FAO State of Biodiversity for Food and Agriculture in Finland

Irina Herzon, Tanja Rajala, Petri Heinimaa, Traci Birge, Elina Kiviharju, Marjo Keskitalo, Juha Kantanen, Juha Helenius

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Abbreviation:

AnGR	Animal Genetic Resources
AqGR	Aquatic Genetic Resources
CAP	Common Agricultural Policy of the European Union
CBD	Convention on Biological Diversity
CWR	Crop Wild Relative
EAFRD	European Agricultural Fund for Rural Development
EU	European Union
FGR	Forest Genetic Resources
FSC	Forest Stewardship Council
GBIF	Global Biodiversity Information Facility
GDP	Gross Domestic Product
GHG	Greenhouse Gas (emissions)
HELCOM	Baltic Marine Environment Protection Commission
HNV farmland	High Nature Value Farmland
IAS	Invasive Alien Species
IFOAM	International Federation of Organic Agriculture Movements
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
IPM	Integrated Pest Management
LEADER	European Union programme to support rural development projects initiated at the local level in order to revitalise rural areas and create jobs
Metla	Finnish Forest Research Institute
METSO	Forest Biodiversity Programme for Southern Finland (2008–2025)
MTK	Central Union of Agricultural Producers and Forest Owners in Finland
MTT	MTT Agrifood Research Finland

MYTVAS	National agrobiodiversity monitoring programme in Finland on the impacts of agri-environment measures
NBSAP	National Strategy for the Conservation and Sustainable Use of Biodiversity
PEFC	Programme for the Endorsement of Forest Certification Schemes
PGR	Plant Genetic Resources
RKTL	Finnish Game and Fisheries Research Institute
SYKE	Finnish Environment Institute
TEEB	The Economics of Ecosystems and Biodiversity, a global initiative focused on drawing attention to the economic benefits of biodiversity
Tike	Finnish statistics authority, compiles statistics on the structure of Finnish agriculture
UAA	Utilized Agricultural Area
UNESCO	United Nations Educational, Scientific and Cultural Organization
VACCIA	Vulnerability Assessment of Ecosystem Services for Climate Change Impacts and Adaptation project in Finland (2009-2011)
VELMU	Finnish Inventory Programme for the Underwater Marine Environment (2004–2015)
WFD	Water Framework Directive
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

Finland is characterised by a northerly location within the boreal and tundra zones, with abundant forest and water resources. Agricultural production is limited to a low number of crop varieties and animal breeds adapted to northern conditions. Agricultural production is highly specialised, mechanised and dependent on high external inputs. The only indigenous land use type is reindeer husbandry in northern Finland. Utilization of wild foods is commonplace though much traditional knowledge has been lost. The shares of agriculture, fisheries and wild food procurement in the national economy are not high, though the activities remain important for rural livelihoods and culture.

Finland has one of the world's best levels of knowledge on the state and trends of production and associated biodiversity. Trends in many species and communities are well documented and monitored, and new research programmes have been endorsed to fill key gaps. The latter include topics on climate change, invasive species, wild crop relatives, marine environments, and functional biodiversity. However, firm evidence on drivers of changes is limited due to the complexity of interacting causes as well as time, cost and methodological constraints. For production systems, particularly knowledge of functionally important species is mostly lacking except for pests and weeds. Research on other ecosystem services than provisioning ones remains insufficient to quantify the services' flow, establish trends and drivers, and relate them to biodiversity components. The actual changes in the delivery of ecosystem services across all production systems remain largely unknown and in most cases the effects are inferred from the changes in relevant ecosystem processes rather than confirmed by specific evidence on the flow of services.

As elsewhere, the ultimate causes of adverse changes in biodiversity stem from modern land use patterns aimed at intensive production of biomass for human consumption. Once Finland joined the EU, global market forces contributed to further specialization on fewer varieties and breeds. More specific drivers include: high levels of regional segregation of agricultural production by crop and animal husbandry and of external inputs, lack of extensive grazing on semi-natural grasslands, lack of decaying wood and changes in tree species composition in commercial forests, and persistent eutrophication from agricultural lands. Climate change and several invasive species are among new threats.

The state of several components of biodiversity, especially populations of species that are legislatively protected, has improved or stabilized in the last decade. Finland has been implementing policy and other interventions for enhancing biodiversity for food and agriculture across all relevant sectors. The legislative base is comprehensive and several policies underwent revisions in the recent decade to explicitly include biodiversity and ecosystem services as political objectives. Important cross-sectoral collaboration networks and fora have also been established in the last ten years. These increasingly involve a variety of stakeholders as partners in deliberation at different policy levels. Thematic projects accompanied by advice and, in some cases, financial incentives to stakeholders have been

successful in developing, implementing and valorizing best practices. However, evidence on the efficiency of a number of policy and other interventions, and especially their overall impact, often remains limited and mixed.

Challenges remain for the conservation of many components of both production and associated biodiversity, including wild foods, as well as sustaining ecosystem services relevant for production. In particular, the biodiversity associated with agricultural ecosystems dependent on traditional land-use practices remains critically endangered. In forests, the most important reasons for species being threatened are related to the use of forests. Several species of economically important fish remain critically endangered. The prevailing pattern of biodiversity loss in Finland is likely to currently be an erosion of population-level diversity due to incremental deterioration in habitat quality, as well as time lags in species' response to suboptimal habitat quality, rather than conversion to different land-use or habitat types. Efforts to quantify and address the process have so far been insufficient, in so far as isolation remains an issue and extinction debt has been quantified for some groups. The key obstacle seems to stem from pursuit of economically profitable resource use for private land owners, which sidesteps biodiversity and ecosystem conservation. The concept of the green economy, including the monetary and non-monetary values of ecosystem services, is still new; its content, meaning, share and potential in decision-making and practical operations have not been fully understood and therefore not utilized. Despite a wealth of knowledge and decades of awareness building, there is still a generally low level of public and political recognition of biodiversity's role in functional ecosystems. Most recently there have been severe cuts in funding for conservation.

Finland identified actions and priorities to improve the conservation and sustainable use of biodiversity for food and agriculture in all national strategies and action plans, and particularly in its national biodiversity strategy action plan (NBSAP) for the Convention on Biological Diversity (CBD). Among the identified priorities are: developing efficient stakeholder engagement practices at all stage of decision making and implementation; strengthening collaboration among sectoral and academic institutions and supporting interdisciplinary research; developing methodologies that deal with complex situations, predicting uncertainties, and tradeoffs; improving knowledge on biodiversity for systems that have clear gaps; and mainstreaming biodiversity conservation and ecosystem service sectorally and cross-sectorally frameworks. A long-term strategic direction is to integrate the state of the environment, including the state of biodiversity, into economic accounting and other valuation of social welfare by developing well-being indicators for Finnish society to complement GDP data.

CHAPTER 1: INTRODUCTION TO THE COUNTRY AND TO THE ROLE OF BIODIVERSITY FOR FOOD AND AGRICULTURE

Preparation of the Country Report

In preparation of this report we did not engaged in a systematic process with stakeholders, as was suggested by FAO. Instead, we relied upon the recent stakeholder process for preparing the National Strategy for the Conservation and Sustainable Use of Biodiversity (2012–2020), which covered biodiversity for agriculture and food. We also drew heavily from the Strategy and the Fifth National Report to the Convention on Biological Diversity (2014). We referred extensively to the national sectoral reports to FAO on Forest, Animal and Plant Genetic Resources to avoid as much as feasible repeating information already available in them. In order to complement the key reports and to access the most up-to-date information, we additionally reviewed some of the recent scientific and grey literature and interviewed a number of stakeholders and experts (Annex 1). The report has undergone a national commenting round in the key institutions (Annex 2).

The forestry sector is considered in the report only in respect to its contribution to food supply (such as berries and mushrooms, and hunting) but not in its use for timber and other non-food commodity production. Additionally, species and genetic diversity of trees was expected to have an indirect impact on the wild food resources. Questions dealing with gaps and priorities, specific management challenges and priorities, and planned actions are largely derived from the Fifth National Report to the Convention on Biological Diversity as the most recent and holistic source. These were further developed in interviews with stakeholders. Chapter 6, Future agendas for conservation and sustainable use of biodiversity for food and agriculture, is almost entirely based on the above report. For more specific details readers should consult the report.

General overview of the country

The total area of Finland is 338 145 km^2 and consists of 23 072 km^2 agricultural land, 227 690 km^2 of forests and scrub land, 9 390 km^2 built-up and related land area, 33 552 km^2 is water, and 33 378 km^2 classified as other areas. Finland lies in an intermediate zone between maritime and continental climates, belonging for the most part to the boreal vegetation zone. Temperate zone is present marginally along the southern coast. Though situated between the northern latitudes 60° and 70°, Finland enjoys more favourable climate than areas at similar latitudes due to the warming effect of the Gulf Stream. Conditions for growth vary considerably along the longitudinal gradient, which is reflected in the use of land for agricultural purposes, forestry, and conservation planning.

The majority of Finland's 65 000 (2014) farms are family-owned and run. Forest is an integral part of a Finnish farm and comprises on average half of the farm area. Forestry is also an

integral part of the whole farm's economy. Private forest owners own 61 % of the forest land, the state 25 % and enterprises 5 %. Modern agricultural production is highly specialized: about 21 % of working farms specialize in dairy husbandry and 62 % in crop production (2008). Pork, beef, and egg production are also common. Fur farming is carried out both in connection with agriculture and on specialised fur farms. Cereal farming is the most important agricultural sector in southern Finland while the relative importance of livestock husbandry, forestry, and wild food harvesting increases at higher latitudes. Horticulture is not large nationally. Fruits and berries are important both in commercial production and home gardens. Irrigation is practiced on about 88 000 hectares of fields and gardens, which is below 0.5 % of the utilized agricultural area (UAA). Reindeer husbandry is an important industry in northern Finland with about 600 reindeer (domesticated *Rangifer tarandus tarandus*) farms and 200 000 animals. The income from reindeer herding is below 20 million €, which is small in comparison to the tourism industry in Lapland, which is valued at 500 million €. Reindeer herding has high value as national cultural capital.

Population of Finland in 2013 was 5 439 000, with about 1.8 million rural residents. Agriculture employed 3.1 % of the population full-time in 2012 and the figure has been declining. The share of women employed in agriculture was 35 % in 2011. The age of farmers has been increasing and now the average age is 50.6 years; the share of young people entering the sector is declining. Compilation of statistics on the labour force and labour input in agriculture is difficult. Members of the farm family often work off-farm, and only about half of farm family income is from agriculture. The food sector (excluding retail trade) employs about 300 000 people (12 %) in primary production, production input industry, services, and food industry (2012). The forestry sector employs about 65 000 people (3 % of the workforce; 2014). Beekeeping is practiced by 3 000 beekeepers. Although average honey yield in Finland is considered good, the shortness of the season causes challenges to the sector's competitiveness. The annual capital flow in the apiculture sector is about 20 million €.

Rainbow trout raised in sea cages account for about 90 % of aquaculture production. The second important species is whitefish, with four other species making up the remainder. The sector has considerable potential for growth, as consumption of imported grown fish is five times that of domestically grown. Of the production units, 84 % are situated in coastal areas and the remaining are in inland waters. A portion of aquaculture production is juvenile production for stockings in rivers, lakes and coastal areas. Half of the stockings are court-mandated compensation and mitigation for the negative impacts of human activities, including: hydropower structures, regulation of water level, industrial and human effluent, and timber rafting. There are 471 aquaculture production units with a total of 171 food fish farms, 107 juvenile rearing farms and 197 non-fed production systems. Aquaculture food production value is 56 million € and juvenile production value is 24,5 million € of which half is the value of stockings into wild. The value of professional fisheries is 56 million € and recreational fishing 51 million €. Recreational fisheries are important to the tourism industry. Fish farming has been a fast-growing sector in food production and is becoming economically

more important than capture fisheries. The aquaculture sector's value stands at about 80,5 million €, and the value of the whole value chain of fish is some 500–800 million €.

In 2011, Finnish GDP was 35 173 € per inhabitant countrywide but in countryside GDP was 27 858 € per rural inhabitant. Forest sector contribution to Finland's GDB was 4 % in 2013. Regionally, however, the share may be as high as 10 %. Of the Finnish goods exports, about 20% are wood industry products with an export value of 11 billion euros (2012). The share of agriculture was 2 % (2012) but the role of agricultural production in rural livelihoods and food sector employment is considerable. Annual profit in the agricultural sector has been highly variable with an overall long-term declining trend. In 2012, it stood at about 1 061 million €. The number of farms in 2012 declined 35 % over two decades, although the total agricultural area remained roughly the same.

3. Provide a summary of the role of biodiversity for food and agriculture in improving food security and nutrition, the livelihoods of farmers, pastoralists, forest dwellers and fisher folk, ecosystem health and sustainability of production systems in your country. Specific attention should be given to associated biodiversity, ecosystem services and to wild foods. The summary should also draw attention to the *ex situ* and *in situ* conservation of biodiversity for food and agriculture, the most significant aspects of use to improve food security and nutrition in the country, major changes observed in the last 10 years and the main factors causing changes. Significant risks or dangers to the conservation and use of biodiversity for food and agriculture may also be highlighted.

Due to the country's northern position, the diversity of crops and livestock breeds utilized for food in Finland is relatively low and production is centred on cereals and forage crops (80–90 % of the field crop area). Field crop diversity varies among growing zones, which are mainly determined by the sum temperature. In the northern-most zones, only early yielding cereals, forages, and potato can be grown. The number of utilized cultivars of the main cereals has been growing steadily. About half of the cultivars used are domestic, but foreign cultivars are also frequently tested for introduction to Finnish markets. The number of cultivars has remained constant for oilseed crops (*Brassicas*) and forage grasses and clovers. Due to general low profitability of agricultural production in Finland, novel crops are being tested and introduced in order to diversify production in rural areas, raise farm income and improve rotations (for example, camelina (*Camelina sativa*), quinoa (*Chenopodium quinoa*) and lentils (*Lens culinaris*)). At the moment no statistics on cultivars for horticulture are available for Finland. In the commercial vegetable seed trade, only imported cultivars are used. Local specialty varieties are available and used on a small scale by mainly organic gardens.

Finland has several landraces of crop plants and native animal breeds adapted to northern conditions. These are regarded as a globally unique genetic resource. They also represent a national cultural heritage. In Finland, old indigenous animal breeds have not been lost, except the native pig populations. Exotic animal species, such as ostrich, alpaca, bison, and wild boar,

are currently raised on some farms. Horses raised for meat and insects as protein for human consumptions are potential lines of production.

Reindeer husbandry by Sámi people is the only indigenous production system in Finland though non-Sámi people also practice it. It is not known to what extent the Finnish reindeer population differs from reindeer populations living in neighbouring countries. The reindeer herds depend on wild plants and lichens, and during winter subsist almost entirely on lichens. It has been established that as many as 60 wild plants, lichens, and fungi are part of the reindeer diet at different seasons. The annual consumption of reindeer meat stands at about 0.5 kg per person nationally but in the Sámi regions it is a major source of animal protein. Additionally to traditional open grazing, reindeer are also kept in enclosed pens (especially for tourism) and may be given supplemental fodder of hay and grains, although year-round feeding is not economically viable.

Traditionally, the Nordic dark bee has been bred in Finland, and nowadays there are about 50–100 colonies in Finland. The purity of the current population is unknown. The commonest breed currently used is Italian (*Apis mellifera ligustica*).

A particular characteristic of the Finnish fisheries is created by the arctic climatic conditions, under which waters are covered by ice for part of the year. The main fishing period is about eight months and winter ice fishing with nets, hooks, and traps is common during the cold months. There are around sixty species of fish indigenous to Finland, of which approximately twenty are fished commercially and recreationally. Additionally there is one species of fished crayfish. Most of the national catch is comprised of herring and sprat taken for industrial purposes by a small number of trawlers. There is a small but active freshwater commercial fishing industry, largely targeting vendace. Total landing for the largest fishing harbours in 2003 was 51.9 million tons. Recreational fishing is one of the most important outdoor recreational activities in Finland. Nearly 30 % of the population reported having engaged in some kind of fishing activity in the past year. The number of people engaging in recreational fishing has, however, been decreasing. Recreational fishermen caught 25 million kg of fish in 2012. The consumption of fish is 14.7 kg per person as product weight out of which 3.8 kg is from domestic sources.

Use of wild foods through fishing, hunting, and collection of wild mushrooms and berries is highly popular in Finland. The forests are the most important ecosystem that supports such activities. Finnish forests are regarded as semi-natural stands and are multi-use. In Finland, the general public has the right to access public and privately owned land for recreation and exercise, including berry and mushroom picking. The recent assessment put the value of recreation in commercial forests at 28–48 million €, which is considerably above the expenses by the state on recreational facilities (10–13 million €). Also, bogs are important for certain berries.

There are 37 edible species of wild berries (mostly *Vaccinium* and *Rubus*) and 200 edible species of mushrooms, of which about 30 species are allowed on the market. It is estimated that the forests produce in a good year about 2 billion kg of edible mushrooms and 1 billion kg of berries. Of these, only 10 % of berries and 3 % of mushrooms are collected. The harvested volume of the eight most important wild berries in 2005 was worth of 77.2 million € (about 50 million kg), of which only a fraction comes to the market. Over 90 % of the respondents consume wild berries on a regular basis. The consumption of the berries overall (including wild) has increased in the recent decade from about 14 to 16 kg per person per year. About half of the surveyed respondents in the most recent survey reported partaking in wild berry and mushroom picking. They largely collect berries for the household consumption (73 %) rather than for the market. Most of the marketed berries are picked in northern Finland; in southern Finland berries are picked mainly for household use. The value of berries collected for household in 2005 use was estimated at 53.8 million €.

Statistics for mushroom production are sparse, but the existing information indicates that the socio-economic value of mushroom picking is increasing. Flow of main wild mushroom species (*Lacteous agarics, Boletuses, Chanterelle*) to market was about 299 200 kg in 2013. Around 40 % of the surveyed people pick mushrooms for food. In years of high yield, ceps (*Boletus edulis*) are potentially the main economic product of pine forests, with monetary value two to three times of the annual forest wood production. However, the yield is subjected to considerable annual fluctuations and the highly praised species is not abundant across the whole country.

Hunting in the Nordic countries has socio-economic importance for revenue generation, household subsistence, and cultural and recreational significance. The number of hunters has been increasing steadily for the past decades in Finland and amounts to more than 300 000 Finns. About 40 % of them also own land, covering in total 30 % of the country's land area. Other land is available for hunting through rents and permits. Game is a source of income for landowners because they own hunting rights and may lease the rights to hunters. The most important game species is moose (*Alces alces*), which can be hunted on over 90 % of land area. Annual consumption of moose is approximately 2 kg per person per year, and 63 039 moose were felled in 2013. The forest game birds are also highly prized: annually, over 100 000 hunters engage in this activity. The use of wild foods provides an important source of supplementary food, especially in regions with low employment and disadvantaged conditions for agricultural production. The overall value of game meat is estimated at 83 million € per year. However, its current role in food security is not considerable in the globalised food market. Hunting tourism has an additional and significant economic impact regionally.

Compared to the low number of production species, the associated biodiversity in Finland is considerable. For example, though agricultural land occupies only about 7 % of the land area, it is estimated that up to 30 % of all species use it at least at some times of the year. About 9

% of the agricultural area is considered to correspond to the definition of High Nature Value farmland (HNV), mainly due to the presence of semi-natural grasslands, animal husbandry, and mosaic agricultural landscape.

Research on ecosystem processes relevant to production of food and evaluation of ecosystem services have grown rapidly in the recent decade in Finland (see VACCIA). Areas of especial focus are processes related to water purification, soil nutrient cycling, pollination, and biological pest control. Health-related benefits associated with use of forests, including for collection of wild foods, have been studied recently. Efforts for economic assessment of ecosystem services in Finland have been undertaken (TEEB Nordic; TEEB Finland). For example, the value of honeybee pollination service of selected crops could be around 18 million €, of home gardens production 39 million €, and of wild berries 3.9 million €. Though most of the pollination service is being provided by a domesticated honeybee, wild pollinators, especially bumblebees, are active in cooler and windier weather conditions than honeybees – an attribute of particular relevance for the northern climate. Pollination by bumblebees is particularly crucial for wild berries.

Both *in situ* and *ex situ* approaches are implemented in Finland to preserve genetic resources of plants and domestic animals. The landrace varieties of crops (in total 19 are registered) are maintained *in situ* but only some ten growers have registered landraces or old cultivars. *In situ* conservation programmes are supported by EU subsidies for indigenous crop varieties and animal breeds. The programme for cattle is especially extensive and includes, among others, keeping the most endangered breeds on a government owned prison farm and on vocational colleges' farms, maintaining gene bank registers and mating planning. Because yields of these breeds are considerably smaller than those of commercial animal breeds, their *in situ* conservation requires additional funding. In the national Animal Genetic Resources conservation strategy, conservation through utilization of native animal breeds is emphasised and the use of these breeds in specialised production is encouraged. The volume of *in situ* conservation is restricted by its costs.

In forestry, *in situ* conservation of the main tree species' genetic resources is well developed in gene reserve forests. The National Plant Genetic Resources Programme (2001) lists 15 native tree species included in the genetic conservation strategy. The natural populations of rare broadleaved species growing in valuable habitat types are further protected under the Forest Act and under the Nature Conservation Act. The share of strictly protected forests is 9%, which is internationally very high. Though there is not special in-site protection of wild foods, they are enhanced through conservation of forests and management of commercial forests. The role of the national parks as wild foods sources is considerable (there are 37 national parks in Finland with the combined area of 9 789 km^2). Collection of berries and mushrooms, as well as certain forms of recreational fishing, are allowed. Though hunting is not allowed, the parks serve as refuges and sources areas for game animals. In the absence of native predators, their populations may grow to damaging levels. Due to the everyman's

right of access to the land in Finland, collection of berries and mushrooms on commercial forests, both public and private, is substantial.

In-situ conservation of forest biodiversity is also practiced outside the state protected areas in private reserves, private forests protected under temporary contracts (Forest Biodiversity Programme for Southern Finland METSO) and in management of all commercial forests according to the Forest Act (for example, habitats of special importance are spared from logging). *In situ* protection of game is also practiced on private lands by hunting associations. Hunting pressure overall is strictly regulated and enforced.

Ex situ programmes for agricultural biodiversity for food are extensive; the national strategies define the number of embryos and semen doses which should be stored in the *ex situ* cryobank for each native animal breed, for imported breeds with long breeding history in Finland (tens of animal generations), most valuable indigenous and introduced fish species, and crops. A new fish gene resource programme is under preparation. Much of the effort is part of international, especially Nordic countries, programmes to preserve seed and germplasm with an objective of promoting conservation and sustainable use of genetic resources of crops and animals adapted to northern climate.

In forestry, *ex situ* conservation is applied only to species that are rare and grow either mixed with other species or in small stands. Often the distribution is fragmented and the genetic differentiation among populations is higher than with the major species. The gene pool is primarily maintained in living trees but not directly for wild foods.

For associated biodiversity, *ex situ* work is scarce. *In situ* conservation of the associated agricultural biodiversity has largely been maintained through the agri-environment payments within the European Agricultural Fund for Rural Development (EAFRD). Several of the environmental payments directly or indirectly enhance agricultural production and associated biodiversity. Forest *in situ* biodiversity is largely protected in the national parks and strict nature reserves on state-owned land. Finland also has conservation programmes for the rare vegetation types. Voluntary protection of forests has been also increasing in scope. In commercial forests, habitats of special importance are protected under the Forest Act. In fisheries, the current *in situ* priority is for enhancing natural reproduction of native species, rather than the traditional reliance on restocking. Fish passage strategy and the becoming new act on fisheries will give better possibilities to preserve and enhance the vulnerable wild population of many fish species.

Two major political and economic changes affected the state of plant genetic resources in Finland. Firstly, Finland became a member of the European Union, whose agricultural policy reforms have shaped the structure of agricultural production. Secondly, Finnish agriculture, horticulture, and associated research have been more market-driven since 1996. Most of the investments in plant production and associated research have been made in the major crops. Consequently, minor crops are becoming more marginalized. Non-profit-oriented plant

breeding of many horticultural crops has disappeared or is being terminated in Finland. Plant breeding of some nationally important crops, such as rye and potato, is supported by the National Emergency Supply Agency. Overall numbers for native animal breeds decreased until the 1990s but are relatively stable currently. The decrease in numbers of breeding animals in these breeds has been due to lower productivity of the native breeds. In Finland, the animal production is based on imported breeds in most of the farm animal species. For example, all poultry genetic material and beef cattle for production are of imported origin. In addition, a significant part of genetic material of pigs is imported and there are several imported breeds of horses, cattle, and honeybees raised in Finland.

Most recent changes in forestry relate to decrease in demand for printing paper and decline in the value of the production and exports of the sawmill industry. This forces the forestry sector to diversify further and invest in new wood-based products such as bio-based chemicals and materials and to boost production of bioenergy from forest sources. Also, increased public pressure for even more flexible management of forests, such as recreation and game management, resulted in a new Forest Act.

Aquaculture is currently considered the most environmentally responsible way to produce animal protein for human consumption. The actions at the EU level on blue bioeconomy have changed the direction of domestic aquaculture, which has suffered from exceptionally strict permits. Dispersion of new alien species into the aquatic environment may cause an unexpected fallback to wild fish species in both sea and fresh water environments. The spread of new fish diseases and parasites is a major threat to aquaculture and in some cases also to wild fish stocks.

Significant risks or dangers stemming from climate change and due to the country's northern position are predicted and have already been observed for conservation and use of biodiversity in Finland. For example, use of landrace varieties is further jeopardised with their replacement by new crops and new varieties. In forestry, the coniferous zone is predicted to retreat northwards. This will likely affect berry and mushroom production. Wild berry production may also be threatened by a shift in flowering to earlier dates when there is still a risk of frost. Northern mosses and shrubs may replace lichens that are essential for reindeer. In agriculture, increased runoff due to milder winters could further jeopardize water quality and aquatic biodiversity. Milder climate, however, may also allow species with southern ranges to colonize the country's ecosystems. This poses a complex question on whether such natural colonizations should be accepted as inevitable change or restricted in an effort to preserve indigenous species and communities.

Table 1. Production systems present in the country.

Sector	Code	Production system names	Present (Y/N)
Livestock	L1	Livestock grassland-based systems: Tropics*	N

	L2	Livestock grassland-based systems: Subtropics*	N
	L3	Livestock grassland-based systems: Temperate*	Y
	L4	Livestock grassland-based systems: Boreal and /or highlands*	Y
	L5	Livestock landless systems: Tropics	N
	L6	Livestock landless systems: Subtropics	N
	L7	Livestock landless systems: Temperate	Y
	L8	Livestock landless systems: Boreal and /or highlands	Y
Forests	F1	Naturally regenerated forests: Tropics	N
	F2	Naturally regenerated forests: Subtropics	N
	F3	Naturally regenerated forests: Temperate	Y
	F4	Naturally regenerated forests: Boreal and /or highlands	Y
	F5	Planted forests: Tropics	N
	F6	Planted forests: Subtropics	N
	F7	Planted forests: Temperate	Y
	F8	Planted forests: Boreal and /or highlands	Y
Aquaculture and Fisheries	A1	Self-recruiting capture fisheries: Tropics	N
	A2	Self-recruiting capture fisheries: Subtropics	N
	A3	Self-recruiting capture fisheries: Temperate	Y
	A4	Self-recruiting capture fisheries: Boreal and /or highlands	Y
	A5	Culture-based fisheries: Tropics	N
	A6	Culture-based fisheries: Subtropics	N
	A7	Culture-based fisheries: Temperate	Y
	A8	Culture-based fisheries: Boreal and /or highlands	Y
	A9	Fed aquaculture: Tropics	N
	A10	Fed aquaculture: Subtropics	N
	A11	Fed aquaculture: Temperate	Y
	A12	Fed aquaculture: Boreal and /or highlands	Y
	A13	Non-fed aquaculture: Tropics	N
	A14	Non-fed aquaculture: Subtropics	N
	A15	Non-fed aquaculture: Temperate	N
	A16	Non-fed aquaculture: Boreal and /or highlands	N
Crops	C1	Irrigated crops (rice): Tropics	N
	C2	Irrigated crops (rice): Subtropics	N
	C3	Irrigated crops (rice): Temperate	N
	C4	Irrigated crops (rice): Boreal and /or highlands	N
	C5	Irrigated crops (other): Tropics	N
	C6	Irrigated crops (other): Subtropics	N
	C7	Irrigated crops (other): Temperate	Y
	C8	Irrigated crops (other): Boreal and /or highlands	Y
	C9	Rainfed crops: Tropics	N
	C10	Rainfed crops: Subtropics	N
	C11	Rainfed crops: Temperate	Y
	C12	Rainfed crops: Boreal and /or highlands	Y
Mixed	M1	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Tropics	N
	M2	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Subtropics	N
	M3	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Temperate	Y
	M4	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Boreal and /or highlands	Y
Others	O1	Apiculture	Y

5. List in Table 2 the production systems that have been identified as occurring in your country in Table 1, indicating the codes and/or the names of the production systems as provided. Provide a description for each production system. Countries may wish to use the following criteria, where information is available:
Environmental features and characteristics:
a) additional information on climate (arid, semi-arid, humid, subhumid);
b) features of the landscape mosaic.

Rural livelihoods and sustainable use:
c) share of smallholders*;
d) proportion of the production system found in urban or peri-urban context;
e) share of the population actively contributing to the production system disaggregated by gender, including number of employees if available;
f) importance of the production system to the incomes, livelihoods and well-being of rural communities;
g) levels of agricultural intensification and reliance upon synthetic inputs, modern varieties, fossil fuels, etc.

Table 2. Production systems present in the country.

Code of production system	Name of production system	Description [a]
L3	Livestock grassland-based systems: Temperate	Relatively few livestock farms occur in the temperate zone of Finland, mainly beef production along the southern coast. The agricultural landscape is dominated by arable cropping. Direct sales of meat to urban population (the capital hub) have been increasing. Public support payments covered 34.8 % of agriculture's gross return in 2013.
L4	Livestock grassland-based systems: Boreal	Livestock farms are concentrated in southwest and western Finland. Share of production income in agriculture declines towards the north being replaced by forestry, hunting, fishing, and tourism. Contribution of the livestock sector overall to the agricultural sector economy is 37 % and is a predominant source of income. In the northern parts of Finland (Lapland) reindeer herding is an important livelihood.
L7	Livestock landless systems: Temperate	Not present in this zone.
L8	Livestock landless systems: Boreal and /or highlands.	There are no feedlot systems in Finland. However, the pig, poultry, and fur farms largely buy in their fodder rather than growing it on-farm. Production is concentrated to this zone. Reliance upon modern breed and external inputs (including fodder imported from overseas) is generally high.
F3	Naturally regenerated forests: Temperate	Naturally generated forest cover is 73 % across the whole country. Natural generation happens by leaving seed pine trees after the clearcut.
F4	Naturally regenerated forests: Boreal and /or highlands	As above.
F7	Planted forests: Temperate	About a third of the commercial forests across the country are re-planted after the final logging. Forestry is highly mechanised with low inputs of labour.

F8	Planted forests: Boreal and /or highlands	About a third of the commercial forests across the country are re-planted after the final logging. The rest regenerate from the retention (seed) trees or neighbouring forest stands. Share of production income in the rural areas from forestry is high. Forestry on private lands supplements agricultural production. Forestry is highly mechanised with low inputs of labour.
A3	Self-recruiting capture fisheries: Temperate	Baltic Sea area is the main fishing area for commercial fisheries. Recreational fisheries are most common in inland waters, but coastal and archipelago areas are also important (some 25 % of the catch). Major part of fisheries is targeted at wild fish populations.
A4	Self-recruiting capture fisheries: Boreal and /or highlands	Small part of professional fisheries is present in inland waters, mainly targeting vendace. Recreational fisheries are most common in inland waters (some 75 % of the catch). Major part of fisheries targets wild fish populations.
A7	Culture-based fisheries: Temperate	Most valuable and depleted fish species are supported by stockings. This activity supports fishing in the whole area for all fishing groups
A8	Culture-based fisheries: Boreal and /or highlands	Most recreational fisheries are in lakes and rivers, with the most valuable and depleted fish species supported through stockings. This supports also small scale rural tourism services and fishing tourism.
A11	Fed aquaculture: Temperate	Aquaculture production is concentrated in coastal and archipelago areas. Aquaculture is an important employer in remote areas. Production is in semi-intensive net cages using mainly with dry feed.
A12	Fed aquaculture: Boreal and /or highlands	Aquaculture production occurs up to mid Lappland. Juvenile production in inland waters mainly occurs in the central part of the country. Water recycling farms in urban and industrial areas are integrated with industrial heat sources to minimize overall energy use.
A15	Non-fed aquaculture: Temperate	In coastal areas natural food ponds to produce fingerlings for stockings in the sea area.
A16	Non-fed aquaculture: Boreal and /or highlands	Companies operate natural food ponds to produce fingerlings of native whitefish, pikeperch, and grayling for stocking in lakes, rivers and sea area. Only possible to operate in rural areas. Production level slightly elevated by liming and fertilization.
C7	Irrigated crops (other): Temperate	Only 3 % of the UAA is irrigated. Levels of agricultural intensification and reliance upon synthetic inputs, modern varieties, and inputs are generally high across the whole country. The relative share of farm subsidies is high.
C8	Irrigated crops (other): Boreal and /or highlands	As above.
C11	Rainfed crops: Temperate	Cereal farming is the most important agricultural sector in this zone. Most outdoor vegetable crops and apples are grown here. The agricultural landscape is relatively open.
C12	Rainfed crops: Boreal and /or highlands	Cereal farming is important but a high share of crop is used as animal fodder. The majority of Finnish greenhouse vegetables are produced here. Agricultural landscape is highly mosaic and dominated by forest, except along the Western coast. Production income in agriculture declines going north, being replaced by forestry, hunting, fishing, and tourism. Contribution of the crop production sector overall to the agricultural sector economy is 13 %.

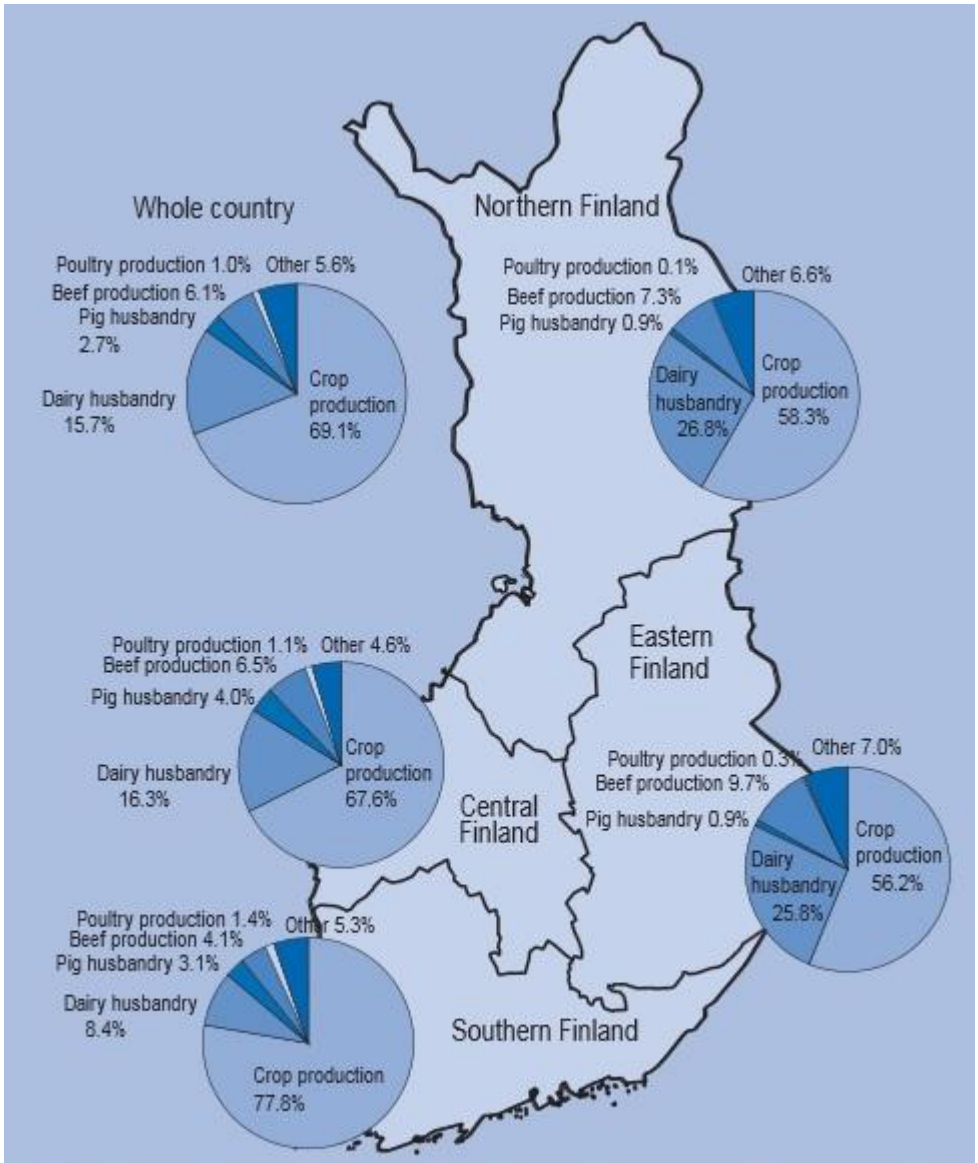
M3	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Temperate	Mixed systems are marginally present in the temperate zone. The definition of mixed system is based on Standard Output: if less than 2/3 of the total economic output comes from one product, the farm is classified as mixed system.
M4	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Boreal and /or highlands	Most farmers engage in other production or resource use activities such as fishing, hunting, bioenergy production, as well as off-farm work. In the north, importance of the mixed sources of income based on natural resources to the incomes, livelihoods, and well-being of rural communities is high.
O1	Apiculture	Bees are kept by about 3 000 beekeepers. Climate restricts production.

