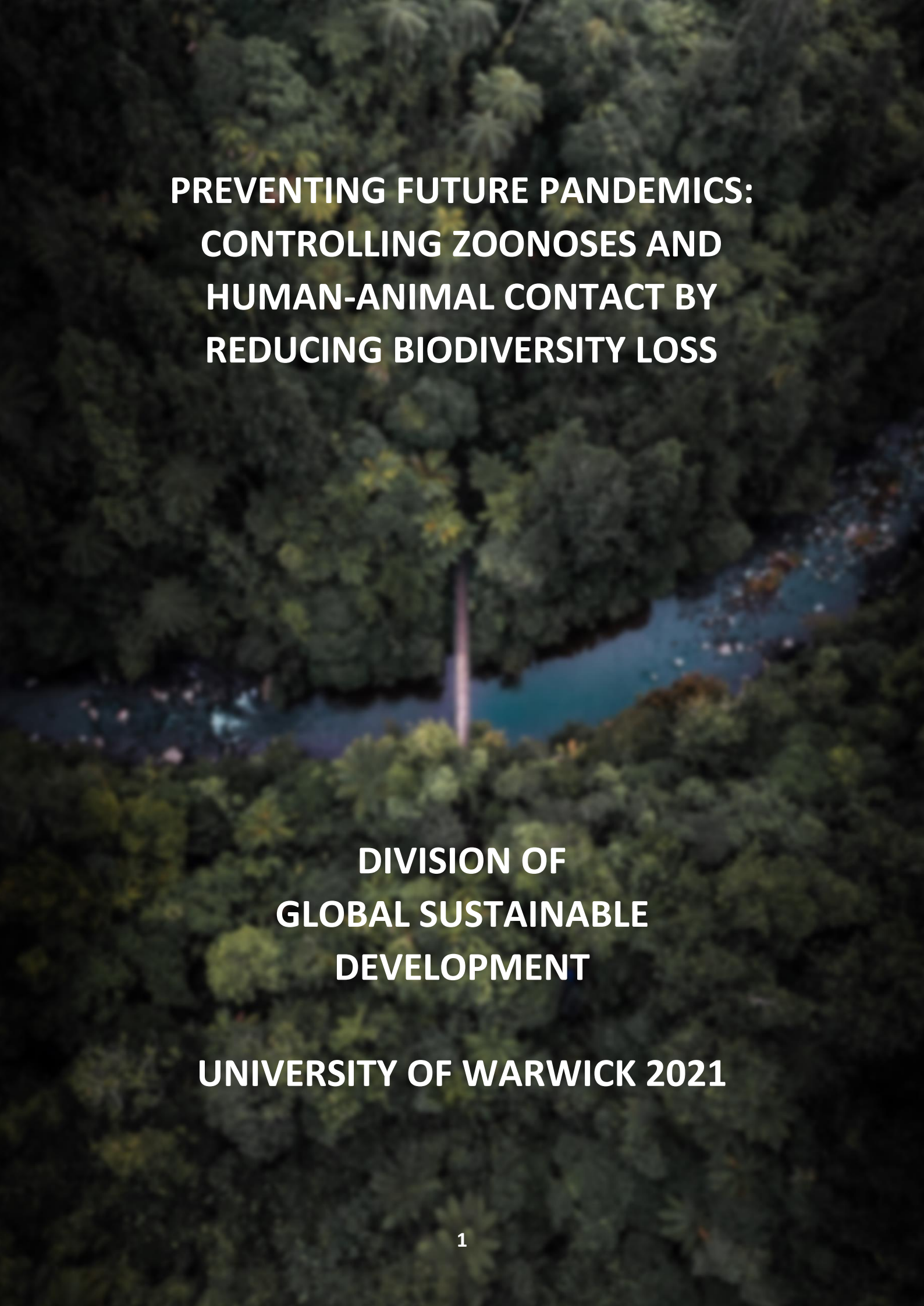

PREVENTING FUTURE PANDEMICS: CONTROLLING ZOONOSES AND HUMAN-ANIMAL CONTACT BY REDUCING BIODIVERSITY LOSS

DIVISION OF
GLOBAL SUSTAINABLE
DEVELOPMENT

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Executive Summary

Zoonotic diseases are on the rise and with this comes the increased risk of pandemics. The main causes driving this growth are land-system changes and biodiversity loss, also referred to as biosphere integrity. By maintaining and restoring biodiversity, contact between humans and wild species will be reduced and the dilution effect will be heightened. This decreases the potential for animal-to-human disease transmission whilst also promoting the health of the planet. Although the United Nations (UN) and the World Health Organisation (WHO) currently have policies in place regarding this issue, they do not go into enough detail to be of any use, and new reports are suggesting that they have not been very effective and many targets have not been achieved. Two new policies can be introduced and managed by UNEP with the aim of mitigating future pandemics. Firstly, negative incentives and subsidies which promote biodiversity loss need to be removed. Secondly, deforestation and habitat loss needs to be tackled by creating protected areas. Finally, in addition to the two new policies, there needs to be an ongoing conversation between UNEP and the general public to raise awareness about how integral biodiversity is in the mitigation of epidemics, something at the forefront of people's minds due to the current COVID-19 pandemic.

Foundational Science: Discussion and Analysis

