MUGS (Midwest Undergraduate Geography Symposium) 2026

Macalester College

List of Abstracts

Note: abstracts in alphabetical order by first author's last name, regardless of presentation type (15-minute presentation, lightning talk, poster).

Fiora Boyer, Macalester College

Asthma, Terrain, and Inequality in the Salt Lake Valley

Asthma is a chronic respiratory disease affecting millions of Americans, with prevalence shaped by environmental and geographic conditions. This study examines the spatial distribution of asthma in Salt Lake City, a basin metropolitan area where surrounding topography contributes to frequent temperature inversions that trap air pollutants near the surface. These conditions increase exposure to respiratory irritants and may exacerbate asthma risk. This research evaluates whether variation in topography is associated with differences in asthma prevalence across census tracts. Areas are classified based on their relative topographic position to identify locations more likely to experience reduced air circulation. Spatial patterns of asthma are analyzed to identify clustering, and statistical modeling is used to assess the relationship between topographic conditions and asthma prevalence while accounting for socioeconomic factors. Asthma estimates are derived from the CDC PLACES dataset. This study highlights how geographic context may influence respiratory health in inversion-prone regions.

Caleb Browne, Macalester College

Detecting Roof Repair Dynamics Using PlanetScope Imagery in Cape Coral / Fort Myers After Hurricane Ian

Hurricane Ian's September 2022 landfall caused catastrophic roof damage across Lee County, Florida, amid a deepening insurance crisis that has left many homeowners underprotected. This study uses PlanetScope monthly basemaps (~3 m resolution) from September 2022 through September 2023 to track the persistence of FEMA blue tarps on single-family parcels in Cape Coral and Fort Myers, exploring how repair speed relates to property value and initial damage level. Blue tarps have a distinct spectral signature — high reflectance in the blue band and low reflectance in red — so a custom Blue Index was developed from PlanetScope's RGB bands to classify tarp pixels, with shadows and swimming pools masked beforehand. The classified pixels were then intersected with single-family parcel boundaries, and any parcel with at least 10% blue-pixel coverage was flagged as damaged at that time step. A block-level linear regression showed that a one-percentage-point increase in initially damaged homes corresponded to 1.43

additional days of recovery (R2 = 0.68), and mapping residuals revealed neighborhoods that recovered faster or slower than their damage level would predict.

Gryphon Cruse, Hannah Thiher, Lauren Peterson, Syndney Nelson, University of Saint Thomas and St. Catherine University

Identifying Optimal De-Paving Locations to Reduce Urban Heat Islands in the Twin Cities
Urban heat islands impact many people in Minnesota, particularly lower-income communities. Additionally, the Twin Cities have significant areas of unused or underused pavement that could be repurposed to mitigate those urban heat islands by adding greenery. This study identifies priority locations for de-paving and re-greening in the Twin Cities to maximize urban heat island mitigation. We used weighted overlay analysis in ArcGIS to integrate the Twin Cities Metro Area Road Surface Area layer, the TMCA 1-Meter Classification layer, the Land Surface Temperature layer, and the Equity Considerations for Place-Based Advocacy and Decisions in the Twin Cities layer. The results identify priority zones in areas of persistent poverty with the greatest heat vulnerability and lowest canopy coverage. Implementation of de-pavement and tree planting in our identified areas would address thermal inequity and urban heat islands, increase carbon sequestration, and expand access to greenery for communities with inequitable access.

Gabriel Donelly Higgins, Macalester College

Cropland and NDVI: Measuring Change in Ukraine

For years after the 2022 Russian Invasion of Ukraine the front lines between Russia and Ukraine have stayed relatively stable. Ukraine was one of the world's largest wheat exporters prior to 2022 but its ability to export wheat has been halted by Russia. Conflict does not always lead to cropland abandonment and occupying forces can sometimes introduce policies that increase cropland production. The aim of this project was to detect statistically significant differences in NDVI between cropland at different locations in Ukraine's frontlines and different zones of control. Sentinel-2 images from summers prior to 2022 were classified for cropland using supervised classification. The cropland class was used as a mask to compare cropland from sentinel-2 images in summers prior to 2022 and the summer of 2025. Points were randomly distributed over locations' cropland in an NDVI composite to collect NDVI values before and after the Russian Invasion. Hypothesis testing was then used to compare changes in NDVI values at locations before and after the Russian Invasion and between locations across Ukraine.

