Session 1: Climate Mitigation, Law, Communication, and the Arts

Location: Polar Library, 176 Scott Hall. Chair: Renato Frasson

1. Christian Blanco: Firm's response to climate change
2. Theresia Yazbeck & Gil Bohrer: Large Eddy Simulations of Sustainable Greenbelts in Industrial Complexes
3. Sophie Manaster: Gender Differences in Pro-Environmental Behaviors and Carbon Footprint Feedback Response
4. Chante Vines: Baseline methane concentrations using eddy covariance methods near a hydraulic fracturing site
5. Jose Maria Alvarez de la Puente: Biochar and Vermicompost Use as Peat Based Growing Media Partial Replacement to Produce Containerized Ornamentals
6. Kyuha Lee & Bhavik Bakshi: Adaptation of Manufacturing Processes and Their Supply Networks to Climate Change
7. Klaus Lorenz & Ratan Lal: Long-term effects of organic agriculture on soil organic carbon stocks up to one-meter depth
8. Halina Steiner: Legal Hydrologies: Prior Appropriation Doctrine
9. Victoria Abou-Ghalioum: How I see myself behind the wheel: Effects of symbolic attributes and experience on EV adoption
10. Zac Patterson: Using Engaged Pedagogy to Explore the Complexities of Climate Change in Secondary Education
11. Reed Kurtz: Ecology, Hegemony, and the Struggle for Climate Justice: Politics of the Climate Justice Movement
12. Shelly Casto: Art & Ecology at the Wexner Center for the Arts
13. Poster withdrawn
14. Michael Mercil: Report on the Weather (An Update)

Session 2: Climate Impacts: Ecology, Fires, Public Health

Location: South & West Hallways. Chair: Atar Herziger

15. Kerri Dobson: Coastal environments with moderate nutrient concentrations may provide refuge to corals under predicted future ocean conditions
16. Yueh-Fen Li: Characterizing the relic DNA contribution to microbial community profiles in an acidic Arctic peat bog

17. Tianqi Zhang & Desheng Liu: Applying Unsupervised Learning in Exploring Local Variations of Vegetation Change
18. Rowan McLachlan: Phenotypic Variation in Hawaiian Corals Provides Insight into Coral Selection for Restoration
19. G. Matt Davies: Peatland wildfire severity and post-fire gaseous carbon fluxes
20. Matthew Shumar & Stephen Matthews: Quantifying land use & climate pressures on avian distribution by looking back to understand the magnitude of future projections
21. James Price: Assessment of the coral microbiome and the underlying coral physiology across a range of natural temperature and pCO2 environment
22. Stephen Matthews & Louis Iverson: Habitat dynamics of tree and bird distributions in response to climate change
23. Jorge Villa Betancur & Gil Bohrer: Methane transport through wetland plants
24. James White: Tundra Fires in Alaska: A Weather Perspective
25. Roger Grau Andres & G. Matt Davies: Burning increases post-fire carbon emissions in a heathland and a raised bog, but fire severity has no effect

27 Lyndsie Collis & Jim Hood: Nutrient availability modifies stream ecosystem response to warming

28 Xiaoyu Li & Sathya Gopalakrishnan: Housing Market Volatility Signals Coastal Resilience: Evidence from Long-Term Price Trends and Adaptation in the United States

29 Traven Wood & Mark Weir: Development of a Computational Model to Forecast Microcystin Concentrations in Drinking Water Treatment Intakes

30 Matthew Hamilton: Cross-level linkages in an ecology of climate change adaptation policy games

Session 3: Impacts & Observations: Agriculture, Water, Energy.

Location: Learning Center, 177 Scott Hall. Chair Desheng Liu

31 Margaret Beetstra & Robin Wilson: A panel study of farmer adaptation in the Western Lake Erie Basin in the face of climate change

32 Darrenn Drewry: Simultaneous improvement in water use, productivity and albedo through crop structural modification

33 Laura Mason: Intercropping with indigenous shrubs relieves drought stress of millet in the Sahel: Are microbes helping?

34 Whitney King: Riverine phosphorus cycling dynamics in an ag watershed during a critical time of loading

35 Tongxi Hu: A Bayesian Analysis of Historical Maize Yield Record in the US

36 Kristi Lekies & Richard Moore: Climate Education Solutions for the U.S. Corn Belt

37 Jordan Pino: Developing a Winter Storm Power Outage Impact Model for a Midwestern Utility

38 Haley Kujawa: Planning for nutrient management in a future climate: is one watershed model enough?

39 Jangho Park & Guzin Bayraksan: Multistage Distributionally Robust Approach to Water Allocation under Climate Uncertainty

40 Dylan Wood & Mehrzad Rahimi: A Modeling Framework for Assessing and Communicating Environmental Risks due to Hurricanes

41 Oguz Demir: Using 0.5-2 GHz Microwave Radiometry for Arctic Sea-Ice Thickness and Salinity Retrieval

42 Ning Zhang: Comparison of Three Methods on Standardizing Soil Moisture Measurements from Different Sensors

43 Linda Weavers & John Lenhard: Ohio Water Resources Center: Investing in Climate Change Research that Relates to Ohio Water Resources

44 Bryce Adams & Stephen Matthews: Mapping continuous forest gradients with harmonic regression of Landsat time series across southeastern Ohio

45 Forrest Schoessow & Evan Vega: UAS remote sensing platforms for change monitoring in high-altitude alpine environments

46 Brandi Downs: GNSS-Reflectometry Applications in Climate Research

47 Jiayong Liang: Estimating daily surface water fraction by using MODIS derived water indices

48 Suzanne Hodgkins: Multi-disciplinary, Interactive Data Management Solutions for Upscaling Arctic Carbon Cycling

49 Bidhyananda Yadav: A Framework for Reproducible Research in Computational Hydrology using Python

50 Robin Bautista-Jimenez: Lowering Health Risks from Mosquito Born Diseases Associated with the Increase in Natural Disasters caused by Climate Change

Session 4: Physical Science Basis

Location: Polar Rock Repository. Chair: Shanshui Yuan.

51 Zhiying Li: Spatio-temporal hydroclimatic variability in Ohio

52 Elizabeth Griffith: Disruption of the marine biological carbon pump over Eocene hyperthermals

53 Camilo Rey Sanchez & Matt Davies: Microbiota and water level dynamics drive methane exchange velocity in a temperate kettle-hole peat bog in Ohio

54 Hanyang Li: Constraining uncertainties associated with black carbon emissions during biomass burning

55 Yang Ju: Quantification of methane emissions from different land-cover patches in a heterogeneous wetland

56 Stacy Porter: Multi-decadal Climate Variability Observed in a Pacific Basin-wide Ice Core Collection

57 Emilie Beaudon: Characterizing the Chemical Signature of the 2015-16 El Niño in the Quelccaya Ice Cap Snow to Calibrate Past ENSO Reconstructions

58 Paolo Gabrielli: 7000 year of aerosol deposition to the Alps from the Ortles ice core

59 Aja Ellis: Making the qualitative-to-quantitative transition in ice core nanoparticle studies: a case study from the Italian Alps

60 George Grant: Significance of Climate on d18O of Cellulose and Implications for Paleoclimate

61 Yuechun Wang: Impacts of Soil Moisture Initializations on WRF-Simulated North American Monsoon System

62 Zachary Leasor: Improvements in Monthly Temperature Forecasts Utilizing Antecedent Soil Moisture

63 Chen Zhao: Validation of WRF-Hydro simulated soil moisture at the watershed scale

64 Kira Harris: Geomorphic and Sedimentological Controls on Hyporheic Flow in an Alpine River

65 Anne Carey & Devin Smith: Are climate dynamics reflected in the stable isotope hydrology of Irish River water during 2018?

66 Rachel Gabor: Persistent Urban Impacts to Surface Water Quality via Impacted Groundwater

67 Michalea King: Understanding the pulse of the Greenland ice sheet: What we are learning from high-resolution records of glacier changes

68 Allison Chartrand: Estimates of deformation associated with basal channels on the Getz Ice Shelf from InSAR-derived velocity grids

69 Melisa Diaz & Christopher Gardner: Climate Change at 85 Degrees South: Heekin Lakes from 1996 to 2018

Poster #:1

Firm's response to climate change

Christian Blanco

We analyze over 10,000 climate change disclosure surveys submitted to the CDP (formerly the Carbon Disclosure Project) from 2007-2016. We show that firms' sentiment towards climate change has changed using text analysis. We identify different climate change strategies that firms now implement, including setting Science-based targets.

Poster #:2

Large Eddy Simulations of Sustainable Greenbelts in Industrial Complexes

Theresia Yazbeck & Gil Bohrer

Techno-Ecological Synergy (TES) is a technique for including ecosystems in industrial processes design. One of the main participants in TES is the forest ecosystem, which is able to reduce air pollution emitted during industrial processes. We tested the relative efficiency of different designs of forest buffers around an industrial complex in absorbing potential aerosol pollution and improving air quality downwind. We simulated the interactions between the forest-buffer belt and the atmosphere using the Parallelized Large Eddy Simulation Model (PALM). Three canopy-structure set up were considered: a homogenous canopy, canopy strips parallel to the wind and canopy strips perpendicular to the wind. For each canopy strip scenario, we considered thin and wide strips, while the space between strips equals to the strip's width. Sparse and dense canopies were simulated for each case. The results showed that thinner strips had a larger scalar uptake, and sparse canopies are being more efficient than dense canopies in cleaning the air. Those results can be explained by canopy-induced turbulence structures that couple the air within and above the canopy and lead to more effective leaf area where this coupling is stronger.