The planetary boundaries framework first established by Rockstrom et al. in 2009 was created to "define the safe operating space for humanity [whilst respecting] the Earth system" (*2009; pp1*). This policy brief encompasses three of the planetary boundaries proposed by Steffen et al. in a similar paper published in 2015 and will explain how future pandemics can be avoided if steps are taken to remain within the safe operating space.

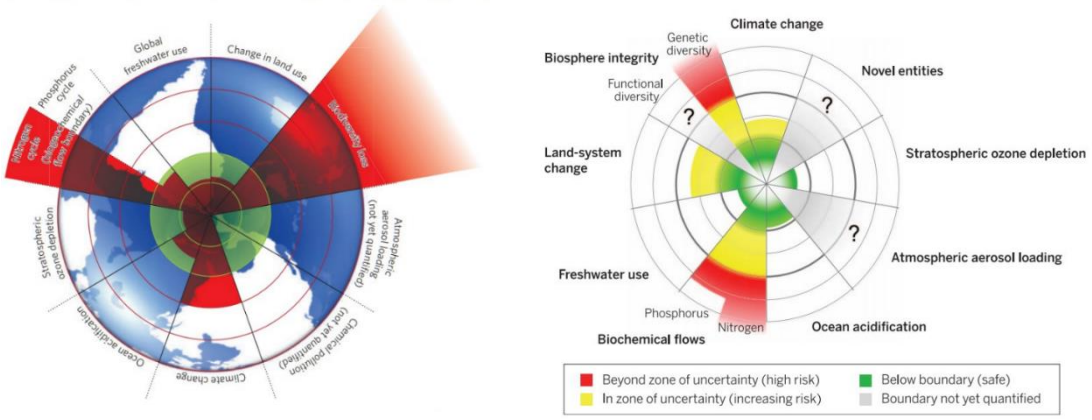

FIGURE 1: The planetary boundaries originally proposed by Rockstrom et al. They were later developed into a new framework by Steffen et al.

Novel Entities

Novel entities are defined as "new substances, new forms of existing substances, and modified life forms that have the potential for unwanted geo-physical and/or biological effects" (*Steffen et al. 2017*). Under this definition, emerging pathogens can be classed as novel entities; this includes zoonotic diseases, which are infectious diseases that can be transmitted from animals to humans (*WHO, 2020*). The number of zoonotic diseases is on the rise, as shown in Figure 2, with 75% of new outbreaks originating in animals (*Salyer et al. 2017*) and it is estimated that roughly 2.2 million deaths are caused by zoonoses a year (*Rozenbaum, 2020*). Environmental changes are driving these infectious spillovers, and unless they are addressed, pandemics, not dissimilar to the recent SARS-CoV-2 outbreak, will continue to become ever more likely (*Haider et al. 2020*). New epidemics bring with them a range of negative impacts; from affecting both physical and mental health, to damaging the economy, politics and international security (*Qiu et al. 2016*). Measures need to be taken to mitigate the risk of potential outbreaks. This can be done by improving biodiversity and reducing land-system change.

