



M | SNRE
CAPSTONE

C O N F E R E N C E

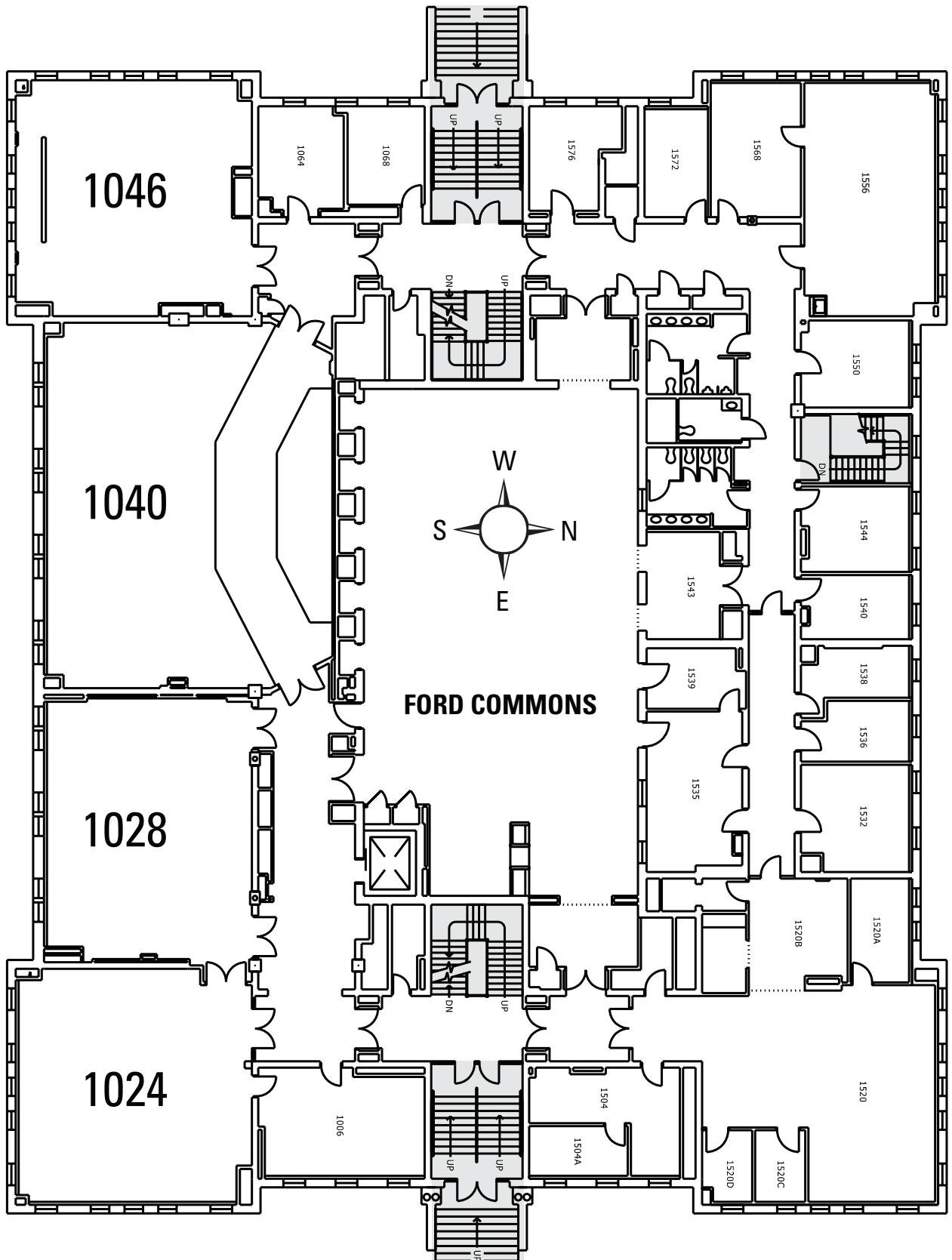
A CELEBRATION OF GRADUATE STUDENT RESEARCH

APRIL 6-7, 2017



DANA BUILDING - FIRST FLOOR

DIAG ENTRANCE



Format

CONFERENCE

- Incorporates thesis and practicum students with master's project team presentations
- Concurrent themed sessions
- Breakouts follow each session to discuss presentations in each theme

STRUCTURE

- 20 minutes with 5-minute Q&A (25 minutes total)
- Each presentation articulates the research question, explains findings, addresses the project's impact, and presents recommendations

95 PRESENTERS, 43 PRESENTATIONS, 5 THEMES

- Behavior & Adaptation
- Sustainable Systems
- Ecosystem Management
- Urban Systems & Design
- Conservation Ecology

THANK YOU

- Thanks to the many student volunteers who help make this event possible by moderating the sessions.
- Thanks also to Dr. Avik Basu, instructor of the master's project planning course.
- Special thanks to Erin Lane, Employer Relations Manager, who organizes this conference annually

Schedule

THURSDAY, APRIL 6, 2017

- 5:00 p.m. General welcome by Dan Brown, Interim Dean, SNRE (Room 1040)
- 5:20 p.m. Concurrent sessions
• Behavior & Adaptation (Room 1028)
• Sustainable Systems (Room 1040)
- 7:50 p.m. Reception (Ford Commons)
- 8:30 p.m. Opening night of the 2017 Capstone Conference concludes

FRIDAY, APRIL 7, 2017

- 8:30 a.m. Coffee (Ford Commons)
- 9:00 a.m. Concurrent sessions
• Sustainable Systems (Room 1028)
• Ecosystem Management (Room 1040)
- 12:20 p.m. Lunch (Ford Commons)
- 1:20 p.m. Concurrent sessions
• Urban Systems & Design (Room 1028)
• Conservation Ecology (Room 1040)
- 5:05 p.m. Reception (Ford Commons)
- 6:00 p.m. 2017 Capstone Conference concludes





Themes

BEHAVIOR & ADAPTATION

Thursday evening: Room 1028

- 5:20 p.m. *Hiking along the Color Line: African American Participation in Outdoor Recreation*
Teona Williams (EJ)
- 5:45 p.m. *The Chinese Safari: Cultural Identity and Wildlife Conservation in Kenya's Tourism Industry*
Amanda Kaminsky (EPP)
- 6:10 p.m. *Building on Common Ground: Using Community Articulations of Support to Promote Affordable Housing Developments in Ann Arbor, Michigan*
Mary M. Jones (EJ)
- 6:35 p.m. *Buffer Zone Planning in Shivapuri-Nagarjun National Park: How Inclusive Policymaking Can Inform More Resilient Park-People Relations and Protect Ecological Services in Nepal's Capital*
Ashley Dickerson (LA); Qianyun Yuan (LA)
- 7:00 p.m. *The Role of Observational Learning in Developing Ecotourists' Environmentally Responsible Behavioral Intentions*
Benjamin Morse (BEC)
- 7:25 p.m. *How Does Ecosystem-Based Adaptation Work Through Poverty Alleviation? A Case Study from Forest Communities in Southwest China*
Beilu Duan (EPP/CE)

SUSTAINABLE SYSTEMS

Thursday evening: Room 1040

- 5:20 p.m. *Pricing Policies for the Integration of Distributed Energy Resources in Utility Systems*
Syne Salem (SS); Niel Patel (SS); Cecilia Lee (SS); Lingchen Sun (SS); Cazzie Palacios Brown (SS)
- 5:45 p.m. *Property Assessed Clean Energy (PACE) Renewable Energy Program Plan and Pilot Project*
Rees Blanchard (SS)
- 6:10 p.m. *Solar Microgrids in Rural India: Consumer Preferences and Market Modeling*
Sachiko Graber (SS/BEC); Tara Narayanan (SS)
- 6:35 p.m. *Can the Right Tool Unlock Green Building Investment? A Decision-Aiding Tool for Profitable Energy Efficiency Investments in the Commercial Real Estate Industry*
Ryan Moya (SS); Daniel Patton (SS)
- 7:00 p.m. *A Review of 10 Carbon Dioxide Removal Options*
Carissa De Young (BEC); Katelyn Johnson (SS/BEC); Derek Martin (SS); Andrew Stolberg (SS); Xilin Zhang (SS)

- 7:25 p.m. *Determining Power System Capacity Value of Steam-Constrained Cogeneration*
Daniel Ryan (SS)

Friday morning: Room 1028

- 9:00 a.m. *Regional Scale Characterization of Water Use and Competition Impacts for U.S. Food Crops*
Robert Meyer (SS)
- 9:25 a.m. *Environmental and Economic Life Cycle Assessment of Alternative-Source Water at Bell's Brewery, Inc.*
Alex Engel (SS); Peter Goodspeed (CE); Chris Monti (SS); Samhita Shiledar (SS)
- 9:50 a.m. *Valuing Plastic and Post-Consumer Waste*
Malcolm Albin (EPP); Alexis Apostol (EJ); Helen Lee (SS); Carl Spevacek (BEC/CE/EPP); Nikole Vargas (EPP/SS); Julio Villasenor Suarez (EPP)
- 10:15 a.m. *Define the Innovative Sustainable Solutions for Film-Based Packages*
Yifan Xu (SS)
- 10:40 a.m. *Emissions Mitigation Potential of Grid Scale Energy Storage Systems for Peak Load Shifting*
Bhuvan Neema (SS)
- 11:05 a.m. *Opportunities for Sustainable Materials Management and Zero Waste in Detroit*
Reema Abi-Akar (BEC/SS); Gabriel Jones (EJ); Yi Tang (SS)
- 11:30 a.m. *Waste Not: Strategies to Reduce Ann Arbor's Municipal Solid Waste and Improve Diversion in the Commercial Sector*
Caroline Larose (EPP)
- 11:55 a.m. *Baggage Tractor Life Cycle Analysis: Diesel, CNG, and Electric*
Kit Price (SS)

ECOSYSTEM MANAGEMENT

Friday morning: Room 1040

- 9:00 a.m. *Ecotourism in a Buffer Zone Community Forest in Nepal*
Yihan Wang (EPP)
- 9:25 a.m. *The Effect of Touristic Development on Biodiversity in a Mediterranean Island Ecosystem*
Eric Krawczyk (CE)
- 9:50 a.m. *Assessing Resilience in Socioecological Systems: Linking Management and Ecology in Apple Orchards in Michigan to Predict Farm Capacity to Respond to Insect Pests*
Hailey Schurr (CE)



- 10:15 a.m. *Supporting Conservation and Decision Making in the Northwoods: Mapping Forest Values, Services, and Threats*
Kate Keeley (BEC/EPP); Elliott Kurtz (EI); Luxian Li (CE); Ed Waisanen (EI/EPP); Yu Xin (CE/EI); Fan Zhang (EI)
- 10:40 a.m. *Implications of Dikes on Macroinvertebrate Diversity in the Shiawassee Flats*
Jacob Pollock (EI/CE)
- 11:05 a.m. *An Exploration of Impacts and Stakeholder Interests Relating to Tower and Kleber Dams on the Upper Black River in Northeastern Michigan*
Lauren Edson (CE); Kevin He (EPP/CE); Molly Watters (BEC/EPP)
- 11:30 a.m. *Inspiration Ridge Preserve: Baseline Ecological Inventory and Management Plan*
Christina Carlson (EPP); Alexandra Clayton (CE); Joshua Flickinger (EI/CE); Flora Yifan He (EI/CE); Sarah Turner (CE)
- 11:55 a.m. *Trail Design and Interpretive Signage for Valles Caldera National Preserve*
Yun Liu (LA/BEC); Jamie McArdle (LA/BEC)

