**Publications**

**Objective 1: Evaluate Natural Resource Management Decisions and the Effects of Climate Change to Understand Associated Welfare Impacts**

1. Mulungu, Kelvin, Dale T. Manning, and Martina Bozzola (2025). Once Bitten, Twice Shy? Direct and Indirect Effects of Weather Shocks on Fertilizer and Improved Seed Use. Food Policy.
2. Sloggy, Matthew, Dale T. Manning, Chris Goemans, and Roger Claassen (2025). Insurance and Extraction Incentives in a Common Pool Resource: Evidence from Groundwater Use in the High Plains. Journal of Environmental Economics and Management.
3. Mulungu, Kelvin, Dale T. Manning, Chiza Kumwenda, Lukonde Mwelwa, and Lackson Mudenda (2025). Farm Production, Marketing, and Children’s Nutritional Outcomes in Rural Zambia. Agricultural Economics.
4. Manning, Dale T. and Ed Barbier (2025). Natural capital and aggregate income growth. Environment and Development Economics."
5. Marcillo, E., K.A. Grogan, C.D. Court, and O.M. Savchenko. Environmental Risks and the Profitability of Florida’s Hard Clam Aquaculture Industry. Accepted for publication in Aquaculture Economics and Management"
6. Atallah, Shady S. “Spatial bioinvasion externalities with heterogeneous landowner preferences.” Land Economics (vol. 101, no. 2).
7. Backstrom, Jesse D. and Richard T. Woodward. 2024. “The Nature of Discrimination in Recreation Decision Making” American Journal of Agricultural Economics (forthcoming. October, 2024); Article DOI: 10.1111/AJAE.12545
8. Bergtold, J.S., M.M. Caldas, A. Joslin and M. Gharib. 2024. Wildfire across agricultural landscapes: farmer and rancher experiences and perceptions in the Southern Great Plains. Environmental Hazards 4: https://doi.org/10.1080/17477891.2024.2304201
9. Blevins, S., K. Hansen, G. Paige, A. MacKinnon, and C. Bastian. “Economic Evaluation of Water Management Alternatives in the Upper Green River Basin of Wyoming,” Water. 16,12(2024): Article 1685. pp. 1-16. https://doi.org/10.3390/W16121685
10. Liu, Yiqing, "Three Essays on the Nonmarket Valuation of Air Pollution and Extreme Weather: Implications for Outdoor Recreation, Ph.D. Dissertation under the supervision of Roger H. von Haefen, Department of Agricultural and Resource Economics, NC State University, October, 2024.
11. Dugstad, Anders, Alemarie Ceria, Mia Comeros, and Kirsten LL Oleson. ""Exploring the influence of activity participation on the economic value of nature-based recreation in the Sierra Nevada."" Journal of Environmental Management 360 (2024): 121081.
12. Gazal, K., J.J. Hwang, and B. Eastman. 2024. “West Virginia Forest Landowners’ Preferences for Forest Carbon Offset Programs.” Trees, Forests and People. DOI: https://doi.org/10.1016/j.tfp.2024.100683.
13. "H. Spencer Banzhaf, Yaqin Liu, Martin Smith, and Frank Asche, “Nonparametric Tests of the Tragedy of the Commons,” Journal of Economic Behavior and Organization 224, 2024, pp. 521-36.
14. H. Spencer Banzhaf and Yaqin Liu, “Non-Parametric Tests of Output- and Cost-Sharing Games,” Economics Letters 247, 2025, (with Y. Liu)."
15. Hashida, Yukiko & Lewis, David J. & Cummins, Karen, 2025. "Prescribed fires as a climate change adaptation tool," Journal of Environmental Economics and Management, Elsevier, vol. 130(C).
16. Hashida, Yukiko and Steven J. Dundas. 2024. Barriers to coastal managed retreat: Evidence from New Jersey's Blue Acres Program. Marine Resource Economics 39 (3): 179 – 205. doi: 10.1086/729868
17. Lowe Mackenzie, Ashley C., Steven J. Dundas and Bo Zhao. 2024. The Instagram effect: Is social media influencing visitation to public land? Land Economics 100 (2): 256 – 277. doi: 10.3368/le.100.2.122920-0192R1
18. Rupp, David E., Steven J. Dundas, Laura Mazaud, and Suzanne de Szoeke. 2024. How tourists ‘escaping the heat’ may drive future increases in municipal water demand in Oregon coastal communities. Discover Water 4: article 72. doi: 10.1007/s43832-024-00133-6
19. Hill, Alexandra E., Jesse Burkhardt, Jude Bayham, Katelyn O'Dell, Bonne Ford, Emily V. Fischer, and Jeffrey R. Pierce. ""Air pollution, weather, and agricultural worker productivity."" American Journal of Agricultural Economics 106, no. 4 (2024): 1329-1353.
20. Corwin, Kimberley A., Jesse Burkhardt, Chelsea A. Corr, Paul W. Stackhouse Jr, Amit Munshi, and Emily V. Fischer. ""Solar energy resource availability under extreme and historical wildfire smoke conditions."" Nature Communications 16, no. 1 (2025): 245."
21. Hulugh, V.,G Redmore, L., & Zavaleta Cheek, J. Assessing conservation planning in South Dakota: Challenges and opportunities in collaboration, public participation, and climate information. (Abstract Accepted at Park Stewardship Forum)
22. Zavaleta Cheek, J., B. den Braber, P.E. Corbett, N.J. Lambrecht, E.C. Vansant, A. Agrawal, M. Brandt, and L.V. Rasmussen. Trees buffer the short-term effects of heavy rainfall shocks on household food insecurity. (In review Proceeding of the National Academy of Sciences)
23. Jungers, B., Abbott, J. K., Bair, L. S. 2024. Casting Away Invaders: Unpacking Anglers’ Willingness to Accept Compensation for Harvesting Invasive Species. Agricultural & Applied Economics Association Annual Meeting, New Orleans, LA. July 30, 2024.
24. Petrolia, D.R. and J. Haner. “What is the Value of Ecosystem Services Provided by Recent Restoration Efforts on the Northern Gulf Coast?” Bays & Bayous 2024 Symposium, Biloxi, MS, November 19-20, 2024."
25. Keller, J. C., Harrison, B., & Lang, C. (2024). Land for Whom? Diversity, Land Trusts, and Farmers and Gardeners from Marginalized Backgrounds in New England, US. Society & Natural Resources, 37(10), 1435-1451.
26. Levesque, V. R., Bell, K. P., & E.S. Johnson. 2024. The role of municipal digital services in advancing rural resilience. Government Information Quarterly, 41(1), 101883. https://doi.org/10.1016/j.giq.2023.101883
27. Gabe, T. and K.P. Bell .2024.. Economic Contribution of Outdoor Recreation in Maine. Technical report prepared to inform Maine’s Outdoor Recreation Economy Roadmap, June 2024.
28. Gabe, T. and K.P. Bell. 2024. Outdoor Recreation in Maine: Recent Trends and Future Opportunities. Technical report prepared to inform Maine’s Outdoor Recreation Economy Roadmap, July 2024.
29. Noblet, C.L., Bell, K.P., Cotton, B., and V. Levesque. 2024. Assessing Maine's Coastal Public Boat Launch and Waterfront Facility Sites. Technical report prepared in collaboration with K. Leyden and M. Britsch of the Maine Coastal Program, Maine Department of Marine Resources, June 2024.
30. Lynne Lewis, Leslie Richardson and Jennifer Raynor. “The Nature of the Beast: Wildlife Valuation from the Iconic to the Ordinary” with Leslie Richardson and Jennifer Raynor. Volume 16:167-186. Annual Review of Resource Economics (ARRE) October 2024.
31. Tietenberg, Tom and Lynne Lewis. Natural Resource Economics: The Essentials, 2nd Ed.Routledge, Taylor and Francis Group, September 2024
32. "McNamara, D.E., Smith, M.D., Williams, Z., Gopalakrishnan, S., and Landry, C.E., ‘Policy and Market Forces Delay Inevitable Real Estate Price Declines on the US Coast’, 2024, Nature Communications, 15, 2209 https://doi.org/10.1038/s41467-024-46548-6.
33. Li, Xiaoyu, Gopalakrishnan, S., and Klaiber, H.A., “Local Adaptation and Unintended Coastal Vulnerability: The Effect of Beach Nourishment on Residential Development in North Carolina, 2024, Journal of the Association of Environmental and Resource Economists, Vol 11, Issue No. 3
34. Miteva, D.A., Cheng, Y., Miller, A., Gopalakrishnan, S., ‘The Value of Forests in Reducing Malaria Mortality in India’, Accepted, Environment and Development Economics.
35. Liu, B., Roopsind, A. and Sohngen, B., 2024. Overlapping extractive land use rights increases deforestation and forest degradation in managed natural production forests. World Development, 174, p.106441.
36. Pradhananga, A., D. Pennington, D. Miteva, S. Cheng (2024). “Farmer Perspectives about the Minnesota Agricultural Water Quality Certification Program”. Report to the Minnesota Agricultural Water Quality Certification Program.
37. Warner, Cody, Duncan Callaway, and Meredith Fowlie, “Risk-Cost Tradeoffs in Power Sector Wildfire Prevention” (February 2024). Energy Institute WP-347
38. Fowlie, Meredith. “Fighting Fires in the Power Sector” Energy Institute Blog, UC Berkeley, February 20, 2024, https://energyathaas.wordpress.com/2024/02/20/fighting-fires-in-the-power-sector/
39. Callaway, Duncan, Fowlie, Meredith, and Warner, Cody. “Your Electricity Bill on (Wild)Fire” Energy Institute Blog, August 26, 2024, https://energyathaas.wordpress.com/2024/08/26/your-electricity-bill-on-wildfire/
40. Boomhower, Judson and Fowlie, Meredith and Gellman, Jacob and Plantinga, Andrew, ""How Are Insurance Markets Adapting to Climate Change? Risk Classification and Pricing in the Market for Homeowners Insurance"" (June 2024) NBER Working Paper 32625.
41. "Wang, Y., and D.J. Lewis. 2024. Wildfire and climate change have lowered the economic value of western US forests by altering risk expectations. Journal of Environmental Economics and Management, 123: 102894. https://doi.org/10.1016/j.jeem.2023.102894.
42. Johnson, K.K., and D.J. Lewis. 2024. Weather variability risks slow climate adaptation: An empirical analysis of forestry. Journal of Environmental Economics and Management. 125: 103000. https://doi.org/10.1016/j.jeem.2024.103000."