[a] Levels of agricultural intensification and reliance upon synthetic inputs, modern varieties, and inputs are generally high across the whole country and production systems. The relative share of state subsidies of the farm income is high.

From the next Table onwards the data are combined by Temperate and Boreal zones due to a marginal representation of the former in Finland.

Provide a map of production systems in your country, marking the places and regions mentioned in the Country Report.

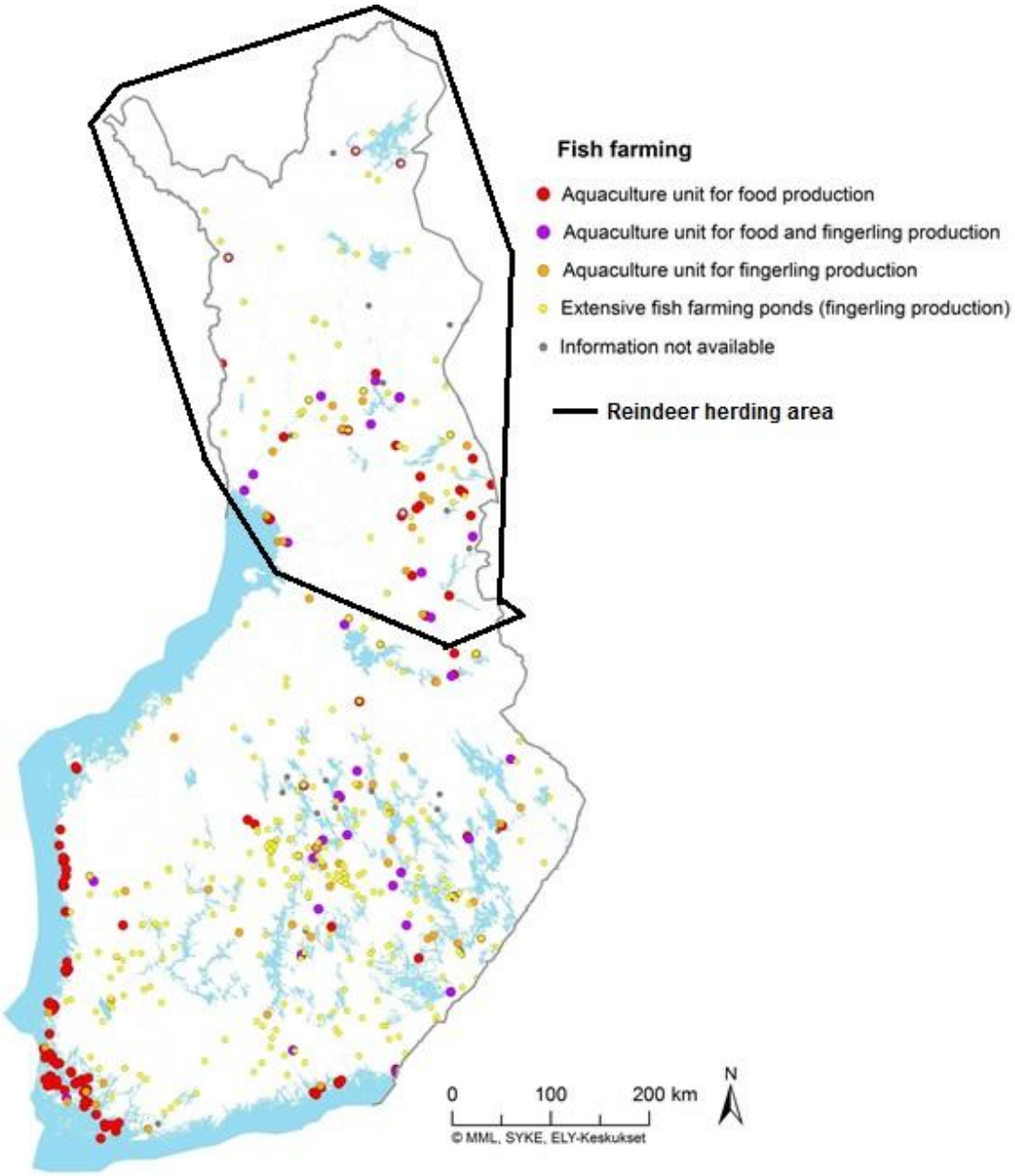
Figure 1. a) Agricultural production by regions; Others refer to such activities as tourism, production of bioenergy; b) Distribution of fish farms in Finland.



Distribution of farms receiving agricultural support according to production line in 2013 (main regions of Uusimaa and Åland according to NUTS II have been included in Southern Finland). Source: Finnish Agency for Rural Affairs.

Source: Niemi & Ahlstedt 2014.

Figure 1. b) Distribution of fish farms and reindeer herding in Finland



Source: Adopted from Setälä et al. 2014, Copyright MML, SYKE.

Table 3. Area under production, production quantity and contribution to the agricultural sector economy for production systems in the country.

Code of production system	Name of production system	Area (indicate unit)	Production - quantity (indicate unit)	Contribution to the agricultural sector economy (%)	Reference year
L3, L4	Livestock grassland-based systems: Temperate & boreal	18 036 farms on 548 430 ha; 196 500 reindeer pastured on 114 000 ha	2.2 billion liters milk and 82.6 million kg beef, lamb, and horse meat; 4.4 million kg reindeer meat	17.5 million € reindeer	2012, 2014
L7, L8	Livestock landless systems: Temperate & boreal	2 234 pig and poultry farms	107.4 million kg poultry, 62.2 million kg eggs		2012, 2014
F3, F4	Naturally regenerated forests: Temperate & boreal	16.3 million ha	Flow to the markets: 16 million kg berries (10 commonest species) & 309 354 kg mushrooms; 63 039 felled moose	Berries 21.3 million €; mushrooms 0.8 million €; game meat: estimated 83 million €	2012, 2013
F7, F8	Planted forests: Temperate & boreal	5.9 million ha	incl. into above		2011, 2012
A3, A4	Self-recruiting capture fisheries: Temperate & boreal	Sea ca. 170 000 km², inland waters 34 544 km²	132.9 million kg sea catch and ca 40 000 kg from inland waters	117 million €	2012, 2013
A7, A8	Culture-based fisheries: Temperate & boreal				2012
A11, A12	Fed aquaculture: Temperate & boreal	171 units that produce fish for food, 107 units that produce fish for ongrowing and stockings into wild	13.6 million kg fish	80,5 million €	2014
A15, A16	Non-fed aquaculture: Temperate & boreal	197 units that produce fish for stockings into wild	incl. into above	incl. into above	2014
C7, C8	Irrigated crops (other): Temperate & boreal	88 000 ha	114.7 million kg irrigated and potentially irrigated crops		2010–2012
C11, C12	Rainfed crops: Temperate & boreal	40 483 farms on 1.2 million ha	3731.5 million kg		2012

M3, M4	Mixed systems (livestock, crop, forest and /or aquatic and fisheries): Temperate & boreal	2 333 farms on 157 820 ha			2013
O1	Apiculture	3 000 beekeepers, 39 000 bee colonies	Approx. 940 000 kg honey	20 million €	2012

8. Comment on the effects on biodiversity for food and agriculture of production destined for exportation versus production for local and/or national consumption. Where information is available, indicate for each production system the proportion of production that is destined for export, the major commodities involved, the impact on the methods of production (e.g. adoption of specific production practices to meet export needs) and the implications for biodiversity.

Finland is largely self-sufficient in production of dairy products, beef, pork, poultry, and eggs (production to consumption range of 80–115 %). Non-processed exported agricultural production is 12.2 % of total production. Main export commodities include dairy products, oats and rye. Some of the reindeer meat products are exported. In 2013, Finland exported 61 million kg of fish and fish products but also imported 116 million kg of fish and fish products over the same period.

Many wild berries and mushrooms are important export products (e.g. premium mushroom species cep, *Boletus edulis,* and wild bilberries*, Vaccinium myrtillus*). There is only very limited information available on the mushroom trade. However, it has been estimated that some 482 tons of frozen or boiled mushrooms were exported from Finland in 2010. Ceps are particularly highly valued mushrooms in southern Europe. A new export addition is the genus *Drosera*, extensively collected and exported to central Europe for the medicines industry. While the export has grown in recent years, it remains below imports for most berries and mushrooms. Some novel non-timber products from forests have been finding the markets, for example birch sap. Up to 97 % of the sap is exported to central Europe and Japan. Exact data on the share of wild foods used for domestic consumption and for exports are missing. Recreational fishing and hunting products are mainly consumed domestically and do not reach export markets.

Honey exports in 2013 totaled 8 000 kg and were worth 40 000 €.

Since 1991 exports have been growing and in 2007 an estimated 600 000 hectares of Finnish farmland was used to grow the raw material for export. Imports have been growing even faster. Net displacement of agricultural land increased between 1991 and 2007 and stood at 223 000 hectares in 2007. Meeting export needs had minor effect on adoption of specific production practices in agricultural or aquaculture sectors. In forestry, high dependence on external markets and use of forests for international tourism put substantial consumer pressure on development of more biodiversity friendly management methods. Finland

markets its agricultural produce for export as that of high quality and coming from clean nature.

Effects of drivers of change on associated biodiversity

9. What have been the most important drivers (Annex 3) affecting the extent and distribution of associated biodiversity (Annex 1) in the last 10 years in your country? In describing the drivers you may wish to indicate the production systems where associated biodiversity is most affected and identify drivers that are common to the various components of associated biodiversity listed. Indicate where possible the indicators used to measure changes, along with the sources of information.

The Fifth National Report to the Convention on Biological Diversity (2014), the most important proximate reasons behind changes in associated biodiversity in Finland as: changes in forest environment (31 % of all threatened species affected), overgrowth of meadows and other open habitats (26 %), random factors (9 %), construction on land (6 %) and of waterways (5 %), mining and land extraction (4 %), and peatland drainage (3 %). Most of the changes described above took place during 1950–1990s. In the last 10 years, populations of many species, especially those that are legislatively protected, have stabilized or increased. The current prevailing pattern of biodiversity loss in Finland is likely to stem from a slow erosion of population-level diversity due to incremental alterations in habitat quality rather than conversion to different land-use or habitat types. This is due to low human population density, low proportion of man-made environment, and comprehensive legislation and law-enforcement in Finland. Qualitative changes of the type described are more difficult to confirm and their impacts on long-term population stability are little studied. Every land use type contains taxa and whole biotope types which have continued their decline during the recent decade.

Associated biodiversity, including crop wild relatives (CWR), under the most imminent threat of extinction in agricultural environments is that of traditionally managed biotopes such as semi-natural meadows and pastures. These types of biotopes are regarded among the most endangered nationally. Their continuous existence depends largely on extensive animal husbandry. Low-intensity semi-natural grasslands have been rendered largely unnecessary in modern production systems, where livestock are grazed on cultivated highly productive pastures or kept indoors. In Rainfed crops systems, utilization of such grasslands is further limited due to absence of livestock and mowing machinery. Other proximate reasons for declines in associated biodiversity – such as simplification of the landscape and chemical inputs – stabilized or reversed in the last decade due to policy interventions. However, the associated biodiversity that benefited include mainly species able to withstand intensive production rather than endangered species. Across all agricultural systems, impact of the policies overall remained negative because farm, landscape and regional level specialization and homogenization have been encouraged rather than moderated. Biodiversity in the southern regions particularly suffers from loss of livestock.

Threats from forestry on biodiversity in forest ecosystems remained unchanged or slightly decreased during the period 2000–2010. A relatively intensive use of commercial forests for timber production has been ameliorated in recent decades by an increased uptake of voluntary forest conservation agreements and since the 1990s by conservation practices such as protection of valuable habitats under the Forest Act. Efficiency by the former is limited however due to a small coverage and evidence for efficiency of the latter remains mixed.

In aquatic ecosystems, eutrophication from agricultural systems remains a threat in both marine and inland water bodies. Though the monitoring data show that the nutrient load potential of agriculture, measured by nutrient balances, has decreased continuously for nitrogen and phosphorus due to a decrease in the use of synthetic fertilisers, the nutrient concentration has not decreased in the Baltic Sea. There were minor changes in the ecological status of lakes and rivers between 2008 and 2013. Forestry operations and peatland extractions further add to the sediment load in waters, though many improvements have been made in the regulatory basis for forestry operation. The critically endangered Saimaa ringed seal continues to be negatively impacted by fishing activities in Lake Saimaa.

For both agricultural and forestry systems, increased biomass harvesting for energy production – in response to the climate change mitigation efforts – exerts additional pressures on biodiversity.

The key drivers behind the above patterns across all land-use types are, according to the Annex 3, Changes in land and water use and Changing economic, socio-political and cultural factors. Other drivers of most relevance for Finland are Pollution and external inputs, Climate change, Pests, diseases, alien invasive species, Markets, trade and the private sector, Policies, and Advancements and innovations in science and technology.

The information here is largely derived from the national indicator framework Biodiversity.fi. Assessment on the status of endangered species is carried out every 10 years, and the most recent evaluation is the 2010 Red List of Finnish Species. Other sources include The Fifth National Report to the Convention on Biological Diversity (2014), national monitoring programme MYTVAS, and original research publications.

10. Where associated biodiversity is believed to be affected by climate change, please provide additional information on the nature, severity and frequency of the climate threat and the production systems impacted.

In the northern conditions, climate change is predicted to have dramatic effects on the temperature and precipitation patterns, which will impact both production and associated biodiversity. The main pattern will be replacement of northern (boreal) species and ecosystems with more southern ones. The speed of colonization of species will differ and, therefore, the resulting ecosystem composition is likely to vary greatly from the present ones. Climate change is expected to have both positive and negative consequences on the diversity

of both production and associated biodiversity. Positive impact relates to colonization of the original ecosystems with novel species and introduction of novel production varieties. Impacts on related ecosystem services are poorly understood.

For associated biodiversity, negative impacts may be particularly drastic for species and habitat types with the northernmost distribution, and species dependent upon already rare and fragmented habitats (such as semi-natural grasslands). Overall, climate change is mentioned to be a future threat to 70 habitat types in Finland.

Many associated species have been demonstrated to benefit from climate warming. Population increases of several southern species were documented in protected areas in Finland. For agricultural systems, newcomers into the weed flora are predicted to establish populations in Finland, though competition with already existing weed species may be a limiting factor. The prevalence of many pathogens and pests will likely to increase. Projections for species performing key ecosystem services, such as biological pest control or pollination, are largely missing.

Whole forest types are predicted to change with the retreat of coniferous trees. This will likely have a profound impact on all levels of associated biodiversity. There are implications for production forests with risks in wind- and pest-induced damage to forest stands. This may potentially impact associated species, including those collected for food.

For aquatic ecosystems, climate change is predicted to impact water levels and flood rhythms, as well as increase erosion load from agricultural fields unprotected by frost. These and forecasted drastic events, such as floods and dry spells, are likely to adversely affect associated biodiversity. The length of the growing season and reduced ice-cover period will have both positive and negative influences for aquaculture and fish stocks. Cyprinid and percid fish species are more likely to benefit from the changes, whereas the cool water salmonids will be vulnerable to negative influences especially during the reproduction phase. In aquaculture, increased water temperature will increase losses for those species which are under farming presently. However, shorter ice period will have a positive effect on the growth. Diseases and parasites and new invasive species may have unexpected negative influences both on aquaculture and fisheries.

Some of the climate change driven changes above have already been registered, but most are predicted rather than already observed.

Effects of drivers of change on biodiversity for food and agriculture

11. For each production system present in your country as indicated in Table 1, fill in the code and name of each production system in Table 4 (repeat Table for each production system). For each production system indicate which drivers have been influencing biodiversity for food and agriculture, disaggregated by sector, during the past 10 years (description of drivers can be found in Annex 3). Drivers may have a strongly positive (2),

positive (1), negative (-1), and strongly negative effect (-2), or no effect at all (0) on biodiversity for food and agriculture. If the effect of the driver is unknown or not applicable, please indicate not known (NK) or not applicable (NA).

In the tables below, estimates by zones were pooled together because the temperate zone is only marginally represented in Finland and studies specific to it are lacking. For forests, no evidence exists separately for individual types.

Table 4. Effect of drivers on sector biodiversity within production systems in the country, by animal (AnGR), plant (PGR), aquatic (AqGR) and forest (FGR) genetic resources.

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Livestock L3, L4, L7, L8	Changes in land and water use and management	-1	0	-1	-1
	Pollution and external inputs	NK	NK	NK	-1
	Over-exploitation and overharvesting	0	-1 a	NA	NA
	Climate change	1	NA	NK	-1 e
	Natural disasters	NK	NA	NK	NK
	Pests, diseases, alien invasive species	-1	NA	-1	NK
	Markets, trade and the private sector	-1 b	NA	-2	NK
	Policies	-1	0 c	1	0
	Population growth and urbanization	NK	NA	NK	NK
	Changing economic, socio-political, and cultural factors	-1	NA	1 d	NA
	Advancements and innovations in science and technology	1	NA	1	1

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Forests F3, F4, F7, F8	Changes in land and water use and management	NA	1	NA	NK
	Pollution and external inputs	NA	0	NA	NA
	Over-exploitation and overharvesting	NA	0	NA	-1 a
	Climate change	NA	1	NA	NK
	Natural disasters	NA	NA	NA	NA
	Pests, diseases, alien invasive species	NA	-1	NA	NA
	Markets, trade and the private sector	NA	1	NA	NK
	Policies	NA	1	NA	NK
	Population growth and urbanization	NA	NK	NA	NK
	Changing economic, socio-political, and cultural factors	NA	1	NA	NK
	Advancements and innovations in science and technology	NA	1	NA	NA

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)

Code or name		PGR	FGR	AnGR	AqGR
Aquaculture & fisheries A3, A4	Changes in land and water use and management	NA	NA	NA	-1
	Pollution and external inputs	NA	NA	NA	0
	Over-exploitation and overharvesting	NA	NA	NA	-1
	Climate change	NA	NA	NA	0
	Natural disasters	NA	NA	NA	NA
	Pests, diseases, alien invasive species	NA	NA	NA	-1
	Markets, trade and the private sector	NA	NA	NA	1
	Policies	NA	NA	NA	1
	Population growth and urbanization	NA	NA	NA	1
	Changing economic, socio-political, and cultural factors	NA	NA	NA	1
	Advancements and innovations in science and technology	NA	NA	NA	1

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Aquaculture & fisheries A7, A8	Changes in land and water use and management	NA	NA	NA	0
	Pollution and external inputs	NA	NA	NA	-1
	Over-exploitation and overharvesting	NA	NA	NA	-1
	Climate change	NA	NA	NA	1
	Natural disasters	NA	NA	NA	0
	Pests, diseases, alien invasive species	NA	NA	NA	-1
	Markets, trade and the private sector	NA	NA	NA	1
	Policies	NA	NA	NA	1
	Population growth and urbanization	NA	NA	NA	1
	Changing economic, socio-political, and cultural factors	NA	NA	NA	1
	Advancements and innovations in science and technology	NA	NA	NA	1

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Aquaculture & fisheries A11, A12	Changes in land and water use and management	NA	NA	NA	1
	Pollution and external inputs	NA	NA	NA	1
	Over-exploitation and overharvesting	NA	NA	NA	1
	Climate change	NA	NA	NA	-1
	Natural disasters	NA	NA	NA	0
	Pests, diseases, alien invasive species	NA	NA	NA	-1
	Markets, trade and the private sector	NA	NA	NA	1
	Policies	NA	NA	NA	1
	Population growth and urbanization	NA	NA	NA	0
	Changing economic, socio-political, and cultural factors	NA	NA	NA	1
	Advancements and innovations in science and technology	NA	NA	NA	1

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Irrigated crops (other) C7, C8	Changes in land and water use and management	NK	NA	NA	NK
	Pollution and external inputs	NK	NA	NA	NK
	Over-exploitation and overharvesting	NK	NA	NA	NK
	Climate change	1 a	NA	NA	NK
	Natural disasters	0	NA	NA	NA
	Pests, diseases, alien invasive species	-2 a	NA	NA	NK
	Markets, trade and the private sector	-2 b	NA	NA	NK
	Policies	0 c	NA	NA	NK
	Population growth and urbanization	1 d	NA	NA	NK
	Changing economic, socio-political, and cultural factors	1	NA	NA	NK
	Advancements and innovations in science and technology	1	NA	NA	NK

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Rainfed crops C11, C12	Changes in land and water use and management	-1 a	NK	NA	-1
	Pollution and external inputs	NK	NK	NA	-1
	Over-exploitation and overharvesting	NK	NA	NA	NK
	Climate change	1	NA	NA	-1
	Natural disasters	NK	NA	NA	NA
	Pests, diseases, alien invasive species	-1 b	NA	NA	NK
	Markets, trade and the private sector	-1 b	NA	NA	NK
	Policies	0c	NA	NA	0
	Population growth and urbanization	NK	NA	NA	NK
	Changing economic, socio-political, and cultural factors	1 d	NA	NA	NK
	Advancements and innovations in science and technology	1	NA	NA	1

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Mixed M3, M4	Changes in land and water use and management	-1	NA	-1	-1
	Pollution and external inputs	NA	NA	NK	-1
	Over-exploitation and overharvesting	NA	NA	0	NK
	Climate change	1	NA	NK	-1
	Natural disasters	NA	NA	NK	NK
	Pests, diseases, alien invasive species	-1	NA	NK	NK
	Markets, trade and the private sector	-1	NA	-1	NK
	Policies	0	0	1	0
	Population growth and urbanization	NK	NA	NK	NK
	Changing economic, socio-political, and	1	NA	1	NK

	cultural factors				
	Advancements and innovations in science and technology	1	NA	1	NK

As above in Livestock and Rainfed

Production systems	Drivers	Effect of drivers on sector biodiversity for food and agriculture (2, 1, 0, -1, -2, NK, NA)			
Code or name		PGR	FGR	AnGR	AqGR
Apiculture, O1	Changes in land and water use and management	NA	NA	NK	NA
	Pollution and external inputs	NA	NA	0	NA
	Over-exploitation and overharvesting	NA	NA	NK	NA
	Climate change	NA	NA	-1	NA
	Natural disasters	NA	NA	NA	NA
	Pests, diseases, alien invasive species	NA	NA	-2	NA
	Markets, trade and the private sector	NA	NA	NK	NA
	Policies	NA	NA	NK	NA
	Population growth and urbanization	NA	NA	NK	NA
	Changing economic, socio-political, and cultural factors	NA	NA	NK	NA
	Advancements and innovations in science and technology	NA	NA	NK	NA

Effects of drivers of change on ecosystem services

12. What have been the main drivers (descriptions in Annex 3) affecting regulating and supporting ecosystem services (descriptions in Annex 4) in the country during the last 10 years? Describe, for each production system identified in Table 1, the major driver(s) affecting ecosystem services and indicate the effect on ecosystem services as being strongly positive (2), positive (1), negative (-), strongly negative (-2), no effect (0), not known (NK), or not applicable (NA) in Table 5 (repeat table for each production system).

Table 5. Major drivers and their effect on ecosystem services in production systems.

Production systems	Drivers	Effect of drivers on ecosystems services (2, 1, 0, -1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
	Changes in land and water use	NK	NK	-1	NK	-2	-2	-1	-2	-1 a

Livestock L3, L4, L7, L8	and management									
	Pollution and external inputs	-1 b	NK	-1	NA	-1	-1c		-1	-1
	Over-exploitation and overharvesting	NA	NA	NA	NA	NA	NK	NA	-1 a	NA
	Climate change	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Natural disasters	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Pests, diseases, alien invasive species	NK	NK	-1	NK	NK	NK	NK	-1	NK
	Markets, trade and the private sector	NK	-1	NK	NK	-1 d	NK	NK	-1	NK
	Policies	NK	NK	1	NA	-1 j	NK	NK	-1	0 g
	Population growth and urbanization	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Changing economic, sociopolitical, and cultural factors	1 f	1 f	NK	NK	1	1	NK	1	NK
	Advancements and innovations in science and technology	NK	1	1	NK	NK	NK	NK	NK	1 e

Production systems	Drivers	Effect of drivers on ecosystems services (2, 1, 0, -1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Forests F3, F4, F7, F8	Changes in land and water use and management	NK	NK	NK	NK	NK	-1 a	NK	1 b	NK
	Pollution and external inputs	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Over-exploitation and overharvesting	NK	NK	NK	NK	NK	-1 a	NK	-1	NK
	Climate change	NK	NK	NK	NK	NK	NK	NK		NK
	Natural disasters	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pests, diseases, alien invasive species	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Markets, trade and the private sector	NK	NK	NK	NK	NK	NK	NK	1 c	NK
	Policies	NK	NK	NK	NK	NK	-1 a	NK	1 b	NK
	Population growth and urbanization	NK	NK	NK	NK	NK	NK	NK	-1	NK
	Changing economic, sociopolitical, and cultural factors	NK	NK	NK	NK	NK	NK	NK	1	NK
	Advancements and innovations in science and technology	NK	NK	NK	NK	NK	NK	NK	NK	NK

Production	Drivers	Effect of drivers on ecosystems services

systems		(2, 1, 0, -1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Aquaculture & fisheries A3, A4, A7, A8, A11, A12	Changes in land and water use and management	NA	-1 a	1	NK	1	NA	NK	-1	NK
	Pollution and external inputs	NA	NK	-1	NK	NK	NA	NK	-1	NK
	Over-exploitation and overharvesting	NA	NK	NK	NK	NK	NA	NK	-1 b	NK
	Climate change	NA	NK	NK	NK	1	NA	NK	NK	NK
	Natural disasters	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Pests, diseases, alien invasive species	NA	1	NK	NK	NK	NA	NK	1	NK
	Markets, trade and the private sector	NA	NK	NK	NK	NK	NA	NK	-1 a	NK
	Policies	NA	NK	1	NK	NK	NA	NK	1	NK
	Population growth and urbanization	NA	NK	NK	NK	NK	NA	NK	NK	NK
	Changing economic, sociopolitical, and cultural factors	NA	NK	1 c	NK	NK	NA	NK	1 c	NK
	Advancements and innovations in science and technology	NA	NK	1	NK	NK	NA	NK	NK	NK

Production systems	Drivers	Effect of drivers on ecosystems services (2, 1, 0, -1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Irrigated crops (other) C7, C8	Changes in land and water use and management	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Pollution and external inputs	-1 d	NK	NK	NK	NK	NK	NK	NK	NK
	Over-exploitation and overharvesting	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Climate change	NK	-1 b	NK	NK	NK	NK	NK	NK	NK
	Natural disasters	NK	NK	NK	NK	NK	NA	NK	NK	NK
	Pests, diseases, alien invasive species	NK	-1	-2 e	NK	NK	NK	NK	NK	NK

	Markets, trade and the private sector	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Policies	1	1 f	NK	NK	NK	1		1	
	Population growth and urbanization	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Changing economic, sociopolitical, and cultural factors	1 c	1	NK	NK	1	1	NK	NK	NK
	Advancements and innovations in science and technology	1 a	1 a	NK	NK	NK	NK	NK	NK	NK

Production systems	Drivers	Effect of drivers on ecosystems services (2, 1, 0, -1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Rainfed crops C11, C12	Changes in land and water use and management	NK	1 c	0	NA	-2	-2	-1	-2	-1
	Pollution and external inputs	0 a	?	-1	NA	-1	-2 j	NK	-1	-1
	Over-exploitation and overharvesting	NA	Na	NA	NA	NA	NA	NA	NA	NA
	Climate change	NK	-1 b	-1	NK	NK	-1	NK	NA	NA
	Natural disasters	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pests, diseases, alien invasive species	-2	-1 c	NK	NA	NK	NK	NK	-1	NK
	Markets, trade and the private sector	NK	-1	NK	NA	-1	0 d	NK	-1	NK
	Policies f	NK	NK	NK	NK	NK	-1	NK	-1	-1
	Population growth and urbanization	NK	NK	NK	NK	NK	NK	NK	NK	NK
	Changing economic, sociopolitical, and cultural factors	1	1	NK	NA	1	1	NK	1	NK
	Advancements and innovations in science and technology	NK	1	1	NA	NK	1 g	NK	NK	NK h

Production systems	Drivers	Effect of drivers on ecosystems services (2, 1, 0, -1, -2, NK, NA)

Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Mixed M3, M4	Changes in land and water use and management	NK	-1 c	0	NA	-2	-2	-1	-2	-1
	Pollution and external inputs	0 a	NK	-1	NA	-1	NK	NK	-1	NK
	Over-exploitation and overharvesting	NA	NA	NA	NA	N a	NA	NA	NA	NA
	Climate change	NK	-1 b	-1	NK	NK	-1	NK	NA	NA
	Natural disasters	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Pests, diseases, alien invasive species	-2	-1 c	NK	NA	NK	NK	NK	-1	NK
	Markets, trade and the private sector	NK	-1	NK	NA	-1	0 d	NK	-1	NK
	Policies	NK	0 f	NK	NK	NK	NK	NK	-1	NK
	Population growth and urbanization	NK	NK	NK	NA	NK	NK	NK	NK	NK
	Changing economic, sociopolitical, and cultural factors	1	1	NK	NA	1	1	NK	1	NK
	Advancements and innovations in science and technology	NK	1	1	NA	NK	1 g	NK	NK	NK h

Production systems	Drivers	Effect of drivers on ecosystems services (2, 1, 0, -1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Apiculture, O1	Changes in land and water use and management	NK	NK	NA	NA	NA	NA	NA	NA	NA
	Pollution and external inputs	-1	NK	NA	NA	NA	NA	NA	NA	NA
	Over-exploitation and overharvesting	NK	NK	NA	NA	NA	NA	NA	NA	NA
	Climate change	-2	NK	NA	NA	NA	NA	NA	NA	NA
	Natural disasters	NK	NK	NA	NA	NA	NA	NA	NA	NA
	Pests, diseases, alien invasive species	-2	NK	NA	NA	NA	NA	NA	NA	NA

	Markets, trade and the private sector	-1	NK	NA	NA	NA	NA	NA	NA	NA
	Policies	NK	NK	NA	NA	NA	NA	NA	NA	NA
	Population growth and urbanization	NK	NK	NA	NA	NA	NA	NA	NA	NA
	Changing economic, sociopolitical, and cultural factors	NK	NK	NA	NA	NA	NA	NA	NA	NA
	Advancements and innovations in science and technology	1	1	NA	NA	NA	NA	NA	NA	NA

13. Briefly describe the main driver(s) affecting ecosystem services in each production system, as identified in Table 5. Include where possible a description of the components of associated biodiversity that are affected, the indicators used to measure change, and the source of information.

The actual changes in the delivery of ecosystem services (= end products of the processes) remain largely unknown and, in most cases, the effects are inferred from the changes in relevant ecosystem processes rather than confirmed by specific evidence on the services. For example, changes in populations of pollinators plausibly impact on pollination services (= change in yield).

The main drivers fall under Changes in land and water use and management and relate to the ongoing intensification and specialization of production in agricultural systems under the current economic climate. This in turn leads to increased external inputs (mainly fertilizers), further separation of livestock and arable production, and reduction in non-cropped areas. These are likely to impact native pollinators (through loss of habitat), biological nitrogen fixation (through application of inorganic fertilizers), and soil formation (from sub-optimal application of organic matter). Habitat provisioning function in agroecosystems is further affected by reduction in quantity and quality of the semi-natural habitats. Some of the drivers from agriculture are impacting functioning in aquatic ecosystems, especially those related to water purification capacity and nutrient cycling. In forestry, the most recent negative impact has been observed from a drive for utilizing tree stumps for bioenergy, which is likely to weaken soil formation function.

In fisheries, the weak native salmonid populations are supported by stockings of the native and local fishes. Genetic contamination from the raised and re-stocked salmon continues impacting the habitat provisioning for native stocks. However, there is no escapee problem from the aquaculture on the wild native fish stocks in Finland. Aquaculture production is in the process of moving to less sensitive areas and decreasing negative influences, which will enable ecosystem recovery in the present coastal and archipelago areas.

In the recent decade, however, some of these pressures have been alleviated by legislative and voluntary interventions. The agri-environmental policy includes several targeted measures relevant to ecosystem processes, especially in soil formation and nutrient cycling.

The recent implementation of integrated pest management (IPM) as an obligatory approach in pest management aims at reduction of pesticide use and increased reliance on biological control and other non-chemical methods. However, the effects are not yet confirmed. Policies have in part offset the negative tradeoffs also from timber procurement (e.g. establishment of riparian buffer zones and protection of keystone habitats). However, effectiveness of such policy interventions for provisioning of ecosystem services remains unconfirmed. The pressures of the policy overall may remain negative through its focus on economic performance of farms rather than overall sustainability. So far, utilization of ecosystem processes such as nutrient recycling and biological control to try to compensate for instead of external inputs have been implemented only marginally.

Overgrazing in Finland is confined to reindeer herding areas. Formerly, reindeer herd sizes was limited mainly by the carrying capacity of the pastures used for winter grazing. Presently, herders in Finland put out silage and hay for their reindeer. Such winter feeding as well as the anti-parasite medication, enable herders in many regions to keep larger herds than the natural pastures can sustain by themselves. Further, the erection of fences to limit reindeer movement has resulted in local overgrazing. This management has resulted in some known impacts on ecosystem processes in soil.

There are several examples of advancements and innovations in science and technology that are specifically targeted at the processes related to ecosystem services: precision biological control through use of pollinators as mobile agents in delivering biocontrol substances; fractioning of manure to improve nutrient cycling, and subsoil application of liquid manure to avoid areal emissions.

Indicators used to measure change are from the national indicator framework Biodiversity.fi, national monitoring programme MYTVAS, the Fifth National Report to the Convention on Biological Diversity (2014), reports from several research programmes (e.g. EKOAR, VACCIA, TEEB Nordic, TEEB Finland), original research publications (see full reference list) as well as plausible changes in ecosystem services inferred from the uptake of management practices relevant to the underlying processes.

Effects of drivers of change on wild foods

14. What were the main drivers affecting the availability, knowledge and diversity of wild foods during the last ten years in the country? In Table 6, indicate the major drivers affecting availability, knowledge and diversity of wild foods, and if the effects are strongly positive (2), positive (1), negative (-1), strongly negative (-2), no effect (0), not known (NK), or not applicable (NA).

Table 6. Drivers affecting availability, knowledge and diversity of wild foods.

