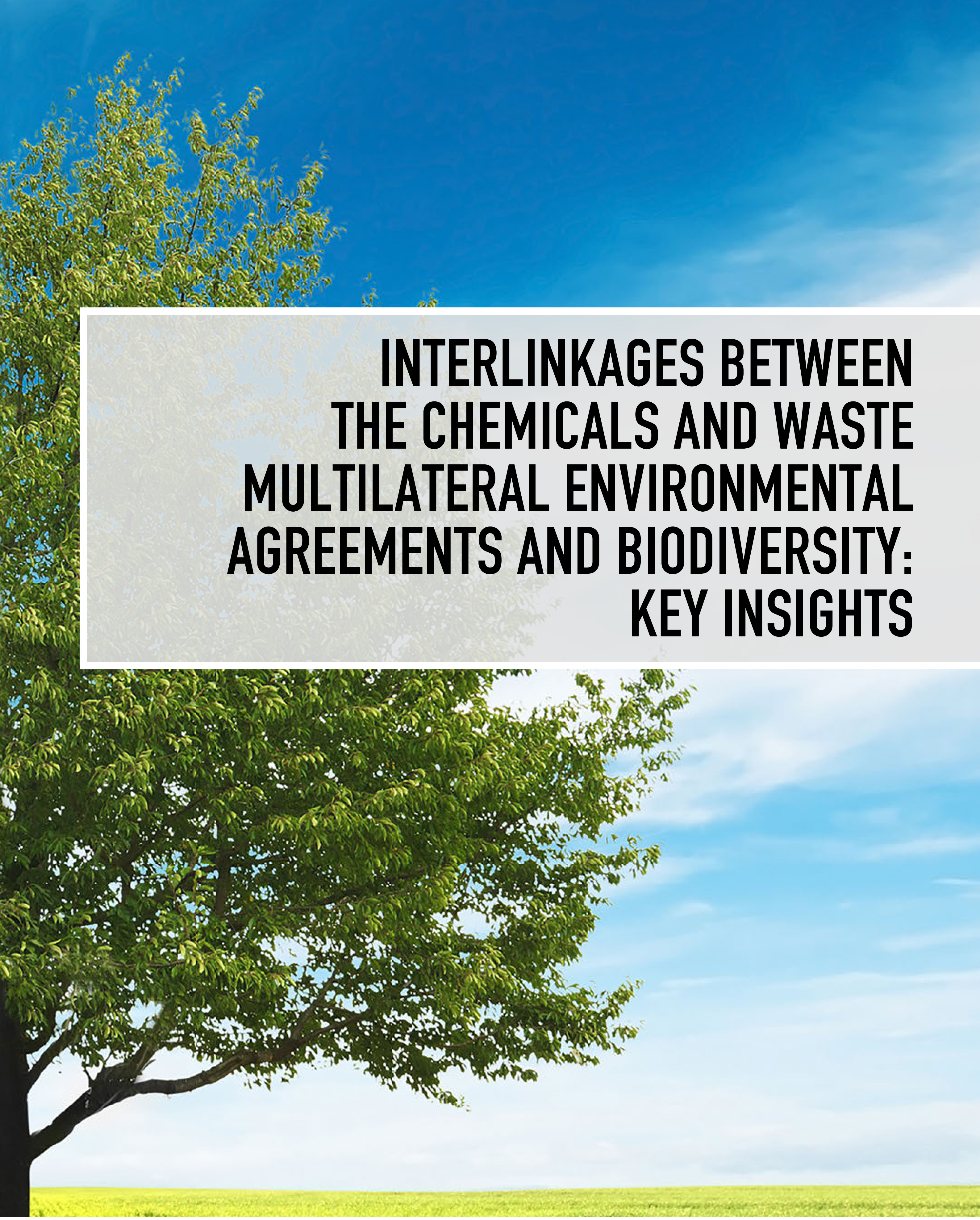

INTERLINKAGES BETWEEN THE CHEMICALS AND WASTE MULTILATERAL ENVIRONMENTAL AGREEMENTS AND BIODIVERSITY: KEY INSIGHTS

UN environment programme

BASEL / ROTTERDAM / STOCKHOLM CONVENTIONS

MINAMATA CONVENTION ON MERCURY

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INTERLINKAGES BETWEEN THE CHEMICALS AND WASTE MULTILATERAL ENVIRONMENTAL AGREEMENTS AND BIODIVERSITY: KEY INSIGHTS

INTRODUCTION

The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, the 1998 Rotterdam Convention on the Prior Informed Consent Procedure for certain Hazardous Chemicals and Pesticides in International Trade, the 2001 Stockholm Convention on Persistent Organic Pollutants, and the 2013 Minamata Convention on Mercury all aim at protecting human health and the environment from hazardous chemicals and waste.

The preparation of the exploratory study was inspired by ongoing discussions of a post-2020 global biodiversity framework and illustrates the interlinkages between the work of the above four global chemicals and waste conventions and the subjects preoccupying the Convention on Biological Diversity (CBD) and other biodiversity-related conventions, thereby positioning the four conventions to contribute to ongoing discussions and the implementation of the post-2020 global biodiversity framework, and future work of the CBD and other biodiversity-related instruments.

1

KEY LINKAGES TO GLOBAL SUSTAINABLE DEVELOPMENT PROCESSES

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At the 2002 World Summit on Sustainable Development (WSSD) governments agreed to "achieve, by 2020, that chemicals are used and produced in ways that lead to the minimization of significant adverse effects on human health and the environment (...)."

The Basel, Rotterdam, Stockholm and Minamata conventions contribute to this goal through their specific and individual legal mandates. In addition, the non-binding Strategic Approach to International Chemicals Management (SAICM), has also aimed at the 2020 goal by focusing on important chemicals and waste issues not covered by the above multilateral environmental agreements (MEAs), and is currently in the process of considering its beyond-2020 objectives, structure and targets. The United Nations Environment Assembly (UNEA), which is the governing body of the United Nations Environment Programme (UNEP), also provides leadership on chemicals issues and the interlinkages with other areas of UNEA and UNEP endeavours, such as biological diversity.

Despite these and other collective efforts, UNEP's 2019 Global Chemicals Outlook II concluded that the WSSD 2020 goal will not be achieved.

