Unveiling the Nexus

The Interdependence of
Animal Welfare, Environment &
Sustainable Development

| FOREWORD

One year ago, the United Nations Environment Assembly (UNEA) explicitly acknowledged that "*animal welfare can contribute to addressing environmental challenges*" and "*achieving the Sustainable Development Goals*". This builds on the growing consensus on the importance of animal welfare. The UN Secretary-General has asserted that a first step towards living in Harmony with Nature is the explicit recognition that animals are sentient beings, not mere property, who must be afforded respect and legal recognition (i). The Committee on World Food Security (CFS) (ii) has stated that policy action to promote animal welfare is essential to achieve sustainable agriculture. The One Health High Level Expert Panel (OHHLEP) has included animal welfare within the foundational principles underpinning One Health (iii).

By "Unveiling the Nexus", we want to illuminate the value of an animal welfare perspective for addressing the drivers of environmental challenges and sustainable development. We have done so by highlighting some of the important links between animal welfare and biodiversity, climate change, pollution, health, food security, and livelihoods. This draws on examples from the expanding scientific evidence base on how improving animal welfare, for all animals, can better people's lives and the environment. Our thanks to all the experts from within our membership, staff, and friends who helped and identified references, and for all their efforts and impressive knowledge.

The report aims to provide the United Nations, Member States, intergovernmental organisations, and other stakeholders with an initial exploration of how improving animal welfare can support efforts to address the drivers of harm to nature and stimulate progress across the Sustainable Development Agenda. We also hope that this publication supports and inspires a collective vision as well as the production of a groundbreaking, progressive, and transformational report by the UN Environment Programme (UNEP), as requested by UNEA.

The WFA members team & friends

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| OVERVIEW FOR POLICYMAKERS

WHY THE NEXUS MATTERS

Today, the international community has the opportunity to take transformative action to protect the environment and achieve sustainable development. Urgent global crises of biodiversity and nature loss, climate change, widespread pollution, and severe and systemic animal welfare compromises can be halted and reversed. People can be protected from future epidemics, pandemics, and the suffering, loss of life and economic setbacks they have brought, and provided with safe, available food and livelihoods needed to thrive.

Transformative action requires a system-based understanding. It needs solutions that are multifactorial, multidisciplinary, and multicultural. It needs to avoid reducing one problem by causing others, such as reducing farms' climate emissions but increasing human or animal health risks. It requires an inclusive approach that welcomes diverse perspectives and is constructive in its focus on mutual reinforcements and win-win solutions. It needs to draw on scientific data alongside the valid values and views of compassionate Indigenous communities who care for and about their sentient animals and environments. It needs to extend beyond exploitative and market-driven values to all forms of value for all life, including the aspirations of current and future generations.

WHY ANIMALS MATTER TO THE NEXUS

Nature needs animals to flourish. Its food webs, ecosystems, and biogeochemical cycles rely on animals' health, relationships, needs, behaviour, interactions, resilience, and adaptations – all of which are animal welfare issues. Even domestic animals, altered and integrated into human lives and systems, are parts of nature. Humans also need animals to flourish. Our environments, communities, livelihoods and health all rely on the well-being of animals.

Addressing animal welfare can uncover new opportunities to assess and support the transformation needed for the environment and sustainable development. It is a catalyst that, combined with other global concerns, can create a virtuous cycle and strengthen the foundations for development, in contrast to the continuation and expansion of production and consumption patterns that harm animal welfare, which amplify risks in these areas and erode the foundations of sustainable development, the environment, and, ultimately, life.

It is thus fitting that Member States declared in the 2030 Agenda for Sustainable Development that *"in these Goals and targets, we are setting out a supremely ambitious and transformational vision. We envisage a world free of poverty, hunger, disease and want, where all life can*

ANIMAL WELFARE IS AN INSTRUMENTAL LEVER FOR DEVELOPMENT
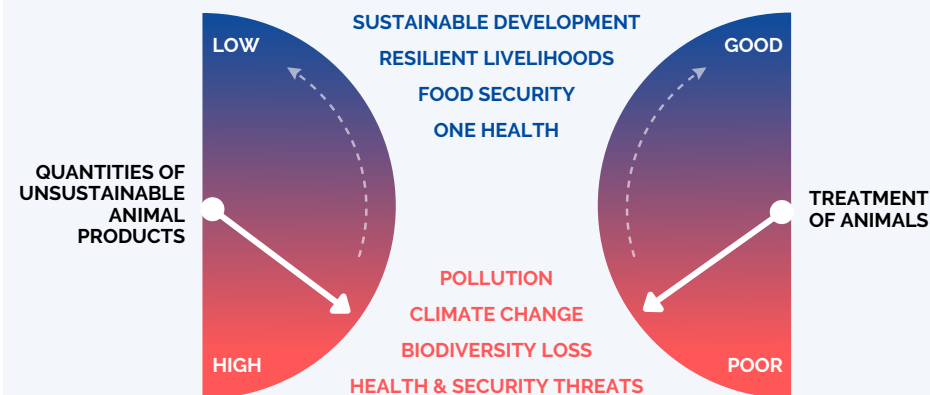
thrive" and envisioned *"a world in which... humanity lives in harmony with nature and in which wildlife and other living species are protected"*.

Animal welfare matters in itself. It is humanity's responsibility to respect and protect animals, with the UN Secretary-General affirming that: *"a first step to recognizing the rights of Nature is the recognition that non-human animals are sentient beings, not mere property, and must be afforded respect and legal recognition."*(1) In the 2021 High-Level Political Forum Ministerial Declaration, UN Member States called for *"increased ambition and urgency of action to protect wildlife and other living species"*. Animal welfare also plays an instrumental role in the environment and sustainable development. The World Organization for Animal Health (WOAH) recognises in this regard that *"animal welfare is a responsibility that must be shared between governments, communities, the people who own, care for and use animals, civil society,*

educational institutions, veterinarians and scientists... to ensure any such use is humane, as defined through the [WOAH's] international standards for animal welfare, in recognition of the sentience of animals."(2). The 2019 Global Sustainable Development Report highlighted animal welfare as a critical issue to be explicitly addressed by the UN system.

INTERLINKAGES WITHIN THE NEXUS

The promotion of animal welfare reflects and strengthens the core principle of the 2030 Agenda, and could be considered a prime example of its application. Policy action to advance and promote animal welfare epitomises and advances policy coherence, as enhanced animal welfare provides positive impacts across the Sustainable Development Goals (SDGs) and stimulates balanced progress across the three dimensions of development. Peer-reviewed research shows that *"there is a strong positive mutually reinforcing correlation between achieving*

the SDGs and improving animal welfare"(3) WOAH's Director General in 2018 declared that "*only if concerns of animal health and animal welfare were observed could some of the SDGs be achieved*"(4).

Numerous international organisations and renowned experts, including from UNEP, WOAH, and the World Bank, as well as scientific studies referenced in this report, provide further compelling evidence that promoting better animal welfare practices, while reducing the demand and supply of animal products, can have significant positive impacts across environmental and sustainable development dimensions. According to FAO, animal welfare is key to achieving SDG 2 on hunger eradication and SDG12 on sustainable consumption (5). It is also instrumental in improving human health and well-being, preserving livelihoods, protecting biodiversity and ecosystem services, and contributing to policy goals such as the Paris agreement and the recently adopted Kunming-Montreal Global Biodiversity Framework.

As UNEP notes in its latest Emissions Gap Report 2022, a combination of measures targeting the demand side, protection of ecosystems, and farm-level improvements is needed. In this context, there are two separate levers that enable a healthy environment and sustainable development:

Improved animal welfare practices

Agricultural and fisheries systems characterised by higher animal welfare, including well-run agroecological and integrated systems, address key drivers of the triple planetary crises. They have lower greenhouse gases (GHG)

emissions, have higher carbon sequestration potential compared to industrial animal farming, and are more resilient to climate change and disasters, thereby supporting mitigation and adaptation. They are also more biodiversity rich and support ecosystem services, including pollination, and temperature regulation. Lastly, they are less polluting. For example, manure can be used as fertiliser at ecologically balanced levels in an integrated way, rather than polluting soil, water, and air.

High welfare systems further contribute to multiple dimensions of sustainable development. Their better conditions for farmed terrestrial and aquatic animals reduce risks of zoonotic diseases emerging, spreading, and amplifying. Their positive impact on animal health and well-being avoids the need for routine antibiotic use, reducing antimicrobial resistance (AMR). They result in higher quality food and contribute to the productivity of food systems through healthier animals, thereby improving food security and nutrition. Lastly, they have positive impacts on the livelihoods of smallholders, for many of whom animals are their primary productive asset, creating employment opportunities in the rural economy and reducing poverty.

Ensuring the high welfare of wildlife is equally important. Welfare guidelines for wildlife trade and use can lead to lower mortality rates, reduced wildlife capture, prevent the emergence of zoonotic diseases, and diminish the scope for illegal trade, including its associated criminality and security risks.

Reduced consumption of unsustainable animal products

As UNEP has recognised already, reducing dependencies on animal products, both from domesticated and wild animals, can help reduce the risk of disease and future pandemics. It also contributes to food security by reducing the demand for animal feed and, in turn, making food like cereals and soy more plentiful and affordable for human consumption. Lastly, it can generate new livelihood opportunities. For example, plant-based agriculture has substantial potential to create new jobs worldwide. Plant-rich diets have substantially lower emissions than animal-based ones, providing the basis to meeting global climate goals. They further free up land for nature-positive land-use, such as afforestation and rewilding, and lower pollution levels. Moving away from the commercial exploitation of wild animals directly impacts biodiversity protection and restoration.

