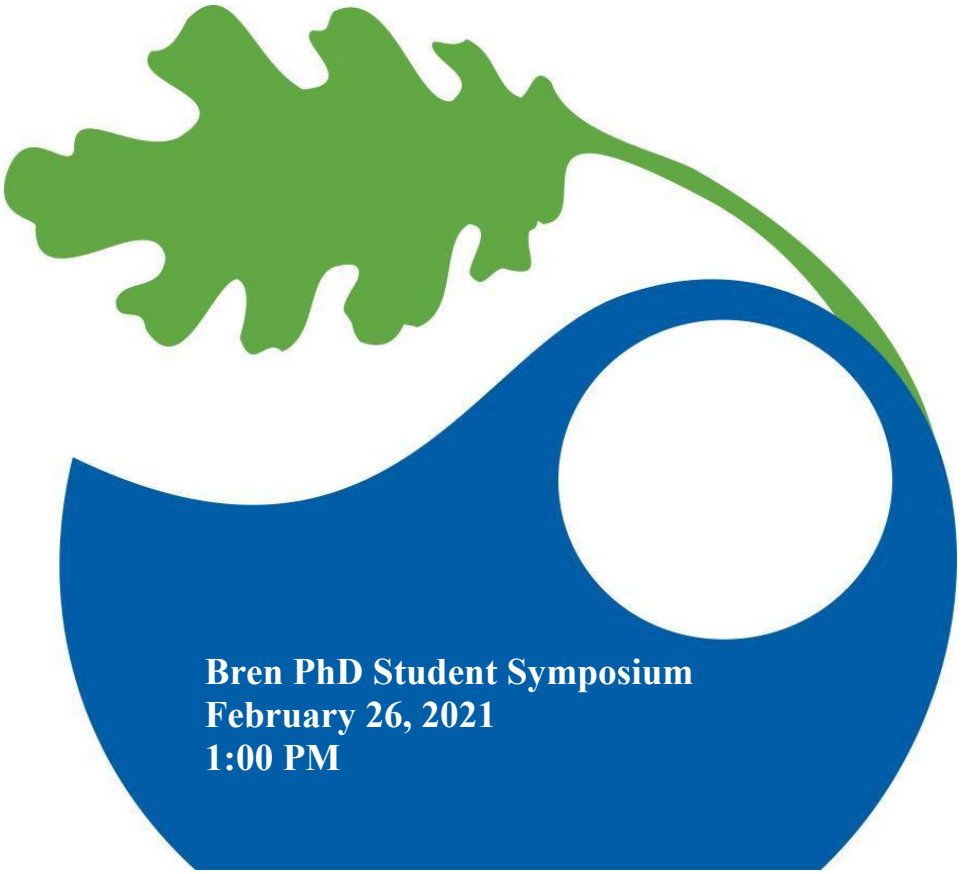




BREN SCHOOL
ENVIRONMENTAL SCIENCE & MANAGEMENT
UNIVERSITY OF CALIFORNIA, SANTA BARBARA



Bren PhD Student Symposium
February 26, 2021
1:00 PM

Symposium Schedule

This symposium will have short (3 minutes) and long (12 minutes) oral presentations, with one short break (20 minutes).

1:00 – 1:05 pm: Welcome remarks
Ignacia Rivera,
Chair, PhD Symposium Committee

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

The Bren School expresses its sincere gratitude to our sponsors of the PhD student symposium.

Sponsors



And thank you to the Bren School's Corporate and Institutional Partners:
Brownstein Hyatt Farber Schreck, Catena Foundation, Deckers Outdoor Corporation, Eli Lilly, Grove Plating Company, Irvine Ranch Conservancy, Kingfisher Foundation, Lean Green Way, Moulton Niguel Water District, Rhodium Group, Tetiaroa Society, The Nature Conservancy, Toad and Co., Walton Family Foundation

Symposium Schedule

(CONTINUED)

1:10 – 1:25 pm: Erin Winslow

Coral bleaching: Understanding dynamics for conservation

1:25 – 1:30 pm: Anna Boser

West Nile virus risk mapping using satellite derived temperature data

1:30 – 1:45 pm: Violaine Desgens-Martin

Fate and ecotoxicity potential of pharmaceuticals and personal care products using modeling as a guidance tool

1:45 – 2:00 pm: Nakoa Farrant

Assessing ecological and social implications of abandoned agricultural land

2:00 – 2:05 pm: Annette Hilton

The secret life of groundwater: How to track subsurface groundwater movement with vertical hydraulic gradient

