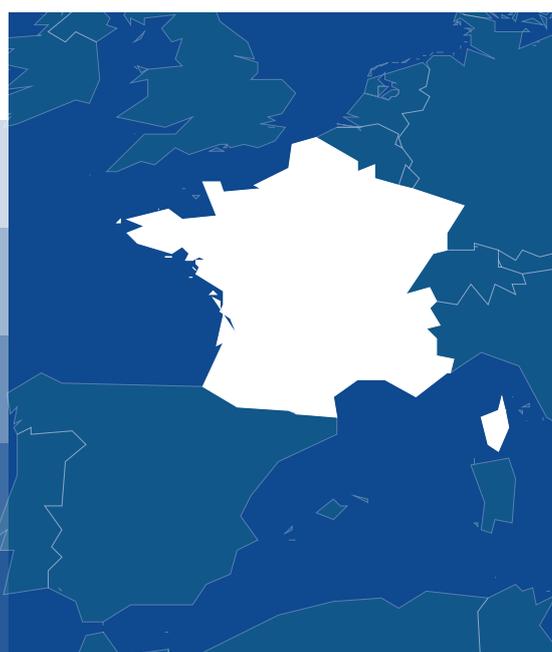


France

Country profile



Key messages

- France has an Agrobiodiversity Index status score of 68.8 reflecting a moderate to high integration of agrobiodiversity into the food system.
- In consumption, there is a high diversity of food items available for consumption resulting in relatively low prevalence of diet-related diseases.
- In production, crop species richness is high relative to other Mediterranean countries, yet there is potential to substantially increase the diversity of livestock breeds in production, improve soil biodiversity, and increase the proportion of natural habitat in cropped landscapes.
- In conservation, *ex situ* conservation of a diversity of crop cultivars and plant species is high compared to other countries around the world, but useful wild plants are poorly represented in genebanks and botanical gardens.
- There is potential for more diverse and stronger policies for integrating agrobiodiversity across the whole food system.

Pillar 1: Agrobiodiversity in consumption for healthy diets
Pillar 2: Agrobiodiversity in production for sustainable agriculture
Pillar 3: Agrobiodiversity in conservation for future use options