DEEPENING OUR SCIENTIFIC UNDERSTANDING OF THE NEXUS

UNEA has recognised the vital role of animal welfare in achieving sustainable development and environmental protection. In its Animal Welfare - Environment - Sustainable Development Nexus Resolution, it acknowledged that animal welfare can contribute to addressing the climate change, biodiversity loss, and pollution crises, all linked to human health and well-being and achieving the sustainable development objectives.

To further understand these links, UNEA

requested UNEP to analyse the nexus between animal welfare, the environment, and sustainable development. This analysis can help policymakers find cross-sectoral and mutually-reinforcing solutions to complex and interdependent challenges. It can also prevent decisions that embed harmful practices and facilitate the development of cross-sectoral and coherent governance and policy.

The success of the Nexus report will require an open-minded collaboration between UNEP, WOAH, the Food and Agriculture Organization (FAO), the World Health Organization (WHO), OHHLEP, member states, scientific experts, civil society, and animal welfare organisations.

UNEP's Nexus Report will need to draw on its recent trailblazing reports, and data from ecology, ethology, public health, environmental, medical, veterinary, and animal welfare sciences. It will need to focus on major overlaps, positive feedback loops, synergies, mutually reinforcing solutions, and upstream multi-problem prevention. The report will need to consider animal welfare, the environment, and sustainable development in a balanced and indivisible manner. The needs of the most vulnerable people who rely on animals, and the animals themselves, will need to be prioritised resisting the lure of industrial technofix promises or marginal changes to business-as-usual.

The Nexus report by UNEP has the potential to drive transformative change that ensures the health and well-being of the environment, animals, and humans.

| DEFINITIONS

Animal Welfare is commonly accepted as "*the state of an animal as it attempts to cope with its environment*"(6). The WOAH Terrestrial Code, adopted by its 182 member countries, defines it as "*the physical and mental state of an animal in relation to the conditions in which it lives and dies. An animal experiences good welfare if the animal is healthy, comfortable, well nourished, safe, is not suffering from unpleasant states such as pain, fear and distress, and is able to express behaviours that are important for its physical and mental state*" (7). Several prominent frameworks can be used to measure animal welfare, including the five freedoms and the (modernised) five domains (8).

One Health is defined as: "*an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals, and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent*"(10). Underpinning the One Health definition are principles of equity, parity, transdisciplinarity, and equilibrium. The latter refers to seeking "*a harmonious balance between human–animal–environment interaction*" and acknowledging, among others, "*the intrinsic value of all living things within the ecosystem*". Further, stewardship is also identified as a key underlying principle and "*the responsibility of humans to change behaviour and adopt sustainable solutions that recognize the importance of animal welfare and the integrity of the whole ecosystem, thus securing the well-being of current and future generations*"(9).

Nexus refers to a link or overlap between two or more issues (11). In policymaking, a nexus has become a common framework to understand, explore, and find solutions to complex and interdependent challenges, and identify opportunities across sectors. Solutions can be technical or structural and provide the opportunity to avoid investments that embed non-sustainable or harmful practices in the long term as a narrow or short-term solution to one issue (12). A nexus framework supports policymakers and facilitates the development of cross-sectoral and coherent governance and policy to manage externalities better, minimise trade-offs, and unlock co-benefits and synergies (13).

Sustainable Development: With the UN General Assembly's adoption of 'Transforming our world: the 2030 Agenda for Sustainable Development', Member States "*committed to achieving sustainable development in its three dimensions – economic, social and environmental – in a balanced and integrated manner*". With this, Member States redefined the concept of sustainable development by i) clarifying that the three dimensions of sustainable development are one integrated whole, ii) elevating the protection of the environment to equal the need for economic prosperity and social progress; and iii) determining that progress across the three dimensions can only be achieved in a balanced and concurrent manner.

| BACKGROUND

UNEA'S ANIMAL WELFARE—ENVIRONMENT—SUSTAINABLE DEVELOPMENT NEXUS RESOLUTION

THE NEXUS RESOLUTION

Building on the UN General Assembly Resolution 70/1 (14), which sets out the sustainable development agenda, and the report of the UN Secretary-General on harmony with nature (15), UNEA adopted the Animal Welfare - Environment - Sustainable Development Nexus Resolution on 2 March 2022 (16).

In this resolution, UNEA acknowledged that "*animal welfare can contribute to addressing environmental challenges*" i.e. the interconnected crises of climate change, biodiversity loss, and pollution. The Assembly further acknowledged animal welfare's contribution to "*promoting the One Health approach and achieving the Sustainable Development Goals.*" UNEA also noted that the health and welfare of animals, sustainable development, and the environment are connected to human health and well-being.

To further understand these links, UNEA requested UNEP to analyse the nexus between animal welfare, the environment, and sustainable development.

THE NEXUS REPORT & PROCESS

Based on the resolution, the report is expected to:

- refer to the "*strong body of science supporting animal welfare*". This includes growing evidence on animal sentience.

- explore how animal welfare can help address environmental challenges, promote One Health, and achieve the Sustainable Development Goals. For this, animal welfare impacts on climate change (SDG 13), biodiversity (SDGs 14 and 15), pollution (SDGs 6 and 12), poverty and food security (SDGs 1 and 2) and health (SDG 3) appear to be particularly relevant.

- consider all animals' welfare: wild and domesticated.

UNEP has been asked to prepare the report in collaboration with the FAO, WHO, WOAH, and OHHLEP, and in consultation with stakeholders, including Member States, other relevant intergovernmental organisations, scientific experts, and civil society and animal welfare organisations. This participatory approach throughout the report's development will contribute to its completeness, quality, and broad support.

THIS DOCUMENT

WFA, on behalf of 48 animal protection organisations worldwide, has produced this document to support those developing and contributing to the Nexus report. It aims to provide stakeholders with a starting point to explore further why improving animal welfare is essential for the environmental and development community.
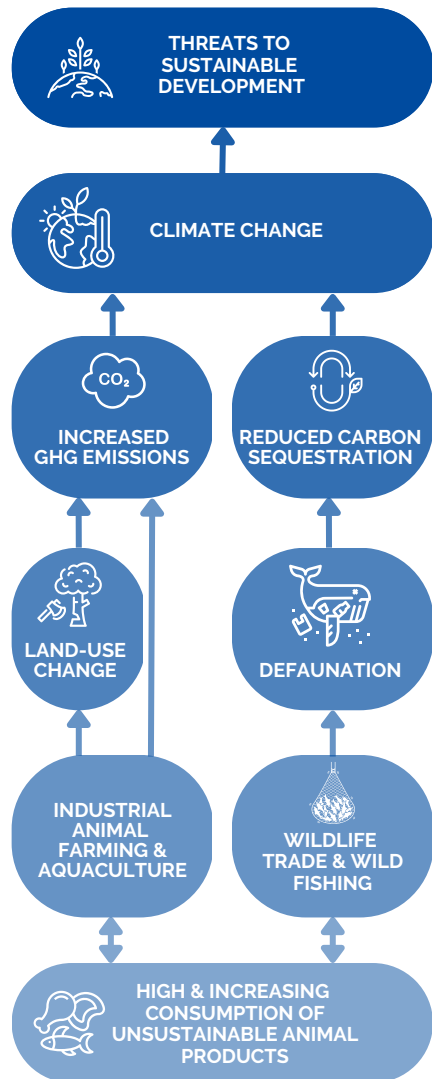
| TOPICAL SUMMARIES

ANIMAL WELFARE IS AN OPPORTUNITY TO TACKLE & COPE WITH CLIMATE CHANGE

THREATS TO SUSTAINABLE DEVELOPMENT

CLIMATE CHANGE

INCREASED GHG EMISSIONS

REDUCED CARBON SEQUESTRATION

LAND-USE CHANGE

DEFAUNATION

INDUSTRIAL ANIMAL FARMING & AQUACULTURE

WILDLIFE TRADE & WILD FISHING

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL PRODUCTS

Human-caused climate change is leading to unprecedented global crises that threaten sustainable development, impacting poverty reduction, food security, access to clean water, sanitation, and exacerbating health risks. As ecosystems become disrupted by climate change, human well-being and the sustainability of economies are also affected. Bold and ambitious action is needed to reduce GHG emissions, build resilience, and ensure a more equitable, sustainable, and prosperous world.

THE NEXUS BETWEEN ANIMAL WELFARE & CLIMATE CHANGE

The industrial exploitation of animals contributes significantly to climate change. Animals, like humans, produce GHG emissions. However, animals' natural behaviours in their environments also play a direct and vital role in maintaining nature's ability to sequester carbon. As the impacts of climate change become more apparent, it is becoming increasingly clear that the protection of animals and their welfare plays a fundamental role in keeping global warming below 1.5° degrees Celsius and helping communities to adapt.

High-welfare animal agriculture & plant-rich diets, and climate change

Using a Tier 2 methodology (IPCC, 2006) and life cycle assessment approach, FAO estimates that animal agriculture contributes 14.5 per cent of total anthropogenic emissions (17). In 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) estimated an even higher contribution of the sector, finding that "*approximately 25 percent of the globe's GHG emissions come from land clearing, crop production and fertilization, with animal-based food contributing about 75 percent of that.*"(18).

A closer examination of livestock-related contributions to climate change shows that the production and processing of feed for industrial systems of animal agriculture, primarily due to land-use change, accounts for almost half of the sector's GHG emissions, according to FAO. Manure storing and processing associated with industrial production adds around ten per cent, with an additional six per cent coming from the processing and transportation of animal products (19).