**Objective 2: Advance Economic Valuation Methods and Uses to Enhance Natural Resource Management, Policy, and Decision-Making**

1. Ahmadiani, Mona, and Richard T Woodward. 2025. “Fishing for Anglers in a Sea of Data: Using Mobility Data to Identify and Track Recreational Fishing in the Gulf of Mexico.” Texas A&M University. https://dx.doi.org/10.2139/ssrn.5029674.
2. Dong, L., Lang, C., & Parent, J. (2024). Focusing the view: Improved methods for assessing viewshed impacts of onshore wind turbines. Journal of Environmental Economics and Management, 128, 103068.
3. H. Spencer Banzhaf and Lala Ma, “Environmental Justice.” In The Elsevier Encyclopedia of Resource, Energy, and Environ-mental Economics, ed. by M. Khanna, 2024, https://doi.org/10.1016/B978-0-323-91013-2.00045-9).
4. Hwang, J. and D.R. Petrolia. 2025. “Revisiting Opt-Out Responses and Consequentiality in Contingent Valuation.” Journal of Agricultural & Resource Economics 50(1): 162-78.
5. Hwang, J.J. 2024. “Subjective Perceptions about Benefit and Cost Levels in Contingent Valuation.” Agricultural and Resource Economics Review. DOI: https://doi.org/10.1017/age.2024.8.
6. Lang, C., Wichman, C. J., Weir, M. J., & Pearson‐Merkowitz, S. (2025). Cost misperception and voting for public goods. American Journal of Agricultural Economics, 107(2), 558-582.
7. Li, L., & Livy, M. R. (2025). Who values urban open spaces? investigating heterogeneity in the capitalization of open space in New York City. Landscape and Urban Planning, 255, 105259.
8. Li, L., & Long, D. (2024). Who values urban community gardens and how much?. Food Policy, 126, 102649.
9. Lynne Lewis, Leslie Richardson and John Whitehead. “Fat Tails and WTP: Kristrom revisited,” Land Economics. November 2024.
10. Morawetz, UB, Klaiber, HA, and Zhao\*, H. “The Impact of Traffic Noise on the Capitalization of Public Walking Area: A Hedonic Analysis of Vienna, Austria.” JOURNAL OF ENVIRONMENTAL MANAGEMENT. Vol 353: 120060. 2024.
11. Morawetz, UB. and Klaiber, HA. “Rent Control and Neighborhood Income. Evidence from Vienna, Austria.” ECONOMIC ANALYSIS AND POLICY. Vol 84: 145-158.
12. Penn J, Hu W, and T Ye. 2024. “Efficacy of Hypothetical Bias Mitigation Techniques: A Cross-Country Comparison. Journal of Environmental Economics and Management. 125: 102989.
13. Petrolia, D.R., F. Enyetornye, Z. Chen, and S. Yun. 2025. “The Value of Oyster Reef Restoration.” Marine Resource Economics 40(1): 45-64.
14. Petrolia, D.R., S. Yun, F. Enyetornye, and Z. Chen. “Valuation of oyster reef restoration.” Bays & Bayous 2024 Symposium, Biloxi, MS, November 19-20, 2024."
15. Quainoo, R., Howard, G., Gaur, V., & Lang, C. (2024). Model choice and framing effects: Do discrete choice modeling decisions affect loss aversion estimates?. Journal of choice modelling, 53, 100524.
16. Savchenko, O., R. Botta, R. Koeneke, J. Hilsenroth, K.A. Grogan, H. Harris, and C.D. Court. 2025. Valuing Coastal Fisheries and Seagrasses: A Case Study of Estuarine Resources on Florida’s Nature Coast. Ecological Economics, 230:108517.
17. Schap, JA, JL McGuire, AM Lawing, FK Manthi, and RA Short. 2024. Ecometric models of small mammal hypsodonty can estimate paleoprecipitation across eastern Africa. Palaeogeography, Palaeoclimatology, Palaeoecology, 643:112181. IF = 2.6. 10.1016/j.palaeo.2024.112181"
18. Siciliano-Martina, L, JL McGuire, MA Hurtado-Materon, RA Short, DA Lauer, JA Schap, J Müller, FK Manthi, JJ Head, and AM Lawing. 2024. Ecometrics demonstrates that the functional dental traits of carnivoran communities are filtered by climate. Ecology and Evolution, 14(10):e70214. IF = 2.3. 10.1002/ece3.70214

**Objective 3: Integrated Policy and Decision-Making**

1. Ahmadiani, Mona, and Richard T Woodward. 2025. “Fishing for Anglers in a Sea of Data: Using Mobility Data to Identify and Track Recreational Fishing in the Gulf of Mexico.” Texas A&M University. https://dx.doi.org/10.2139/ssrn.5029674.
2. Gharib, A.A., Arabi, M., Goemans, C., Manning, D.T. and Maas, A., 2024. Integrated water management under different water rights institutions and population patterns: Methodology and application. Water Resources Research, 60(11).
3. Hwang, J.J., J. Strager, and M. Walker. 2025. “The Economic Benefit of Spearfishing as an Impure Public Good: A Case Study of Invasive Lionfish in Florida.” Fisheries Research. DOI: https://doi.org/10.1016/j.fishres.2024.107194.
4. "Innes-Gold, Anne A., Paul Carvalho, Lisa C. McManus, Seaenna Correa-Garcia, Stacia D. Marcoux, Kirsten LL Oleson, Kaci Stokes, and Elizabeth MP Madin. ""Modeling the interactive effects of sea surface temperature, fishing effort, and spatial closures on reef fish populations."" Theoretical Ecology 17, no. 4 (2024): 289-300.
5. Perng, Lansing Y., Kirsten M. Leong, Mariska Weijerman, and Kirsten LL Oleson. ""A multi-decadal assessment of social thresholds and outcomes in marine social-ecological systems in Hawaiʻi."" Marine Policy 163 (2024): 106141."
6. Rashford, B.S., A. Nagler. 2025. Estimating Development Risk for Agricultural Lands in Wyoming. UW Extension Bulletin, University of Wyoming, In Press.
7. Steinbuks, Jevgenijs, Yongyang Cai, Jonas Jaegermeyr, and Thomas W. Hertel (2024). Assessing Effects of Climate and Technology Uncertainties in Large Natural Resource Allocation Problems. Geoscientific Model Development, 17(12), 4791–4819. https://gmd.copernicus.org/articles/17/4791/2024/
8. Li, Yang, Michael A Wulder, Zhe Zhu, Jan Verbesselt, Dainius Masiliūnas, Yanlan Liu, Gil Bohrer, Yongyang Cai, Yuyu Zhou, Zhaowei Ding, Kaiguang Zhao (2024). DRMAT: A multivariate algorithm for detecting breakpoints in multispectral time series. Remote Sensing of Environment, 315, 114402. https://doi.org/10.1016/j.rse.2024.114402
9. Youngho Kim, Erik Lichtenberg, and David A. Newburn, “Payments and Penalties in Payments for Ecosystem Services Programs, Journal of Environmental Economics and Management 126 (2024).
10. Youngho Kim, David Newburn, Erik Lichtenberg, Haoluan Wang, and Derek Wietelman, "Evaluating the Effectiveness of Economic Incentives to Enhance Riparian Buffer Adoption and Environmental Benefits for Water Quality and Carbon Sequestration", final report to the Harry R. Hughes Center for Agro-Ecology, Queenstown, Maryland, October 2024."