In 2015, the United Nations General Assembly adopted the 2030 Agenda for Sustainable Development, with 17 Sustainable Development Goals (SDGs). The Basel, Rotterdam, Stockholm and Minamata conventions are contributing to the achievement of a number of the SDGs adopted by the United Nations General Assembly in 2015 through the achievement of their own objectives, aided by their own internal strategic frameworks and effectiveness evaluations.

The sound management of chemicals and waste is an enabler to many of the SDGs, starting with SDG 12 on sustainable consumption and production. Of 169 targets and 231 unique indicators under the SDGs, around 69 targets and 91 related indicators have been cited to be relevant to chemicals and waste. The Implementation Plan of the UN Environment Assembly's Towards a Pollution-Free Planet aims to accelerate and scale up action to reduce pollution and to support countries in implementing the 2030 Agenda and achieving the SDGs through existing MEAs and other international initiatives.

In its 2019 Global Assessment Report on Biodiversity and Ecosystem Services, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services noted that SDG Target 12.4 on waste management is an area likely to have many positive implications for nature and nature's contributions to people as well as a greater quality of life for all people. The report considered that waste, through its impacts on air and water quality, has negative impacts on wellbeing, especially in poor and vulnerable communities. This target relates closely to SDGs 6, 14, and 15, as well as aspects of SDGs 3 and 11, in terms of trends in pollution and its impacts on health and the environment.

The 1992 Convention on Biological Diversity (CBD) is part of a cluster of biodiversity-related MEAs that includes, among others, its Cartagena Protocol on Biosafety and Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization. The CBD is now leading the preparation of a post-2020 global biodiversity framework, with targets for 2030, aimed at ultimately achieving its 2050 vision of Living in Harmony with Nature, as mandated by CBD COP decision 14/3.

This study outlines the specifics of the above four chemicals and waste conventions and how through regulations on chemicals and waste management they contribute to the conservation and sustainable use of biological diversity and the services provided by ecosystems, most recently called "nature's contributions to people" (NCP) by IPBES in its 2019 Global Assessment Report.

2

POLLUTION ONE OF THE MAIN DRIVERS OF BIODIVERSITY LOSS

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Pollution is one of the main drivers of biodiversity loss. The Strategic Plan for Biodiversity 2011-2020, adopted under the CBD and acknowledged by other multilateral processes, includes a specific target on pollution. Aichi Biodiversity Target 8 calls for pollution, including from excess nutrients, to be brought to levels that are not detrimental to ecosystem function and biodiversity by 2020. While most of the reporting on this target has focused on excess nutrients, the study highlights other important pollutants regulated by the Basel, Rotterdam, Stockholm and Minamata conventions, whose management can result in improvements to the state of biological diversity and nature's contributions to people. The most recent UN report on progress under the Aichi Targets, the Global Biodiversity Outlook 5 (GBO-5), concluded that this target has not been achieved.

Given the many benefits of chemicals to humanity, for example in consumer products, industry and medicine, it is not surprising that society is currently amid an intensification of the production, distribution and use of chemical-based products around the globe. The production, use and trade of chemicals is growing in all regions of the world, driven by global megatrends such as population and increasing consumption. Global sales in chemicals were worth approximately 3.5 trillion USD (including pesticides but excluding pharmaceuticals) in 2017 and chemicals production is expected to double in size between 2017 and 2030. However, hazardous chemicals and other pollutants (e.g. endocrine-disrupting chemicals and pharmaceutical pollutants) continue to be released in large quantities and are ubiquitous in humans and the environment. The global waste market has become a viable economic sector, estimated at USD $410 billion per year, from collection through to recycling, yet only about one-third of the world's municipal solid waste is properly managed, and much of that is increasingly hazardous. Marine litter, including plastics and microplastics, is now found in all oceans, at all depths.

It is within this setting that the four conventions and their contributions to, and interlinkages with, biological diversity and nature's contributions to people are investigated in this exploratory study.[1] The study also identifies challenges and emerging issues in the four subject areas below.

MERCURY AND BIODIVERSITY

Mercury is a highly toxic heavy metal that poses a global threat to human health and the environment, persists in the environment and bioaccumulates and biomagnifies in the food chain. Together with its various compounds, it causes a range of severe health impacts, including damage to the central nervous system. Exposure to mercury occurs mainly through ingestion of fish and other marine species contaminated with methylmercury (MeHg), through inhalation of mercury vapour during occupational activities or spills, or through direct contact from mercury use. Mercury is transported around the globe through the environment, so its emission and release can affect human health and the environment even in remote locations. Once released, mercury persists in the environment where it circulates between air, water, sediments, soil and biota in various forms, and may not be removed from this cycle for a century or more. Furthermore, due to climate change, future releases of mercury from melting permafrost could be twice the amount contained in the rest of all soils, the atmosphere and the oceans combined.

Although naturally-occurring in the Earth's crust, due to its unique properties it has also been used in or released from various products and processes for hundreds of years. Over 2000 tonnes of mercury are emitted into air annually from the top 17 anthropogenic sources, with almost 38% derived from artisanal and small-scale gold mining (ASGM), and this, along with emissions from stationary combustion of coal (e.g. coal-fired power plants), contributes 60% of emissions. Estimates of releases from the ASGM sector to land and water combined are 1220 tonnes worldwide (sources from year 2015), with other sources accounting for about 580 tonnes of releases to water, with 42% of that from waste treatment (including use and disposal of mercury-added products and the disposal of municipal wastewater), 41% from ore mining and processing, and 16% from the energy sector. ASGM activities are the single biggest source of mercury releases to soil and often take place in biodiverse and sensitive ecosystems around the world.

[1] The BRS Secretariat and the Minamata Secretariat have also prepared a study on the interlinkages among chemicals and waste and climate change.

