 2009), resulting in dispossession and conflict. Rights-based assessments are needed to protect tenure and livelihoods (De Schutter, 2009; FAO, 2012).

Security in territorial rights is the precondition for effective resource management. Recognized territories are less deforested and deliver better ecosystem services (Ding *et al.*, 2016; FAO and FILAC, 2021). Assessments should be based on Indigenous rights, rather than on external criteria (De Schutter, 2009; FAO, 2012).

Financing can be counterproductive where Indigenous Peoples' rights are neglected, enabling land grabbing or green finance projects undermining governance (FAO, 2012, 2021; Dunlap, Verweijen and Tornel, 2024). Policy coherence is critical. Financial, environmental and economic pressures can undermine territorial rights. Secure tenure and FPIC, together with finance and adaptation safeguards, protect ecosystem integrity and Indigenous food systems (FAO, 2012, 2021).

#### 4.10 Gender, youth, language and equity as foundational dimensions of territorial rights

Women, youth and elders contribute differently to IPFS. Women are often custodians of seeds, food knowledge and preservation, while youth learn through engagement with the land. With territorial disruption comes loss of ecological knowledge and language (Treacle and Krell, 2014).

In Amazonia women's work in home gardens supports biodiversity and intergenerational knowledge transfer, but land encroachment increases their work and reduces food security and knowledge transfer (Kuhnlein *et al.*, 2013; Poirier and Neufeld, 2023). Maasai women milk cattle and prepare food, while youth learn grazing and hunting from elders, and land restrictions disrupt these learning pathways (Kuhnlein *et al.*, 2013; Treacle and Krell, 2014).

Protection of territorial rights is critical for knowledge of continuity, food security and community cohesion (Kuhnlein *et al.*, 2013; Treacle and Krell, 2014). The Committee of the Elimination of All Forms of Discrimination against Women's (CEDAW) general recommendation No. 39 calls for States to ensure the participation of Indigenous women in territorial governance (CEDAW, 2022). The Convention of the Rights of the Child's (CRC) General Comment No. 11 Links Indigenous children's rights to culture, health and adequate food with territorial integrity (CRC, 2009). Ownership of land does not guarantee fair distribution, and equity gaps can arise within communities. Securing land may result in commercialization, which can weaken sharing and increase inequality (Kuhnlein *et al.*, 2013; Grey and Patel, 2015). Disability, accessibility and reciprocity safeguards should be in policies. Territorial governance must be inclusive, with fair voice for all members, especially women and youth.

#### 4.11 Indigenous Peoples in urban, peri-urban and displaced context

Displacement has led many Indigenous Peoples to urban and peri-urban areas, but IPFS are not entirely lost (Poirier and Neufeld, 2023; UN DESA, 2021). Urban-rural linkages, remittances, seasonal travel, and cultural gatherings, maintain food linkages (Kuhnlein *et al.*, 2013; UN DESA, 2021). Territorial rights need to evolve, not lapse. They can be exercised as rights of return, seasonal harvesting or co-management and benefit-sharing over ancestral territories, applying FPIC and access and benefit-sharing (ABS) mechanisms. Indigenous rights do not end when people migrate; States' obligations to urban Indigenous Peoples remain (United Nations, 2021).

Examples include Māori whānau in New Zealand, who maintain links through visits, marae gatherings and peri-urban gardens; Maasai pastoralists in peri-urban areas travel seasonally, graze animals, send remittances and celebrate festivals. Urbanization of Indigenous Peoples' foods can contribute to community resilience, but it is not a replacement for recognizing Indigenous Peoples' rights to their traditional lands. States should collect disaggregated data on urban Indigenous Peoples and ensure culturally adequate food, health services and participation in territorial governance (United Nations, 2021).

#### 4.12 Policy gaps and pathways to actions

A key obstacle is the gap between formal recognition and actual realization of territorial rights. Free, prior and informed consent (FPIC) recognized in the International Labour Organization (ILO) Convention No. 169 and UNDRIP, is often a procedural formality rather than a substantive right. Indigenous Peoples are often "informed" or consulted rather than engaged through genuine consent. For FPIC to be a binding requirement, Indigenous Peoples must have the final say over relocation, the storage and disposal of hazardous materials, redress and restitution, and the management of activities affecting their territories and food systems. States should enact statutory recognition of customary tenure, including water and marine tenure. FAO should assist States in drafting legislation that recognizes IPFS and customary tenure.

Decentralized recognition can work where national reform is blocked: subnational statutes, tribal compacts, municipal co-management and court settlements can build recognition upwards from the local level.

Governance is fragmented. Land, water, biodiversity, climate and nutrition policies are developed independently. Governments should require indicators of territorial rights across these areas, reporting through the Committee on World Food Security (CFS). Financial mechanisms are usually biased against Indigenous livelihoods. Financial flows should be directed to Indigenous-led conservation and food systems with FPIC as a precondition for disbursement. Data sovereignty is critical. Indigenous Peoples should be able to control the collection, ownership and use of data on their territories and knowledge. States and research institutions should follow the Collective Benefit, Authority to Control, Responsibility and Ethics (CARE) principles (Carroll *et al.*, 2020) and the First Nation's Ownership, Control, Access and Possession (OCAP) principles (FNIGC, 2014) and ensure that Indigenous women and youth are represented in governance. Food sovereignty requires moving from symbolic recognition to real adherence to international legal standards.

#### 4.13 Conclusion

This chapter has shown how territorial rights shape IPFS through interconnected pathways of governance, ecology, knowledge and nutrition. Land loss and poor governance, exacerbated by climate change and extractive projects, degrade IPFS and ecosystems, with effects on health, food security and culture. A rights-based

approach, respecting self-governance, land, territories, resources and knowledge, is crucial. Examples of restitution are the Ogiek judgment (African Court on Human and Peoples' Rights, 2017), the Whanganui settlement (New Zealand, 2017), Canadian fisheries rights restorations and India's Forest Rights Act 2006. These show that restitution is legally and politically achievable.

Implementing FPIC as a right, legal protection of customary tenure and better sectoral coordination require binding measures that put Indigenous Peoples at the centre. Data sovereignty, fair participation and financial transformation are also needed.

Rights-based governance that recognizes the food systems and knowledge of Indigenous Peoples is not only a matter of justice but also a precondition for transforming food systems to be truly just, sustainable and inclusive.

## Chapter 5. Co-creation of knowledge

### Key messages:

- Disrupted food systems need to be transformed to improve food security and nutrition while supporting health and the cultural, social, and ecological foundations on which these systems depend, for Indigenous Peoples and for society as a whole.
- This transformation can be supported through co-creation of knowledge, in which Indigenous knowledge holders and scientists generate and apply knowledge together through a horizontal dialogue of knowledge systems. This requires mutual respect, reciprocity, shared benefits, transparency, trust, ethical engagement, plural evidence, and shared decision-making, without privileging one knowledge system over another. Widening the current science-policy interface to a broader knowledge-policy interface that recognizes Indigenous Peoples' knowledge as a legitimate source for improved food security and nutrition.
- Indigenous Peoples must participate as rights and knowledge holders, not merely as stakeholders or informants. Co-creation rests on self-determination, free, prior and informed consent (FPIC), safeguarding of knowledge, equitable benefit-sharing, and governance arrangements that address colonial power asymmetries. Indigenous Peoples are the only ones authorized to assert their voice and knowledges position before third parties, without external intermediaries.
- Indigenous Peoples' knowledge systems include diverse methods and methodologies, including storytelling, oral histories, territorial observation, ceremonies, talking circles, relational interviewing, participatory learning, and Indigenous Peoples-guided processes, many of which combine qualitative, quantitative, experiential and spiritual dimensions.
- Bridging science with Indigenous Peoples' ways of knowing requires attention to how each knowledge system develops concepts, methods and methodologies, analysis and synthesis, and to how these can be connected.
- Intercultural co-creation of knowledge can support successful policy design, resilience and sustainable food-system transformation only if knowledge governance, territorial rights, cultural protocols, language, spirituality, collective rights and knowledge sovereignty are respected throughout the process. Any approach that establishes conditions for the validity of Indigenous Peoples' knowledge systems is inappropriate.

*"We nurture nature because nature nurtures us"*

A Yucatec Maya expression detected in story telling;  
a way to understand the concept of sustainable development.

### 5.1 Co- creation of knowledge

This chapter discusses processes for intercultural co-creation of knowledge and presents a model for bridging science and Indigenous Peoples' ways of knowing, aiming to transform disrupted food systems and inform public policy. Indigenous Peoples' food systems (IPFS) are among the world's longest-standing living food systems. Many have been profoundly disrupted by colonial processes, including dispossession of lands and territories, restrictions on traditional food harvesting, forced assimilation, suppression of Indigenous languages

and knowledge transmission, and the erosion of Indigenous governance systems (Coté, 2016; Malli *et al.*, 2023). The food systems' resilience reflects not only their capacity to adapt to changing environmental and social conditions, but also Indigenous Peoples' continued efforts to maintain, reclaim and revitalize their food systems, knowledge, cultural practices and governance, including through the selective incorporation of practices from other cultures (FAO, 2021; Knorr and Augustin, 2025; IFAD, Canada and TIP, 2022). These food systems are grounded in Indigenous sciences and ways of knowing, being and doing, developed, tested and transmitted across generations through observation, lived experience, relationships with the land and waters, and cultural and spiritual practices. They constitute sophisticated, living knowledge systems that continue to evolve (Lemke and Delormier, 2017; CCA, 2026). The UN Declaration on the Rights of Indigenous Peoples recognizes Indigenous Peoples' rights to maintain, control, protect and develop their knowledge systems, sciences and cultural heritage, particularly through Article 31 (United Nations, 2007) and these rights are increasingly recognized globally (Ehsani *et al.*, 2024; Vijayan, 2022). In order to avoid perpetuating the existing power imbalances in the recognition of Indigenous knowledge systems, co-creation of knowledge needs to be based on respect of Indigenous Knowledge Systems and must occur in a situation of equal partnership where Knowledge Holders freely opt in and where Indigenous rights are adequately protected from knowledge extractivism (CCA, 2026; de Haan, 2024; Petriello *et al.*, 2024; Yua *et al.*, 2022).

Co-creation, when done adequately, offers a route to transform disrupted food systems (de Vries *et al.*, 2024; Bello Cartagena *et al.*, 2025; Utter *et al.*, 2021; Webb and Sonnino, 2021; Wertheim-Heck and Romero Herrera, 2023). Ultimately, the objective is not simply to bridge different ways of knowing, but to support Indigenous Peoples' rights and capacities to determine the future of their food systems, while recognizing that other food systems have much to learn from Indigenous knowledge and practices, and that such learning, when undertaken with respect for Indigenous rights and self-determination, can contribute to more equitable, sustainable and effective food systems and public policies (Coté, 2016; CCA, 2026).

Key ingredients for successful intercultural co-creation: Better science-policy interfaces (Singh *et al.*, 2021, 2022). Policies based on knowledge in general, not only Western scientific knowledge (FAO, 2024) are needed for "interweaving" science and Indigenous ways of knowing. This could mean comprehending the function of knowledge brokers (Cvitanovic *et al.*, 2025).

Knowledge co-creation requires articulation which allow Indigenous People to decide how to have effective governance and management structures (Kreiling & Paunov, 2021), that enable collaboration between Indigenous Peoples as right holders and other participants implementing knowledge-policy interfaces. Also needs a transdisciplinary approach based on principles and values (Kaiser & Gluckman, 2023, 2025; Lauter, 2023). It needs relationships and trust building between the participants as central (Lauter, 2023), and the development of ethical engagements between the different ways of knowing and interrupting colonial patterns and power relations present in trained scientists (Stein *et al.*, 2024).

This chapter is structured as follows: Section 5.2 elaborates on the concept of knowledge co-creation and provides a working definition; Section 5.3 examines the interface between knowledge, policy and governance; Section 5.4 discusses principles and values for effective co-creation; Section 5.5 presents a model for bridging Western scientific approaches with Indigenous Peoples' ways of knowing; and Section 5.6 articulates these elements into a comprehensive framework.