Caroline Fitzpatrick, Macalester College

The First "15 Minute City:" Sustainable Urban Development in Pre-Capitalist Morocco

We find ourselves in the age of globalization with a rising population rate, increased access to information, global trade, and more transnational dynamics that bridge the geographic and mental gap between "us" and "them," or "near" and "far." As an American college student studying urban geography, I have become well-acquainted with the current urbanist discourse that praises the likes of Copenhagen, Paris, Rome, et cetera for representing the pinnacle of

urban living. From design, to infrastructure, to sustainability, these cities seem to simply have it all "right," according to many contemporary urbanist scholars. Are these "perfect" cities? Or has the Global North maintained a dominant hegemony on urban scholarship and discourses that centers themselves and ignores the Global South? My research is centered around the urban geography of Morocco, specifically Morocco's centuries-old, continuously operating fortified cities known as "medinas" that remain significant places of heritage and culture. I argue that Moroccan medinas have implicitly promoted sustainable urban development for centuries through their pre-capitalist built environment that encourages community-gathering, pedestrianism, dense housing, and a craft-based economy. In my research, I aspire to expand upon the current sustainable urban development discourse by increasing representation of model cities from Morocco, and by conducting a geographic information system (GIS) and geospatial analysis.

Megan Gangl, University of Minnesota-Duluth

Socially Constructed Wildlife Limits: From Biological Carrying Capacity to Wolf Policy in the Upper Midwest

This paper examines how wildlife population limits are socially constructed and translated into public policy. Traditional wildlife management has relied on biological carrying capacity (BCC) to define sustainable populations, but growing human–wildlife interactions reveal that ecological limits alone are insufficient. Conflicts often arise when wildlife populations exceed levels that people are willing to tolerate, prompting a shift toward socially informed frameworks such as wildlife acceptance capacity (WAC), cultural carrying capacity (CCC), and wildlife stakeholder acceptance capacity (WSAC). Focusing on gray wolf management in the Upper Midwest, this study analyzes Minnesota and Wisconsin's 2023 wolf management plans to evaluate how social tolerance is operationalized. Both plans reject fixed population targets in favor of adaptive, values-based management, yet they diverge in emphasis. Wisconsin's plan prioritizes stakeholder conflict and regulated harvest to balance competing interests. Conversely, Minnesota's plan emphasizes long-term coexistence, public engagement, and collaborative governance. These findings demonstrate that wildlife limits are not fixed ecological truths but dynamic, socially negotiated outcomes shaped by values, conflict, and governance structures. By bridging the gap between biological data and human values, these plans reflect a new era of management in shared, compromised landscapes.

Jordan Glass, Macalester College

Investigating Heat Island Effects in Phoenix, Arizona, Compared with Surface type and Median Income

Urban heat islands (UHIs) are becoming a larger factor in modern city planning as global warming threatens to make hot cities hotter and thereby more difficult to live in. Typically, the most affected populations of UHIs are in lower-income communities which have less access to heat-dissipating surfaces or shades, and lower percentages of ground covered by plants. This paper aims to investigate a three-fold comparison of surface temperature, surface type, and local median incomes by community to investigate both the root causes and socio-economic causes

and impacts of UHIs. This is with the goal of hopefully identifying areas of heat island reduction, and suggesting more minor changes the city can make in order to create lasting impacts that can help the hottest cities in the country survive ever-hotter summers, while mitigating the effects these UHIs have on lower-income communities to help them save money and significantly improve quality of life.

Jakob Gustafson, Benjamin Kovalcik, Nicole Martens, Madeline Vang, University of Saint Thomas and Saint Catherine University

Modeling pollinator habitat connectivity between three St. Paul college campuses

Pollinators provide important ecosystem services and are vital to the functioning of both native ecosystems and human food systems. However, native pollinators face increasing threats from urbanization, which fragments their habitat and reduces the native plants they depend on. The goal of this project is to model how increasing the number of residential pollinator gardens will impact bee populations and connectivity between existing islands of pollinator habitat at the University of St. Thomas, Macalester College, and St. Catherine University. The study area will be the neighborhoods surrounding these campuses. Key data layers include 30-meter resolution land use and land cover data, as well as Metropolitan Council parcel data. Our analysis relies on tools including random points, cost-distance analysis, and focal statistics to determine areas where turf grass could be converted into pollinator gardens. We will identify three scenarios for pollinator gardens between the three campuses and calculate their connectivity potential. The results of this study could be used to promote pollinator gardens and show homeowners in the neighborhood how they are part of a larger pollinator habitat network.