ASGM is on the rise and is practiced in many megadiverse countries, with many of the 15-20 million miners worldwide relying on mercury to process mined gold, with possible health, environmental and ecosystem impacts on approximately 100 million people in ASGM communities worldwide. Impacts of this type of mining on biological diversity occur directly through the clearing of forests to prepare mining sites, and where mercury is used to amalgamate gold ore, the subsequent burning off and emissions into the atmosphere are deposited in the environment, with related releases to soils and in tailings leaching into nearby streams and rivers, where much of the activities take place. In the Amazon Basin, for example, ASGM activities have been documented to lead to biodiversity loss and polluted fisheries, and a number of endemic or threatened freshwater fish may be at risk from ASGM activities. In many ASGM operations, the mercury that operators use to extract gold from ore comes through trade that violates national or international laws on the import, marketing or use of mercury. Food webs in many of the world's biomes and ecosystems have MeHg concentrations at levels of concern for ecological and human health. The UN's 2018 Global Mercury Assessment concludes that "mercury loads in aquatic food webs are at levels of concern for ecological and human health around the world." Many species of fish and wildlife are impacted by the adverse effects of mercury on their physiology, behaviour and reproductive success. Because of biomagnification of methylmercury, long-lived piscivorous or other top predatory animals in aquatic food chains are at greatest risks of elevated dietary methylmercury exposure (e.g. tuna). Tropical ecosystems appear to be particularly sensitive to elevated methylation rates and many such ecosystems are 'megadiverse', home to many of the world's most sensitive ecosystems containing numerous species.

Atmospheric, terrestrial, and oceanic pathways deliver methylmercury to Arctic environments, distant from the source of original emission or release. Levels of mercury, (along with polychlorinated biphenyls (PCBs)), remain a significant exposure concern for many Arctic biota, including polar bears, killer whales, pilot whales, seals, and various seabird, shorebird, and birds-of-prey species. The levels of these chemicals put these species at higher risk of immune, reproductive and/or carcinogenic effects. This is complicated by the fact that Arctic wildlife and fish are exposed to a complex cocktail of environmental contaminants in addition to mercury, including legacy persistent organic pollutants (POPs), emerging chemicals of concern, and other pollutants that in combination may act to increase the risk of biological effects. The added influence of environmental factors such as climate change, invasive alien species, emerging pathogens, and changes in food web dynamics, on top of existing chemical exposures, may significantly increase the risk of health effects and population impacts.

Ecosystem services/nature's contributions to people are affected by mercury in the environment. Apart from impacts on nature's ability to regulate air and water quality, there are impacts on foods that are grown in soil or harvested from fresh and marine waters, including foods that are part of a region's culture and identity, such as rice and fish. Moreover, indigenous peoples in many areas of the world but especially groups within the Amazonian region and Inuit from the Arctic are at increased risk of mercury exposure. Many from these communities are reliant upon traditional and locally caught foods such as fish and marine mammals not only for sustenance, but as a strong basis for their culture, spirituality, recreation, and economy.

The development of the Minamata Convention on Mercury was spurred on by recognition that the significant levels of mercury in the environment from human activities required international action. It is a legally binding convention that contains provisions that regulate anthropogenic activities throughout the entire life cycle of mercury, from its primary mining through its various uses to the management of mercury as waste and management of sites contaminated with mercury. The monitoring, scientific, implementation and evaluation work is overseen by the Conference of the Parties to the Convention. In addition, the UNEP has prepared the periodic Global Mercury Assessments, including the 2018 assessment, which provides the most recent information available for the worldwide emissions to air, releases to water, and transport of mercury in atmospheric and aquatic environments.

PERSISTENT ORGANIC POLLUTANTS (POPS) AND BIODIVERSITY

Persistent organic pollutants (POPs) are human-made chemicals that persist in the environment for long periods, become widely distributed geographically, bio-accumulate in the fatty tissue of humans and wildlife, and have harmful impacts on the environment and human health. They have been shown to have impacts on ecosystems and biota at all levels of the food chain, and also affect nature's contributions to people.

POPs are found in the environment around the globe, including close to industrial and urban settings, but also in remote locations such as the Arctic and Pacific Ocean trenches at 7-10,000 metres below sea level. Primary sources of POPs are those with direct fluxes into the environment (such as the use of industrial chemicals or pesticides, or emissions from industrial processes) and secondary sources are already contaminated environmental compartments that can release POPs subsequent to their use or production. Climate change may affect emissions of POPs by enhancing volatilisation and re-volatilisation, and lead to increased atmospheric emissions especially in remote areas, such as Alpine lakes or the Arctic. Recent research shows that the global plastics crisis is exacerbated by POPs, which are both contained in, and absorbed by, plastics circulating in the world's oceans.

Effects of POPs on the environment have been observed in a range of ecosystems. POPs are having effects in freshwater ecosystems, such as lakes and rivers, the latter often contributing POPs to coastal marine environments. Mangroves have been shown to contain a suite of chemicals, including POPs, resulting in impacts on both plants and animal biota, as well as large-scale changes in diversity, or ecosystem structure, as vulnerable populations decline as a result of exposure to chemical pollutants. Aquatic biota, including aquatic vascular plants, seagrasses, algae and other water plants, fish, crabs and mussels, are being adulterated by POPs. Effects are also being found in terrestrial species and warrant further study.

Accumulation of POPs in marine mammals, such as Baltic seals, bottle-nosed and striped dolphins and killer whales, is associated with population declines. Levels of PCBs remain a significant exposure concern for many Arctic biota, including polar bears, killer whales, pilot whales, seals and various seabird, shorebird, and birds-of-prey species. The levels of these chemicals put these species at higher risk of immune, reproductive and/or carcinogenic effects. PCB-mediated effects on reproduction and immune function may threaten the long-term viability of over 50% of the world's killer whale populations. Contaminant exposure is one of the largest threats to polar bears after loss of sea ice habitat due to climate change.

Nature's contributions to people, such as the regulation of air quality, water quality (including groundwater), coastal protection, and the formation, protection and decontamination of soils are affected by the presence of POPs. The provision of materials such as food, including for indigenous peoples in the Arctic, who are reliant on subsistence harvests as part of a traditional diet, are affected. They and others around the world are also deprived of nature's non-material contributions such as recreation, aesthetic enjoyment of nature, learning, and spiritual and social-cohesion experiences.

