Mending the Broken Relationship with Nature: Tackling the Biodiversity, Ecosystems, Health and Climate Change Nexus Post-COVID-19
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For further information on this policy brief, please address your enquiries to:
Dr. Stefanos Fotiou
Director, Environment and Development Division
Economic and Social Commission for Asia and the Pacific (ESCAP)
Email: fotiou@un.org

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Summary

This policy brief highlights how human health is directly linked to the state of biodiversity and climate change in the Asia-Pacific region. Improving human health and mitigating against future health disasters requires simultaneously addressing these causative factors in an integrated fashion.

Coronavirus SARS-CoV-2 (COVID-19) is a zoonotic disease, transmitted by animals to humans. Zoonotic diseases are driven by many environmental factors that enhance the interface between wild animals, domestic animals and humans. Prior to the COVID-19 outbreak, the region’s environmental health was already under enormous pressure. The COVID-19 pandemic is therefore a call to urgently restore and reconnect a sustainable relationship between nature and human societies.

This poses the following questions:

- What are the environmental issues that pose threats to human health and how are environmental and human health related?
- What are the approaches that can be used to understand these interactions?
- What are the concrete policy actions that can be implemented to mend the broken relationship between human societies and the environment and address, at the same time, the global biodiversity, climate and health crises?

It is critical to generate knowledge to bring about change that emphasizes a shift away from current development trajectories characterized by biodiversity loss and ecosystem degradation, unsustainable production and consumption patterns, pollution, and climate change. A framework to address the nexus between the health of the natural world and human health within the limits of what nature can provide, in alignment with the 2030 Agenda for Sustainable Development, is imperative.

A combination of institutional weaknesses, structural economic weaknesses and behavioural weaknesses in the way we manage our environment led to the degradation of environmental health in the region and are linked to the environmental drivers of zoonoses:

- Institutional weaknesses reflect weak governance and institutional capacities. They include a lack of political commitment, despite the available science, to address critical environmental issues such as the biodiversity and climate crises, and siloed approaches to the management of environmental and human health.

- Structural weaknesses, arising from the prevalence of an unsustainable economic paradigm include land use change, unsustainable urbanization, all types of pollution, and issues in the way the economic, financial and business sectors take into account the environment.

- Behavioural weaknesses are linked to unsustainable lifestyle and consumption patterns. They encompass illegal wildlife hunting, trade and increase in international live animal exports, unsustainable agro-food systems and the unsustainable impacts of population growth.

With a framework addressing these linkages, specific institutional, structural economic, and behavioural change solutions are offered to ensure that environmental health and human health are protected, and offers perspectives on how to simultaneously address the causative factors of zoonoses in an integrated manner, focusing on the nexus between biodiversity, ecosystems, human health and climate change.

Key institutional solutions include the adoption of a regional agenda that would bring in all relevant actors, strengthen environmental laws, regulations and their enforcement, and enhance monitoring capacity, with a focus on addressing the biodiversity and climate crises. Structural economic solutions look at how to render land management and urbanisation more sustainable, at reducing and managing pollution.
appropriately and at how putting nature at the economic paradigm can improve both human and environmental health. Finally, behavioural change solutions focus on better managing wildlife and wildlife trade, at promoting sustainable agri-food systems as well as overall sustainable consumption and production.
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<tr>
<td>CBD</td>
<td>Convention of Biological Diversity</td>
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I. Introduction

The world is now facing a major climate crisis, the sixth massive biodiversity extinction due to human activities, and a global health crisis caused by COVID-19. Failure to address these issues together will pose major threats to the achievement of the 2030 Agenda for Sustainable Development. We therefore need to urgently mend our broken relationship with nature in order to set the world on a greener, more resilient and sustainable trajectory.

The Asia-Pacific region has significant biodiversity and numerous endemic species and hosts sixteen biodiversity hotspots and seven megadiverse countries. Indicators, however, show the severe decline to this biodiversity and highlight multiple threats. Drivers of biodiversity loss include land use and land cover change, climate change, pollution, and over-exploitation of natural resources. These natural ecosystems are however recognized to provide important ecosystem services, many of which have substantial economic value.

The region is a major contributor to climate change, producing more than half of all global CO2 emissions, and is home to six of the top ten carbon-emitting countries. Currently, the nationally determined contributions (NDCs) submitted by member states fall short of reaching the targets set by the Paris Agreement. Health indicators for the region show a high burden of communicable and non-communicable disease. Pollution and environmental factors, along with lifestyle, are significant contributors.