	Effect of drivers (2, 1, 0, -1, -2, NK, NA)		
	Availability of wild	Knowledge of wild	Diversity of wild

Drivers	foods	foods	food
Changes in land and water use and management	-1	NA	0
Pollution and external inputs	NK	NA	NK
Over-exploitation and overharvesting	-1 a,e	NK	NK
Climate change	NK	NA	NK
Natural disasters	NA	NA	NA
Pests, diseases, alien invasive species	-1 d	NK	NK
Changing markets	1	1	NK
Policies	1	NK c	NK
Population growth and urbanization	-1	-1	NK
Changing economic, socio-political, and cultural factors	1 b	2	NK
Advancements and innovations in science and technology	1 f	1	NK

15. Briefly describe the main drivers affecting the availability, diversity and knowledge of wild foods in your country, as identified in Table 6. Include where possible indicators used to measure change, along with the source of information.

The key drivers are urbanization of the society and depopulation of the countryside that directly affects traditional ways of using wild foods. The younger generation is also less active in collecting mushrooms and berries, though there has been a positive change most recently. Hunting has also been increasing but recreational fishing is declining. There is growing interest in better utilization of wild foods both for own consumption and exports. This is supported by national programmes of supporting and valorizing values of local food, including wild foods. Digital identification of species via advancements and innovations in science and technology may help promote knowledge of wild species in the increasingly urban population.

Evidence for underlying causes driving wild food availability is complex and should be treated with caution. For example, while it is known that some forest game bird species are suffering from modern forestry practices, no clear explanations for the general decline in small game populations have been found. Habitat degradation and fragmentation through forestry have the highest adverse impact, while overharvesting is seldom a problem (locally berries are being depleted by commercial collectors). Some ungulates generally benefit from habitat fragmentation but most other species, including small game and wild reindeer, suffer from it. Additionally, clear-cutting has been greatly affecting the berry-producing shrubs, which are also important food for game.

Climate change as a driver is stated as a potential future force. As the boreal ecoregion retreats further north and is replaced temperate broadleaf forest, the prevalence of key forest berries may also decrease. Asynchrony between pollinator activity and berry blossoms may increase as a result of climate change. Utilization of berries may also become less safe than before due to increased prevalence of the tick-borne encephalitis and *Lyme borreliosis*.

Eutrophication of coastal waters has influenced the composition of fish population and, together with higher water temperature, this has favoured spring spawning species like cyprinid and percid species. Production from aquaculture has decreased mainly due to the strict permits policy, which forced production to neighbouring countries, such as Sweden.

Evidence is drawn or inferred from such sources as: the Fifth National Report to the Convention on Biological Diversity (2014), reports from research programmes (e.g. TEEB Nordic) and reports of sectoral institutions, original research publications (see full reference list), and expert interviews.

16. Which drivers have had the most significant effect on the involvement of women in the maintenance and use of biodiversity for food and agriculture?

Women in Finland generally enjoy equal rights to food and other ecosystem services, and to other means of production, with men. Women are especially active in berry and mushroom picking and in utilizing them for home consumption. Women's percentage of new hunting permits has increased recently. Social networking such as the Martha Organization has been important in retaining and promoting traditional knowledge in utilization of wild foods.

17. Which drivers have had the most significant effect on the maintenance and use of traditional knowledge relating to biodiversity for food and agriculture?

Modernization removed practically all the traditional agriculture and forestry already decades ago. However, the whole population is at least aware of several traditional ways of using wild foods, and large proportions of the population practice recreational harvesting of wild fish, game, berries and mushrooms.

The only ethnic group with traditional ways of land use in Finland is the Sámi people. Finland has a comprehensive policy to promote the maintenance and preservation of the traditional Sámi way of life and culture, and the northern biodiversity supporting it. Changing economic, socio-political, and cultural factors are the key drivers. For example, some traditional practices in reindeer herding have changed, which leads to local overgrazing. Impact of climate change on the maintenance and evolution of traditional knowledge in northern Finland has already occurred and is expected to increase.

Changing economic, socio-political, and cultural factors as well as Population growth and urbanization have had mainly an adverse impact on traditional knowledge in wild food use overall. In the recent decade, Finland has seen an increase in popularity of wild food procurement and use of traditional crop varieties and animal breeds.

Advancements and innovations in science and technology have been particularly important for *ex situ* preservation of production biodiversity but also for delivering knowledge on wild foods (e.g. electronic guides).

18. Which drivers have had the most significant effect on the role of biodiversity for food and agriculture in improving food security and sustainability?

Internationalization, as well as interest in healthy, super and diet foods, have resulted in shifts in Finnish diet. Consumers have become familiar with a greater variety of products. This led to the diversification of the domestic markets to match changing tastes (e.g. introduction of maize, salad mixes, grains and pseudo grains). Specialty product meadow-raised meat is a concrete example of coupling biodiversity conservation and market mechanisms.

The EU membership and joining Common Agricultural Policy (CAP; in 1995) had a significant historical impact on Finnish food security and self-sufficiency. Advancements and innovations in science and technology resulted in implementation of the modern methods for preservation of genetic diversity of production plants and animals and for their use in breeding. Some agronomic practices focused at diversified cropping spatially and as rotations are in development or being implemented. Developments with considerable role for food security include use legumes for nitrogen fixation instead of imported fertilizers, production of domestic protein feed, and more efficient utilization of manure. There are also a growing number of social innovations in farm and food system development toward more sustainable modes (e.g. community-supported agriculture, food cycles). Some of these are outcomes of transnational partnerships and projects in education, planning and implementation promoting sustainability of food production on regional and global levels.

Many policies regulating land use and directed at conservation of *in situ* diversity contribute directly or indirectly to food security and sustainability. These policies have been at both national and international levels and include those related to Finland's international development efforts. National programmes in support of local food production, including labelling of 'Hyvää Suomesta – Produce of Finland', are also having an impact.

Some of the Changing economic, socio-political, and cultural factors – such as interest in utilization of wild foods for domestic consumption and in local food generally – have been contributing to sustainability.

19. Referring to the information provided in this Chapter, identify countermeasures planned or in place to reduce adverse consequences of drivers on a) associated biodiversity, b) ecosystem services and c) wild foods. Provide any expected outcomes, lessons learned and best practices.

Most of countermeasures that are being developed and/or implemented are sector-based interventions. The conservation policies, on the other hand, cut across all sectors. The measures for the associated biodiversity and ecosystem services by the sectors are summarized in the Fifth National Report to the Convention on Biological Diversity, Finland (2014).

In agricultural systems, the most far-reaching and potentially effective countermeasures have been implemented as part of volunteer public agreements with farmers for agri-environment payments under the EAFRD. Some of these specifically target associated biodiversity and many indirectly impact processes relevant for ecosystem services (for example, control of erosion from fields and increasing organic matter in soils). The set target is, among others, to halt the biodiversity decline and reduce nutrient load into waters. Improving financial sustainability of farms and ensuring domestic primary production are also important EAFRD policy objectives. The extent to which the policy-driven measures have been successful vary considerably according to region, measure, biodiversity component and nutrient type. One of the key lessons learnt is the need to considerably improve efficiency of such public payments in terms of outcomes. This could be done through targeting of the interventions on a regional, farm and even parcel level; landscape-level planning (also as a mean to address the issue of connectivity of habitats); cooperation among many farm holdings and various stakeholders; and sufficient advisory and extension services. Agreements based on results rather than actions have been suggested as a way of improving efficiency.

Legislative changes of the recent decades have also moved towards better environmental performance of agricultural production (for example, cross-compliance mechanism of the CAP). In forestry, some of the most detrimental forest management practices, such as large-scale clear logging and deep ploughings of regeneration areas, have been banned. Several biodiversity-friendly management options, such as retention trees and buffer zone along water courses, have been introduced. Domestic tree species are being used in forest regeneration, which is likely to be favourable toward wild food species. Evidence on specific benefits of the changed practices on biodiversity and ecosystem functioning have been mixed and difficult to document though the rate of forest species declines in several taxa has slowed down. A freshly approved Forest Act allows for more diverse management practices for forests depending on the multiple possible objectives (including game and associated biodiversity). Efforts toward sustainable hunting following the scientifically-endorsed recommendations on game management have resulted in recent years in a successful increase and sustainable state in some populations.

Several volunteer initiatives for protecting valuable forest systems or species are being implemented. The Forest Biodiversity Programme for Southern Finland (METSO) involves compensatory payments to land owners. A successful initiative of engaging forest owners in retention of non-logged buffers around nests of birds of prey does not involve compensation and is based entirely upon advisory services and good will. Also, preliminary results from non-clear cut (or continuous cover) forestry have been promising in terms of conservation outcomes, social acceptance and economic performance, though evidence remains species, group, and context dependent.

In aquaculture, improvements in site selection for net cages in the coastal and archipelago areas have decreased the local nutrient loads to the most sensitive areas. The use of local fish

as a source of fishmeal and oil would decrease the import of nutrients from other areas to the Baltic Sea region (www.aquabest.fi). In fisheries, the most important countermeasures have involved construction of passages for migrating fish in areas affected by hydropower and other dams, lake regulation practices that are adjusted for species needs, prevention of nutrient pollution of waters from land (through, for example, constructed wetlands). One of the lessons learnt was an imperative of cooperation among stakeholders along entire migrating routes and breeding grounds of fish, and amongst landowners over whole water catchments.

Across all systems, outcomes of many projects, in which environmental authorities, NGOs, advisers, and land-users cooperated from the beginning, have been impressive. Participatory approach in planning and implementing countermeasures seems to be a valuable approach for resource management both for land and aquatic systems. It is not without its own challenges and requires developed deliberation institutions. There is also an urgent need for incentives in universities to encourage, recognise and reward engagement of researchers in decision-making processes. Targeting, cost-effectiveness, availability of quality advisory and extension services and awareness rising have been stressed in all intervention cases. Piloting of interventions before their large-scale implementation and basing countermeasures on evidence of efficacy have also been highlighted.

There have been also increased cross-sectoral cooperation in research and implementation in areas of food production, associated biodiversity and ecosystem services. Such national programmes as Finnish Biodiversity Research Programme FIBRE and Biodiversity and Monitoring Programme MOSSE aimed at biodiversity but funded together by the Ministry of Agriculture and Forestry and Ministry of Environment are notable examples. Valuable experiences have also been gained in participatory approach that engages stakeholders at all stages of implementation and development of the research agenda. Processes of developing the national agri-environmental policy or Water Framework Directive are good examples of such engagement in Finland.

For more details on specific programmes and projects see questions 54, 66 and 79.

20. Describe the overall 1) state, 2) trends and 3) state of conservation of diversity of forest, aquatic, animal or plant genetic resources in your country with respect to:
a) common characteristics shared by all sectors;
b) major differences between sectors;
c) synergies or trade-offs in the state of diversity between sectors.
The responses should include relevant information on socio-economic, political and cultural dimensions as well as biological ones. Information on the significance of common characteristics, differences, synergies and trade-offs with respect to achieving food security and nutrition, sustainable production or the provision of ecosystem services should also be provided

The common character shared by all sectors in Finland is the country's northern position, which greatly restricts the variety of crops and animals in production. In forestry, the number of indigenous tree species in Finland is also low, with many species at the limits of their distribution, which generally results in relatively narrow natural intraspecific genetic diversity. The agriculture and forestry sectors clearly differ in the trends of production diversity. The agriculture sector experienced a dramatic opening of the domestic markets to international trade when Finland joined the EU in 1995, leading to an increase in utilization of imported breeding material. With small exceptions, mainly for hobby farming and tourism-based enterprises, farming in Finland is mainly based on imported breeds. For example, domestic breeding of poultry ceased completely at the end of the 1990s and poultry production is now based on imported material.

Crop production is highly specialized, relying on a relatively few cultivars of very few species in simple rotations (for example, the commonest rotation for farms under 25 hectares includes only cereals). The situation has not changed considerably in the last decade. For example, uptake for an agri-environment subsidy for diversified cropping remained so marginal that it has been abandoned. Only a handful of novel crops have been introduced to Finland and their production remains marginal. About 15-20 % of plant production farms cultivate special crops, such as oil crops, legumes, pseudo-cereals, potato and sugar beets. Their cultivation areas are restricted: currently about 6–8 % of the arable land.

The forestry sector has always been based almost entirely on indigenous tree species and the use of domestically produced breeding material. In most cases, experimental transfers have shown that tree germplasm from elsewhere cannot thrive here.

Culturally, Finland is characterized as a modern, technology-orientated society for natural resource use, with a strong belief in engineering approaches, mechanization, increased scales and such efficiency as biomass harvested per unit labor or unit land area. Emphasis on eco-

efficiency and on conservation of nature values or cultural heritage has been secondary to the technological orientation. The high level of urbanization and the continuing retreat from rural professions have further alienated the population from biological diversity and ecosystems.

In aquaculture, genetic diversity is in the center of broodstock rearing to produce egg material for stocking, and advanced methods to avoid inbreeding have been widely taken into practical use. The currently prevailing strategy of supporting freshwater fisheries of salmonids by restocking rivers with hatchery fish has been shown to have negative effects on the natural populations of a variety of fish species. There are also some indications of successful stocking in which little or no negative effect was found on the genetic diversity of the native populations. Therefore, the practice has to be carefully monitored and managed.

The importance of national genetic resources and their utilization for food security and nutrition have been acknowledged as key issues in the national plant and animal (including fish) breeding programmes. Finnish cultivars are bred for boreal growing conditions with a short growing season, so they contribute to the food security of the country. Domestic cultivars are cropped on 2/3 of the arable land of Finland, showing that genetic resources contribute to national agricultural sustainability. Especially in connection with climate change, further genetic diversification could be critical for sustained food security. The role of crop genetic potential to sustain yields can be crucial, especially in situations of disruption of imported agricultural inputs. Furthermore, landraces of crop plants and native farm animal breeds adapted to northern conditions are a globally unique genetic resource. In Finland they represent the national cultural heritage, and are considered as part of the agricultural history.

In forestry, safeguarding the genetic diversity of the tree species is seen as a tool to sustain the capacity of stands to adapt to changes in the environment, so it is taken into account in tree breeding, the production of forest reproduction material, regeneration, and forest management. No forests in Finland are established from clones of an individual tree, as the reduction of genetic variability would weaken the survival of tree species as the climate changes.

The relationships of the genetic diversity of production species with those of associated species, and with ecosystem functioning, are still poorly understood. In some cases, it is known that cropping diversity also promotes diversity of the associated organisms. Similarly, diversity of the forest tree stand enhances associated biodiversity and the production of wild foods. At the same time, the presence of key species in both systems has been demonstrated to be of prime importance for certain ecosystem processes and habitat provisioning. Use of genetic diversity for transgenic organisms may also become relevant, for example in potato production. New transgenic varieties are seen as a potential risk to populations of native species. At the same time, the state of scientific assessment and monitoring of the

environmental impacts of the use of genetically modified organisms is of a high standard in Finland.

Research on ecosystem services has been rapidly developing but evidence most often stops at documenting the state of species populations or the rate of processes that are known to be important. The actual change in quantity of the services (= final benefits) being provided to and/or consumed by the society is rarely estimated. Evidence of how the diversity of forest, aquatic, animal or plant genetic resources influences ecosystem functioning is not documented.

There are no clear trade-offs in the state of diversity between sectors in Finland, since the relative shares of forested and agricultural land have been stable in the past decade, and primer draining of aquatic systems for agriculture and forestry has not been practiced recently. Synergies exist between the erosion of diversity in agricultural and aquatic systems driven by high chemical inputs and mechanical disturbance of soils. These drive degradation of several ecosystem services related to soil productivity and water purification. Bioenergy demand results in synergies between agriculture and forestry.

21. Have any changes been detected in your country for the different production systems over the last 10 years in components of associated biodiversity? If so, indicate if trends are strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 7. If no information is available, indicate not known (NK). If not applicable, (NA).

Table 7. Trends in the state of components of associated biodiversity within production systems.

Production system	Trends in last 10 years (2,1,0,-1,-2, NK, NA)			
Code or name	Micro-organisms	Invertebrates	Vertebrates	Plants
L3 Livestock grassland-based systems: Temperate	NK	-2	-1	-1
L4 Livestock grassland-based systems: Boreal	-1 a	-1	0	-1
L7 Livestock landless systems: Temperate	NK	NK	NK	NK
L8 Livestock landless systems: Boreal and /or highlands	NK	NK	NK	NK
F3 Naturally regenerated forests	NK	-1	-1	-1
F4 Naturally regenerated forests	-1	-1	-1	-1
F7 Planted forests	NK	-2	-2	-2
F8 Planted forests	NK	-2	-2	-2
A3 Self-recruiting capture fisheries	-1 b	-1	-1	-1
A4 Self-recruiting capture fisheries	-1	-1	-1	-1
A7 Culture-based fisheries	-1	NK	-1	-1
A8 Culture-based fisheries	-1	NK	-1	-1
A11 Fed aquaculture	NK	NK	NK	NK
A12 Fed aquaculture	NK	NK	NK	NK
A15 Non-fed aquaculture	NK	NK	NK	NK
A16 Non-fed aquaculture	NK	NK	NK	NK

C7 Irrigated crops (other)	NK	NK	NK	NK
C8 Irrigated crops (other)	NK	NK	NK	NK
C11 Rainfed crops	NK	-2	-1	-1
C12 Rainfed crops	NK	-2	-1	-1
M3 Mixed systems	-1	-2	-1	-1
M4 Mixed systems	-1	-2	-1	-1
O1 Apiculture	NK	NK	NA	NA

22. Briefly describe the changes or trends in diversity recorded in Table 7. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.

The cumulative pattern of the state of biodiversity in the last decade shows an overall downward trend, the rate of which seems to be slowing. Population sizes and ranges of a number of species have stabilized or increased. Yet, trends continue downward for other taxa, especially those in need of specific conditions present in currently rare habitat types. Therefore, the overall trends are still negative. Three patterns area common to all ecosystems in question. Firstly, currently in Finland a drastic decline in biodiversity is seldom observed in any of the ecosystems. Due to the low human population density, a low share of human-made environments, comprehensive legislation and good law enforcement, environmental changes in the country are more often incremental alterations in habitat quality rather than abrupt conversions of one habitat type to another. Finland has not experienced large-scale human-made disasters such as desertification or rapid urban sprawl. For industrial disaster, see question 41.

Secondly, the state of populations of many species has considerably improved because of modified land-use practices due to policy interventions and cultural changes. Populations of several species strictly protected by legislation from exploitation and populations that are well represented within the national network of protected areas have increased. Some species have also benefitted from human management: for example, in aquatic systems, certain fish species benefitted from increased productivity, which in turn enhanced wildfowl species dependent on them. Also, new species expanding their northern range are frequently registered due to climate change.

Thirdly, instead of a drastic loss of species there have been on-going qualitative changes in diversity and long-term viability of populations. These can potentially be far-reaching but are still poorly understood or documented, and a considerable extinction debt has been forecasted for communities dependent on traditional extensive grazing and mowing and those of old-growth forests. The relevance of such species as wild food is unlikely to be high. In aquatic systems, a large number of species and whole communities have been eroding because of increased turbidity of waters and impaired photosynthesis.

There is clear insufficient knowledge of below-ground biodiversity in agricultural and forestry systems. The state of microorganisms is poorly known and not monitored, except for aquatic species responsible for algal blooms.

The state of biodiversity has been monitored in Finland with a set of indices: Biodiversity.fi (the national indicator framework of over 100 indicators; see www.biodiversity.fi). It is based on several monitoring programmes carried out by sectoral institutions and within research programmes. The indicators on aquatic species are largely under development and the Table utilizes expert knowledge. Many of the indicators summarize the trends with the 1990s as the baseline period. The trends for some groups, e.g. birds and butterflies of the agricultural systems, exist on a yearly basis. The assessment of threatened species is made in Finland every ten years (the latest results published in 2010). Populations of vertebrates and vascular plants are particularly well monitored, while evidence for microorganisms exists only for individual cases. These indices, as well as some original research studies, were used as sources.

Importantly, no specific indicators exist for the genetic diversity of the associated species and wild relatives of production species. There is no category of "genetically threatened species" in Finland, nor "genetic reserves" conservation areas. As a rule, rare or threatened species as well as species with restricted ranges tend to have reduced genetic variation. Many species in Finland that are classified as rare occur at their northernmost edge of distribution and may have unique genetic characteristics (some are sub-species of the boreal zone) that are poorly documented.

23. Have any changes been detected in your country for the different production systems over the last 10 years in regulating and supporting ecosystem services? If so, indicate if trends are strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 8. If no information is available, indicate not known (NK). If not applicable, (NA).

Table 8. Trends in the state of regulating and supporting ecosystem services within production systems.

Production systems	Trends in last 10 years (2,1,0,-1,-2, NK, NA)

Code or name	Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Provisioning of habitat	Production of oxygen/ Gas regulation
L3 Livestock grassland-based systems	NK	NK	-1	NK	-1	-1 a	NK	-1	-1
L4 Livestock grassland-based systems	NK	NK	-1	NK	-1	-1	NK	-1	-1
L7 Livestock landless systems: Temperate	NK	NK	NK	NK	0	NK	NK	NK	NK
L8 Livestock landless systems: Boreal and /or highlands	NK	NK	NK	NK	0	NK	NK	NK	NK
F3 Naturally regenerated forests	NK	NK	NK	0	1	NK	NK	-1	NK
F4 Naturally regenerated forests	NK	NK	NK	0	1	NK	NK	-1	NK
F7 Planted forests	NK	-1	NK	0	1	NK	NK	0	NK
F8 Planted forests	NK	-1	NK	0	1	NK	NK	0	NK
A3 Self-recruiting capture fisheries	NA	NK	-1	NK	1	NA	NK	-1	NA
A4 Self-recruiting capture fisheries	NA	NK	-1	NK	NK	NA	NK	-1	NA
A7 Culture-based fisheries	NA	NK	NK	NK	NK	NA	NK	-1	NK
A8 Culture-based fisheries	NA	NK	NK	NK	NK	NA	NK	-1	NK
A11 Fed aquaculture	NA	1	NK	NK	NK	NA	NK	NK	NA
A12 Fed aquaculture	NA	1	NK	NK	NK	NA	NK	NK	NA
A15 Non-fed aquaculture	NA	1	NK	NK	NK	NA	NK	NA	NK
A16 Non-fed aquaculture	NA	1	NK	NK	NK	NA	NK	NA	NK
C7 Irrigated crops (other)	NK	-1	NK	NK	NK	NK	NK	NK	NK
C8 Irrigated crops (other)	NK	-1	NK	NK	NK	NK	NK	NK	NK
C11 Rainfed crops	NK	-1	-1	NK	-1	-1 b	NK	-1	NK
C12 Rainfed crops	NK	-1	-1	NK	-1	-1	NK	-1	NK
M3 Mixed systems	NK	-1	-1	NK	0	-1	NK	-1	NK
M4 Mixed systems	NK	-1	-1	NK	0	-1	NK	-1	NK
O1 Apiculture	NK	-2	NA	NA	NA	NA	NA	NA	NA

24. Briefly describe the changes or trends in diversity recorded in Table 8. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.

The changes in the flow of ecosystem services remain mostly inferred from the state of change in ecosystems, rather than confirmed by research on the ecosystem service outcomes (= benefits). Land-use cover is used for inferring CO_2 sequestration and the state of habitats for habitat provisioning, and both are based on monitoring data. Increased incidences of pest and pathogen infestations documented in recent studies might indicate weakening of pest

and disease regulation processes and could be driven by climate change. There are already known cases of new pests and diseases in crop production. The water-purification function of vegetation beside water bodies may also have deteriorated due to the mild winters of the last decade; eroding material from non-frozen agricultural soils is not sufficiently well intercepted outside the vegetative period. The presence of wetlands as buffers of floods and for preventing spread of forest fires are relevant for natural hazard regulation, but no change is established for these. GHG emissions have increased regionally in livestock systems due to recent conversions of peat soils to arable uses. Specialization of production and their regional polarization may have impaired soil formation and nutrient cycling processes. In forestry, wood production increased because of temperature-driven acceleration in nitrogen cycling and productivity changes. However, this also leads to simultaneous depletion of soil nutrients and to within-tree biomass distribution in which root growth is reduced relative to above-ground growth. The phenomenon may have some profound impact on ecosystem processes. Understanding on the change in pollination capacity of Apiculture sector over the last decade is incomplete but the pollination capacity is likely to be insufficient due to lack of awareness and the ongoing Colony Collapse Disorder.

The time horizon is varied but mainly covers the last 10–20 years. Indicators for provisioning of habitat are derived from Biodiversity.fi. Indicators on ecosystems services are currently under development. Sources of information on changes are reports from the relevant projects (EKOAR, TEEB Finland, MYTVAS, VACCIA, TEEB Nordic), original research publications and expert knowledge.

25. Is there evidence that changes in biodiversity for food and agriculture have impacted ecosystem services in your country? Indicate if strongly increasing (2), increasing (1), stable (0), decreasing (-1) or strongly decreasing (-2) in Table 9 and provide a description of specific situations and documentation where available (repeat table for each production system).

Table 9. Impact of changes in biodiversity for food and agriculture on ecosystem services.

Production system	Changes	Impact of changes in biodiversity for food and agriculture on ecosystem services (2, 1, 0,-1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
	Changes in animal genetic	NA	NA	NA	NA	NK	NK	NA	0	NK

Livestock L3, L4, L7, L8	resources									
	Changes in crop genetic resources	NK	-1	NK	NA	0 a	-1	NK	-1	NK
	Changes in forest genetic resources	NA	NK	NK	NK	NK	NK	NK	NK	NK
	Changes in aquatic genetic resources	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Changes in micro-organism genetic resources (associated biodiversity)	NK	NK	-1	NA	NK	NK	NK	-1	NK
	Changes in invertebrates genetic resources (associated biodiversity)	NK	-1 c	-1	NK	NK	NK	NK	-1	NK
	Changes in vertebrates genetic resources (associated biodiversity)	NK	NK	-1	NK	NK	NK	NK	-1	NK
	Changes in plants genetic resources (associated biodiversity)	NK	NK	NK	NK	NK	NK	NK	-1	NK

Production system	Changes	Impact of changes in biodiversity for food and agriculture on ecosystem services (2, 1, 0,-1, -2, NK, NA)								
Code or name		Pollination	Pest and disease regulation	Water purification and waste treatment	Natural hazard regulation	Nutrient cycling	Soil formation and protection	Water cycling	Habitat provisioning	Production of oxygen/ Gas regulation
Fisheries and aquaculture A3, A4, A7, A8, A11, A12	Changes in animal genetic resources	NA	NA	1	NK	NK	NK	1	NK	NK
	Changes in crop genetic resources	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Changes in forest genetic resources	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Changes in aquatic genetic resources	NA	1	1	NK	1	1	NK	1	NK
	Changes in micro-organism genetic resources (associated biodiversity)	NA	NK	NK	NK	NK	NK	NK	NK	NK
	Changes in invertebrates genetic resources (associated biodiversity)	NA	NK	NK	NK	NK	NK	NK	NK	NK
	Changes in vertebrates genetic resources (associated biodiversity)	NA	NK	NK	NK	NK	NK	NK	NK	NK
	Changes in plants genetic resources (associated biodiversity)	NA	NK	NK	NK	NK	NK	NK	NK	NK

26. Briefly describe the impacts on ecosystem services recorded in Table 9. Where possible provide information on: baseline levels (last 10 years, indicate if otherwise), measurements and indicators used, the extent of change, and the likely cause(s). Include references to the sources of information.

There are very few studies from Finland that would attribute changes in components of biodiversity to the changes in the rate of processes and further to the flow of services. For example, the rates of manure decomposition from dung pats have been attributed to the functional diversity of dung beetles on pastures. The presence of beetles also altered the emissions of GHG. Of the group, 50 % of species are red-listed. However, whether the decline in the dung beetle species numbers has had an impact on the nutrient cycling in pastures or climate regulation is not ascertained. Populations of species within the group that are functionally important have suffered drastic declines. Although there is some evidence of changes in the states of native pollinator populations, no impact on yield has been attributed to this. Data on population changes of many functionally important species in agricultural and forest systems are missing. Notable exceptions are aspen (*Populus tremula*) populations that have increased due to the modified forestry practices; of 40 species of dung beetles, more than a half are endangered or rare.

It is documented that diversity of crops enhances ecosystem functioning and a number of regulating services in fields (for example, in pest regulation, soil structure, nutrient cycling). Modern crop cultivars are thought to be less dependent on mycorrhiza for absorbing soil phosphorus but have higher capacity for utilizing nutrients. A reduced diversity of production animals in favor of the highly productive breeds has led to the abandonment of semi-natural biotopes (habitat provisioning) and intensified pasture use (impacting soil structure). In the last decade, changes in production diversity have been minor. On reindeer forest pastures, a decline in microorganism diversity has been implicated in resulting changes in soil functioning.

A number of major impacts are documented in aquatic systems: an increase in numbers of perch-family fish in lakes due to eutrophication has been related to the reduced food resources for waterfowl through the cascade effect on food chains (habitat provisioning; provisioning service) and to nutrient cycling services. Similarly, regularly occurring bursts in populations of algae (algae bloom) adversely affect several regulating services and provisioning services.

Most of the available information is based on individual case studies with little data available at the national level. On account of the lack of objective indicators for measuring ecosystem service provisioning, research has frequently relied on stakeholder perceptions of ecosystem services. While personal experience is an adequate indicator for some ecosystem services

(mainly cultural), such perceptions are subject to bias and may be inappropriate for assessing other ecosystem services and their underlying supporting mechanisms.

The time horizon is varied but mainly covers last 10–20 years. The project VACCIA has synthesized evidence from Finland in agricultural, forest and aquatic ecosystems that links climate change to the state of biodiversity and ecosystem functioning, and through that has forecast changes in several ecosystem services. The TEEB Nordic study compiled evidence on the socio-economic importance of ecosystem services with a focus on biodiversity in the Nordic Countries. The TEEB Finland project furthered the topic specifically for this country (the report is due in early 2015).

27. List any associated biodiversity species or sub-species (if information is available) that are in some way actively managed in your country to help provide regulating or supporting ecosystem services in Table 10. Indicate in which production systems they occur and indicate if diversity information is available. Provide any available sources of information.

Table 10. Associated biodiversity species that are in some way actively managed in your country to help provide regulating or supporting ecosystem services.

Ecosystem service provided	Actively managed species (name) and sub-species (where available)	Production systems (code or name)	Availability of diversity information (Y/N)	Source of information
Pollination	5 species of pollinating insects	C11, C12, M3, M4, C7, C8	Y	Evira
Pest and disease regulation	145 species for biological control	C11, C12, M3, M4, C7, C8	Y	Evira
Water purification and waste treatment	Biomanipulation: pikeperch	A3, A4, A7, A8	Y	RKTL
Nutrient cycling	Biomanipulation: cyprinids (roach, bream, ide etc.)	A3, A4	Y	RKTL
Water cycling	Aquaculture, 4 species (sturgeon, pikeperch, whitefish, rainbow trout)	A11, A12	N	RKTL
Habitat provisioning	*Populus tremula*	F3, F4, F7, F8	Y	The Fifth National Report to the Convention on Biological Diversity (2014)

28. Does your country have monitoring activities related to associated biodiversity? If yes, describe these. Where possible provide information on the components of associated biodiversity that are monitored and on the geographical coverage of the monitoring system (local, regional, national, global). Include references to the sources of information, if possible.

Monitoring programmes largely follow EU and international standards, utilizing for example Corrine land-cover data and long term ecological research monitoring. Several long-term monitoring programmes on biodiversity are run, such as a long-term monitoring study on the impacts of agri-environment measures (MYTVAS); long-term monitoring of game populations (separate monitoring programmes for marine and inland waterfowl, small game and large mammal predators, freshwater fish populations and marine fish stocks; as well volunteer-based monitoring of birds and butterflies. Monitoring schemes are from local to national scale, and data contribute to the global efforts. Approximately 70 % of all biodiversity-related monitoring work is conducted voluntarily by experts and enthusiasts. Results are summarized at Biodiversity.fi.

The Finnish Ministry of Agriculture and Forestry monitors the state of natural resources as part of its Natural Resources Strategy. The total number of indicators is 39, with several so-called key indicators that are considered the best way to show the status and trends in natural resources. Examples include environmental risks to due to pesticide use, nitrogen balance on arable land, greenhouse gas emissions from agriculture, genetic diversity of production animals, and bird populations on farmland. The Ministry also established a national indicator on high nature value, based on the readily available farm records, and monitors its development.

Several research programmes focused on obtaining data on the state of biodiversity, such as the Biodiversity and Monitoring Programme (MOSSE; 2003–2006), Forest Biodiversity Programme for Southern Finland (METSO; 2004–2016), and the research programme of deficiently known and threatened forest species PUTTE II (2009–2016). The latter aims at filling the knowledge gaps in distribution and population state of threatened species in Finland. The research projects are national in scope but operate in restricted focus areas.

29. List in Table 11 any components of associated biodiversity for which there is evidence of a significant threat of extinction or of the loss of a number of important populations in your country. Specify the degree of the threat according to the classification in use in your country or following the IUCN Red List Categories and Criteria. Include a description of the threat and list references or sources of information if available.

Table 11. Main threats to associated biodiversity identified as at risk.

Associated biodiversity species	Degree of threat	Main threat (indicate)	References or sources of information if available
Several taxa of insects, especially butterflies, beetles, wild bees	Varied	Abandonment of traditional biotopes formerly extensively grazed or mown	The Red List of Finnish Species and Biodiversity.fi
Vascular plants	Varied	Abandonment of traditional biotopes formerly extensively grazed or mown	The Red List of Finnish Species and Biodiversity.fi

Fungi of the Agaricales and Gasteromycetes groups	Varied	Abandonment of traditional biotopes formerly extensively grazed or mown	Biodiversity.fi
Dung beetle species (75 % of the species)	Varied	Reduction in area and distribution of pastures, especially permanent and semi-natural	The Red List of Finnish Species and Biodiversity.fi
Crop wild relatives (11 %)	Varied	Landscape simplification, intensive production, abandonment of traditional biotopes	The Red List of Finnish Species and Biodiversity.fi
Birds	Varied	Landscape simplification, intensive production	The Red List of Finnish Species and Biodiversity.fi
Forest fungi species (20 %)	Varied	Commercial forestry, rarity of old-growth forest; cessation of traditional grazing in forests	The Red List of Finnish Species and Biodiversity.fi
Forest beetle species (17 %)	Varied	Commercial forestry, rarity of old-growth forest; cessation of traditional grazing in forests	The Red List of Finnish Species and Biodiversity.fi
Forest butterfly species (16 %)	Varied	Commercial forestry, rarity of old-growth forest; cessation of traditional grazing in forests	The Red List of Finnish Species and Biodiversity.fi
Forest wild bee species (11 %)	Varied	Commercial forestry, rarity of old-growth forest; cessation of traditional grazing in forests	The Red List of Finnish Species and Biodiversity.fi
Forest species of lichen (11 %)	Varied	Commercial forestry, rarity of old-growth forest; cessation of traditional grazing in forests	The Red List of Finnish Species and Biodiversity.fi
17 marine fish species (Baltic Sea)	Varied	Eutrophication, overgrowing, overfishing and hunting	The Red List of Finnish Species and Biodiversity.fi
53 species of fish of inland waters	Varied	Water regulation /management because of dams	The Red List of Finnish Species and Biodiversity.fi
15 species of fish of inland waters	Varied	Eutrophication and chemicals	The Red List of Finnish Species and Biodiversity.fi

The most updated information on species level is available in The Red List of Finnish Species. According to it, 23.3 % of all nationally threatened species occur in rural biotopes and cultural habitats.

30. Does your country currently have any *ex situ* conservation or management activities or programmes for associated biodiversity for food and agriculture? These may include, for example, culture collections, collections of pollinators, etc. If so, list these in Table 12.

Table 12. *Ex situ* conservation or management activities or programmes for associated biodiversity for food and agriculture.

