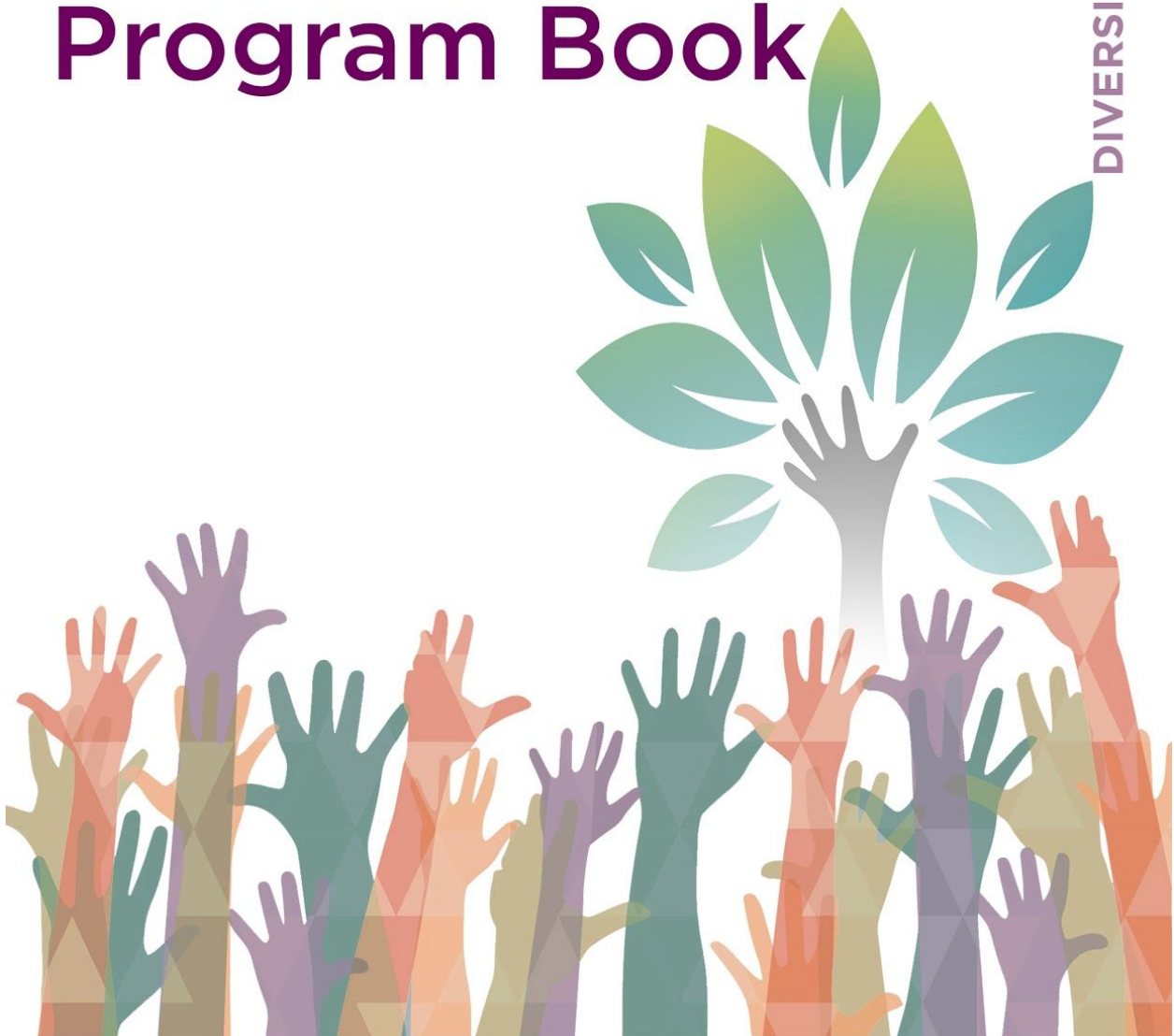7TH Annual
Forestry GSO Research Symposium

DIVERSITY AND INCLUSION

February 8, 2018
Michigan State University | Chittenden Hall 130

Program Book

Sponsors

Letter From the Department Chair

Dear Students, Faculty, Alumni, and Friends of MSU Department of Forestry,

Welcome to the 7th Annual Graduate Student Research Symposium! Every year, I look forward to this key event in the annual cycle of MSU Forestry. The Research Symposium provides a focused opportunity to learn about each other's research and I hope over the course of the day that many of us will further see how our own research intersects with the research of our colleagues.

