Joshua M. Rapp

Associate
Harvard Forest, Harvard University
Petersham, Massachusetts 01366

978-727-9848 (cell)
rapp@fas.harvard.edu
joshuamrapp.com

Passionate about applying science to solve environmental problems. Experienced in field research, data analysis and visualization, and communicating science to diverse audiences.

EDUCATION

2010	Ph.D., Biology, Wake Forest University
2003	M.S., Forestry, University of Vermont
1997	B.S., Geology, Duke University

WORK EXPERIENCE

2017-present — Associate, Harvard Forest, Harvard University: *Sugar maple ecology and management*

- Research on sugar maple ecology and ecological forecasting of maple syrup production.

2016-present — New Salem (MA) Conservation Commissioner

- Enforcement of the Massachusetts Wetlands Protection Act.
- Conduct field visits to evaluate potential management impacts on wetlands, review land-use permit applications and forest cutting plans, recommend mitigation actions, and issue permits.

2018 — Forestry Assistant, Massachusetts Department of Conservation and Recreation: *Continuous Forest Inventory*

- CFI Forester: Survey Continuous Forest Inventory plots across Massachusetts.
- Work independently to plan and execute field work.
- Navigate across rough terrain to locate plot locations using GPS and maps.
- Identify all woody vegetation in plots and measure tree characteristics with high accuracy.
- Assure high quality data is submitted in a timely manner.

2017 — Research Assistant, Harvard Forest, Harvard University: *Sustainable Working Landscapes*

- Field crew leader and data wrangler for the Sustainable Working Landscape project at Harvard Forest, putting Stewardship Science for the Wildlands and Woodlands vision in action.
- Project Ecologist for the Harvard Forest Schoolyard Ecology Our Changing Forests project.

- Led a crew of 3 field assistants in collecting data in the Walden Woods of Lincoln and Concord, MA
- Collected data on forest history and health, with a focus on white pine needle decline, hemlock decline due to hemlock woolly adelgid, and deer browse impacts on forest regeneration
- Supervised data entry and provided Quality Assessment/Quality Control of data
- Summarized data and created data visualizations for reports to colleagues and funders
- Taught K-12 school teachers how to establish forest monitoring plots, collect data, and visualize data through workshops and site visits

2015-2017 Postdoctoral Researcher, University of Massachusetts Amherst: *Climate effects on the culture and ecology of sugar maple*

- Project coordinator for a DOI Northeast Climate Science Center funded project on "Climate effects on the culture and ecology of sugar maple".
- Wrote and managed USGS grant: Northeast Climate Science Center: Climate Effects on the Culture and Ecology of Sugar Maple. (with coPIsToni Lyn Morelli and Kristina Stinson, University of Massachusetts Amherst; Selena Ahmed, Montana State University; David Lutz, Dartmouth University; and Ryan Huish, Hollins University). $149,867
- Coordinated the Acer Climate and SocioEcological Research Network (ACERnet blogs.umass.edu/acernet).
- Organized and hosted workshop on Sugar Maple in a Changing Climate. Northeast Climate Science Center, University of Massachusetts Amherst.
- Designed field surveys, collected data, analyzed data, and wrote reports and articles for ecological studies on maple sap and syrup flow and quality.
- Analyzed ecological datasets and modeled ecological processes using the statistical program R.
- Submitted and obtained IRB approval for surveying maple producers about historical changes in sap flow and quality, and attitudes related to climate change.
- Wrote articles describing research for a general audience for Maple Syrup Digest.
- Interviewed for media stories, including Chicago Tribune, Worchester Telegram, Climate Central.
- Drafted manuscripts for scientific publications.
- Presented research at scientific symposium.
- Developed and taught course on “Ecology, Economy, and Future of Maple Syrup” to two sections of 19 students

2015-2016 Charles Bullard Fellow in Forest Research, Harvard Forest, Harvard University: *Maple syrup, climate change, and the ecology and management of New England forests*

