

Timeline of Sustainable Development (Emergence of Anthropocene)

~200000 years ago: appearance of modern *Homo sapiens*.

50000 to 10000 BCE: Quaternary (Pleistocene to Holocene) megafauna extinctions (more than half of all species >40kg, especially Australia and Americas – human predation a significant contributor).

~11700 years ago, last Ice Age ends giving rise to modern climate era and flourishing of humanity. Rock pigeons believed to be first domesticated animals about 10000 years ago.

7000 BC: Jericho (pop 2000) thought to be longest continuously inhabited city.

4000 BC: Feng Shui philosophy of harmony between environment and physical landscape.

3000 BC: Knossos, Crete believed to establish first landfill (miden).

500 BC: Athens introduces law requiring waste be dumped at least 1 mile from city; Sun Tzu's *The Art of War* and strategy of resource use and planning.

202 BC: travel begins on the silk road.

376: influx of Goths into Roman Empire – thought to be pivotal point in decline of the Empire.

c. 825: first appearance in print of numerical analysis by mathematicians al-Khwarizmi and al-Kindi (introduction of algebra, trigonometry – imported to Italy by Fibonacci 300 years later)

859: Fatima al-Firhi founds first degree-granting university in Fez, Morocco.

960-1279: Song dynasty flourishes in China, thought to be first to use of paper currency, earliest use of inoculations against smallpox, spreads to Ottoman Empire (becomes widespread post-1721 when Mary Wortley Montagu – wife of British Ambassador to Turkey – inoculates her own children).

1215: Magna Carta establishes English constitutional tradition.

1347: Stora Kopparberg, Sweden, oldest commercial corporation, receives Royal Charter.

c. 1350: Middle Ages end and the Renaissance begins in Europe (ends ~ 1550).

1366: City of Paris forces butchers to dispose of animal waste outside of the city.

1388: English Parliament forbids throwing of garbage into ditches, rivers and waters.

c. 1400-1800: Hanseatic League of cities, northern Europe, supported commerce and defense; replaced largely by emergence of nations, e.g. Sweden, Denmark, Netherlands, UK, Germany.

1440: Guttenberg's printing press.

1472: Italy's Banca Monte dei Paschi di Siena opens (oldest surviving bank).

1492: Columbus lands on Hispaniola, sets up first New World settlement at Santo Domingo.

1517: Martin Luther begins the Protestant Reformation.

1522: Magellan ends first voyage around the world.

1532: Niccolò Machiavelli's *The Prince*.

c. 1540: evidence of atmospheric pollution from colonial mining in Peru and Bolivia.

1570-1620: noticeable drop in CO₂ emissions linked to death of some 50 million indigenous Americans, triggered by arrival of Europeans, and forests returning to 65 million Ha of abandoned agricultural lands.

1602: Dutch East India Company founded, leading to world's first stock exchange in Amsterdam (shares returned approx. 16% p.a. 1602-1650).

1607: founding of Jamestown VI, oldest of the original 13 colonies and key conduit for invasive species, e.g. dandelions, tobacco, earth worms, honey bees, purple loosestrife, common sparrow.

1609: Bank of Amsterdam established - thought to be the first modern central bank; Hugo Grotius publishes *Mare Liberum* proposing international waters, leading to UK and France declaring territorial waters of 5 km (effective cannon range).

1637: height of tulip mania; single bulbs sold for as much as ten-times annual salaries (generally recognized as first example of a 'speculative bubble').

1640: Isaac Walton *The Compleat Angler* (fishing and conservation); the first global convergence of the value of silver, standardizing the metal's value.

1648: Treaty of Westphalia and the rise of modern system of states; end of *Thirty Years' War*.

1651: Thomas Hobbes *Leviathan*.

1662: extinction of dodo bird, Mauritius.

1665-66: London's 'great plague' kills 100000; 'great fire' begins 2 Sep 1666 in Pudding Lane, burns for four days leaving some 200000 homeless.

1670: Hudson Bay Company established (world's largest landowner with 15 percent of North America).

1679: Antoni van Leeuwenhoek in letter to Royal Society suggests earth's maximum carrying capacity is 13.4 billion humans.

1690: Gov. William Penn requires Pennsylvania settlers to preserve one acre of trees for every five acres cleared; John Locke, *Two Treatises and Essay Concerning Human Understanding*.