It is now recognized that the combined impacts of climate change and biodiversity loss are a significant threat to human health and wellbeing. Zoonoses— infectious diseases transmitted from animals to humans—are a major concern making up an increasing proportion of all newly identified infectious diseases. Zoonotic pathogens may be bacterial, pathogenic or viral, and can spread through direct contact, through food, water or the environment (WHO 2020). There are over 200 known types of zoonosis, most notable are Ebola, rabies, Middle East Respiratory Syndrome (MERS), avian influenza (H5N1), HIV, and COVID-19. Figure 1 and Figure 2 display the types of recently emerging and re-emerging infectious diseases (non-zoonotic included) and the growing number of outbreaks over the past few decades, respectively. It is therefore urgent to restore a harmonious relationship between nature and human societies to ensure sustainable development and mitigate future zoonoses.

This policy brief is focused on the biodiversity, climate change and human health nexus. It provides information on the state and drivers of biodiversity loss and climate change and how it impacts human health. A nexus describes the dependencies, interdependencies, or connections between two or more issues or factors, such as sectors in an economy, and the synergies, conflicts, and trade-offs between them. Zoonoses are closely linked to environment and development patterns and their drivers include land-use changes that increase the risk of diseases. Among other environmental drivers, biodiversity loss can negatively impact human health through multiple pathways. Factors that negatively affect the ecosystems that produce our food, such as loss of pollinators, impact agricultural production. Additionally, land-use change destroys wildlife’s natural habitats which enhances the interface between wildlife and human populations, increases the risk of transmission of infectious diseases and reduces the provision of services provided by these ecosystems. It is vital to have intact biodiversity and functioning ecosystems as they provide a variety of critical services. Ecosystem services are the benefits people obtain from ecosystems, which include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services, such as nutrient cycling, that maintain the conditions for life on Earth (Leemans and De Groot 2003).
Figure 1: Newly emerging, re-emerging, and deliberately emerging infectious diseases from 1981 to 2020 (Source: Morens and Fauci 2020)

Figure 2: Global number of infectious disease outbreaks and richness of causal diseases from 1980–2010. (a) total global outbreaks (left axis, bars) and total number of diseases causing outbreaks in each year (right axis, dots), (b) host type, (c) pathogen taxonomy and (d) transmission mode (Source: Smith et al. 2014)
Climate change and its effect on wildlife habitats further enhance this risk. Due to climatic changes, species are forced to shift habitats with many moving into increasingly smaller areas, or new semi-natural habitats that may be in close proximity to humans (Lorentzen et al. 2020). As these animals interact with their novel ecosystem, animals and humans alike are exposed to viruses that are potentially lethal to humans. Biodiversity on the other hand can affect the climate change system and helps build climate resilience through nature-based mitigation such as carbon sequestration, and adaptation measures from mangroves that reduce flood and storm surge impacts or plant species that can adapt to drastic weather changes.

The COVID-19 pandemic has reinforced knowledge of zoonosis and its links to biodiversity loss and climate change and the importance of shifting development trajectories. The recovery phase from this global pandemic provides an opportunity to work more effectively towards achieving the principles of the 2030 Agenda, focusing on balancing progress on People, Planet, Prosperity, Peace, and Partnerships. An integrated approach addressing the biodiversity, health and climate nexus provides insight and guidance on which factors need to be focused on in building forwards better post-COVID-19. Three areas require focus: 1) institutions need to be strengthened to enhance regional coordination and governance to ensure biodiversity/ecosystem conservation and to address the climate crisis; 2) structural economic change is needed to focus on sustainable land management and urbanization, address environmental pollution, and place nature at the center of the economic paradigm; and 3) individual and societal behavior needs to be shifted away from unsustainable destructive practices causing environmental degradation.
II. An Integrated Approach on Biodiversity, Health and Climate

It is important to seek a balance between human health, wellbeing, and equity at a global scale with environmental processes and natural system functions—emphasizing the linkages between human health and nature, and nature’s limitations, thresholds, or boundaries. Human health and society depend on flourishing natural systems, and therefore wise stewardship of these natural systems is essential. A more in-depth analysis of the links between environmental changes and ecosystem impairments and their impact on health (Figure 3) depicts how the escalation of human pressure on the environment drives biodiversity loss and climate change, which has direct health effects on human populations (water shortages, exposure to pollutants, radiation, natural disasters), ecosystem-mediated health effects (altered infectious disease risks, depletion of natural medicine, mental health issues) and indirect health effects due to livelihood loss, crop failure, migrations/displacement, and conflict.

Furthermore, the interlinkages between human health and the environment echo well the interrelatedness of the Sustainable Development Goals (SDGs) and how progress on specific goals can have co-benefits on other goals. For instance, SDG 3 on good health and wellbeing relies on good nutrition, freedom from hunger and thirst (SDG 2), clean air (SDG 13), clean water (SDG 6), life below water (SDG 14), life on land (SDG 15) and sustainable energy (SDG 7).