- Competitive research fellowship on forest research. Lead investigator for research on "Maple syrup, climate change, and the ecology and management of New England forests".
- Designed a research program that used USDA Forest Service Forest Inventory and Analysis data and LANDIS II forest landscape model outputs to create spatially explicit estimates of potential taps in sugar maple and red maple trees in New England under current conditions and future climate and land-use scenarios.
- Used FIA data to develop relationships between potential taps and stand biomass.
- Collaborated with other investigators to use LANDIS outputs to make spatial projections of potential taps.
- Used GIS software to create maps of potential taps.
- Compared projected potential taps to actual taps reported by the National Agricultural Statistics Service.
- Presented findings at scientific meetings (Harvard Forest Research Symposium).
- Drafted manuscripts for publication in scientific journals.
- Guest Instructor, University of Massachusetts Amherst: Experimental Methods in Ecology (2x).

2014-2015 Postdoctoral Scholar, University of California, Davis: *Stochastic life-history theory: pollination and resource limitation in plant reproduction*

- Conducted empirical and theoretical research on the evolutionary implications of plant flower costs and resource dynamics.
- Reviewed literature to mine data on floral traits.
- Collated data from the literature, unpublished data, and field collected data.
- Designed analysis of floral traits to test ecological theory.
- Developed analytical models of floral evolution and and coded them in R to develop ecological theory.
- Collaborated with interdisciplinary teams to develop theory and analyze data on floral traits and evolution.
- Presented results of studies at professional meetings including Ecological Society of America and Harvard Plant Biology Symposium.
- Published peer reviewed studies in scientific journals (American Naturalist).

2011-2014 Postdoctoral Fellow, Tufts University and Harvard Forest, Harvard University: *Masting dynamics in sugar maple and whitebark pine*

- Project lead for two research projects related to seed production, resource dynamics, and pollination dynamics in white bark pine (Montana) and sugar maple (Massachusetts) using observational, experimental, and modeling approaches.
- Designed and implemented inventory and monitoring of reproductive output of individual trees, and health of tree stands.
- Planned and carried out multiday field campaigns in montane environments (Montana), directing a field crew of 24 people and instructing them in safe operating procedures.
- Used GIS to select sample sites and present spatial data.
- Estimated sample sizes and design sample surveys appropriate for study objectives.
- Data analysis in R, including generalized linear mixed models and analysis of time series data ranging from 5 to 20 years.
- Conducted analyses of forest resources to address questions about tree mortality risk and resiliency of whitebark pine forests, and seed production and maple syrup production.
- Used established statistical techniques to analyze forest data, interpreted results to identify trends, and drafted manuscripts for publication in professional journals.
- Collaborated with interdisciplinary teams to analyze forest inventory and monitoring data.
- Presented results of studies at professional meetings and to nontechnical audiences.
- Wrote and published peer-reviewed journal articles in Journal of Ecology, Forest Ecology and Management, and Annals of the New York Academy of Sciences.
- Guest Instructor, Harvard University: Global Change Ecology: Forests, Ecosystem Function, and the Future (3x).
- Guest Instructor, Tufts University: Tropical Ecology and Conservation.
- Guest Instructor, University of Massachusetts Amherst: Forest tree and shrub identification.

2004-2010 Doctoral student, Wake Forest University: *Climatic control on plant performance across an Andean altitudinal gradient*

- Taught introductory biology and ecology labs; two sections of 12- 18 students per semester (8 semesters): Biological Principles (3x); Ecology and Evolutionary Biology (3x); Community Ecology; Biology & the Human Condition
- Guest Lecturer, Wake Forest University: Tropical Ecology
- Designed and conducted research on plant population, community, and ecosystem ecology in tropical montane forest ecosystems

