

## David A. Orwig

Harvard Forest  
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### Education

Pennsylvania State University	Ph.D.	Forest Resources	1995
Pennsylvania State University	M.S.	Ecology	1991
Rochester Institute of Technology	B.S.	Biology	1989

*M.S. Thesis* Age-structure and composition of successional forests of Spotsylvania Battlefield, Virginia. Major Professor: Dr. Marc D. Abrams.

*Ph.D. Dissertation* Community and dendroecological attributes of oak-pine forests in northern Virginia. Major Professor: Dr. Marc D. Abrams.

### Positions

June 1997 - present. Forest Ecologist. Harvard Forest, Harvard University.

September 2007 - present. Adjunct Associate Professor. University of Massachusetts, Amherst.

June 1995-May 1997. Research Associate. Harvard Forest, Harvard University.

August 1989 to May 1995. Graduate Teaching Assistant. Pennsylvania State University.

### Professional Organizations

Ecological Society of America  
American Geophysical Union

### State and Local Organizations

City of Gardner Conservation Commission 2015-present  
Massachusetts Forest Reserve Science Advisory Committee 2012-present  
Massachusetts Statewide Wood Energy Team Advisory Committee 2015-present  
Friends of Mohawk Trail State Forest Board Member 2022-present

## **Awards**

2021. Harvard University Certificate of Teaching Excellence (Fall Semester Freshman Seminar).

2020. Harvard University Certificate of Teaching Excellence (Fall Semester Freshman Seminar).

2017. Harvard University Certificate of Teaching Excellence (Spring Semester Freshman Seminar).

2013. Harvard University, Advising Programs Office, Certificate of Distinction, Exemplary Intellectual and Personal Guidance of Undergraduate Students.

2011. Harvard University Certificate of Distinction in Teaching (Spring Semester Freshman Seminar).

2010. Harvard University Certificate of Teaching Excellence (Spring Semester Freshman Seminar).

1992 and 1994. Forest Resources Professional Travel Award, Penn State University.

## **Research Grants**

2021-2023. *Adaptive forest management options for white ash influenced by the invasive emerald ash borer.* USDA-NIFA-CARE (\$299,999). Principal Investigator

2021-2024. *Collaborative Proposal: Redefining the ecological memory of disturbance over multiple temporal and spatial scales in forest ecosystems.* NSF-DEB (\$ 707,511). Co-Investigator

2019 – 2025. *From Microbes to Macrosystems: Understanding the response of ecological systems to global change drivers and their interactions.* NSF: LTER (\$6,762,000). Co-Investigator

2019. *Is Carbon Starvation a Proximal Cause of Tree Mortality from Defoliation?* NSF Rapid Response Research grant (\$99,340) Co-Investigator.

2018. *Megaplot re-census activity.* Smithsonian Tropical Research Institute. (\$15,000). Principal Investigator.

2016-2019. *Assessing the potential for climate change and forest insects to drive land-use regime shifts.* NSF CNH (\$879,251). Co-Investigator.

2015-2020. *Coordinating the Development of Terrestrial Lidar Scanning for Aboveground Biomass and Ecological Applications*. NSF RCN-IBDR (\$502,070). Co-Investigator.

2013-2019. *Harvard Forest LTER V: New Science, synthesis, scholarship, and a strategic vision for society*. NSF LTER (\$5,879,997). Co-Investigator.

2011-2013. *A foodweb approach to native plant protection in a forest ecosystem*. USDA AFRI Pest and Beneficial Insects in Plant Systems. (\$422,302). Co-Investigator with E. Preisser, T. Holmes and J. Elkinton.

2010-2014. *Forest ecosystem dynamics plot at the Harvard Forest*. Smithsonian Tropical Research Institute. (\$305,865). Principal Investigator.

2010. *Wildlands and Woodlands- A vision for the NE Landscape*. Conservation & Research Foundation (\$2,000).

2009-2010. *Ecological Patterns and Consequences of Catastrophic Mortality of a Foundation Species due to Abrupt Climatic and Biotic Stresses*. NSF Rapid Response Research grant. (\$99,532) Co-Investigator.

2009-2010. *Asian Longhorned Beetle (ALB) Dendrochronology*. USDA Federal Lands Forest Health Program, (\$15,000).

2008-2009. *Impact of the invasive Sirex noctilio on pine stands of the northeastern US and southern Ontario*. USDA Federal Lands Forest Health Program. (\$10,000).

2006-2012. *Integrated Studies of the Drivers, Dynamics, and Consequences of Landscape Change in New England*. NSF LTER IV Grant (\$4.9 million). Co-Investigator.

2004. *Nutrient Analysis Equipment for Community, Ecosystem, Hydrological, and Physiological Research at Harvard Forest*. NSF DBI Multi-user Equipment Grant (\$59,640). Co-I with D. Foster, A. Ellison, and N.M. Holbrook.

2003. *Forest Response to the Decline of a Dominant Species: Ecosystem to Regional Analyses of the Impact of the Hemlock Woolly Adelgid on Northeastern Forests*. NSF Ecosystems Grant (\$400,000). Co-I with D.R. Foster and D.B. Kittredge.

2003. *Forest Response to the Decline of a Dominant Species: Ecosystem to Regional Analyses of the Impact of the Hemlock Woolly Adelgid on Northeastern Forests*. NSF Supplemental Grant (\$6,000). Co-I with D. Foster and D.B. Kittredge.

2001. *Forest Response to the Introduced Hemlock Woolly Adelgid: Development of Silvicultural*

*Guidelines.* USDA Focus Funding (\$35,000).

2000- 2006. The Dynamic New England Landscape: Interactions Among Disturbance, Environmental Change, and Ecosystem Pattern and Process. NSF LTER III Grant (\$4.2 million). Co-Investigator.

1998. *Community and Historical Ecology Collaborations for Undergraduates at the Harvard Forest LTER Site: Investigating Mechanisms for Forest Change.* NSF Supplemental Grant (\$15,000). Co-Investigator.

1997-1999. *Forest Ecosystem response to the introduced hemlock woolly adelgid in southern New England.* USDA (\$240,000). Co-I with D. Foster.

1996. *Community and historical ecology collaborations for undergraduates at the Harvard Forest LTER site: multi-scale analysis of vegetation dynamics.* NSF Supplemental Grant (\$27,982). Co-Investigator.

1991-1994. *Woody vegetation and fuel survey for evaluating wildfire hazard in three battlefields of the Fredericksburg National Military Park.* U.S. Department of Interior, National Park Service. (\$103,209). Research Assistant with M.D. Abrams.

