“The Environment is Everything That Isn’t Me”

Albert Einstein

Georges M. Halpern, MD, DSc

with Yves P. Huin

This essay is an homage to Carl Sagan. Please watch –again- this short video. Just double-click on the picture above.

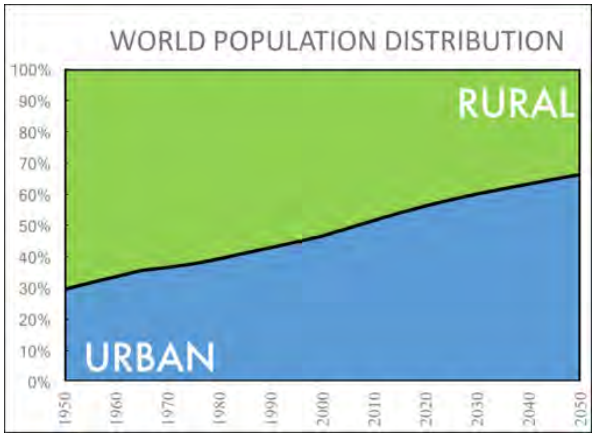
I did only know cities for 4 decades. Although I was born in Warsaw, Poland, my early childhood was in Paris, France where my mother rushed to reunite with her husband. Then –after the 5-year WW II intermission- it was Paris again. My occasional explorations of the countryside or surrounding woods were disastrous: I kept falling by tripping on half-hidden stones, scratched my thin pale skin, got sunburnt after a few minutes of exposure, got all the chiggers of the place under my skin –where they created large horribly itching areas. Besides the chiggers, the wasps, hornets, horseflies, even the bees kept stinging me –and ONLY me! I rapidly retreated into the cradle of the city, inhaled with delight the exhalation of wet cobbles after a shower, felt at home in the metro, walked day and night until I had memorized all the streets, passageways, blind alleys or avenues and boulevards. Paris was mine, but I also conquered Copenhagen, Edinburgh, Innsbruck, Parma, and –as described in detail in my essay *Memoria & Memorie* available on *www.drgeorges.net*, Venezia and Hong Kong amongst hundreds of others in 142 countries.

Cities Belong to Humans, and Humans Belong to Cities

The word *city* and the related *civilization* come, via Old French, from the Latin root *civitas*, originally meaning citizenship or community member and eventually coming to correspond with *urbs*, meaning city in a more physical sense. The Roman *civitas* was closely linked with the Greek *polis.* Cities have physical streets and buildings and a collection of people who create, maintain, develop, improve housing, transportation, sanitation, utilities, land use, and communication. Cities have shops, restaurants, education at many levels, healthcare, social services, policing and firefighting, entertainment, art, culture, tourism, hospitality, magic pasts and hopes for an even better future.

Characterized by population density, symbolic function, and urban planning, cities have existed for thousands of years. Civilization and the city both followed from the development of agriculture, that enabled production of surplus food, and thus, a social division of labor, with concomitant social stratification, and trade. Cities have also arisen without agriculture, due to alternate means of subsistence e.g. fishing), to use as communal seasonal shelters, to their value as bases for defensive and offensive military organization, or to their inherent economic function.

The history of cities goes back to –at least- the eighth millennium BCE, and their developments, hazards, florescence, decay or destructions populate millions of documents. But urbanization has accelerated exponentially since the 18th century.



The more recent numbers are summarized below:

Urbanization occurs as individual, commercial flight, social and government action reduce the time and expense of commuting and transportation and improve opportunities for jobs, education, housing, and transportation. Living in a city can provide opportunities of proximity, diversity, and marketplace competition. As against this, there may be alienation issues, stress, increased cost of living, and negative social aspects that result from mass marginalization. Suburbanization, which is happening in the cities of the largest developing countries, may be regarded as an attempt to balance these negative aspects of urban life while still allowing access to the large extent of shared resources.

In cities, money, services, wealth and opportunities are centralized. Many rural inhabitants come to the city to seek their fortune and alter their social position. Businesses, which provide jobs and exchange capital, are more concentrated in urban areas. Whether the source is trade or tourism, it is also through the ports or banking systems, commonly located in cities, that foreign money flows into a country.

Many people move into cities for the economic opportunities, but this does not fully explain the very high recent urbanization rates in places like China and India. Rural flight is a contributing factor to urbanization. In rural areas, often on small family

farms or collective farms in villages, it has historically been difficult to access manufactured goods, though the relative overall quality of life is very subjective, and may certainly surpass that of the city. Farm living has always been susceptible to unpredictable environmental conditions, and in times of drought, flood or pestilence, survival may become extremely problematic.

Cities offer a larger variety of services, including specialist services not found in rural areas. These services require workers, resulting in more numerous and varied job opportunities.

Elderly people may be forced to move to cities where there are doctors and hospitals that can cater for their health needs. Varied and high quality educational opportunities are another factor in urban migration, as well as the opportunity to join, develop, and seek out social communities.

Urbanization also creates opportunities for women that are not available in rural areas. This creates a gender-related transformation where women are engaged in paid employment and have access to education. This may cause fertility to decline. However, women are sometimes still at a disadvantage due to their unequal position in the labour market, their inability to secure assets independently from male relatives and exposure to violence.

People in cities are more productive than in rural areas. An important question is whether this is due to agglomeration effects or whether cities simply attract those who are more productive.

Economists have recently shown that there exists a large productivity gain due to locating in dense agglomerations. It is thus possible that agents locate in cities to benefit from these agglomeration effects.

As cities develop, effects can include a dramatic increase and change in costs, often pricing the local working class out of the market, including such functionaries as employees of the local municipalities.

Problems now affect the developing world, rising inequality resulting from rapid urbanization trends. The drive for rapid urban growth and often efficiency can lead to less equitable urban development. Think tanks such as the Overseas Development Institute have proposed policies that encourage labor-intensive growth as a means of absorbing the influx of low-skilled and unskilled labor. One problem these migrant

workers are involved with is the growth of slums. In many cases, the rural-urban low skilled or unskilled migrant workers, attracted by economic opportunities in urban areas, cannot find a job and afford housing in cities and must dwell in slums. Urban problems, along with infrastructure developments, are also fueling suburbanization trends in developing nations, though the trend for core cities in said nations tends to continue to become ever denser. Urbanization is often viewed as a negative trend, but there are positives in the reduction of expenses in commuting and transportation while improving opportunities for jobs, education, housing, and transportation. Living in cities permits individuals and families to take advantage of the opportunities of proximity and diversity. While cities have a greater variety of markets and goods than rural areas, infrastructure congestion, monopolization, high overhead costs, and the inconvenience of cross-town trips frequently combine to make marketplace competition harsher in cities than in rural areas.

In many developing countries where economies are growing, the growth is often erratic and based on a small number of industries. For young people in these countries, barriers exist such as lack of access to financial services and business advisory services, difficulty in obtaining credit to start a business, and lack of entrepreneurial skills, for them to access opportunities in these industries. Investment in human capital so that young people have access to quality education and infrastructure to enable access to educational facilities is imperative to overcoming economic barriers.

The existence of *Urban heat islands* has become a growing concern over the years. An urban heat island is formed when industrial and urban areas produce and retain heat. Much of the solar energy that reaches rural areas is consumed by evaporation of water from vegetation and soil. In cities, where there is less vegetation and exposed soil, most of the sun's energy is instead absorbed by buildings and asphalt; leading to higher surface temperatures. Vehicles, factories and industrial and domestic heating and cooling units release even more heat. Thus, cities are often 1 to 3 °C (1.8 to 5.4 °F) warmer than surrounding landscapes.

The occurrence of eutrophication in bodies of water is another effect large urban populations have on the environment. When rain occurs in these large cities, the rain filters down the pollutants such as CO2 and other greenhouse gases in the air onto the ground below. Then, those chemicals are washed directly into rivers, streams and

oceans, causing a decline in water quality and damaging marine ecosystems.

In July 2013, a report issued by the United Nations Department of Economic and Social Affairs warned that with 2.4 billion more people by 2050, the amount of food produced should increase by 70%, straining food resources, especially in countries already facing food insecurity due to changing environmental conditions. The mix of changing environmental effects, environmental conditions, and the growing population of urban regions, according to UN experts, will strain basic sanitation systems and health care, and potentially *cause a humanitarian and environmental disaster*.

In the developing world, urbanization does not translate into a significant increase in life expectancy. Rapid urbanization has led to *increased mortality from non-communicable diseases* associated with lifestyle, including cancer and heart disease. Differences in mortality from contagious diseases vary depending on the disease and location.

Urban **health** levels are on average better in comparison to rural areas. However, residents in poor urban areas such as slums and informal settlements suffer "*disproportionately from disease, injury, premature death, and the combination of ill-health and poverty entrenches disadvantage over time*" (UNFPA, 2012). Many of the urban poor have difficulty accessing health services due to their inability to pay for them; so, they resort to less qualified and unregulated providers.