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## 5.2 Co-creation of knowledge

Co-creation of knowledge has gained prominence over the past twenty years (de Vries *et al.*, 2024; Wertheim-Heck and Romero Herrera, 2023; Wheeler *et al.*, 2020), but it is not a new idea. Deloria Jr. (1970) presented a “Linear-Holistic Model” to further the understanding of western science and traditional knowledge. The model was expanded (Deloria Jr., 1999) and used by the Stoney Nakoda Nations (2022) for the reintroduction of bison in Banff National Park, Canada.

Co-creation is acknowledged as a key feature for food systems transformation (Bello Cartagena *et al.*, 2025; FAO, 2018; Utter *et al.*, 2021; Wezel *et al.*, 2020) and was one of the topics discussed during the 2021 UN Food Systems Summit, championed by Indigenous Peoples as a game-changer. The Summit was seen by the UN Permanent Forum on Indigenous People Issues (UNPFII) as an entry-point to raise issues of territorial protection, knowledge governance, value systems, spirituality and collective rights (IWGIA, 2022). However, some Indigenous Peoples’ organizations later claimed that their participation was symbolic rather than transformative and the Summit did not address structural power imbalances (CSM, 2021; La Vía Campesina, 2020).

In the Americas, the concept of “diálogo de saberes” [dialogue of knowledges] is employed to describe co-creation, stemming from the political resistance movements of the 1960s (Argueta Villamar, 2012) and defined as the interaction between scientific, Indigenous, traditional and popular knowledge (Leff, 2006; Fernández-Lomelín *et al.*, 2024; Val *et al.*, 2024).

This report uses the term “co-creation” rather than “co-construction” (e.g. Ahn and Class, 2011; Campanella *et al.*, 2022), “co-inquiry” (e.g. Bell *et al.*, 2010; Frank, *et al.*, 2022), “co- development” (e.g. Chen, 2021; Terrado *et al.*, 2023), “co-innovation” (e.g. Bossink, 2002; Goñi Mazzitelli, 2025), “co-production” (e.g. Monakhova *et al.*, 2025; Nehring *et al.*, 2023, 2025) or “co-design” (e.g. Lam and Pitsaki, 2018; O'Donnell *et al.*, 2025). Key organizations have adopted and promote co-creation, such as the Agroecology Coalition (2024); FAO's Agroecology Knowledge Hub (2025); HLPE (2019); IPBES (2024); OECD (2021); and, according to Webb and Sonnino (2021), the European Commission.

In some contexts, co-creation is used as an umbrella term for co-design and co-production (Vargas *et al.*, 2022). The Khasi in India distinguish co-creation as strategic and co-production as more operational (Miller, 2017). Rodriguez Valencia (2020) follows a similar understanding with the Bribri people in Costa Rica and Panama. The distinction between co-creation and co-production is reflected in language. In Yucatec Maya, co-creation (*múulan tsikbali' na't*) implies innovation, while co-construction (*múulan tsikbali' meyaj*) and co-production (*múulan tsikbali' múuch meyaj*) imply repetition. The same thinking may exist in other Indigenous People languages.

This report adopts the following working definition of co-creation: *it is a process in which knowledge holders from different cultural ways of knowing, including learning, creating, innovating and transmitting knowledge,*

*interact under a safe environment and conditions to create new knowledge, intercultural knowledge, that can be used to meet challenges in the transformation of, mostly but not only, Indigenous Peoples food systems.* For effective intercultural co-creation of knowledge some elements require attention. (see also de Vries *et al.*, 2024; Bello Cartagena *et al.*, 2025; Utter *et al.*, 2021; Webb and Sonnino, 2021).

There has been an increase in publications on knowledge co-creation with different understandings of the concept. For instance, FAO's White/Whipala paper on Indigenous Peoples' Food Systems (2021), is understood as a co-creation of knowledge between Indigenous People and non-Indigenous People participants, as well as scientists and non-scientists. An example of intracultural knowledge creation is that of a Yucatec Maya farmer who created a new variety of maize by combining traditional knowledge and genetics demonstrated that the success was preceded by an intercultural creation of knowledge (Rosado-May *et al.*, 2025a).

Collaboration for knowledge generation for biodiversity conservation can ease tensions and mistrust (Esmail *et al.*, 2023) Co-creation as a methodological approach has been conceptualized as having subjective (diverse actors) and objective (interdisciplinary) components (Poto *et al.*, 2025). This report adds "intercultural" to co-creation so as to explicitly involves the intersection and interaction of multiple disciplines.

A methodologically sound process for bridging the gap between science and Indigenous Peoples' ways of knowing (Weaver, 2023) for effective integration requires a framework sensitive to cultural differences and the social and spiritual dimensions of Indigenous Peoples' knowledges, and underpinned by legal and policy measures (Ijatuyi *et al.*, 2025). This report presents a model recognizing the four main pillars of the scientific knowledge system: concepts, methodology, analysis and synthesis, and connects them with Indigenous Peoples' ways of knowing.

### 5.3 Interface between knowledge-policy and governance

The need to strengthen the science-policy interface has been a recurring theme since the 2021 UN Food Systems Summit. Turnhout *et al.* (2021) highlighted the need for credibility, legitimacy and diversity of knowledge in addressing food systems governance. Singh *et al.* (2022) suggested connecting the science-policy interface to society through global networks and new knowledge hubs. Elouafi (2025) analysed today's food-system crisis and indicated how scholars and practitioners have grappled with how to translate rigorous research into policy action and proposed to bridge the divide for addressing converging crises in climate nutrition and livelihoods; Hainzelin *et al.* (2023) suggested four elements for a more active science, policy interface that would allow for the inclusion of diverse forms of knowledge..?

The prevailing science-policy interface privileges scientific knowledge, despite growing recognition of Indigenous knowledge systems in public policy. A more just and inclusive approach, consistent with UNDRIP and Indigenous Peoples' right to self-determined development, requires a broader understanding of what constitutes knowledge and whose knowledge informs policy. A critical starting point is therefore a shift from the "science-policy interface" to a "knowledge-policy interface."

Explicit consideration of Indigenous knowledge within such interfaces remains limited. The United Nations Educational, Scientific and Cultural Organization (UNESCO's) Local and Indigenous Knowledge Systems programme acknowledges Indigenous Peoples' knowledge as an increasingly influential contribution to the

global science-policy processes (Nakashima, 2015). In Canada, the Xáxl'i'p forest community successfully negotiated the inclusion of their knowledge in forest management, although scientific knowledge remained dominant (Diver, 2017). Questa *et al.* (2023) addressed the question on what counts as knowledge when designing public policies for Indigenous Peoples. They argue for Indigenous Peoples' knowledge, represented by Indigenous knowledge holders themselves, to be recognized alongside scientific knowledge and propose co-creation through dialogue between knowledge systems as a basis for public policy concerning Indigenous Peoples.

#### 5.4 Principles and values, key elements to guide effective and just co-creation of knowledge

One of the challenges to effective and just knowledge co-creation is the need for all participants to work on solid bases and understandings (Tudose *et al.*; 2023; Cremades *et al.*, 2021; Chatenier *et al.*, 2009).

Indigenous knowledge holders' participation in co-creation has been documented but not extensively. Théberge *et al.* (2019) published a book demonstrating the importance of ethics in the process of research when collaborating with Indigenous Peoples. Fitzsimmons *et al.* (2024) wrote about participation of Indigenous knowledges in co-creation processes using story telling with safe methods of “dadirri” and the “yarning circle”. Anderson (2022) documented a similar process in Canada. Sheriff *et al.* (2019) examined the process of effective co-creation of knowledge, and nine critical success factors on health issues were identified as shared power, strong leadership, shared vision, shared goals, willingness to take risks, cross-cultural connection, community empowerment, valuing Aboriginal knowledge, ongoing investment and adaptability. Hauser (2025) developed a pentagon model (orientation, collaboration, transformation, culture, innovation) to measure the level of co-creation.

Much of Indigenous knowledge, traditionally transmitted through oral traditions, remains poorly understood or insufficiently recognized by scientific approaches. An ethical approach to intercultural co-creation of knowledge requires greater recognition of oral forms of knowledge transmission such as storytelling, anecdotes, teasing, as well as the importance of cosmogony, spirituality, collective rights, and the interdependence of tangible and non-tangible elements (Brooks and Renick, 2024). These considerations reinforce the importance of Indigenous knowledge holders not merely participating in, but leading and shaping, intercultural processes of knowledge co-creation..

Reflecting on the first United Nations Decade of Indigenous Peoples (1995-2004), the recognition of Indigenous Peoples' Rights, and understanding the need for cooperation between different ways of knowing to establish an interface between science and Indigenous knowledges, Durie (2004b) proposed four principles for the cooperation between science and Indigenous knowledge: mutual respect, shared benefits, human dignity and discovery. Chastin *et al.* (2015) In a survey of academics identified ten fundamental values: open access, recognized contribution, ethics and legal, transparency, rigorous evaluation, clear problem, plural evidence, critical reflection, diversity and structured and flexible processes.

These contributions provide a foundation for developing a shared set of values and principles to guide intercultural co-creation of knowledge. Such principles should be developed collaboratively by a diverse group representing different cultures, disciplines, generations, genders, and institutions, with Indigenous knowledge holders playing a central role in defining them. Rather than establishing a universal framework, the objective would be to identify common principles that can be adapted to different cultural and regional contexts while respecting Indigenous Peoples' rights, knowledge systems, and priorities.

#### 5.4 Bridging science with Indigenous Peoples' ways of knowing

## 5.5. Bridging scientific tradition with Indigenous Peoples' ways of knowing

Efforts to bridge science and Indigenous ways of knowing have revealed persistent power imbalances and challenges related to trust on the one hand and recognition and respect on the other, whereby Indigenous knowledge is undervalued (CCA, 2026; Årleskog *et al.*, 2021; Lauter, 2023; Vincent *et al.*, 2020; Verloigne, 2025; Nelson *et al.*, 2024). For example, Indigenous knowledge research in Africa has been marginalized and treated as unsubstantiated (Malapane *et al.*, 2022). In addressing the question, whose knowledge counts? Indigenous knowledge systems are regarded as “unscientific” when evaluated against traditional hierarchies of evidence and rated at the bottom of the quality scale (Milbank *et al.*, 2021).

Durie (2004a) argues that debates over the validity of different knowledge systems can divert attention from exploring how they interact and complement one another. Indigenous knowledge systems and scientific approaches cannot be validated solely through each other's standards, as they are grounded in different philosophies, methodologies and criteria for establishing knowledge. In Malawi, Kita (2025) highlights how institutional privilege and distrust of scientists can undermine the transmission and continued use of Indigenous knowledge related to climate early warning systems. This raises broader questions about the recognition of Indigenous knowledge systems as sciences in their own right. Sahai (2013) argues that Indigenous knowledge developed, tested, and refined over millennia constitutes a form of science that cannot be overlooked, especially in developing countries. Stein *et al.* (2024) further examine how colonial patterns and power relations continue to shape interactions between conventional and Indigenous sciences.

The Special Rapporteur on the rights of Indigenous Peoples published the report A/HRC/51/28 on Indigenous women and the development, application, preservation and transmission of scientific and technical knowledge (2022). The report recommends the use of “scientific and technical knowledge” when referring to Indigenous Peoples' knowledge, to avoid terms that have historically devalued it.

Merçon (2025) moves the discussion toward the value of different ontologies, while Brock *et al.* (2024) argue that Indigenous ways of knowing can help to fill the gaps in food system decision-making.

