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Biodiversity for food and agriculture – from genetic resources to ecosystems and food systems

Irene Hoffmann, Commission on Genetic Resources for Food and Agriculture

CGN Genetic Diversity Event, Omnia, Wageningen 15 March 2023

Assessments

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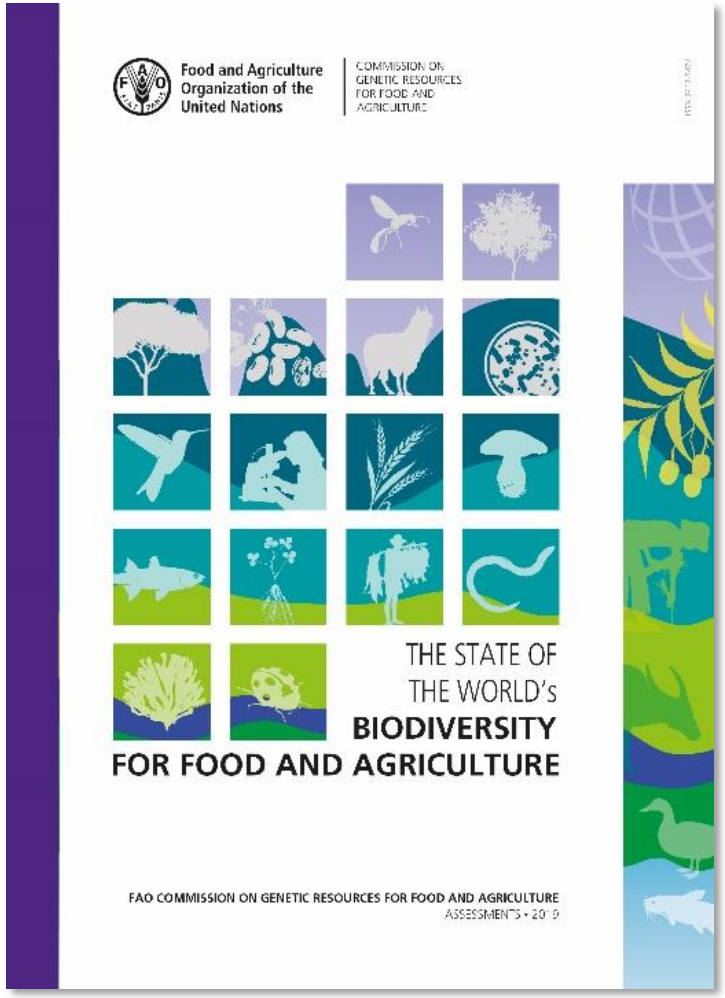
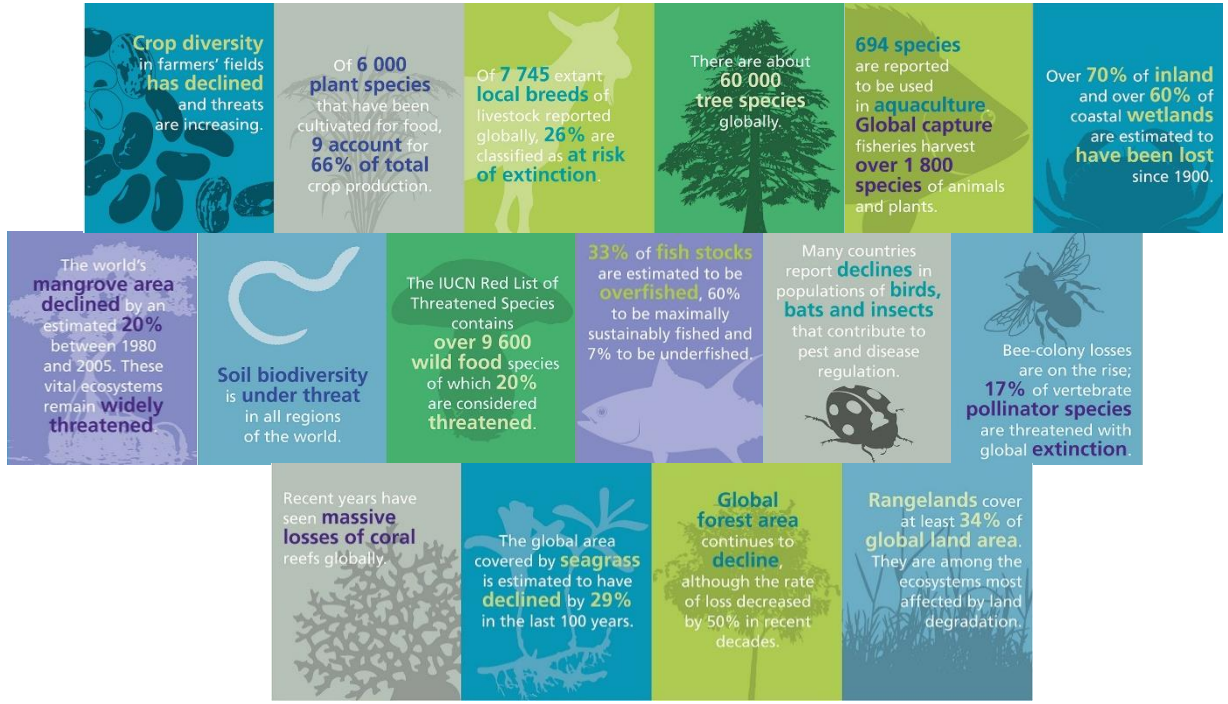
Biodiversity for food and agriculture is declining