While urbanization is associated with improvements in public hygiene, sanitation and access to health care, it also entails changes in occupational, dietary and exercise patterns. It has mixed effects on health patterns, alleviating some problems and accentuating others.

For instance, in children, urbanization is associated with a lower risk of under-nutrition, but a higher risk of overweight. Overall, body mass index and cardiovascular conditions increase sharply with national income and the degree of urbanization. Agriculturists have studied the effects on health of urbanization and globalization: *fast food* is often food of choice, which is causing a decline in health. Easier access to non-traditional foods may lead to less healthy dietary patterns. In India, the prevalence of diabetes in urban areas appears to be more than twice as high as in rural areas. In general, major risk factors for chronic diseases are more

prevalent in urban environments.

Different forms of urbanization can be classified depending on the style of architecture and planning methods as well as historic growth of areas. In cities of the developed world, urbanization traditionally exhibited a concentration of human activities and settlements around the downtown area, the so-called inmigration. In-migration refers to migration from former colonies and similar places. The fact that many immigrants settle in impoverished city centers led to the notion of the "*peripheralization of the core*", which simply describes that people who used to be at the periphery of the former empires now live right in the center.

Recent developments, such as inner-city redevelopment schemes, mean that new arrivals in cities no longer necessarily settle in the center. In some developed regions, the reverse effect, originally called counter-urbanization has occurred, with cities losing population to rural areas, and is particularly common for richer families. This has been possible because of improved communications, and has been caused by factors such as the fear of crime and poor urban environments. It has contributed to the phenomenon of shrinking cities experienced by some parts of the industrialized world.

When the residential area shifts outward, this is called *suburbanization*. Several researchers and writers suggest that suburbanization has gone so far to form new points of concentration outside the downtown both in developed and developing countries such as India. This networked, poly-pattern of urbanization is called variously exurbia, edge city, network city or postmodern city. Los Angeles is the best-known example of this type of urbanization. Interestingly, in the United States, this process has reversed as of 2011, with "*re-urbanization*" occurring as suburban flight due to chronically high transport costs.

Rural migrants are attracted by the possibilities that cities can offer, but often settle in shanty towns and experience extreme poverty. The inability of countries to provide adequate housing for these rural migrants is related to *overurbanization*, a phenomenon in which the rate of urbanization grows more rapidly than the rate of economic development, leading to high unemployment and high demand for resources.

Most of the urban poor in developing countries unable to find work, can spend their

lives in insecure, poorly paid jobs. According to research by the Overseas Development Institute pro-poor urbanization will require labor-intensive growth, supported by labor protection, flexible land use regulation and investments in basic services.

Urbanization can be planned urbanization or organic. Planned urbanization, i.e.: planned community or the garden city movement, is based on an advance plan, that can be prepared for military, aesthetic, economic or urban design reasons. Examples can be seen in many ancient cities; although with exploration came the collision of nations, which meant that many invaded cities took on the desired planned characteristics of their occupiers. Many ancient organic cities experienced redevelopment for military and economic purposes, new roads carved through the cities, and new parcels of land were cordoned off serving various planned purposes giving cities distinctive geometric designs. UN agencies prefer to see urban infrastructure installed before urbanization occurs. Landscape planners are responsible for landscape infrastructure (public parks, sustainable urban drainage systems, greenways etc.) which can be planned before urbanization takes place, or afterward to revitalize an area and create greater livability within a region. Concepts of control of the urban expansion are considered in the American Institute of Planners.

As population continues to grow and urbanize at unprecedented rates, **new urbanism and smart growth** techniques are implemented to create a transition into developing environmentally, economically, and socially sustainable cities. *Smart Growth* and *New Urbanism*'s principles include walkability, mixed-use development, comfortable high-density design, land conservation, social equity, and economic diversity. Mixed-use communities work to fight gentrification with affordable housing to promote social equity, decrease automobile dependency to lower use of fossil fuels, and promote a localized economy. Walkable communities have a 38% higher average GDP per capita than less walkable urban metros. By combining economic, environmental, and social sustainability, cities will become equitable, resilient, and more appealing than urban sprawl that overuses land, promotes automobile use, and segregates the population economically.

Megacities, cities with population in the multi-millions, have proliferated into the dozens, arising especially in Asia, Africa, and Latin America. Currently the most

populated city is Tokyo, Japan, reaching 40 million residents; it also illustrates the Japan industrious creativity: think of a rebirth after *the Night of the Black Snow* (9 March 1945), when the waves of USAF B29s led by Curtis LeMay bombed and burned to the ground the entire area and its inhabitants!

Economic globalization fuels the growth of these cities, as new torrents of foreign capital arrange for rapid industrialization, as well as relocation of major businesses from Europe and North America, attracting immigrants from near and far. A deep gulf divides rich and poor in these cities, with usually contain a super-wealthy elite living in gated communities, and large masses of people living in substandard housing, with inadequate infrastructure and otherwise poor conditions.

Cities around the world have expanded physically as they grow in population, with increases in their surface extent, with the creation of high-rise buildings for residential and commercial use, and with development underground.

Cities figure prominently in *traditional Western* culture, appearing in the Bible in both evil and holy forms, symbolized by Babylon and Jerusalem. Cain and Nimrod are the first city builders in the Book of Genesis. In Sumerian mythology Gilgamesh built the walls of Uruk.

Cities can be perceived in terms of **extremes or opposites**: at once liberating and oppressive, wealthy and poor, organized and chaotic. The name anti-urbanism refers to various types of ideological opposition to cities, whether because of their culture or their political relationship with the country. Such opposition may result from identification of cities with oppression and the ruling elite. This and other political ideologies strongly influence narratives and themes in discourse about cities. In turn, cities symbolize their home societies.

Writers, painters, and filmmakers have produced innumerable works of art concerning the urban experience. Classical and medieval literature includes a genre of descriptions which treat of city features and history. Modern authors such as Charles Dickens and James Joyce are famous for evocative descriptions of their home cities. Fritz Lang conceived the idea for his influential 1927 film Metropolis while visiting Times Square and marveling at the nighttime neon lighting. Literature, film, and other forms of popular culture have supplied visions of future cities both utopian and dystopian. The prospect of expanding, communicating, and increasingly interdependent world cities has given rise to images such as Nylonkong (NY, London, Hong Kong) and visions of a single world-encompassing ecumenopolis.

The creation of civilization –i.e. stabilization on nomadic tribes- resulted in a hugely complex series of interactions. The progress in knowledge is adding complexity by the second. The approach, pioneered and still led by the Santa Fe Institute, is brilliantly summarized by its leader and former (2005-2008) president Geoffrey West, in many publications and books, and magisterially in this 2011 TED talk:

https://www.ted.com/talks/geoffrey_west_the_surprising_math_of_cities_and_corporations

Humans Impact the Environment

The anthropogenic (human) impact on the environment involves changes to biophysical ecosystems, biodiversity, and natural resources caused directly or indirectly by humans, including global warming, environmental degradation (e.g. ocean acidification), mass extinction and biodiversity loss, ecological crises, and ecological collapse. Modifying the environment to fit the needs of society causes bad effects, that become worse as human urbanization and overpopulation continues. The list of human activities that cause damage (either directly or indirectly) to the environment is huge –and growing. But some of the problems, including global warming and biodiversity loss pose an existential risk to humanity, and overpopulation causes those problems.

The term anthropogenic designates an effect or object resulting from human activity. The term was first used in the technical sense by Russian geologist Alexey Pavlov. The atmospheric scientist Paul Crutzen introduced the term "*Anthropocene*" in the mid-1970s. The term is sometimes used in the context of pollution emissions that are produced because of human activities but applies broadly to all major human impacts on the environment.

Besides **human overpopulation**, against which in 2017, over 15,000 scientists around the world issued a second warning to humanity which asserted that rapid human population growth is the "*primary driver behind many ecological and even societal threats*', **overconsumption** is possibly the major culprit. A prolonged pattern of overconsumption leads to environmental degradation and the eventual loss of resource bases.

Humanity's overall impact on the planet is affected by many factors besides the raw number of people. Their lifestyle (including overall affluence and resource utilization) and the pollution they generate (including carbon footprint) are equally important. In 2008, *The New York Times* stated that the inhabitants of the developed nations of the world consume resources like oil and metals at a rate almost 32 times greater than those of the developing world, who make up most the human population.

The applications of **technology** often result in unavoidable and unexpected environmental impacts, which according to the I = PAT equation (Human impact = Population x Affluence x Technology) is measured as resource use or pollution generated per unit GDP. Environmental impacts caused by the application of technology are often perceived as unavoidable for several reasons.

First, given that the purpose of many technologies is to exploit, control, or otherwise "improve" upon nature for the perceived benefit of humanity while at the same time the myriad of processes in nature have been optimized and are continually adjusted by evolution, any disturbance of these natural processes by technology is likely to result in negative environmental consequences.

Second, the conservation of mass principle and the first law of thermodynamics (i.e., conservation of energy) dictate that whenever material resources or energy are moved around or manipulated by technology, environmental consequences are inescapable.

