

2015 W-3133 Multistate Project Annual Meeting Program
February 25-27, 2015
Hilton Pensacola Beach Gulf Front, Pensacola Beach, Florida

Wednesday 6:00 - 8:00pm President's Welcome Reception, *Room TBA*

Thursday 8:00 - 8:30am Registration & Continental Breakfast, *Aquamarine*

<i>Time</i>	<i>Session 1, Moderator: Amy Ando</i>	<i>W-3133 Objective(s) & Affiliations</i>
8:30	Assessing spatial heterogeneity in behaviors and attitudes: implications for land and water resource management in a changing environment, Kathleen Bell , <i>Blair VanderLugt, Jessica Balukas, Abigail Kaminski</i>	1 - Univ of Maine
8:55	The impact of residential development pattern on wildland fire suppression expenditures, <i>Anna Scofield, Don McLeod, B. Rashford, R. Coupal, S. Lieske</i>	1 - Univ of Wyoming / Univ of the Sunshine Coast
9:20	Investigating the Impact of Wildfire and Post-fire Flooding on House Prices in Flagstaff, Arizona, <i>Julie Mueller, Ryan Lima, Abe Springer</i>	1,2 - Northern Arizona Univ
9:45	Making hedonic data look more like experimental data: The benefits of pre-processing the sample via matching, <i>Christine Blinn, Rob Johnston, Klaus Moeltner</i>	1,2 - Virginia Tech Univ / Clark Univ
<i>10:10 Break / Session 2, Moderator: Joonghyun Hwang</i>		
10:30	Preferences for Attributes of Improved Cookstoves and What to do When Respondents Prefer to Pay More, Sahan Dissanayake , <i>Shannon Kooser, Abebe Damte Beyene, Randall Bluffstone, et al.</i>	1,2 - Colby College / Portland St Univ / et al
10:55	Using Random Weather Variation to Estimate Demand for Coastal Recreational Fishing: Implications for a Changing Climate, Steve Dundas & Roger von Haefen	1,2 - North Carolina St Univ
11:20	Assessing the Value of Public Lands in Western North Dakota in Community Land Trusts, Robert Hearne & Felix Fernando	1,2 - North Dakota St Univ
11:45	Enhanced Geospatial Meta-Analysis and Environmental Benefit Transfer: An Application to Water Quality Improvements, Robert J. Johnston , <i>Elena Y. Besedin, Ryan Stapler</i>	2,3 - Clark Univ / Abt Associates
<i>12:10 Lunch / Session 3, Moderator: Brian Vander Naald</i>		
1:30	Wildfire risk mitigation: What do homeowners (think they) have to lose? James Meldrum , <i>Patricia Champ, Travis Warziniack, Hannah Brenkert-Smith</i>	1,2 - Univ of Colorado / USDA Forest Service
1:55	Economic Value of Multi-peril Coastal Hazard Insurance, Craig Landry	1,2 - Univ of Georgia
2:20	Land Use Change Modeling and Ecosystem Service Quantification with Multi-Stakeholder Support – An Application in Rhode Island, Emi Uchida & Andy Boslett	1,3 - Univ of Rhode Island
<i>2:45 Break / Session 4, Moderator: Lynne Lewis</i>		
3:05	Heaps and Leaps in Recreation Survey Response Data, Scott Shonkwiler	2 - Univ of Georgia
3:30	Reshaping the Environmental Valuation Reference Inventory (EVRI), Ann Cavlovic & Kimberly Rollins	2 - Environment Canada
3:55	The Effect of a Specific Stated Preference Survey Response Strategy on Welfare Estimates, Matthew Interis & Dan Petrolia	2 - Mississippi St Univ
<i>4:20 Members' Business Meeting</i>		
<i>5:00 Adjourn</i>		

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Friday 8:00-8:30am Registration & Continental Breakfast, *Aquamarine*

		<i>W-3133 Objective(s) & Affiliations</i>
<i>Time Session 5, Moderator: Roger von Haefen</i>		
8:30	Is Mixed Logit the Silver Bullet for Recreation Demand Models? Ashley Barfield , <i>Greg Colson, Scott Shonkwiler</i>	2 - Univ of Georgia
8:55	Demand for Urban Tree Cover in California: Comparison of Spatial Hedonic Model & Instrument Variable Method, <i>Yingdan Mei, Brent Sohngen, Diane Hite</i>	2 - Ohio St Univ / Auburn Univ
9:20	Producer Preferences for Contracts on a Risky Bioenergy Crop, Kwabena Krah , <i>Dan Petrolia, Keith Coble, Angelica Williams</i>	2 - Mississippi St Univ
9:45	Using Stated-preferences to Estimate Demand for Undersupplied Goods and Services in Developing Countries, Dale Manning & <i>John Loomis</i>	2 - Colorado St Univ
<i>10:10 Break / Session 6, Moderator: Craig Landry</i>		
10:30	Using the Expected Damage Function Approach to Value Wetlands Ecosystem Services on the Gulf Coast, Luke Boutwell & <i>John V. Westra</i>	2 - Louisiana St Univ
10:55	Revisiting Determinants of Hypothetical Bias: An Up-To-Date Meta-Analysis, Jerrod Penn & <i>Wuyang Hu</i>	2 - Univ of Kentucky
11:20	Recreational Activitiy Choices with a Limited Consideration Set, Brian Vander Naald	2,3 - Univ of Alaska Southeast
<i>11:45 Lunch / Session 7, Moderator: Matt Interis</i>		
1:00	Second-best multi-site user intercept study design versus benefit transfer in the southern Lake Michigan recreational fishery, Ben Gramig & <i>Mitchell Zischke</i>	2,3 - Purdue Univ
1:25	Estimating the Value of Biodiversity for Ecosystem Services: Biological Pest Control in Agriculture, <i>Deborah Letourneau, Amy Ando, Julie Jedlicka, Anita Narwani, Edward Barbier</i>	2,3 - UC-Santa Cruz / Univ of Illinois / UC- Berkeley / et al
1:50	Matched-pair and matched-hat approaches to evaluate personal discount rates, LeRoy Hansen & <i>Daniel Hellerstein</i>	3 - USDA Economic Research Service

2:15 *Adjourn*

2015 W-3133 Project Meeting Attendees

Last	First	Affiliation	Email
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W-3133 Annual Member's Meeting Minutes from 26 February, 2015

Hilton Pensacola Beach, Pensacola, Florida

Meeting commenced at 4:15pm

Facilitator: President Dan Petrolia

Members in attendance (17): Dan Petrolia (president), Amy Ando (vice-president), Julie Mueller (secretary), Kathleen Bell, John Bergstrom, Ben Gramig, LeRoy Hansen, Bob Hearne, Fen Hunt, Matt Interis, Craig Landry, Dale Manning, Don McLeod, Klaus Moeltner, Kim Rollins, Scott Shonkweiler, Roger von Haefen

- The meeting commenced with a discussion of election of the next officer. Ben Gramig of Purdue University was elected.
- Discussion continued regarding the proceedings with Fen Hunt. It was decided that the incoming chair collects accomplishments of members. Members send the incoming chair publications and abstracts and she organizes according to:
 - the past year's accomplishments (impacts),
 - opportunities,
 - target audience,
 - and any changes in the projects goals or procedures
- The next item of business was next year's location. The following locations were suggested:
 - Austin, TX
 - Tucson, AZ
 - Portland, OR
 - Tempe, AZ

Members emphasized that the incoming chair has the final decision on the venue.