1700: per capita GDP ~ \$170; average life expectancy ~ 36 years; the start of tea as a major commodity in England.

1720: In India hundreds in Khejadali killed trying to protect trees from the Maharaja of Jodhpur (considered origins of 20th century Chipko movement).

1755: Immanuel Kant *Universal Natural History and Theory of the Heavens*.

1775: Percival Pott, an English surgeon, observes that chimney sweeps develop cancer through contact with soot (first recognition of environmental factors and cancer).

1762: Jean-Jacque Rousseau argues in *The Social Contract* for city-states and personal freedoms. Voltaire's writings (1731-1764) critique European politics (esp. French).

1771: John Smeaton (who built Smeaton's Lighthouse, self-declares) first 'Civil Engineer'.

1776: Adam Smith, *The Wealth of Nations*.

1770s to 1830s: launch of Industrial Revolution in Britain (textiles, steam power, iron); peak of transatlantic slavery.

1779: Ned Ludd allegedly destroys textile machinery giving rise to *Luddite* movement

1781: James Watt patents a steam engine.

1788: James Hutton *Theory of the Earth; or an Investigation of the Laws observable in the Composition, Dissolution, and Restoration of Land upon the Globe*, Royal Society of Edinburgh (credited as start of modern geology - Abu al-Rayhan al-Biruni, AD 973-1048, was one of the earliest geologists, whose works included writings on the geology of India).

1798: Thomas Malthus, *An Essay on the Principles of Population*.

1795: Immanuel Kant, *Perpetual Peace*.

1800: per capita GDP ~ \$200; average life expectancy ~ 40 years.

1807: Britain bans African slave trade; steamship invented.

1815: Mt. Tambora, Indonesia erupts, killing 90000, globally precipitating 'year without a summer'; Congress of Vienna and the end of Napoleonic Wars in Europe; William Smith publishes geological map of Great Britain.

1818: Baron von Drais patents *Laufmaschine* (bicycle) developed to replace horses that starved during Mt. Tambora's volcanic winter.

1820: approximate start of fossil fuel (coal) driven aspects of Industrial Revolution; atmospheric CO₂ concentration ~ 280 ppm; global population 1 billion.

1830: Charles Lyell *Principles of Geology*.

1836: Ralph Waldo Emerson, *Nature*.

1842: Edwin Chadwick's report *Sanitary Condition of the Labouring Population of Great Britain* – supports his 1834 'Poor Act'.

1845: John Snow produces London's 'ghost map' linking cholera to contaminated water source; Alexander von Humboldt Volume I of *Kosmos*.

1846: first mechanically drilled oil well, Baku, Azerbaijan (Oil Springs, ON dug by hand in 1858, and Titus, PN percussive drill and 'oil gusher' in 1859, led to today's commercial oil industry).

1848: Jules Dupuit (an economist and engineer) credited with first use of cost-benefit analysis; Public Health Act, Britain begins waste regulation (amended 1875 assigning duty to local authorities); Karl Marx and Friedrich Engels, *The Communist Manifesto*.

1850: first submarine telegraph cable (English Channel), Atlantic Ocean bridged 8 years later (Newfoundland to Ireland).

1853: first international meteorological conference (Brussels); US Navy recommends standardized measurement protocols (US Weather Bureau established in 1870, Meteorological Services Canada in 1871, International Meteorological Organization in 1873).

1854: Chief Seattle's famous open letter (speech), including, '*Man did not weave the web of life, he is merely a strand in it. Whatever he does to the web, he does to himself*'; Elisha Otis demonstrates his 'fail safe platform' at the Crystal Palace of New York's World Fair – start of modern elevators (first passenger elevator 488 Broadway, NY, 1857); Henry David Thoreau retreats to the woods near Concorde, MA, pens *Walden*.

1855: Limited Liability Act, UK; Thomas Cook offers first international tour package.

1858: Alfred Wallace publishes on natural selection - Charles Darwin, *The Origin of Species* (1859); year of the 'Great Stink' Parliament commissions Joseph Bazalgette to build London's sewer system.

1862: first products made from plastic (widespread manufacture begins in the 1930s); John Ruskin *Unto This Last*; Louis Pasteur establishes germ theory.