Poster #:3

Gender Differences in Pro-Environmental Behaviors and Carbon Footprint Feedback Response

Sophie Manaster

Feedback on individual consumption is a common tool used to increase pro-environmental behaviors (PEBs; e.g., recycling, reducing energy consumption) and is a useful tactic for climate change mitigation. One aspect that influences feedback's efficacy on promoting PEB change is whether feedback messages are framed effectively to target audiences. Understanding how demographic variables, such as gender, influence response to feedback can inform more effective feedback strategies. This study uses data from a sample of 393 U.S. adults who participated in an experiment in which they were randomly assigned to receive a bogus positive, negative, or neutral feedback message after taking a carbon footprint quiz. Participants' PEBs were assessed before and after receiving the feedback. Overall, we found that women reported engaging in PEB significantly more frequently than men. Women were also found to report engagement in PEB significantly more after receiving positive and negative feedback, while the opposite effect was observed for men, who reported the most PEB after receiving neutral feedback. These findings suggest that feedback interventions may be more effective in encouraging PEB if they use more emotional language when targeting women, and neutral language when targeting men, informing more effective feedback strategies to promote PEB in society.

Poster #:4

Baseline methane concentrations using eddy covariance methods near a hydraulic fracturing site

Chante Vines

Horizontal drilling and hydraulic fracturing (HF) have increased natural gas exploration within the Marcellus Shale. In many sites, mobile monitoring has shown positive correlations between methane concentration and gas production due to released fugitive emissions. However, mobile monitoring does not provide temporally continuous observations. Furthermore, natural emissions around the site may add to the observed methane fluxes. We set up an eddy covariance tower in West Virginia near a hydraulic fracturing site. Continuous measurements 6 months prior to the start of any drilling activity allowed us to parameterize a model for the baseline methane concentration. Our observations continued during the stages of well development including construction of the well pad, vertical drilling, and horizontal drilling, and will continue through the hydraulic fracturing and production stages. An artificial neural network (ANN) model trained with emissions before HF was used to model methane concentrations throughout the drilling timeline. Methane isotopic data assists in distinguishing between the sources of methane concentration - biological (microbes in streams or livestock) or hydraulic fracturing activity. Most of the observed values that exceed the 95-percentile confidence limit of the modeled baseline concentrations are during the horizontal and vertical drilling periods and show a typical geological isotopic ratio.

Poster #:5

Biochar and Vermicompost Use as Peat Based Growing Media Partial Replacement to Produce Containerized Ornamentals

Jose Maria Alvarez de la Puente

Vermicompost, and biochar can be used as peat substitutes in the ornamental containerized bedding plant production as an interesting biotic strategy to store carbon in garden soil.

This research aims to contrast the hypothesis that is possible to grow commercial quality plants of Petunia hybrida and Pelargonium peltatum using biochar and vermicompost as partial substitute of peat based growing media. Those plants also will be able to adapt themselves conveniently to a garden soil after being transplanted, and to diminish nutrients leachate.

Three different comparative greenhouse studies were conducted to assess these hypotheses.

Results obtained may be of interest to producers of bedding ornamental plants in container who wish to:

• reduce the consumption of peat for the production of ornamental plants in containers.

• reduce the carbon footprint

• reduce nitrate´s leachate of in this productive sector.

In this context it would be possible to store carbon in urban gardening soil all around the world for long periods of time for a maximum value of one million metric tons per year, just by partially replacing the peat of the usual substrate with a mixture of 20

Poster #:6

Adaptation of Manufacturing Processes and Their Supply Networks to Climate Change

Kyuha Lee & Bhavik Bakshi

Fossil fuel power generation and manufacturing plants are major contributors to greenhouse gas emissions, and thus to climate change. They rely heavily on water resources, both for generating steam and cooling the process. However, water resources could be affected by drought under future climate change due to projected increase in temperature and variability in precipitation. To combat climate change and its impact, there is a need for implementation of technologies and policy changes that reduce CO2 emissions. In this work, we investigate how manufacturing processes and their supply networks could be affected by future changes in climate and how they could adapt to maintain their productivity. To mitigate and adapt to climate change, we examine the effectiveness of technologies and carbon tax policy that help reduce CO2 emission and water consumption. For example, green urea production employs water instead of methane as feedstock to provide hydrogen to urea since the electrolysis of water usually has smaller carbon footprints than the conventional steam reforming of methane. Another technology includes the use of renewable energy sources instead of fossil fuels. Additionally, we examined the effectiveness of CO2 emission regulations, such as carbon tax.

Poster #:7

Long-term effects of organic agriculture on soil organic carbon stocks up to one meter depth

Klaus Lorenz & Ratan Lal

Organic agriculture (OA) is practiced on 1 percent of the global agricultural land area and its importance continues to grow. Yields under OA are about 20 percent lower and the attendant lower soil carbon (C) inputs together with tillage for weed control may contribute to lower profile soil organic carbon (SOC) stocks under OA. We studied SOC stocks up to one meter depth at long-term field experiments comparing OA and conventional agriculture at sites in Canada, the USA, the U.K. and Italy. The SOC stocks under OA were up to 25

Poster #:8

Legal Hydrologies: Prior Appropriation Doctrine

Halina Steiner

According to the 2014 Government Accountability Report, 80 percent of state water managers expect water shortages within the next decade. This can result from strains on existing infrastructure from population growth, climate change, and extreme weather events. Increasingly, landscape architects lead design teams for green infrastructure, flood management, coastal resiliency, among others. With an increase in these projects, how do we provide resources to learn about the complex legal environment that may impact their design? Associate Justice Brennan of the U.S. Supreme Court asked “After all, if a policeman must know the Constitution, then why not a planner?”.

Legal Hydrologies features the work of 17 students illustrating the Prior Appropriation Doctrine. Eight drawings feature different aesthetics, such as comic book, political cartoon, historic cartography, infographic, and timeline among others. Illustrating one law eight ways allows students to test which techniques people respond and react to. If possible, the team would like to include a survey/box to receive feedback on the drawing set. Legal Hydrologies responds to the necessity to educate design professionals, students, and clients about water law.

Poster #:9

How I see myself behind the wheel: Effects of symbolic attributes and experience on EV adoption

Victoria Abou-Ghalioum

Vehicle electrification is key to reducing greenhouse gas emissions, necessitating strategies to increase adoption beyond current low rates. Electric vehicles (EVs) are highly visible objects that can signal certain identities of the driver (e.g., environmentalist). We utilize identity theory as an overarching framework to test the psychological mechanisms by which symbolic attributes (perceptions of EVs as reflections of one's identity) of environmentalist, tech-innovator, and socially responsible citizen identities predict EV adoption. Literature shows mixed findings of experience (riding or driving) as a direct predictor of EV adoption. Because experience allows individuals to assume the identity of EV drivers, we expect experience to reinforce EVs as symbolic attributes. Therefore, experience is tested as a moderator in the attributes–adoption relationship. Analyses from 535 central Ohio survey respondents on EV acceptance find that stronger evaluations of the tech-innovator and socially responsible citizen symbolic attributes positively predict EV acceptance. Surprisingly, stronger evaluations of environmentalist attributes negatively predict acceptance. We find support for experience positively strengthening the environmentalist symbolic attributes–EV adoption relationship. Extensions of identity theory regarding symbolic attributes and practical implications are discussed. Specifically, professionals can strengthen campaigns by offering EV experiences, such as test drives, to specific populations to increase adoption.

Poster #:10

Using Engaged Pedagogy to Explore the Complexities of Climate Change in Secondary Education

Zac Patterson

Climate change is a complex topic that transcends the realm of the physical sciences. The topic is of global importance and is closely tied to the sociopolitical landscape. Given the implications of climate change and the potential dangers it poses to life on earth, it is a moral obligation of secondary environmental science teachers to create an open learning environment where the complexities of climate change can be explored and analyzed without judgement.

While climate scientists have generated a wealth of valuable information that can be easily and efficiently be obtained by secondary students, I argue that for students to truly grasp the complexity and the magnitude of the topic of climate change secondary teachers must adopt an engaged pedagogy. Such a pedagogy helps create a learning environment conducive to encouraging students to become reflexive and critical thinking societal participants engaged in the topic of climate change.

Poster #:11

Ecology, Hegemony, and the Struggle for Climate Justice: Politics of the Climate Justice Movement

Reed Kurtz

My poster is based on field research that I have conducted at the COP23 climate negotiations in Bonn, Germany 2017 for my dissertation on the politics of climate justice. My poster provides a descriptive analysis of four types of political praxis by climate justice actors observed in and around the COP23: Organizing and Planning; Public Discourse and Communicative Practices; Lobbying and 'Orderly' Political Force; and Direct Action and 'Disorderly' Political Force. Using a Gramscian Ecological framework that I have developed out of engagements with critical human geography and Marxist political theory, I argue that these four modes of political praxis are what constitute climate justice as an antisystemic movement in world climate politics. The annual COP negotiations are important sites not just for climate justice movement actors to participate visibly and publicly in climate politics, but they are also important for the self-organization and reproduction of climate justice as a global 'movement of movements.' Among the modes of political praxis observed by climate justice movement actors, direct action is most significant for their stated objective of 'system change not climate change.'

Poster #:12

Art & Ecology at the Wexner Center for the Arts

Shelly Casto

Information about the Wexner Center's course for high school students integrating art and ecological issues.