- Fen Hunt wanted to increase member's awareness of new pre-doc and post-doc funding awards, as well as undergraduate funding opportunities. Discussion continued on the state of USDA and NIFA funding. Funding is increasing as well as competitiveness. Fen encouraged members to incorporate inter-disciplinary work and bring in geographers, hydrologists, and others. Congratulations were in order for those receiving funding this year. Fen also encouraged members to investigate the grants available in the areas of the value of food safety and livestock production ([AFRI](#)). She also emphasized that those researchers from land grant institutions should recognize the land grant aspect in acknowledging funding. Finally, if any members have a chance to come to DC to present, she would welcome the opportunity.
- Ben solicited assistance with AAEEA nominations
- Meeting adjourned at 5pm.

Papers and Selected Abstracts
(presenter indicated with *)

**W-3133: Benefits and Costs of Natural Resources Policies Affecting Ecosystem Services
on Public and Private Lands
2015 Project Annual Meeting Program
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W-3133 aims to facilitate economics research around three objectives:

Objective 1: *Land and Water Resource Management in a Changing Environment*

Objective 2: *Economic Valuation Methods*

Objective 3: *Integrated Ecosystem Services Valuation and Management.*

Title: Assessing spatial heterogeneity in behaviors and attitudes: implications for land and water resource management in a changing environment

Authors: Kathleen P. Bell*, Blair P. VanderLugt, Jessica Balukas, and Abigail Kaminski;
School of Economics, University of Maine

W-3133 Objective: 1

Abstract: Patterns in human behavior and attitudes influence the extent of numerous land and water resource management issues and the complexity of addressing these issues. Understanding whether and why these patterns vary over space is as an important challenge. Meeting this challenge requires the development of models that are based on behavioral theories and that acknowledge social and biophysical drivers of heterogeneity. This research makes an important contribution by recognizing the potential for heterogeneous objective functions and empirically testing the significance of such heterogeneity for economic models of land-use behaviors and conservation attitudes.

Our empirical work begins by evaluating the extent of heterogeneity in attitudes and then integrates our knowledge of these attitudes into our assessment of heterogeneity in behavior. We also employ spatial statistical tests to assess the spatial distributions of attitudes and behaviors. We employ survey responses from landowners in the Portland and Bangor Metropolitan Areas of Maine and visitors to Maine to complete our empirical research. These regions serve as an excellent study area for this research because there is considerable variation in social and biophysical landscape characteristics. We employ a segmentation approach to group individuals based on their attitudes regarding land ownership and coastal water quality. Statistical tests are then used to determine differences between groups and to explore the spatial distribution of the groups. We then estimate discrete regression models of the adoption of multiple management behaviors to gauge the significance of these groupings and other independent variables at explaining variation in the adoption rate of these behaviors.

Our work to date reveals interesting findings about heterogeneity in landowner objectives and behaviors.

First, our segmentation analysis confirmed heterogeneity in objectives across owners, identifying three unique groupings. In addition, we found evidence of distinct spatial patterns across these groupings and that including such information in behavioral models improved their performance. This work to date studying landowners advances the land-use dynamics literature and provides valuable insights to policymakers and stakeholders seeking to reach out to segments of landowners and to foster greater cooperation among landowners. Ongoing work looking at similar patterns related to coastal water quality issues strives to advance the water management literature and benefit coastal stakeholders.

Title: The impact of residential development pattern on wildland fire suppression expenditures

Authors: Anna Scofield, D. McLeod*, B. Rashford, R. Coupal and S. Lieske, All Authors University of Wyoming except Lieske at University of the Sunshine Coast, Australia

W-3133 Objective: 1

Abstract: The wildland urban interface (WUI) increases wildland fire suppression expenditures and impedes land managers' ability to reduce fire risk. Policies to reduce these WUI impacts are hindered by jurisdictional externalities — federal agencies are charged with protecting homes from wildland fires, while local governments decide where and how development can occur. Policymakers therefore need an understanding of WUI characteristics that drive firefighting expenditures to develop effective solutions for existing and future (reduced cost of protection) WUI development. Despite a growing body of literature indicating that the spatial pattern of development impacts the efficiency and cost of public service provision, the effect of WUI development pattern on fire suppression expenditures has received only cursory treatment in the literature. We address this gap by empirically modeling the relationship between fire suppression expenditures and the spatial pattern of residential development. Data is used for 280 fires in the Northern Rockies (CO, MT and WY) to estimate a regression model relating suppression expenditures to fire characteristics, management characteristics, and the spatial pattern of development. We find that the effect of WUI development on suppression expenditures is highly dependent on spatial pattern. Though past research has confirmed that the presence of structures influences expenditures, our results indicate that the effect of development on fire suppression expenditures cannot be accurately assessed without considering the spatial pattern of development. A unit increase in the complexity of development pattern increases expenditures by approximately six percent. The difference in expenditures between fires with dispersed or clustered structures can be as much as \$620,000. These results indicate that policies that control the spatial pattern of WUI development can be nearly as effective as policies that completely restrict WUI development.

Title: Investigating the Impact of Wildfire and Post-fire Flooding on House Prices in Flagstaff, Arizona

Authors: Julie M. Mueller, The W.A. Franke College of Business, Northern Arizona University; Ryan Lima*, School of Earth Sciences and Sustainability, Northern Arizona University; Abe Springer, School of Earth Sciences and Sustainability, Northern Arizona University

W-3133-Objectives: 1, 2

Abstract: The Schultz wildfire burned over 15,000 acres outside of Flagstaff, Arizona in 2010. The wildfire burned on steep slopes, and catastrophic flooding followed as monsoonal rains moved unimpeded down the disturbed terrain. While the wildfire itself did not burn any structures, the post-fire flooding caused extensive property damage and loss of life. The market costs of the Schultz wildfire and flooding are well-documented, however, no research investigates the non-market impacts of the wildfires and subsequent flooding. We will use a Hedonic Property Model (HPM) to estimate the non-market costs of the 2010 Schultz wildfire and flood on house prices near Flagstaff, AZ.