1863: London's tube opens (first in world); John Tyndall gives public lecture, *On Radiation Through the Earth's Atmosphere*, explaining the greenhouse effect; International Committee of the Red Cross, one the first global NGOs.

1864: George Perkins Marsh, *Man and Nature: Physical Geography as Modified by Human Action*.

1865: International Telegraph Union – first global regulatory agency.

1866: Ernst Haeckel, a German zoologist, coins the term *ecology*.

1869: Suez Canal opens.

1872: Yellowstone Park established (Yosemite in 1890); Robert Smith describes acid rain.

1884: Greenwich Mean Time established.

1885: Banff Park established; Canadian Pacific Railway completed.

1886: George Grinnell founds the Audubon Society.

1888: Nikola Tesla sells his patent for polyphase AC induction motor to George Westinghouse (Westinghouse and Tesla win bid, over Edison and DC power, to light World Expo in Chicago, 1893).

1889-90: global flu pandemic (1,000,000 dead).

1890: American bison face extinction, likely less than 1000 animals (est 60,000,000 in 1491).

1891: Telluride, CO first community to receive AC supplied (hydro) electricity.

1892: Sierra Club starts (Henry Senger of Berkeley and John Muir).

1893: New Zealand becomes first country to give women the right to vote.

1895: Gillette invents first disposable razor.

1896: Svante Arrhenius, a Swedish chemist, calculates how changes in levels of atmospheric carbon dioxide could alter temperature through the greenhouse effect (Nobel Laureate 1903); Hamilton, ON and Buffalo, NY receive transmitted AC (hydro) electric power (from DeCew Falls and Niagara Falls respectively – ends the first ‘standards war’ in favor of AC transmission over DC); first modern Olympics.

1898: Gifford Pinchot, US Secretary of Interior encourages ‘wise use’.

1899: Thorstein Veblen coins the term *conspicuous consumption*.

1900: global GDP \$2 trillion (about \$680 per capita); average life expectancy ~ 48 years.

1901: first awarding of Nobel Prizes.

1902: Willis Carrier invents air conditioning.

1903: Wright Brothers inaugural flight.

1905: the term *smog* coined by Henry Des Voeux in London.

1906: Vilfredo Pareto (Italy) observes that 80% of land is owned by 20% of his compatriots.

1907: Francis Galton after visiting a London livestock fair publishes in *Nature* on the uncanny accuracy of ‘crowd sourced’ weight estimate of an ox (1197 lb vs 1207 lb).

1908: Ford’s first Model T.

1909: Canada-US Boundary Water Treaty, leads to International Joint Commission 1912, and Niagara River Water Diversion Treaty 1950; President Theodore Roosevelt convenes North American Conservation Conference (US, Canada, Newfoundland, Mexico).

1912: Alfred Wagner introduces concept of ‘Continental Drift’, corroborated by Tuzo Wilson, in *Theory of Plate Tectonics* ("Evidence from Islands on the Spreading of Ocean Floors". *Nature* 1963. Term *Pangaea* coined in a 1927 symposium.); Corrado Gini publishes *Variability and Mutability* (leading to Gini coefficient).

1913: first household refrigerator.

1914: Panama Canal opens; last known passenger pigeon, a female named Martha, dies at the Cincinnati zoo; first scheduled commercial passenger flight.

1915: Ecological Society of America – Ecologists Union (1946) – Nature Conservancy (1950).

1917: October (Bolshevik) Revolution in Russia.

1918: Fritz Haber receives Nobel Prize for the synthesis of ammonia.

1918-20: global flu pandemic (75,000,000 dead).

1920: League of Nations established by Treaty of Versailles (US abstains).

1925: General Motors and Standard Oil spokesmen claim in Public Health Service hearings there are no alternatives to leaded gasoline as an anti-knock additive (Scientific American reported in 1918 that alcohol-gasoline was ‘universally’ expected for anti-knock).

1927: Sir Arthur Tansley coins the term *ecosystem*; global population 2 billion; development of the television.

1929: aluminum foil invented; Swann Chemical Company develops PCBs; Wall Street crash; Alexander Fleming discovers penicillin.

1930: Mahatma Gandhi leads Salt March from Ahmedabad to Dandi; Sigmund Freud, *Civilization and Its Discontents*.

1930s: Franklin D. Roosevelt's New Deal includes strong ecological component (designed to overcome soil erosion).