Third, according to the second law of thermodynamics, order can be increased within a system (such as the human economy) only by increasing disorder or entropy outside the system (i.e., the environment).

Thus, technologies can create "order" in the human economy (i.e., order as manifested in buildings, factories, transportation networks, communication systems, etc.) only at the expense of increasing "disorder" in the environment. According to several studies, increased entropy is likely to be correlated to negative environmental impacts.

The environmental impact of **agriculture** varies, based on the wide variety of agricultural practices employed around the world. Ultimately, the environmental impact depends on the production practices of the system used by farmers. The connection between emissions into the environment and the farming system is indirect, as it also depends on other climate variables such as rainfall and temperature.

There are two types of indicators of environmental impact: "*means-based*", that is based on the farmer's production methods, and "*effect-based*", that is the impact that farming methods have on the farming system or on emissions to the environment. An example of a *means-based* indicator would be the quality of groundwater that is

affected by the amount of nitrogen applied to the soil. An indicator reflecting the loss of nitrate to groundwater would be *effect-based*.

The **environmental impact of agriculture** involves a variety of factors from the soil, to water, the air, animal and soil diversity, plants, and the food itself. Some of the environmental issues that are related to agriculture are climate change, deforestation, genetic engineering, irrigation problems, pollutants, soil degradation, and waste.

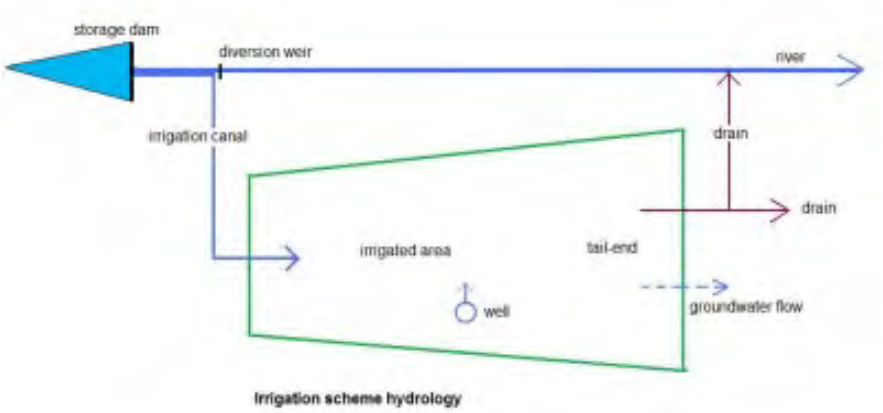
The environmental impact of **fishing** can be divided into issues that involve the availability of fish to be caught, such as overfishing, sustainable fisheries, and fisheries management; and issues that involve the impact of fishing on other elements of the environment, such as bycatch and destruction of habitat such as coral reefs.

These conservation issues are part of marine conservation and are addressed in fisheries science programs. There is a growing gap between how many fish are available to be caught and humanity's desire to catch them, a problem that gets worse as the world population grows.

Like other environmental issues, there can be conflict between the fishermen who depend on fishing for their livelihoods and fishery scientists who realize that if future fish populations are to be sustainable, then some fisheries must reduce or even close.

The journal *Science* published a four-year study in November 2006, which predicted that, at prevailing trends, the world would run out of wild-caught seafood in 2048. The scientists stated that the decline was a result of overfishing, pollution and other environmental factors that were reducing the population of fisheries at the same time as their ecosystems were being degraded. Yet again, the analysis has met criticism as being fundamentally flawed, and many fishery management officials, industry representatives and scientists challenge the findings, although the debate continues. Many countries, such as Tonga, the United States, Australia and New Zealand, and international management bodies have taken steps to appropriately manage marine resources.

The environmental impact of **irrigation** includes the changes in quantity and quality of soil and water because of irrigation and the ensuing effects on natural and social conditions at the tail-end and downstream of the irrigation scheme.



An irrigation scheme often draws water from the river and distributes it over the irrigated area. As a hydrological result, it is found that:

- the downstream river discharge is reduced,
- the evaporation in the scheme is increased,
- the groundwater recharge in the scheme is increased,
- the level of the water table rises,
- the drainage flow is increased.

These may be called *direct* effects. Effects on soil and water quality are *indirect* and complex, and subsequent impacts on natural, ecological and socio-economic conditions are intricate. In some, but not all instances, water logging and soil salinization can result. However, irrigation can also be used, together with soil drainage, to overcome soil salinization by leaching excess salts from the vicinity of the root zone.

Irrigation can also be done extracting groundwater by (tube) wells. As a hydrological result, it is found that the level of the water descends. The effects may be water mining, land/soil subsidence, and, along the coast, saltwater intrusion.

Irrigation projects can have large benefits, but the negative side effects are often overlooked. Agricultural irrigation technologies such as high powered water pumps, dams, and pipelines are responsible for the large-scale depletion of fresh water resources such as aquifers, lakes, and rivers. Because of this massive diversion of freshwater, lakes, rivers, and creeks are running dry, severely altering or stressing surrounding ecosystems, and contributing to the extinction of many aquatic species.

The estimated global loss of agricultural land by degradation and abandonment at 12 million hectares per year [R. Lai & BA Stewart, 1990, Springer, NY]. Such losses are attributable not only to soil erosion, but also to salinization, loss of nutrients and organic matter, acidification, compaction, water logging and subsidence. Human-induced land degradation tends to be particularly serious in dry regions.

Despite estimated losses of agricultural land, the amount of arable land used in crop production globally increased by about 9% from 1961 to 2012 and is estimated to have been 1.396 billion hectares in 2012.

Global average soil erosion rates are thought to be high, and erosion rates on conventional cropland generally exceed estimates of soil production rates, usually by more than an order of magnitude. In the US, sampling for erosion estimates by the US NRCS (Natural Resources Conservation Service) is statistically based, and estimation uses the Universal Soil Loss Equation and Wind Erosion Equation. For 2010, annual average soil loss by sheet, rill and wind erosion on non-federal US land was estimated to be 10.7 t/ha on cropland and 1.9 t/ha on pasture land; the average soil erosion rate on US cropland had been reduced by about 34% since 1982. No-till and low-till practices have become increasingly common on North American cropland used for production of grains such as wheat and barley. On uncultivated cropland, the recent average total soil loss has been 2.2 t/ha per year. In comparison with agriculture using conventional cultivation, it has been suggested that, because no-till agriculture produces erosion rates much closer to soil production rates, it could provide a foundation for sustainable agriculture.

Environmental impacts associated with **meat production** include use of fossil energy, water and land resources, greenhouse gas emissions, and in some instances, rainforest clearing, water pollution and species endangerment, among other adverse effects. The Intergovernmental Panel on Climate Change has estimated that about 10 to 12% of global anthropogenic GHG (greenhouse gas) emissions (expressed as 100-year carbon dioxide equivalents) were assignable to all of agriculture, including the livestock sector, in 2005 and again in 2010. The percentage assignable to livestock would be some fraction of the percentage for agriculture.

Globally, enteric fermentation (mostly in ruminant livestock) accounts for about 27% of anthropogenic methane emissions. Over the decade 2000 through 2009, atmospheric methane content increased by an average of only 6 Tg (or millions of

metric tons) per year (because nearly all natural and anthropogenic methane emission was offset by degradation), while atmospheric carbon dioxide increased by nearly 15,000 Tg per year. At the currently estimated rate of methane degradation, slight reduction of anthropogenic methane emissions, to about 98% of that decade's average, would be expected to result in no further increase of atmospheric methane content.

Other anthropogenic GHG emissions associated with livestock production include carbon dioxide from fossil fuel consumption (mostly for production, harvesting and transport of feed), and nitrous oxide emissions associated with use of nitrogenous fertilizers, growing of nitrogen-fixing legume vegetation and manure management.

Livestock production, including feed production and grazing, uses about 30% of the earth's ice-free terrestrial surface: about 26% for grazing and about 4% for other feed production.

Excessive use of vegetation by grazing can be especially conducive to land degradation in dry areas.

Considerable water use is associated with meat production, mostly because of water used in production of vegetation that provides feed. For example, "*green water*" use is evapotranspirational use of soil water that has been provided directly by precipitation; and "*green water*" has been estimated to account for 94% of global beef

cattle production's "*water footprint*", and on rangeland, as much as 99.5% of the water use associated with beef production is "*green water*".

Impairment of water quality by manure and other substances in runoff and infiltrating water is a concern, especially where intensive livestock production is carried out. In the US, in a comparison of 32 industries, the livestock industry was found to have a relatively good record of compliance with environmental regulations pursuant to the Clean Water Act and Clean Air Act, but pollution issues from large livestock operations can sometimes be serious where violations occur.

Data of a USDA study indicate that, in 2002, about 0.6% of non-solar energy use in the United States was accounted for by production of meat-producing livestock and poultry. And according to some studies appearing in peer-reviewed journals the growing demand for meat is contributing to significant biodiversity loss as it is a significant driver of deforestation and habitat destruction.