Similarly, industrial capture fisheries contribute to climate change through emissions from fishing vessels (20), direct disturbance to ocean sediments (21), and loss of carbon sequestration capacity due to the removal of aquatic animals (22). Bottom trawling, a significant contributor to overfishing, is a particularly harmful method that releases significant amounts of carbon that would otherwise be

stored in the seabed. It also causes ocean acidification and reduces the ocean's ability to store CO2. At the ecosystem level, it can displace entire benthic communities through habitat destruction Aquaculture is another contributor to climate change, with an average emission intensity comparable to the production of terrestrial monogastric species (23).

Conversely, higher welfare and lower input systems can be a part of the solution. Silvopasture and agroecological solutions and grass-based and mixed-farm systems have greater capacities for carbon sequestration (24). For example, on degraded land, such carefully managed systems could offset a share of the emissions from livestock (25). Local breeds are more adaptable to local climate conditions and often have lower emissions per unit of production (26).

This shift should happen in tandem with a move towards more plant-rich food systems, which are instrumental to meeting the climate goals as "*impacts of the lowest-impact animal products typically exceed those of vegetable substitutes*"(27), according to research published in Science.

The Intergovernmental Panel on Climate Change (IPCC) states that "*diets high in plant protein and low in meat and dairy are associated with lower GHG emissions.*"(28) This is consistent with UN long-standing guidance, including from WHO and FAO. The EAT-Lancet Commission also recognises that "*food is the single strongest lever to optimize human health and environmental sustainability on Earth*".

It adds that diets "*rich in plant-based foods and with fewer animal source foods… are 'win-win' in that they are good for both people and planet.*"(29)

A 2020 study concluded that even if all fossil fuel emissions were ceased immediately, the current state of global food systems would make it impossible to meet the 1.5°C target and challenging to meet the 2°C target (30). However, by adopting plant-rich diets and moderating the consumption of animal products, food system emissions could be decreased by 47 per cent compared to the status quo.

The role of enhancing animal welfare in food systems and reducing the reliance on industrial animal agriculture has also been acknowledged by IPBES, "*Feeding the world in a sustainable manner, especially in the context of climate change and population growth, entails food systems that ensure adaptive capacity, minimize environmental impacts, eliminate hunger, and contribute to human health and animal welfare*" (31). "*Reducing intensively farmed meat consumption is good for people and the planet.*"(32) says UNEP.

The critical role of animal welfare in carbon sequestration

According to UNEP and other experts, defaunation, involving the reduction of terrestrial and marine vertebrate animals due to hunting, fishing, trade and habitat loss, significantly erodes the ability of forests and oceans to capture and store carbon (33). These two crucial carbon sinks heavily rely on the welfare of animals, specifically their health and natural behaviour, to sustain their carbon sequestration capacity. The combined carbon sequestration of the ocean and terrestrial ecosystems amounts to 5.6 gigatons annually, which is equivalent to 60 per cent of all human-made emissions (34). Large tropical trees, for instance, require large vertebrate animals for seed dispersal and regeneration (35), and a reduction in animal populations and their free movement can hamper forest regeneration. Marine animals play a crucial role in carbon sequestration in the ocean, with UNEP introducing the term "fish carbon" to recognize their potential in mitigating climate change and preserving biodiversity (36). From whales providing necessary nutrients to phytoplankton, which absorb carbon, to fish and other marine animals depositing stored carbon in faecal pellets on the ocean floor, animals play a significant role in maintaining the ocean's capacity as a carbon sink.

Animal protection as a priority for effective adaptation

Building resilience among the most vulnerable populations is crucial as natural disasters become increasingly frequent and intense. Smallholder livestock keepers, fisherfolk and pastoralists are often the hardest hit by climate-induced disasters, and they rely heavily on their animals for survival. Therefore, protecting animals is a priority to safeguard these people's livelihoods.

This is in line with the Sendai Framework for Disaster Risk Reduction, which calls for protecting productive assets to reduce the impact of disasters (37), defining livestock and working animals as important productive assets of the poor and those most vulnerable to disasters.

In its contribution to the UN Framework Convention on Climate Change (UNFCCC) Koronivia Joint Work on Agriculture, FAO noted that "*livestock is vulnerable to direct and indirect climate change impacts, such as drought, floods, thermal stress, water unavailability, poor-quality forage, and pests and diseases. Therefore, adaptation strategies must comprise context-specific adaptation options, while prioritizing measures that strengthen the role of livestock management systems as providers of ecosystem services. This can contribute to sustainable development and poverty reduction, as well as integrating work under the three Rio Conventions with that towards achieving the SDGs*"(38). Adaptation strategies are also needed for coastal communities involved in fishing and aquaculture, given the increasing adverse climate change impacts.
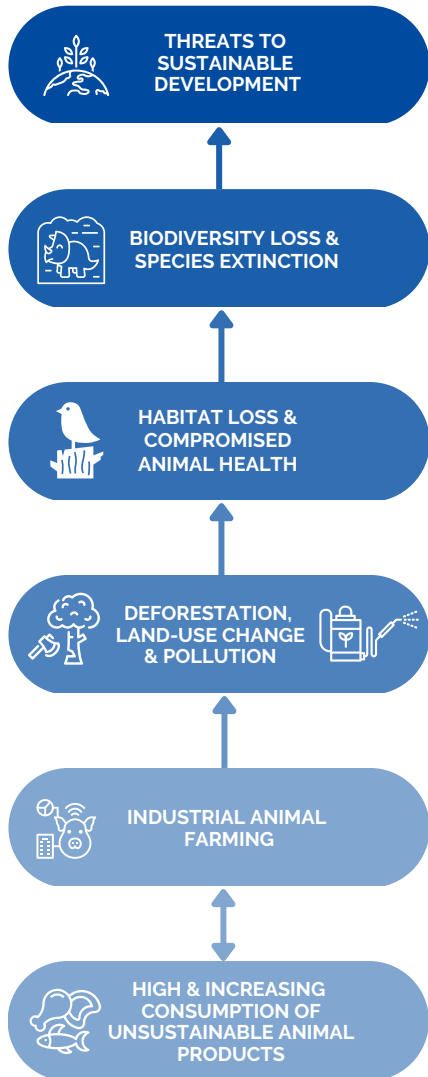
Lastly, besides its climate change mitigation potential discussed above, reducing meat consumption is an essential adaptation strategy as it reduces the strain on land and water resources and ultimately mitigates vulnerability to climate change and resource scarcity, according to the IPCC (39).

POLICY TAKEAWAYS

As UNEP notes, a combination of measures targeting the demand side, protection of ecosystems, and farm-level improvements is needed (40).

- **Animal welfare's role in mitigating and adapting to climate change is evident.** Positive animal welfare interventions in production systems can reduce GHG emissions and help mitigate disaster risk. In addition, policies and practices that protect animals enable them to make their crucial contribution to Earth's carbon capture. This applies to both wild and domesticated, terrestrial and marine animals.

- **The adoption of plant-rich diets can mitigate food systems' emissions,** while lessening animal suffering and positively impacting human and animal health and well-being. Promoting these as part of the global effort to address today's most acute environmental challenge is essential.

ANIMAL WELFARE IS AN OPPORTUNITY TO PREVENT BIODIVERSITY LOSS

THREATS TO SUSTAINABLE DEVELOPMENT

BIODIVERSITY LOSS & SPECIES EXTINCTION

HABITAT LOSS & COMPROMISED ANIMAL HEALTH

DEFORESTATION, LAND-USE CHANGE & POLLUTION

INDUSTRIAL ANIMAL FARMING

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL PRODUCTS

Biodiversity loss refers to the decline in the variety and number of living organisms in a particular habitat or on Earth. Globally monitored population sizes of mammals, fish, birds, reptiles, and amphibians have declined an average of 68 per cent between 1970 and 2016 (41). These drastic species population reductions are an indicator of planetary health, revealing a broken relationship between humans and the natural world, as well as insufficient action to protect planetary health to date.

The loss of biodiversity poses a significant threat to sustainable development. It harms ecosystems and undermines their ability to provide vital goods and services, such as food and water security, a clean and healthy environment, and climate change mitigation, all essential for human well-being and development. Additionally, animals and ecosystems hold cultural significance, particularly for many Indigenous peoples. IPBES warns that current negative trends in biodiversity and ecosystems will undermine progress towards 80 per cent of the relevant targets in SDGs related to poverty, hunger, health, water, cities, climate, oceans, and land (42).

THE NEXUS BETWEEN ANIMAL WELFARE & BIODIVERSITY LOSS

In 2020, IPBES concluded that nature has been most negatively impacted by land-use change, closely "*followed by the direct exploitation, in particular overexploitation of animals, plants and other organisms*"(43). The report notes that unless action is taken to reduce the intensity of the drivers of biodiversity loss, approximately 25 per cent of animal and plant species will face extinction, with many at risk within decades.

Transforming food systems is key to preserve & restore biodiversity

Agriculture uses half of the world's habitable land, with more than three-quarters of it utilised for grazing and cultivating crops for animal feed - animal farming accounts for 77 per cent of globally available farming land (44) and about 40 per cent of global arable land (45). Agricultural expansion, driven largely by the need to sustain industrial systems of animal agriculture, is the primary cause of land-use change causing biodiversity loss.