Warmer temperatures associated with climate change have already led to larger and more intense wildfires in the western United States, and the trend is expected to continue (Westerling et al. 2006). Much of Arizona's ponderosa pine forest is currently predisposed to catastrophic wildfire due to human activities which have moved forest structures outside of their natural range of variability, in terms of both wildfire regime and stand density. (Covington and Moore 1994, Covington et al. 1997). Forest restoration, especially for forested watersheds, could greatly mitigate wildfire and resulting flooding. Securing adequate funding for restoration, however, has been the greatest socio-political impediment to conducting forest restoration (Hjerpe et al. 2009).

We will use the HPM to compare the market prices of houses sold before and after the Schultz wildfire and flood. We also plan to incorporate explicit spatial modeling of the wildfire area and floodplain. While HPMs have been used before to determine the costs (or benefits) of wildfires on housing prices (Hansen et. al, 2014), to the authors' knowledge, no other study has investigated the effect of associated wildfire and flood events. Quantifying the predicted economic costs that wildfires in flood-prone areas could have in regards to housing values and subsequent property tax revenues will improve knowledge of the non-market benefits of restoration, resulting in improved management opportunities for policymakers regarding forested watershed restoration.

Title: Making hedonic data look more like experimental data: The benefits of pre-processing the sample via matching

Authors: Christine Blinn, Department of Forest Resources and Environmental Conservation, Virginia Tech; Rob Johnston, George Perkins Marsh Institute and Department of Economics, Clark University; Klaus Moeltner*, Department of Agricultural and Applied Economics, Virginia Tech

W-3133 Objectives: 1, 2

Abstract: The pre-processing of observational data via nonparametric methods such as matching to reduce bias in the estimation of causal effects has become standard practice in political science and related fields. In contrast, they have to date been largely ignored in applied economics, such as environmental valuation based on property sales data. Yet, these simple and highly effective tools are perfectly suited to improve estimation accuracy and efficiency in this area. We illustrate the advantages of pre-processing - and the pitfalls of ignoring it - with application to flood hazards in New England communities.

Title: Preferences for Attributes of Improved Cookstoves and What to do When Respondents Prefer to Pay More

Authors: S. T. M. Dissanayake*, Colby College and Portland State University; Shannon H. Kooser, Colby College; Abebe Damte Beyene, Environmental Economics Policy Forum for Ethiopia; Randall Bluffstone, Portland State University; Zenebe Gebreegziabher, Environmental Economics Policy Forum for Ethiopia and Mekelle University; Alemu Mekonnen, Environmental Economics Policy Forum for Ethiopia and Addis Ababa University; Peter Martinsson, University of Gothenburg; Michael Toman, The World Bank

W-3133 Objectives: 1, 2

Abstract: I present results from a study to investigate the preferences for improved cook stoves using a choice experiment administered in Ethiopia. Previous research indicates that traditional cooking methods are harmful to the environment due to inefficient burning of fuelwood and human health and wellbeing due to smoke and as well as, as people need to cut down trees or collect other biomass sources for fuel. However, improved cookstoves can solve these environmental and health problems, as well as provide a sustainable method for cooking and heating in developing countries. Using a choice experiment survey, this study examines Ethiopian households' valuations of different characteristics of stoves, including durability, fuel reduction, smoke reduction and the amount of time they may save using new technology. It also considers demographic factors that may affect a household's willingness to pay for stoves, in an effort to determine what makes these clean technologies desirable in an Ethiopian context. Results demonstrate that various demographic differences affect the valuation of clean cookstoves, as households with few females and children are willing to pay more for new stoves. The results of this study have implications for global sustainable development initiatives in many parts of the world.

The study surprisingly finds that respondents' prefer higher priced stoves, the coefficient on the price attribute is positive for both a conditional logit analysis and a mixlogit analysis. This could potentially be explained by the respondents' assuming the higher price stoves are more durable. We find some evidence of this as we find a positive and significant coefficient for an interaction term between price and durability. At the same time it can be argued that the positive coefficient on the price attribute suggests that that the survey was badly designed or the estimation was

misspecified. I am hoping to present these results and get feedback on alternate methods to disentangle the interaction between price and durability.

Title: Using Random Weather Variation to Estimate Demand for Coastal Recreational Fishing: Implications for a Changing Climate

Authors: Steve Dundas and Roger H. von Haefen*, North Carolina State University

W-3133 Objectives: 1, 2

Abstract: Outdoor recreation is an economic engine for many coastal areas in the United States. These same coastal communities are likely the most vulnerable locations to the potential impacts of climate change. This paper estimates the demand for coastal recreational fishing and examines the potential impacts on demand with a warmer climate. Short-run variation in temperature, precipitation, wind speed, and hurricane events are used to estimate impacts on this demand to then be able to infer the likely long-run impacts due to climate change. The goal is to identify potential adaptive behaviors in recreation activities through the allocation of leisure time in response to a warming climate.

An empirical model of demand for recreational fishing on the Atlantic and Gulf Coasts of the United States is developed to exploit variations in demand across space and time (2004-2010). A large dataset is assembled using the Marine Recreation Information Program (MRIP) intercept and phone survey data and high resolution weather data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) and NOAA. The data cover over 2500 intercept sites along the Atlantic and Gulf Coasts from Maine to Louisiana and the phone surveys used are conducted from 2004-2010. This extensive dataset allows estimation of both the site choice and the participation decision. The estimation proceeds as a sequential two-level nested logit with the first stage modeling conditional site choice using the intercept data. This stage recovers the travel cost parameter and the alternative specific constants (ASCs) for each site. Choice-based sampling requires a second step to calibrate the ASCs based on the market share of each recreation site. The participation decision is modeled in the second stage using the phone survey data and by incorporating weather data on temperature, precipitation, wind, and hurricane events. This stage recovers the ASC for the 'no trip' alternative, parameters on weather and demographic variables, and the dissimilarity coefficient.

Parameter estimates from this model of recreation demand are then used in combination with global climate model predictions to simulate potential responses to climate change. The results of the counterfactual simulations capture changes in recreation demand as a response to weather variables, potentially revealing adaptive strategies to pursuing outdoor recreation activities with climate change. Preliminary results for the first stage are reasonable and the counterfactual welfare analysis will proceed in the coming weeks.

Title: Assessing the Value of Public Lands in Western North Dakota in Community Land Trusts

Authors: Robert Hearne* and Felix Fernando

W-3133 Objectives: 1, 2

Abstract: North Dakota municipalities and counties own considerable amounts of land which can be dedicated toward future parks, school, or sold to meet private sector demands. This research will assess the value of these lands in meeting a specific need of public sector employees housing.