Poster #:14

Report On the Weather (An Update)

Michael Mercil

In “Report on the Weather (An Update),” Mercil reviews his series of Living Culture Initiative Projects with the Wexner Center for the Arts—culminating with his recent planting of Site set-aside—and presses for urgent, visible and tangible demonstration of OSU’s aspirational commitment to act as a “fixed beacon” that “illuminates the path” for “addressing the most pressing issues of our day.”*

*From Time and Change: Ohio State’s Strategic Plan.

Poster #:15

Coastal environments with moderate nutrient concentrations may provide refuge to corals under predicted future ocean conditions

Kerri Dobson

Under predicted future ocean conditions, elevated seawater temperatures and pCO2 will affect coral simultaneously. Studies have shown that these conditions can be detrimental to the physiology of the coral host and its endosymbiotic algae. Moderate nutrient additions, however, may offer physiological benefits and aid in mitigating elevated temperature and pCO2 stress in corals. To investigate, fragments of two Indo-Pacific corals Acropora millepora and Turbinaria reniformis were grown for 33 days under 8 treatments of a fully factorial experimental design including two seawater temperatures (26.5°C, and 31.5°C), two pCO2 levels (401 atm, and 760 atm), and two nutrient levels (ambient nutrients, and moderate nutrients). Preliminary results suggest that T. reniformis is resilient under all temperature and pCO2 conditions, with no effect of the moderate nutrient addition observed on either host or endosymbiont physiology. In contrast, moderate nutrients stimulated productivity of A. millepora endosymbionts when exposed to the dual stress of elevated temperature and pCO2. Isotopic evidence indicates that inorganic N additions are incorporated and recycled between endosymbiont and host, and that N incorporation diminishes under temperature and/or pCO2 stress. Overall, this suggests that coastal environments with moderate nutrient additions may provide a refuge to A. millepora under predicted future ocean conditions.

Poster #:16

Characterizing the relic DNA contribution to microbial community profiles in an acidic Arctic peat bog

Yueh-Fen Li

Relic DNA is abundant in diverse soils and obscures estimates of soil microbial diversity. Our project study site is a thawing Arctic peatland complex, in a region known for preserving human bodies for thousands of years. To assess the contribution of relic DNA to 16S rRNA amplicon-based studies of resident microbial communities at our site, we quantitatively compared the soil microbial community with or without relic DNA removal along a habitat gradient, using propidium monoazide (PMA) treatment before DNA extraction, qPCR, and 16S rRNA gene amplicon sequencing. Relic DNA comprised roughly half to three quarters of the total DNA by qPCR, and inflated the richness an average of 25

Poster #:17

Applying Unsupervised Learning in Exploring Local Variations of Vegetation Change

Tianqi Zhang & Desheng Liu

Vegetation in the tundra environment plays an essential role in global energy and carbon cycling processes. Previous investigations in the Arctic area have shown spatial variations in the correlations between vegetation change and climate warming. Although potential controlling factors in causing these spatially non-identical patterns have been discussed, which could originate from local variations (e.g., plant family, snow metrics, topography etc.), control strengths and senses (positive or negative) of these local variations have been seldom explored. Recently, machine learning algorithms have been applied in remote sensing studies. By applying an unsupervised clustering using the time series of spectral signature at per-pixel basis, which can be affected by the abovementioned factors, pixels categorized as the same cluster are similar to each other in terms of background and species information. The intra-cluster similarity and inter-cluster differences in vegetation change pattern relative to climate warming, therefore, could be detected.

Poster #:18

Phenotypic Variation in Hawaiian Corals Provides Insight into Coral Selection for Restoration

Rowan McLachlan

Coral reefs are threatened due to ocean warming and acidification, and their persistence hinges on corals capacity for adaptation. To maximize adaptive potential, genotypes with increased phenotypic resilience to climate change conditions should be selected for restoration; a strategy known as Climate Adjusted Provenancing (CAP). Corals from Kne'ohe Bay (Oahu, HI) would be excellent candidates for CAP as they currently experience temperatures and pH levels not expected to occur on most Hawaiian reefs until 2050. We hypothesize that Kne'ohe Bay corals (a) are phenotypically distinct from conspecific populations on other nearby reefs, and (b) possess phenotypic traits that facilitate their resilience. Three species were sampled from four sites around Oahu, which during the summer, span a natural range of temperature and pH profiles representative of today, through those predicted by 2050. Biomass, protein, lipid, chlorophyll a, and the 13C coral host - 13Calgal endosymbiont (a proxy for heterotrophy) were quantified in each coral. Preliminary results suggest that CAP would be well suited for Montipora capitata, suitable for Porites compressa, but not recommended for Porites lobata. Furthermore, corals collected from Kne'ohe Bay possessed much higher energy reserves (protein and lipid): traits which have been shown to decrease the susceptibility to and increase the recovery from coral bleaching. Future research (including carbohydrates, endosymbiont density, and lipid classes) is being conducted to further investigate phenotypic resilience traits.

Poster #:19

Peatland wildfire severity and post-fire gaseous carbon fluxes

G. Matt Davies

The future status of peatlands as carbon sinks is uncertain given predicted environmental change. Several factors can affect the magnitude of the peatland carbon sink including disturbances such as wildfire. There is at present little evidence of how wildfire affects emissions of CO2 and CH4. Effects are likely to vary according to wildfire severity, and may be noticeable immediately post-fire when little recovery has taken place. Here, we investigate five UK peatland wildfires (2011-2012) in the immediate post-wildfire period measuring CO2 and CH4 fluxes using static chambers. Fire severity was described using a modified form of the Composite Burn Index. A hierarchical partitioning approach indicated time since fire was most strongly associated with fluxes of both but soil temperature, for CO2, and fire severity for CH4. were also important Using a liner mixed modelling approach to account for repeated measures, fire severity was a significant term for CH4 and borderline significant for CO2. Mean fluxes of CH4 were consistently lower on burnt sites. However, additional data from a previous fire in the north of Scotland showed contrasting trends. These results suggest that wildfire can affect gaseous carbon fluxes but the responses can be variable in both space and time.

Poster #:20

Quantifying land use & climate pressures on avian distribution by looking back to understand the magnitude of future projections

Matthew Shumar & Stephen Matthews

The impact of changing landuse patterns on avian distributions has prompted substantial conservation action. However, there is great need to assess the impacts of climate change relative to other pressures. Here we combine two randomForest analyses to intersect contemporary directional changes in bird distributions with projected change in bird habitat. First we examined distributional data for 103 species from two breeding bird atlases in Ohio (1982-1987, 2006-2011). Modeled species distributions incorporated both climate and landcover data. To assess performance, models were back-projected with environmental data from the first atlas to quantify actual change. Mean true skill statistic (TSS) for 70 species indicated good model performance to capture spatial patterns on change. Forty-five species models were dominated by land cover while 22 were strongly influenced by climate. At the eastern US extent, we modeled these same forest bird distributions using Breeding Bird Survey data with predictors of climate, elevation, and tree species abundances. Models were projected to assess potential trajectories of bird distribution for each for each decade until 2070 when climate change in the eastern US is likely to have reached or exceeded ~2ºC. By intersecting these approaches, we show the importance of both landcover and climate on avian distributions.

Poster #:21

Assessment of the coral microbiome and the underlying coral physiology across a range of natural temperature and pCO2 environment

James Price

Increasing sea surface temperatures and ocean acidification are threatening the long-term survival of corals and the persistence of coral reef ecosystems. The coral microbiome has been identified as a potential factor in the resilience of corals to these changing environmental conditions. Coral reefs surrounding Oahu, Hawai'i, USA exist among a natural gradient of environmental conditions, with some sites experiencing summertime temperature and pCO2 levels not expected to occur in most tropical waters until mid-century. We hypothesize that local variability in seawater temperatures and pCO2 drive coral-associated bacterial community composition, and that these differences are species-specific. To test this, we characterized the bacterial communities of four coral species from six sites around Oahu. We found that the bacterial community composition differs between Porites and Pocillopora corals, and that the structure of these communities was unrelated to several parameters of coral physiology. Additional analyses are underway to determine if differences in the temperature and pCO2 properties among sites further influences the bacterial community composition. Overall, characterizing the coral microbiome across a range of environmental conditions can help restoration and protection efforts to target corals better adapted for predicted future ocean conditions.

Poster #:22

Habitat dynamics of tree and bird distributions in response to climate change

Stephen Matthews & Louis Iverson

Observed and measurable climate change is affecting ecological systems worldwide. The continued rapid change in global climate is now exerting transformative pressures on forests and wildlife. It is, therefore, critical that we understand how species may respond and how we may facilitate adaptations and resilience under a host of global change agents. Forests of the eastern United States are diverse and play a foundational role in many ecosystems. The Landscape Change Research Group strives to understand the potential consequences of climate change on the habitat of 134 tree and 147 bird species across the eastern United States is accessible at www.nrs.fs.fed.us/atlas. These results point to the potential for marked changes in habitat conditions across the eastern U.S. for bird and tree species, with the extent of the responses driven by greenhouse emission pathways. We integrate these results to further quantify colonization likelihoods over the coming century as well as quantify additional climate pressures that could impact these ecosystems (e.g., national drought trends, and changes in plant hardiness zones). In the end we strive to understand the dynamic processes of change in disturbed landscapes and translate them to models, tables, and maps for science delivery and regional climate change adaptation plans.

