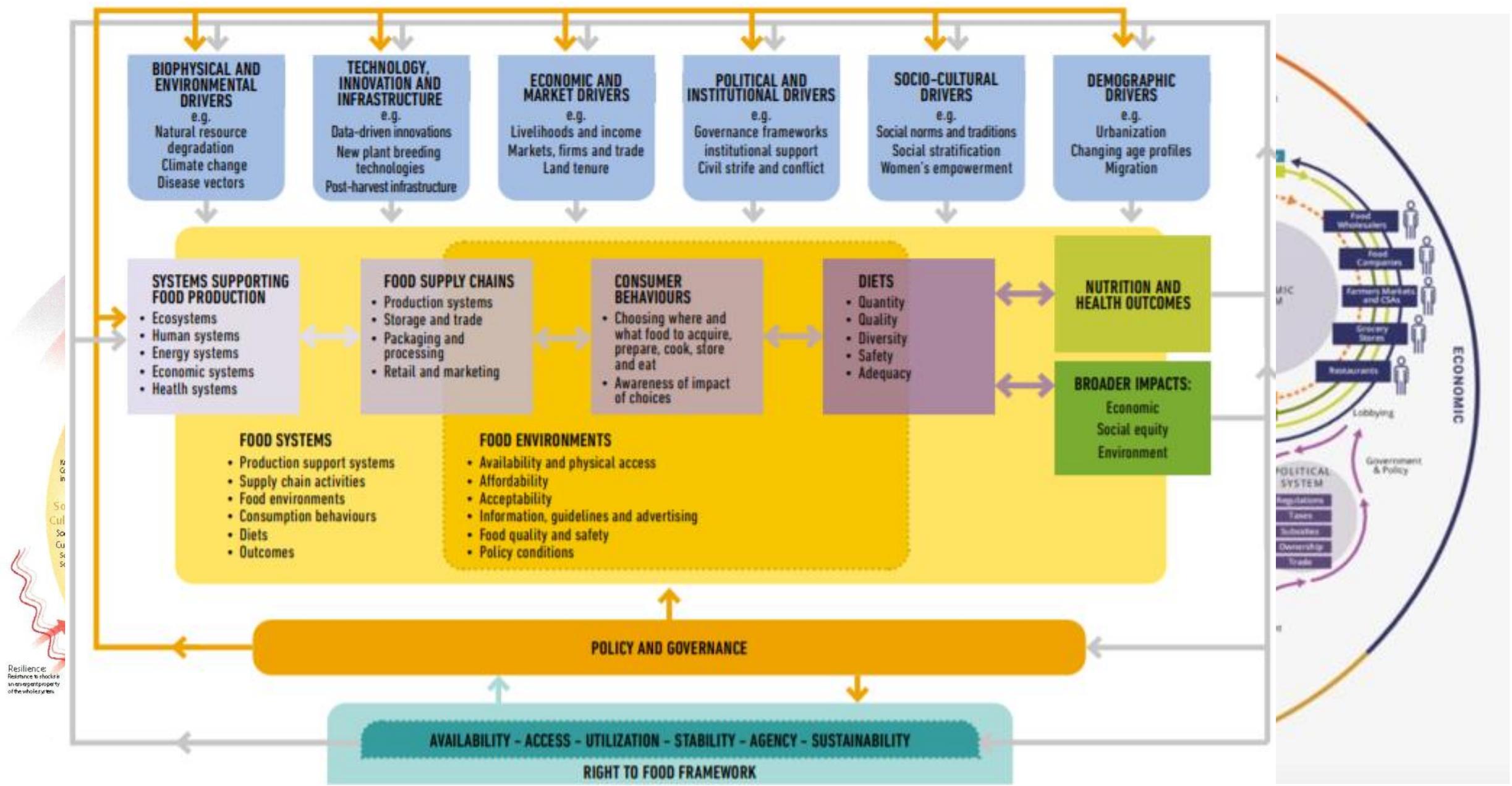# Sustainable agrifood systems in mountains

IPROMO 2022 - Sustainable management of mountain areas
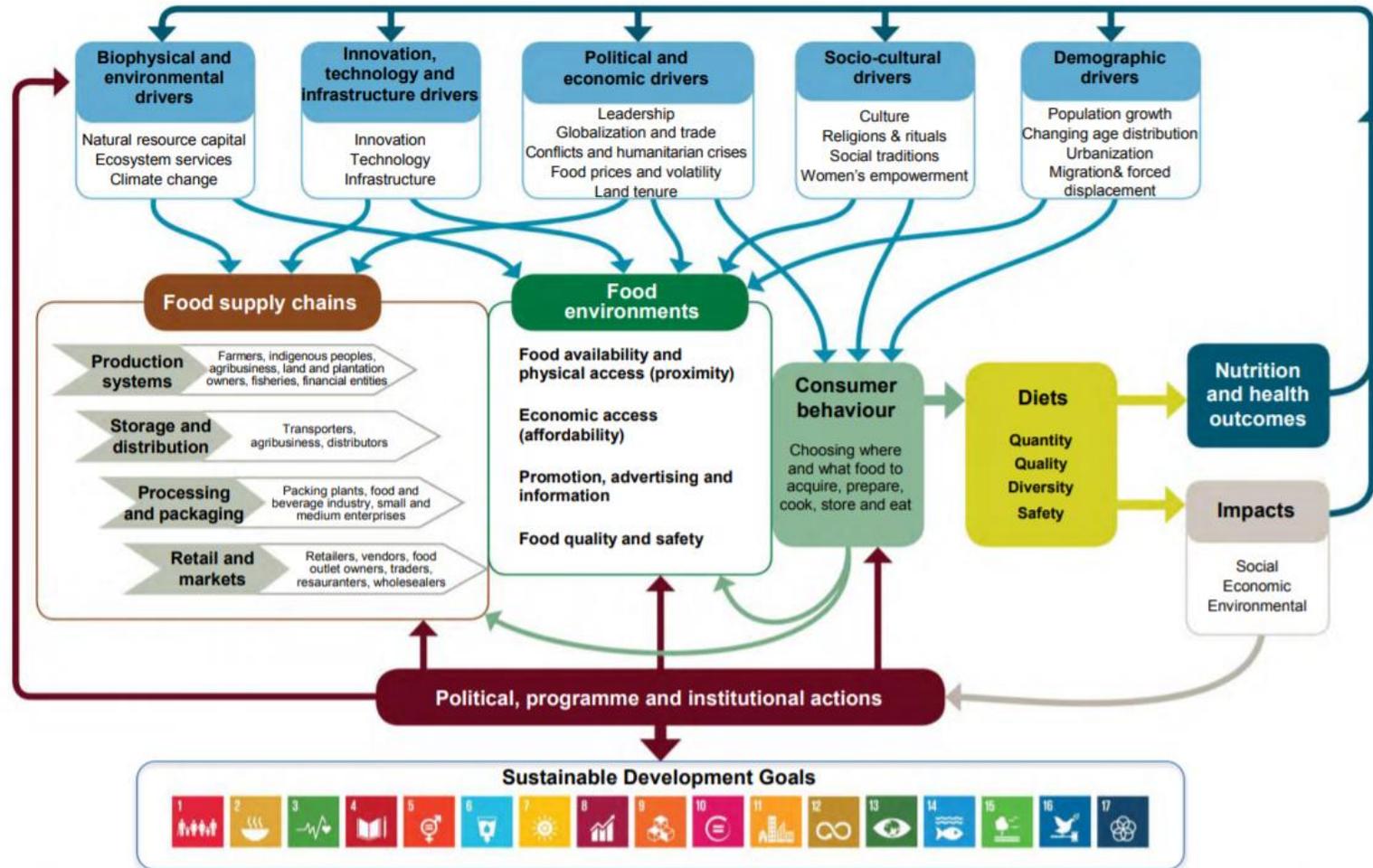**6 July 2022**