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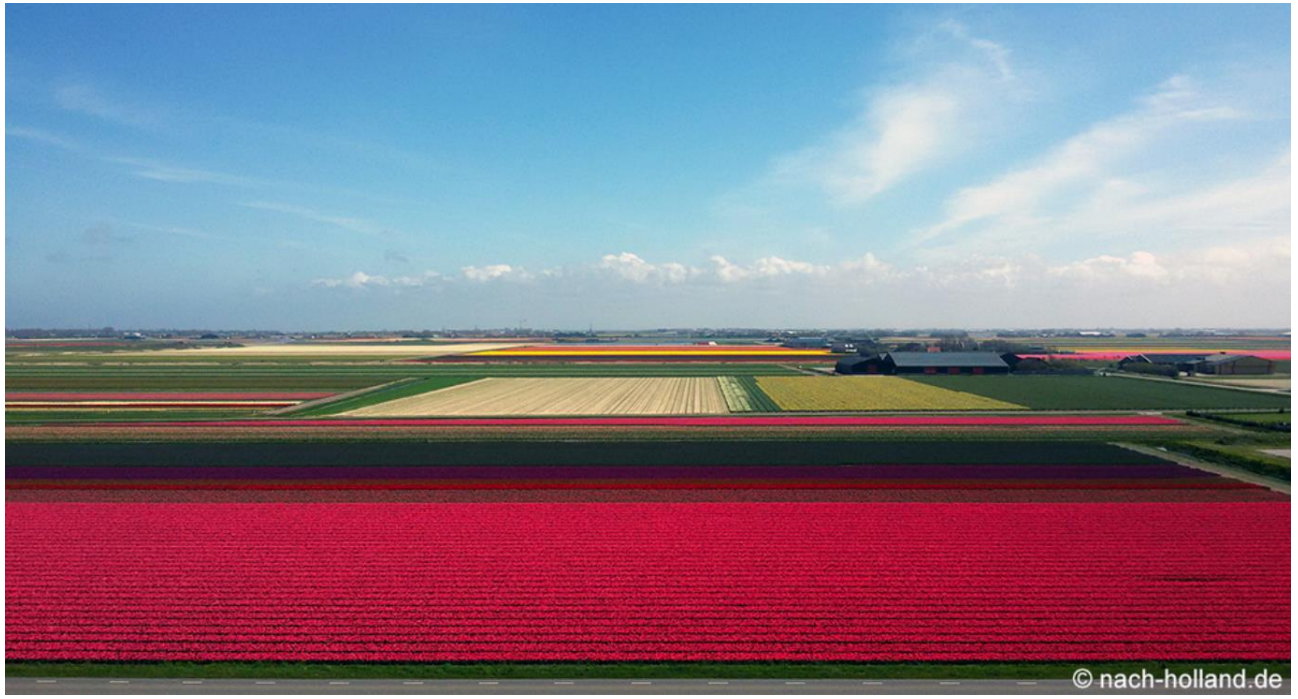
Loss of landscape diversity



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64% of global agricultural land is at risk of pesticide pollution by >1 AI

