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# CoEvolution Revisited - 2020

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## INTRO

***We should no longer talk about how to deal with disasters caused by global warming or climate change, but how to survive environmental collapse.***

### OVERVIEW:

World population grew 6.8% from 6.933 in 2010 to the current world population of 7.8 billion. It is expected to reach 8.6 billion in 2030, rising to 9.8 billion in 2050.

World GDP grew 33.84% from 66.051 2010 to a projected 88.40 in 2020, five times faster than population growth. Economic growth requires energy and other natural resources that negatively impact the environment. [International Monetary Fund – World Economic Outlook]

Atmospheric CO<sub>2</sub> was 338 ppm in January 2010 and 413 ppm in January 2020, a 22.2% increase. [Climate.gov <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>]

The last time the atmospheric CO<sub>2</sub> amounts were this high was more than 3 million years ago, when temperature was 2°–3°C (3.6°–5.4°F) higher than during the pre-industrial era, and sea level was 15–25 meters (50–80 feet) higher than today. [Climate.gov <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>]

**Summary:** Changes recorded; population up 6.8%, atmospheric carbon up 22%, global GDP up 33% resulting in massive downturns in natural system conditions and characteristics.

### GENERAL STATEMENT OF ENVIRONMENTAL CONDITIONS:

The Wildlife Conservation Society [summarizes it in a news release](#): "23 percent of the world's landmass can now be considered wilderness, with the rest—excluding Antarctica—lost to the direct effects of human activities." [The Journal Nature "Protect the Last of the Wild" Nov 2018]

In 2010, global average temperature was [0.88°C](#) (1.6°F) above pre-industrial levels. Temperature increase in 2019 is [shaping up](#) to be about 1.1 degrees C (2°F) above pre-industrial levels. [World Resources Institute. <https://www.wri.org/blog/2019/12/6-ways-climate-changed-over-past-decade>]

10% of the world is covered by glaciers, and a further 19% is barren land – deserts, dry salt flats, beaches, sand dunes, and exposed rocks.<sup>1</sup> This leaves what we call 'habitable land'. **Half** of all habitable land is used for agriculture. [UN Food and Agriculture Organization]

Roughly 37% of Earth's land is today employed for agricultural purposes, with about 11% used for growing crops and the remainder for pasture. [European Space Agency <https://earth.esa.int/web/guest/earth-topics/agriculture>]

40 percent of the *Earth's land* is now given over to *agriculture*. [National Geographic. [www.nationalgeographic.com](http://www.nationalgeographic.com) › 2005/12 › [agriculture-food-crops-land](#)]

Global mean [sea level rise](#) was roughly 3.3 millimeters (mm) per year (0.13 inch/yr) between 1993 and the present. This trend accelerated significantly this past decade: Between 2010 and 2018, sea level rise grew to about 4.4 mm/yr (0.17 inch/yr), rising almost 2 inches overall in the past decade. [World Resources Institute]

### WARNING:

In 2008/09, while we were completing the CoEvolution report, Margaret Davidson, Director of Coastal Services, NOAA, said that the three primary indicators of global environmental change will be stronger, more frequent, and more random storms and events produced by the increasing changes in the environment. The randomness will be a barrier to people looking for trend lines as the trend will be randomness, not a straight-line traceable trajectory. This will provide critics with data that they will misinterpret as environmental accidents and not an actual trend. The consequences of seeing the increase in environmental activity as an accident will prevent effective action to slow and reverse negative environmental impacts.

### GLOBAL CHAOS TRIGGER EVENTS:

1. Collapse of the Greenland ice shelf

Margaret had said that the research had shown that a massive chunk of ice could unexpectedly slide off the southern end of Greenland into the Atlantic creating a 50' high wave, a tsunami or tidal wave, endangering 30 to 40 million people living along the East Coast of North America from Newfoundland to Miami, Long Island is so flat the wave would sweep across the entire island. The wave would also endanger the other coastal areas of Europe. One of the great concerns is the way it would sweep across the dykes of the Netherlands, inundating the entire country.

