Research Statement
Fanglin Sun

I am an environmental economist studying environmental policy and regulation, ecosystem service valuation, and the economic impacts of climate change. Across diverse topics, my research shares a common objective of problem of broad interdisciplinary interest and the use of novel datasets to tackle environmental problems. My work sheds light on effective means to protect the environment while simultaneously managing rapid economic development.

Fiscal Stimulus Programs for Greener Vehicles

In response to the global economic downturn of 2008-2009, many countries adopted so-called “green stimulus” measures by allocating sizable portions of their national stimulus packages towards programs with environmental objectives. These policies attempt to stimulate short-run economic recovery while simultaneously advancing long-run environmental goals. However, little is known about the effectiveness of such policies. In my job market paper, “Green Stimulus: Tax Incentives in China's Automobile Market” (joint with Rudai Yang and Dong Yuan), we investigate the effectiveness of a large-scale green stimulus measure in China: a major sales tax cut for greener vehicles. In early 2009, with less than a week’s notice, the Chinese government cut the sales tax on small engine size vehicles from 10% to 5%. A year later in 2010, the tax rate was raised to 7.5%. Using administrative data covering every car sold in China from 2006 to 2011, a difference-in-differences design is employed to estimate the impacts of the program on new vehicle sales and the environment.

China’s program is found to have played a significant role in stimulating auto demand and is likely to have contributed to the Chinese automobile industry’s relatively successful weathering of the economic downturn. However, it was an expensive policy measure from the perspective of controlling emissions. The tax incentives boosted sales for the very large set of eligible vehicles by 16%, while reducing sales for similar but ineligible vehicles. The policy not only influenced consumers’ vehicle choices but also changed the timing of purchase – there was substantial pulling forward of future purchases to take advantage of the tax cut. Furthermore, unlike subsidies for greener products such as solar panels, hybrid or electrical vehicles that have often been criticized as regressive, the tax cut had stronger effects in stimulating demand for eligible cars in less developed regions of China. My results provide the first evidence on the effectiveness of a major green stimulus program during the Global Financial Crisis in a developing country context and have implications for the efficiency and fairness of future policy design.

Ecosystem Service Valuation

With rising sea levels and increasingly intense storms associated with climate change, there is substantial interest in alternative defensive measures for protecting low-lying coastal communities against coastal flooding. In a second paper, “Coastal Wetlands Reduce Property Damage during Tropical Cyclones” (joint with Richard Carson), I explore the role of coastal wetlands in reducing property damage during tropical cyclones impacting the U.S. and estimate the economic value of this protective service. To accomplish this, I combine GIS spatial analysis and economic models to analyze property damage caused by 88 tropical storms and hurricanes hitting the U.S. between 1996 and 2016 and find that counties with more wetland coverage experienced significantly less property damage. For coastal communities suffering property damage due to a storm, a 1% loss of
coastal wetlands is associated with a 0.6% increase in property damage. I provide the first reliable estimates of the expected marginal value of coastal wetlands for storm protection for all counties along the Gulf and Atlantic coasts. The value varies widely across coastal U.S. counties with an average value of about $1.8 million per km$^2$ per year and a median value of $91,000/km^2$. I also find that wetlands confer relatively more protection against weaker storms and in states with weaker building codes. The model constructed can be used to estimate property damage under different wetland loss scenarios. Recent wetland losses are estimated to have increased property damage from Hurricane Irma by $430 million. This paper represents an important methodological contribution to the field of ecosystem services valuation and has substantial implications for policy makers considering how to increase local resilience to storm damage as well as for the current controversy over the U.S. Clean Water Act.

**Extreme Weather and Behavioral Responses**

I am also interested in how climate change influences time allocation decisions. In “Extreme Temperature and Time Use in China” (joint with Teevrat Garg and Matthew Gibson), I look at the role of extreme weather in individual leisure and work choices in China. Using detailed household longitudinal data, I examine how individuals and families make time allocation decisions in response to temperature. How this temperature response has evolved throughout China’s dynamic transition from a low-income to a middle-income country is investigated. Extreme temperatures are found to significantly reduce time allocated to work at both the high and low end of the temperature spectrum, with especially large reductions beyond 80°F or below 25°F. In terms of time use in housework, there is little response to cold temperatures, but there are significant reductions at the high end of the temperature spectrum. In the future, we will examine the distributional impacts of temperature within the household, as well as heterogeneous effects of across gender, age, income, and mitigation behaviors. Results of the study have important implications in policy design for assessing the productivity losses expected under climate change in a developing country context.

Moving forward, I plan to do more work on tropical cyclones and wetlands. One project I have done preliminary work on is “Valuing Wetland Fragmentation in Coastal Flooding Mitigation”. This project looks at how fragmentation of wetland affects its capacity for delivering storm protection service for coastal communities. The density and connectivity of wetlands is measured following methods adopted by the forest fragmentation literature. I examine how the fragmentation of wetlands in the storm path influences property damage, controlling for storm and economic characteristics. This study addresses the value of conservation and restoration strategies to improve landscape connectivity and maintain ecosystem services.

Another work in progress investigates how the water level at the time when a storm hits affects storm damage. The point in the tidal cycle at which a storm hits is largely random in the sense that it is not forecastable well in advance of the storm. This is in stark contrast to well known estimated propensities for different parts of the coast to be hit by a tropical cyclone. I use water level observations at coastal tide stations provided by NOAA at the time when a storm hits in combination with predicted tide levels based on physical factors. The results have important implications for estimating property damage of tropical cyclones under various sea-level rise scenarios, as well as for coastal flooding mitigation and adaptation strategies.