Poster #:23

Methane transport through wetland plants

Jorge Villa Betancur & Gil Bohrer

Plants play a key role determining the spatial heterogeneity of CH4 emissions from wetland ecosystems. Besides providing recent photosynthates that fuels methanogenesis, plants are often the major pathway for CH4 release to the atmosphere due to gas transport through the aerenchyma. While the physical mechanisms for gas transport is fairly understood and included to some extent in global carbon models, the biological mechanisms remain largely underrepresented in current models. We investigated the relationship between CO2 uptake and CH4 flux in different cosmopolitan wetland plant species. Our goal was to assess the dependency of stomata control on CH4 flux and how CH4 and CO2 flux per leaf area changed through the growing season. Accordingly, we measured simultaneously the change of CH4 and CO2 concentrations in leaf chambers of Typha angustifolia (cattail), Nelumbo lutea (American lotus), and Nyphaea odorata (water lily). Chambers were deployed three times during the growing season. Each deployment consisted of five replicated measurements during three times of the day. Our results indicate that stomata regulation was an important control of CH4 flux from water lily. Additionally, CH4 flux per leaf area was species-specific, increasing (cattail), decreasing (American lotus) or peaking (water lily) throughout the season.

Poster #:24

Tundra Fires in Alaska: A Weather Perspective

James White

Tundra fire has been shown to deeply influence local ecology and global carbon cycling while posing a serious threat to rural Alaskan communities. Moreover, tundra fire regimes are likely changing rapidly alongside global climate change. Despite its growing importance, the meteorological conditions behind tundra fire spread have not been studied in detail. This analysis takes advantage of newly available daily fire spread perimeters for Alaska alongside high resolution weather reanalysis data and ground observing station records to identify active fire spread days and the specific weather conditions that help drive them. This analysis has revealed clear synoptic weather patterns associated with fire growth such as weak near-surface pressure fields in conjunction with weak upper atmospheric flow. Furthermore, this analysis suggests that the primary driver behind tundra fire is most often the existence of strong surface solar heating associated with sunny weather. Notably, synoptic wind fields have shown to be an overall poor predictor of tundra fire spread. These findings challenge current tundra fire models. This research will greatly help meteorologists at the National Weather Service and Alaska Fire Service predict active tundra fire days to protect life and property.

Poster #:25

Burning increases post-fire carbon emissions in a heathland and a raised bog, but fire severity has no effect

Roger Grau Andres & G. Matt Davies

Intense summer droughts are projected to become more frequent in northern peatlands due to climate change. Drought-induced increases in fire severity may lead to greater belowground carbon loss, potentially contributing to a positive feedback to climate change. We completed 19 experimental fires on two sites, a raised bog with deep (>2 m) peat soils and a heathland with shallower peaty podzols Within each fire we simulated drought in 2 x 2 m plots using rain-out shelters, while other plots were burnt under ambient conditions. Drought-treated plots experienced greater fire severity, measured both as consumption of ground fuels and of belowground heating. The response of the post-fire carbon fluxes to increased fire severity in drought plots was similar to plots burnt under ambient conditions. Averaged across all burnt plots, burning altered mean net ecosystem exchange from a net carbon sink at the heathland to a carbon source and at the raised bog. Burning also increased CH4 flux at the raised bog. Burning had no significant effect on soil water [DOC].

Poster #:27

Nutrient availability modifies stream ecosystem response to warming

Lyndsie Collis & Jim Hood

Climate change and eutrophication are two major drivers of ecosystem change. While the independent effects of temperature and nutrients are well-studied, we lack knowledge of the interactive effects of these stressors. Understanding these effects in river systems, which play an important role in global carbon and nutrient cycles, is particularly important. To examine temperature-nutrient interactions in rivers we conducted three successive stream-side channel experiments in the southwestern region of Iceland that manipulated water temperature (8°C-25°C) as well as nitrogen (N; 0-14.3 uM) and phosphorus (P; 0-6.5 uM) supplies and ratios (N:P; 0.02-40 M). On the basis of previous research, we predicted that N supply rate and N:P stoichiometry would control biofilm assemblage structure, N2-fixation rates, and gross primary production (GPP). We found that N2 fixation increased with temperature (71-fold over the experimental temperature range), decreased with N supply rate (44-fold over the N treatment gradient), and shaped the temperature dependence of GPP. Surprisingly, P supply and N:P ratio did not influence N2-fixation or GPP, suggesting that P supply was not limiting in this system even at high N supply rates and ratios. Our results indicate the importance of nutrient by temperature interactions in shaping ecosystem responses to warming.

Poster #:28

Housing Market Volatility Signals Coastal Resilience: Evidence from Long-Term Price Trends and Adaptation in the United States

Xiaoyu Li & Sathya Gopalakrishnan

We develop a quarterly index of housing prices for all the 280 beach towns by recovering the time and location fixed effects from a hedonic model after controlling for observable beach quality characteristics (Epple 1987). Following similar work on price volatility (Haile et al. 2016; Yang 2008), we measure the volatility of coastal housing price with the standard deviation of quarterly housing prices in a 4-year period. We find that storm occurrence increases the price volatility, but this hazard-induced volatility is mitigated by the frequency and extent of adaptation. That is, the effect of storm occurrence is weaker with more frequent beach nourishment and larger amount of sand replenished. Our preliminary results indicate the effectiveness of beach nourishment in reducing the storm-related housing price volatility. While beach nourishment can reduce the direct damage of storms (Pompe & Rinehart 1995), investments in shoreline stabilization are perceived as a signal of lower expected risks in coastal housing market (Keeler et al. 2018). By examining departures in price trends, we begin to empirically identify factors that affect climate vulnerability in the coastal zone. Because human adaptations to climate change has not received enough research attention empirical analysis of the coastline complex adaptive system.

Poster #:29

Development of a Computational Model to Forecast Microcystin Concentrations in Drinking Water Treatment Intakes

Traven Wood & Mark Weir

Microcystins are a class of hepatotoxins that are synthesized by cyanobacteria. These cyanobacteria and related Microcystins present significant public health and engineering challenges due to their potential to form harmful algal blooms (cyanoHAB) in drinking water sources. Current methods for forecasting cyanoHABs are limited in two areas; first, they are dependent on current and historic data that will be less predictive as climatic changes intensify. Second, forecasting cyanoHABs have significant uncertainty when extrapolating these forecasts to Microcystin concentrations that are relevant to water treatment plants (WTP).

Therefore, a computational model is being developed as a stochastic system using a combination of Markov chains within a Monte Carlo simulation. This model will incorporate the phylogeny and physiology of cyanobacteria with metrological and water quality parameters to forecast Microcystin concentrations at a WTP intake. In collaboration with OEPA and USGS, data from Tappan Lake, a drinking water source for the village of Cadiz, Ohio, is being used for model development and testing. The goal of this model is to provide a computational framework that accounts for the variability and uncertainty of the inputs associated with Microcystins, providing enhanced cyanotoxin-event resiliency for WTPs amid a changing climate.

Poster #:30

Cross-level linkages in an ecology of climate change adaptation policy games

Matthew Hamilton

Social and ecological outcomes of climate change adaptation governance systems are shaped by interplay across the spatial levels at which policy actors and decision-making forums operate. We focus on the conditions under which actors participate in adaptation policy forums operating at higher or lower levels than the actors' own level. We estimate an exponential random graph model using data collected from a survey of climate change adaptation policy actors participating in decision-making forums operating at different spatial levels within the Lake Victoria region in East Africa. We find that actors are less likely to engage in cross-level linkages compared to within-level linkages. Conditioning on this general tendency, actors are even less likely to participate in forums operating at lower levels in which their collaborators also participate. By contrast, actors are more likely to participate in forums operating at lower levels when influential actors jointly participate. These findings, which highlight distinct roles of social and political capital in cross-level forum participation, have implications for efforts to improve climate change adaptation governance in the Lake Victoria region, as well as other multilevel governance systems.

Poster #:31

A panel study of farmer adaptation in the Western Lake Erie Basin in the face of climate change

Margaret Beetstra & Robin Wilson

In recent years, harmful algal blooms (HABs) in Lake Erie have increased in scale dramatically due to a combination of climate change, warmer and wetter conditions, and agricultural management decisions that lead to nutrient runoff. In response, the 4Rs of Nutrient Stewardship were developed as a campaign and certification program to encourage and teach farmers to apply fertilizer at the right time, place, rate, and from an appropriate source as an adaptive strategy to combat the effects of climate change. We collected panel data in early 2016 and 2018 of farmers in the Western Lake Erie Basin (WLEB) to determine the behavioral impact of 4R educational efforts on the knowledge, beliefs, and management practices. We conducted descriptive and regression analyses to understand the relationship between different demographic and on-farm characteristics and the longitudinal adoption rates of 4R practices. Results revealed that there was no net increase in 4R practice adoption over time for most practices. Many farmers are not taking advantage of adaptive strategies to help protect their operations and local water systems from the negative effects of nutrient runoff, a trend that is alarming in the face of anticipated effects of climate change.

Poster #:32

Simultaneous improvement in water use, productivity and albedo through crop structural modification

Darrenn Drewry

Agricultural lands provide a tremendous opportunity to address challenges at the intersection of climate change, food and water security. Global demand for the major grain and seed crops is beginning to outstrip production, while population growth and the expansion of the global middle class have motivated calls for a doubling of food production by the middle of this century. This is occurring as yield gains for the major food crops have stagnated. At current rates of yield improvement this doubling will not be achieved.