Catherine Kane, Macalester College

The Political Ecology of Beltway Banditry

This paper investigates the domestic environmental impact of U.S. national security policy, using Northern Virginia as a case study for how overseas conflict shape domestic landscapes. While military-induced ecological change is often studied abroad, this paper uses the framework of political ecology to trace the “chains of explanation” from American military interventions to the urbanization of the National Capital Region. By synthesizing qualitative economic history with quantitative spatial analysis and satellite imagery, I argue the rise of urban hubs like Tysons and Reston are a direct byproduct of 21st-century defense spending and privatization rather than traditional market forces. I further conclude that the U.S. military-industrial complex acts as a primary architect of regional land-use change, effectively imprinting the strategies of modern warfare onto the American built environment.

Jack Karlen, Victoria Carroll, Justin Jones, University of St. Thomas

Modeling the impact of pollinator-friendly gardens on bee populations and habitat connectivity in three Saint Paul Neighborhoods

Destruction of grassland habitat has contributed to the significant decline in insect populations. To help mitigate these effects, this study evaluates how varying levels of pollinator garden adoption influence habitat connectivity and biodiversity in St. Paul. We focused on the Merriam Park, Macalester-Groveland, and Highland Park neighborhoods, where pollinator garden initiatives are already underway. Using ModelBuilder in ArcGIS Pro, we modeled how an increase in the number of pollinator gardens might benefit bee populations, pollinator diversity and habitat connectivity. Our primary data layers were Metropolitan Council parcel data and TCMA 1-meter resolution landcover data. We use the Erase, Dissolve, Clip, and Generate Random Points tools to generate maps depicting different levels of pollinator gardens adoption in residential yards between the University of St. Thomas, Macalester College, and St. Catherine University. The universities will serve as islands of habitat while gardens in the surrounding neighborhoods act as corridors to enhance connectivity. Our research found changing front yards to pollinator gardens will significantly increase pollinator connectivity, pollinator numbers and biodiversity. Connectivity gains were greatest when gardens were spatially clustered, creating continuous habitat corridors. These findings demonstrate how targeted residential planting strategies can support urban biodiversity and inform local conservation planning.

Ezra Korn-Meyer, Macalester College

Investigating the Sustainability of Senior Living at the Marvella Community in St. Paul

This study is concerned with the sustainability agenda within the realm of planned senior living communities. How is senior living compatible with urban sustainability? How are these facilities implementing the sustainability agenda? What lessons can be drawn from the sustainability measures unique to these living arrangements? I propose that the elderly are uniquely positioned *and inclined* to leading sustainable lives, and that the rest of us could learn something from the sacrifices they are willing to make in order to prioritize what is truly important to them. Scott Campbell's planner's triangle provides a framework for the negotiation between economic development, social justice and equity, and environmental protection. In an effort to select a salient and accessible case, I will focus my scope entirely on the Marvella, a retirement community managed by Presbyterian Homes located within the Highland Bridge brownfield site redevelopment in Saint Paul. Through observation of the facilities and analysis of the political economy involved in its creation, I find that Marvella succeeds in offering residents a uniquely sociable, empowering atmosphere, housed in an energy-efficient complex well-integrated into the surrounding neighborhood, if only they can afford to live there.

Solomon Landman-Feldman, Macalester College

Greenspace for Yesterday, Today and Tomorrow: How American Cities Maintain Their Parks Despite Population Loss

Many American cities lost population after 1950, even if their metropolitan area was still growing. This loss of population often caused cities to struggle to maintain their infrastructure, as it was built for a much larger population which no longer existed. One kind of public infrastructure, parks, provide a variety of mental and physical health benefits, and they promote social and environmental sustainability. This research examines three American cities –

Cincinnati, Detroit, and St. Louis – that have experienced significant population decline between 1950 and 2020. Each of these cities uses a different mix of private and public funding sources, and they all have had their own unique challenges in maintaining their parks. Despite this, every one of these cities has shown through unique strategies that it is possible to maintain their greenspace despite population loss and funding challenges.