Figure 3: Mechanisms by which the harmful effects of ecosystem change can affect human health (Source: Whitmee et al. 2015)
Thus, an integrated approach provides a framework for the development, implementation, and assessment of ambitious, integrated policies that address these linkages in alignment with the 2030 Agenda for Sustainable Development and the post-2020 Biodiversity Conservation Framework. It can help frame integrated and holistic solutions to build better symbiotic relationships between humans and ecosystems that have impacts on health and resilience as well as economic and social co-benefits within environmental limits. Therefore, in working towards an integrated approach, shifting away from current development trajectories characterized by unsustainable overconsumption patterns and environmentally destructive practices is vital. It also requires dealing with the injustices of current development patterns and developing the necessary knowledge to bring about this change.

In the following sections, we will look at the status of the environment and human health in Asia and the Pacific, analyze key fault lines and barriers to achieving an integrated approach in the region, and propose national and regional level collaborative action to restore the sustainable relationship between people and nature.
A. Current Progress Towards the 2030 Agenda and SDGs

The 2030 Agenda for Sustainable Development with its 17 SDGs was adopted in 2015 and focuses on the universal eradication of poverty, action on climate change, reducing unemployment, strengthening gender equality, promoting peaceful societies, and ending environmental degradation. The principles behind this agenda have been defined as the 5 'P's, People, Planet, Prosperity, Peace, and Partnerships. These emphasize the intertwined nature of this agenda, where progress on one 'P' must balance and support progress on another. Implementing these principles of the 2030 Agenda can help to address many of the underlying risks to humans, including zoonosis.

Currently, the Asia-Pacific region is not on track to achieve any of the 17 SDGs by 2030 (Figure 4). The Asia and Pacific SDG Progress Report 2021 (ESCAP 2021) highlights three issues: insufficient progress has been made, insufficient data is available to monitor progress, and the region has regressed in its climate- and ocean-related goals. There is a significant disparity within the Asia-Pacific region regarding the goals of reduced inequality; responsible consumption and production; and peace, justice, and strong institutions. However, while progress has been made on economic growth, in terms of gross domestic product (GDP), this growth came at the cost of the region’s biodiversity and ecosystem services. With massive acceleration in efforts and action, goals related to meeting basic needs, health and wellbeing, education, water and sanitation, and safe and just societies are achievable. However, events such as COVID-19 compromise progress to meet the goals with lockdown measures heavily affecting mobility and migration, forcing digitalization of education, and decreasing democratic government conduct—having significant human and economic costs (Shulla et al. 2021). Current trends of biodiversity loss and climate change in the region is concerning as biodiversity loss is forecasted to worsen in most countries by 2030 and nearly half of all global greenhouse gas (GHG) emissions originate in the Asia-Pacific. These are far off target and will require significant policy adjustments and economic refocus if there is any chance of meeting these goals in the future.
B. Current State of Biodiversity

Biodiversity in the Asia-Pacific region is one of the richest and most diverse. This region has innumerable islands and an extensive coastline known for their high levels of species endemism and rich coastal and marine ecosystems. The WWF Living Planet Report 2020 (see Almond et al. 2020) and IPBES Asia-Pacific Assessment (IPBES 2018) show species and ecosystems are in severe decline and face multiple threats. The direct drivers of biodiversity loss are land-use and land cover change, natural hazards, climate change, pollution, over-exploitation, and the impacts of invasive alien species. The indirect drivers of loss include changes in human demography, economic development, cultural transformation, advancing destructive technologies and rapid urbanization.

The most severely impacted ecosystems are evergreen forests, alpine ecosystems, limestone karsts ecosystems, inland wetlands and estuaries, mangroves, and coastal habitats. There has been a steady decline in large vertebrate populations due to illegal trade and poaching, and the few remaining individuals are restricted to only the best-managed protected areas. In IPBES’s Regional Assessment on Biodiversity and Ecosystem Services for Asia and the Pacific (2018), estimates place 25 percent of the region’s endemic species at high risk of extinction, and bird extinctions on some islands are as high as 88 percent of historically recorded species. Thirty seven percent of aquatic and semi-aquatic species in the region are threatened due to pollution, commercial agriculture, and overfishing. While the number and size of protected areas have increased, 75 percent of biodiversity remains unprotected. The transformation of natural ecosystems for agriculture and urbanization are predicted to increase in pace and area in the immediate future. Additionally, illegal hunting and trade have increased rapidly in the past 15 years due to its high profitability. Economic studies show the international export of live animals is currently worth approximately US$21 billion per annum (Bolland 2017), with four of the top ten global importers and exporters found within the Asia-Pacific region (Andersson et al. 2021).

While dependence on these resources varies across the region, evidence shows that human wellbeing is strongly tied to nature. The loss of biodiversity translates into a loss of ecological structure and function, which disrupts ecosystem service delivery. Examples of this are: changes in biodiversity can cause impacts on human health through increased frequencies of pest and disease outbreaks. Changes may also affect agricultural production through the loss of pollinators. Tourism may also be negatively impacted by the loss of charismatic species and scenic landscapes. With its enormous wealth of genetic material, biodiversity represents an important future resource that some industries, such as the medical industry, may draw on in the future.