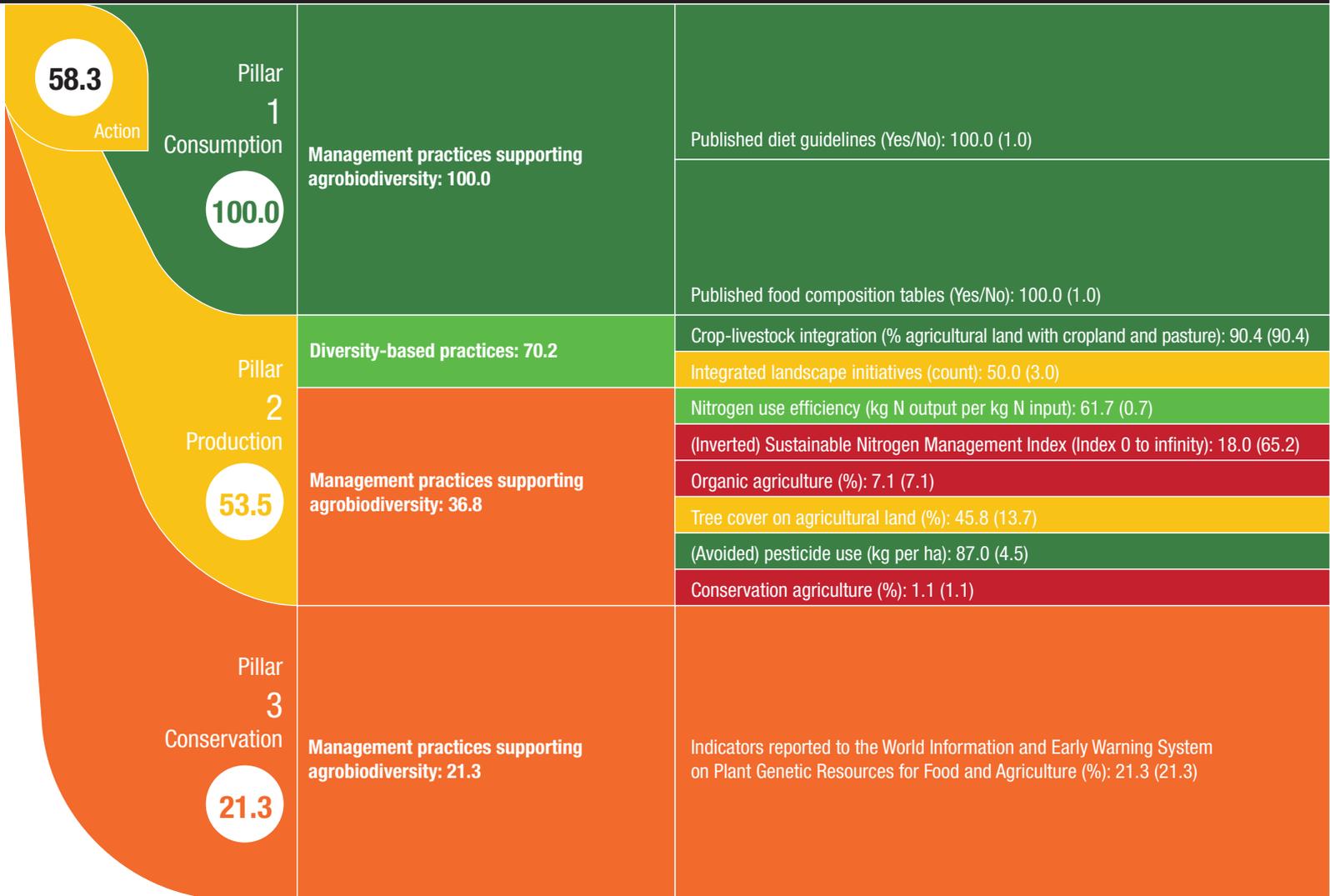
Score	41-60	61-80	81-100
0-20			
21-40			

All raw scores are scaled from 0 to 100. See Annex 2 for details.

SUB-INDICATOR (raw scores)	INDICATOR	PILLAR
Overall agrobiodiversity: 0 (0)	Commitments supporting agrobiodiversity: 0	Pillar 1 Consumption 17.2 Commitment 0.0
Varietal/breed diversity: 0 (0)		
Species diversity: 0 (0)		
Functional diversity: 0 (0)		
Underutilized species: 0 (0)		
Overall agrobiodiversity: 33.3 (1)	Commitments supporting agrobiodiversity: 25.0	Pillar 2 Production 25.0
Varietal/breed diversity: 33.3 (1)		
Species diversity: 33.3 (1)		
Functional diversity: 0 (0)		
Underutilized species: 0 (0)		
Pollinator diversity: 33.3 (1)		
Soil biodiversity: 33.3 (1)	Commitments supporting agrobiodiversity: 26.6	Pillar 3 Conservation 26.6
Landscape complexity: 33.3 (1)		
Overall agrobiodiversity: 33.3 (1)		
Varietal/breed diversity: 33.3 (1)		
Species diversity: 33.3 (1)		
Functional diversity: 33.3 (1)		
Underutilized species: 0 (0)		



PILLAR	INDICATOR	SUB-INDICATOR (raw scores)
--------	-----------	----------------------------



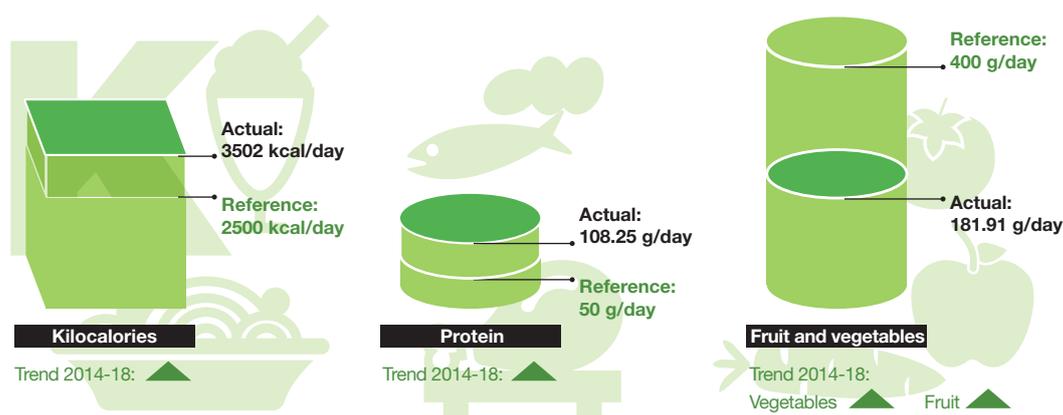
Context

France is a high-income country in Western Europe covering an area of 549,087 km².¹ With 67 million inhabitants, France has a population density of 122 people per km² and a primarily urban population (81%).²⁻⁴ France has a mixed economy with a gross domestic product (GDP) of US\$2.7 trillion in 2019.⁵ Agriculture, forestry, and fishing contribute only about 1.6% to GDP, but are still a key sector of the country's economy.⁶ In 2016, 0.1% of the French population lived below the poverty line,⁷ no data are available on the country's multidimensional poverty index.⁸