## **Research Interests**

My research interests encompass various aspects of forest ecology and ecosystem science, with particular emphasis on dendroecology and the role of land use history and disturbance on forest composition and structure. My doctoral dissertation focused on the responses of co-occurring tree species to various disturbances and included studies of radial growth, ecophysiology, canopy recruitment, and successional dynamics of oak-pine forests in Virginia. I have examined the composition, structure, and radial growth dynamics in many old-growth forests, including northwestern and southeastern Pennsylvania, the southern Appalachians, the Shawangunk Mountains of New York, and Wachusett Mountain in Massachusetts. More recently, I have integrated stand, community, landscape, and ecosystem approaches in examining the ecological consequences of invasive insect pests in forests of southern New England. In addition, I have been the principal investigator of a large 35 ha plot at Harvard Forest, where every woody stem over 1 cm diameter at breast height, has been tagged, mapped, and measured twice (> 120,000 stems). With these studies, I expect to increase our understanding of forest dynamics and life history strategies in relation to natural and anthropogenic disturbances.

## **Ad-hoc Reviewer**

*Bulletin of the Torrey Botanical Society*

*Oikos*

*Canadian Journal of Forest Research*  
*Northern Journal of Applied Forestry*  
*Ecology*  
*The American Midland Naturalist*  
*Dendrochronologia*  
*Journal of Biogeography*  
*Ecological Applications*  
*Tree Physiology*

*Natural Areas Journal*  
*Journal of Ecology*  
*Biological Invasions*  
*Ecosphere*  
*Rhodora*  
*Forest Science*  
*Conservation Biology*  
*Ecohydrology*

**Subject matter editor** for *Northeastern Naturalist* 2014-present

## Refereed Publications and Technical Reports

1. Seischab, F.K. and **D. Orwig**. 1991. Catastrophic disturbances in the presettlement forests of western New York. *Bull. Torrey Bot. Club* 118:117-122.  
<https://doi.org/10.2307/2996851>
2. **Orwig, D.A.** and M.D. Abrams. 1993. Temperate forests of the eastern United States. *In* S.K. Majumdar, E.W. Miller, D.E. Baker, E.K Brown, J.R. Pratt, and R.F. Schmalz, eds., *Conservation and Resource Management*. Pennsylvania Academy of Science. pp. 97-116.
3. **Orwig, D.A.** and M.D. Abrams. 1994. Land-use history (1720 - 1992), composition, and dynamics of oak-pine forests within the Piedmont and Coastal Plain of northern Virginia. *Can. J. For. Res.* 24:1216-1225.  
<https://doi.org/10.1139/x94-160>
4. Mikan, C.J., **D.A. Orwig**, and M.D. Abrams. 1994. Composition, structure and successional dynamics of a pre-European settlement dry oak forest in southeastern Pennsylvania. *Bull. Torrey Bot. Club* 121:13-23.  
<http://dx.doi.org/10.2307/2996880>
5. **Orwig, D.A.** and M.D. Abrams. 1994. Contrasting radial growth and canopy recruitment patterns in *Liriodendron tulipifera* and *Nyssa sylvatica*: gap obligate versus gap-facultative tree species. *Can. J. For. Res.* 24:2141-2149.  
<https://doi.org/10.1139/x94-276>
6. Abrams, M.D. and **D.A. Orwig**. 1994. Temperate Hardwoods. *In* *Encyclopedia of Agricultural Sciences*. Academic Press, Inc. pp. 289-302.
7. Abrams, M.D., **D.A. Orwig**, and T. DeMeo. 1995. Dendroecology and

successional dynamics of a presettlement-origin white pine-mixed oak forest in the southern Appalachians. *Journal of Ecology* 83:123-133.

<http://dx.doi.org/10.2307/2261156>

8. Abrams, M.D. and **D.A. Orwig**. 1995. Community and radial growth dynamics of a 320 year-old pitch pine rock outcrop community in southeastern New York. *Oecologia* 101:353-360.  
[https://ui.adsabs.harvard.edu/link\\_gateway/1995Oecol.101..353A/doi:10.1007/BF00328822](https://ui.adsabs.harvard.edu/link_gateway/1995Oecol.101..353A/doi:10.1007/BF00328822)
9. **Orwig, D.A.** and M.D. Abrams. 1995. Dendroecological and ecophysiological analysis of gap environments in mixed-oak understories of northern Virginia. *Functional Ecology* 9:799-806. <http://dx.doi.org/10.2307/2389977>
10. Abrams, M.D. and **D.A. Orwig**. 1996. A review of dendroecology and successional dynamics of old-growth and second-growth oak and pine forests in the eastern United States. *Radiocarbon In: Tree rings, environment, and humanity* (eds. J.S. Dean, D.M. Meko, and T.W. Swetnam) *RADIOCARBON* 1996, pp. 343-352.
11. Abrams, M.D. and **D.A. Orwig**. 1996. A 300-year history of disturbance and canopy recruitment for co-occurring white pine and hemlock on the Allegheny Plateau, U.S.A. *Journal of Ecology* 84:353-363. <http://dx.doi.org/10.2307/2261198>
12. Foster, D.R., **D.A. Orwig**, and J.S. McLachlan. 1996. Ecological and conservation insights from reconstructive studies of temperate old-growth forests. *Trends in Ecology and Evolution* 11:419-424. [https://doi.org/10.1016/0169-5347\(96\)10047-1](https://doi.org/10.1016/0169-5347(96)10047-1)
13. Abrams, M.D., **D.A. Orwig**, and M.J. Dockry. 1997. Dendroecology and successional status of two contrasting old-growth oak forests in the Blue Ridge Mountains, U.S.A. *Can. J. For. Res.* 27:994-1002. <https://doi.org/10.1139/x97-042>
14. **Orwig, D.A.** and M.D. Abrams. 1997. Variation of radial growth responses to drought among species, site, and canopy strata. *Trees* 11:474-484.  
<http://dx.doi.org/10.1007/s004680050110>
15. **Orwig, D.A.** and D.R. Foster. 1998a. Forest response to the introduced hemlock woolly adelgid in southern New England, USA. *J. Torrey Bot. Soc.* 125:59-72.  
<http://dx.doi.org/10.2307/2997232>
16. **Orwig, D. A.** and D. R. Foster. 1998b. Ecosystem response to an imported pathogen: the hemlock woolly adelgid. *Arnoldia* 58: 41-44.