The IPBES Asia-Pacific regional assessment shows the economic value of nature to people in the region has considerable value (IPBES 2018). Calculations for the restoration and management of forests and woodlands in the region have been shown to be US$864 per hectare per year, the replacement of carbon stores would be US$760 per hectare per year. Valuations of wetlands for their water regulating services are estimated at US$3,957 per hectare per year. In addition to these provisioning services, high economic values were also observed for physical and psychological experiences associated with wetlands with values of US$1,506 per hectare per year. The rich biodiversity is also a valuable resource for future options and benefits for people, a value that cannot be measured. However, global trends show a downward trajectory in the economic value of ecosystem services in the region due to environmental depletion and degradation.

C. Current State of the Climate and Climate Change Drivers

Cities within the Asia-Pacific region are major contributors to climate change and are expected to produce more than 50 percent of GHG emissions over the next 20 years (ESCAP 2020b). The clear-felling and burning of forests are a major source of carbon emissions in the region. If the Paris Agreement targets are to be met and climate change kept within the 1.5
degrees Celsius target, then a 7 percent annual reduction in emissions will be required over the next ten years. This is roughly equivalent to cutting all emissions in the six highest carbon emitting countries in the region. The NDCs submitted by member states fall short of reaching this ambitious target.

Whilst there are large local and intra-regional variations within future climate change projections, the following changes are anticipated for the broader Asia-Pacific region. Temperatures are expected to increase above the global mean for most of the Asia-Pacific region (Christensen et al. 2007; Kirtman et al. 2013). Increases in precipitation are also anticipated in many areas. However, some decreases in rainfall are also predicted within Central Asia, particularly in summer (Liu et al. 2020). Reductions in snow and ice are anticipated in the Himalayan and Tibetan regions as glaciers shrink and permafrost thaws. It is also expected that the frequency and intensity of extreme events will likely increase. More droughts and heatwaves are anticipated with greater intensity and duration. Extreme wind and rainfall events associated with tropical cyclones and hurricanes are also expected to increase. These events are likely to generate severe flooding, which may cause landslides. A rise in sea level is expected, as well as increases in both the minimum and maximum sea temperatures (Mcleod et al. 2019).

Climate change will affect all ecosystems, increase the risk of natural disasters, and cause wide-scale species extinctions. This is likely to have major economic impacts and potentially cause large-scale human health crises. Climate change will affect key sectors of the economy, including the tourism, agriculture, and fishing sectors. Rising temperatures and changing rainfall patterns, combined with periods of drought, are likely to change river drainage patterns and river flows. This has implications for freshwater supply in the region. Rising sea levels and more intense rainfall events may result in flooding and enhanced coastal and mountain erosion, placing those who live in these regions at greater risk. Shifting species habitats and ranges are likely to result in multiple species extinctions. This may constrict the livelihood opportunities of the rural poor which depend on wild nature. Human health may also be impacted as an increased frequency of pests and disease is also anticipated (Trebiicki and Finlay 2019).

Environmental factors, particularly those linked to disease transmission, lifestyle, and diet, account for much of the premature mortality in this region (WHO 2008). There are several prevalent communicable diseases, including HIV and AIDS, dengue fever, and malaria. The risk factors associated with some of these major communicable diseases are environmental. Non-communicable diseases prevalent in the region include cardiovascular disease, cancer, and diabetes. Risk factors of these are linked mainly to the use of tobacco and alcohol, unhealthy diets, and inadequate physical activity. Certain links have been drawn to urbanization in the region and shifting lifestyles.

This region is home to the top 30 most polluted cities globally (ESCAP 2020b). More than 90 percent of this urban population is currently exposed to levels of air pollution that pose significant health risks. In 2016, 2.2 million deaths were attributed to air pollution (ESCAP 2020b). Of these, 29 percent resulted from heart disease, 27 percent stroke, 22 percent chronic
obstructive pulmonary disease, 14 percent lung cancer, and 8 percent pneumonia. Air pollution is a significant compounding factor to the poor health of the region.

Poor health has direct economic impacts, resulting in reduced economic growth and lower domestic and foreign investment levels. Addressing the identified regional health concerns will require a strong focus on environmental issues, enhanced food production, and counterbalancing the negative lifestyle trends associated with globalization. Environmental quality and environmental health ultimately underpin human health.

In the next section, we will analyze a number of fault lines in the environmental and development system that hinder progress towards achieving a healthy nexus between nature and society.
An integrated approach highlights the need to protect nature, restore degraded ecosystems, and accelerate climate action to mitigate the risk of future pandemics (ESCAP 2020a). Emergent long-term recovery strategies, based on this approach, specifically to address the drivers of zoonosis and reduce the risk of future pandemics, are outlined in Figure 5 below.