Consumption for healthy diets

Important ingredients of the French diet include fresh fruits, vegetables, meat, fish and seafood, cheese, bread, rice, pasta, and red wine (Figure 1).⁹ The traditional meal forms part of France's culture and intangible heritage, and follows a specific order: aperitif (alcoholic beverage served before a meal), starter, main course (meat/fish and a vegetable), cheese, dessert, digestif.^{10,11} On average, a healthy person in France lives up to 83 years. In 2019, 2.5% of the French population was undernourished and in 2018, 6% were facing moderate to severe food insecurity, a 0.3% decrease compared to 2017.^{12,13} The latest 5-year average (2012–2016) of anemia prevalence in reproductive women was 16.3%, with an average annual increase of 0.7%.¹⁴ and almost 5% of the population suffers from diabetes.¹⁵ No data on prevalence of stunting and wasting in children were found.^{16,17} An estimated 21.1% of adult women (aged 18 years and over) and 22.0% of adult men are living with obesity.¹⁸

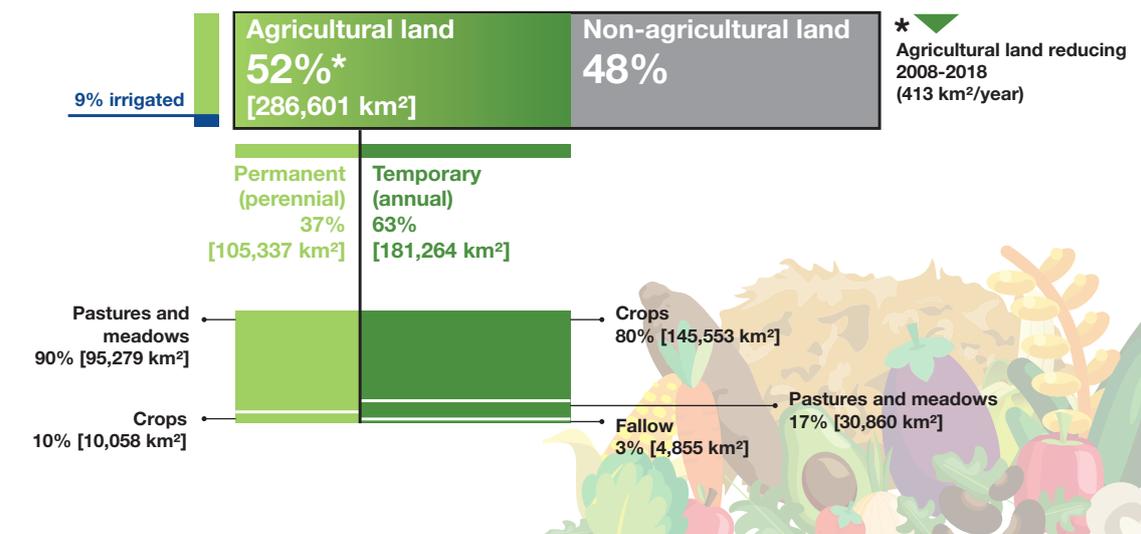
Figure 1: Kilo-calorie, protein, fruit and vegetable supply



Production for sustainable agriculture

The agricultural sector represented 2.4% of employment in 2019, a decrease of 0.9% since 2010.¹⁹ France has over 400,000 agricultural holdings, where 824,000 people live, 70% of whom are farmers. 30% of the permanent agricultural workforce is female. In 2019, agri-food was the sector that generated the third largest trade surplus of EUR 7.9 billion.²⁰ France owns the biggest cattle herd in Europe with 19 million head of cattle, including 3.6 million dairy cows. Agricultural land in France spans over 286,601 km² (Figure 2).²¹ The top three crops in terms of economic value contributing to GDP (in % of total contribution from agriculture) are grapes (0.6%), wheat (0.3%) and potato (0.1%).²² Fish production by capture in 2016 was 561,173 tonnes and for aquaculture in 2018 amounted to 185,150 tonnes.^{23,24} Livestock production, consisting mainly of eggs, milk, and meat (pig), was around 69.5 million tonnes in 2018.²⁵ Crop yields in France are predicted to be adversely affected by climate change under a wide range of climate models and emission scenarios. For instance, under the worst-case scenario (business as usual), it is predicted that the yields of winter wheat, winter barley, and spring barley will face a decline of between 17% and 33%.²⁶ Climate-induced land-use change is expected to cause crop land expansion at the expense of forests and pastures, in the event of a temperature rise²⁷ and will negatively impact freshwater ecosystems by lowering their biodiversity.²⁸ Soft wheat, a popular arable crop, faces both soil-borne (eyespot, take-all) and foliar (mainly Septoria leaf spot, rusts and Fusarium foot rot) fungal diseases, which will affect yield, although future climate scenarios also predict a decline in such infections.²⁹