**2025 Annual Meeting Abstract**

**Session 1: Recreation**

**Paper Title:** Consumer surplus from 100 top federal recreation sites in the U.S. estimated using mobility data

**Presenter:** Stephen C. Newbold

**Coauthors:** Aaron J. Enriquez, Leslie Richardson, Tyler Kjorstad

**Objective:** 1 & 2

**Abstract:** The U.S. National Park Service (NPS) manages more than 400 federal recreation sites, including national parks and preserves, recreation areas, monuments, parkways, seashores, and lakeshores. However, large-scale efforts to quantify the aggregate value from top recreation sites—particularly using revealed preference data—have been limited. This is primarily due to the high cost of collecting sufficient travel cost data from a large number of visitors to many sites over extended time periods. In this study, we use mobility data from StreetLight to estimate a zonal multi-site travel cost model of the demand for visits to the top 100 most popular NPS sites. Our estimation approach uses a multi-site repeated choice framework and zonal mobility data, which record the number of visitors from every U.S. zip code to every site in our dataset for all months between 2016 and 2022. We estimate the price elasticity of demand, fixed effects for all destinations (recreation sites) and origins (zip codes or counties), and the total consumer surplus provided by all 100 sites every month. To address a unique challenge in the data—censoring of visitor origins—we developed a modified estimator. For each time period, StreetLight reports the total number of visits to every site as well as the share of visits that originated from zip codes contributing at least 0.1% of total visits. It turns out that even this apparently low censoring threshold leaves the origins of a large share of visitors to many popular sites in many months unaccounted for. For example, the origins of 50% or more of all visitors to Yellowstone National Park in peak visitation months are censored in the data. To handle this data limitation, we used a hybrid algorithm that combines contraction mapping and non-linear least-squares to estimate both latent (uncensored) and observed (censored) visits from all origins to all destinations. Our basic estimation strategy should be applicable in many settings where zonal visitation data are available, and our modified estimator could be adapted to other contexts with similar forms of data censoring. Our results are expected to provide a range of policy-relevant insights, including the aggregate value generated by the top 100 NPS recreation sites and how value estimates vary by characteristics such as site type and region. Additionally, we discuss lessons learned from using cellphone-based mobility data across a diverse array of recreation site types.

**Paper Title:** Quantifying Recreational Benefits from Fish Consumption Advisories: Insights from Cellphone Mobility Data

**Presenter:** Xibo Wan

**Coauthors:** Jiameng Zheng, Ruohao Zhang, Wendong Zhang, Yongwang Ren

**Objective**: 2

**Abstract:** Ambient water pollution at recreational sites increases visitors' pollution exposure risks and negatively impacts public health. To mitigate the damage, the federal EPA and state agencies disclose chemical contamination levels in surface water bodies to the public through fish consumption advisories. Previous studies have focused on how fish advisories affect anglers' utility, but advisories can also influence the recreational value for all visitors. To address this challenge, this paper uses cellphone mobility data and employs a revealed preference approach to estimate the recreational benefits associated with these advisories.  
To quantitatively assess the impact, we utilize a discrete choice model analyzing annual visits and travel expenses of Michigan residents to water-based parks, focusing on whether these parks are subject to fish consumption advisories. A significant challenge in our analysis is the potential endogeneity of fish consumption advisories, which could be influenced by the location and popularity of parks—factors that also affect recreational choices. We tackle this issue by employing historical upstream chemical emissions as instrumental variables, which, although less related to current location preferences, are strongly indicative of contamination levels. Previous research on estimating recreational benefits typically relies on survey data or administrative sources (such as the MRIP survey from NOAA), which are either expensive or only capture a subset of potential recreational activities. We collect data of recreational visits to water-based parks from Spectus cellphone GPS locations at census block group level. We then apply an empirical Bayes method and incorporate sample weights to account for zero trip shares and enhance data representativeness of cellphone data. To validate our approach, we use an alternative cellphone database from Advan to test the robustness of our findings and examine how differences in policies between cellphone data providers affect the results.  
Preliminary results indicate that visitors are, on average, willing to pay $9.2 to avoid water-based parks with fish consumption advisories. Furthermore, our analysis reveals that the disclosure of pollution levels through these advisories enhances visitor welfare by $2.78 per capita. We plan to expand our study to cover a broader great lake region including New York and Pennsylvania.

**Paper Title:** Estimating the welfare implications of management across the land-sea interface: A case study from Hawaiʻi

**Presenter:** Kirsten L.L. Oleson

**Coauthors:** Ashley Lowe Mackenzie; Ela Ural; Lansing Perng; Lucia Herzekova

**Objective:** Objective 3

**Abstract:** Hawaiʻi’s coastal environments are critical for the state economy and broader social welfare, yet face increasing threat from land-based pollution, development, overharvesting, and climate change. This research program focuses on building integrated ecological-economic models to guide efficient and equitable land and marine management. Specifically, we focus on estimating the ecological impacts of land-based pollution, fishing, and ocean chemistry and temperature on coral reef ecological function. These functional changes translate into consequences for both market and non-market ecosystem services, including fisheries, recreation, and tourism, as well as less-studied cultural services critical to Hawaiian sense of place and Native Hawaiian cultural practices and spirituality. The team is employing multiple valuation approaches, including stated and revealed preference methods, to estimate the welfare effects of future management and climate change scenarios. We further examine the distributional effects of these changes by evaluating social vulnerability. We are also exploring alternative valuation approaches that are better aligned with Native Hawaiian worldviews.

**Paper Title:** Gamification in Stated Preference Surveys, Measuring WTP for an Assured Water Supply Program

**Presenter:** Lee Parton

**Coauthors:** Lee Parton, Steven Dundas, Jerrod Penn, Kendra Kaiser, Christa Howarth, Sophia Borgias, Faith Sternlieb

**Objective:** 2 & 3

**Abstract:** The purpose of this early-stage project is to estimate Willingness to Pay (WTP) for an Assured Water Supply Program (AWSP) in Idaho’s Treasure Valley, home to Boise and the state’s three largest cities. Rapid urbanization throughout the Treasure Valley is impacting ground water levels, with some private wells going dry in parts of the valley. Policy options are being explored, such as requiring new developments to prove water supplies for a specified period. Utilizing a discrete choice experiment we are estimating WTP for an AWSP designed to reduce the external costs of new development on existing groundwater users. In addition to estimating WTP, we are testing the impact of low cost survey gamification interventions on respondent comprehension, WTP, attribute non-attendance.

**Session 2 Wildfire and/or Air Quality**

**Paper Title:** The Capitalization of Wildfires

**Presenter:** Emma A. Gjerdseth

**Coauthors:** Anya Nakhmurina, Jude Bayham, Eli P. Fenichel

**Objective:** 1, 2 & 3

**Abstract:** Wildfires pose significant challenges, including threats to human life and property (Milne et al. 2014; McCoy & Walsh 2018), reduced recreational opportunities (Hesseln et al. 2004), and air pollution (O'Dell et al. 2021; McCaffrey et al. 2018). Fires alter ecosystems by destroying forest canopy and vegetation, and reducing soil permeability (Warziniack & Thompson 2013), which leads to heightened vulnerability to flooding and erosion, and increased runoff during precipitation events, carrying ash, sediment, and debris downstream (Parise and Cannon 2012). In turn, degrading water quality and accelerating accumulation of sediment in reservoirs (Warziniack & Thompson 2013). Although these fires burn in the same forests that supply a large share of this country’s drinking water (Warziniack & Thompson 2013), the impact of wildfires on water treatment costs remain understudied in the economics literature (Bayham et al. 2022).   
  
What happens when the forest surrounding a watershed burns, and how do wildfires capitalize? We propose a novel way to value the damage from wildfire: tracking changes in municipal bonds issued by water treatment facilities. Bonds provide a key financing tool for governments and other institutions, allowing them to fund capital projects and ongoing operations without immediate tax increases. Instead, they can rely on a stream of revenue (e.g., taxes) to repay the principal amount alongside periodic interest payments over a fixed period to investors. Municipal bonds provide a powerful tool to quantify the dollar damage of wildfires for two reasons. First, the prices of bonds are determined by investors. This suggests all credit-risk-relevant information is reflected in bond prices, including expected increases in water treatment costs due to watershed contamination. Second, municipalities, and most water treatment facilities, routinely issue bonds, which allows us to track changes over time and makes our approach feasible.   
  
Our research design compares municipal water treatment facilities that experience a wildfire in a supplying watershed with those untouched by fires. To identify affected facilities, we overlay detailed maps of wildfire boundaries with locations of water treatment plants and the watersheds that supply them. Next, we combine these spatial data with municipal bond data at the issuer level to assess the how wildfire risk is priced in municipal bonds. We also examine municipal tax revenues and operating expenses to further understand the economic impact of wildfires. Our approach leverages bond markets as a lens to quantify and value investors’ expectations about wildfire-related risks as repayment is tied to local economic conditions. This relationship is especially clear for water facilities as bond prices reflect expectations about future revenue flows and repayment, which should include the perceived cost of wildfire risk on operating expenses.  
  
**Paper Title:** Managing Disaster Under Pressure: Estimating the Impact of Media Attention on Wildfire Suppression

**Presenter:** Cal Bryan

**Objective:** 1

**Abstract:** The sharp increase in the cost of controlling wildfires is a result of the rapid growth in severe wildfire incidents. The federal government spent over $4 billion in a single year on wildfire suppression for the first time in 2021. The federal government currently manages a stock of resources to fight these fires with constraints that are often binding. There has been a diminishing supply of wildland firefighters in recent years, despite the growth in wildfire damages and limited capital resources available. Wildfire is not just expensive; it's a highly salient natural disaster drawing the attention of the media and general public. It is important that we determine any causes of firefighting resource misallocation, particularly ones that are human-driven. In this study, I investigate whether attention from the media to wildfire influences suppression decisions.   
  