Palm oil, produced from the oil palm, is a basic source of income for many farmers in Southeast Asia, Central and West Africa, and Central America. It is locally used as a cooking oil, exported for use in many commercial food and personal care products and is converted into biofuel. It produces up to 10 times more oil per unit area as soya beans, rapeseed or sunflowers. Oil palms produce 38% of vegetable oil output on 5% of the world's vegetable-oil farmland. Palm oil is under increasing scrutiny in relation to its effects on the environment (e.g. massive fires to deforest with toxic smoke reaching neighboring countries, pollution of streams and water tables, soil depletion, etc.)

Introductions of species, particularly plants into new areas, by whatever means and for whatever reasons have brought about major and permanent changes to the environment over large areas. Examples include the introduction of *Caulerpa taxifolia* into the Mediterranean, the introduction of oat species into the California grasslands, and the introduction of privet, kudzu, and purple loosestrife to North America. Rats, cats, and goats have radically altered biodiversity in many islands. Additionally, introductions have resulted in genetic changes to native fauna where interbreeding has taken place, as with buffalo with domestic cattle, and wolves with domestic dogs.

The environmental impact of **industrial energy** harvesting and consumption is diverse. In recent years, there has been a trend towards the increased commercialization of various renewable energy sources. In the real world, consumption of fossil fuel resources leads to global warming and climate change. However, little change is being made in many parts of the world. Rapidly advancing technologies can achieve a transition of energy generation, water and waste management, and food production towards better environmental and energy usage practices using methods of systems ecology and industrial ecology.

The environmental impact of **biodiesel** includes energy use, greenhouse gas emissions and some other kinds of pollution. A joint life cycle analysis by the US Department of Agriculture and the US Department of Energy found that substituting 100% biodiesel for petroleum diesel in buses reduced life cycle consumption of petroleum by 95%. Biodiesel reduced net emissions of carbon dioxide by 78.45%, compared with petroleum diesel. Life cycle emissions of hydrocarbons were 35% higher and emission of various nitrogen oxides (NOx) were 13.5% higher with biodiesel. Biodiesel derived from various vegetable oils (e.g. canola or soybean oil), is readily biodegradable in the environment compared with petroleum diesel.

The environmental impact of **coal mining and burning** is diverse, but significant. Legislation passed by the US Congress in 1990 required the United States Environmental Protection Agency (EPA) to issue a plan to alleviate toxic air pollution from coal-fired power plants. After delay and litigation, the EPA had a court-imposed deadline of March 16, 2011, to issue its report, but the Trump administration has a very pro-coal industry policy, and hope for reduced environmental impact of coal mining and burning has vanished.

The environmental impact of **electricity generation** is significant because modern society uses large amounts of electrical power. This power is normally generated at power plants that convert some other kind of energy into electricity. Each such system has advantages and disadvantages, but many of them pose environmental concerns.

The environmental impact of **nuclear power** results from the nuclear fuel cycle processes including mining, processing, transporting and storing fuel and radioactive fuel waste. Released radioisotopes pose a health danger to human populations, animals and plants as radioactive particles enter organisms through various transmission routes. Radiation is a carcinogen and causes numerous effects on living organisms and systems. The environmental impacts of nuclear power plant disasters such as the Chernobyl disaster, the Fukushima Daiichi nuclear disaster and the Three Mile Island accident, among others, persist indefinitely, though several other factors contributed to these events, including improper management of fail-safe systems and natural disasters putting uncommon stress on the generators. The radioactive decay rate of particles varies greatly, dependent upon the nuclear properties of a specific isotope.

The environmental impact of the **oil shale industry** includes the consideration of issues such as land use, waste management, and water and air pollution caused by the extraction and processing of oil shale. Surface mining of oil shale deposits causes the usual environmental impacts of open pit mining. In addition, the combustion and thermal processing generate waste material, that must be disposed of, and harmful atmospheric emissions, including carbon dioxide, a major greenhouse gas. Experimental *in situ* conversion processes and carbon capture and storage technologies may reduce some of these concerns in future, but may raise others, such as the pollution of groundwater.

The environmental impact of **petroleum** is often negative because it is toxic to almost all forms of life. ***Climate change exists***. Petroleum, commonly referred to as oil, is closely linked to virtually all aspects of present society, especially for transportation and heating for both homes and for commercial activities.

The environmental impact of **reservoirs** is coming under ever increasing scrutiny as the world demand for water and energy increases and the number and size of reservoirs increases.

Dams and the reservoirs can be used to supply drinking water, **generate hydroelectric powe**r, increasing the water supply for irrigation, provide recreational opportunities and flood control. However, adverse environmental and sociological impacts have also been identified during and after many reservoir constructions. Although the impact varies greatly between different dams and reservoirs, common criticisms include preventing sea-run fish from reaching their historical mating grounds, less access to water downstream, and a smaller catch for fishing communities in the area. Advances in technology have provided solutions to many negative impacts of dams but these advances are often not viewed as worth investing in if not required by law or under the threat of fines. Whether reservoir projects are ultimately beneficial or detrimental—to both the environment and surrounding human populations— has been debated since the 1960s -and probably long before that. The construction of the Three Gorges Dam on the Yang Tse River, and other similar projects throughout Asia, Africa and Latin America have generated considerable environmental and political debate.

Compared to the environmental impact of traditional energy sources, the environmental impact of **wind power** is relatively minor. Wind powered electricity generation consumes no fuel, and emits no air pollution, unlike fossil fuel power sources. The energy consumed to manufacture and transport the materials used to build a wind power plant is equal to the new energy produced by the plant within a few months. While a wind farm may cover a large area of land, many land uses such as agriculture are compatible, with only small areas of turbine foundations and infrastructure made unavailable for use. There are reports of bird and bat mortality at wind turbines, as there are around other artificial structures. The scale of the ecological impact may -or may not- be significant, depending on specific circumstances. There are conflicting reports about the effects of noise on people who live very close to a wind turbine.

Artificial light at night is one of the most obvious physical changes that humans have made to the biosphere, and is the easiest form of **pollution** to observe from space. The main environmental impacts of artificial light are due to light's use as an information source (rather than an energy source). The hunting efficiency of visual predators generally increases under artificial light, changing predator prey interactions. Artificial light also affects dispersal, orientation, migration, and

hormone levels, resulting in disrupted circadian rhythms.

Manufactured Products may have a significant impact on the environment.

The environmental impact of **nanotechnology** can be split into two aspects: the potential for nanotechnological innovations to help improve the environment, and the possibly novel type of pollution that nanotechnological materials might cause if released into the environment. As nanotechnology is an emerging field, there is great debate regarding to what extent industrial and commercial use of nanomaterials will affect organisms and ecosystems.

The environmental impact of **paint** is diverse. Traditional painting materials and processes can have harmful effects on the environment, including those from the use of lead and other additives. Measures can be taken to reduce environmental impact, including accurately estimating paint quantities so that wastage is minimized, use of paints, coatings, painting accessories and techniques that are environmentally preferred.

The environmental impact of **paper** is significant, which has led to changes in industry and behavior at both business and personal levels. With the use of modern technology such as the printing press and the highly mechanized harvesting of wood, paper has become a cheap commodity. This has led to a high level of consumption and waste; but there is now a trend towards sustainability in the pulp and paper industry.

Some scientists suggest that by 2050 there could be more **plastic** than fish in the oceans…

The environmental impact of **pesticides** is often greater than what is intended by those who use them. Over 98% of sprayed insecticides and 95% of herbicides reach a destination other than their target species, including non-target species, air, water, bottom sediments, and food. Pesticide contaminates land and water when it escapes from production sites and storage tanks, when it runs off from fields, when it is discarded, when it is sprayed aerially, and when it is sprayed into water to kill algae. Some pesticides contribute to global warming and the depletion of the ozone layer.

The environmental impact of **pharmaceuticals and personal care products** (PPCPs) is being investigated. PPCPs are substances used by individuals for personal health or cosmetic reasons and the products used by agribusiness to boost growth

or health of livestock. PPCPs have been detected in water bodies throughout the world. The effects of these chemicals on humans and the environment are not yet known, but may prove significant.

The **environmental impact of mining** includes erosion, formation of sinkholes, loss of biodiversity, and contamination of soil, groundwater and surface water by chemicals from mining processes. In some cases, additional forest logging is done near mines to increase the available room for the storage of the created debris and soil. Besides creating resulting from leakage of chemicals also affect the health of the local population. Some mining methods have significant environmental and public health effects.

The environmental impact of **transport** is significant because it is a major user of energy, and burns most of the world's petroleum. This creates air pollution, including nitrous oxides and particulates, and is a significant contributor to global warming through emission of carbon dioxide, for which transport is the fastest growing emission sector.