1931: floods in China (up to 4 million deaths).

1933: Gerhard Domagk synthesizes prontosil (Nobel Laureate 1939) ushering in wide spread use of antibiotics; convention on the preservation of fauna and flora.

1936: US Corps of Engineers initiates use of cost benefit analysis (e.g. Federal Navigation Act).

1937: last known Balinese tiger shot.

1939: first jet plane, German He 178; World's Fair, New York, General Motors promotes 'Futurama', the 'new and attractive' (car-dependent) suburbs.

1942: Joseph Schumpeter publishes, *Capitalism, Socialism and Democracy*, and coins the term *creative destruction*; Oxfam founded; invention of the computer.

1943: aerosol can invented.

1944: Bretton Woods Conference; IMF and World Bank created (GDP becomes a standard metric for a country's economy); von Neumann and Morgenstern, *Theory of Games and Economic Behavior*.

1945: United Nations established (replaces the League of Nations, 45 member nations); UNESCO established (November convening conference held at Institute of Civil Engineers, London); first test detonation of atomic bomb (Trinity site, New Mexico, July 16) – nuclear testing provides clear global stratigraphic marker between 1945 and 1963, when Nuclear Test Ban takes effect after some 500 nuclear blasts; World War Two ends – more than two-thirds of today's 195 countries did not exist as sovereign states or within existing boundaries.

1946: Ten Thousand Villages, Mennonite Central Committee begins selling locally-sourced socially preferable products; convention for regulation of whaling.

1947: International Organization for Standardization (ISO) founded in Geneva (replaces the International Federation of the National Standardizing Associations founded in 1926); Canadian Wildlife Service; UN introduces international guidelines of economic indicators (by country); Marshall Plan announced; GATT formed.

1948: IUCN founded in Fontainebleau; IMF publishes first balance of payments manual; Organization for European Economic Cooperation (OEEC) created (mainly to administer the Marshall Plan) – reformed to Organization for Economic Cooperation and Development (OECD) in 1961.

1949: Aldo Leopold, *A Sand County Almanac* (introduces 'land ethics'); NATO established.

1950: two Canadians at Union Carbide invent polyethylene garbage bags; 84 countries.

1952: London's 'great smog' leaves at least 4000 dead.

1953: Hooker Chemical sells Love Canal site to Niagara Falls School Board for \$1 with a deed that explicitly declares presence of waste. Niagara Falls Gazette extensively chronicles waste issue 1976-78. August 1978 President Carter declares the site a Federal Health Emergency (along with Times Beach, MI. Love Canal largely responsible for creation of US site remediation "Superfund").

1954: first nuclear power plant, Obninsk, USSR; Harrison Brown *The Challenge of Man's Future*.

1955: Watson and Crick publish double helix structure of DNA; Bandung Conference launches Non-Aligned Movement; first McDonald's restaurant opens.

1956: Minamata disease (mercury poisoning) first discovered in Minamata, Japan; first use of intermodal shipping on *Ideal X* (Newark to Houston), now about 17 Mn containers worldwide regulated by ISO 668 (dimensions) and ISO 6346 (labelling); Hubbert's peak theory (and curve) introduced in 'Nuclear Energy and the Fossil Fuels' to American Petroleum Institute.

1957: Thalidomide first marketed in Germany (causes more than 10000 birth defects worldwide before drug sales discontinued in 1962); Asian flu leaves 2,000,000 dead; European Economic Community (EEC) replaces the European Coal and Steel Community (1951).

1958: John K Galbraith, *The Affluent Society*.

1959: Moses Abramovitz questions if GDP accurately measures a society's overall well-being; The Antarctic Treaty.

1960: Vance Packard, *The Waste Makers*; OPEC founded by Iran, Iraq, Kuwait, Saudi Arabia and Venezuela; global population 3 billion; 91 countries worldwide.

1961: World Wildlife Fund (WWF), Switzerland – internationally changes names to World Wide Fund for Nature (1986), WWF US and Canada maintain original name; Lewis Mumford, *The City in History: Its Origins, Its Transformations, and Its Prospects*; Jane Jacobs, *The Death and Life of Great American Cities* (introduces the term 'social capital'); Yuri Gagarin first person to orbit the earth.

1962: Rachel Carson, *Silent Spring*; Thomas Kuhn, *Structure of Scientific Revolutions*; launch of the first communications satellite.

