Interlinkages between the Environmental Effects Assessment Panel and the Kunming-Montreal Global Biodiversity Framework, and scope for reciprocal contributions

1. Background

Under the United Nations Convention on Biological Diversity (CBD), the Kunming-Montreal Global Biodiversity Framework (GBF) was adopted in Montreal on 19 December 2022. The GBF sets out goals and targets for achieving sustainable biodiversity across ecosystems and health by 2050.

The Environmental Effects Assessment Panel (EEAP) of the Montreal Protocol operates under the United Nations Environment Programme (UNEP) providing environmental and health assessments for the Parties to the Montreal Protocol, as well as to the general public. The Montreal Protocol was adopted on 16 September 1987.

The figure below shows a few of the interlinkages between EEAP and the GBF and reflects opportunities for collaborative engagement.

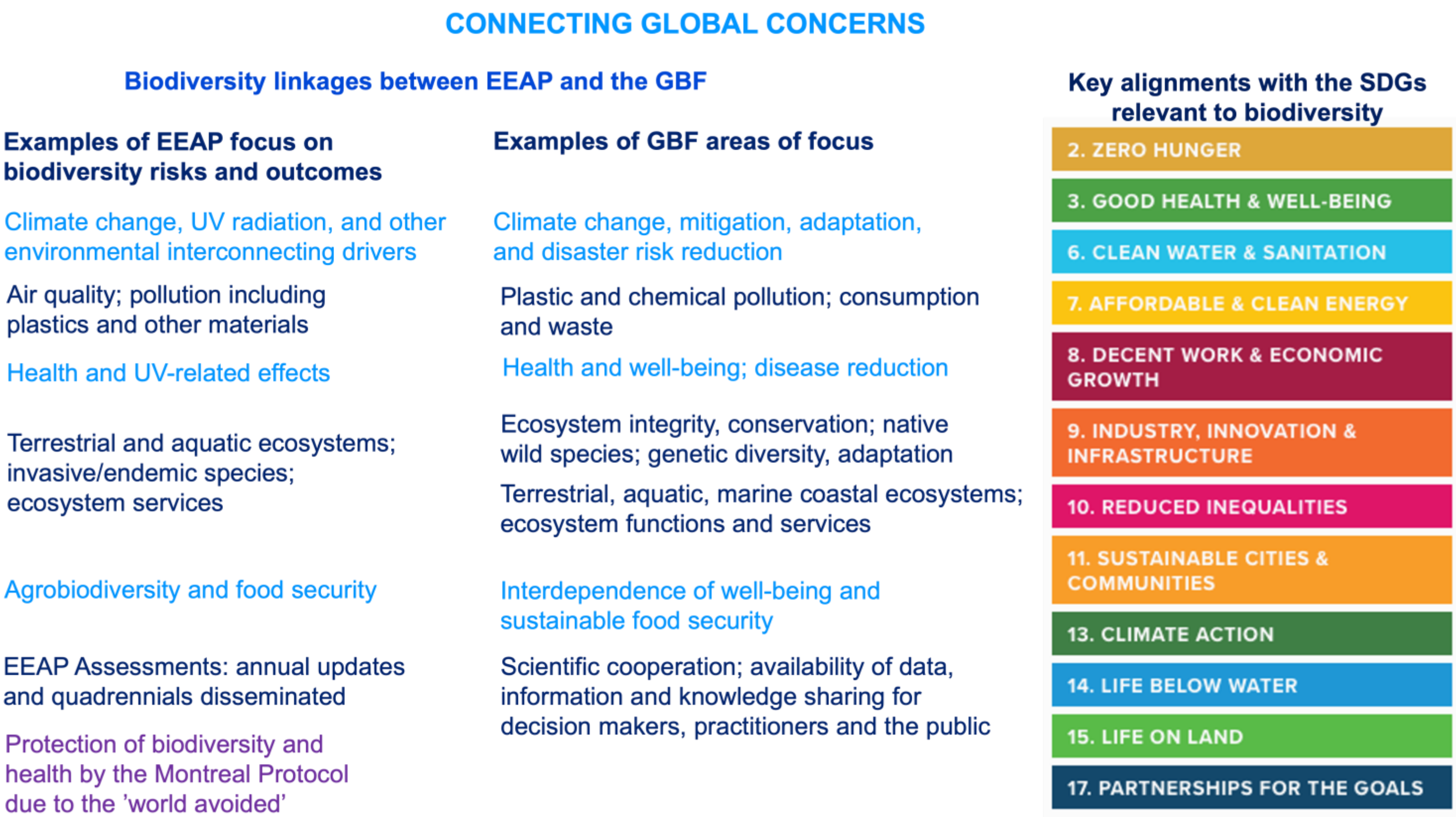

Figure 1. Overview of the current linkages between the Environmental Effects Assessment Panel (EEAP) of the Montreal Protocol and those of the Convention on Biodiversity (CBD) and Global Biodiversity Framework (GBF) together with SDGs relevant to biodiversity.