17. **Orwig, D.A.** and M.D. Abrams. 1999. Impacts of early selective logging on the dendroecology of an old-growth, bottomland hemlock-white pine-northern hardwood forest on the Allegheny Plateau. *J. Torrey Bot. Soc.* 126: 234-244. <https://doi.org/10.2307/2997278>
18. **Orwig, D.A.** and D.R. Foster. 2000. Stand, landscape, and ecosystem analyses of hemlock woolly adelgid outbreaks in southern New England: an overview. *In Sustainable Management of Hemlock Ecosystems in Eastern North America. Symposium Proceedings USDA GTR-NE 267.*
19. Yorks, T.E., J.C. Jenkins, D.J. Leopold, D.J. Raynal, and **D.A. Orwig**. 2000. Influences of eastern hemlock mortality on nutrient cycling. *In Sustainable Management of Hemlock Ecosystems in Eastern North America. Symposium Proceedings USDA GTR-NE 267.*
20. **Orwig, D.A.**, C.V. Cogbill, D.R. Foster, and J.F. O'Keefe. 2001. Variations in old-growth structure and definitions: Development and dynamics of forests on Wachusett Mountain, Massachusetts. *Ecological Applications* 11:437-452. <https://esajournals.onlinelibrary.wiley.com/doi/10.1890/1051-0761%282001%29011%5B0437%3AVIOGSA%5D2.0.CO%3B2>
21. Motzkin, G., **D.A. Orwig**, and D.R. Foster. 2002. History and dynamics of a ridgetop pitch pine community: Mount Everett, Massachusetts. Harvard Forest Paper Number 25.
22. **Orwig, D.A.** 2002a. Stand dynamics associated with chronic hemlock woolly adelgid infestations in southern New England. *In Proceedings: Hemlock Woolly Adelgid in the Eastern United States Symposium.* (eds. R.C. Reardon, B.P. Onken, and J. Lashomb) pp. 36-46. New Jersey Agricultural Experiment Station Publication, New Brunswick, NJ.
23. Orwig, D.A. and M.L. Kizlinski. 2002. Vegetation response following hemlock woolly adelgid infestation, hemlock decline, and hemlock salvage logging. *In Proceedings: Hemlock Woolly Adelgid in the Eastern United States Symposium.* (eds. R.C. Reardon, B.P. Onken, and J. Lashomb) pp. 106-117. New Jersey Agricultural Experiment Station Publication, New Brunswick, NJ.
24. **Orwig, D.A.** 2002b. Ecosystem to regional impacts of introduced pests and pathogens- historical context, questions, and issues. *Journal of Biogeography* 29:1471-1474. <https://doi.org/10.1046/j.1365-2699.2002.00787.x>

25. Cobb, R.C. and **D.A. Orwig**. 2002. Impact of hemlock woolly adelgid on decomposition: an overview. *In* Proceedings: Hemlock Woolly Adelgid in the Eastern United States Symposium. (eds. R.C. Reardon, B.P. Onken, and J. Lashomb) pp. 317-322. New Jersey Agricultural Experiment Station Publication, New Brunswick, NJ.
26. Foster, D.R., S. Clayden, **D.A. Orwig**, B. Hall, and S. Barry. 2002. Oak, chestnut and fire: climatic and cultural controls of long-term forest dynamics in New England, USA. *Journal of Biogeography* 29:1359-1379. <https://doi.org/10.1046/j.1365-2699.2002.00760.x>
27. **Orwig, D.A.**, D.R. Foster, and D.L. Mause. 2002. Landscape Patterns of Hemlock Decline in New England Due to the Introduced Hemlock Woolly Adelgid. *Journal of Biogeography* 29:1475-1487. <https://doi.org/10.1046/j.1365-2699.2002.00765.x>
28. Tingley, M.W., **D.A. Orwig**, G. Motzkin, D.R. Foster, and R. Field. 2002. Avian response to removal of a forest dominant: consequences of hemlock woolly adelgid infestations. *Journal of Biogeography* 29:1505-1516. <https://doi.org/10.1046/j.1365-2699.2002.00789.x>
29. Kizlinski, M.L., **D.A. Orwig**, R.C. Cobb, and D.R. Foster. 2002. Direct and indirect ecosystem consequences of an invasive pest on forests dominated by eastern hemlock. *Journal of Biogeography* 29:1489-1503. <https://doi.org/10.1046/j.1365-2699.2002.00766.x>
30. Motzkin, G., **D.A. Orwig**, and D.R. Foster. 2002. Vegetation and disturbance history of a rare dwarf pitch pine community on Mount Everett, Massachusetts. *Journal of Biogeography* 29:1455-1467. <https://doi.org/10.1046/j.1365-2699.2002.00764.x>
31. Foster, D. G. Motzkin, J. O'Keefe, E. Boose, **D. Orwig**, J. Fuller, and B. Hall. 2004. The environmental and human history of New England. *In* *Forests in Time: The environmental consequences of 1,000 years of change in New England*. Pp. 43-100. Yale University Press, New Haven, CT.
32. Foster, D., D. Kittredge, B. Donahue, G. Motzkin, **D. Orwig**, A. Ellison, B. Hall, B. Colburn, and A. D'Amato. 2005. *Wildlands and Woodlands: A vision for the forests of Massachusetts*. Harvard Forest, Petersham, MA.
33. Stadler, B. T. Müller, **D. Orwig**, and R. Cobb. 2005. Hemlock woolly adelgid in New England forests: canopy impacts transforming ecosystem processes and landscapes. *Ecosystems* 8: 233-247.