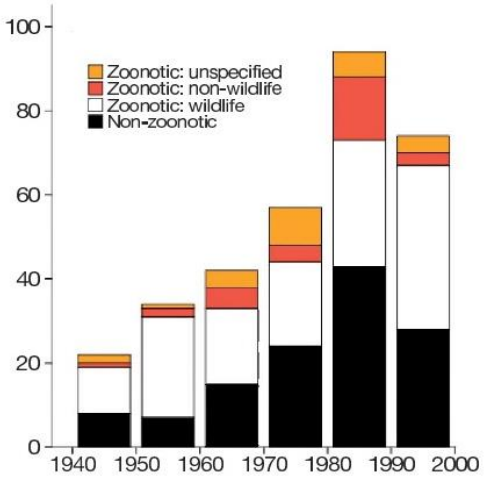

FIGURE 2: Shows the rise in emerging infectious diseases.

Biosphere Integrity and Land-System Change

One of the primary environmental changes which is driving the emergence of novel zoonotic diseases is biodiversity loss, caused by humans who continue to push the boundaries between natural ecosystems and the urban world (*Ostfeld, 2009*). Biological diversity is defined by the Convention on Biological Diversity as "the variability among living organisms from all sources … this includes diversity within species, between species and of ecosystems" (*CBD, 1992: pp3*). Recent reports, such as the one from the IUCN (Figure 3), show that land-system change, such as forests being converted to pastures and cropland for agricultural use, as well as the exploitation of habitats for activities like logging, have resulted in significant biodiversity loss, with more than 8,500 species now classified as "threatened" (*Maxwell et al. 2016*). Studies have shown that the clearing of habitats has severely damaged biosphere integrity. When this is carried out alongside a variety of human activities, human-to-animal contact dramatically increases, bringing with it the risk of spillover, where "pathogens become established and transmissible within a new host population" (*Keesing et al. 2010*).

Additionally, it has been suggested that a reduction in biodiversity has an impact on the dilution effect, as high host biodiversity mitigates the risk of a single pathogen spreading through a population or transferring between species, stopping it from becoming zoonotic (*Ostfeld, 2009*). Maintaining biosphere integrity as well as preventing land-system change is critical to controlling the emergence of zoonotic diseases and effective action needs to be taken quickly before a new pandemic emerges.

Assessment of Existing Governance

As the world came to terms with the COVID-19 pandemic, the United Nations Environment Programme released a joint report with the World Health Organisation (*2020*), highlighting key areas contributing to the rise in zoonotic diseases. The report states that "the health of the planet and the health of other species" is crucial to preventing future pandemics, and concludes with 10 policy recommendations which could be implemented to mitigate potential future outbreaks. However, despite the fact that land-system change and biodiversity are some of the main drivers of zoonotic diseases, they are only mentioned in two of the policies. Other recommendations made in the report, such as the expansion of scientific knowledge, take up valuable space which could have been used as supplementary advice as supposed to main policies.

Whilst the two policies provided for reducing biodiversity loss and habitat change are good and based on sound evidence, they are broad and untargeted, with little information on how they will be enforced. Since the causes of new diseases vary between countries, it would have been useful for each policy to have been split up and made specific for a particular group of countries.