The industrialisation of animal farming is further leading directly to biodiversity loss through the disappearance of local varieties and breeds of domesticated plants and animals. IPBES notes that by 2016, over 9 per cent of the domesticated breeds of mammals used for food and agriculture had become extinct, and at least 1,000 are threatened (46). Agricultural industrialisation for feed production leads to population declines in birds, insectivorous mammals, and insects, including through the recurrent use of chemical fertilisers and pesticides (47). In addition to these being important issues in themselves, they pose serious risks to global food security by undermining the basis for and resilience of many agricultural systems to threats such as pathogens and climate change.

Conversely, integrating and promoting animal welfare as an essential policy concern has the potential to significantly help preserve biodiversity and restore and regenerate the world's ecosystems. The International Panel of Experts on Sustainable Food Systems highlights the need for a transition to agroecological systems that are integrated within ecosystems and their biodiversity, which they state is necessary and viable irrespective of whether the starting point is highly specialised industrial agriculture or forms of subsistence farming in developing countries (48). Major financial institutions, such as JPMorgan Chase, have also recognised the need for transformative change throughout the food system to avoid further massive depletion of forests and grassland, overuse of water, food-related health problems, and dangerous levels of climate change (49).

In this context, FAO recommends holistic approaches, such as agroecology, agroforestry, and conservation agriculture (50). The IPCC has also recognised the potential of these methods to reduce climate risk for food systems and enhance their sustainability. Done well, these approaches work in harmony with animals and their place within natural processes. They can support biodiversity and ecosystem services (such as pollination, temperature regulation, and carbon sequestration), positively impacting food security, nutrition, health and well-being,

and livelihoods (51). UN organisations recognise systems of consumption and production that embrace concerns for animal welfare as effective for delivering on the biodiversity goals agreed upon in the 2030 Agenda and the recently adopted Kunming-Montreal Global Biodiversity Framework (GBF) (52). For instance, transitioning to high animal welfare systems that primarily rely on animal feed grown in integrated crop-livestock farms would significantly reduce the impetus for land-use change. Together with a shift towards plant-rich diets, this could free up a significant portion of land for restoration (53). It would further be an invaluable strategy for achieving the GBF's goal of protecting 30 per cent of land and water by 2030. Such a transition would also greatly reduce total agricultural climate emissions and restore natural carbon sequestration by forests and biodiverse grasslands (54).

Upholding wild animal welfare helps combat biodiversity loss

The exploitation of wild animals and their natural habitats is the second main driver of global biodiversity loss (55). IPBES and others have identified the trade of wild animals as a significant contributor to this loss, with its global worth estimated to be up to US$220 billion per year, of which up to one-tenth is illegal (56). It is also linked to crime and security risks. A recent UN report on World Wildlife Crime highlights the links between illegal wildlife trade and professional criminal groups involved in other transnational offences (57). The report notes that the illicit proceeds from the wildlife trade can fuel conflict and instability. The

exploitation and trade of wild animals also have indirect impacts, such as the spread of non-indigenous species through the exotic pet trade (58).
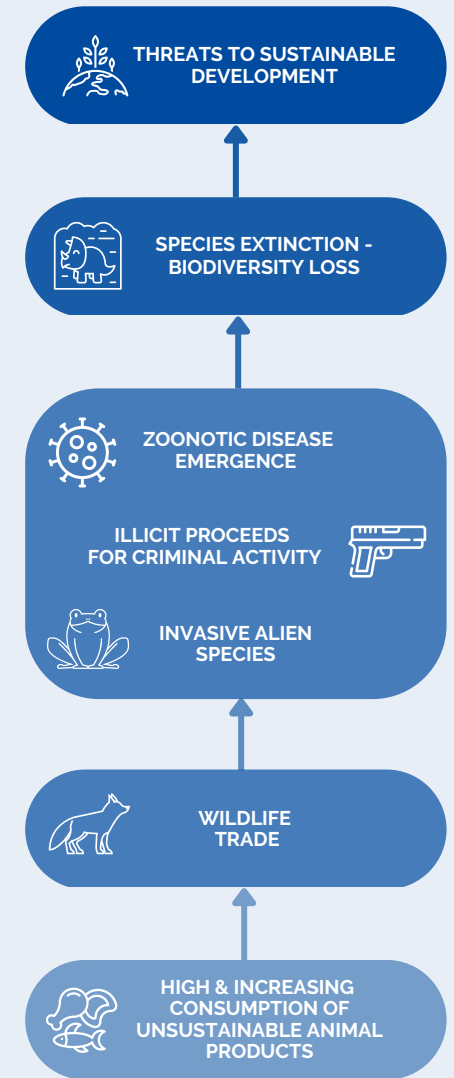
These effects can be avoided, or at least reduced, by protecting wild animals from the harmful effects of exploitation, trade and the destruction of their habitats. Where trade does occur, animal welfare guidelines for wildlife trade and transport can lead to lower mortality rates, wildlife capture, risk factors for the emergence of zoonotic diseases, and scope for illegal trade, including its associated criminality and security risks (59).

Where animals and habitats have been exploited, rewilding is an increasingly pursued approach to enhance biodiversity, which aims to restore healthy ecosystems by reintroducing animals and creating wild and biodiverse spaces (60). The concept of rewilding runs counter to the exploitation of wildlife, in recognising the intrinsic value of wild animals and their contribution to the integrity and functioning of ecosystems, and relies on the core animal welfare principle of freedom to express natural patterns of behaviour. Rewilded ecosystems can also help mitigate climate change by increasing carbon removal from the atmosphere and protect against climate change impacts by reducing soil erosion and flood risk, for example. Rewilding can also create socio-economic opportunities for local communities (e.g. through ecotourism), reduce the effects of and costs associated with environmental hazards (such as flooding), and improve human health and well-being by improving access to nature (61).
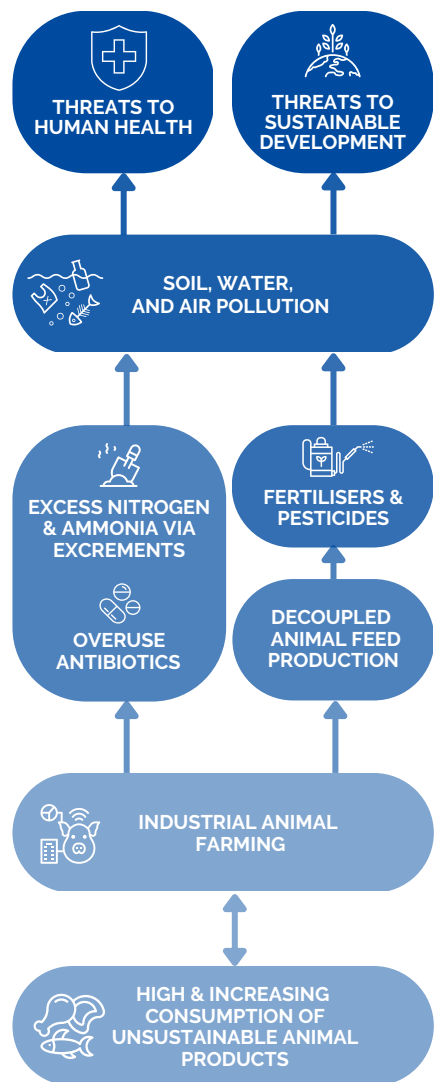
POLICY TAKEAWAYS

Considering animal welfare and developing a culture of coexistence are essential to halt biodiversity loss and achieve sustainable development. They also reflect evolving attitudes towards animals and the significance of human-animal interactions.

- **A reduction of animal products is necessary to preserve and restore biodiversity.** For instance, a shift to plant-rich diets can significantly reduce land-use and help achieve the GBF's goals. Further, a move away from destructive behaviour patterns, such as commercial hunting and wildlife trade offers a pathway towards the 2050 Vision of Living in Harmony with Nature (62). Promoting rewilding efforts may be a way to restore healthy ecosystems and enrich biodiversity on which humans, animals, and the environment depend.

- **Systems that support high animal welfare are good for biodiversity.** Agroecological systems that are integrated within ecosystems work in harmony with animals and their place within natural processes. They can support biodiversity and ecosystem services (such as pollination, temperature regulation, and carbon sequestration), positively impacting food security, nutrition, health, and livelihoods. Transitioning to high animal welfare systems that primarily rely on animal feed grown in integrated crop-livestock farms or on materials people cannot eat would reduce the impetus for land-use change, thereby reducing negative impacts on biodiversity.

THREATS TO SUSTAINABLE DEVELOPMENT

SPECIES EXTINCTION - BIODIVERSITY LOSS

ZOONOTIC DISEASE EMERGENCE

ILLICIT PROCEEDS FOR CRIMINAL ACTIVITY

INVASIVE ALIEN SPECIES

WILDLIFE TRADE

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL PRODUCTS

ANIMAL WELFARE IS AN OPPORTUNITY TO REDUCE POLLUTION

THREATS TO HUMAN HEALTH

THREATS TO SUSTAINABLE DEVELOPMENT

SOIL, WATER, AND AIR POLLUTION

EXCESS NITROGEN & AMMONIA VIA EXCREMENTS

OVERUSE ANTIBIOTICS

FERTILISERS & PESTICIDES

DECOUPLED ANIMAL FEED PRODUCTION

INDUSTRIAL ANIMAL FARMING

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL PRODUCTS

Pollution, the introduction of harmful substances or contaminants into the natural environment, can take many forms, impacting air, soil, freshwater, and oceans (63). Its environmental impact can have direct consequences for sustainable development as it leads to ecosystem damage, loss of biodiversity, and multiple health issues. Pollution is responsible for around nine million premature deaths each year, and the most significant burden of this impact falls on low- and middle-income countries (64). Even within countries, there are significant disparities between the populations experiencing the greatest burden of pollution exposure (65), and pollution is increasingly seen as an environmental justice issue (66). Controlling and preventing pollution is vital to protect the environment, safeguard health, and ensure a sustainable future.

