

Is Earth Nearing an Environmental "Tipping Point"?

Humanity may be pushing the planet toward sudden, irreversible ecological changes

By Lauren Morello and ClimateWire | June 7, 2012

Human activities are pushing Earth toward a "tipping point" that could cause sudden, irreversible changes in relatively stable conditions that have allowed civilization to flourish, a new study warns.

There are signs that a toxic brew of climate change, habitat loss and population growth is dramatically reshaping life on Earth, an international team of researchers reported yesterday in the journal Nature.

Those pressures are greater than the natural forces that caused the end of the last ice age roughly 11,700 years ago, a time when half the planet's large mammal species went extinct and humans migrated out of Africa.

"We are doing enough to cause one of these tipping points," said lead author Anthony Barnosky, a paleobiologist at the University of California, Berkeley. "The question now is, how close are we? Is it inevitable? What are the changes that we see coming down the road that we should be aware of in order to make the best of it, essentially."

The answer provided by Barnosky and more than 20 other experts in paleontology, ecology, geology, population biology and complex systems isn't comforting.

The scientists say it's likely -- though not certain -- that Earth is close to another wholesale transformation, but when that will happen and whether it will be irreversible isn't clear.

"We know that at the landscape scale, if you disturb between 50 to 90 percent of patches, you see major changes in ones that you haven't disturbed directly," Barnosky said. "We know that we are at a point on the planet where you have more than 43 percent of the land surface wholesale transformed for human needs. If we transform more and more, we'll be at a point where even places we haven't transformed with our sledgehammers will go through major changes."

The researchers say there is a pressing need for better models and observations to help anticipate future changes and determine how close the planet is to a global tipping point.

The difficulty lies in developing methods to pinpoint the thresholds beyond which systems can flip from relative stability or slow, linear change to rapid transformation.

Scientists hope to reduce 'biological surprises'

"We need to be able to anticipate what are the worst-case scenarios and develop work-arounds in time to actually work around them," Barnosky said. "What we don't want are huge biological surprises that affect how we grow our food or where we get our water."

The idea isn't new. In recent years, scientists who study the climate have argued that humans have changed it enough to push Earth into a new geologic epoch, the Anthropocene. Biologists have warned that accelerating rates of species loss suggest the planet is entering the sixth great extinction in its history, on par with the event that wiped out the dinosaurs.

In 2009, another international team of scientists publishing a study in Nature attempted to lay out a series of seven "planetary boundaries" to preserve conditions in which humans can thrive -- and argued that the world has blown by three of those boundaries already.

"They're all pieces of the same puzzle," Barnosky said. "What's different about what we've come up with here is that we've looked at the past. We talk about the Anthropocene and all of these changes, but there hasn't really been a context to put it in."

The new study uses seven major, undisputed planetary shifts as its benchmarks: the transition 11,700 years ago from the last ice age to the current "interglacial" climate; the five mass extinctions that occurred 65 million, 200 million, 251 million, 359 million and 443 million years ago; and the Cambrian explosion 540 million years ago, when the number and type of species increased rapidly.

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They tried to compare the forces currently reshaping the planet with the causes of those earlier planetary shifts.

They include the rapidly growing human population, which now stands at roughly 7 billion and is projected to reach 9 billion by 2045 -- a factor that didn't play into events like the previous mass extinctions or the end of the previous ice age.

That surge in population is likely to multiply the stress from land-use change, freshwater depletion and climate change, the new paper says, unless humans wean themselves from fossil fuels, reduce the amount of land and water consumed per person, and protect yet-untouched parts of the land and oceans from future development.

U.N. report points to 'irreversible changes'

Stuart Pimm, a conservation biologist at Duke University who did not contribute to the analysis, questioned the way Barnosky and his colleagues presented their results.

But Pimm agreed that the possibility of rapid, large-scale change is real.

"When you cut through all the unnecessary jargon and hype of tying this to obscure mathematics, they are saying we could be experiencing some significant changes, and they could be rapid. And they could be quite devastating," he said. "I think it's entirely plausible that could happen."

The new analysis comes as the U.N. Environment Programme issued its own report warning that Earth is undergoing unprecedented changes.

"As human pressures on the Earth system accelerate, several critical global, regional and local thresholds are close or have been exceeded," UNEP's fifth Global Environmental Outlook says. "Once these have been passed, abrupt and possible irreversible changes to the life-support functions of the planet are likely to occur, with significant adverse implications for human well-being."

The analysis, released ahead of the U.N. Conference on Sustainable Development later this month in Rio de Janeiro, examines the world's progress toward achieving 90 environmental goals that have broad international agreement.

Humanity has made significant progress on just four of those goals, the report found. Climate change is among those for which no progress has been made.

Meanwhile, there are signs of "complex, non-linear changes" already at work in parts of the world, the report says -- such as increased incidence of malaria in areas where average temperatures have crossed the threshold that encourages the spread of mosquitoes that carry the disease.

But the situation is not hopeless, the UNEP analysis finds. It says the world is capable of meeting sustainability targets by the middle of the next century to improve human well-being and protect the environment.

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