José Valls Bedeau, FAO

Session Overview

➢**Agri-food systems transformation**

  ➢**Agri-food systems – Concept and definitions**

  ➢**Agri-food systems and sustainability – Where do we stand**

  ➢**Transforming agri-food systems**

  ➢**Sustainable agri-food systems in mountain areas**

  ➢**Opportunities for sustainable agri-food systems in mountain areas**

➢**International processes and policy context**

  ➢**The SDGS and the UN Food System Summit**
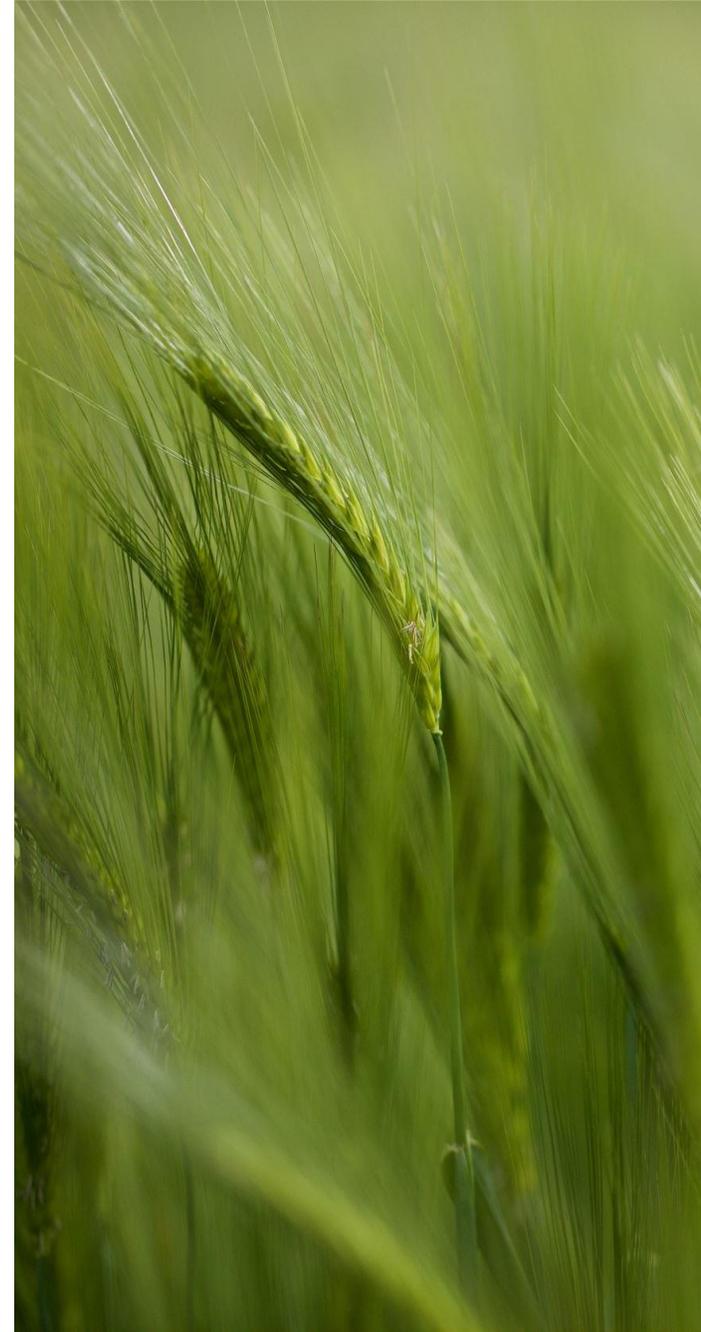
  ➢**Other international mechanisms**

A food systems framework captures the complexity of the interrelationships of drivers of change at a broader scale with the outcomes
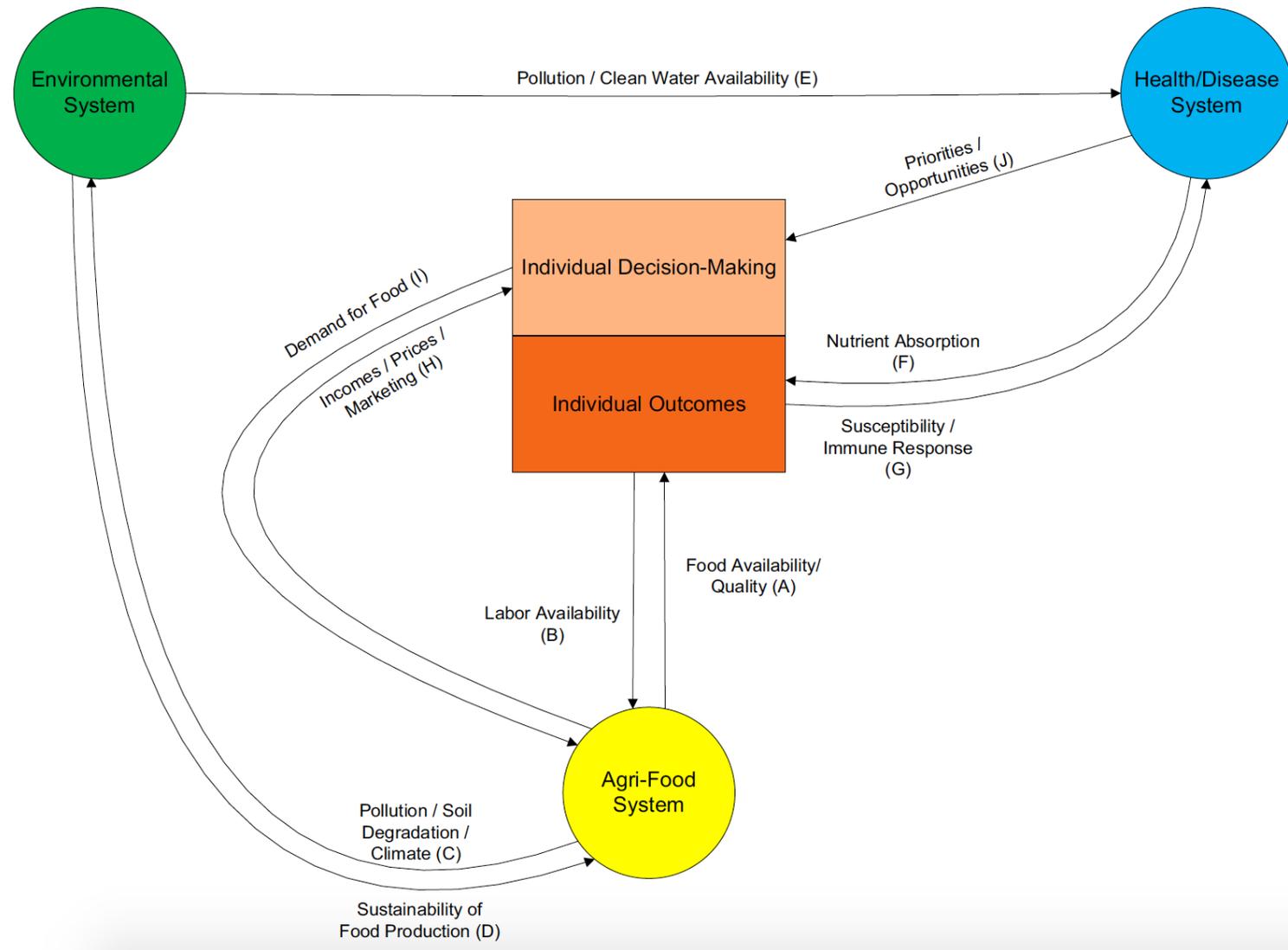and functioning of food systems.

Agri-food systems defined

Agri-food systems encompass the **entire range of actors** and their interlinked value-adding activities involved in the **production, aggregation, processing, distribution, consumption and disposal** of products that originate from agriculture, forestry or fisheries, and parts of the broader **economic, societal and natural environments** in which they are embedded. FAO, 2018

They are **sustainable** when they deliver food security and nutrition for all in such a way that the economic, social and environmental bases to generate food security and nutrition for future generations are not compromised. FAO, 2018

Agri-food systems interact with other systems

Hammond, R.A. and Dubé, L., 2012. A systems science perspective and transdisciplinary models for food and nutrition security. *Proceedings of the National Academy of Sciences*, *109*(31), pp.12356-12363.

Importance of the food environment

Turner, C., Aggarwal, A., Walls, H., Herforth, A., Drewnowski, A., Coates, J., Kalamatianou, S. and Kadiyala, S., 2018. Concepts and critical perspectives for food environment research: A global framework with implications for action in low-and middle-income countries. *Global food security*, 18, pp.93-101.

AGRI-FOOD SYSTEMS

- ✓ People
- ✓ Actors
- ✓ Activities
- ✓ Sectors
- ✓ Natural Resource, economy, climate, society

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The world is not on track to achieve food security and nutrition targets.
The number of hungry people was slowly on the rise since 2014, until 2019 (COVID-19).

The number of hungry people

(Source: The State of Food Security and Nutrition in the World, 2021)

There is progress on child stunting and exclusive breastfeeding. But obesity is on the rise. More than 3 billion people cannot afford a healthy diet

Global nutrition targets (SDG 2.2), and targets endorsed by the World Health Assembly (Source: The State of Food Security and Nutrition in the World, 2021)

Agri-food systems are fueling climate change and natural resource degradation

- Biodiversity is collapsing. One million species are at risk of extinction
- Deserts are spreading. Wetlands are being lost and we lose 10 million hectares of forests every year
- Ecosystems are disappearing before our eyes
- Today, we are at 1.2 °C of warming and already witnessing unprecedented climate extremes and volatility in every region and on every continent

- Agri-food systems contribute to approximately 1/3 of all greenhouse gas emissions
- They account for 70% of fresh water use and are a major cause of biodiversity loss
- 14 percent of food produced globally is lost from post-harvest up to the retail level (FAO, 2019);
- 17 per cent of total global food production may be wasted (UNEP, 2021)

Food Systems emissions are estimated to be 21–37% of total net anthropogenic GHG emissions, when including pre- and post-production activities. (IPCC, 2019)

Global greenhouse gas emissions from food production — Our World in Data

Global Emissions
52.3 billion tonnes of carbon dioxide equivalents

Non-food: 74%
Food: 26%

Retail: 3% of food emissions
Packaging: 5% of food emissions
Transport: 6% of food emissions
Food processing: 4% of food emissions
Supply chain 18%

Livestock & fish farms 30% of food emissions
Livestock and fisheries 31%
Methane from cattle's digestion ("enteric fermentation")
Emissions from manure management
Emissions from pasture management
Fuel use from fisheries

Crops for animal feed 6% of food emissions
Crops for human food 21% of food emissions
Crop production 27%

Land use for human food 8% of food emissions
Land use for livestock 16% of food emissions
Land Use 24%
Land use change: 18%
Cultivated organic soils: 4%
Savannah burning: 2%

Data source: Joseph Poore & Thomas Nemecek (2018). Reducing food's environmental impacts through producers and consumers. Published in Science.
OurWorldinData.org – Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Hannah Ritchie.