I also greatly appreciate that the theme for this year's event is diversity and inclusion. The Department of Forestry – faculty, staff, and students – is strongly committed to becoming a more diverse and dynamic community, where everyone's voice is heard and role is respected. Equity, respect, and inclusion are part of our core values. As a land grant and public university, it is integral to our mission to provide access to a great education and opportunities for everyone. As a dynamic community of scholars and teachers, we come to better decisions and are more effective when we embrace and really work to understand diverse perspectives and experiences.

Congratulations and thanks to our graduate students for organizing today's event and choosing this symposium's theme.

Sincerely,

Richard K. Kobe

Chairperson and Professor

Department of Forestry

Keynote Speaker

Dr. Leo Zulu, PhD

Associate Professor

Department of Geography, Environment, and Spatial Sciences, Michigan State University

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Dr. Leo C. Zulu (PhD) is a human geographer and Associate Professor in the Department of Geography, Environment, and Spatial Sciences at Michigan State University. His research focuses on nature-society interactions mainly in Sub-Saharan Africa. This includes social forestry, community-based natural resources management, environmental governance and development, solid biomass energy (including charcoal), extractive resources management, land use and environmental change, agriculture and livelihoods, and climate change governance and adaptation. He has more than 25 years of combined research and professional experience in these areas, including nearly a dozen as a professional in social forestry in Malawi and in regional forestry and biodiversity coordination among southern African countries. He has also worked on various assignments with the United Nations Framework Convention on Climate Change (UNFCCC) Secretariat to support the Least Developed Countries (LDC) Experts Group. Work includes training LDC experts on the development of National Adaptation Plans of Actions, providing technical expertise on the development of guidelines for National Adaptation Plans (NAPs), advancing adaptation knowledge, facilitating workshops, and conducting technical studies. Dr. Zulu is working on various projects in Malawi, Ghana and Zambia, including supporting REDD+ preparedness, development of a national charcoal strategy, and research on the nexuses of energy choices and environment, agriculture and health, and sustainable agriculture and youth/gender inclusion. He continues to advise several graduate students in the MSU Department of Forestry.

Schedule

* Indicates prospective talk. (All others are retrospective.)

08:30 – 09:00	Registration
09:00 – 09:15	**Words of Welcome**
09:15 – 10:15	Keynote Address by **Dr. Leo Zulu**
10:15 – 10:30	Break
	SESSION I: 10:30 – 11:45 Moderator: Erika Kraus
10:30 – 10:45	**Sarah Greene -** Alternate options for managing MSU's ash trees: What are the costs and benefits?
10:45 – 11:00	**Patrick Engleken** - Effects of Emerald Ash Borer on Riparian Forest Structure
11:00 – 11:15	**Katie Minnix** - Caliciopsis canker disease in Michigan*
11:15 – 11:30	**Joshua James** - Long-term effects of prescribed fire season and frequency on soil carbon pools in a Pinus resinosa forest in northern Minnesota
11:30 – 11:45	**Jaron Adkins -** Soil microbial community structure across a fire severity gradient in burned Sierra Nevada mixed-conifer forest
11:45 – 12:00	Remarks by **Dr. Richard Kobe**, Chair, Department of Forestry
12:00 – 01:15	**LUNCH** (Lunch served downstairs in Basement)
	SESSION II: 01:15 – 2:30 Moderator: Erika Kraus
01:15– 01:30	**Catherine Henry -** Acer saccharum growth response to climate, as mediated by management, site quality, and stand structure*
01:30 – 01:45	**Chase Brooke -** Determining fire history in the Moquah Barrens using fire-colored plant silica*
01:45 – 02:00	**Malcolm Itter -** Assimilation of tree-ring and forest inventory data to model interactions between climate and forest dynamics
02:00 – 02:30	**Megan Kress** - Computational approaches to detect individual trees from LiDAR point clouds
02:30 – 02:45	Break
	SESSION III: 02:45 – 03:45 Moderator: TBD
02:45 – 03:00	**Emily Huizenga-** Measuring Social Drivers of Potential Forest Water Quality Markets in Michigan*
03:00 – 03:15	**Shivan Gc -** A closer look at Michigan's logging sector: Preliminary findings from 2017 Michigan logger survey
03:15 – 03:30	**Gang Lu-** The impact of PES programs on poverty alleviation: Did poor households benefit more from China's SLCP?
03:30 – 03:45	**Katherine Wood** - Plant-soil feedbacks affect tree seedling light-gradient partitioning
03:45 – 04:00	Wrap-Up & Awards Symposium Committee Members
05:30 – 07:30	Dinner Reception at **Korea House**