Components of associated biodiversity	Organisms, species and sub-species (where available) conserved	Size of collection	Conservation conditions	Objective(s)	Characterization and evaluation status
Micro-organisms	Different taxa e.g. archaea, bacteria, cyanobacteria,	About 5 500 cultures	Living microorganisms	Teaching, research and application	HAMBI Culture Collection, a non-profit organization supported by the

	yeasts, filamentous fungi and virus				University of Helsinki
Invertebrates	*Parnassius apollo* and *Parnassius mnemosyne*		Grown in captivity with subsequent release to nature (semi-natural grasslands)	Restoration of native populations	Part of research project work
Invertebrates	*Bombus terrestris*	NK	Grown families for sale for the gardens	Pollination of production crops	NK
Invertebrates	Live nematodes	NK	For sale for the gardens	Biological control	NK
Vertebrates	*Perdix perdix*	Bird farms; ca. 2 000 birds per year are released	Grown in captivity with subsequent release to agrolandscapes	Restoration of native populations	Poor survival of the released birds is confirmed. The reason is partly in use of a non-native sub-species
Vertebrates	Fish in miltbank	12 species or morphs in *ex situ* collections	In liquid nitrogen	Preservation of genetic material and use of it for broodstock establishment	Success evaluated when used
Vertebrates	Fish in live gene bank	15 species or morphs in *ex situ* collections	State fish farms	Preservation of genetic material and use of it for stocking material	Success evaluated with markings and genetic sampling in some cases
Plants	Crop wild relatives (CWR)	56 taxa are found in *ex situ* collections	Botanic gardens' living collections, seed collections or in vitro	Conservation of plant genetic resources	Most of the collections have only one accession per taxon of CWR; 75 % of the priority CWRs (160 taxa) are not in any *ex situ* collection
Plants	Nationally threatened taxa	18 % of the species; sizes vary	Botanic gardens	Conservation	The target is 75 % of taxa. There are problems with quality with respect to genetic intactness

31. Does your country currently have any *in situ* conservation and management activities or programmes in your country that support the maintenance of associated biodiversity? If so provide any available information on organisms and species managed or conserved, site name and location, production system(s) involved, conservation objective and specific actions that secure associated biodiversity or ecosystem services (if any).

Table 13. *In situ* conservation or management activities or programmes for associated biodiversity for food and agriculture.

Components of associated biodiversity	Organisms, species and sub-species (where available) conserved	Site name and location	Production system(s) involved (code or name)	Conservation objective(s)	Specific actions that secure associated biodiversity or ecosystem services
Micro-organisms	NA	NA	NA	NA	NA
Invertebrates	Semi-natural grasslands; nature reserves; key habitats in commercial forests; marine reserves	Across the country	L3, L4, A11, A12	Conservation of associated biodiversity on traditionally used sites	Extensive management by mowing and grazing
Vertebrates, fish	Marine reserves; inland waters	Across the country	A3, A4, A7, A8	Preservation of the endangered species, increasing the spawning possibilities	Regulation of fishing, restoring river and spawning habitats, improving migration routes
Vertebrates	Semi-natural grasslands; nature reserves; marine reserves	Across the country	L3, L4, A11, A12, F3, F4, F7, F8	Conservation of associated biodiversity on traditionally used sites; conservation of species intolerant of logging	Extensive management by mowing and grazing; setting aside areas of particular conservation value
Plants	As above	As above	L3, L4, C7, C8, C11, C12, F3, F4, F7, F8	As above	As above
Plants	Crop wild relatives (CWR)	13 % of taxa have 100 % of their population conserved within the existing protected areas	L3, L4, C7, C8, C11, C12, F3, F4, F7, F8	Conservation of the maximum taxonomic and genetic diversity of Finland's CWR	As above

32. What activities are undertaken in your country to maintain traditional knowledge of associated biodiversity? Has traditional knowledge of associated biodiversity been used to inform conservation and use decisions in your country? Please share best practices and lessons learned.

Use of traditional knowledge of land users in respect to associated biodiversity has been most commonly utilized in conservation planning in Sámi regions in connection to the reindeer herding traditions. National legislation, including the National Strategy on Biodiversity, aims

to safeguard Sámi traditional knowledge, practices and innovations. For this, Sámi traditions of reindeer husbandry, fishing, hunting and handicraft will be supported to preserve traditional knowledge for future generations. Traditional knowledge of local land users has also been utilized in regional planning of traditional biotope conservation and management across the country. The key characteristic of both examples is a strong involvement of land owners and/or users at the initial stages of planning.

A specific example in using traditional knowledge in conservation is the national payment scheme for damage to reindeer owners inflicted by the golden eagles (*Aquila chrysaetos* L.) funded by the government. Before 1998 it was based on reimbursement for actual kill by eagles, which was difficult to confirm. It also did not motivate the herders to accept the eagles as an associated species. The current payments are made available on the number of breeding territories and nests of the bird species, and relate to the average kill of reindeer made by the breeding pair in its lifetime. The scheme was set up and is overseen in close collaboration between public authorities and Sámi communities. The latter are further involved in extensive monitoring of the species. There has been an apparent increase in the national population of golden eagles, although it is difficult to determine how much of this is due to improvements in survey efficiency. Most importantly, the attitudes of herders towards this predator are reported to have changed drastically, with the eagle now being seen as a resource rather than a pest. Poaching of eagles by reindeer herders was a serious problem since the species is responsible for a high proportion of overall reindeer mortality. During the scheme, poaching in reindeer regions has all but disappeared. An important success factor has been establishing good relations between the herders and officials.

The national Martha Organization and its local associations have a long and continuing tradition in running programmes and campaigns to promote the use of wild food and cooking traditional foods. They produce web-based and printed educational and awareness materials.

33. Provide any available information on gender dimensions with respect to the maintenance of and knowledge about associated biodiversity. These may include differences in the roles and insights of women and men with respect to maintaining particular resources, monitoring their state, overseeing their management at different stages of production or ecosystem management.

Finland enjoys one of the world's top levels in gender equality. There are several non-governmental organizations that maintain and promote knowledge on associated biodiversity and their membership is open to both genders (See also Chapter 5).

State and trends of wild resources used for food

34. Provide in Table 14 a list of wild food species known to be harvested, hunted, captured or gathered for food in your country, and that are not already included in a completed or ongoing Country Report on Forest, Aquatic, Animal or Plant Genetic Resources. Indicate in

or around which production system the species is present and harvested, and the change in state of the species over the last 10 years (strongly increasing (2), increasing (1), stable (0), decreasing (-1), or strongly decreasing (-2), or not known (NK)). Indicate where differences within species have been identified and characterized.

Table 14. Wild species used for food in the country

Species (local name)	Species (scientific name)	Production systems or other environments in which present and harvested	Change in state (2,1,0,-1,-2, NK)	Differences within species identified and characterized (Y/N)	Source of information
Ahven	*Perca fluviatilis*	A3, A4	0	N	RKTL
Hauki	*Esox lucius*	A3, A4	0	N	RKTL
Kuha	*Sander lucioperca*	A3, A4	1	Y	RKTL
Siika (lake wild population)	*Coregonus lavaretus f. nilssoni*	A3, A4	0	Y	RKTL, ymparisto.fi
Muikku	*Coregonus albula*	A3, A4	0	N	RKTL
Kampela	*Platichthys flesus*	A3, A4	1	N	RKTL
Made	*Lota lota*	A3, A4	-1	N	RKTL
Lohi (lake wild population	*Salmo salar m. sebago*	A3, A4	1	Y	RKTL
Lohi (sea wild population)	*Salmo salar*	A3, A4	-2	Y	RKTL
Harjus (inland waters)	*Thymallus thymallus*		0	Y	The Red List of Finnish Species
Harjus (marine population)	*Thymallus thymallus*	A3, A4	-2	Y	The Red List of Finnish Species
Taimen (sea migrating populations)	*Salmo trutta*	A3, A4	-1	Y	The Red List of Finnish Species
Taimen (inland populations)	*Salmo trutta*	A3, A4	-1	Y	The Red List of Finnish Species
Nieriä (Lake Saimaa, population)	*Salvelinus alpinus*	A3, A4	1	Y	The Red List of Finnish Species
Ankerias	*Anguilla anguilla*	A3, A4	0	N	The Red List of Finnish Species
Toutain	*Aspius aspius*	A3, A4	1	N	The Red List of Finnish Species
Nahkiainen	*Lampetra fluviatilis*	A3, A4	0	N	The Red List of Finnish Species
Hirvi	*Alces alces*	F3, F4, F7, F8, L3, L4, C11, C12	0	N	RKTL
Metsäpeura	*Rangifer tarandus fennicus*	F3, F4, F7, F8, L3, L4, C11, C12	0	N	RKTL
Valkohäntäpeura	*Odocoileus virginianus*	F3, F4, F7, F8, L3, L4, C11, C12	1	N	Biodiversity.fi
Metsäkauris	*Capreolus capreolus*	F3, F4, F7, F8, L3, L4, C11, C12	1	N	Biodiversity.fi
Villikani	*Oryctolagus cuniculus*	L3, L4, C11, C12	2	N	MMM
Metsäjänis	*Lepus timidus*	F3, F4, F7, F8, L3, L4, C11, C12	2	N	The Red List of Finnish Species
Villisika	*Sus scrofa*	F3, F4, F7, F8, L3, L4, C11, C12	1	N	The Red List of Finnish Species

Kanadanhanhi	*Branta canadensis*	L3, L4, C11, C12, A3, A4, A7, A8	2	Y	RKTL
Metsähanhi	*Anser fabalis*	F3, F4, F7, F8, A3, A4, A7, A8	0	Y	The Red List of Finnish Species
Merihanhi	*Anser anser*	F3, F4, F7, F8, A3, A4, A7, A8	1	Y	RKTL
Heinäsorsa	*Anas platyrhynchos*	L3, L4, F3, F4, F7, F8, A3, A4, A7, A8	0	N	RKTL
Riekko	*Lagopus lagopus*	F3, F4, F7, F8	2	N	The Red List of Finnish Species
Kiiruna	*Lagopus muta*	F3, F4, F7, F8	-1	Y	RKTL
Pyy	*Tetrastes bonasia*	F3, F4, F7, F8	0	N	RKTL
Teeri	*Tetrao tetrix*	F3, F4, F7, F8	0	N	The Red List of Finnish Species
Metso	*Tetrao urogallus*	F3, F4, F7, F8	0	Y	The Red List of Finnish Species
Peltopyy	*Perdix perdix*	L3, L4, C11, C12	-2	Y	The Red List of Finnish Species
Fasaani	*Phasianus colchicus*	L3, L4, C11, C12	0	N	RKTL
37 edible species of wild berries and 200 edible species		F3, F4, F7, F8	Varied	Y	Metla

Wild food resources at risk

35. List in Table 15 any wild food species for which there is evidence of a significant threat of extinction or of the loss of a number of important populations in your country. Specify the degree of threat according to the classification in use in your country or following the IUCN Red List Categories and Criteria. Include a description of the threat and list references or sources of information if available.

Table 15. Main threats to wild food species identified as at risk.

Wild food species (scientific name)	Degree of threat	Main threat (indicate)	References or sources of information if available
Thymallus thymallus (marine)	CR (Critically Endangered)	Chemical pollution, water regulation, drainage and peat extraction, climate change	The Red List of Finnish Species
Thymallus thymallus (inland waters in southern Finland)	NT (Near Threatened)	Chemical pollution, water regulation, drainage and peat extraction, climate change, overfishing	The Red List of Finnish Species
Salmo trutta (marine migrators)	CR (Critically Endangered)	Overfishing, water regulation, drainage and peat extraction, chemical pollution, random factors, natural dynamics	The Red List of Finnish Species
Salmo trutta (inland waters south from the Arctic Circle)	EN (Endangered)	Overfishing, drainage and peat extraction, water regulation, forestry operations, chemical	The Red List of Finnish Species

		pollution, random factors, natural dynamics	
Salmo trutta (inland waters south from the Arctic Circle)	NT (Near Threatened)	Overfishing, drainage and peat extraction, water regulation, chemical pollution, random factors, natural dynamics	The Red List of Finnish Species
Salmo salar m. sebago (lake)	CR (Critically Endangered)	Overfishing, water regulation, random factors, natural dynamics	The Red List of Finnish Species
Salmo salar (Baltic Sea)	VU (Vulnerable)	Overfishing, chemical pollution, random factors	The Red List of Finnish Species
Salmo salar (Arctic)	VU (Vulnerable)	Overfishing, hybridization, threats caused by alien species, random factors	The Red List of Finnish Species
Salvelinus alpinus (Lake Saimaa)	CR (Critically Endangered)	Overfishing, climate change, chemical pollution, random factors	The Red List of Finnish Species
Salvelinus alpinus (Lapland)	NT (Near Threatened)	Overfishing, water regulation, chemical pollution, competition, climate change	The Red List of Finnish Species
Acipenser oxyrinchus	RE (Regionally Extinct)	Decline of reproduction success and possibilities	The Red List of Finnish Species
Anguilla anguilla	EN (Endangered)	Decline of reproduction success, migration obsatacle to growing areas in land waters	The Red List of Finnish Species
Aspius aspius	NT (Near Threatened)	Water regulation, chemical pollution, overfishing	The Red List of Finnish Species
Belone belone	DD (Data Deficient)	Not known	The Red List of Finnish Species
Coregonus lavaretus f. lavaretus (migrating)	EN (Endangered)	Water regulation, climate change, overfishing, hybridization, drainage and peat extraction, chemical pollution	The Red List of Finnish Species
Coregonus lavaretus f. nilssoni	NT (Near Threatened)	Water regulation, hybridization, overfishing, chemical pollution	The Red List of Finnish Species
Coregonus lavaretus f. pallasi	VU (Vulnerable)	Water regulation, hybridization, overfishing	The Red List of Finnish Species
Coregonus lavaretus f. widegreni	VU (Vulnerable)	Chemical pollution, climate change	The Red List of Finnish Species
Lampetra fluviatilis	NT (Near Threatened)	Water regulation, chemical pollution, climate change, drainage and peat extraction, overfishing	The Red List of Finnish Species
Psetta maxima	DD (Data Deficient)	Not known	The Red List of Finnish Species
Lepus timidus	NT (Near Threatened)	Competition, hybridization, other known threat, climate change	The Red List of Finnish Species
Rangifer tarandus fennicus	NT (Near Threatened)	Forestry operations, other known threat, hybridization, disturbance	The Red List of Finnish Species
Rangifer tarandus tarandus	RE (Regionally Extinct)	Domestication	The Red List of Finnish Species
Sus scrofa	DD (Data Deficient)	Climate change	The Red List of Finnish Species

Ursus arctos	VU (Vulnerable)	Formerly hunting, that is now regarded to be at sustainable level	The Red List of Finnish Species; The Finnish Wildlife Agency
Anas acuta	VU (Vulnerable)	Hunting, changes outside of Finland	The Red List of Finnish Species
Anser fabalis	NT (Near Threatened)	Hunting, drainage and peat extraction	The Red List of Finnish Species
Anas querquedula	VU (Vulnerable)	Hunting, changes outside of Finland	The Red List of Finnish Species
Mergus serrator	NT (Near Threatened)	Not known	The Red List of Finnish Species
Mergus merganser	NT (Near Threatened)	Not known	The Red List of Finnish Species
Lagopus lagopus	NT (Near Threatened)	Drainage and peat extraction, climate change	The Red List of Finnish Species
Somateria mollissima	NT (Near Threatened)	Threats caused by alien species, chemical pollution, climate change, changes outside of Finland	The Red List of Finnish Species
Tetrao tetrix	NT (Near Threatened)	Changes in the proportion of tree species, formerly also hunting and reduction of old forests and big trees; currently, hunting is practiced at sustainable level	The Red List of Finnish Species; The Finnish Wildlife Agency
Tetrao urogallus	NT (Near Threatened)	Formerly reduction of old forests and big trees, hunting; currently, hunting is practiced at sustainable level	The Red List of Finnish Species; The Finnish Wildlife Agency

Provide information, where available, as to how the loss of wild food species affects the livelihoods of those that depend on them and on the general impact of their loss on food security and nutrition. Include references to the sources of information, if possible.

In Finland, a highly industrialized country with high standard of living, people in general do not depend on wild food species for their livelihoods, using them instead to supplement their diets and incomes, especially in regions with high unemployment and poor conditions for agriculture. On the level of the whole economy, the direct economic importance of such foods is small and has mainly declined over the long term. The reduction in the availability of wild foods is compensated by commercially produced foodstuffs and imports. For example, food from the collapsed freshwater populations of native salmonids has been replaced by imported farmed salmon, and wild berries harvested from farmed and forested biotopes by commercially produced cultivars ad imports. However, the procurement of wild foods is still important, especially in remote areas and for niche enterprises specialized in these products. It is reflected in the high popularity of such activities and in the volumes collected or hunted for domestic consumption. Wild game meat accounts nationally for about 2 % of the total meat consumption.

A special group in terms of dependency on wild foods is the indigenous Sámi people, who continue to utilize game and fish as a significant share of the diet.

The pollution and eutrophication of surface waters impairs safe and enjoyable fishing and reduces the safe consumption of native fish: the current official recommendations restrict consumption of wild salmon and large predator lake fish due to certain contaminants.

36. Are any *ex situ* conservation or management activities or programmes established in your country for wild food species? These may include, for example, culture collections, collections of insects, fungi, etc. If so, list these in Table 16.

Table 16. *Ex situ* conservation or management activities or programmes for wild food species.

Wild food species conserved (scientific name)	Size of collection (number of accessions and quantities)	Conservation conditions	Objective(s)	Characterization and evaluation status
Finnish indigenous fish species (12 species; e.g. *Thymallus thymallus, Salmo trutta m. trutta, Salmo salar m. sebago & Salvelinus alpinus*)	2 956 individuals in milt bank and ca. 58 000 individuals in live gene bank in RKTL fish farms	Water basins; Collections of fish milt	Conservation of Finnish indigenous fish genetic resources	Preservation of native fish stocks, genetic characterization to evaluate the genetic quality of material
Non-indigenous fish species (7 species: *Salvelinus namaycush, Oncorhynchus mykiss, Salmo salar* (Neva River population), *Salvelinus alpinus* (Hornavan Lake population), *Coregonus peled, Stenodus leucichthys, Salvelinus fontinalis)*	15 258 individuals in milt bank and ca. 11 000 individuals in live genebank RKTL fish farms	Water basins; Collections of fish milt, rearing brood fishes	Conservation of fish genetic resources for stocking and aquaculture	The use of material for stockings and for aquaculture
Perdix perdix	Ca. 2 000 birds are released to nature per year	Bird farms	Sustaining hunting	Introductions of birds into hunting areas
Phasanius colchicus	Several farms and private enterprises	Not known	Maintenance of the populations for hunting	Introductions of birds into hunting areas

Common partridge grown in captivity is a non-native sub-species that survives poorly in Finnish conditions. The native sub-species does not breed well in captivity so is seldom used (2–3 growers only). Released pheasants also have poor survival rates and the feral population depends heavily on winter feeding by hunters. Therefore, *ex situ* management for both species has a minor conservation value.

Conservation of wild resources used for food

37. Are any *in situ* conservation and management activities or programmes established in your country that supports maintenance of wild food species? If so list these in Table 17 provide the following information for each activity or programme: site name and location,

production system(s) involved, conservation objective and specific actions that secure wild food species (if any).

Table 17. *In situ* conservation or management activities or programmes for wild food species.

Wild food species conserved (scientific name)	Site name and location	Size and environment	Conservation objective(s)	Actions taken
Finnish indigenous fish species e.g. *Thymallus thymallus* (marine), *Salmo trutta* (marine) & *Salmo salar m. sebago*	Many locations around Baltic Sea and inland waters: Thymallus thymallus in Bay of Botnia, Salmo trutta in open rivers running into Baltic Sea, Salmo salar m. sebago on rivers Ala-Koitajoki, Pielisjoki and Lieksanjoki	Hundred thousands of young fish	Conservation of indigenous fish genetic resources	Fish introductions to the nature into suitable reproducing areas
Signal crayfish (*Pacifastacus leniusculus*)	Lakes in the southern Finland	Thousands of individuals	Maintenance of signal crayfish populations	Assisted colonization of signal crayfish
Grey partridge (*Perdix perdix*) & Common pheasant (*Phasanius colchicus*)	Farms around Finland, mainly by local hunting associations	Not known	Maintenance of the native populations, mainly for hunting	Managing habitats to improve survival of native birds

38. What activities are undertaken in your country to maintain traditional knowledge of wild food species (indicate if the extent to which these have already been described in sector reports)? How can traditional knowledge of wild food species be accessed and used to inform conservation and use decisions?

A notable example in Finland is legislative protection of the Sámi way of life based on reindeer herding. The objective is formulated as "sustainable use of natural resources, preservation of the traditional environment and other environmental issues". This objective is achieved through the national conservation and other land-use legislation. For example, the National Strategy on Biodiversity aims to safeguard Sámi traditional knowledge, practices and innovations. For this, Sámi traditions of reindeer husbandry, fishing, hunting and handicraft will be revived to preserve traditional knowledge for future generations. Finland also committed itself to developing the operational capabilities of the Sámi, including the status of women in particular, while securing the opportunities of the Sámi to take part in such activities at all necessary levels. An example of use of the traditional knowledge in managing wild species (predation by the golden eagle) is given in section 32, above.

A relevant national organization is the Martha Organization, which aims at promoting the quality and standard of domestic life. It is run mainly but not exclusively by and for women,

and includes activities on food and nutrition, home gardening, and environmental protection. It carries out cultural and civic education.

Hunting clubs retain traditional knowledge and regulate sustainable use of game and wild fish. Through improving living conditions for game species, they often simultaneously support associated biodiversity in forest, farmland, and aquatic systems. Additionally, hunting for moose involves groups that often comprise a cross-section of the community, from teenagers to seniors. Such hunting groups provide an important social network and can in some cases be among the last remaining organized activities in remote villages.
Growing interest in local foods, including legislative support, has resulted in an increased range of projects and activities on local foods that frequently include wild foods as well. This is particularly important for urban areas, where there is both purchasing power for buying wild foods and a risk of loss of knowledge of traditional and wild foods.

Accessing traditional knowledge is in part dependent upon communication between stakeholders. Processes that are inclusive of stakeholder experiences and concerns could help identify research questions for scientific study to support conservation goals. Wide-scale involvement of hunters in game monitoring is a good example

39. Provide any available information on gender dimensions with respect to the maintenance of and knowledge about wild food species. These may include differences in the roles and insights of women and men with respect to harvesting particular resources, monitoring their state, overseeing their ecosystem management.

Hunting is predominantly men's activity, so management negotiations and outreach have been mainly targeted at men, but the share of women involved has been increasing. On the other hand, predominantly women's organizations (e.g. Martha) promote the use of wild berries, mushrooms, and herbs. In capture fisheries and recreational fishing, women typically participate in the capture and handling of the catch, and the proportion of women participating in recreational fishing has been increasing.

Natural or human-made disasters and biodiversity for food and agriculture

40. Has your country experienced any natural or human-made disaster(s) that has had a significant effect on biodiversity for food and agriculture and/or on ecosystem services in the past 10 years? List in Table 18 those for which any information exists on their effect on biodiversity for food and agriculture and/or ecosystem services. Indicate the effect on different components or services as significant increase (2), increase (1), no change (0), some loss (-1), significant loss (2), or not known (NK).

Table 18. Natural or human-made disasters that has had a significant effect on biodiversity for food and agriculture in the past 10 years in the country.

Disaster description	Production system(s) affected (code or name)	Effect on overall biodiversity for food and agriculture (2, 1, 0, -1, -2, NK)	Effect on ecosystem services (2, 1, 0, -1, -2, NK)
Talvivaara mine: Gypsum pond leak in 2012-2013	A3, A4	-2	NK
Mining exploration on Natura 2000 site without a permit	F4	-2	NK

41. Briefly summarize any available information, including the year of the disaster, a description of the effects of the disaster on the different components of biodiversity for food and agriculture and/or on the effects on ecosystem services, and references to the supporting documentation.

In Finland, the most serious disasters originate from discharge of crude oil and other chemicals. According to the official register PRONTO there were about 20 000 cases in 2006–2012. The impact of most of these is estimated as fairly localized. The most serious recent human-made disaster with extensive environmental impact is a leak at the Talvivaara mine in 2012–2013. Substances known to be environmentally damaging, including cadmium, aluminum and uranium, leaked into the surrounding waters, wiping out freshwater fish. The impact on benthic and plankton communities – the food basis for many fish species – is considered to be large-scale and long-term. Effects specifically on ecosystem services have not been studied and documented. In the wake of this disaster, Finland undertook a survey of mining activities, including identifying at-risk existing and closed mines and drawing up further risk-mitigation actions.

42. Provide any available evidence from your country that changes in biodiversity for food and agriculture caused by natural or human-made disasters have had an effect on livelihoods, food security and nutrition.

The environmental impacts of mining are growing as mining activities have increased during the past decade. Harmful impacts of mining on biodiversity are, however, limited to a restricted number of species. In 2000 mining and extraction of aggregates were estimated as the primary cause of threat to 2 % of all endangered species, but by 2010 this share had risen to 4 %.

Specific evidence of recent changes in biodiversity for food and agriculture caused by natural or human-made disasters having an effect on livelihoods, food security, and nutrition are not available. The exception is the Talvivaara accident that impaired livelihoods, including traditional utilization of wild foods, of the local communities.

43. Provide any available evidence that the enhanced use of biodiversity for food and agriculture has contributed to improving livelihoods, food security and nutrition in the context of natural or human-made disasters. Describe and provide source of information.

Not available.

Invasive alien species and biodiversity for food and agriculture

44. Are there invasive alien species identified in your country that have had a significant effect on biodiversity for food and agriculture in the past 10 years? List in Table 19 those for which any information exists on their effect on biodiversity for food and agriculture and/or ecosystem services. Indicate the effect on different components or services as strong increase (2), increase (1), no effect (0), some loss (-1), significant loss (-2), or not known (NK).

Table 19. Invasive alien species that have had a significant effect on biodiversity for food and agriculture in the past 10 years.

Invasive alien species (scientific name)	Production system(s) affected (code or name)	Effect on components of biodiversity for food and agriculture (2,1,0,-1,-2, NK)	Effect on ecosystem services (2,1,0,-1,-2, NK)
Aphanomyces astaci (As, Ps1)	A3, A4	-2	NK
Heracleum persicum, H. mantegazzianum, H. Sosnowskyi	L3, L4, C11, C12	-1	NK
Arion lusitanicus	C7, C8	-1	NK
Nyctereutes procyonoides	F3, F4, F7, F8	-2	NK
Neovison vison	L3, L4, C11, C12, F3, F4, F7, F8, M3, M4	-2	NK

45. Briefly summarize any available information related to the invasive alien species listed in Table 19, including a description of the effects of the invasive alien species on the different components of biodiversity for food and agriculture and/or on the effects on ecosystem services, and references to the supporting documentation.

In total, 157 invasive alien species have been identified as permanently established in Finland and as causing clearly identifiable, direct or indirect damage. Of these, 100 are derived from agriculture and forestry. Some may constitute a threat to the indigenous natural environment. Of the alien species in other groups, five occur in the territorial waters of Finland in the Baltic Sea, five in inland waters, six are land vertebrates, 24 are plant species, and nine are indoor pests. In addition, 123 potentially or locally harmful alien species have been identified that may cause direct or indirect damage. About a third of these are agricultural and forestry species, and while most are already present in the country, some are still outside its borders.

There are several cases of invasive species that have already caused appreciable damage to biodiversity for food and agriculture. The crayfish plague is a disease of the native crayfish (*Astacus astacus L.*) unintentionally imported from the Americas on an American species of

crayfish (*Pacifastacus leniusculus* Dana). Since crayfish is a highly prized traditional food in Finland, the disease had a profound impact on its availability nationally. Three related plant species from genus Heracleum have been overtaking semi-natural grasslands, mainly to the detriment of associated biodiversity but also impairing use of the areas for production. The raccoon dog (*Nyctereutes procyonoides* Gray) and American mink (*Neovison vison* Schreber) both have an appreciative detrimental impact on populations of game bird species. The former species additionally spreads several serious diseases, which are threats to both native populations of mammal game species and to humans through wild berries and mushrooms. Some other invasive species (such as *Lupinus polyphyllus* Lindl. and *Impatiens glandulifera* Royle) are also found on the semi-natural grasslands but their pressure on the native flora is less considerable. A snail species from Spain (*Arion lusitanicus* Mabille) has been spreading in southern Finland, destroying production on horticultural farms. Impacts of the above species specifically on ecosystem services have not been documented.

Two alien fish species (*Carassius gibelio* Bloch and *Neogobius melanostomus* Pallas) have been recognized as highly harmful but so far their range is restricted.

46. Has biodiversity for food and agriculture contributed to managing the spread and proliferation or controlling established invasive alien species in your country? If yes, provide information on the invasive alien species involved, the components of biodiversity for food and agriculture and any indication on how the components of biodiversity contributed to managing the spread and proliferation or controlling established invasive alien species in your country. Provide references to the supporting documentation.

No evidence.

Similarities, differences and interactions

47. Comment on those aspects with respect to the state, trends and conservation of associated biodiversity or wild food biodiversity in relation to the state, trends and conservation of sector genetic resources. It would be helpful to provide your observations under the following headings: a) main similarities between associated biodiversity, wild food diversity and the different sectors; b) major differences between associated biodiversity, wild food diversity and the different sectors; c) synergies or trade-offs between associated biodiversity, wild food diversity and the different sectors.

A gradual decline of the population sizes and numbers of sub-populations is the common characteristic of biodiversity loss in the past decades in all ecosystems. The process leads to disruption of the metapopulation dynamics in dispersal, recolonization and genetic exchange for associated species. Without drastic measures to improve the quantity and quality of habitat, genetic erosion is likely to progress in both associated species and those used as wild food. The process has certain similarities with the state of the sectors' genetic resources in so

far as small populations of endangered breeds and landraces are preserved, but their utilization in production is highly restricted, putting them at risk. Among the production sectors, fisheries have undergone particularly severe declines in migratory, river-spawning native fish species, leading to considerable losses in catches. In agricultural and forest ecosystems, the availability of wild food seems not to be drastically reduced, except for a few individual species. Climate change is expected to have an impact on all sectors by factors including temperature, moisture regime, pests and colonization.

The major difference between the state of knowledge and conservation of associated biodiversity and the sectors' genetic resources is that the latter is considerably better studied and more conservation options (both *ex situ* and *in situ*) have been explored and put into use than is the case with associated species. Functionality of the associated biota is still relatively little understood, appreciated or utilized. There has been considerable progress made in conservation on a species and biotope levels while conservation of genetic level has not been explicitly addressed.

There is a certain synergy between conservation of associated biodiversity and genetic production diversity insofar as the traditional breeds and cultivars are better adapted to production systems that rely more on natural processes rather than outside inputs, and to extensive than intensive management. For example, traditional breeds are better suited, so more used in extensive grazing on semi-natural grasslands, and traditional cultivars are more often utilized in organic production. Such systems simultaneously also support higher levels of associated biodiversity, including crop wild relatives. They also have cultural appeal to people as part of the national heritage.

There are no clear trade-offs in the state of diversity between sectors in Finland, since the relative shares of forested and agricultural land have been stable in the past decade, and primer draining of aquatic systems for agriculture and forestry has not been practiced recently. Synergies exist between the erosion of diversity in agricultural and aquatic systems driven by high chemical inputs and mechanical disturbance of soils. These drive degradation of several ecosystem services related to soil productivity and water purification. Synergy between land-based sectors of agriculture and forestry exists in an intensified biomass removal from the respective ecosystems driven, for example, by bioenergy demand. The sustainability of such practices has been questioned. On the other hand, social pressures of the recent decades for taking biodiversity into account in the use of natural resources resulted in amending practices and local extensification of resource extraction.

Gaps and priorities

48. With respect to the state, trends and conservation of associated biodiversity and ecosystem services:

Specific management challenges, priorities, and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. The issue is also covered in respected sectoral strategies, such as the National Forest Strategy 2025. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

a) What are the major gaps in information and knowledge?

There are major gaps in information and knowledge about functioning of associated biodiversity in terms of direct and indirect benefits to production and other aspects of human well-being. While adverse impacts of associated biodiversity to production (e.g. weeds and pests) have been a traditional focus of agricultural research, conservation research is mainly concerned with the intrinsic value of organisms. Holistic research on ecosystem services provided by associated biodiversity is still in its infancy, also in Finland. While population trends in many species are well documented and, in several cases, the impacts of these species on ecosystem processes are known, there is little evidence on how these translate into benefits or losses to production.

Monitoring of populations of many functionally important taxa are either poorly representative or non-existent (e.g. bumblebees). Due to the lack of funding, monitoring of farmland birds ended in 2014. Sporadic project-based inventories, without follow-up monitoring, result in data gaps for assessing the state of ecosystem services.

Relatively little is known about the biodiversity of inland aquatic environments (both species and habitat types) and of underwater habitats. There is a lack of detailed information on marine and coastal areas that are regionally, locally, and species-specifically significant in ecological terms.

There is a lack of knowledge on fish diseases and tools for predicting them. In fisheries, not all actors are aware of the consequences of disease, or familiar with instructions and regulations on disease prevention, hence elevating the risk of the spread of diseases.

Problems of accurate scale are identified as concerns also in the Finnish context, for example, in assessing pollination ecosystem services. The concern is that land-cover maps used as indicators do not accurately reflect the impacts of micro-scale management and drivers.

b) What are the main capacity or resources limitations?

Research on ecosystem services is complex and requires an interdisciplinary approach, which in turn sets limitations in human and financial capacity. The research frameworks combing experimental, field- or forest-stand, and landscape-level research as well as social and economic implications are still underdeveloped, also in Finland.

c) What are the main policy and institutional constraints?

Policy and research institutions are by tradition sectoral and not always able to provide sufficient stimuli to interdisciplinary research or implementation. For example, despite the fact that almost all Finnish farms own also forest and function as one ecological and economic unit, issues related to functioning and management of agricultural land and forestry, including subsidies, are dealt with separately. This constrains agroforestry practices. Similarly, protection of aquatic systems damaged by agricultural runoff has been a challenge.

While in environmental administration, ecosystem services and their importance for human well-being are widely recognized and stated explicitly in policy documents and national mandates, the concept and its economic implications are not well known among decision-makers and end-users.

d) What actions are required and what would be the priorities?

Challenges and measures for the associated biodiversity by the sectors are summarized in the Fifth National Report to the Convention on Biological Diversity (2014) by Finland. For the agricultural sector, the key challenge remains on how to maintain semi-natural grasslands within a highly specialized and intensive production sector. The priorities are defined as i) making conservation and management of biodiversity among the focus areas of diversified agriculture, ii) securing continuity in the management of semi-natural habitats, iii) halting the decline in the biodiversity of ordinary agricultural environments, and iv) reducing the impact of agricultural production on other ecosystems.

For forestry, the priorities include i) improving long-term systematic development efforts and cooperation between various stakeholders, ii) developing the network of protected areas in order to enhance the representativeness and connectivity of protected forests, and iii) implementing nature management methods in commercially managed forests.

For fisheries, the priorities are i) improving the natural reproduction of native fish populations, ii) reducing diffuse pollution from agricultural and forestry lands, iii) restoration of rivers and streams to their natural state, while reintroducing threatened species, and iv) establishing an ecologically representative, well-administered network of protected marine areas.

For other land use, increasing recycling and improving knowledge of the suitability of substitutive construction materials for different purposes would decrease the demand of aggregates from virgin sources and mining needs.

Among actions required in all sectors are also high-standard research, development of integrated management, establishing indicators for non-provisioning ecosystem services,

innovative tools and approach to valorize the role of biodiversity and ecosystem services, participatory research, awareness and education, and sufficient funding.

49. With respect to the state, trends and conservation of wild resources used for food:

a) What are the major gaps in information and knowledge?

Quantifying effects on human nutrition and health of substitution of wild resources with commercially produced (e.g. wild mushrooms vs. cultivated) and clarifying other dimensions of wellbeing such as stress-reduction, sense of place, and cultural satisfaction while procuring wild foods, including game, should be considered.

Knowledge of links between the performance of hatchery fish in the wild and their influence on the native populations is incomplete and mixed.

Knowledge of the efficiency of restoration projects and management, especially in the long term, is critically important. Such challenges were identifies as the most important in order to carry out efficient restoration: coping with unpredictability, maintaining connectivity in time and space, assessment of functionality, management of conflicting interests and social restrictions and ensuring adequate funding.

b) What are the main capacity or resources limitations?

Better utilization of wild foods is constrained in Finland by high wages, long distances, and seasonality that make most Finnish wild berries and mushrooms uncompetitive on the domestic and international markets.

Capacity of small-scale (often family) enterprises to process berry harvest during intensive, short period of time.

c) What are the main policy and institutional constraints?

There are difficult trade-offs in achieving objectives for high-output production in forests and agricultural lands and maintaining favorable conditions for the whole variety of wild food species. The respective policies for production sectors have production-driven priorities for land-use, even if biodiversity (including wild foods) is explicitly formulated as an objective.

d) What actions are required and what would be the priorities?