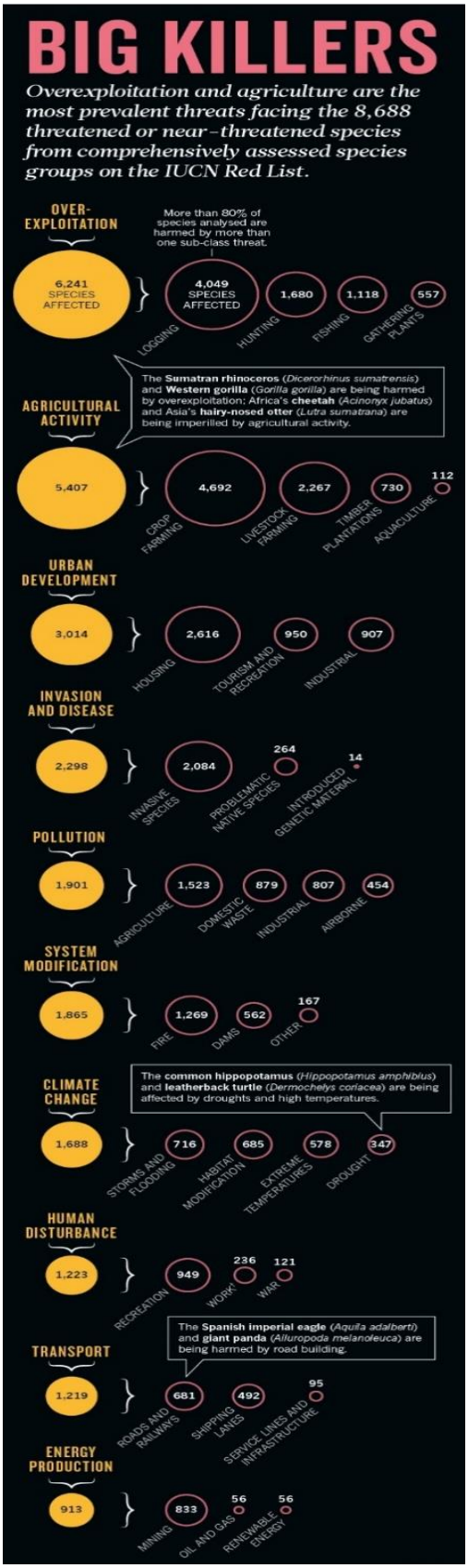

FIGURE 3: The IUCN list of threats to biodiversity

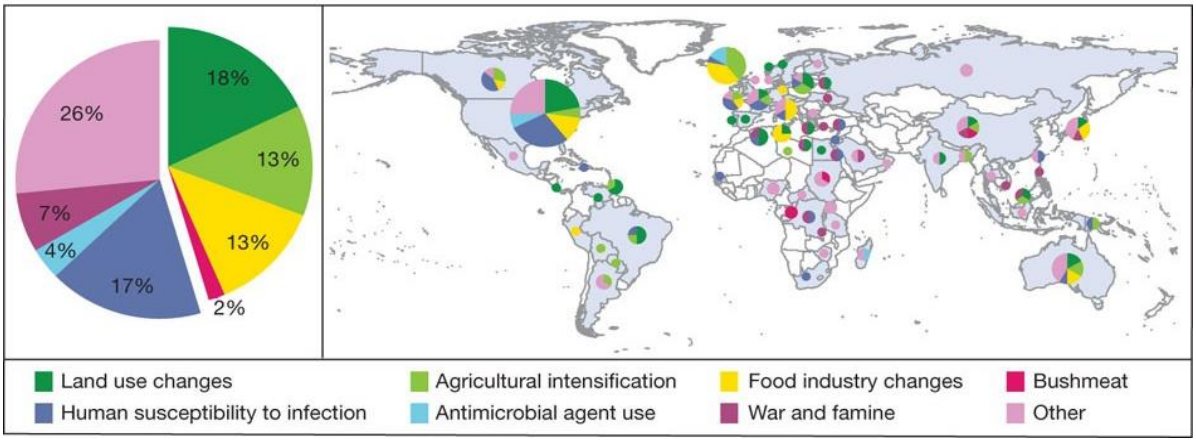

FIGURE 4: The impacts of biodiversity on transmission and emergence of infectious diseases

Figure 4 shows that South America has seen the majority of infectious diseases occurring due to land-use change, whereas in Africa and Asia, consumption of bushmeat as well as "other" factors, such as climate change and human behaviour are causing the problems. Policies cannot be uniform; they must be adapted to specific regions of the world or else they will prove ineffective.

In addition to this, the Global Biodiversity Outlook report (*2020*), shows that 14 of the 20 targets set by the UN and WHO in 2011 to improve biodiversity, were "not achieved" and the other 6 were only "partially achieved"; Table 1 outlines a brief summary of the findings. This report shows that current policymaking by the UN and WHO is not proving useful, concluding that "at our current trajectory, biodiversity, and the services it provides, will continue to decline" (*Global Biodiversity Outlook. 2020: pp12*). Changes are not happening at the pace or scale necessary for a sustainable future and a new course of action is needed.