2:05 – 2:20 pm: Fatiq Nadeem

Forecasts: Consumption, production and behavioral responses

2:20 – 2:25 pm: Liliana Sierra

Community-based compliance and enforcement (CBCE) in small-scale fisheries: A review

2:25 – 2:40 pm: Haozhe Yang

Future of renewable electricity supply

2:40 – 3:00 pm: Break

3:00 – 3:15 pm: Elliot Finn

Partisan and place-based identity interact to shape environmental opinion

Symposium Schedule

(CONTINUED)

3:15 – 3:30 pm: Jiajia Zheng

Residential solar-plus-storage systems: Life-cycle cost and carbon emissions

3:30 – 3:35 pm: Cori Lopazanski

Quantifying effects of mangrove deforestation on fisheries catch

3:35 – 3:50 pm: Nicol Parker

Prioritizing pesticide management: Contemporary chemical and crop contributions to environmental toxicity in California

3:50 – 3:55 pm: Chen Xing

Response of interdecadal temperature variability in the Pacific Ocean to external forcing in climate models

3:55 – 4:10 pm: Casey O’Hara

At-risk marine biodiversity faces extensive, expanding, and intensifying human impacts

4:10 – 4:15 pm: Brian Lee

Quantifying bat foraging behavior over California agriculture using ground-based radar

4:15 – 4:30 pm: Patrick Hunnicutt

Community leaders mitigate instability from public service shortages: Evidence from post-conflict Liberia

4:15 – 4:30 pm: Sandy Sum

From boneyard to table: The effects of border enforcement on economic outcomes in the US

4:30 – 4:40 pm: Closing Remarks, Ignacia Rivera

5:00 pm: Awards Ceremony: [Join Zoom here](#)

Symposium Abstracts

In order of appearance

Erin Winslow

Advisor: Hunter Lenihan

Co-authors: Hunter Lenihan, Deron Burkepille, Tom Adam, Kelly Speare, Jim Hench

Title: Coral bleaching: Understanding dynamics for conservation

Summary: Coral reefs are under increasing threat as thermal anomalies become more frequent and more severe all over the world. The Indo-Pacific experienced the worst ever recorded bleaching event in the austral summer of 2019 when a warm water mass moved through the South Pacific. Over 40% of coral was at least 75% bleached and/or dead following the peak of heat stress around Moorea, French Polynesia, but there was ecological and spatial heterogeneity in bleaching severity. Our work shows that variation in bleaching is attributed to thermal stress, water depth, size of coral colony, and genus of coral. Understanding which corals are more susceptible to bleaching and where refuge may exist from thermal stress is imperative for conservation of coral in perpetuity.

Anna Boser

Advisors: Ashley Larsen, Kelly Caylor

Co-authors: Daniel Sousa, Ashley Larsen, Andrew MacDondald

Title: West Nile virus risk mapping using satellite derived temperature data

Summary: Mosquito-borne diseases threaten over 80% of the world's population, and are increasing in intensity and geographical range with environmental change. Mapping and understanding the risk profile of mosquito-borne illness is instrumental for mitigation efforts, but limitations on the spatial and temporal resolution of available data leads to a gap in fine-grained understanding of where and when risk is present. West Nile virus (WNV), the most prevalent mosquito-borne illness in California, benefits from well-understood relationships between many risk-contributing mosquito traits and temperature, its main abiotic determinant. Here, we leverage the established relationship relating air temperature to mosquito biting rates and West Nile virus transmission probabilities and fine resolution land surface temperature (LST) measurements from the Ecosystem Spaceborne Thermal Radiometer Experiment (ECOSTRESS) (2018-2020) to resolve fine resolution maps of risk over different times of day. To do so, we first use the LST measurements to model air temperature at a 30m resolution, and then apply the laboratory derived equations to resolve biting and transmission rates. We evaluate the suitability of such maps for evaluating differences over varying land cover types by leveraging unique, high quality agricultural data available in the larger Bakersfield, CA area. Our approach allows us to resolve meaningful differences throughout the day and across the landscape in biting rates and WNV transmission probabilities for the leading vector in the region. Combining high resolution remote sensing with laboratory derived epidemiologically relevant relationships enables understanding of mosquito-borne illness risk at unprecedented resolutions and gives us new insights on the spatio-temporal dynamics of such diseases.