2. Breakup of the Antarctic ice cap

“It’s among the fastest-warming regions of the planet,” spokesperson Clare Nullis from the World Meteorological Organization said in [a release from the UN](#). “We hear a lot about the Arctic, but this particular part of the Antarctic peninsula is warming very quickly. Over the past 50 years it’s warmed almost 3°C.” [UN World Meteorological Association]

## **FIVE FACTORS DRIVING ENVIRONMENTAL COLLAPSE**

These five factors were developed in the course of completing a study for the US Forest Service with participation from NOAA, BLM, US Army Corps of Engineers, and the Global Ecosystem Center. Each of the factors below can be considered both individually and in their interactive effects on each other; Fragmentation, Depletion, Pollution, Erosion, Extinction

The items entered under each category were selected from a scan of recent literature since 2010 to demonstrate the dire condition and accelerating trends now observable in various environmental categories.

### **FRAGMENTATION**

*The breakup of natural corridors, ecosystems and watersheds by the construction of human systems. Fragmentation results from the construction of transportation infrastructure like roads, rail, and trails; subdivision of large land parcels; and ecosystem alterations like dams.*

The degree of forest fragmentation, for example, is a major threat to biodiversity conservation and ecosystem service provision. Haddad et al. (2015) 28 estimated that in 70% of the forest masses of the world, a forest edge can be found within a mean distance of less than 1km. [WWF Living Planet Report: 2018]

### **DEPLETION**

*The growing demands of the Human Network’s requires Natural System resources. Depletion includes renewable resources (forests, water) and nonrenewable resources (minerals, pristine streams, wildlife habitat)*

Despite decreased deforestation rates in some regions, forest ecosystems are still under great threat. According to [WRI research](#), 30 percent of global forest cover has been cleared, while another 20 percent has been degraded. Most of the rest has been fragmented, leaving only [about 15 percent](#) intact. (Analysis 2018 - Data for year 2016). [World Resources Institute. <http://www.intactforests.org/>]

While globally the rate of forest area net loss has slowed due to reforestation and the establishment of new plantations, as well as policy and regulatory efforts to reduce forest conversion, it has continued at relatively high levels in tropical forests, particularly in some frontier areas in South America, sub-Saharan Africa and Southeast Asia 53. In one study carried out in 46 countries in the tropics and subtropics, large-scale commercial agriculture and local subsistence agriculture were responsible for about 40% and 33% of forest conversion, between 2000 and 2010 54. The remaining 27% of deforestation was due to urban growth, infrastructure expansion and mining (this is further explored in FAO FRA 2016 27) [WWF Living Planet Report: 2018. Page 50]

### **POLLUTION**

*The introduction of non-natural waste products into the Natural System. Alters the chemical composition of air, water, and land. Invasive species were also included in this category as they are a type of human introduced intrusion that alters the natural composition of flora and fauna.*

## CO2

Atmospheric CO2 was 338 ppm in January 2010 and 413 ppm in January 2020, a 22.2% increase. [Source: *Climate.gov* <https://www.climate.gov/news-features/understanding-climate/climate-change-atmospheric-carbon-dioxide>]

### Deepwater Horizon Oil Spill – 2010

As the worst offshore oil spill in U.S. history approaches its 10th anniversary in April, a study by two University of Miami researchers shows that a significant amount of oil and its toxic footprint moved beyond fishery closures where it was thought to be contained and escaped detection by satellites as it flowed near the Texas shore, west Florida shore and within a loop current that carries Gulf water around Florida's southern tip up toward Miami.

In their [study](#), published Wednesday in *Science*, the researchers dubbed it “invisible oil,” concentrated below the water's surface and toxic enough to destroy 50 percent of the marine life it encountered. Current estimates show the 210 million gallons of oil released by the damaged BP Deepwater Horizon Macondo well spread out over the equivalent of 92,500 miles.