It is implausible to expect that there will only be a direct causal relationship from media attention to firefighting decisions; there is likely simultaneity where firefighting decisions affect the degree of media attention. Therefore, I use a two-stage least squares econometric approach where the occurrence of a catastrophic mass shooting instruments for the impact of media attention. I theorize that these events will cause news outlets to divert media resources away from wildfire and to coverage of the mass shooting, creating an exogenous change in the media’s attention to wildfire.   
  
I create a unique panel dataset to carry out this analysis that contains daily information on aerial suppression decisions, firefighting costs, and measures of media attention for 265 wildfires from 2017 to 2019. Information on aerial suppression decisions comes in the form of the amount of large airtanker fire retardant drops with data provided by the USFS. Data on daily firefighting costs comes from the USFS’s ICS209 reports. The data on wildfire media attention comes from GDELT and accounts for both internet and television media.   
  
My results do not suggest that media attention has any bearing on wildfire suppression decisions. I find a negative first-stage effect on the impact of a mass shooting on media attention to wildfire, supporting my theory that these events distract the media’s attention to wildfire. Then, in the second-stage, I do not find that the instrumented measures of media attention influence either the amount of aviation used to suppress wildfire or the daily firefighting costs. This is true for contemporaneous measures of these outcomes, as well as suppression decisions measured over the next several days.  
  
This research has important implications for both wildfire and the larger literature on natural resource economics. The media provides a lot of public benefit; my research does not support restricting their access to wildfire incidents for efficiency reasons, as some states have recently considered. Additionally, I provide an identification strategy that could be used to determine the effect of media on resource allocations for other types of natural disasters.

**Paper Title:** Wildfire Impacts on the Value of Safe Drinking Water: Evidence from Housing in Oregon’s Willamette Basin

**Presenter:** Steven J. Dundas

**Coauthors:** Yuhan Wang, Amila Hadziomerspahic, Beth M. Haley, Sonja H. Kolstoe

**Objective:** 1 & 3

**Abstract:** Climate change and other factors have led to a significant recent increase in the frequency and severity of wildfires in the Western U.S., posing substantial threats to human well-being, health, and the provision of ecosystem services. While the potential economic impacts of wildfires are extensive, the impacts of these fires on nonmarket watershed ecosystem services are an understudied component. Natural science research indicates that wildfires may affect water supplies by amplifying problems related to soil erosion, flooding, sedimentation, and nutrient concentrations. These issues could lead to drinking water service disruptions or costly new expenditures in water treatment facilities in affected communities. Despite these challenges, it is unclear whether housing market participants are likely to respond to wildfire risks through the lens of its impact on drinking water quality.   
  
This study disentangles and identifies the potential effect of wildfire on drinking water by leveraging the occurrence of large and unexpected wildfires in upstream watershed areas in Oregon’s Willamette Basin. The western slopes of the Cascades mountain range did not have prior post-colonial history of large wildfire events and the Labor Day windstorm in September 2020 resulted in five (5) megafires, each over 100,000 acres in size burning immediately and simultaneously. Many public water service areas saw significant portions of their source water watersheds burn severely (e.g., Eugene, Salem), while others were not impacted by this fire event (e.g., Portland). We compile comprehensive data on over 410,000 housing transactions, wildfire locations, and water quality from 2013 to 2024 across 11 counties in Oregon and Washington. By leveraging temporal and spatial variation in residential land transaction data, wildfire locations, and public water system service areas, our difference-in-difference approach estimates the average treatment effect of the upstream Labor Day 2020 wildfires on downstream residential housing markets. We take care to avoid estimating the direct effects of fire (proximity, view of burn scars) by removing areas near fire boundaries and control for water quality in surface water (e.g., turbidity, dissolved oxygen) associated with recreation services, in addition to our research design to identify the wildfire impact on drinking water. Our preliminary results suggest that wildfires have a short-lived negative impact on housing prices (-1.1% to -1.6%) in treated communities after the Labor Day fires through their effect on drinking water quality, with these impacts lasting for about 1 year before returning to baseline trends. Our findings are robust to alternative treatment definitions and fire event time windows. On-going analyses will determine if treated communities with multiple and varied water sources were more resilient to this fire event. Our results thus far suggest that individuals in the Western U.S. may be starting to recognize risks to drinking water supplies from wildfire as observed through housing values, but similar to other hazard events, the change in risk perceptions on purchasing behavior (if any) is likely short-lived.

**Paper Title:** Managed Agricultural Trade and Environmental Externalities: Evidence from U.S. Suspension Agreement

**Presenter:** Weizhe Weng

**Coauthors:** Yetian Cai, Le Wang, Zhengfei Guan

**Objective:** Objective 1

**Abstract:** Managed trade policies, which strategically control import volumes, are essential to the agricultural market and significantly impact agricultural production, food security, and economic stability. A growing body of research has documented the environmental consequences of agricultural trade in developing countries, where weak institutional capacity often enables environmental degradation. However, the environmental impacts of managed agricultural trade in developed countries remain largely unexplored. This gap is particularly notable given the theoretically ambiguous relationship between trade and environmental quality and emerging evidence of environmental challenges from agricultural practices in developed countries.  
  
We address this gap by examining the causal impacts of managed agricultural trade on environmental outcomes in the United States. While previous U.S.-focused research has explored how agricultural production affects the environment through mechanisms such as land-use changes and fertilization, our study is the first to causally link managed trade policies to environmental externalities in a developed country context. We empirically quantify the environmental pollution stemming from managed import restrictions and compare it to economic surplus impacts. Our analysis focuses on the 2014 suspension agreement between the United States and Mexico, which imposed quantity restrictions on Mexican sugar exports to the U.S. This policy presents a unique research opportunity since it represents the only exception to agricultural trade policy under the North American Free Trade Agreement (NAFTA), allowing us to explore the unintended consequences of transitioning from free trade to managed trade. We focus on agricultural fires and associated air pollution as our environmental outcomes, chosen for their direct connection to agricultural practices and their significant health impacts. These outcomes are particularly consequential for rural communities located near the source of pollution, which often have limited capacity for adaptation and avoidance.   
  
Our analysis leverages nationally comprehensive and spatially granular land use and fire information derived from advanced remote sensing data and modeling. This unique dataset allows us to link high-frequency fire information to land use parcels and identify the exact source of agricultural fires. Our data spans from 2008 to 2023, providing substantial coverage of both pre- and post-trade shock periods and allowing us to examine both immediate responses and longer-term adaptations to the policy change.  
  
Our empirical strategy addresses two key challenges in identifying the causal effects of managed trade on environmental outcomes. First, trade policies are implemented at the national level, making it difficult to establish counterfactuals. Second, sugarcane production is naturally constrained by geographic and climatic factors. We overcome these challenges by developing a spatially explicit trade exposure index that combines remote sensing data on historical sugarcane acreage with agronomic suitability measures. This approach builds on recent methodological advances in the difference-in-difference analysis and allows us to compare environmental outcomes across counties with varying degrees of trade exposure.   
  
Our analysis yields two main findings. First, we establish a causal link between managed trade policy and environmental externalities: counties most exposed to the trade policy experienced a more than threefold increase in agricultural fires relative to less exposed counties, with an additional 16 fire events per month compared to a baseline mean of 4.7 fires. Second, we document heterogeneous temporal effects that depend on historical production patterns. Counties with limited historical production show stronger long-term responses, likely due to available land for expansion, while traditionally high-production areas exhibit more immediate environmental impacts.

**Session 3 Bioeconomics and Policy**

**Paper Title:** Accounting for Climate Change and Carbon Dioxide in National Accounts

**Presenter:** Eli Fenichel

**Objective:** 3

**Abstract:** No environmental challenge gets more attention than climate change, which means there is great interest in putting climate, carbon, or both on natural asset balance sheets. Accounting for climate or carbon, which are not the same thing, raises three issues: allocating a global commons to nations, which carbon to count in case of carbon accounting, and the potential for double counting. This paper derives a “social cost of carbon” from a capital theoretic perspective. It provides new insights into the measurement of the price of adding carbon to atmosphere in order evaluate of the severity of these concerns from a theoretical perspective.   
We find that the EPA’s/ National Academy of Sciences, Engineering and Medicine (NASEM) concept of a social cost of carbon is close to the a theoretical price (marginal cost) for adding carbon to the atmosphere. This is different than the inframarginal value of storing terrestrial carbon. Furthermore, we find The EPA/ NASEM omit terms in a theoretically derived marginal value of carbon additions to the atmosphere. However, it is an open question as the magnitude of these omitted terms. Still, some of these terms may help explain some of the disputes around concepts like productivity effects.  
We find that here is not theoretical concern about double counting with respect to include carbon in asset accounts. However, if estimates of the accounting price of climate, carbon, or other assets is subject to omitted variables bias, then double counting could be an issue. Given the econometric scrutiny that climate estimates have attracted, the omitted variables bias concern is not greater than for other imputed asset values, which have often received less econometric scrutiny.   
Second, we show that ideally only carbon moved between the atmosphere and terrestrial (or marine) systems would be counted. However, including fixed carbon would not affect measures of change-in-wealth if care is taken with unit conversions and price indices. However, including fixed carbon would lead to erroneous measure of levels of wealth, though this may be like how structures are treated in national accounts.   
The issue of allocating carbon to countries is non-trivial and does not appear to have a ready-made solution. Climate accounts could be kept at a global level. This works because all countries experience their own climate, and country specific damages could be used. However, climate is exogenous to the policy decisions of most countries. Therefore, it is not clear what kind of asset climate is. Going from a global accounting to a national accounting appears to be the greatest barrier to including climate or carbon on balance sheets.