Timeline for reversing biodiversity loss

Historical

1970   2010   2050   2100

Increased conservation efforts
+ more sustainable production
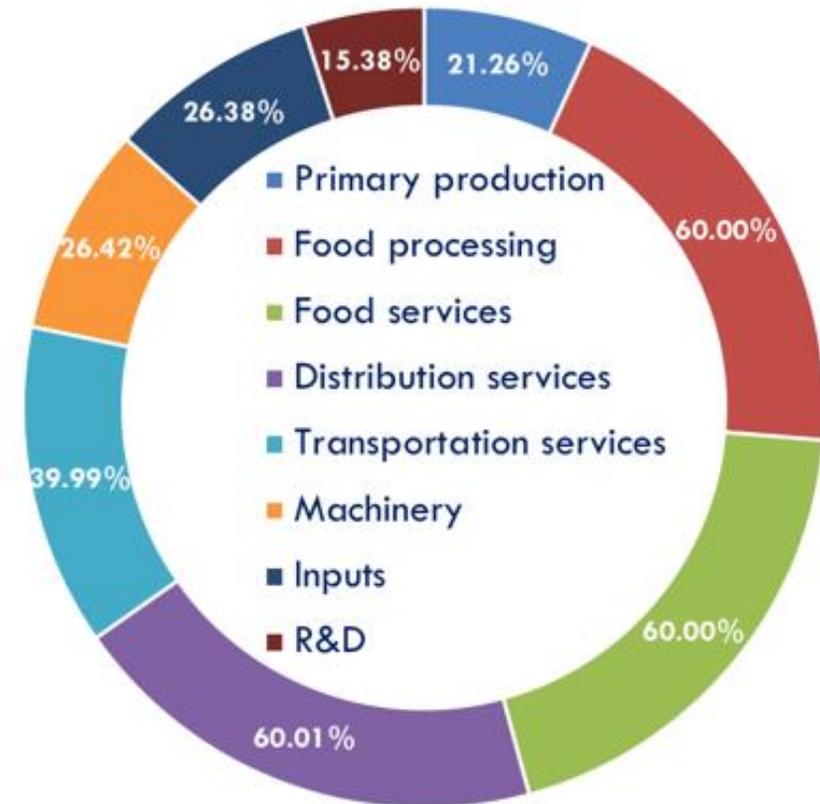+ more sustainable consumption

Increased conservation efforts

Business as usual

This artwork illustrates the main findings of the article, but does not intend to accurately represent its results (https://doi.org/10.1038/s41586-020-2705-y)

nfographic courtesy of International Institute for Applied Systems Analysis

Agri-food systems are the world's largest economic system, measured in terms of employment, livelihoods, planetary impact

Where in value chain	Jobs	Livelihoods
Primary production	716.77	2,023.80
Food processing	200.73	484.54
Food services	168.97	339.44
Distribution services	96.34	241.48
Transportation services	41.61	101.05
Machinery	6.51	13.18
Inputs	4.89	11.06
R&D	0.13	0.29
Total	**1,280.93**	**3,214.84**

- Primary production — 21.26%
- Food processing — 60.00%
- Food services — 60.00%
- Distribution services — 60.01%
- Transportation services — 39.99%
- Machinery — 26.42%
- Inputs — 26.38%
- R&D — 15.38%

Communities face multiple challenges in feeding a growing population in a sustainable and healthy manner:

✓ How to reduce agri-food systems' footprint on land, water, GHG, biodiversity

✓ How to prevent transboundary and emerging agri-food system threats

✓ How to Eliminate poverty and reducing all forms of inequalities by 2030

"Business as usual" is no longer an option: transformative changes of agri-food systems are needed for all countries

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   ➢ **The SDGS and the UN Food System Summit**

   ➢ **Other international mechanisms**

FOOD SYSTEMS EVOLUTION & IMPLICATIONS
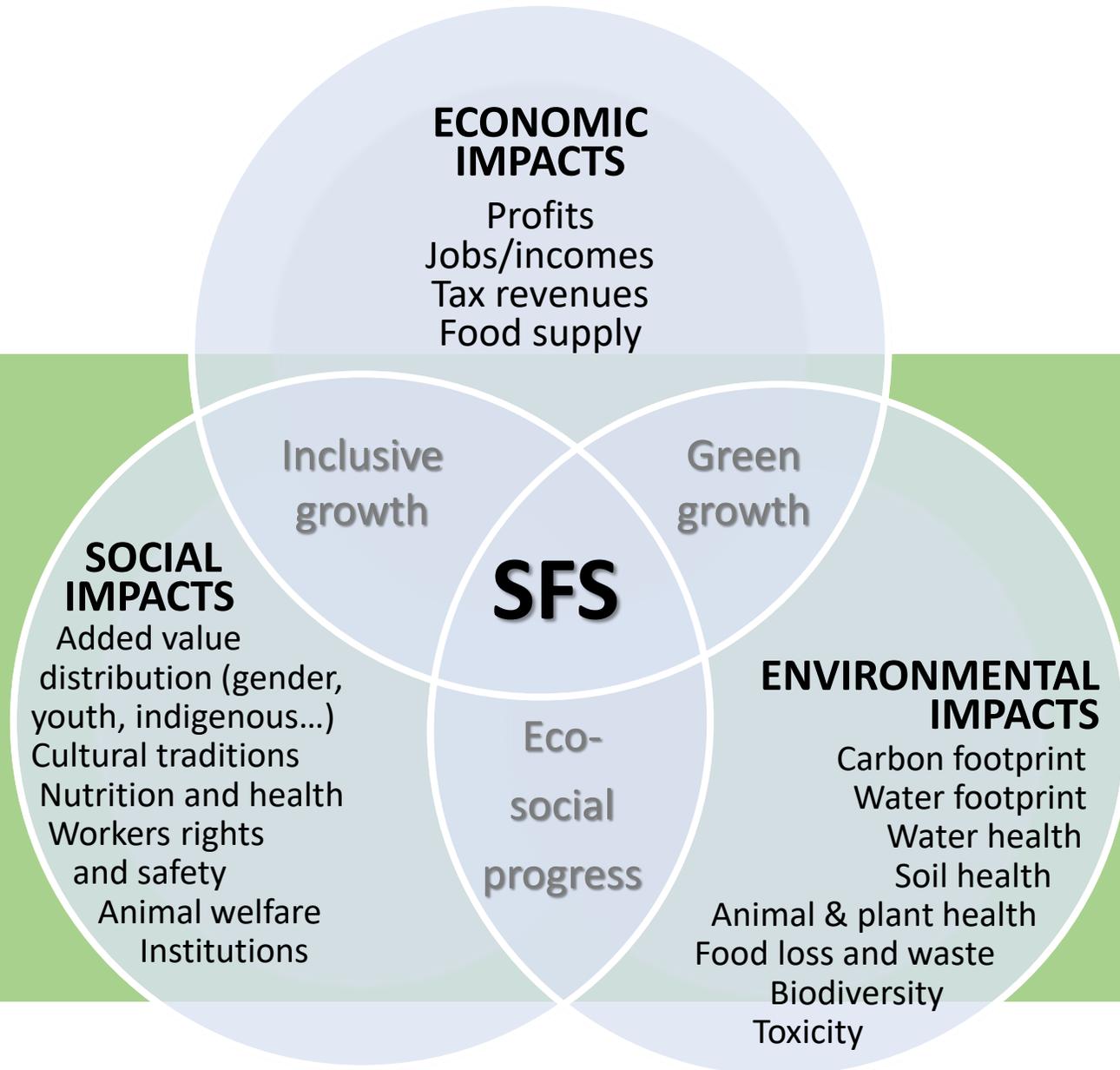
Traditional (pre-industrial)

Modern (industrial)

Alternative (post-industrial)

Need for agri-food systems transformation

ECONOMIC IMPACTS
Profits
Jobs/incomes
Tax revenues
Food supply

Inclusive growth

Green growth

SFS

SOCIAL IMPACTS
Added value distribution (gender, youth, indigenous…)
Cultural traditions
Nutrition and health
Workers rights and safety
Animal welfare
Institutions