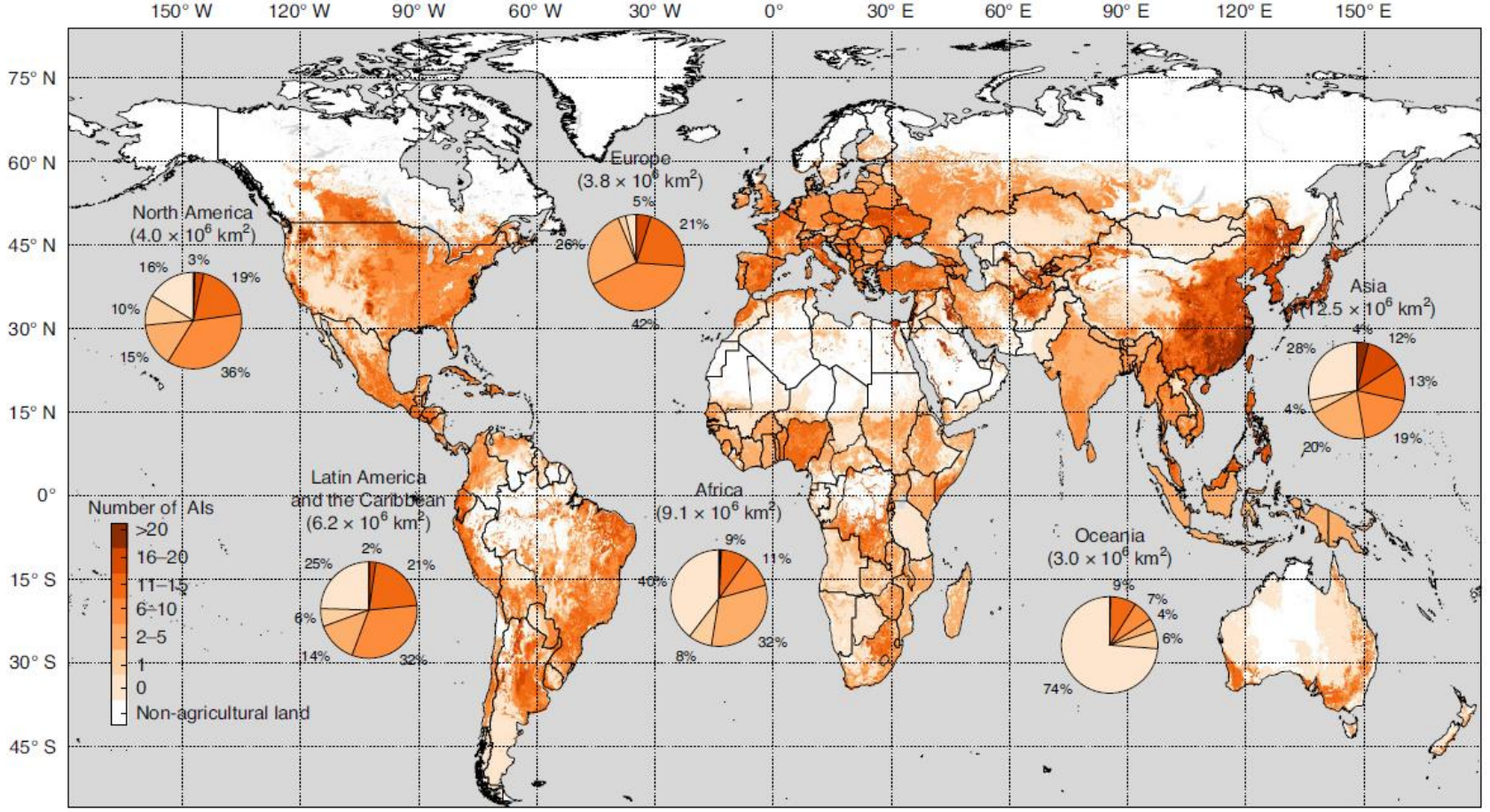

Fig. 2 | Global map of the number of AIs posing risks to the environment. The map has a spatial resolution of 5 arcmin, which is approximately 10 km × 10 km at the Equator. The pie charts represent the fraction of agricultural land contaminated by different numbers of AIs in each region, and the values in parentheses above the pie charts denote the total agricultural land in that region.

31% of area at high pollution risk.
Of which 34% in high biodiversity regions.

More than 80% of groundwater in high biodiversity areas is at some risk of pesticide pollution.

Tang et al., 2021

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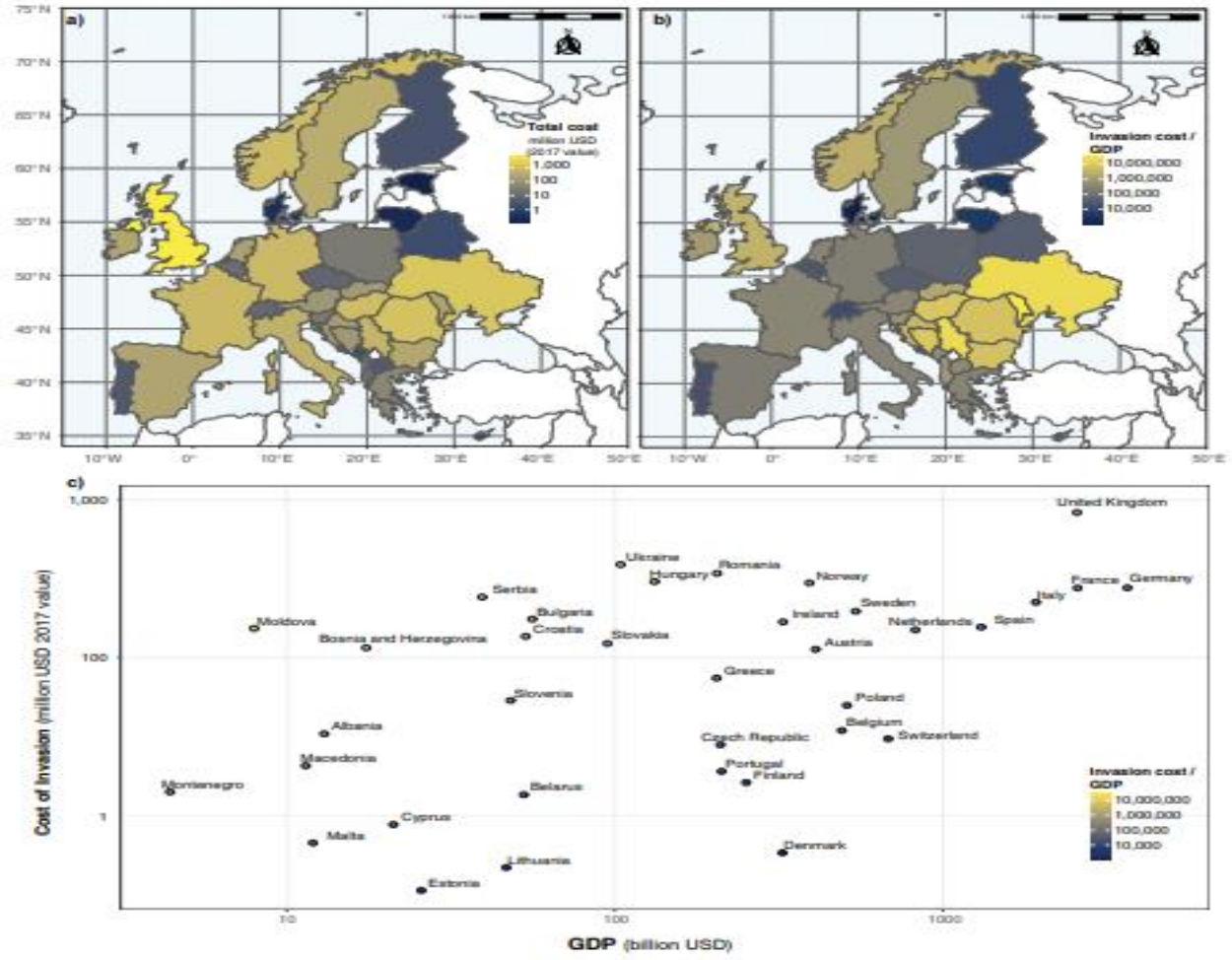
About 50% of 1517 recorded IAS were intentionally introduced