Establishing an adequate network of protected forests and game reserves in the south of the country, where most people live; and implementing nature management methods in commercially managed forests.

Implementation of land-use practices on agricultural and forest lands that support viable populations of species that are used as wild foods on state and private lands through the modified practices of resource utilization supported by policy and with stakeholder involvement.

Achieving viability of self-recruiting fisheries that would be independent from restocking needs.

Reconciliation of the high numbers of large carnivores and seals with game management and fisheries.

Applying game management methods to limit the detrimental impacts of invasive alien species on native game animal populations.

50. With respect to the impact and response to natural or human-made disasters and biodiversity for food and agriculture:
a) What are the major gaps in information and knowledge?
b) What are the main capacity or resources limitations?
c) What are the main policy and institutional constraints?
d) What actions are required and what would be the priorities?

The issue remains relevant for Finland, though the country already has strict regulations for waste management and an impact-assessment framework for major land-use projects. The environmental impacts of mining are growing as mining activities have increased in the past decade, curing which restructuring of regional governance has seen environmental protection (e.g. environmental impact and permits for development and activities) subsumed under the umbrella of economic development and funded by the Ministry for Employment and the Economy. The lack of independent regional environmental offices has weakened environmental oversight at the regional level. Adverse impacts of mining on landscape, biodiversity, and livelihoods of local people continue to be a politically debated topic. Effective vetting of mining proposals and stringent monitoring of continuing operations are needed, as well as more resources to carry out such tasks. Evaluations should be developed involving all relevant stakeholders through deliberation institutions and accounting for economic and non-monetary values around alternative land use scenarios.

51. With respect to the impact of invasive alien species on biodiversity for food and agriculture:

Specific management challenges, priorities, and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

Little is known about the distribution and abundance of many invasive fish species, as they most often are not the target of fisheries. Knowledge on other aquatic invasive species is also quite scarce.

a) What are the major gaps in information and knowledge?

Thus far, the economic impacts of invasive alien species have not been evaluated in detail in Finland, but the potential costs are likely to be high (as indicated by the existing evaluations in other countries).

Tools of forecasting the risks are still underdeveloped.

b) What are the main capacity or resources limitations?

Preventing the spread of invasive alien species and their detrimental impacts in aquatic ecosystems depends on a rigorous system of prevention and early identification, which is still missing.

Resources for monitoring and early action are limited. Removal of the already established populations is a long-term investment.

Few people are aware of the risks of invasiveness, for example, many ornamental plants are potential or existing invasive species.

c) What are the main policy and institutional constraints?

The issue has a cross-sectoral nature and requires close and systematic coordination of efforts. Since the issue is relatively new, the policies and above all the implementation are constrained by lack of awareness and experience.

d) What actions are required and what would be the priorities?

A national strategy on invasive alien species (IAS) will be/should be/has been implemented, with the related action plan of 16 sets of measures for preventing and controlling their impacts. Some of the actions have been accomplished or are well under way: development of legislation on invasive alien species, establishment of an expert and monitoring body, launching communications and training, development of the guidelines on estimating the costs of alternative management approaches on the IAS, and establishing a portal on invasive alien species. Other measures of priority are: creation of advance warning and risk assessment systems and the development of research and monitoring. This includes i) identification and prioritization of the invasive alien species; ii) monitoring of the main pathways in order to prevent the introduction and establishment of invasive alien species in Finland; and iii) bringing the most harmful species under control at the earliest stage possible.

The International Maritime Organization's Convention for the Control and Management of Ships' Ballast Water and Sediments, aimed at preventing the spread of invasive alien species in the ballast waters of vessels, will be ratified.

The Finnish Advisory Board for Invasive Alien Species acts as the expert body on questions and policies concerning invasive alien species, and will continue to coordinate and follow the implementation of the National Strategy on Invasive Alien Species.

52. For each of the production systems present in your country (indicated in Table 1) indicate in Table 20 the extent of use of management practices that are considered to favour the maintenance and use of biodiversity for food and agriculture. Significant increase (2), some increase (1), no change (0), some decrease (-1), significant decrease (-2), not known (NK), not applicable (NA)), and any identified change in biodiversity for food and agriculture associated with the practice (strongly increasing (2) increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK), not applicable (NA).

Table 20. Management practices that are considered to favour the maintenance and use of biodiversity for food and agriculture.

Production system: Livestock L3, L4			
Management practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	92 a	0	0
Integrated Pest Management (IPM)	100 b	2	NK
Pollination management	1 c	2	2
Landscape management	8 d	-1	2
Sustainable soil management practices	4 e	1	NK
Conservation agriculture	10	2	0
Water management practices, water harvesting	1 f	1	NK
Agroforestry	0.007 g	1	2
Organic agriculture	9	1	1
Low external input agriculture	NK	NK	NK
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	0,4 h	0	2
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

Foornote: There is no readily available statistics on agri-environment measures implemented for the production systems as defined for the report, therefore the data are the same by all agricultural systems. Separate data are given whenever possible, also for forest systems and aquatic systems.

Production system: Forests F3, F4, F7, F8			
Management practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA

Pollination management	NA	NA	NA
Landscape management	100 j	1	0
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	20 k	0	-2
Agroforestry	0.005 l	1	2
Organic agriculture	NA	NA	NA
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	9	1	1
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	100	0	1

Production system: Aquaculture and fisheries A3, A4, A7, A8, A11, A12			
Management practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA
Pollination management	NA	NA	NA
Landscape management	NA	NA	NA
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	100	0	0
Agroforestry	NA	NA	NA
Organic agriculture	0	0	0
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	100	0	0
Conservation hatcheries	7	2	1
Reduced-impact logging	NA	NA	NA

Production system: Irrigated crops C7, C8			
Management practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	92	0	NK
Integrated Pest Management (IPM)	100 b	2	NK
Pollination management	NK	NK	NK
Landscape management	NK	NK	NK

Sustainable soil management practices	NK o	!!!	NK
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NA	NA	NA
Agroforestry	NA	NA	NA
Organic agriculture	5	-1	NK
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

Production system: Rainfed crops C11, C12			
Management practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	92 a	0	NK
Integrated Pest Management (IPM)	100 b	2	NK
Pollination management	1 c	2	2
Landscape management	8 d	-1	2
Sustainable soil management practices	4 e	1	NK
Conservation agriculture	10	2	0
Water management practices, water harvesting	1 f	1	NK
Agroforestry	0.007 g	1	2
Organic agriculture	4	1	1
Low external input agriculture	NK	NK	NK
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	0,4 h	0	2
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

Production system: Mixed M3, M4			
Management practices (Annex 5)	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	92 a	0	NK
Integrated Pest Management (IPM)	100 b	2	NK
Pollination management	1 c	2	2
Landscape management	8 d	-1	2
Sustainable soil management practices	4 e	1	NK

Conservation agriculture	10	2	0
Water management practices, water harvesting	1 f	1	NK
Agroforestry	0.007 g	1	2
Organic agriculture	9	1	1
Low external input agriculture	NK	NK	NK
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	0,4 h	0	2
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

Production system: Apiculture O1			
Management practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK, NA)
Integrated Plant Nutrient Management (IPNM)	NA	NA	NA
Integrated Pest Management (IPM)	NA	NA	NA
Pollination management	NK	NK	NK
Landscape management	NK	NK	NK
Sustainable soil management practices	NA	NA	NA
Conservation agriculture	NA	NA	NA
Water management practices, water harvesting	NA	NA	NA
Agroforestry	NA	NA	NA
Organic agriculture	10	1	NK
Low external input agriculture	NA	NA	NA
Home gardens	NA	NA	NA
Areas designated by virtue of production features and approaches	NA	NA	NA
Ecosystem approach to capture fisheries	NA	NA	NA
Conservation hatcheries	NA	NA	NA
Reduced-impact logging	NA	NA	NA

Provide or cite references to any documentary evidence that exists to support the evaluation given above. Indicate where practices used in a production system are affecting biodiversity for food and agriculture in another production system.

Where evidence exists of an effect of any of these practices on biodiversity for food and agriculture, provide a brief summary of the effect, the components of biodiversity for food and agriculture affected, and available indicators. Include any available references or reports.

The information here is largely derived from the national monitoring programme MYTVAS, working documents on the implementation of the agri-environment measures (extent of

practices in agricultural systems), and the national indicator framework Biodiversity.fi. The Fifth National Report to the Convention on Biological Diversity (2014), additional agricultural statistics from the Information Center of the Ministry of Agriculture and Forestry Tike, and original research studies were also used. The indicators that are used for all the systems include the state of protection and implemented measures, the state of groups of species (indicator, threatened, red-listed etc.), and the state of other relevant characteristics (e.g. amount of dead wood for forests, nutrient loading for waters). Most indicators for fisheries are currently under development.

Most of the practices that enhance environment in agricultural systems are among those financed under the Common Agricultural Policy, especially its agri-environment schemes. In Finland, at least some of these practices on over 90 % of land and by over 90 % of farmers, so there is wide coverage. Despite this, the effects on biodiversity remain largely marginal (MYTVAS). Most practices aim at protecting soils from erosion and waters from pollution by nutrients. The likely positive effects are therefore expected for the aquatic systems through reduction in eutrophication levels. The evidence of the realized biodiversity benefit is not clear, however, which may result from, on one hand, the fairly undemanding and untargeted nature of implementation and hence its low overall efficiency, and, on the other hand, a time-lag between the improvement in nutrient runoff and the state of waters and the biotic response. For most such practices, evidence on biodiversity impact is lacking. A notable exception is organic farming which is also supported through the EU's rural policies (rural development programmes). The adoption of organic farming is at 10 % of agricultural land. As organic farms sustain higher habitat and species level diversity than conventional farms, organic farming very clearly contributes to biological diversity and associated ecosystem services.

Some of the agri-environmental payments are specifically targeted at supporting biodiversity (such as management of semi-natural grasslands) and their effects are demonstrated to be locally high (MYTVAS; Biodiversity.fi). Their uptake among farmers and the area managed is, however, limited. Some grazed forests – a traditional practice in the boreal zone – are managed under agri-environmental contracts.

From 1 January 2014, all professional users of plant protection products must observe integrated pest management procedures (the EU legislation). Due to the recent nature of the implementation, the impact is not yet evident. There are farms in Finland that can be categorized as Low external input agriculture but no information is available on their numbers and land area.

In commercial forest systems, the fundamental practice that favors biodiversity is use of indigenous tree species. Others include the requirement of the Forest Act to preserve valuable habitats, favoring of mixed tree stands, and retention of structural characteristics important for biodiversity (e.g. amount of dead wood). Forest treatments are also applied according to the landscape: the boundaries of clear cutting are designed to comply with the

contours of the terrain and untreated corridors are left along the water courses (Landscape management). The potential of these practices is cited as only marginally because of the small sizes of protected patches, insufficient width of the buffer zones, and inadequate implementation. There is also evidence of the positive outcomes of policies: retention trees and preservation of aspens (key species for Finnish forests) proved to be important for some threatened species. METSO programme's outcome has particularly been successful in protecting from logging temporary or permanently biologically valuable forest stands. According to the genuine changes of categories in red-list forest species in 2000–2010, the rate of decline has slowed down but the situation overall continues to worsen (Biodiversity.fi).

All Finnish forests are classified as semi-natural in contrast to intensively managed plantations. They can also be regarded as belonging to the reduced-impact logging type due to the Forest Act guiding the forestry operations.. Another novel approach of managing forest stands without clear-cutting them has been developing with about 50 000 hectares enrolled. There is as yet no documented evidence on its positive effects on biodiversity. Grazed forests can be regarded as agroforestry, and many are managed by Metsähallitus (or the National Forest Board) as cultural heritage sites (a nationally financed conservation measure) or by farmers with the financial support under the agri-environmental programme. While the management is essential for supporting biodiversity, the total area is critically marginal.

Support for extensive grazing within forests – as a traditional way of procuring animal forage – benefits both agricultural and forest-associated biodiversity, although it limits regrowth of commercial trees. The practice is financially supported from the national budget. Another instance of practices used in one production system with effects on another is soil protection and nutrient management practices in agriculture and forestry that are expected to benefit the state of aquatic communities. While there have been significant achievements on land, the ultimate benefits in water are not yet clear.

In fisheries, the most important tools of supporting native fish populations, including endangered ones, used for consumption have been captive growth for restocking of inland waters, combined with regulation of fisheries. As local measures, migration passages have been constructed through dams, and water levels regulated on rivers and lakes in order to take into account the needs of wildlife. A watershed-level planning for the protection of habitats from natural hatcheries through the migration routes has been increasingly promoted and is central to the recently reformed national Fishing Act. Extensive river restorations have also been carried out across the country, but the effects are only partially known. In marine waters, designation of protected areas and combating pollution from land are the priority actions. Finland has several sea and coastal conservation areas. The Baltic Sea Protected Areas established under HELCOM (Baltic Marine Environment Protection Commission) cover 7 % of the national territorial waters and exclusive economic zone, which can be regarded as protected hatcheries.

The nutrient load to waters from aquaculture has decreased dramatically as a result of decline in the total fish production, advances in animal breeding of rainbow trout and whitefish for better growth, development of fish feeds, and better feeding practices. Also the development of more effective vaccines has had a big role in developing the management practices and outcome.

53. For each of the production systems present in your country (indicated in Table 1) indicate in Table 21 the extent of use of diversity based practices that involve the use of biodiversity for food and agriculture. A definition of the diversity based practices listed is provided in Annex 6. Strongly increasing (2), increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK)) and any identified change in biodiversity for food and agriculture associated with the diversity based practice (strongly increasing (2) increasing (1), stable (0) decreasing (-1), strongly decreasing (-2), not known (NK)).

Table 21. Diversity based practices that involve the enhanced use of biodiversity for food and agriculture.

Production system: Livestock L3, L4			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	NK	NK	NK
Base broadening	NK	NK	NK
Domestication	NA	NA	NA
Maintenance or conservation of landscape complexity	100	0	NK
Restoration practices	1	1	2
Management of micro-organisms	NA	NA	NA
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA

Production system: Forests F3, F4, F7, F8			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	NK	NK	NK
Base broadening	NK	NK	NK
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	100 b	0	0
Restoration practices	100 b	2	1
Management of micro-organisms	NA	NA	NA

Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA

Production system: Fisheries A3, A4, A7, A8			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	0	0	1
Base broadening	4	1	1
Domestication	0	0	1
Maintenance or conservation of landscape complexity	NA	NA	NA
Restoration practices	NA	NA	NA
Management of micro-organisms	2	1	1
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA

Production system: Aquaculture A11, A12, A15, A16			
Diversity based practices (Annex 6)	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	1	1	1
Base broadening	0	0	0
Domestication	1	1	1
Maintenance or conservation of landscape complexity	80	2	2
Restoration practices	5	1	1
Management of micro-organisms	NA	NA	NA
Polyculture/Aquaponics	1	1	1
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA
Others [please specify]			

Production system: Irrigated crops C7, C8			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	100	0	2

Base broadening	100	0	2
Domestication	1	1	1
Maintenance or conservation of landscape complexity	100	0	NK
Restoration practices	NA	NA	NA
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA

Production system: Rainfed crops C11, C12			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	47 a	1 a	2
Base broadening	100 b	1	2
Domestication	0,005% c	1	NA
Maintenance or conservation of landscape complexity	100	0	NK
Restoration practices	1	1	2
Management of micro-organisms	NA	NA	NA
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA

Production system: Mixed M3, M4			
Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	100	0	2
Base broadening	100	0	2
Domestication	NA	NA	NA
Maintenance or conservation of landscape complexity	100	0	NK
Restoration practices	1	1	2
Management of micro-organisms	NA	NA	NA
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA*	NA	NA

Production system: Apiculture O1

Diversity based practices	Percent of production area or quantity under the practice (%)	Change in production area or quantity under the practice (2,1,0,-1,-2, NK, NA)	Effect on biodiversity for food and agriculture (2,1,0,-1,-2, NK)
Diversification	NK	NK	NK
Base broadening	NK	NK	NK
Domestication	NK	NK	NK
Maintenance or conservation of landscape complexity	NA	NA	NA
Restoration practices	NA	NA	NA
Management of micro-organisms	NK	NK	NK
Polyculture/Aquaponics	NA	NA	NA
Swidden and shifting cultivation agriculture	NA	NA	NA
Enriched forests	NA	NA	NA

Briefly summarize the information that exists on the effect of the diversity based practice on different components of biodiversity for food and agriculture. Indicate where practices used in a production system are affecting biodiversity for food and agriculture in another production system. Include any available references or reports to support the evaluation given above.

Overall only minor cropping diversification took place in the cereal-dominated production systems. For example, the area of grasses, fallow and special crops totaled 45 % in 2004 and 47 % in 2013. Regionally up to 37 % of the spring cereals are still grown as mono- or biculture (only 1 or 2 cereal during a typical 5-year rotation period). The areas dedicated to the special crops varied: for 11 crops they decreased and for 12 increased between 2004 and 2013 with the total area experiencing a slight decline. The average crop diversity index was 1,5 in 90s and 1,7 by 2011. It seems that farmers are becoming more aware of the importance of an adequate crop rotation as part of agronomically sound crop production.

In all agricultural systems, there is a continuous use of practices related to base broadening and domestication. For example, wild strawberry (*Fragaria vesca L.*) accessions have been analyzed in order to understand climatic adaptation in this species for strawberry breeding. A cross-compliance regulation that covers basically all agricultural land in Finland prohibits removal of most types of the landscape elements that would lead to unwarranted landscape simplification. Restoration of abandoned semi-natural biotopes and wetlands is further subsidized by the agri-environmental policy. The above is being implemented in all agricultural systems, though restoration and consequent management of semi-natural grasslands is implemented mostly on livestock and mixed farms. Both practices are likely to positively affect associated biodiversity but evidence on this is missing.

In forestry, targeted restoration of production forests to their natural state is run under a METSO Programme. Although the scope of the work is marginal in relation to the confirmed

needs (a target of 13 500 hectares of restored habitats), the programme has been successful in attracting participation of private owners and in attaining results. Furthermore, the preservation of valuable habitats, leaving retention trees and buffer zones maintain landscape-level structural diversity and can also be classified as restoration practices. Continuous-cover forestry can be considered an enriched forest practice. Currently practiced on just 50 000 hectares, it has been growing in popularity, especially for urban forests. Evidence for its realized impact varies from well documented (indicator FO20 Restoration and management of protected forests; Biodiversity.fi) to non-confirmed and questioned. Also, restoration of bogs, relevant for some berries and game, covered 20 000 hectares by 2013.

Restoration is also carried out on wetlands (on agricultural and forest lands) and on river basins. There is evidence that restoration of spawning grounds and nursery areas for fish brings beneficial outcomes for endangered fish species, although with a delay of many years. In fisheries, a native strain of sea trout has been taken into a preservation programme to enhance its wild stocks. Breeding of rainbow trout and whitefish has developed them to be fit for aquaculture.

In apiculture, research in a traditional breed that is resistant against mites (*Varroa destructor*) is underway with an aim of introducing the trait into the mainstream honeybee breed.

54. List and briefly describe any specific programmes or projects that have been undertaken in the country to support any of the practices listed in Table 20 and Table 21. Provide information where available on what types of activities were supported, areas and numbers of farmers, pastoralists, forest dwellers and fisher folk involved, state and outcome with respect to components of biodiversity for food and agriculture.

1. Most of the implementation work related to both production and associated biodiversity conservation in agricultural systems is carried out under the EAFRD. Funding is available mostly to the land managers for practices but also to other stakeholders for delivering advice and running projects. The programme supports such practices as integrated plant nutrient management (e.g. fertilization based on soil fertility state, timing, and manner of fertilizing to prevent runoff), sustainable soil management practices (e.g. winter cover, use of organic matter), conservation agriculture (reduced tillage), water management practices (regulated drainage), agroforestry (grazing on traditional wooded pastures), organic agriculture, and landscape management (e.g. establishing fields for biodiversity such as game and meadow fields; multifunctional wetlands). Management of non-cropped elements (e.g. mid-field woodlots, buffer zones) contributes to the maintenance of landscape complexity. Restoration is further supported by the non-productive investments under this programme (e.g. making new fences, removal of undergrowth, re-creation of wetlands). The programme also supports the use of heritage cultivars and breeds.

The programme covers about 90 % of the agricultural land and the same ratio of farmers, but the uptake of practices aimed at biodiversity is much smaller (no estimate is available). Most

of the practices that are implemented on a large scale (such as margins along watercourses) have been shown to be of low value for biodiversity.

Since the country joined the EU in 1995, organic farming has been included as an option for farmers supported by EAFRD over all the programme periods. The impact of these schemes has varied between the programme periods, but very clearly contributed to doubling of farmland under organic farming to the present 10 %. Recently, the government included in its programme (white paper "Lisää luomua", More Organic) an ambitious goal to increase organic land-use to 20 % by 2020. There is evidence of positive effects of organic practices on biodiversity and ecosystem processes from Finland. However, due to lower yields, there is a need for a bigger production area under organic as compared to conventional production. Since there is little pressure on land resources in Finland and fallowing is presently widely used, this is not seen as a problem.

The positive impact on biodiversity of several practices has been confirmed as part of the national monitoring programme MYTVAS (MYTVAS 2014). Especially management of the traditional semi-natural biotopes and supporting a network of non-cropped areas (such as fallows) have clear positive outcomes for associated biodiversity. The implementation scope has, however, not been sufficient to stop declines in species of the traditional biotopes nationally. The scale of use of heritage cultivars is regarded as not satisfactory.

2. TEHO-Plus project – a bottom-up project initiated by a regional administration unit under the Ministry of Agriculture and Forestry together with the Union of Agricultural Producers. Particular priority areas of the project included the targeting of agri-environmental measures, provision of farm-specific advice, compiling an information package on agri-environmental issues, and supporting use of nutrient balances in planning farming practices. It focused mainly on more efficient use of nutrients and prevention of water pollution from agriculture, which indirectly enhances aquatic biodiversity, and some work on agricultural biodiversity was also conducted.

For the purpose of farm visits, the project developed an environmental test for farms that can be completed online (www.ymparisto.fi/tehoplus > ympäristökäsikirja). Completing the test only takes a couple of minutes, and based on the farmer's responses, it returns five development suggestions, among which the farmer and the adviser may together choose the most suitable for the farm. The test is supported by an "environmental handbook for farms" that serves as an information source for advisers and a general reference book for farmers. In addition, separate publications and reports were produced (topics also covered associated biodiversity, constructed wetlands, and ecosystem services in agriculture). By 2013, it involved 175 farms and hundreds of stakeholders. The impact on biodiversity has not been evaluated.

The experiences showed that farmers react well to the advice provided in a practical and understandable manner and are willing to cooperate in developing and testing innovative

solutions for reducing the environmental load of agriculture. Bringing such work from the offices to the fields has the best impact in attracting stakeholders.

3. The Forest Biodiversity Programme METSO 2008–2025 aims at voluntary conservation in private forests and is run in collaboration between the Ministry of Agriculture and Forestry and the Ministry of Environment. It includes the restoration of valuable habitats. During 2008–2011, 16 000 hectares of privately owned forests were permanently protected and 21 000 hectares were safeguarded under temporary conservation agreements. Also, 14 000 hectares of state-owned forest were protected. Specific impacts on biodiversity are not monitored, only uptake of the agreements, but the ecological quality of the protected forest stands is confirmed to be high.

4. In respect to conservation of genetic resources, there has been diverse work done on Finnish landraces and locally adapted germplasm of cultivated plants such as cereals, fruit trees, vegetables, and ornamental plants well adapted to the Nordic conditions (described in detail in the national report to FAO, 2008). However, they are not characterized to genotype level. It included registering the landraces and genotypes, as well as evaluating collections and making decisions about storage mandates. Both have relevance for diversification practices and base broadening.

Several projects have been run to promote use and understanding of the national genetic resources. Outputs include a catalogue of the horticultural species used in home gardens, an online portal for registering traditional and heritage cultivars, and educational materials for different stakeholders (including agricultural educators and students). On the portal, anyone can announce their potentially valuable plants and possible landraces, provide relevant information and evaluation as well as cultural/historical data. Efforts have been made to increase the interest of private garden owners in local, heritage or culturally interesting horticultural plants, and to increase their awareness of plant genetic resources. There has been work with some museum gardens in maintaining the original plant accessions, adding to the touristic attraction of the museums. The projects also contributed to the public awareness about the importance of genetic crop diversity.

5. The National Strategy for Wetlands and Waterfowl (approved in 2014) aims at: i) management of the existing wetlands, ii) restoration and enhancement of wetlands that have been destroyed or adversely impacted by human activities, iii) establishment of new wetlands as replacement for those that are not restorable, iv) support of viable populations of waterfowl and their sustainable use, and v) promotion of knowledge on wetlands and waterfowl among the population and to inspire stakeholders into the management of wetlands.

The strategy has been developed in close collaboration with conservation organizations and hunting associations under the auspices of the Ministry for Agriculture and Forestry. An example of projects implemented under the strategy is the "Return of Rural Wetlands"

(www.kosteikko.fi). The project was co-funded by the EU Life+ programme and promotes the establishment, restoration and management of wetlands, the most important habitats for waterfowl, which also contribute to water purification from agricultural land. To date, 44 demonstration wetlands covering 240 hectares have been established in collaboration with stakeholders. The aim is to inspire others to undertake their own projects, and the experiences in establishing the nationwide network of demo-wetlands are actively promoted and communicated (seminars and guided tours). The project provided funding only for planning and materials, with work carried out voluntarily by the stakeholders, which fostered commitment to long-term site management. Each site received a jointly developed management plan approved by the local authorities. Although the focus is on game species, there are considerable positive effects for associated biodiversity, water quality and landscape values.

6. Result-based payments for the golden eagle: This regionally administered national compensation programme (described further in question 33) was introduced in 1998 to replace a former payment scheme based on confirmed reindeer kill by the golden eagle. The payments are made available to reindeer herders in Lapland, and the national population of the species has apparently increased. The programme's participatory approach has resulted in cooperation and positive attitudinal changes.

7. A number of projects on increasing diversity in crop production have been run (e.g. project "The role and exploitation of biodiversity in crop production"). The biodiversity components studied included functional biodiversity of weeds, diversified crop selection, increased plant diversity in cultivated grasslands, classification of biodiversity at farm level, economic calculations and the acceptance of diversifying measures among the consumers. The results supported decision-making on biodiversity actions in the EARD, for example, a new type of field specifically for associated biodiversity – meadow fallow – was introduced with uptake of approximately 6 000 hectares in the first years.

Most recently, two relevant projects have been completed. Intercropping and cultivar mixtures: provision of yield stability and food security (2012–2014) studied the potential of widening the use of intercropping and cultivar mixtures in Finland. Additionally, use for intercropping as one target for plant breeding was considered. Sustainability through crop diversity to climate induced changes in plant production (Monisopu; 2009–2014) generated information on the current situation of crop rotation, new information and cropping system methods have been produced from the field experiments. Such aspects as nutrient use and cycling, yield formation, inputs needs and economy of production have been studied.

8. The Aquabest project: the project strived to demonstrate that aquaculture in the Baltic Sea region has the potential to become a sustainable and responsible food production system. It addressed the following problems: i) aquaculture relies upon nutrients imported from oceans, thus contributing to the eutrophication of the Baltic Sea; ii) spatial planning knowledge has not been transferred throughout the Baltic Sea Region, so aquaculture has not developed in

offshore or other remote areas with less environmental effects, competition and conflicts; iii) the feasibility of recirculation farming has not been assessed and technology transferred throughout the Baltic Sea region, and the technology needs to be adapted from fresh water to salt water, and iv) licensing systems do not always encourage adoption of eco-efficient technologies and practices. The results of the project are summarized in the publication "Aquabest recommendations". Industry and public authorities are encouraged to take forward the recommendations in their work. Aquabest affected environmental law reform, particularly in Finland and the Åland Islands.

Sustainable use of biodiversity for food and agriculture

55. What are the major practices in your country that negatively impact associated biodiversity and/or wild foods? Answers can be provided in Table 22 where examples of general types of practices are listed

Table 22. Major practices that negatively impact associated biodiversity and/or wild foods in the country.

Types of practices	Major practice (Y/N)	Description	Reference
Over-use of artificial fertilizers or external inputs	Y	Due to the agri-environmental payments, greatly reduced overall. Regionally, excess of manure inputs remains a serious challenge	MYTVAS, 2014
Over-use of chemical control mechanisms (e.g. disease control agents, pesticides, herbicides, veterinary drugs, etc.)	N	No large-scale negative impact; but locally lead to environmental damage (e.g. killing of non-cropped vegetation; antibiotic-resistant bacteria; residue in food, especially on strawberry)	FA4 Pesticide use; Biodiversity.fi
Inappropriate water management	Y	Construction of dams in rivers have prevented ascending salmon from migrating to spawning areas and destroyed spawning and juvenile production areas of migrating fish species in the best breeding rivers of the Lake Saimaa landlocked salmon	MMM Fish passage strategy, background report, 2012
Practices leading to soil and water degradation	Y	Leaching of nutrients from agricultural lands, caused by e.g. sub-optimal field management, is still a serious challenge. Presence of harmful substances in waters and organisms. Enriching of pharmaceutical residues to the fish is a threat. Soil degradation because of the simplified crop rotations, decline in soil organic matter.	MYTVAS, 2014; BS3 and IW3 Harmful substances; Biodiversity.fi
Over-grazing	Y	On reindeer winter pastures, the quality and amount of lichen pastures have decreased	AL4 Lichen pastures; Biodiversity.fi
Uncontrolled forest clearing	N	Occasional cases	
Fishing in protected areas	N	No significant negative impact in Finland	RKTL
Overharvesting	Y	Overharvesting of some fish stocks like migratory whitefish in Gulf of Bothnia and as	RKTL

		bycatch endangered sea trout in whitefish and pikeperch gill net fishery	
Abandonment and inadequate management	Y	Concerns traditionally managed biotopes - meadows, extensive pastures and grazed forests, that are critically endangered and support considerable endangered flora, including crop wild relatives, and fauna.	Biodiversity.fi; MYTVAS, 2014; Fitzgerald, 2013

Please comment on the reasons why the practices are in use and discuss if trade-offs are involved.

Most Finnish forest land is managed as even-age and fairly monospecific stands with a logging and seeding cycle between 65 and 90 years. This approach has led to adverse ecological changes in forests. A small area, lack of connectivity and low quality of the remaining natural forest patches (hosting large numbers of specialized species) are regarded as the most serious threat to forest biodiversity. Another characteristic of managed forests is low volume of dead wood (an important resources for highly specialized associated biodiversity). However, the role of species dependent on dead wood and specific to old-growth forests as food is low. The use of Finnish forests is defined as multifunctional and, indeed, commercial forests are widely used for recreation. There remain a trade-off between harvesting of large volumes of biomass and other uses of forests, including preservation of biodiversity and procurement of wild foods and recreation, which is confirmed through biological research and forest user opinions.

Similar trade-offs exist in all agricultural systems, where the economic drives for intensive and homogenous output reduces diversity of both production and associated biodiversity. For example, the use of large amounts of imported soya-based feed for agricultural animals has negative impacts on the use of nationally grown fodder and thus crop diversity, and disadvantages sustainable utilization of semi-natural pastures. It also upsets nutrient balances on all levels and has a negative side-effect on biodiversity in the exporting countries. Regional specialization of livestock and arable sectors has been driven historically by policies for optimizing production types by climatic and soil characteristics. This, however, has led to disruption in nutrient cycling: excess manure in some regions and lack of organic matter and necessity of using inorganic fertilizers in the others, as well as suboptimal crop rotations.

There was a steep decrease in the use of herbicides by the mid-1990s, which led to increased weed pressure in crops. The increase in the sales of herbicides since 1996 may thus be seen as a reaction to the crop losses. The adoption of conservation tillage has driven an increase in use of herbicides and fungicides, which is a clear trade-off with the other merits of this practice.

In livestock production, a few highly productive breeds are favoured at the expense of heritage ones. The former are not suited well to the utilization of extensive pastures and roughages, which leads to their abandonment and the loss of associated biodiversity. Practices in reindeer herding regions have also intensified in order to sustain a higher density

of animals and improve their winter survival. This leads to local overgrazing, use of winter hay and helminthicides, all disruptive to the ecological cycles of tundra.

In fisheries, a typical approach to maintain salmonid fisheries has been restocking of the depleted native stocks with farm-grown smolt as most of the reproduction areas are no longer available for wild production. There is a risk that this leads to the genetic pollution and homogenization of the remaining wild populations. The tradeoff is the support of recreational fishing and safeguarding of the natural state of populations, and the use of waters for energy production.

56. Briefly describe any actions and countermeasures taken to limit unsustainable use and/or support sustainable use of associated biodiversity and/or wild foods.

Mainly, it has been done through development of respective legislation base, improving its implementation, increasing awareness and participatory approaches. Also, research and implementation projects play an important role.

57. Provide in Table 23 any information available that lack of biodiversity for food and agriculture is limiting food security and nutrition, and/or rural livelihoods in the different production systems in your country. Indicate the production systems affected together with any information on the extent of problem (significant lack (2), some lack (1)), describe the effects on livelihood, food security and nutrition, and the components of biodiversity for food and agriculture that are limited. The list of components of biodiversity for food and agriculture given in Annex 1 should be used where possible.

Table 23. Effect of the lack of biodiversity for food and agriculture on production, food security and nutrition and livelihood.

Production system	Biodiversity component for which diversity is lacking (An1)	Extent of problem (2,1)	Effect on food security and nutrition	Effect on livelihood	Reference
Livestock L4	Lichen	2	Reindeer winter forage	Loss of local income	Biodiversity.fi; Nordic nature, 2010
Forests F3, F4, F7, F8	Wild food (berries)	1	Supplement to nutrition	Loss of local income	Metla
Aquaculture and fisheries A3, A4, A7, A8, A11, A12, A15, A16	Migratory salmonids	2	Fishing possibilities for these species are marginal	Major influence on Rural attraction and fishing tourism	RKTL
Rainfed crops C11, C12	Pollinators	1	Yields of rapeseed are locally below the potential	Unrealised income	Dr. Hokkanen

Irrigated crops C7, C8	Pollinators	1	Yields of strawberry are locally below the potential	Unrealised income	Hokkanen et al., 2011

There are little quantitative data on the effects above. However, there is increasing evidence overall that declines in numbers of species of crops and their cultivars and in number of species of domestic production animals and their breeds, in association with homogenization and monocultures, specialization at farm, landscape and regional level, is a vicious circle resulting in increased vulnerability and reduced resilience of the food production systems when faced by environmental or socio-economic pressures. As this general pattern of monoculturalization (loss of agricultural system diversity and associated biological diversity) prevails in Finland, a serious concern about loss of food security is justified.

Modern forestry practices drastically affect the availability and diversity of forest berries and mushrooms. In particular, the cover of some berry-bearing bushes suffers from the final stage of clear-cutting (down to 25 % from before the clear-cutting state). Forestry operations in Lapland have been demonstrated to undermine winter foraging resources for reindeer (through damaging lichen cover), thus adversely affecting the traditional livelihood of Sámi herders. On the other hand, the lichen cover also seriously suffers from overgrazing by reindeer herds that exceed pasture carrying capacity. About 90 % of the Sámi areas are managed by Metsähallitus according to the Akwé Kon principles.

In fisheries, the most endangered species are salmonids reproducing in river areas, and due to poor stocks, fishing possibilities are marginal to that what they could be, except for a few cases such as salmon in Tornionjoki and whitefish in many lakes. As the major part of fishing of these species takes place in rural areas, the poor status of the stocks hinders the development of fishing tourism.

The contribution of biodiversity for food and agriculture to improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification

58. Where available, provide information that increasing the amount of biodiversity for food and agriculture, including associated biodiversity, in production systems in your country have improved the following:

a) productivity;
b) food security and nutrition; - this is an area where very clearly more research is needed
c) rural livelihoods;
d) ecosystem services;
e) sustainability;
f) resilience;
g) sustainable intensification.

Research has traditionally focused at the effects of agriculture on biodiversity, rather than the importance of biodiversity for agriculture.