THE NEXUS BETWEEN ANIMAL WELFARE & POLLUTION

How animals are treated can lead to pollution, particularly in industrial agriculture, aquaculture and fisheries. The agriculture sector is a major contributor to pollution. Further, the waste of a substantial proportion of food means that a significant portion of agricultural pollution occurs without even contributing to improving food

security. Certain agricultural practices contribute more heavily to pollution than others (67). As a 2017 FAO report on water pollution from agriculture states, "*the increase in demand for food with high environmental footprints, such as meat from industrial farms, is contributing to unsustainable agricultural intensification and to water-quality degradation.*"(68) For example, industrial agricultural systems that raise animals in confined, dense populations tend to produce more manure and other wastes than can be assimilated by the available land (69), compared to integrated systems that facilitate manure management. This results in soil and water pollution. Pollution from animal wastes carries additional risks to human and environmental health as it can contain pathogens, heavy metals, and veterinary pharmaceuticals (70,71). In addition, the high concentration of animals and their wastes can cause air pollution that disrupts the lives and health of neighbouring communities (72). The production of crops for animal feed can result in further pollution as these crops rely on inputs like fertilisers and pesticides (73). The rise of intensive aquaculture and industrial fishing also pose pollution problems due to overcrowding.

Agricultural systems differ in their polluting impacts particularly across soil, air and water pollution:

Soil pollution

Manure can be a beneficial source of nutrients that can support and improve

local soil structure and moisture retention while preventing erosion (74).

High-animal welfare systems that integrate animals with the land enable the replacement of synthetic fertilisers with manure rather than producing manure in such quantities that it becomes a pollutant, or relying on feed crops that require fertiliser and pesticide inputs. These systems can include organic farming, agroecology, integrated crop-livestock systems, permanent grassland, and agroforestry, including silvopastoral systems. However, when manure and other farm wastes accumulate in quantities that exceed plants' ability to utilise the nutrients, it can lead to run-off of nutrients and contaminants (75). Pollutants may also become volatile and contribute instead to air pollution (76).

Air pollution

Agriculture is the dominant source of air pollution in some regions (77) and the second largest source globally (78), with research indicating that, at least in some countries, the majority of this is linked to the production of animal-based foods (79). Industrial animal agriculture produces air pollutants, most commonly particulate matter, ammonia, and hydrogen sulphide, which all pose human health risks, including respiratory problems and chronic lung disease (80). These pollutants arise directly from manure production on farms and indirectly from the nitrogen fertilisers used to grow feed crops (81). A move toward higher-welfare extensive and

integrated crop-livestock systems can reduce air pollution by ensuring that manure can be used on-farm with minimal aerosolisation (and run-off or leaching) as well as minimise the need for fertilisers and pesticides in another location to produce animal feed. A transition towards plant-rich diets can further reduce the contribution of agriculture to pollution.

Water & marine pollution

Industrial animal agriculture can also be a substantial source of water pollution (82), affecting freshwater and marine ecosystems and resources with nutrients such as nitrogen, phosphorus and potassium from manure, as well as pathogens, veterinary pharmaceuticals and antimicrobials, heavy metals, and hormones (83,84). These pollutants can directly harm human health (85). Nutrients like nitrogen and phosphorus can also lead to eutrophication, a process whereby a massive bloom in algae depletes the water of oxygen, killing fish and other marine animals. Cyanobacteria, a common form of algae that can proliferate under these conditions, poses a particular risk as it produces toxins that can poison humans and other animals using the water (86). High-welfare animal systems that allow animals to graze or feed on crop residues grown on the farm, as opposed to industrially produced feed crops, reduce the reliance on chemical fertilisers and thus further mitigates pollution from agriculture (87). Because

such types of extensive systems tend to recouple animal and crop systems and have a lower reliance on high input feeds, there is less risk of runoff or leaching and subsequently lower levels of water pollution (88).

High stocking densities and excessive feeding can compromise animal welfare and cause toxic wastewater from both aquaculture (89) and intensive terrestrial farming (90). Industrial animal agriculture operations produce vast amounts of manure: some produce over 1.6 million tons a year (91). When this waste exceeds the ability of the land to assimilate it, it can leach into groundwater or run off into nearby bodies of water. The European Commission's Sustainable Finance Platform published two reports in 2022 that included an assessment of whether livestock production systems could contribute to pollution prevention and control. The reports emphasise the coupling of feed production and nutrient creation and cycling within the same farm, and provide an overview of how integrated crop-livestock systems facilitate the production of nutrients such as nitrogen for crops through animal manure and the use of nitrogen-fixing plants (such as legumes). By minimising the need for inputs like feed or fertilisers in integrated crop-livestock systems (and ensuring the farm's capacity supports the number of animals raised there), there is a substantial reduction in water and air pollution (92).
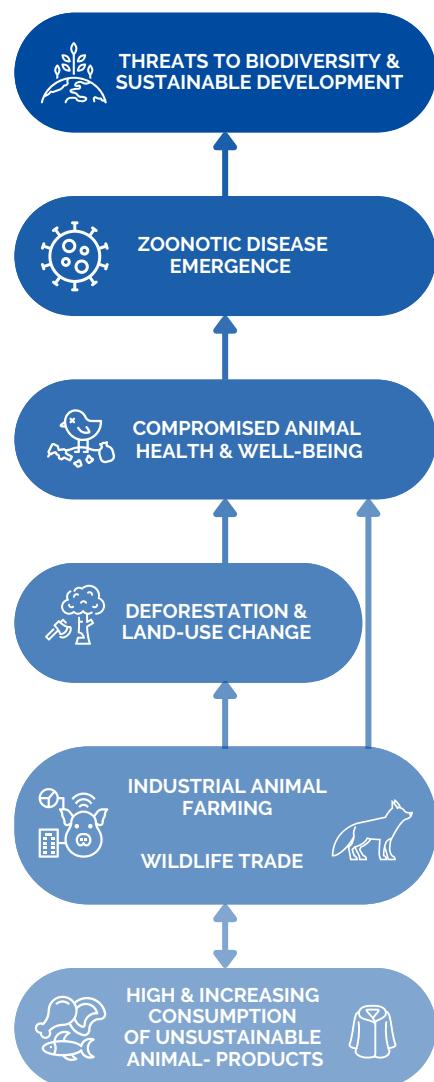
Aquaculture contributes to water pollution and eutrophication through the release of dissolved nutrients, particulate nutrients, and chemicals such as antifoulants and medications (93). Commercial industrial fishing practices are also a significant source of marine plastic pollution with consequential harms to biodiversity. In capture fisheries, abandoned fishing nets and gear, or ghost gear, kill wildlife and pose serious ocean plastics pollution issues. Around 6 per cent of all nets may become lost each year, resulting in ghost gear representing around ten per cent of marine plastic pollution (94). One study found that at the time of recovery, "*870 'ghost nets' recovered in the coastal waters of Washington, USA contained more than 32,000 individual marine animals, including more than 500 birds and 23 mammals*"(95).

POLICY TAKEAWAYS

Pollution has significant impacts on human health and the environment, and the industrial production of animal products is a key contributor to various forms of pollution worldwide. Prioritising animal welfare can provide a lever to shift toward production and consumption systems that have a lower burden of pollution, as can transitioning to lower demand for animal source foods.

- **Shifting to higher welfare animal production systems can provide solutions to the substantial pollution created by industrially producing high numbers of animals and concentrating them in small areas of land**. These systems reintegrate animals with the land, enabling the use of manure as a fertiliser rather than producing it in such quantities that it becomes a pollutant. These systems can include agroecology, integrated crop-livestock systems, permanent grassland, and agroforestry including silvopastoral systems. Their lower pollution can also reduce disease burden among animals, improve human health and well-being, support environmental conservation, and contribute to equity.

- **Shifting current animal feed crops used in industrial systems to human consumption offers the opportunity to significantly reduce a range of pollutants** (96,97,98). Shifts to moderate the consumption of animal products, including from fisheries and aquaculture, can reduce the total pollution from animal products, and help ensure that any animal products that are consumed come from higher welfare, lower pollution systems.

ANIMAL WELFARE IS AN OPPORTUNITY TO ENSURE ONE HEALTH

THREATS TO BIODIVERSITY & SUSTAINABLE DEVELOPMENT

ZOONOTIC DISEASE EMERGENCE

COMPROMISED ANIMAL HEALTH & WELL-BEING

DEFORESTATION & LAND-USE CHANGE

INDUSTRIAL ANIMAL FARMING

WILDLIFE TRADE

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL- PRODUCTS

Human activities have a significant effect on the health and well-being of humans, animals, and ecosystems. The emergence of zoonoses and AMR are prime examples of this.

Zoonoses, infectious diseases that jump from animals to humans, account for a significant portion of all newly identified infectious diseases and many existing ones in humans (99). They are a great public health concern, causing animal diseases and death and posing a severe threat to human health (100). With their potential to cause global pandemics, such as COVID-19, it has become increasingly clear that we cannot isolate human health from the health of other species and the environment. Moreover, zoonoses can spread to other animal populations, including threatened ones (101), leading to the death of wildlife and further biodiversity loss, which can destabilise ecosystems. Zoonotic diseases can also have severe economic consequences, including increased healthcare costs and disruptions to trade and agriculture.