Khue Le and Catherine Kane, Macalester College

Heroin Commodity Chain

This poster examines the global heroin commodity chain, including how the production, distribution, and consumption are connected across regions. Comparing the American and European supply systems, showing how heroin originates from poppy-growing regions in Latin America, Afghanistan, and the Golden Triangle before moving through transnational trafficking routes. The study highlights how heroin flows from Myanmar and Afghanistan into neighboring countries and onward to global markets, including Europe via the Balkan route. At the street level, informal networks and urban inequality shape local consumption patterns. The study highlights the need to understand drug trafficking as a global system connecting local communities to international markets.

Millie Mamantov, Macalester College

Connecting Through the Grapevine

My poster presentation is about the possibilities surrounding cold-climate grape growing here in Minnesota and throughout the region. Grapes are primarily imported, but it is entirely possible to grow them here in the Midwest. This is already done to a small degree, but is a practice not nearly harnessed enough for how common of a fruit they are. I argue that not only would this decrease carbon emissions associated with transportation, but growing grapes in residential areas would strengthen interpersonal bonds between communities.

Zach Marshak, Macalester College

Local and Sustainable Solutions in the Development of Rural Transportation Infrastructure

Transportation infrastructure is a foundational element of global development, historically leveraged to integrate rural areas into regional and global markets. While mainstream frameworks prioritize large-scale motor-vehicle-centric projects to drive economic growth and agricultural commercialization, recent evidence highlights a complex reality of uneven outcomes. This paper examines the impacts of traditional transportation policies on rural livelihoods, identifying critical institutional and environmental burdens. Drawing on case studies from Africa and Asia, the analysis reveals that infrastructure often fails to benefit rural and disadvantaged communities who are recipients of such projects, while the prioritization of new construction over maintenance rapidly erodes initial socio-economic gains. Furthermore, the study identifies a significant "environmental trade-off," where improved connectivity leads to habitat fragmentation, soil degradation, and the unsustainable intensification of chemical inputs.

To address these failures, this presentation proposes a reimagined framework that shifts away from a top-down, and highway focused model toward decentralized, participatory strategies. By prioritizing community-based maintenance, intermediate transport technologies, and local knowledge, development can foster resilient livelihoods that are both socially inclusive and ecologically sustainable.

Katie Martin and Dylan Jeppe, Macalester College

Powered Up: Tracing the Commodity Chain of Electric Vehicle Batteries

We are studying electric vehicle batteries as a commodity because of the critical role that electric vehicles will play in the global transition towards a more sustainable future. We will be researching the sustainability of electric vehicle batteries and two related subcategories of sustainable ethics and usage. Firstly, we will explore the sustainability of the batteries. This will include researching the environmental impacts of mining the rare earth minerals necessary for the production of the batteries, the economic impacts of mines and factories on local communities, the health impacts of mines, the social impacts of mines, and studying the life cycle of the batteries. Secondly, we will explore how the usage of EVs is on the rise. The demand for EVs continues to rise as people and countries reach for a more sustainable future. EVs play a crucial role in this because they offer a lower-carbon-emitting car. Different countries approach the transition to EVs differently, with some countries offering subsidies for EV users. Third, will we discuss the sustainability ethics of the EV battery commodity chain. This is important because battery sourcing ethics has already come into question for EV giants like Tesla. We will look at questions like: What companies are the most transparent about where their resources are coming from? What companies may be exploitative? Are EVs and their batteries as eco-friendly as they seem (media-analysis)? These three perspectives of analysis interest us because, as part of a generation of potential EV car owners, exploring the ins and outs of a critical component in the batteries is important in understanding the overall sustainability of the battery commodity chain.