<https://link.springer.com/article/10.1007/s10021-003-0092-5>

34. **Orwig, D.A.** and D.B. Kittredge. 2005a. Silvicultural options for managing hemlock forests threatened by hemlock woolly adelgid. *In: Reardon, R. and B. Onken (Eds). Proceedings of the 3<sup>rd</sup> symposium on hemlock woolly adelgid in the eastern United States. USDA Forest Service, Newtown, PA. pp. 212-217.*
35. **Orwig, D.A.** and D.B. Kittredge. 2005b. Silvicultural options for managing hemlock forests threatened by hemlock woolly adelgid. Umass extension fact sheet. Amherst, MA.
36. Jefts, S. and **D. Orwig**. 2005. The effects of HWA outbreaks on ecosystem level changes in southern New England. *In: Reardon, R. and B. Onken (Eds). Proceedings of the 3<sup>rd</sup> symposium on hemlock woolly adelgid in the eastern United States. USDA Forest Service, Newtown, PA. pp. 305-306.*
37. Ellison, A.M., M.S. Bank, B.D. Clinton, E.A. Colburn, K. Elliott, C.R. Ford, D.R. Foster, B.D. Kloeppel, J.D. Knoepp, G.M. Lovett, J. Mohan, **D.A. Orwig**, N.L. Rodenhouse, W.V. Sobczak, K.A. Stinson, J.K. Stone, C.M. Swan, J. Thompson, B. Von Holle, and J.R. Webster. 2005. Loss of foundation species: consequences for the structure and dynamics of forested ecosystems. *Frontiers in Ecology and the Environment* 3(9):479-486.  
<https://esajournals.onlinelibrary.wiley.com/doi/full/10.1890/1540-9295%282005%29003%5B0479%3AALOFSCF%5D2.0.CO%3B2>
38. Foster, D.R. and **D.A. Orwig**. 2006. Pre-emptive and salvage harvesting of New England forests: when doing nothing is a viable alternative. *Conservation Biology* 20:959-970. <https://doi.org/10.1111/j.1523-1739.2006.00495.x>
39. Stadler, B., T. Muller, and **D. Orwig**. 2006. The ecology of energy and nutrient fluxes in hemlock forests invaded by the hemlock woolly adelgid. *Ecology* 87:1792-1804. <https://esajournals.onlinelibrary.wiley.com/doi/10.1890/0012-9658%282006%2987%5B1792%3ATEOEAN%5D2.0.CO%3B2>
40. Cobb, R.C, **D.A. Orwig**, and S. Currie. 2006. Decomposition of green foliage in eastern hemlock forests of southern New England impacted by hemlock woolly adelgid populations. *Canadian Journal of Forest Research* 36:1-11.  
<https://doi.org/10.1139/x06-012>
41. D'Amato, A.W., **D.A. Orwig**, and D.R. Foster. 2006. New estimates of Massachusetts old-growth forests: useful data for regional conservation and forest reserve planning. *Northeastern Naturalist* 13: 495-506.  
[https://doi.org/10.1656/1092-6194\(2006\)13\[495:NEOMOF\]2.0.CO;2](https://doi.org/10.1656/1092-6194(2006)13[495:NEOMOF]2.0.CO;2)

42. Pederson, N., A.W. D'Amato, and **D.A. Orwig**. 2006. Central hardwood natural history from dendrochronology: maximum ages of rarely studied species. *In* Proceedings: 15<sup>th</sup> Central Hardwood Forest Conference (eds. Buckley, D.S. and W.K. Clatterbuck). Knoxville, TN. USDA For. Serv. So. Res. Stn. Asheville, NC. pp. 695-701.
43. Preisser, E., A. Lodge, **D. Orwig**, and J. Elkinton. 2008. Range expansion and population dynamics of co-occurring invasive herbivores. *Biological Invasions* 10:201-213. <https://doi.org/10.1007/s10530-007-9123-z>
44. **Orwig, D.A.**, R.C. Cobb, A.W. D'Amato, M.L. Kizlinski, and D.R. Foster. 2008. Multi-year ecosystem response to hemlock woolly adelgid infestation in southern New England Forests. *Canadian Journal of Forest Research* 38:834-843. <https://doi.org/10.1139/X07-196>
45. D'Amato, A.W., and **D.A. Orwig**. 2008. Stand and landscape-level disturbance dynamics in old-growth forest ecosystems in western Massachusetts. *Ecological Monographs* 78: 507-522. <https://doi.org/10.1890/07-0593.1>
46. D'Amato, A.W., **D.A. Orwig**, and D.R. Foster. 2008. The influence of successional processes and disturbance dynamics on the structure of old-growth and second-growth *Tsuga canadensis* forests. *Ecological Applications* 18:1182-1199. <https://doi.org/10.1890/07-0919.1>
47. Cobb, R.C., and **D.A. Orwig**. 2008. Changes in decomposition dynamics in hemlock forests impacted by hemlock woolly adelgid: restoration and conservation of hemlock ecosystem function. *In* Proceedings: Fourth Symposium on hemlock woolly adelgid in the eastern United States (eds. B. Onken and R. Reardon). pp 157-167. USDA Forest Service, Morgantown, WV.
48. Rollinson, C.R. and **D.A. Orwig**. 2008. Evaluating chemical treatments of hemlock woolly adelgid in southern New England. *In* Proceedings: Fourth Symposium on hemlock woolly adelgid in the eastern United States (eds. B. Onken and R. Reardon). pp 293-300. USDA Forest Service, Morgantown, WV.
49. Smith, H.S. and **D.A. Orwig**. 2008. Influence of hemlock woolly adelgid and elongate hemlock scale on leaf-level physiological performance of eastern hemlock. *In* Proceedings: Fourth Symposium on hemlock woolly adelgid in the eastern United States (eds. B. Onken and R. Reardon). pp 308-316. USDA Forest Service, Morgantown, WV.

50. Miller-Pierce, M., E. Preisser, and **D. Orwig**. 2008. Interactions between invasive herbivores: *Adelges tsugae*, *Fiorinia externa*, and their impact on eastern hemlock growth and foliar chemistry. pp. 244-245 In B. Onken and R. Reardon [eds.], Fourth Symposium on Hemlock Woolly Adelgid in the Eastern United States. US Forest Service, Hartford, CT.
51. Dukes, J.S., J. Pontius, **D. Orwig**, J.R. Garnas, V.L. Rodgers, N. Brazee, B. Cooke, K.A. Theoharides, E.E. Stange, R. Harrington, J. Ehrenfeld, J. Gurevitch, M. Lerda, K. Stinson, R. Wick, and M. Ayres. 2009. Responses of insect pests, pathogens, and invasive plant species to climate change in the forests of Northeastern North America: What can we predict? *Canadian Journal of Forest Research* 39:1-18. <https://doi.org/10.1139/X08-171>
52. D'Amato, A.W., **D.A. Orwig**, and D.R. Foster. 2009. Understory Vegetation in Old-Growth and Second-Growth *Tsuga canadensis* Forests in Western Massachusetts. *Forest Ecology and Management* 257:1043-1052. <https://doi.org/10.1016/j.foreco.2008.11.003>
53. Motzkin, G., **D.A. Orwig**, and D.R. Foster. 2009. *Dwarf pitch pine communities in the Southern Taconics: Race Mountain, Bear Mountain, and "Hill 1914*. Harvard Forest Paper Number 29.
54. Albani, M., P.R. Moorcroft, A. M. Ellison, **D. A. Orwig** and D. R. Foster. 2010. Predicting the impact of hemlock woolly adelgid on carbon dynamics of Eastern U.S. forests. *Canadian Journal of Forest Research* 40:119-133. <https://doi.org/10.1139/X09-167>
55. Dodds, K.J., P. de Groot, and **D.A. Orwig**. 2010. The impact of *Sirex noctilio* in *Pinus resinosa* and *Pinus sylvestris* stands in north central North America. *Canadian Journal of Forest Research* 40:212-223. <https://doi.org/10.1139/X09-181>
56. Miller-Pierce, M.R., **D.A. Orwig** and E. Preisser. 2010. Effects of hemlock woolly adelgid and elongate hemlock scale on eastern hemlock growth and foliar chemistry. *Environmental Entomology* 39:513-519. <https://doi.org/10.1603/EN09298>
57. Ellison, A.M., A. Barker-Plotkin, D.R. Foster, and **D.A. Orwig**. 2010. Experimentally testing the role of foundation species in forests: The Harvard Forest Hemlock Removal Experiment. *Methods in Ecology and Evolution* 1:168-179. <https://doi.org/10.1111/j.2041-210X.2010.00025.x>
58. Foster, D., B. Donahue, D. Kittredge, K. Fallon Lambert, M. Hunter, B. Hall, L. Irland, R. Lileholm, **D. Orwig**, A. D'Amato, E. Colburn, J. Thompson, J. Levitt, A.