**Paper Title:** The Fiscal Role of Biodiversity and Pathways for Conservation Finance

**Presenter:** Dale Manning

**Coauthors:** Eli P. Fenichel, Amy Ando, Anya Nakhmurina

**Objective:** 2

**Abstract:** There is burgeoning interest in ‘biodiversity and conservation finance.’ To finance conservation, there must be a cashflow to repay investors. While it is understood that natural capital contributes to economic production and human well-being, the question for biodiversity finance is to whom do conservation actions capitalize financially? This differs from conventional approaches to measuring the non-market value of environmental resources based on welfare measures. Nevertheless, environmental economists can contribute to efforts to finance conservation by connecting environmental resources to financial and fiscal impacts. Identifying contexts in which the scale of conservation benefits and costs align can point both public dollars and private capital towards profitable investments in biodiversity and conservation.  
  
In this project, we demonstrate that the loss of bats to White-nose Syndrome (WNS) affects rural county finances in ways that generate opportunities for financing conservation. First, WNS, which wipes out bat populations, causes a decrease in rural county revenue of approximately $150 per person on average. Second, rural counties with WNS experience an increased borrowing cost of 0.10 percentage points. These impacts are robust across a range of econometric specifications including recent methods developed for staggered difference-in-differences. The loss of bats capitalizes into local government finances because it decreases agricultural profitability, land values, and associated tax revenues. Results suggest that local governments have opportunities to increase net revenue by investing in bat conservation or restoration.   
  
We then use a bond pricing model to demonstrate how private investors could profit from investments in bat restoration. Bonds issued in counties that have lost bats to WNS have higher interest rates, and thus lower prices. Therefore, private entities could monetize investments in biodiversity by purchasing cheaper bonds, restoring bat populations, and then selling more expensive bonds as recovering government revenues reduce perceived lending risks. We parameterize the model using our data and econometric estimates to illustrate the returns to simultaneous investment in municipal bonds and bat conservation. Accounting for the tax-exempt status of municipal bonds, we demonstrate an average gross return of approximately 2% from the change in bond yields after bat restoration. This return suggests the possibility for income-generating opportunities from investments in conservation.   
  
Importantly, this private investment strategy does not require any new action from governments. In combination with revenue-positive returns to local governments, however, our results suggest opportunities for public-private partnerships that share the costs of conservation while generating net returns for both local governments and investors while improving environmental outcomes. Generally, the capitalization of nature at local government scales can generate financial returns to investment in conservation and could be further explored as a pathway for financing the conservation and management of environmental resources.

**Paper Title:** Integrating Human Decision-Making into a Hydrological Model to Accurately Estimate the Impacts of Agricultural Policies

**Presenter:** Greg Howard

**Coauthors:** Mahesh Tapas, Randall Etheridge, Ariane Peralta, and Matthew Mair

**Objective:** 1 & 3

**Abstract:** Accelerated eutrophication poses a significant threat to ecosystems, necessitating effective policies to mitigate nutrient loading. This study adopts an interdisciplinary approach, merging concepts from econometric and engineering frameworks to develop a socio-hydrological model. The study surveyed 279 farmers in the Tar-Pamlico River Basin to gauge their willingness to consider conservation contracts that require cover crop adoption and/or reduced fertilizer use. Analyses revealed a general reluctance among farmers to adopt these best management practices (BMPs). Our hydrological model, developed using the Soil and Water Assessment Tool Plus (SWAT+), demonstrated that the targeted application of two BMPs (30% reduction in nitrogen fertilizer application and the implementation of cover crops, each targeted on 25% of agricultural land) resulted in significant reductions in nitrate export. The reduction in nitrate loss was more substantial with cover crops compared to reduced nitrogen application, highlighting their potential effectiveness in mitigating nutrient pollution. We further develop a socio-hydrological model combining our SWAT+ model with a farmer behavioral model built on farmer survey responses. This integrated model finds smaller reductions in nitrate export due to limited farmer participation. This study reveals that traditional hydrological models can overestimate nutrient reduction benefits by a factor of 8 for cover crops and by a factor of 25 for reduced fertilizer application. This work highlights the value of socio-economic integration in environmental modeling. Models that account for people’s views and preferences are essential for the accurate assessment of potential agri-environmental policy and, thus, the optimization and adoption of policy.

**Paper Title:** Developing a bioeconomic model in Iowa based on the cost-effectiveness of ecosystem services provided by perennial grassy feedstocks

**Presenter:** Jessica Stephenson

**Coauthors:** John Tyndall

**Objective:** Objective 3

**Abstract:** Expanding renewable energy systems that utilize perennial grassy feedstocks is one of the USDA’s climate smart policy priorities. These bioenergy crops are being explored to deliberately dovetail environmental and economic goals by diversifying agricultural landscapes and fostering economic development opportunities for renewable natural gas. The bioenergy feedstock system explored in this presentation includes native prairie strategically integrated within and adjacent to conventional row crops and winter hardy annual crops (e.g., cereal rye) that “perennialize” crop ground by cover cropping row crop fallow periods. We demonstrate how cutting-edge conservation planning tools can be leveraged to spatially identify opportunities to mitigate nitrate-N loss and greenhouse gas emissions from agricultural land within a 20-mile radial “supplyshed” around an anaerobic digester facility in east central Iowa. The grassy feedstocks will be co-digested with cattle manure generated at the digester facility to serve as the digestion stock for the production of renewable natural gas. The Agricultural Conservation Planning Framework (ACPF) and Financial and Nutrient Reduction Tracking (FiNRT) GIS toolsets were used to create conservation-oriented biomass feedstock scenarios and measure the cost-effectiveness per pound of nitrate reduced and greenhouse gas emissions. Direct costs of establishment, management, harvest and transport over the mid-term (10-20 years) as well as opportunity costs (e.g., land rent values) are calculated and the biomass payment for biomass to farmers are annualized for each scenario. Two land management scenarios were analyzed based on existing regional plans, including the Iowa Nutrient Reduction Strategy and the Iowa Audubon’s plan to connect important bird areas, and two scenarios were based on marginal cropland and highly erodible lands. The scenarios illustrate the viability of an anaerobic digester and estimate the ecological impacts to the 20-mile supplyshed. Methods for developing regional bioeconomies are demonstrated that show it is possible to jointly produce new commodities (e.g., biomass, biogas, sequestered carbon), while mitigating nutrient loss from farm fields, enhance wildlife habitat and reduce greenhouse gas emissions.

**Session 4 Recreation**

**Paper Title:** The economic value of coral reefs under future climate scenarios for the Main Hawaiian Islands

**Presenter:** Ashley Lowe Mackenzie

**Coauthors:** Lansing Perng, Anders Dugstad, Carlo Fezzi and Kirsten L.L. Oleson

**Objective:** 1, 2 & 3

**Abstract:** Coral reefs, characterized by their rich diversity, are productive ecosystems contributing to the provision of a wide range of ecosystem services, including recreation, coastal protection, and marine biodiversity. Climate change impacts, including ocean warming and acidification, pose a significant threat to coral reefs and the associated provisioning of ecosystem services. The variability of these impacts underlines the need to develop more spatially explicit tools in coastal ecosystem management that integrate and assess potential ecological and socio-economic outcomes. To address this gap, we employ a predictive ecological model and project changes in coral reef cover using downscaled predictions from socioeconomic pathway (SSP) climate scenarios. Using future scenarios, we estimate welfare impacts from recreational value of coral reefs across populations and sites using a benefit function transfer derived from a primary study for residents of Hawaii on the island of Maui (Fezzi et al., 2023). The integrated assessment approach considers both site-specific characteristics, income distributions and regional predicted population growth under climate scenarios to connect ecological consequences and economic wellbeing. We highlight environmental justice concerns by identifying historically disadvantaged communities and the regional vulnerabilities associated with welfare changes. Our findings can inform policy decisions and resource allocation strategies promoting a more comprehensive and holistic approach to ecosystem management in the MHI.  
   