- Monitored tree growth, mortality, and reproduction in a network of 12 one hectare tree plots established by the Andes Biodiversity and Research Group (ABERG) across a 2500 meter altitudinal gradient in Peru.
- Supervised a field crew of 2-5 people on field campaigns in remote monate environments for field campaigns ranging from 1-3 months
- Interacted with scientists, Manu National Park (Peru) staff, field station employees and local citizens.
- Installed, monitored, and analyzed data from micrometerological sensors associated with the ABERG plot network.
- Designed and implemented reciprocal transplant experiments to test the response of tree establishment and epiphyte survial to a climate gradient.
- Used GIS to plan research, analyze spatial data, and present results
- Used R to carry out statistical analysis of ecological data with modern statistical techniques, including Bayesian methods.
- Wrote manuscripts for publication in scientific journals, including Ecology, Global Change Biology, Soil Biology & Biochemistry, Climate Research, F1000 Research, Journal of Tropical Biology, and Hydrology and Earth System Sciences.
- Presented results of studies at professional meetings and conferences.
- Collaborated with interdisciplinary teams to complete analyses of forest ecosystems.
- Used statistical techniques to conduct analyses of forest resource data and identify trends.
- Designed forest inventory and monitoring methods applicable to multiple spatial and temporal scales.

2004 Research Assistant, University of Montana: *Snowshoe hare ecology*

- Snowshoe hare (Lepus amicanus) distributional ecology in Yellowstone National Park. Live-trapped show shoe hair, and performed snowshoe hare pellet and vegetation surveys.

2004 Botany Intern, Ashoka Trust for Research in Ecology and the Environment (India): *Epiphyte diversity*

- Designed and carried out a research project on the vascular epiphyte diversity of Shola forests in the Talakaveri Wildlife Sanctuary, Karnataka, India.

2004 Botanist (GS-5), USDA Forest Service, Northeastern Research Station: *Vascular plant diversity*

- Performed botanical surveys of vascular plant species at the Forest Ecology Research and Demonstration Area in Paul Smith's, New York.

- Identified all vascular plant species in experimental plots, prepared herbarium specimens, and maintained a botanical database in MS Access.

2001-2003 Masters student, University of Vermont: *Ecological community mapping using the National Vegetation Classification System at the Lake Umbagog National Wildlife Refuge: an evaluation of methodology*

- Taught field ecology and natural history, statistics, environmental science, and insect biodiversity lab sections to 15-20 undergraduates: Natural History and Field Ecology (2x); Introduction to Environmental Science; Biostatistics; Insect Biodiversity.
- Conducted research on ecological communities at the Lake Umbagog National Wildlife Refuge.
- Used aerial photo-interpretation, field sampling, and GIS analysis to map ecological communities using the National Vegetation Classification on 18,000 acres.
- Wrote a peer-reviewed scientific article, a report for the US Fish and Wildlife Service, and a popular article published in Northern Woodlands describing the research.

2001 Research Assistant, University of California, Berkley: *Marbled Murrelet ecology*

- Research assistant for a project on the ecology and conservation of Marbled Murrelets in central California.
- Performed auditory, visual and radio telemetry surveys of Marbled Murrelets on land and at sea, and searched for and monitored nests.

2000-2001 Research Assistant, University of Massachusetts, Amherst: *Darwin's fox ecology*

- Research assistant for a project on Darwin's Fox (Pseudalopex fulvipes) behavioral ecology and conservation in Nahuelbuta National Park, Chile.
- Performed surveys of foxes both day and night using radio telemetry.

1999 Resource Assistant, Student Conservation Association and Baxter State Park, Maine

- Performed trail maintenance and construction in Baxter State Park, Maine.

1998-1999 Teacher, Mayatan Bilingual School, Copan Ruinas, Honduras

- Taught english, math, and science to third grade students and math to seventh grade students.

1997-1998 AmeriCorps Member, SCA New Hampshire Parks AmeriCorps

- Taught environmental education in elementary school in Concord, New Hampshire.
- Advised high school student environmental clubs and tutored highschool students.

- Performed trail work and other maintenance in New Hampshire State Parks.

1997 Geologist (GS-5), United States Geological Survey (NAGT_USGS Cooperative Summer Field Training Program): *Paleolimnology*

- Performed lab work for the Western Lakes Project, measuring grain-size and magnetic properties of lake sediments.

1995 Resource Assistant, Student Conservation Association and United States Forest Service

- Mapped trails using GPS in the Pecos Wilderness, Santa Fe National Forest.

PUBLICATIONS

Horwath, A.B., J. Royles, R. Tito, J.A. Gudiño, N.S. Allen, W. Farfan-Rios, **J.M. Rapp**, M.R. Silman, Y. Malhi, V. Swamy, J. P.L. Farfan, H. Griffiths. 2019. Bryophyte stable isotope composition, diversity and biomass define tropical montane cloud forest extent. Proceedings of the Royal Society B. 286: 20182284.