1963: Martin Luther King – 'I Have a Dream' speech, Washington, DC; global human population growth peaks at 2.19% per year; Edward Lorenz publishes a paper *Deterministic Nonperiodic Flow* giving rise to the 'Butterfly Effect'; issuance of the first Eurobond.

1964: Norman Borlaug director of International Wheat Improvement Program, Mexico (leads to 'Green Revolution', receives 1970 Nobel Peace Prize).

1965: Oxfam launches "Helping-by-Selling".

1967: Environmental Defense Fund (goes to court to stop Suffolk Co Mosquito Control Commission from spraying DDT); *Torrey Canyon* oil tanker runs aground near Cornwall, UK; Churchman introduces the term *wicked problem*; European Community (replaces EEC).

1968: Paul Ehrlich, *Population Bomb*; Garrett Hardin introduces *Tragedy of the Commons* (follow-on essay in 1976, carrying capacity as an ethical concept, 'Lifeboat Ethics'); Aureilio Puecpei founds the Club of Rome; Hong Kong flu leaves 1,000,000 dead; first UN Biosphere Conference in Paris (hosted by UNESCO).

1969: Friends of the Earth; Pollution Probe, Toronto; Cuyahoga River, OH catches on fire again (leads to Clean Water Act, Great Lakes Water Quality Agreement, US EPA); Icelandic herring stock collapses; Pearson Commission on World Bank and international development (leads to IDRC); Neal Armstrong steps on the moon; first Boeing 747.

1970: International Development Research Center (Gov. of Canada); first Earth Day(s) (coins the term 'sustainable society' – some 20 million people participate peacefully in US); 134 countries worldwide.

1971: Greenpeace (starts in Vancouver); International Institute of Economic Development (London, UK); Rene Dubos and Barbara Ward, *Only One Earth*; Ralph Nader *et al Action for Change* (which launches more than 100 college campus Public Interest Research Groups); Pierre Wack, begins scenario planning at Royal Dutch Shell; OECD recommends 'polluter pay principle'; UN Conference on the Human Environment, Stockholm (114 countries participate,

109 recommendations including creation of UNEP); Klaus Schwab founds the World Economic Forum (WEF) in Geneva.

1972: UNCHE held in Stockholm launches UN Environment Program (Maurice Strong chairs UNCHE and first Executive Director of UNEP); Club of Rome publishes *Limits to Growth*; BRAC (formerly Bangladesh Rural Advancement Committee); first 'blue marble' photograph of earth from Apollo 17; Goldsmith and Allen *Blueprint for Survival*; convention for protection of world cultural and natural heritage; Archie Cochrane publishes *Effectiveness and Efficiency: Random Reflections on Health Services, on the importance of using evidence to provide equitable health care*.

1973: OPEC oil crises; E.F. Schumacher, *Small is Beautiful*; Ignacy Sachs founds the International Research Centre on Environment and Development (CIRED) in Paris; women in Himalayan villages begin the Chipko movement to protect trees from commercial logging; Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) adopted; MARPOL Convention (pollution from shipping); first handheld mobile phone demonstrated (Motorola).

1974: Rowland and Moilna publish on CFC and ozone (Nobel Laureates 1995) – data on CFCs from James Lovelock; Club of Rome, *Mankind at the Turning Point*; Worldwatch Institute (founded by Lester Brown with \$500,000 grant from Rockefeller Brothers Fund); Bucharest conference 'Science and Technology for Human Development'; TERI, Tata Energy Research Institute, established in Delhi by Dabari Seth; global population 4 billion.

1975: CITES comes into force; UN Habitat and Human Settlements Foundation; first UN conference on women and development, Mexico City; Worldwatch Institute (Lester Brown).

1976: Eric Hoffer, *The Ordeal of Change*; Body Shop founded by Anita Roddick; OECD releases Guidelines for Multinational Enterprises (voluntary standards for responsible business); Habitat I, Vancouver.

1977: Green Belt Movement starts in Kenya (Wangari Muta Maathai, founder, is awarded Nobel Peace Prize in 2004); Sullivan Principles created to help US companies apply pressure to South Africa to end apartheid; protests in the Philippines lead to the World Bank's withdrawal of support for four dams on the Chico River.