- Ellison, W. Keeton, J. Aber, C. Cogbill, C. Driscoll, and C. Hart. 2010. *Wildlands and Woodlands: A Vision for the New England Landscape*.
59. Orwig, D.A. 2011. Hemlock Woolly Adelgid. In *Encyclopedia of Biological Invasions* (eds. D. Simberloff and M. Rejmanek). Pp. 320-323. University of California Press, Berkeley and Los Angeles, CA.
60. Dodds, K.J. and **D.A. Orwig**. 2011. An invasive urban forest pest invades natural environments-Asian longhorned beetle in northeastern forests. *Canadian Journal of Forest Research* 41: 1729-1742. <https://doi.org/10.1139/x11-097>
61. Preisser, E.L., M.R. Miller-Pierce, J. Vansant, and **D. A. Orwig**. 2011. Declining eastern hemlock (*Tsuga canadensis*) regeneration in the presence of hemlock woolly adelgid (*Adelges tsugae*). *Canadian Journal of Forest Research* 41:2433-2439. <https://doi.org/10.1139/x11-155>
62. **Orwig, D.A.**, J. Thompson, N.A. Povak, M. Manner, D. Niebyl, and D.R. Foster. 2012. A foundation tree at the precipice: eastern hemlock health following the arrival of *Adelges tsugae* in central New England. *Ecosphere* 3(1):10. <http://dx.doi.org/10.1890/ES11-0277.1>
63. **Orwig, D.A.**, A. Barker-Plotkin, E. Davidson, H. Lux, K. Savage, and A.M. Ellison. 2013. Foundation species loss affects vegetation structure more than ecosystem function in a northeastern USA forest. *PeerJ* 1:e41 <http://dx.doi.org/10.7717/peerj.41>
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## Non-technical Reports and Abstracts

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### **Research Presentations (Talks and Posters)**

1991. Poster presented: Eighth Central Hardwood Forest Conference. The Pennsylvania State University, University Park, PA. "Effect of stand age on forest composition at Spotsylvania Battlefield, Virginia" D.A. Orwig and M.D. Abrams.
1992. Ecological Society of America. Honolulu, Hawaii. "Land-use history and successional status of mixed oak forests on the Piedmont and Coastal Plain of Virginia," D.A. Orwig and M.D. Abrams.
1994. International Conference on Tree Rings, Environment, and Humanity: Relationships and Processes. Tucson, Arizona. "Dendroecology and successional dynamics of old-growth oak and pine forests of the eastern United States," D.A. Orwig and M.D. Abrams.
1994. Poster presented: International Conference on Tree Rings, Environment, and Humanity: Relationships and Processes. Tucson, Arizona. "Dendroecological attributes relating to life history strategies of mixed oak forests of north-central Virginia," D.A. Orwig and M.D. Abrams.
1994. Poster presented: Ecological Society of America. Knoxville, Tennessee. "Contrasting radial growth and canopy recruitment patterns in *Liriodendron tulipifera* and *Nyssa sylvatica*: gap obligate versus gap-facultative tree species," D.A. Orwig and M.D. Abrams.
1996. Poster presented: Ecological Society of America. Providence, Rhode Island. "Forest ecosystem response to hemlock woolly adelgid outbreaks in southern New England," D.A. Orwig and D.R. Foster.

1997. Poster presented: Eastern U.S. Old-Growth Forests: Pattern, Process, Value, and Management. Clarion, PA. "Stand composition and vegetation dynamics of old-growth forests on Wachusett Mountain, Massachusetts," D.A. Orwig, D.R. Foster, and J. O'Keefe.

1998. Poster presented: Ecological Society of America. Baltimore, Maryland "Hemlock woolly adelgid damage in relation to hemlock distribution across southern New England landscapes," D.A. Orwig and D.R. Foster.

1999. Ecological Society of America. Spokane, Washington. "Landscape patterns of hemlock woolly adelgid damage in southern New England," D.A. Orwig, D.R. Foster and D.L. Mausel.

2000. Ecological Society of America. Snowbird, UT. "Ecosystem response to the removal of hemlock from southern New England forests," D.A. Orwig, R.C. Cobb, M.L. Kizlinski, S.J. Currie, and D.R. Foster.

2001. North American Forest Insect Work Conference. Edmonton, Alberta, Canada. "Ecosystem to Regional analyses of hemlock woolly adelgid outbreaks in southern New England."

2002. Hemlock Woolly Adelgid Symposium. East Brunswick, NJ. "Stand dynamics associated with chronic HWA infestations in southern New England."

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2002. Poster presented: Ecological Society of America. Tucson, AZ. "Vegetation and disturbance history of a rare dwarf pitch pine community on Mt. Everett, Massachusetts," G. Motzkin, D.A. Orwig, and D.R. Foster.

2003. North American Forest Ecology Workshop. Corvallis, OR. "Forest Response to the decline of a dominant species: ecosystem to regional analyses of hemlock woolly adelgid impacts in New England.

2004. Poster presented: Ecological Society of America. Portland, OR. "Assessing N Availability Through Multiple Resin Extractions Following the Onset of the Hemlock Woolly Adelgid", Sultana S Jefts and D.A. Orwig.

2004. Poster presented: Ecological Society of America. Portland, OR. "Landscape level analyses of hemlock woolly adelgid outbreaks in Massachusetts." D.A. Orwig and N. Povak.

