



Daylight Map of the World

Credit: UNEP/NASA





Human Impacts on the Planet Visualising Change over Time

Human interactions with the environment leave many traces. For much of human history, human impact on the Earth's surface has been relatively minor. In the last several hundred years, however, that impact has grown tremendously. Change brought about by human activities can now be objectively measured; it can even be seen from space. A study by the National Aeronautics and Space Administration (NASA 2003a) known as The Human Footprint (Figure 3.1) is a quantitative analysis of human influence across the globe that illustrates the impact of people and their activities on the Earth.

Evidence of change is not always visible on the landscape. Change also occurs in the atmosphere, in the soil, and in the oceans and other water bodies. In these environments, evidence of change can still be "seen," however, by detecting and measuring things such as rising average global temperatures, the concentrations of certain gases in the atmosphere, and various chemical contaminants in water.

Change alone is not the only problem. It is the degree to which human activities are changing the Earth that is also cause

Map of the Human Footprint

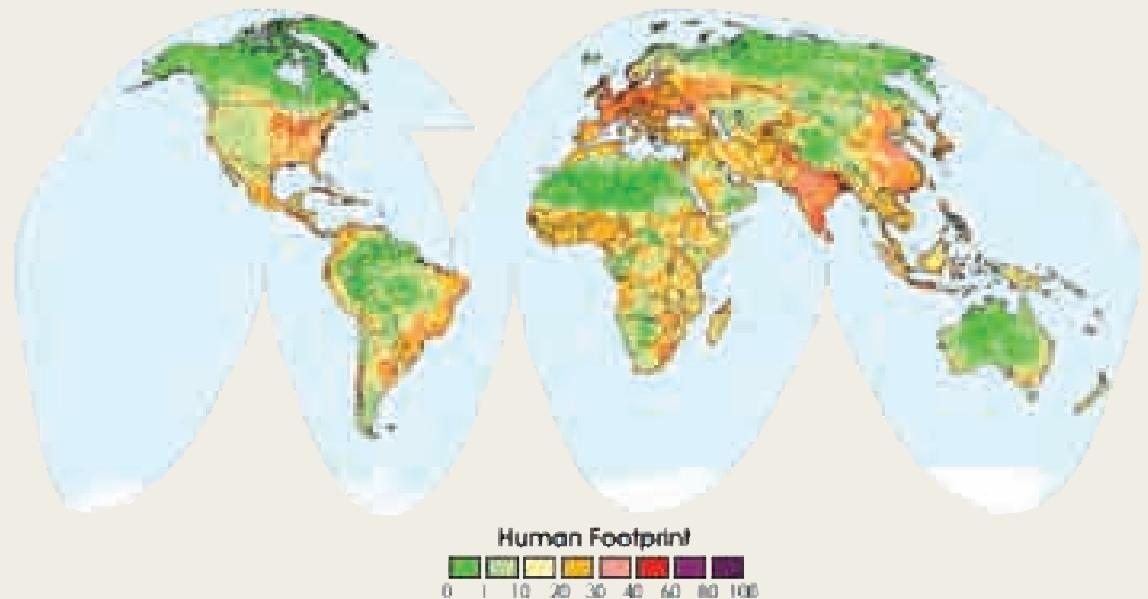


Figure 3.1: The Human Footprint is a quantitative analysis of human influence on the Earth's surface. In this map, human impact is rated on a scale from 0 (minimum) to 100 (maximum) for each terrestrial biome. The color green indicates areas of minimal impact while purple indicates areas of major impact. Credit: Scott, Michon 2003. *The Human Footprint*. NASA: Socioeconomic Data and Applications Center. Source: http://earthobservatory.nasa.gov/Newsroom/NewImages/Images/human_footprint.gif

for growing concern. For instance, the results of a recent ten-year study concerning the ecological effects of industrialized fishing in the world's oceans reveals that large predatory fish species including tuna, marlin, sharks, cod, and halibut have declined by an estimated 90 per cent from pre-industrial levels (Myers and Warm

2003). Furthermore, the average size of surviving individuals among these species is only one-fifth to one-half what it was previously.

The composition of the Earth's atmosphere is also undergoing rapid change. Since life began on Earth, changes in climate have ordered the distribution of

Credit: Apollo Mbaz/UNEP/Topfoto





Credit: Paiboon Pattanasitubol /UNEP/Topfoto

organisms and their behavior. Today, increases in atmospheric concentrations of greenhouse gases are expected to cause more rapid changes in the Earth's climate than have been experienced for millennia (Figure 3.2). At least some of the increase globally is due to human activity, and certainly, local impacts such as urban heat islands have profound effects on regional climatic conditions. As shown in Figure 3.2, waste generation and disposal is one of the ways in which humans contribute greenhouse gases to the atmosphere.

