

News from the IAEH

Promoting Ecohealth through Geography and Governmental Partnerships

Ecohealth is truly interdisciplinary and now includes the relatively new field of exposure science. In 2012, the National Research Council released *Exposure Science in the 21st Century: A Vision and a Strategy*, in which application of geospatial knowledge and technology such as remote sensing, global positioning systems (GPS), and geographic information systems (GIS) are highlighted as means of facilitating Ecohealth research. Remote sensing provides global coverage of the earth's land, water, and atmosphere, and is especially useful for estimating exposure in information-poor and inaccessible regions. GPS has been used in exposure assessments, for it gives accurate information on locations of an individual or species, which helps provide precise estimates of exposure. GIS allows integration of data from different geographic sources, providing quantitative information on the topologic relationship between an exposure source and a receptor, and enables vivid geo-visualization to support Ecohealth decision-making processes. Because the National Research Council stressed the importance of geography for Ecohealth applications needed by the US Environmental Protection Agency (EPA), this intersection of exposure science and geography provides a golden opportunity for geography students to participate in cutting-edge ecological and human health research.

The advancement of Ecohealth cannot disregard governmental partnerships. Through research fellowships, students can apply their knowledge and skills acquired in the classroom to solving real-world problems. There are many science education and research programs designed for students and recent graduates through partnerships with federal facilities and agencies, the academic community, and industry. The research

fellowship program that I participate in, Oak Ridge Institute for Science and Education (ORISE), partners with federal agencies including the EPA, US Centers for Disease Control and Prevention, US Food and Drug Administration, and US Department of Agriculture. Tapping into one of the many research opportunities available through governmental partnerships enables students to acquire new skills, such as web development, laboratory work with advanced facility, and complex modeling. Many federal agencies, including EPA, are devoted to realizing their mission of protection ecosystems and human health by incorporating cutting-edge science and technology.

My research fellowship at EPA is an example of how geography and governmental partnerships can benefit students in Ecohealth studies. As a research participant, I joined a development team for a cloud-based tool, the *übertool* (www.ubertool.org), which is a collection of models, tools, data, and workflows that perform ecological and human health exposure assessment. I applied my knowledge and skills in GIS to develop an online mapping tool to geo-visualize co-occurrence of endangered species, agricultural land use, and time series of pesticide usage in the US. This web-GIS project allowed me to incorporate a suite of skills that I obtained from multiple classes (e.g., Cartography, Programming in GIS, Seminar in Geographic Information Science, Digital Image Processing, and Advanced Remote Sensing and Geospatial Techniques) and helped me review and synthesize my GIS studies. And at the same time, this experience provided a unique opportunity to learn federal regulations—in this case, the Federal Insecticide, Fungicide, and Rodenticide Act and the Endangered Species Act, which are important drivers for real-world Ecohealth applications. This partnership also expanded my horizons by introducing me to fate and transport processes and chemical exposure, aspects that are not typically present in geography courses.

From my own experience, I see multiple benefits that students can obtain from governmental partnerships—students not only enhance one's skills but also acquire new knowledge. As a MS student, I appeal to more universities to facilitate opportunities for research and training with government agencies. It is a great arena for graduate students to secure their external research funding, especially in the situation of budget cut, where overall teaching and research assistantships at university level are reduced. Moreover, since an internship or off-campus training experience is not compulsory in most graduate programs, universities should provide research-oriented and problem-solving courses that give students hands-on experience with course credit. As geospatial thinking and techniques are promoted more and more throughout interdisciplinary research, education, and public service, there will be increasing potential for uncovering the spatial aspects of ecosystems, environments, and population health. As there is no “one size fits all” solution in Ecohealth, collaborations with a range of agencies are of the utmost importance in further developing the field and the next generation of practitioners.

Mingshu Wang

Center for Geospatial Research, Department of Geography,
University of Georgia, Athens, GA, USA
Oak Ridge Institute for Science and Education, Oak Ridge,
TN, USA

PROFESSIONAL RESPONSE BY TOM PURUCKER

Research fellowships can be of great benefit to the participant, giving an opportunity to apply learned skills and pick up new ones with a specific context for their application. The EPA, like many federal agencies, faces scientific and technological challenges in fulfilling its mission of protecting human health and the environment. Much of this

mission involves analyzing available data, making robust estimates of risk, and using algorithms to estimate potential scenario-based health outcomes.

One example is how the EPA registers pesticides for use in the US. The EPA must assess whether a pesticide can be used without being harmful to humans or posing environmental risks—an Ecohealth outcome. To accomplish this, mathematical models are used to predict pesticide concentrations in different environmental media and, ultimately, predict health and environmental effects. The suite of models that the EPA uses has been evolving since the 1980s, with a wide range of algorithmic complexity and technical implementation for the many components, from FORTRAN executables to Microsoft Excel spreadsheets.

As illustrated through the above essay, research fellows are doing much of the heavy lifting to integrate and modernize these models to create a uniform web service implementation. This effort combines relevant spatial information, chemical properties, exposure parameters, pesticide use properties, and effects data into a single decision support “dashboard” that is accessible to anyone with a web browser. The dashboard conducts assessments and harmonizes parameterization more efficiently across the many models currently used to estimate ecological pesticide risk in the US. By extension, this also facilitates comparing different national standards of approval for globally manufactured chemicals.

With recent federal hiring limits due to budgetary constraints and in a time of rapid technological change, there is a need for young health professionals who have a technological edge. Fellowship programs such as ORISE fill this need within the federal enterprise while simultaneously giving prospective health professionals a ground-level view of health protection and regulation: a true win-win situation.

Tom Purucker

National Exposure Research Laboratory, U.S. Environmental
Protection Agency, Athens, GA, USA