Rapidly growing population in western North Dakota has generated a swift increase in demand for public services (law enforcement, education, emergency services etc.). But public services are grappling with the challenge to enhance services as lack of affordable housing has become a significant barrier for recruiting and retaining new and existing employees. The shift in housing demand is exacerbated by oil industry policies which provide housing generous subsidies to attract workers, technicians, and managers.

One possible solution would be for local governments to dedicate public lands to community land trusts, or similar arrangements, which would be dedicated toward housing for public sector workers, such as teachers, public health care workers, and police officers. In such a community land trust the residents would own the dwellings but the land would remain in the trust for a specified period of time.

This research will assess the benefits and costs of transferring public lands toward this community purpose. A variety of institutional norms will be assessed. A decision framework for hub communities will be presented.

Title: Enhanced Geospatial Meta-Analysis and Environmental Benefit Transfer: An Application to Water Quality Improvements

Authors: Robert J. Johnston*, George Perkins Marsh Institute and Department of Economics Clark University; Elena Y. Besedin, Abt Associates Inc.; Ryan Stapler, Abt Associates Inc.

W-3133 Objectives: 2, 3

Abstract: Meta-regression models (MRMs) are commonly used within benefit transfer to approximate mean willingness to pay (WTP) for environmental and ecosystem service improvements. These estimates are often an important component of policy analysis. With rare exceptions, theory suggests that these estimates should be sensitive to core economic factors including geospatial scale (the geographical size of affected environmental resources or areas), market extent (the size of the market area over which WTP is estimated) and substitute availability (the availability of proximate, unaffected substitutes). No MRMs in the current valuation literature enable simultaneous adjustments for these factors, leading to benefit transfers that fail key tests of content validity. This paper reports on a novel meta-analysis for US water

quality benefit transfer that incorporates quantitative measures of these and other spatially explicit factors predicted by theory to influence WTP. The metadata combine primary study information with extensive geospatial data from geographic information system (GIS) data layers and other external sources. The result is the first meta-analytic benefit function able to test and adjust for combined value surfaces associated with quantitative measures of geospatial scale, market extent and spatially differentiated substitutes. Scenario analyses for US water quality improvements demonstrate that these adjustments are crucial to accurate benefit transfer and aggregation.

Title: Wildfire risk mitigation: What do homeowners (think they) have to lose?

Authors: James Meldrum*, Institute of Behavioral Science, University of Colorado at Boulder; Patricia Champ, Rocky Mountain Research Station, USDA Forest Service; Travis Warziniack Rocky Mountain Research Station, USDA Forest Service; Hannah Brenkert-Smith, Institute of Behavioral Science, University of Colorado at Boulder

W-3133 Objectives: 1, 2

Abstract: The wildland-urban interface (WUI) consists of many homes that face potential destruction by wildfire. In the interests of protecting people and property and reducing public expenditures on wildfire suppression, many publicly-funded programs attempt to encourage homeowners to mitigate wildfire's risks to private property.

In recent research, we investigate such programs by analyzing paired responses to homeowner surveys and professional risk assessments for properties in numerous WUI communities in western Colorado. Two-stage decision modeling suggests that participation in cost shared mitigation is a function of property-specific, homeowner-perceived risk levels and the presence of barriers for blocking mitigation actions, whereas willingness to pay (WTP) for mitigation is a function of property size, respondents' income, and attitudes about the controllability of wildfire. This information is directly useful for practitioners considering cost-share incentive programs to encourage risk mitigation.

Here, we continue this analysis, using individual-level estimates of WTP as an opportunity for further insight into homeowners' wildfire risk mitigation decisions. Specifically, we recognize that WTP is a function of homeowners' expectations regarding the change in probability of wildfire damage with respect to the "purchased" mitigation (Δ) and the economic loss that the homeowner would experience in event of wildfire damage (L). Although we do not have direct measurements of respondents' perceptions of Δ , we know that the value is bounded by 0 (for mitigation that is completely ineffective at reducing risk) and by the joint probability of the homeowners' expectations that wildfire will occur on their property and that, if it does, their homes will be destroyed (*JointProb*, a measure elicited by the survey). Using these bounds, we estimate that respondents implicitly expect substantial losses (L) in the event of a wildfire.

We compare these preliminary estimates of implicit, subjectively-related losses with survey data on potentially relevant factors, including expectations about the specific impacts of a wildfire on

one's property, measures of risk attitudes, and questions about (knowledge of) wildfire risks' influence on respondents' homeowners insurance. In particular, we explore the relationship between this present result and a related, recent analysis of the survey data that suggests little to no association between homeowners insurance considerations and homeowners' risk mitigation decisions.

Title: Economic Value of Multi-peril Coastal Hazard Insurance

Author: Craig E. Landry*, Department of Agricultural and Applied Economics, University of Georgia

W-3133 Objectives: 1, 2

Abstract: Using NFIP Policy-in-Force and survey data, we model household insurance decision processes for multi-peril hazard insurance. Our dataset includes revealed preference information on flood insurance purchase for a systematic sample of coastal households in the US southeast. We couple this with stated preference data eliciting willingness-to-pay for additional erosion hazard coverage (currently only indemnified within NFIP under certain circumstances). The dataset includes information on insurance prices (NFIP rates and randomly assigned bids for erosion coverage), objective and subjective risk measures, regulatory circumstances, and household & community characteristics. We estimate reduced form bivariate probit models in order to assess the determinants of multi-peril insurance demand and assess the value of multi-peril hazard insurance for households in the coastal zone.

Title: Land Use Change Modeling and Ecosystem Service Quantification with Multi-Stakeholder Support – An Application in Rhode Island

Authors: Emi Uchida and Andy Boslett*, Department of Environmental and Natural Resource Economics, University of Rhode Island

W-3133 Objectives: 1, 3

Abstract: In the United States, 81% of the population live in urban areas (World Bank, 2014). Along with overall population numbers, this proportion is expected to increase in the future with corresponding impacts on the environment in America's urban-rural fringe. As a result, many cities in the United States have implemented policies to protect natural areas. This is especially true in Rhode Island, where over 21,000 hectares of forest were developed from 1972 to 1999 (Novak and Wang, 2004). In anticipation of further development, Rhode Island has developed a plan, titled *Land Use 2025*, to protect natural land from encroaching urbanization.

Recently, the ecosystem services paradigm has been used in environmental policy and management to better understand the benefits of preservation, often in the context of a rapidly-urbanizing world. The purpose of our study is to evaluate ecosystem service delivery dynamics across potential future development and policy scenarios in Rhode Island. We use InVEST to

estimate future statewide ecosystem service provision as a result of potential conservation policies within the context of urban and agricultural development. To our knowledge, we are one of the first studies to examine changes in multiple ecosystem services in southern New England.