2. Relevance of the Montreal Protocol for the GBF

The Montreal Protocol and its Amendments have successfully prevented catastrophic amounts of solar UV radiation from reaching the Earth's surface, while at the same time reduced global warming through the phase-out of ozone-depleting substances, most of which are potent greenhouse gases. In addition, the Kigali Amendment has focused on phasing down alternative compounds to the ozone-depleting substances, as some of these alternatives also have high global warming potentials such as many of the hydrofluorocarbons. Thus, the Montreal Protocol is protecting the ozone layer as well as mitigating effects of climate change.

Stratospheric ozone affects climate change and, conversely, climate change affects stratospheric ozone. Resultant changes in solar UV radiation and climate can, in turn, interact to affect the environment and human health. Thus, many commonalities exist between the EEAP and GBF (Figure 1). These commonalities encompass the challenges of the triple crisis of biodiversity loss, climate change, and pollution that threaten a sustainable Earth including health and well-being.

3. EEAP assessments of some of the biodiversity risks of relevance to GBF

Projected changes in biodiversity are expected globally as the Earth continues to warm and experiences more frequent and intense extreme events (e.g., flooding and droughts). These rapidly changing conditions, including rising carbon dioxide levels, increased pollution, altered UV radiation, and other climate change factors can be expected to change the structure and functioning of ecosystems.

These factors are inextricably linked and their effects need to be considered in their interconnected complexity by intergovernmental bodies, policymakers, and scientists. For example, modelling studies have shown that UV radiation and climate change are key factors in shaping the distribution of certain plant species. These projections show that suitable habitat ranges under certain climate change scenarios will contract for some species and expand for other species.

The above environmental factors will determine suitability of habitat and the shift of species along elevational or latitudinal gradients into areas to which they may not be adapted or will be outcompeted by existing species. About one million species are at risk of extinction according to the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

The following are some examples of the findings from the EEAP assessments within the context that global declines in biodiversity will affect ecosystem function, and *vice versa*, in both terrestrial and aquatic ecosystems.

3.1 Terrestrial biodiversity

UV irradiation at the Earth's surface will change with changes in cloud cover, aerosols, ice and snow cover, and extreme weather events. Some species will successfully acclimate or adapt to these new conditions, while others may not.

Climate change will also result in new combinations of species with new pests, pathogens and seasonal mismatches, e.g., between plants and their pollinators. These changes could further contribute to biodiversity loss.

a) Many exotic invasive species are more tolerant than native species to high solar radiation, including UV radiation, and environmental extremes associated with disturbed habitats. These conditions may therefore foster the spread of invasive species.

b) Plants shifting to higher latitudes or lower elevations because of climate change will encounter reduced UV irradiance. This can decrease UV-induced protective compounds, some of which also serve as deterrents against herbivores. When species shift to high elevations or low latitudes, more resources may be allocated towards protection against UV radiation and pests, diverting resources away from growth and reducing competitive ability. This could, in turn, contribute to changes in community composition and the loss of certain species.

c) In tropical regions, where biodiversity hotspots are most concentrated, UV irradiation is also high, and even small increases in global warming and UV irradiation may pose risks to ecosystems and their biodiversity.

d) Feedbacks to the climate system due to community disruptions or extinction of species can result in reduced carbon storage by vegetation and increased emissions of greenhouse gases from decaying matter, enhanced by the action of UV radiation.

3.1.2 Agrobiodiversity

Biodiversity is an integral part of food security due to the increasing global demand for food, fuel, and animal feed. This demand has resulted in increased pressures to convert natural landscapes into agricultural systems, with associated land degradation and loss of habitat for species. Food production and its growing intensification has caused an estimated loss of 60% of terrestrial biodiversity globally.

The close interconnection of biodiversity and climate change, of which UV radiation is a component, will increasingly determine which crop species and varieties can be grown agriculturally, and what will survive in a rapidly changing environment with rising global temperatures and other associated environmental and anthropogenic factors as populations grow.

a) Species distribution models determine how climate change will affect future suitability of habitats through changes in key abiotic drivers including UV radiation. These models thereby also provide information on suitable areas for conservation and planting crops for different scenarios of climate and solar UV radiation. Forecasting future distribution ranges of ecologically and agriculturally important crop and tree species will aid in preserving agrobiodiversity.

b) The increasing use of plastics in agriculture, such as for mulch, netting, and irrigation, poses a threat to crops due to the breakdown of the plastics by UV radiation and other climate factors. During this breakdown, toxic by-products are often released that can be harmful to soils and crops. According to the UN Food and Agriculture Organization, approximately 12.5 million tonnes of plastics are used in agriculture annually.