By subsector, **road transport** is the largest contributor to global warming. Environmental regulations in developed countries have reduced the individual vehicles emission; however, this has been offset by an increase in the number of vehicles, and more use of each vehicle. Energy use and emissions vary largely between modes, causing environmentalists to call for a transition from air and road to rail and human-powered transport, and increase transport electrification and energy efficiency. Other environmental impacts of transport systems include traffic congestion and automobile oriented urban sprawl, which can consume natural habitat and agricultural lands. The health impact of transport emissions is also of concern. A recent survey of the studies on the effect of traffic emissions on pregnancy outcomes has linked exposure to emissions to adverse effects on gestational duration and possibly also intrauterine growth.

The environmental impact of **aviation** occurs because aircraft engines emit noise, particulates, and gases which contribute to climate change and global dimming. Despite more fuel-efficient and less polluting turbofan and turboprop engines, the rapid growth of air travel in recent years contributes to an increase in total pollution attributable to aviation. In the EU, greenhouse gas emissions from aviation increased by 87% between 1990 and 2006. Among other factors leading to this phenomenon

are the increasing number of hypermobile travelers and social factors that are making air travel commonplace, such as frequent flyer programs.

The environmental impact of **roads** includes the local effects of highways (public roads) such as on noise, light pollution, water pollution, habitat destruction/ disturbance and local air quality; and the wider effects including climate change from vehicle emissions. The design, construction and management of roads, parking and other related facilities as well as the design and regulation of vehicles can change the impacts to varying degrees.

The environmental impact of **shipping** includes greenhouse gas emissions and oil pollution. In 2007, carbon dioxide emissions from shipping were estimated at 4 to 5% of the global total, and estimated by the International Maritime Organization (IMO) to rise by up to 72% by 2020 if no action is taken. There is also a potential for introducing invasive species into new areas through shipping, usually by attaching themselves to the ship's hull.

Human activity is causing environmental degradation, which is the deterioration of the environment through depletion of resources such as air, water and soil; the destruction of ecosystems; habitat destruction; the extinction of wildlife; and pollution. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable. As indicated by the I=PAT equation, environmental impact (I) or degradation is caused by the combination of an already very large and increasing human population (P), continually increasing economic growth or per capita affluence (A), and the application of resource depleting and polluting technology (T).

In the context of **climate variation**, anthropogenic factors are human activities which affect the climate. The scientific consensus on **climate change** is "*that climate is changing and that these changes are in large part caused by human activities,*" and it "*is largely irreversible."*

"*Science has made enormous inroads in understanding climate change and its causes, and is beginning to help develop a strong understanding of current and potential impacts that will affect people today and in coming decades. This understanding is crucial because it allows decision makers to place climate change in the context of other large challenges facing the nation and the world. There are still some uncertainties,*

and there always will be in understanding a complex system like Earth's climate. Nevertheless, there is a strong, credible body of evidence, based on multiple lines of research, documenting that climate is changing and that these changes are in large part caused by human activities. While much remains to be learned, the core phenomenon, scientific questions, and hypotheses have been examined thoroughly and have stood firm in the face of serious scientific debate and careful evaluation of alternative explanations." — United States National Research Council, Advancing the Science of Climate Change.

Of most concern in these anthropogenic factors is the increase in CO2 levels. As listed in previous paragraphs, this is due to emissions from fossil fuel combustion, followed by aerosols (particulate matter in the atmosphere), and the CO2 released by cement manufacture. Other factors, including land use, ozone depletion, animal husbandry (ruminant animals such as cattle produce methane, as do termites), and deforestation, are also of concern in the roles they play – both separately and in conjunction with other factors – in affecting climate, microclimate, and measures of climate variables.

Biodiversity generally refers to the variety and variability of life on Earth, and is represented by the number of different species there are on the planet. Since its introduction, *Homo sapiens* (the human species) has been killing off entire species either directly (such as through hunting) or indirectly (such as by destroying habitats), causing the extinction of species at an alarming rate. Humans are the cause of the current **mass extinction**, called the *Holocene extinctio*n, driving extinctions to 100 to 1000 times the normal background rate. The Holocene extinction continues, with meat consumption, overfishing, ocean acidification and the amphibian crisis being a few broader examples of an almost universal, cosmopolitan decline in biodiversity. Human overpopulation (and continued population growth) along with profligate consumption are considered to be the primary drivers of this rapid decline. A 2017 statement by 15,364 scientists from 184 countries warned that, among other things, this sixth extinction event unleashed by humanity could annihilate many current life forms and consign them to extinction by the end of this century. Now, to immerse you in the truth; just watch this 9-minute unavoidable video: *The Sixth Extinction:*

https://www.youtube.com/watch?v=z9gHuAwxwAs&feature=youtu.be

Defaunation is the loss of animals from ecological communities. It is estimated that more than 50 percent of all wildlife has been lost in the last 40 years, and that by 2020, 68% of the world's wildlife will be lost. In South America, there is a 70 percent loss.

Because of human overpopulation, **coral reefs** are dying around the world. Coral mining, pollution (organic and non-organic), overfishing, blast fishing and the digging of canals and access into islands and bays are serious threats to these ecosystems. Coral reefs also face high dangers from pollution, diseases, destructive fishing practices and warming oceans. The list of factors impacting reefs is long, including the ocean's role as a carbon dioxide sink, atmospheric changes, ultraviolet light, ocean acidification, biological virus, impacts of dust storms carrying agents to far flung reefs, pollutants, algal blooms and others. Reefs are threatened well beyond coastal areas. General estimates show approximately 10% world's coral reefs are already dead, and about 60% of the world's reefs are at risk due to destructive, human-related activities. The threat to the health of reefs is particularly strong in Southeast Asia, where 80% of reefs are endangered.

In the May 8, 2001 of the Proceedings of the National Academy of Sciences, David Tilman and Clarence Lehman (University of Minnesota) published an article titled: **Human-caused environmental change: Impacts on plant diversity and evolution**. Here are their introduction and their conclusions:

"Human-caused environmental changes are creating regional combinations of environmental conditions that, within the next 50 ton100 years, may fall outside the envelope within which many of the terrestrial plants of a region evolved. These environmental modifications might become a greater cause of global species extinction than direct habitat destruction. The environmental constraints undergoing human modification include levels of soil nitrogen, phosphorus, calcium and pH, atmospheric CO2, herbivore, pathogen, and predator densities, disturbance regimes, and climate. Extinction would occur because the physiologies, morphologies, and life histories of plants limit each species to being a superior competitor for a combination of environmental constraints. Changes in these constraints would favor a few species that would competitively displace many other species from a region. In the long-term, the "weedy" taxa that became the dominants of the novel conditions imposed by global change should become the progenitors of a series of new species that are progressively

less weedy and better adapted to the new conditions. The relative importance of evolutionary versus community ecology responses to global environmental change would depend on the extent of regional and local recruitment limitation, and on whether the suite of human-imposed constraints was novel just regionally or on continental or global scales."

"Anthropogenic changes in environmental limiting factors are likely to cause significant loss of plant diversity, leaving many niches empty and creating plant communities dominated by weedier species (poor competitors but good dispersers). The extent of this effect will depend both on the number of constraints that are changed (i.e., dimensionality) and on the magnitude of such changes. Because the impact of multidimensional environmental changes are expected to be multiplicative, a series of relatively small changes may be as important as a single major change. The vacant niches of a region experiencing a major change in an environmental constraint, such as a high rate of N deposition, indicate several things about such habitats.

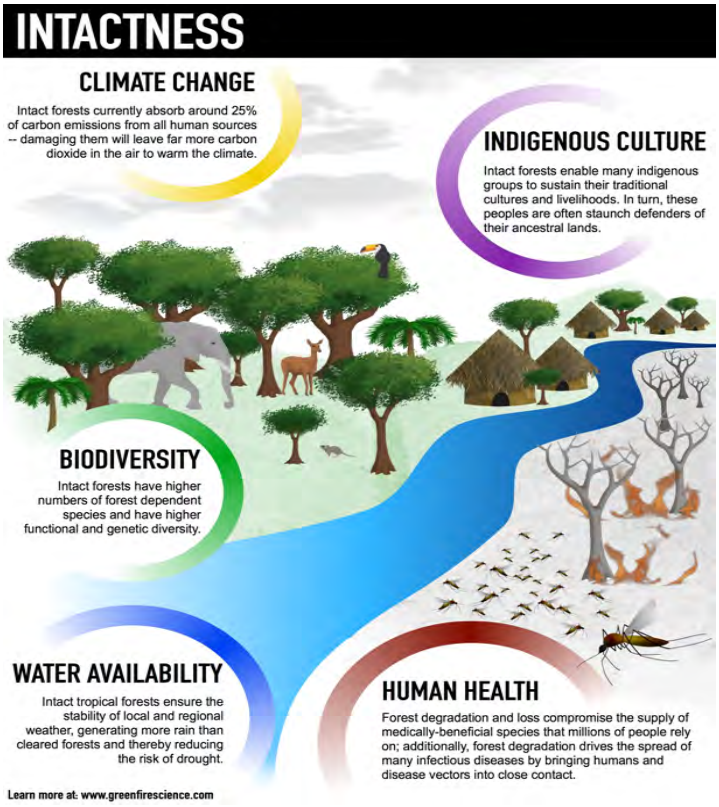
First, species that have traits that fall within the newly created vacant niches should be able to invade into, spread through, and persist if propagules are regionally available.