Eco-social progress

ENVIRONMENTAL IMPACTS
Carbon footprint
Water footprint
Water health
Soil health
Animal & plant health
Food loss and waste
Biodiversity
Toxicity
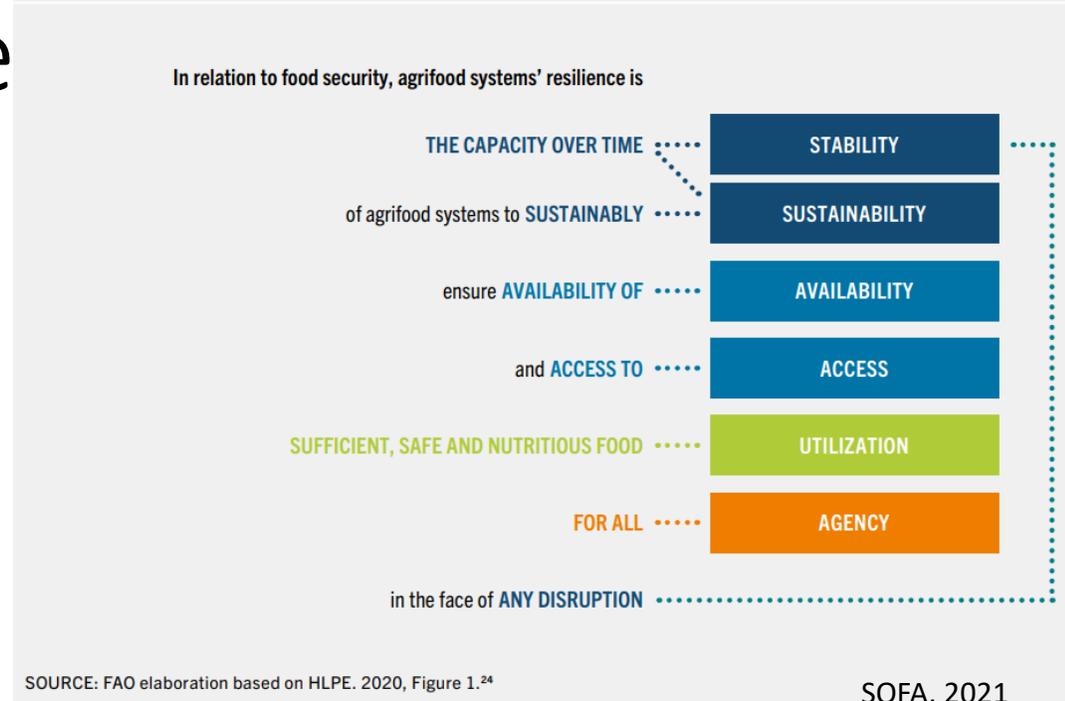
✓ **Productive and prosperous**
✓ **Equitable and inclusive**
✓ **Empowering and respectful**
✓ **Resilient**
✓ **Regenerative**
✓ **Healthy and nutritious**

Agri-food Systems Resilience

- The COVID-19 pandemic, climate change, and conflict are exposing the fragilities of agri-food systems.

- These fragilities put at risk food security and nutrition for hundreds of millions of people.

FIGURE 1 AGRIFOOD SYSTEMS' RESILIENCE AND THE SIX DIMENSIONS OF FOOD SECURITY

In relation to food security, agrifood systems' resilience is

THE CAPACITY OVER TIME ····· **STABILITY**

of agrifood systems to SUSTAINABLY ····· **SUSTAINABILITY**

ensure AVAILABILITY OF ····· **AVAILABILITY**

and ACCESS TO ····· **ACCESS**

SUFFICIENT, SAFE AND NUTRITIOUS FOOD ····· **UTILIZATION**

FOR ALL ····· **AGENCY**

in the face of ANY DISRUPTION ·····

SOURCE: FAO elaboration based on HLPE. 2020, Figure 1.²⁴

SOFA, 2021

Agri-food systems' resilience is defined as "*the capacity over time of agri-food systems, in the face of any disruption, to sustainably ensure availability of and access to sufficient, safe and nutritious food for all, and sustain the livelihoods of agri-food systems' actors*".

SOFA, 2021 definition based on Tendall et al. (2015)

Agri-food Systems Resilience

Basic resilience elements

Diversity: in domestic production, imports, supply chains

Redundant and robust food transport network

Guarantee continued access to food for all

THE STATE OF FOOD AND AGRICULTURE 2021 (fao.org)

Resilience building is a **system-wide multi-risk**, **multi-actor** and **multi-sectoral** effort!

Rethinking food systems, changing paradigms

FROM…	TO…
Continued focus on productivity as prime driver of agriculture	Greater focus on system efficiency – healthy diets, sustainable (low waste) food systems
More, cheaper, food driving more waste and ill health, and more climate change	Greater recognition of values associated with food, not just price, higher farm-gate prices and sustainable practices
Less biodiversity, more uniformity, erosion of soils and natural capital	More multi-functional landscapes (fewer monoculture landscapes), more rural employment and more efficient agri-food systems
Not all relevant stakeholders are considered	Consumers and civil society are key players
Food systems viewed as a sectoral issue	Agri-food systems interconnected with other systems and sectors
Focus on finding globally applicable solutions	Understanding that food systems are context-specific, requiring diverse solutions

Agri-food systems: trade offs towards Agenda 2030

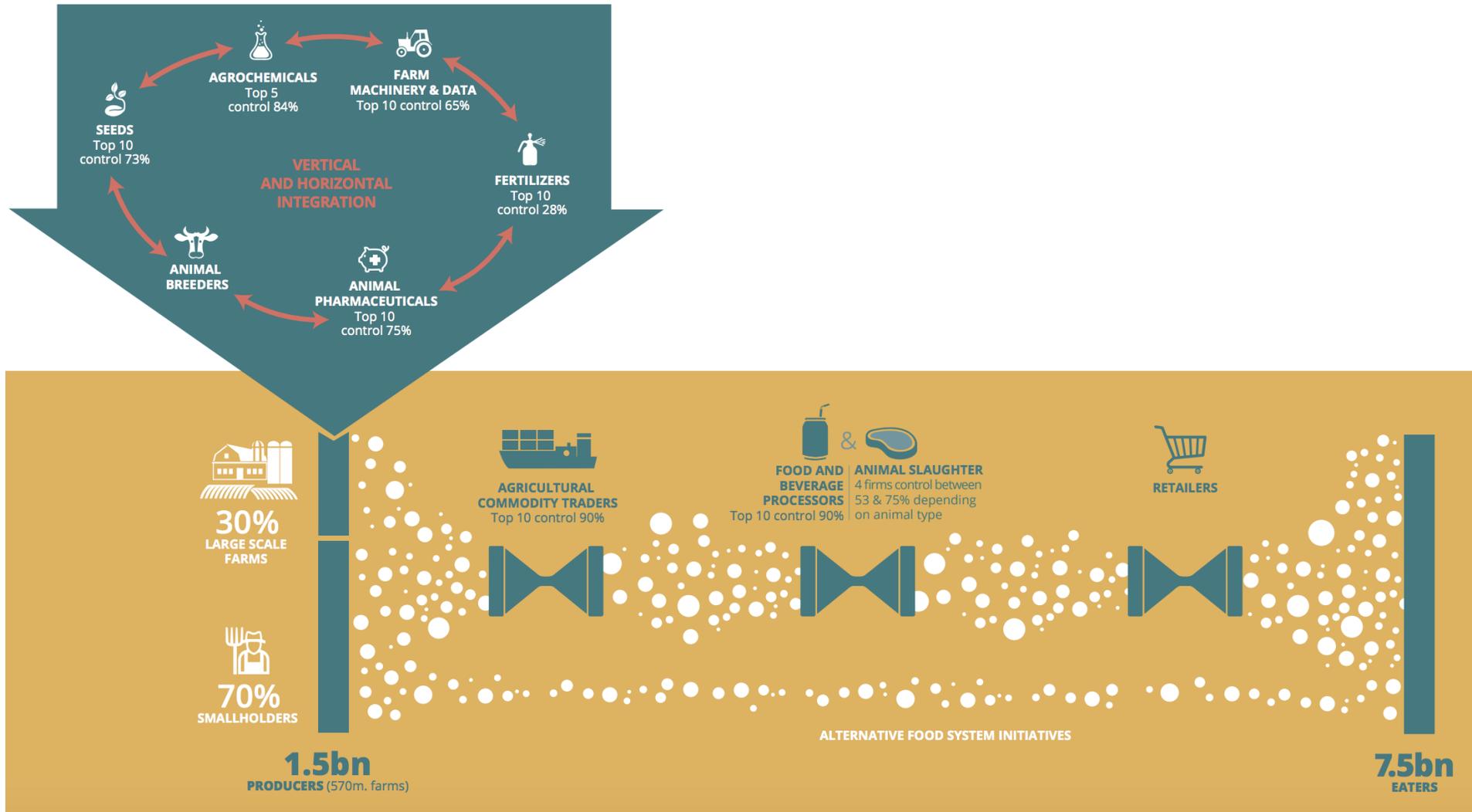| Selected conflicting objectives	
Achieving sustainable yields (internalizing social – environmental costs)	Achieving food security and nutrition (improving purchasing power of vulnerable people)
Increasing agri-food output	Reducing agri-food GHG emissions
Achieving Sustainable yields	Minimizing land use expansion
Increasing Employment	Increasing wages
Innovating tecnologies	Increasing employment
Increasing foreign currency inflows	Increasing economic diversification
Increasing food availability	Using biomass as renewable energy
Funding social protection schemes	Funding public infrastructure and R&D
...	...