In our multi-stage framework, we forecast urbanization and agriculture expansion trajectories using county-level returns to different land uses (Lubowski et al, 2006). We then use NLCD 2001-2011 land use change data to create a model of forest and agricultural area likelihood of transition at the 30m cell level. We apply this model to understand where changes in urban and agricultural development are most likely to occur in the future. The results of this model are then used to sequentially allocate changes in land use to those cells most suitable and likely to transition (e.g., Kovacs et al, 2013).

Scenario development is driven by multi-stage changes within each model. First, we modify future land use mixes by adjusting land use returns to accommodate different economic conditions and environmental policies. Second, we change cell likelihood of development by adjusting urban services boundaries and increasing investments in land protection to mirror land-based policies centered on local zoning, urban services extensions, and investments in forest protection around conservation areas. We then integrate our scenarios into InVEST, focusing on carbon sequestration, habitat refuge, and nutrient retention.

We uncover synergisms and tradeoffs in the delivery of these ecosystem services while identifying the efficacy of different conservation measures in improving ecosystem service delivery relative to the baseline policy of no further conservation. The context of Rhode Island is small enough to take advantage of high-resolution data while also being relevant to decision-making. This is important, as much of the ecosystem service valuation work in the economic literature has been disconnected from a policy or management context (Ferraro et al, 2011). We link our work to policy and management in two distinct ways. First, we assess changes in ecosystem service provision between different land use and conservation policies across potential economic futures. Second, we integrate feedback from stakeholder groups across Rhode Island.

Title: Heaps and Leaps in Recreation Survey Response Data

Author: J. Scott Shonkwiler*, University of Georgia

W-3133 Objective: 2

The estimation of economic values for environmental amenities is critical to making informed resource management decisions and accurately assessing environmental damages. Revealed preference methods for measuring economic values require data on observed behavior. Systematic biases in reporting past behavior may compromise the methods used to derive values from revealed preference data.

Numerous studies have found that reported recreation frequency has been overestimated (e.g. Connelly and Brown). Another dimension of recall bias is the prevalence of respondents to round

off responses to end in a zero or five. Tourangeau, Rips, and Rasinski report that open-ended questions which require a numerical response may manifest these characteristics: i) the larger the number to be reported the more likely it will be a round value; ii) the distances between successive rounded values increase as the numbers increase.

In looking at several population based surveys we find that first there is a large proportion of zeros which suggests what Sarker and Surry call a fast decay process. Second there is a disproportionate number of rounded responses (termed heaping in the survey response literature) and some evidence of rounding to the half-dozen and dozen. Lastly, we see some very large reported values which are almost all rounded to the nearest 10—these are big leaps. The zero problem may be addressed by considering a flexible estimator for the recreation demand model. If the zeros are generated by a different process than the non-zero responses, then hurdle count data models may need to be estimated.

Vaske and Beaman propose some methods for reducing the bias that heaping may generate. Their approach attempts to smooth out the heaps by distributing the values over an interval whose shape is related to the underlying distribution of the un-heaped data. How can we define the intervals to which the heaped data will be assigned? If we assume that rounded data signal approximations and if we subscribe to the notion that respondents tend to exaggerate their participation, then it follows that the intervals will include values no greater than the heaped value. Further the larger the heaped response, the larger the interval to which it should be assigned. Essentially this is an empirical issue.

Implementation of a count data estimator with numerous censored regimes does pose the complication that sums of probabilities comprise each of the intervals. In the case of the negative binomial distribution, we show how incomplete beta functions can be used to compute cumulative probabilities—thus greatly simplifying the censored estimation.

Title: Reshaping the Environmental Valuation Reference Inventory (EVRI)

Authors: Ann Cavlovic*, Environment Canada; Kimberly Rollins, Environment Canada

W-3133 Objective: 2

Abstract: Monetized values of environmental impacts associated with governmental policies and development projects are increasingly required for benefit-cost analysis. However, constraints around timelines, funding and analytical resources often prevent detailed primary research of these values. In such situations, benefit transfer methods (using values from previous studies with similar analytical contexts) have been shown to provide a cost-effective approach to generate defensible estimates of environmental values. Benefit transfer methods generally require that practitioners define criteria that align results from previous studies with policy sites, and then invest significant time conducting targeted literature searches to assemble appropriate studies to use for benefit transfer. The Environmental Valuation Reference Inventory (EVRI) is a web-based tool initially developed in the late 1990s by Environment Canada and the U.S. Environmental Protection Agency to support benefit transfer by facilitating access to the

empirical findings of thousands of valuation studies. The EVRI database, the largest of its kind in the world, consists of carefully written summaries (“captures”) of the key variables contained within each of these studies, e.g. study location, valuation technique, survey instrument, type of environmental asset being valued, etc.

The content of the EVRI database has continued to expand over the last 15 years, due to sustained funding from member countries. However, some functionalities of the website no longer meet users’ objectives, and the classification system of ecological goods and services used in EVRI was developed prior to currently adopted taxonomies. There is now an opportunity window to redesign the interface, improve the website features and to update the classification system with criteria that are more relevant for benefit transfer.

This session will start with a short presentation of the current state of the EVRI database and some challenges associated with the re-vamp, then followed by a discussion will be initiated to seek environmental valuation experts’ broad feedback on the website, the features that should be prioritized for improvement during the re-vamp, and EVRI’s role vis-a-vis other database initiatives/valuation models. We also welcome practical guidance for tackling key challenges, namely the reclassification of the database’s massive amount of information to an updated taxonomy, as well as how to reformat information to make it useful for benefit transfer (with needs for precise, contextualized information) and for the creation of meta-analysis (with needs for succinct, synthesized information).

Note: Participants residing in EVRI Club member countries (United States, Canada, Mexico, United Kingdom, France, Australia, New Zealand) are invited to create a user account online (www.evri.ca) in advance of the session, in order to access the database and provide recommendations. Participants from countries not listed above are invited to contact us (evri@ec.gc.ca) for temporary website access.

Title: The Effect of a Specific Stated Preference Survey Response Strategy on Welfare Estimates

Authors: Matthew G. Interis* and Daniel R. Petrolia, Department of Agricultural Economics, Mississippi State University

W-3133 Objective: 2

Abstract: A common strategy in elections with a plurality winner is that a voter chooses his more preferred of the two most likely winners, even if neither is his unconditional favorite candidate. In stated preference valuation surveys, respondents often face similar incentives – they are asked to choose their favorite among competing, mutually-exclusive alternatives (e.g. favorite public restoration program) under the assumption that the alternative most people choose is most likely to be implemented. Because respondents face incentives similar to those in a plurality-winner election, they might also adopt similar strategies. In particular, they may choose their more preferred of the two alternatives they believe to be most likely to win, regardless of their unconditional favorite alternative.