URBAN SYSTEMS & DESIGN

Friday afternoon: Room 1028

- 1:20 p.m. *The Color of Pollution: Assessing Community Demographics and Coal Power Plant Siting between 1950 and 2010*
Ember McCoy (EJ)
- 1:45 p.m. *Measuring Urban Sustainability—Ann Arbor’s STAR Communities Certification Experience*
Angey Wilson (BEC)
- 2:10 p.m. *Allocation of Ridesharing Facilities Using a Shareability Assessment Model*
Zahra Bahrani Fard (SS)
- 2:35 p.m. *The Impact of Decarbonized Electricity on the Adoption of Electric Vehicles in Texas*
Xinwei Li (SS)
- 3:00 p.m. *Improving Urban Sustainability of Transportation System by Shared Mobility: A Case Study for Ann Arbor*
Rui Shi (SS)
- 3:25 p.m. *Green Bay Packers Titletown Development Sustainability Recommendations*
Wiles Kase (EPP); Robert Kraynak (SS); Melissa Morton (SS); Sean Pavlik (SS); Kavya Vayyasi (SS)

- 3:50 p.m. *Sharing Space, Creating Place: Studying the Impact of Shared Streets on Human Behavior and the Capacity to Create Public Space*
Hillary Hanzel (LA)
- 4:15 p.m. *Pewabic: “Tiling” the Story of Revitalization in Detroit through Public Gardens*
Matthew Bertrand (LA); Yihui Chen (LA); Zilu “Xevy” Zhang (LA)
- 4:40 p.m. *Distance from Neighborhood Green Infrastructure (GI) in Detroit and Impact on Perception of Safety*
Sanaz Chamanara (LA)

CONSERVATION ECOLOGY

Friday afternoon: Room 1040

- 1:20 p.m. *Canceled*
- 1:45 p.m. *NOAA Great Lakes Region Public-Private Partnership*
Jerry Guo (CE); Zhanyang Gao (SS)
- 2:10 p.m. *Nature and Nurture Farmstead Plan*
Jared Aslakson (CE); Yihan Li (CE); Michael Lordon (CE); Alex Peters (CE/LA)
- 2:35 p.m. *Urbanites Meet Urban Ants: Ant Species Distributions across the Urban Matrix in Ann Arbor, Michigan*
Eliot L. Jackson (CE)
- 3:00 p.m. *Conservation and Cattle Production: Improving the Matrix through Silvopasture*
John Andreoni (EJ/CE); Lillie Kline (CE/BEC); Astrid Santiago (SS); Alex Truelove (SS)
- 3:25 p.m. *Vishwamitri: A River and Its Reign*
Alex de Sosa Kinzer (LA/CE); Xinming Liu (LA/EI); Dhara Mittal (LA); Rubin Sagar (CE); Krithika Sampath (CE); Chase Stone (EPP); Yundi Yang (CE)
- 3:50 p.m. *Are Lake Trout (*Salvelinus namaycush*) Diets Changing after Declines in Alewife (*Alosa pseudoharengus*) Populations in Lake Michigan?*
Miles Luo (CE)
- 4:15 p.m. *Forecasting Lake Erie Harmful Algal Blooms*
Devin Gill (BEC/CE); Tonghui Ming (EI); Wanqi Ouyang (EI)
- 4:40 p.m. *Land Rights and Well-Being of India’s Indigenous People*
Melissa Rice (EJ/EPP)



Behavior & Adaptation

HIKING ALONG THE COLOR LINE: AFRICAN AMERICAN PARTICIPATION IN OUTDOOR RECREATION

Presenter: Teona Williams, MS, Environmental Justice

Adviser: Dorceta Taylor

Location: United States

Summary: This research seeks to build on the work of environmental historians who focus on race and nature. There is a discourse in the United States that African Americans are apathetic to nature and do not participate in outdoor recreation. However, history tells us that nature and, through extension, outdoor recreation held a special place in African American everyday life. Nature was a place of leisure and healing and a way to escape Jim Crow politics. This thesis continues along similar veins by highlighting the African American experience in nature via outdoor recreation. Additionally, the thesis proposes to wrestle critically with dominant discourses around race, class, gender, and outdoor recreation. It therefore explores (1) outdoor recreation preferences among gender, (2) outdoor recreation preferences among races, (3) outdoor recreation preferences among the black diaspora, and finally (4) barriers to outdoor recreation. The thesis engages critically with both outdoor recreation literature and survey data in order to develop a body of literature that broadly addresses university students' engagement with outdoor recreation, specifically focusing on how African American students experience and navigate outdoor recreation in comparison to other students. The study pulled from archival records, a survey developed for the purposes of this study, newspaper articles, and secondary sources. I provide a review of outdoor recreation literature, outline my methodology, underscore outdoor recreation preferences across different identities, draw conclusions from the results, and work to establish a framework on the intersections of outdoor recreation and race.

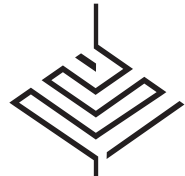
THE CHINESE SAFARI: CULTURAL IDENTITY AND WILDLIFE CONSERVATION IN KENYA'S TOURISM INDUSTRY

Presenter: Amanda Kaminsky, MS, Environmental Policy and Planning

Adviser: Bilal Butt

Locations: Nairobi and Narok County, Kenya

Summary: This research explores the social and environmental consequences of Chinese tourism expansion in Kenya. It aims to shed light on a little-studied aspect of China-Africa relations, informing the tourism industry and conservation stakeholders in East Africa and beyond. Using survey data, key informant interviews, and participation observations collected on-site in Kenya during the summer of 2016, I examine how postcolonial narratives of wildlife conservation are being restructured to reflect the Chinese tourist gaze. I argue that Chinese safaris are reinforcing stigmas surrounding animals as aesthetic objects, consistent with the concept of the bounded "scenic spot" common within traditional Chinese domestic tourism.



BUILDING ON COMMON GROUND: USING COMMUNITY ARTICULATIONS OF SUPPORT TO PROMOTE AFFORDABLE HOUSING DEVELOPMENTS IN ANN ARBOR, MICHIGAN

Presenter: Mary M. Jones, MS, Environmental Justice

Client: Washtenaw County Office of Community and Economic Development

Adviser: Victoria Campbell-Arvai

Location: Ann Arbor, Michigan

Summary: According to a 2014 needs assessment report, rising housing costs in Washtenaw County are expected to outpace income gains, resulting in unbalanced, unsustainable growth. Despite the need for more affordable housing units, residents have consistently raised opposition against proposed affordable housing developments in city neighborhoods, displaying classic patterns of the NIMBY phenomenon (“not in my backyard”). In partnership with the county’s Office of Community and Economic Development (OCED), this project explores how OCED can minimize NIMBYism to affordable housing projects by leveraging latent community support through a public awareness campaign. To this end, I conducted 19 in-depth interviews with individuals connected to affordable housing issues in Washtenaw County (e.g., advocates, current and former government officials, small business owners, and developers). Though current research on NIMBYism tends to focus on the sources of community opposition, I took a strengths-based approach to better understand how this diverse body of community members articulated their support for affordable housing. Most of the interviewees couched their support in references to the benefits affordable housing provides the community as a whole and in their core values of equity and fairness. This finding suggests there is an untapped opportunity to boost support for affordable housing through a strategic public awareness campaign that places community at the center and draws on these deeply resonant values.

BUFFER ZONE PLANNING IN SHIVAPURI-NAGARJUN NATIONAL PARK: HOW INCLUSIVE POLICYMAKING CAN INFORM MORE RESILIENT PARK-PEOPLE RELATIONS AND PROTECT ECOLOGICAL SERVICES IN NEPAL’S CAPITAL

Presenters: Ashley Dickerson, MLA, Landscape Architecture; Qianyun Yuan, MLA, Landscape Architecture

Client: ForestAction Nepal

Advisers: Arun Agrawal, Victoria Campbell-Arvai

Location: Kathmandu, Nepal

Summary: Institutional application of “buffer zones” around areas of importance for biological conservation has grown significantly since the 1980s, and perhaps nowhere as much as in Nepal, where 24% of the nation’s total land area is allocated under such a program. In practice, the intention of a buffer zone is simultaneously to alleviate the pressures from human development on conservation areas and to address the socioeconomic requirements of affected populations. While the buffer zone concept has been hailed by many for its consideration of indigenous rights, it is far from the magic elixir that some would hope for. We spent three months in the capital of Nepal, Kathmandu, over the summer of 2016 interviewing members of government and local environmental organizations to glean insight into what has been learned from 20 years of implementing the buffer zone concept. The timing of our study couldn’t be more critical, as the Nepalese government in early 2016 declared a new buffer zone around Shivapuri-Nagarjun National Park (SNNP), less than 10 miles north of Kathmandu. SNNP protects many regionally and internationally important ecological and cultural assets, but its most significant purpose is as the source of Kathmandu’s primary water supply. With the aid of a local translator, we spoke with dozens of community members living in the park and in the proposed buffer zone to get a sense for their ways of living and their perspectives on the conservation policies that have impacted them.



THE ROLE OF OBSERVATIONAL LEARNING IN DEVELOPING ECOTOURISTS' ENVIRONMENTALLY RESPONSIBLE BEHAVIORAL INTENTIONS

Presenter: Benjamin Morse, MS/MPP, Behavior, Education, and Communication

Adviser: Michaela Zint

Location: South Korea

Summary: This study applied the four-step observational learning process described in 1986 by Albert Bandura (engagement, observation, reproduction, and reinforcement) to investigate how tour guides, peer ecotourists, and local community members influence ecotourists' environmentally responsible behavioral (ERB) intentions. A total of 207 completed questionnaires (59% response rate) were obtained from ecotourists in Korea, and path analyses were conducted to explore the degree to which the hypothesized model predicted ecotourists' ERB intentions. The model moderately predicts ERB intentions, indicating a link between ecotourism participation and intention to engage in ERBs in the future. The model also indicates that positive reinforcement and reproduction of observed ERBs are important predictors for intentions and that reproduction occurs, in turn, from observation and engagement, suggesting that Bandura's four-step observational learning process explains ecotourists' ERB intentions. Implications for improving ecotourism programs reveal that ecotourism managers should engage participants in ERBs during ecotourism experiences and provide positive feedback and should allocate more resources for interpretive training for tour guides that emphasizes modeling ERBs. Lastly, insight from this study and our model may help others, outside of the tourism sector, with ways to encourage ERBs and build a more environmentally responsible constituency.

HOW DOES ECOSYSTEM-BASED ADAPTATION WORK THROUGH POVERTY ALLEVIATION? A CASE STUDY FROM FOREST COMMUNITIES IN SOUTHWEST CHINA

Presenter: Beilu Duan, MS, Environmental Policy and Planning, and Conservation Ecology

Adviser: Maria Carmen Lemos

Location: Guangxi, China

Summary: Ecosystem-based adaptation (EbA) is an approach that uses ecosystem services to help people combat climate change impacts. For rural communities that rely on natural resources, the impacts of climate change exacerbate poverty and vice versa. There are many studies showing that ecosystem services help rural communities alleviate poverty or adapt to the impacts of climate change. However, few studies suggest how ecosystem services may help these communities combat climate change impacts through poverty alleviation. This study focuses on a case in Guangxi, China, to understand this potential pathway of EbA in forest communities. The results show that 1) compared with farm crops, bamboo plantation may be a more resilient livelihood, as bamboo maintain steady production in the face of climate risks like flood and drought ($p < 0.05$); 2) although bamboo may be a reliable income source, the mass plantation of bamboo will sacrifice the diversity of livelihoods (e.g. types of livestock) and thus may lead to the decrease of total household income. These findings will enhance understanding of the pathway and tradeoffs of EbA in rural communities, and support the design of EbA projects in subtropical forest ecosystems and communities in the future.