Plants have evolved to maximize the capture of radiation in the upper leaves, resulting in sub-optimal monoculture crop fields for maximizing productivity and other biogeophysical services. Using the world's most important protein crop, soybean, as an example, we show that by applying multi-objective numerical optimization to a micrometeorological crop canopy model that significant, simultaneous gains in water use, productivity and reflected solar radiation are possible with no increased demand on resources. This work sets a path for crop structural modifications that can simultaneously meet multiple agronomic objectives with no additional added resources.

Poster #:33

Intercropping with indigenous shrubs relieves drought stress of millet in the Sahel: Are microbes helping?

Laura Mason

The Sahel region of West Africa is a global change hotspot, where faster-than-average climate warming and erratic rainfall intersect with vulnerable biome transition zone and rapid population growth. The staple crop, millet, is grown during the rainy season by subsistence farmers without fertilizer or irrigation. Increasingly erratic rainfall is thus a major threat to crop production. Native farming practices reveal a potential solution: where farmers intercrop with two indigenous shrubs, millet drought resilience is dramatically increased. Our lab recently identified a mechanism underlying improved drought tolerance: shrubs perform hydraulic redistribution of water surface soil, assisting crops through growing-season drought periods. Additionally, the moister, carbon-rich soils under the shrub canopy harbor a distinct and active microbial community. Research in other semi-arid environments has identified rhizosphere microorganisms that promote plant resistance to drought, and preliminary research has shown that these shrubs harbor some of the same microbial genera. We therefore hypothesize that a second mechanism by which shrubs confer drought resilience to intercropped millet through microbial community activities, and we plan to test this hypothesis using metagenomic analyses of each community in field sites in Senegal. Outcomes will lay the foundation for future metagenomics research in a larger campaign for food security.

Poster #:34

Riverine phosphorus cycling dynamics in an ag watershed during a critical time of loading

Whitney King

Annual development of harmful algal blooms (HABs) in the western basin of Lake Erie have been attributed to an increase in dissolved reactive phosphorus (DRP) loads, mainly from agricultural sources in the Maumee watershed. The majority of DRP loading to Lake Erie occurs during high flow events, which are predicted to increase in frequency and magnitude in response to climate change. Rivers could potentially buffer or intensify the relationship between total phosphorus (P) loading and HABs by altering the form of P loading to the lake (DRP versus particulate). Yet, the relative importance of this mechanism is unknown. We sampled suspended sediments and P sorption/desorption rates during high flow events for rivers in the Maumee watershed. Our preliminary results suggest that rivers could buffer the impact of P loading by being a site for the sorption of DRP onto particles, 70

Poster #:35

A Bayesian Analysis of Historical Maize Yield Record in the US

Tongxi Hu

Agriculture production is influenced severely by both human-related and natural factors, such as technology advance and climate change. To isolate the impacts of climate, previous studies, especially those using statistical models, have simplified impacts of non-climate factors too much. Most statistical models, for instance, treat the relationship between crop yield and technology advance as fixed, linear or quadratic. However, simplifying impacts of some factors will bias the impacts of other factors. Thus, we presented a new model based on the Bayesian framework to incorporate both climate and non-climate factors on historical maize yield without any simplification. Our results show that technological advance is non-linear impacts on maize yield, and such impacts vary with locations. Growing season temperature can cause yield loss in 30.1

Poster #:36

Climate Education Solutions for the U.S. Corn Belt

Kristi Lekies & Richard Moore

The USDA AFRI grant "Climate change, mitigation, and adaptation in corn based cropping systems" (2011-2016) involved more than 100 researchers focused on measuring GHG and carbon sequestration across the Corn Belt as well as building cropping solutions that are resilient in times of a changing climate. A primary goal of the education component was to build capacity to prepare society's next generation to understand and address environmental challenges. Activities included identification of national agriculture and climate change curricula across the United States; climate camps for science and agriculture teachers; university summer field courses on climate, agriculture, and aquatic systems at Stone Lab; and internships for undergraduate students. Along with research activities, graduate students participated in webinars and professional development activities to enhance their ability to become transdisciplinary scientists and present research findings to policymakers. Additionally, the project engaged in ongoing communication and collaboration with other Coordinated Agricultural Projects and the National Council for Science and the Environment.

Poster #:37

Developing a Winter Storm Power Outage Impact Model for a Midwestern Utility

Jordan Pino

Winter storms cause extensive damage to the power infrastructure system throughout the United States each year. This damage leaves millions without power for extended periods of time. Specifically, the accurate and timely prediction of order volume (i.e. the number of trouble tickets) is essential for utility companies in order to lower costs and speed restoration times. Obtaining an accurate order count prior to a large winter event allows for better positioning of crews and resources. Here, we develop a statistically-driven model for a large, investor-owned utility company in the northern United States that predicts the number of orders each day. The utility company serves over 6 million customers, stretching from the Ohio-Indiana border to the New Jersey shore. Therefore, the model is regional, meaning it is run for one operating company within the utility service territory. This regionally specific model allows for better prediction of order volume since the service territory encompasses a wide range of meteorological and environmental conditions. The model incorporates static environmental variables such as elevation characteristics, land cover type, population density, tree species, and root zone depth. In addition, dynamic storm-specific variables such as precipitation, temperature, wind speed, soil moisture and antecedent precipitation.

Poster #:38

Planning for nutrient management in a future climate: is one watershed model enough?

Haley Kujawa

Planning resilient water management under a changing climate is a problem everywhere. A common approach of incorporating climate change analysis into watershed management consists of using a single watershed model driven by an ensemble of climate models. While this method may capture the range of future climate predictions, it does not account for bias introduced by the watershed model. This study quantifies uncertainty given independently set-up process-based watershed models used for climate change analysis. Five models for the Maumee watershed were created by independent research groups using the Soil and Water Assessment Tool (SWAT). Each group was allowed freedom to retain differences in model structure, management, and parameterizations. All models performed well when compared with discharge and nutrients observations near the watershed outlet. We drove the SWAT models with daily temperature and precipitation predictions from an ensemble of six general circulation models (GCMs). An ANOVA approach was used to partition the uncertainty from GCMs and SWAT. The results show the GCM is the main source of uncertainty in discharge (96

Poster #:39

Multistage Distributionally Robust Approach to Water Allocation under Climate Uncertainty

Jangho Park & Guzin Bayraksan

This paper investigates a multistage distributionally robust optimization (MDRO) to water allocation under climate uncertainty. MDRO acknowledges that future uncertainties are not fully known. It creates an ambiguity set of distributions that is believed to contain the true distribution with the desired probability. It then optimizes a worst-case objective within conditional ambiguity sets over the stages. We propose a decomposition algorithm to solve a dual of MDRO with phi-divergences. We apply the MDRO to allocate water in a rapidly-developing area of Tucson, Arizona. Tucson faces considerable uncertainty to provide water for its citizens in the future. The primary sources of uncertainty in the Tucson region include the unpredictable future population growth, the availability of water from the Colorado River, and the effects of climate variability and how this relates to water consumption. We integrate forecasts for all these sources of uncertainty in a single optimization model for robust and sustainable water allocation. We use this model to analyze the value of constructing additional treatment facilities to reduce future water shortages. The results indicate that MDRO can provide water resource managers with essential insights to minimize their risks and, in revealing critical uncertainties in their systems, plan for the future.

Poster #:40

A Modeling Framework for Assessing and Communicating Environmental Risks due to Hurricanes

Dylan Wood & Mehrzad Rahimi

Computer models frequently inform hazard mitigation efforts for impacts due to hurricanes both in the long and short term. Effectively mitigating hazards in this way requires efficient and accurate modeling, collaboration between engineers in various fields, and straightforward communication of relevant model outputs to policy makers. As the effects of climate change cause hurricanes and other tropical storms to increase in frequency and intensity, the need to solve these issues increases in urgency. Risks posed to flood defense systems can be especially relevant to decision makers, as failures of these systems could alter flood patterns and lead to significant losses; however, poor understanding exists of how to appropriately communicate these data to decision makers. This study develops high-fidelity hydraulic models (e.g., hurricane storm surge and overland flooding) and geotechnical simulations (e.g., slope failures or piping failures in levees), to improve our understanding of storm risk. Moreover, by human-in-the-loop experimentation, we study how to use this improved understanding to develop more in-depth decision rules for individuals and the community.

Poster #:41

Using 0.5-2 GHz Microwave Radiometry for Arctic Sea-Ice Thickness and Salinity Retrieval

Oguz Demir

Sea ice is an important element of the cryospheric system, and has significant impacts on Earth's climate and on global water circulation. Sea ice thickness regulates the heat flow between oceans and the atmosphere. The salt content of sea ice also impacts ocean salinity and contributes to driving deep sea currents. Therefore, understanding and estimating sea ice and its properties is important to improve the prediction of cryospheric and oceanic processes.

The Ultra-Wideband Software-Defined Microwave Radiometer (UWBRAD) developed at The Ohio State University measures microwave thermal emissions from 0.5-2 GHz, and was deployed in an airborne observation in Greenland in 2017 for observations of various terrain types. UWBRAD also acquired sea-ice emission data over the Lincoln Sea in this campaign. This presentation will review the dataset acquired and present initial analyses of the relationship between measured brightness temperatures and sea ice properties. The analyses to be discussed include comparisons with the onboard infrared FLIR camera recordings and with Sentinel C-band SAR measurements. An emission model is also applied for the retrieval of ice characteristics such as ice thickness and salinity. Results for these parameters will be presented.