Faison E.K., S. DeStefano, D.R. Foster, **J.M. Rapp**, J.A. Compton. 2016. Multiple Browsers Structure Tree Recruitment in Logged Temperate Forests. PLoS ONE 11(11): e0166783. doi:10.1371/journal.pone.0166783

Faison, E. K., S. DeStefano, D.R. Foster, G. Motzkin, and **J. M. Rapp.** 2016. Ungulate browsers promote herbaceous layer diversity in logged temperate forests. Ecology and Evolution. doi:10.1002/ece3.2223

Rosenheim, J.A., N.M. Williams, S.J. Schreiber, and **J.M. Rapp**. 2016. Modest pollen limitation of lifetime seed production is in good agreement with modest uncertainty in whole-plant pollen receipt. American Naturalist. **187**:397-404.

Rapp, J.M. and E.E. Crone. 2015. Maple syrup production declines following masting. Forest Ecology and Management. **335**:249-255.

Clark, K.E., M.A. Torres, A.J. West, R.G. Hilton, M. New, A.B. Horwath, J.B. Fisher, **J.M. Rapp**, A. Robles Caceres, and Y. Malhi. 2014. The hydrological regime of a forested tropical Andean catchment. Hydrology and Earth System Sciences. **18**: 5377-5397.

Girardin, C.A.J., Y. Malhi, K.J. Feeley, **J.M. Rapp**, M.R. Silman, P. Meir, W. Huaraca Huasco, N. Salinas, M. Mamani, J.E. Silva-Espejo, K. García Cabrera, W. Farfan Rios, D.B. Metcalfe, C.E. Doughty, L.E.O.C. Aragão. 2014. Seasonality of above-ground net primary productivity along an Andean altitudinal transect in Peru. Journal of Tropical Ecology. **30**:503-519.

Crone, E.E. and **J.M. Rapp.** 2014. Resource depletion, pollen coupling and the ecology of mast-seeding. Annals of the New York Academy of Sciences. **1322**:21-34.

Rapp, J.M. and M.R. Silman. 2014. Epiphyte response to drought and experimental warming in an Andean cloud forest [v2; ref status: indexed, http://f1000r.es/3le] F1000Research. **3**:7.

Rapp, J.M., E.J.B. McIntire, and E.E. Crone. 2013. Sex allocation, pollen limitation and masting in whitebark pine. Journal of Ecology. **101**:1345-1352.

Rapp, J.M. and M.R. Silman. 2012. Diurnal, seasonal, and altitudinal trends in microclimate across a tropical montane cloud forest. Climate Research. **55**:17-32.

Rapp, J.M., M.R. Silman , J.S. Clark , C.A.J. Girardin , D. Galiano , and R. Tito. 2012. Intra- and inter-specific tree growth across a long altitudinal gradient in the Peruvian Andes. Ecology. **93**:2061-2072. FACULTY of 1000 RECOMMENDED

Marthews, T.R., Y. Malhi, C.A.J. Girardin, J.E. Silva-Espejo, L.E.O.C. Aragão, D.B. Metcalfe, **J.M. Rapp**, L.M. Mercado, R.A. Fisher, D.R. Galbraith, J.B. Fisher, N. Salinas-Revilla, A.D. Friend, N. Restrepo-Coupe, and R.J. Williams. 2012. Simulating forest productivity along a neotropical elevational transect: temperature variation and carbon use efficiency. Global Change Biology. **18**:2882-2898.

Fierer, N., C.M. McCain, P. Meir, M. Zimmerman, **J.M. Rapp**, M.R. Silman, R. Knight. 2011. Microbes do not follow the elevational diversity patterns of plants and animals. Ecology. **92**:797–804.

Girardin, C.A.J., Y. Malhi, L.E.O.C. Aragão, M. Mamani, W. Huaraca Huasco, L. Durand, K. J. Feeley, **J. Rapp**, J.E. Silva-Espejo, M. Silman, N. Salinas, R. J. Whittaker. 2010. Net primary productivity allocation and cycling of carbon along a tropical forest elevational transect in the Peruvian Andes. Global Change Biology. **16**: 3176-3192.

