National Center for Atmospheric Research

September 2013

NCAR Fellows News

SEPTEMBER EVENTS

October 2: ASP Seminar

The ASP Seminar Series will begin on October 2 with speaker Sarah Michaels of the University of Nebraska. Details to follow.

Research Reviews

Research Reviews will resume on October 16th and continue on the third Wednesday of each month at 11:00 am

The National Center for Atmospheric Research is sponsored by the National Science Foundation

Teaching as a Learning Tool by Sara Hughes

We all know that teaching can be the most effective way to learn, and this spring I was reminded of that lesson while teaching a course at the University of Colorado, Boulder. The Environmental Studies department gave me the opportunity to teach an upper level (juniors and seniors) undergraduate course on the condition that it would engage students in critical thinking on an important environmental topic. In response I developed a course called "Cities and the Environment," and our critical thinking challenge was to determine whether cities are good or bad for the environment – and under what conditions we might answer that question differently. It was an excellent opportunity not only for me to engage with the university and increase my teaching experience, but also, it turned out, to really learn a lot about a topic I thought I had under my belt.

The course was divided into five components. We first reviewed the history of cities and the reasons why we have cities in the first place. One of our books, *City and Environment,* by Christopher Boone and Ali Modarres, gives a great overview of the economic and security advantages that cities offered to early civilizations. Second, we discussed urbanization and resource use patterns: how do urban centers use water, land, and energy. It turns out that in many ways cities use water and energy resources more efficiently and are able to capitalize on economies of scale that rural areas can't access. At the same time, the consumptive lifestyle that often accompanies urban life (e.g., going to movies, out to dinner, cinema and theater events) can counteract these efficiencies, and in many cases city dwellers end up using more resources than their rural counterparts.

Sara Hughes

Xiaolin Ren from the Climate and Global Dynamics Division here at NCAR gave a great guest lecture on the resource use implications of urbanization trends in India and China, and Melissa Haeffner from Colorado State University talked to the class about some of the initiatives Chicago is taking to lower energy use. Amelia Nuding from Western Resource Advocates also gave a guest lecture on the energy-water nexus and described her work with

Continued Page 2

Teaching as a Learning Tool (continued)

water utilities in the western states to reduce water use and capitalize on energy savings opportunities.

In our third component we discussed the concept of sustainability in the built environment. We defined sustainability as actions or conditions able to achieve economic, environmental, and social aims. I asked the students to describe how well they think cities perform along these three criteria: the students almost unanimously thought cities performed best in providing economic opportunities and worst in providing environmental benefits. Paty Romero-Lankao from the NCAR Research Applications Laboratory talked to the students about her work with the IPCC and the problematic assumptions we often make about how cities will grow and perform in the future. The students really enjoyed this global perspective and some of the counter-intuitive results – such as the fact that India's carbon dioxide emissions have been decreasing despite rapid urbanization. Olga Wilhelmi, also from the Research Applications Laboratory, gave a guest lecture about the urban heat island effect – the high temperatures that cities can experience due to impervious surfaces and heat absorption. The students were astonished by the high mortality rates associated with urban heat islands, and many ended up focusing on urban heat islands in their final papers.

Our fourth component focused on cities and climate change. In many ways cities have taken the lead in developing programs and plans for reducing greenhouse gas emissions and adapting to the potential consequences of climate change. While the students thought this was a positive development overall, they questioned whether this was an adequate long-term strategy for dealing with climate change; they still wanted to see federal action. For an in-class exercise I assigned the students to play the roles of different groups that would attend a city council meeting in a typical city, and to try and negotiate with each other for their preferred activities to be included in the city's climate change strategy. They did a good job of finding synergies between their interests: for example, the "business coalition" and the "health advocates" both supported a local farmers' market as a way to support local agriculture and reduce the city's reliance on imported food.

Finally, we explored the justice dimensions of cities and their relationship to the environment. In many cases poor urban populations bear the greatest environmental burdens and have the least amount of access to environmental amenities. The students came to realize that all urban residents must have a safe, clean environment to live in if we are to develop truly sustainable cities.

So, what did we decide? Are cities good for the environment or bad for the environment? I polled the students at the beginning and at the end of the class and both times the answer seemed to be: both. By the end, however, the students' answers were much more detailed and nuanced. Cities have economies of scale and efficiencies, and can allow for things like public transportation and walking to the grocery store, but in practice they often sprawl and generate excessive amounts of waste. Interestingly, several students said that while they were pretty convinced that living in a city is better for the environment, they personally preferred a future that involved living in a cabin in the woods. Edward Glaeser, an economist and the author of one of our other course books, *Triumph of the City*, tells us that this is fine as long as they're willing to bear the costs that that lifestyle may entail. The students seemed to think this was a fair trade.

Teaching the course was a rewarding experience in many different ways. It was valuable to view my research topic through fresh eyes, to be privy to the students' insights on the different topics, and to have some of my own assumptions questioned. It also felt like a very concrete contribution to the community – many students were environmentalists and said they now had a completely different view of cities and the role they may play in efforts to develop a more sustainable society. As part of one of their assignments, the students met with people in the Boulder community to learn more about local sustainability efforts. One team of students interviewed people from ten different restaurants in Boulder to rank them in terms of their sustainability – perhaps unsurprisingly, The Kitchen* topped their list. I was also able to hone my teaching skills and experiment with different in-class exercises and assessment methods. The students were curious, critical, and engaged and because of this I think the course was an excellent learning experience for all involved.

*The Kitchen is a Boulder Restaurant with an emphasis on community and sustainability

Sara Hughes is an ASP Postdoc working in RAL. She is wrapping up her fellowship and preparing to take a position in the Air, Climate and Energy Division of the EPA in Durham, North Carolina.