Source: FAO, 2018. Drawn from *The future of food and agriculture – Alternative pathways to 2050 (FOFA 2050)*. Rome.

Key challenge: Managing the trade-offs

Adopting an inclusive approach is required to assess the impact of decisions and interventions on communities, environment and economy, and try to minimize trade-offs and increase synergies.

➢ Analysing whole system outcomes to track aggregate system performance (using indicators, indices, modelling tools), and;

➢ Analysing ethical, legal and political tensions in agri-food systems that influence types and distribution of outcomes for different stakeholders. (K. Mausch et al. 2020)

Different interests, power asymmetries

VERTICAL AND HORIZONTAL INTEGRATION

- **AGROCHEMICALS** Top 5 control 84%
- **FARM MACHINERY & DATA** Top 10 control 65%
- **SEEDS** Top 10 control 73%
- **FERTILIZERS** Top 10 control 28%
- **ANIMAL BREEDERS**
- **ANIMAL PHARMACEUTICALS** Top 10 control 75%

30% LARGE SCALE FARMS

70% SMALLHOLDERS

1.5bn PRODUCERS (570m. farms)

AGRICULTURAL COMMODITY TRADERS Top 10 control 90%

FOOD AND BEVERAGE PROCESSORS Top 10 control 90%

ANIMAL SLAUGHTER 4 firms control between 53 & 75% depending on animal type

RETAILERS

ALTERNATIVE FOOD SYSTEM INITIATIVES
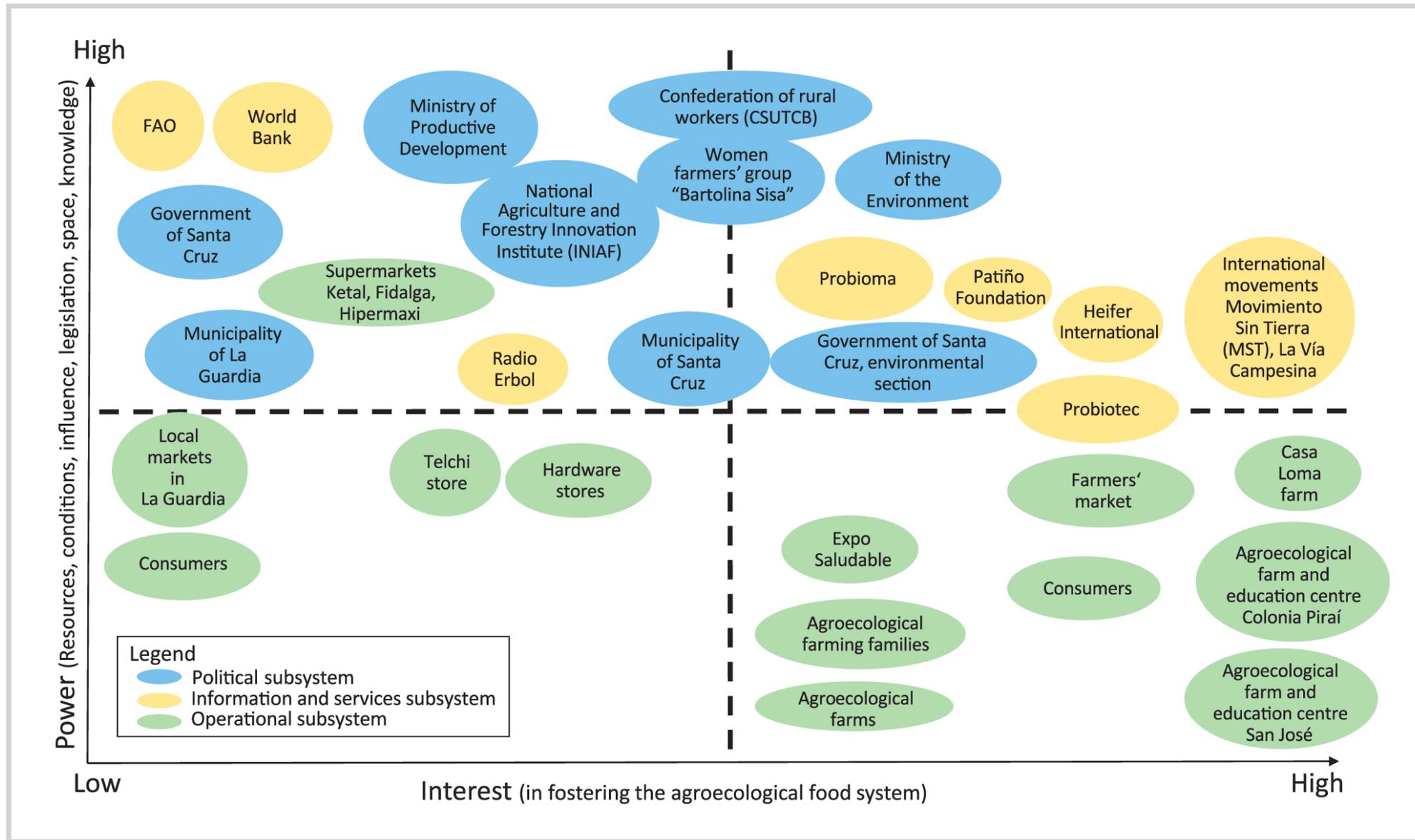
7.5bn EATERS

The Governance Challenge starts at local level

Science and models can help us identify the actions that are most likely to lead to optimal results. But governance will determine how these actions will be implemented.

We need to build coalitions of actors with the capacity to deliver the maximum sustainable change, given the differences of interest, resources and power that exist across food systems
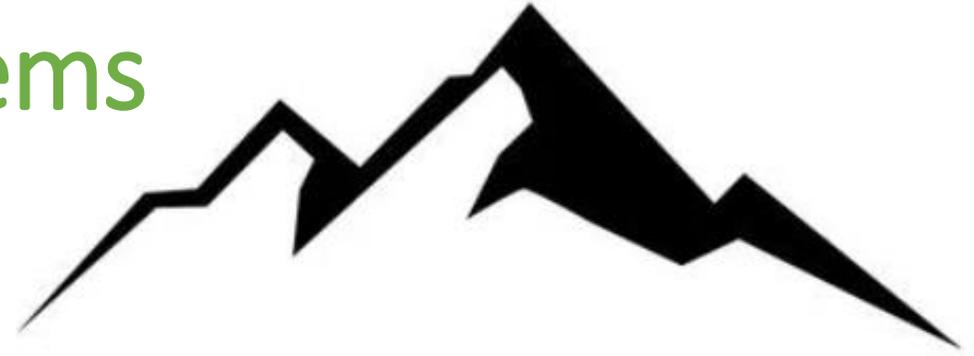
Agri-food system actors

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- ➢**Other international mechanisms**

Mountains and food systems

- Home to 1.1 billion people

- 27% of Earth's surface

- 50% percent of the world's biodiversity hotspots

- Half of humanity relies on mountain freshwater for everyday life

- There are 260+ documented sustainable land management technologies practiced in mountains

- 62% of mountain people live in rural areas, where agricultural production is mainly carried out by smallholder farmers and pastoralists.

(Source: Romeo, R., Grita, F., Parisi, F. and Russo, L. 2020. Vulnerability of mountain peoples to food insecurity: updated data and analysis of drivers. Rome, FAO and UNCCD)

Mountains and SFS

Agriculture techniques developed over centuries; production while preserving natural resources, rich in biodiversity, agrobiodiversity, biocultural diversity

Diversity of agricultural varieties, wild crops and animal breeds ensure diversified and affordable healthy diets and increase the resilience to climate change

Ecosystems functions such as the protection and retention of slopes, provision of freshwater to downstream population, etc.

Challenges for Mountain Food Systems (5)

The **COVID-19 pandemic** has added to and amplified existing challenges facing mountain food systems, as evidenced by the near breakdown of food supply chains, the food shortages in many developing countries, and the increase in people suffering from acute food insecurity.

(https://www.fao.org/mountain-partnership/news/news-detail/it/c/1447244/)

- Access to markets, supply chains and labor availability getting cut off

- Bans on food exports

- Impacts on tourism

- Emphasised pre-existing issues (inequality, marginalisation, etc.)