Intentional introduction of plants

- 46% thru horticulture / nursery trade
- 21% thru agriculture
- 8% thru land reclamation / erosion control

(Turbelin et al 2017)

Economic costs of invasive alien species across Europe (Haubrock et al 2021)

The use of many biodiversity-friendly practices is reported to be increasing

Management practices and approaches	Production systems (PS)											
	Livestock grassland-based systems	Livestock landless systems	Naturally regenerated forests	Planted forests	Self-recruiting capture fisheries	Culture-based fisheries	Fed aquaculture	Non-fed aquaculture	Irrigated crop systems (rice)	Irrigated crop systems (other)	Rainfed crop systems	Mixed systems
Landscape management	↗	↗	↗	↗					↗	↗	↗	↗
Ecosystem approach to fisheries					↗	↗	↗					
Restoration	↗		↗	↗	↗				↗	↗	↗	↗
Diversification	↗	↗	↗	↗	↗	↗	↗		↗	↗	↗	↗
Home gardens	↗	↔	↗	↗					↗	↗	↗	↗
Agroforestry	↗	↗	↗	↗					↗	↗	↗	↗
Polyculture/aquaponics							↗					↗
Organic agriculture	↗	↗	↗	↗					↔	↗	↗	↗
Low external input agriculture	↗↙	↗	↗	↗					↗	↗	↗↙	↗
Sustainable soil management	↗	↗	↗	↗					↗	↗	↗	↗
Management of micro-organisms	↗		↗	↗	↗				↗	↗	↗	↗
Conservation agriculture	↗	↗	↗	↗					↗	↗	↗	↗
Integrated plant nutrient management	↗	↗	↗	↗					↗	↗	↗	↗
Integrated pest management	↗	↗	↗	↗	↗				↗	↗	↗	↗
Pollination management	↗	↗	↗	↗						↗	↗	↗
Enrichment planting			↗	↗								↗
Reduced-impact logging			↗	↗								
Domestication	↗	↔	↗↙	↗			↗		↗	↗	↗	↗
Base broadening	↗	↗	↗↙	↗					↗	↗	↗	↗

Proportion of countries reporting the PS that report any trends (%)

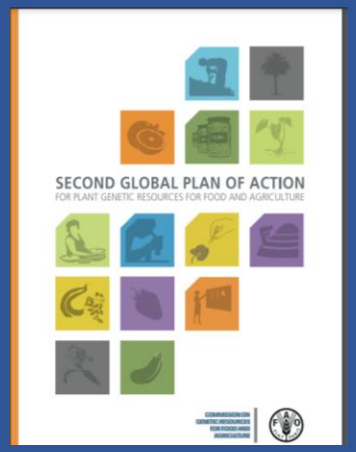
0–9
10–19
20–29
30–39

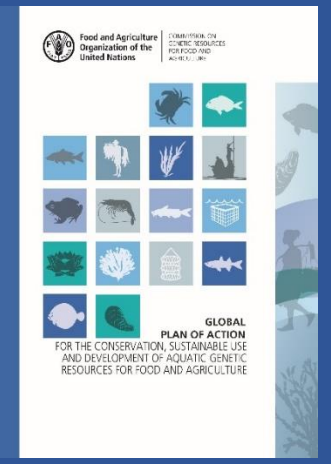
Notes: Analysis based on 91 country reports. See main report for details of the methodology.