Acknowledgements: NSF GRFP

Violaine Desgens-Martin

Advisor: Arturo Keller

Co-author: Arturo Keller

Title: Fate and ecotoxicity potential of pharmaceuticals and personal care products using modeling as a guidance tool

Summary: Pharmaceuticals and personal care products (PPCPs) are considered contaminants of emerging concern. Although a wide array of PPCPs have been used for several decades, the research on the potential continued impacts these have on environmental systems has only gained traction relatively recently. These compounds make their way in the environment via various sources, including wastewater treatment plants (WWTPs). Although a fraction of PPCPs is removed during wastewater treatment, the removal efficiency varies based on the compound, and the plant's design and protocols. Here, the ChemFate model will be used as a predictive tool to quickly determine the environmental fate and ecotoxicity risks of PPCPs once discharged from WWTPs. The ChemFate model was used in the context of the pandemic in order to evaluate the ecotoxicity risks of COVID-19 treatment agents to exposed aquatic organisms of selected fresh- and seawater bodies of Los Angeles County. Additionally, predicted results obtained for selected PPCPs will be compared to experimental data from cities with environmental monitoring programs. Finally, we will determine the ecotoxicity potential of 61 PPCPs, including 18 PFAS, from freshwater samples collected downstream from wastewater treatments plants in Southern and Central California. Using modeling tools to predict environmental concentrations and subsequently rapidly identifying potential ecotoxicity risks of a wide array of compounds, including the 61 PPCPs and two COVID-19 treatment agents evaluated here, can provide useful data decision makers can use to assess and monitor future risks.

Nakoa Farrant

Advisor: Ashley Larsen

Co-authors: Ashley Larsen, Dar Roberts, Carla D'Antonio

Title: Assessing ecological and social implications of abandoned agricultural land

Summary: Millions of acres of agricultural land have been abandoned globally in recent decades. Abandoned fields may support biodiverse vegetation that offers ecosystem services. Alternatively, abandoned land may foster ecosystems dominated by invasive species. We lack an understanding of where biodiversity may benefit from widespread abandonment, and how those revegetation trajectories impact humans. My work investigates succession patterns on abandoned fields in Hawai'i where cultivated area decreased by 50% from 1980 to 2015. Preliminary analysis points to soil organic matter content as a key driver of native and invasive vegetation succession patterns on former sugarcane fields, though further study of biophysical and landscape traits is ongoing. Extending the scope to abandoned pastoral land and pineapple fields will enhance our theoretical framing of how drivers of succession vary with agricultural legacy. From this improved understanding of post-abandonment succession, land management plans can be developed for a variety of interests such as biodiversity conservation, carbon storage, or food security through recultivation of former fields. Insight derived from the unique opportunities in Hawai'i can guide a broader and more global effort to manage abandoned agricultural land more sustainably with respect to ecological and human needs.

Acknowledgement: Ford Foundation Predoctoral Fellowship

Annette Hilton

Advisor: Scott Jasechko

Co-author: Scott Jasechko

Title: The secret life of groundwater: How to track subsurface groundwater movement with vertical hydraulic gradient

Summary: Groundwater travels unseen below the land surface, complicating efforts to understand how aquifers interact with surface waters. Vertical hydraulic gradient is the potential for vertical groundwater flow in aquifers. By measuring vertical hydraulic gradients, we can quantify groundwater flow directions and rates. Here I calculate spatiotemporal distributions of vertical hydraulic gradients using well water level measurements in five major aquifer systems in the US. My results reveal decadal-scale changes in vertical hydraulic gradients in all five aquifer systems; four out of five systems increase in their downward potential of water flow, meaning more water may be flowing down into the subsurface rather than upward to discharge to surface waters. Understanding the potential for vertical water flow has great implications for (1) surface water-groundwater interactions, (2) contaminant transport in aquifer units, (3) identifying areas of vulnerability in aquifer systems.

Fatiq Nadeem

Advisor: Kelsey Jack

Co-authors: Matthew Gibson, Arman Rezaee, Sanval Nasim, Husnain Fateh

Title: Forecasts: Consumption, production and behavioral responses

Summary: Economic theory predicts forecasts are an important determinant of welfare. In developing countries, however, limited information and human capital may make it difficult for agents to produce accurate, precise forecasts. This plausibly limits the scope for optimal responses to uncertain future events. We study the effects on forecast consumption, production, and behavioral responses from two randomized interventions in Lahore, Pakistan: 1) provision of one-day ahead air pollution forecasts; and 2) general forecasting training aimed at reducing behavioral biases. On average, subjects exposed to forecasts were willing to pay roughly 60 percent of the cost of mobile internet access to continue receiving them. Both interventions reduced air pollution forecast error, and receipt of forecasts increased demand for protective masks. These results document substantial demand for forecasts among urban residents in the developing world. They suggest that modest educational interventions may durably improve forecasting-relevant human capital.

