UC SANTA BARBARA
Bren School of Environmental Science & Management

Bren PhD Student Symposium

March 3, 2023
1:00 – 4:30 PM

Symposium Schedule

This symposium will have short (3 minutes) and long (12 minutes) oral presentations, with one short break (25 minutes).

1:00 – 1:05 pm: Welcome remarks,
Gabriela Alberola
Co-Chair, PhD Symposium Committee

1:05 – 1:10 pm: Highlights of PhD research at Bren School,
Dr. Steven Gaines,
Dean and Professor, Bren School

The Bren School expresses its sincere gratitude to our sponsor of the PhD student symposium:

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AEP Channel Counties Chapter, Bank of America Charitable Foundation, Brownstein Hyatt Farber Schreck, California Homebuilding Foundation, Deckers Outdoor Corporation, Eli Lilly and Company, Latham & Watkins, O'Melveny & Myers, Professional Environmental Managers Association (PEMA), Resources Legacy Fund, Rhodium Group, Rincon Consultants, Southern California Edison, The Nature Conservancy, Toad & Co.

Symposium Schedule

(CONTINUED)

ORAL PRESENTATION I

1:10 – 1:25 pm: Nathaniel Grimes
“Index Insurance Induced Behavior Change in Fishers”

1:25 – 1:30 pm: Risa Lewis
“Policy Impacts of a Satisficing Model of Private Carbon Emissions Reduction”

1:30 – 1:45 pm: Nākoa Farrant
“Evaluating Drivers of Alternative Revegetation Pathways Following Agricultural Disturbance”

1:45 – 2:00 pm: Phoebe Racine
“Pandemic Shifts in Diversity of California Seafood Consumption”

2:00– 2:05 pm: Gabriela Alberola
"Vulnerability and Politics: What Drives the Subnational Allocation of Climate Adaptation Funding in Latin America and the Caribbean?"

2:05 – 2:20 pm: Leonardo Manir Feitosa
"Interaction between Prices and Life Histories Can Drive Species Extinct in Open Access Fishing"

2:20 – 2:35 pm: Kaili Brande
“Bark Traits and Expected Conferred Resistance to Fire-induced Mortality in Three California Oak Species”

2:35 – 3:00 pm: Break (refreshments available in the courtyard)

Symposium Schedule

(CONTINUED)

ORAL PRESENTATION II

3:00 - 3:15 pm: Sandy Sum
"The Equity Implications of Irrigation Cutbacks in California"

3:15 - 3:20 pm: Allie Caughman
"Climate Change Undermines Benefits of Low Movement Evolution within Marine Protected Areas"

3:20 - 3:35 pm: Haozhe Yang
"Decarbonizing China's Electricity Sector Brings Significant Health Benefits but may Widen Regional Disparities in Employment"

3:35 - 3:50 pm: Jacob Gellman
"Non-market Damages of Wildfire Smoke: Evidence from Administrative Recreation Data"

3:50 - 3:55 pm: Jaxon Stuhr
"Supply Chain Modeling with Sectoral Efficiency Potentials for the US Manufacturing Sector"

3:55 - 4:10 pm: Liliana Sierra Castillo
"The Implications of the "Blue Transitions" in Small-scale Fishery Communities in Baja California Sur, Mexico"

4:10-4:15 pm: Louis Graup
"Riperia"

Symposium Schedule

(CONTINUED)

4:15-4:20 pm: Closing Remarks,
Gabriela Alberola,
Co-Chair, PhD Symposium Committee

4:20 pm: Reception

Symposium Abstracts

In order of appearance

Title: Index Insurance Induced Behavior Change in Fishers

Speaker: Nathaniel Grimes
Advisors: Christopher Costello, Steve Gaines

Abstract: Weather variability generates significant risk in fisheries. Fluctuations in stock recruitment can arise from shocks in sea surface temperature, changes in current patterns, and drops in primary production, all leading to less fish available to harvest. The act of fishing is impacted by weather as well. Rough seas, storms, and strong winds increase danger to fishers, while simultaneously making it more difficult to fish, lowering economic productivity. Currently, fishers have limited options to protect against financial income risk. Index Insurance is a new tool gaining momentum as a possible policy tool to alleviate financial risk for fishers. Fishers receive payouts to compensate for loss in the event of a harmful weather shock under index insurance. However, insurance is known to create moral hazards that change behavior. Before widespread adoption, behavior change must be considered to justify index insurance as a viable tool. I test whether index insurance will incentivize fishers to overfish or reduce fishing pressures. My theoretical model predicts that under standard assumptions in most fisheries models, index insurance will encourage overfishing. However, depending on the risk response of fishers, there is a possibility that index insurance will reduce harvest, assisting recovery of fish stocks. Index insurance holds promise as a risk tool. Insights from this study will help guide contract designs and target fisheries to ensure protection for fishers in both the short and long term.