Sustainable Systems

PRICING POLICIES FOR THE INTEGRATION OF DISTRIBUTED ENERGY RESOURCES IN UTILITY SYSTEMS

Presenters: Cecilia Lee, MS, Sustainable Systems; Cazzie Palacios Brown, MS/MBA, Sustainable Systems; Niel Patel, MS, Sustainable Systems; Syne Salem, MS, Sustainable Systems, and MS, Electrical Engineering; Lingchen Sun, MS, Sustainable Systems/Industrial and Operations Engineering

Client: DTE Energy

Adviser: Thomas Lyon

Location: Ann Arbor, Michigan

Summary: “Distributed generation” (DG) refers to decentralized energy generated by a variety of small-scale technologies that connect to a low-voltage distribution grid. DG includes a range of technologies, including solar photovoltaic (PV) cells which convert sunlight into electric current. Electricity produced can be consumed on site or sent to other consumers on the grid. Under current federal law, utilities are required to compensate solar DG owners for the electricity they produce. We attempt to model the various compensation policies and rate structures that the utility could use and the effects of those policies on DG and non-DG customers in Michigan. Our research focuses on the qualitative and quantitative analysis of some of the pricing and policy mechanisms being used or proposed across the United States. The goal was to understand how different scenarios impact residential customers with and without distributed generation. Specifically, we examined fixed-cost shifts from solar DG owners to other customers and solar ownership economics under a range of policy options. Our methods included literature reviews and quantitative analysis. The literature analysis focused on synthesizing passed or proposed distributed energy policy trends across the United States. We then developed a model to serve two major purposes: modeling the cost shift to non-DG customers and the attractiveness of installing solar PV. We found that, among the scenarios we explored, retail rate net metering yields the highest net present value for solar DG customers, while net billing at the wholesale rate yields the lowest net present value for solar DG customers. We also found that the cost shift due to solar DG is smaller than the combined health and environmental benefits that are provided by solar DG.

PROPERTY ASSESSED CLEAN ENERGY (PACE) RENEWABLE ENERGY PROGRAM PLAN AND PILOT PROJECT

Presenter: Rees Blanchard, MS, Sustainable Systems

Clients: Northport Energy Action Taskforce (NEAT) and Levin Energy Partners

Adviser: Greg Keoleian

Location: Northport, Michigan

Summary: Energy efficiency and renewable energy generation technologies offer a largely unrealized potential for savings to commercial property owners. Michigan PACE and similar programs finance facility upgrades for energy efficiency and renewable energy generation. This practicum worked with a millwork business in Northport to evaluate different technology upgrades using PACE and Michigan Saves. Recommendations were based on avoided costs, energy, and greenhouse gas emissions. Performance varied considerably between distributed-generation and energy-efficiency technologies, which included lighting replacement, solar PV, and replacement of the current heating system with high-efficiency wood boilers. Most projects showed negative cash flow over a 20-year time horizon. Solar PV performed well in terms of cost and energy savings. Final recommendations and lessons learned from the pilot project will be used to advise client groups and provide a template for future energy projects in Northport.



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SOLAR MICROGRIDS IN RURAL INDIA: POLICY AND MARKET ANALYSIS

Presenters: Sachiko Graber, MS, Sustainable Systems and Behavior, Education, and Communication; Tara Narayanan, MS, Sustainable Systems, and MA, Applied Economics

Client: The Energy and Resources Institute (TERI)

Adviser: Jose Alfaro

Location: Uttar Pradesh, India

Summary: This research investigates the potential of renewable, off-grid electricity generation, which provides both environmental sustainability and development opportunities, especially in developing countries. The government of India has supported microgrid markets through recent policy mechanisms. Although microgrids are promoted in rural areas, rural consumer needs are poorly understood. This work seeks to shed light on consumer preferences for various attributes of electricity and to predict future outcomes in the rural electricity market. We carried out surveys in 22 villages of rural Uttar Pradesh, covering 216 households, and conducted choice experiments that disaggregated the willingness-to-pay contribution of different electricity quantities. A mixed logit analysis of the data collected shows that consumer preference for electricity is based most significantly on (in order of strength of preference) power, reliability, and price. Results also indicate that consumers are currently more satisfied with microgrid than grid power supply. An agent-based model of household level agents was created with the mixed logit results as a framework. This model identifies the type of solar microgrid systems that would receive the greatest consumer support and therefore could successfully integrate more renewable generation into rural India. On the basis of these findings, the study can inform policy recommendations and microgrid development in order to strengthen the rural electricity sector and improve electricity access.

CAN THE RIGHT TOOL UNLOCK GREEN BUILDING INVESTMENT? A DECISION-AIDING TOOL FOR PROFITABLE ENERGY EFFICIENCY INVESTMENTS IN THE COMMERCIAL REAL ESTATE INDUSTRY

Presenters: Ryan Moya, MS/MPP, Sustainable Systems; Daniel Patton, MS/MBA, Sustainable Systems

Client: CWD Real Estate

Adviser: Andy Hoffman

Location: Grand Rapids, Michigan

Summary: Office buildings within the U.S. commercial real estate (CRE) sector spend more than \$32 billion annually on energy and contribute 18% of U.S. carbon dioxide emissions. All the major stakeholders involved have something to gain from reducing energy consumption, and yet the CRE market has been slow to make large-scale changes. Building owners and management firms must weigh many factors before deciding to make an investment in energy efficiency, and the bandwidth to do so is often limited. Our project explored how quantitative decision making could result in quicker and more effective energy efficiency investment decisions. Ten technologies were identified with a demonstrated ability to save energy and earn a positive return on investment. Combining Energy Star Portfolio Manager and a decision-aiding process of our own design, we developed an easy-to-use tool that decides which of the 10 technologies is recommended for a specific property. Using this tool, we generated recommendations for 5 key properties owned by Grand Rapids-based CWD Real Estate.

A REVIEW OF 10 CARBON DIOXIDE REMOVAL OPTIONS

Presenters: Carissa De Young, MS/MBA, Behavior, Education, and Communication; Katelyn Johnson, MS, Sustainable Systems and Behavior, Education, and Communication; Derek Martin, MS, Sustainable Systems; Andrew Stolberg, MS, Sustainable Systems; Xilin Zhang, MS, Sustainable Systems

Client: University of Michigan Energy Institute

Advisers: Rosina Bierbaum, John DeCicco

Location: Ann Arbor, Michigan

Summary: As the world community seeks to keep global warming below 2 degrees Celsius through 2030, additional efforts beyond carbon emissions reduction are necessary. Carbon dioxide removal (CDR) goes beyond reducing the emissions of existing activities to actively pull carbon dioxide out of the atmosphere for long-term sequestration. However, research on CDR has been fragmented, and minimal attention has been given to a comprehensive review of all alternatives and their relative merits. This study reviews the cost and annual CDR potential of 10 CDR options. Options are classified as mature, near-term, and long-term solutions, with additional attention given to geographic implementation potential and the options' inherent risks and tradeoffs. A literature review was conducted for each CDR option. Estimates from the literature review were standardized across all CDR options and analyzed to develop estimate ranges for cost and removal potential. The study includes an analysis of afforestation/reforestation, soil carbon sequestration, biochar, accelerated weathering, direct air capture, terrestrial bioenergy with carbon capture and storage (BECCS), aquatic BECCS, ocean storage, ocean fertilization, and carbon utilization. Aquatic and terrestrial BECCS are estimated to have the greatest CDR potential, with soil carbon sequestration and afforestation/reforestation offering the lowest-cost options.



DETERMINING POWER SYSTEM CAPACITY VALUE OF STEAM-CONSTRAINED COGENERATION

Presenter: Daniel Ryan, MS/MBA, Sustainable Systems

Adviser: Jeremiah Johnson

Location: Ann Arbor, Michigan

Summary: Combined heat and power (CHP) plants have received a resurgence of attention from power system planners and policy makers in an effort to realize the full potential of the technology. CHP plants that are thermal-primary do not always maximize the benefits provided to the power system. In this study, we examine how power system planning metrics can be applied to CHP plants. By applying this methodology to this type of electric generation, CHP plant owners and grid operators can be better informed of the capacity value that these plants provide to the power system. Understanding this value can lead to better utilization of existing CHP capacity and potentially lead to new builds, resulting in a more efficient use of carbon-based fuels for electric generation. Using the University of Michigan's central power plant as a case study, we found the effective load-carrying capability (ELCC) of the plant to be 56% of its rated capacity in Michigan's Lower Peninsula. We also showed that if steam demand could be increased for this thermal-primary plant then the ELCC of the plant would increase linearly. Currently, local steam demand is greatest during winter months while regional daily electric peaks are greatest during summer months. Therefore, an increase in campus steam use during summer months would likely be required to increase the ELCC of the plant.

REGIONAL SCALE CHARACTERIZATION OF WATER USE AND COMPETITION IMPACTS FOR U.S. FOOD CROPS

Presenter: Robert Meyer, MS/MSE, Sustainable Systems

Adviser: Greg Keoleian

Location: Ann Arbor, Michigan

Summary: Our growing population and increasingly variable climate conditions challenge our ability to meet pressing demands for food, water, and energy. With approximately 70% of U.S. freshwater resources applied to agriculture and most withdrawals occurring in water-scarce regions, critical analysis is required to determine how regional water use and availability impact user competition for water resources. Aiming to provide insight into the cradle-to-farmgate impacts of different U.S. consumed crops, this thesis begins with a comprehensive literature review to consider the progress and opportunities occurring around water scarcity studies over the last 40 years. Based on empirical data and emerging water impact assessment models, a methodology is proposed that provides characterization of 10 U.S. consumed crops at regional levels (county, watershed, state, and national), resulting in production-weighted water competition footprints for each crop. This analysis also considers water competition footprints of crop imports and exports, which factor into national water footprint values of U.S. consumed crops. Results contrast water use and competition footprint values for select crops at different spatial scales, indicating the significant impact agricultural processes have in water-scarce regions. This research is expected to contribute toward diet-level impact studies, filling gaps where additional life cycle water assessment methods are needed.

ENVIRONMENTAL AND ECONOMIC LIFE CYCLE ASSESSMENT OF ALTERNATIVE-SOURCE WATER AT BELL'S BREWERY, INC.

Presenters: Alex Engel, MS, Sustainable Systems; Peter Goodspeed, MS, Conservation Ecology; Chris Monti, MS/MBA, Sustainable Systems; Samhita Shiledar, MS, Sustainable Systems, and MSE, Chemical Engineering

Client: Bell's Brewery, Inc.

Advisers: Shelie Miller, Joe Arvai

Location: Kalamazoo, Michigan

Summary: Bell's Brewery, Inc., is a microbrewery in Comstock, Michigan, a township outside the city of Kalamazoo. As water is such a crucial component of brewing and of beer itself, the brewery was concerned with the reliability of the quantity and quality of water that it sources from Kalamazoo. These concerns include the risk of failing water infrastructure and toxic contamination of the water supply from legacy contaminants. Furthermore, with the projected increase in water consumption, Kalamazoo may not be able to provide an adequate quantity and quality of water from its pump stations. It was necessary to explore the feasibility of increasing the brewery's current water consumption from the city, alternatively sourcing water from an adjacent municipality or pumping water from an on-site water well field. Our analysis methods included energy modeling, environmental impact assessment by life cycle assessment using SimaPro, life-cycle costing based on primary research, and groundwater impact modeling using ArcGIS and R. Our results provide indicative guidance on the costs and environmental impacts for the different sourcing options.