Assessing the fault lines blocking progress towards achieving a healthy nexus, they are categorized into three themes: institutional weaknesses, where weak governance and institutional capacity contributes to environmental degradation; structural economic weaknesses, linked to unsustainable economic development; and behavioural weaknesses, that relate to lifestyle and consumption patterns.

Figure 5: Conceptual framework for mitigating the risks of zoonosis through a focus on the nexus between biodiversity, ecosystems, human health and climate.
A. Institutional Weaknesses

**Unsustainable use of biodiversity and ecosystems.** The continuing loss of biodiversity on a global scale represents both direct and indirect threats to human health, wellbeing, and survival. The lack of adequate conservation and sustainable use of biodiversity and ecosystems is driven by land use change in terrestrial and freshwater ecosystems, climate change, pollution, invasive alien species, and a growing demand for natural resources and energy due to growing human populations. Research shows that biodiversity loss is linked to the emergence of infectious diseases and the emergence of new pathogens and the re-emergence of known diseases including dengue and malaria. Some theories even suggest that dominant species in an ecosystem (i.e., humans and the livestock upon which we depend) could place a target on its own back and be the main focus of pathogens, suggesting we are likely to see an increasing prevalence of zoonoses amongst humans (Salkeld et al. 2013). Nature and the diversity of microorganisms, flora, and fauna is also a source of medicine and inspiration for medical treatments. Close to 50 percent of medical drugs are developed from natural products, with about 50 to 70,000 plant species harvested for medicines. Biodiversity loss thus limits the discovery of potential treatments for many diseases and health problems and can be considered as a “health insurance” for human populations.

Unsustainable coastal development and exploitation of marine resources have made marine ecosystems vulnerable. The issue of coastal development and unsustainable management of marine resources is compounded by marine pollution, ocean acidification—both from terrestrial and marine sources—and climate change all of which are adding stress to fragile coral reefs, the most biodiverse ecosystem on earth. Furthermore, toxic bioaccumulation of heavy metals is prevalent in fish with harmful implications for human health as these toxins move up the food chain. Long-term intake of seafood with high levels of arsenic and cadmium may lead to health problems such as skin lesions, nerve damage, skin cancer and diseases of the blood vessels. Additionally, consumption of food with high levels of lead and mercury can affect the development of the nervous system, particularly in children, infants and developing foetuses.

**BOX 1: THE DILUTION EFFECT?**

The dilution effect suggests that changes in the levels of biodiversity affect the risk of zoonosis. An increase in species diversity will reduce the risk of zoonoses to humans and livestock, meaning that the risk is diluted by a greater number of species, with the opposite being true for removing species. When ecosystems and habitats are transformed into agriculture or plantations, they experience a large-scale biodiversity loss. Potential host species for disease are likely to include those species that have been removed. The parasite burden may fall on to those remaining species, including humans. So, the risk becomes concentrated on the few remaining species. If these changes in an ecosystem impact the species responsible for amplifying a pathogen, then disease risk will decrease. However, if the reverse is true and the species responsible for amplifying a pathogen benefits from the transformation, then disease risk increases.

**Climate change.** Similarly, the climate crisis largely derives from a lack of sufficient climate ambition to meet the 1.5°C scenario of the Intergovernmental Panel on Climate Change (IPCC), despite some national commitments to reach carbon neutrality and some ambitious NDCs. Climate change is a direct result from unsustainable consumption and production patterns, of a growing demand for natural resources and energy due to growing human populations, of financial incentives promoting fossil fuel use instead of greener energy, and of the degradation of the natural ecosystems with the capacity to capture and absorb carbon.

Climate change disrupts ecosystems, affects food production, increases the occurrence and impacts of natural disasters, is linked to air pollution and is also forecasted to increase disease prevalence (Khasnis and Nettleman 2005). Looking at the impacts on
ecosystems and wildlife, climate change may bring wild animals closer to humans, further heightening the chances of zoonotic outbreaks. For instance, bats are a common vector of disease; their natural habitat includes caves and trees. Due to climatic changes, species are forced to shift habitats. Many species move into increasingly smaller areas, or new semi-natural habitats that may be in close proximity to humans, given humans increasing sprawl. As these animals interact with their novel ecosystem, animals and humans alike are exposed to new viruses that could have been dormant in bats and are potentially lethal for humans (lyssavirus, SARS, Ebola). Another example is the increasing frequency of dengue fever due to higher temperatures increasing the available habitat for the dengue fever vector, the Aedes aegypti mosquito, while also increasing the longevity of the mosquito.

Silos in government and policy making prevent integrated approaches that effectively address environmental issues jointly with other sectors (productive sectors and health). Additionally, it does not provide the adequate platform to address the environment as one of the three pillars of sustainable development.