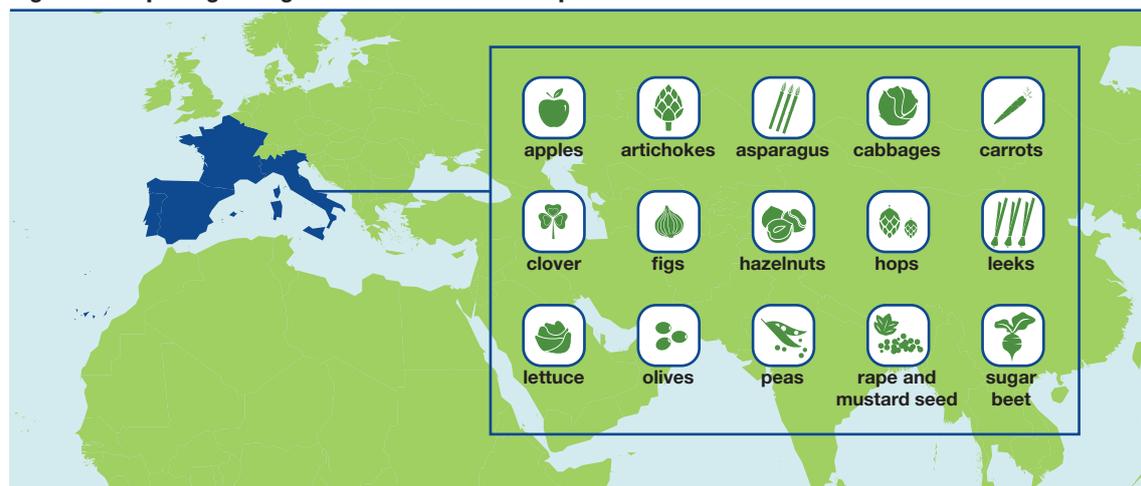
Figure 2: Land used for agriculture



Conservation for future use options

France forms part of several global biodiversity hotspots (Atlantic, Continental, Mediterranean and Alpine), with several types of ecosystems and landscapes (Figure 3).³⁰ The country's rich and diverse flora count around nearly 4,900 native plant species (~40% of European flora).^{31,32} France has 1,755 sites which fall under 'Natura 2000', a network of protected sites for biodiversity conservation across Europe, which is equivalent to 13% of its terrestrial land and 11% of its marine exclusive economic zone.³³ From 2001 to 2019, France lost 11,400 km² of forest cover. This loss is attributed to forestry, shifting agriculture, wildfires and to a lesser extent urbanization.³⁴ The main pressures driving agrobiodiversity and biodiversity loss in France are habitat degradation, impact of invasive alien species and climate change.³⁵

Figure 3: Crops originating from Southwestern Europe



Agrobiodiversity Index score

France has an Agrobiodiversity Index status score of 68.8.

Status: What's driving the Agrobiodiversity Index score?

For France, we see that scores are highest in consumption (85.2), followed by conservation (71.3), and production (49.8). This indicates that agrobiodiversity is relatively effectively used in consumption for healthy diets and conserved for current and future use options, while there is potential for much better use of agrobiodiversity in production for sustainable agriculture. We can take a closer look at the indicator scores to understand what underlies the differences in status of agrobiodiversity across the pillars of France's food system.

Consumption

Species diversity: Food species diversity is high in France relative to other countries in the world and average compared to the nine other Mediterranean countries. Consumption of fruits, vegetables, nuts, and wholegrains is, however, below global average values and can be further increased.³⁶

Functional diversity: The functional diversity score of 90 reflects a low number of Disability Adjusted Life Years attributable to dietary risk factors, indicating that diets are quite well in balance for human health needs. Consumption of fruits, vegetables, whole grains, legumes, and nuts can still be further increased to reduce dietary health risks.³⁶ Consumption of red meat is high and can be lowered to reduce dietary health risks.³⁶

Underutilized species: Over 60% of energy in French diets is obtained from sources other than major cereals, roots, and tubers, explaining the 100 score for underutilized species in this category and indicating that diets are not overly dependent on major staples. This does not mean that the potential of underutilized and local species is at its maximum but that the diet is not overly dependent on the major staples.

There were no data available on varietal diversity in consumption.