Grace McDonnell, Ella Oestreicher, Danny Raymond, Dr. Harry Jol, Wanxin Huang, Dr. Rahul Kumar, Jeffrey Munar, and Dr. Lea Soria, UW-Eau Claire

Verifying the Scale of High-Energy Events Throughout the Filipino Gamay Coastal Plain

The geomorphic history of coastal plains can be visualized through their formation and unique subsurface layering, which can indicate natural disaster occurrences and lasting environmental impacts. Topographically corrected ground penetrating radar (GPR) profiles provide new insights on how coasts develop and are impacted by high-energy events within the Gamay coastal plain sequence. To verify the scale of high-energy events throughout the Filipino coastal plain sequence, GPR reflections from two coastal sites were collected. The project scope focuses on the second coastal site to reveal the scale of Gamay's coastal events, with the second site situated a kilometer northeast of the first site. Data were collected using a Sensors and Software pulseEKKO Pro® GPR unit with 100 MHz antennae at two coastal sites. The antennae separation was 1 m, and the step size was 0.25 m along all transects. Four GPR profiles were collected along three transects perpendicular to the modern coastline and one transect parallel to

the coastline, linking the other three. Data were processed in EKKO Project. Erosional truncations were then identified and used for interpretation. Profiles at the second site correlated to the subsurface activity experienced at the first, effectively verifying large-scale, high-energy events throughout Gamay Bay.

Jack McNeely, Rowdah Jama and Katelyn Olson, University of Saint Thomas

Building Community by Conserving Nature: Optimal sites for pollinator gardens in St. Paul Minneapolis and St. Paul have some of the most thriving public green spaces in the US. But there are some locations where communities are greatly neglected. This project uses geographic information systems to identify what locations within the Twin Cities have green space potential. This is through exploring how native plant gardens can operate as important pollinator habitats, as well as community spaces with hands-on exposure environments. We utilized multiple data sets in GIS, including the Equity Considerations data layer to find areas with persistent poverty for potential project locations. Ecological Land Type Associations of Minnesota to perform an analysis of land use types and Land Surface Temperature data layers to find areas with a high heat index. We defined our analysis through using the raster calculator, reclassify, and zonal statistics tools to create a suitability model that targets optimal sites for pollinator gardening. Our results illustrate how local green infrastructure can address environmental and social challenges while aiding underprivileged neighborhoods through community cultivation.

Joe Melloh and Drew Morral, Macalester College

Commodity Chain of the Playstation 2

During the growth of the gaming industry through the 1980s and into the 2020s, the Playstation 2 helped establish Sony as a dominant force in the gaming industry. This rapid growth of gaming has led to a strong gaming culture in many countries in the global north. Given the complex nature of the Playstation 2 production network—involving both hardware and software—it can operate in both global and hyper-regional contexts. We will trace the Playstation 2 all the way back from production to cultural impact, making sure to emphasize the vast nature of its production network. In our poster we will look into how media, advertising, and design work their way into culture and help shape our imaginations as consumers of the brand or product in particular.

Ella Oestreicher, UW-Eau Claire

The characterization of a fluvial channel located within the coastal plain of Gamay Bay, Northeast Samar, Philippines, through ground penetrating radar subsurface imaging

Gamay Bay is in a high-impact weather prone region (tropical cyclones, tsunamis, storm surges) within Northeast Samar, Philippines where over 23,000 people live. The characterization of Gamay Bay's subsurface sediment layering helps inform past depositional and erosional events. The study sought to characterize the hinterland within Gamay Bay through ground penetrating radar (GPR). The GPR method is a noninvasive geophysical technique used for subsurface

imaging and characterizing sediment layering. The GPR transmitter antennae sends electromagnetic (EM) radio wave pulses into the subsurface, which reflect changes in sediment and are recorded by the receiver. Surveys were collected using a Sensors and Software® pulseEKKO GPR Pro with 100MHz antennae. The transmitter and receiver antennae were placed 1m apart sending EM pulses every 0.25m intervals along 2 transects. EM velocities calculated from hyperbolas in GPR data ranged from 0.06-0.08m/ns which indicated moist sand and clay. GPR data was combined with ground-truth coring data to validate GPR profile interpretations. Corers were pushed 1m into the ground at areas of sediment deposition noted from GPR profiles. Grain size, shape, and sorting were recorded and confirmed high-energy depositions of sand, and low-energy depositions of clay. GPR profiles and ground-truth data in tandem revealed a fluvial channel.