Meier, C.L., **J. Rapp**, R. Bowers, M.R. Silman, and N. Fierer. 2010. Fungal growth on a common wood substrate across a tropical elevation gradient: temperature sensitivity, community composition, and potential for above-ground decomposition. Soil Biology & Biochemistry. **42**: 1083-1090.

Rapp, J., D. Wang, D. Capen, E. Thompson, and T. Lautzenheiser. 2005. Evaluating error in using the National Vegetation Classification System for ecological community mapping in northern New England. Natural Areas Journal **25**: 46-54.

Reynolds, R. L., J. G. Rosenbaum, **J. Rapp**, M. W. Kerwin, J. P. Bradbury, S. M. Colman and David Adam. 2004. Record of late Pleistocene glaciation and deglaciation in the southern Cascade Range; I, Petrological evidence from lacustrine sediment in Upper Klamath Lake, southern Oregon. Journal of Paleolimnology **31**: 217-233.

In progress

Rapp, J.M., D.A. Lutz, R.D. Huish, B. Dufour, S. Ahmed, T.L. Morelli, and K. Stinson. Finding the sweet spot: shifting climate optimum for maple syrup production in North America. *In revision.*

GRANTS and AWARDS

2015-2016	Charles Bullard Fellowship in Forest Research. Harvard Forest, Harvard University. $40,848.

2015-2017	Northeast Climate Science Center: Climate Effects on the Culture and Ecology of Sugar Maple. Senior Personnel and Primary Grant Writer (*with* co-PIs-Toni Lyn Morelli and Kristina Stinson, University of Massachusetts Amherst; Selena Ahmed, Montana State University; David Lutz, Dartmouth University; and Ryan Huish, Hollins University). $149,867
2008, 2009	Alumni Student Travel Award, Wake Forest University, Graduate School. $300
2008, 2009	Elton C. Cocke Travel Award, Wake Forest University, Biology Department. $500
2005, 2009	Vecellio Grant for Graduate Research, Wake Forest University. $1500
1997	Monetary Award for contribution to the Western Lakes Project, USGS. $500

WORKSHOPS

2017	What are the impacts of climate change on maple syrup production and can we manage for them? Forest Ecosystem and Monitoring Cooperative Conference, University of Vermont. *Discussion group leader.*
2015	Sugar Maple in a Changing Climate. Northeast Climate Science Center, University of Massachusetts. *Organizer and Host*.
2014	Eddy Covariance and Eddy Pro Workshop. LI-COR Biosciences. At Harvard University.
2014	LI-6400XT Introductory Workshop. LI-COR Biosciences. At Harvard University.
2013	Integrating Evidence on Forest Response to Climate Change: Physiology to Regional Abundance: A Training Workshop for Macrosystems Research, Duke University
2011	Mixed models and matrix models: Workshop on statistical analysis of stochastic models of plant population dynamics, Harvard Forest, funded workshop
2011	Adaptation to climate from a spatial perspective, European Science Foundation sponsored workshop, Lammi Biological Station, University of Helsinki, Finland
2010	OTS-PASI, Expanding the Frontier in Tropical Ecology through Embedded Sensors, La Selva Costa Rica, funded workshop

SERVICE

Reviewer: American Naturalist, BioScience, Canadian Journal of Forest Research, Global Ecology and Biogeography, Ecology, Ecospheres, Journal of Ecology, Journal of Biogeography, American Journal of Botany, Journal of the Torrey Botanical Society, Journal of Environmental Management, PLOS ONE, Plant Ecology, Ecography, Swiss National Science Foundation, Trees – Structure and Function, Canadian Journal of Forest Research
Organizer: Ecolunch, Department of Biology, Wake Forest University (2009)
Member: Ecological Society of America (2004-present)
Panelist: Harvard Forest Summer Student Program Graduate School panel (2013)

PRESENTATIONS

Conference Presentations

MacLean, M.G., J.M. Rapp, and M. Duveneck, 2018. *What happens to maple syrup in the different New England Landscape Futures scenarios?* Scenarios, Services, and Society RCN Capstone Meeting, Amherst, Massachusetts.