Poster #:42

Comparison of Three Methods on Standardizing Soil Moisture Measurements from Different Sensors

Ning Zhang

Each soil moisture monitoring network commonly adopts different sensor technologies. This results in different measurement units, depths and impedes large-scale soil moisture applications that seek to integrate data from multiple networks. Therefore, a comprehensive comparison of different sensors to identify the best approach for integrating and homogenizing measurements from different sensors is required. This study compares three commonly used sensors, including Stevens Water Hydra Probes, Campbell Scientific CS616 TDR and CS 229-L heat dissipation sensors based on data from May 2010 to December 2012 from the Marena, Oklahoma, In Situ Sensor Testbed (MOISST). All sensors are installed at common depths of 5, 10, 20, 50, 100 cm.

The results reveal that the differences between the three sensors tends to increase with depth. The CDF plots showed CS 229 is most sensitive to moisture variation in dry condition and most easily saturated in wet condition, followed by Hydra probe and CS616. Our results show that calculating percentiles is a good normalization method for standardizing measurements from different sensors. Our preliminary results demonstrate that CDF matching can be used to convert measurements from one sensor to another.

Poster #:43

Ohio Water Resources Center: Investing in Climate Change Research that Relates to Ohio Water Resources

Linda Weavers & John Lenhard

The Ohio Water Resources Center is the federally-authorized and state-designated Water Resources Research Institute for the state of Ohio. Our mission is to enable and conduct state-relevant water-related research; foster collaboration among academic investigators, governmental bodies, and water professionals; train the next generation of water scientists; and educate the public on water resources issues in Ohio. The increase in intensity and frequency of precipitation events anticipated to occur due to climate change will impact water resources in Ohio. For example, in urban areas increases in heavy precipitation events cause problems for city wastewater and stormwater infrastructure, such as increased discharge from combined sewer overflows, overloaded sewage systems and water treatment facilities. In rural areas, similar events increase water run-off and nutrient export from non-point sources to rivers and lakes. This increased nutrient load coupled with increases in temperatures is anticipated to increase the severity and length of harmful algal blooms. The Ohio Water Resources Center funds research that relates to many areas connected to climate change, including greenhouse gas emissions, carbon sequestration, green infrastructure effectiveness, water infrastructure resilience, nutrient transport and harmful algal bloom monitoring.

Poster #:44

Mapping floristic gradients of forest composition using an ordination-regression approach with landsat OLI and terrain data in t

Bryce Adams & Stephen Matthews

Eastern deciduous forests are incurring rapid species turnover as the result of recent changes to natural and anthropogenic disturbance processes and climate change. We employed an ordination-regression approach to mapping the current species composition of forest assemblages as floristic gradients across a 5000-km2 area in southeastern Ohio's Central Hardwoods Forest Region. Forest plot data (n = 699 plots; 99 species/genera) were projected onto a 3D ordination solution using non-metric multidimensional scaling, and floristic gradients, via their ordination scores, were related to spectral reflectance provided by a multitemporal Landsat 8 OLI image using the regression-type Random Forest model. Approximately 61

Poster #:45

UAS remote sensing platforms for change monitoring in high-altitude alpine environments

Forrest Schoessow & Evan Vega

Throughout the tropical Andes, the cryosphere is destabilizing as climate warms. The transformation of snow and glacial ice loss is inextricably linked to water availability, water quality, and geohydro-hazard risk that have broad human impacts in watersheds below. Since these changes are underway and not likely to be halted, there is a pressing need for more highly accurate, cross scale, on-demand, spatially distributed data to inform scientific understanding and adaptive risk management strategies. Our group has leveraged advances in science and technology to develop an unmanned aerial system (UAS) specifically designed to collect aerial observation data at extreme altitudes in the Andes of Peru (4500-6800m a.s.l.). This UAS carries active and passive remote sensing instrumentation for measuring surface energy and mass flux; and programmable autonomous mission planning enables generation of high resolution time-series data over repeat flights. The capabilities of UAS for on-demand remote sensing can greatly improve our capacity to observe tropical glacier dynamics at finer spatial-temporal scales, better understand the processes that drive them, and improve our capability for predicting future hazard chain evolution in high mountain environments. This presentation will review the development of the RANGER platform, discuss instrument techniques, and summarize its hazard management applications.

Poster #:46

GNSS-Reflectometry Applications in Climate Research

Brandi Downs

Global Navigation Satellite System Reflectometry (GNSS-R) utilizes reflections of GNSS signals off the Earth surface for remote sensing. GNSS-R operates as a unique passive, bi-static radar system and observes an expanding range of Earth surface parameters, such as ocean surface wind speed, sea ice, soil moisture, and ocean altimetry. Since it uses signals from existing GNSS satellite transmitters, it only requires deployment of receiver hardware, which lowers size and costs and allows it to be deployed on small satellite constellations with increased coverage and revisit rate. GNSS operates in the L-band and is capable of penetrating rain, snow, and ice. This has motivated researchers to explore cryosphere applications of GNSS-R, including sea ice and ice sheet altimetry, extent, and characterization. Researchers at the OSU ElectroScience Lab (ESL) are members of the CYGNSS Science Team, a constellation of 8 microsatellites with GNSS-R instruments that were launched in Dec 2016. ESL researchers are also working on the development of a next generation bi-static radar receiver that will enable major improvements in weather and climate science. In this poster, we will review some of the GNSS-R research taking place at ESL, which spans both engineering and science topics.

Poster #:47

Estimating daily surface water fraction by using MODIS derived water indices

Jiayong Liang

Emergency response and management to flooding, the costliest disaster, require timely synoptic observations. Being able to acquire information on Earth surface efficiently, remote sensing has been used to monitor water for decades. However, current sensor design leads to an inevitable compromise between temporal and spatial resolution, which limits the application in sudden or extensive floods. This study aims to address that compromise by estimating surface water fraction from the MODIS images, which are daily available but with a relatively low spatial resolution of 500 m. The Automated Water Extraction Index (AWEI) is designed to better perform in shadowed and built-up areas, and this index is used in the proposed method for water classification and fraction estimation. A relationship between MODIS derived water indices and surface water fraction is first fitted by a pair of a coarse MODIS image and a fine water classification map from a Landsat image (30 m resolution). The fitted function is then applied on other MODIS images to produce a series of daily surface water fraction maps. In the experiment, the root-mean-square error is about 6

Poster #:48

Multi-disciplinary, Interactive Data Management Solutions for Upscaling Arctic Carbon Cycling

Suzanne Hodgkins

Quantifying carbon balances in rapidly changing permafrost peatlands is essential for understanding climate feedbacks. Reconciling multi-scale estimates of these carbon balances requires interdisciplinary exploration of relationships among microbiological, geochemical, environmental, remote sensing, and other data. We address this challenge with two nested databases, in two related projects examining carbon cycling and climate feedbacks in Arctic peatlands. The IsoGenie Database (IsoGenie-DB) is a novel data management and exploration platform developed to integrate interdisciplinary datasets from the IsoGenie Project (http://isogenie.osu.edu) at a thawing permafrost peatland in Arctic Sweden. The IsoGenie-DB has a Neo4j graph database core, which organizes data based on the system's inherent spatial and temporal relationships, with a front-end web portal (https://isogenie-db.asc.ohio-state.edu/) providing differential data access for non-coding project members and the general public. The IsoGenie-DB codebase has the flexibility to be expanded to larger-scale projects and became the platform for A2A-DB, a database for the Archaea to Atmosphere (A2A) project that scales up from IsoGenie's site to the pan-Arctic. This expandable, integrated database platform supports custom queries that explore the links between diverse and multi-scale data types, which in these projects can inform carbon cycling feedback models of the Arctic.

Poster #:49

A Framework for Reproducible Research in Computational Hydrology using Python

Bidhyananda Yadav

This study addresses the tenets of computational reproducibility in hydrology with a data-driven application rooted in the synthesis of existing data. Focused on the prediction of mean flow velocity (vmean) in ungauged basins, we demonstrate the implementation of automated end-to-end workflow in Python. It entails a search for catchment proxies to predict the vmean of an ungauged catchment; hence, necessitating the analysis of ~1077 reference watersheds to derive statistical relationships. The general approach is based on a sequence of Jupyter Notebooks covering a full spectrum of computational workflows that include data download and cleaning; integration of heterogeneous data; development of machine learning algorithms; and finally, the analysis, visualization, and presentation of results. The Python libraries Numpy and Scipy are used for general numerical computation; ArcPy and Geopandas for mapping; Pandas for tabulating the data; Matplotlib for visualization; and Scikit-Learn for machine learning algorithms. Outcomes of research in the form of tables and figures are seamlessly linked to the manuscript prepared using Markdown. A Markdown document can be readily converted to many common formats including LaTeX and Microsoft Word. With this approach, we have largely addressed the technical aspects of computational reproducibility – from ideation to the preparation of the manuscript.

Poster #:50

Lowering Health Risks from Mosquito Born Diseases Associated with the Increase in Natural Disasters caused by Climate Change

Robin Bautista-Jimenez

The increase in number and intensity of natural disasters associated with climate change creates new niches for mosquitoes along with new health risks. The CDC identifies the major mosquito born diseases as chikungunya virus, dengue virus, Eastern equine encephalitis virus, Japanese encephalitis virus, La Crosse encephalitis, malaria, West Nile virus, yellow fever, and zika virus. Each of these has its own unique attributes that can be related to environmental circumstances. For example, the diapause (over wintering) traits of different mosquito species differ widely. Besides natural disasters, climate change also affects the ecological niche for mosquitoes through the gradual shift of environmental conditions such as precipitation and temperature. So identifying geographic locations and local niches (such as construction sites) where there is increased probability for mosquitoes to breed is a key to lowering the health risks. Recommendations for domestic and international public policy to address this new health risk and to increase infrastructure resilience will be outlined in a paper.