Production

Varietal diversity: The diversity of livestock breeds maintained in production in France is moderate relative to other countries in the world and above average for the ten Mediterranean countries. France has over 50 breeds of horse, sheep, and chicken in production, but fewer than ten breeds of donkey, duck, goose, and turkey. In addition to averting the loss of animal genetic resources, keeping multiple breeds in production should help farmers maintain livelihoods in times of pest and disease outbreaks or other production challenges, e.g. because different breeds have different resistance to pests and diseases.

Species diversity: With 85 distinct commodities in production, crop species richness is high relative to the Mediterranean average value of 74 crop species, which is moderate compared to the global maximum of 123 (in China). The top ten crops by harvested area are wheat, barley, rapeseed, maize, grapes, sunflower seed, sugar, triticale, peas, and potatoes. The area coverage of different crops in production per 10x10 km is relatively even, meaning cropped landscapes have a high diversity relative to other countries in the world. Also, a very high percentage (96%) of agricultural land contains a high diversity of crop species at 10x10 km scales. This does not mean that crop diversity is at its maximum, and seeking ways to enhance crop diversity at field, farm, and landscape levels is recommended to enhance natural pest and disease controls, yield stability, biodiversity, and other ecosystem services.³⁷ With 32 recorded freshwater fish species, fish richness is low relative to other countries in the world, but average compared to the nine other Mediterranean countries. Livestock species diversity in production is moderate compared to other countries in the world and average compared to the nine other Mediterranean countries. Actions to boost livestock richness in areas of the country where it is low would help ensure farmers in all regions rely on a wide species base, helping shield them against pests and diseases and other production challenges.

Soil biodiversity: Soil biodiversity is moderate for most of the country, averaging 0.6 on a scale of 0.11 to 1.35 (representing the minimum and maximum global extremes). Integrated plant nutrient management can help maintain and restore soil health, such as through increased use of cover crops, application of mulch and animal manure, and intercropping with legumes.

Landscape complexity: 33.2% of France's cropped landscapes have at least 10 ha of natural vegetation at 1x1 km scales, which is well below the 100% recommendation, but average compared to the nine other Mediterranean countries. Maintaining natural vegetation in and around cropland helps maintain habitat connectivity and ecosystem functioning to sustain nature's contributions to agriculture, including reducing the risk of pest and disease outbreaks, maintaining pollinators, and safeguarding crop wild relatives. Retaining at least 10% natural habitat at local (1x1 km) and landscape (10x10 km) scales could be achieved on farm through practices such as live fences (trees, hedgerows), woodlots, flower strips and set aside, and off farm by safeguarding portions of natural or semi-natural forests, wetlands and grasslands around cultivated areas.

There were no data on functional diversity, underutilized species, or pollinator diversity in production.

Conservation

Varietal diversity: France scores the highest varietal diversity score globally (100), meaning that there is a high diversity of crop species of French origin in crop samples relative to other countries in the world safely stored in genebanks. This does not mean, however, that all local landraces in France are safely conserved.

Species diversity: The species diversity score is high (70.4), indicating that France has a high diversity of its cultivated and wild species conserved in genebanks, and a high number of known crop wild relative species have been found in-country, relative to other countries in the world.

Underutilized species: France has a moderate score (43.6) for the underutilized species indicator (wild useful plants). While 86.2% of known wild useful species are conserved *in situ*, their representativeness in *ex situ* repositories is very low (0.9%).³⁸

There were no data available on functional diversity of genetic resources in conservation.



Credit: Pixabay/RD Law

Actions: What actions are being taken to maintain and increase agrobiodiversity?

Consumption: France has food-based dietary guidelines in place. These can be further improved by explicitly taking into account sustainability measures including biodiversity. France has national food composition tables. These can be regularly updated and expanded.

Production:

- **Diversity-based practices:** Available data indicate that diversity-based practices are widespread in France, with 90.4% of its agricultural landscapes (10x10 km areas) containing both cropland and pasture, facilitating crop–livestock integration. Three known integrated landscape initiatives actively promote agrobiodiversity in France: Sensibilization to landscape of the Natural Regional Park of the Golfe du Morbihan; Association Pour La Defense du Patrimoine et de l'Environnement de Sainte-Mere, and; UNISCAPE - the Network of Universities especially dedicated to the implementation of the European Landscape Convention.
- **Production management practices supporting agrobiodiversity:** Nitrogen use efficiency is high relative to other countries in the world, at 0.7 kg nitrogen output per kg nitrogen input, putting France among the top 40% of countries for nitrogen use efficiency levels recorded globally. However, the environmental efficiency of production is very low based on the Sustainable Nitrogen Management Index (SNMI) score, which combines data on both nitrogen use efficiency and land use efficiency (crop yields). Given the high nitrogen use efficiency in France, the low SMNI score likely reflects that more nitrogen is being removed from the soil than is being added, degrading soil fertility and resulting in lower yields. Soil fertility can be improved by measures such as applying manure, mulching, and planting leguminous cover crops. The very high score for the sub-indicator on avoided pesticide use (87) reflects a very low use of pesticides, estimated at 4.5 kg per hectare, well below the highest global user (28.0 kg per ha in Mauritius). France has played a leading role in driving forward discussions on an EU-wide ban on glyphosate and encouraging farmers to reduce agrochemical applications through initiatives such as 'EcoPhyto'.³⁹ It has, however, endorsed the use of neonicotinoids until 2023, a class of insecticides linked to widespread bee and other insect mortalities, which could represent a significant setback.⁴⁰ Reduced pesticide use has a strong positive impact on soil biodiversity, pollinators, and natural enemies of pests, with benefits for agriculture and biodiversity. Based on national statistics, organic agriculture is practiced on 7.1% of agricultural land in France, which is well below the 100% recommendation, but third highest across the ten Mediterranean countries, behind Italy and Spain. Conservation agriculture adoption is very low at 1.1% of agricultural land, again putting France at third highest of the ten countries. Trees are integrated into 13.7% of



agricultural land in France, which is moderate relative to other countries in the world and high compared to the nine other Mediterranean countries. Evidence suggests tree coverage on farm can be increased to up to 30% with limited impacts on yield,⁴¹ while providing valuable carbon sequestration services and helping maintain tree, soil and animal biodiversity in agricultural landscapes. Drought-resistant and native tree varieties could be prioritized to minimize water consumption while providing other benefits to farmers.

Conservation: While France has reported on only 21.3% of the indicators to the World Information and Early Warning System (WIEWS) on Plant Genetic Resources for Food and Agriculture (PGRFA) for monitoring progress on the implementation of the FAO second Global Plan of Action (GPA) on PGRFA, its country report shows that it has been very active in the conservation and management of its plant genetic resources on all the priority actions of the second GPA.⁴² France is a large country and has several overseas territories. It has a large network of Biological Research Centers and other actors which operate independently from each other, and there is no central national coordinating body for the conservation of plant genetic resources. However, France is in the process of establishing a national coordinating structure to provide support to the PGR networks within its territory.⁴³

Overall, France has taken considerable actions towards agrobiodiversity conservation: surveying and inventorying local genetic resources and conducting *in situ* and *ex situ* conservation. It has also promoted use of its plant genetic resources for food and agriculture, for example characterizing and evaluating resources.⁴³

Commitments: How supportive of agrobiodiversity are national policies?

The commitments analysis for France was based on their *National Biodiversity Strategy and Action Plan for 2011-2020 (NBSAP)*.

Consumption: No policy commitments were found which support agrobiodiversity in consumption for healthy diets, resulting in a score of 0. This is likely to reflect that policies on nutrition are not well reported in France's National Biodiversity Strategy and Action Plan.

Production: France has a low score for commitments to agrobiodiversity in production (25.0). France mentions varietal diversity, species diversity, soil biodiversity, pollinator diversity and landscape complexity in the context of making agriculture more sustainable. However, these and other elements of agrobiodiversity are not explicitly incorporated into any strategies or targets.

Conservation: France has a low score for commitments to agrobiodiversity in conservation (26.6). France mentions the importance of conserving food and agricultural genetic resources including varietal diversity, species diversity, and functional diversity, yet there are no specific strategies or targets in the NBSAP to help drive forward these ambitions.



Recommendations

This section suggests concrete actions that can be taken to improve the use and conservation of agrobiodiversity for more sustainable food systems (Table 1). The list of actions is by no means exhaustive or prescriptive. It is intended for review, discussion and improvement by in-country policy specialists.

Table 1: Recommended actions to enhance agrobiodiversity in the national food system

Food system pillar in the Agrobiodiversity Index	Recommendations	Contributing to:	
		Risk and resilience	Global policy
Consumption for healthy diets	<p>Maintain, safeguard and further expand the rich diversity in diets with special emphasis on vegetables, fruits, nuts, and whole grains.</p> <p>Collect data on varietal diversity and underutilized species in diets to further drive food system diversification.</p>		<p>SDG2 Zero Hunger</p> <p>SDG12 Responsible Consumption and Production</p> <p>United Nations (UN) Decade of Action on Nutrition - reducing overweight obesity and anemia</p>
Production for sustainable agriculture	<p>Collect data on local and traditional crop species and varieties in production to improve monitoring. Improve land use efficiency by restoring soil health using agroecological farming practices such as applying organic fertilizer, mulching, intercropping with legumes. Reinforce commitments to reducing harmful pesticide use to safeguard soil biodiversity, pollinators, and natural enemies of pests, with benefits for agriculture and biodiversity.</p>		<p>Convention on Biological Diversity (CBD) Post-2020 Goal 1' No Net Loss</p> <p>SDG 1 No Poverty</p> <p>2 Zero Hunger</p> <p>14 Life Below Water</p> <p>15 Life on Land</p>
Conservation for future use options	<p>Pursue the establishment of a national coordinating structure for Plant Genetic Resources for Food and Agriculture (PGRFA) to more effectively monitor the status of PGRFA within France and its overseas territories.</p>		<p>CBD Post-2020 Goal 3 Genetic Diversity & 4 Nature's benefits</p> <p>SDG 15 Life on Land</p> <p>FAO second Global Plan of Action on Plant Genetic Resources for Food and Agriculture</p>