Rapp, J.M., S. Ahmed, B. Dufour, R.D. Huish, D.A. Lutz, T.L. Morelli, and K. Stinson, 2017. *Finding the sweet spot: climate optimum for maple syrup production.* Forest Ecosystem and Monitoring Cooperative Conference, Burlington, Vermont.

Rapp, J.M., S. Ahmed, A. Brunelle, B. Dufour, R.D. Huish, D.A. Lutz, T.L. Morelli, and K. Stinson, 2017. *Maple syrup in a changing climate.* Northeast Climate Science Center's Regional Science Meeting. Amherst, Massachusetts. Poster.

Rapp, J.M, M.J. Duveneck, and J.R. Thompson. 2016. *(Re)expansion of the maple syrup industry in New England: projecting where the taps will be in a changing environment.* 27th Annual Harvard Forest Ecology Symposium, Harvard Forest, Harvard University, Petersham, Massachusetts. Poster.

Rapp, J.M. 2015. *Sugar maple in a changing climate: What do we know?* Sugar Maple in a Changing Climate. Northeast Climate Science Center, University of Massachusetts Amherst. Massachusetts.

Rapp, J.M., S.J. Schreiber, J.A. Rosenheim, N.M. Williams, and L.D. Harder. 2015. *Increase the mean, reduce the variance, or bet on a bonanza: How should plants respond to environmental variability in pollen receipt?* Ecological Society of America 100th Annual Meeting. Baltimore, Maryland.

Rapp, J.M., S.J. Schreiber, J.A. Rosenheim, N.M. Willimas, and L.D. Harder. 2015. *Plant evolutionary response to stochastic pollen receipt: Increase the mean, reduce the variance, or bet on a bonanaza?* 10th Annual Plant Biology Symposium, Arnold Arboretum, Harvard University, Boston, Massachusetts. Poster.

Rapp, J.M. and E.E. Crone. 2014. *Endogenous resource dynamics drive sugar maple masting and maple syrup production.* Ecological Society of America 99th Annual Meeting. Sacramento, California.

Rapp, J.M. and E.E. Crone. 2014. *Resource allocation to reproduction drives carbon dynamics from shoots to landscapes in sugar maple (Acer saccharum).* Gordon Research Conference: Unifying Ecology Across Scales. Biddeford, Maine.

Rapp, J.M. 2013. *Maple syrup production declines following masting.* Vermont Monitoring Cooperative Conference, Burlington, Vermont.

Rapp, J.M. and M.R. Silman. 2013. *The role of species and diversity in forest ecosystem function along an Andes-to-Amazon gradient.* Association of Tropical Biology and Conservation 50th Anniversary Meeting, San José, Costa Rica.

Rapp, J.M. 2012. *Intra- and inter-specific tree growth across a long altitudinal gradient in the Peruvian Andes*. Andes Biodiversity and Ecosystem Research Group Conference, Sequoia National Park, California.

Rapp, J.M. and E.E. Crone. 2012 *Pollination limitation, sex allocation, and masting in whitebark pine*. Ecological Society of America 97th Annual Meeting, Portland, Oregon

Rapp, J.M., E.C. Crone, and J.D. Crall. 2012 *Bees, keys, and maple syrup: Investigating seed production in sugar maple*. 8th Annual Plant Biology Symposium, Arnold Arboretum, Harvard University, Boston, Massachusetts. Poster.

Rapp, J.M. and E.C. Crone. 2012 *Trees make seeds: Does reproductive ecology matter for forest carbon dynamics?* 23rd Annual Harvard Forest Ecology Symposium, Harvard Forest, Harvard University, Petersham, Massachusetts

Rapp, J.M. 2011 *Bees, keys, and maple syrup: seed production in sugar maple*. LTER graduate student and post-doc retreat, Hubbard Brook Experimental Forest, New Hampshire

Rapp, J.M. 2011 *Tree growth across a 1700 meter altitudinal gradient in the humid tropics*. Adaptation to climate from a spatial perspective, Lammi Biological Station, University of Helsinki, Finland

