The Open University

Rio+20 - United Nations Conference on Sustainable Development - Audio

Tackling Climate change

Dr. Barbara Pizzileo

In the 21st century, humanity faces the challenge of feeding a growing population, which will require additional amounts of land and water. At the same time, agriculture activities and human use of fossil fuels cause the emission of greenhouse gases including CO2 and methane into the atmosphere, exacerbating climate change.

The expression "climate change" often makes think of a warmer planet…not entirely bad news for many of us! Nevertheless climate change carries with it all sorts of potentially nasty consequences. There may be increases in flooding, drought and storm damage, possible reductions yields of some of the crops that we can grow through drought or heat stress or disease, and changes in the locations of the places where we can grow them. Climate change also will damage critical ecosystems that provide services that humans depend upon, such as cleaning water and air, as well as providing a habitat for many species.

Now here's a nice problem: take 194 representatives from different countries with fundamentally different history and culture and get them to agree how to share the trillion-dollar cost of avoiding dangerous climate change completely. Call that the climate mitigation problem, all we had to do in principle was work out how to jointly reduce global CO2 emissions to zero (or less) in the space of a few years.

Now, like some epic tragedy, having failed to avoid all man-made climate change by flunking the mitigation test, we are dealt an even harder exam question: climate change adaptation: in this new game, a significant amount of climate change becomes inevitable, and the continuously evolving, multidimensional nature of this climate-change adaptation, by ecosystems, societies and individuals thoroughly undermines the standard mitigation approach that quantifies the global impacts avoided compared to a given baseline. Adaptation implies dynamic variation of the fundamental social and environmental assumptions that define the baseline itself, while its perceived benefits are context- and observer-specific.

The adaptation problem is therefore characterized by pervasive uncertainty arising from three basic sources related to climate, actors and systems. The "climate" problem involves highly uncertain biophysical impacts with strong variation at local scales; the "actor" problem involves the adaptive capacity of individuals and the fundamental observer-dependence of best outcomes, while the "system" problem involves the complex interactions between impacted social, technical and economic systems. All three involve interactions between local, regional and global processes.

The energy system will be affected both by the mitigation policies to be implemented and by adaptation strategies, given for example the changes in the heating and cooling requirements and in the availability of resources like bioenergy and hydroelectricity.

At the Open University, together with other partners from UK, Germany, Spain and Switzerland, we are working to solve these problems in the context of a European Union research project, ERMITAGE, which stands for Enhancing robustness and model integration for the assessment of global environmental change. Enhancing robustness means we need to understand the uncertainties involved in future prediction. Models, in this case, are computer models. They come into the picture because in order to understand how issues of food, water, ecosystem protection, economy, energy and climate change interact, the first step to solve the adaptation problem indeed consists of allowing a communication between these systems. In other words, even we have a decent understanding of how these individual processes work, which in some cases we do, we don't necessarily understand how they interact. That understanding is often encapsulated in the form of computer models that can predict how things will change in the future subject to certain inputs and assumptions. So the task is to link together models that we already have for the individual systems. In this way we hope to provide guidance to policy makers about the consequences of different actions, and identify policy pathways that are closer to optimal in terms of a better outcome for both people and ecosystems, as well as pointing out those pathways that have less beneficial outcomes. Another aspect of this challenge, hard to tackle, is to get different models, written in different programming languages, to talk to each other. This has been addressed in our project by using a novel computing technology which is designed to help researchers from different institutions work together more easily.

Many scientists have already highlighted the large climate impacts that are projected to occur if we don't reduce emissions of greenhouse gases at all. They have also shown that in reducing greenhouse gas emissions, we have to be very careful about the way biofuel is produced. Biofuels have large demands for water and land use. In particular, a policy to encourage the growing of biofuel crops to produce energy could cause the destruction of all remaining natural forest, emitting large amounts of carbon into the atmosphere, hence actually causing climate change, and also causing the extinction of large numbers of species. In ERMITAGE we will be looking for ways of managing energy production and land and water use that reduce climate change, preserve natural forests and improve agricultural systems.