The 2001 Stockholm Convention on Persistent Organic Pollutants contains provisions on the prohibition and/or elimination of the production and use, import and export of listed POPs (initially 12 at time of adoption, with 30 chemicals now regulated). The Convention also regulates POPs such as dioxins and furans that are unintentionally released during industrial processes, by requiring the use of best available techniques and the promotion of best environmental practices for preventing releases of POPs into the environment. The Convention also regulates the management of POPs wastes at both the domestic level and when subject to transboundary movements, where their movement is governed by the Basel Convention. New chemicals can be added to the Convention through a process based on examination of proposals by the Persistent Organic Pollutants Review Committee, which makes recommendations to the Conference of the Parties for listing and related controls. Proposed chemicals are assessed against a number of criteria, including their impact on biodiversity. The Conference of the Parties also oversees the global monitoring, implementation and evaluation work of the Convention.

Primary emissions of the first 12 POPs listed to the Stockholm Convention (legacy POPs) are declining, and concentrations measured in air and in human populations have declined and continue to decline or remain at low levels due to restrictions on POPs that predated the Stockholm Convention and are now incorporated in it. For the POPs listed since the Convention's entry into force in 2004, such as certain brominated diphenyl ethers (BDEs) and perfluorooctane sulfonic acid (PFOS), concentrations in air are beginning to show decreases, although in a few instances, increasing and/or stable levels are observed.

Based on limited data from only two regions, the levels of brominated diphenyl ethers (BDEs) and perfluorooctane sulfonic acid (PFOS) seem to be gradually declining in human tissues, but information regarding changes over time is very limited. Temporal trend information for PFOS in water is also very limited. However, where it is available, some data shows detectable concentrations of PFOS and perfluorooctanoic acid (PFOA) in nearly every region studied. Remobilization of regulated chemicals continues to be a problem, and for some chemicals e.g. PCB, PBDEs and other new POPs, emissions continue from stockpiles, continued product usage and waste disposal/dismantling/recycling practices.

PESTICIDES AND BIODIVERSITY

Pesticide use is a well-documented threat to birdlife, with bird populations having declined 20-25% since pre-agricultural times with one of the major causes being pesticides. Pesticide poisoning is currently the greatest threat to the Andean condor, and bald eagle populations in the USA that declined in part because of exposure to DDT.

By affecting insects and pollinators, pesticides may impact a wide range of ecosystem services. For example, while animal pollination directly affects the yield and/or quality of about 75 per cent of global food crop types, pollinators are important beyond agriculture and food production, as they and their habitats provide ecological, cultural, financial, health, human, and social values. For example, nearly 90 per cent of wild tropical flowering plant species and 78% of those in temperate zones depend, at least in part, on the transfer of pollen by animals. Pollination also maintains genetic diversity in wild plants. Pollinators also contribute directly to medicines, biofuels, fibres, construction materials, musical instruments, arts and crafts, recreational activities, and as sources of inspiration for art, music, literature, religion, traditions, technology and education, including for many indigenous people.

Declines in pollinator diversity are expected to continue globally, with adverse effects on pollinators having direct effects on agricultural yields and food supplies. Currently, 16.5% of vertebrate pollinators are threatened with global extinction, rising to 30% for island species. Pesticides are one of the drivers of this decline in addition to changes in land-use and management intensity, use of herbicides in conjunction with genetically modified crops, invasive alien species, pollinator management and pathogens, and climate change-induced range shifts-threatening both managed and wild pollinators and the services they provide.

The present scale of use of systemic insecticides such as fipronil and the neonicotinoids (one third of the sales globally of insecticides) has resulted in widespread contamination of agricultural soils, freshwater resources, wetlands, non-target vegetation, and estuarine and coastal marine ecosystems. The combination of prophylactic use, persistence, mobility, systemic properties and chronic toxicity is predicted to result in substantial impacts on biodiversity and ecosystem functioning. Fipronil and neonicotinoids are the pesticides most frequently cited as affecting pollinators, which are suffering a decline globally. Neonicotinoids have been shown to significantly reduce the reproductive capacity of male honeybees (drones), and exposed bumble bee colonies experienced a significantly reduced growth rate and suffered an 85% reduction in the production of new queens. Neonicotinoids are a significant factor in the decline of mayflies, a food chain foundational species, because they are extremely vulnerable to pesticide impacts even at very low exposure levels. Due to these facts this study focuses in part on these pesticides. This does not imply that other pesticides might not have similar negative impacts on biodiversity.

In terrestrial ecosystems, insecticides and herbicides can contaminate air, soil, water, and vegetation, including non-target organisms such as birds, fish, beneficial insects, and non-target plants. Pesticide exposure has been suggested as a contributing factor in monarch butterfly declines in the western United States. Declines in terrestrial insect abundances observed in North America and Europe of approximately 10% per decade between 1960 and 2005 were linked to pesticide use and land use changes. Flying insects in protected areas in Germany were shown to have declined by more than 75 per cent during the previous 27 years, with agricultural intensification, including pesticide use, as a plausible explanation.

Pesticide use has been linked to a reduction in aquatic plants, reduced fish egg production, and high mortality and reduced growth in amphibians. If pesticides are misused or overused, they can poison agricultural soil, reduce its resilience, and interfere with natural nutrient cycles. The diversity and functions of soil invertebrates and micro-organisms are known to be affected by the use of herbicides and pesticides. Negative impacts on soil biodiversity may impact on current and future food security. Glyphosate and its degradation product AMPA[2], have accumulated in the environment and could potentially contribute to some antibiotic resistance in bacteria, such as penicillin. However, the mechanism for this resistance is not clear and further research is required, including on how this relates to the emergence of animal, human and plant diseases. Stockpiles of banned and/or obsolete pesticides have accumulated over the decades in developing countries and economies in transition, leaving a legacy of polluted soil.

Freshwater species combine to provide a wide range of critical services for humans, such as flood protection, water filtration, carbon sequestration, nutrient cycling and the provision of fish and other protein. These services are jeopardized by water pollution, including pesticide run-off. Soil biodiversity, which is affected by pesticides, is not only key to sustaining food production and other ecosystem services, but also to detoxifying polluted soils, suppressing soil-borne diseases and contributing to the nutritional quality of food.