Secondly, any heritable variation within existing species that allowed individuals to fill the vacant niches would be favored.

For instance, following N deposition, there would be especially strong selection favoring those individuals with greater competitive ability for light, even if this cost dispersal ability. Until the available genetic variation for such traits was consumed, such evolution would be rapid. However, it seems unlikely that such species could rapidly evolve to be equivalent to the species of habitats that had a long evolutionary history of nitrogen rich soils. As such, these newer systems might long be susceptible to invasion by such species, with such invasion often leading to the displacement of the species that were evolving in situ*."*

And very recently (2018), an international team led by James EM Watson (Australia), published a long article titled **The Exceptional Value of Intact Forest Systems** in *Nature Ecology & Evolution*: "*As the terrestrial human footprint continues to expand, the amount of native forest that is free from significant damaging human activities is in precipitous decline. There is emerging evidence that the remaining intact forest supports an exceptional confluence of globally significant environmental values*

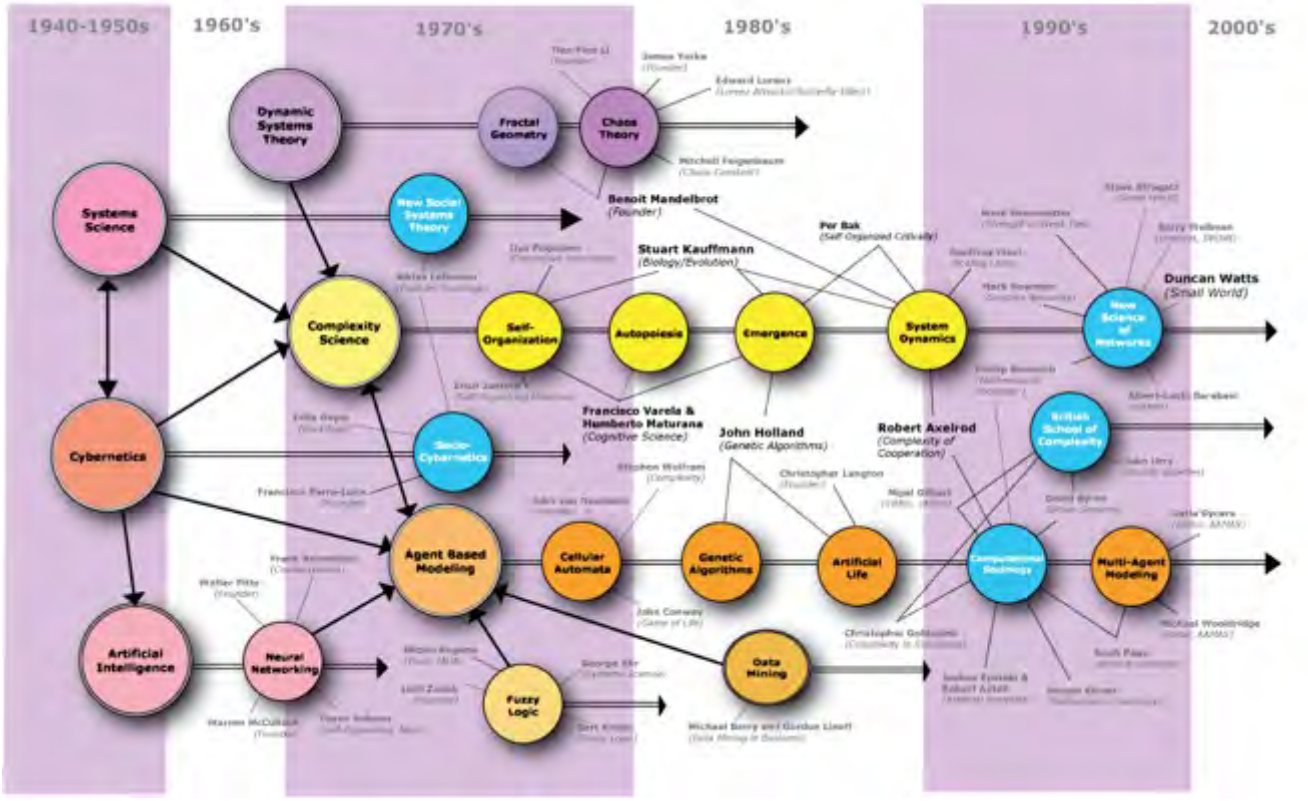
relative to degraded forests, including imperiled biodiversity, carbon sequestration and storage, water provision, indigenous culture and the maintenance of human health.



Here we argue that maintaining and, where possible, restoring the integrity of dwindling intact forests is an urgent priority for current global efforts to halt the ongoing biodiversity crisis, slow rapid climate change and achieve sustainability goals. Retaining the integrity of intact forest ecosystems should be a central component of proactive global and national environmental strategies, alongside current efforts aimed at halting deforestation and promoting reforestation."

Schematic representation of the transition (from L to R) of a non-hunted, faunally intact tropical forest to an overhunted, defaunated forest (from JEM Watson's article)

Human-Environmental Interactions can also be defined as interactions between the human social system and (the "rest" of) the ecosystem. Human social systems and ecosystems are **complex adaptive systems**. **Complex** because ecosystems and human social systems have many parts and many connections between these parts**. Adaptive** because they have feedback structures that promote survival in a constantly changing environment.



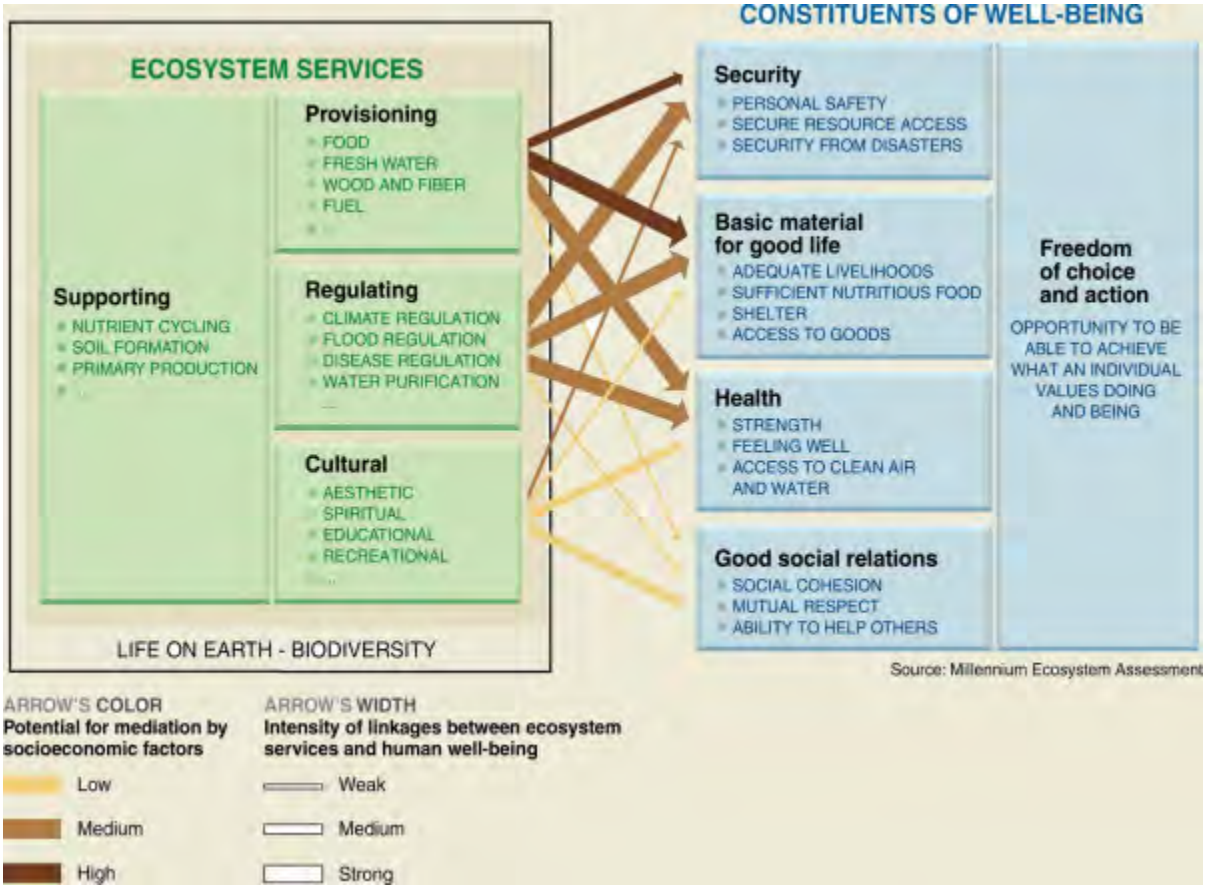
Complexity is not for one-liner politicians.