Listed in order of presentation

Alternate options for managing MSU's ash trees: What are the costs and benefits?

Sarah Greene

Emerald ash borer (EAB) is a phloem feeding beetle that has affected MSU's ash population. To protect ash trees against this insect, MSU Landscape Services applies insecticides every 2-3 years. Although costly to apply, using insecticides allows ash trees and their ecological services to remain on campus. Quantifying these benefits via iTree has allowed the university to justify continued treatment of the ash population. Other options are available to the university, but the costs and benefits of these options must be examined. Three options are evaluated: preemptive removal of all ash trees, treatment of trees ≥ 23cm, treat with TREE-äge® on all trees every four years.

Effects of Emerald Ash Borer on Riparian Forest Structure

Patrick Engelken

Emerald ash borer EAB, a phloem-boring insect native to Asia, was detected in North America in 2002 and is now present in 31 states and two provinces. It first became established in southeast Michigan and has since caused widespread death of ash trees across much of its range. Rapid loss of a major overstory species can result in cascading ecosystem-level effects. These could be especially significant within riparian forests, which are unique in that they exert influence not only on surrounding forests and waterways, but on downstream conditions as well. To assess these effects, we delineated canopy gaps resulting from ash mortality bordering streams at sites in southern Michigan representing a temporal gradient of EAB invasion. We surveyed species composition, snags and coarse woody debris within gaps and the surrounding forest. We also assessed regeneration dynamics of trees, shrubs and herbaceous plants, to evaluate current and future composition of sites.

Caliciopsis canker disease in Michigan*

Katie Minnix

Caliciopsis pinea has been identified as the key fungal pathogen contributing to *Pinus strobus* mortality in New England and Georgia. *Caliciopsis* is also thought to be responsible for reports of flagging and lower branch dieback and seedling mortality in Michigan, although symptoms found here appear to be less severe than those seen in other states. Genetic analysis of a fungal culture isolated from cankers on symptomatic white pine suggests that the pathogen in Michigan is not *C. pinea*, but is closely related to *Caliciopsis orientalis*, a species found on eastern hemlock in Canada. Future work will focus on the collection of more isolates of *Caliciopsis* in Michigan. Koch's postulates will be used to verify that the *Caliciopsis* isolate is the causal disease agent on *P. strobus* in Michigan. Surveys of white pine stands throughout the state will be conducted to determine the extent and severity of *Caliciopsis* canker disease in Michigan.

