Final Progress Report
Sustainability Science Program
September 1, 2007 – July 31, 2008

Name: Carolyn Kousky
Date: July 17, 2008
Your field(s):   Public Policy
Degree: PhD in Public Policy, Kennedy School of Government, Harvard
                 University. Degree expected in November 2008
Faculty host(s) at Harvard name and department: William Clark and Richard
Zeckhauser, Kennedy School

Description of SSP-related research activity, including a title**:**

1. Designing Payments for Ecosystem Services: Lessons from Previous Experience with
Incentive-based Mechanisms (with Kelsey Jack and Kate Sims)

2. Responding to Risk: Information and Decision Making in the Floodplains of St. Louis
County, Missouri (dissertation)

Abstract (one paragraph):

1. Payments for ecosystem services (PES) are policies in which individuals or
communities are compensated for undertaking actions that increase the provision of
ecosystem services such as water purification, flood mitigation, and carbon sequestration.
PES policies rely on incentives to induce behavioral change, and can thus be considered
part of the broader class of incentive- or market-based mechanisms for environmental
policy. By recognizing that PES programs are incentive-based, policy-makers can draw
on insights from the substantial body of accumulated knowledge about this class of
instruments. In particular, this paper offers a set of lessons about how the environmental,
socio-economic, political, and dynamic context of a PES policy is likely to interact with
policy design to produce policy outcomes, including environmental effectiveness, cost
effectiveness, and poverty alleviation.

2. This dissertation is an economic study of individual and firm decision making
regarding flood risk in the United States. It is composed of three papers, all of which
focus on St. Louis County, located at the confluence of the Missouri and Mississippi
Rivers. The first paper asks if a severe flood causes homeowners to update their
assessment of flood risk as seen in the capitalization of risk into property prices.
Properties in 100-year floodplains were discounted 3.2% to 4.5% before the flood, but
there was no price discount for properties in 500-year floodplains before the flood. A
repeat sales model and property fixed effects model are used to estimate changes in the
discount post-flood. For 100-year floodplains there was no change in price, but prices
fell by approximately 3% post-flood for property in 500-year floodplains. In addition,
prices fell significantly post-flood for all properties in municipalities where most of the
damage occurred. The second paper looks at the demand for flood insurance among

residential homeowners using data on all the policies-in-force in St. Louis County for the years 2000-2006. The paper examines the contract choices and retention rates of policyholders and explains variation in take-up rates and average coverage amounts by census tract in terms of economic, demographic, and geographic variables. Take-up rates are much lower in St. Louis County than in coastal areas. Risk variables, including the extent of 100-year and 500-year floodplains, being on a major river, and the presence of a levee, as well as wealth variables, are significant predicators of take-up rates and average coverage amounts. The third paper shifts focus to firms and uses a simple game-theoretic model to explain the decision of firms to locate in a hazardous area through the effects of signals (proxies firms look to as an indication of risk levels) and spillovers (positive or negative externalities from one firm to a neighboring firm). The hypotheses derived concerning the type of firm that is first to invest in a risky location and the dynamic of development over time are compared to development patterns in the floodplain of Chesterfield, Missouri.

Identification of the problem you address (1 sentence to a paragraph):

1. Many lessons from previous research on the design and implementation of incentive-based mechanisms are applicable to PES policy, and yet relatively little has been written on this. We close this gap with our paper, offering a set of lessons about how the environmental, socio-economic, political, and dynamic context of a PES policy is likely to interact with policy design to produce policy outcomes, including environmental effectiveness, cost effectiveness, and poverty alleviation. The paper is written for both academics and practitioners of PES policies.

2. The costs from flood related events are rising worldwide. These papers focus on how people make decisions regarding flood risk.

Key question asked about the problem (1 sentence to a paragraph):

1. What are the key lessons from research and experience on incentive-based mechanisms and what do they say about PES policies?

2. Is there a risk premium for locating in the floodplain? How does new information alter this risk premium? Why do firms choose to locate in hazardous areas? What factors drive the decision to purchase flood insurance?

The methods by which you answered that question (1 sentence to a paragraph):

1. Literature review and synthesis

2. Mixed qualitative, analytic, and econometric methods

Principle literature upon which the research drew (methodological and substantive, e.g., innovation, incentive-based environmental management, science and technology studies):

1. Incentive-based mechanism literature, PES studies

2. Risk analysis and management literature, natural hazards literature, disaster insurance literature, studies of human-environment interactions, studies of decision-making, behavioral economics, hedonic property studies

Empirical data acquisition description (1 sentence to a paragraph):

1. As this paper was more of a synthesis of the literature, there was no empirical data acquisition.

2. Data on property sales in St. Louis County from the St. Louis County Revenue Department spanning the years 1979 to 2006 were merged with a parcel level, GIS database from the St. Louis County Planning Department. A GIS layer from FEMA's Q3 data was used to identify parcels in a Special Flood Hazard Area (SFHA). Q3 data is made by FEMA by digitizing Flood Insurance Rate Maps (FIRMs) and is for sale on their website. Data on policies-in-force in St. Louis County for the years 2000-2005 were acquired from the National Flood Insurance Program.

Geographical region studied (if appropriate):

1. N/A

2. United States

Recommendations that might be relevant for your problem (1 sentence to a paragraph):

1. Our paper highlights the fact that no single policy is right for every scenario. Previous experience with incentive-based approaches suggests it is unlikely a PES approach will always be a win-win-win option for improving livelihoods, the environment, and reducing costs. Potential tradeoffs among these goals can be assessed reasonably well by considering the correlation between characteristics of poor landholders and their land, characteristics of the costs and benefits of providing ecosystem services, and the political feasibility of different policy options.

2. The dissertation discusses many specific ways to improve the National Flood Insurance Program in the United States, from updating flood maps more frequently to incentives for encouraging better use of floodplains.

A description of the final product(s) you have/are aiming to produce (e.g., article in X journal):

1. Paper published in the *Proceedings of the National Academy of Sciences*

2. Dissertation

Description of major other intellectual or professional advancement activity(ies) over the past academic year, including working title(s) (e.g., PhD qualifying paper, dissertation, non-SSP research project paper, job search):
Completed job search and dissertation.

Please list citations for reports, papers, publications and presentations that built on your fellowship research (please list full citations here, paragraph length abstracts, and attach copies of URLs if possible):

Kousky, C. (2006). Using Ecosystem Services to Reduce Disaster Losses. *Risk Management Review* Fall: 9-10. Online: http://opim.wharton.upenn.edu/risk/review/Fall2006.pdf

Jack, B. K., C. Kousky, and K. E. Sims (2008). "Designing Payments for Ecosystem Services: Lessons from Previous Experience with Incentive-based Mechanisms." *Proceedings of the National Academy of Sciences* 105(28): 9465-9470.

Kousky, C. (2008). Costs and Risks are Escalating. St. Louis Post-Dispatch. June 30. http://www.rff.org/News/Features/Pages/CostsandrisksKousky.aspx

Principal collaborators outside Harvard (list name and institution):

Erwann Michel-Kerjan at the Wharton School of the University of Pennsylvania.

List any awards or grants that you have received this year for the current or coming year. Please provide details regarding title of award, financial amount, and date of award:
Lincoln Institute for Land Policy Dissertation Fellowship, 2007-2008 academic year. Fellowship is for $10,000.

Please attach an updated CV.
Attached.