

# YOUNG ENVIRONMENTAL SCHOLARS CONFERENCE

November 13, 2018 | Frances C. Arillaga Alumni Center

## ABSTRACTS

### *Oral Presentations Group 1*

#### **Burning for Baskets, Subsistence, and Resilience: Indigenous Prescribed Fires in Northwest California – Tony Marks-Block**

After more than a century of fire suppression policies and timber extraction, Northwest California Indians are promoting the resurgence of prescribed fire in forests to enhance ecocultural resources and reduce wildfire risks. Preceding colonialism, Northwest California Indians employed landscape burning to either alter or facilitate conditions to increase the abundance of species for subsistence foods, fibers, and ceremonies as well as to inhibit the severity of wildfires. With the prohibition of these practices, fire-sensitive timber species like Douglas fir have come to predominate the landscape at the expense of hardwood forests and savannas valued by California Indians for productive acorns, nuts, berries and associated wildlife. Communities along the Klamath River began to pilot small-scale “cultural burns” (1 – 50 ha) in the last decade through collaborative efforts with public land agencies, fire regulators, environmental non-governmental organizations, and Tribal governments. These cultural burns have supported the growth of plant stems and leaves gathered by California Indians for basketry materials and have improved acorn and berry harvesting. The positive outcomes of these fires and collaborations has led to recent approvals of larger-scale (2254 ha) thinning and burning treatments in forests that were once managed as plantations. Leadership by California Indians to integrate fire-enhanced ecocultural resources into management objectives along with broader shifts toward ecological and collaborative management has created opportunities to reimagine the forests of Northwest California while revitalizing Indigenous livelihoods.

#### **Unavoidable risks: persistent water contact despite local knowledge of schistosomiasis risk in an endemic region of northern Senegal - Andrea Lund**

Human schistosomiasis is a snail-borne parasitic disease affecting hundreds of millions worldwide. Direct contact with snail-infested surface water is the primary route of exposure. Development of water resources, including dams and irrigation schemes, expands available snail habitat, increasing the pathogenicity of the landscape to local populations exploiting natural resources to generate income. This has been the case along the Senegal River since the construction of the Diama Dam in 1986. Designed to promote year-round agriculture in the drought-prone Sahel, local populations—whose livelihoods are predominately agricultural—have suffered high prevalence and intensity of infection. The region still remains one of the most hyperendemic in the world for schistosomiasis. Because of the convergence of water resources development, resource-dependent livelihoods and the social ecology of exposure, schistosomiasis is considered an illustrative case of a disease-driven poverty trap, although literature to date remains largely theoretical. With qualitative data generated from 12 focus groups in 4 villages, we use theme analysis to investigate how perceptions of schistosomiasis, its environmental source and reported preventive behaviors may suggest the presence of a disease-driven poverty trap in this setting. The data reveal three key findings: (1) local knowledge of schistosomiasis risk is high, (2) preventive behaviors have been adopted, but ultimately, (3) exposure persists, likely due circumstances characteristic of a disease-driven poverty trap. These findings highlight the capacity of local populations to participate actively in schistosomiasis control as well as the

limitations of widespread human treatment in the absence of interventions that address environmental sources of infection.

### **Understanding the economic impacts of artisanal palm oil production in Ghana - Ruth Adu-Daako**

This study was carried out to understand the economic impacts of artisanal production of palm oil in farming communities. In Ghana, an important way through which women are participating in the oil palm economy is through the artisanal processing of unrefined palm oil which is a key ingredient in traditional West African diet. I had in-person qualitative interviews with 15 workers largely women, engaged in different activities at artisanal mills in the Juaben district of Ghana. My findings showed that due to limited access to land and capital, oil palm farming is done largely by men with a greater proportion of the harvest purchased by large industrial mills. That notwithstanding, women are able to find self-employment in oil palm processing through a combination of strong relational skills, trust and diligence which they adopt to build long-term business relationships with farmers. In addition, they provide essential trade financing to farmers that enables them to maintain their farms and meet family emergencies. Also, they provide direct economic benefits to farming communities by providing temporal employment opportunities, and the growth of other businesses like transportation, retailing, food vending and market activities. There was also growth in standard of living related to ability to provide better education, healthcare and meals for family. From an economic development perspective, this study provides evidence to inform the design of strategies aimed at developing the informal palm oil sector in Ghana.