Weak environmental law and regulations and/or their lack of enforcement have direct consequences towards the sustainable use and management of biodiversity and natural resources, on climate change, and pollution. For example, the lack of ability to combat illegal wildlife trade and to appropriately ensure health standards in live animal trade can lead to the emergence of zoonosis. There is also a lack of joint environmental action at all levels that prevent immediate action. Protecting the environment is a joint responsibility, that should be shared by individuals through their consumption and lifestyle choices, by policymakers, and by all parts of society who manage and use the environment.

B. Structural Economic Weaknesses

Land-use change augments the risk of diseases as it enhances the interface between wildlife and human population, increases the risk of transmission of infectious diseases and reduces the provision of services provided by these ecosystems. The emergence of zoonoses is considered a ‘logical consequence of pathogen ecology, as microbes exploit new niches and adapt to new hosts.’ Land cover changes driven by deforestation, the industrialization of agriculture, afforestation and urban sprawl are the most significant driver of infectious disease emergence and transmission (Loh et al. 2015). Research by Morand (2020) shows the effect of the rapid expansion of livestock production on epidemics and biodiversity loss. As livestock production has grown in response to increasing demand for animal protein, the number of epidemics linked to livestock match this increase, and it is also matched with an associated loss of biodiversity. The increased risk of interaction between wildlife and humans due to land conversion to farms and high demand for animal food can strain a farm’s ability to adequately prevent and control diseases—creating additional risks to the emergence of zoonosis. Other studies have also shown a relationship between the loss of forest cover and outbreaks (Figure 6)
Unsustainable urbanization. There is no historical precedent for an urban transition on such a massive scale in Asia and the Pacific. Urbanization is characterized by the conversion of rural land, increased population density and built-up area, socioeconomic change and ecological fragmentation, which can have profound impacts on the epidemiology of infectious diseases such as COVID-19, with urban slums and wet markets for example creating new ecological niches and risk factors for such diseases. These factors are all magnified by climate change, creating increased opportunities for zoonotic spill over events to occur. Informal settlements and slum communities are particularly vulnerable, given the coexistence of poor living conditions coupled with poverty and precarious employment situations, such as large numbers of subsistence labourers.

Pollution affects ecosystems and human health. One example is the bioaccumulation of heavy metals and in the food chain and their impacts in terms of human health. Microplastics enter food and water many humans consume. Health risks associated with this include hormonal interferences, reduced fertility, various cancers and weakened immune systems. Air pollution is one of the largest environmental hazards worldwide and specifically in the Asia Pacific (OECD 2020a). The deterioration of ecosystems contributes to this health issue, as another result of unsustainable agriculture and unregulated land use change (forest fires, slash and burn agricultural practices).

Growth as the only measure of progress. Society is unable to shift away from the idea that development is measured by economic growth. This siloed view of growth is unsustainable and extremely destructive, as economic growth often occurs at the expense of natural resources. This systemic way of thinking needs a holistic approach, which considers environmental limitations and dependencies. The financial market systems are also based on this outdated measure of development, with environmental degradation not internalized in costs or risks. A shift from a focus on the current financial growth model towards wealth accounting, that includes natural capital, would support the adequate valuation of ecosystems as risk adjusted returns. The financial sector needs to better account for these risks in governance, strategy, due diligence and in screening of investments.

There are many financial incentives, including taxes and subsidies that promote a brown economy and environmental pollution. Currently, countries provide
more than US$500 billion annually in subsidies that are potentially harmful to nature. This is more than five times annual public and private spending to protect biodiversity (OECD 2020b). A common example of a potentially harmful fiscal measure is the issuance of loans, grants and guarantees without any environmental conditions, to bailout companies that have a heavy biodiversity footprint (e.g., airline and coal companies). Some countries have introduced subsidies potentially harmful to biodiversity (e.g., fertilizer subsidies), and temporarily waived or reduced biodiversity-relevant taxes (e.g., on oil/gas exploration and production), charges (e.g., on commercial operators in conservation areas) and fees (e.g., licencing fees for mining; protected area entrance fees).

C. Behavioural Weaknesses

Illegal wildlife hunting, trade and increase in international live animal exports can lead to the emergence of zoonosis, if not catering for the health and wellbeing of animals and for human health risks.

Unsustainable food production systems also play a major role in the emergence of zoonoses. In addition to driving land use changes, selective breeding for specific characteristics reduces genetic diversity, including agro-biodiversity, hereby reducing the long-term resilience of agricultural system to environmental changes and climate change and increasing zoonotic disease risk. Growth in livestock production creates greater likelihood of wildlife interacting with domestic animals, potentially acting as intermediate viral hosts and drives the expansion of agricultural land. Intensive agriculture is also associated with intensive use of agrochemicals that have effects on the ecology of soils and watercourses and the indiscriminatory use of antibiotics, causing antimicrobial resistance including in bacteria of public health significance. The persistent organic pollutants (POPs) from agriculture and industry processes are also quite severe in the Asia-Pacific region and impact human health and the environment. Additionally, poor sanitation of animal holding facilities and poor welfare standards stress animals, reducing their immune response and leave them susceptible to diseases.