To analyze Human Environmental Interactions, it is important to be aware of specific characteristics of the human social system. The **type of society** strongly influences peoples attitude towards nature, their behavior and therefore their **impact on ecosystems**. Important characteristics of human social systems are population size, social organization, values, technology, wealth, education, knowledge and many more. Especially values and knowledge strongly influence peoples "*view of life*" and consequently define the way people act. The choice of possible actions is then limited by the available technology.

People modify the environment for their purposes and obtain benefits (Ecosystem

Services) from it. These **Ecosystem Services** are essential for **human well-being** and include for example the provision of resources like water, timber, food, energy, information, land for farming and many more. Obviously by using these resources people affect the environment in a lot of ways. Furthermore, people often reorganize existing ecosystems to achieve new ones that seem to be more effective in serving their needs.

The **Millennium Ecosystem Assessment (MA)** analyzed how Ecosystem Services and constituents of **human well-being** are interlinked. The MA research program was launched with support from the United Nations in 2001.

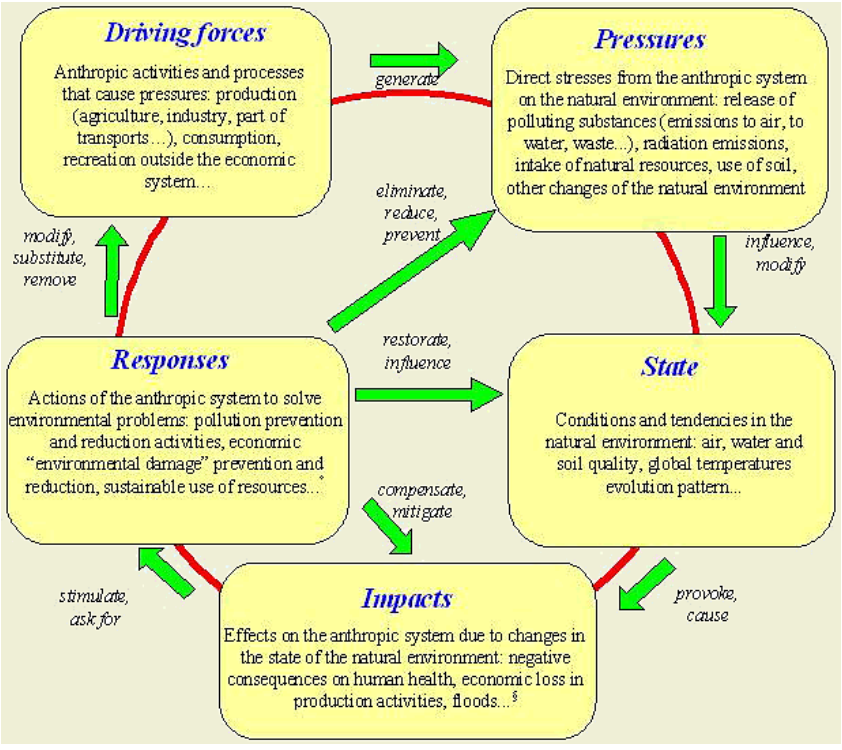


The terms **coevolution and coadaptation** describe the never-ending process of **mutual adjustment** and change between human social systems and the environment. Peoples actions have consequences on the environment. But also, the

environment influences human activities. Human social systems must adapt to their specific environment. Natural phenomena like storms, earthquakes force people to react. These natural phenomena can either be directly or not primarily caused by human actions and again influence human **behavior as people must respond to a new situation.**

The **Drivers-Pressures-State-Impact-Response (DPSIR)** model was originally developed by the European Environmental Agency (EEA) and is used to assess and manage environmental problems. Many national and European institutions adopted this conceptual framework. It identifies the various **causal chains of links** between human activities and environmental degradation. The model distinguishes several categories of indicators to explain how the *state* of the environment is changed due to human activities. Human activities increase or mitigate *pressure* on the environment. The driving forces which initiate human activities are mainly socio-economic and socio-cultural forces.

The following graphic explains the DPSIR process:



The Loneliest Tree on Earth Talks to YOU

On remote Campbell Island in the sub-Antarctic waters off New Zealand, stands a tree that keeps the record of global human Activity. Listen to him:

"That's me. I am "the loneliest tree", keeper of memory. In my limbs are rings that record humanity's acts—most notably, a scar from your martial ambitions. In my wood is a clear radioactive trace from the A-bomb tests of the 1950s and 60s. Scientists propose me, the sole spruce on Campbell island, as the "golden spike" that could mark the "great acceleration". That's when the effects of technology became so profound and far-reaching that they registered around the globe, even here. And I'm afraid it's stirred up a scientific war of sorts.

The International Union of Geological Sciences (IUGS) defines Earth's time scale, and calls our current age the Holocene epoch.

Although the era began 11,700 years ago, after the last major ice age, holocene means "entirely recent." The scientists who study my tree rings, however, and others, have been campaigning for an era change, saying this is the Anthropocene Age. The new epoch of geological time is—of course! —defined by humans, and the name is derived from the Greek "anthro."

Because I'm so far from your activity, I'm a sure sign of this new era, paleoclimatologist Chris Turney from the University of New South Wales, Australia told the BBC recently. My rings can register the toxicity of human habits, despite my remote location. "The problem with any Northern Hemisphere records is that they largely reflect where most major human activity has happened," he explains.

*Not so with me. I "*record the far-reaching nature of that activity*" even in the Southern Hemisphere. Turney says scientists "*can't think of anywhere more remote than the Southern Ocean*."*

I don't mind, really. But I'd like to clarify. Despite what humans call me, I am not lonely. Because I am not alone. My home is cradled by the ocean's embrace, and though I'm the only Sitka spruce growing in this soil, I share the land with plants, grasses, rocks, insects, and animals. Human explorers first discovered our home in 1810, calling it an "uninhabited island." That just goes to show how little people know about life. Perhaps if humans could appreciate the interconnectedness of all creations, they would be less inclined to engage in the activities that lead to difficulties for all. Sure, the Earth is always changing. Still, since about the time of your first visit to my island in the early 19th century, you've been making products that pollute our planet. Your Industrial Revolution began this process, and the rate of change only continued to accelerate thereafter.

Humanity's environmental imprint quickly became toxic when you began opening factories that spewed smoke and choked the air with carbon emissions. This led to rapid transformations in oceans, coastal zones, the atmosphere, and on land. And then you kept going.

Take the creation of plastics, for example. For trees, this innovation in the early- to mid-20th century seemed great at first. We thought you would hurt us less if you didn't need our wood to make your goods. For a very brief moment, it seemed we'd coexist peacefully. But humans, who are relative newcomers to life, are immature.

You can't do anything in moderation, with due consideration. And soon enough you were trashing the planet, filling the land and oceans with countless products, not least bottles. Plastic production has ballooned from 2 million metric tons annually in 1950 to 380 million metric tons in 2015.

Now, while your scientists attempt to establish this new geological age of rapid environmental change, it's getting uncomfortably hot and awkward for the rest of us living things.

Many humans already realize that your race has gone too far, been too audacious, assuming you own the space we all share. Yet some of you still don't see, and that scares me. It's not change that I resist—call it whatever age you wish! Change is constant; no

one knows this better than a tree who watches countless season pass. Rather, it's the fact that you humans insist on the destructive activity, long after the record has reflected its dangerous effects."

Finding Wisdom in Asian Philosophies

In the long history of **Chinese civilization**, **harmony** has always been a highly valued virtue. Chinese people have always put an emphasis on harmony. It encompasses the fundamental principles of nature, society and humanity. It is also a prerequisite for cultivating one's morality, protecting one's family, governing one's nation and stabilizing the world. Harmony is at the core of Chinese traditional culture.

Harmony can be interpreted as the ideological concepts of conscientiousness, concordance, peacefulness and gentleness. Harmony and peacefulness are at the core of Chinese traditional culture. The ideal of harmony **between nature and humans** suggests that *humans should respect and appreciate nature and follow the guiding principles of the universe*. In addition to respecting and protecting nature, we should understand that *harmony is conducive to the generation of all living beings*. When cultivating ourselves, we should have a peaceful mind, when dealing with

others we should follow the principle of harmony, not uniformity or mindless consensus, and when governing a country, we should fully understand that if the government functions well, harmony will be achieved among people and between nature and man.

Equilibrium and harmony were highly valued by people in ancient times. "*Pursuing harmony*" refers to moderation, fitting, balance and harmony. From the sentence "*The harmony is beneficial to all things*" in the Book of Changes, the balance of Yin and Yang is essential to all four seasons, all things, including the long-term stability of the state.