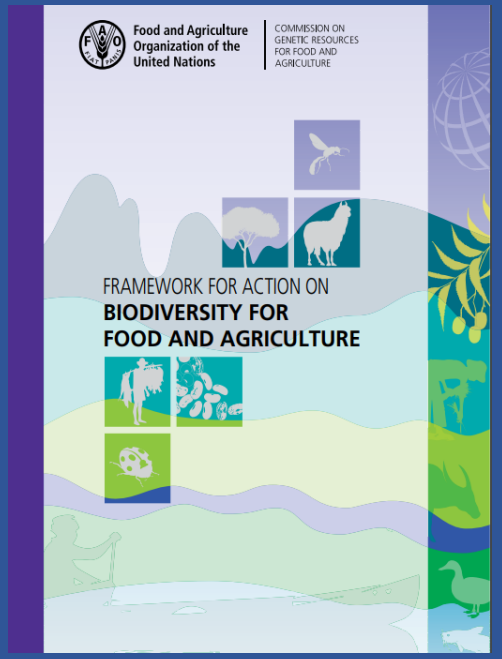
Global policy landscape

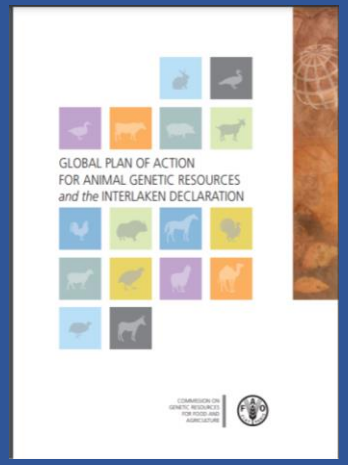
CGRFA

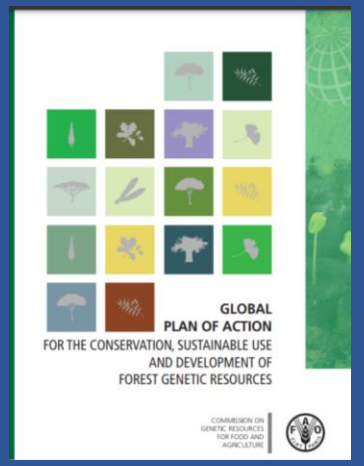
Policy response to the SOWs











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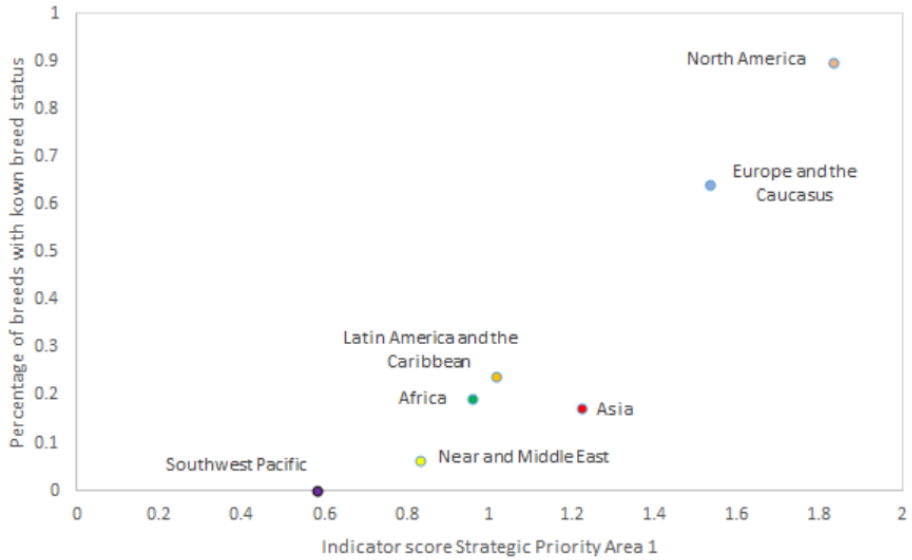
National implementation of GPAs

- Monitoring frameworks with response/ process and resource indicators, incl. SDG 2.5.
- Sectoral differences, incl. networks
- Better reporting on process than GRFA
  - 41 (of 66 reporting countries) reported national strategies for FGR in 2022
  - 70 % of countries reported that a strategy or policy on PGR existed in 2019
  - >60% of countries reported national strategies for AnGR in 2020
- Difficult to link process and state of resource

Figure 10. Relationship between implementation of Strategic Priority Area 1 and the availability of breed population data at regional level



- More focus / better data on *ex situ* than *in situ* / on farm conservation
- Sustainable use / development / breeding of GRFA difficult to grasp

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Framework for Action on Biodiversity for Food and Agriculture

Strategic Priority Area 1: Characterization, assessment and monitoring of biodiversity for food and agriculture

1.1 Improve availability of, and access to, information on biodiversity for food and agriculture

Strategic Priority Area 2: Management of biodiversity for food and agriculture

2.1 Promote sustainable use of biodiversity for food and agriculture and integrated approaches to its management

2.2 Improve conservation and restoration of biodiversity for food and agriculture

Strategic Priority Area 3: Institutional frameworks for biodiversity for food and agriculture

3.1 Build capacity through awareness raising, research, education and training

3.2 Strengthen legal, policy and incentive frameworks

3.3 Improve cooperation and funding

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Kunming-Montreal Global Biodiversity Framework (GBF)

11 Sections

Four Goals for 2050

23 Targets for 2030

Cop-15-dec-4, 5, 6, 8, 10, 11

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Targets of the Kunming-Montreal GBF directly related to agrifood sectors

Target 1: Addressing land and sea use change

Target 2: Ecosystem restoration

Target 4: Extinction risk and genetic diversity

Target 5: Use, harvesting and trade of wild species

Target 6: Invasive alien species

Target 7: Pollution

Target 8: Climate change

Target 9: Benefits from the use of wild species

Target 10: Sustainable agriculture, aquaculture, fisheries and forestry

Target 11: Nature's contribution to people, including soil health and pollination

Target 13: Access and benefit sharing from the utilization of genetic resources

Target 14: Mainstreaming biodiversity

Target 16: Sustainable consumption choices & global footprint of consumption

Target 18: Incentives and subsidies harmful to biodiversity

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Mutual supportiveness of FA-BFA and KM-GBF

FA-BFA	KM-GBF
SPA 2.1.9	Target 1 spatial planning
SPA 3.2.9	Target 2 restoration
SPA 1.1.6, 2.2.1, 2.2.4, 3.2.13	Target 3 protected areas
SPA 2.1.1, 2.2.2, 2.2.3, 3.3.3	Target 4 genetic diversity
SPA 2.1.3, 2.1.6	Target 7 pollution
SPA 1.1.1., 1.1.2, 3.2.12	Target 9 wild species
SPA 2.1.2, 2.1.4, 2.1.5, 2.1.7, 2.1.8, 3.3.10	Target 10 agriculture
SPA 1.1.4, 1.1.5	Target 11 ecosystem services
SPA 3.2.11, 3.3.6	Target 13 ABS
SPA 3.2.10	Target 16 consumption
SPA 3.2.8	Target 18 incentives