Agriculture is a major land use covering approximately 37.5% of the planet's global land area. While the agricultural sector provides several obvious benefits to people, large-scale agriculture also puts significant pressure on biodiversity. This occurs mainly through changing land use to agriculture, certain agricultural practices and through adverse impacts of input-intensive agriculture involving pesticides and fertilizers, particularly for aquatic and soil ecosystems. Globally about one-third of all land is moderately to highly degraded due to erosion, salinization, compaction, acidification and chemical pollution of the soil, with contamination of soils with pesticide residues a major concern in intensive crop-production systems. Pollution from within agricultural production systems and beyond, including pesticides, plastics and heavy metals, urban effluent and excess nutrients, is a major cause of the decline in many populations of many important species of associated biodiversity.

Today, pesticide production is a multi-billion-dollar industry and production is steadily moving from the OECD to transitional and developing countries, and global sales have increased dramatically (USD 50 billion in 2019), although pesticide use by unit of agricultural area has remained stable. China is both the number one consumer and producer of pesticides. Consumption is next largest by the US, Brazil, Argentina and Mexico, with use increasing in a number of upper middle-income and lower middle-income countries experiencing greater growth in intensity of pesticide use.

Herbicides account for most of global pesticide use, with glyphosates used with certain genetically engineered crops (not currently regulated by either of the Rotterdam or Stockholm conventions) the largest-volume herbicides in use today. Glyphosates have been used extensively over the last several decades because it was assumed their impacts were minimal, but because they are being intensively applied, leaving increasing environmental and plant residues, questions are now being raised about their environmental and human health impacts.

Occupational exposure for farm workers results in adverse health effects, including from poisoning due to excessive exposure or inappropriate use. Trade in unidentified, fake, obsolete and banned chemicals occurs in licit and illicit markets and can contribute to such exposure. Other major routes of human and environmental exposure to pesticides are through food and water intake (e.g. pesticide residues). In addition to being regulated under the Stockholm Convention, a large number of pesticides (e.g. DDT) and industrial chemicals are regulated by the Rotterdam Convention's prior informed consent procedure.

The 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade grew out of the recognition of the dramatic growth in chemical production and trade during the previous three decades, which raised concerns about the potential risks posed by hazardous chemicals and pesticides. Countries lacking adequate infrastructure to monitor the import and use of these chemicals are particularly vulnerable. The Convention's Annex III lists pesticides and industrial chemicals that are subject to its prior informed consent procedure, which involves the provision of information to Parties through a decision guidance document about listed chemicals to facilitate the making of informed import decisions. All Parties are required to take appropriate measures to ensure that exporters within their jurisdiction comply with the decisions, among other things. The listing process involves consideration by a Chemical Review Committee, which makes listing recommendations for pesticides and industrial chemicals to the Conference of the Parties for decisions that are made on a consensus basis. Developing countries or countries with economies in transition experiencing problems with severely hazardous pesticide formulations under conditions of use in their territory may also propose these for inclusion in Annex III. Chemicals proposed for listing are assessed against a number of criteria, including their impact on biodiversity.

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[2] Aminomethylphosphonic acid (AMPA) is one of the primary degradation products of the herbicide glyphosate.

HAZARDOUS WASTES AND OTHER WASTES AND BIODIVERSITY

Today, humans extract more from the Earth and produce more waste than ever before. The best estimate of the global amount of municipal solid waste is around 2.1 billion tonnes per year with at least 33 per cent of that amount not managed in an environmentally sound manner. As the proportion of discarded chemically intensive products increases, municipal wastes are becoming hazardous wastes. Overall, hazardous waste generation increased by 50% between 2007 and 2015, mainly due to growth in countries with lower-middle and higher-middle income. The total amount of hazardous waste generated was estimated to be 390-94 million MT in 2015. Waste, through its impacts on air and water quality, has negative impacts on wellbeing, especially in poor and vulnerable communities.

Electrical and electronic waste (e-waste) is one of the fastest-growing waste streams due to consumer demand, perceived and planned obsolescence and rapid changes in technology, among other things. In 2019, it was estimated that 53.6 million tonnes (Mt) were generated globally, up by 9.2 Mt since 2014, and is expected to grow to 74.7 Mt by 2030. The e-waste pollution problem disproportionately affects developing countries, where electronic devices are often disposed of in a non-environmentally sound manner, often compounded by the fact that such wastes are not all domestically generated. About 7-20% of e-waste generated in high-income countries is either refurbished products that are shipped to low-or middle-income countries as second-hand products, or illegally exported under the guise of reuse when the product has no lifespan left. Exports of e-waste to lower-income countries in South East Asia and Africa are a concern because, although this provides income to a very large informal waste recycling sector in countries such as China, India, Ghana and Nigeria, the workers and those living in e-waste communities are subject to exposure from the toxic chemicals and metals in e-waste. Despite the valuable raw materials in e-waste (e.g. copper, gold, silver), there is only about a 20% recycling rate, partly due to product design, with the fate of about 80% of e-waste being uncertain. This poses a problem because e-waste also contains hazardous materials like lead, mercury, cadmium, nickel, beryllium, zinc and persistent organic pollutants like flame retardants or those found in product fluids, lubricants and coolants.

Open dumping is the most common method of hazardous waste disposal in developing countries and means that many hazardous wastes and other wastes are not being managed in an environmentally sound manner as provided by the Basel Convention and its technical guidelines. Waste dumps and informal recycling are major sources of pollution in many countries, and toxic wastes, including e-waste, accumulates in such dumps. Roughly 33 per cent of the world's solid waste ends up in open dumpsites. Forty-eight of the world's 50 biggest active dumpsites are in developing countries and pose a serious threat to human health and the environment, affecting the daily lives of approximately 64 million people. Uncontrolled disposal of municipal solid waste leads to severe and various environmental and social impacts: heavy metals pollution in water, soil, and plants; open burning causing polluting emissions; waste picking within open dump sites posing serious health risks to people; and release of municipal solid waste in water bodies augmenting global marine litter. Open burning is common in many low-income countries and releases large amounts of hazardous substances to the environment, making dumps a major global source of some substances of high concern such as dioxins and furans and mercury.