In this paper, we simulate the effect of respondents' adopting this particular strategy on willingness to pay estimates. Existing political science literature on voting in elections shows that 2-17% of voters behave this way. We simulate over this range on a data set of stated preferences for habitat restoration along the Gulf of Mexico coast. Each respondent was asked to choose his most-preferred among three competing restoration programs (i.e. a choice experiment). One important variable we collected is the respondents' perceptions of the alternative that is most likely to lose.

We perform the simulations over two assumptions on the draws. The default assumption is that each respondent has an equal (2-17%) chance of being selected to have been a strategic voter. One of the other two alternatives (i.e. of those *not* chosen) is randomly selected to be each randomly selected strategic voter's actual most-preferred alternative. Counterfactual willingness to pay values and distributions are then re-estimated for each simulation. The alternative assumption is that respondents who actually chose the alternative they believed to be the likely loser are not strategic voters and are therefore not included in the pool of candidate strategic voters.

As far as we know, this is the first paper to examine this particular type of strategic behavior in choice experiments. Other literature has examined, for example, strategic responses when the hypothetical incentives of a stated preference survey do not align with reality, or strategic responses caused by the presence of more than one choice question. The strategy we analyze is simple and common in political science literature so it is surprising it has not yet been examined in environmental valuation literature.

Title: Is Mixed Logit the Silver Bullet for Recreation Demand Models?

Authors: Ashley S. Barfield*, Greg Colson, and J. Scott Shonkwiler; Department of Agricultural and Applied Economics, University of Georgia

W-3133 Objective: 2

Abstract: This study compares the multinomial probit [MNP] model to its popular and natural competitor, the mixed logit [MXL] model, in the context of recreational site choice data. We assess the models' relative performances by applying them to a common dataset – the Mid-Atlantic beach visitation dataset gathered and examined by George R. Parsons and D. Matthew Massey. Both the MNP and MXL approaches provide advantages over traditional multinomial logit [MNL] and nested logit models.

The MNP and MXL models are equipped to deal with these challenges while also remaining unbound by the IIA axiom. Compared to standard MNL and nested logit models, MNP and MXL models are more flexible and their respective simulation methods are capable of handling a wider variety of datasets. By comparing the MNP and MXL models, we explore the extent to which MXL specifications capture correlations in utilities for different alternatives. This correlation is necessarily accounted for in MNP models when the error term covariance matrix is constructed,

normalized, and specified using the Cholesky decomposition method. If the MXL model captures the majority of these correlations, its results should be quite similar to those of the MNP model. If our results indicate that the models provide significantly different pictures of these correlations, we may confront the claim that MXL models can approximate *any* random utility model (including a probit) and discuss the merit of increasing MNP models' prevalence in the non-market valuation literature.

Title: Demand for Urban Tree Cover in California: Comparison of Spatial Hedonic Model and Instrument Variable Method

Authors: Yingdan Mei, Ohio State University; Brent Sohngen, Ohio State University; and Diane Hite*, Auburn University

W-3133 Objective: 2

Abstract: There has been much concern in California and elsewhere that as development occurs, trees are removed from development sites, and carbon is lost. An earlier study (Pearson et al. 2011) suggests that up to 15,904 acres per year are deforested in the development process in California. The loss of tree cover could have important consequences for home value as trees not only provide aesthetic benefits to residents but also generating the ecological benefits of improving the local air quality, as well as bringing the economic benefits arising from energy saving. However, since most of the benefits do not have a market price, it is difficult to calculate these benefits, even welfare changes.

For this study, we develop a two-stage hedonic price model and utilize a series of specifications to assess the influence of urban trees on house values and then estimate the demand for urban trees in California. The hedonic price method, established by Rosen (1974), proposes that houses are bundled goods, with the total house value being determined by implicit expenditures for various characteristics. The first stage hedonic price model is used to derive marginal implicit prices for attributes of interest (e.g. Garrod and Willis, 1992; Powe et al., 1995; Tyrvaainen and Miettinen, 2000; Kong et al., 2007; Netusil et al., 2010; Sander et al., 2010); the second stage instrumented marginal implicit prices to estimate the demand curve and to implement welfare analysis. In this research, we calculate the tree cover for each parcel using a program called eCognition, which is superior to the traditional RS methods because it can separate lawns from trees. Then we match the parcel data, tree cover data, socioeconomic data, and other relevant data files together to form the final dataset.

In our study of the first stage model to estimate the benefits of urban trees, one of the most troublesome identification issues is associated with the spatial spillovers. More specifically, the price of house i is likely to be influenced by neighboring house prices, and neighboring house prices may be correlated with the percentage of tree cover in the i^{th} parcel. If the neighboring house price has been omitted, the percentage of tree cover in this parcel tends to be highly correlated with the error term (the neighboring house price falls into the errors), thus resulting in an endogeneity problem, which causes biased the estimation results. In other words, there might be a feedback effect between house price and the percentage of tree cover. Higher tree cover would

lead to a higher house price and a higher house price may result in more tree cover within each parcel. Under these circumstances, the percentage of tree cover within each parcel is associated with the unobservables that contribute to the house price. Failure to diagnose and correct such spatial autocorrelation may lead to the inefficient estimated coefficients and even a failure of consistency. This paper tests spatial dependence using the Lagrange-Multiplier Robust tests and finds significant spatial correlations in house prices for each of five California counties. Our identification strategy relies on flexibly controlling for unobserved spatial effects by using the Spatial Lag Model (SAR) and instrument variable (IV) techniques to get consistent estimates of urban tree cover. The SAR model solves the problem by establishing the spatial weight matrix to incorporate the neighboring house price while the IV method is to find the exogenous variation of urban tree cover. Soil permeability and available water capacity have been shown to be a strong predictor of the percentage of tree cover and valid instruments. We also carry out a series of robust check for the validity of the IVs.

In the second stage demand estimation, the main problem is identification of demand parameters. Since the same information is used for the two stages, demand cannot be identified from the hedonic alone. We use market segmentation to identify the demand parameters by collecting data from five geographic markets, assuming that residents in each market share common cost and preference structures. In our study, market segments consist of the five counties in California: Sonoma, Napa, Shasta, Placer, Los Angeles. To address price endogeneity, we instrument the implicit prices to estimate the demand for urban tree cover. We first estimate the implicit price of urban tree cover for each county and obtain the five different coefficients for the relationship between urban tree cover and house price. Then we calculate the implicit price for each observation and get the instrumented implicit price. Finally, the data is pooled to estimate the demand curve. This paper makes three contributions to the literature. Firstly, this study is the first one to estimate the demand curve of urban tree covers in California. Most of previous studies only focus on the first stage marginal price estimation. Estimation of the demand curve for urban tree cover is significant because it is necessary to measure the benefits of nonmarginal changes in urban tree cover. Second, we show that although urban tree cover has a significant positive effect on house prices for most counties, which is consistent with the previous literature, there is still a negative relationship between tree cover and house prices in Shasta. The negative result indicates that the undeveloped, rural nature of the county results in sufficient tree cover in Shasta, so increasing tree cover would bring local residents negative effects, such as reduced development. Finally, we make a methodological contribution by comparing the spatial lag model with the instrument variable techniques to address the issue of omitted variable bias.