1978: Lester Brown, *The Twenty Ninth Day*; World Bank's first World Development Report (WDR), *Prospects for Growth and Alleviation of Poverty*; UN Habitat established (replaces UN HHSF, 1975); China reforms (opens) its economy; year in which Genuine Progress Indicator peaked globally – declining ever since (on average GPI does not increase beyond a GDP/capita ~ \$7000/ca); Manuel Castells *City, Class and Power*.

1979: Three Mile Island nuclear accident; James Lovelock, *The Gaia Hypothesis*; Ralf Dahrendorf *Life Chances*; Greenpeace International, Amsterdam; introduction of China's one child policy; NTT Japan, launches first cellular network.

1980: World Conservation Strategy (IUCN); *Our Common Crises* (Willy Brandt, chair); first GMO patent issued (a bacterium that digests crude oil – US Supreme Court rules to permit patenting of life forms); The Global 2000 Report to the President; Mount St. Helens erupts.

1981: *Bermuda's Delicate Balance* (an applied systems approach to people and the environment); start of *Ashoka: Innovators for the Public* by Bill Drayton.

1982: World Resources Institute (Gus Speth starts with a \$15 million grant from MacArthur Foundation); UN General Assembly approve World Charter of Nature; *Our Common Security* (Olof Palme, chair); Internet protocol (TCP/IP) introduced as standard protocol on the ARPNET; Latin America debt crises.

1983: Grameen Bank established, Bangladesh; WCED created; H.T. Odum introduces systems ecology (flow of materials); Kitchener first city in Canada to launch Blue Box recycling program (>80% participation); Development Alternatives, India.

1984: Bhopal chemical leak (10000 dead, 30000 injured); Jane Jacobs, *Cities and the Wealth of Nations*; first Worldwatch *State of the World*; Debt-for-nature swap endorsed by Thomas Lovejoy, WWF – first transaction between Conservation International and Bolivia (1987); Third World Network established.

1985: Metropolis city association (HQ Montreal); Antarctica ozone hole discovered; 'Responsible Care', Canadian Chemical Producers; France sinks Greenpeace Rainbow Warrior in New Zealand.

1986: Chernobyl nuclear accident.

1987: Montreal Protocol; *Our Common Future* (the Brundtland Report); atmospheric CO₂ concentration exceeds 350 ppm; ISO (quality management) 9000 series; global population 5 billion; Conservation International founded.

1988: Intergovernmental Panel on Climate Change created; Chico Mendez, assassinated in Brazil; Canada's National Roundtable on Environment and Economy (closed 31 March 2013); Canadian Council of Resource and Environment Ministers (CCREM); Piper Alpha oil production platform, North Sea, explodes – killing 167; Canada-US Free Trade agreement (first of many bilateral trade agreements); E.O. Wilson, *Biodiversity*.

1989: Stockholm Environment Institute; Exxon Valdez oil tanker runs aground; 'Endangered Earth', Time magazine's 'Planet of the Year'; Berlin Wall falls; Gallopoulos and Frosch popularize the term *industrial ecology* in special issue of Scientific American, 'Managing Planet Earth'; The Natural Step introduced by Karl-Henrik Robert; Basel Convention (controlling shipping of hazardous waste); extinction of golden toad, Costa Rica.

1990: International Institute of Sustainable Development (Winnipeg); ICLEI (HQ in Toronto); Canada's Green Plan for a Healthy Environment (with \$3 Bn over 5 years funding); McDonalds restaurant opens Pushkin Square, Moscow (eventually becomes chain's busiest – est. 40000 patrons/day – closes 2014, re-opens several months later); 'dolphin safe' labelling for tuna introduced; East and West Germany reunited; Nelson Mandela freed from prison; 166 countries worldwide.

1991: Global Environment Facility, Washington DC; Canadian cod fishery collapses; Government of Canada's National Waste Reduction Handbook; Environment Canada's State of Canada's Environment; Environmentally Sustainable Economic Development - Building on Brundtland, edited by Robert Goodland, Herman Daly, Salah El Serafy, Bernd von Droste; Wuppertal Institute, Germany; 'Acid Rain Treaty' signed between Canada and US; India reforms (opens) its economy; Soviet Union collapses; World Wide Web introduced.