2004. Poster presented: Ecological Society of America. Portland, OR and The 6<sup>th</sup> Annual Eastern Old-Growth Forest Conference, Moultonborough, NH. “Old-growth forest composition and structure within the Cold River Gorge, Massachusetts,” A. D’Amato and D.A. Orwig.
2005. 3<sup>rd</sup> symposium on hemlock woolly adelgid in the eastern United States. Asheville, NC. “Silvicultural options for managing hemlock forests threatened by hemlock woolly adelgid.” D.A. Orwig and D.B. Kittredge.
2005. Poster presented: 3<sup>rd</sup> symposium on hemlock woolly adelgid in the eastern United States. Asheville, NC. “The effects of HWA outbreaks on ecosystem level changes in southern New England.” S. Jefts and D.A. Orwig.
2005. Poster presented: Ecological Society of America. Montreal, Canada. “Changes in Ecosystem Response Associated with Hemlock Woolly Adelgid Infestation and Preemptive Logging in Southern New England,” H. Lux, D. Orwig, S. Jefts, and D.R. Foster.
2005. Poster presented: Ecological Society of America. Montreal, Canada. “Structure and Dynamics of *Tsuga canadensis*-dominated Old-Growth Forests in Western Massachusetts,” A. D’Amato and D.A. Orwig.
2006. Poster presented: 17th U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species. Annapolis, MD. “Adaptation during northern range expansion in the elongate hemlock scale *Fiorinia externa*,” E. Preisser, A. Lodge, D. Orwig, and J. Elkinton.
2006. Poster presented. Entomological Society of America Annual Meeting. Indianapolis, IN. “Northern range expansion of the invasive hemlock woolly adelgid and elongate hemlock scale,” E. Preisser, A. Lodge, D. Orwig, and J. Elkinton.
2006. Ecological Society of America, Memphis, TN. “Relationships between disturbance dynamics and forest structure in old-growth eastern hemlock forests,” A. D’Amato and D.A. Orwig.
2006. Ecological Society of America, Memphis, TN. “The direct and indirect effects of hemlock woolly adelgid infestation on eastern hemlock forests.”
2006. Ecological Society of America, Memphis, TN. “Range expansion and community impact of the invasive herbivores *Adelges tsugae* and *Fiorinia externa* in New England,” A. Lodge, E. Preisser, D. Orwig, and J. Elkinton.

2007. Poster presented: 18th U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species. Annapolis, MD “Production and Evaluation of Eastern Hemlocks (*Tsuga canadensis*) potentially resistant to the Hemlock Woolly Adelgid (*Adelges tsugae*),” T. Caswell, R. Casagrande, E. Preisser, B. Maynard, D. Orwig, and J. Elkinton.

2007. Poster presented: 18th U.S. Department of Agriculture interagency research forum on gypsy moth and other invasive species. Annapolis, MD. “Interactions between the invasive hemlock woolly adelgid and elongate hemlock scale during northern range expansion,” E. Preisser, A. Lodge, D. Orwig, and J. Elkinton.

2007. Ecological Society of America, San Jose, CA. “Range expansion and population dynamics of co-occurring invasive herbivores,” E. Preisser, A. Lodge, D. Orwig, and J. Elkinton.

2007. Invited Talk, Virginia Polytechnic University, Blacksburg, VA. “Two decades of hemlock woolly adelgid impacts on southern New England Forests.”

2007. Invited Talk, Connecticut Forest Conservation and Forest Science Forum, Storrs, CT. “Silvicultural options for managing hemlock forests.”

2008. Fourth Hemlock Woolly Adelgid Symposium, Hartford, CT. “Ecological and management implications of hemlock logging in Massachusetts.”

2008. Poster presented: Fourth Hemlock Woolly Adelgid Symposium, Hartford, CT. “Interactions between invasive herbivores *Adelges tsugae* and *Fiorinia externa*, and their impact on eastern hemlock growth and foliar chemistry.” M. Miller-Pierce, D.A. Orwig and E. Preisser.

2008. Poster presented: Fourth Hemlock Woolly Adelgid Symposium, Hartford, CT. “Evaluating chemical treatments of hemlock woolly adelgid in southern New England.” C. Rollinson and D.A. Orwig.

2008. Poster presented: Fourth Hemlock Woolly Adelgid Symposium, Hartford, CT. “Influence of hemlock woolly adelgid and elongate hemlock scale on leaf-level physiological performance of eastern hemlock.” H. Smith and D.A. Orwig. (poster won 2<sup>nd</sup> prize).

2008. New England Society of American Foresters Annual Meeting, Saratoga Springs, NY. “Forest management with hemlock woolly adelgid.”



2008. Invited talk, University of Massachusetts Natural Resources Conservation Seminar, Amherst, MA. “Hemlock woolly adelgid in New England: what has this pest really done to our forests?”

2008. Invited talk, Eastern Kentucky University, Richmond, KY. “The chronic impacts of hemlock woolly adelgid infestation on eastern hemlock forests.”

2008. Invited talk, Eastern Kentucky University, Richmond, KY. “Ecosystem impacts resulting from the demise of a foundation species in New England.”

2008. Poster presented: Eastern CANUSA Forest Science Conference, Orono, ME. “Effects of *Sirex noctilio* in Pine Stands and Silvicultural Options to Reduce its Impact,” with K. Dodds, R. Cooke, G. Dubois, P. de Groot, and D.A. Orwig.

2009. Paper presented: Southern Forest Insect Work Conference. Gulfport, MS. “Stand level impacts of *Sirex noctilio* in the northeastern U.S. and southern Ontario.” K.J. Dodds, P. de Groot, and D.A. Orwig.

2009. Poster presented: Ecological Society of America, Albuquerque, NM. “Long-term Forest Dynamics Resulting From Chronic Hemlock Woolly Adelgid.” R. Ribbons and D.A. Orwig.

2009. Poster presented: Ecological Society of America, Albuquerque, NM. “The interactions between two invasive herbivores and their influence on eastern hemlock foliar chemistry and subsequent competitive mechanisms.” M.R. Miller-Pierce, D.A. Orwig, and E. Preisser.

2009. Poster presented: American Geophysical Union, San Francisco, CA. “Long-term changes in calcium (Ca) sources in a base-poor forest ecosystem: insight from stable Ca-isotopes in tree rings.” J. Farkas, A. Dejeant, D. A. Orwig, and S. B. Jacobsen.

2010. Poster presented: 21st U.S. Department of Agriculture interagency research forum on invasive species. Annapolis, MD. “Asian long-horned beetle behavior in forests of Worcester, MA.” K.J. Dodds and D.A. Orwig.