Title: Producer Preferences for Contracts on a Risky Bioenergy Crop

Authors: Kwabena Krah*, Daniel Petrolia, Keith Coble, and Angelica Williams; Department of Agricultural Economics, Mississippi State University

W-3133 Objective: 2

Abstract: This study employs a stated choice experiment survey to identify producer preferences for contracts to produce Giant Miscanthus. Preliminary results indicate that price offered per ton

of harvested Miscanthus, yield insurance availability, and biorefinery harvest have significant positive effects on the probability of a producer accepting a contract to produce Giant Miscanthus. The results show that risk-neutral farmers are more willing to accept contracts relative to risk-loving farmers, *ceteris paribus*. Farmers who perceive yield risk of Miscanthus to be greater than their current crop are less likely to accept Giant Miscanthus contracts.

Title: Using Stated-preferences to Estimate Demand for Undersupplied Goods and Services in Developing Countries

Authors: Dale Manning*, Department of Agricultural and Resource Economics, Colorado State University; John Loomis, Department of Agricultural and Resource Economics, Colorado State University

W-3133 Objective: 2

Abstract: Many remote areas of the developing world lack access to goods and services that could improve economic livelihoods. High costs of servicing remote rural areas often deny households the opportunity to reveal preferences in the market for goods and services such as water, electricity, and even consumer electronics. Therefore, governments and potential investors cannot use revealed preference techniques to estimate demand. In this paper, we use stated preference methods to estimate demand for electricity in remote villages of rural Rwanda. We combine responses to contingent behavior and valuation questions to quantify the demand for electricity across two villages. Our estimation strategy allows for the separation of total benefit into consumer surplus and electricity bill revenues. This provides information for governments and investors interested in meeting unmet demand for electricity.

Preliminary results indicate differences in WTP across villages and benefit estimation strategies. Contingent valuation for a fixed amount of electricity per month provides a lower WTP estimate than contingent behavior that provides more flexibility in the timing of use, not a totally unexpected result given that consumers value flexibility in choosing the quantity of electricity consumed.

The data for this analysis come from a household survey carried out in summer 2014 in two rural Rwandan villages. The villages are part of a project to bring micro-grid electricity to remote areas and project engineers require an electricity demand projection for an area that has no direct access to electricity. Despite a lack of electricity in the villages, frequent interaction with electrified areas means that households are familiar with potential uses of electricity. In fact, the villages have, on average, more than one cellphone per household. This familiarity means that households can provide informed responses to stated preference survey questions.

After pre-testing various WTP elicitation methods, it was determined that households could provide a WTP range using a payment card approach. Thus, households were asked to indicate a range for the maximum WTP for 4 hours of electricity per day for a month. Interval regression (Cameron and Huppert 1989) is used to estimate household WTP for electricity as a function of household characteristics and current energy use. Next, a contingent behavior question asked households how many hours of electricity they would use per day at a range of prices. The

integral of demand curves constructed from the CB question is matched to the total CV WTP for 4 hours of electricity.

Both estimation techniques indicate a WTP for electricity that exceeds realistic costs of supplying electricity to remote areas. The two villages in the study differ significantly, pointing to the danger in using benefit transfer from one region to another. The results here demonstrate clear benefits from expanding electricity access to remote rural villages. Furthermore, many villages likely have a WTP for electricity that would provide positive returns to private investment in electricity infrastructure.

Title: Using the Expected Damage Function Approach to Value Wetlands Ecosystem Services on the Gulf Coast

Authors: J. Luke Boutwell*, John V. Westra; Department of Agricultural Economics, Louisiana State University

W-3133 Objective: 2

Abstract: Coastal communities along the gulf coast are annually threatened by coastal storms. Population growth, land-use change and potentially changing storm regimes are likely to increase coastal vulnerability to these events. Increasingly, coastal management entities are managing land resources to reduce the economic impact of natural disasters. This is true in areas where coastal storms are regular events and land loss is increasing coastal vulnerability. The Louisiana Coastal Master Plan allocates billions of dollars to coastal restoration projects, many of which are intended to mitigate economic damages from tropical storms and hurricanes. Despite this significant proposed investment, the risk reduction value of these projects has not been analyzed, and the wisdom of using wetlands as storm buffers has been questioned. This analysis uses model simulation data and hurricane impact data to estimate the parish (county)-level impacts of hurricanes along the US Gulf Coast. Using this information, a damage model is estimated that describes economic damages as a function of population, wetland protection and storm intensity. The results describe the value of wetlands in various contexts and can be used to estimate how wetland loss, population growth and climate change may influence a region's vulnerability to economic damage resulting from coastal storms. This approach is referred to as the expected damage function (EDF) approach and is promising for improving the value estimates for ecosystems that mitigate damages from natural disasters.

Title: Revisiting Determinants of Hypothetical Bias: An Up-To-Date Meta-Analysis

Authors: Jerrod Penn* and Wuyang Hu, Department of Agricultural Economics, University of Kentucky

W-3133 Objective: 2

Abstract: The presence of hypothetical bias (HB), when hypothetical willingness to pay from stated preference approaches exceeds “real willingness to pay” from actual or binding valuations, has garnered frequent attention in environmental economics and related literature. In response, theories to explain and tools to mitigate HB have grown, including some meta-analyses. The last meta-analysis to examine the *magnitude* of HB across studies is Murphy et al. (2005), which had 83 observations based on 28 studies, whose most recent article was published in 2003 and includes very few observations that used choice experiments. A more recent analysis by Little, Broadbent & Berrens (2012) used an indicator for the presence of hypothetical bias includes 225 observations based on 96 studies, but inherently ignores the cardinal value of HB in their analysis.

This study conducts an updated meta-analysis using a dataset much larger than previous meta-analyses, including recent works, and a more elaborate model to test potential determinants of HB. We augment the dataset by employing a Turnbull lowerbound estimate of WTP, a previously overlooked tactic, to include an additional 27 studies not in Murphy et al (2005). At present, there are 768 observations based on 108 studies included in the analysis, which includes most, if not all, studies from previous meta-analyses. Results corroborate previous findings for some variables and differ with others. New variables such as the use of respondent endowments and elicitation mechanism also significantly contributed to the magnitude of HB. These results help further explain HB’s presence and its potential amelioration in future studies.