Plastics, another area of global concern, are ubiquitous in aquatic, atmospheric, and terrestrial ecosystems. Global plastic production was 359 million tonnes in 2018 and expected to double by 2050, with about 8 million tonnes of it ending up in the oceans. COVID-19 has resulted in a resurgence in single use plastics. Three-quarters of all marine debris is plastic, a persistent and potentially hazardous pollutant, which fragments into microplastics that can be taken up by a wide range of marine organisms. There are more than 800 marine and coastal species affected by marine debris through ingestion, entanglement, ghost fishing and dispersal by rafting, as well as habitat effects. 100% of marine turtle species, up to 66% of marine mammal species, and 50% of seabird species are affected by entanglement or ingestion of plastics from the ocean.

Marine plastic debris is made of chemicals, including POPs, but it also accumulates contaminants like POPs and can transport them long range. Macro- and micro-plastics can also transport invasive alien species, including harmful algal blooms, pathogens, and non-native species, with at least 300 species known to disperse by rafting on debris, which can form a new habitat. Pathogen dispersal via "microbial rafting," increases the likelihood of disease outbreaks which is highest in tropical regions. The generation of microplastic wastes may also be fueling the spread of antibiotic resistance.

Much less studied are the impacts of plastics on terrestrial species, although it is notable that a critically endangered species, the California condor, had reduced nestling survival due to ingestion of junk including plastic debris, threatening the re-establishment of a viable breeding population. Microplastics in the soil have a detrimental ecological impact on soil macro- and microbiota and are a major route for transferring toxic chemical pollutants, heavy metals and pesticides into the human food chain. There is a growing body of evidence that microplastics interact with terrestrial organisms that mediate essential ecosystem services and functions, such as soil dwelling invertebrates, terrestrial fungi and plant-pollinators, thus suggesting that microplastic pollution might represent an emerging global change threat to terrestrial ecosystems. One study estimated that the full implementation of all commitments to date would reduce plastic waste entering the environment by only around 7%. Nature's contributions to people such as food provision and freshwater/groundwater regulation are affected as a result of non-environmentally sound management of hazardous and other wastes. Marine debris in general damages fisheries and aquaculture, marine transport, shipbuilding and marine tourism. Microplastics that co-pollute the marine environment with metal, antibiotics, and human pathogens pose an emerging health threat globally, threatening humans who ingest marine-derived foods. Pollution from major dump sites with hazardous wastes leach into rivers, which can affect both freshwater and coastal marine fisheries and recreational activities. The regulation of air and water quality are affected due to open burning and large open dumpsites. Nature's ability to contribute to the formation, protection and decontamination of soils are affected due to soil pollution.

Awakening environmental awareness and corresponding tightening of environmental regulations in the industrialized world in the 1970s and 1980s led to increasing public resistance to the disposal of hazardous wastes and an escalation of disposal costs, causing some operators to seek cheap disposal options for hazardous wastes in Eastern Europe and the developing world. There, environmental awareness was much less developed, and regulations and enforcement mechanisms were lacking. It was against this background that the 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was negotiated to combat the "toxic waste trade".

The overarching objective of the Basel Convention is to protect human health and the environment against the adverse effects of hazardous wastes and other wastes. It covers a wide range of wastes defined as "hazardous wastes" based on their origin and/or composition and their characteristics (including mercury, POPs, and pesticide wastes, as well as two types of wastes defined as "other wastes", household waste and incinerator ash). At its 2019 meeting, the Conference of the Parties amended three annexes to the Convention in relation to plastic waste, with the new entries coming into effect on January 1, 2021. Within the Convention are embedded obligations in relation to the prevention and minimization of the generation of hazardous and other wastes as well as in relation to their environmentally sound waste management (ESM), with thirty technical guidelines developed to provide ESM guidance for priority waste streams. For permitted transboundary movements, the prior informed consent scheme of the Convention requires that before an export may take place, the authorities of the State of export notify the authorities of the prospective States of import and transit, providing them with detailed information on the intended movement, which can only proceed if and when all States concerned give their written consent. Each transboundary movement must be accompanied by a movement document, which must be signed each time the shipment changes hands, to allow for tracking of each shipment from point of generation until point of environmentally sound disposal. The Conference of the Parties oversees the work of the Open-ended Working Group and the Implementation and Compliance Committee, as well as numerous small intersessional working groups, and is currently undertaking a review of progress under its 2011-2020 strategic framework.

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CONCLUSIONS FROM THE EXPLORATORY STUDY ON INTERLINKAGES BETWEEN CHEMICALS AND WASTE AND BIODIVERSITY

3 CONCLUSIONS FROM THE EXPLORATORY STUDY ON INTERLINKAGES BETWEEN CHEMICALS AND WASTE AND BIODIVERSITY

1. Pollution is one of the key drivers of biodiversity loss. Chemicals and waste are ubiquitous in the environment and found in all parts of the globe, and global production and distribution of chemicals-based products continues to increase. The Basel, Rotterdam, Stockholm and Minamata conventions address some of the most significant chemicals and waste pollution that has been identified over the last several decades and are thus contributing to the conservation and sustainable use of biological diversity.

2. Mercury is persistent in the environment, and while some emissions are naturally-occurring (e.g. rock weathering), anthropogenic emissions are increasing, polluting the air, freshwater and oceans, with severe consequences for human health and the environment, particularly biodiversity (e.g. mercury bioaccumulation in biota). Artisanal and small-scale gold mining (ASGM) is the biggest polluter to air, land and water, often fed by the illegal trade in mercury. Significant re-volatilization is expected to occur due to melting permafrost, snow and ice as a result of climate change.

3. POPs are human-made chemicals that are persistent in the environment and are found around the globe in air, water and soil. While the concentrations of legacy POPs continue to decline or remain at low levels, emissions from PCBs continue and along with DDT continue to be found in biota, the former associated with population declines in killer whales. For POPs listed after 2004, concentrations in air are beginning to show decreases, although in some instances increasing and/or stable levels are observed, but information is lacking for human tissues and other media. Re-volatilization continues to occur, including for legacy POPs such as PCBs and more is expected due to climate change. Large remaining stockpiles of obsolete pesticides and PCBs remain an issue.