### **Designing Resilient Social-Environmental Standards for Development Finance Institutions: Implications from the 2012-2016 World Bank Safeguards Review -Gus Greenstein**

To facilitate economic development with minimal social-environmental costs, multilateral development banks (MDB) must implement standards which ensure that they support low-risk projects and mitigate the negative impacts that can occur as a result of project development. What combination of academic knowledge, political processes, and organizational dynamics are currently shaping the social-environmental standards of MDBs? To answer this question, I use theories of resource dependency and sociological institutionalism to examine the World Bank's (WB) 2012-2016 Safeguards Review and Update, through which the WB overhauled its social-environmental standards. While official WB accounts state that the resulting Environmental and Social Framework (ESF) "make[s] people and the environment... safer from any adverse impacts," many observers believe that it carries weaker protections than the standards it replaced. Through 37 interviews with current and former employees of the WB, other MDBs, donor and borrower country representatives, and global NGOs, I find that key features of the ESF represent a response to rising competition among financiers more so than an effort to operationalize new knowledge and/or international norms. Most notably, client countries – empowered by new, alternative financiers – drove the transition toward greater use of their own legislative systems and procedures requiring fewer impact mitigation procedures prior to loan approval. Facing financial pressures and borrower aversion to loan conditions, WB staff and management held incentives to align with borrowers' policy objectives. These findings highlight need for a multi-pronged approach to ensuring durable standards among development financiers, including: enhanced global coordination between financiers, increased investment in systems for assessing and implementing borrowers' social-environmental standards, and rigorous analysis of the relative benefits of different regulation frameworks.

### **The landscape of voluntary property buyouts to manage flood risk in the United States – Carolien Kraan**

Managed retreat from flood-prone areas is an increasingly important adaptation option for reducing risks to people and assets. Learning from experiences to date, such as the long-running property buyout programs in the United

States, is essential in informing future deployment. Since 1989, the US Federal Emergency Management Agency has supported voluntary buyouts of over 40,000 properties in floodplains, with the land subsequently maintained as open space. Here, we analyze where buyouts have occurred with respect to flood risk, socioeconomics and demographics, and local capacity. The evaluation is attuned to adaptation effectiveness and equity. Buyouts have taken place in almost every US state, yet approximately half are concentrated in fewer than 10 states and in program years 1989–1998. Buyout projects have been small; project size is most often only 1–3 properties. As measured by disaster declarations, property damages, and flood zones, buyouts have been concentrated in more flood-prone areas, and bought-out properties are largely single-family homes and primary residences. Results suggest that capacity of local governments has enabled participation in the FEMA buyout programs, yet bought-out properties are concentrated in areas of greater social vulnerability, raising concerns that effects of buyouts may be inequitable. A random forest analysis was conducted to assess variable importance in differentiating between counties that have done buyouts versus those that have not. Property damage, population and population density were determined to be of highest importance in the random forest. Opportunities for improvements arise. For example, accelerating the buyout process would likely increase deployment and ease burdens for property owners, and more consistent project reporting could catalyze learning in the policy process through time.

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### ***Oral Presentations Group 2***

#### **High-tide flooding disrupts local economic activity – Miyuki Hino**

Evaluation of observed sea level rise impacts to date has emphasized sea level extremes, such as from tropical cyclones or other storms. Far less is known about the consequences of more frequent high-tide flooding. Empirical analysis of the disruption caused by high-tide floods, also called nuisance or sunny-day floods, is challenging due to the short duration of these floods and their impacts. Through a novel combination of data sources and empirical methods, we estimate the effects of high-tide flooding on local economic activity. High-tide flooding already measurably affects local economic activity in the historic downtown of Annapolis, Maryland, reducing visits to the affected area by 1.7% (95% confidence interval of 1.0%–2.6%). There is no evidence that visits are recovered at other times or in other places. With three and 12 inches of additional sea level rise, high-tide floods would reduce visits by 3.6% (3.2%–4.0%) and 24% (19%–28%), respectively. A more comprehensive understanding of the impacts of high-tide flooding, including on health and transportation, can help to guide efficient responses—from local adaptations to global mitigation of climate change.

#### **When Floods Hit the Road: commute disruption due to coastal flooding and sea level rise in the San Francisco Bay Area – Indraneel Kasmalkar**

Extreme storm events have the potential to generate flooding on low-lying coastal roads, causing significant disruption to traffic networks. Known for its already high levels of traffic congestion, the San Francisco Bay Area faces the risk of flood inundation along major corridors. A coastal flooding event in this region can cause massive commute disruptions, triggering socioeconomic consequences such as loss of wages and jobs for individuals, economic costs for businesses due to the delay or absence of workers, and increases to road accidents and loss of life. Moreover, rising sea levels will continue to increase the frequency of such flood-induced commute disruption. By modeling the effects of coastal flooding on traffic networks, we develop a framework to assess the risks posed by global sea level rise, quantify the socioeconomic impacts of commute disruption, and identify potential areas for intervention.