AMR is a serious global threat where microorganisms become resistant to medicines (102), hindering progress towards multiple SDGs. Without action, it could result in up to 10 million deaths per year (103) (SDG 3) and US$100 trillion in economic losses by 2050 (104). AMR can also affect food safety and security by reducing crop yields,

increasing food prices, and spreading from animals' to humans' pathogens (SDG 2). AMR developed on farms can spread through the environment, such as in contaminated drinking water, recreational waters, effluent from agricultural and animal production, and waste streams from pharmaceutical manufacturing and hospitals, which has implications for clean water and sanitation (SDG 6)(105). Addressing AMR to maintain global health gains and ensure a sustainable future is crucial.

THE NEXUS BETWEEN ANIMAL WELFARE & ZOONOTIC DISEASES

The ways in which we treat animals are the main drivers of zoonoses. Most of these pathogens originate from domesticated animals and anthropogenically disrupted habitats, directly or through food systems and other vectors (106). Increasing human demand for animal protein, unsustainable agricultural intensification, wildlife exploitation and use, as well as land use change (including deforestation) and habitat encroachment are some of the main human-mediated factors that contribute to the emergence of zoonotic diseases (107,108).

Industrial animal agriculture and the emergence of zoonotic diseases

Industrial animal agriculture is particularly linked to the emergence, transmission, and amplification of pathogens, including zoonotic diseases (109,110). Poor welfare practices associated with large-scale indoor production, overcrowding, inadequate nutrition, and increased reliance on high-performance breeds of farm animals that

develop illnesses can undermine animals' immune systems, increasing their risk of contracting diseases. On-farm stressors, concluded the European Medicines Agency and the European Food Safety Agency, "*interfere with the normal behaviour of the animals and have been shown to alter the immune system of animals and susceptibility to diseases*"(111).

A recent study of nearly 2,500 European pig holdings, nearly all of which are farmed industrially, found in over 50 per cent of the farms a year-round presence of up to four major swine influenza A virus lineages with the potential to play a crucial role in the generation of new human pandemic viruses (112). This is part of a global trend of zoonotic disease emergence coinciding with the large-scale industrial production of pigs, poultry, and farmed wildlife species (113).

The greater the number of farmed animals, the higher the risk of zoonotic outbreaks (114). "A *certain way to reduce risk of zoonosis and emerging infectious diseases globally (…) is to reduce dependence on intensive animal-based food production systems*"(115). In addition, good animal welfare practices can help minimise the risk of disease transmission in several ways. Ensuring adequate space and ventilation can reduce overcrowding and the spread of diseases. Raising slower growing, regionally appropriate breeds of farm animals and promoting genetic diversity within farm animals that are kept in higher welfare systems improves their immune systems, health, and welfare (116). In aquaculture, appropriate

stocking densities, feeding, and environmental enrichment specific to species and life stages can reduce stress and thus reduce the risk of infection, disease amplification, and transmission. Further, providing animals with good nutrition to strengthen their immune systems and proper sanitation measures, such as regular cleaning and disinfection, can also reduce the risk of disease transmission. All of these prevention strategies should be the first line of defence against disease.

Industrial animal farming as a bridge for wild-type viruses

Industrial farming of animals can also serve as a means for diseases to spread from wildlife to humans (117). Land use change by expansion of farmland into forests and wetlands can bring farmed animals into close proximity with wildlife, such as bats, creating a bridge for naturally occurring viruses to be transmitted to humans (118). This expansion can cause loss, turnover, and homogenisation of biodiversity and exposes adjacent human communities to wildlife harbouring microbes that can become zoonotic pathogens with pandemic potential (119).

In addition, industrialised farms can facilitate the evolution of more virulent pathogens from their less harmful wild types. Crowding thousands or tens of thousands of genetically identical animals creates a perfect mixing vessel for viruses to mutate into more dangerous strains (120,121). Highly pathogenic avian influenza (HPAI), for instance, is often generated in commercial poultry farms, where an innocuous wild-type

virus known as low pathogenic avian influenza can transform into a deadly strain that causes high mortality rates in poultry and clinical infection in humans, as was the case in the U.S. in 2022 (122). This strain can then spread to wild birds (123). A similar risk is emerging from swine influenza viruses that are highly adapted to infect humans (124).

The connection between wildlife trade and potential pandemics

The destruction of ecosystems and the trade and consumption of wildlife have been identified as underlying causes of pandemics (125). Capture, intensive breeding, and transportation of wild animals can compromise their welfare and suppress their immune systems, making them more susceptible to contracting and shedding pathogens.

In addition, markets where live and dead animals, domestic and wild, are sold in close proximity have been recognised as potential hotspots for zoonotic disease transmission. For instance, the severe acute respiratory syndrome (SARS) coronavirus, which led to a multi-country epidemic in 2002-03, was associated with masked palm civet cats sold in informal markets (126). Animal markets provide ideal conditions for the spread of zoonotic diseases by allowing for close contact between humans and animals, and the mixing of different species, which increases the likelihood of cross-species transmission of diseases (127).

A holistic One Health approach is key to prevent zoonotic outbreaks

When estimating the global value of lives lost due to zoonoses, researchers estimated the value to be at least

US$350 billion annually, with an additional US$212 billion in direct economic losses. In contrast, tackling the root causes of pathogen spillover from animals to humans is estimated at an annual investment of approximately US$20 billion. Prevention would cost around 5 per cent of the yearly value of lives lost from emerging infectious diseases (128). Interventions include better management and reduction of wildlife trade and substantially reducing deforestation (129).

Similarly, several studies found that mass dog vaccination programs can be cost-effective compared to the economic costs associated with human rabies cases that cause 59,000 preventable human deaths annually (130). A study estimated that a total of US$6.3 billion (over 13 years) for mass dog vaccination would be sufficient to eliminate dog-mediated human rabies by 2030 (131), requiring an additional investment of US$3.9 billion above 2017 spending levels up to 2030. This pales next to the current annual financial burden of rabies cases estimated at US$8.6 billion per year - a staggering US$69 billion from now to 2030.

In this context, One Health and similar holistic approaches offer an ideal frame for comprehensive strategies to prevent diseases with pandemic potential. According to OHHLEP, prevention refers to "*preventing the critical first step, i.e. preventing a pathogen from transferring from animals to humans.*" It adds, "*prevention includes addressing the drivers of disease emergence, namely ecological, meteorological and anthropogenic factors and activities that increase spillover risk*"(132).

"Preventing zoonotic diseases requires international coordination to reduce the high demand for animal-sourced foods, improve forest conservation governance, and selectively intensify the lowest-producing ruminant animal systems without confinement". (133)

THE NEXUS BETWEEN ANIMAL WELFARE & AMR

The routine use of antimicrobials in animals is fuelling AMR

Globally, 70 per cent of all antimicrobials are used in farm animals (134), with a significant portion being vital in human medicine. This is mainly done to maintain the health and productivity of the animals. They are routinely administered to whole herds or flocks of healthy animals to promote growth and prevent diseases that may arise from crowded and stressful living conditions as well as the reliance on high-growth breeds that are prone to illnesses.

Industrial animal farming results in higher use of antimicrobials per animal than high-welfare farming systems. For instance, research shows that weaning piglets at 22-25 days of age, which is common in industrial pig farming, results in 15-20 times higher use of antimicrobials compared to later weaning at around 35 days or more (135,136). Fast-growing meat chickens receive more antimicrobials per bird compared to slower-growing birds (137).

The overuse of antimicrobials in industrial farming contributes to AMR in animals which can then be transferred to

humans, undermining the efficacy of antimicrobials in human medicine. This is true in aquatic as well as terrestrial systems. Heuer et al. warned in the journal Clinical Infectious Diseases a decade ago: "*Intensive use of antimicrobial agents in aquaculture provides a selective pressure creating reservoirs of drug-resistant bacteria and transferable resistance genes in fish pathogens and other bacteria in the aquatic environment*"(138).

Industrial animal farming systems also lead to the prevalence of antibiotic-resistant bacteria in soil (139) and spread AMR through animal waste (140). Widespread environmental releases of biological AMR pollutants, such as animal waste not typically treated and produced in copious amounts in industrial animal farming operations, establish a major exposure point for AMR in the environment, particularly in water, soil, and air. These help antimicrobial-resistant microbes to spread between and among people, animals, and other environmental reservoirs, disrupting the microbial composition of environmental media and affecting biodiversity and ecosystem services (141).

Improved animal welfare can reduce antimicrobial use

By improving living conditions and reducing animal stress levels, disease incidence can be reduced, and the use of prophylactic and subtherapeutic antimicrobials can be eliminated. Moreover, good nutrition, hygiene, vaccination, and effective disease and herd management can reduce the entry and spread of infections, reducing the

need for antimicrobials. Thus, "*farming systems with heavy antimicrobial use should be critically reviewed, to determine whether/how such systems could sustainably reduce the use of on-farm antimicrobials. If a sustainable reduction in the use of on-farm antimicrobials is not achievable, these systems ideally [should] be phased out*" (142).