Title: Satisficing Behavior in Private Carbon Emissions Reduction and Policy Impacts

Speaker: Risa Lewis
Advisor: Christopher Costello

Abstract: Policymakers across the world are increasingly using carbon pricing to address externalities from greenhouse gas emissions, but these pricing policies may have unintended outcomes if the assumption of marginal costs and benefits of emissions does not strictly hold for private, individual consumption of emissions-intensive goods (the average person's carbon footprint). There are many reasons to believe that the choice process for private consumption of emissions-intensive goods does not occur on the margin, including the misunderstanding of emissions and damages and the extent to which pro-environmental warm glow is derived from social reputation and relative consumption. This work seeks to use a model of satisficing-like private carbon emissions consumption to understand if and when such a model may imply that optimal carbon taxes need to be adjusted. Further work includes considering the impact on carbon policy crowding out effects, alternative units of measurement to heuristically track emissions, the willingness to pay for correct information about emissions intensity and the role of complexity in this evaluation.

Title: Evaluating Drivers of Revegetation Following Agricultural Disturbance

Speaker: Nākoa Farrant
Advisor: Ashley Larsen
Co-authors: Carla D'Antonio, Dar Roberts

Abstract: Agricultural land continues to be abandoned globally due to a variety of environmental and social factors such as reduced water availability and rural to urban migration. Recent studies have characterized patterns of revegetation on abandoned agricultural land, finding that secondary vegetation can recover the structural and functional traits of nearby undisturbed ecosystems over several decades. However, some abandoned fields have low vegetation cover for decades after agricultural disturbance ceases. We lack an understanding of what environmental factors drive alternative pathways for vegetation recovery following abandonment. Here we use the rich empirical opportunity of sugarcane fields in Hawai‘i that were abandoned between 4 and 117 years ago to enhance our understanding of what environmental factors drive vegetation recovery. Preliminary analyses suggest that the relevance of environmental drivers varies with the structure of secondary vegetation that develops. For example, the recovery of shrubs may primarily be driven by precipitation and soil pH and cation exchange capacity; while the recoveries of trees and grasses are affected by those environmental conditions as well as elevation, slope, and the age of the volcanic substrate. This ongoing research effort seeks to distill relationships between environmental conditions and vegetation outcomes to guide future management of abandoned fields toward a variety of goals such as conservation of biodiversity or carbon storage.

Acknowledgements: UC Santa Barbara Graduate Opportunity Fellowship

Title: Pandemic Shifts in Diversity of California Seafood Consumption

Speaker: Phoebe Racine
Advisors: Steve Gaines, Darcy Bradley
Co-authors: Matto Mildenberger, Mike Weir, Ashely Bae, Elliot Matthews, Steve Gaines, Darcy Bradley

Abstract: US seafood consumption has consolidated dramatically in recent decades, becoming increasingly dominated by the consumption of a limited number of species that are primarily imported. This trend does not bode well when considering necessary diet shifts to reduce greenhouse gas emissions. The EAT–Lancet dietary guidelines suggest consuming a greater diversity of regenerative crops and low trophic level species. The COVID-19 pandemic, with its broad supply chain impacts, had the chance to disrupt trends towards a consolidated seafood supply chain. Did the diversity, relative abundance, and composition of seafood species consumption change due to the pandemic? If so, what aspects of the pandemic can explain some of this shift? In order to understand the pandemic's effect on the diversity of seafood consumption, we developed a panel across California from August 2020 to August 2021 (3 time points, n=618). Using fixed effects models and Shannon and Simpson's diversity indices, we assess whether diversity of seafood consumption shifted due to COVID case numbers, an individual's risk tolerance towards COVID, and California's unique tiered system, which mandated levels of economic openness by county depending on COVID case counts and test positivity. We then describe these shifts and relationships between species using network analyses. Our preliminary results show that restaurant closures decreased the richness of species consumed and the consumption of less common species. However, consumption of dominant species (shrimp, salmon and tuna) remained static. This potential narrowing of diet underscores some of the challenges of making necessary diet shifts, highlighting the importance of expanding seafood literacy and supporting local seafood markets and development of low trophic aquaculture.

Title: Vulnerability and Politics: What Drives the Subnational Allocation of Climate Adaptation Funding in Latin America and the Caribbean?