Developing an intercultural approach to knowledge co-creation requires recognizing the different philosophies, methodologies, and cultural contexts through which knowledge is generated, interpreted, and transmitted. Ijatuyi *et al.* (2025) emphasize the need for approaches that are sensitive to cultural differences and recognize the social and spiritual dimensions of Indigenous knowledge systems. One possible framework for facilitating dialogue between different ways of knowing is to examine four interrelated dimensions of knowledge creation: 1. Concepts; 2. Methodologies and methods; 3. Analysis; and 4. Synthesis. These dimensions provide a starting point for exploring how knowledge is created within different systems, without assuming that all follow the same processes or criteria. Science itself encompasses diverse epistemological and methodological approaches, and there is no single scientific method through which knowledge is produced. Similarly, Indigenous knowledge systems have their own foundations, methods, and ways of establishing and transmitting knowledge, which must be understood on their own terms. Different approaches to bringing knowledge systems into dialogue have been described as “bridging” (Mistry and Berardi, 2016), “braiding” (Edgar Webkamigad *et al.*, 2026), and “weaving” (Tengö *et al.*, 2017; Ban *et al.*, 2026).

**Concepts.** Concepts are central to the ways knowledge is developed, communicated, and applied. They are embedded in language, culture, worldviews, and relationships with the natural and social environment. Language

is particularly important because it carries knowledge, values, beliefs, and traditions across generations (UNPFII, 2016)

Indigenous languages express concepts that may not have direct equivalents in Western scientific terminology and whose meanings cannot always be captured through translation alone. Understanding these concepts therefore requires attention to their cultural, historical, social, and spiritual dimensions. Aboukakrine *et al.* (2025), for example, illustrate how concepts shape knowledge and practices. Among the Yucatec Maya, Rosado-May and Poot Cahun (2020) examined ecological concepts expressed in the Maya language and their relationship with concepts used in ecology, including dynamic equilibrium, ecological niches, competition, carrying capacity, sustainability and the ecosystem. Their work shows how Indigenous concepts inform the management of agricultural systems such as the Milpa and reflect understandings of ecological relationships developed through generations of observation and experience. While some of these concepts have parallels in ecology, their meanings are embedded in Maya language, culture, and worldview. Another example comes from Karen communities in Myanmar, where the concept of Ma Doh Ma Kha, meaning "you help me, I help you," expresses principles of reciprocity that shape social relationships and collective approaches to food sovereignty. Suhardiman *et al.* (2025) describe how this concept underpins community institutions, including rice banks, and connects contemporary food sovereignty initiatives with longstanding cultural values, customary governance, and rotational farming practices. This example illustrates how Indigenous concepts extend beyond ecological knowledge to encompass social organization, collective responsibilities, and relationships within the community.

A further illustration is provided by alder-based shifting cultivation systems in Nagaland, India, where the management of *Alnus nepalensis*, within traditional agricultural systems reflects detailed knowledge of ecological processes and soil fertility. Comparisons between alder-based and conventional shifting cultivation have shown higher soil organic carbon, available nitrogen, and microbial biomass in alder-based systems (Kalidas Singh *et al.*, 2021). Scientific approaches can help explain some of the biological processes involved, including nitrogen fixation, while Indigenous agricultural knowledge reflects generations of observation, experimentation, and adaptation to local environmental conditions. This example illustrates how different knowledge systems can contribute complementary explanations and understandings of the same agricultural practice, without one needing to validate the other.

These examples demonstrate that Indigenous knowledge systems have developed concepts that may converge with those used in scientific approaches, while others express distinct understandings of relationships, responsibilities, and the environment.

**Methods and methodologies.** Just as concepts are embedded in particular cultural and epistemological contexts, the methods used to generate and transmit knowledge reflect different ways of understanding the world. Methodology refers to the broader principles and approaches that guide knowledge creation, whereas methods are the specific tools, practices, and techniques used within these approaches (Harvey *et al.*, 2023). Indigenous Peoples have developed and maintained their own methodologies and methods for knowledge creation, although these have often been marginalized or insufficiently recognized.

Indigenous research methodologies are grounded in Indigenous ontologies, epistemologies, and values, and cannot be understood simply as adaptations of scientific research approaches. Wilson (2001) emphasizes relationality as a fundamental principle, whereby knowledge is understood through relationships among people, communities, the natural environment, and creation. Research therefore entails responsibilities toward these relationships, rather than focusing exclusively on the production of knowledge. Smith (2005) highlights the importance of decolonizing research methodologies by challenging the historical dominance of Western research

practices and restoring Indigenous Peoples' authority over knowledge creation. Chilisa (2020) further demonstrates that qualitative, quantitative, and mixed methods can be employed within Indigenous methodologies when they are grounded in Indigenous worldviews, values, and priorities. The distinction is therefore not necessarily in the research techniques themselves, but in the principles guiding their use, interpretation, and governance.

Indigenous knowledge systems employ diverse methods for generating, testing, transmitting, and sharing knowledge. These methods are embedded in specific cultural contexts and guided by relationships, responsibilities, and community protocols. Storytelling, for example, is a key Indigenous research method through which knowledge, values, relationships, and responsibilities are transmitted, interpreted, and renewed (Kovach, 2021; Archibald Q'um Q'um Xi'em, 2018). To help their researchers better understand and engage with Indigenous methodologies, some universities have developed guidance describing Indigenous research principles, methods, and practices. The University of Northern British Columbia (2025) emphasizes relationality, respect, relevance, reciprocity, responsibility, holism, storytelling, self-determination, and cyclical learning, listing methods like storytelling, oral histories, talking circles, ceremonial methods, participant observation, land-based methods, language/concepts, artistic practices, relational interviewing, and community-guided research. The University of Alberta (2025) defines Indigenous research methodology as research by and for Indigenous Peoples, using their traditions and knowledges (Evans *et al.*, 2008), recognizing methods such as storytelling, personal reflection, visiting, sharing circles, ceremony, art, and dance. Kirkness and Barnhardt (2001) proposed the 4Rs (respect, relevance, reciprocity, responsibility), which guide research with Indigenous Peoples.

A concrete example comes from the Yucatec Maya, whose method of “*tsikbal*” illustrates a culturally grounded process of knowledge creation and transmission involving conversation, body language, observation, trials, measurement, and discussion with others. Rosado-May *et al.* (2025c) describe how *tsikbal* supports the transmission and development of agricultural knowledge among Maya farmers and contributes to the continuity of traditional food systems. This example demonstrates how knowledge can be generated through processes that combine observation, practice, dialogue, and collective learning, supporting scientific integration .

Approaches to intercultural co-creation can draw on these different methodological traditions while recognizing their distinct foundations. One example is Etuaptmumk, or Two-Eyed Seeing, a guiding principle originating in Mi'kmaw knowledge and introduced to academic research by Mi'kmaw Elders Albert and Murdena Marshall in collaboration with Cheryl Bartlett (Bartlett *et al.*, 2012). It emphasizes learning from the strengths of both Indigenous and other ways of knowing for mutual benefit, without requiring either to be subordinated to the other. Rather than prescribing specific research methods, Two-Eyed Seeing provides guidance for respectful dialogue, co-learning, and collaboration. Its application must nevertheless recognize the distinct origins of the principle and the importance of Indigenous leadership in determining how it is used.

**Analysis.** Within Indigenous knowledge systems, analysis is grounded in cultural values, relationships, worldviews, and knowledge accumulated across generations. Analysis may combine direct observation, practical experience, collective reflection, and understandings of relationships among people, other living beings, and the environment. Its purpose extends beyond interpreting information to guiding decisions, practices, and responsibilities within communities and their territories (Ijatuyi *et al.*, 2025) An example comes from the (the Yucatec Maya, where the concept of “error” is absent; knowledge and innovation stem from experience accumulation. Their language conflates searching and finding, reflecting a continuous process (Rosado-May *et al.*, 2020, 2025b).

Data management and interpretation are sensitive to the cultural context in which it is generated.. Sharakhmatova (2025) drawing on four case studies involving Indigenous Peoples of the Kamchatka peninsula, Russian Federation. Including Koryaks, Itelmens, Evens, Kamchadals, and Aleuts, examines the documentation, protection, and management of Indigenous Peoples' knowledge. The study highlights the importance of understanding how knowledge is defined, organized, interpreted, and transmitted within Indigenous communities, including the relationships between knowledge, cultural identity, and territory. These considerations are particularly important when Indigenous knowledge is documented or analyzed through research approaches developed outside the communities concerned.

**Synthesis.** Synthesis involves bringing together knowledge, observations, experiences, and interpretations to develop broader understandings that can guide decisions and practices. Within Indigenous knowledge systems, it can draw on collective experience, long-term observation, cultural values, spirituality, and relationships with territory and the natural environment. An illustration comes from the BaTonga People in Zimbabwe, whose knowledge of seasonal and weather patterns brings together observations of environmental conditions and accumulated experience to anticipate changes and guide agricultural practices. Siambombe *et al.* (2018) describe how this knowledge contributes to decisions about farming, food security, and responses to environmental uncertainty. Such practices illustrate how different observations and experiences can be brought together into understandings that inform collective decisions and adaptation to changing conditions.

Indigenous food systems offer particularly relevant examples of synthesis. Developed and adapted over generations, they bring together knowledge of biodiversity, ecological relationships, soils, water, climate, food production, harvesting, and conservation, as well as cultural values, social organization, spirituality, and responsibilities toward the environment. These different dimensions are often closely interconnected rather than treated as separate fields of knowledge. Agricultural practices and food-system governance can therefore be understood as expressions of accumulated and continuously evolving knowledge.

Research on biodiversity conservation further illustrates the importance of Indigenous territorial governance and management. Dawson *et al.* (2021) and Schuster *et al.* (2019) highlight the contributions of Indigenous Peoples and their territories to biodiversity conservation. These findings underscore the value of Indigenous stewardship and decision-making, although conservation outcomes alone do not explain how knowledge is analyzed or synthesized within specific communities. Understanding these processes requires engagement with Indigenous knowledge holders and recognition of the ecological, cultural, and social dimensions that inform their decisions.

Synthesis can also occur through intercultural research, where insights from different knowledge systems contribute to a shared question without necessarily being combined into a single explanation. Govorchin *et al.* (2025), for example, describe the use of Two-Eyed Seeing in a knowledge synthesis process combining Indigenous storytelling and Western scoping-review methods to examine Indigenous approaches to harm reduction in Canada. This illustrates how different approaches can contribute to knowledge synthesis while maintaining their distinct foundations and forms of interpretation. Importantly, synthesis undertaken within Indigenous knowledge systems should be distinguished from academic syntheses conducted about Indigenous knowledge, since the latter do not necessarily reflect Indigenous processes of knowledge creation.

For the purposes of this chapter, synthesis within Indigenous knowledge systems can be understood as a process through which accumulated observations, experiences, collective knowledge, values, and relationships with people and territory are brought together to develop understandings that guide practices, decisions, and the transmission of knowledge across generations. This is a provisional description rather than a universal definition, recognizing that Indigenous Peoples have their own ways of understanding and expressing these processes.

Indigenous food systems provide living examples of how such knowledge is generated, maintained, and adapted. Some Indigenous-managed agricultural heritage systems recognized under FAO's Globally Important Agricultural Heritage Systems (GIAHS) programme illustrate the relationships between ecological knowledge, agricultural practices, biodiversity, and cultural heritage (FAO, 2025). At the same time, the disruption of Indigenous food systems through colonization, dispossession, environmental degradation, and restrictions on access to territories can affect not only practices and resources but also the processes through which knowledge is created and transmitted (Bergström, 2021; Fernández-Llamazares *et al.*, 2021; Malapane *et al.*, 2024; Reyes-García *et al.*, 2013). Supporting the continuity and revitalization of these systems therefore requires respect for Indigenous Peoples' rights, knowledge systems, cultural practices, and relationships with their territories.

**Bridging science and Indigenous Peoples' ways of knowing, a model.** The literature reviewed and discussions on concepts, methods and methodologies, analysis and synthesis demonstrate that bridges can be built between science and Indigenous Peoples' ways of knowing through the four components, to co-create knowledge. Figure 5.1 represents a model to express the idea of bridges.