But the oil's reach was 30 percent larger than that estimate, the new study says. “Oil in these concentrations for surface water extended beyond the satellite footprint and fishery closures, potentially exterminating a vast amount of planktonic marine organisms across the domain,” the researchers wrote. The findings show that the government's understanding of how oil flowed from Deepwater Horizon was limited and that it underestimated the extent to which marine life was killed or poisoned by toxic crude. [*Washington Post* – Feb. 12, 2020 - *The toxic reach of Deepwater Horizon's oil spill was much larger — and deadlier — than previous estimates, a new study says.*]

### China pollution sources up by more than half since 2010

The number of pollution sources in China has increased by more than half in eight years, the environment ministry said on Thursday (March 29) as it embarks on a nationwide survey to determine the damage done by more than 30 years of untrammelled growth. The announcement from the newly minted Ministry of Ecology and Environment (MEE) underlines the challenges facing China, in its fifth year of a war on air, water and soil pollution, as it tries crack down on data fraud and improve monitoring. [*The Straits Times* – March 29, 2018]

### Plastic Pollution

Annual Global Plastics Production

2010 – 313 million tons per year

2015 – 381 million tons per year

Up 68 million tons per year in 5 years (21.7%)

Cumulative Production

2010 – 6.06 billion tons

2015 – 7.82 billion tons

Up 1.76 billion tons (29%) in 5 years

[*Our World in Data* – September 2018]

## EROSION

*The reduction of natural areas of the planet by the growth of the Human Network, including urban expansion, resource extraction, agricultural development, and industrial forestry.*

In March 2018, the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) released its latest Land Degradation and Restoration Assessment (LDRA), finding that only a quarter of land on Earth is substantively free of the impacts of human activities 178. By 2050 this fraction is projected to decline to just a tenth. Wetlands are the most impacted category, having lost 87% of their extent in the modern era. [*WWF Living Planet Report: 2018. Page 42*]

Yet it is not just forest area that is being reduced by human activities; forest quality is also being affected. On a global scale, the area of minimally disturbed forests declined by 92 million hectares between 2000 and 2013, at the rate of 0.6% per year 55. Using proximity to forest edges as a way of measuring forests' vulnerability shows that 60-70% of the world's forests are at risk from the negative effects of human activities, altered microclimate and invasive species 28,56,57. [*WWF Living Planet Report: 2018. Page 50*]

A century ago, only 15% of Earth's surface was used to grow crops and raise livestock. Today, more than 77% of land (excluding Antarctica) and 87% of the ocean has been modified by the direct effects of human activities. [*The Journal Nature "Protect the Last of the Wild" Nov 2018*]

Between 1993 and 2009, an area of terrestrial wilderness larger than India — a staggering 3.3 million square kilometres — was lost to human settlement, farming, mining and other pressures. In the ocean, areas that are free of industrial fishing, pollution and shipping are almost completely confined to the polar regions. [*The Journal Nature "Protect the Last of the Wild" Nov 2018*]

Sea ice extent is smallest in September every year. The rate of September sea ice decline has been 13% per decade relative to the 1981-2010 average. During this past decade, Arctic sea ice minimum reached its lowest level since at least 1979, the year record-keeping began. [*World Resources Institute*]

Glacier melt grew from 460 milliliters of liquid water in the 1990s to 500 in the 2000s to 850 milliliters in 2010-2018. [*World Resources Institute*]

The ice loss seen every year has accelerated at [a rate of nearly sixfold since the late seventies](#), and the meltdown of this particularly sensitive area is responsible for somewhere around a [quarter of global sea-level rise](#). [*UN World Meteorological Association*]

## **EXTINCTION**

*The disappearance of species and the networks they support and depend on within the Natural System. Extinction includes animals, plants and even entire ecosystems.*

467 species have been declared extinct in the past decade. [*International Union for the Conservation of Nature*]