Agrobiodiversity highlight

Florilège: providing access to all of France's crop diversity information

Florilège is the name of a web portal established to provide information on all France's plant genetic diversity held in crop collections around the mainline country and in Corsica and the French overseas regions. The portal was set up by the French agricultural research and international cooperation organization (CIRAD), the national institute for agricultural research (INRA) and the French Research Institute for Development (IRD) under a program called ARCAD (Agropolis Resource Centre for Crop Conservation, Adaptation and Diversity).

France's crop diversity is held in 37 crop collections in 18 Biological Resources Centers (BRGs) throughout the country. As well as providing online access to this information, the portal also promotes the conservation and study of Mediterranean and tropical crop genetic resources in France and its territories. The collections in mainland France comprise samples of apricot, cherry, melon, tomato, cereals, rapeseed, wheat, barley, oat, rye, maize, legumes, and rice, among others. The Corsican one focuses on Citrus, and the French overseas region collections include banana, sugarcane, mango, coffee, cocoa, pineapple, vanilla, yam, and rubber. The collections total 27,000 live plant samples, living in the form of plants in fields, seeds, and *in vitro* tissue culture.

Sources: ⁴⁴



Credit: Pixabay/David Mark

References

- World Bank. Land area (sq. km). (2020).
- World Bank. Population, total. (2020).
- World Bank. Population density (people per sq. km of land area). (2020).
- World Bank. Urban population (% of total population). (2020).
- World Bank. GDP (current US\$). (2020).
- World Bank. Agriculture, forestry, and fishing, value added (% of GDP). (2020).
- World Bank. Poverty headcount ratio at \$1.90 a day (2011 PPP) (% of population). (2020).
- Alkire, S., Kanagaratnam, U. & Suppa, N. *The Global Multidimensional Poverty Index (MPI) 2020*. (2020).
- Chaltiel, D. *et al.* Programme national nutrition santé - Guidelines score 2 (pnns-gs2): Development and validation of a diet quality score reflecting the 2017 French dietary guidelines. *British Journal of Nutrition* 122, 331–342 (2019).
- Julien-David, D. & Marcic, C. Food, nutrition and health in France. in *Nutritional and Health Aspects of Food in Western Europe* 109–131 (2020). doi:10.1016/B978-0-12-813171-8.00007-X.
- UNESCO. Gastronomic meal of the French. *United Nations Educational Scientific and Cultural Organization*. (2010).
- World Bank. Prevalence of undernourishment (% of population). (2020).
- FAO, IFAD, UNICEF, WFP & WHO. *The State of Food Security and Nutrition in the World 2020. Transforming food systems for affordable healthy diets*. (2020).
- World Bank. Prevalence of anemia among women of reproductive age (% of women ages 15–49). (2020).
- World Bank. Diabetes prevalence (% of population ages 20 to 79). (2020).
- World Bank. Prevalence of stunting, height for age (% of children under 5). (2020).
- World Bank. Prevalence of wasting, weight for height (% of children under 5). (2020).
- Global Nutrition Report France country profile 2020. (2020).
- World Bank. Employment in agriculture (% of total employment) (modeled ILO estimate) (2020). (2020).
- French Ministry of the Economy, Finances and Industry . (2020).
- World Bank. Agricultural land (sq. km). (2020).
- FAO. Value of Agricultural Production. <http://www.fao.org/faostat/en/#data/QV> (2018).
- World Bank. Capture fisheries production (metric tons). <https://data.worldbank.org/indicator/ER.FSH.CAPT.MT> (2020).
- FAO. *FAO Yearbook. Fishery and Aquaculture Statistics 2018/FAO annuaire. Statistiques des pêches et de l'aquaculture 2018/FAO anuario. Estadísticas de pesca y acuicultura 2018*. (2020).
- FAO. Annual livestock production (tonnes) (2018). (2020).
- Gammans, M., Merel, P. & Ortiz-Bobea, A. Negative impacts of climate change on cereal yields: statistical evidence from France. *Environmental Research Letters* 12, 054007 (2017).
- Lungarska, A. & Chakir, R. Climate-induced Land Use Change in France: Impacts of Agricultural Adaptation and Climate Change Mitigation. *Ecological Economics* 147, 134–154 (2018).
- Bayramoglu, B., Chakir, R. & Lungarska, A. Impacts of Land Use and Climate Change on Freshwater Ecosystems in France. *Environmental Modeling and Assessment* 25, 147–172 (2020).
- Bancal, M.-O. & Gate, P. Climate change and the wheat crop: the main impacts. in *The Green Book of the CLIMATOR project* 155–168 (2011).
- OFB. Comment évoluent les écosystèmes et habitats en France ? (2020).
- IUCN. Biodiversity in France. (2020).
- OFB. Comment évoluent les espèces en France ? (2020).
- Rouveyrol, P. & Leroy, M. *L'efficacité du réseau Natura 2000 terrestre en France*. (2021).
- Global Forest Watch. Tree cover loss from 2001 to 2019 (kha). (2020).
- OFB, SDES & MTE. *Bilan annuel de l'observatoire national de la biodiversité 2020: six questions sur la biodiversité en France*. (2020).
- Global Nutrition Report: Action on equity to end malnutrition. (2020).