2010. Keynote Speaker. New England Regional Society of American Foresters Meeting, Nashua, NH. “New England Forests in Transition: How Humans, Pests, and Climate Shape Forest Dynamics.”

2010. Invited talk and webinar, United States Fish and Wildlife Service, Hadley, MA. “Hemlock woolly adelgid in eastern forests: long-term trends, biological and chemical control, and recommended best management practices.”

2010. Poster presented: Ecological Society of America, Pittsburgh, PA. “Tracking forest change, guiding forest management: stewardship science in the Wildlands and Woodlands of New England.” D. Orwig, D. Foster, B. Hall, E. Boose, A. D’Amato, E. Faison, C. Hart, M. Kelty, G. Motzkin, J. Pallant, E. Silver, J. Thompson, and R. Van de Poll.

2010. Invited talk: Ecological Society of America, Pittsburgh, PA. “Overview of eastern dendroecology and new directions.”

2010. Land Trust Alliance’s Rally 2010: The National Land Conservation Conference, Hartford, CT. “Harnessing conserved land for science and adaptive management.”

2011. Invited talk: Massachusetts Audubon Society, Princeton, MA. “Old-growth forest monitoring on Wachusett Mountain.”

2011. Invited talk: Keystone Cooperators Outreach Workshop, Petersham, MA. “New England Forest Pests: Life History, Range, and How to Identify Them.”

2011. Invited talk: Ecological Landscaping Association, Boston, MA. “New England Trees in Decline & Successful Treatment Options.”

2011. Invited talk: Holy Cross Environmental Studies Lecture, Worcester, MA. “The impacts of the Asian longhorned beetle on forests of Worcester, MA.”

2011. Poster presented: American Geophysical Union Annual Meeting, San Francisco, CA. “Evaluating the influence of disturbance and climate on red spruce (*Picea rubens* Sarg.) at its southern continuous range margin using dendrochronology.” R. Ribbons, M. Kelty, N. Pederson, and D. Orwig.

2012. Posters presented: Massachusetts Forest Landowners Association, West Brookfield, MA. “Pest threats to Massachusetts Forests-2011 update -1&2.” D. Orwig and J. O’Keefe.

2012. Invited talk: Harvard University Museum of Natural History Lecture Series. “Forest Invaders: How invasive species are reshaping the wooded landscape of New England.” D. Orwig and D. Foster.

2012. American Geophysical Union Annual Meeting, San Francisco, CA. “A black swan and sub-continental scale dynamics in humid, late-holocene broadleaf forests.” N. Pederson, J. M. Dyer, R. W. McEwan, A. Hessler, C. Mock, D.A. Orwig, H. Reider, and B. Cook.

2013. Poster presented: Ecological Society of America, Minneapolis, MN. “The impact

of co-occurring invasive insects on eastern hemlock health and chemistry.” Waiqui, V.A., J.N. Brokaw, E.L. Preisser, and D.A. Orwig.

2013. PAGES meeting, Goa, India. “Regional-scale dynamics in humid, late Holocene broadleaf forests.” N. Pederson, J. M. Dyer, R. W. McEwan, A. Hessler, C. Mock, D.A. Orwig, H. Reider, and B. Cook.

2013. Invited lecture: University of Massachusetts, Amherst. “New England Invasive Forest Pests: Critical threats to our region.”

2013. Invited talk: Keystone Cooperators Meeting, Petersham, MA. “New England Forest Pests: Their impacts and the role of citizen science.”

2013. Invited talk: Plymouth State University. “Eastern hemlock at the precipice: stand and landscape dynamics after the arrival of hemlock woolly adelgid in New England.”

2013. New England Natural History Conference, Springfield, MA. “Landscape –Level Impact of Hemlock Woolly Adelgid on Forest Structure and Composition.”

2014. Ninth International Conference on Dendrochronology, Melbourne, Australia. “Deeper Time, Deeper Dynamics: Tree-ring Insights Across a Humid, Temperate, Broadleaf Region.” Pederson, N., A. Bell, B. Cook, E. Cook, N. Devineni, J. Dyer, K. Eggleston, A. Hessler, U. Lall, R. McEwan, C. Mock, D. Orwig, H. Rieder, R. Seager, and K. Vranes.

2014. Poster presented: Entomological Society of America, Eastern Branch Annual Meeting, Williamsburg, VA. “The effect of hemlock woolly adelgid infestation on eastern hemlock foliar and fine root bacterial abundance.” J. Vendettuoli, E.L. Preisser, D. Orwig, and J. Krumins.

2014. New England Natural History Conference, Springfield, MA. “Imperiled Old-Growth Hemlock Stands of southern New England.”

2014. Invited talk: Harvard University Life Sciences Outreach Program. “Hemlock woolly adelgid impacts on forest ecosystems: how to incorporate into a high school curriculum.”

2014. Invited talk: Tufts University “Forest Dynamics on a Grand Scale: the Harvard Forest Global Earth Observatory Plot.”

2014. Poster presented: American Geophysical Union Annual Meeting, San Francisco, CA. “Comparison of stem map developed from crown geometry allometry linked census

data to airborne and terrestrial lidar at Harvard Forest, MA.” Franklin Sullivan, Michael Palace, Mark Ducey, David Orwig, Bruce Cook, Lucie Lepine.

2014. Invited talk: American Geophysical Union Annual Meeting, San Francisco, CA. “A Long Term View of Forest Response to Environmental Change: 25 Years of Studying Harvard Forest.” J. Munger, Steven Wofsy, Jakob Lindaas, David Foster, and David Orwig.

2015. Poster presented: Harvard Forest Annual Symposium, Petersham, MA. “Long-term structural dynamics of virgin *Tsuga canadensis*-*Pinus strobus* forests on the Harvard Tract, Pisgah, NH. A.W. D’Amato, D.A. Orwig, D.R. Foster, A. A. Barker Plotkin, and P.K. Schoonmaker.

2015. Poster presented: Ecological Society of America, Baltimore, MD. “Initial census, composition, and spatial patterns within the 35 ha ForestGEO plot at Harvard Forest.” D.A. Orwig, J.A. Aylward, H.L. Buckley, B.S. Case and A.E. Ellison.

2015. Poster presented: Ecological Society of America, Baltimore, MD. “Impact of the hemlock woolly adelgid and plant defenses on a native defoliator.” C.M. Wilson, J.F. Vendettuoli, D.A. Orwig, and E.L. Preisser.