Source photo: http://www.fao.org/mountain-partnership/news/news-detail/en/?dyna_fef[uid]=1401352

Impacts of climate change in mountain areas

The 2022 IPCC cross-chapter paper 5 on Mountains highlighted that:

*"There is high confidence that **climate change** is largely negatively impacting on **food, fibre** and other **ecosystem products**, including agriculture, and ecosystem services across many different mountainous region"*

(b) Observed impacts of climate change on human systems

IPCC, 2022: Summary for Policymakers

Climate change and mountain social-ecological systems

DIRECT IMPACT

Precipitation changes
(e.g. drying up springs,
erratic rainfall, cloud burst)
[CCP5.2.2, CCP5.2.6,
Ch 4.2.6]

Increasing
wildfire weather
[CCP-BOX 5.1, CCP1.2.2
WGI AR6 Ch 11.8.3]

Mountain ecosystems provide
vital services, including water, forest,
carbon storage and cultural values
[CCP5.2.1, CCP1, Ch 2.4]

INDIRECT IMPACT

Decreasing
pollinator diversity
[CCP1, Ch 2.4,
Box 5.3]

Climate induced
hazards
(e.g. landslides)
[CCP5.2.6, CCP1,
Ch 4.2.6, Ch 16]

People in and around mountain regions depend
on these services for livelihood, income
generation, food, health and well-being
[CCP5.2.3, CCP5.2.5,
Ch 2.4, Ch 8.2]

CLIMATE CHANGE

Altering habitat conditions
[Ch 2.2, Ch 4, Ch 5 (ES), CCP1.2.2]

Shortage of fodder
Declining livestock populations

Decreasing regeneration potential
Threatening native and endemic species
[CCP-BOX 5.1, CCP5.2.1, CCP5.2.3]

**Decreasing quality and
quantity of ecosystem products**
[Ch 2.1, Ch 5.7, Ch 8.2.1, Ch16]

Poverty
Food, nutrition and health insecurity
Outmigration [CCB-MIGRATE]
Increase in area of fallow land
[CCP5.2.3, CCP5.2.5]

IPCC, 2022:
Cross-
Chapter
Paper 5:
Mountains

ADAPTATION OPTIONS IN MOUNTAIN REGIONS

Promote water harvesting (roof top, rain water) and multi-purpose projects for disaster risk management [CCP5.2.6, CCP5.2.7.2, Ch 4.7.1.1]

Promote mountain products (wild edibles, medicinal plants, cash crops, ecotourism) [CCP5.2.3, CCP5.2.5, Box 2.2, Ch 5.7]

Promote conservation of native flora and fauna and their habitat restoration [CCP5.4.1, Ch 2.2.6, Ch 15.5.4, CCB-FEASEB]

Promote agroforestry practices [CCP5.2.3, CCP5.4.3, Box 2.2, Ch 5.6.3, CCB-FEASEB]

Education and awareness-building [CCP5.2.7]

Crop diversification/ crop change [CCP5.2.7, CCP5.4.3]

Help species to adapt and protect refugia [CCP5.2.1, CCP5.2.6, CCP5.2.7]

Restoration of degraded land/wasteland [CCP5.2.7]

IPCC, 2022: Cross-Chapter Paper 5: Mountains

Group activity

Look at these four elements (water, energy, food and livelihoods) and the factors influencing them.

How are these aspects linked, how do they impact each other?

Select one of these and think of an example from your experience/knowledge.

What are key aspects to consider when managing the linkages in your example?

Figure 3: Generic overview of the WEF nexus in a mountain context. It depicts key components, interlinkages, influencing factors (grey area) and the institutional framework (modified based on [47]).

Source: Wymann von Dach, S. & Fleiner, R. 2019. Shaping the water– energy–food nexus for resilient mountain livelihoods. Issue Brief on Sustainable Mountain Development. Bern, Switzerland: Centre for Development and Environment (CDE), with Bern Open Publishing (BOP).

Water-Energy-Food Nexus in Mountain areas

WEF Nexus approach

- System-wise approach
- Focus on interdependence food, water and energy
- Supports integrated policy solutions to minimize trade-offs and maximize synergies across sectors
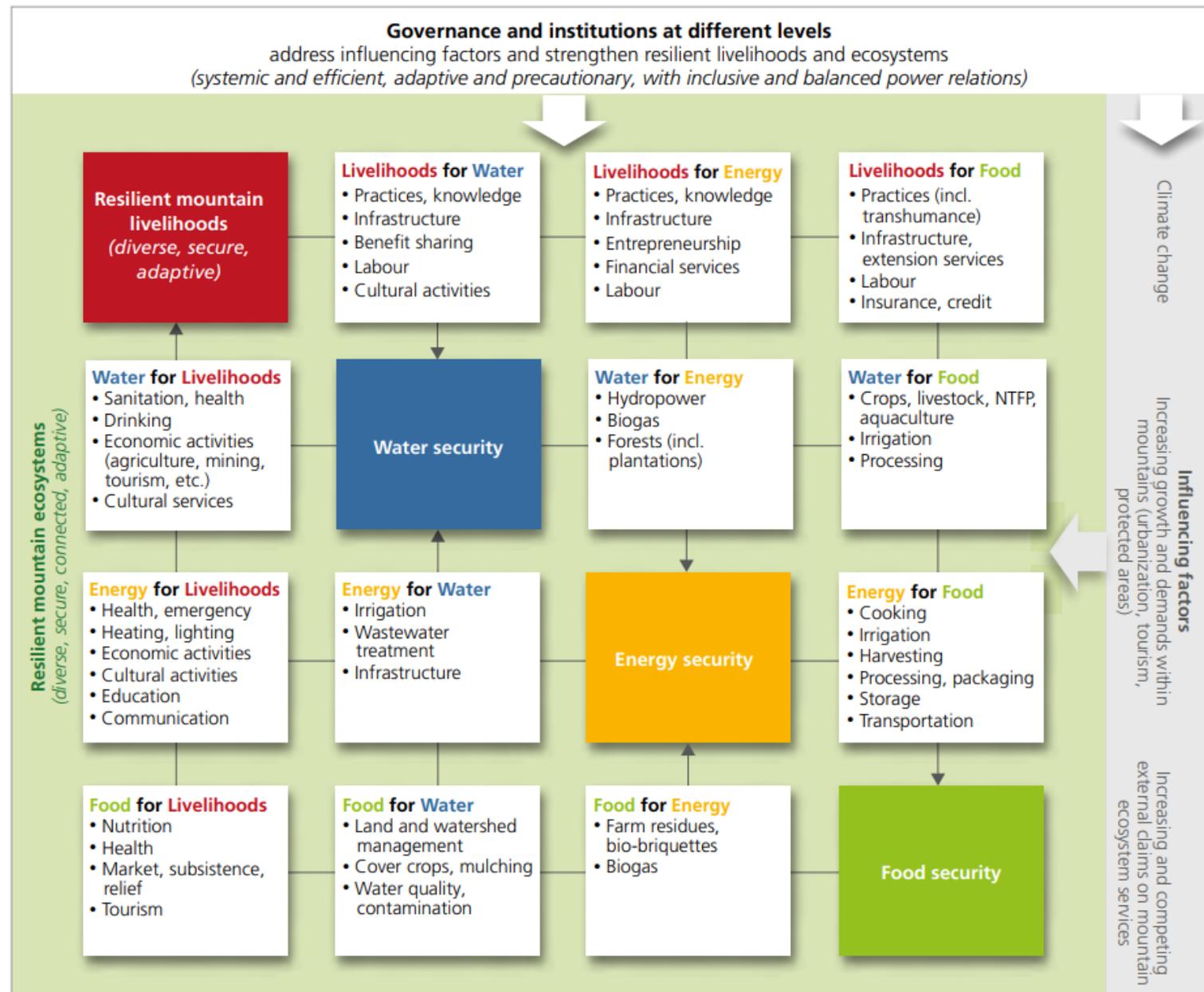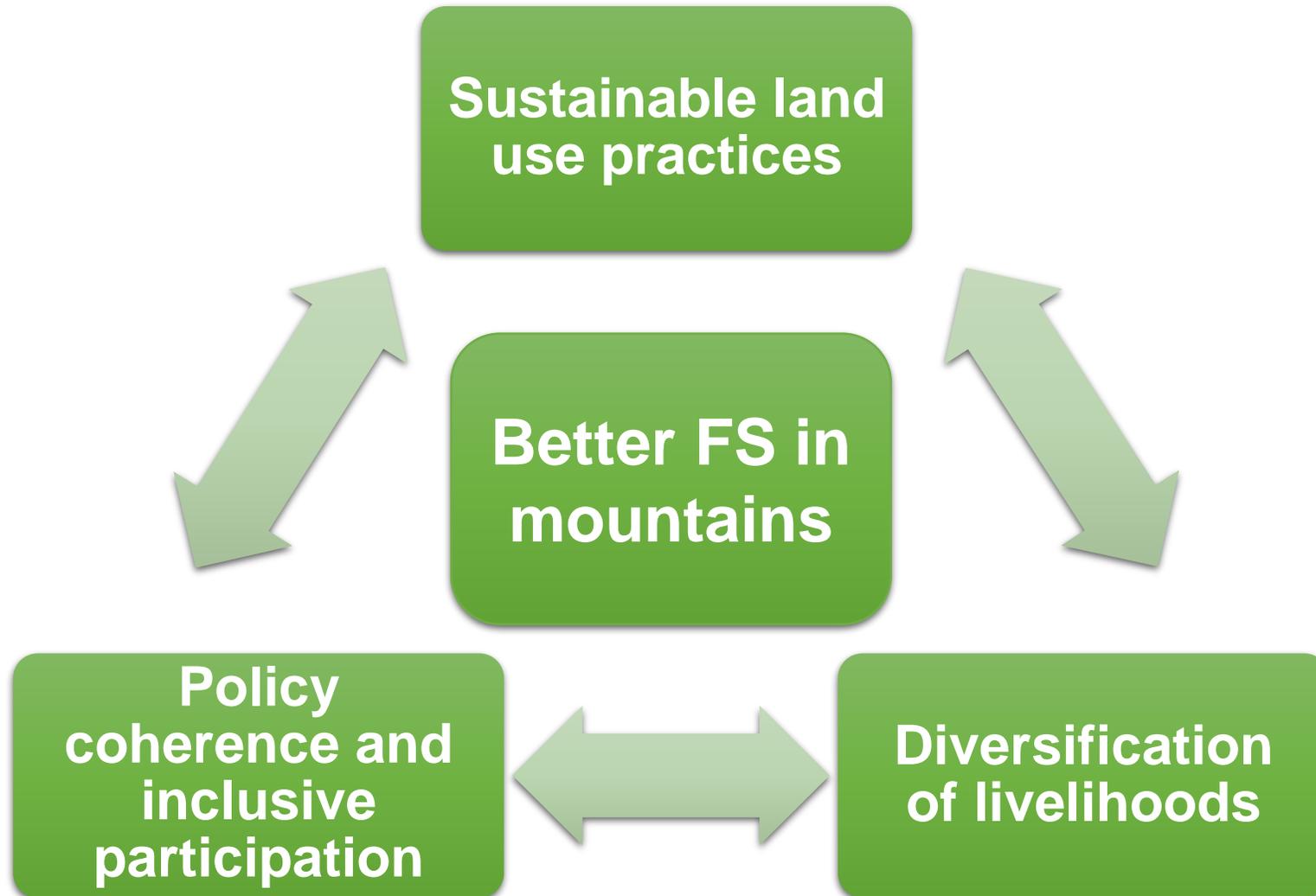- Ensure policy coherence and coordination across sectors and stakeholders