Megan Precopio, Macalester College

Uprooting Livelihoods: Agricultural Development as a means of Colonial Extraction and Undermining Uyghur Identity in Xinjiang, China

The Xinjiang Uyghur Autonomous Region is a resource rich province in the Southwest of China, and the homeland of the Uyghur people, a majority Muslim Turkic ethnic group. Following China's economic liberalization in the 1980s, Xinjiang has been the recipient of many 'development' and 'poverty alleviation' campaigns from Beijing, which have brought an influx of ethnic Han migrants, extractive infrastructure, and state capital into the region. Development policies have also transformed Xinjiang's agricultural production, reshaping Uyghur majority rural areas into agrobusiness-dominated production and processing hubs powered by coerced Uyghur labor. Policies that encourage land consolidation, large agricultural firms, and utilization of rural surplus labor have allowed the Chinese government to capture Uyghur land and labor resources to serve their economic and political goals. These policies have uprooted traditional Uyghur livelihoods and eroded their connection to the land as part of a larger systematic effort by the Chinese state to weaken Uyghur cultural identity.

Pablo Quiñonero Koch, Macalester College

Pollution Externalities: Evaluating California High-Speed Rail as a Transportation Solution

Transportation is the largest source of greenhouse gas emissions in the United States. Rising emissions from automobiles and aviation contribute to climate change, air pollution, long-term economic costs due to environmental damages, and its associated spatial inequalities. Addressing these externalities requires a shift towards alternative transportation systems that reduce dependency on high-polluting travel modes. This paper examines the sustainability problem of CO2 emissions in transportation and evaluates the effectiveness of US high-speed rail as a potential solution. High-speed rail networks have been successfully implemented in countries such as Spain, China, Japan, Germany, and France, demonstrating the ability to provide fast, reliable, and low-emission transportation between major population centers. Serving as a substitute for short-haul flights and car travel, high-speed rail has potential to significantly reduce emissions while improving transportation efficiency and economic connectivity within the US. This paper discusses the environmental and economic benefits of expanding high-speed

rail in the United States, particularly in California's urban corridors, and evaluates the feasibility of this transition through metrics such as emissions reductions, ridership demand, and cost-benefit analysis.

Eva Ronshaugen, Lila Hughes, and Xochizeltzin Castañeda-Camacho, St. Olaf College

Potential Negative Impact of Mining Development in the Boundary Waters Canoe Area Wilderness, Minnesota

Land degradation is one of the major problems affecting the environment worldwide. Pollutants in water affect wildlife species and human wellbeing. The Boundary Waters Canoe Area Wilderness (BWCAW) is located within the southernmost edge of the boreal forest ecosystem in Minnesota. The area comprises pristine forests, streams, lakes, and wildlife species at risk such as Gray Wolf (Canis Lupus), Canada Lynx (Lynx Canadensis), and Moose (Alces Alces). In 2019 the Twin Metals Minnesota (TMM) company proposed to start operations at the Maturi deposit (225,504 km2) which is a repository of copper, nickel, cobalt and platinum in the region. A twenty-year mining ban was placed in 2023 to prevent the environmental impacts but ongoing attempts by TMM may overturn this ban. The work analyzes the potential negative impacts of mining operations in the BWCAW. Using literature review, spatial analysis, input-output models, historical data/survey, the results illustrate that mining would negatively impact natural resources such as water, soils, inhabitant's wellbeing and tourism activities.

Will Rosenberg, Macalester College

The Exploited "Othering" of Mining Disputes in Minnesota's Iron Range and the Twin Cities Urban Core

The Boundary Waters are a federally overseen recreational wilderness area in Northern Minnesota. They have been the subject of many battles in congress over land rights and usage. The Boundary Waters are situated right near (sometimes bordering) Minnesota's Iron Range. A region of the state that's famous for its mineral mining. Post World War II, the Iron Range took a devastating financial blow as the United States turned to foreign trading for minerals and strengthened environmental regulations on mining. The area has been in decline for decades and has been searching for profitable solutions. Antofagasta, a Chilean mining giant, has a subsidiary called Twin Metals Minnesota. Twin Metals aims to build a copper-sulfide mine near Ely Minnesota, which happens to border the Boundary Waters. This could have devastating impacts on the Rainy River Watershed. Non-profits and organizations around the state have been fighting this possibility. Iron Rangers feel a disconnect from the urban core of the Twin Cities trying to fight this potentially profitable opportunity for the Iron Range. Politicians and corporations are using potential profits and a cycling boom and bust industry to exploit a growing divide over what to do with Minnesota's public lands.