1992: William Rees introduces *ecological footprint*; 'Earth Summit' in Rio de Janeiro (Agenda 21) – Convention on Biological Diversity signed, comes into force 1993; Union of Concerned Scientists issues *Warning to Humanity*; Business Council for Sustainable Development (becomes WBCSD in 1995); Francis Fukuyama, *The End of History*.

1993: Robert Putnam, *Making Democracy Work*; founding of the European Union (replaces EC); Forest Stewardship Council (FSC) founding assembly held in Toronto.

1994: John Elkington coins the term *triple bottom line*; Interface (a carpet company) founded by Ray Anderson; CEOs of seven largest tobacco companies state under oath before US House Subcommittee that they believe nicotine is not addictive; NAFTA enacted January 1st.

1995: World Trade Organization launched (replaces GATT which commenced 1948); Francis Fukuyama, *Trust*; first Conference of the Parties (COP1) UNFCCC, Berlin; Graedel and Allenby, *Industrial Ecology*; Fourth World Conference on Women in Beijing; Ken Saro-Wiwa hanged in Nigeria.

1996: ISO 14000 series (environmental management); Habitat II, Istanbul; Ismael Serageldin (World Bank), *Sustainability and the Wealth of Nations*; first commercial harvest of genetically modified crop; first cloning (Dolly the sheep).

1997: Kyoto Protocol adopted 11 December; launch of Journal of Industrial Ecology; Global Reporting Initiative (GRI – sustainability guidelines released in 2000); Costanza *et al.* publish *The value of the world's ecosystem services and natural capital*; Janine Benyus *Biomimicry*; WRI, *Resource Flows: The Material Basis of Industrial Economies*; forest fires burn more than 5 Mn Ha (largest global total in human history).

1998: Hunter and Amory Lovins with Ernst von Weizsäcker publish *Factor Four* (call to double wealth while halving resource consumption); Google launched; WBCSD-WRI GHG protocol; UN Habitat and World Bank sign MOU to establish Cities Alliance (incl. 20 City Development Strategies first 3 years); European Union blocks imports of GMOs.

1999: Amartya Sen, *Development as Freedom*; Donella Meadows, *Twelve leverage points* (system intervention); Dow Jones Sustainability Indexes; Seattle anti-globalization protests; global population 6 billion; Euro introduced.

2000: Hernando de Soto, *The Mystery of Capitalism*; Paul Crutzen (Nobel Laureate) with others popularizes the term *Anthropocene* (the geologic epoch 'Age of Man' to replace the Holocene); UN Millennium Development Goals; Carbon Disclosure Project; Jantzi Social Index (securities, Canada); Yale's Environmental Sustainability Index (becomes Environmental Performance Index, 2006); per capita GDP ~ \$6500, global total ~ \$41 trillion (total wealth \$117 trillion – Credit Suisse); average life expectancy ~ 78 years; 187 countries.

2001: 9/11 terrorist attacks; China joins WTO; Enron scandal; Human Genome Project publishes working draft; start of the *Acumen Fund* by Jacqueline Novogratz; Stockholm Convention on Persistent Organic Pollutants.

2002: Global Reporting Initiative; Hindu-Muslim violence in Gujarat leaves more than 1000 dead; terrorist bombing in Bali; Chechen rebels take hostages in Moscow theatre, 116 dead; international Fairtrade certification mark launched – worldwide use, except US; ~ 1 Bn internet connections; Braungart and McDonough, *Cradle to Cradle: Remaking the Way We Make Things*.

2003: World Bank's WDR, *Sustainable Development in a Dynamic World*; US and Britain launch war against Iraq; European heat waves (70000 dead).

2004: Facebook launched; HIV/AIDS pandemic peaks (started approx. 1960 Congo Basin, traversing through Kinshasa, 30,000,000 dead); China surpasses US as world's largest generator of solid waste; terrorist attacks in Spain, 200 dead; Chechen terrorists take 1200 school children hostage, 340 dead; ASCE, *Sustainable Engineering Practice*, with WFEO – followed by *The Vision for Civil Engineering in 2025* (2006).

2005: Royal Academy of Engineering publishes, *Engineering for Sustainable Development: Guiding Principles*; Hurricane Katrina; C40 cities association begins (London); Millennium Ecosystem Assessment; Walmart adopts global sustainability strategy; Ellen Johnson-Sirleaf becomes Africa's first female head of state (Liberia); London hit by terrorist attacks, 52 dead, more than 700 wounded; Jared Diamond, *Collapse*.