Instead of relying on the routine use of antimicrobials, we need to develop "*health-orientated systems for rearing animals*" (143). In such systems, animals would be raised in extensive, naturalistic conditions that prevent overcrowding and avoid excessive herd and flock sizes, which can accelerate the transmission of pathogens, limiting antibiotic use to non-systemic clinical diseases (144,145). The systems would ensure that animals can engage in their natural behaviours and minimise the stress that can undermine the animals' immunity and make them susceptible to disease (146). For example, there would be no early weaning of pigs as this involves several stressors, including premature separation from the sow, mixing with unfamiliar pigs and getting accustomed to a new diet and new housing (147). These health-oriented systems would ensure good air quality, such as low dust levels, ammonia, and carbon dioxide, as poor air quality can lead to respiratory disease. They would avoid using genetically selected animals for fast growth rates and high yields as these animals are vulnerable to immunological and metabolic problems (148). Workers would receive training to monitor and identify physical and behavioural welfare indicators.
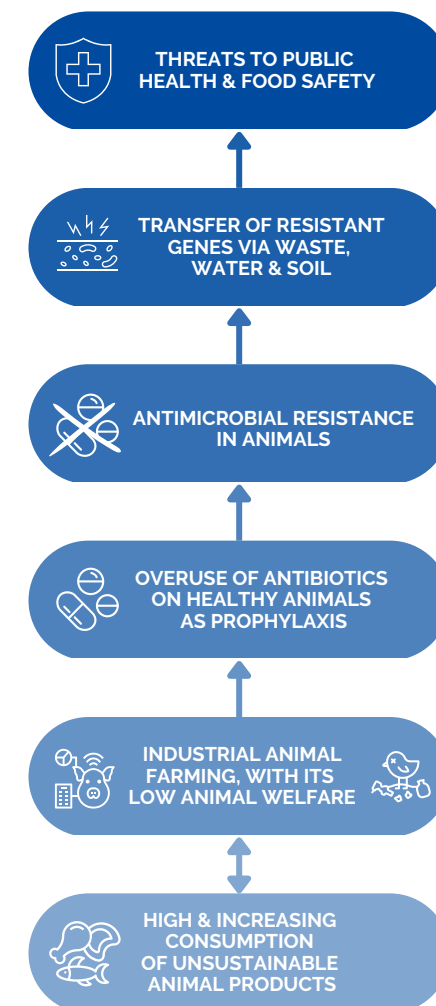
POLICY TAKEAWAYS

One Health is essential "*to sustainably balance and optimise the health of people, animals and ecosystems*"(149).

- **Animal well-being is at the centre of sustainable public health.** The improved state of animals' well-being can enhance their health, reduce disease incidence, and avoid the need for routine antibiotic use. Such improvements can help promote global health by, for instance, reducing the risk of zoonotic diseases and AMR. In this way, improving the treatment of animals is critical for achieving One Health, which requires humans to acknowledge responsibility for adopting sustainable solutions that protect animal welfare and ecosystem integrity. These are essential for the well-being of current and future generations (150).

- **Reducing dependencies on animal products, from domesticated and wild, can help reduce disease risk.** Wildlife exploitation and trade, for instance, has been linked to the emergence of pandemics, as animals kept in poor environments and under stress are more susceptible to diseases. Intensive breeding and transportation of animals can also weaken their immune systems, making them more vulnerable to pathogens.

Multisectoral partnerships like the One Health Quadripartite (151) are needed, as well as governments, international institutions, and the private sector incorporating One Health into their policies. Existing One Health plans should be expanded to protect the environment and animal welfare.

"The more successful the actions aiming at improving animal health and welfare are, the more successful will be the attempts to reduce the use of antimicrobials" - Federation of Veterinarians of Europe (152)

THREATS TO PUBLIC HEALTH & FOOD SAFETY

TRANSFER OF RESISTANT GENES VIA WASTE, WATER & SOIL

ANTIMICROBIAL RESISTANCE IN ANIMALS

OVERUSE OF ANTIBIOTICS ON HEALTHY ANIMALS AS PROPHYLAXIS

INDUSTRIAL ANIMAL FARMING, WITH ITS LOW ANIMAL WELFARE

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL PRODUCTS

ANIMAL WELFARE IS AN OPPORTUNITY TO INCREASE FOOD SECURITY

All human beings have the right to adequate food, including all the nutritional elements needed to live a healthy and active life, and the right to be free from hunger (153). Food security is a public responsibility and a crucial aspect of sustainable development. Its realisation is inextricably linked to health and education outcomes, economic growth, and environmental sustainability. However, the unsustainable production of food can undermine food security in the long run. This is because such food systems can contribute to deforestation, soil degradation, water scarcity, and pollution and greenhouse gas emissions. These negative impacts can ultimately undermine the long-term viability of food production and lead to shortages, price hikes, and reduced access to food, especially for vulnerable populations. Therefore, a shift to sustainable food systems is essential.

SDG 2 aiming to "end hunger, achieve food security and improved nutrition and promote sustainable agriculture by 2030" recognises these interlinkages. In the last decade, however, the number of people suffering from hunger and food insecurity has been on the rise. As many as 828 million people may have suffered from hunger in 2021 (154). It is time to re-evaluate the world's food systems to provide nutritious food for all while supporting people's livelihoods and protecting the environment (155).

THE NEXUS BETWEEN ANIMAL WELFARE & FOOD SECURITY

Good animal welfare practices can contribute to food security by improving the productivity, health, and well-being of farm animals. They can reduce waste and the economic losses associated with disease outbreaks and other production losses, as well as help maintain the long-term sustainability of food systems by reducing the environmental impact of animal production. Animal welfare is indispensable for ensuring food security and nutrition (156).

Reduced animal protein dependence can enhance food systems efficiency

The industrial production of animal products, particularly livestock, relies heavily on using human-edible food such as cereals as animal feed. Between 36-40 per cent of global crop calories are used as animal feed (157,158) with even higher proportions in countries with mostly industrial livestock farming (159,160). Most feed grain, 69 per cent, is used in the highly industrialised pig and poultry sectors (161).

The use of grain and other human-edible food reduces the global food balance as livestock convert grain inefficiently into meat and milk. According to the FAO, they convert the carbohydrates and protein contained in grain into a smaller quantity of energy and protein than humans could have gained directly by consuming the grain (162). For every 100 calories of human-edible cereals fed to animals, only 17-30 calories enter the human food chain (163,164), and for every 100 grams of grain protein fed to animals, just 43 grams enter the human food chain as meat or milk (165). Similarly, 90 per cent of the wild fish used in animal feeds could instead be eaten directly by humans (166). "*Almost a third of the total food value of global crop production is lost by "processing" it through inefficient livestock systems*"(167).

This highly inefficient food system is leading to a net drain on the world's food supply, causing food insecurity and inequity (168). According to the IPCC, "*aquaculture and livestock dietary components may also compromise crops and forage fish that provide essential nutrients for low-income households increasing nutritional insecurity in regions of sub-Saharan Africa, Asia and Latin America*"(169). In the case of forage fish for aquaculture feed, food security of coastal communities is put at risk as forage fish is an important source of protein and income (170).

If food production and consumption continue in their current form, food security will face a double challenge. First, projected growth of the world's population to 9.7 billion by 2050 increases overall demand for food. Second, as people become more numerous and richer, global demand for animal products could potentially increase by 70 per cent until 2050, which will further strain available calories and protein if produced by using human-edible food as animal feed (171).

To combat food insecurity and malnutrition, available resources need to be used more efficiently. This requires two concurrent changes. First, production needs to shift away from

using human-edible food as animal feed. Animals only contribute positively to food production when they convert materials that humans cannot consume into food humans can eat, i.e., if fed on grass (on marginal, non-crop land), by-products, crop residues, and unavoidable food waste (172,173). As this would result in a halving of global animal protein production, an equivalent shift in consumption towards more plant-rich diets would be required. The shifts in production and consumption are in line with UNEP's recommendation to reduce the use of grain production to feed animals and produce more food for direct human consumption (174). Studies have shown that if the cereals used as animal feed were used for direct human consumption, they could feed an additional 3.5 billion to 4 billion people each year (175,176).

In the medium- to long-term, alternative proteins, i.e., meat, eggs, dairy, and seafood made from plants and cells without the use of live animals, will likely provide a complementary pathway that could increase efficiency of food production, while reducing harm to animals. For example, cultivated meat has the potential to be substantially more efficient than traditional meat production methods. Studies suggest that it could use land up to 60-300 per cent more efficiently than poultry and 2,000-4,000 per cent more efficiently than beef (177).

Better treatment of animals can improve food systems' quality & productivity

Industrial animal agriculture entails conditions that are detrimental to the welfare of animals. Alternative high-welfare systems can allow for increased productivity without threatening sustainable development. In 2014, the CFS promoted "*supporting animal health and welfare (...) to sustainably increase productivity, product quality, and safety*" (178), and in 2016, it further recommended to "*improve animal welfare delivering on the five freedoms and related WOAH standards and principles*" (179). Even, the way humans work with, respond to, and interact with animals in food systems can improve or reduce production (180). For example, in dairy cows and goats, negative interactions with or fear of humans can lead to reduced milk production (181). In pigs, negative handling can lead to impaired growth and lower reproductive performance (182). And in poultry, fear of people can lead to lower egg production and poorer quality and slower growth (183). Additionally, better animal welfare practices can lead to reduced mortality rates (184).

Higher levels of animal welfare can also result in healthier and safer food for people. Farming of free-range animals that consume fresh forage and have higher activity levels has been shown to provide meat with better nutritional quality than industrially reared animals. For example, pasture-fed beef and free-range chicken have a lower fat content and higher levels of beneficial omega-3 fatty acids compared to grain-fed beef and industrially farmed chicken (185,186).

POLICY TAKEAWAYS

It is imperative to transform food systems and supply chains to improve food security and human health, and support a more sustainable and humane environment for animals. This will help ensure that food production no longer breaches planetary boundaries.