Figure 3: Generic overview of the WEF nexus in a mountain context. It depicts key components, interlinkages, influencing factors (grey area) and the institutional framework (modified based on [47]).

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Building better food systems in mountains

Examples (1)
Certification, labelling and geographical indications

The Mountain Partnership Products (MPP) initiative is a certification and labelling scheme based on environmentally and ethically sound value chains.

- 10 000 farmers involved (60% women)
- 13 producers organizations
- 20 products already carrying the MPP narrative label
- 8 countries: Bolivia, India, Kyrgyzstan, Mongolia, Nepal, Panama, Peru and the Philippines
- Sales increase up to 49%
- Production increase up to 40%
- Selling price increase up to 25%

- Capacity development on production techniques and product development
- Training on entrepreneurship and marketing
- Preservation of mountain agrobiodiversity and ancient varieties
- New market opportunities for indigenous crop varieties
- 4 countries coming soon: Guatemala, Lesotho, Papua New Guinea and Rwanda

Examples (2)
Certification, labelling and geographical indications

Case study: **Dried Apricots - Batken, Kyrgyzstan**

Tien-Shan Mountains, Class 4: elevation 1 500-2 500 m and slope ≥ 2

- Organic sundried apricots traditionally cultivated by family farmers

- Drying extends their expiration period and provides an important source of energy and income to local people during the winters.

- Apricot orchards also protect the environment, contributing to soil conservation and preventing natural disasters.

- The farmer cooperative Alysh-Dan serves domestic and foreign markets

Examples (3)
Certification, labelling and geographic indicators

*A **Geographical Indication (GI)*** is a sign (certification or label) used on goods that have a specific geographical origin and possess qualities or a reputation that are due to that origin.

Natural Factors	Human Factors
• soil • climate • water	• local culture • expertise • tradition

Contribute to:

➢ strengthening sustainability of local and global food systems
➢ preservation of traditional food products, environment, landscapes and biodiversity
➢ improve market access for origin-linked products
➢ higher incomes, the preservation of local resources and know-how, and potential new market linkages with the tourism sector.
➢ collective action (bring stakeholders together)

Improve local, national, regional and global legal frameworks to protect intellectual property rights

Promote sustainable consumption and production

Scale-up traditional indigenous (and heritage) food systems and agroecological production systems

Examples (4)
Certification, labelling and geographic indicators

Case study: **[Georgia: Support to Sustainable Value Chains through the Development of Geographical Indications in the Dairy Sector](#)**

Tusheti region, elevation 1 650 and 4 493 m

- FAO and EBRD support

- Trained on food safety and quality, certification and marketing of GI-protected foods

- Opportunities to celebrate food heritage, including in agritourism

- *Tushetian guda* cheese
  - Native breeds of cows and sheeps
  - preserving cultural heritage and providing new job opportunities for young people
  - Collective action

Examples (5)
Agroecology

In the mountainous regions of Tavush and Lori, Armenia, women have improved household economies by foraging for aromatic and medicinal plants to sell to organic tea producers (The Armenia Gender Project 2018).

Due to the rising market demand for high-quality, traditional mountain products, mountain farmers, particularly women, can improve their livelihoods.

(Source: Promoting Mountain Biodiversity Through Sustainable Value Chains (bioone.org))

Ararat, Armenia © FAO/Karen Minasyan

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Food systems and SDGs

The 2030 Agenda for Sustainable Development, including the 17 Sustainable Development Goals (SDGs), are global objectives that will shape national development plans (2015 -2030).

From ending poverty and hunger to responding to climate change and sustaining our natural resources, **food and agriculture lies at the heart of the 2030 Agenda.**

Overall Summit Portfolio of Action

	Secretary General's Statement of Action - Areas of Convergence		
	People	Planet	Prosperity
National Food Systems Transformation Pathways / Strategies	165 Member States made statements at the Summit – including 78 Heads of State and Government 116 Member States have posted National Food Systems Transformation Pathways / Strategies		
Areas of Action	Nourish All People / Boost Nature-Based Solutions of Production / Advance Equitable Livelihoods, Decent Work, & Empowered Communities / Build Resilience to Vulnerabilities, Shocks, and Stresses		
	Support Means of Implementation (Finance; Governance; Knowledge, Innovation, Technology, & Data; Capacity)		
Multi-Stakeholder Initiatives and Constituency Commitments	Multi-stakeholder initiatives and hundreds of complementary stakeholder commitments from actors at local, national, and global level posted on a digital platform space (producers, youth, IPs, civil society, private sector, SMEs, cities)		
Knowledge Base	Compendium		
Follow Up and Review	Approach to Follow Up and Review		

Top priorities from member state statements

Priority	Count
COVID-19 recovery	81
Collaboration / cooperation	81
Food security / zero hunger	65
Nutrition / diets	60
Sustainable production	51
Climate change resiliency, mitigation & adaptation	50
Child stunting / school feeding	43
Support for small farmers / family farming	40
Science and technology	39
Environment / nature / biodiversity	38
Investment / financing	36
Improve / increase / modernize Ag production	35
Innovation / research	30
Food loss and waste	28
Trade (strengthen, reform, subsidies)	28
Local food supply / self-sufficiency	27
Empowering women, youth, IPs	25
Poverty reduction / decent livelihoods	23
Inclusivity / equitability / social welfare	22
Food safety	21
Health / One health / NCDs	18
Blue foods / marine resources	15
Conflict / natural disasters / crises	14
Engaging the private sector	13
Education	13
Policy / ministerial / sectoral coordination	12
Sustainable consumption	12
Food systems governance	11
WASH / water management	11
Infras...	9
Land rights (access, reform)	9

Mountain areas at the Summit

- Independent FSS Dialogue: *"Mountains and sustainable food systems: Drivers of sustainable development"*

- Side event at the Pre-Summit: *"Food systems as a key pillar of sustainable development in mountains"*

Different solutions identified:

➤ **Protect traditional and indigenous food systems, local knowledge and practices**

➤ **Include the impacts of climate change** on mountains in policies

➤ **Address land rights and tenure issues**

➤ **Manage mountain food systems with a landscape perspective**

➤ **Promote specialized mountain products**

➤ **Tailor technology and innovations** to all people

➤ **Recognize women** as holders of agroecological knowledge and agents of agrobiodiversity conservation for food systems

Source: https://www.fao.org/mountain-partnership/events/event-detail/en/c/1400485/

Land-freshwater Nexus Cluster Coalition

- The Land-freshwater Nexus Cluster Coalition proposes a systematic, collaborative approach to manage land and water resources