Fezzi, C., Ford, D. J., & Oleson, K. L. L. (2023). The economic value of coral reefs: Climate change impacts and spatial targeting of restoration measures. Ecological Economics, 203, 107628. https://doi.org/10.1016/j.ecolecon.2022.107628

**Paper Title:** The Welfare Impacts of Climate Change: A Medium-Difference Analysis of Shoreline Recreational Fishing

**Presenter:** Roger von Haefen

**Coauthors:** Yiqing Liu

**Objective:** 1 & 2

**Abstract:** Climate change has different causal effects on many outcomes for societies and economies, with wide-ranging implications for human health, civil conflict and aggression, agriculture production, economic growth, labor productivity and supply, and migration. Specifically in the context of outdoor recreation, several recent studies have estimated how climate impacts outdoor recreation using year-to-year variations in climate. (Dundas and von Haefen, 2020; Chan and Wichman, 2020; Chan and Wichman, 2022). These estimates miss important adaptations that arise over longer-run time scales. Therefore, to evaluate the accuracy of these estimates, it is helpful to compare estimated impacts that leverage data over longer time scales.  
In this paper, we exploit different temporal scales of climate variation to identify longer-run estimates of the recreation/climate relationship than what previous recreation studies have investigated by analyzing a representative mode of recreational shoreline fishing activities with detailed saltwater recreational angler data over a fifteen-year time horizon (2004-2018) for the entire East and Gulf coast regions. However, due to data limitations, we are unable to implement a full long-difference model (Emerick and Burke, 2016); instead, we employ what we refer to as a medium difference approach that examines recreational behavioral over five- and ten-year time periods.  
The econometric analysis reveals two key findings. First, similar to the findings from Dundas and von Haefen (2020), the results presented in this paper also exhibit an inverted-U-shaped temperature-response function for coastal recreational fishing participation, with participation decreasing significantly at extreme temperatures below 45°F and above 85°F. This pattern is consistent across high, medium, and low-frequency data, confirming that moderate temperatures (particularly around 60-65°F) positively impact fishing trips, while extreme temperatures reduce anglers’ tendency to participate. Second, the impact of precipitation on fishing demand is generally insignificant, while the parameter estimates of precipitation fluctuating around zero. For instance, light precipitation days (less than 2.0 inches) have minimal impact, as the parameter estimates are nearly zero. Moderate precipitation (1.5 to 2.0 inches) however, exhibits a slightly positive trend, suggesting a more appealing situation for shoreline fishing under overcast conditions and moderate precipitation. Days with heavy precipitation tend to discourage participation in shoreline fishing; however, the effect is not statistically significant.   
Having established the baseline results, we employ an ensemble of climate projections derived from coupled ocean-atmosphere general circulation models (GCM) to analyze forecasted climate impacts. The aggregate welfare impacts from temperature changes (keeping precipitation fixed in the future) using our medium-run analysis ae qualitatively similar to those using year-to-year temperature fluctuations on shoreline fishing activities. In fact, we find slightly larger effects using our medium difference approach, similar to Emerick and Burke (2016).  
Overall, our current analysis provides empirical insight into the economic cost of climate change over longer time horizons. The study indicates that there is no evidence of significant smaller effects of climate change on shoreline fishing, implying substantial losses under future climate changes without further investment in outdoor recreation sector. It further draws attention to the importance of accounting for regional variations and developing targeted climate adaptation policies to mitigate the adverse impacts of climate change on recreational shoreline fishing, especially over longer time periods.

**Paper Title:** The Value of Local Outdoor Recreation and Leisure in the U.S. – Evidence from the American Time Use Survey

**Presenter:** Andie Creel

**Objective:** 1

**Abstract:** Spending time outdoors is a popular, accessible leisure activity for most households. Economists traditionally valued outdoor recreation by focusing on specific sites or activities due to data limitations. This paper utilizes the American Time Use Survey, providing a representative sample of U.S. citizens and their outdoor activities. Findings indicate that Americans primarily engage in leisurely outdoor activities like walking, pet care, and socializing, with most trips being local and involving under 30 minutes of travel. Participation rates are high across income quintiles and racial groups, challenging the notion that affluent white individuals in recreational sports dominate outdoor activities.  
  
Using my preliminary travel cost model, I find that local outdoor leisure contributes, on average, more than four trillion 2023 U.S. dollars per year in consumer surplus, and the average annual surplus has increased by more than $2 trillion over the past 20 years. Similar to how changes in the gross domestic product (GDP) measure the strength of the economy, estimating the changes in the surplus from outdoor leisure determines if access and quality of recreation opportunities have been increasing or decreasing. My findings support the conclusion that local outdoor leisure opportunities have become more beneficial to Americans over the past two decades and that local outdoor leisure opportunities have been managed to maintain their capacity to provide welfare, on average. This paper fills a gap in knowledge about the national value of local outdoor trips, which little was known prior. Measuring this flow of benefits from outdoor leisure is the first step to valuing natural spaces that support outdoor leisure as forms of natural capital.  
  
I estimate consumer surplus changes based on travel time for recreation, which households give up to “produce” leisure opportunities. This time cost is not captured in GDP or inflation metrics as it lacks market transactions, fitting instead within the household production accounting boundary—like time spent cooking or car repairs at home. Thus, I use travel time to represent the “price” of an outdoor trip.  
  
I subset the data by different demographic types and test if the trend in welfare over time significantly varies across demographic types (i.e., model multiple “representative” agents). I find that consumer surplus from outdoor leisure trips has been increasing for all income quintiles. I cannot conduct a similar analysis for racial groups due to a lack of statistical power. However, I find that how I choose to price the opportunity cost of time has a large impact on the consumer surplus estimated for different income quintiles and racial groups. Interestingly, this choice has a relatively small impact on the aggregated national value of local outdoor leisure. This means that choices about pricing time in travel cost models have a large impact on the estimated distribution of benefits but smaller implications for the total value.

**Paper Title:** Elk hunting lottery application demand

**Presenter:** Frank Lupi

**Coauthors:** Dane Erickson

**Objective:** 2

**Abstract:** The Northern Lower Peninsula of Michigan supports a reintroduced elk herd of around 1,300 animals. Each year a highly competitive lottery is used to allocate about 260 elk tags to Michigan elk hunters. To analyze demand among elk lottery applicants and explore alternate license pricing and structures, a discrete choice experiment was implemented through a survey of past elk lottery applicants. The choice experiment presents applicants with elk lottery scenarios with varying license and application fees, as well introducing alternate methods for securing funding for conservation purposes, such as setting aside tags to be auctioned for fundraising and steering revenues to a dedicated fund. Across all scenarios, applicants were found to have very inelastic demand for the elk lottery application. Introducing a tag auction and raising the license fee were found to reduce demand, while the introduction of a dedicated fund increased elk lottery demand. Compared to other studies for more common game species, the elk lottery application demand is about 10 times more inelastic. In particular, the findings suggest that the agency could double the application fee and raise 95% more application revenue while only losing 2.3% of the applicants. The results provide a framework for wildlife managers to better understand the demand for elk lottery applications and consider alternate methods to secure adequate funding for elk conservation.

**Session 5 Stated Preference**

**Paper Title:** Controlling for problematic responses in survey data: A Causal Forest approach

**Presenter:** Klaus Moeltner

**Coauthors:** Yuetong Zhang, Robert J. Johnston

**Objective:** 1, 2 & 3

**Abstract:** Problematic responses that are inconsistent with underlying utility theory are an ubiquitous and pervasive problem in stated preferences research. Perhaps the most prominent examples are “protest-NO’s” and “protest-YES’s” in contingent valuation elicitation. These are typically flagged with standard follow-up questions asking survey-takers why they voted in favor or against a hypothetical environmental policy intervention. Thus, while observability is less of an issue, how to deal with them in estimation is a trickier problem. Dropping these cases from analysis can lead to severe sample attrition and risk of selection bias. Ignoring them, i.e. treating them as legitimate, introduces measurement error and corresponding bias for choice probabilities and willingness-to-pay (WTP) estimates. Both approaches preempt any learning about underlying drivers of protest behavior. A third, less frequently employed strategy explicitly incorporates problem responses in the analysis, e.g. via hurdle or switching models. However, this requires strong structural assumptions on functional relationships and error distributions. It is also typically a multi-step, and thus inherently inefficient estimation approach.  
  
In this study we show how a Causal Random Forest (CF) framework that interprets protest NO’s and YES’s as binary, multi-arm “treatment effects” can be fruitfully employed to recover heterogeneous effects of protest behavior on voting probabilities. Perhaps more importantly, it also allows for the derivation of the counterfactual “clean” voting probability in absence of protest behavior for all individuals, including observed protesters. All of this is implemented in a fully nonparametric fashion using the full sample, thus avoiding any risk of mis-specification or selection bias. Our method, which can incorporate a large number of explanatory variables, reveals important drivers of protest responses, illustrates clearly the bias one would incur by dropping or ignoring protests, and shows how valid WTP estimates can be obtained using the “purged” choice probabilities. Our empirical application is with respect to valuing water quality improvements in New England.

**Paper Title:** Interacting Incentives for Agricultural Conservation Subsidies and Trading Programs: Implications for Water Quality and Carbon Sequestration Benefits in the Chesapeake Bay Watershed

**Presenter:** David Newburn

**Coauthors:** Youngho Kim, Erik Lichtenberg, Derek Wietelman, Haoluan Wang

**Objective:** 1

**Abstract:** Agricultural conservation practices such as riparian forest buffers yield water quality benefits and other ecosystem services. Federal conservation subsidy programs, such as the Conservation Reserve Enhancement Program (CREP), offer payments to farmers for riparian forest buffers based on soil rental rates related to opportunity costs and acreage installed, i.e., pay for effort. However, it is widely known that in a first-best setting market-based mechanisms, such as water quality trading (WQT), are an efficient means of reaching abatement targets. Credits issued under WQT are tied to modeled reduction estimates in emissions, i.e., pay for performance. WQT markets enter into a policy landscape where conservation subsidy programs like CREP already exist. Given that simultaneous enrollment is restricted, we first address whether the presence of conservation subsidies crowds out participation in WQT. We evaluate the program performance and water quality implications of both CREP and WQT when offered in isolation as well as in scenarios where farmers can choose between competing incentive options. Additionally, we investigate whether stacking WQT payments with payments from nascent forest carbon offset programs increases the attractiveness of WQT relative to CREP.  
  