Rapp, J.M. 2010 *Growth phenology and climate seasonality in an Andean cloud forest*. Andes Biodiversity and Ecosystem Research Group Fourth Annual Conference, Marathon, Florida

Rapp, J.M. and M.R. Silman. 2009 *Diameter growth across an altitudinal gradient in the cloud forest tree genus Weinmannia*. Ecological Society of America 94th Annual Meeting, Albuquerque, New Mexico

Rapp, J.M. and M.R. Silman. 2009. *Epiphyte survival across an altitudinal gradient during drought.* 5th International Canopy Conference, Bangalore, India. Poster.

Rapp, J.M., K.J. Feeley, and M.R. Silman. 2009. *Using demography to understand distribution limits in the Cloud Forest Tree Genus Weinmannia*. Association for Tropical Biology and Conservation, Marburg, Germany. Poster.

Rapp, J.M. and M.R. Silman. 2009. *Do natural history collections and plot data predict the same species distributions?* Southeastern Ecology and Evolution conference. Gainesville, Florida. Poster.

Rapp, J.M. and M.R. Silman. 2008. *Does adult performance control distributions of Weinmannia?* Andes Biodiversity and Ecosystem Research Group Third Annual Conference, Bettmeralp, Switzerland

Rapp, J.M. 2002 *Ecological Community Mapping of the Lake Umbagog National Wildlife Refuge.* Graduate Research Symposium, School of Natural Resources, University of Vermont

University Seminars

Rapp, J.M., and S. Ahmed. 2017. *What are the impacts of climate change on maple syrup production and can we manage for them?* Northeast Climate Science Center, University of Massachusetts Amherst.

Rapp, J.M. 2015. *Seeds and Syrup: Ecological forecasting for a non-timber forest industry*. University of Massachusetts Amherst.

Rapp, J.M. 2013. *Masting, carbon, and maple syrup economics.* Tufts University.

Rapp, J.M. 2010. *Tree growth and temperature in the tropics: Analysis across an Andean altitudinal gradient*. Harvard Forest.

Rapp, J.M. 2010. *Demographic performance of cloud forest trees across an altitudinal gradient*. Wake Forest University.

Rapp, J.M. 2003. *Evaluation of ecological community mapping using the National Vegetation Classification System at the Lake Umbagog National Wildlife Refuge*. University of Vermont.

POPULAR ARTICLES and TECHNICAL REPORTS (non-peer reviewed)

Rapp, J.M. 2016. How will climate change affect maple syrup? Maple Syrup Digest. **55:**16-20.

Rapp, J.M. 2015. Examining the impact of seed production on sap sugar content. Maple Syrup Digest. **53**: 14-19.

Rapp, J. 2004. A Place in Mind. Northern Woodlands magazine, Corinth, Vermont, U.S.A.

Rapp, J. 2003. Ecological Communities of the Lake Umbagog National Wildlife Refuge: Classification and Mapping with the National Vegetation Classification System (report submitted to the Trust for Public Land and the U.S. Fish and Wildlife Service.) School of Natural Resources, University of Vermont, Burlington, Vermont, U.S.A.

Rapp, J. 2003. Costa Rica: Crossroads in the Plant World. Ecolog, Newsletter from the Ecological Planning students, School of Natural Resources, University of Vermont, Burlington, Vermont, U.S.A.

Rapp, J. 2002. Kinglets in the Cold: Small Survivors. Ecolog, Newsletter from the Ecological Planning students, School of Natural Resources, University of Vermont, Burlington, Vermont, U.S.A.

Barton, J., C. Dacey, J. Hilke, J. Kart, E. Faison, K. Lange, V. Levesque, **J. Rapp**, and A. Wheeler. 2002. Wheeler and Farm Bureau Tracts: Assessment and Recommendations for the Vermont Youth Conservation Corps. Botany Department, University of Vermont, Burlington, Vermont, U.S.A.

OUTREACH

Events

How Does Climate Affect Sugar Maple Trees? *Presentation for park staff and volunteers at* Indiana Dunes National Lakeshore, Porter, Indiana, March 28, 2018.