Long-term effects of prescribed fire season and frequency on soil carbon pools in a Pinus resinosa forest in northern Minnesota

Joshua James

Prescribed fire is a widely used management tool in red pine [Pinus resinosa Ait.] forests of the Lakes States region. However, there are few studies that have investigated the long-term effects of season and frequency of fire on soil properties. Soil represents a significant pool of fire-affected carbon [C] that has direct and indirect effects on forest nutrient cycling and vegetation responses. Therefore, we leveraged a historical prescribed fire study [1959-70] with remeasurements in 2015 to evaluate the effects of fire season and frequency on soil properties in a red pine forest in northern Minnesota. Prescribed fire treatments had legacy effects on soil properties, whereas C stocks and concentrations were unaffected 45 years post-fire. Summer treatments had desirable effects on soil properties for red pine ecosystems, and may be a valuable approach to increase the variability in burn schedules representative of historical regional fire regimes and support multiple management objectives.

Soil microbial community structure across a fire severity gradient in burned Sierra Nevada mixed-conifer forest

Jaron Adkins

Microbial communities in forest soils perform important ecosystem functions, including mediating soil carbon storage and regulating nutrient cycling, but microbial communities are sensitive to ecosystem disturbances. Wildfires are the one of the most common disturbances in forested ecosystems of the western United States, where wildfire severity has increased relative to historical norms. Disturbance-induced alterations to microbial communities may impact ecosystem recovery and the services provided by ecosystems. We investigated whether soil microbial community structure varied across wildfire severity levels three years after the Chips Fire burned Sierra Nevada mixed-conifer forest in northern California. Preliminary results suggest that the soil fungal-to-bacterial ratio decreased with increasing fire severity.

Acer saccharum growth response to climate, as mediated by management, site quality, and stand structure*

Catherine Henry

Given the global importance of forest ecosystems for cultural, economic, and ecological services, advancing knowledge to improve adaptive management under climate change is an impactful area of research. My proposed research will inform adaptive management strategies for northern hardwood forests by quantifying climate variation`s impact on sugar maple, Acer saccharum, growth, a dominant species in this system. Specifically, I aim to characterize growth as a function of climate, site quality, and stand structure in order to identify traits of drought-stressed as well as drought-resilient northern hardwood stands. With this information, I can predict how sugar maple growth will vary across a broad geographic region for various future climatic changes and management scenarios. This research will utilize a dendrochronological dataset from an estimated 1,100 sugar maple basal discs across northern Michigan. This study will advance our understanding of drought-adaptive management as well as basic ecological relationships in forest ecosystems.

Determining fire history in the Moquah Barrens using fire-colored plant silica*

Chase Brooke

Pine Barrens are a critically threatened ecosystem in the Midwest that experienced a high fire frequency prior to the Wisconsin cutover and the advent of fire suppression policy. In the 1950s, efforts to restore these barrens that were historically grass and forb dominated but were being encroached upon by pine and deciduous forests. This proposed research would characterize the fire history of the Moquah barrens in the Chequamegon-Nicolet National Forest by comparing the quantity fire-colored plant phytoliths present in fire excluded, and fire managed portions of the barrens. From this, I will determine the utility of fire-scarred phytoliths as measures of relative fire history, and tie these ratios to known patterns of fire occurrence and location in the area. In doing so, I aim to build a fire history measure to complement existing dendrochronological records and bring new insight into the historical patterns of fire in this rare ecosystem.

Assimilation of tree-ring and forest inventory data to model interactions between climate and forest dynamics

Malcolm Itter

The frequency of climate extremes is expected to change over the next century. Managing forest ecosystems in the face of changing climatic conditions requires we understand interactions between climate and forest dynamics. Analyses focused on modeling such interactions face a data challenge. Tree rings provide sufficiently long records to model climate effects on growth, but provide little information on forest dynamics. Forest census data provide detailed measurements of forest growth, mortality, composition, and structure over time, but are rarely of sufficient length or resolution to understand forest responses to climate. We nested a growth and yield model within a Bayesian state space framework to assimilate tree-ring and forest census data to reconstruct forest dynamics, advance understanding of their interactions with climate, and identify forest characteristics promoting resistance and resilience to climate extremes. The framework is demonstrated through its application to data from a long-term red pine experiment in northern Minnesota.