A number of projects on increasing biodiversity in crop production have contributed to a more diversified crop production in Finland (e.g. the project "The Role and Exploitation of Biodiversity in Crop Production"). According to the fresh results of MONISOPU project, crop rotation practices in Finland may improve the average annual yield of spring cereals by about 10% compared to the cereal monoculture. Crop rotations may increase nitrogen content of cereals is cultivated after oil crops and legumes. Different crops preceding cereals lowered the occurrence of wheat disease, therefore reducing use of fungicides. Crops introduced into crop rotation with cereals also provide new market possibilities for rural entrepreneurs. Positive examples are buckwheat, quinoa, linseed, oil hemp and caraway. A recent entry of caraway (*Carum carvi* L.) into widespread cultivation made Finland one of the major producers of this crop in the world. Use of other crops for soil improvement and as break crops is also being promoted with some success. Interest to this issue remains high (for example, the projects "Intercropping and cultivar mixtures: provision of yield stability and food security", 2012–2014, and "Sustainability through crop diversity to climate-induced changes in plant production", 2009–2014). Diversified cropping systems are considered more resilient towards fluctuating weather conditions and climatic shifts though evidence from Finland is still lacking.

Although cultivation of special crops is small-scale, when incorporated into copping systems, they may have large overall impact on the system's sustainability. Most of the special crops in Finland are dicots that have positive impact as preceding crops for cereal. More diverse and extensive use of particularly legumes as part of intercropping and crop rotations contributes to all of the above aspects (e.g. the EU project "Legume Futures"). Yet, currently less than 1 % of arable land is sown to grain legumes in Finland. It is estimated that 9–10 % would be needed to replace imported protein feed (food security). As part of the recent CAP reform, the share of legumes in cropping is promoted as ecological compensation area. In is believed that legume cropping will promote associated biodiversity but evidence on effects is missing.

Diversifying mushroom picking for export has had a considerable impact on local livelihoods, especially in regions with poor agricultural potential. Some family businesses have started to successfully produce birch sap as a drink. According to one company's owners, a two-hectare birch grove yields an income of around 10 000 €. See question 8.

Several native species are used as biological control agents, especially in greenhouse production.

There are national breeding programmes for cattle, pigs, fur animals, horses, and sheep. As a result of effective breeding carried out over many decades, originally imported dairy cattle

and pig breeds are now of high international quality. In addition to yield and efficiency, longevity and health characteristics are emphasized in the selection of breeding animals.

For aquaculture, one new fish species has been imported to Finland, namely sheefish (*Stenodus nelma* Pallas). The native pike-perch (*Sander lucioperca* L.) has been taken into recycling farming as a new species. Removing certain fish from eutrophic lakes as a tool to reduce phosphorus in an ecosystem (biomanipulation) has in some cases proven to be effective but long-term effects require continuous active work on the fish stock.

In the new EAFRD programmeming period, participatory research closely involving stakeholders (farmers) is being promoted through so called innovation operational groups.

What specific actions have you undertake to strengthen the contribution of biodiversity for food and agriculture to improving these outcomes? For each of these aspects, briefly describe the nature and scale of the actions implemented, the production systems involved, and the outcomes, results obtained or lessons learned from these actions.

Where available provide information on the components of biodiversity for food and agriculture involved, the stakeholders involved and the gender aspects of these actions. Note that information on policies, legislation or regulations should be reported in Chapter 5 and your response here should be concerned with interventions at production system level.

Funding is made available for projects that test and disseminate best practices on subjects including use of legumes for nitrogen fixation and soil improvement, diversified cropping, use of mulches and catch crops, landscape diversification, incorporation of semi-natural grasslands into production, game-friendly forestry operation, and revival of native fish populations. Such projects have been critical for the implementation of the top-down national programmes and policies and greatly contributed to further improvements of the latter.

Research projects of the above type are usually accompanied with extension activities to promote implementation of the results into practice, and they often result in policy recommendations to ease and support implementation by political tools.

For more details on example projects see question 79.

59. Do you have information on the proportion of the population in your country that uses wild food on a regular basis for food and nutrition? If available, include information such as the proportion of the diet that is collected from the wild in normal time and in times of scarcity, drought, natural and human-made disaster, and the degree to which wild foods are used (for subsistence, supplementing, nutrition, other).

Provide explanations and additional information as regards the gender differences in the patterns of use, management and consumption of wild food, including data disaggregated by sex.

Game and fish is a significant share of the indigenous Sámi population's diet. Most Finns, especially in the countryside and remote areas, engage in some form of wild food procurement. Wild berry and mushroom picking was practiced by about half of those surveyed. Recreational fishing is one of the most important outdoor recreational activities in Finland. An estimated 30 % of the population participates in recreational fishing at least once a year. The share of the population engaged in hunting is rising and is currently at 6 %. However, wild foods do not comprise a major source of nutrition for most of the population. Rather, wild foods are primarily supplementary food, with procurement providing recreational and cultural value.

Gender data is available only for hunting (37 % of men and 19 % of women hunt). No other comparable data for the food-type criteria above is available.

60. Describe in Table 24 the extent to which you consider that ecosystem approaches have been adopted for the different production systems in your country (widely adopted (2), partially adopted (1), not adopted (0), not applicable (NA)) and indicate whether ecosystem approaches are considered of major importance (2), some importance (1), no importance (0), not applicable (NA). You may also want to describe landscape approaches that have been adopted in your country.

Table 24. Adoption of and importance assigned to ecosystem approaches in production systems in the Country.

Production systems Code or name	Ecosystem approach adopted (name)	Extent of adoption (2,1,0,NA)	Importance assigned to the ecosystem approach (2,1,0,NA)
Livestock L3, L4, L7, L8; Irrigated crops C7, C8; Rainfed crops C11, C12; Mixed M3, M4	National network of protected areas; High Nature Value Farmland	1	2
Forests F3, F4	National network of protected areas; National Forest Strategy	2	2
Forests F3, F4	METSO	1	2
Forests F3, F4	National Forest Strategy 2025	2	2
Forests F3, F4	Forestry environmental guide of Metsähallitus	2	2
Fisheries A3, A4, A7, A8	National network of protected areas; The River Basin Management Plans	2	2
Aquaculture A11, A12, A15, A16	The National aquaculture spatial plan	1	2

61. For each production system in which an ecosystem and landscape approach has been widely adopted (as indicated in Table 24) describe:
a) The specific actions that have been taken to ensure adoption;
b) Any observed results from adoption;
c) Plans for adoption or for further adoption in new or existing production areas;
d) Lessons learned.

See examples in question 67.

In all cases dealing with an ecosystem approach, it was important to establish cross-sectoral collaboration networks and forums, to involve a variety of stakeholders as partners in deliberation at different policy and implementation levels. The combination of ground research, advice and, in some cases, financial incentives has proved to be successful. However, the approach is still relatively new, so policies and above all implementation are constrained by lack of experience and conservative attitudes.

Gaps and priorities

62. With respect to the use of management practices or actions that favour or involve the use of biodiversity for food and agriculture:

Specific management challenges, priorities, and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

a) What are the major gaps in information and knowledge?

Efficiency of management is frequently not known with certainty. Firm evidence of the causal effects of management on biodiversity components is mostly lacking. Agricultural experimental research seldom involves associated biodiversity.

Methodologies for taking account of indirect and cumulative impacts of the land use on nature are undeveloped but this is often disregarded. Linkages of production to other ecosystem services and valuation of non-production ecosystem services is lacking, limiting assessment of production and land-use trade-offs. Understanding of different production modes and systems on ecosystem services bundles is lacking.

Research on organic agriculture as the production system most dependent on ecosystem processes is small and severely underfunded in Finland. Research on agroecological methods within conventional agriculture is also marginal.

There is limited understanding of various benefits for diversifying crops and their agronomy, including those on the associated biodiversity. Resources have been focused at the major crops though specialized crops may be more profitable for Finland. Plan breeding work for minor crops is limited. In particular, an understanding of the influence of diversification on functional biodiversity would be needed in order to reinforce interactions benign for crop production.

In fisheries, the ownership of waters by private individuals is a fairly conservative system and introducing new ways of managing fish stocks taking into account, for example, biodiversity aspects is a slow process.

b) What are the main capacity or resources limitations?

Understanding success of interventions often requires extensive long-term and multi-factorial monitoring, which is expensive and complex, often requiring cross-sectoral components for a comprehensive result.

Experimental work on the importance of diversity for production and for associated public benefits (ecosystem services) is complex. There is a lack of experts to run it.

Funding for implementation and monitoring has been reduced and the short-term prospects are not encouraging. Increased reliance on short-term projects hinders data continuity, monitoring, and follow-up.

c) What are the main policy and institutional constraints?

There are institutional constraints for setting up a cross-sectoral and holistic monitoring system: sectoral institutions often compete for resources, and academic funding for interdisciplinary funding is limited, although it has increased in the last decade.

Deliberation takes place at the national and regional policy level, whereas participatory processes are not integrated to local and operational level decisions.

Some sectoral policies support opposite development pathways (for example, intensified production for food, timber, and bioenergy vs. biodiversity conservation or wild foods; increasing overall farm size vs. halting biodiversity loss).

Distribution chains are dominated by large-scale industrial actors in both agricultural and forestry sectors. This does not favor localized, small-scale, and diversified cropping and production. In particular, this is known to impair organic systems and use of domestically grown protein feed for animals.

Improving policy environment for local foods, including amending procurement processes to allow favoring local foods in municipal procurement (currently not allowed under EU competition rules) to support local farming and diversified production, and making the

regulatory environment more friendly toward small and medium scale food-processing enterprises.

Resources should be focused on evidence-based successes (as identified by e.g. National Monitoring Programme MYTVAS). Extension services and cooperation with farmers engaged in conservation activities should be promoted.

d) What actions are required and what would be the priorities?

Integrated efforts are needed, in which ecological and environmental (including climate change mitigation and adaptation), economic (including rural livelihoods), and social (including food security) goals are approached in holistic ways consistently from policy to strategic to tactical (implementation) levels.

Full-scope implementation of the existing sectoral policies that have already endorsed biodiversity conservation objectives, also in terms of best practices, is needed.

Sufficient monitoring and interdisciplinary evaluation of the efficiency of interventions and management practices should be secured and further developed. Efficiency of the practices should be greatly boosted considering the limited funding. Effects on biodiversity should be explicitly taken into account in agronomic research and implementation.

Co-operation between public administration, research, and education on the one hand, and land users, breeding organizations, food industry, environmental authorities, and hobby societies on the other hand, should be further promoted to facilitate information transfer and implementation. Participatory research involving end users should be promoted.

Streamlining of the policy objectives and interventions is necessary in some cases where trade-offs exist.

Research efforts are needed to develop (certified) organic farming and agroecological methods, including diversified cropping, that explicitly rely on ecosystem services.

63. With respect to the sustainable use of biodiversity for food and agriculture:

Specific management challenges, priorities, and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature, and interviews.

a) What are the major gaps in information and knowledge?

Understanding and measuring both negative and positive externalities, including ecosystem services, of land and water use remains a challenge.

More precise understanding of resilience and threshold values in systems is needed. Current data are often insufficient to draw predictions and risk assessment with regard to in sustainable state of resources, including biodiversity.

Methodologies for taking account of indirect and accumulative impacts of the land use on nature are undeveloped and this is often disregarded.

The key challenge for the sustainable use of the Baltic Sea and its coastal areas is posed by the lack of information on the biodiversity of underwater habitats, and the lack of detailed information on areas that are regionally, locally, and species-specifically significant in ecological terms.

Data from the fish catches in inland waters are too general to provide reliable information on the situation of the endangered species.

b) What are the main capacity or resources limitations?

There is growing concern about the capacity to fulfil international commitments and legal obligations for monitoring, oversight and assessment due to reduced funding. A growing number of environmental and conservation experts do not get employment.

Sustainable use of biodiversity is still only marginally integrated into all levels of education (for example, vocational) and sectors (for example, outside ecological or agricultural disciplines); this results in lack of expertise.

There are currently few resources available for research on the state of fish stocks.

c) What are the main policy and institutional constraints?

Conservation of biodiversity as a resource has not been fully integrated into economic accounting and other valuation of the social welfare, so the current economic and social frameworks limit its mainstreaming.

Biodiversity policy is considered science-driven and top-down, rather than addressing Finnish people's problems. Other environmental problems (such as Baltic Sea eutrophication and climate change) have been framed as having a direct impact on citizens and industries. This downplays biodiversity issues on the political agenda.

Many sectoral policies prioritize their respective objectives (mainly targeted at the economic output and employment) and sustainable use of biodiversity remains a peripheral issue.

There are still few incentives in universities that recognise, encourage and reward engagement of researchers in decision-making processes.

While the agri-food sector is fairly small and vulnerable, food processing and marketing is highly centralized and regulates the national agri-food sector through pricing. With the policy

emphasising economic profitability of production, alternative arrangements aimed at ecological sustainability are marginalized and difficult.

Management of inland fisheries is guided by local organizations and many of the biodiversity issues would require larger operational areas. As the present management includes a lot of voluntary work, it is vulnerable to changes in interest.

d) What actions are required and what would be the priorities?

Full-scope implementation of the existing sectoral policies that have already endorsed biodiversity conservation objectives is needed. Biodiversity-relevant objectives should be included in other national policies of relevance.

The state of the environment, including biodiversity, should be integrated into the economic accounting and other valuation of the social welfare, through developing well-being indicators for Finnish society to complement GDP data.

Sustainable use of biodiversity should be made mainstream in other aspects of societal development.

Expanding the use of native species and relatives of crop plants would promote their conservation.

Subsidies that are detrimental to biodiversity should be identified and reallocated, taking social, economic, and cultural conditions into account. Biodiversity commitments can be fulfilled more cost-efficiently, by developing economic instruments such as incentives and taxation.

64. With respect to the contribution of biodiversity for food and agriculture to improving productivity, food security and nutrition, livelihoods, ecosystem services, sustainability, resilience and sustainable intensification:

Specific management challenges, priorities, and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature, and interviews.

a) What are the major gaps in information and knowledge?

Knowledge of the population and genetic levels of diversity for species with a potential to contribute to production, for example, crop wild relatives or wild harvested plants.

Understanding of the scope and dynamics of ecosystem services originating from the associated species for all production systems, regions, and management types, along with estimation of the realized and potential trade-offs (e.g. weed damage). Understanding of the buffering functions of diversity in the face of change (e.g. climate).

Understanding of the thresholds of the system's state in a situation of potential collapse or drastic change (e.g. in relation to pollution levels or climate change, or under combined pressures).

There is a great need for information on the environmental impacts of livelihoods that utilize natural resources and for the objective assessment of environmental impacts, particularly as concerns inland waters, in order to guide economic activity, and to justify the introduction of new technologies and restrictions. Research on trade-offs of different development scenarios on bundles of ecosystem services is needed.

b) What are the main capacity or resources limitations?

In terms of conservation of the production genetic resources, a special challenge for the future conservation work is the decreasing trend of active farms in Finland. The trend is likely to lead to situations where there are fewer opportunities to keep heritage breeds and crops, since the bigger farms favor a few international commercial breeds and crops. The trend toward fewer active farms is a result of a policy to reduce the number of farms and farmers (but not area under cultivation) in Finland.

Research and implementation funding.

Effective cross-disciplinary methodologies, including analysis of trade-offs of alternative scenarios and between sectors and stakeholders.

The growers of heritage cultivars experience the registration process as time-consuming and expensive. Heritage animal breeds poorly fit the modern production demands for intensive production.

c) What are the main policy and institutional constraints?

As in 63.

d) What actions are required and what would be the priorities?

Further development of methodologies for quantifying provisioning of the key ecosystems services underlying production.

Improving management of traditional biotopes through policy support but above all their sustainable utilization in the current food production systems, which would potentially contribute to food security and livelihoods.

Research on utilization and trends in use of wild-harvested plants in order to ensure their sustainable and safe use.

Crop breeding and development of agronomic practices for utilizing legumes and special function crops (such catch crops) fitted for different production systems. Understanding of effects of modified cropping systems on associated biodiversity, synergies, and trade-offs.

Research on genetic variability of CWR as material for plant breeding with an aim of improving adaptive capacity of crop cultivars to the impacts climate change. Practical conservation actions, including monitoring, for CWR.

For conservation of genetic resources, promoting branding, and marketing of products from the native breeds and crops in order to have living populations.

65. With respect to the adoption of ecosystem approaches:

a) What are the major gaps in information and knowledge?

As in 62.

b) What are the main capacity or resources limitations?

Research on ecosystem level is inherently complex and expensive, requiring not only specialists in respective fields but also experts with cross-disciplinary research. The ecosystem approach in itself is fairly novel.

c) What are the main policy and institutional constraints?

The approach usually involves many diverse stakeholders, and hence diverse values and perceptions. Processes may be difficult and lengthy, resulting in compromises that undermine efficient implementation. Deliberation takes place at the national and regional policy level, whereas participatory processes are not integrated to local and operational level decisions.

The approach is holistic and cross-sectoral. Holism implies analytical challenges and complicated models, while the cross-sectoral characteristic implies administrative coordination and perhaps even reorganization of responsibilities, which always faces resistance.

d) What actions are required and what would be the priorities?

Promotion and broader implementation of the approaches that have proven to be effective and efficient. Piloting of approaches that have proven to be effective and efficient in other countries of the region or in areas of a similar biophysical character.

Generating up-to-date, accurate and more comprehensive information on the occurrence of threatened species across all the systems and outside the protected areas, and advice and instructions on methods of protecting them to the resource users and planners.

For the Baltic Sea and the coastal areas, generation of information on the biodiversity of underwater habitats, and on areas that are regionally, locally, and species-specifically significant in ecological terms.

Developing deliberation institutions (participatory research, policy formulation, and implementation) at local and operational level decisions.

CHAPTER 5: THE STATE OF INTERVENTIONS ON CONSERVATION AND USE OF BIODIVERSITY FOR FOOD AND AGRICULTURE

66. Identify and describe the main policies, programmes and enabling frameworks that support or specifically address the objectives below, briefly describing the policies, programmes or enabling frameworks listed and provide any available information on the extent of implementation or of lessons learned. For each objective, list up to 10 major policies, programmes and enabling frameworks.

a) Support the integrated conservation and sustainable use of biodiversity for food and agriculture across sectors*;

1. The Government adopted a resolution on the 2012–2020 strategy for the conservation and sustainable use of biodiversity in Finland in 2012 – "Saving Nature for People". All five strategic goals of the national strategy call for an integrated approach between conservation and sustainable use of resources. Goal 3 explicitly refers to the conservation of genetic diversity and Goal 4 to the benefits from biodiversity and ecosystem services. The two combined are thus relevant to biodiversity for food and agriculture. Goal 1 is about bringing the conservation and sustainable use of biodiversity into the mainstream of both government and society, which is an integrated target. The government has assigned the relevant ministries to implement the strategy by working together with civil society and other stakeholders.

The progress has been most recently reviewed in the Fifth National Report to the Convention on Biological Diversity (2014) that details the implementation for each of the Aichi targets and the lessons learned. The key highlights:

- The Convention has not yet received enough public or political recognition in the country. Only by raising public awareness, and with the support of public opinion and the broad participation of all relevant stakeholders in preparing and implementing actions on both conservation and sustainable use, can we improve our commitment to the sound implementation of the Convention.
- Biodiversity cannot be safeguarded by traditional nature conservation measures alone. The input of society as a whole is required. The strategy places economic and cultural values related to biodiversity at the heart of decision-making on the use of natural resources. Particular attention is paid to the sustainability in the use of natural resources.

2. The EU Water Framework Directive (WFD) adopted in 2009 aims at achieving good chemical and ecological status of surface waters, and good chemical and quantitative status of groundwater. Good ecological status is defined in terms of the species occurring naturally in a body of water, so it includes fisheries and aquaculture. The Act on Water Resources Management based on the WFD further indicates that surface waters and groundwater shall

be protected, enhanced and restored so that the water status objectives can be reached by 2015 at the latest. The River Basin management Plans are under review to be adopted by the Government at the end of 2015.

Implementation of the WFD has progressed in accordance with statutory actions and targets. This includes river basin management planning and development of marine spatial planning. Nature conservation objectives have been integrated within the water protection strategies. Evaluation and development of other sector legislation (environmental protection, forestry, fishery, mining, construction, and land use) has been active in 2009–2013. Amendments of the Nature Conservation Act have simplified enlargement and establishment of protected areas.

Reducing discharge of phosphorus and nitrogen from sources of diffuse pollution (mainly agriculture) is the most challenging task. The programme therefore works in close collaboration with Ministry of Agriculture and Forestry to ensure sufficient implementation of practices that reduce nutrient runoff, although there is also an important trade-off with the amount and quality of agricultural produce and competitiveness of Finnish agriculture.

Among lessons learned are positive experiences in truly cross-sectoral cooperation (for the first time, all sectors affecting waters have been brought together to meet the objectives), and the importance of a bottom-up approach in developing river basin management planning. The process in Finland has been praised by the European Commission.

3. Finland is actively involved in work in the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) to ensure that a suitable knowledge base is available to support policy decisions on biodiversity at the national and international levels. The objective of IPBES, which covers marine, inland water, and terrestrial ecosystems, are to promote the conservation and sustainable use of biodiversity and to safeguard human well-being and sustainable development in the long term. The contrast between the success stories on national biodiversity conservation and the persistent pressures on biodiversity has been acknowledged. An important lesson is that solutions must be implemented broadly across all the sectors of human activity in order to achieve the objectives of the National Strategy on Biological Diversity.

4. The proposal for Finland's National Strategy on Invasive Alien Species (IAS) was prepared in collaboration between a broadly based working group and experts, involving more than 100 people. The objective of Finland’s National Strategy on IAS is to minimize the threat and damage caused by invasive alien species, both potential and already present in Finland. The strategy is based on an integrated approach cutting across sectors. The Ministry of Agriculture and Forestry has established the Finnish Advisory Board for IAS, which acts as the expert body on questions and policies concerning invasive alien species. One of its most important tasks is to coordinate and follow the implementation of the National Strategy on IAS.

The lessons learned include that, i) action to combat invasive alien species should be taken at the earliest stage possible, because this is the most effective and least costly approach to prevent damage, and ii) knowledge on the key pathways of the (potentially) invasive species is necessary.

b) Support the conservation and sustainable use of associated biodiversity;

The material in a) addresses associated biodiversity as well. Additional relevant sectoral policies include:

1. The national EAFRD, especially its agri-environment schemes, is a key enabling framework that addresses conservation and enhancement of both production and associated biodiversity components. It does so through delivering payments to land-users for specified measures with environmental objectives. It also funds extension and advisory services on environmentally friendly practices and implementation projects.

The lessons learned include the needs for i) better targeting of the interventions on a regional, farm and even field level, ii) landscape-level planning and increased cooperation among many farm holdings, and iii) sufficient advisory services for land-users.

See also question 54.

2. The national Forest Strategy 2025 aims at developing the forest sector into a biocluster that also produces materials and services on an extensive basis for various sectors. The objectives of the programme include strengthening forest-based business and increasing the value of production, improving the profitability of forestry and strengthening forest biodiversity, environmental benefits, and welfare implications. In terms of biodiversity, the more specific aims are to halt the decline of forest habitat types and species, and to establish a favorable trend in the state of biodiversity.

The Programme is implemented across the whole country.

3. Under the national strategy for conserving the crop wild relatives a prioritized national list of CWR was produced, CWR hotspot sites identified, and a gap analysis for *ex situ* and *in situ* conservation needs performed. The key lessons include that i) the key main action to conserve CWR taxa in Finland would be to prevent overgrowing of meadows and other open habitats that are dependent on traditional extensive management; ii) studies on the population size and the genetic diversity of the threatened species are needed, iii) conservation action plans are especially needed for threatened CWR taxa within and outside conservation areas, and iv) there is a need for similar work on wild-harvested plants, many of which are not listed as CWR.

4. For the marine and coastal environments that support important fisheries, the Ministry of the Environment has established the Finnish Inventory Programme for the Underwater Marine Environment (VELMU) in 2004, implemented through cooperation between the

environmental administration, several ministries, Metsähallitus, universities, research institutions, NGOs and stakeholder groups. The surveys are currently extended from the pilot areas to cover 17 000 observation sites around all coastal areas of Finland. The inventory is due in 2015, but the work is likely to continue after the project ends. The collected data will be used, for example, to plan the maintenance and use of the marine protection areas included in the European Union Natura 2000 network, and for marine environment planning regulated by the Marine Strategy Framework Directive.

5. Policies governing fisheries have been under revision: a new law on fisheries will come into force in early 2016. The main objective of the revision is to improve conditions for natural reproduction of native fish populations and to establish a new evidence-based system for regulating sustainable fisheries. The law promotes the coordination and involvement of various stakeholders and the mainstreaming of objectives into other relevant land-use policies. The most relevant sectors are energy (with regard to hydro-energy and water-level regulation) and agriculture (with regard to reduction in water eutrophication from nutrients).

6. Associated biodiversity in forests is considered and will be affected by a number of national strategies and programmes, such as the Bioeconomy Strategy, Strategic Programme for the Forest Sector (MSO), Bioenergy Strategy, Forest Biodiversity Programme for Southern Finland (METSO), Energy and Climate Policy Strategy, and various rural and regional policy strategies and programmes.

c) Address food security and nutrition with explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods;

1. One of the objectives of the CAP is to support agricultural food production across all EU member states, achieved mainly through agricultural land-based subsidies to land-owners and investment support. The EAFRD has several measures targeted specifically at both production and associated biodiversity components (as above).

In spite of the generic policy goal, and inconsistently with it, national policies to sustain food sovereignty are discouraged in the EU. Finland's food self-sufficiency has decreased in recent years. This externalization of food ecosystems implicates increasing demand for food produced in areas and systems with little emphasis on ecosystem services and overall sustainability. An example is increase in use of soya meal imported from Latin America as feed protein for monogastrics. Through this Finland contributes to loss of biodiversity and ecosystem services elsewhere, at the same time suffering from the simplification of its own cropping systems.

2. Conservation of national genetic diversity of production species of plants and animals is seen as a key strategy of achieving food security but also promoting nutritional value. The Finnish Advisory Board for Genetic Resources has a mandate covering animal, fish, plant, and forest tree genetic resources. The council is nominated by the Ministry of Agriculture and

Forestry and its work includes apart of implementation and coordination, also newsletter and research and outreach seminars.

The Finnish National Programme for Plant Genetic Resources (founded in 2003) aims at enhancement of conservation of genetic resources of production plants in agriculture and forestry. The focus of the national activities is on vegetatively propagated plants, while the seed samples are stored collaboratively in the NordGen (the Nordic Genetic Resource Center) seed collection. The joint Nordic programme since 2010 specifically targets the development of selection procedures, methods, and decision-making tools that are adapted to northern conditions and take into account climate change. For example, in the SUPRI project, spring barley is used as a model plant for the implementation. There are several working groups for plant groups that run projects on topics ranging from the social and cultural value of genetic heritage to *ex situ* and *in situ* conservation. The national programme has also been active in outreach through various media including its website (www.mtt.fi/kasvigeenivarat), newsletter and presentations and events.

The national programme on animal genetic resources was last updated in 2004.

The country report for the FAO on agricultural plant genetic resources was prepared in 2008, the second report on animal genetic resources in 2014, and that on forest genetic resources in 2011.
3. The Finnish Seed Trade Act, 728/2000 aims at maintaining high quality crop production by promoting the supply and use of seed of high quality and adapted to Finnish conditions as well as providing relevant information.

The decree on seed production, approval and marketing that came into force in 2000 applies to cereals, forage landraces, and pulses. There is a financial subsidy for producing seed of 19 landraces and heritage cultivars. Registration of the landrace or cultivar is required, and the seed producer pays the registration costs. It also covers growing of the heritage cultivars. About 10 farms, mainly operated by old farmers who have been growing the crops for a long time, registered as seed producers for these. The obligatory registration fee, which is as high as the state support provided, has been a key obstacle to these programmes but it will be alleviated under the current EAFRD.

d) Address the maintenance of ecosystem services with explicit reference to biodiversity for food and, associated biodiversity and/or wild foods;

1. The strategy for the conservation and sustainable use of biodiversity in Finland “Saving Nature for People” specifically addresses the issue of ecosystem services derived from biodiversity. As described above.

2. Several of the measures under the EAFRD enhance ecosystem functioning and potentially are strengthening delivery of ecosystem services (as above).

3. The National Forest Strategy (as above) explicitly states ecosystem services in its objectives. With particular regard to state-owned forests, whether managed for commercial production, recreation or research, it strives to implement the objectives through better planning, management, and provisioning of advice.

4. The Ministry of the Environment chaired an ecosystem services and biodiversity planning group, the aim of which was to raise general awareness of ecosystem services, in order to structure and implement the ecosystem service goals included in the 2012–2020 strategy and action plan for the conservation and sustainable use of biodiversity in Finland. The working group promoted research and development work on the theme, with special attention paid to the wide array of benefits produced by ecosystems. The working group drafted, monitored and promoted communication on ecosystem services, enhanced cooperation between the authorities and various research institutions on projects related to ecosystem services – such as the objectives of the 2020 European Union Biodiversity Strategy – and prepared Finland's opinions for international ecosystem services meetings, such as IPBES. The TEEB Finland project's outcomes presented in early 2015 are among the most recent in this area.

e) Improve resilience and sustainability of production systems with explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods;

1. Finland's National Strategy for Adaptation to Climate Change was adopted in 2005 (see question 69).

2. See The Finnish Advisory Board for Genetic Resources in Finland in 66 c).

3. According to the national implementation framework of the EU Water Framework Directive (as above), Finland must also anticipate climate change by reducing the harm caused by floods or drought, which is relevant for resilience.

4. The strategy for the conservation and sustainable use of biodiversity in Finland, "Saving Nature for People" specifically addresses the issue of resilience in Target 15, stating that by 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks have been enhanced through conservation and restoration. Finland participates in global efforts to restore at least 15 % of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification. The impacts of the increased use of bioenergy on biodiversity and the nutrient and carbon cycles of forests have been assessed, and guidelines have been set to safeguard biodiversity. Urban biodiversity is enhanced through conservation measures, management measures, and the provision of structures that promote biodiversity. Developing so-called "green" and "blue" infrastructure nationally is also envisaged as promoting adaptation and resilience to climate change.

See above.

5. One of the objectives of Finland's National Forest Strategy 2025 is to strengthen forest biodiversity and environmental benefits. The role of forests in climate change mitigation through carbon stocks along with moves towards bioenergy, on the one hand, and adaptation of forestry practices to climate change, on the other, are taken in to account. Threats of climate change for forest biodiversity and the role of biodiversity in forest ecosystem resilience (including the state of waters and soils) are discussed.

Forest legislation is the most powerful means by which forest policy can ensure the sustainability of forestry. The Forest Act lays down provisions on the restrictions and preconditions for the use of commercial forests. In early 2014, an extensive package of the new Forest Act and related decrees entered into force. In addition to the state's obligations to protect biological diversity on its lands through protection of valuable habitats, private forest owners now also have increased freedom of choice in managing their own forest, taking biodiversity into account. The Act increased the area of designated habitats of special importance where special characteristics should be preserved. The Forest Act also allows planned and coordinated nature management and restoration measures for reinforcing the important characteristics of these habitats. The habitats of special importance to be protected now include hardwood swamps with cloudberry (a wild food resource).

f) Support farmers, pastoralists, forest dwellers and fisher folk to adopt and maintain practices that strengthen the conservation and use of biodiversity for food and agriculture.

1. The EAFRD (as above).

2. With regard to indigenous cultures, the Sámi People's traditional use of nature is protected by Akwé Kon guidelines. The National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity are being also implemented so as to safeguard the traditional livelihoods of Sámi People. Its communications programme includes information on the Nagoya ABS Protocol, on access to genetic resources and on the fair and equitable sharing of benefits arising from their utilization. The Sámi Parliament is a party to the negotiations and implementation.

3. Policies governing fisheries have been under constant development, for example a new act on fisheries will come into force in 2016. The Fish Passage Strategy (2012) aims at reinforcing, in particular, the natural reproduction of threatened migratory fish stocks. Reaching the objectives requires several measures, depending on the specific watercourse and fish stock, with fish passages as one of the main elements. The Strategy calls on assessing the need for fish passages and the selection of sites, supporting and improving cooperation to promote the projects, and promoting the implementation of other support measures concerning the recovery of migratory fish stocks as part of the fish passage solutions.

4. Forest owners have access to additional funding for protection of biodiversity on privately owned forest land (METSO Programme). The programme is among the biggest investments of the Finnish government into conservation. The agreements are supported by advice on managing forests while taking biodiversity into account.

5. Under the Ministry of Agriculture and Forestry, several policy documents have been prepared for sustainable management of game. For example, Management Plan for Forest Game Bird Species Populations in Finland (2014). The aim is primarily to improve habitat and population management of the game in the managed forests. The Plan stresses the long-term character of the work for it to have an appreciative effect on the game populations and suggests that the local habitat management may offset the potential negative impact of the climate change. The key role in the Plan implementation resides with private forest owners because the activities are totally voluntary. This highlights the importance of adequate information, advice, training and cooperation

67. List up to 10 major policies, programmes and enabling frameworks in your country that enhance the application of an ecosystem approach or a landscape approach and that contain an explicit reference to biodiversity for food and agriculture, associated biodiversity and/or wild foods. Include a brief description of the policies, programmes and enabling frameworks together with any information on the extent of their application (production system and area) and observed effect. Where possible provide examples of best practices or lessons learned.

1. The Finnish Board on Ecological Restoration is a nationwide cooperation body established by the Finnish Forest Agency. The working group's task is to evaluate, develop and promote the quality of the ecological restoration and management of natural and semi-natural habitats, and their impact on society. Members include actors in the management of Finland's natural environments and semi-natural grasslands, researchers, and other experts. Its activities cover habitats on land and in freshwaters, in protected areas, in forests, and on agricultural land, whether state-owned or in private ownership. In every case, activities in privately owned areas are performed in cooperation with landowners. The group has solid scientific expertise and develops practical expertise by preparing guidebooks on the topic in question, and organizing training events and seminars. Specific focus areas for restoration are forest ecosystems, semi-natural grasslands, peat-lands, and freshwater habitats.

The extend and lessons are described under respective restoration programmes and projects (e.g. METSO).

2. Development of the national network of protected areas involves ecosystem and landscape approaches. The most relevant types of areas are national parks, Natura 2000 areas, High Nature Value farmlands, and Baltic Sea protected areas. National parks have rules and regulations to ensure that use of land, including that for food production and forestry, does not hinder associated biodiversity. Collection of wild foods is permitted in the national parks.

The Natura 2000 network is in place to conserve important biotopes and species throughout Europe, but it does not preclude activities that do not compromise conservation efforts, including food production, recreational fisheries and use of wild foods. The network covers mainly underwater vegetation in the archipelagos and along the coast, lakes, large rivers, small bodies of water, cliffs, and cultural environments (such as heritage farms).

The ecosystem approach is based on the national evaluation and conservation of the biotopes according to the IUCN criteria. Several cultural biotopes traditionally used for food production are among the most endangered.

3. With regard to aquatic ecosystems, the River Basin Management Plans, adopted by the government, the "Programme of Measures" and "Programme for Implementation of River Basin Management Plans 2010–2015" will also promote the conservation of biodiversity and the pursuit of sustainable use objectives. These describe the measures required to achieve good water quality over entire watersheds. The measures considered necessary include restoration of potential spawning and nursery areas, construction of fishways and maintenance of natural by-pass channels, removal of obstacles preventing fish migration up and down rivers, decreasing loads, and the use of natural hydrological engineering methods. The impact of these measures is enhanced by regulating fishing and fish introductions and by providing guidance on, among others, the sustainable use of migrating fish populations. The focus therefore shifts from the re-stocking of the threatened and degraded native populations of fish towards a more holistic management of the ecosystems with the objective of supporting natural reproduction.

The effectiveness of some of these measures is well established (for example, construction of fishways and by-pass channels), but the overall effects will be seen with time.

4. The National aquaculture spatial plan was approved in 2014. The aim of spatial planning is to minimize the load of aquaculture in areas that are environmentally and recreationally vulnerable. Production is thus allocated to areas with better tolerance of emissions. The aim of spatial planning is to move the production to the outskirts of water systems, which would also reduce the conflicts between other water system uses, such as leisure housing, recreational use, and nature conservation. Furthermore, centralizing the small units of one company increases the profitability of aquaculture and minimises its carbon footprint.

