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Environmental economics may sound like an oxymoron. Most people associate economics with business interests that are largely unconcerned with the environment. Some may feel that economics is the source of environmental problems. However, economics concerns more than business activity. At its core, economics studies how people allocate scarce resources, including environmental resources. The environment connects to economics in that people value environmental resources in their own right, and environmental resources are essential inputs into producing almost all other goods.

As economists see it, the essence of environmental problems is that environmental goods are typically not priced like other goods, and so there can be little incentive to manage environmental resources efficiently. This basic insight, plus economists modeling skills, allows economists to help address environmental problems in at least four ways: (1) by characterizing the essence of environmental problems and determining when policy intervention may be needed; (2) point toward efficient solutions to problems; (3) help quantity tradeoffs between environmental goods and other kinds of goods; and (4) evaluate tradeoffs of specific policies.

In graduate studies at the University of California, Berkeley, Michael studied environmental economics, economic theory, and applied statistics. His dissertation used tools from finance to better understand natural resource prices, like oil, coal, and metal prices. Standard theories predict that prices for these kinds of resources ought to increase steadily over time. But until recently, the long-run trend has been flat or down. Michael attempted to explain this disparity by the way resource prices fluctuate with turns in the broader economy. For example, since oil prices often spike during recessions and fall during booms, investors may hold these resources as a kind of insurance. Such behavior could feed back and affect price trends in ways economists had not considered. The same phenomenon also affects valuation of investments that save energy resources, like solar and wind infrastructure.

Michael then went to work for the U.S. Department of Agriculture (USDA), where he examined how U.S. agricultural policies affect farm structure, land values, production, and conservation. This work made extensive use of data from the USDA Census of Agriculture, as well as some administrative data from programs like crop insurance and the Conservation Reserve Program. Michael showed how statistics, like average farm size, mask growing concentration of agricultural production on larger farms, and how traditional commodity support payments likely accelerate that trend. Other work showed that subsidies increased land values less than previously believed, indicating subsidies mainly benefit farmers, not landowners. Michael also considered different ways conservation goals might be

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achieved at a lower cost. While working at USDA, he also taught econometrics at Johns Hopkins School of Advanced International Studies.

At USDA, Michael began collaborating with Wolfram Schlenker, a rising star environmental economist at Columbia University. Michael and Wolfram went on to statistically model crop yields and link them to weather patterns. Around the time that this work started getting attention, Michael was recruited to a faculty position at North Carolina State University (NC State).

Shortly after arriving at NC State, Wolfram and Michael published their statistical crop modeling work in the Proceedings of the National Academy of Sciences. His most influential work to date, it documents a strong, robust, and pervasive link between crop outcomes and exposure to extreme heat. This was considered unusual, because most crop modelers emphasize rainfall over temperatures. When the authors extrapolated that relationship to projected climate changes it indicated sharp declines. This work and subsequent work by Michael, Schlenker, and David Lobell (a professor at Stanford University) showed this pattern to be even more pervasive, and has begun to unravel some of the underlying mechanisms. Schlenker and Michael have also used links with weather to disentangle the forces of supply and demand in world commodity markets, and to draw out inferences of ethanol policies on food prices.

Currently, Michael is continuing to work with Schlenker and Lobell on climate impacts. Most of this work involves detailed statistical analysis of massive databases on crop outcomes and weather. They are engaging with crop scientists and combining and comparing their statistical models with process-based plant models. These efforts should help to further unravel the mechanisms underlying the effects of extreme heat, inform strategies for adaptation, and improve predictions. Michael is also investigating how world commodity markets can adapt to a changing climate, with potentially lower and more volatile crop yields. A lot of this modeling involves grain storage, which will become more important as crop yields become more volatile.

Michael hopes to use some of his statistical and storage dynamics modeling skills to investigate Hawai‘i’s water resource challenges. Michael hopes to bring his statistical modeling skills to bear on aquifer modeling. The storage management tools he has used to model global food commodity prices should also be useful for evaluating alternative groundwater management strategies given uncertainties about climate change and sea-level rise. Michael is also delving into Hawai‘i’s energy challenges, especially those surrounding rapid growth of solar and wind, and how to best regulate a system with distributed generation.