The UN [estimates](#) as many as 1 million species are now at risk of extinction; that number includes 40 percent of all amphibian species, 33 percent of corals, and around 10 percent of insects. [*UN's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*]

The latest index shows an overall decline of 60% in population sizes between 1970 and 2014. Species population declines are especially pronounced in the tropics, with South and Central America suffering the most dramatic decline, an 89% loss compared to 1970. Freshwater species numbers have also declined dramatically, with the Freshwater Index showing an 83% decline since 1970. [*WWF Living Planet Report: 2018. Page 7*]

In the 20th century freshwater fishes have had the highest extinction rate worldwide among vertebrates 100. [*WWF Living Planet Report: 2018. Page 66*]

Over the past 50 years our Ecological Footprint – a measure of our consumption of natural resources – has increased by about 190%. *WWF Living Planet Report: 2018. P28* [*Global Footprint Network. National Footprint Accounts 2018 edition. <<https://data.footprintnetwork.org/>> (2018)*]

Populations are in decline in all realms, but declines are especially pronounced in the three tropical realms. Here, average vertebrate abundance in 2014 was less than half of what it was in 1970. The LPI indicates that the Neotropical realm, covering South and Central America, and the Caribbean, has suffered the most dramatic decline at 89% loss compared to 1970. Nearctic and Palearctic populations are faring slightly better with declines of 23% and 31%. [*WWF Living Planet Report: 2018. Page 92*]

From 1970 to 2014, there was a **60 per cent overall decline in vertebrate population sizes**. [*WWF Living Planet Report: 2018*]

the population abundance of monitored mammals, birds, reptiles, amphibians and fish have, on average, **dropped by more than half** in little more than 40 years. [*WWF Living Planet Report: 2018*]

### **North American Birds:**

...according to a new study. It estimates that North America is home to nearly three billion fewer birds today compared to 1970—that's more than 1 in 4 birds that have disappeared from the landscape in a mere half a century. [*The Journal Science* <https://www.audubon.org/news/north-america-has-lost-more-1-4-birds-last-50-years-new-study-says>]

*North American Forest Generalists:* Habitat loss and fragmentation are a major issue in all forests. Logging, wildfires, and human development all threaten to carve up North America's woods. Warming temperatures could also change the plant composition of forests. About **482 million individuals have been lost since 1970**, a nearly 20 percent loss, according to the study. [*The Journal Science* <https://www.audubon.org/news/north-america-has-lost-more-1-4-birds-last-50-years-new-study-says>]

*North American Western Forest:* Western forests are all those south of the boreal in western Canada and the United States, and including the mountain forests of northern Mexico. Wildfire is a bigger threat in western forests than it is in eastern forests. These forests also face threats from logging, clearing for development, fragmentation, and climate change. [*The Journal Science* <https://www.audubon.org/news/north-america-has-lost-more-1-4-birds-last-50-years-new-study-says>]

*North American Grasslands:* These are among the most threatened biomes on the planet. Loss of habitat to urban and agricultural development, along with liberal pesticide use, has had detrimental effects on the birds that rely on these habitats. The study found that grasslands have **lost nearly 720 million birds** since 1970—a greater than 40 percent decline. [*The Journal Science* <https://www.audubon.org/news/north-america-has-lost-more-1-4-birds-last-50-years-new-study-says>]

*North American Boreal forest:* Clearing for oil and gas development, logging, widespread fires, and climate change all threaten boreal forest habitat. It has also historically been difficult to monitor boreal forest species and the threats to them. Some **500 million birds have been lost in this habitat** since 1970—a more than 30 percent decline. [*The Journal Science* <https://www.audubon.org/news/north-america-has-lost-more-1-4-birds-last-50-years-new-study-says>]

*North American Western Forests:* About **140 million birds have been lost since 1970**, [from the Western Forest of Canada, US and Northern Mexico] the study estimates—a nearly 30 percent loss. [*The Journal Science* <https://www.audubon.org/news/north-america-has-lost-more-1-4-birds-last-50-years-new-study-says>]