Speaker: Gabriela Alberola
Advisor: Mark Buntaine

Abstract: What drives the allocation of climate change adaptation funding within countries? The UN Framework Convention on Climate Change establishes that priority in the allocation of international funds should be given to the most vulnerable developing countries. Climate change risks, however, are not distributed equally within countries. Furthermore, international aid is susceptible to political processes, which can further impair a fair distribution of funds and projects. Therefore, it is critical to understand what drives the subnational allocation of climate adaptation funding and whether these funds are reaching the most vulnerable communities within recipient countries. This paper follows the allocation of climate adaptation projects from 15 international funds to 1205 municipalities in 7 countries in Central America and the Caribbean. In addition to the creation of maps of hot and cold spots of international adaptation funding in the region at the municipal level, this paper explores two questions: are the most vulnerable municipalities receiving adaptation funding, and does partisan alignment play a role in the allocation these funds.

Title: Interaction between Prices and Life Histories Can Drive Species Extinct in Open Access Fishing

Speaker: Leonardo Manir Feitosa
Advisor: Steve Gaines
Co-authors: Matthew Burgess, Christopher Free, Steven D. Gaines

Abstract: Fisheries management traditionally focuses on the target species—usually the most economically important. Theory predicts that open access (OA) fisheries with constant prices cannot drive a target species to extinction because the fishery will become unprofitable before the last fish is caught. However, previous work has shown that situations with non-constant prices, and situations where multiple species are co-caught in the same multi-species fishery—both common situations in real fisheries—can cause extinction under certain conditions. To explore these two threats together, we extend the Gordon-Schaefer model for an OA two-species fishery composed of a strong (high productivity) and a weak (low productivity) stock with different prices and ask, (1) under which growth rate ratios can these two stocks be exploited without the weak stock going extinct if it has zero price, and (2) does the existence of a price increase extinction risk for the weak stock? We consider that extinction can only occur if profits remain positive at the level of effort that drives the weak stock extinct. We define strong stock as the species with the smallest catchability to population growth rate ratio. Our model demonstrates that even when the weak stock has no value, it only persists for a small range of growth rate ratios for any strong stock price value. Adding a constant price for the weak stock decreases the weak stock biomass at equilibrium—severely so, if the price is high. While this substantial decline in the weak stock biomass does not mathematically drive it extinct, its population is dangerously driven to extremely low levels, thus greatly enhancing the risk of extinction from other stochastic events. Our findings highlight the importance of fisheries management to prevent fisheries-driven extinctions.

Acknowledgements: Fulbright Brazil/CAPES

Title: Bark Traits and Expected Conferred Resistance to Fire-induced Mortality in Three California Oak Species

Speaker: Kaili Brande
Advisors: Frank Davis, Bruce Kendall

Abstract: Fire is increasing in frequency and intensity in many California ecosystems, including foothill oak woodlands. While oaks are generally considered to be fire resistant, we have a limited understanding of the relationship between tree size and fire resistance. Bark is one of the most important mechanisms for a tree to protect itself from fire-induced damage. However, bark traits of California oak species have been little studied. To quantify the “fire adaptedness” of California oak species, bark thickness growth patterns were evaluated in three dominant species of Southern California foothills. Using field measurements and adapted code from Schwilk and others (2013), cross-sectional bark thickness was calculated trigonometrically at two measurement heights. A mixed effects model was used to parse differences in allometric growth patterns by size, and a paired t-test was used to evaluate growth patterns by height. At the higher measurement height, a negative size-dependent allometric growth pattern was observed for all three species, with coast live oak showing the most negative pattern (indicating fire-adaptedness). Bark thickness also differed significantly at the two measurement heights, showing a pattern of bark tapering (indicating fire-adaptedness) for coast live oak only. Future work will relate bark thickness and stem diameter to time to cambium kill, an important metric of a tree’s vulnerability to heat-induced damage. Bark traits other than thickness will also be measured, and the relative effects of each trait on time to cambium kill will be evaluated to better understand what traits play a key role in fire resistance. This information can be useful toward estimating the vulnerability of a stand based on species and individual tree sizes that are present in the stand. This could aid site preparation efforts prior to prescribed fire implementation, such as fuel reduction efforts (i.e. brush clearing, thinning) around individuals that are expected to be more vulnerable.