In this paper, we develop an integrated assessment model that combines a stated preference (SP) study on agricultural landowner decisions on riparian forest buffer adoption with complex spatial biophysical models to assess the water quality and carbon sequestration benefits in the Chesapeake Bay region. The SP analysis uses data from a discrete-choice experiment conducted via a survey of Maryland agricultural landowners (n=8,923) to understand how program characteristics (upfront vs. annual payment, contract length) and landowner and farm characteristics affect riparian buffer adoption. The biophysical model generates parcel-specific estimates of water quality benefits (Kim et al., JEEM, 2024). We also estimate carbon sequestration benefits arising from riparian buffer adoption using newly available high-resolution forest carbon sequestration data in the northeastern US (Ma. et al., ERL, 2021). Integrating program participation rates elicited from the SP survey with our parcel-specific environmental benefits allows us to conduct policy simulations to characterize how landowners would 1) enroll in CREP and WQT when offered in isolation, 2) sort into CREP and WQT when considered in competition, and 3) sort into CREP and WQT when allowing for the stacking of carbon payments.  
  
Our simulations reveal several key results. First, WQT programs in isolation have the potential to provide sufficient financial incentives for landowners to engage in riparian buffer installation. However, CREP subsidy levels currently in place for riparian buffers are extremely generous, such that the inefficient pay-for-effort programs substantially outcompete the more efficient WQT programs when both are jointly considered. Second, carbon payments are small in magnitude compared to those in either CREP or WQT. Stacking carbon payments with water quality payments thus has little effect on landowner participation in emissions trading programs. Lastly, our analysis serves as an upper bound for participation in trading when competing with subsidy programs, as our analysis assumes highly favorable conditions for trading markets (e.g., thick markets, no transaction costs). The barriers to WQT programs have been analyzed theoretically and in practice (Fisher-Vanden and Olmstead, JEP, 2013). Our analysis shows that competition with incumbent pay-for-effort programs is yet another potential reason that WQT and forest carbon offset programs have largely seen limited trading activity.

**Paper Title:** Contract Design in Water Conservation Payments for Ecosystem Services Programs: A Stochastic Payment Card Approach in Southwestern Georgia

**Presenter:** Lusi Xie

**Coauthors:** Kuhelika Ghosh, Gabriela Perez-Quesada, Aaron Hrozencik, Mark Masters

**Objective:** 1, 2 & 3

**Abstract:** Over-extracting freshwater for irrigation reduces streamflow, disrupts aquatic ecosystems, and threatens habitats for endangered species. Climate change exacerbates these challenges by increasing drought uncertainty and creating more heterogeneity and variability in the costs and benefits of reducing water withdrawals. Water buyback, a form of payment for ecosystem services (PES), compensates farmers for reducing irrigation water use to preserve in-stream flows for environmental benefits. While these programs have seen significant investments in the United States and Australia, few studies have assessed their cost-effectiveness by considering the influence of farmers’ preferences and willingness-to-accept (WTA) on contract design. Moreover, despite a range of U.S. state and federal conservation programs, most notably the Conservation Reserve Enhancement Program (CREP), aiming to address the negative externalities of irrigation water withdrawals, farmers’ interest in these programs has been minimal, partly due to program payment levels and attributes.   
This paper aims to elicit farmers’ preferences and compensation requirements for water buyback PES contracts to conserve water for endangered species during uncertain droughts in southwest Georgia, USA. We conduct an online stated preference survey with landowners who make operation decisions to understand their preferences on contract attributes and elicit corresponding WTA using a stochastic payment card approach.   
Given the variability of the climate conditions and water conservation programs already in place in the state, three contract attributes are considered to strike a balance between program flexibility, program feasibility, and drought uncertainty. Key contract attributes include irrigation suspension types (i.e., no water use, limited use, or conditional suspension during drought), contract durations (ranging from one year to permanent), and a signing bonus for conserving surface water. The stochastic payment card, with seven payment levels ranging from $100 to $730 per acre and per year, is chosen to reflect heterogeneous estimated forgone irrigation revenue. To address potential social desirability bias, we also use an inferred valuation method, where respondents answer the same question in the stochastic payment card for a typical farmer with similar irrigated fields. The survey collects additional data on farm operations, farmers’ demographics, and risk and time preferences. Invitations will be sent to 2,500 eligible landowners, with data analyzed using discrete choice models to estimate coefficients and WTA in both present and future values. Environmental benefits, measured as increased streamflow from irrigation reductions, will be calculated using water meter data and production details for enrolled fields, enabling a comparison of the cost-effectiveness of multi-year contracts. We are currently conducting focus groups and will pilot test and launch the survey in January 2025 with preliminary results available in March 2025.   
This research contributes to the design of water buyback PES programs by incorporating farmers' preferences and testing the presence of social desirability bias in WTA estimates using a stochastic payment card approach. Insights from this study will support the development of contracts that balance program flexibility, feasibility, and environmental objectives under climate uncertainty. Furthermore, this research can inform the design of future irrigated land retirement and abatement programs by characterizing farmers’ preferences for various program attributes and payment levels.

**Paper Title:** A Test of Ex-Ante, Simul, and Ex-Post Hypothetical Bias Mitigation Methods

**Presenter:** Jerrod Penn

**Coauthors:** Qi Jiang (Clemson), Wuyang Hu (Ohio State)

**Objective:** 2

**Abstract:** Hypothetical bias, the difference between economic values derived from purely hypothetical survey responses versus responses with binding consequences, undermines the validity of stated preference methods. In this study, we conduct a discrete choice experiment of preference for charitable donations using an online survey panel based on the receiving charity (e.g. Make-A-Wish, 4H Foundation, NWF, etc.), whether the receiving entity is local or national, a potential match in donation, and the importance of recognition for donating (email, letter, letter and sticker of appreciation). It features a split-sample experiment with nine treatments: a hypothetical control group, an incentivized/real group, and seven hypothetical bias mitigation methods. Three HB treatments are ex-ante: Honest Priming, Cheap Talk, and Oath. Three other HB treatments are simul: Repeated Opt-out Reminder, Default (pre-assigning to the opt-out option), and Unsure (akin to including a ‘don’t know’ response). The remaining HB treatment is ex-post, a qualitative Certainty Follow-up.   
   
Based on a sample size of roughly 200 respondents per treatment, preliminary results demonstrate significant evidence of HB, that WTP in the hypothetical control group is overstated compared to the incentivized treatment. HB is most evident in the opt-out behavior (i.e., the extensive margin) and relatively modest in attribute valuations (the intensive margin). We find that Certainty Follow-up is most effective, substantially reducing or eliminating HB. Default and Cheap Talk also show some evidence of success. Conversely, Honest Priming, Oath, Repeated Opt-out Reminder, and Unsure show little evidence of reducing HB. We also explore the costliness of these strategies in terms of the time required from respondents compared to their HB mitigation effectiveness.

**Session 6: Land Use and Housing**

**Paper Title:** Estimating Water Quality Benefits with Revealed Preference

**Presenter:** Jiameng Zheng

**Coauthors:** Yoojin Cha, Daniel Douglas, Dimitris Friesen, Yusuke Kuwayama, Sheila Olmstead, Daniel Phaneuf

**Objective:** 2

**Abstract:** A long literature in economics considers the impacts of environmental conditions on housing markets, valuing exposure to disamenities like hazardous waste sites (Cassidy et al. 2023), air pollution (Bento et al. 2015, Bajari et al. 2012), shale gas wells (Muehlenbachs et al. 2015), and flood risk (Hino and Burke 2020). When applied to water pollution, hedonic property models suggest that willingness to pay (WTP) for water quality improvement is positive but small, and falls to zero beyond 2-3 kilometers from polluted water (Poor et al. 2007, Walsh et al. 2017, Guignet et al. 2017, Keiser & Shapiro 2019). This result is inconsistent with the recreation demand literature, which suggests that individuals value water quality at recreation sites even at significant distance (Bockstael et al. 1987,…,English et al. 2018). Prior work (Kuwayama et al. 2022) provides evidence that the traditional hedonic approach may not fully capture capitalized recreational values.  
   
In this paper, we adapt this more comprehensive approach to valuing water quality in three U.S. coastal areas with active housing markets, rich aquatic recreation opportunities, and important pollution challenges: Puget Sound, Long Island Sound, and the Texas Gulf Coast. Adapting Phaneuf et al. (2008) and Kuwayama et al. (2022), we estimate the capitalization effects of local and recreational water quality improvements in two stages. First, we estimate a random utility model (RUM) of recreation demand to produce a recreational utility index – an estimate of average compensating variation per trip at the zip-code or county-year level, depending on location. In the second stage, we estimate a hedonic property model with property fixed effects to control for time-invariant unobservable property characteristics. We include both local water quality very near properties (within 3 km) to estimate WTP for local water quality, as well as the recreation utility index from the first-stage RUM.  
  