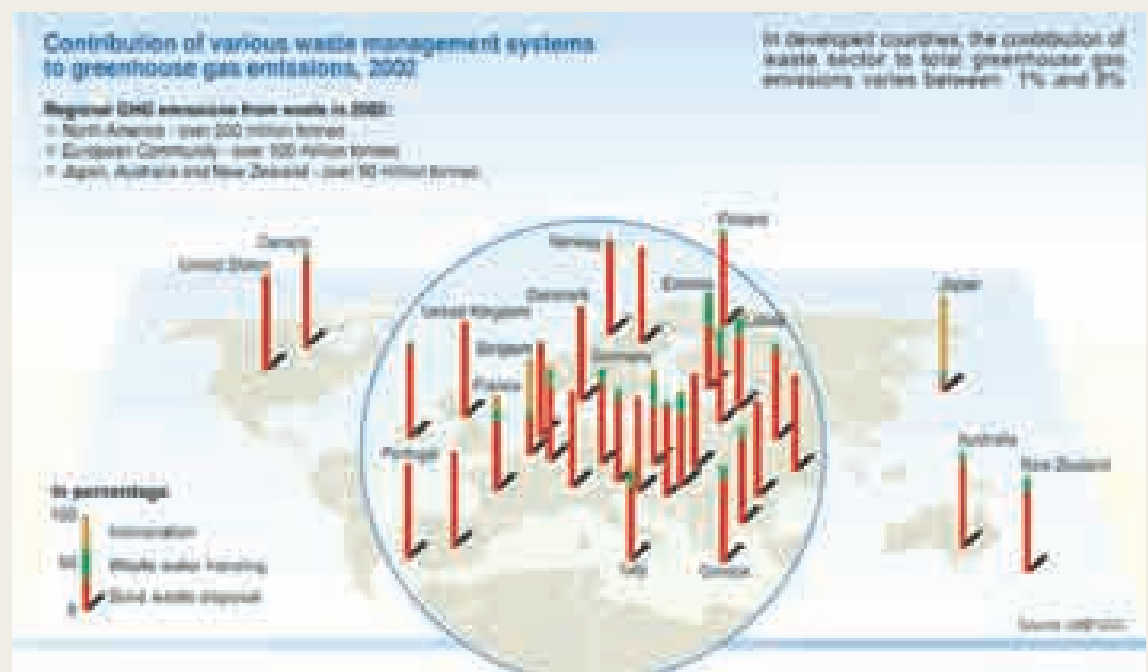
An emerging global impact issue is that of electronic or E-waste—a collective term for discarded electronic devices. Over the past decade, E-waste has become one of the world's fastest growing waste streams and—due to the presence of lead, mer-

cury, brominated flame retardants, and other hazardous substances—one of the most toxic. The disposal of computer waste in particular is becoming a difficult issue as millions of computers and other electronic devices are rapidly becoming obsolete as each year the industry produces ever-greater quantities of less-expensive equipment. There are an estimated 300 million obsolete computers in the United States, with fewer than ten per cent destined for recy-

cling each year. Even when a computer is sold to a secondhand parts dealer, however, there is a good chance it will end up in a dump in the developing world (Figure 3.3).

The Earth's forests are also under pressure. Tropical forests are now being subjected to the same heavy exploitation as were temperate forests a few generations ago. Pressures from logging, mining, hydropower, and a hunger for land are

Figure 3.2: The disposal and treatment of waste can produce emissions of several greenhouse gases that contribute to global climate change. Even the recycling of waste produces some emissions, although these are offset by the reduction in fossil fuels that would be required to obtain new raw materials. Both waste prevention and recycling help address global climate change by decreasing greenhouse gas emissions and saving energy (Environmental Protection Agency). Source: http://www.grid.unep.ch/waste/html_file/42-43_climate_change.html



leading to large areas of forest being converted to serve other purposes. The integrity of forest ecosystems is being affected as the timber and paper industries remove vast areas of mature tropical and temperate forests. As a consequence, forest ecosystems lose their ability to support complex biodiversity and thousands of plant and animal species disappear forever.

Several globally significant environmental trends that have occurred between 1980 and 2000 may also be contributing to loss of forest ecosystems, including global warming (the two warmest decades on record are the 1980s and 1990s), three intense El Niño events, changes in cloudiness and monsoon dynamics, and a 9.3 per cent increase in atmospheric CO₂. Although these factors, along with others, are thought to exert their influence globally, their relative roles are still unclear.

An observed decline in tropical cloud cover is probably one of the more important recent climatic changes, although none of the existing climate models can

accurately simulate this effect. It is known that continued reductions in tropical cloud cover, if accompanied by reduced rainfall, will have profound implications for tropical ecosystems in terms of water stress, productivity, ecological community composition, and disturbance patterns.

Images of Change

Various types of ground-based instruments, together with *in situ* surveys and analyses, can measure many of the changes being brought about on the Earth as a result of human activities. But such changes can also be observed—in more detail and with a “big picture” perspective—from space by Earth-orbiting satellites that gather images of the Earth’s surface at regular intervals. The Landsat series of Earth-observing satellites has compiled a data record of the planet’s land surfaces that spans the past thirty years and continues today.

By comparing two images of the same area taken ten, twenty, or even thirty years apart, it is often easy to see human-induced

changes in a particular landscape. Few places remain on our planet that do not show at least some impact from human activities.

The focus of this chapter is a set of specific case studies in which satellite images, taken at different times, are paired so as to reveal changes and human impacts on the atmosphere, oceans and coastal zones, freshwater ecosystems and wetlands, forests, croplands, grasslands, urban areas, and the tundra regions.

The changes that we see in pairs of satellite images should make us cautious. Some are positive changes. But many more are negative. These images could be seen as warning signs. At the least they should provide us with food for thought and prompt us to ask pointed questions: How can we be more protective of our environment? How can we use the environment in ways that will not reduce the ability of the Earth to support us in perpetuity?



Figure 3.3: The high tech boom has been accompanied by E-waste, which represents the largest and fastest-growing type of manufacturing waste product. Recycling E-waste involves major producers and users, and the shipping of obsolete equipment and other products to Asia, Eastern Europe, and Africa where recyclers, such as the people in this photo, are exposed to toxic substances. Source: http://www.grid.unep.ch/waste/html_file/36-37_ewaste.html

Credit: Unknown/UNEP/Basel Action Network