Title: The Equity Implications of Irrigation Cutbacks in California

Speaker: Sandy Sum
Advisor: Tamma Carleton
Co-author: Anna Boser

Abstract: California has a long history of unregulated groundwater use which has led to unsustainable groundwater depletion. As droughts become more frequent and severe due to climate change, policies to curb water use will become increasingly more salient. A market-based solution (e.g. cap and trade) is usually favored by economists as the least-cost way to achieve a given cutback target. However, the redistribution of water induced by a market-based solution also spatially alters who ultimately gets to use the resource as trading occurs. Without careful analysis, these policies may inadvertently further burden already disadvantaged communities. In this paper, we assess the equity implications of using a market-based solution to allocate water cutbacks in California. We utilize satellite-derived evapotranspiration data and irrigation measures from 2016-2021 to estimate zip code level marginal abatement cost (MAC). MAC curves, extensively used to assess societal costs over different cutback policy options, can also be used to identify potentially inequitable outcomes. We use our estimated MAC curves to evaluate the equity impacts of water trading in California for various dimensions of equity including income and race/ethnicity.

Acknowledgements: H. William Kuni Bren Fellowship

Title: Climate Change Reduces Population Benefits from MPAs by Interfering with Movement Evolution

Speaker: Allie Caughman
Advisor: Steve Gaines, Darcy Bradley
Co-authors: Steve Gaines, Darcy Bradley

Abstract: Marine protected areas (MPAs) are important conservation tools that confer ecosystem benefits by removing fishing within their borders to allow stocks to rebuild. Because MPAs are traditionally fixed in space and time, fishing pressure outside the MPA can exert selective pressure for low movement alleles, leading to fish that move less to remain protected within MPAs than fish outside. While evolving to move less may be useful for conservation in the present, it could be detrimental in the face of climate change for species that need to move to track their thermal optimum. Here, we build a spatially explicit simulation model to assess the impact of movement evolution in and around static MPAs resulting from both fishing mortality and temperature dependent natural mortality on conservation benefits across five climate scenarios: i) linear mean shift in temperature, ii) El Nino/La Nina conditions, iii) heat waves, iv) heatwaves with mean shift in temperature, and v) no climate change. For each scenario, we examine the impact of climate and MPA size on movement evolution and resulting conservation benefits. We found over time, selection pressure from climate change reverses the increase of low movement alleles within the MPA, which in turn decreases population at a quicker rate than expected from just climate mortality. In fact, all three climate scenarios with steady increases in temperature resulted in extinction, even for the largest MPAs. Our findings suggest that while static MPAs may conserve species for a time, other strategies will need to be employed to conserve species into the future.

Acknowledgements: NSF GRFP

Title: Decarbonizing China's Electricity Sector Brings Significant Health Benefits but may Widen Regional Disparities in Employment

Speaker: Haozhe Yang
Advisor: Ranjit Deshmukh
Co-authors: Qian Luo, Gang He, Jiang Lin, Jeremiah Johnson, Fernando Garcia-Menendez, Olivier Deschenes, Ana Mileva

Abstract: Understanding the costs and the spatial distribution of health and employment outcomes of China's low-carbon electricity pathways is critical to enable an equitable transition. We integrate an electricity system planning model, a health impact model, and a multiregional input-output model to quantify provincial-level impacts of electricity system decarbonization on costs, health outcomes, employment, and labor compensation. Even without specific CO_2 constraints, declining renewable energy and storage costs enable a 21% decline in CO_2 emissions in 2040 compared to 2020 under the least-cost pathway (Reference scenario). Pursuing 2ºC and 1.5ºC compatible carbon emission targets (85% and 99% decrease in 2040 versus 2020 for CO_2 emissions, respectively) avoids 44% and 61% of premature deaths caused by air pollution from electricity generation over 2020-2040, but annual average costs per demand increase significantly (21% and 46%, respectively). Compared to reference, lower electricity demand in the 2ºC pathway leads to fewer electricity sector-related jobs (7%) but the 1.5ºC pathway gains 12% more jobs because of significantly greater renewable energy deployment. While disparities in health impacts across provinces narrow as fossil fuels phase out, disparities in employment opportunities widen with wealthier East Coast provinces gaining the most jobs because of manufacturing and offshore wind.

Acknowledgements: UCSB Chancellor's Fellowship

Title: Non-Market Damages of Wildfire Smoke: Evidence from Administrative Recreation Data

Speaker: Jacob Gellman
Advisor: Andrew Plantinga
Co-authors: Margaret Walls, Matthew Wibbenmeyer