- **By reducing the number of animals industrially farmed, the commercial demand for animal feed can be lowered,** making foods like cereals and soy mo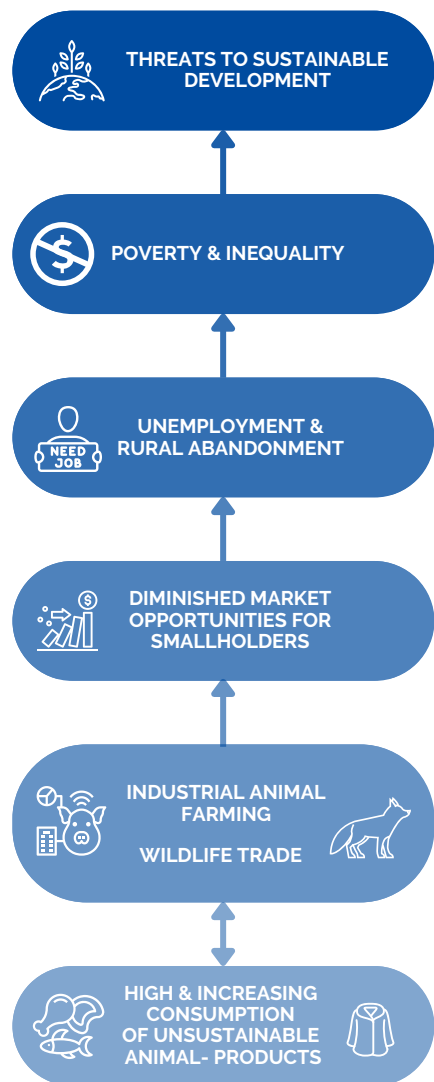re affordable for human consumption. This, in tandem with improving access to plant-based nutrition, can enhance dietary health and open up significant amounts of land for nature-positive regenerative agriculture, rewilding, or afforestation

- **Increasing support for higher-animal welfare systems,** for example through agro-ecological solutions, can improve the quality of food while contributing to the productivity of food systems through healthier animals.

ANIMAL WELFARE IS AN OPPORTUNITY TO SECURE LIVELIHOODS

THREATS TO SUSTAINABLE DEVELOPMENT

POVERTY & INEQUALITY

UNEMPLOYMENT & RURAL ABANDONMENT

DIMINISHED MARKET OPPORTUNITIES FOR SMALLHOLDERS

INDUSTRIAL ANIMAL FARMING

WILDLIFE TRADE

HIGH & INCREASING CONSUMPTION OF UNSUSTAINABLE ANIMAL- PRODUCTS

Eradicating poverty is a pressing global challenge and an essential prerequisite for sustainable development, as recognised by the 2030 Agenda. The achievement of the first SDG to "*end poverty in all its forms everywhere*" requires integrated, coordinated, and coherent strategies at all levels to address the root causes and challenges of poverty, as emphasised by Member States at Rio+20 (187). However, progress towards this goal has been uneven, and inequalities persist.

To effectively eradicate poverty, improving access to sustainable livelihoods, opportunities and productive resources is recognised as an effective action. Such efforts will not only contribute to the achievement of SDG 1 but also play an important role in fostering innovation (SDG 9), and reducing inequality within countries (SDG 10).

In addition to these benefits, prioritising poverty eradication can also help address the intertwined challenge of environmental degradation. By empowering individuals and communities to adopt sustainable practices through access to education and job opportunities, they can transition to more sustainable livelihoods, and contribute to environmental protection.

THE NEXUS BETWEEN ANIMAL WELFARE & LIVELIHOODS

Livelihoods in animal agriculture & fisheries

According to FAO and the World Bank, livestock supports the livelihoods of at least 1.3 billion people worldwide (188), being the primary productive asset of around one billion of the world's poorest (189). The International Fund for Agricultural Development (IFAD) has estimated that one billion smallholders in developing countries depend on livestock for food and income (190). Animals help rural households achieve their livelihood objectives by providing food for families, generating additional income, and acting as a buffer during crises. Additionally, animals supply manure for crops, draught power for tilling, and transport for products and families.

The fisheries sector similarly is an important source of livelihoods globally, with an estimated 58.5 million people engaged as full-time, part-time, occasional or unspecified workers in fisheries and aquaculture. Of these, approximately 21 per cent were women. By sector, 35 per cent were employed in aquaculture and 65 per cent in capture fisheries (191).

The importance of animal welfare in securing livelihoods and aiding poverty eradication is underexplored. However, indications are that the growth in low-welfare industrial animal agriculture is affecting the livelihoods of the rural poor. In contrast, the introduction of high

welfare systems can be a catalyst for poverty eradication and addressing environmental challenges.

Since the beginning of this millennium, it has been recognised that the industrialisation of animal agriculture has a distinctly negative impact on smallholder producers, employment options in the rural economy, and poverty. As early as 2003, FAO pointed out that industrial animal production "*may occur at the expense of diminishing the market opportunities and competitiveness of small rural producers*" (192). The World Bank went one step further and noted that the intensification of livestock production brings "*a significant danger that the poor are being crowded out*" (193). The CFS has more recently confirmed that "*intensive agricultural systems are associated with negative effects on employment, wealth distribution, ancillary economic activity in rural areas and service provision in rural areas*" (194).

As animals are often the primary productive asset of the poor, enhancing the welfare of animals (through better veterinary care, feed, shelter, etc.) will enhance their productive capacity and increase food security and income. IFAD notes that such animal welfare-enhancing activities include vaccinating animals against major diseases, building them shelters, preserving fodder for difficult times, and promoting silvopastoral and other sustainable systems (195). Similarly, better welfare can also be associated with improved financial returns for working equids, from brick kilns to resilience after disasters (196).

According to the World Bank, "*growth in agriculture remains in general two to three times more effective at reducing poverty than an equivalent amount of growth generated in other sectors*"([197](#)). Growth in high-welfare livestock systems is even more effective in this regard and is the only route to doing so sustainably, as confirmed by the CFS, which stated in 2014: "*supporting animal health and welfare promotes human safety and health and is a prerequisite to sustainably increase agricultural and livestock productivity and to secure product quality and safety*"([198](#)). In 2016, the CFS further stressed the importance of animal welfare and included in its policy recommendations "*to improve animal health and welfare in all livestock systems*"([199](#)).

A recent World Bank case study in Colombia that involved the conversion of nearly 32,000 hectares of degraded land to silvopastoral systems had, between 2011 and 2018, achieved a 17 per cent increase in milk production, 18.5 per cent reduction in production costs, and an increase in incomes by up to US$523 per hectare/per year. Like shade-grown coffee, shade-grown cows in silvo-pastoral systems are more productive and more sustainable than cows raised in open fields: the shade lowers the animals' heat stress so they produce less methane, while the diversified vegetation improves their diet and productivity. In addition, the high-welfare silvo-pastoral system of livestock production has allowed for the capture of CO2 and the conservation of native biodiversity ([200](#), [201](#)).

Wildlife & Livelihoods

Wild animals are not only an integral part of the natural world, but also provide an important source of livelihood security for poor rural communities. The decline in wild animal populations is thereby a serious concern, with the World Bank estimating that it will contribute to an annual loss of over US$70 billion in developing countries. This loss of income deepens poverty and further alienates and marginalises already disadvantaged communities ([202](#)). Protecting wild animals and their habitats is critical for sustainable environmental and development efforts.

In 2018, the UN General Assembly recognised "*the potential of sustainable tourism, including ecotourism, to eradicate poverty by improving individual livelihoods in local communities and to generate resources for community development projects*". It further encouraged Member States to promote ecotourism as a tool to foster environmental protection ([203](#)). Protecting wild animals and their habitats is necessary to maintain and utilise that potential sustainably.

Job creation from alternatives to animal products

"*There are business opportunities to develop new systems and technologies that also enhance animal welfare. Interest in the welfare of farm, companion, laboratory animals etc. can lead to new industries to supply this demand and to new innovation opportunities*"([204](#)).

Several recent studies identify significant potential to create new job opportunities from changes to food systems, including transitioning to more plant-rich diets. For Latin America and the Caribbean, a 2020 study by the International Labour Organisation and Inter-American Development Bank estimated that a shift in diets could create 19 million new full-time equivalent jobs by 2030 ([205](#)). Compared with 4.3 million jobs in livestock herding, poultry, dairy, and fishing lost in this scenario, this would be a net increase of 15 million jobs in the region compared to a business-as-usual scenario, reducing agricultural GHG emissions and improving public health. Socio-economic modelling analysis of the French food system found that "*a just transition involving a systematic, policy-led recomposition of the food system that prioritizes climate health and biodiversity could maintain and generate more jobs across the European agri-food sector without loss of income than the business-as-usual scenario, while offering more diversified foods and despite reductions in total production*"([206](#)). This includes livelihoods from alternative products, which could support 8 million jobs worldwide by 2040 ([207](#)), including new and higher-skilled jobs in Brazil, the United States, and Europe, all countries with major livestock industries ([208](#)).

POLICY TAKEAWAYS

- **High-welfare animal agriculture can be an effective way to address poverty and promote sustainable agricultural development.** Integrating animal agriculture systems, such as silvopastoral systems, have the potential to positively impact smallholder producers, employment options in the rural economy, and poverty. Industrial animal agriculture, on the other hand, has been shown to have negative effects on these areas. Enhancing animal welfare through measures such as veterinary care, feed, and shelter can increase the productive capacity of animals, which is particularly important for the poor who rely on animals as their primary productive asset.

- **Plant-based agriculture has substantial potential to create new jobs worldwide.** The evidence suggests that a shift towards plant-based production could not only have positive social and environmental impacts, but also economic.

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