Acknowledgements: International Growth Center, Abdul Latif Jameel Poverty Action Lab, Lahore University of Management Sciences, Williams College and the University of the South

Liliana Sierra

Advisor: Steve Gaines

Co-authors: Steve Gaines, Jono Wilson, Gonzalo Banda-Cruz

Title: Community-based compliance and enforcement (CBCE) in small-scale fisheries: A review

Summary: Small-scale fisheries represent around 90% of the world's fisheries, providing nearly half of global seafood supply. These fisheries are key for food security of people in the poorest countries in the world, yet most suffer from ineffective management. Co-management in small-scale fisheries has been demonstrated to be an effective strategy to achieve desired management objectives across a range of geographies and contexts. Some key components to successful co-management include access to the fishery, fishery harvest management, research, community organization, economic development, collaboration and building supporting institutions, and enforcement and compliance. Enforcement and compliance are usually assumed to be carried out by government officials and local authorities, but for many small-scale, community-based fisheries, the nature of the fishery precludes investment in enforcement by state-sponsored programs, obligating the community to respond. As a result, numerous community-based enforcement programs have arisen, spanning a wide range of approaches to incentivize sustainable fishing practices in small-scale fisheries, but there is surprisingly little understanding in the scientific literature, as well as the practitioner space, regarding the different considerations that lead to successful (and unsuccessful) programs. To better understand the mechanisms, challenges, and opportunities for community-based enforcement, we performed a systematic literature review of co-managed small-scale fisheries around the world. We organize our findings into three categories of enforcement: Detection, Deterrence, and Detention. Within each we provide an overview of the mechanisms, equipment used, challenges, and opportunities to achieve successful community-based enforcement programs. Our work is some of the first to highlight this important component of small-scale fisheries management, and such guidance may be instrumental in furthering the advancement of sustainable fisheries management.

Acknowledgements: The Nature Conservancy

Haozhe Yang

Advisor: Sangwon Suh

Co-author: Sangwon Suh

Title: Future of renewable electricity supply

Summary: The global resource of renewable energy is abundant to meet the demand of electricity if we transition to a 100% renewable energy world. However, the supply of renewable energy resources are unevenly distributed across the world. Moreover, the cost of renewable energy could limit the supply of electricity. Identifying the global and regional supply of renewable energy is critical to build a world with 100% renewable electricity. In our work, we estimate the supply curve of renewable electricity at a country level. Our work finds that renewable resources fall short of meeting local electricity demand in many countries, but building a regional transmission network could help meet the regional demand. We also find that the transition to 100% renewable energy could decrease the cost of electricity in Northern and Southern America and Oceania, but increase the cost of electricity in Asia and Eastern Europe.

Elliott Finn

Advisor: Sarah Anderson

Title: Partisan and place-based identity interact to shape environmental opinion

Summary: Place structures communities, economies, and culture. These factors create place-based identities that shape political attitudes, opinions, and values. Political parties activate place-based identity threat for political gain. Individuals exposed to partisan, place-based organizing will amplify, dampen, and radicalize their opinions and behaviors. Average party members will amplify their opinions towards stronger partisan opinions when exposed to organizing efforts from their own party that targets place-based threat. Strong partisans react in more unpredictable and politically extreme ways. These individuals are the most likely to engage in political action or join fringe movements when exposed to similar organizing efforts. Individuals who are not part of the party appealing to place-based identity threat are likely to move their opinions towards the party supporting place identity. I use a survey of urban, suburban, and rural California residents to test whether rural identity interacts with partisan identity to explain divergent support for environmental policies. Preliminary evidence suggests support for the outlined theory. Place of residence interacts with Republican partisan identity; conditional on party strength, rural residents report the lowest support for environmental policies. Place-based, rural identity is likely amplifying, radicalizing, and dampening environmental public opinion via an interaction with party.