Abstract: Wildfire smoke pollution is growing in the western United States. Estimates of the health impacts of wildfire smoke are numerous, but there are few revealed preference estimates for the damages of smoke. Smoke is challenging to value with revealed preference methods because it is a transient environmental bad: it may blanket an area for several days before winds change or a fire is extinguished. In this paper we study a setting where individuals are directly exposed to wildfire smoke and where avoidance behavior is measured with high frequency: outdoor recreation. We combine millions of administrative campground reservation records with satellite data on wildfire, smoke, and air pollution. These data are rich among most studies of recreation, with nearly 1,000 campgrounds, a large geographic reach, detailed individual-level behavior, and high frequency daily data. The data allow us to model sequential recreation decisions under varying information, where preferences are correlated across decisions using a novel control function approach. We estimate that wildfire smoke reduces welfare by $107 per person per trip. Damages are increasing and convex when campgrounds are affected by consecutive days of smoke, and are attenuated when smoke events are sufficiently far from active fires. In total, 21.5 million outdoor recreation visits in the western United States are affected by wildfire smoke every year, with annual welfare losses of approximately $2.3 billion. These findings contribute to a growing body of evidence on the costs of wildfire smoke.

Title: Supply Chain Modeling with Sectoral Efficiency Potentials for the US Manufacturing Sector

Speaker: Jaxon Stuhr
Advisor: Eric Masanet

Abstract: As net zero pledges and policies become ever more prevalent, the Industrial Sector lags the rest of the economy. Manufacturing specifically has developed a reputation for being “hard to abate” due to its highly heterogeneous nature and reliance on byproduct fuels. One primary strategy for decarbonizing manufacturing is Supply Chain Analysis, which quantifies the embodied carbon of manufactured goods. Goals and policies are then implemented to incentivize production of goods produced via low-carbon methods, with theoretical embodied-carbon targets relying on accurate models of supply-chain impacts. Currently, such data is scarce and often very old, with numerous studies noting the need for improved process-specific data on industrial energy consumption. This work estimates energy savings associated with implementation of Best Available Technologies by NAICS sector and end-use. A framework was developed that disaggregates energy usage for key end-uses into specific processes, estimating savings potential at the process level. When implemented in the Material Flows through Industry tool, our results quantify the supply-chain savings potential for hundreds of manufactured products, with both sectoral and end-use resolution of energy and emissions savings. These results are relevant to both policy makers and those in industry, providing insight into realistic embodied-carbon goals for an array of products, as well as how these goals can most effectively be realized through implementation of existing efficiency improvements.

Acknowledgements: National Renewable Energy Laboratory

Title: The Implications of the “Blue Transitions” In Small-scale Fishery Communities in Baja California Sur, Mexico

Speaker: Liliana Sierra Castillo
Advisor: Steve Gaines, Jono Wilson
Co-authors: Halley Froelich, Erendira Aceves-Bueno, Jono Wilson, Steve Gaines, Caroline Ferguson

Abstract: Small-scale fisheries provide nearly half of the world’s seafood supply, however most of them are overexploited, affecting numerous livelihoods. The “blue transition” is the idea that with the implementation of aquaculture (the farming of aquatic organisms in controlled or semi-controlled environments), fishing effort will decrease, resulting in a recovery of the fishery resources, which keeps being proposed. These transitions tend to focus on technical and economic aspects, leaving aside the local context of the communities. We propose that using a “resilience approach”, is fundamental to understanding these transitions. It allows us to study them in a systematic, holistic way. We aim with this study to use empirical data from two communities in Baja California Sur, Mexico, to demonstrate what these transitions look like and their implications at the local scale, and determine if a resilience approach can be used to understand them. The data for this study came from a combination of in-depth interviews and surveys that were carried out over two years (2021–2022) using a sequential mixed methods design. Multiple correspondence analysis was used to determine the relationship between the variables that represented the context of each community, and their transition to aquaculture. The results demonstrate that the local context of each community is fundamental for the capacity to adapt and transition to aquaculture. Community A had a high attachment to their culture, which can be a factor in understanding why most people refuse to transition to aquaculture. While Community B has high flexibility to do other activities besides fishing, resulting in the entirety of the community transitioning to aquaculture. The resilience approach allowed us to understand that these transitions are a continuum process that gradually changes the system until it transforms (if it is wanted and necessary) into a new system.

Title: Riparia

Speaker: Louis Graup
Advisor: Naomi Tague

Abstract: Riparia are hotspots of biodiversity near the stream in water-limited forests of the Western US. Access to groundwater allows riparian trees to continue transpiring and serve as hydrological microrefugia while the rest of the forest suffers from water stress during drought periods. Because of this, riparia need extra attention from forest managers to preserve these habitat refuges under climate change, since they are particularly threatened by snow drought, which could diminish groundwater resources. Science communication is paramount to highlighting the importance of these areas to the public and policymakers. Art and poetry strike emotional chords, rather than data and figures which are mostly unrelatable to non-experts.

The 2023 Bren PhD Student Symposium Committee

Gabriela Alberola (co-chair)

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