Poster #:51

Spatio-temporal hydroclimatic variability in Ohio

Zhiying Li

Understanding past hydroclimatic variability is important for informing water resources management. In this study, seasonal and annual meteorological data and water discharge records for a 60-year period (1957-2016) were analyzed in the State of Ohio, USA to assess the spatio-temporal hydroclimatic variability and linear trends in precipitation, temperature and discharge. Trends were identified using the non-parametric Mann-Kendall test. Correlations were calculated to identify the relationship between discharge and meteorological variables. Additionally, a contribution analysis using the Budyko framework was conducted to assess the sensitivity of discharge to changes in meteorological variables and other factors. Results show that mean annual precipitation, mean temperature, and minimum temperature have statistically significant increasing trends of 2.67 mm/y, 0.01 /y, and 0.02 /y, respectively. Precipitation in winter and summer, mean temperature in summer, and minimum temperature in winter, spring, and summer increase significantly. A total of 20 discharge gauging stations has significant increasing trends. These stations are concentrated in the northwestern, central, and southwestern parts of the state. The interannual variability in meteorological variables and discharge has increased. Annual discharge was positively correlated with precipitation. Precipitation tends to play a more important role in increasing runoff than other meteorological variables at annual scale.

Poster #:52

Disruption of the marine biological carbon pump over Eocene hyperthermals

Elizabeth Griffith

Transient hyperthermal events superimposed on early Eocene warming are used to test the effect of extremely elevated temperatures on the export of carbon (C) from the sunlit surface ocean and recycling in the water column, processes that largely control the efficiency of the ocean C sink. We reconstructed changes in the biological C pump over three early Eocene hyperthermals using marine (pelagic) barite extracted from Ocean Drilling Program Site 1263 on Walvis Ridge (SE Atlantic) together with benthic foraminiferal data. The combined data suggests increased remineralization in the water column during transient hyperthermals: more organic matter was exported from the photic zone, but less made it to the seafloor, disrupting the ocean biological C pump and sequestration of C into the ocean's interior.

Poster #:53

Microbiota and water level dynamics drive methane exchange velocity in a temperate kettle-hole peat bog in Ohio

Camilo Rey Sanchez & Matt Davies

Peatlands store up to a third of Earth's soil carbon pool but they also emit methane (CH4), a powerful greenhouse gas. To better understand the spatial heterogeneity in temperate peatland CH4 emissions and their response to physical and biological drivers, we studied CH4 dynamics in Flatiron Lake Bog, a kettle-hole peat bog in Ohio. Among hydrobiotic zones within the bog, median CH4 fluxes were highest in the open water (OW), then decreased and became more fluctuating towards the exterior concentric vegetation zones as the WL dropped, with extreme emission hotspots observed in the Tamarack mixed woodlands (TMW). Plants were not sources or transport pathways of CH4 flux but slight sinks. Higher CH4 pore-water concentrations and emissions were correlated with a higher abundance of methanogens, yet, pore-water concentrations were weakly correlated to the fluxes. The ratio between pore-water concentration of CH4 in the top of the peat profile and CH4 flux (CH4 exchange velocity) were explained by the ratio of methanogens to methanotrophs relative abundance. This study illustrates the importance of the interactions between water level and microbial composition to better understand CH4 fluxes from wetlands.

Poster #:54

Constraining uncertainties associated with black carbon emissions during biomass burning

Hanyang Li

Black carbon (BC) plays a major role in the climate system due to its ability to absorb solar radiation. One major source of BC is open biomass burning (BB), which contributes roughly 40

Poster #:55

Quantification of methane emissions from different land-cover patches in a heterogeneous wetland

Yang Ju

Methane (CH4) is the second most important greenhouse gas following carbon dioxide, but has 26-43 times greater potential effect on global warming. Wetlands are the largest contributor among all the natural sources of methane in the atmosphere and contribute 20

Poster #:56

Multi-decadal Climate Variability Observed in a Pacific Basin-wide Ice Core Collection

Stacy Porter

The multi-decadal shifts in the climate of the Pacific Ocean have both global and regional ramifications. Pacific decadal variability influences global surface temperature and modulates the effects of El Niño-Southern Oscillation and other large-scale oscillations on specific regional climates. Thus, it is crucial to understand the drivers of the multi-decadal behavior of the Pacific Ocean not only to support improvements to future climate projections but also to better define present local and regional climatic impacts. Current understanding of this behavior is limited due to relatively short observational records. This project seeks to provide a basin-wide history of Pacific climate variability using ice core records from four different regions around the Pacific Ocean (South America, Tibetan Plateau, Antarctic Peninsula, and southeast Alaska). Statistical analysis of the individual ice core records reveals a unique signature of Pacific climate variability on interannual and multi-decadal timescales over the 20th century. Preliminary results indicate a strong predictive potential to construct a history of Pacific decadal variability over past centuries back to ~1400 CE with annual resolution and possibly to 1000 CE with decadal resolution.

Poster #:57

Characterizing the Chemical and Physical Signature of the 2015-16 El Niño in the Quelccaya Ice Cap Snow and Ice to Calibrate Past ENSO Reconstructions

Emilie Beaudon & Lonnie Thompson

Pacific Sea Surface Temperature (SST) anomalies had reached +3°C in the Niño 3.4 region in November 2015 making this one of the strongest El Niños in 100 years. This warm phase of the El Niño - Southern Oscillation (ENSO) has pronounced differential impacts across the tropical Pacific as well as in South America. Peru statistically experienced flooding in the northern and central coastal regions and drought conditions in the south on the Altiplano. However, the 2015-16 El Niño event led to drought throughout the Peruvian Andes. El Niño is a warm and dry episode, phase locked with the accumulation season on the Quelccaya Ice Cap (QIC) so that this strong event created conditions favorable for reduced accumulation, enhanced surface ablation and dry deposition of soluble and insoluble aerosols. Here we present new glaciochemical (major and organic ions, dust, black carbon, oxygen isotopes) results from three consecutive snow and ice sampling campaign on QIC framing the climax of the 2015/2016 El Niño episode in Peru. We allocate the ionic and black carbon sources and describe the biogenic and evaporitic contributions to Quelccaya snow chemistry under El Niño atmospheric conditions. Elution factors and ionic budgets are compared to those of the snow

Poster #:58

7000 year of aerosol deposition to the Alps from the Ortles ice core

Paolo Gabrielli

In 2011 four ice cores were extracted from the summit of Alto dell'Ortles (3859 m), the highest glacier of South Tyrol in the Italian Alps. Dating of the ice cores from Alto dell'Ortles based on 210Pb, 3H, beta activity and 14C determinations, combined with an empirical model (COPRA), provides evidence of a chronologically ordered ice stratigraphy from the modern glacier surface down to the bottom ice layers with an age of 7 kyrs back to the Northern Hemisphere Climatic Optimum (NHCO; 6-9 kyrs BP), the warmest interval in the European Alps during the Holocene. At the end of the NHCO temperatures started to decrease and progressively more favourable glacial conditions characterized the Eastern Alps at the end of the NHCO. Here we present a 7000year record of aerosol deposition in terms of major ions and dust (from core #2 and crustal trace elements from core #3). We observe a long term trend decrease in aerosol species over time that we explain in terms changes in atmospheric circulation during the Holocene.

Poster #:59

Making the qualitative-to-quantitative transition in ice core nanoparticle studies: a case study from the Italian Alps

Aja Ellis

Modern atmospheric particles are currently of great interest to the environmental and health science communities, with ongoing efforts to constrain particle characteristics (chemistry, composition, lifetime) and distributions (spatial, temporal). They are large contributors to the uncertainty in global climate models, both directly through radiative forcing and indirectly due to cloud and ice formation in the atmosphere. Measurements of atmospheric particles in ice cores have been accomplished through particle number counts with limited size range and without composition information or through electron microscopy detailing particle composition but without statistical rigor. Low- and Mid-latitude ice cores are comparatively rare and more representative of the local source regions than their remote polar counterparts, thereby offering a better opportunity to contain a record of nanoparticles with unknown atmospheric transport and lifetimes. Four ice cores were drilled in 2011 at the summit of Alto dell'Ortles (3859 m), Northern Italy. By combining traditional methods of aerosol characterization (electron microscopy) with techniques like single particle mass spectrometry, we detail the nanoparticle record of human activities in the Mediterranean region through the rise of the Roman Empire, European industrialization, and into the modern age.

Poster #:60

Significance of Climate on d18O of Cellulose and Implications for Paleoclimate

George Grant

Stable oxygen content of cellulose in annual tree rings is commonly used as a temperature proxy for paleoclimate reconstruction. The trees from which the samples are obtained may grow under vastly different climate conditions and factors influencing the cellulose stable oxygen (d18O) value may vary. Consequently, the application of a general climate reconstruction equation may not be appropriate, even if a single genus is used for calibration. We use d18O values of extracted cellulose from globally distributed spruce (Picea) with corresponding climate data to determine if regional environmental factors influence d18O and if so, which are the most influential.

Over 700 globally distributed Picea d18O values of extracted cellulose samples were examined. 16 corrected climate parameters obtained from nearby metrological stations were compared to the collected d18O values. The relationship between isotopic composition of cellulose and climate parameters were identified through Pearson correlation.