Our approach for modeling commute patterns relies on three datasets: a federal database of home and workplace locations of employees; a regional road network for the Bay Area; and regional coastal flood projection maps for

the Bay Area. After overlaying the flood maps on the road network to identify inundated road links, we use an Iterative Traffic Assignment model to dynamically assign commuters to their feasible shortest-time routes. Our model allows us to identify changes in commute patterns in response to various coastal flooding scenarios, estimate corresponding increases in commute time, and assess potential areas of high congestion. More broadly, our work begins to highlight the far-reaching impacts of coastal flooding, where inundated roadways in the immediate vicinity of the Bay can disrupt commute patterns much further inland. Communities and businesses across the greater Bay Area stand to be adversely affected due to sea level rise over the coming decades.

### **Policy suggestions to develop and regulate schools with a focus on environmental education in Hong Kong – Man Sze Hui**

#### Central Thesis

Advocating for policy change to provide for and regulate the development of schools with a focus on environmental education (i.e. green schools) in Hong Kong possibly through the construction of a legal framework.

#### Methodology

- A. Surveying the field: what are the existing laws and policies regarding green schools in Hong Kong? What are the key problems to be solved? What is the gap to be filled?
- B. Identifying core principles/potential models from case study of other countries: understanding the core law and policy supporting and regulating environmental education in the US and Japan, which are known to be quite advanced in environmental education.
- C. Applying the core principles to the specific situation of Hong Kong: analyzing the different principles/models from Part B and developing a set of policy-making criteria to assess which of them would work in Hong Kong.
- D. Making policy suggestions on how to provide a favorable environment for the development of schools with a focus on environmental education in Hong Kong, possibly through the development of a legal framework.

### **Lynne Zummo**

Scientists agree that climate change presents a significant threat (IPCC, 2014). However, Americans remain divided; fewer than half see climate change as both human-caused and threatening (Brenan & Saad, 2018), despite massive scientific evidence to the contrary. Research points to political stance as a key predictor of this doubt, with liberals tending towards acceptance and conservatives tending towards skepticism of the scientific consensus (Drummond & Fischhoff, 2017; McCright, Dunlap, & Xiao, 2014). Despite the enormous sway of political beliefs on adults, little research in science education has attended to youth and politics. This study uses sociocultural theory to examine the role of political ideologies in youths' discourse around climate change in the science classroom. It asks about the discourses (or ways of speaking and writing) youth use, as well as the relationships between those discourses and youths' political stances, acceptance of anthropogenic warming, and sociopolitical context. It presents initial findings from a study involving a computer-based activity in which students were asked to write responses to a hypothetical climate denier. This study used mixed-methods approaches to analyze students' writing and understand relationships between students' writing and their political perspectives.

### **Can the US military be a stronger voice against climate change than the scientific community? – Benjamin Schafel**

Despite a general consensus by the scientific community that climate change exists, and humans are largely responsible, there remains a strong divide between the political left and right. Given that the public systematically filters messages from politicians and scientists through partisan lenses, does climate change communication suffer

from a framing issue or from a delivery source issue? I use an experiment, embedded in a survey of the American public, to show that the US military is more effective than the scientific community at shaping climate change public opinion across all political parties in believing that climate change is occurring, that it is a threat to US national security, and that steps must be taken to prevent further temperature rising. In areas where the scientific community is unable to influence public attitudes, both Democrat and Republican, the US military is able.

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### ***Poster Presentations***

#### **Enabling the renewable transition by regulating energy storage in Mexico – Aurea M. Fuentes Morales**

The International Energy Agency's (IEA) report Tracking Clean Energy Progress published in 2017 highlights three issues limiting the use of energy storage by grid operators: i) the lack of clarity and transparency in market rules and regulations; ii) the lack of markets for flexibility and ancillary services, and iii) the low penetration of new business models. I consider these problems can be used as guidelines to evaluate the Mexican energy storage policy and as standards for any corresponding improvements to the regulation.

Accordingly, the purpose of this study is to assess the current regulatory scheme applied to energy storage as a necessary element to guarantee the proper deployment of renewable sources of electricity in Mexico. Although the legal and constitutional reforms enacted in 2013 set progressive goals for the generation of power from clean sources, its comprehensiveness is yet to be analyzed.

Currently, the Electricity Market Guidelines is the only regulation that recognizes energy storage as a concept. It establishes that storage equipment shall be registered under the category of 'power plant' before the National Center for Energy Control, the Wholesale Electricity Market operator.