3.2 Aquatic biodiversity

UV radiation together with rising temperatures and pollution decreases primary productivity of aquatic ecosystems, which can lead to a loss in biodiversity. An important consideration for ecosystem biodiversity is the recognition of the linkages across ecosystems, such as the movement of nutrients and organisms between terrestrial and aquatic ecosystems.

Human activities release contaminants such as oil, UV filters in sunscreens, and microplastics into the aquatic environment, which are then modified by UV radiation, frequently amplifying adverse effects on aquatic organisms and their environments. All of these factors can contribute to the loss of aquatic biodiversity.

a) Input of terrestrial organic matter regulates the transparency of UV radiation in most inland and coastal waters. For example, where terrestrial run-off has increased, organisms sensitive to UV radiation are invading habitats with low UV transparency. This results in selective predation on certain species and changes in the composition of the community, with cascading effects on other parts of the aquatic food web and its biodiversity.

b) Exposure of many types of plastics to UV radiation also releases organic matter and other substances into surface waters, as well as greenhouse gases. There is concern that some of the released substances may be toxic to aquatic organisms.

c) Tropical coral reefs are highly diverse and economically important ecosystems that are naturally exposed to high levels of UV radiation because they occur close to the surface in clear, tropical waters. Climate change-associated heat stress causes coral bleaching and can lead to coral extinctions. In sensitive corals these heat-related stresses are worsened by the naturally high UV radiation levels characteristic of tropical coral reef communities, disrupting their biodiversity.

3.3 Health and biodiversity

Maintaining the biodiversity of plants and animals is essential for the health and stability of ecosystems, and the many valuable services provided to humans. The diversity of Earth's ecosystems also contribute more than 50% of the global GDP and include cultural and economic value.

a) Pollution in different forms is an increasing threat to life on Earth. Solar UV radiation alters the life cycles of toxic chemicals and other pollutants in the atmosphere and on Earth, with both beneficial or adverse consequences for health and the environment and its biodiversity.

b) In the case of plastics, an estimated 391 million metric tonnes of plastic are produced annually. Exposure to solar UV radiation breaks down the plastics into microplastic and nanoplastic particles. These particles are found in aquatic and terrestrial ecosystems, as well as in the air, and are inhaled or ingested by micro-organisms, plants, and animals including humans, with as yet only little knowledge available of their biological effects.

c) Human health and well-being ultimately depend on healthy, diverse ecosystems and the services they provide. Disruption of ecosystems and loss of biodiversity by the combined effects of climate change and UV radiation pose critical risks for disease, food security, and the climate system.

4. Geoengineering and biodiversity

Geoengineering or Solar Radiation Modification (SRM) is another potential threat to ecosystem biodiversity. In the context of SRM, one example is stratospheric aerosol injection of sulphate particles for decreasing incoming solar radiation to Earth. This modification is projected to decrease stratospheric ozone, mainly in polar regions in spring, and disrupt ecosystem structure and productivity by altering climate and UV radiation. While SRM may reduce global warming in the short-term, providing some protection from rising temperatures, it is likely to have many unintended consequences for biodiversity and life on Earth. These consequences of SRM on the biosphere have yet to be thoroughly assessed.

5. World avoided through the Montreal Protocol

The contribution of stratospheric ozone to UV radiation and climate change was most pronounced over the period when stratospheric ozone over Antarctica was being rapidly depleted (1970s to late 1990s). If the Montreal Protocol had not been implemented these climatic trends would have continued into this century and intensified, significantly damaging biodiversity, food security and health. The climatic impact would have been more evident in Antarctica and other parts of the Southern Hemisphere, with life forms exposed to stronger drying trends over summer and cooler summers in East Antarctica. This would have caused more pronounced shifts in species to new habitats, likely with some adaptation but also more loss of species.

6. Examples of suggestions for contributions and collaborations towards implementation of the GBF

a) Sharing of information and reviewers for draft documents to maintain consistency of content across topics approached from similar and different perspectives.

b) Attend key meetings and present relevant updates if needed.

c) Through informal contacts, identify issues of importance to policymakers and other intergovernmental bodies and discuss ways in which to best disseminate issues requiring action.

d) Through informal contacts, identify key gaps in science-based knowledge of biodiversity.