VALUING PLASTIC AND POST-CONSUMER WASTE

Presenters: Malcolm Albin, MS/MBA, Environmental Policy and Planning; Alexis Apostol, MS/MBA, Environmental Justice; Helen Lee, MS/MBA, Sustainable Systems; Carl Spevacek, MS, Behavior, Education, and Communication, Conservation Ecology, and Environmental Policy and Planning; Nikole Vargas, MS/MBA, Environmental Policy and Planning, and Sustainable Systems; Julio Villasenor Suarez, MS/MBA, Environmental Policy and Planning

Client: Amcor

Adviser: Ming Xu

Location: Ann Arbor, Michigan

Summary: Amcor provides responsible rigid and flexible packaging solutions to the food, beverage, healthcare, home and personal care, and tobacco packaging industries. Amcor has integrated sustainability into and across its five core values of safety, integrity, teamwork, social responsibility, and innovation. This project assists Amcor by developing new tools through which to evaluate sustainability at the company. The project has two objectives. The first is to provide a natural capital valuation using GHGs, water quantity, and waste as environmental key performance indicators. Amcor considers itself a leader in sustainability, and could be the first plastic manufacturer to perform and publish a natural capital assessment. This achievement would not only distinguish Amcor as an industry leader in sustainable practices, but would also give the company a competitive advantage, as it would be in a position to provide this information if necessary for future regulations or certification processes. In addition, Amcor would be in a position to lead the entire plastic and broader manufacturing markets in the use of natural capital assessments. The second is a model created to predict post-consumer waste and recycling rates, globally, where data is lacking. With this, Amcor will be able to quantify their post-consumer waste footprint as the industry evolves and determine how their sustainability initiatives are improving post-consumer waste recovery rates.

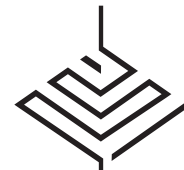
DEFINE INNOVATIVE SUSTAINABLE SOLUTIONS FOR FILM-BASED PACKAGES

Presenter: Yifan Xu, MS, Sustainable Systems

Adviser: Ming Xu

Location: Ann Arbor, Michigan

Summary: To support Procter & Gamble's vision and goals for recycling of packaging materials, this project will conduct a life cycle assessment (LCA) study to compare environmental impacts of various end-of-life pathways for post-consumer recyclable wastes that contain plastic film waste. This study will define the environmental impact of waste recycling in different scenarios. It has in total four variables: (1) Is plastic film waste included? (Different composition of wastes might have different environmental benefits when recycled.); (2) Are the wastes collected curbside or dropped off by consumers? (Different collection vehicles, e.g. trucks or passenger cars, could cause different environmental impacts.) (3) Does the collection occur in urban or rural areas? (Different collection distances due to varied availability of wastes could generate different environmental impacts.) (4) Are residuals going to be incinerated with energy recovery or landfilled? SimaPro was used for life cycle assessments. Input data was collected from previous published reports or journals. Driving distance due to different population density, different collection vehicles, and residual treatment methods have minor effects on the total environmental impact. One explanation could be the small fraction of plastic film wastes, and that the environmental benefit of recycling is so large that it dominates other impacts from collection and residual treatment.



EMISSIONS MITIGATION POTENTIAL OF GRID SCALE ENERGY STORAGE SYSTEMS FOR PEAK LOAD SHIFTING

Presenter: Bhuvan Neema, MS/MSE, Sustainable Systems

Adviser: Jeremiah Johnson

Location: Ann Arbor, Michigan

Summary: The cost of energy storage systems (ESS) has declined significantly in recent years. Because of regulations and state policies, such as energy storage mandates, we have seen a marked increase in ESS development for power grid applications. The majority of such policies and regulations are designed to compensate ESS for their performance to provide grid services. However, these policies do not weigh the environmental impacts of ESS in their performance evaluation. This study presents a robust modeling approach to evaluate the environmental benefits of using ESS for power system resource adequacy service. A dynamic unit commitment optimization model is developed that investigates the emissions mitigation potential of grid-connected ESS to shift peak load generation from natural gas combustion turbines to combined cycle units. Using the energy arbitrage and capacity value of ESS, the dispatch model examines the cost of CO₂ abatement for an ESS penetration level of 100–6,000 MWh on the grid. We determined that, in the use phase, Li-ion battery ESS have potential for a reduction of 35.4–49.6 ton CO₂/year per MWh of storage on the grid at a marginal cost of \$476–\$974 per ton CO₂ in the Electric Reliability Council of Texas (ERCOT) grid region. ESS can also improve the grid load factor by 0.12–1.45% for distributed systems. However, storage beyond 200 MW and capacity of 3 hours has significantly lower marginal impact on the peak load in the ERCOT grid. With such an approach, policy makers, grid operators, and utilities can determine the emissions abatement benefits of ESS, which can be used to make the economic case for storage in power grid applications.

OPPORTUNITIES FOR SUSTAINABLE MATERIALS MANAGEMENT AND ZERO WASTE IN DETROIT

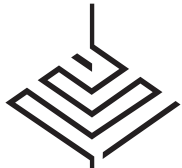
Presenters: Reema Abi-Akar, MS, Behavior, Education, and Communication, and Sustainable Systems; Gabriel Jones, MS/MUP, Environmental Justice; Yi Tang, MS, Sustainable Systems

Client: East Michigan Environmental Action Council (EMEAC)

Advisers: Greg Keoleian, Tony Reames

Location: Detroit, Michigan

Summary: Zero waste and sustainable materials management (SMM) are two ways of reframing the process of waste management (WM), changing the focus from waste to potentially useful material. For cities to move forward with waste reduction strategies, it is necessary to understand existing WM systems. This study examined WM practices in three case-study cities that rely heavily on waste-to-energy (WTE) incineration: Detroit, Baltimore, and Minneapolis. The focus was mostly on Detroit because of its unique WM history of privatization and environmental justice. We interviewed 14 stakeholders across the public, private, nonprofit, and community sectors in all three locations to understand how their WM system functions, its history, what they consider to be the successes and challenges of the system, and what they hope to achieve in the future. We developed five major themes from these interviews—political, social, economic, procedural/logistical, and environmental—that provide insight into barriers and opportunities for WM stakeholders. Additionally, we examined the flow of materials in each city using Sankey diagrams, as well as the demographic changes in the communities around the WTE facilities using distance-based spatial analysis methods. Ultimately, we came up with a set of considerations for future WM practices in Detroit, including increased transparency, policy and legislation proposals, a tiered funding structure, environmental accountability, and a reframing of WM as SMM. Despite our focus on Detroit, our findings also have policy implications and practical recommendations for other cities that are struggling to advance a more sustainable and just WM system.



WASTE NOT: STRATEGIES TO REDUCE ANN ARBOR'S MUNICIPAL SOLID WASTE AND IMPROVE DIVERSION IN THE COMMERCIAL SECTOR

Presenter: Caroline Larose, MS/MBA, Environmental Policy and Planning

Client: The Resource Management Team

Adviser: Joe Arvai

Location: Ann Arbor, Michigan

Summary: Ann Arbor has long been regarded as among the most progressive and sustainable cities. However, the city has not continued to support this reputation through action in solid waste management. Ann Arbor's total solid waste tonnage has increased steadily every year, while other comparable cities have seen flat or declining total solid waste despite growing population. In diversion rates and diversion goals, Ann Arbor has also lagged behind the most progressive cities and is far behind those cities with a comprehensive organics pickup similar to Ann Arbor's. The objective of this research is to benchmark the practices of model cities and survey the current state of waste practices in Ann Arbor's commercial sector in order to recommend actions for Ann Arbor to improve waste diversion and reduction in its commercial sector. The research was conducted by completing a comprehensive waste benchmarking analysis and review of city stakeholders to (1) distill a set of best municipal solid waste management, education, and awareness practices; (2) survey the constraints, challenges, and interests of businesses in improving diversion; (3) evaluate the success and reproducibility of diversion and waste reduction strategies; and (4) identify optimal goals and metrics for Ann Arbor to reclaim its status as a sustainably progressive city. This research has led to a set of actionable recommendations that support the city's interests in being more sustainable by reducing its landfill waste in the commercial sector through directly addressing needs of businesses and adopting strategies from successful peer cities.

BAGGAGE TRACTOR LIFE CYCLE ANALYSIS: DIESEL, CNG, AND ELECTRIC

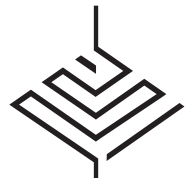
Presenter: Kit Price, MS, Sustainable Systems

Client: United Airlines

Adviser: Greg Keoleian

Location: Ann Arbor, Michigan

Summary: This study looked at the life cycle fuel emissions as well as material production burdens of United Airlines' baggage tractors, using three different fuel sources: diesel (which currently powers most of United's baggage tractors), CNG, and electricity. A baggage tractor vendor, Charlotte America, provided a rough material breakdown of the components for the CNG and electric baggage tractors, for the purpose of comparing the parts that differed between the tractors (engine versus battery). This comparison was used to determine the differences in manufacturing burdens of each vehicle. The GREET.net model was used for the emission intensities of the upstream and use phases of the different fuels as well as for material production. For electricity, NERC subregion grid feedstock mixes (from eGrid 2014) were used to generate electricity emission intensities for each of United's seven domestic hubs. Data for use-phase modeling was provided by United Airlines and Charlotte America. The purpose of this analysis was to help United Airlines determine which type of baggage tractor (electric or CNG) to invest in at each of the company's domestic hubs in order to further the company's efforts in sustainability.



Ecosystem Management

ECOTOURISM IN A BUFFER ZONE COMMUNITY FOREST IN NEPAL

Presenter: Yihan Wang, MS, Environmental Policy and Planning

Client: ForestAction Nepal

Adviser: Arun Agrawal

Location: Chitwan National Park, Nepal

Summary: Ecotourism is highly adopted throughout the world to provide alternative income for local communities and to incentivize conservation behavior. However, controversies remain in relation to ecotourism's effectiveness in addressing those issues. Considering ecotourism's enormous challenges and uncertain future, this paper takes a practical approach to explore ecotourism's potential as a tool for promoting conservation and community development, with the goal of providing standards and guidelines for future ecotourism development around protected areas to sustain a balance between income generation and environmental conservation. To examine the research question in terms of who participates in community forest decision-making and who benefits from ecotourism, I travelled to the field to conduct focus group interviews and collect surveys from 100 households across nine villages in Baghmara Community Forest in summer 2016. The households were selected randomly to ensure representative samples. The survey questions include households' demographic information, income source, perspectives on ecotourism's impacts on livelihood, and suggestions for future ecotourism development. Questions are not designed to address causal inference between those variables and households participation level, but rather to identify significances of correlation. Results show that increasing equal distribution of tourism revenue among communities is necessary to ensure community participation in decision-making, and alternative energy use such as solar and biogas is recommended to reduce the dependence of locals on firewood. Further studies are needed to investigate ecotourism's impacts on community culture and political empowerment, and to design policies that are tailored to community incentives to influence motivation in conservation practices.

THE EFFECT OF TOURISTIC DEVELOPMENT ON BIODIVERSITY IN A MEDITERRANEAN ISLAND ECOSYSTEM

Presenter: Eric Krawczyk, MS, Conservation Ecology

Adviser: Johannes Foufopoulos

Location: Naxos, Greece

Summary: Tourism development is a prominent force shaping the modern world. While tourism constitutes a significant fraction of many economies, it also incurs many negative ecological consequences, such as the exploitation of natural resources and the degradation of the native landscape. The Mediterranean Basin, a biodiversity hotspot, is currently being developed to accommodate increased tourism, the impacts of which are currently unknown. We conducted our research on a typical Mediterranean island that has experienced a recent expansion in development due to tourism (Naxos, Aegean Sea, Greece) between May and July 2016. We created maps of the present landscape and the landscape of 1982, during the economic shift to tourism on the island, for comparisons of development. Bird surveys were conducted by use of survey stations at increasing distances from the study site. Reptiles were surveyed by conducting transects outward from the study site. We separated birds into synanthropic and non-synanthropic species, and found that synanthropic species tend to live closer to human development while non-synanthropic species tend to live farther away from development. Reptile abundance increased with distance from human development. The presence of predators, in this case domestic and feral cats, also seemed to decrease reptile abundance. For both birds and reptiles, species richness and diversity increased the farther away the animals lived from development. According to the GIS analysis, development on Naxos increased 6.73% and has become more clustered since 1982. These results support the idea that the effects of development are the same on island ecosystems as they are on mainland ecosystems. To determine whether these findings can be applied to all island ecosystems, this method should be utilized on additional island ecosystems in the Mediterranean region as well as islands in other regions of the world.