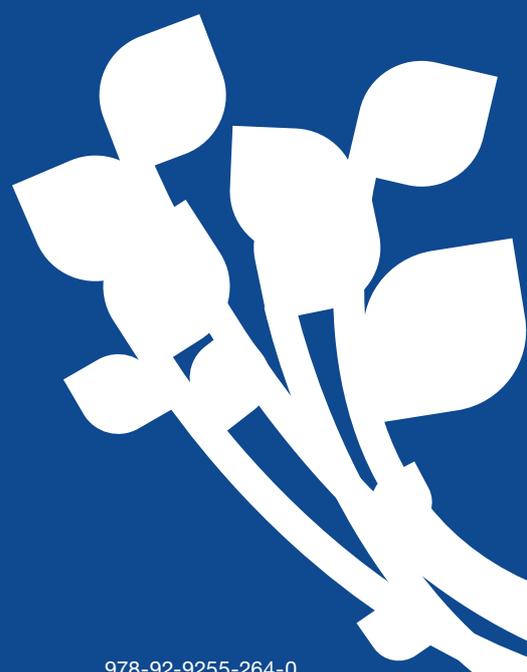
37. Tamburini, G. *et al.* Agricultural diversification promotes multiple ecosystem services without compromising yield. *Science advances* 6, eaba1715 (2020).
38. Béné, C. *et al.* When food systems meet sustainability – Current narratives and implications for actions. *World Development* 113, (2019).
39. Stokstad, E. France’s decade-old effort to slash pesticide use failed. Will a new attempt succeed? *Science* (2018) doi:10.1126/science.aav6762.
40. York, J. France approves three-year use of controversial pesticide. *Connexion France* (2021).
41. Blaser, W. J. *et al.* Climate-smart sustainable agriculture in low-to-intermediate shade agroforests. *Nature Sustainability* 1, 234–239 (2018).
42. Direction générale de l’Alimentation – Ministère de l’Agriculture de l’Agroalimentaire et de la Forêt. *Mise en œuvre du deuxième plan d’action mondial pour les Ressources Phytogénétiques pour l’Agriculture et l’Alimentation - Rapport France.* (2015).
44. Florilège. La biodiversité pour la agriculture en France. <http://florilege.arcad-project.org/fr>. (2020).

End notes

- I. The Convention on Biological Diversity is an international treaty for the sustainable use and conservation of biological diversity. In 2010 it launched a strategic plan, running from 2011 to 2020, with 20 ambitious targets known as the Aichi Targets from the city in which they were signed. The international community has developed new targets, but their signature has been delayed due to the COVID-19 crisis.



Credit: Pixabay/Peter H



THIS COUNTRY PROFILE IS A CHAPTER OF THE “AGROBIODIVERSITY INDEX REPORT 2021: ASSESSING MEDITERRANEAN FOOD SYSTEMS”, DOWNLOADABLE HERE: <https://cgspace.cgiar.org/handle/10568/118471>

Alianza



The Alliance of Bioversity International and the International Center for Tropical Agriculture (CIAT) delivers research-based solutions that harness agricultural biodiversity and sustainably transform food systems to improve people's lives.

Bioversity International and CIAT are CGIAR Research Centres.

<https://alliancebioversityciat.org>

978-92-9255-264-0

<https://alliancebioversityciat.org/tools-innovations/agrobiodiversity-index>