Rachel Scher, Macalester College

Change Over Time at the Lower Se San 2 Dam

The Mekong River Basin comprises the Mekong River and its many tributaries, which have provided the populations of mainland Southeast Asia with fish and other resources for thousands of years. With the rise of renewable energy development, various countries along the Mekong, most notably Laos, have built hydroelectric dams for electricity generation. One of these dams is the Lower Se San 2 dam, which lies along the Sesan River and Srepok River in Cambodia. Hydro Power Lower Se San 2 Co., LTD, is a joint venture between China's Huaneng Group and Cambodia's Royal Group. After getting their plan approved by the Cambodian government, dam construction began in 2013 and ended in 2017. During this construction period, large areas of forests were deforested to clear space for the water. By 2018, the dam was fully operating. What was previously forest and villages was completely flooded by then. All of the people who were living in the flooded area had moved to other villages, and the journey for thousands of migratory fish had been made more challenging. For my project, I will compare different types of land from 3 different time periods using images from Sentinel 2. 1 image from 2015, which is when the dam was still under construction, and the mass deforestation had not started yet. 1 image from 2017, which is when all of the necessary deforestation would have been completed, but the dam was not fully operating yet, so the water did not start flooding yet. And finally, 1 image from 2019, which is when the water has already flooded. I will classify what areas are forest, deforested, and water. From these classifications, I can determine the areas that became deforested (forest-> deforested) and the areas that became flooded (forest -> water) over time.

Rachel Scher, Macalester College

Legal and Traditional Systems of Land Division in Rural Cambodia

Under modern-day globalization and capitalism, it is important to determine what each area of land is used for. In my presentation, I will cover different types of land designation in rural Cambodia and how they have been managed. The most common type of land designation is a private land title, where families get their own small plots of land to farm and live on. More than 60% of Cambodia's population are smallholder farmers. Another common land designation in Cambodia is protected areas. They cover more than 25% of Cambodia's land area and are managed by the Ministry of Environment (MoE). Despite their protected status, many of the protected areas have human settlements within them, so the enforcement of protective laws varies. Contrasting the protected areas are the areas of land under Economic Land Concession (ELCs). ELCs are large areas of land that have been bought out by large corporations, both Cambodian and International. Most of them are agrobusiness plantations that produce rubber, cassava, cashews, and other crops. Many of them are located in protected areas, or areas that used to be protected areas. Some rural communities also have their own large areas of land. Community Forests are forests that are managed by members of the local community; they are not exploited. Because of their designation, they cannot be bought out as economic land concessions. Indigenous Communities can apply for Indigenous Community Land Titles (ICLTs), which is usually a very long process needing full community involvement and cooperation. To further look into these community land designations, I will be presenting my own field data from 3 different communities: Veal Konsaeng, Bu Sra, and Andong Kralong. They all have different stories of how they were affected by recent history, dealing with ELCs and protected areas, getting support, and receiving their official land designations.

Owen Schmeichel, Macalester College

Mycorrhizal Diversity and Seasonality in Western Mexico.

Mycorrhiza is the term used to describe the relationship between plant roots and fungi, where the plant supplies the fungus with sugar in exchange for water and nutrients. 70-90% of plants form mycorrhizal relationships with fungi (Parniske 2008), yet we don't fully understand what shapes these underground ecosystems (Kuyper & Jansa 2023). I hope to discover whether consistent photosynthesis throughout the year is correlated with mycorrhizal diversity. To do this, I will compare the EVI of Western Mexico during the wet and dry seasons (September and March). I will use MODIS terra imagery to create a seasonality index based on the difference in EVI between the wet and dry seasons. The Society for the Protection of Underground Networks has a global map of estimated mycorrhizal diversity, which I will compare to the seasonality layer to answer the research question.I will look for correlations between mycorrhizal diversity and seasonality while accounting for overall vegetation with the MODIS images. Consistent photosynthesis means a constant flow of food for fungi, which could lead to high diversity, even in areas with low overall productivity. A better understanding of what habitats are suited to mycorrhiza can help us preserve these ecologically important organisms.