Economics of BFA management

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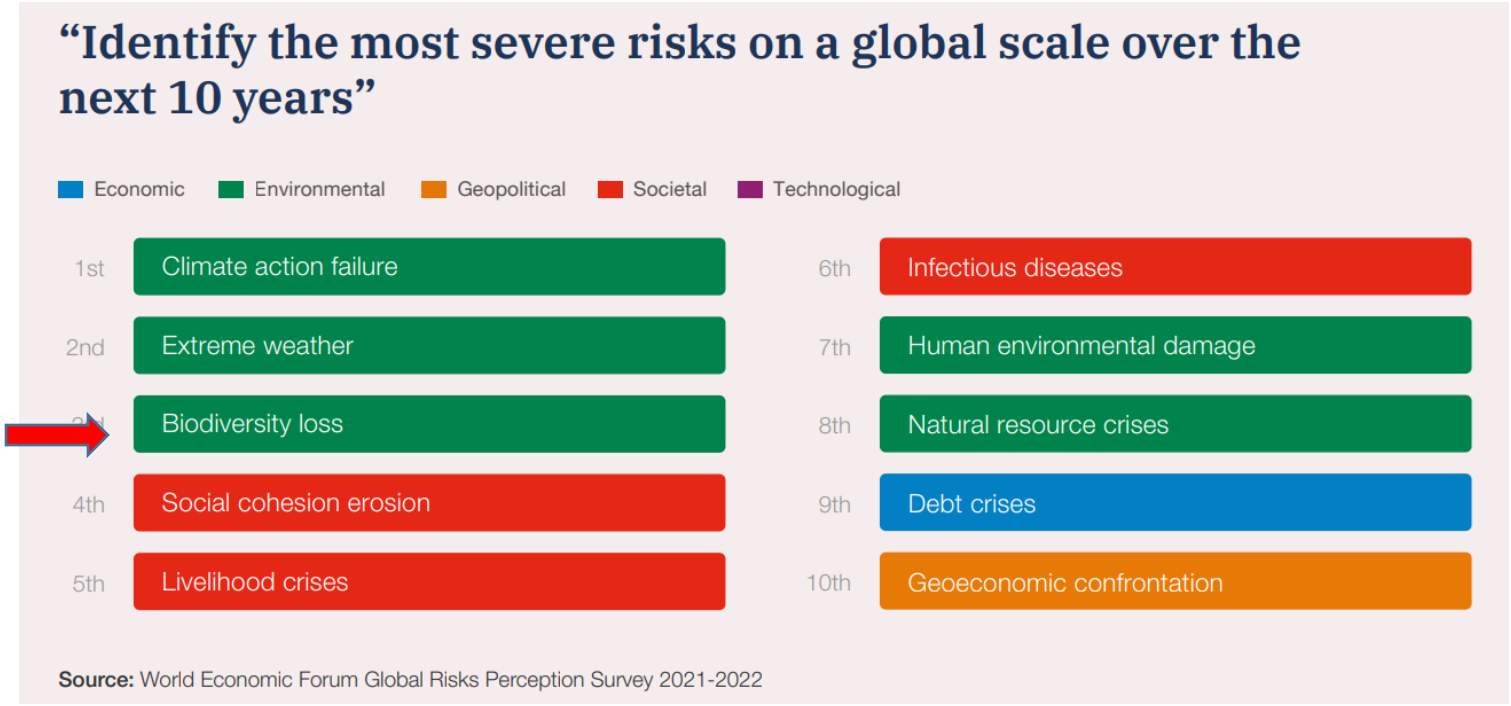
Industry leaders' view



Source: World Economic Forum

The Global Risks Report 2021 12

Genomics and other technologies get cheaper

In all GR

- Genomics and IT, DSI increasing
- **Characterization** and understanding (biology /evolution/ environment)

In GRFA

- **Conservation** targeting, curating – population reconstitution / cloning
- **Use** / breeding in developed countries and commodities with large numbers and sophisticated breeding programmes
    - potential for underutilized species; improvement of nutrition quality; rare and difficult-to measure traits; inbreeding control etc

Huge economies of scale - Huge technology / capacity gaps

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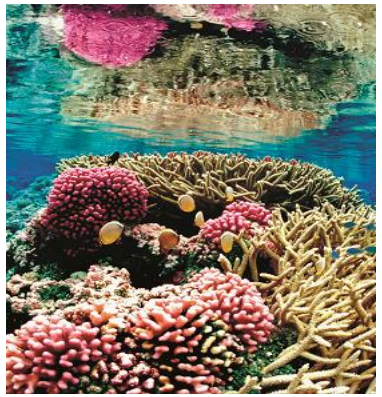
How to get the market to pay prices that include externalities? Who pays for public goods the market does not pay for?



- BFA and nature conservation, custodianship
- PES, regulating and supporting ecosystem services