ASSESSING RESILIENCE IN SOCIOECOLOGICAL SYSTEMS: LINKING MANAGEMENT AND ECOLOGY IN APPLE ORCHARDS IN MICHIGAN TO PREDICT FARM CAPACITY TO RESPOND TO INSECT PESTS

Presenter: Hailey Schurr, MS, Conservation Ecology

Adviser: Ivette Perfecto

Location: Ann Arbor, Michigan

Summary: Because apples are one of the most abundant crops in Michigan, the capacity of apple orchards to adapt to new insect pests has broad and significant implications for farmer livelihoods, consumer and farm worker health, and conservation in this state. There is potential that resilience to pest outbreaks is associated with certified organic chemical management. However, little is known about the actual implications of organic versus conventional management for orchard resilience to pests. This research has two objectives: (1) to compare ant community structure and pest removal behavior in organic and conventional apple orchards, and (2) to evaluate how farmer values, perceptions of insects, experienced adaptive capacity to pests, and sources of management knowledge correlate with chemical management decisions. Ant sampling took place at two certified organic and two conventionally managed apple orchards in southern Michigan in the summer of 2016. Sampling consisted of identifying ants at tuna baits and scoring ant behavior at larval baits. Long-form interviews were conducted with 10 orchard owners/managers across the Midwest to determine the relationship of farmer values, perceptions, experiences, and knowledge sources to management decisions. Ant communities were both more abundant and diverse in certified organic apple orchards than in conventionally managed orchards. At the certified organic orchards, ants were significantly more aggressive towards larvae and were more effective predators. Farmers' decision-making processes, sources of management knowledge, and perception of insects correlated consistently with management strategy.

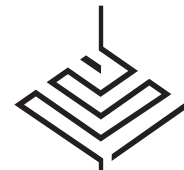
SUPPORTING CONSERVATION AND DECISION MAKING IN THE NORTHWOODS: MAPPING FOREST VALUES, SERVICES, AND THREATS

Presenters: Kate Keeley, MS, Behavior, Education, and Communication, and Environmental Policy and Planning; Elliott Kurtz, MS, Environmental Informatics; Luxian Li, MS, Conservation Ecology; Ed Waisanen, MS, Environmental Informatics and Environmental Policy and Planning; Yu Xin, MS, Conservation Ecology and Environmental Informatics; Fan Zhang, MS, Environmental Informatics

Client: The Nature Conservancy

Adviser: Bill Currie

Summary: Forests of the Northwoods ecoregion provide important economic, ecological, and cultural resources to 124 counties across northern Michigan, Wisconsin, and Minnesota. Successful conservation and management of the Northwoods requires coordinated action by managers and stakeholders across jurisdictional boundaries. This pilot study tests the utility of online Story Maps as a platform to facilitate coordinated regional-scale environmental decision making. We integrated Ecosystem Services and Human Well-Being frameworks to create spatial indicators of forest-derived values important in the Northwoods: timber jobs, water quality, and outdoor recreation. Story Maps were created for each value showing spatial distribution of resources, indicators of health, potential threats to the future of the values, and other information of value to managers. Within the Story Map, text, multimedia, and interactive elements are used to provide context around spatial data aiding interpretation. This makes the spatial data more accessible and useful for decision makers and the public to understand how local actions may affect the region as a whole.



IMPLICATIONS OF DIKES ON MACROINVERTEBRATE DIVERSITY IN THE SHIAWASSEE FLATS

Presenter: Jacob Pollock, MS, Environmental Informatics and Conservation Ecology

Adviser: Mike Wiley

Location: Saginaw, Michigan

Summary: Hydrologic connectivity joins aquatic ecosystems to each other through the exchange of water, organic matter, and organisms. It represents an important aspect of restoration in wetland ecosystems. Dikes disconnect floodplains from adjacent river systems and thus present an interesting study system for analyzing hydrologic connectivity and macroinvertebrate communities. Both diked and naturally connected floodplains exist in the Shiawassee National Wildlife Refuge. The goal of my study was to assess how important dikes are to structuring macroinvertebrate richness and diversity. Using a nested model of vegetative microhabitats within larger floodplain units, aquatic macroinvertebrate surveys were conducted in spring and summer of 2016. Water quality measurements were collected in the field while hydrologic connectivity was determined by use of ArcGIS software. Trophic diversity was also studied through stable isotope analysis of top predators, odonates, in the systems. Results of the analysis show flooding or dike height (a proxy for flooding frequency) was important in determining community structure and richness within the refuge. Significant reduction in the richness of macroinvertebrates was seen in the refuge: the additional of a 2-meter dike to the connected units would reduce their richness by an average of 15 taxa. Flooding height also significantly reduced the crustacean and gastropod diversity, altering the food web of refuge floodplains. Stable isotope data showed higher trophic diversity in connected sites, supporting findings of changes to the community structure. My research will be beneficial in future assessments of the refuge's recent restoration project to increased hydrologic connectivity in several floodplain units, including a plot of agricultural land restored to floodplain.

AN EXPLORATION OF IMPACTS AND STAKEHOLDER INTERESTS RELATING TO TOWER AND KLEBER DAMS ON THE UPPER BLACK RIVER IN NORTHEASTERN MICHIGAN

Presenters: Lauren Edson, MS, Conservation Ecology; Kevin He, MS, Environmental Policy and Planning, and Conservation Ecology; Molly Watters, MS, Behavior, Education, and Communication, and Environmental Policy and Planning

Clients: Michigan Department of Natural Resources and Grand Traverse Band of Ottawa and Chippewa Indians

Adviser: Steven Yaffee

Location: Onaway, Michigan

Summary: Tower and Kleber dams operate on the Upper Black River in the northeastern Lower Peninsula of Michigan, and their license is set to expire on April 30, 2024. A decision to relicense or remove the dams will need to be made by the Federal Energy Regulatory Commission and the dam owner within the next several years. We were asked to conduct a preliminary scoping phase in preparation for this decision-making process. We sought to understand (1) the current ecological, economic, and social conditions of the Black River watershed and the dams' impacts; (2) the interests and goals of a diverse set of stakeholders (e.g., environmental nonprofits, landowners) and community members relating to the dams; and (3) what considerations, conversations, and research should be included in a future decision-making and/or relicensing process. We conducted a broad and site-specific literature review and interviewed members of identified stakeholder groups. We also initiated public engagement for the dam decision-making process by holding a large public meeting where we presented our preliminary findings and gathered questions and input from attendees. Our meeting and final reports aim to provide our clients and stakeholders with a broad, baseline understanding of issues surrounding the dams as they begin the decision-making process regarding the dams' future.



INSPIRATION RIDGE PRESERVE: BASELINE ECOLOGICAL INVENTORY AND MANAGEMENT PLAN

Presenters: Christina Carlson, MS/MBA, Environmental Policy and Planning; Alexandra Clayton, MS/MPP, Conservation Ecology; Joshua Flickinger, MS, Environmental Informatics and Conservation Ecology; Flora Yifan He, MS, Environmental Informatics and Conservation Ecology; Sarah Turner, MS, Conservation Ecology

Client: Center for Alaskan Coastal Studies

Adviser: Bill Currie

Location: Homer, Alaska

Summary: The Inspiration Ridge Preserve (IRP) is a 690-acre property in Homer, Alaska, home to a diverse array of wildlife and habitat. IRP is currently owned and managed by Nina Faust and Ed Bailey, but in the coming years management will be passed to the Center for Alaskan Coastal Studies (CACS), a nonprofit organization dedicated to fostering land stewardship. CACS plans to manage the preserve for environmental education and to protect native flora and fauna. Our goal was to establish a baseline ecological inventory of the preserve and to create habitat maps to serve as references for future preserve management. We conducted field work at the IRP in May and August 2016 for a total of eight weeks. We collected data on vegetation communities, anadromous fish, and wildlife presence. We collected vegetation data through field surveys and remote sensing techniques, conducted anadromous fish surveys on small tributaries, and employed camera traps to track and monitor wildlife presence on the property. GIS data and maps were compiled at U-M upon return. We created maps and accumulated baseline ecological data to support management recommendations for CACS. Our recommendations include a plan for long-term management and use of photo-monitoring points to monitor the preserve.

TRAIL DESIGN AND INTERPRETIVE SIGNAGE FOR VALLES CALDERA NATIONAL PRESERVE

Presenters: Yun Liu, MLA, Landscape Architecture and MS, Behavior, Education, and Communication; Jamie McArdle, MLA, Landscape Architecture and MS, Behavior, Education, and Communication

Client: Valles Caldera National Preserve

Adviser: Mark Lindquist

Location: Jemez Springs, New Mexico

Summary: Valles Caldera National Preserve has recently been designated as a National Park Property. Although it was managed under a national trust with intent of preservation and public recreation for a number of years, the current infrastructure is inadequate for hosting a significant number of visitors while still protecting the sensitive ecological and cultural features that epitomize the caldera. Therefore, the administration is looking to develop a circulation system from remnant logging roads that will allow visitors to experience the preserve while minimizing disruption of sensitive areas. This project focuses on development of trails and accompanying interpretive materials for day-use areas, which the administration has identified as a priority for development. The research team has set out to deliver design concepts for day-use trails that recognize and protect sensitive ecological and cultural resources while highlighting the importance of these features for visitors. Accompanying interpretive material reinforces connections between visitors and the natural systems of the preserve while providing legible direction and aesthetically pleasing venues to enhance visitor experiences. The team's approach included on-site analysis, GIS technologies, and review of literature and previous studies, combined with review of precedent sites and programs. This approach informed both design concepts for trail layout and delivery of interpretive information. The resulting product is intended to be used in development of day-use areas of Valles Caldera National Preserve, while the driving influences and concepts can be extrapolated to other areas of the preserve. Concept plans, interpretive themes, and details and materials, along with illustrations converting trail experiences, are meant to be used in development of these systems. The framework for design decisions and influencing factors can be referenced in expanding development to additional areas of the preserve.



Urban Systems & Design

THE COLOR OF POLLUTION: ASSESSING COMMUNITY DEMOGRAPHICS AND COAL POWER PLANT SITING BETWEEN 1950 AND 2010

Presenter: Ember McCoy, MS, Environmental Justice

Adviser: Paul Mohai

Location: USA

Summary: A variety of studies provide evidence for the relationship between air pollution from coal power plants and adverse human health impacts. Moreover, there is significant evidence that these risks primarily and disproportionately burden disempowered populations: low-income persons and communities of color. However, much of existing environmental sociology research provides insight on the current social distribution of environmental hazards through “cross-sectional” analyses examining one point in time, leaving out discussion on disparities at the time of plant siting and on post-siting demographic change. The establishment of current racial and socioeconomic disparities among populations surrounding coal-fired power plants (CFPPs), along with research focusing on other environmental hazards, has prompted scholars and policy makers to search for explanations of why, how, and when these disparities occur. The purpose of this project is to address this gap by evaluating the community demographics surrounding CFPPs nationwide using the U.S. Census Bureau’s decennial data from 1950 to 2010. Through the areal appointment method in ArcMap, I evaluate racial and socioeconomic variables such as race, median household income, and educational attainment in the 3-mile radius around each coal-fired power plant at the time of siting. My research will test the hypothesis that racial and socioeconomic disparities were present in the communities near CFPPs before these plants were built and that those disparities increased as knowledge of the adverse impacts of air pollution throughout the 1970s and 1980s increased.