- Proposes the development of incentives and initiatives that promote integrated land and water resources management in food systems to protect watersheds and conserve surface and groundwater resources

- Integrate innovative and traditional land and water resources management solutions for mountain, highland and lowland ecosystems

Land-freshwater Nexus Cluster Coalition Website

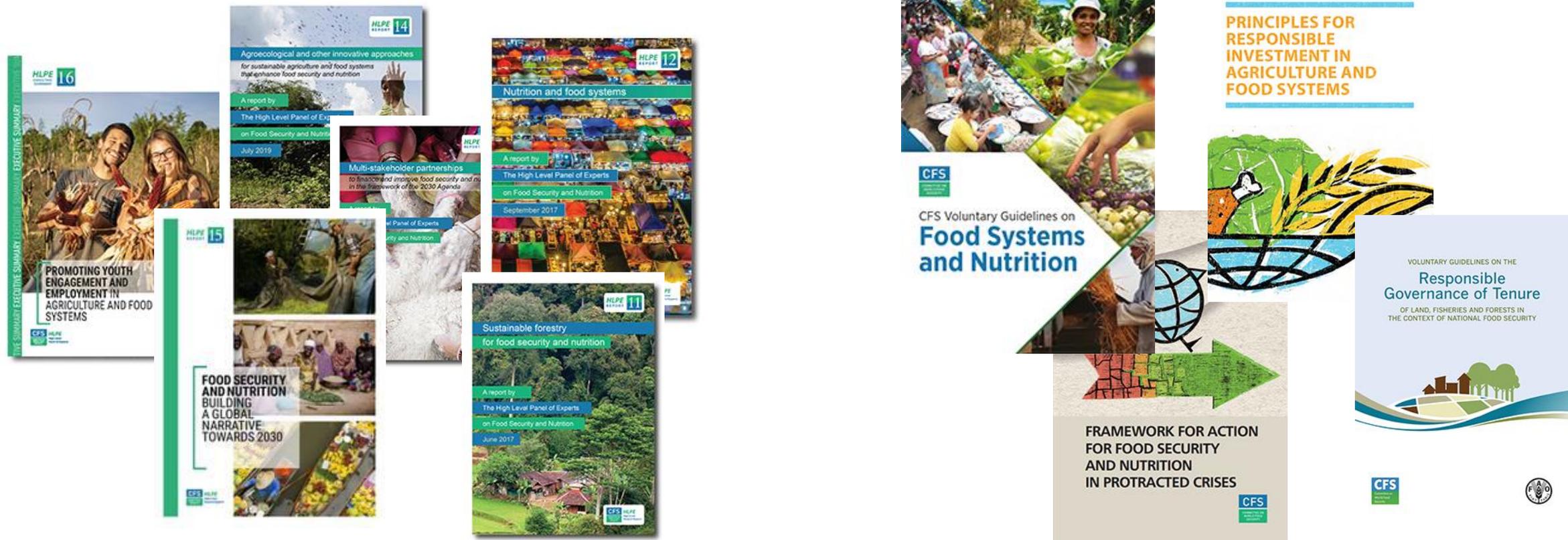# National Pathways and Mountains

- In their National Pathways, different countries recognized the need to focus on mountain food systems, in particular on production systems, livelihoods, food security and ecosystems in mountainous regions.
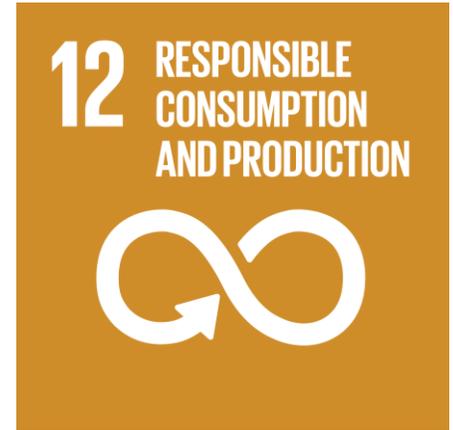 - E.g. Albania, Algeria, China, Lao PDR, Nepal, Switzerland

CFS –mountains, HLPE, VGFSyN

- [HLPE Reports | Committee on World Food Security (fao.org)](#)
- [CFS: Policy Products (fao.org)](#)

One Planet Network / FAO

10-Year Framework of Programmes on Sustainable Consumption and Production Patterns (10YFP).

·An implementation mechanism for Sustainable Development Goal 12

·The One Planet network, a multi-stakeholder partnership for Sustainable Development

·A network that leads the shift to sustainable consumption and production, providing unified direction, tools and solutions

Sustainable Food Systems

Sustainable Lifestyles and Education

Sustainable Buildings and Construction

Consumer Information

Sustainable Tourism

Sustainable Public Procurement

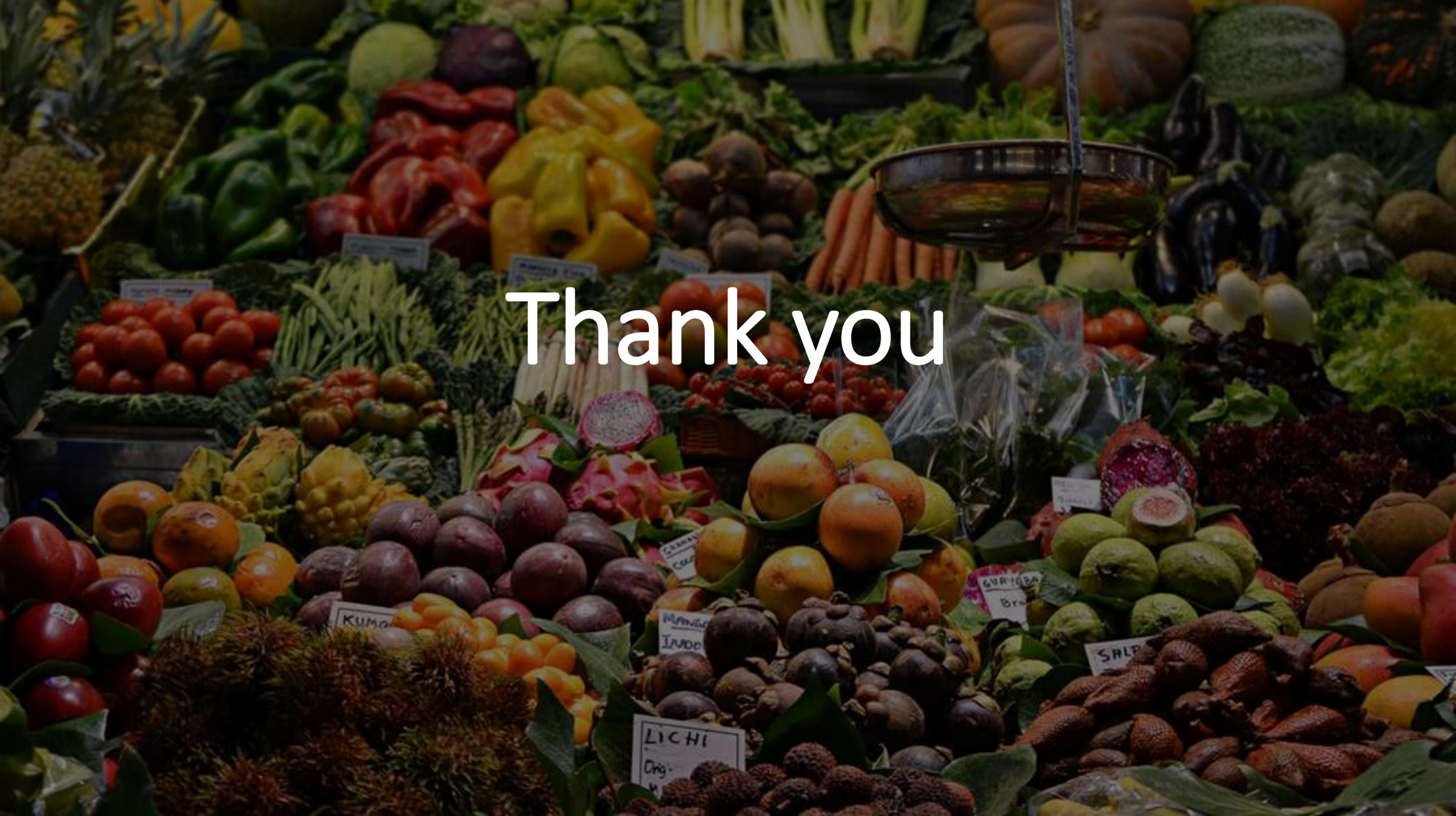One Planet Network | https://www.oneplanetnetwork.org/

Open discussion on international processes

➢ Do you see these international process (e.g. National Pathways, coalitions, CFS, global networks, etc.) as relevant for sustainable development in mountains?

➢ How could these processes be used or leveraged? What opportunities could emerge for mountains?

Pre-Summit, FAO. Source: https://forestsnews.cifor.org/74689/food-systems-summit-reveals-challenges-of-transforming-global-food-production?fnl=en