The proposal for the new guidelines for environmental protection in fish farming was completed in 2013. The guidelines for environmental protection in fish farming are general ones on best practices in fish farming for ensuring environmental protection. The objective of the guidelines is to streamline the authorities' operations and monitoring. In Finland, the starting point for the development of fish farming is the reconciliation of business and environmental policies. The aim is to create the prerequisites required for an ecologically and economically sustainable increase of production.

5. For forestry, the principal policy framework is the National Forest Strategy 2025. Both the Strategy and the METSO Programme have elements of the ecosystem and landscape approaches and deal with associated biodiversity and wild foods. The whole country is covered by the programmes but the focus is particularly in southern Finland, where the smallest share of forests is under state protection, and hence where certain forest types and species most urgently need protection.

In Finland 13% of the surface area of forests and scrubland is strictly protected or in restricted forestry use. This includes the habitats of special importance specified in the Forest Act. The share of strictly protected forests is 9%, which is internationally very high. As regards the need, however, protection areas are unevenly distributed between the different parts of the country: in southern Finland the share of strictly protected forests of the forest area is just 2.3% while in northern Finland it is 15.8%.

During 2008–2011, altogether 16 000 hectares of privately owned forests were permanently protected and 21 000 hectares were safeguarded under temporary conservation agreements. Also, 14 000 hectares of the state-owned forest were protected. The biological value of the areas safeguarded under METSO has been confirmed to be high, and the METSO sites complement the existing network of protected areas. However, even if the overall target of the Programme is implemented (about 125 000 hectares), the total would be modest in relation to the national forest area of about 23 million hectares. Three lessons can be drawn from the experiences with METSO programme. Firstly, there is a need for the most cost-efficient allocation of this major public investment. Secondly, METSO-based protection can be even more integrated with other tools for forest conservation and general land use planning; for example, practicing of light use (non-clear cut) forestry in the buffer zones around METSO sites. Thirdly, the voluntary nature of the programme as an alternative to the existing legislative protection has been cited as one of the reasons behind the success of the programme's implementation.

6. The National Assessment of the Economics of Ecosystem Services in Finland (TEEB Finland) (2013–2014) aimed to initiate a systematic national process to incorporate the value of ecosystem services into all levels of decision-making. The project's goal was to identify Finland's key ecosystem services and to propose methods that assess their current status and future trends. It also aimed to provide preliminary estimates on the economic importance of some key services, especially the ones that so far remain under-recognized, such as regulating and cultural services. TEEB Finland analyzed the opportunities for improving the governance of ecosystem services, including exploring how ecosystem services can be linked to supporting the development of sustainable green economy. The project produced recommendations for effective integration of ecosystem services into decision-making processes, and for governing natural capital and ecosystem services. Finally it identified major knowledge gaps. The report is due in January 2015.

7. Use of land administered by Metsähallitus (that is, state owned) and of waters is planned in multi-objective resource planning. The aim is to reconcile the opportunities and needs of different stakeholders in terms of use for nature conservation, forestry, recreation, eco-tourism, real estate development and land trade. The natural resource planning process assesses characteristics of the region in terms of economic, ecological and social sustainability. Ecological assessment aims to ensure the survival and dispersal of living organisms. The social review evaluates the use of the area, including that for recreation subsistence needs. A variety of alternative calculations to illustrate the dependency relationships between different approaches, as well as the advantages and disadvantages, are calculated.

Metsähallitus staff and local stakeholders (so-called co-operation groups) take part. The key output is region-specific land use guidelines.

68. Describe up to 10 major policies, programmes and enabling frameworks in your country that embed the use of biodiversity for food and agriculture, including its different components, into disaster management and response.

A completely revised Mining Act came into force in July 2011. The objective of the new Act is to safeguard mining and ore prospecting in a socially, economically and ecologically sustainable manner. Under the Act, permit consideration is based on a comprehensive survey, taking account not only of the requirements of ore prospecting and mining, but also other factors such as the environmental impacts of operations, impacts on the landscape, land use and safety (including sparing use of natural resources, nature conservation, and the reconciliation of the different needs for use of areas). Additionally, possible restrictions in other legislation, such as the Nature Conservation Act, should be taken into account when granting permits. Environmental permits for mining are determined under a permit procedure in accordance with the Environmental Protection Act.

69. Describe up to 10 major policies, programmes and enabling frameworks in your country that embed the use of biodiversity for food and agriculture, including its different components, into climate change adaptation and mitigation strategies and plans (NAPAs, NAPs, NAMAs, etc.).

1. The National Strategy for Adaptation to Climate Change was adopted in 2005. The most recent evaluation was conducted in 2013 to assess the progress in adaptation as well as to give feedback and recommendations for the revision of the strategy. The aim of this adaptation strategy is to develop the country's capacity to adapt to climate change and to reduce the costs to the society where possible. The strategy describes the impacts of climate change and potential adaptation measures for 15 sectors for a period extending until 2080. The revision, "The National Adaptation Plan for Climate Change 2022" was published in 2014. The most important measures to be taken by 2015 are:

- the integration of climate change adaptation into routine planning, implementation, and development processes;
- preparations for extreme events and assessments of the impacts of climate change incorporated into the planning of long-term investments;
- improvement and establishment of existing and new observation and warning systems;
- implementation of the Climate Change Adaptation Research Programme 2006–2010;
- preparations for forthcoming changes in the international operating environment.

2. The National Climate and Energy Strategy (2008) aims at ensuring that the national targets for 2020 are achieved and to prepare a pathway towards meeting the long-term energy and climate objectives set by the EU. The long-term goal is a carbon-neutral society. Implementation will have an indirect impact on biodiversity through mitigation of climate change. However, some implementation pathways, such as increases in peat production and in the use of forests for bioenergy, are likely to cause an additional strain on biodiversity. The instructions for forest biomass remove for bioenergy some with mitigation measures aimed at minimizing the adverse impact. The issue remains highly debated.

3. National plant and animal breeding programmes.

Conservation of genetic resources aims not only at securing availability of the resources to meet the needs of farmers, plant and animal breeding and research, but also for more efficient utilization of these resources in the face of climate change.

See above.

4. All the key Programmes and strategies in Finland relevant to conservation, and to biodiversity for food and agriculture, explicitly address climate change adaptation issues and actions.

70. What arrangements are in place or foreseen in your country that help to ensure that the conservation of biodiversity for food and agriculture is taken into account in national planning and policy development of sectors other than agriculture (e.g. NBSAPs or infrastructure development such as transport or energy)?

Finland has submitted the NBSAP in 2013 based on its National Strategy for the Conservation and Sustainable Use of Biodiversity 2012–2020 (“Saving Nature for People”). One of the key strategic goals is to mainstream biodiversity conservation issues (including that for food and agriculture) into all relevant sectors. Therefore, relevant ministries have been directed to implement the strategy by working in cooperation with civil society, commercial interests, and other stakeholders to create a cost-effective and purposeful action plan that contains quantitative and qualitative bases for monitoring. Sufficient resources are allocated to the Sámi Parliament to take part in the implementation of the NBSAP.

One of the strategic aspects of the NBSAP specifically takes biodiversity into account in both land-use and traffic route planning. Planning must be based on sufficient and correctly targeted biodiversity impact assessments, extending to the natural environment outside the area covered by the plan, and to the functioning of ecosystems. Although environmental impact assessment is a standard practice in Finland, it often focuses solely on the occurrence of certain species and habitats in the area under planning. A more holistic ecosystem-based approach is called upon.

A completely revised Mining Act came into force in July 2011. The objective of the new Act is to safeguard mining and ore prospecting in a socially, economically and ecologically sustainable manner. Under the Act, permit consideration is based on a comprehensive survey, taking account not only of the requirements of ore prospecting and mining, but also other factors such as the environmental impacts of operations, impacts on the landscape, land use and safety (including sparing use of natural resources, nature conservation, and the reconciliation of the different needs for use of areas). Additionally, possible restrictions in other legislation, such as the Nature Conservation Act, should be taken into account when granting permits. Environmental permits for mining are determined under a permit procedure in accordance with the Environmental Protection Act.

The objectives of the National Forest Strategy 2025 have been approved by other major stakeholders, including its policies on climate and energy as well as rural and regional policies and strategies. The growing use of forests for bioenergy production has to be balanced with biodiversity conservation, which is attempted through instructions for minimizing the impact. The Strategy acknowledges that there are trade-offs in pursuing both objectives, so engagement of the energy sector is essential (see also the National Energy and Climate Strategy 2013).

The TEEB Finland project ("Economics of Ecosystem Services and Biodiversity Finland 2013–2014") aimed to systematically incorporate the value of ecosystem services into all levels of decision-making. The project will also analyze the opportunities for improving the governance of ecosystem services, including exploring how ecosystem services can be linked to supporting the development of sustainable green economy. The project will produce recommendations for effective integration of ecosystem services into decision-making processes, and for governing natural capital and ecosystem services.

The Fifth National Report to the Convention on Biological Diversity (2014) states that “Evaluation and development of other sector legislation (environmental protection, forestry, fishery, mining, construction and land use) has been active in 2009–2013”.

71. Has your country identified any obstacles to developing and implementing legislation that would protect associated biodiversity? List and describe initiatives in Table 25.

Table 25. Obstacles to developing and implementing legislation that would protect associated biodiversity identified in the country

Component of associated biodiversity	Obstacles to legislation for protection of associated biodiversity
All	Natura 2000 network: opposition from land private land owners
Forest biodiversity	Forest Act: development and implementation of the new legislation has been challenging
Aquatic biodiversity	Fisheries Strategy: optimization of water levels
Threatened migratory fish stocks	Fish Passage Strategy: biological factors and existing management
Agricultural and aquatic biodiversity	Nitrate Directive: opposition of land users to legislative restrictions
All	Public or political recognition
All	Funding

Provide a concise description of the obstacles to legislation reported in Table 25 and specify a course of action proposed to address this, where possible. Where possible provide examples of best practices or lessons learned.

The implementation of the Natura 2000 network demanded by the EU on Finland's accession, was met with severe opposition of land owners. They objected to legislative protection of biologically valuable sites designated by environmental administration and experts, because of the purely top-down and rapid enforcement of designation, and the insufficient negotiation with the stakeholders. This provided a valuable learning experience, and many important lessons were drawn from it so that similar mistakes are avoided. In the most recent conservation policies (as exemplified in this report), extensive negotiations with stakeholders have been commonplace.

The process of changing the legislation on forestry (the Forest Act), has been laden with difficulties of deliberating among opinions and interests of owners, industry and public. The challenge is to change the prevailing infrastructure and traditions of several decades in forest management. The forestry industry is highly centralized, and used to be dominated by the pulp industry. Currently, an even more diversified use of forestry has received a political backing. The lack of support and skills at ground level for non-traditional forest management methods remains an obstacle to the law's implementation though special training has been recently provided. Awareness building, updated vocational education and valorizing best practices are needed.

Serious challenges for the implementation of the Fisheries Strategy lie in optimizing patterns of water-level regulation for both biodiversity (including fish) and production of hydro-energy. Funding for the implementation is clearly insufficient, due to the high expense of construction of fish passages. Implementation of the Fish Passage Strategy is further complicated by regulation of fishing, weak status of the original spawning areas, and changes to mandatory stocking. Secure funding, strong commitment from the parties involved, piloting and valorizing of best practice are needed.

There has been strong opposition to more stringent, although scientifically justified, restrictions on maximum allowed levels of both nitrogen and especially phosphorus fertilizers as part of Nitrate Directive and agri-environmental programme. The restrictions are needed at a level that would reduce pollution of waters yet support good quality yields, both of which vary with soil type, land use history, and crop. The farmer representatives strongly favored voluntary agreements and subsidized practices rather than legislative tools to reduced fertilization. Nevertheless, this is expensive to implement and subject to willingness to join the agreements. The example highlighted the complexity of implementing a policy through normative as compared to voluntary approaches. Further political pressure, evaluation of the cost-efficiency of the available political tools, participatory projects and best practice development are needed.

Despite decades of awareness building, there is still a generally low level of public or political recognition of the Convention of Biological Diversity and its objectives. Lack of understanding of the role of associated biodiversity and ecosystem functioning slows down integration of its conservation into the existing policies and frameworks. Awareness building, especially on functional roles of different components of biodiversity, is needed. The role of independent advisory bodies drawing attention to biodiversity issues as part of general land use and providing best available knowledge and expertise on biodiversity-friendly practices is critical.

Reduced funding for conservation, as part of general economic instability, is a looming concern for the implementation of all policies (currently, only 0.6 % of the state funding is allocated to the Ministry of Environment). Commitments from the decision-makers, diversified sources of funding and operational cost-efficiency are needed. Coherence in policies (e.g. removal of perverse subsidies) is a way for achieving cost-efficiency. Finland is examining its possibilities for increasing its economic, intellectual and technical efforts to implement the CBD and to identify all suitable resources.

72. Has your country taken measures with the aim of ensuring that access to its genetic resources shall be subject to its prior informed consent (PIC) and that benefits arising from their utilization shall be shared in a fair and equitable manner? If yes, identify for which resources and for which uses (e.g. to conduct research and development on the genetic and/or biochemical composition of the genetic resource) prior informed consent has to be obtained and benefits have to be shared. Indicate in Table 26 for the different categories (and possibly uses) of associated biodiversity, if prior informed consent has to be obtained and benefits have to be shared (Y: yes, N: no).

Table 26. Policies and programmes governing the access to its genetic resources of associated biodiversity established in the country.

Component of associated biodiversity	Intended use (e.g. any use, research and development, commercial use)	PIC and benefit-sharing required (Y/N)

Finland is committed to the ratification (in 2015) of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization as expressed in Target 16 of the National Biodiversity Strategy.

Prior to ratifying the Nagoya ABS (Access and Benefit-Sharing) Protocol, Finland will examine the national legislative measures, new legislation, if any, and the implementation system required for the ratification of the protocol. The system to be devised, and its implementation tools, will be harmonised with other national, international, and EU legislation on genetic resources. The starting point for the system controlling access to genetic resources and sharing of benefits is the basic principle of the Convention, establishing the full rights of states to their own natural resources. Hence, states can themselves determine the tools they use for achieving the Convention's goals.

See question 73 for specific information related to indigenous communities.

73. Has your country taken measures with the aim of ensuring that the prior informed consent or approval and involvement of indigenous and local communities is obtained for access to genetic resources and that benefits arising from the utilization of genetic resources that are held by indigenous and local communities, are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms? If yes, provide a description of the measures and where possible, examples of best practices or lessons learned.

Governance of the involvement of Sámi people in the decision-making concerning utilization of the genetic resources and related traditional knowledge held by them is currently based on the following international agreements: the Convention on Biological Diversity, the Universal Declaration on Human Rights, and the Convention for the Safeguarding of Intangible Cultural Heritage. There is currently no specific national regulation or practice for the governance of access to and benefit sharing of genetic resources and traditional knowledge held by Sami people.

In future, the main instrument for governance of access to and benefit-sharing of genetic resources and related traditional knowledge will be the Nagoya Protocol. Implementation of the Protocol to national legislation is presently ongoing. Compliance of the Protocol will be based on EU Regulation 511/2014, which has already come into force. Access to genetic resources will be regulated by a specific national law. It is anticipated that the law will come into force during 2015. Specific national regulation will also be drafted on access to and use of the genetic resources and related traditional knowledge by the Sami people.

Information management

74. List and describe any linkages between sector information systems on biodiversity for food and agriculture at national level. Where possible provide examples of best practices or lessons learned.

Specifically for biodiversity for food and agriculture there has been extensive cooperation across the production sectors in conservation of genetic resources of production species of plants and animals. There exists a The Finnish Advisory Board for Genetic Resources in Finland, whose mandate covers animal, fish, plant and forest tree genetic resources. The council is nominated by the Ministry of Agriculture and Forestry and its work includes, apart from implementation and coordination, also newsletters, research and outreach seminars.

The examples below cover all species, including those that are used or potentially can be used for food and agriculture.

Approximately 120 indicators included in the national biodiversity indicator collection at www.biodiversity.fi have been generated in close collaboration among all relevant institutions and administrations.

Seven Finnish research institutions, agencies, and organizations have been collaborating in creating a national web-portal of invasive alien species www.vieraslajit.fi.

LYNET is a network of research and development projects in the field of natural resource management, to which all sectoral research and academic institutions contribute.

Finland is a member of the Global Biodiversity Information Facility (GBIF) established in 2001. Recent policy decisions require free access to information generated using public funds. The programme's aim is to digitize and share through GBIF all information deposited in Finnish museums of natural history as well as that collected by research institutions, authorities, and amateur naturalists. So far, 14.6 million specimens of national biodiversity-related data are shared with 10 national information sources for GBIF in Finland. One of the lessons learnt was realizing the need for a virtual Finnish Biodiversity Information Centre that would enable integration of the species observation systems of expert amateur naturalist communities into professional systems and thereby facilitate wider use of existing data. Also, it forced development of other existing data systems, such as the environmental administration's TAXON database for red-listed species.

In 2011 the forestry sector introduced a national operating model for the transfer of information on threatened species and its use in forestry. The model makes available to forestry organizations information compiled by environmental bodies. The model also gives instructions on how data on the occurrence of threatened species can be taken into account in forestry planning and implementation. Information has also been produced on species recognition, habitat requirements, and treatment recommendations. The landowners and

actors in the forest sector have access to the presentations of the species to be used in forest planning, and advice on implementation of forest treatments.

75. Has your country established national information systems on associated biodiversity? List in Table 27, along with a description of the components of associated biodiversity addressed, and a brief description of information included, use and applications of the information system.

Table 27. National information systems on associated biodiversity in the Country.

National information system (List)	Components of associated biodiversity addressed (List)	Concise description of information systems
Biodiversity.fi	All	Includes more than 100 indicators reflecting the development of various components of biological diversity as well as factors driving these developments. Financed by the Ministry of Environment and it has been developed in close cooperation by Finnish environmental research organizations and non-governmental organizations
LYNET portal		A database of research and development projects in field of natural resource management
National web-portal of invasive alien species	Invasive alien specie	www.vieraslajit.fi; general information on alien species and their management options, a species-specific search feature
The Finnish Inventory Programme for Marine Underwater Environment VELMU (2011–2015)	Species, communities and habitats of underwater environment	The goal of the programme is to create a knowledge basis for conservation of underwater environment, support sustainable use of marine resources, and aid in informed Maritime Spatial Planning

76. Has your country established information systems intended to support maintenance of traditional knowledge on biodiversity for food and agriculture, including associated biodiversity? If yes, describe these and include information where available on socio-economic, policy and collective action aspects.

One of the headings of LUMONET is Indigenous Peoples, under which information related to Sámi culture and natural resource use is collected.

Stakeholder participation and ongoing activities that support maintenance of biodiversity for food and agriculture

77. List the most important stakeholder groups, including groups or associations of farmers, forest dwellers, fisher folk and pastoralists, NGOs or other civil society organizations active in the conservation of biodiversity for food and agriculture. Briefly summarize their scope, objectives and activities and any outcomes to date. Where possible provide examples of best practices or lessons learned.

The Central Union of Agricultural Producers and Forest Owners (MTK) and its sibling organization The Central Union of Swedish-speaking Agricultural Producers (13 000 members) are a trade organization and interest group representing farmers, forest owners and rural entrepreneurs. MTK has approximately 150 000 members in local agricultural producers' organizations and regional forest owners' unions. www.mtk.fi/en_GB/

The Finnish Wildlife Consortium was founded in 2011 under the auspices of the Ministry of Agriculture and Forestry. This taskforce is comprised of the Ministry and relevant publicly funded organizations: Finnish Wildlife Agency, regional game councils, Finnish Game and Fisheries Research Institute, Finnish Forest Research Institute, Metsähallitus, and Finnish Food Safety Authority. Its tasks are to secure viable game populations, assure diversified and sustainable use of game, and to coordinate the game management according to different expectations. It adopts a strategy and working documents to guide the implementation. Game administration is set with the goals of striking a balance between viable game animal populations, ethical and responsible hunting, and keeping wildlife conflicts and damages caused by game animals under control. The newest impact goal is to create well-being through game husbandry.

The Finnish Hunters' Association was founded in 1921. It aims to influence the future of hunting in Finland and the EU level. The Association has more than 2 600 local hunting clubs with a total of nearly 160 000 members. Among other activities it has been actively managing game populations and their habitats on agricultural and forested lands as well as wetlands. www.metsastajaliitto.fi

The Federation of Finnish Fisheries Associations is a national bilingual organization developing and promoting fisheries. Together with its member associations and other stakeholder groups it promotes the availability of high quality and clean Finnish fish and fishing experiences for everybody. Management, use and control of fisheries are based on management plans drawn up by district fisheries. The associations comprise 3000 local fishery societies, 200 fishery districts, 150 fishermen's associations, and 150 other fishing-related organizations. A major proportion of Finland's 450 000 cottage owners are members of a local fishery organization. Altogether there are some 800 000 members. www.ahven.net.

The Finnish Federation for Recreational Fishing was founded in 2000. The founder members were the Finnish Association for Recreational fishing, the Finnish Association for Hunters and Fishermen and the Finnish Federation for Sports Fishing. The Federation promotes all kinds of recreational fishing which are beneficial for naturally self-renewing fish stocks in a sustainable and versatile way. www.vapaa-ajankalastaja.fi/?lang=en

The Finnish Fish Farmer's Association is an interest group founded in 1964. Its objective is to protect the operational conditions of aquaculture and at the same time to ensure the supply of fish in Finnish food production. The association promotes the interests of fish farmers and is represented in research and development projects concerning production engineering,

quality and environmental issues in aquaculture. It is actively involved in international organizations (for example, the Federation of European Aquaculture Producers and Copa-Cogeca) and is active in the EU work (for example, in the Aquaculture Advisory Council). www.kalankasvatus.fi/en/kalankasvattajaliitto/

The Finnish Professional Fishermen's Association (SAKL ry.) is the representative of Finnish professional fishermen and the fishing industry. www.sakl.fi/index.php/fi/sahkeet

The Finnish Organic Association promotes Finnish organic production, as well as business and consumer activity. Conservation of nature and better utilization of natural processes are among the objectives of organic production. www.luomuliitto.fi/jarjesto/

The Finnish Organic Research Institute's expert network operates under the University of Helsinki and MTT Agrifood Research Finland (the latter is currently part of the Natural Resources Institute). The Institute promotes organic food production and consumption throughout the Finnish food chain by the means of research, science, communication, education, and development projects. www.luomuinstituutti.fi/en/

The Finnish Landrace Association Maatiainen states its main purpose as to conserve traditional varieties of ornamental and useful plants, original landraces of domestic animals and rural landscapes and to promote their active utilization. www.maatiainen.fi/english.htm

The Association of Useful Plants promotes organic farming in the home. www.hyotykasviyhdistys.fi/yhdistys

The Finnish 4H Organization runs Forest Education, which aims to develop in young people an appreciation of the importance of conserving forest land as a source of products, benefits, and services necessary for quality living.

The national environmental NGOs have a common working group on agriculture (Jämyrä) that aims at collaborative engagement on agricultural policy formulation and implementation.

Leader Local Action Groups (funded under the EAFRD) are registered associations that develop rural areas by funding local rural development projects and supporting local enterprises. A few of the projects deal with multifunctional development of rural areas, therefore also enhancing their ecological sustainability. There are 55 of such groups in mainland Finland and one in the Åland Islands.

The National Rural Network coordinates and helps to ensure commitment on rural development issues, disseminating information on the opportunities and achievements of the rural development programmes.

78. Describe any incentives or benefits to support activities for the conservation and sustainable use of biodiversity for food and agriculture or associated biodiversity (such as payments, provision of inputs, subsidies or other forms of incentives/ benefits). Briefly

describe how these have been applied, to what extent and the stakeholders involved (including provisions on gender balance if any). Indicate any lessons learned and planned development incentives.

The agri-environmental schemes under EAFRD are a key funding framework that addresses conservation and enhancement of both production and associated biodiversity components. It does so through delivering payments to land users for specified measures with environmental objectives. It also funds advisory services on environmentally-friendly practices and implementation projects. The payments are available mainly to land owners, but also other stakeholders. Especially the LEADER mechanism is based on broad stakeholder participation. Overall, 91 % of farmers receive some form of such subsidies, which cover 94 % of the utilized agricultural area. The agreements with the state are made for 5 years. Also, one-off investment support is available for drastic improvements such as habitat restoration or construction of multifunctional wetlands.

The implementation scope and lessons learned are described under 67. The revised version of the Programmes will be launch in 2015. Among the changes, the incentives for organic production and management of the traditional biotopes are strengthened. The payments for the conservation of genetic resources of production plants and animals are also improved. On the other hand, most of the funding will be paid for activities without tangible outcome for biodiversity (such as planning) and funding for more demanding and efficient measures, including those focused on biodiversity, is estimated to fall short of need and programme targets.

The Forest Biodiversity Programme for Southern Finland (METSO) provides payments to forest owners specifically for biodiversity protection on privately-owned forest land. The agreements are supported by advice on management methods for better taking biodiversity into account. The implementation scope and lessons learned are described in 67.

There are three relevant international certification schemes for modified land-use implemented in Finland. About 8 % of agricultural land area is certified under IFOAM (International Federation of Organic Agriculture Movements) organic production criteria.

The Forest Stewardship Council (FSC) promotes responsible forestry; the first Finnish national standard came into force in spring 2011. So far, 461 000 hectares of forests have been certified http://fi.fsc.org/index.htm (in Finnish), predominantly by forest-based industry companies as well as private forest owners under group certification of the companies.

The Programme for the Endorsement of Forest Certification schemes (PEFC) aims at promoting ecologically, socially, and economically sustainable forestry throughout the world. Approximately 20.7 million hectares of Finnish production forests (95 %) are certified under the Finnish PEFC system. The Finnish system was endorsed for membership of PEFC in the year 2000. Ecological sustainability criteria take into account biodiversity e.g. by preserving

typical forest habitats and ensuring species survival. For example, as a result of PEFC certification the number of retention trees at clear felling sites has increased.

A novel, recently developed certification scheme has been developed for meat from animals grown on semi-natural pastures ("meadow meat"). The target is to enhance sustainable utilization of forage from such biologically valuable habitats and prevent their abandonment. The scheme is not yet implemented.

The Marine Stewardship Council (MSC) label is known to about 30 % of Finns but only 6 % are able to interpret it as a sign for sustainable fisheries. At the market, there are 336 MSC products and 14 enterprises are certified.

79. List up to 10 major projects (either in progress or completed in the last five years) that support the conservation and sustainable use of biodiversity for food and agriculture, associated biodiversity and/or wild foods. For each project listed describe the components of biodiversity, the production system and area covered, and the results, outcomes and lessons learned. Projects described in sector reports need not be described here.

1. TEHO & TEHO Plus projects:

See question 54.

2. Return of Rural Wetlands:

See question 54.

3. Järki project:

The project focuses on agri-environmental issues, i.e. water protection, biodiversity and related recreational use in Finland. www.jarki.fi/en/node/62.

4. Pasturing bank:

National online web tool that links landowners with potential pastureland to owners of animals in need of a pasture; especially targeted at maintenance of semi-natural grasslands; www.laidunpankki.fi/

One of the biggest problems in Finland is the overgrowing of meadows and other open habitats due to lack of grazing. The "Pasturing Bank" is a network tool that was established in 2005 as a project output. It is a nationwide network that enables landowners and owners of grazing animals find each other. The aim of the Pasturing Bank is to increase the contractual relationship that benefits both land and cattle owners. Pastures provide welfare, appropriate exercise and a balanced diet for the grazing animals. Grazing animals also enliven the landscape and create a positive image of agriculture and the countryside.

In 2010 the Pasturing Bank's website received more than 10 000 per year, with popularity continuing to increase. The number of entries is on average 120–150. The website is owned by the advisory organization ProAgria South-Finland, with MKN Landscape Services Ltd responsible for the updates. The key lessons learned are that the landscape grazing requires careful planning and contracts. One practical challenge is the daily control of the animals, which usually requires the participation of a landowner or local association.

5. PGR Secure:

PGR Secure is a collaborative EU-funded project 'Characterization of biodiversity resources for crop wild relatives to improve crops by breeding'. The Finnish part of the project was national in scope, and covered all relevant biotopes (mainly within agricultural systems). It produced a prioritized national inventory of CWR for Finland (of 209 taxa), identified CWR hotspot sites (five areas that, if established as genetic reserves, would conserve over 60 % of the priority species), and conducted a gap analysis for *ex situ* and *in situ* conservation needs. The project thus contributed to the implementation of the National CWR Strategy for Finland.

The key findings of the project were: i) the key main action to conserve CWR taxa in Finland would be to prevent overgrowing of meadows and other open habitats that are dependent on traditional extensive management; ii) for threatened species, studies on population levels and their genetic diversity are needed; iii) especially threatened CWR taxa need conservation action plans within and outside conservation areas; and iv) there is a need for similar work for wild harvested plants, many of which are not listed as CWR.

6. Baltic Sea Farmer of the Year Award:

The Award was founded 2009 by Worldwide Fund for Nature in cooperation with farmers' organizations from around the Baltic Sea. The purpose of the award is to highlight best practices in "Baltic-friendly" farming and to recognize and highlight farmers who are leading in innovative measures to reduce runoff from their farms. The award intends to promote cooperation around the region in implementing best environmental practices in agriculture. The focus is at reducing nutrient runoff, but enhancement of associated biodiversity is also among the criteria.

A prize sum of 1 000 € is given to each national winner and a prize sum of 10 000 € to the regional winner, selected by an international jury. The winning farms with their innovative agriculture practices are presented in an open-source booklet Best Practices of Baltic Friendly Agriculture (available online).

The key lesson learned is realization of how much success depends on highlighting farmers and farms (both organic and traditional) who are taking concrete and innovative measures to achieve more sustainable agriculture, and thereby contributing to creating a healthier Baltic Sea. They provide inspiration not only to other farmers in the region but also to many other stakeholders in the Agricultural and Environmental sectors. The competition has also helped

facilitate discussions between farmers/agricultural sector and the environmental sector – ministries, universities, NGOs etc. In 2014, the Polish national competition reached a new high with 27 applicants and won the European Commission CAP Communication Award in 2013.

The Rapala fund distributes some 20 000 € for small-scale activities in the fisheries sector for supportive actions to promote, among other, biodiversity issues.

7. Härkää sarvista (HÄÄVI):

The HÄÄVI project organized landscape management for high nature value areas mainly in Central Finland during 2009–2012. The project created cooperation networks facilitating contracts between owners of valuable sites and cattle owners. The results were encouraging – the grazing area covered 220 hectares of endangered traditional biotopes with threatened species. Management plans were created for approximately 1 000 hectares comprising nearly 140 contracts. The project prevented harmful overgrowth of the landscape and encouraged local people to take care of nearby landscapes. The project was rewarded as the best landscape project in Finland in 2014.

80. List in Table 28 up to 10 major landscape based initiatives to protect or recognize areas of land and water in your country of particular significance for biodiversity for food and agriculture.

Table 28. Landscape based initiatives to protect or recognize areas of land and water in the country with particular significance for biodiversity for food and agriculture.

Landscape based initiatives*	Description of sites and their characteristics of relevance to biodiversity for food and agriculture	Extent (area)
IUCN	Category V: Civil campsites, recreational forest (Inari); use of wild foods is allowed	1 215 km²
UNESCO	Merenkurkku archipelago; no agricultural use but recreational fishing is allowed	1 944 km²
High Nature Value (HNV) farmland	Many places around Finland, especially in Åland islands; high relevance for agricultural biodiversity	An estimate for 2012 is 199 000 ha (8.6 % of the UAA)
Programmes for the Protection of Old-Growth Forests and Herb-Rich Forests	According to the national criteria, across the country; very low relevance for agricultural biodiversity but high for fisheries and wild foods	320 000 ha and 5 300 ha
Forest Biodiversity Programme for Southern Finland METSO	10 types of biologically valuable forest biotopes on private land; very low relevance for agricultural biodiversity but high for fisheries and wild foods; in implementation an optimization software Zonation is being used to account for the whole network conservation efficiency	41 000 ha
Regional ecological planning	The main approach of Metsähallitus towards multi-purpose land-use planning for forest use that takes into account economic use, biodiversity and ecosystem services protection. Use of forests for procurement of wild foods is an integral part of it.	To date, 112 plans have been made.
Natura 2000 network	Incl. protected areas, wilderness areas and areas taking part in nature conservation programmes; very low	49 000 km² (15 % of the territory)

	relevance for agricultural biodiversity but high for fisheries and wild foods; includes also heritage farms	
Regional planning for biodiversity in agricultural landscapes	Aimed at increasing participation of farmers in the agri-environment schemes specially designed for biodiversity enhancement (e.g. management of semi-natural grasslands); run across the country	210 620 ha
Finnish Inventory Programme for Marine Underwater Environment VELMU (2011–2015)	Aid in informed Maritime Spatial Planning and a Finnish Marine Atlas; high relevance for fisheries	Ca. 17 000 observation sites

Collaboration between institutions and organizations

81. Describe existing linkages and collaboration between sectors in national programmes and policies governing conservation and sustainable use of biodiversity for food and agriculture. These may include overall strategies and plans developed by your country, committees or other national bodies which oversee or support collaboration, shared actions, facilities or resources and specific activities which involve inter-sector collaboration.

Finland is in the process of merging three major sectoral institutions in applied research, i.e. the Game and Fisheries Research institute, the Finnish Forest Research Institute and Agrifood Research Finland into one body, "The Natural Resource Centre". The move is intended to strengthen collaboration in, among others, biodiversity for food and agriculture, associated biodiversity and wild foods, as well as improve cost-efficiency of research allocations.

All the natural resource use strategies and programmes in Finland (incl. National Biodiversity Strategy, Fisheries Strategy, Rural Development Programme, Forest Programme etc.) have being developed through collaborative work in broad-based working groups.

An example of collaborative work in a non-governmental sector is Jämyrä – a loose taskforce of environmental (e.g. WWF, BirdLife Finland) and other (Hunters Union) NGOs devoted to agricultural policies and practices.

The Finnish Wildlife Agency has been successful in collaborating locally with the Finnish Hunters' Association and its hunting clubs, on one hand, and land-owners (agricultural and forest lands alike), on the other hand, in implementing game management within and beyond the EAFRD.

The Organic Institute is an expert network under the University of Helsinki and Agrifood Finland, which aims to promote organic production in the country. It coordinates research in organic agriculture along the lines of primary production, environment, food industry, and society.

82. How are ministries working together to meet Aichi Targets as they may apply to the conservation and sustainable use of biodiversity for food and agriculture in your country?

The Fifth National Report to the Convention on Biological Diversity (2014) indicates a relatively strong commitment of all sectors and stakeholders to the implementation of the convention. Throughout the report, there are references to several ministries involved in different ways into the convention's implementation. The national action plan, which is based on and implements the strategy, includes 105 measures. These have been introduced alongside specification of the ministries responsible for them and their target schedules. For each measure, the ministry bearing main responsibility is mentioned first, and the other participating ministries are referred to in the order laid down. Cooperation will continue to play a key role in the achievement of the strategy's objectives. The strategy will be implemented through the Action plan, developed with the help of broad-based cooperation between ministries, NGOs, stakeholders and various economic sectors.

The preparation process on most of the national strategies and enabling framework described above entails collaborative process between all relevant ministries and civic groups.

There is a permanent working group that meets regularly to further the process. It consists of representatives of the Ministry of the Environment, Ministry of Agriculture and Forestry, Ministry of Social Affairs and Health, Ministry of Employment and the Economy, Ministry of Defence, Ministry of Foreign Affairs, Ministry of Education and Culture, Ministry of Transport and Communication, Sámi Council, Metsähallitusta, SYKE (Finnish Environment Institute), several NGOs, and some other institutions.

83. What future actions have been planned to support your country's efforts in addressing Aichi Targets as they may apply to the conservation and sustainable use of biodiversity for food and agriculture in your country?

The future actions planned to support Finland's efforts in addressing Aichi Targets, including those of relevance to biodiversity for food and agriculture, are outlined in detail in the Fifth National Report to the Convention on Biological Diversity (2014). The most relevant are:

To bring the environment into the mainstream, especially with regard to sustainable use of natural resources.

Actions on linking the Sámi community's traditional knowledge into the protection of biodiversity.

Ensuring conservation of biodiversity of agricultural habitats, in particular that of traditional rural biotopes, mainly through improving the respective subsidy system, its targeting and enhancing advisory services, education, training and research and cooperation between various actors.