We make three major contributions: novel estimates of the value of water quality in three understudied urban coastal regions, the further development of a promising revealed-preference approach to valuing water quality at large spatial scale, and an analysis that considers whether the value of water pollution control capitalizes differentially with property markets’ demographic and socioeconomic characteristics. Preliminary results suggest that in each of the three regions, amenity and recreational values of water quality improvements both capitalize into property prices and can be separately identified. These results are consistent with the conclusion that hedonic models that do not match properties with the recreation sites that may be valued by their owners will tend to underestimate the economic value of water pollution control. Preliminary results also suggest differential capitalization effects of local and recreational DO improvement by income and race in some of the three regions.

**Paper Title:** Local Economic Impacts of the Conservation Reserve Program

**Presenter:** Matthew Wibbenmeyer

**Coauthors:** Hannah Druckenmiller, Yanjun (Penny) Liao, Rich Iovanna, Brandon Holmes, Alex Thompson

**Objective:** 1

**Abstract:** The Conservation Reserve Program (CRP) is America’s largest voluntary conservation program, with 22 million acres—approximately the size of Indiana—currently enrolled across the United States. By removing large areas of environmentally sensitive land from agricultural production, the program may have a significant impact on land use within agriculturally productive regions and, potentially, on local economic activity. These impacts are likely to be multifaceted. In decreasing agricultural production, CRP enrollment may cause farm employment to decline. But because farm owners are financially compensated for enrolling land in the program, effects on local economic activity are not necessarily negative and could depend on many factors, including, for example, whether farm owners live (and spend money) locally or are absentee. CRP enrollment may also enhance local natural amenities, raising property values and increasing demand for outdoor recreation. These off-farm public benefits could increase local consumer spending and jobs in areas with significant CRP acreage.   
  
This project brings together parcel-level administrative data from the CRP program, provided by the US Department of Agriculture, with a variety of public and proprietary data sources to study CRP impacts on a range of economic outcomes at a national scale. Outcomes of interest include home prices, local employment, wage incomes, business growth and expansion, and migration. Data on home prices and characteristics come from CoreLogic transactions and county assessors’ data. Data on business establishment outcomes come from the proprietary National Establishment Time Series (NETS) Database (employment and establishment counts) and the Bureau of Labor Statistics Quarterly Census of Employment and Wages (QCEW, wages). Data on county-to-county migration come from the Internal Revenue Service.   
  
We investigate the effects of CRP enrollment on these various outcomes using a suite of empirical strategies adapted to each outcome and data set. To estimate effects of CRP enrollment on property values, we use a hedonic repeat-sales econometric strategy, which controls for fixed property characteristics correlated with both home prices and CRP enrollment. We compare changes in the price of properties that experienced changes in enrolled CRP land nearby to changes in the price of properties that were bought and sold in the same years, but which experienced no changes in CRP land nearby. Initial estimates indicate that changes in CRP land are associated with a small positive and statistically significant effect on property values. We use event study and heterogeneity analyses to rule out alternative explanations and investigate channels through which CRP land affects home prices.   
  
To estimate effects of CRP enrollment on business establishments, jobs, and wages, we aggregate employment and establishment outcomes at the county-by-industry level and estimate the effect of CRP on business outcomes using a difference-in-differences strategy. The strategy compares correlations between changes in CRP enrollment and changes in business outcomes across industries connected and unconnected to the agricultural sector. Aggregating business outcomes to the county-by-industry level allows us to capture effects of CRP enrollment throughout the county. We estimate effects of CRP enrollment on county in- and out-migration by comparing changes in migration across counties that recently experienced varying levels of CRP enrollment. Initial results regarding effects of CRP enrollment on local economic outcomes and migrations are forthcoming but will be available at the time of the W5133 meeting.

**Paper Title:** Large Livestock Facilities and Farmland Values: Evidence from Competitive Bidding by Concentrated Animal Feeding Operations

**Presenter:** Chen-Ti Chen

**Coauthors:** Yongjie Ji, Qinan Lu, Wendong Zhang

**Objective:** 1 & 2

**Abstract:** Environmental externalities from intensified livestock production, particularly from concentrated animal feeding operations (CAFOs), continue to raise concern among the US public and policymakers. One such externality comes in the form of environmental dis-amenity that contributes to lower property or land values near these livestock operations. This paper seeks to examine the effect of CAFOs on nearby farmland values through a salient angle of competitive bidding by CAFOs on nearby parcels to satisfy nutrient management requirements. The federal Clean Water Act regulates surface water pollution from CAFOs. As part of the requirements, CAFOs must implement approved nutrient management plans to prevent nutrient runoffs. One common management practice is to secure enough croplands to comply with land application rate of manure as a substitute for fertilizers. As costs from waste transportation are typically high, CAFO operators have an incentive to secure adjacent farmlands for manure application. This would potentially cause competition for farmlands as more operations concentrate geographically, resulting in an upward pressure on nearby farmland prices.   
We construct a novel multi-state dataset combining historical parcel level records of farmland transactions with facility-level CAFOs permitting records from 2006 to 2022 in Iowa, Minnesota, and Nebraska. These three states are major livestock production states accounting for one-third of more than 21 thousand CAFOs in the nation. Our farmland transaction data comes from ATTOM Data Solutions and Growers Edge, providing over 65,000 arm’s length farmland sales transactions. Each farmland transaction record includes sales prices, acres, sale date and location, buyer/seller information, and farmland characteristics. The CAFOs data are collected from respective state agencies, with permitting records containing information on both the facility locations and the dates regulated facilities were first recorded. Using ArcGIS, we calculate the nearest distance in miles from the sold farmland parcel to nearby CAFOs.  
Our primary empirical strategy uses a hedonic price model to identify the effect of proximity to CAFOs on farmland values. Economic theory suggests land prices reflect not only used and non-use values from land characteristics and ambient environmental amenities, but potential alternative uses. We estimate a hedonic equation regressing farmland sales price on the proximity of farmland parcels to CAFOs. We estimate the model using both the treatment intensity (i.e., the distance to the nearest CAFO) and semi-parametrically with 1-mile distance bins in different specifications, while controlling for county and year fixed effects. As such, our sources of variation come from within-county repeated sales of farmland parcels and CAFO entries. Our preliminary results using a subsample of Iowa farmland sales document sizable premiums capitalized into farmland just adjacent to CAFOs. Particularly, we find a 6% premium on average for land sales prices within 1 mile of a CAFO, relative to a similar farmland parcel located 5 miles away from a CAFO. In addition, this effect tends to be localized within close proximity of CAFOs, supporting our hypothesis of higher economic incentive to bid and purchase nearby parcels to spread manure. Our analysis will also uncover how effects vary by capacity, type, and density of CAFOs.

**Paper Title:** Understanding Economic and Environmental Justice Implications of Participation in Voluntary Managed Retreat Programs

**Presenter:** Yukiko Hashida

**Coauthors:** Steven Dundas

**Objective:** 1 & 2

**Abstract:** An important open empirical question in the area of coastal climate adaptation is understanding the voluntary decisions of households to participate in managed retreat programs and identifying potential barriers to participation. In previous work (Hashida & Dundas, JEEM 2023) we noted a potential anomaly in the behavioral response to such programs using a hedonic pricing model and locations of participating parcels in the New York Rising Housing Recovery Program. We estimated an effect that suggested that some households in state-designated Enhanced Buyout Areas (EBAs), where the program was offering full pre-Superstorm Sandy fair market value plus incentives up to 15 percent above market value, choosing to sell on the open market for up to 20 percent less than pre-storm values. This incongruity suggests that there may be barriers related to language, income, or other factors that prevent some households from participating in a state program that they could benefit from. In addition to seemingly irrational within-EBA results, the managed retreat program has two distinct parts, a buyout component that demolishes the home and creates open space, and an acquisition component that auctions properties to developers to rebuild homes to stricter building codes. Each component is likely to have different distributional effects on community composition and economic after program outcomes interventions. To investigate these questions, we have assembled significant micro-level household data on participants in both the buyout and acquisition components and non-participants within all EBAs in the NY Rising program. Our dataset includes program participation locations and timing, housing transactions outside the program, demographics linked to households from both Home Mortgage Disclosure Act records and DataAxle (a private data vendor), and location information for a significant majority of NY Rising participants at three points in time (2012, 2018, 2024). Our plan is to first produce extensive descriptive data to visualize and understand the dynamics of the participation choice, including where participants move after accepting a program offer and how that may differ between program components and for owners and renters. Next, we estimate a set of panel discrete choice decision-models with all households in each EBA to try to identify a potential mechanism for seemingly sub-optimal housing market decisions. We anticipate our model results will reveal significant determinants of the voluntary participation decision in managed retreat programs. These results will help show if the barriers to participate are economic in nature or if there are systemic inequities in access to a potentially beneficial program. We anticipate having a clear descriptive story and preliminary results from our decision models ready in time for the workshop.