Population growth and unsustainable consumption behaviours affect ecosystems and human health. With growing human populations comes a growing demand for food, water, energy, which take a toll on natural resources and the state of the environment. Rising incomes and lifestyle changes and continued resource-intensive growth patterns are expected to further exacerbate resource depletion and ecosystem degradation, increase pollution levels and drive climate change.
V. Building Forward Better Post-COVID-19 – Recommendations

A. Greening the Recovery Packages

To ensure a green and resilient recovery in the Asia-Pacific region, it is important to design green recovery packages as a first step. Using an integrated approach framework, several environmental-specific measures can address global environmental changes in addition to limiting and mitigating the impacts of environmental degradation on human health. Government stimulus packages should aim to accelerate decarbonization, build cleaner energy security-based independence and support the implementation of the Paris Agreement. Stimulus investments should be spent in line with existing national environmental and climate objectives, and recovery plans should at least maintain, if not strengthen, existing environmental standards and policies related to climate change, air and water pollution, biodiversity loss, and other environmental challenges.

Regulatory measures that promote the conservation, sustainable use and restoration of biodiversity are opportunities for the region to build back better. However, the prevalence of harmful activities persistently outweighs these options. Since the COVID-19 pandemic began, many governments have weakened land-use policies, waste collection requirements, air and agricultural pollution standards, project permitting processes, and environmental monitoring and reporting requirements. In addition to weakening existing environmental regulation, some countries have postponed the entry-into-force of forthcoming environmental regulations (OECD 2020c). Beyond adopting green recovery packages, there are broader and longer-term opportunities to adopt holistic approaches that jointly address the fault lines of environmental health and human health.

B. Institutional Change Solutions

Adopt a regional agenda targeting the nexus between biodiversity, ecosystems, human health and climate, bringing in all relevant actors: Regional best practices exchange and capacity building platforms can support policy makers to embed environmental considerations into COVID-19 recovery packages, including at the local level, which is critical for the achievement of national, regional, and global environmental and sustainable development objectives. All relevant stakeholders, including all sectors of government—breaking siloes—civil society, academia/research and private citizens should be engaged in this approach. Furthermore, it is important that the regional agenda focus on strengthening existing environmental regulations affecting the drivers of environmental and human health degradation, and on supporting their implementation frameworks.

Ensure biodiversity and ecosystem conservation: Governments need to create strong national frameworks to embed biodiversity and ecosystem services into the disease prevention, poverty eradication, global Biodiversity Agenda (Post 2020 Biodiversity Framework) and sustainable development agendas. Nature-based solutions have the potential to lift a billion people out of poverty and create productive growth to the global economy while reducing disaster risk and supporting vital biodiversity and ecosystem functions and services such as clean air, clean and plentiful freshwater, pollination services, and control of pests and diseases.
Promoting biodiversity conservation and restoration can also provide short-term jobs that could form an important part of green recovery packages. Conservation of protected areas, and measures that reduce unsustainable exploitation of high biodiversity regions will reduce the interface between wildlife-livestock and humans—helping to prevent the spill over of novel pathogens (IPBES 2020). Conservation policies should focus on large-scale integrated restoration of degraded ecosystems, enhanced management of protected areas to increase resilience to natural and health disasters and on the protection of biodiversity corridors. Strengthening transboundary conservation is also of primary importance. Protected area networks have been increasing steadily since 1990, with some countries in the region at the forefront of the designation of marine reserves (CBD 2016).

**Raise climate ambition and urgently address the climate crisis:** A green pandemic recovery could cut up to 25 percent off the expected 2030 emissions based on pre-COVID-19 policies, but to date, the opportunities for adopting recovery measures accelerating a green transition has largely been missed (UNEP 2020). It is urgent to raise climate ambition to meet the 1.5°C scenario of the IPCC. Addressing climate change would also largely support protecting biodiversity and ecosystems as climate change is one of the key drivers of biodiversity loss.

Furthermore, ecosystem-based adaptation measures, involving a wide range of ecosystem management activities to increase the resilience and reduce the vulnerability of people and the environment to climate change, provide co-benefits such as clean water and food for communities, risk reduction options and benefits, and other services crucial for health, livelihoods, and human well-being. Climate smart practices in agriculture also provide positive benefits for biodiversity.