To ensure conservation of genetic resources for agriculture, forestry and fisheries. To ratify the Nagoya Protocol on access to genetic resources and the fair and equitable sharing of benefits arising from their utilization.

To ensure and further develop efficient cooperation among government, civil society, commercial interests and other stakeholders, also across borders. To improve communication and enhance public awareness of biodiversity. To strengthen the status of environmental education while creating opportunities for children and young people to participate and be heard in decision-making relating to their own neighborhood environment and on environmental policy.

To implement the national strategies relevant to biodiversity: e.g. for IAS, regional water resources management plans and action plans, the National Programme for the Implementation of River Basin Management Plans for inland and coastal waters, the Programme for the Protection of the Baltic Sea, and others as described above.

To safeguard the operating conditions of Finnish food production that help to direct environmental management in agriculture towards the conservation of biodiversity and the sustainable use of natural resources.

In reindeer herding areas, to ensure continuing compensation for the damage caused by predators. Outside the reindeer herding area, to prevent financial damage caused by large carnivores to the owners of domestic animals, and to ensure the continuity of the compensation scheme for seal damage and of subsidies for seal-proof traps.

To identify innovative funding sources for the protection of biodiversity, and to investigate the establishment of a protection fund for channelling private and public donations towards nature conservation. So far, conservation in agricultural systems has been based almost entirely on agri-environment subsidies, the overall funding for which is likely to be reduced in future years.

To develop sustainable development and well-being indicators for Finnish society, which would complement GDP. These new indicators would describe biodiversity and ecosystem services.

To develop legislation on nature conservation to respond to the challenges posed by the degradation of biodiversity, while ensuring the full national implementation of EU regulations on nature conservation.

To take into account the sustainable use of biodiversity and ecosystem services in land use and project planning. More specifically, to promote conservation of biodiversity in the planning of land and marine areas and in environmental impact assessments; and to apply the voluntary Akwé: Kon Guidelines to land use planning and guidance on planning in the Sámi homeland.

To study the impacts of the use of bioenergy and wind power on biodiversity, and take them into account when developing regulations, subsidies and guidelines.

84. Is your country involved in the implementation of regional and/or international initiatives targeting the conservation and sustainable use of associated biodiversity? List initiatives in Table 29.

Table 29. Regional and/or international initiatives targeting the conservation and sustainable use of associated biodiversity

Initiatives	Scope (R: regional, I: international)	Description	References
The Green Belt of Fennoscandia	R	An ecological corridor of various protected areas and other valuable nature targets that stretches from the Gulf of Finland to the Arctic Ocean along the border of Finland, Russia and Norway. The Green Belt is an important tool in securing and protecting the biodiversity and sustainable use of natural resources in the border zone of these three countries.	The Fifth National Report to the Convention on Biological Diversity (2014)
EU-funded projects such as ALTER-Net, MONIMET, SCALES, STEP, VACCIA, KnowSeas, BAMBI, INSPIRE, BLUEPRINT	I	All the listed projects focused at associated biodiversity	Webpages of Finnish Environment Institute, BONUS, LIFE+ programmes and/or the projects' pages
The network of Baltic Sea marine protected areas	I	Established under HELCOM; covers 7 % of the national territorial waters and exclusive economic zone.	HELCOM 2013

Capacity development

85. What training and extension programmes, or elements of programmes, at all levels, exist that target the conservation and sustainable use of associated biodiversity?

The key enabling programmes are i) the European Agricultural Fund for Rural Development EAFRD, especially its agri-environment schemes, which funds advice on environmentally friendly practices and implementation projects in agricultural systems, and ii) the Forest Biodiversity Programme for Southern Finland METSO, which provides advice in managing forests while taking biodiversity into account. Part of the EAFRD for mainland Finland is a network called Rural.fi, providing a portal on rural issues, including biodiversity.

Most projects aimed at biodiversity include advisory elements through published or online materials, demonstration projects, and tailored training and dissemination events.

86. What higher education programmes exist that target the conservation and sustainable use of associated biodiversity genetic resources? List in Table 30 the institutions, as well as the programmes and enrolment, disaggregated by sex, if possible.

Table 30. Higher education programmes specifically targeting the conservation and sustainable use of associated biodiversity genetic resources in the country.

Institution	Programme	Level	Enrolment		
			Total	Male	Female
University of Helsinki, Faculty of Agriculture and Forestry	Agroecology, Pathology, Plant Breeding, Forest ecology and management, Forest and game animal science	Master	30	NA	NA
University of Helsinki, Faculty of Biological and Environmental Science	General Microbiology, Plant Biology, Ecology and Evolutionary Biology, Genetics	All levels	156	34	122
University of Helsinki, Faculty of Biological and Environmental Sciences	Aquatic sciences: hydrobiology, limnology and fisheries sciences	Bachelor, Master and doctor	16	NA	NA
University of Eastern Finland	Environmental Science	Bachelor, master	40	NA	NA
University of Turku	Molecular Systems Biology	Bachelor, master	NA	NA	NA

University level education on plant genetic resources is provided at most of the faculties of biosciences in Finland, as well as at the Faculty of Agriculture and Forestry of the University of Helsinki, where education in plant breeding is also provided. Some of the research and training takes place at the Nordic and EU levels. The National Plant Genetic Resources Programme participates in training on PGR issues at both college and university levels.

Knowledge generation and science for the management and sustainable use of biodiversity for food and agriculture

87. List up to 10 major institutions within your country directly involved in research on the conservation and sustainable use of associated biodiversity. Provide a concise description of the institutions, of their key research programmes and, where possible, provide the number of active researchers.

1. The Finnish Environment Institute (SYKE) is both a research institute and a centre for environmental expertise. SYKE forms part of Finland's national environmental administration and mainly operates under the auspices of the Ministry of the Environment but also the Ministry of Agriculture and Forestry. The activities focus on five themes, each involving research and development, support, consultancy and training, gathering and processing of information. The themes are: Support for climate policy, Consumption and production, and sustainable use of natural resources, Built environment and land use, The Baltic Sea, inland waters and water resource management, and Ecosystem services and biological diversity. There are overall 700 employees, of which majority are researchers.

2. The Natural Resources Institute Finland (LUKE) was formed in 2015 from merging of three major research institutes: Finnish Game and Fisheries Research Institute RKTL, Agrifood Research Finland MTT, and Finnish Forest Research Institute Metla. The Finnish Game and

Fisheries Research Institute's key tasks include the evaluation, projection and statistical assessment of fish and game resources, as well as maintaining the diversity of fish stocks and fostering economic activities related to fish, game and reindeer. Results aim at meeting the requirements of economic interests and those carrying out practical work. There are about 270 employees, of which most are researchers.

MTT Agrifood Research Finland is a leading research institution developing sustainability and competitiveness of the food system. Research is conducted within five areas: Sustainable and competitive food production, Responsible food chain – better consumer well-being, Environmentally friendly agriculture, Environmentally friendly agriculture, and Smartly from renewable resources. MTT employs around 750 people at 14 locations across Finland. MTT Agrifood Research Finland coordinates national programmes for agricultural plant and domestic animal genetic resources.

The Finnish Forest Research Institute (Metla) is the main forest research institution in Finland and one of the biggest forest research institutes in Europe. The research unit network covers the whole country. The aim is to promote, through research, the economical, ecological, and socially sustainable management and use of forests. Metla has over 300 researchers. The Institute conserves genetic resources of the forest trees.

3. The University of Helsinki is the leading high education institution in Finland. Some 470 doctorates are completed annually. The relevant education and research units are the Department of Agricultural Sciences (focuses at plant production in agriculture and horticulture, animal production and agrotechnologies), and the Department of Forest Sciences. Both departments are recently ranked among top 20 research and education institutions in their fields internationally. The agroecology study line targets explicitly associated biodiversity in agriculture. The Centre of Excellence in Metapopulation Biology of the Department of Biosciences also studies some of the components of the associated biodiversity in agricultural and forest systems, including population genetics and land-use responses, particularly in around the effects of fragmentation. University's Centre for Environment HENVI coordinates and carries out environmental research and teaching.

4. University of Turku has hundreds of on-going research projects which employ thousands of researchers from the university and other organizations. Relevant research is carried out at its Department of Biology (e.g. Ecological Interactions and Ecological Genetics Research and Molecular Biosciences; Tundra ecology) and Department of Geography (research on dynamic landscapes, their patterns, processes and development).

5. The University of Eastern Finland is home to international research areas and education, especially related to climate change and human health, forests, global change and bioeconomy. Among most relevant recent topics are Large lake research - Ecosystems and food web interactions (2011–2014), Transnationalization of Forest Governance (transnational forest governance networks in Northern and Central Europe), Fire as a tool in maintaining and

restoring forest successional properties and biodiversity in managed and protected forests (2002–2004), Baltic Landscape in change - innovative approaches towards sustainable forested landscapes (2012–2014).

Gaps and priorities

88. With respect to information management, national policies, programmes and enabling frameworks that support or influence the conservation and sustainable use of biodiversity for food and agriculture and the provision of ecosystem services, and govern exchange, access and benefits:

Specific management challenges, priorities and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

a) What are the major gaps in information and knowledge?

In most cases, it is difficult to separate the direct impacts of various drivers on biodiversity, for example, climate change from other land-use changes.

Many of the effects of changed or implemented practices appear with a time-lag (for example, in population dynamics or state of waters), which poses challenges to the monitoring of the effectiveness of the measures.

There are major gaps in understanding how ecosystem processes translate into measurable benefits to people (ecosystem services) for all sectors. In most cases, there is no evidence to document that a change in a process results in a change in welfare.

Ways of socially acceptable dealing with trade-offs in ecosystem services under each land-use setting are undeveloped. The results of economic and other valuations of ecosystem services are largely specific to a site and respondent group and cannot be generalized.

b) What are the main capacity or resources limitations?

The policies and enabling frameworks that govern biodiversity conservation are generally complex, and have to be embedded into already existing socio-economic context(s) as well as into a highly varied ecological context. Their implementation often requires novel understanding and skills, and considerable re-learning. It also frequently involves dealing with trade-offs (e.g. public vs. private benefit, short- vs. long-term outcomes) and subjective preferences. Therefore, the implementation process is slow and ridden with resistance from land-users.

The implementation requires considerable financial resources that are unlikely to be adequate in the near future.

Education and research for biodiversity conservation, on the one hand, and those for land use, on the other hand, are run by separate departments and institutions.

There is a lack of trained taxonomists and museum professionals specialization in processing species data, which complicates monitoring and assessment of changes in species. Taxonomic research on a number of invertebrate, algal and fungal groups has progressed slowly. At the same, current employment for such specialists is poor.

The resources for advisory services on issues outside profit-making objectives are not sufficient. The state advisory services mainly deals with administrative aspects of the available subsidies rather than on the achievement of environmental or conservation results.

c) What are the main policy and institutional constraints?

The sectoral borders with their traditions and background (e.g. education scope) and respective political pressures challenge cross-sectoral policies and development. Efficient collaboration among researchers from sectoral institutions and with academic institutions is not always present.

The objectives of the sectoral policies are often contradictory and involve serious trade-offs. For example, intensification and specialization of production as a means to support competitiveness remains the mainstream policy framework, within which the environmental incentives, largely voluntary, are expected to provide solutions. The efficiency of this approach is questioned.

So-called green accounting based on ecosystem service flows and natural capital is not part of general welfare accounting.

d) What actions are required and what would be the priorities?

Further development of predictive tools for ecosystem changes, also explicitly dealing with uncertainly.

Work on the national ecosystem assessment process, including economic valuations and indicators.

Better functioning science-policy interface institutions, especially at the highest political level, for more efficient and timely decision-making.

Development of science and education to deal with complex and whole-system situations in a cross-disciplinary manner, as well as participatory modes of research with stakeholders taking part in setting research questions.

Secure essential long-term funding and employment for professionals in the fields of conservation and resource use.

Further development of the impact-assessment processes for plans and projects so they are open, participatory, and based on professionally conducted inventories whose quality is assured.

Incorporation of the ecosystem-service framework into operational setting of businesses.
Continuous cooperation across sectors.

89. With respect to stakeholder participation and ongoing activities that support maintenance of biodiversity for food and agriculture and collaboration between institutions and organizations:

Specific management challenges, priorities and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

a) What are the major gaps in information and knowledge?

In most cases, it is difficult to separate the direct impact of land-use practices from those of other drivers, for example, climate change. Many of the effects of changed or implemented practices appear with a time-lag. Participants may be demotivated by the lack of clear evidence about the efficiency of interventions.

b) What are the main capacity or resources limitations?

Traditions of efficient collaborative work, including that on land-user level, are fairly young in Finnish society, resulting in lack of personal skills and supportive environment.

Independent advisory sources are relatively small in comparison with those provided by industry or other profit-making institutions.

Comprehensive stakeholder involvement is time-consuming, so it is expensive to implement. Financial resources are unlikely to be sufficient in the near future.

Decision-makers are mostly either unprepared or lack the necessary skills for integrating stakeholders into comprehensive decision-making process.

c) What are the main policy and institutional constraints?

Top-down is still the prevailing approach in conservation. Deliberation takes place at the national and regional policy level, whereas participatory processes are not integrated to local and operational-level decisions. This is a critical constraint in trade-off situations, such as

those between conservation of large carnivores and pasture-based livestock systems, or between seals and fisheries.

Policies that take effect through regulative institutional changes (e.g. agri-environment payments) are conditioned by normative and cultural-cognitive institutions based on practices and measures rather than outcomes, demotivating land users.

Local-level practices and solutions are not supported by the predominant, highly globalized supply chains.

Conservation objectives in other sectoral policies are mostly not operational. Their objectives are vague, indicators are missing, so there is no implementation at the stakeholder level.

d) What actions are required and what would be the priorities?

Fairly radical institutional changes are needed to allow for long-term governance development and empowerment, such as elements of result-based actions in all payment frameworks to promote governance and self-regulation.

Securing a certain level of continuity in programmes and enabling frameworks that involve investments and system re-design on behalf of land-users.

The institutions and legislation need development so that stakeholders are encouraged to innovate and develop solutions for conservation and sustainable resource use for local and regional levels. New ways of supporting, valorizing and multiplying these should be made available.

Formulation of conservation objectives within sectoral policies in a way that they can be operationalized.

Training in the necessary skills for engaging stakeholders.

90. With respect to capacity development:

Specific management challenges, priorities and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

a) What are the major gaps in information and knowledge?

Developing the role and potential of traditional knowledge and practices of all land-user groups relevant for the conservation and sustainable use of biodiversity, and support for retro-innovation.

Experts trained within disciplines often lack skills in interdisciplinary work. Education and research for biodiversity conservation and those for land use are run by separate departments and institutions.

b) What are the main capacity or resources limitations?

The implementation requires considerable financial resources that are unlikely to be adequate in the near future. Employment of conservation experts in all fields of land use is declining.

Involvement of researchers from the sectoral institutions into university-level teaching is complicated by the recent cuts to educational funding, and funding for the input of outside experts (unless they are docents) is no longer available.

c) What are the main policy and institutional constraints?

Breaking with traditional disciplinarily of education with the focus at memorizing rather than understanding and applying is still a challenge in some vocational and high institutions.

d) What actions are required and what would be the priorities?

More advanced vocational training that would integrate biodiversity ecosystem functioning into all production systems.

Development of science and education to deal with complex and whole-system situations in a cross-disciplinary manner.

Enhancement of research and education on sustainable utilization of natural resources based on understanding of ecosystem functioning, thresholds and boundary conditions.

Securing essential long-term funding and employment for professionals in the fields of conservation and resource use.

Developing legislation and administrative procedures related to the protection of the traditional knowledge and practices, along with innovations, specifically but not exclusively of the indigenous Sámi community, relevant for the conservation and sustainable use of biodiversity.

91. With respect to for the management and sustainable use of biodiversity for food and agriculture:

Specific management challenges, priorities and measures are detailed in the Fifth National Report to the Convention on Biological Diversity (2014) that deals with overall biodiversity. Below are some of the key issues relevant for biodiversity for food and agriculture derived from the report, literature and interviews.

a) What are the major gaps in information and knowledge?

The functioning of complex natural systems, especially when these are further embedded into socio-economic context(s), is a challenging research topic, and the thresholds and boundary conditions of ecosystems are, as a rule, not known.

High levels of uncertainty (noisy systems), and a multitude of interacting impacts and drivers on biodiversity reduce the predictive capacity of ecosystem models and scenarios, including those related to climate change.

It is difficult to separate the direct impact of land-use practices from those of other drivers, such as climate change. Many of the effects of changed or implemented practices appear with a time-lag.

Some components of biodiversity relevant for food and agriculture are poorly known, such as the diversity and functioning of microorganism, soil and underwater biotic communities.

While in environmental administration, ecosystem services and their importance for human well-being are widely recognization, the concept and its economic implications are not well known among decision-makers. The concepts of the green economy are still new, and their content, meaning, share and potential in decision-making and practical operations are not yet fully understood.

b) What are the main capacity or resources limitations?

The knowledge generation for and implementation of the policies require considerable financial resources, which are unlikely to be adequate in the near future.

Employment of conservation experts in all fields of land use is declining.

Interdisciplinary and cross-disciplinary research is complex with slow academic return; training in the necessary skills is limited.

c) What are the main policy and institutional constraints?

The objectives of sectoral policies are often contradictory and involve serious trade-offs.

d) What actions are required and what would be the priorities?

Raising public awareness, and with the support of public opinion and the broad participation of all relevant stakeholders in preparing and implementing conservation and sustainable use actions.

Development of science and education to deal with complex and whole-system situations in a cross-disciplinary manner.

Enhancement of research and education on sustainable utilization of natural resources based on understanding of ecosystem functioning, thresholds and boundary conditions.

Work on the national ecosystem assessment process, including economic valuations and indicators, so that the content, meaning, and potential of ecosystem services and natural capital are recognized in decision-making and practical operations.

Better functioning science-policy interface institutions, especially at the highest political level, for more efficient and timely decision-making. Incorporation of the ecosystem service framework into operational setting of businesses.

Secure essential long-term funding and employment for professionals in the fields of conservation and resource use.

Further development of the impact-assessment processes for plans and projects so there are open, participatory, and based on professionally conducted inventories whose quality is assured.

CHAPTER 6: FUTURE AGENDAS FOR CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY FOR FOOD AND AGRICULTURE

Enhancing the contribution of biodiversity for food and agriculture

This section provides an opportunity for countries to highlight their plans and priorities, and to describe current constraints to achieving them on enhancing the contribution of biodiversity for food and agriculture to human wellbeing, environmental health and sustainable production. Include any information that might be useful in informing future policies to help strengthen the contribution of biodiversity for food and agriculture to the broader sustainability and development objectives listed below.

92. Describe planned actions and future priorities to improve the conservation and sustainable use of biodiversity for food and agriculture with specific reference to enhancing its contribution to:
a) improving food security and nutrition;
b) improving rural livelihoods;
c) improving productivity;
d) supporting ecosystem function and the provision of ecosystem services;
e) improving the sustainability and resilience of production systems;
f) supporting sustainable intensification.

Refer to the future needs and priorities identified in previous Chapters. The different topics may be dealt with jointly or individually as appropriate to country plans and approaches. Replies should include country perspectives on:

- Ways and means of improving the capacity and operations of the institutions within your country concerned with or affected by the maintenance and use of biodiversity for food and agriculture and particularly of associated biodiversity, including universities, government programmes, NGOs, breeders, private sector entities, organizations and social movements of small-scale producers. Actions to improve collaboration between stakeholders should be included.
- Ways and means of supporting the development of new policies or the implementation of the current policies that support the integrated conservation and sustainable use of biodiversity for food and agriculture, and that also specifically target associated biodiversity.
- The major information and knowledge gaps that remain to be addressed and options that exist to address them.

Countries should indicate the ways in which planned actions will contribute to the UN Strategic Plan for Biodiversity and to achieving the Aichi Targets as well as to how they link to other related processes undertaken through the Convention on Biological Diversity.

Among the priorities identified in Chapter 5 several stand out:

1. Developing efficient stakeholder engagement practices at all stage of decision making and implementation;
2. Strengthening collaboration among sectoral and academic institutions and supporting interdisciplinary research;
3. Developing methodologies that deal with complex situations, predictive uncertainties and tradeoffs;
4. Improving knowledge on biodiversity for systems that have clear gaps; and
5. Mainstreaming biodiversity conservation and ecosystem service frameworks.

Finland identified actions and priorities to improve the conservation and sustainable use of biodiversity for food and agriculture in all the national strategies and action plans described above. They are summarised in the Fifth National Report to the Convention on Biological Diversity (2014). The key actions that address the priorities and the perspectives outlined above are presented below. All of these are such that have potential to directly contribute to the relevant Aichi Targets.

1. Generally positive experiences of developing policies through work in cross-sectoral and multi-actor working groups will be continued. Funding is available specifically for participatory-based research and implementation as part of the EAFRD of 2015–2022. Decision-making nationally and internationally will be improved through work of the intergovernmental scientific body IPBES.

2. Collaboration among sectoral will be strengthen through pooling the key institutions devoted to land use research into one institution. The database of research and development projects in field of natural resource management, to which all sectoral research and academic institutions contribute, will continue working. There are funds available nationally and internationally specifically allocated to interdisciplinary research (about 10 % of the funding of the Academy of Finland) that call for collaboration within the universities and among them and the sectoral institutions. Finnish researchers will continue to actively participate in the EU research calls (e.g. Horison 2020, Life+). Also, in education current funding available through Erasmus+ calls for engagement of stakeholders into education.

3. Work of the ecosystem services and biodiversity planning group will be continued and research on economic importance of biodiversity and ecosystem services building up on the results up-to-date will be enhanced. Other research relevant to conservation in all systems of land- and water- use will be promoted and sufficient funding secured.

4. Knowledge and understanding of the status of and trends in threatened species in Finland will be enhanced. Knowledge on poorly known ecosystems, such as underwater, will be improved. So will understanding on invasive species. The set of the national biodiversity indicator set (www.biodiversity.fi) will be enlarged by new relevant indicators.

5. Every attempts will be made to mainstream the concepts of ecosystem services and the green economy into the basic decision-making and practical operations. Five objectives of the Finland's biodiversity strategy focus on the mainstreaming of biodiversity issues across society, the introduction of new participants in the work to advance biodiversity causes, a decision-making process based on robust research data. Biodiversity will be taken into account in steering systems governed by the relevant legislation. Legislative and administrative measures will be revised and developed, while the range of steering instruments will be expanded to rely more on various actors taking responsibility and engaging in voluntary action.

In respect to the relevant national Aichi targets, the following specific actions and objectives are outlined.

National target 6 based on the Aichi target 6 states: All aquatic biotic resources are managed and utilized sustainably, applying an ecosystem based approach. The concept of Maximum sustainable yield is applied in fisheries. Living natural resources are utilized within safe ecological limits. Fish stock management plans are drafted for all threatened fish populations and where necessary for commercially fished populations and groups of populations. Fisheries have no significant adverse impacts on threatened species or vulnerable ecosystems. Fish migration routes and spawning areas are safeguarded in waters of importance to migratory fish and commercially fished species. Depleted fish stocks are strengthened and native fish populations restored with the help of introductions.

The central legislation pieces that address the target are: Fish Passage Strategy, reformed Fishing Act, and National salmon and sea trout strategy, as described above.

National target 7 is identical to the Aichi target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.

The EAFRD is the key framework that outlines objectives and provides tools for conservation in agricultural systems. It shares the strategic target of halting biodiversity decline by 2020. Among the most important specific objectives is to manage 42 000 hectares of semi-natural grasslands, of which 8 000 hectares are regionally and nationally valuable, under the agri-environmental agreements. Other quantitative objectives for such practices as environmental fallow, winter cover, traditional breeds and varieties are also of relevance for biodiversity.

Additionally, there is a national target of increasing the area under organic production to 20 % by 2020.

The amended Forest Act plays the key role for the implementation in the forest ecosystems. One important objective of it is to provide forest owners with more flexible choices on managing forests for multiple objectives. The Ministry of Agriculture and Forestry is in charge of undertaking revision of the statutes, forest management recommendations and guidelines, forest management planning, associated advisory services and training, financing systems so that multipurpose use of forests is enhanced. It has also allocated environmental support denoted it the Act on the Financing of Sustainable Forestry effectively with respect to safeguarding biodiversity. This will be particularly important for improving habitat management for game species.

For the aquatic ecosystems, the National aquaculture spatial plan (2014), the new guidelines for environmental protection in fish farming (2013), WFD and the most important legislative tools aiming at conservation and sustainable use of species and habitats in marine and freshwater environments.

National target 13 based on Aichi target 13 states: The genetic biodiversity of Finland's cultivated plants and their wild relatives, forest trees, fish stocks, and farmed and domesticated animals has been preserved and safeguarded.

Among specific objectives outlined under the national programme on genetic resources are: to secure future of the gene banks, continue high level research work, also as part of international network cooperation, on characterization of genetic resources applying novel genomic tools and approaches, to engage in multidisciplinary studies on values of genetic resources, to strengthen networking among owners of native breeds and varieties, and to secure sufficient funding for research and implementation.

Strengthening the conservation and management of associated biodiversity and wild foods

This section provides an opportunity for countries to highlight their plans and priorities, and to describe current constraints to achieving them on the conservation and management of associated biodiversity and of wild foods.

93. Describe planned actions and future priorities to support conservation and management of the components of associated biodiversity and wild foods including the development of monitoring programmes and of information systems or databases. Replies should cover country perspectives on:

- Ways and means of improving the capacity and operations of the institutions within your country concerned with or affected by the maintenance and use of biodiversity for food and agriculture and particularly of associated biodiversity, including universities, government programmes, NGOs, breeders, private sector entities, organizations and social movements of small-scale producers. Actions to improve collaboration between stakeholders should be included.
- Ways and means of supporting the development of new policies or the implementation of the current policies that support the integrated conservation and sustainable use of biodiversity for food and agriculture, and that also specifically target associated biodiversity.
- The major information and knowledge gaps that remain to be addressed and options that exist to address them.

Future priorities and planned actions to support conservation and management of all components of associated biodiversity are detailed in the Fifth National Report to the Convention on Biological Diversity (2014). The key issues relevant for biodiversity for food and agriculture (including associated biodiversity and wild foods) derived from the report are listed below (refer to the report for more details).

These targets are especially relevant for the capacity building:

Target 17 (for 2015). The implementation and impacts of the National Strategy and Action Plan for the Conservation and Sustainable Use of Biodiversity in Finland have been monitored for the purposes of an interim report produced in 2015. The strategy will be implemented and evaluated cost-effectively in collaboration with various businesses and other stakeholders.

Target 18 (for 2020). The traditional knowledge, innovations and practices of the indigenous Sámi community relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, restored and conserved, subject to national legislation and relevant international obligations, by developing legislation and administrative procedures related to the protection of this traditional knowledge. Finland's implementation of the CBD allows for the full and effective participation of the Sámi community at all relevant levels in line with decisions set out in the CBD and by COPs (Conference of Parties to the Convention on Biological Diversity).

Target 19 (for 2020). Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends have been improved, and are widely utilized, applied and transferred to those needing such knowledge and technology. The impact assessment processes for plans and projects are open, participatory, and based on professionally conducted inventories whose quality is assured.

Target 20 (for 2020). Finland assesses opportunities to increase the availability of financial, human and technical resources to facilitate the effective implementation of the Strategic Plan

for Biodiversity 2011–2020. Finland strives to obtain resources from all appropriate sources in accordance with the consolidated and agreed process defined in the Strategy for Resource Mobilization. National implementation depends on the availability of resources within spending limits set out in central government budget frameworks. This work will be steered in line with the needs assessments that are developed and reported by all Parties to the CBD.

The ways and means of improving the capacity and operations of the institutions are outlined above (see question 92, points 1 and 2). Ways and means of supporting the development of new policies or the implementation of the current policies that support the integrated conservation and sustainable use of biodiversity for food and agriculture, and that also specifically target associated biodiversity are outlined above (see question 92, points 3–5).

The major information and knowledge gaps that remain to be addressed and options that exist to address them are (see also 92, point 4):

1. Comprehensive knowledge on most regulating and supporting services is currently missing. Several ongoing research projects aim at filling in some of the knowledge gaps: for example, Impacts of climate change on multiple ecosystem services: Processes and adaption options at landscape scales (CLIMES); Soil carbon model – Yasso; The relationships of biotopes, habitat structure and habitat quality to the provision of ecosystem services (ES-LUPPI); Controls of supporting ecosystem services through the load of terminal electron acceptors (TEA-SERVICES); Securing the Conservation of biodiversity across Administrative Levels and spatial, temporal and Ecological Scales (SCALES).

2. Methodologies of incorporating the value of ecosystem services into all levels of decision-making have been missing for the national level. The Economics of Ecosystem Services and Biodiversity Finland (2013–2014) project aims to identify major knowledge gaps in relation to the task of. The report will become available in January 2015.

3. Relatively little is known about the biodiversity of inland aquatic environments, both as regards species and habitat types. The key challenge for the sustainable use of the Baltic Sea and the coastal areas is posed by lack of information on the biodiversity of underwater habitats, and the lack of detailed information on areas that are regionally, locally and species-specifically significant in ecological terms. A research programme VELMU has been set up to address this gap.

There are also some knowledge gaps on threatened species of relevance to food and agriculture necessary for preparing action plans. The goals are to ensure long-term monitoring and research activities and managing species data.

4. More understanding is needed about the optimal policy mix for each sector; these should be balanced according to the cost-efficiency, social acceptance and sustainability and included alternatives of legislative and voluntary-based tools, backed by financial and other forms of public support, action- and results-based approaches.

94. Describe planned actions and future priorities with respect to implementing ecosystem approaches for the various components of biodiversity for food and agriculture.

These targets are especially relevant for the ecosystem approaches:

Target 11 (for 2020). Finland's network of protected areas and the measures applied to conserve biodiversity in the use of other areas together cover at least 17 % of the terrestrial environments and inland waters of the country, and 10 % of coastal and marine areas. The functionality and coverage of the network have particularly been improved in southern Finland. Protected areas are suitably managed and ecologically and regionally representative. They are well connected, and green infrastructure also connects them to wider landscape entities, with regard to the special features of heritage landscapes. Biodiversity also continues to be safeguarded in commercially managed forests.

In 2014, the Government decided to continue METSO programme until 2025. It will be assessed and revised as necessary. The Ministry of Agriculture and Forestry and Ministry of the Environment will pay attention to biodiversity values and the ecosystem services of state-owned recreational areas and research forests in connection with the METSO programme; develop and test regional cooperation models suitable for privately-owned forests through METSO cooperation network projects.

Ecosystem approach is particularly relevant for habitat restoration. The Ministry of the Environment and Ministry of Agriculture and Forestry undertake application of such approach in the planning of restoration measures. Development of spatial planning methodology for forestry and agriculture is being increasingly used in prioritization of restoration sites.

Development and implementation of the river basin management plans are based on the ecosystem approach and consider whole watersheds.

Improving stakeholder involvement and awareness

This section provides an opportunity for countries to highlight their plans and priorities, and to describe current constraints to achieving them with respect to stakeholder involvement in the conservation and sustainable use of biodiversity for food and agriculture with specific reference to the recognition and involvement of farmers, pastoralists, fishers and forest dwellers, addressing gender equality, and supporting the roles and contributions of women.

95. Describe planned actions and future priorities to improve stakeholder awareness, involvement and collaboration in the conservation and sustainable use of biodiversity for food and agriculture. Include a description of the major challenges that will need to be overcome.

All national Targets outlined in 93 include also stakeholder involvement at different stages of the planning and/or implementation, as well as awareness building and/or advisory services.

In order to achieve the overall mission of the national Strategy for the Conservation and Sustainable Use of Biodiversity in Finland for the years 2012–2020, Finland undertakes to implement actions related to the conservation and sustainable use of biodiversity must be realised effectively with due regard to citizens' constitutional property rights and Finland's traditional everyman's right of access to the land, while also ensuring that all citizens meet their responsibility to preserve biodiversity. The indigenous Sámi community's traditional knowledge related to biodiversity will be respected.

A specific challenge is to change the prevailing traditions in production ecosystem management of the preceding decades that do not account for biodiversity as an objective.

96. Describe planned actions and future priorities to support the role of farmers, pastoralists, fisher folk, forest dwellers, and other rural men and women dependent on local ecosystems in the conservation and use of biodiversity for food and agriculture. Replies should include information on recognizing and enhancing the role of indigenous peoples. Include a description of the major challenges that will need to be overcome.

All national Targets outlined in question 93 aim also at support of the land owners and users through providing some forms of public support (financial, logistic, information) in return to their environmentally sound and conservation-friendly resource management.
In respect to the indigenous people, see Target 18 (for 2020). More specific actions have been identified as:

- The Sámi Parliament takes part in the implementation, monitoring and evaluation of the National Biodiversity Strategy and Action Plan effectively and promotes the swift implementation of goals related to Sámi people.
- Sufficient resources are allocated to the Sámi Parliament to take part in the implementation of the NBSAP
- The Sámi Parliament takes part effectively in the ratification process and implementation of the Nagoya Protocol.
- The implementation of projects aiming at revitalizing traditional knowledge has begun.
- The Sámi Parliament pays due regard to the needs of the intergenerational continuation, transmission and development of traditional Sámi knowledge in all its activities.
- The Sámi Parliament promotes the foundation of a centre of research for traditional Sámi knowledge

97. Describe planned actions and future priorities to improve recognition of the contribution of women to the conservation and use of the different components of biodiversity for food and agriculture, including associated biodiversity. Include a description of the major challenges that will need to be overcome.

Finland enjoys one of the world's top levels in the state of gender equality and there are no specifically planned actions in this respect.

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MA15 / FA12 Directive farmland species: strong decline (>1,5% annual decline or over 35% in 20 years)
MA7 Traditional rural biotopes area: no trend
FA7 Traditional rural biotopes: management improved but state is still weak
FA9 Farmland birds: stable in the 10 yrs
MA8/ FA8 High Nature Value (HNV) farmland slow decline (<0,5% annual decline or under 10% in 20 years)
FA11 Red-listed farmland species: In the estimates for the year 2010 the proportion of red-listed species in farmland habitats is greater than in 2000. The amount of red-listed species is predicted to remain approximately the same in the groups of spore plants, lichens and beetles. In contrast to this, in the amount of red-listed birds, vascular plants, fungi and butterflies a distinctive increase is expected.
ME13 Metsien uhanalaiset lajit: Metsälajien uhanalaisuudessa vuosien 2000 ja 2010 välillä tapahtuneet aidot luokkamuutokset osoittavat uhanalaistumiskehityksen jatkuneen. Lievä laskeva kehitys (<0,5% vuosittainen lasku tai alle 10% 20 vuodessa)
ME17 Talousmetsien luonnonhoito "Nykyisistä luonnonhoitomenetelmistä muun muassa säästöpuiden on voitu todeta auttaneen joidenkin uhanalaisten kovakuoriaisten tilannetta." Lievä kasvava kehitys (<0,5% vuosittainen kasvu tai alle 10% 20 vuodessa)
IW11 Threatened inland water species: A quarter of the changes in inland water species' conservation statuses were positive and three quatrers negative between years 2000 and 2010.

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Annex 1. Contributors to the report and reviewers:

Elina Andersson, University of Helsinki
Anne Antman, Natur och Miljö
Tarja Haaranen, MTK
Laura Hauta-aho, University of Helsinki
Timo Hytönen, University of Helsinki
Minna Kaljonen, SYKE
Jaana Kaipainen, MMM
Jukka Kivelä, University of Helsinki
Mikko Kuussaari, SYKE
Saija Kuusela, SYKE
Jaana Kyyrä, TIKE
Aino Launto-Tiuttu, MTK
Aleksi Lehikoinen, Finnish Museum of Natural History
Leena Linden, University of Helsinki
Stina Nyström, WWF
Tuomo Ollila, Metsähallitus
Antti Paasivaara, RKTL
Tuula Pehu, MMM
Minna Pirhonen, University of Helsinki
Eeva Primmer, SYKE
Jukka Rintala, RKTL
Tomas Roslin, University of Helsinki
Fredrick Sdoddard, University of Helsinki
Riikka Söyrinki, ProAgria
Juha Tiainen, RKTL
Marcus Walsh, Innofor

Annex 2. Institutions that provided revision comments to the draft:

Central Union of Agricultural Producers and Forest Owners
Evira
Finnish Association for Nature Conservation
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