**Jeffrey Sachs - The Age of Sustainable Development**

**Lecture 1, Chapter 4**

One of the most important messages of sustainable development is that we have become a threat to ourselves. Economic production has become so large, our productivity in many ways are so high, and the numbers of us on the planet so vast that the effect of this economic activity on the physical earth itself has become overwhelming. For the first time in human history, for the first time in the planet's history, one species, that would be us, human beings, are threatening the fundamental part of the Earth's own dynamics: the climate system, the water cycle, the nitrogen cycle, the ocean chemistry.

Think about the basic arithmetic. There are 7.2 billion of us on the planet now. On average, each individual is producing around twelve thousand dollars of output per year, rough number averaged over the whole year. But with 7.2 billion people, an average of twelve thousand dollars per person it means that the world economy as a whole has an output of between 80 and 90 trillion dollars per year-many times larger than ever in the past and continuing to expand rapidly. And the result of all of that, in the water we are using, the energy that we are burning, the land that is being devoted to feeding the planet, the chemicals that are produced, and the pollution that results from that, poisoning the air and the waterways, is leading to an unprecedented environmental crisis. One of the things that's notable about this crisis is it's felt by rich and poor alike.

Have a look at my own city-swimming for survival during the superstorm that we experienced in October-November 2012, what we called hurricane Sandy. But halfway around the world same year, Beijing experienced massive flooding. Or take a look at Bangkok in the astounding floods of October 2011-again, a major world city underwater, deluged by unprecedented rains. And as in all of these cases a huge setback for the economy, loss of life, massive loss of property, billions or tens of billions of dollars of damage, and unsettled global economy because a disruption in one part of the world in a world of interconnected production of supply chains that stretch across the world mean that a flood in Bangkok can disrupt automobile production or computer production all over the world because of components for factories that I can’t get to market during these disasters.

The kinds of disasters that are being felt are varied but what is clear is that they are rising in number. What we call hydro-meteorological shocks or disasters-water and weather related whether it's deluges, extreme storms, hurricanes, and typhoons have huge impact. Storm surges and floods have swept over Manhattan and Beijing or Bangkok. Massive droughts, droughts that lead to the remarkable shocking phenomenon you see here of terrible forest fires that spread across the American west in 2012. These kinds varied storm shocks, heat waves, droughts, floods have become the new normal for the world.

In fact it's part of a world that is so new and so stark that the scientists, notably the geologists, have given our age even a new name. They call it the anthropocene-a new word that comes from its Greek roots Anthropos and cene. Anthropos meaning human, cene meaning epoch or age of the earth and what the scientists are telling us is that this is the human age of the planet. They don't mean that in a good way they mean it in a its uniqueness in a very dangerous way that humanity is changing the water cycle, the climate, is warming the temperatures, is melting the glaciers, is threatening the great ice sheets over Antarctica and Greenland, is causing the oceans to become more acidic, is threatening other species with survival in such a fundamental way that the planet behaves differently now, even from an geologic point of view, hence the Anthropocene.

One of the main drivers and these changes is humanity’s massive use of coal, oil and natural gas; three energy sources we call fossil fuels. When we burn coal, oil and gas to move our cars, heat our buildings, drive our industrial production, produce electricity, we end up with carbon dioxide emitted into the atmosphere. And carbon dioxide in the atmosphere changes the climate. This stark graph which we will revisit later on, shows the cycles of carbon dioxide concentrations in the atmosphere. Shown here over the last 800 thousand years. Well by natural processes, mainly changes of the Earth's orbit and the effects that produced, carbon dioxide in the Earth's history has gone up and down in a kind of wave-like manner. But look at the recent few years, the blink of an eye in terms of the Earth's history. Carbon dioxide has suddenly soared to levels of 400 parts-per-million co2 in the atmosphere, something not seen on the planet, not for eight hundred thousand years, indeed not for three million years .And this is causing massive disruption of the climate system: global warming and more extreme events of droughts and floods.

We'll be talking a lot about this and what can be done about it but it is a stark illustration of how humanity is changing the basic Earth processes. A group of scientists got together a few years ago and noted that it's not only the carbon dioxide in the air but many other things that we're doing: the way we're using water, the way that we're putting nitrogenous fertilizers into the soil to help crop productivity, but putting it on in such large amounts that the nitrogen cycle itself is affected. And the way that carbon dioxide in the atmosphere affects the ocean chemistry making the ocean more acidic. The way we're chopping down trees to make room for new pastoral and farmland. Another words all of the varied effects of a big crowded planet and a lot of economic activity threatening the planet systems.

And so this group of scientists said we are trespassing boundaries that are safe for Humanity. So the scientists said we need to identify the safe operating limits for the planet; we need understand what those planetary boundaries are. And around the circle you see here is their visualization of those planetary boundaries. Have a close look. Climate change, ocean acidification, ozone depletion, the nitrogen cycle, the phosphorus cycle, global freshwater use, changes in land use, loss of biodiversity driving other species to extinction, that is, aerosol loading, the particles we’re putting into the atmosphere through industrial processes, and chemical pollution, poisoning air and waterways.

These are planetary boundaries that we trespass at profound risks for ourselves and for our children. A core goal of the science of sustainable development is to understand these risks and most importantly to determine what we can do so that we stay within the safe operating limits of humanity, we honor and respect these planetary boundaries, as we continue to improve our well-being. It's the combination of economic prosperity, social inclusion, ending poverty, and ensuring environmental sustainability that is the holistic objective of sustainable development.