2006: Stern Review (makes economic case for climate action); Danish newspaper challenges Muslim taboos in publishing cartoons; Iraq sees severe civil strife between Sunnis and Shiites; bombing in Mumbai commuter trains kills more than 200; Porter and Kramer (HBR), *Strategy & Society: The link between competitive advantage and corporate social responsibility*.

2007: Al Gore's *An Inconvenient Truth* wins Academy Award (IPCC and Gore share Nobel Peace Prize); iPhone unveiled; Tesco, a UK grocer, pledges CO₂ labelling for all products (discontinued 2012).

2008: some global food prices increase 43 percent; US financial markets tumble (global recession begins, \$20 trillion+ global wealth lost); world passes 50 percent urban mark.

2009: ISO 31000 (risk management) series; G20 Pittsburgh Summit – leaders call for phasing out fossil fuel subsidies; Copenhagen climate negotiations (COP 15) fails to reach agreement (cities play key role); Elinor Ostrom receives Nobel Prize in Economics for her work on governance of the commons; China overtakes US as world's largest GHG emitter; first year more items connected to the internet than people living (launches 'internet of things' – number of connected devices doubles every ~ 5 years); Sustainability Consortium founded.

2010: Deepwater Horizon oil spill, Gulf of Mexico; Nagoya Protocol (Convention on Biological Diversity) and Cartagena Protocol (Biosafety); more than 400 die in massive Pakistani flooding; G8 pledges to double aid to Africa to \$50 Bn/year, cancel debt, and open trade; WBCSD Vision 2050.

2011: Arab Spring starts in Tunisia; world population exceeds 7 billion (last 1 billion took only 12 years, next 1 billion expected within ten years); COP17 climate negotiations in Durban yield mixed results (framework for future agreement beyond Kyoto – anticipated for COP21 in Paris, 2015); Osama bin Laden killed; South Sudan declares independence (Africa's 54th country, UN's 193rd member); Norway hit by terrorist attacks; Occupy Movement starts Sept in New York City; western black rhino hunted to extinction.

2012: Rio+20 strives (unsuccessfully) for an agreement to 'greening' the world's economies; Russia joins WTO; in Pakistan 14-year-old Malala Yousafzai shot in the head; 'Lonesome George', last known specimen of the Pinta island tortoise, dies.

2013: World Federation of Engineering Organizations (WFEO) Model Code of Practice for Sustainable Development and Environmental Stewardship; May 9th daily average atmospheric CO₂ 400.03 ppm at Mauna Loa, HI (Ralph Keeling continuously measuring CO₂ concentrations since 1958 – first time concentration exceeds 400); clothing factory collapses in Bangladesh killing at least 900; Edward Snowden admits to leaking classified US intelligence; Saudi Arabia declines seat on UN Security Council; Nelson Mandela dies at age 95; April – average foreign currency exchange reaches \$5.3 trillion per day

2014: Malala Yousafzai awarded Nobel Peace Prize; The New Economy report launched by Nick Stern and President Calderon; McDonalds, Pushkin Square, Moscow closes; WWF Living Planet report launched (states that between 1970-2014 half of all wildlife lost); ISO 37120; global wealth \$262 trillion (Credit Suisse) – 94.5% of wealth held by 20% of adults, \$798,000 and above places you in wealthiest 1%.

2015: launch of SDGs; terrorist shootings in Paris; COP21 Paris, new UNFCCC agreement anticipated.

2016: Habitat III planned (Quito).

2022: India and China's population both expected to reach 1.4 billion; from this point on India world's most populous country (at least for rest of Century).

2025: 101 cities expected to have populations over 5 million (~907 million total; up from 691 million in 2006).

2026: human population likely 8 billion (5 Bn urban); atmospheric CO₂ ~ 421 ppm; >100 Bn devices connected to internet.

2042: human population likely 9 billion (6.3 Bn urban); atmospheric CO₂ ~ 450 ppm.

2050: 122 cities expected to have populations over 5 million (~1.4 Bn; 154 cities with populations over 5 million expected by 2100 – total population ~ 2.4 Bn).

From: D. Hoornweg, 'A Cities Approach to Sustainability' (2015) University of Toronto (updated October, 2015).