Title: Recreational Activity Choices with a Limited Consideration Set

Author: Brian Vander Naald, School of Arts and Sciences, University of Alaska Southeast

W-3133 Objectives: 2, 3

Abstract: There exists a body of literature concerned with the deleterious effects of researcher-chosen exogenous consideration sets on WTP estimates in stated preference studies [Parsons et. al. (2000); Von Haefen (2008); DeShazo, et. al. (2009)]. Summers in Juneau, Alaska contain a natural experiment that potentially avoids the problem of exogenously chosen consideration sets altogether. The nearly 1,000,000 cruise-ship passengers who visit Juneau each summer are constrained in three ways that are typically at least partially unobservable to researchers: by time, the number of activities available to them, and the distance they can travel to engage in those activities. In choosing to consume an Alaskan cruise, passengers implicitly define their own recreational consideration sets to what is available in ports of call. I exploit this natural feature of Juneau's tourism industry and use a survey of cruise ship passengers to estimate the recreational value of two particularly interesting ecosystem services: whales and glaciers.

Using a simple survey instrument, respondents were shown an exhaustive list of recreational opportunities, and their associated prices, in the Juneau port of call. They were asked to rank the opportunities given the set of prices. Prices for each opportunity were then changed, and respondents were asked to re-rank their preferred opportunities after the price changes. Information on basic sociodemographics, as well as hometown and the number of people in the respondent's party was also collected. Preliminary results from pretest data show that of

respondents with complete rankings, those with more time in port are more sensitive to price changes, *ceteris paribus*.

Title: Second-best multi-site user intercept study design versus benefit transfer in the southern Lake Michigan recreational fishery

Authors: Ben Gramig, Dept. of Ag Economics, Purdue University; Mitchell Zischke, Dept. of Forestry and Natural Resources, Purdue University

W-3133 objectives: 2, 3

Abstract: The Indiana Department of Natural Resources and the Illinois Natural History Survey have been conducting annual creel surveys using stratified random sampling designs at shoreline and boat launch locations on Lake Michigan and at public access points to the lake's tributaries for more than a decade. These annual surveys have been focused primarily on catch (species, size, etc), catch rate and fishing effort, without collecting any angler socio-economic information. The talk will offer two proposed alternatives to estimating the value of the southern Lake Michigan recreational fishery: (1) piggy-backing limited socio-economic questions onto ongoing creel surveys to enable a second-best valuation based on a multi-site user intercept survey; (2) using additional socio-economic questions to conduct a benefit function transfer based on a prior study in the Great Lakes region. Sampling and econometric considerations will be raised, and help clarifying the opportunity to make a methodological contribution will be solicited from participants.

Title: Estimating the Value of Biodiversity for Ecosystem Services: Biological Pest Control in Agriculture

Authors: Deborah K. Letourneau, University of California Santa Cruz; Amy W. Ando*, Dept. of Agricultural and Consumer Economics, University of Illinois Urbana-Champaign; Julie Jedlicka, University of California Berkeley; Anita Narwani, Swiss Federal Institute of Aquatic Science and Technology; Edward Barbier, University of Wyoming

W-3133 Objectives: 2, 3

Abstract: Recent meta-analyses indicate that an increase in the number of natural enemy species raises the overall effectiveness of biological control of insect pests in agricultural settings. Understanding the value of an increase or loss of natural enemy species for biological control services, however, requires studies that quantify the effects of such changes in enemy species richness on crop yield and/or insecticide inputs. We use experimental results reported in the ecological literature to develop a model and methodology for estimating the economic value of changes in natural enemy richness or functional diversity for biological pest control and demonstrate the use of that model on two sample crops. This case illustrates that a reduction in natural enemy species richness can have large negative effects on consumer and producer well-being in crop markets, but those effects depend on complex trophic interactions, not just the total

number of enemy species (or even functional groups) that are present. We conclude by discussing the additional data and research that are needed in order to make economic valuation of ecosystem services in agricultural settings more feasible, rigorous, and realistic in the future.

Title: *Matched-pair* and *matched-hat* approaches to evaluate personal discount rates

Authors: LeRoy Hansen and Daniel Hellerstein; USDA Economic Research Service

W-3133 Objective: 3

Abstract: This analysis tests the hypothesis that agricultural land owners' time preference for money, or personal discount rate (PDR), that is greater than a market rate of 4 percent. Lacking ideal data, we use data from two reasonable-similar USDA programs—the Conservation Reserve Program (CRP) and the Wetland Reserve Program (WRP). Both pay farmers to retire cropland and restore converted and farmed wetlands. The WRP currently has about 2.5 million while the CRP has about 2.2 million wetland-related acres. The programs' most notable differences are the payment schedules and contract lengths. Most WRP contracts are permanent while CRP contracts are for 10-15. The WRP offers a single, upfront payment. The CRP offers annual payments.

We devised two methods that allow contract comparisons. Our *matched-pair* approach attempts to match similar CRP and WRP contracts—similar contracts are about the same size, in close proximity (hence are likely to lie on similar types of lands), and were accepted into the programs on about the same year. The pairs are proxies for observations on individuals' selections of alternative contract offers. The concept is that each pair represents the landowner's (hypothetical) options to enroll a given field.

The *matched-hat* method generates models that predict WRP and CRP payments (the y-hats) by county, for given-sized contracts. The pairs are proxies for program payment alternatives individuals within the county are likely to see. The concept is that we are observing average payments made for CRP and WRP contracts on similar lands.

To allow comparisons between annual and upfront payments, we assume that landowners are interested in maximizing the net present value (NPV) of rental income from a parcel of land:

$$NPV = \sum_{t=0}^T (R_t - C_t) \exp(-d \times t)$$

where

T = time horizon (total length of time to discount over)

R_t = revenue (e.g., rental payment) earned in year t

C_t = costs in year t

d = net discount rate = 1 - PDR. Thus, a PDR of 4% yields d=0.96

In the matched pair analysis, we set the CRP PDR (which is unknown) equal to the WRP's and solved for *d*. Based on median values of the NPV's, we found that (across all pairs) the PDR was around 14%.

In the matched hat analysis, we estimated cost functions that generated county-level estimates of NPV for both programs, assuming $d=4\%$ in computing the CRP NPV. We test the hypothesis that WRP NPV (\hat{Y}_{WRP}) equals CRP NPV (\hat{Y}_{CRP}), by county following the conditions applied when testing sample means:

$$\frac{\hat{Y}_{WRP} - \hat{Y}_{CRP}}{\sqrt{(s_{WRP}^2/n_{WRP} + s_{CRP}^2/n_{CRP})}}$$

where s_p and n_p are the standard error and observations of the estimated \hat{Y} 's.

We reject the hypothesis across most of the 1,400 counties in this analysis, which suggests that upfront incentive payments are more cost-effective than annual. In a second step, we estimated the value of d that would minimize the difference between \hat{Y}_{WRP} and \hat{Y}_{CRP} . Results suggest that the PRD is less than 18 percent, but analysis of the possible size of the PDR continues.