While the existing framework could be considered as a single legal impediment, I intend to provide a broader policy analysis by assessing if the current regulation incentivizes or discourages participation by highlighting some of its shortcomings for businesses and clean energy access objectives.

As a proposal, I believe energy storage should be regulated as a separate activity from generation, with all the attributes recognized by the Electric Industry Law. To me, a comprehensive energy storage regulation is the means to address the three problems previously identified by the IEA for the Mexican context. This includes dissecting the density of relevant statutory and regulatory layers to identify where legal change can happen for fulfilling access and sustainability.

#### **Using Embedded Assessments to Explore Student Learning in a Residential Environmental Education Program - Archana Kannan**

Environmental education (EE) seeks to provide a deeper understanding of the systems of the world with the overarching motivation of encouraging sustainability. Historically, out-of-school learning environments such as nature parks, museums, zoos, and residential camp programs, have been powerful avenues for promoting EE. However, it is challenging to measure impact of out-of-school EE programs because participants cannot be "tested." Formal testing violates their expectations about freedom of choice, leisurely participation, positive affect, and social interaction (Falk & Dierking, 2000; NRC, 2009; Fu et al., 2015). While surveys and interviews have been used widely to assess a variety of environmental learning outcomes, they have limitations – they tend to be intrusive to the learner, burdensome for the educator, and susceptible to reactive effects of measurement. In recent years, researchers in out-of-school education have become interested in embedded assessments (EA) – assessments that not only capture student learning outcomes in a valid and reliable way, but so do in a way that is contextually sensitive (e.g., Ardoin et al., 2014, 2016; Fu et al., 2016; Schwartz & Arena, 2013). EAs are designed to be a part of the student learning experience and do not disrupt the "flow" of the learner. This paper discusses early stages of my project aimed at developing embedded assessments for residential programs at NatureBridge. I will highlight a specific EA that we developed in Spring 2018 – student journaling and reflection cards – along with the rubric that we used to systematically code students' artwork and reflections. My poster will feature:

- (i) A review of EA from the literature (with examples from prior studies)
- (ii) Theoretical underpinnings behind EA development
- (iii) An EA for NatureBridge: Student Reflection Cards
- (iv) Next steps and future directions

### **Journaling as an embedded assessment tool for understanding development of nature-self relationships – Anna Lee**

Social and behavioral scientists have taken an interest in recent years in the phenomenon of connectedness to nature and ways of measuring it. This study explores the potential of journaling as an embedded assessment tool for understanding connectedness to nature. Advantages of this method are (1) its unobtrusive nature, (2) its easy integration into curricula, and (3) the intrinsic educational benefits of journaling in addition to its use for assessment. We collected daily journals from students in two environmental education camps. Combining quantitative linguistic analysis methods with qualitative content analysis, we uncover evidence of how students participating in environmental education experiences think about themselves and nature in relation to each other. These studies may lay groundwork for further development of journaling as a tool for measuring connectedness to nature

### **Environmental Justice: The Intersection of Law and Energy in the San Joaquin Valley – Luna Martinez**

The California Public Utilities Commission (“CPUC” or “Commission”) is exploring the economic feasibility of options to bring affordable energy options to residents of disadvantaged communities in the San Joaquin Valley. Many residents of these communities lack access to natural gas and are reliant on propane and wood for cooking and heating. Assembly Bill (AB) 2672 initiated the current CPUC proceeding, aiming to identify eligible communities and affordable energy options for those communities. The three categories of energy options specified by statute are: a) extending natural gas pipelines; b) increasing existing subsidies to residential customers; and c) other alternatives that would increase access to affordable energy.

The proceeding is split into three phases. In Phase I, now completed, the CPUC, identified 170 disadvantaged communities and the energy options to explore in Phase II. Phase II, now active, tasks the CPUC with evaluating the scope, feasibility, and cost effectiveness of pilot projects exploring ways to bring affordable energy options to select San Joaquin Valley communities. Phase III, which will open at a later date, will evaluate the implementation progress of the authorized pilot projects and review the data collected.

Within Phase II, numerous parties have provided comments on a broad range of issues. Those parties include energy providers like PG&E, environmental nonprofits like NRDC, and the Berkeley Law School Environmental Law Clinic (ELC). ELC is advocating in this proceeding on behalf of the Center on Race, Poverty, and the Environment, Leadership Counsel for Justice and Accountability, and Self-Help Enterprises.

The success of this project would make affordable and sustainable energy options available to communities that have been the recipients of institutional racism and historical marginalization for decades. Driven by principles of environmental justice, ELC has centered community input as the driver of all decisions.