While tree ring cellulose d18O has been used for mean annual temperature reconstructions, we found that the most influential climate factors were minimum annual and winter temperature. This finding highlights the importance of local climate and isotopic conditions on tree ring cellulose d18O extracts. This impacts the inference of climate conditions through cellulose d18O in paleoclimate reconstructions.

Poster #:61

Impacts of Soil Moisture Initializations on WRF-Simulated North American Monsoon System

Yuechun Wang

The North American Monsoon System (NAMS) displays greater spatial and temporal variability than other monsoon systems. Previous work has shown that local-scale interactions with land surface and topography are important for explaining North American monsoon rainfall patterns and the initialization of mesoscale features is critical for the modeling of NAMS. This study investigates how soil moisture conditions influence the NAMS. This study uses the Weather Research and Forecasting (WRF) Model with the Noah-MP land surface model. The study period spans 2015-2017 and the simulations are initialized at UTC 0:00 on May 1st and end at UTC 0:00 October 1st each year. North American Regional Reanalysis (NARR) 3-hourly product provides the atmospheric initial and lateral boundary conditions. For each year, three sensitivity experiments are conducted with WRF using soil moisture fields from: (1) NARR, (2) Noah/Global Land Data Assimilation System (GLDAS) and (3) Soil Moisture Active Passive (SMAP) L4 product. The NARR simulations serve as a control run. To evaluate model performance, diurnal and seasonal monsoon rainfall patterns are compared with observations from Tropical Rainfall Measuring Mission (TRMM) 3B42 product and Climatic Research Unit (CRU) TS4.0 dataset. The study will improve our understanding of the impacts of land-atmosphere interactions on monsoon system and predictions of NAMS.

Poster #:62

Improvements in Monthly Temperature Forecasts Utilizing Antecedent Soil Moisture

Zachary Leasor

Previous research has successfully demonstrated the value of incorporating soil moisture in subseasonal to seasonal (S2S) temperature forecasts. Soil moisture has shown the most potential to improve temperature predictions during the warm season, when persistent anomalous temperatures can be affected by antecedent soil moisture. This provides the motivation for an objective analysis of methods used to implement soil moisture in operational forecasts. Specifically, this study examines forecast model sensitivity to the data type used to describe the relationship between monthly temperatures and antecedent soil moisture in Oklahoma. Modeled soil moisture from the NLDASv2 Noah land surface model and in situ measurements from the Oklahoma Mesonet are both examined as potential predictors of temperature. Forecast models are constructed using multiple linear regression to predict monthly maximum temperatures at a one-month lag during the warm season. Results suggest improvements in monthly temperature forecast skill when including antecedent soil moisture as a predictor variable. Using modeled soil moisture as a predictor variable may produce more skillful forecasts than in situ measurements. However, evidence suggests that forecast models tend to be more sensitive to changes in the period of record than changes in the input soil moisture data type.

Poster #:63

Validation of WRF-Hydro simulated soil moisture at the watershed scale

Chen Zhao

Soil moisture is a critical parameter controlling the partition of rainfall into runoff and infiltration. Models that simulate runoff generation processes are strongly influenced by initial soil moisture. Accurate assessment of initial soil moisture is important for the predictive capability of models. This study aims to quantify the influence of spatial pattern of initial soil moisture on the runoff simulated by WRF-Hydro. WRF-Hydro is a community model which has been coupled with WRF, Noah LSM and terrain routing model, and it is the core of recently developed National Water Model. In this study, offline WRF-Hydro version 5 is employed. The study region is the Walnut Gulch watershed in Arizona. For the WRF-Hydro setup, the spatial resolution of the main domain is 4 km, and the coupled routing model is conducted at 250 m resolution, to calculate overland flow. The meteorological forcing data is coming from NLDAS-2. Totally 4 initial soil moisture scenarios are tested. The results indicate that WRF-Hydro simulated runoff are strongly influenced by the spatial pattern of initial soil moisture.

Poster #:64

Geomorphic and Sedimentological Controls on Hyporheic Flow in an Alpine River

Kira Harris

The hyporheic zone of rivers, where surface water temporally enters the sediments and may mix with groundwater, can impact surface water quality, and vary with physical parameters such as bed geomorphology and subsurface geology. Complex streambed morphology and sediment characteristics in meandering rivers lead to heterogeneity in hyporheic exchange. To assess and quantify physical controls on hyporheic exchange in a meandering alpine river, sediment samples were collected for grain size analysis in East River, Colorado (USA). Additionally, vertical hydraulic head gradient measurements were taken at eighty locations along a 200 m meander. A ground-penetrating radar system was also used for subbottom imaging of the river channel to further understand how streambed morphology influences subsurface geology and fluid flow. We hypothesize that grain size and permeability of the riverbed control vertical fluid fluxes in the bed over smaller scales (e.g. grain to bedforms), while the meander morphology controls larger scale patterns over tens of meters. Preliminary observations show that a region of focused groundwater discharge occurs in thick, permeable alluvium on the downstream edge of the point bar. These results will improve understanding of the interplay between hyporheic flow and streambed sediment properties, further influencing porewater chemistry and overall water quality.

Poster #:65

Are climate dynamics reflected in the stable isotope hydrology of Irish River water during 2018?

Anne Carey & Devin Smith

After a record cold, wet, and snowy winter of 2017–18, Ireland suffered a drought in Summer 2018. Stable isotope analyses were performed of stream samples collected in March, May, June, and August 2018. Data from Met Éireann show total rainfall of 173.2 mm at its Athenry synoptic station for January 2018. Mean monthly January total is 116.7 mm. Record wet weather continued through April 2018. In May the weather became warm, sunny, and dry. We constructed a regional meteoric water line (RMWL) from 558 published D and 18O analyses of samples collected at two locations during 1960 through 2016. Our samples from seven locations along the Shannon River and three of its tributaries in March 2018 clustered tightly together and plotted above the Global Meteoric Water Line (GMWL) and our calculated RMWL. Samples collected at those same Shannon River locations and other locations along the main stem of the Shannon River in June and August 2018 all plotted below the GMWL and the RMWL. Calculated d-excess also showed a strong evaporative signal in the summer samples. We speculate on both the role of climate and the relationship of the loughs along the rivers in controlling stable isotopic signals observed.

Poster #:66

Persistent Urban Impacts to Surface Water Quality via Impacted Groundwater

Rachel Gabor

A large fraction of the global population lives along the edges of mountains and depends on water resources from those mountain environments, which largely originates as snow or glacier ice. Climate change is predicted to impact this water resource in many ways, such as changing relative amounts of snow vs. rain and the timing and total amounts of precipitation. This results in alterations to hydrologic flow paths and concerns about future water quantity. Water quality is directly tied to both water quantity and hydrologic flow paths so these changes can compound water quality impacts from the growing urban areas. In order to better manage water resources for mountain-adjacent urban areas in a changing climate, it is first necessary to understand how urban environments interact with natural hydrology and alter water quality. To that end we focused on a watershed in Salt Lake City, Utah which has an abrupt transition from protected montane to heavily urbanized ecosystems. We found that water from a subsurface aquifer played a significant role in controlling water quality. We propose an evolving model of urban river-watershed interactions from envisioning urban streams as a channelized pipe to including the role of groundwater exchange with alluvial aquifers.

Poster #:67

Understanding the pulse of the Greenland ice sheet: What we are learning from high-resolution records of glacier changes

Michalea King

Ice loss from the Greenland Ice Sheet is a dominant source of present-day sea level rise. Some of this ice is lost through the flow and subsequent calving of marine-terminating outlet glaciers, termed "ice discharge". Here we show how, by assimilating various remotely sensed data products, we can resolve detailed records that demonstrate how total ice discharge varies on seasonal to decadal time scales. We analyze these records to identify areas of rapid change, and infer how glaciers respond to environmental perturbations. We highlight how surface meltwater runoff, which forms on the ice sheet's surface in the spring and summer months and can infiltrate to the beds of glaciers, can impact glacier flow speeds. This work will enable us to better understand how short-term changes in glacier speeds and discharge contribute to ice sheet mass-balance.

Poster #:68

Estimates of deformation associated with basal channels on the Getz Ice Shelf from InSAR-derived velocity grids

Allison Chartrand

Basal channels are present throughout the ice shelves of Antarctica and in a few ice tongues in Greenland, but little is known about how they evolve over time and how they impact ice shelf instability. We have shown that the surface depression associated with a basal channel on the Getz Ice Shelf in West Antarctica is not advecting as expected with ice flow. In an effort to further characterize this apparent migration, strain rates were calculated for the Getz Ice Shelf so that the deformation field around the basal channel could be examined. The basal channel is indeed associated with large tensile principal strain rates parallel to the direction of migration. Previous studies have shown that some ice shelf features, such as transverse rifts, may be identified from the deformation field. Several other basal channels in the study area were also associated with strain rate anomalies, so this work indicates that the location of basal channels, and possibly zones of basal channel migration, may be identified using strain rates as well. Basal channels may weaken ice shelves, leading to increased sea level rise, so it is important to characterize them so that predictions of Antarctic discharge can be improved.

Poster #:69

Climate Change at 85 Degrees South: Heekin Lakes from 1996 to 2018

Melisa Diaz & Christopher Gardner

Over the last two decades, anomalous warming events have drastically altered coastal Antarctic regions. The December 2001-January 2002 melt event in the McMurdo Dry Valleys resulted in a lake level increase of 0.65 m, a 600