MEASURING URBAN SUSTAINABILITY—ANN ARBOR’S STAR COMMUNITIES CERTIFICATION EXPERIENCE

Presenter: Angey Wilson, MS, Behavior, Education, and Communication

Client: City of Ann Arbor

Adviser: Maria Carmen Lemos

Location: Ann Arbor, Michigan

Summary: The sustainability of urban areas can be complex to measure, especially by the detailed and broad metrics that cover everything from the built environment, climate, and energy to the local economy, community, and equity. To support this process, STAR communities created a framework and certification program that local governments can use to assess the sustainability of their communities. In May 2016, Ann Arbor launched the STAR communities program and began the long process of collecting data to complete as many as possible of the over 500 metrics, within 44 objectives, spread across seven goal areas. During this process a full exploration and critical review of the system and processes utilized to determine these sustainability ratings is also being performed. Research steps include a literature review of urban sustainability and measurement tools, interviews, and gathering and analyzing data, as well as employing GIS maps and various reporting tools provided by organizations around the web. Besides the certification process, this project also includes an analysis of both the STAR rating system and the City of Ann Arbor, in order to identify areas for process efficiency and improvement. Moreover it will also suggest how other cities can learn from the City of Ann Arbor’s experience, especially in proactive preparation and streamlining data collection.



ALLOCATION OF RIDESHARING FACILITIES USING A SHAREABILITY ASSESSMENT MODEL

Presenter: Zahra Bahrani Fard, MS, Sustainable Systems

Adviser: Ming Xu

Location: Ann Arbor, Michigan

Summary: Personal car transit has contributed to a wide range of problems in cities, from air pollution and traffic congestion to urban sprawl and increase in the cost of driving for users. Today, ridesharing is known as a cost-effective and sustainable mode of transportation that is aimed at transforming mobility to a service. The current literature on ridesharing focuses mainly on developing optimized models for finding ride matching for dynamic ridesharing. Limited attention is paid to studying static ridesharing and planning to manage the travel demand at the city level. Incorporating ridesharing in static traffic-assignment models and transportation planning decisions can improve accessibility within cities, increase ridesharing, and reduce dependency on privately owned vehicles. This research is aimed to fill this gap by predicting and modeling the future demand for ridesharing in urban areas and allocating necessary facilities to meet future needs. The analytical framework has two major components: Shareability Assessment and Geographic Allocation of Ridesharing Facilities. The Shareability Assessment part uses GPS coordinates of origins and destinations as model input and will collectively identify areas with high potentials for ridesharing. The Geographic Allocation of Ridesharing Facilities model uses city-specific information (land uses, available parking lots, etc.) to identify best areas for allocating ridesharing facilities. Results of this study include a model for finding potential high demand areas for ridesharing and a set of policy recommendations for application of the model in different cities.

THE IMPACT OF DECARBONIZED ELECTRICITY ON THE ADOPTION OF ELECTRIC VEHICLES IN TEXAS

Presenter: Xinwei Li, MS, Sustainable Systems

Advisers: Jeremiah Johnson, John DeCicco

Location: Ann Arbor, Michigan

Summary: Transportation electrification is playing an important role in reducing greenhouse gas (GHG) emissions. However, the GHG mitigations from plug-in electric vehicles largely lie in the carbon intensity of the power system. This research is to investigate how a decarbonized electric grid would affect the environmental and economic performance of plug-in electric vehicles by building an economic dispatch power system model and a passenger car model. In the power system part, accounting for the economic dispatch of generators, I built a model in Matlab to identify the least-cost strategies for Texas to meet the mass-based emission targets of EPA's Clean Power Plan (CPP) from 2015 to 2030. Combining recent forecasts on future loads, fuel prices, renewable capital costs, and the renewable potential, I also modeled scenarios that use a series of proxy CO₂ prices to achieve the emissions targets. The model outputs, indicating capacity additions and retirements under each scenario, were used to estimate changes to generation mix and carbon emissions in the electric grid for each model year. In the passenger car model, I compiled recent studies on the technology progress and cost projection of plug-in vehicles to identify the capital costs and the efficiency of plug-in electric vehicles in 2030. The results show that the capital costs of plug-in electric vehicles are largely decreasing as the technology progress goes on, and GHG mitigations in the use phase of electric vehicles are also decreasing as electricity becomes cleaner. However, the risk of increased electricity rates from electric grid upgrading may weaken the market competitiveness of plug-in electric vehicles.

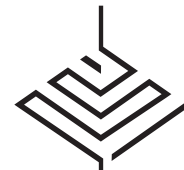
IMPROVING URBAN SUSTAINABILITY OF TRANSPORTATION SYSTEM BY SHARED MOBILITY: A CASE STUDY FOR ANN ARBOR

Presenter: Rui Shi, MS, Sustainable Systems

Adviser: Ming Xu

Location: Ann Arbor, Michigan

Summary: The current transportation sector in the United States relies heavily on private automobiles, which consume a large amount of fuel energy and emit a large quantity of greenhouse gases. Shared mobility, such as ridesharing and bikesharing, could probably improve sustainability of the current urban transportation system by decreasing the total vehicle miles traveled, thus saving fuel energy and reducing greenhouse gases. This research project utilized the real-world private vehicle trajectory data of the city of Ann Arbor, applied vehicle trips' matching algorithm, evaluated potential bike trips, and used linear programming optimization to achieve the maximum reduction of vehicle miles traveled. The results indicate that 1.05% of total vehicle miles can be avoided by ride sharing and 3,799 vehicle trips could be replaced by bike trips, which could reduce 534.89 tons of CO₂ emissions correspondingly. The results show a low potential for sharing; however, this might be due to the limited vehicle data and the irregular travel pattern of private vehicles. The ridesharing potential is sensitive to passengers' time tolerance for detour of their trips. Policies and incentives to encourage longer time tolerance for ridesharing should be implemented to promote ridesharing. Also, because bikesharing can contribute to reduction in vehicle miles, bikesharing programs should receive more consideration and investment in future urban systems.



GREEN BAY PACKERS TITLETOWN DEVELOPMENT SUSTAINABILITY RECOMMENDATIONS

Presenters: Wiles Kase, MS/MBA, Environmental Policy and Planning; Robert Kraynak, MS/MBA, Sustainable Systems; Melissa Morton, MS/MBA, Sustainable Systems; Sean Pavlik, MS/MBA, Sustainable Systems; Kavya Vayyasi, MS, Sustainable Systems

Client: Green Bay Packers

Advisers: Joe Arvai, Mark Lindquist

Location: Green Bay, Wisconsin

Summary: While some professional sports leagues have made strides in sustainability within their facilities, the National Football League (NFL) as a whole, and most teams individually, have not substantially addressed the issue. The Green Bay Packers are in the early stages of addressing sustainability. Titledown, a commercial center the Packers are developing next to Lambeau Field, began with no sustainability plans or goals. This situation has since changed in some key areas after this team presented Packers administrators with sustainable options. Sustainability is important and relevant in the Titledown Development because of the large environmental and socioeconomic footprint of this commercial area. The objective of our research was twofold: to provide the Green Bay Packers with concrete sustainability recommendations to be implemented within the Titledown Development, and to provide the Packers with recommendations for a high-level sustainability strategy that will guide their future sustainability efforts. Our research methods consisted of a survey of current literature related to the specific sustainability topics touched upon by the project, stakeholder interviews, informational interviews with industry experts and peer organizations, and on-site light meter data collection. Through our work, we were able to influence the Green Bay Packers to implement a more sustainable playfield and lighting infrastructure in their Titledown Development. We additionally were able to provide the Packers with a framework for shaping and achieving their organizational sustainability goals.

SHARING SPACE, CREATING PLACE: STUDYING THE IMPACT OF SHARED STREETS ON HUMAN BEHAVIOR AND THE CAPACITY TO CREATE PUBLIC SPACE.

Presenter: Hillary Hanzel, MLA, Landscape Architecture

Adviser: Stan Jones

Locations: London, United Kingdom; and Vienna, Austria

Summary: Streets are a large part of our built environment, and their design affects how we use them, behave in them, and interact with each other. They have great potential to be wonderful public spaces, or they can be unsafe and unpleasant for everyone. The concept of “shared space” is being applied to main streets abroad as a radical solution to creating better streets that serve a multitude of users and reinvigorate our public realm. My thesis investigates how people behave in shared spaces to learn whether they improve access for nonmotorized users and whether they expand the use of the street as a public space. This study had a multifaceted approach to analyzing shared streets, including an extensive literature review of current research and studies as well as site visits to observe and record behavior at two recent shared-street projects in Europe. Results show that shared spaces are successful under the right conditions. Pedestrian traffic, vehicular speed and traffic flows, surrounding building use, and design all impact user behavior in these spaces. However, if the right conditions aren’t present, shared streets will not function as shared spaces and will instead perform as conventional streets.



PEWABIC: “TILING” THE STORY OF REVITALIZATION IN DETROIT THROUGH PUBLIC GARDENS

Presenters: Matthew Bertrand, MLA, Landscape Architecture; Yihui Chen, MLA, Landscape Architecture; Zilu “Xevy” Zhang, MLA, Landscape Architecture

Client: Pewabic Society, Inc.

Adviser: Bob Grese

Location: Detroit, Michigan

Summary: Faced with the interconnected challenges of population loss, vacant lands, and economic disinvestment, citizens of legacy cities like Detroit increasingly seek opportunities to manufacture their own social, economic, and ecological revitalization. This master’s project offers a case study exploration of the potential for arts-based revitalization through a campus landscape design for Pewabic Pottery, one of the last surviving pottery studios of the early-20th-century Arts and Crafts era and a widely appreciated Detroit arts institution. The medium for this exploration is Pewabic’s current 1.25-acre campus, which includes a half-acre of vacant land once occupied by neighboring businesses. The project also considers multiple future scenarios considering purchase of adjacent parcels, both vacant and occupied. We adopted a process-oriented approach to support revitalization efforts by drawing connections between arts-based revitalization literature and the slate of participatory design practices used across multiple design disciplines. Methods used to engage Pewabic’s community of stakeholders included a series of design workshops, event tabling, and surveys. Design outcomes may also contribute over time toward revitalization by serving as an aesthetic catalyst to promote ecological design principles while enhancing Pewabic’s capacity to attract and engage visitors. We expect that the participatory design process will enhance participants’ social capital, sense of agency in realizing community improvement, and positive community image, all of which represent key means described in the literature through which arts-based efforts and organizations contribute to revitalization.

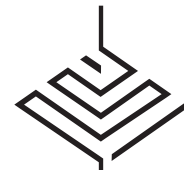
DISTANCE FROM NEIGHBORHOOD GREEN INFRASTRUCTURE (GI) IN DETROIT AND IMPACT ON PERCEPTION OF SAFETY

Presenter: Sanaz Chamanara, MLA, Landscape Architecture

Advisers: Joan Nassauer, Mark Lindquist

Location: Detroit, Michigan

Summary: Installation of green infrastructure (GI) is becoming common in many cities around the world. GI projects in the USA are designed to address stormwater issues and will affect the physical and social environment in the neighborhoods in which they are placed, but few studies have surveyed their impact on safety in these neighborhoods. So for measuring the impact of GI on the perception of safety in residential areas, we conducted a household survey (n = 163) with residents living near the sites of GI interventions in the Warrendale neighborhood in Detroit between November 2014 and April 2015. This survey is part of a larger transdisciplinary research collaboration, NEW-GI—Neighborhood, Environment, and Water research collaborations for Green Infrastructure in legacy cities. Results demonstrate that greening of neighborhoods, by changing their social and physical environments, improves their health and safety. The aim of this study is to give a theoretical basis to concepts proposed for creating safer cities. The ultimate goal is to help planners and policy makers take into account different factors in GI projects to create safer places for people in residential areas.