How Does Climate Affect Sugar Maple Trees? *Presentation for* Science Saturday, Sugar Maple Research *at* Indiana Dunes National Lakeshore, Porter, Indiana, February 24, 2018.

Flowers on your Pancakes? *Drop in activity at the* Collections Up Close: Magnificent Maples *event at* The Arnold Arboretum, Boston, Massachusetts, April 21, 2013.

Maple research presentation for Arbor Day. *Assembly of 3rd – 6th graders at the* Petersham Center School, Petersham, Massachusetts, April 26, 2013.

Ecological Communities of the Lake Umbagog National Wildlife Refuge: Classification and Mapping with the National Vegetation Classification System. Lake Umbagog National Wildlife Refuge *staff meeting.* Errol, New Hampshire, May, 2003.

Natural History of the LaPlatte River. LaPlatte Watershed Partnership *meeting.* Shelburne, Vermont, April, 2003.

Landscape Inventory and Assessment of the Wheeler and Farm Bureau Tracts, Richmond, Vermont. (*with* J. Barton, C. Dacey, J. Hilke, J. Kart, E. Faison, K. Lange, V. Levesque, and A. Wheeler). *Public meeting sponsored by* Richmond Land Trust and Vermont Youth Conservation Corps. April, 2002.

Media interviews

What Does Climate Change Mean for Vermont's Maple Sugarers? Chris Richard. CivilEats. May 2, 2018.

Maple syrup inc.: Vermont's maple syrup tradition goes high tech, high finance. Stephanie Hanes. The Christian Science Monitor. April 18, 2018.

Ecologist: Climate change sours maple syrup prospects. Susan O'Leary. Northwest Indiana Times. February 28, 2018.

'Weird' is the word to describe 2017 maple sugaring season. Dianne Lederman. Mass Live. March 28, 2017.

Maple Mayday. Joanna Cummings. The Analytical Scientist. July 2016.

Indiana Park Studies Impact of Climate Change on Maple Syrup. Nick Janzen. Indiana Public Radio. April 4, 2016.

Climate Change Is Coming for Your Maple Syrup. Brian Kahn. Climate Central. March 28, 2016.

What Climate Change Means for Maple Syrup. Allyson Morin. Stories for Strangers. March 24, 2016.

Sap to syrup: In Petersham, researcher tracks climate effects on sugar maples. George Barnes. Worcester Telegram. March 7, 2016.

Is Climate Change Killing the Maple Syrup Industry? Evan Garcia. Chicago Tonight. February 22, 2016.

Climate Change May Impact Maple Syrup Production. Christin Nance Lazerus. Post-Tribune. February 19, 2016.

Studying Climate Change Impact on Maple Syrup Quality. Janet Lathrop. UMass Amherst press release. February 10, 2016.

Sugar and Seeds. Todd McLeish. Discoveries. Northern Woodlands magazine. Spring 2015.

The Bloom is On for Maple Syrup. Joshua A. Krisch. New York Times. January 5, 2015.

Study: Maple Syrup Production Declines After a Big Seed Year. Carrie Healy. New England Public Radio. December 28, 2014.

How New Research is Changing What We Know About Maple Syrup Production. David Oliver. Food

Dive. December 10, 2015.

More Maple Seeds, Less Maple Syrup. Clarisse Hart. Tufts Now. November 7, 2014.

Who Feasts: You, or the Squirrels? New Findings from Harvard Forest. Lynda Mapes. Blog post. November 4, 2014.

Interview with Joshua Rapp – Sex allocation, pollen limitation and masting in a pine species. Scott Chamberlain. Journal of Ecology blog. August 2, 2013.

Whitebark Pine Trees: Is Their Future at Risk? NSF press release 13-101. June 10, 2013.

Whirlybirds and Maple Syrup. Alvin Powell. Harvard Gazette. March 22, 2012.

A Walk in the Clouds. Jim Robbins. Condé Nast Traveler. March 2008.

Climbing Against Time. Michael Tennesen. National Wildlife. April 2007.

Uphill Battle. Michael Tennesen. Smithsonian Magazine. August 2006.

LANGUAGES

English (native), Spanish (conversational), R statistical programming language (fluent)