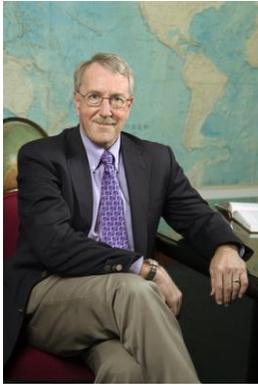


“The Role of Ecosystem Science in Food Security”
Presented by the Association of Ecosystem Research Centers
October 24, 2013



Dr. William Easterling
Dean of the College of Earth and Mineral Sciences
Pennsylvania State University
“Can the World’s Farmers Feed 10 Billion People While the Climate Changes?”

The rapid rise in agricultural productivity due to technological innovation and science-based farming methods was one of the great human achievements of the 20th century. The world’s people now face the prospects of needing to double agricultural output by the latter third of the current century to match the growth of demand for food and fibre. That growth will be driven in part by continued population growth and in part by peoples’ increasing wealth. There are many challenges to be confronted in the quest for global food security. How farmers and the agricultural industry deal with climate change will, in large measure, determine success or failure. The Earth is committed to a certain amount of climate change regardless of future greenhouse gas emissions trajectories; such will require adaptive responses by plants, animals, producers, and consumers if society’s goals for global food security are to be met. In this presentation, I will summarize the major challenges to global food security, dwelling particularly on the state-of-the science of how climate change may affect our global agricultural production system. The latest thinking on the combined effects of rising atmospheric CO₂ concentration and climate changes on crop productivity across the globe are considered. Prospects for adaptation in agriculturally important regions are examined. While it appears that global food production on balance will be adequate to meet demand even with advancing climate change, it is clear that many parts of the tropics and dry sub-tropics will see yield decreases and possible loss of comparative advantage. In those regions, increasing numbers of people at risk of hunger are probable.

Dr. Bill Easterling is Dean of the College of Earth and Mineral Sciences at Penn State University, where he is also a professor of geography and earth system science. Previously, he served as the inaugural director of the Penn State Institutes of Energy and the Environment from 2001-2007. Dr. Easterling is an internationally recognized expert on how global warming likely will affect the Earth’s food supply, and was one of the coordinating lead authors of the United Nation’s Intergovernmental Panel on Climate Change report on the effects of climate change. Dr. Easterling has authored over 80 refereed scientific publications in the areas of food and climate, and chaired the National Research Council’s Panel on the Human Dimensions of Seasonal-to-Interannual Climate Variability. He chaired or served on numerous boards and committees of the National Science Foundation, National Research Council, the United Nations Foundation, federal agencies, and industry boards. Easterling is a Fellow of the American Association for the Advancement of Science. Bill Easterling received his Bachelor’s, Master’s, and PhD degrees from the University of North Carolina.



Dr. Elena Bennett
Associate Professor of Ecosystem Ecology
McGill University
“The Role of Ecosystem Science in Managing Food Security”

Agriculture is the largest use of land on the planet—about 38 percent of the Earth’s terrestrial surface is in cropland or pasture. Despite the large scale of agriculture systems, one in seven people are not adequately fed. Agricultural production needs to be increased to reduce hunger and feed a growing and increasingly wealthy population, but further expansion of agriculture will have tremendous impacts on water usage, habitats, biodiversity, carbon storage, and soil conditions. Ecosystem science can help us understand how to reduce environmental impacts. For example, we know that setting aside even small parcels of environmentally-sensitive land from agricultural production can help preserve water, soil quality, and wildlife habitat. Ecosystem science can also help to reduce the impacts of fertilizers, pesticides, and herbicides while maintaining high yields. In the US, for example, our yields are near the highest possible for most key crops. It would cost a lot, in both dollars and environmental damage, to get incrementally better yields here. Finally, ecosystem services can help understand the impacts of calorie allocation. Globally, 36 percent of all calories produced on croplands never become food for human consumption, but are instead used for animal feed or biofuel production. Differences by country are stark: in India less than 10 percent of crop calories are fed to animals; in China, it’s one-third; and in the U.S. it’s 67 percent. Great Britain, Italy, Colombia, Ghana, India, and Pakistan are among the 69 countries that feed more people per hectare of cropland. While these countries may not have higher yields than the U.S., they direct more of what they grow to people and are therefore able to feed more people per land area than the U.S. If we used U.S. croplands to grow only crops for direct human consumption, we could feed more than 1.5 billion people. That means the U.S. alone could feed a staggering 1 billion more people on the calories that do not end up in the food system.