### **Explaining the Gap between American Hispanics and Non-Hispanic Whites – Taylor Orth**

Perhaps seemingly contrary to predictions derived from Maslow’s hierarchy of needs, members of minority groups in the U.S. express more concern about environmental issues than do others. This paper explores the mechanisms by which this relation occurs with regard to Hispanics’ opinions about global warming. Data from multiple nationally representative sample surveys (n=4,808) were used first to demonstrate that American Hispanics are more likely than non-Hispanic whites to believe that global warming has been happening, that warming is a nationally and globally serious problem, to attach more personal importance to the issue, and to feel personally vulnerable to harm from warming. Also, as expected, Hispanics were more likely than non-Hispanic whites to live

in places vulnerable to extreme heat and to threatening weather anomalies (e.g. hurricanes, droughts, or wildfires) and to have less income (meaning less ability to afford cooling mechanisms and recover from losses). But the association of Hispanic/non-Hispanic white identity with global warming opinions was largely mediated by perceptions of personal vulnerability, not by actual temperature patterns, weather vulnerability, or resource scarcity. Thus, rather than being a “luxury” concern for people whose basic living needs are taken care of, global warming opinions appear to be driven importantly by feelings of personal threat.

### **Think Globally, Act Locally: Adoption of Climate Action Plans in California – Gemma Smith**

California has been a global leader in reducing greenhouse gas (GHG) emission. The State has set an ambitious goal of reducing GHG to 1990 levels by 2020, and 80% below 1990 levels by 2050. The statewide goal cannot be accomplished without the support of local stakeholders. We analyzed over 150 city climate action plans (CAPs) in California and examined their reduction goals. We hypothesized five sets of factors that might explain whether a jurisdiction adopts a plan or not, and what kind of target it sets. We find that size of the city, political ideology, and institutional capacity are related to a higher chance of adopting a climate action plan, whereas political ideology and environmental vulnerability explain the progressiveness of targets. We also find evidence of policy diffusion where neighbors are more likely to adopt plans. Our findings identify gaps in the CAPs within the state and address how communities in other states can learn to adopt CAPs as part of efforts to confront climate change.

### **Joint Assessment of Climate Change and Air Pollution Damages for Vehicle Pathways across the United States – Fan Tong**

The transportation sector has recently become the largest contributor to CO<sub>2</sub> emissions in the United States and it is also a major source of criteria air pollutants that lead to important health and environmental consequences. To date, there is no systematic, spatially-explicit assessment of climate change and air pollution monetized damages from on-road vehicles for the United States. We estimate the life cycle damages due to greenhouse gas emissions and criteria air emissions for three representative vehicles at varying spatial scales – counties, states, electricity grid regions, and Continental U.S. We find that for passenger cars, Sports Utility Vehicles, or transit buses, there is no fuel-vehicle pathway that achieves the lowest climate change damages and the lowest air pollution damages in all counties, states, or electricity grid regions. Our results indicate that vehicle electrification has great potential to reduce climate change damages but may increase air pollution damages substantially in regions with high shares of coal-fired power generation, compared to conventional vehicles. We identify trade-offs between mitigating climate change and reducing air pollution by switching to alternative fuels or advanced vehicle technologies. We show that the preferred technology choices are sensitive to economic assumptions such as the social cost of carbon and value of a statistical life, or more generally determined by the relative importance between clean air and decarbonization goals.

### **Opportunities of biodegradable electronics in healthcare and the environment, Helen Tran**

Biodegradable stretchable devices pose remarkable opportunities for health and environmental monitoring, consumer products and national defense. Mechanical compliance, lightweight, and transience are important attributes for applications on dynamic surfaces or in cases where manual recovery would be prohibitively difficult and expensive. For example, conformable implantable devices that are biodegradable would avoid removal surgeries, reducing the likelihood of infection and patient distress. Moreover, the environmentally critical problem of discarded electronic waste would be relieved. Their practical application critically hinges on the development of integrated transistors that simultaneously exhibit the aforementioned attributes while maintaining high electronic performance. While numerous biodegradable, stretchable insulators have been demonstrated as suitable device substrates and dielectrics, imparting biodegradability and stretchability to

electronically conducting and semiconducting materials presents a particular challenge due to the inherent resistance of most conductive chemistries to hydrolytic cleavage and their typical crystalline nature, respectively. To address this challenge, I developed a dual approach relying on recent chemical and mechanical strategies: (1) the use of imine bonds as conjugated and acid-labile backbone linkages and (2) the nanoconfinement of semiconducting polymers within a surface-engineered, biodegradable elastomer to enable stretchability.

**The Adoption of Prescribed Burns in California** – Rebecca Miller