### C. Structural Economic Change Solutions

**Focus on sustainable land management:** Addressing the direct and indirect drivers of ecosystem degradation and destruction bears huge co-benefits for biodiversity and climate change, in addition to ensuring the continuous provision of ecosystem services supporting human health. Sustainable land management policies should be integrated across sectors and focus on achieving land degradation neutrality, afforestation, preferably from a biodiversity perspective, agroforestry, and forest landscape restoration. For example, direct forest-protection payments to outcompete deforestation economically could achieve a 40 percent reduction in areas at highest risk for virus spill over (Dobson et al. 2020), as well as on land use changes from agriculture and urbanization.

**Promote sustainable urbanization:** It is imperative to address urban sprawls that lead to accelerated land use change, unsustainable consumption patterns, and pollution in an effort to promote greener and cleaner cities. Access to public space, including open green space, has a positive impact on health, physically and mentally. Focusing on integrating nature-based solutions within the built environment, in both urban and peri-urban areas, protects biodiversity and mitigates future chances of disease outbreak and transmission. Influencing such environmental measures into the location, spatial patterns and design of place-based features and amenities in the built environment can benefit environmental and public health goals in cities and regions. Regional best-practice sharing platforms for the promotion of sustainable cities could support reducing air pollution, provisioning more green spaces, promoting nature-based solutions in or near cities and protecting urban biodiversity could provide many benefits for the mitigation of zoonosis. Integration of health and environmental goals into the planning of such cities will result in reduced costs and environmental impacts and improved health.

**Addressing environmental pollution that affects human health is critical:** For example, in marine ecosystems, addressing marine litter issues and heavy metal accumulation in the food chain would lessen human health risk and reducing air pollution would lessen the risk of respiratory diseases and the severity of the symptoms associated with COVID-19. Regional platforms and networks supporting the tackling of air pollution as shared risks and responsibilities should be strengthened.

**Put nature at the center of the economic paradigm:** Adopting natural capital approaches, reforming the
financial sector to promote a greener economy, removing financial incentives that promote environmental degradation, are key to ensuring the environment is preserved as a capital supporting economic and social development. As biodiversity moves up the political agenda, a real-world focus in economics is likely to be part of the change. Assessing the economic value of biodiversity and presenting ecosystem services in this way will be an essential part of making information-based judgements, and in promoting the cross-sectoral integration of biodiversity conservation.

D. Behavioural Change Solutions

Better management of consumption of wild animals and wildlife trade: There are risks associated with the hunting and trade of wild animals for human consumption, medicine, and recreational purposes. Increasing regulations on wet markets, wildlife consumption for food, as well as banning illegal wildlife trade across the region would be immediate steps towards mitigating and preventing current and future zoonosis.

Render the agri-food systems more sustainable:
- **Localize food systems**: COVID-19 has exposed the fragility of global value chains. With the shutdown of the global market, the opportunity presents itself to switch to local, national or regional trade (ESCAP 2020c), even though open trade has been important to deliver food to countries in need. Localized food systems benefit communities, provide advantages in sustainability and human nutrition, as well as strengthen agro-biodiversity and make food systems more sustainable. Moving from global to intra-regional food trade and more local food systems would also help prevent future zoonosis and speed up from economic recovery from the pandemic.
- **Transition to agro-ecology**: Agro-ecology is an example of low carbon, risk-informed, resilient, regenerative, and sustainable agricultural practices, which apply ecological principles to food systems. A regional push to support the transition towards agro-ecology in Asia and the Pacific would support environmental progress in the region. Thoughtful principles for food production regenerate farmland and ecosystem functions, mitigate climate change, promote agricultural biodiversity, contribute to resilience building, and reduces disaster risk—therefore mitigating risks of zoonoses. A transition to agro-ecology should be mainstreamed into agricultural sector policy, planning and investments. Sanitary and phytosanitary standards should also be prioritized in agriculture.
- **Enhance animal welfare laws, biosecurity, and sanitary standards**: Enhanced biosecurity, animal welfare laws and more stringent production animal welfare and sanitary standards for phytosanitary and animal production needs more attention. Changes in laws should enforce more stringent regulation of animal welfare standards specifically in known problematic areas such as live animal exports and in high-intensity farms. In particular, ICT-enabled technologies and innovation have potential to prevent and control zoonotic diseases on livestock farms and strengthening research and development and up scaling their applications including in small farms and through south-south cooperation could play an important role.

Promote sustainable consumption and production: Given the growth in human populations, with its impacts on natural resource consumption (food, energy, raw material, water, etc.), it is all the more urgent to increase resource efficiency, fundamentally shift consumption patterns and production processes, improve waste management systems, and transition toward a more circular economy approach.
VI. Conclusion

Reducing the risk of health disasters and enhancing human health into the future requires the radical restructuring of policy, planning and governance approaches, such that they effectively enmesh associated biodiversity and climate change issues. The COVID-19 recovery seems at the same time a huge challenge but an opportunity to initiate this shift towards sustainable development trajectories that promote a healthy relationship between nature and human societies and tackle the great environmental and health challenges of our times.
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