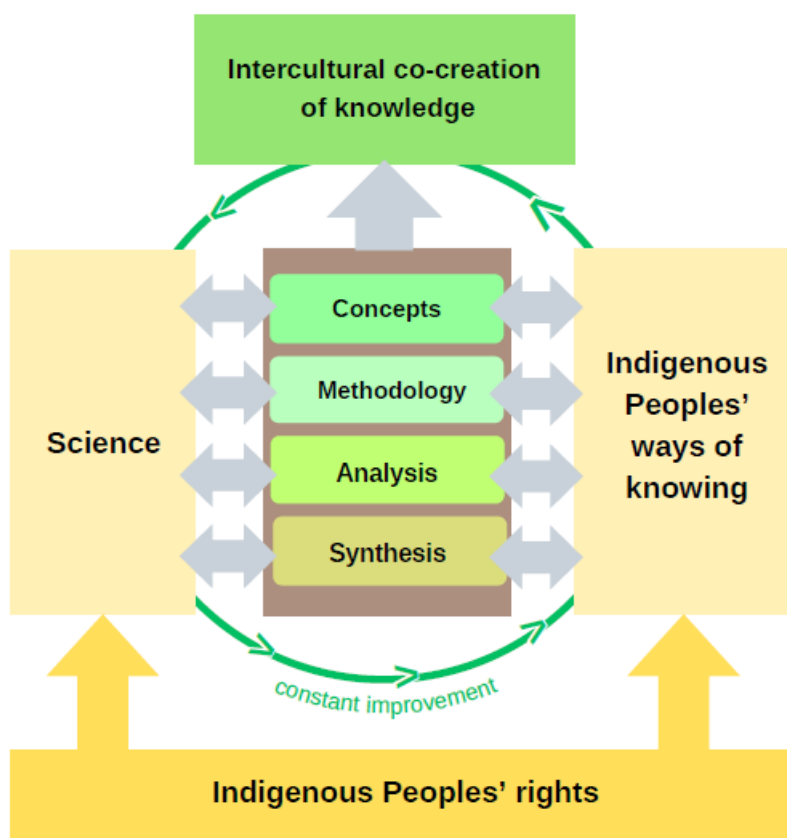


**Figure 5.1. Model representing how to bridge four critical elements for knowledge co-creation between science and Indigenous Peoples' ways of knowing. Indigenous Peoples' rights are the foundation.**

Source: based on Rosado-May, F.J. (2024)

## 5.5 Articulating knowledge-policy interface, principles and values, and bridging science with Indigenous Peoples' ways of knowing

Although knowledge co-creation has received significant attention over the last two decades, its definition and methodologies remain diverse (Mbah and Ezegwu, 2025). There is a paucity of papers on co-creation authored by Indigenous authors, although Indigenous knowledges are cited. Approaches described as bridging, braiding, or weaving knowledge systems offer different ways of facilitating dialogue and collaboration. However, these processes must address the historical power imbalances between Indigenous Peoples and scientific institutions, including the continued underrepresentation of Indigenous knowledge holders in defining research priorities, methodologies, and interpretations. This section presents a framework for co-creation of intercultural knowledge and identifies research gaps. The key elements are shown in Figure 5.2.

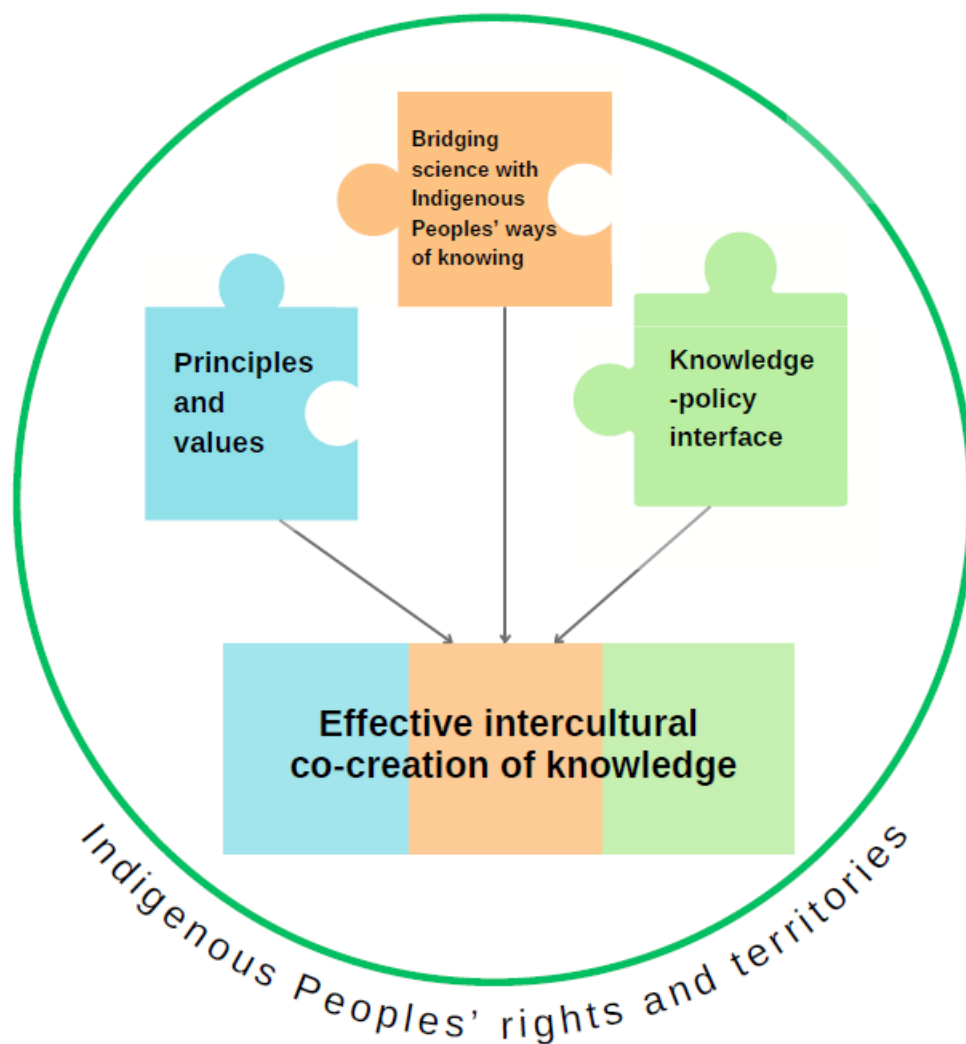


**Fig. 5.2. Conditions supporting equitable intercultural knowledge co-creation.** The three intersecting circles represent governance of the knowledge–policy interface, mutually agreed principles and values, and dialogue across knowledge systems. Their intersection identifies conditions that can support co-creation where Indigenous Peoples choose to participate. The surrounding circle emphasizes that

Indigenous Peoples' rights and self-determination must guide the process. Co-creation does not require the convergence of knowledge systems or the transfer of authority over Indigenous knowledge. Source: Adapted from a framework developed by F. J. Rosado-May (2025), with modifications by the report authors.

The knowledge that Indigenous Peoples could bring to the process of co-creation is the result of Indigenous ways of knowing. However, these ways of knowing and the knowledge system or systems that emerge, have not received enough attention. Indigenous Peoples are losing knowledge as knowledge holders pass away and the transmission of knowledge to new generations is disrupted. Unless this challenge is addressed, processes of knowledge co-creation will no longer have Indigenous knowledge holders take part in them.

Co-creation is not the incorporation of Indigenous knowledge into scientific frameworks or the requirement for convergence of knowledge systems. It is a space where Indigenous Peoples who want to participate can have a dialog and learn from each other and where their rights, values and priorities are respected. Different knowledge systems can complement each other but not necessarily lead to a single or unified understandings.

Indigenous Peoples are rights holders over their systems of knowledge. They are not obliged to co-produce, co-create, nor to share their knowledge nor to authorize its interpretation and use. Strengthening Indigenous knowledge systems requires recognition of Indigenous sciences on their own terms, protection of territorial and collective rights and support for self-determination and governance (CSIPM, 2026).

In settings where co-creation is sought, fair processes require agreed principles and values, appropriate governance arrangements and mechanisms to ensure Indigenous leadership and meaningful participation (CCA, 2026). Research questions, methods, interpretation, access and use of results should be determined in accordance with the rights and protocols of the Indigenous Peoples concerned. Digital technologies create both opportunities and risks. They can help to document and transmit knowledge, but they can also entail appropriation or sharing without authorization. The CARE Principles for Indigenous Data Governance - Collective Benefit, Authority to Control, Responsibility and Ethics - provide important guidance (Carroll et al., 2020).

An effective knowledge–policy interface must go beyond incorporating Indigenous knowledge into existing frameworks. It should enable Indigenous Peoples to influence how problems are defined, what evidence is considered, how decisions are made, and how policies are evaluated. Co-creation does not have to serve policy objectives - it may also support cultural revitalisation, intergenerational learning, territorial governance and food sovereignty.

Figure 5.2 illustrates three conditions for intercultural co-creation: governance of the knowledge–policy interface, mutually agreed principles and values, and dialogue across knowledge systems. This does not imply that knowledge systems must converge or that all knowledge must be shared. Indigenous Peoples' rights and self-determination provide the overarching foundation.

Participation in intercultural research cannot sustain indigenous knowledge systems finally. Despite histories of colonialism and ongoing pressures, Indigenous Peoples continue to sustain and revitalize their knowledge systems. That includes recognition of their rights, protection of their lands and languages, and enabling Indigenous-led knowledge creation and transmission.”

## Chapter 6. Global outlook on Indigenous Peoples' food systems and future food systems

### Key messages:

- A qualitative scenario method looks at how Indigenous Peoples' food systems might evolve to 2035–2040. These pathways show how current governance choices, polycrises, and structural drivers could either make things worse or open space for change.
- The business-as-usual (BAU) scenario keeps deepening the usual risks: territorial fragmentation, climate change, biodiversity loss, extractive expansion, land grabbing, financialization of land and nature, market dependency, policy fragmentation, and weak recognition of Indigenous governance.
- Under BAU, IPFS will probably survive in more constrained, hybrid and externally controlled forms: less autonomy, less biocultural diversity, erosion of knowledge, simpler diets, weaker reciprocity networks, and more vulnerability to shocks.
- A transformative trajectory envisages that unequal power, rights, resources and capabilities are redressed through restoration of territorial rights, collective governance, secure land and water access, effective FPIC, knowledge co-creation and recognition of Indigenous Peoples' decision-making authority. This leads to greater climate resilience, democratized governance, territorial reconstitution and biocultural regeneration.
- Strengthening IPFS is both an obligation to guarantee IP rights, and a strategic move for future food systems' transformation. It needs policies that align global food agendas with Indigenous priorities for sustainability, resilience and equity.

### 6.1 Introduction

As outlined in previous chapters, Indigenous Peoples' food systems are guided by intergenerational responsibility and reciprocal obligations between humans and the natural world. The Mi'kmaw concept of Netukulimk captures this nexus (UNIR, 2020; M'sit No'kmaq *et al.*, 2021). Yet external drivers are eroding the structural foundations of these systems, affecting all dimensions of food security and nutrition. This chapter explores the opportunity for these foundations to be strengthened or weakened in alternative futures. In Canada, colonial rations brought flour, sugar and into many First Nations diets. Bannock, for example, became incorporated into many Indigenous food traditions. Sometimes called the “five white gifts,” these foods contributed to changing dietary practices and understandings of what constituted Indigenous or traditional food, including among Haudenosaunee communities in southern Ontario (Gordon, Lickers Xavier and Tait Neufeld, 2018; Hanemaayer *et al.*, 2020). Indigenous Peoples' food systems are diverse and dynamic, incorporating new foods and practices while maintaining cultural identity (Ahmed *et al.*, 2022; Shafiee *et al.*, 2022; Phillip & Skinner, 2022).

This chapter looks towards 2035–2040, a medium-term horizon that allows the cumulative effects of governance choices, polycrises and ecological pressures to become visible (HLPE, 2025). It uses a qualitative, contrastive scenario methodology, business as usual (BAU) and transformative, for exploring the structural implications of current choices. For example, for Indigenous Peoples living in low-lying coastal and island territories, sea-level rise already threatens livelihoods, food systems and territorial continuity. 6.2 Outlook for Indigenous Peoples' food systems: business-as-usual and transformative scenarios

The scenarios are presented as analytical pathways, not predictions. They are based on evidence from the literature and on existing frameworks (Millennium Ecosystem Assessment, 2003; IPBES, 2016) to portray how governance, territorial rights and responses to shocks could shape the future of IPFS. Thus, the scenarios

provide a structured way of making the diversity, drivers and possible trajectories of Indigenous Peoples' food systems more accessible to readers and decision-makers who may be less familiar with these systems.