Philomena Shuffelton-Sobe, Macalester College

Unsustainable Stories: Agricultural Knowledge on the Great Plains, 1880-1934

This thesis explores stories about how people farmed and learned about farming on the Great Plains from 1880-1920 through three inter-connected narratives: the Allotment system, agricultural education programs at federal Indian Boarding Schools, and the rapid rise and fall of the Dry Farming movement. These systems were built on stories about how people should live with and on the land that promoted unsustainable, destructive ways of farming and knowledge production. This scholarship places Assimilation Era agricultural education for Native and non-Native farmers within the context of the increasing reliance on systems and science and the institutionalization of agricultural knowledge.

Julianna Stewart, Gustavus Adolphus College

Geography and Conflict: The War of the Boko Haram Splinters

Despite the Islamic extremist positions held by both Boko Haram and the Islamic State of West Africa province, religion is not the primary reason for insurgency. Rather, the underlying needs behind their dissent is in response to colonialism. North eastern Nigeria, specifically Borno state, is the epicenter of islamic extremist terrorism. Borno state geographically shares a border with three countries; Cameroon, Chad, and Niger, and it is a part of the broader lake Chad basin. I argue that the geography of Borno and its location in the Lake Chad Basin is vital in the expansion of influence of Islamic Extremist organizations. I maintain that control over the lake secures power across borders both domestically (in Nigeria) and internationally. Control of the lake exerts power over everyone who relies on the lake for farming, fishing, water and trade.

Finally, in policing the lake, organizations like Boko Haram and the Islamic State of West Africa Province are able to become government-adjacent in power and impact.

Daniel Walsh, University of Minnesota

Geographies of Disparity: Spatial Differences in Mobility by Gender in the Twin Cities

How does gender influence spatial patterns of mobility across the Twin Cities? This quantitative research identifies differences in the spatiality of mobility across gender within Hennepin and Ramsey counties before and after the COVID-19 pandemic. Tabular transportation data was sourced from the Metropolitan Council (years: 2019, 2021) and spatialized at the block-group level. More than 130,000 individual trips were used to determine probability values for all block-group connections represented in the data and visualized using varying opacities and other filtering methods. This research concludes that there are significant differences in mobility patterns across gender within the Twin Cities. More importantly, when compared with real-life mobility infrastructure, our data indicates evidence of institutional bias toward male-dominated movement corridors, including within the light rail system. This disparity can serve as a starting point for reimagining urban mobility through a more equitable lens. This research suggests that gender must be considered when designing equitable mobility infrastructure within the Twin Cities and aims to establish a conversation around gendered differences in mobility patterns.

Benjamin Weng, Macalester College

Typhoon Genesis in the Western Pacific: a Comparative Study of the Philippines Atmosphere-Ocean Condition in Active and Inactive Typhoon Seasons

The Philippines is one of the most vulnerable countries to tropical cyclones. On average, 20 tropical cyclones enter its area of meteorological responsibility each year. In 2013, the Western Pacific hatched 31 tropical cyclones, well above the average of 25.6. Super Typhoon Yolanda made landfall on Nov 7th, 2013, at Guiuan, Eastern Samar, Philippines, killing 6352 people. This project aims to study the long-term atmospheric and oceanic conditions in the Western Pacific that drive active typhoon seasons via the lens of remote sensing. Sentinel-1 and AVHRR Pathfinder data are used to analyze and compare two active Pacific typhoon seasons (2013 and 2019) with two inactive Pacific typhoon seasons (2010 and 2023). AVHRR Pathfinder's Global Sea Surface Temperature (GSST) feature provides valuable insights into the genesis of tropical cyclones based on SST. Satellite-based Synthetic Aperture Radars (SARs) on Sentinel-1, with their unique ability to observe the ocean surface through dense clouds in tropical storms, will be exploited. SARs produce vertical wind profiles and wind-speed maps of individual tropical cyclones, enabling cyclone-specific studies.