Dr. Elena Bennett is an Associate Professor at McGill University, where she has worked since 2005. Between 2002 and 2005, she was co-leader of the Scenarios Working Group of the Millennium Ecosystem Assessment. She is a Trottier Public Policy Fellow, a Leopold Leadership Fellow, member of the Global Young Academy, and winner of multiple awards for teaching at both the undergraduate and graduate level. She is on the editorial boards of *Frontiers in Ecology and Environment*, *Regional Environmental Change*, and *Global Food Security*. Dr. Bennett was an invited expert member of the Council of Canadian Academies panel on ‘The Sustainable Management of Water in Agricultural Landscapes of Canada.’ Her research focuses on the provision of ecosystem services in agricultural landscapes. She has an MA and PhD from the University of Wisconsin.



Dr. Dorceta Taylor
Professor of Environmental Sociology
University of Michigan
“Food Insecurity, Health, and Public Policy”

More than 50 million Americans are food insecure; roughly 16 million of those are children. Race, socioeconomic status, and geographic location are related to food insecurity. Food security is especially a concern in urban areas that are food deserts – areas where residents do not have access to places selling healthy and/or affordable food within a mile of their homes. Cities such as Chicago, Boston, and Detroit have lost many of their supermarkets and full-line grocery stores. There are large areas of many cities where residents purchase their foods from liquor stores, convenience stores, gas stations, and pharmacies. Researchers have established a clear link between health, well-being, and access to food. The less access people have to healthy foods, the healthier they are. Additionally, research has found that residents in poor neighborhoods have higher body mass index and eat less healthy foods than residents of more well-off areas. The presence of supermarkets and full-line grocery stores in neighborhoods is associated with greater consumption of fruits and vegetables. Such stores are also carry a wider variety of produce and tend to be cheaper than liquor stores, gas stations, and convenience stores. A major challenge in studying food systems is to identify vulnerable populations and develop effective policies to enhance food access. Children in poor neighborhoods are vulnerable on many fronts – not only might there be inadequate amount of food and poor quality food at home, school lunch programs are at times unhealthy. The schools they attend tend to be surrounded by fast food and other types of food outlets that sell highly-processed, unhealthy foods. Understanding more about the food systems around schools and the policies that might improve things has to be a major imperative in the short term. Encouraging more supermarkets and full-line grocery stores to locate in inner city neighborhoods could provide a solution. We have to figure out the right incentive structure to encourage new stores to locate in cities but also incentives to keep the healthy food outlets currently operating in them to remain. Another solution is to expand opportunities to participate in urban agricultural initiatives.

Dr. Dorceta Taylor is a professor of environmental sociology at the University of Michigan and the coordinator of the Environmental Justice Field of Studies. Dr. Taylor is the Chair of the American Sociological Association’s Environment and Technology Section and the Program Director for the Multicultural Environmental Leadership Development Initiative. She is the author of *The Environment and the People in American Cities: 1600s-1900s. Disorder, Inequality, and Social Change*. She has convened several symposia to discuss diversity in the environmental field. Her research focuses on history of mainstream and environmental justice ideology and activism, social movements and framing, green jobs, diversity in the environmental field, urban agriculture, and food justice. Professor Taylor received two doctorates and three Master’s degrees from Yale University and a Bachelor’s degree from Northeastern Illinois University.