Jiajia Zheng

Advisors: Sangwon Suh

Co-authors: Ranjit Deshmukh, Chia-Chun Lin, Sangwon Suh

Title: Residential solar-plus-storage systems: Life-cycle cost and carbon emissions

Summary: Installations of solar panels and battery storage systems in the residential sector are growing at a rapid pace. However, how residential solar-plus-battery systems affect greenhouse gas (GHG) emissions with an increasingly decarbonized grid is under-evaluated. Here, we examine the impacts of solar-plus-storage systems on life-cycle emissions and costs in current and future years for households across California, using a long-run marginal perspective. We show that depending on the Time-of-Use rates used, a solar-plus-storage system can be -7% to 20% different from a solar-only system in annual life-cycle GHG emissions in California in 2020, with 5%-25% more life-cycle cost. Adding a carbon price can reduce GHG emissions but potentially incur more cost. In 2040, however, solar-plus-storage systems can no longer reduce GHG emissions unless there is a carbon price, but have less cost than solar-only systems. This study calls for careful electricity tariff design and use of a carbon price in reducing system GHG emissions of residential solar-plus-storage systems.

Acknowledgements: Bren Graduate Fellowship

Cori Lopazanski

Advisor: Steve Gaines

Title: Quantifying effects of mangrove deforestation on fisheries catch

Summary: Mangroves are the dominant habitat in tropical and subtropical estuaries, and provide essential services to fisheries: they facilitate larval settlement and recruitment, serve as nursery areas for juveniles, and supply food and structure for continued growth and reproduction. These functions have been well-documented, but studies have failed to establish causal links identifying how specific fisheries depend on mangrove systems. While some local-scale studies have found positive correlations between total mangrove extent and general fisheries productivity, understanding species-level dependence is critical for determining how declines in mangrove habitat may affect how specific fisheries recover. Estimates suggest global mangrove cover has decreased by as much as 35% since the 1980s, and continued deforestation remains a significant threat to remaining mangrove systems. This project leverages existing global scale data to examine the causal effects of mangrove degradation on species-level fisheries catch metrics through time.

Acknowledgements: Sarah Argyropoulos

Nicol Parker

Advisor: Arturo Keller

Co-author: Arturo Keller

Title: Prioritizing pesticide management: Contemporary chemical and crop contributions to environmental toxicity in California

Summary: In California, 13% of waterways assessed for pesticides under the Clean Water Act (section 303(d)) are impaired. In this study, we developed and applied a free, web-based tool to evaluate the distribution of pesticide toxicity in watersheds across California (140), the Pesticide Prioritization Management Model (PMPM). The PMPM provides users with pesticide spatiotemporal toxicity trends, the relative contribution of individual chemicals, cumulative chemical loads, and the toxic load applied to site types (e.g. grape or almond). To enable consideration of agricultural stakeholder interests, the tool also quantifies the economic value (gross) of agricultural sites. We employ the PMPM to evaluate contemporary pesticide toxicity trends for the most recently available 5-year period of pesticide use data. Results demonstrate that for fish, cladocerans, and benthic invertebrates, 11 of California's watersheds receive 80% of pesticide toxic loads. The pesticide application site classes to which 80% of toxic loads were applied include almonds, pistachios, citrus, alfalfa, walnuts, cotton, lettuce/leafy greens, grapes, safflower, miscellaneous truck crops (primarily sugar beet and celery), and corn/sorghum/sudan. Of the hundreds of pesticides in use, fifteen chemicals were observed to introduce 99% of toxicity. While highly variable and complex mixtures of chemicals may occur in individual catchments, these results suggest cumulative toxic concerns at the far-field scale are estimable via considering only a short list of active ingredients.

Acknowledgements: Cal Sea Grant - Bay Delta Science Fellowship

Chen Xing

Advisor: Samantha Stevenson

Co-author: Samantha Stevenson

Title: Response of interdecadal temperature variability in the Pacific Ocean to external forcing in climate models

Summary: There is interdecadal variability in sea surface temperature over the Pacific Ocean, which is known as the Pacific Decadal Variability (PDV). PDV is an important background for the global climate. However, how the PDV responds to external forcing is not fully understood. In this study, I analyze the performance of PDV external response through large ensemble models and CMIP models. The ensemble mean trend of the CMIP5 model is nearly zero, but the ensemble mean of the CMIP6 model has a strong decadal response, with a clear decreasing trend after the 1990s. By fingerprinting, two main external forcing patterns were extracted. The first one is the global mean surface temperature variation consisting of greenhouse gas warming, and the other one is the hemispheric different temperature variation due to anthropogenic aerosols. According to the time series and spatial pattern, greenhouse gases do not contribute to the PDV decadal response; instead, it prohibits the PDV response. The anthropogenic aerosol effect is highly correlated with the external PDV response. The aerosol-cloud indirect effect is found to be one of the reasons for the difference between CMIP5 and CMIP6. Over the North Pacific, aerosol-induced low clouds reflect more incoming solar radiation and reduce surface temperatures. Since most CMIP6 models include indirect aerosol-cloud effects while most CMIP5 models do not, the models in CMIP6 exhibit a PDV response to external forcing. But it is unclear whether the strong aerosol effect is real or just a model bias.