My wife Emiko Oguiss initiated me to the –obvious and hidden- beauties of the natural world. She is a gifted gardener, horticulturist and arboriculturist. A visit of a Japanese temple's garden, or a stroll in our barely tamed hilly Northern Californian environment result in discoveries that force respect, admiration, and urge to protect our diverse environments. In fact, her Japanese culture is built on ***Wa*** 和, usually translated into English as ***harmony***. It implies a peaceful unity and conformity within a social group, in which members prefer the continuation of a harmonious community over their personal interests. The kanji character *wa* (和) is also a name for "Japan; Japanese". *Wa* is considered integral to Japanese society, and derives from traditional Japanese family values. This explains why the concept that *the fountain of youth is a forest* has developed in Japan. Indeed, research shows that trees **do** have healing powers.

For one thing, they release antimicrobial essential oils, called phytoncides, that protect trees from germs and have a host of health benefits for people. The oils boost mood and immune system function; reduce blood pressure, heart rate, stress, anxiety, and confusion; improve sleep and creativity; and may even help fight cancer and depression. These and other impressive benefits of forest medicine are catalogued by physician Qing Li, chairman of the Japanese Society for Forest Medicine, in his upcoming book *Forest Bathing*, out in April 2018.

The contemporary concept of "*forest medicine*" originated in Japan, a place where nature has long been celebrated. The Japanese party when flowers bloom, the moon is bright, and when fireflies multiply.

The country's two major religions, Buddhism and Shintoism, consider forests

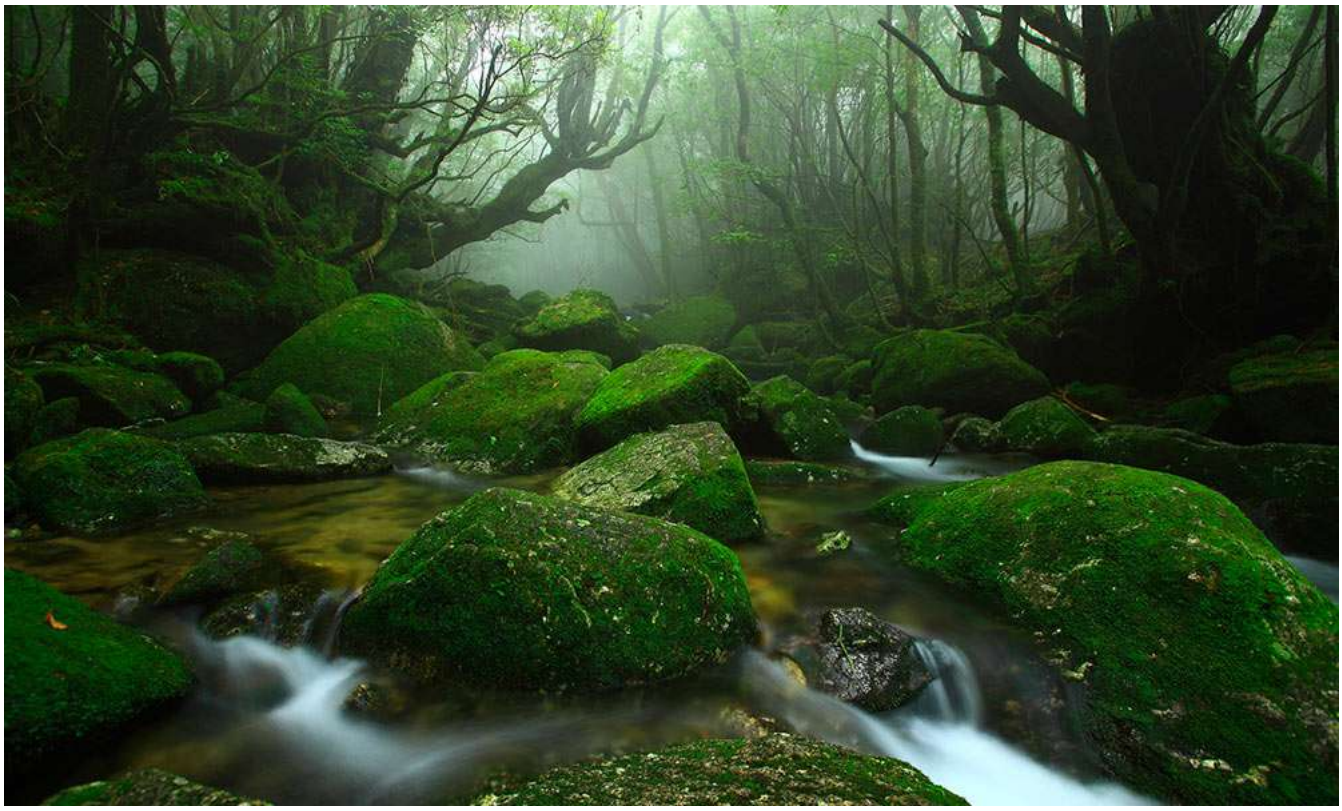
mystical. "*For Zen Buddhists, scripture is written in the landscape*," writes Li. "*In Shinto, the spirits are not separate from nature, they are in it. They are in the trees, in the rocks, in the breeze, the stream, the waterfall.*"

In 1982, the Japanese government introduced the concept of *shinrin yoku*, or "*forest bathing*," urging citizens to make use of the country's 3,000 wooded miles for therapy. Tomohide Akiyama, then chief of the forestry ministry, understood intuitively that the woods do people good, while distance from nature makes us sick. While Japan was championing forest bathing, an American scientist was formulating a thesis that explains why nature moves all people, wherever they are from. According to *Biophilia,* the 1984 book by evolutionary biologist Edward O. Wilson, people have a biological urge to commune with the primordial mother, Earth, which nurtures us. He believed that humans have evolved to love all forms of life and the processes that reflect our existence, which are everywhere visible in nature. Wilson called that attachment *biophilia*, from the Greek *bios*, meaning life, and *philos*, meaning loving. Our urge to merge with nature is impossible to measure biologically, Wilson said. Yet he believed that "*our existence depends on this propensity, our spirit is woven from it, hopes rise on its currents*." Biophilia may explain why trees can heal us even at a distance.

Medical researcher Roger Ulrich in 1984 published a study called "*View through a window may influence recovery after surgery*." Records from a Philadelphia hospital over a decade showed patients with green views recovered sooner and were less depressed than those forced to stare at buildings. Ulrich had firsthand experience with this phenomenon: he became interested in the therapeutic possibilities of green views because he had a childhood illness which kept him in bed for long stretches, where he observed a tall pine outside his window.

Trees' benefits are easily transferred to cities and indoor settings—just visit a park or grow plants at home, where you can see, smell, and touch the healers. In fact, forest medicine may be the most accessible, inexpensive health care available to humanity.

Li encourages us to see trees as part of our family, and to feel close to these quiet cousins. *"The greatest delight which the fields and woods minister is the suggestion of an occult relation between [humanity] and the vegetal*," he wrote in *Nature*. "*I am not alone and unacknowledged. They nod to me and I to the*m."



But this *Fountain of Eternal Youth* is now threatened in many parts of the world: in Southeast Asia where huge areas are deforested for palm oil; in the Brazilian Amazon to create immense grazing areas for cattle; in the United States where the shrinking of National Parks for oil drilling is an obsession of the Trump administration; in Africa, where large Chinese companies convert thousands of hectares of very diverse environments into monocultures for food; a disaster is happening in Poland where one of the last primeval forests of Europe is threatened, and if you ask my friend Bill Laurance, of the James Cook University in Australia, this is just the tip of a much larger problem, fueled by greed, quick (large) profits, crass ignorance and appalling political incompetence.

Let us be good stewards of the Earth we inherited. All of us must share the Earth's fragile ecosystems and precious resources, and each of us has a role to play in preserving them. If we are to go on living together on this earth, we must all be responsible for it.

Kofi Annan

And for hope, dreams and magic, click, watch and listen to Leonard Bernstein, conducting the Boston Symphony Orchestra in Ludwig van Beethoven's 6th Symphony in F, op. 68, "*Pastoral*":

https://www.youtube.com/watch?v=t2VY33VXnrQ&ab_channel=rogerbridgland

Acknowledgements

This essay was initially an ode to cities, where interactions, structures, and ultimately civilizations get started and develop. But we do not live millennia ago. We are now facing the complex problems that resulted, and developed from "civilized" humans. And the destructive trend has been accelerating dramatically since the 20th century. Our planet –the *pale blue dot* of Carl Sagan- is at irreversible risk of large, and larger permanent damage. I am concerned about the future of our world, not to mention the ethics and morals that made our forebears strive. Hence these long(er) vaticinations.

The list of references would take many more pages; most can be gleaned from the Wikipedia ones cited, and the numerous other selections.

I am grateful to my wife Emiko, *Para Limes* (NTU, Singapore) and its director Jan W. Vasbinder, Andrew LT Sheng, Geoffrey West (SFI), Bill Laurance (James Cook U, Australia), Laurie HM Chan (U Ottawa & HK PolyU), Timur Kouliev, MD, and –of course - Yves P Huin for skilled editing and formatting.

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