Support to agricultural producers accounts for 15 % of total production value

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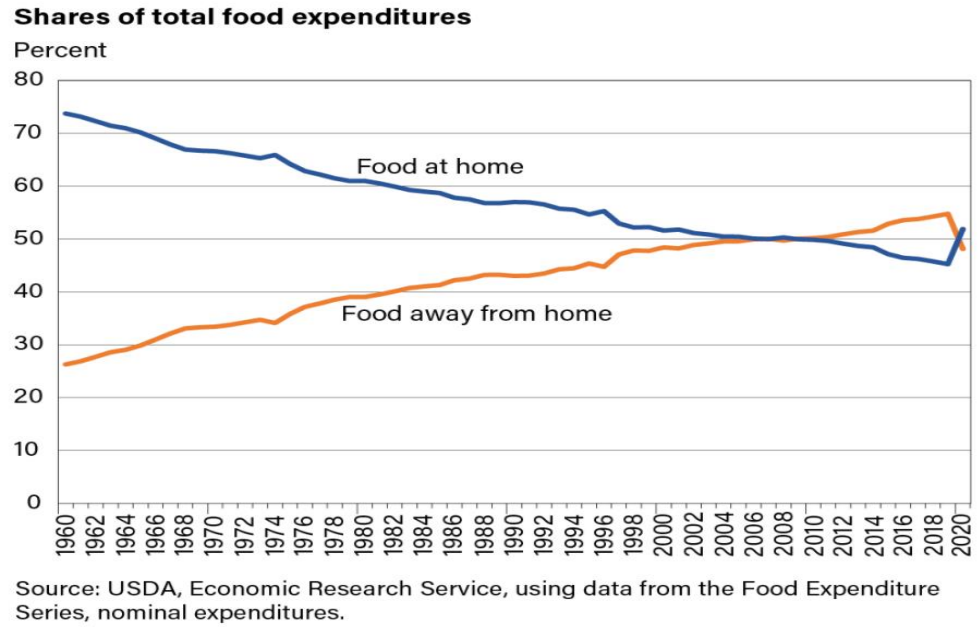
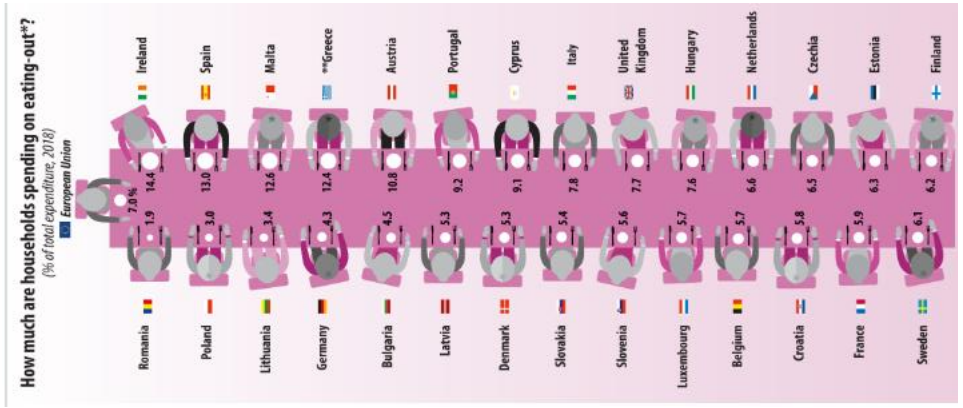
Which consumers?



Source: USDA, Economic Research Service, using data from the Food Expenditure Series, nominal expenditures.



Opportunities

Rising **consumer** preference for

- Fresh and natural food products
- Local or regional and seasonal products

Governments and industry

- Labels and certification
- Promotion of healthy diets, dietary guidelines

Challenges

- Shocks (Covid 19, Ukraine war)
- Affordable food - cheap food
- Rising demand for convenience food & ready meals, food away from home
- Concentration in the food processing industry
- Rising share of supermarkets

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Which farms?

Farm type	Number	Land area	Production	Value chains
family farms	more than 90% of 608 million farms (1)	70–80% of farmland (1)	around 80% of the world's food in value terms (1) ; around 53% of the world's food (4)	
thereoff large farms >50 ha	1% of of 608 million farms (1)	70 % of farmland (1)	75% - 100% of all cereal, livestock and fruit production in N / S America, Australia and New Zealand (5)	integrated into global food chains (2)
thereoff small farms <2 ha	84% of 608 million farms (1)	12% of agricultural land (1)	around 35% of world food (1)	generally excluded from global food chains (2) often untapped intensification potential

1 Lowder et al 2021; 2 Bauluz et al., 2020; 3 Ricciardi et al. 2018; 4 Graeub et al. 2016; 5 Herrero et al. 2017

Europe

EU green deal

- EU biodiversity strategy for 2030, enlarge existing Natura 2000 areas, EU Nature Restoration Plan (reduction of use of fertilizers by > 20%, > 10% of agricultural area under high-diversity landscape features)
- 2022 proposal for a Regulation on nature restoration
- Farm to Fork strategy with pesticide reduction targets, IPM,
- EU Pollinators Initiative
- Common Agricultural Policy
- Action plan for organic production

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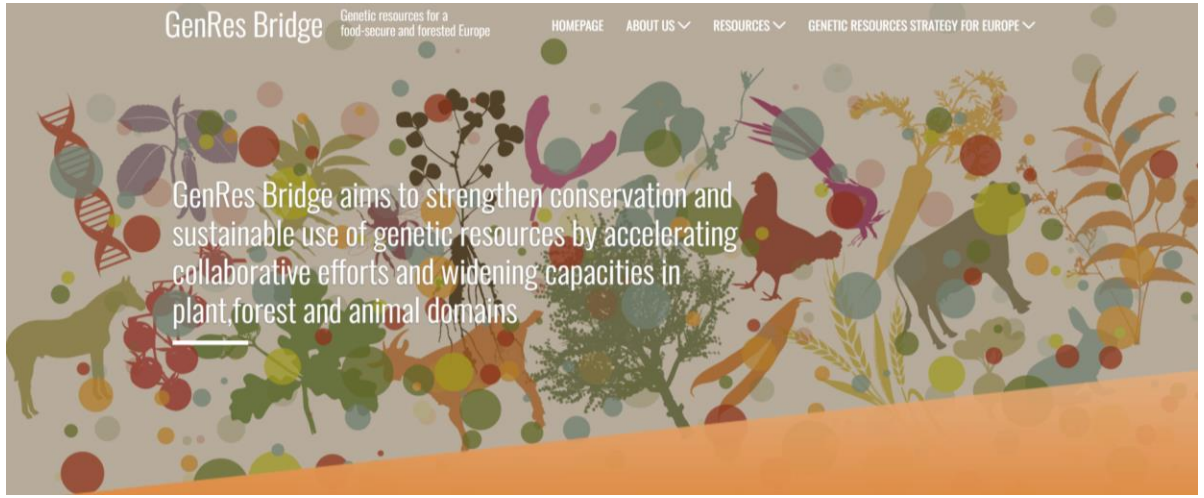
EU GenRes and Horizon 2020 projects