Computational approaches to detect individual trees from LiDAR point clouds

Megan Kress

The increased use of LiDAR Light Detection and Ranging technology as a remote sensing technique demands efficient computational methods for clustering large, three-dimensional point clouds. This retrospective talk summarizes two approaches to individual tree detection within LiDAR point clouds. The first approach delineates trees using the watershed algorithm from topological data analysis TDA, the field of applied mathematics that derives properties of data sets through the "shape" of the points. The second approach clusters the points into individual trees with the ant colony optimization algorithm ACO. The biomimicry of ants' cemetery organization provides the basis for this ACO technique. The ultimate goal of this research is to explore the accuracy and computational complexity of these two approaches that produce individual tree information. These data will then be used as inputs to spatial models that predict forest metrics like above-ground biomass.

Measuring Social Drivers of Potential Forest Water Quality Markets in Michigan*

Emily Huizenga

Billions of people around the world rely on forest lands to filter and provide clean drinking water, but looming threats to forests can lead to the degradation of drinking water quality. Because of its ample forest and water resources, Michigan is uniquely poised to integrate a Payment for Ecosystem Services program for forests providing drinking water. Past programs have not integrated an adequate temporal, spatial, and social preference component. Critiques of these programs often include a conflicting valuation of ecosystem services as a good over a process or service. This research will address these concerns by employing Service-Dominant Logic, a marketing framework, to explore water quality market awareness and consumer/producer willingness to participate in three watersheds in Michigan. This research will advance knowledge of ecosystem service valuation based on underlying social drivers, and provide a holistic framework that will make lasting transformative impacts in forest conservation and management.

A closer look at Michigan's logging sector: Preliminary findings from 2017 Michigan logger survey

Shivan Gc

In the wood products market, logging firms act as supply chain intermediaries meaning that they purchase standing timber from various landownership groups and market the harvested timber to primary forest products mills. Thus, they play an important role for sustainable management of forest resources and for the smooth functioning of forest products industries which comprise substantially to Michigan's economy. A mail survey of logging firms in Michigan was conducted in the spring of 2017 to understand the status and capacity of logging sector in the state. Preliminary findings from the survey with emphasis on current business environment, equipment used by the firms, challenges and opportunities faced by current logging businesses as well as firm succession decision will be presented.

The impact of PES programs on poverty alleviation: Did poor households benefit more from China's SLCP?