4. There needs to be a reduction in nature's exposure to pesticides. Global food security is under threat due to the threats to bees, other pollinators, and the deterioration in soil ecosystems, partly due to pesticides. Agricultural runoff, including pesticides, is a major source of water pollution and contaminant of groundwater aquifers. The impacts of certain high-use pesticides on nature need monitoring and action (e.g. glyphosate, neonicotinoids). The illegal trade in pesticides continues to add to human and environmental exposure.

5. Mismanagement of hazardous wastes in large waste dumps around the world (including e-waste, mercury waste, POPs waste and pesticide waste) is resulting in serious impacts on biological diversity and ecosystem services as well as the health of millions of people, particularly those involved in the informal recycling sector and their communities, and those living near those dumps due to open burning and other releases. The transboundary movement of e-wastes to poorer countries lacking recycling infrastructure continues to add to the environmental impacts of such wastes, although all countries are having difficulties properly managing the volume and complexity of e-waste. The volume of e-waste is expected to continue to grow and needs proactive measures globally to manage it.

6. Plastics, the production of which is expected to double by 2050, have demonstrated impacts on marine species through entanglement, ingestion, contamination, and transport/rafting (including the spread of antibiotic resistance, pathogens and POPs), but may also pose a serious threat to terrestrial ecosystems, including soils. Concerted proactive actions are needed at the international level to address this rapidly growing menace.

7. Mercury, POPs, pesticides and hazardous and other wastes (e.g. plastics) are negatively impacting soil biodiversity around the world. Soils are one of the main global reservoirs of biodiversity with more than 40 % of living organisms in terrestrial ecosystems associated directly with soils during their life cycle.

8. Transformation of key polluting sectors in developing countries, such as ASGM and informal e-waste recycling, can provide major benefits for biodiversity and ecosystem services, as well as the human health of workers and their communities, while promoting significant economic sectors and contributing to a circular economy.

9. Nature's contributions to people and ecosystems worldwide are impacted by mercury, POPs, pesticides and hazardous and other wastes as they impede nature's ability to regulate air and freshwater quality, soils and organisms, create and maintain habitat, and they reduce pollination and seed dispersal

services. These pollutants also affect services such as the provision of food and feed, materials and assistance, and genetic diversity. They affect non-material contributions of particular importance to indigenous peoples around the world, including those regarding the consumption of traditional foods that also support spiritual and religious identity, as well as experiences with nature that contribute to social cohesion, recreation, learning and inspiration.

10. High levels of contamination are found in countries or regions that are megadiverse (e.g. ASGM using mercury), from mercury, POPs, pesticides and hazardous and other wastes, as well as in vulnerable ecosystems like the Arctic, and in locations close to intense industrial activity, often in urban centres. These pose particular challenges for biological diversity and ecosystem services, as well as for human health.

11. Of particular concern is the impact of mercury, POPs, pesticides and hazardous and other wastes in combination with other chemicals, and other natural and anthropogenic stressors (such as climate change, hunting pressure, invasive alien species, emerging pathogens, and changes in food web dynamics) which are having an impact on biodiversity, ecosystem services and human health. Further emphasis in research is needed to enhance understanding on mixtures and cumulative effects, including from long-term low-dose exposures, and how to address them. Risk assessment for pesticides needs improvement, for example, by focusing on high use, ubiquitous pesticides, and on the formulated products rather than just the active ingredient, and by placing a greater emphasis on post-approval monitoring.

12. Climate change is a key factor amplifying the effects of chemicals but is also expected to contribute to the continued re-volatilization of both mercury and POPs, which are persistent in the environment and can cycle between environmental compartments for extended periods of time. Melting permafrost and ice are expected to release significant quantities of both mercury and POPs into the environment.

13. Environmental monitoring for POPs and mercury needs to be improved and consistent in all regions of the world so that the risks to human health and the environment can be fully understood in all regions. Although discussion of the possibility of a broader science platform for chemicals and hazardous wastes is under consideration as part of the ongoing beyond-2020 discussions (the equivalent of the Intergovernmental Panel on Climate Change (IPCC) for climate and IPBES for biodiversity) the current convention processes for environmental monitoring and examining effectiveness are extremely valuable.

14. Illegal trade in mercury, POPs, pesticides and hazardous and other wastes (particularly e-waste) continue to exacerbate both environmental and human health risks, often in poorer countries with limited infrastructure to combat it.

15. Many species are evolving rapidly as they adapt to human drivers of change, including some changes (such as resistance to antibiotics and pesticides) that pose serious risks for society. Close monitoring of such developments is required. Similarly, new technologies that could reduce pesticide use, such as gene drives, require careful assessment due to their potentially irreversible impacts if released into the environment. Reduction of pesticide use, rather than the search for alternatives to current pesticides, can be achieved through alternative techniques, such as integrated pest management practices and agroecological farming.

BUILDING ON THE INTERLINKAGES STUDY

1. In mapping the interlinkages between chemicals and waste and biological diversity, this exploratory study reflects that environmental challenges and their solutions are inter-related, complex and shared. This exploratory study provides a baseline for future work and collaboration between conventions in different spheres and within them. To achieve the 2050 vision of the Convention on Biological Diversity (CBD) through its post-2020 global biodiversity framework and its 2030 pollution target, the significant ongoing contributions of the Basel, Rotterdam, Stockholm and Minamata conventions need to be fully harnessed. Conversely, knowledge and insights garnered through collaboration with the CBD and related protocols and conventions can benefit the work of the four global chemical and waste conventions.

2. As the international community finalizes and implements the post-2020 global biodiversity framework, collaboration between the four chemicals and waste conventions and the biodiversity-related conventions can provide ongoing refinements to the targets and indicators on pollution as they relate to mercury, POPs, pesticides and hazardous and other wastes. This is particularly important as the 2020 GBO-5 concluded that CBD Aichi pollution Target 8 was not achieved.

3. Target 8 did not reference the significant chemicals and waste biodiversity-related issues addressed under the four conventions, and information in this study and the ongoing work of the four conventions can contribute to achieving the CBD's 2030 pollution target. Their ongoing work includes national reporting, environmental monitoring, and treaty effectiveness and strategic framework evaluations where biodiversity considerations could be increasingly integrated, along with efforts to contribute to the 2030 SDGs, which this study highlights as a point at which chemicals, waste and biodiversity issues also converge.