Acknowledgements: Bren Fellowship

Casey O'Hara

Advisor: Benjamin Halpern

Co-authors: Benjamin Halpern, Melanie Frazier

Title: At-risk marine biodiversity faces extensive, expanding, and intensifying human impacts

Summary: Human activities and climate change threaten marine biodiversity worldwide, though sensitivity to these stressors varies considerably by species and taxonomic group. Mapping the spatial distribution of 14 anthropogenic stressors from 2003 to 2013 onto the ranges of 1,271 at-risk marine species sensitive to them, we find that on average species face potential impacts across 57% of their ranges, that footprint is expanding over time, and those impacts are intensifying across 37% of their ranges. While fishing activity dominates the footprint of impacts in national waters, climate stressors are driving the expansion and intensification of impacts. Planned extensions of this work include applying a trait-based vulnerability framework to extend the current study to include ~45,000 marine species, at-risk or otherwise, and projecting future patterns of vulnerability of functional diversity based on climate-driven range shifts. This work is critical to informing conservation priorities to ensure effective, equitable, and sustainable management of the marine ecosystems on which we depend.

Brian Lee

Advisor: Ashley Larsen

Co-authors: Ashley Larsen

Title: Quantifying bat foraging behavior over California agriculture using ground-based radar

Summary: Every evening, hundreds of thousands of Mexican free-tailed bats fly out from their roosts in Central California to feed on tons of insects. Unfortunately, little is known about the movement and feeding behavior of these bats over agricultural areas and their effect on pests. This project utilizes existing ground-based Doppler radar operated by the National Weather Service to track groups of bats across the landscape, with the eventual goal of understanding the feeding behavior of bats over specific crop types over the course of an evening. This information can help multiple stakeholders, from farmers to policymakers, better understand the value of bats and the ecosystem services they provide.

Acknowledgements: Schmidt Environmental Fellowship

Patrick Hunnicutt

Advisor: Mark Buntaine

Co-author: Kou Gbaintor-Johnson

Title: Community leaders mitigate instability from public service shortages: Evidence from post-conflict Liberia.

Summary: Does informal governance support statebuilding after civil war ends? When the state is weak, informal elites—non-state actors who govern by custom rather than by statute—regularly shape citizens’ interactions with the government. Yet current explanations of statebuilding do not systematically evaluate how informal elites may bolster state capacity and legitimacy. We develop a micro-level theory wherein informal elites facilitate statebuilding locally as brokers who institutionalize citizens’ responses to government failures. When citizens believe informal elites can elicit reform on their behalf, they will be less likely to mobilize for protest following costly government failures. Household panel data collected over six months of fieldwork in Liberia support our argument. Citizens who experience shortages in government-provided services are significantly less willing to protest, to shirk on tax payments, and to claim the government is corrupt when they believe informal elites are effective brokers. Interviews with prominent informal elites in Liberia’s capital city clarify their broader contributions to statebuilding, including mitigating political unrest and prevent extrajudicial violence.

Sandy Sum

Advisor: Tamma Carleton

Title: From boneyard to table: The effects of border enforcement on economic outcomes in the US

Summary: Border enforcement is a costly national endeavor that is surprisingly recent. Up until the 1980s, El Paso and Flores, the mirror town on the Mexico side of the border, existed as a single community. In the 80s, the Mexican peso crashed and led to an influx of migrant workers into the US. The question was: are these workers on the net going to cause harm to locals by displacing their jobs, or are they going to bring benefits through stimulating the economy? This toy example can be extended to current US politics around immigration. I propose to study a border strategy change to shed light on its effect on various economic outcomes in the US.

Acknowledgements: Deckers Outdoor Corporation

The 2021 Bren PhD Student Symposium Committee

Ignacia Rivera, Chair

Anna Boser

Leonardo Feitosa

Liliana Sierra Castillo

Mukta Kelkar

Nathaniel Grimes