Genetic Resources

REVIEW

Genetic Resources (2020), 1 (1) 4–16
DOI: 10.46265/genresj.2020.1.4-16
https://www.genresj.org
ISSN: 2708-3764

Global status of genetic resources for food and agriculture: challenges and research needs

Dafydd Pilling, Julie Bélanger *, Stefano Diulgheroff, Jarkko Koskela, Grégoire Leroy, Graham Mair and Irene Hoffmann

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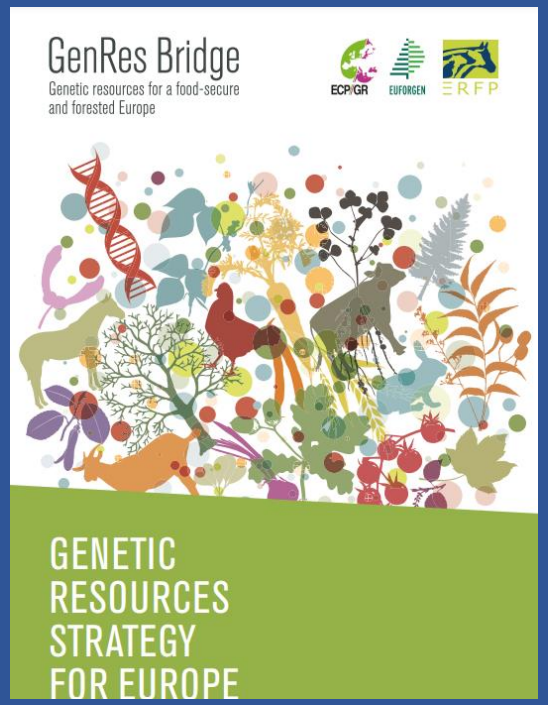
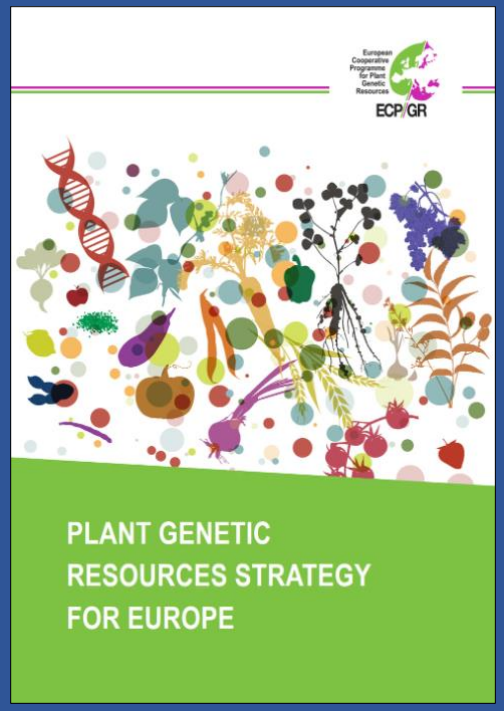
Abstract: Plant, animal, forest, aquatic, micro-organism and invertebrate genetic resources are vital to food security, nutrition, livelihoods and the resilience and adaptability of global agricultural production systems. Despite increasing efforts in recent years, much remains to be done to improve the management of these resources. Many are at risk of extinction or erosion and many have been overlooked in terms of use and development. There is an urgent need to address these deficiencies, both within the individual sectors of food and agriculture and in terms of how genetic resources management can be better integrated across sectors. These efforts will need to include action to address the multiple knowledge gaps that constrain improvements to management. They will also need to include the creation of policy and institutional frameworks that promote collaboration and stakeholder participation and allow sustainable management strategies to be implemented effectively at appropriate scales.

Keywords: genetic resources, food and agriculture, Sustainable Development Goals, global assessments, knowledge gaps

European networks
ECPGR, ERFP and EUFORGEN





New European Reference Centre for Endangered Animal Breeds established

October 10, 2022

From 1 January 2023, experts of Wageningen University & Research (WUR) will work together with IDELE (France) and BLE (Germany) to advise the European Commission, national governments and breed organisations on sustainable breeding programmes for endangered farm animal breeds, as well as the implementation of EU breeding regulations.

The Standing Zootechnical Committee of EU DG SANTE approved the European Commission's proposal to establish an EU Reference Centre for Endangered Animal Breeds (EURC-EAB) on October 3rd, 2022. In this new EU Reference Centre, WUR will be working alongside IDELE (Institut de l'Élevage, France) and BLE (Federal Office for Agriculture and Food, Germany). Sipke-Joost Hiemstra (Wageningen Livestock Research/Centre for Genetic Resources, the Netherlands) has been appointed Director.

The EURC-EAB will collaborate closely with the European Regional Focal Point for Animal Genetic Resources (ERFP). ERFP is the European network of National

Conclusions

Top-down – bottom-up; global – regional – national – local

A lot still needs to be done – innovation – leaving silos and comfort zones

- Cross-sectoral, multi-stakeholder approaches
  - Spatially integrated – land/seascapes
  - Vertical - value chains
  - Policies -regulation – markets – incentives
  - Socio-economic context
- Focus on sustainable use
- Inclusive use of genomics / technologies for ALL GRFA and countries

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Thank you

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http://www.fao.org/cgrfa/