4. More specifically, whether or not the 2030 biodiversity pollution target is drafted to reflect priority pollutants/chemicals such as mercury and other heavy metals, POPs, pesticides, wastes (including plastics) this study provides baseline information about key interlinkages that can serve the four conventions' governing bodies to consider the detailed contributions they could make to the refinement and implementation of the CBD's 2030 pollution target and indicators going forward. Examples could include specific targets related to mercury air emission reductions, reduction of concentrations of POPs in environmental media, enhanced focus of the Rotterdam Convention on neonicotinoids and glyphosate pesticides, the enhancement of legislative implementation of the Basel Convention's plastic waste amendments, or decisions on international cooperation and coordination that build these inter-convention connections (e.g. forwarding this study to the CBD Conference of the Parties, or working on common areas of concern such as ASGM).

5. This study also highlights that current research on and regulation of chemicals in the environment tends to take a simplistic view and does not account for the complexity of the real world, including how to differentiate and quantify the effects of multiple stressors on ecosystems and how to improve risk assessment of such stressors (including at different levels of biological organization) to enhance predictability. Enhanced and focused collaboration between the chemicals and waste conventions and those related to biodiversity provides an opportunity for each to share their pressure points and complexities and mobilize limited resources towards prioritized solutions that benefit both. Collaboration on ASGM, plastics, e-waste, pesticides and pollinators, illegal trade, the sharing of monitoring data and scientific research, along with shared communications and messaging, could produce significant benefits to both the biodiversity and chemicals and waste worlds.

6. Each of these worlds can also alert the other to emerging issues of concern and key developments. This study has identified UNEP's Assessment Report on Issues of Concern for UNEA-5, which consists of an assessment of eight emerging policy issues and other issues of concern under SAICM (e.g. nanomaterials, e-waste) and 11 issues with emerging evidence of risks identified by GCO-II, and identified possible contributions of the four MEAs to addressing those issues. It also identified the ongoing SAICM intersessional process as it shapes the beyond-2020 framework on chemicals and waste and how this relates to the four chemicals and waste conventions.

7. Ultimately, this exploratory study identifies a significant number of areas of convergence between chemicals, waste and biodiversity and suggests the need to resolve challenges in these areas of convergence in a manner that better reflects the interconnectedness within our natural environment.

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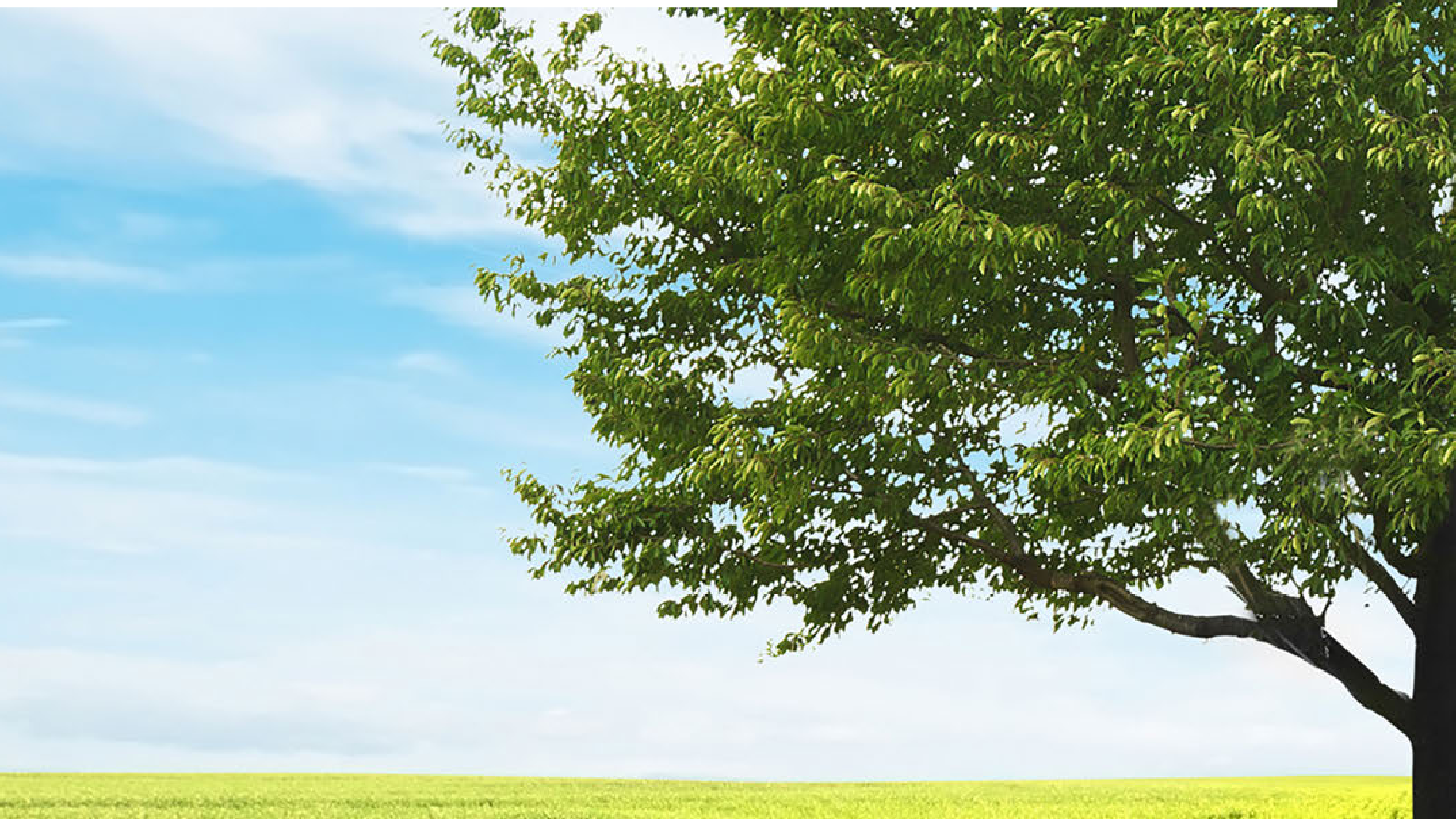

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