Conservation Ecology

NOAA GREAT LAKES REGION PUBLIC-PRIVATE PARTNERSHIP

Presenters: Jerry Guo, MS, Conservation Ecology; Zhanyang Gao, MS, Sustainable Systems

Client: National Oceanic and Atmospheric Administration

Adviser: Allen Burton

Location: Ann Arbor, Michigan

Summary: The National Oceanic and Atmospheric Administration (NOAA) is an American federal agency within the United States Department of Commerce. NOAA's missions include (1) understanding and predicting changes in climate, weather, oceans, and coasts; (2) sharing that knowledge and information with others; and (3) conserving and managing coastal and marine ecosystems and resources. In order to address all kinds of environmental issues in the Great Lakes region, NOAA's regional cooperation team is interested in exploring innovative public-private partnership opportunities that are strategically aligned with NOAA's current priorities and mission critical work. The objective of this project is to provide NOAA with deliverables that include a recommendation list of partner organizations in the Great Lakes and a methodology rubric that specifies our criteria for recommending organizations. Our research methods included literature review, interviews, and criteria evaluation. From our literature review, we not only identified major environmental issues in the Great Lakes region but also did case studies on previous successful public-private partnerships. Our interview targets included NOAA staff and U-M faculty members. On the basis of more than 20 interviews, we determined NOAA's capabilities and needs in the Great Lakes region. We also identified the key environmental issues and topics in which future NOAA partnerships would be most beneficial. Finally, we defined a set of criteria to evaluate potential partners; these criteria are specific to each partner's category. Using our specialized methodology criteria, we evaluated the partners on our list of each category, including industries, foundations, and coastal management, education, restoration, and conservation associations. We will generate an overall score for each organization and submit to NOAA a recommendation list of partner organizations.

NATURE AND NURTURE FARMSTEAD PLAN

Presenters: Jared Aslakson, MS, Conservation Ecology; Yihan Li, MS, Conservation Ecology; Michael Lordon, MS, Conservation Ecology; Alex Peters, MS/MLA, Conservation Ecology and Landscape Architecture

Client: Nature and Nurture, LLC

Advisers: Stan Jones, Jennifer Blesh

Location: Dexter, Michigan, USA

Summary: Our client, Nature and Nurture LLC, is a multifaceted business owned and operated by Mike Levine and Erica Kempter. They have recently acquired 120 acres of property in Scio Township, Michigan, and want to derive their income from this land through farm produce and seeds. Much of the property has been conventionally farmed for 50 or more years, while portions of the property are high-quality woodland and wetland. They are committed to ecologically responsible farming and are interested in using organic practices, restoration agriculture, and agroecological techniques throughout the property. To that end, our role will be to create a site and management plan that does not damage the existing high-quality ecosystems on the site and is able to increase the quality of the soils in the conventionally farmed areas. Our methods include surveys of vegetation, soil, invertebrates, birds, and amphibians and reptiles. Our management plan aims to improve and diversify the habitats that exist on site, and our site plan will allow our clients a flexible and sensible way to meet their business goals. There are several high-quality vegetation populations that merit conservation, and several opportunities to create habitat corridors and diversify habitat types. Further, healthy populations of invertebrates and birds serve as indirect measures of ecosystem services on the site. Management strategies, such as designated no-mow zones, would be beneficial to amphibian and reptiles on the site. Lastly, we believe that implementing perennial agriculture and a swale-based water management system has great potential to improve soil fertility, in addition to diversifying the crops available for sale by our clients.



URBANITES MEET URBAN ANTS: ANT SPECIES DISTRIBUTIONS ACROSS THE URBAN MATRIX IN ANN ARBOR, MICHIGAN

Presenter: Eliot L. Jackson, MS, Conservation Ecology

Adviser: Ivette Perfecto

Location: Ann Arbor, Michigan

Summary: Urban ecology is an increasingly important field as we look to preserve biodiversity and ecosystem services in urban spaces traditionally ignored by ecologists. In the pursuit of predicting ecological processes in urban ecosystems, we must first understand the variety of spatial stratification patterns in urban areas. This study examines the effects of various urban matrix features at the habitat, local, and landscape levels on ant species richness, using ants as indicators of ecosystem function. I surveyed ant richness at both the landscape and local scales by baiting and searching for ants across Ann Arbor city limits (landscape scale) and within six city blocks (local scale). Ant species community composition and richness were compared with landscape features (site proximity to rivers, parks, or urban core), local features (site proportion of vegetation, streets, or buildings) and habitat features (observed substrate or street direction). A positive relationship was found between canopy cover and ant species richness. The composition of ant species within a sample site was more highly related to local habitat factors than site overall composition, or proximity to urban or natural features. Furthermore, at the local scale, species richness was associated with the nearest street city block. The data suggests that small local changes in urban landscapes such as increasing street trees may increase species richness of ants and alter the ecosystem functions provided by specific ant communities.

CONSERVATION AND CATTLE PRODUCTION: IMPROVING THE MATRIX THROUGH SILVOPASTURE

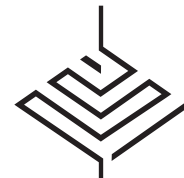
Presenters: John Andreoni, MS, Environmental Justice and Conservation Ecology; Lillie Kline, MS, Conservation Ecology and Behavior, Education, and Communication; Astrid Santiago, MS, Sustainable Systems, and MS, Mechanical Engineering; Alex Truelove, MS, Sustainable Systems

Client: Paso Pacifico

Adviser: Ivette Perfecto

Location: Southwestern Nicaragua

Summary: Agriculture shapes landscapes with important ecological and social implications. Globally, tropical dry forests (TDFs) have historically been disproportionately subject to agricultural conversion. Whereas much of conservation research focuses on forest fragments, our study aims to understand how a high-quality matrix can benefit both biodiversity and farmer livelihoods through connectivity and provision of ecosystem services. The objective of this study is to assess how silvopasture can enhance the conservation value of disturbed TDF habitat while also benefiting local ranchers. We collected data during the summer of 2016 throughout 17 cattle ranches in Nicaragua's Rivas Isthmus, where ranching is the dominant agricultural land use. We studied the ways in which isolated trees influence bird use, pasture quality, and cattle health, as well as rancher perceptions. We documented 130 trees of various species and sizes, 7 main behaviors of 29 bird species in these trees, and the temperature and weight of 116 cattle. Trees with wide canopies, mature fruits, and lower leaf densities experienced significantly higher bird visitation rates. Preliminary results indicate that while pasture growth is lower under trees, measured nutrient quality is higher. The effects of tree cover on cattle health will also be discussed. This study supports the argument that improved tree cover in pastoral systems can enhance their conservation value for resident birds without detriment to agricultural productivity. Today's agricultural practices will likely predict the future of tropical biodiversity. Sustainable land management techniques are therefore crucial to maintaining rich biodiversity, as well as thriving local populations.



VISHWAMITRI: A RIVER AND ITS REIGN

Presenters: Alex de Sosa Kinzer, MLA, Landscape Architecture, and MS, Conservation Ecology; Xinming Liu, MLA, Landscape Architecture, and MS, Environmental Informatics; Dhara Mittal, MLA, Landscape Architecture; Rubin Sagar, MS, Conservation Ecology; Krithika Sampath, MS, Conservation Ecology; Chase Stone, MS, Environmental Policy and Planning; Yundi Yang, MS/MPH, Conservation Ecology

Client: ASP Foundation

Advisers: Allen Burton, Johannes Foufopoulos, Joan Nassauer

Location: Vadodara, India

Summary: In response to the degraded condition of the Vishwamitri River, the Vadodara Municipal Corporation (Vadodara, India) commissioned HCP Design, Planning, and Management Pvt. Ltd. to develop a riverfront design. The resulting proposal, the Vishwamitri Riverfront Development Project (VRDP), intends to mitigate flooding, prevent human-wildlife conflict with crocodiles, increase water quality, and create opportunities for economic development. Since its release in 2014, however, the VRDP has received criticism from numerous NGOs, community activists, and academics from the local university over negative environmental and social impacts. In collaboration with the ASP Foundation, a local stakeholder and VRDP critic, our interdisciplinary team of ecologists, landscape architects, and policy students, including a resident of Vadodara, developed an alternative design framework. To envision a nuanced, holistic future for the river, we first critiqued the VRDP on the basis of current, peer-reviewed literature, regional and global trends in river development, and previous criticisms presented by stakeholders. After identifying overarching criticisms and a two-month field visit to Vadodara, we crafted a plausible design framework for the Vishwamitri River that responds critically, creatively, and specifically to the human and ecological needs of Vadodara and the wider watershed context. In light of the growing body of knowledge in urban ecology, urban stormwater management, and watershed dynamics in India and beyond, in addition to local sentiments regarding the river's identity and cultural importance, our work articulates a vision of complementary dynamism between Vadodara and the Vishwamitri. This vision will be used by our client as a starting point for a fully developed alternative to the VRDP.

ARE LAKE TROUT (*SALVELINUS NAMAYCUSH*) DIETS CHANGING AFTER DECLINES IN ALEWIFE (*ALOSA PSEUDOHARENGUS*) POPULATIONS IN LAKE MICHIGAN?

Presenter: Miles Luo, MS, Conservation Ecology

Adviser: James Diana

Locations: Ann Arbor and Charlevoix, Michigan

Summary: Lake trout are native to Lake Michigan and have historically suffered population declines from overfishing, habitat degradation, and sea lamprey predation. There has been considerable interest among resource managers to restore populations of this commercially and recreationally important species. However, their preferred prey fish, alewife, has suffered plummeting population declines over the last 50 years. A 2011 diet study suggested lake trout still prefer alewife as prey. This study seeks to determine whether lake trout in northeastern Lake Michigan still prefer alewife as prey, even if alewife populations continue to decline. Should lake trout fail to shift their diets to a more abundant prey fish, it may be difficult to justify the continuation of trout stocking programs when there appears to be an insufficient prey base to support them. Trout were collected in May and October during the United States Geological Survey's annual gillnet surveys. Trout were collected in summer months by the United States Fish and Wildlife Service, who collected stomachs from trout caught by anglers during fishing tournaments. All stomachs were examined and all fish and invertebrate prey were identified and measured for length and weight. Preliminary results have shown that lake trout diets consisted almost entirely of alewife and round goby. About equal amounts of each were consumed. These results suggest that lake trout are capable of shifting their diets to more abundant fish. There is likely a strong enough prey base to continue trout stocking programs and restoration efforts.



IMPROVING THE LAKE ERIE HAB TRACKER: A FORECASTING AND DECISION-SUPPORT TOOL FOR HARMFUL ALGAL BLOOMS

Presenters: Devin Gill, MS, Behavior Education, and Communication, and Conservation Ecology; Tonghui Ming, MS, Environmental Informatics; Wanqi Ouyang, MS, Environmental Informatics

Client: Cooperative Institute for Limnology and Ecosystems Research (CILER)

Advisers: Brad Cardinale, Mark Rowe

Location: Ann Arbor, Michigan

This project sought to improve the performance, data display, and utility of Lake Erie's HAB Tracker model for predicting the location and movement of harmful algal blooms (HABs) in western Lake Erie. These improvements will benefit stakeholders by allowing public water systems to prepare for HAB events and by allowing anglers and boaters to avoid affected locations. Specifically, this research addressed three issues: 1) *Microcystis* colony rising/sinking (buoyant) velocity, a parameter in the HAB Tracker model, was measured using an improved method. Statistical relationships were obtained between buoyant velocity and environmental variables, showing lower buoyancy associated with greater light exposure, smaller colony size and deficient nutrient levels. 2) Model skill was assessed in comparison to satellite-derived HAB distributions using a neighborhood-based spatial smoothing method. We found that model skill was improved after spatial smoothing using a 3 km neighborhood. 3) We conducted a series of focus group interviews with Lake Erie charter captains and recreational anglers to evaluate perceptions of HABs and the HAB Tracker. Our results indicate that the majority of anglers seek to avoid fishing in HABs, but that beliefs vary regarding the impact of HABs on fish and human health. We determined that anglers may find the HAB Tracker useful, but we recommend specific changes to improve the presentation of information on the HAB Tracker website to make it more accessible. We also recommend improved content and methods of communication that better reflect angler concerns and interests.