	Biodiversity Target	Achievement Status
1	People are aware of the value of biodiversity	Not achieved
2	Biodiversity has been integrated into development plans	Not achieved
3	Incentives and subsidies that are harmful to biodiversity have been phased out	Not achieved
4	Governments have taken steps towards sustainable consumption and production	Not achieved
5	Rate of habitat loss is at least halved	Not achieved
6	Aquatic environments are managed sustainably	Not achieved
7	All forms of agriculture are managed sustainably	Not achieved
8	Pollution levels are no longer detrimental to biodiversity	Not achieved
9	Invasive species are controlled	Partially achieved
10	Pressures on coral reefs are controlled	Not achieved
11	Inland water areas are conserved effectively	Partially achieved
12	Extinction of threatened species has been stopped	Not achieved
13	Genetic diversity of organisms is maintained	Not achieved
14	Ecosystems that provide valuable services are restored and safeguarded	Not achieved
15	Ecosystems are conserved and restored	Not achieved
16	The Nagoya Protocol is in use	Partially achieved
17	Policies in place on a national biodiversity strategy	Partially achieved
18	Traditional practices are respected but are aligned with national legislation	Not achieved
19	Technologies relating to biodiversity are improved	Partially achieved
20	Financial resources are used to implement biodiversity plans	Partially achieved

TABLE 1: Table outlining the biodiversity targets set in 2010. None of the targets were anticipated to be achieved by the set date in 2020.

Governance Recommendations

All the recommendations below are made in an effort to improve the health of ecosystems and increase species diversity, both nationally and internationally. This will help to slow the spread of emerging pathogens, protecting the human population from zoonotic diseases and future pandemics.

There are 3 steps that need to be taken to tackle the current issues.

1 – Removal of damaging incentives and subsidies

Firstly, damaging incentives and subsidies that further the exploitation of animals and reduction in biodiversity need to be identified and removed. A number of countries still have in place financial incentives that are encouraging biodiversity loss, such as the creation of monoculture plantations which are more profitable than small-input farming (*Grass, 2020*). One idea would be to add taxes to monoculture crops whilst providing aid to farmers who continue to use land sparing methods. The creation of policies to stop negative incentives and subsidies should be overseen by the regional offices and then enforced by UNEP since they have global outreach. Regional management will ensure that new policies are specific for individual countries, since there is substantial variation between nations and some have made more progress in this area than others. A blanket policy would not be productive as they need to take into account existing institutions and differences in cultures.

2 – Reduce rates of deforestation and habitat loss

Secondly, there need to be more policies created to reduce deforestation and habitat loss as removal of forests for agricultural purposes is one of the largest drivers of zoonotic disease emergence. Levels of deforestation are lower than the previous decade, down to 10 million hectares a year from 16 million (*FAO, 2020*), however some countries, such as Brazil, are now beginning to see a rise in numbers once again (*McCarthy, 2020*). UNEP need to enforce policies centred around deforestation, such as the creation of protected forest areas. Like with the previous policy, this should be controlled on a regional basis, with each country having a customised percentage of land dedicated to being natural landscape.

In addition to this, the UN need to ensure that sufficient sanctions, such as a set rate fine, are imposed by governments to deter illegal trade and prevent further habitat loss and deforestation. The money taken by the government when convicting illegal deforestation should then be put back into afforestation efforts.

3 – Campaigns to raise awareness

Whilst these two main policies are being introduced and used, UNEP should be running constant campaigns in a bid to increase awareness of biodiversity loss. It is in the best interest of everyone, from politicians and stakeholders, to healthcare workers and the general public, to want to prevent zoonotic diseases, and the aftermath of COVID-19 will be felt for years to come (*Fernandes, 2020*) (*Rees, 2020*) (*Bartik et al. 2020*). If more people understand the consequences of reduced biodiversity, they will be more likely to take action and UNEP should be providing channels of communication constantly to allow this to happen. This should not be enforced as a policy, allowing space for others to be created. Instead it should be used to compliment the other policies being used.

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