BAU is a business as usual scenario. HLPE (2025) observes that food systems are facing growing pressures due to interconnected causes. For Indigenous Peoples, food insecurity derives from territorial fragmentation, governance gaps, ecological decline, loss of knowledge and values, and market dependency. The BAU scenario worsens these trends: less territorial integrity, less biocultural diversity, weaker governance and more fragile food systems. Some IPFS may face greater constraints, reduced autonomy and increased vulnerability, although trajectories will differ across contexts.

Transformative scenarios are based on Equitably Transformative Resilience (ETR) (HLPE, 2025), which means correcting unequal power, rights and resources. If territorial rights are strengthened, collective governance recognized and biocultural systems supported, IPFS could gain greater recognition and support as socioecological systems by 2035–2040. Territorial recovery and biocultural regeneration can support intergenerational food security and contribute to wider food system transformation. Food security in IPFS is grounded on territorial, cultural and collective dimensions, as discussed in the previous chapters. This chapter contrasts these two trajectories: business as usual and transformative, to show what is at stake and how IPFS can help enable more equitable and sustainable food futures.

The scenarios draw on the interacting pressures identified in Chapters 2 and 4, as well as recurring patterns of disruption, adaptation and resilience across the case studies presented in Chapter 2. They explore how these pressures may deepen existing vulnerabilities under BAU or how strengthened Indigenous territorial rights, governance and food systems may support transformative pathways.

### 6.3 Scenario trajectories

Scenario-building is therefore organized around two analytically distinct trajectories within a 2035–2040 horizon:

#### **Scenario 1: Business-as-usual trajectory**

The business as usual trajectory assumes continuation of current policies and practices such as territorial encroachment. Indigenous Peoples' food systems persist but become more constrained and hybrid, with less biocultural diversity, eroded knowledge and reduced autonomy (Figure 6.1).

This trajectory is characterized by five trends:

- *Intensifying climate change increases systemic risks* : Extreme events, loss of biodiversity, and degradation of ecosystems disrupt food systems. There are limited adaptation and unequal access, communities are on the edge. Climate policies without rights safeguards can also harm Indigenous territories and food systems.
- *Power concentration in food systems intensifies systemic vulnerabilities*: Corporate, financial and political power centralizes production, trade and decisions. Extractive development, poor land governance and dependence on unfair markets work together to undermine Indigenous agency and heighten shock vulnerability.
- *Territorial fragmentation and ecological fragility*: Expansion of corporate-led extractive industries can lead to territorial loss as can the effects of climate change. Under BAU, ecological instability becomes chronic, forcing more reliance on external inputs, wage labour or food aid.
- *Dietary simplification, nutrition transition and market dependence*: Market integration expands as local food infrastructures erode, and dietary diversity can decline.

- *Institutionalization of external governance*: State agencies, NGOs and corporations gain more control over decisions.

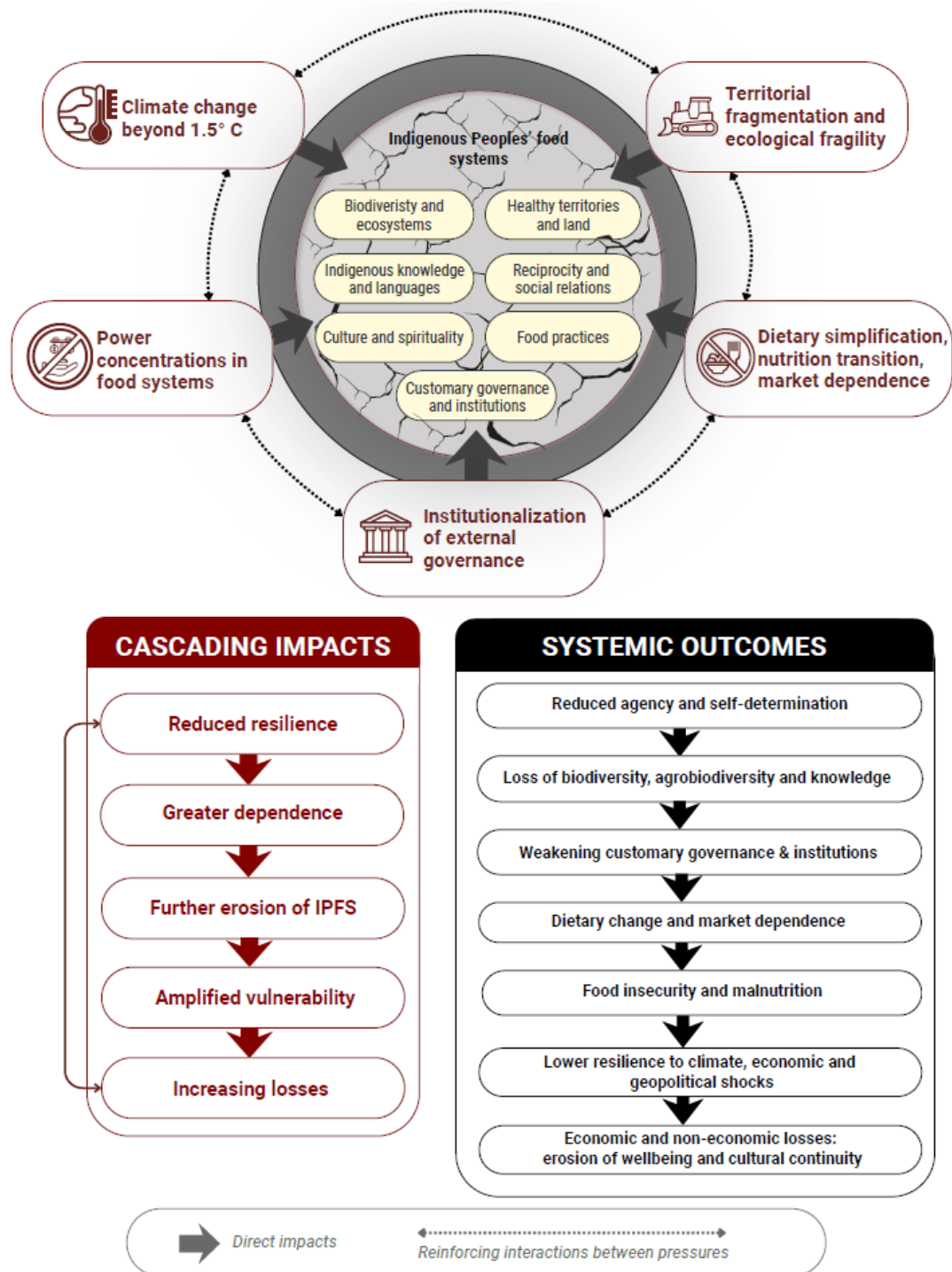


Figure 6.1 Indigenous Peoples' food systems under a business-as-usual scenario using climate change, governance, territorial rights, nutrition, and power systems as key attributes to envision the future of IPFS.

Source: Authors' own elaboration.

## Scenario 2: Transformative trajectory

The transformative scenario fixes the root causes of vulnerability. It restores territorial rights, redistributes decision-making power, and recognizes Indigenous governance. By 2035–2040, IPFS will become recognized socioecological systems that sustain biodiversity, secure food supply, and contribute to overall wider food system transformation (Figure 6.2).

This trajectory is characterized by five trends:

- *Rights-based climate action strengthens resilience:* Rights-based adaptation, secure tenure and Indigenous governance reduce loss and damage. Mitigation projects go through FPIC, so renewables, restoration and carbon initiatives support IPFS instead of undermining them.
- *Democratized food systems governance strengthens equity and resilience:* Indigenous Peoples exercise greater decision-making authority over their food systems, with governments and other actors providing support where appropriate. Food security and resilience are based on strong territorial governance, diverse markets and the recognition of Indigenous knowledge.
- *Territorial reconstitution and Indigenous Peoples' governance:* Stronger governance and secure tenure allow food systems to be restored. Ecological restoration allows the food system to reconstitute itself.
- *Biocultural regeneration and diversified diets and food systems:* Transformative pathways support the regeneration of agrobiodiversity and multispecies food systems, strengthening IPFS diets and resilience.
- *Institutionalization of collective agency and knowledge co-creation:* Transformative trajectory redistributes decision-making authority in food systems. Governance interfaces strengthen local food systems and align policies with territorial production and co-creation.

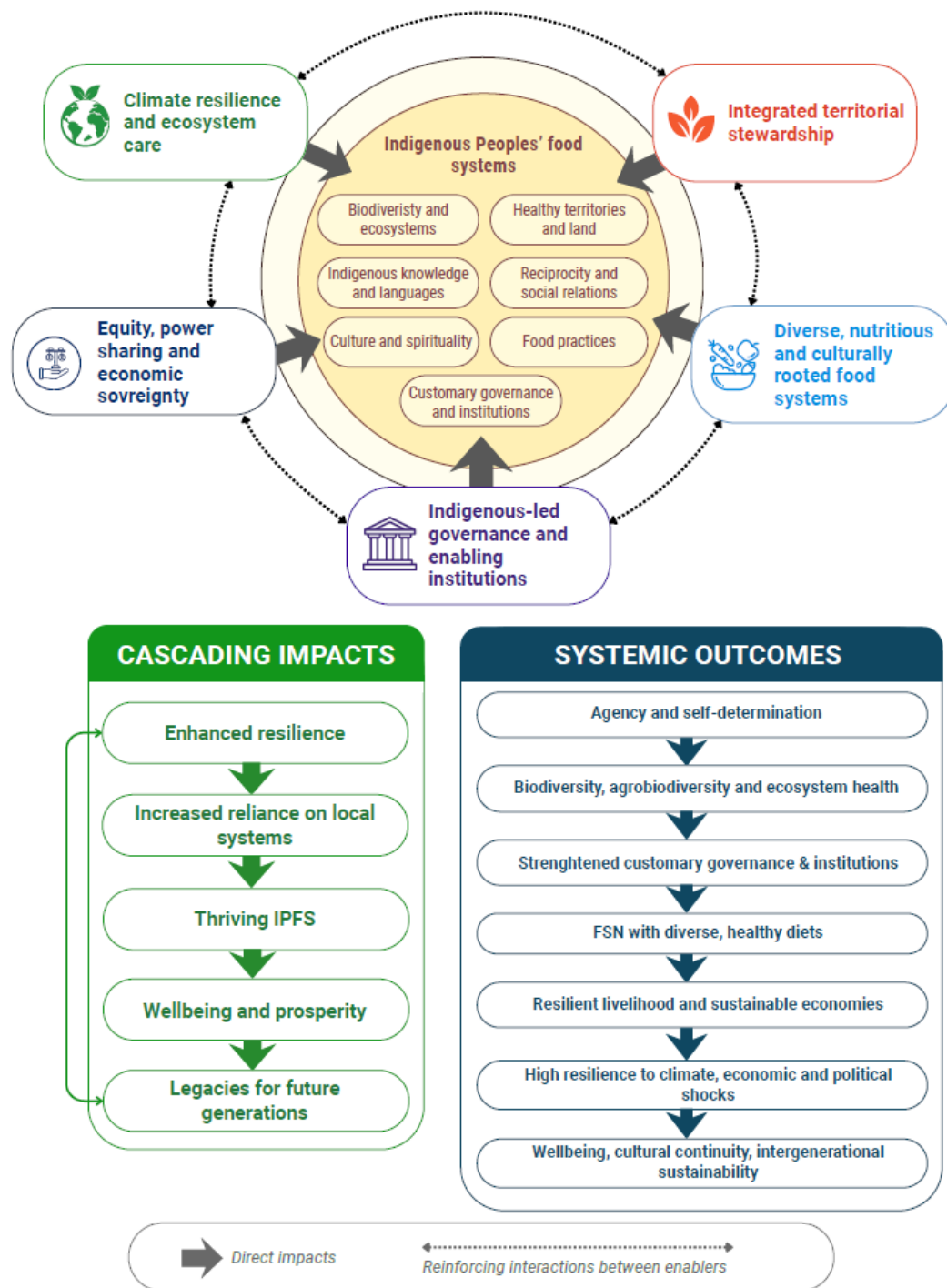


Figure 6.2. Indigenous Peoples' food systems under transformative scenario using climate change, governance, territorial rights, nutrition, and power systems as key attributes to envision their future  
Source: Authors' own elaboration.