### **Insect decline more extensive than suspected - Technical University of Munich (TUM)**

(In Germany) Compared to a decade ago, today the number of insect species on many areas has decreased by about one third. [*Science News* <https://www.sciencedaily.com/releases/2019/10/191030151140.htm>]

In a large-scale biodiversity study, an international research team headed by scientists at TUM surveyed a large number of insect groups in Brandenburg, Thuringia and Baden-Württemberg [Germany] between 2008 and 2017. Since 2008 they measured a decrease of approximately 40 percent in insect biomass in the forests they studied. In grasslands the results were even more alarming: at the end of the study period, the insect biomass decreased to only one third of its former level. [*Science News* <https://www.sciencedaily.com/releases/2019/10/191030151140.htm>]

The last male northern white rhino died in 2018, the last two females are living in captivity and are too old to reproduce. [*UN's Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*]

## **IMPACTS ON THE HUMAN NETWORK:**

The **annual cost** average for billion-dollar **disasters** is \$42.8 billion (CPI-adjusted) over the period of record (1980–2018). The **annual cost** average over the last **5-years** (2014–2018) is \$99.1 billion (CPI-adjusted), more than double the long-term average. Feb 7, 2019 [*Source: Climate.gov*]

With [three devastating hurricanes](#), extreme [wildfires](#), hail, flooding, tornadoes and drought, the United States tallied a record high bill last year for weather-related disasters: \$306 billion. The U.S. had 16 disasters last year with damage exceeding a billion dollars each. That ties 2011 for the number of billion-dollar disasters, but the total cost blew past the previous record of \$215 billion in 2005. [*National Oceanic and Atmospheric Administration (NOAA)*]

The cost alone does not measure the profound non-monetary effects on human beings, and other animal and plant species.

...from the period between 1994 and 2013, which includes 6,873 natural disasters worldwide, which claimed 1.35 million lives or almost 68,000 lives on average each year, and affected 218 million people on average per annum during this 20-year period. [Centre for Research on the Epidemiology of Disasters. CRED]

Recovery depends on the ability to have the financial resources available to take action. They don't exist today, and trends indicate there will be much less available tomorrow.

Earthquakes. Wildfires. Floods. So far, 2016 has seen natural disasters wreak havoc on properties and people. Natural disasters cause huge amounts of economic damage each year, most of which is uninsured – and, in some cases, uninsurable. There is a massive disparity between different regions across the world over the degree of economic loss caused by catastrophes and how much is covered by insurance. Between 1980–2015, catastrophes inflicted \$1.96 trillion of economic losses on the Asia-Pacific region (APAC) with only 10% covered by insurance. This is in stark contrast to the U.S., which suffered similar economic losses at \$1.65 trillion, but had 45% insurance coverage. Businesses need to be better prepared to improve their resilience to such shocks – this starts with understanding the nature of the risk. [AON. The One Brief. <https://theonebrief.com/the-cost-of-catastrophe-assessing-the-impact-of-natural-disasters/>]

## **CONCLUSION:**

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Disasters caused by extreme environmental events have been largely localized to a metropolitan area or subregion within the larger national and global networks. Localized disruptions to the network may create economic and social effects, but do not have serious impact on the larger networks, as they remain functional and resources drawn from those networks can be applied to localized impacts. However, massive superregional impacts across larger scale geographies will have entirely different effects on the network of human activity. These larger-scale events will potentially overwhelm the larger network causing disruptions throughout the entire world. The response required to repair the damage will not be able to effectively draw on the available resources as disruptions throughout the network will prevent the mobilization and application of resources to the affected areas, essentially imploding the network. The disruptions will be lengthy and dramatic with enormous and potentially inconceivable impacts on economic and social activity.

***We should no longer talk about how to deal with disasters caused by global warming or climate change, but how to survive environmental collapse.***