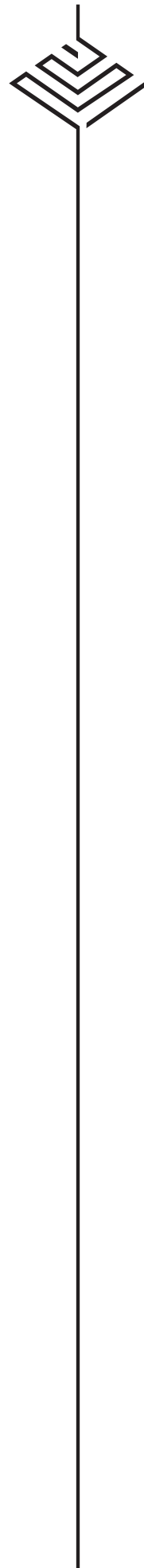
LAND RIGHTS AND WELL-BEING OF INDIA'S INDIGENOUS PEOPLE

Presenter: Melissa W. Rice, MS, Environmental Justice, and Environmental Policy and Planning

Adviser: Arun Agrawal, Rebecca Hardin, Robyn Meeks

Locations: Mahisagar District, Gujarat, India

Summary: The recognition of rural and indigenous people's land rights is a key demand of environmental justice activists, a popular strategy for poverty alleviation, and a focus of policy worldwide. Many researchers have argued that formalizing land rights will improve the well-being of these groups by securing their control of durable income-yielding assets, especially in a cultural context where land ownership is highly valued. In India, indigenous Adivasi people have supported themselves for decades by farming illegally on government forestland. The recent Forest Rights Act (FRA) formally transfers the ownership of forestland parcels to Adivasi households who can prove they have been farming there. The law has the potential to improve the well-being of almost 200 million people – the largest forest-dependent population in the world – but its effects remain unstudied. I evaluated the impact of these rights on the economic well-being of Adivasi farmers, using a survey of 202 households and 50 interviews in Mahisagar District, Gujarat. To isolate the effect of the law, I compared households that applied for and received land rights (treatment) to similar households that applied but did not receive rights (control/counterfactual). Select micro-econometric models revealed that FRA land rights did not have significant effects on food security, agricultural subsidies, and investment in agricultural inputs. The respondents were passionate about getting formal rights but ambivalent about the consequences. Control households anticipated few benefits, while treatment households reported little improvement. Some mentioned a sense of security, more productive farming, and the potential to capture and cultivate additional forestland as benefits.





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Center for Alaskan Coastal Studies

City of Ann Arbor

Cooperative Institute for Limnology and Ecosystems Research (CILER)

CWD Real Estate

DTE Energy

East Michigan Environmental Action Council (EMEAC)

ForestAction Nepal

Grand Traverse Band of Ottawa and Chippewa Indians

Green Bay Packers

Levin Energy Partners

Michigan Department of Natural Resources

National Oceanic and Atmospheric Administration (NOAA)

Nature and Nurture, LLC

Northport Energy Action Taskforce (NEAT)

Paso Pacifico

Pewabic Society, Inc.

The Energy and Resources Institute (TERI)

The Nature Conservancy

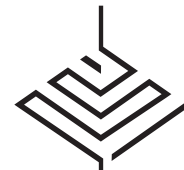
The Resource Management Team

United Airlines

University of Michigan Energy Institute

Valles Caldera National Preserve

Washtenaw County Office of Community and Economic Development



AT A GLANCE — STUDENT PRESENTATION TIMES AND LOCATIONS

Abi-Akar, Reema—Friday @ 11:05 a.m. (Room 1028)	Meyer, Robert—Friday @ 9:00 a.m. (Room 1028)
Albin, Malcolm—Friday @ 9:50 a.m. (Room 1028)	Ming, Tonghui—Friday @ 4:15 p.m. (Room 1040)
Andreoni, John—Friday @ 3:00 p.m. (Room 1040)	Mittal, Dhara—Friday @ 3:25 p.m. (Room 1040)
Apostol, Alexis—Friday @ 9:50 a.m. (Room 1028)	Monti, Chris—Friday @ 9:25 a.m. (Room 1028)
Aslakson, Jared—Friday @ 2:10 p.m. (Room 1040)	Morse, Benjamin—Thursday @ 7:00 p.m. (Room 1028)
Bahrani Fard, Zahra—Friday @ 2:10 p.m. (Room 1028)	Morton, Melissa—Friday @ 3:25 p.m. (Room 1028)
Bertrand, Matthew—Friday @ 4:15 p.m. (Room 1028)	Moya, Ryan—Thursday @ 6:35 p.m. (Room 1040)
Blanchard, Rees—Thursday @ 5:45 p.m. (Room 1040)	Narayanan, Tara—Thursday @ 6:10 p.m. (Room 1040)
Carlson, Christina—Friday @ 11:30 a.m. (Room 1040)	Neema, Bhuvan—Friday @ 10:40 a.m. (Room 1028)
Chamanara, Sanaz—Friday @ 4:40 p.m. (Room 1028)	Ouyang, Wanqi—Friday @ 4:15 p.m. (Room 1040)
Chen, Yihui—Friday @ 4:15 p.m. (Room 1028)	Palacios Brown, Cazzie—Thursday @ 5:20 p.m. (Room 1040)
Clayton, Alexandra—Friday @ 11:30 a.m. (Room 1040)	Patel, Niel—Thursday @ 5:20 p.m. (Room 1040)
De Young, Carissa—Thursday @ 7:00 p.m. (Room 1040)	Patton, Daniel—Thursday @ 6:35 p.m. (Room 1040)
Dickerson, Ashley—Thursday @ 6:35 p.m. (Room 1028)	Pavlik, Sean—Friday @ 3:25 p.m. (Room 1028)
Duan, Beilu—Thursday @ 7:25 p.m. (Room 1028)	Peters, Alex—Friday @ 2:10 p.m. (Room 1040)
Edson, Lauren—Friday @ 11:05 a.m. (Room 1040)	Pollock, Jacob—Friday @ 10:40 a.m. (Room 1040)
Engel, Alex—Friday @ 9:25 a.m. (Room 1028)	Price, Kit—Friday @ 11:55 a.m. (Room 1028)
Flickinger, Joshua—Friday @ 11:30 a.m. (Room 1040)	Rice, Melissa—Friday @ 4:40 p.m. (Room 1040)
Gao, Zhanyang—Friday @ 1:45 p.m. (Room 1040)	Ryan, Daniel—Thursday @ 7:25 p.m. (Room 1040)
Gill, Devin—Friday @ 4:15 p.m. (Room 1040)	Sagar, Rubin—Friday @ 3:25 p.m. (Room 1040)
Goodspeed, Peter—Friday @ 9:25 a.m. (Room 1028)	Salem, Syne—Thursday @ 5:20 p.m. (Room 1040)
Graber, Sachiko—Thursday @ 6:10 p.m. (Room 1040)	Sampath, Krithika—Friday @ 3:25 p.m. (Room 1040)
Guo, Jerry—Friday @ 1:45 p.m. (Room 1040)	Santiago, Astrid—Friday @ 3:00 p.m. (Room 1040)
Hanzel, Hillary—Friday @ 3:50 p.m. (Room 1028)	Schurr, Hailey—Friday @ 9:50 a.m. (Room 1040)
He, Kevin—Friday @ 11:05 a.m. (Room 1040)	Semegen, Sarah—Friday @ 1:20 p.m. (Room 1040)
He, Flora Yifan—Friday @ 11:30 a.m. (Room 1040)	Shi, Rui—Friday @ 3:00 p.m. (Room 1028)
Jackson, Eliot—Friday @ 2:35 p.m. (Room 1040)	Shiledar, Samhita—Friday @ 9:25 a.m. (Room 1028)
Johnson, Katelyn—Thursday @ 7:00 p.m. (Room 1040)	Spevacek, Carl—Friday @ 9:50 a.m. (Room 1028)
Jones, Gabriel—Friday @ 11:05 a.m. (Room 1028)	Stolberg, Andrew—Thursday @ 7:00 p.m. (Room 1040)
Jones, Mary—Thursday @ 6:10 p.m. (Room 1028)	Stone, Chase—Friday @ 3:25 p.m. (Room 1040)
Kaminsky, Amanda—Thursday @ 5:45 p.m. (Room 1028)	Sun, Lingchen—Thursday @ 5:20 p.m. (Room 1040)
Kase, Wiles—Friday @ 3:25 p.m. (Room 1028)	Tang, Yi—Friday @ 11:05 a.m. (Room 1028)
Keeley, Kate—Friday @ 10:15 a.m. (Room 1040)	Truelove, Alex—Friday @ 3:00 p.m. (Room 1040)
Kinzer, Alex—Friday @ 3:25 p.m. (Room 1040)	Turner, Sarah—Friday @ 11:30 a.m. (Room 1040)
Kline, Lillie—Friday @ 3:00 p.m. (Room 1040)	Vargas, Nikole—Friday @ 9:50 a.m. (Room 1028)
Krawczyk, Eric—Friday @ 9:25 a.m. (Room 1040)	Vayyasi, Kavya—Friday @ 3:25 p.m. (Room 1028)
Kraynak, Robert—Friday @ 3:25 p.m. (Room 1028)	Villasenor Suarez, Julio—Friday @ 9:50 a.m. (Room 1028)
Kurtz, Elliott—Friday @ 10:15 a.m. (Room 1040)	Waisanen, Ed—Friday @ 10:15 a.m. (Room 1040)
Larose, Caroline—Friday @ 11:30 a.m. (Room 1028)	Wang, Yihan—Friday @ 9:00 a.m. (Room 1040)
Lee, Cecilia—Thursday @ 5:20 p.m. (Room 1040)	Watters, Molly—Friday @ 11:05 a.m. (Room 1040)
Lee, Helen—Friday @ 9:50 a.m. (Room 1028)	Williams, Teona—Thursday @ 5:20 p.m. (Room 1028)
Li, Luxian—Friday @ 10:15 a.m. (Room 1040)	Wilson, Angey—Friday @ 1:45 p.m. (Room 1028)
Li, Xinwei—Friday @ 2:35 p.m. (Room 1028)	Xin, Yu—Friday @ 10:15 a.m. (Room 1040)
Li, Yihan—Friday @ 2:10 p.m. (Room 1040)	Xu, Yifan—Friday @ 10:15 a.m. (Room 1028)
Liu, Xinming—Friday @ 3:25 p.m. (Room 1040)	Yang, Yundi—Friday @ 3:25 p.m. (Room 1040)
Liu, Yun—Friday @ 11:55 a.m. (Room 1040)	Yuan, Qianyun—Thursday @ 6:35 p.m. (Room 1028)
Lordon, Michael—Friday @ 2:10 p.m. (Room 1040)	Zhang, Fan—Friday @ 10:15 a.m. (Room 1028)
Luo, Miles—Friday @ 3:50 p.m. (Room 1040)	Zhang, Xilin—Thursday @ 7:00 p.m. (Room 1040)
Martin, Derek—Thursday @ 7:00 p.m. (Room 1040)	Zhang, Zilu—Friday @ 4:15 p.m. (Room 1028)
McArdle, Jamie—Friday @ 11:55 a.m. (Room 1040)	
McCoy, Ember—Friday @ 1:20 p.m. (Room 1028)	



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