#### Box 6.1. Indigenous-led ocean governance and climate resilience in the Bering Strait

The Indigenous Peoples of the Bering Strait (Iñupiaq, Central Yup'ik, St. Lawrence Island Yupik) demonstrate the link between Indigenous governance, food security, and resilience to climate change. The food system of these communities is maintained through fishing, hunting, gathering, and food-sharing networks that are enabled by seasonal mobility and stewardship (Behe, 2015; Raymond-Yakoubian and Daniel, 2018). The Alaskan Inuit Food Security Framework combines interdependent dimensions such as culture, decision-making and management with conventional food security. Indigenous food security relies equally on healthy ecosystems, secure territory, governance, knowledge and reciprocity (Behe, 2015).

Climate change, sea-ice loss, changing species, and weather variability upset all of this: These factors affect not just food but culture, knowledge, mobility and stewardship. Indigenous Peoples are developing their own approaches to ocean governance, drawing on Indigenous knowledge and, where appropriate, Western scientific approaches to support planning and adaptation (Raymond-Yakoubian and Daniel, 2018; Alaska Food Policy Council, 2022).

The case studies from Chapter 2 and the Bering Strait example show that moving from BAU to transformative pathways is possible when the right policies, support and tools are in place. Table 6.1 shows how IPFS produce different food security outcomes under different conditions. The contrast between BAU and transformative indicators provides the analytical foundation for the scenarios.

**Table 6.1. Illustrative characteristics of BAU and Transformative trajectories.**

| Indigenous People's food systems' indicators        | Business-as-usual trajectory                                     | Transformative trajectory                                                                   |
|-----------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| <b>Territorial integrity</b>                        | Fragmentation, dispossession, restricted access, insecure tenure | Recognized rights, restored access, secure tenure, stronger governance                      |
| <b>Biocultural food provisioning</b>                | Diets simplified, biodiversity loss, dependence on imports       | Diverse local diets, agrobiodiversity restored, Indigenous practices strengthened           |
| <b>Reciprocity-based food exchange</b>              | Sharing eroded, food monetized, reliance on aid                  | Reciprocity revived, collective exchange, solidarity networks                               |
| <b>Knowledge and intergenerational transmission</b> | Language and knowledge lost, diets homogenized                   | Knowledge revitalized, youth engaged, culturally grounded diets                             |
| <b>Community governance and self-determination</b>  | External control, weak participation, reduced decision-making    | Indigenous-led governance, co-management, effective free, prior and informed consent (FPIC) |
| <b>Moral-ecological stewardship</b>                 | Overextraction, degradation, broken cycles                       | Regenerative management, restored ecological functions                                      |
| <b>Relational values grounded in cosmology</b>      | Nature commodified, ceremonies and reciprocity weakened          | Relational values renewed, cultural continuity, reciprocal relations with nature            |

#### 6.4 Examples of business-as-usual and transformative scenarios

To show how the scenarios work in practice, the indicators from this chapter are applied to the case studies from Chapter 2 and the Bering Strait example (box 6.1). They show how trajectories can play out depending on territorial governance, biocultural diversity and Indigenous decision-making. Table 6.2 illustrates how structural conditions can either weaken or strengthen IPFS by 2035–2040.

**Table 6.2 Illustrative business-as-usual BA and transformative trajectories for selected Indigenous Peoples' food systems (2035–2040).**

| <b>Rio Negro (Brazil), Forest-based mosaic / territorial rooted</b><br>Forest-based mosaic food systems / territorial Rooted |                                                                         |                                                                               |
|------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| <b>Aspect</b>                                                                                                                | <b>Business as usual</b>                                                | <b>Transformative</b>                                                         |
| <b>Trend</b>                                                                                                                 | <i>Structural erosion toward fragmentation</i>                          | <i>Reinforced territorial rootedness and regeneration</i>                     |
| <b>Territorial integrity</b>                                                                                                 | Fragmentation from climate, mining, infrastructure                      | 1.5 °C pathway, recognized rights, restored connectivity                      |
| <b>Biocultural provisioning</b>                                                                                              | Diets simplified, biodiversity loss                                     | Resilient forest management, diversified systems                              |
| <b>Reciprocal exchange</b>                                                                                                   | Market penetration, unfair market access, end of collective labour      | Collective labour and reciprocity maintained                                  |
| <b>Knowledge and practices</b>                                                                                               | Shortened swidden cycles, knowledge loss                                | Revitalized intergenerational transmission                                    |
| <b>Community governance</b>                                                                                                  | External control, loss of autonomy                                      | Indigenous governance, free, prior and informed consent (FPIC), co-management |
| <b>Moral–ecological stewardship</b>                                                                                          | Degradation, reduced fallow                                             | Restored rotational cultivation, regeneration                                 |
| <b>Relational values</b>                                                                                                     | Cosmological relationships weakened                                     | Reciprocal relationships reinforced                                           |
| <b>Sámi (Norway, Sweden, Finland), Mobile herding / pressured</b><br>Mobile herding and pastoral food systems / pressured    |                                                                         |                                                                               |
| <b>Aspect</b>                                                                                                                | <b>Business as usual</b>                                                | <b>Transformative</b>                                                         |
| <b>Trend</b>                                                                                                                 | <i>Intensification of pressures and externally constrained mobility</i> | <i>Recovery, adaptation and strengthened resilience</i>                       |
| <b>Territorial integrity</b>                                                                                                 | Climate, mining, wind energy fragment routes                            | 1.5 °C pathway, Sámi rights, FPIC, migration corridors                        |
| <b>Biocultural provisioning</b>                                                                                              | Snow, pasture and productivity in decline                               | Adaptive herd management and grazing                                          |
| <b>Reciprocal exchange</b>                                                                                                   | Commercialisation, weakened support systems                             | Strengthened community cooperation                                            |
| <b>Knowledge and practices</b>                                                                                               | Disrupted mobility, loss of ecological knowledge                        | Youth engagement, intergenerational knowledge transmission                    |
| <b>Community governance</b>                                                                                                  | Limited participation, reduced authority                                | Co-governance, redistributed decision-making                                  |
| <b>Moral, ecological stewardship</b>                                                                                         | Disrupted ecological cycles                                             | Adaptive grazing, ecological resilience                                       |
| <b>Relational values</b>                                                                                                     | Weakened people-reindeer relationships                                  | Sámi cosmology reinforced                                                     |
| <b>Maasai (Kenya/Tanzania), Pastoral / reconfigured hybrid</b><br>Pastoral food systems / reconfigured hybrid                |                                                                         |                                                                               |
| <b>Aspect</b>                                                                                                                | <b>Business as usual</b>                                                | <b>Transformative</b>                                                         |
| <b>Trend</b>                                                                                                                 | <i>Transition toward fragmentation</i>                                  | <i>Regeneration and strengthened resilience</i>                               |
| <b>Territorial integrity</b>                                                                                                 | Droughts, privatization, enclosures reduce mobility                     | Restored corridors, communal tenure                                           |
| <b>Biocultural provisioning</b>                                                                                              | Milk and diversity decline, reliance on purchased food                  | Diversified pastoral systems, drought resilient                               |
| <b>Reciprocal exchange</b>                                                                                                   | Commercialization, weakened risk-sharing                                | Community networks, customary safety nets                                     |
| <b>Knowledge and practices</b>                                                                                               | Reduced mobility, disrupted knowledge                                   | Revitalized knowledge, intergenerational learning                             |

|                                                                                                                                              |                                                                              |                                                               |
|----------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|---------------------------------------------------------------|
| <b>Community governance</b>                                                                                                                  | Commons institutions lose authority                                          | Customary institutions regain authority                       |
| <b>Moral–ecological stewardship</b>                                                                                                          | Overgrazing, degradation                                                     | Rotational grazing, ecological restoration                    |
| <b>Relational values</b>                                                                                                                     | Livestock-rangeland-culture relationships weakened                           | Pastoral cosmologies guide stewardship                        |
| <b>Bali Aga (Indonesia), Customary agroforestry / reconfigured hybrid</b><br>Customary agroforestry food systems / reconfigured hybrid       |                                                                              |                                                               |
| <b>Aspect</b>                                                                                                                                | <b>Business as usual</b>                                                     | <b>Transformative</b>                                         |
| <b>Trend</b>                                                                                                                                 | <i>Deepening market dependence</i>                                           | <i>Culturally grounded hybrid resilience</i>                  |
| <b>Territorial integrity</b>                                                                                                                 | Tourism, commercial agriculture, external actors                             | Community governance, territorial autonomy                    |
| <b>Biocultural provisioning</b>                                                                                                              | Simplified systems, market dependence                                        | Diversified systems, climate resilience                       |
| <b>Reciprocal exchange</b>                                                                                                                   | Cash relations replace community exchange                                    | Community cooperation and reciprocity                         |
| <b>Knowledge and practices</b>                                                                                                               | Youth migration, loss of agroecological knowledge                            | Youth engagement, intergenerational transmission              |
| <b>Community governance</b>                                                                                                                  | External actors, economic interests replace customary governance             | Customary institutions guide adaptation and tourism           |
| <b>Moral–ecological stewardship</b>                                                                                                          | Intensification, simplified systems                                          | Multilayered agroforestry, soil and water conservation        |
| <b>Relational values</b>                                                                                                                     | Rituals and cosmology in decline                                             | Rituals and cosmology maintain identity                       |
| <b>Bering Strait (Alaska), Marine fisheries / territorial rooted</b><br>Marine fisheries and marine mammal food systems / territorial rooted |                                                                              |                                                               |
| <b>Aspect</b>                                                                                                                                | <b>Business as usual</b>                                                     | <b>Transformative</b>                                         |
| <b>Trend</b>                                                                                                                                 | <i>Marine food systems under increasing climate and governance pressures</i> | <i>Indigenous-led ocean governance and climate resilience</i> |
| <b>Territorial integrity</b>                                                                                                                 | Ice loss, shipping corridors, coastal development                            | 1.5 °C pathway, recognized marine rights, restored access     |
| <b>Biocultural provisioning</b>                                                                                                              | Reduced access to fish and marine mammals, reliance on imports               | Resilient fisheries and hunting, food-sharing systems         |
| <b>Reciprocal exchange</b>                                                                                                                   | Strained sharing networks                                                    | Strengthened sharing networks, community resilience           |
| <b>Knowledge and practices</b>                                                                                                               | Rapid environmental change, disrupted knowledge                              | Participatory monitoring, youth, co-production with science   |
| <b>Community governance</b>                                                                                                                  | Federal control, limited Indigenous decision-making                          | Indigenous-led ocean governance, co-management, FPIC          |
| <b>Moral–ecological stewardship</b>                                                                                                          | Cumulative pressures, reduced resilience                                     | Adaptive marine management, long-term conservation            |
| <b>Relational values</b>                                                                                                                     | Cultural and spiritual relationships difficult to sustain                    | Reciprocal relationships with marine ecosystems               |



The illustrative trajectories in Table 6.2 highlight recurring pressures across different Indigenous Peoples' food systems. Extractive industries and privatization of natural resources restrict Indigenous Peoples' mobility, shorten ecological cycles and weaken territorial foundations. While access to markets can provide a source of staples and other essential foods, exposure to unfair markets can reduce dietary diversity. Indigenous authority is often undermined as governance shifts to external actors (states, markets, corporations) and such a shift may result in the erosion of biocultural diversity, weakened knowledge transmission and increased vulnerability of food systems to climate, economic and political shocks.