Gang Lu

Payments for ecosystem services programs are often considered as an incentive-based mechanism for ecological restoration and poverty alleviation. However, if the poor households do not benefit more, there will be a trade-off between these two goals. China's Sloping Land Conversion Program SLCP is one of the largest PES programs in the world, and it has been implemented since 1999. Using quantile regressions with a dataset containing information for 291 households over the period of 1998-2012, I estimate how the SLCP has benefited households at different income levels. The preliminary results show that participating in the SLCP has increased the income of all households, and lower-income households have benefited more than higher-income households. These results will help policy makers and other stakeholders to better understand the potential impact of the program on households' income, and to better design and implement similar programs in the future.
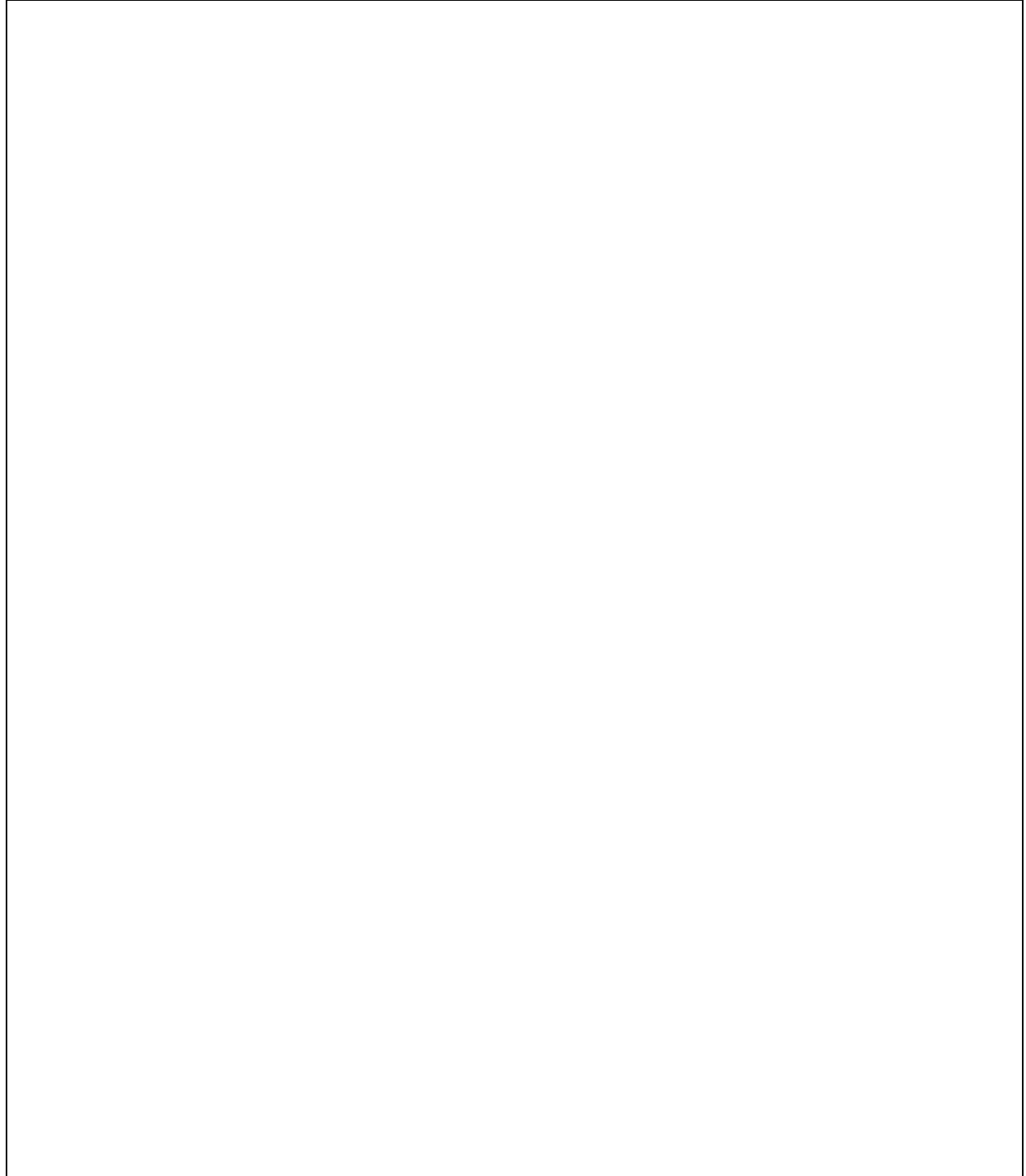
Plant-soil feedbacks affect tree seedling light-gradient partitioning

Katherine Wood

The seedling-establishment phase is a major demographic bottleneck, thereby influencing tree species diversity. Several factors could constrain seedling establishment, but their interactions are not well known. Soil fungal pathogens may reduce seedling populations through distance- and density-dependent mortality. Mycorrhizae may ameliorate or exaggerate pathogen effects, depending upon environmental conditions. Also, species may have differential shade tolerance survivorship under low light, which may confer trade-offs between growth and survivorship defense against pathogens. Despite the importance of pathogens, mycorrhizae, and irradiance in the maintenance of tree species diversity, they are rarely studied together. I conducted a greenhouse experiment, controlling pathogen/mycorrhizae presence and irradiance, across a range of seedling shade tolerances, to test my global hypothesis: shade tolerance is governed by not only physiological carbon balance, but also responses to soil fungal pathogens and mycorrhizae, which in turn exaggerates differences among tree seedling species in understory survival and provide opportunities for species coexistence.

Notes

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