Transformative pathways are possible when structural foundations are strengthened. Three processes recur: recognition of territorial governance, regeneration of biocultural diversity, and institutionalization of collective agency. Secure territorial rights sustain ecological cycles, adaptation, and mobility. Indigenous knowledge such as seed saving, pastoral movement and agroecology keeps biodiversity and resilience going. When governance recognizes Indigenous institutions, food systems can be run through local knowledge, cultural values and community norms

The future of IPFS is not a question of technology or productivity but of the interaction of governance, knowledge, institutions, and ecology. Indigenous Peoples' food systems are complex socioecological systems. When conditions support them, they deliver food security, biodiversity, and climate resilience. When conditions are such that they undermine them, food insecurity and degradation worsen. The choice between BAU and transformative pathways is political and institutional. Strengthening Indigenous governance and biocultural food systems benefits Indigenous Peoples and contributes toward sustainability, resilience and equity.

### 6.5 Policy recommendations for promoting transformative pathways in Indigenous Peoples' food systems

The analysis shows that transformative pathways need the right structural conditions, territorial governance, biocultural diversity and Indigenous agency. Based on the scenarios, the following strategic recommendations can help move towards more resilient and equitable IPFS and avoid BAU. They are summarized in Table 6.3:

**Table 6.3 Policy recommendations for transformation of Indigenous Peoples' food systems towards equitable, self-governed, rights-based and sustainable food systems**

| Recommendation                                                          | Key actors                                                                                              | Specific actions                                                                                                                                           | Mechanisms                                                                      |
|-------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| <b>1. Secure Indigenous territorial rights and governance authority</b> | Governments, and global institutions (e.g. Green Climate Fund [GCF], Global Environment Facility [GEF]) | Legally recognise collective land, water and marine tenure rights; implement binding free, informed and prior consent (FPIC); fund demarcation and titling | Legislative reform, dedicated funding streams, FPIC as precondition for funding |
| <b>2. Support Indigenous biocultural food</b>                           | Governments (agriculture,                                                                               | Integrate Indigenous foods into public procurement, with the agreement of Indigenous Peoples                                                               | Public procurement policies, subsidy                                            |

| <b>Recommendation</b>                                                                         | <b>Key actors</b>                                                                                                                                                                                                     | <b>Specific actions</b>                                                                                                                                                                                                                                                                                                                                            | <b>Mechanisms</b>                                                                                                        |
|-----------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| <b>systems and territorial economies</b>                                                      | environment), donors                                                                                                                                                                                                  | and according to their priorities;; redirect agricultural subsidies to agrobiodiversity; invest in Indigenous-led value chains                                                                                                                                                                                                                                     | reform, donor investment frameworks                                                                                      |
| <b>3. Enable Indigenous-led knowledge systems through co-creation and shared governance</b>   | Research institutions, universities, High-Level Panel of Experts on Food Security and Nutrition (HLPE, FSN)                                                                                                           | Support Indigenous-led research protocols; apply FPIC and context-specific data sovereignty principles (such as First Nation's Ownership, Control, Access and Possession [OCAP], Collective Benefit, Authority to Control, Responsibility and Ethics [CARE]); establish ethical guidelines; co-creation only when and how Indigenous Peoples decide to participate | Research funding conditions, institutional protocols, HLPE-FSN guidelines                                                |
| <b>4. Align global food system transformation agendas with Indigenous Peoples' priorities</b> | Committee on World Food Security (CFS), United Nations Framework Convention on Climate Change (UNFCCC), Convention on Biological Diversity (CBD), United Nations Convention to Combat Desertification (UNCCD), States | Include IPFS indicators in nationally determined contributions (NDCs), National Adaptation Plans (NAPs) and National Biodiversity Strategies and Action Plans (NBSAPs); ensure Indigenous representation in CFS and Rio Conventions' COPs)                                                                                                                         | Multilateral negotiations, national reporting frameworks, CFS governance                                                 |
| <b>5. Strengthen climate resilience of Indigenous Peoples' food systems</b>                   | States, UNFCCC parties                                                                                                                                                                                                | Support Indigenous, led, rights, based adaptation; assess and address climate change impacts and both economic and non-economic loss and damage affecting Indigenous Peoples' food systems.                                                                                                                                                                        | National climate governance frameworks, climate finance mechanisms, participatory monitoring systems and FPIC safeguards |

While the recommendations above identify strategic priorities and implementation targets, their effectiveness only works if they are turned into national policies and practice. Transforming IPFS is not just about new programmes; it also means adapting institutions, regulations and governance to Indigenous realities. The box below shows two examples: CATRAPOVOS in the Brazilian Amazon and Ka Ora, Ka Ako in Aotearoa New Zealand. They illustrate practical institutional changes that can be adapted elsewhere.

### **Box 6.2 Institutional pathways for Indigenizing school feeding programmes: lessons from the Brazilian Amazon and Aotearoa New Zealand**

School feeding can be harnessed as an instrument for food system transformation when adapted to Indigenous food systems. Two examples illustrate different pathways: CATRAPOVOS in the Brazilian Amazon and Ka Ora, Ka Ako in Aotearoa New Zealand (Dey, 2025). In Brazil, CATRAPOVOS helped adapt the implementation of the National School Feeding Programme (PNAE) to facilitate the procurement of traditional foods from Indigenous Peoples and other traditional communities. Indigenous producers had been left out for years (FNDE, 2023; MPF, 2017, 2020). CATRAPOVOS set up a permanent governance structure that brought different institutions together, recognized Indigenous food systems, adjusted sanitary rules to fit traditional practices, and let schools buy food directly from Indigenous territories (Rocha *et al.*, 2024). In Aotearoa, Ka Ora, Ka Ako charted a different course. It is a targeted school feeding programme that includes Indigenous participation through partnerships with iwi and hapū and Māori food providers. Through local procurement, partnerships with iwi and hapū, Māori food providers and Māori-led research, the programme brought mātauranga Māori and territorial food systems into national policy. It also improved child nutrition, cut food insecurity, and boosted regional food economies (Garton *et al.*, 2023; Railton *et al.*, 2026). Although these initiatives followed different institutional trajectories, they converge on common lessons:

#### *Six institutional adaptations for Indigenizing school feeding programmes*

1. Adapt governance arrangements: Make Indigenous participation permanent across design, implementation, monitoring and evaluation.
2. Adapt public procurement frameworks: Simplify the rules. Less paperwork, more flexible contracts, and buying from local Indigenous producers.
3. Adapt food safety regulations: Make sanitary rules that fit Indigenous practices, not the other way around. Public health still comes first.
4. Adapt food quality standards: Widen the definition of quality to include health, culture, territory, biodiversity, seasonality and Indigenous food sovereignty.
5. Adapt programme implementation to Indigenous knowledge systems: Bring Indigenous knowledge into procurement, menus, nutrition education, evaluation and governance.
6. Adapt school feeding to territorial food systems: Use school feeding to strengthen local livelihoods, economies and food systems through local purchasing and Indigenous enterprises.

**Key message:** The main lesson from Brazil and Aotearoa in New Zealand is that governments need to adapt institutions, not Indigenous Peoples, to public food procurement. Changes in governance, procurement, quality and knowledge integration can turn school feeding into a tool for Indigenous self-determination, the right to adequate food, culturally appropriate diets and resilient territorial food systems.

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## 6.6 Conclusion

The scenarios show that the future of IPFS depends on governance, who controls territory, biodiversity and decisions. When territorial, cultural and institutional foundations are intact, IPFS sustain diverse diets, biodiversity and resilience. Business as usual fragments territories, deepens unequal market access or dependence on unfair markets and weakens governance. That erodes biocultural diversity, knowledge, and food security. Transformation is about strengthening territorial governance, backing biocultural food systems, and treating Indigenous institutions as legitimate authorities.

The recommendations in this chapter offer a framework to reverse BAU. They need coordinated action from governments, Indigenous organizations, international bodies, researchers and development partners. But simply strengthening Indigenous institutions is not enough. The institutions that govern food systems also need to change. That means governance that includes Indigenous Peoples, rules that fit their cultures, respect for their knowledge, and public buying that supports their producers. Together, these changes create the conditions for stronger IPFS and a broader transformation of food systems. Indigenous Peoples' food systems should not be seen as vulnerable or residual. They are living socioecological systems that can inform more sustainable, resilient and equitable food futures. Recognizing and supporting them is both a rights issue and a strategic opportunity.

## Chapter 7 Conclusions and recommendations

### 7.1 Conclusions

This report highlights the importance of IPFS as culturally and nutritionally diverse, resilient and locally adaptive food systems. In various locations around the world, they range from intact to fragmented, reconfigured, urbanized or disrupted systems. External factors have eroded Indigenous rights, governance, territories and knowledge over time. Restoring and protecting IPFS is urgent for Indigenous Peoples' food sovereignty, nutrition, and socioeconomic, physical, and cultural well-being, for States seeking to meet the Sustainable Development Goals, and for humanity to access diverse, resilient, and nutritious food systems.

The recommendations that follow aim to shift policy thinking. Their unifying principle is that food should not be treated only as a commodity but as part of culturally enriched, biodiverse and resilient systems that support Indigenous well-being, rights, governance and knowledge.

### 7.2 Recommendations

The recommendations for IPFS to guide policies towards actions at regional, national and international levels focus on three key goals:

- 1) preserve and promote functioning IPFS;
- 2) restore and strengthen IPFS that are under pressure or disrupted; and
- 3) identify lessons that can inform the transformation of other food systems.

The following recommendations ensure a rights-based approach to enacting policies and actions that are required to attain these three goals.

#### **Recommendation 1: Recognize the value of Indigenous Peoples' food and knowledge systems.**

- Recognize Indigenous Peoples as rights holders, and not only as stakeholders.
- Recognize IPFS as living, dynamic systems that require Indigenous Peoples' governance.
- Recognize the well-being and identity of Indigenous Peoples as foundational for achieving food security and nutrition.
- Incorporate the benefits of IPFS (nutrition, biodiversity, resilience) into sustainable production policies.
- Develop and utilize proper metrics that go beyond market value to value IPFS considering all their undervalued benefits.

#### **Recommendation 2: Improve Indigenous Peoples' food security and nutrition outcomes.**

- Address all forms of malnutrition.
- Ensure access to diverse and nutritious diets.
- Reduce dependence on ultraprocessed foods.
- Strengthen intergenerational transmission of knowledge.
- Gather evidence on IPFS and nutritional status.

- Integrate Indigenous Peoples' foods into dietary guidelines, nutrition programmes and public procurement.

**Recommendation 3: Secure Indigenous Peoples' collective territorial rights and governance authority.**

*Territorial integrity and governance*

- Legally recognize collective rights and customary governance systems to lands, waters, forests, fisheries, mobility routes and resources in national and international law.
- Ensure Indigenous Peoples' participation and co-management in land and water governance.
- Ensure participation of Indigenous Peoples in conservation, biodiversity and climate action.
- Fully implement the right of Indigenous Peoples to consultation and guarantee their free, prior and informed consent in all actions affecting them.

*Agrarian and aquatic reforms*

- Protect Indigenous Peoples' territories (land and water).
- Prevent displacement by land-use change and acquisitions.

**Recommendation 4: Support Indigenous Peoples' food systems and territorial economies.**

*Reciprocity-based exchange*

- Recognize reciprocity-based practices (exchange, mutual aid, collective harvesting) that contribute to food security.
- Support Indigenous Peoples-led provisioning systems (production, harvesting, fishing, hunting, processing, storage).
- Strengthen reciprocity-based economies
- Establish community infrastructure for storage and value addition.

*Knowledge-based practices*

- Recognize Indigenous Peoples' role in managing and conserving agrobiodiversity.
- Legally protect the right to save, use, exchange and govern seeds and other genetic materials.
- Support practices in conservation and sustainable use of genetic resources.

*Fair and non-extractive markets*

- Facilitate market systems that support Indigenous Peoples' livelihoods without undermining food sovereignty.
- Promote public procurement from Indigenous Peoples' producers.

**Recommendation 5: Enable Indigenous Peoples-led knowledge systems.**

- Recognize Indigenous governance institutions as legitimate authorities.

- Promote co-creation of knowledge between Indigenous Peoples' and scientific systems.
- Formalize Indigenous Peoples' participation in knowledge-policy interfaces (without external intermediaries).
- Promote inclusive education systems that respect and include Indigenous Peoples' knowledge.
- Support intergenerational and vernacular transmission of knowledge.

**Recommendation 6: Align food-system transformation agendas with Indigenous Peoples' priorities and rights.**

*Policy coherence*

- Ensure that food-system transformation agendas do not displace or marginalize IPFS.
- Ensure accountability and coherence among UN, development and intergovernmental agencies and programmes in relation to IPFS.
- Encourage CFS and the Civil Society and Indigenous Peoples' Mechanism (CSIPM) to engage with the United Nations Permanent Forum on Indigenous Issues and other bodies representing Indigenous Peoples.

*Financing*

- Increase direct, long-term, flexible funding for enhancing IPFS.

**Recommendation 7: Address gender, youth and intergenerational justice.**

- Integrate gender, youth and intergenerational perspectives into IPFS policies.
- Promote initiatives led by Indigenous women and youth, addressing intersectional and multiple dimensions of inequalities.

**Recommendation 8: Ensure data and knowledge sovereignty and governance.**

- Ensure free, prior and informed consent in research and dissemination of knowledge on IPFS.
- Protect sacred, medicinal, genetic and ceremonial knowledge from appropriation.
- Ensure that intellectual property of knowledge on genetic resources, which may be oral, documented, or in other forms, remains with Indigenous Peoples.
- Establish UN protocols and codes of conduct for Indigenous Peoples' knowledge, including clauses to prevent its misappropriation in artificial intelligence systems.
- Support data platforms for IPFS and territorial monitoring.
- Review regulatory frameworks on genetic resources and protect traditional knowledge from patents.

**Recommendation 9: Prioritize climate adaptation strategies for Indigenous Peoples to ensure food security and nutrition.**

- Ensure that climate, conservation and biodiversity policies integrate IPFS.
- Apply appropriate environmental and social safeguards to all climate and biodiversity initiatives affecting IPFS.

- Support Indigenous Peoples-led adaptation and conservation strategies.
- Support Indigenous Peoples-led monitoring of climate impacts, biodiversity loss, water quality, and so on.

**Recommendation 10: Design and implement fair standards and inclusive regulations.**

- Apply accountability mechanisms for corporations operating in Indigenous Peoples' territories.
- Prevent commercial and industrial harm to IPFS.
- Ensure that market standards, certifications and regulations are inclusive of IPFS.

Central to all recommendations is the recognition that IPFS must be recognized on their own terms without subordination or externally imposed validation. Indigenous Peoples are rights holders, and their knowledge systems are independent of conventional scientific knowledge.

The CFS should establish a biennial, Indigenous-led monitoring process to track legal recognition, implementation, direct financing, and participation in decision-making, food security and nutrition outcomes. Indicators, data governance arrangements and review procedures must be jointly defined with Indigenous Peoples and respect their data sovereignty.

For these recommendations to be implemented, funding must reach Indigenous Peoples' organizations directly, political will must be sustained, and the United Nations agencies must coordinate their efforts. Conditional funding, private interests, weak accountability, and continued loss of Indigenous territories and rights undermine political will. These challenges are compounded by limited understanding among many policymakers, scientists and the broader public of Indigenous Peoples' histories, their long struggles for rights and self-determination, and the gains achieved – and sometimes subsequently lost – through these struggles. Addressing this historical and political knowledge gap is essential to avoid treating Indigenous rights as recent claims rather than rights grounded in long histories of resistance, negotiation and recognition. These risks must be tracked and mitigated through transparent reporting and the full participation of Indigenous Peoples in all reviews.

Incremental change is no longer sufficient. These recommendations set out a clear path to recognize, protect, and strengthen IPFS. Their implementation is essential to the continuity of Indigenous cultures and knowledge systems, while contributing more widely to global food security and nutrition, as well as planetary health.

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Annex 1 A  
proposed typology of diversity and contemporary conditions of Indigenous Peoples' food systems

The typology was developed through comparative analysis of the case studies reviewed, earlier FAO reports on IPFS (2009, 2013, 2021), and the experiential and interdisciplinary knowledge of contributing authors. It is further informed by food systems' approaches that recognize diversity in provisioning systems, livelihood studies examining how Indigenous Peoples combine resources and activities, and Indigenous Peoples' scholarship emphasizing territory, relationality and self-determination. The typology aims to capture the contemporary condition and trajectories of change

of IPFS across the globe. It classifies food systems according to how their dominant livelihoods are organized and the ways they are shaped by territorial histories and current drivers of change. The typology is organized along two axes (Table 2.1, 2.2 and Figure 2.1):

**Types of dominant socioecological livelihood values:** This axis identifies the predominant ways of provisioning food and how livelihoods are organized through relationships with ecosystems, territories, labour systems and knowledge practices. These categories are not exclusive; many IPFS combine multiple activities across seasons and spaces. However, one configuration often stays dominant in structuring the system.

**States of current condition of IPFS:** This axis capture the present degree of continuity, pressure, restructuring, and fragmentation or external dependence affecting the food system. This second axis is assessed through the seven IPFS characteristics presented above, examining the extent to which they are still operative, weakened or transformed under contemporary drivers such as land dispossession, climate change, market integration, migration, conflict or policy exclusion.

Used together, the two axes allow systems with similar ecological bases but different current conditions to be distinguished, as well as systems under similar pressures but grounded in different livelihood ecologies. This avoids simplistic binaries such as traditional versus modern and better reflects the dynamic realities of IPFS today.

| <b>Table A2. Types of dominant socioecological livelihood values</b>                                                                                                                       |                                                                                                                                                                               |                                                                                                                                                                                                                                                           |                                                                                                                  |                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Forest-based mosaic food systems</b>                                                                                                                                                    | <b>Mobile herding and pastoral food systems</b>                                                                                                                               | <b>Water and fisheries-based food systems</b>                                                                                                                                                                                                             | <b>Agrarian food systems</b>                                                                                     | <b>Reconfigured food systems</b>                                                                                                                                 |
| <b>Food systems organized through diversified use and stewardship of forest landscapes, often combining cultivation, agroforestry, gathering, hunting, fishing and rotational land use</b> | Food systems centred on mobile herd management across grazing landscapes, relying on seasonal mobility, forage access, animal husbandry knowledge and collective institutions | Food systems primarily organized through fishing, aquatic harvesting and livelihood relations structured by rivers, lakes, wetlands, coasts and marine environments, where water dynamics strongly shape provisioning, mobility and territorial practices | Food systems centred on settled cultivation combining crops, livestock and varying degrees of market interaction | Food systems reorganized through migration, displacement or urban residence, combining purchased foods, kinship networks, remittances and revived food practices |

| <b>Table A2. Functionality states of Indigenous Peoples' food systems</b>                                                                |                                                                                                                                                          |                                                                                                                                                          |                                                                                                                                                            |                                                                                                                                                                                                                                |
|------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Territorial rooted</b>                                                                                                                | <b>Pressured</b>                                                                                                                                         | <b>Hybrid</b>                                                                                                                                            | <b>Fragmented</b>                                                                                                                                          | <b>Externally dependent</b>                                                                                                                                                                                                    |
| <b>Systems where territorial relations, provisioning practices, governance and knowledge remain substantially anchored in Indigenous</b> | Systems under significant climatic, territorial, political or economic stress, but where core characteristics and the systemic coherence are maintained. | Systems where core food-system functions maintained through reconfiguration that integrates Indigenous practices with external provisioning arrangements | Systems where several characteristics have weakened and have lost coherence among key food, system functions, relationships and practices, with increasing | Systems with limited autonomy, with reconfiguration resulting in high reliance on external sources for core provisioning functions, such as humanitarian aid and unstable markets due to severe dispossession and displacement |

|                                                      |  |  |                                                                                           |  |
|------------------------------------------------------|--|--|-------------------------------------------------------------------------------------------|--|
| Peoples' territories and continue to work coherently |  |  | reliance on markets, wage labour, imported foods, state programmes or new infrastructures |  |
|------------------------------------------------------|--|--|-------------------------------------------------------------------------------------------|--|

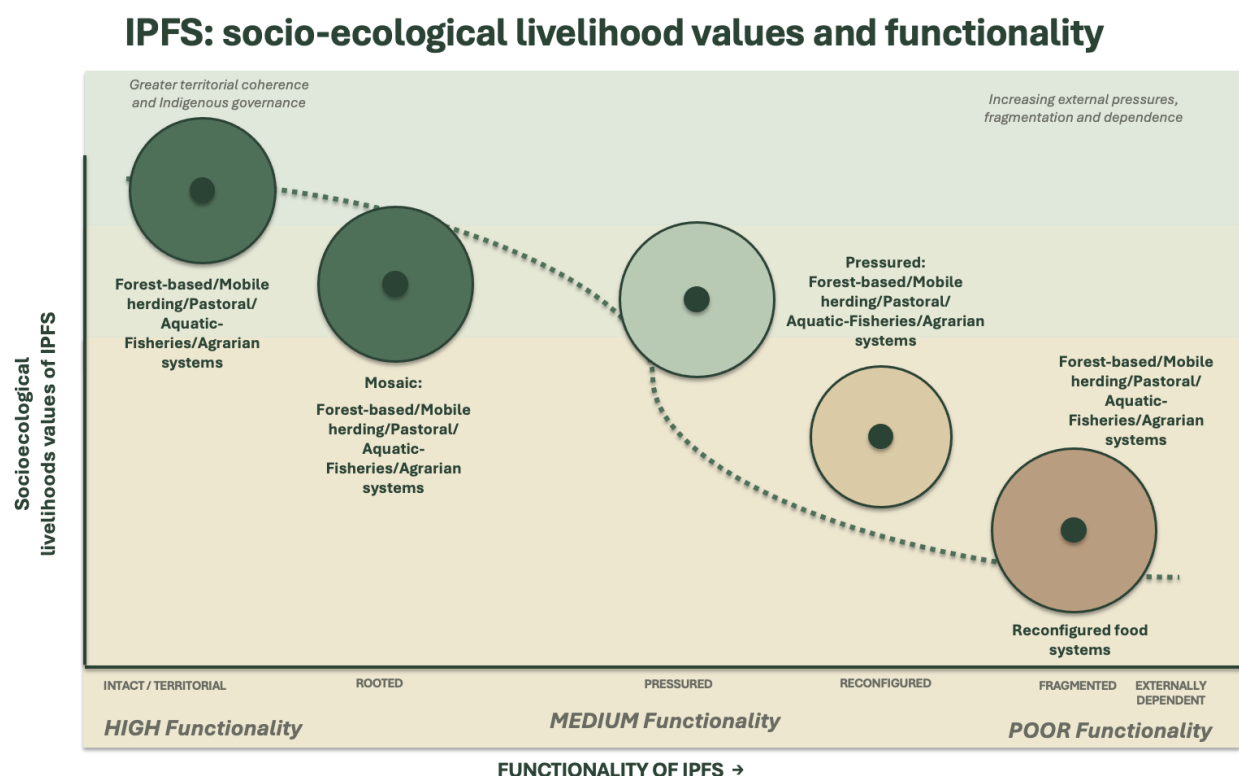


**Figure A2. Typology of Indigenous Peoples' food systems by the range of socio, ecological livelihood values and functionality**

**Source:** Authors' elaboration assisted by artificial intelligence (AI).

*\*Methodological note:* The IPFS types are proposed as analytical tools. A given case may combine more than one livelihood configuration (for example, forest-based and riverine systems) or move over time between different conditions due to changing drivers. The typology is presented to help in the analysis of different trajectories of IPFS that could show continuity, disruption, adaptation and recovery. These conditions are not necessarily sequential or mutually exclusive, and reconfiguration does not necessarily imply a loss of systemic coherence or autonomy.