2015. Ecological Society of America, Baltimore, MD. “Evidence of synchronous extreme disturbance at regional to subcontinental scales in a largely asynchronous system.” N. Pederson, J.M. Dyer, A.E. Hessler, D. Martin-Benito, R.W. McEwan, C. Mock, D.A. Orwig, H.E. Rieder, B.I. Cook, and D. Bishop.

2016. Invited talk: New England Society of American Foresters Winter Meeting, Sturbridge, MA. “Forest disturbance and water quality: considerations for managers.”

2016. Poster presented: European Geosciences Union General Assembly, Vienna, Austria. “Differential response by hardwood and deciduous stands in New England forests to climate change and insect-induced mortality.” W. Munger, S.C. Wofsy, D. Orwig, and C. Williams.

2016. Invited talk: Ecological Society of America, Fort Lauderdale, FL. “Belowground consequences of *Adelges tsugae* invasion in eastern forests.”

2017. Invited talk: Invasive Insect Certification Program: For Landscape, Nursery, and Urban Forest Pests, Hadley, MA. “The impacts and costs of invasive insects in the United States, with a focus on Massachusetts.”

2017. Invited talk: Invasive Insect Certification Program: For Landscape, Nursery, and

Urban Forest Pests, Hadley, MA. “Hemlock woolly adelgid and its impacts on forests in Massachusetts and New England.”

2017. Invited speaker: The Terrestrial Laser Scanning Revolution in Ecology: A Royal Society Theo Murphy Scientific Meeting, Buckinghamshire, UK. “Ecological Change measurement using TLS at Harvard Forest, MA, USA.”

2017. Poster presented: The Terrestrial Laser Scanning Revolution in Ecology: A Royal Society Theo Murphy Scientific Meeting, Buckinghamshire, UK. “Characterizing the impact of an invasive pest with Lidar in Harvard Forest, MA, USA.” P. Boucher, I. Paynter, E. Saenz, F. Peri, C. Schaaf, and D.A. Orwig.

2017. Poster presented: Harvard Forest Annual Ecology Symposium, Petersham, MA. “Monitoring a forest restructured by an invasive insect.” P. Boucher, I. Paynter, E. Saenz, F. Peri, C. Schaaf, and D.A. Orwig.

2017. Poster presented: Association of American Geographers annual meeting, Boston MA. “The Spatial Distribution of Mortality Brought On by an Invasive Pest.” P. Boucher, I. Paynter, E. Saenz, F. Peri, C. Schaaf, and D.A. Orwig.

2017. Poster presented: Association of American Geographers annual meeting, Boston MA. “Defining Hemlock Undergrowth at Harvard Forest.” M. Wieringa, D.A. Orwig, and N. Pederson.

2017. Poster presented: Silvilaser 2017 meeting, Blacksburg, VA. “Monitoring the Impacts of an Invasive Insect on a Temperate Mixed Forest with the Metaproperties of Terrestrial Lidar Scans.” P. Boucher, I. Paynter, Z. Li, E. Saenz, F. Peri, C. Schaaf, and D.A. Orwig.

2017. Silvilaser 2017 meeting, Blacksburg, VA. “Virtual tree volume and aboveground biomass retrieval from TLS calibrated by destructive sampling at Harvard Forest A. Strahler, C. Schaaf, D. Orwig, A. Barker-Plotkin, J. Frank, A. Weiskittel, D. MacFarlane, and P. Radtke.

2017. Silvilaser 2017 meeting, Blacksburg, VA. “Detailed measurements of felled trees at Harvard Forest for developing and testing TLS volume and biomass algorithms and estimators. P. Radtke, J. Frank, A. Weiskittel, D. MacFarlane, S. Clark, G. Dettman, A. Strahler, C. Schaaf, D. Orwig, and A. Barker-Plotkin.

2017. Fall Meeting, AGU, New Orleans, LA, 11-15 Dec. “Progressive Decline in Photosynthetic Uptake Capacity in a Hemlock Stand Infested by Hemlock Woolly Adelgid (B54B-03).” J.W. Munger, D. Orwig, A. Barker-Plotkin, and C. Schaaf.

2017. Poster presented: Fall Meeting, AGU, New Orleans, LA, 11-15 Dec. “Effects of different types of moderate severity disturbance on forest structural complexity and ecosystem functioning: A story of ice and fire (B51E-1847). R. T. Fahey, J. Atkins, C.M. Gough, B.S. Hardiman, L. Haber, E. Stuart-Haentjens, D. Orwig, J.L. Campbell, L. Rustad, and M. Duffy.
2018. Invited talk, Holy Cross University, Schaeffer Family Lecture Series, Worcester, MA. “New England Invasive Forest Pests: Critical Threats and Staggering Costs for Our Region.”
2018. Invited talk, University of Montreal at Quebec. “Eastern hemlock at the precipice: stand, landscape, and ecosystem dynamics following hemlock woolly adelgid arrival in New England.”
2018. Poster presented: Harvard Forest Annual Ecology Symposium, Petersham, MA. “Modeling Tree Volume with a Lightweight, Rapid-Scanning Terrestrial Lidar Scanner.” P. Boucher, C. Schaaf, F. Peri, D.A. Orwig, A. Barker-Plotkin, A. Strahler, Z. Li, P. Radtke, I. Paynter, and P. Raunonen.
2018. Poster presented: Ecological Society of America, New Orleans, LA. “Relating forest health to structure with waveform lidar data.” P.B. Boucher, S. Hancock, K. Krause, B. Cook, D.A. Orwig, Z. Li, F. Peri, I. Paynter and C.B. Schaaf.
2019. Poster presented: Terrestrial Laser Scanning in Forest Ecology: Expanding the Horizon, Ghent, Belgium. “A field experiment using destructive sampling to validate TLS retrievals of leaf area, tree volume, and aboveground biomass at Harvard Forest.” A. Strahler, C. Schaaf, D. Orwig, A. Barker-Plotkin, J. Frank, D. MacFarlane, and P. Radtke.
2019. Poster presented: Terrestrial Laser Scanning in Forest Ecology: Expanding the Horizon, Ghent, Belgium. “Exploring Forests with Terrestrial Lidar: Adapting Forest Inventory.” P. Boucher, I. Paynter, D.A. Orwig, and C. Schaaf.
2019. Poster presented: Terrestrial Laser Scanning in Forest Ecology: Expanding the Horizon, Ghent, Belgium. “Infestation monitoring and science communication with lidar scanners at Harvard Forest.” A. Elmes, P. Boucher, D. Orwig, F. Peri, and C. Schaaf.
2019. Poster presented: Ecological Society of America, Louisville, KY. “Advances in Terrestrial Lidar Scanning of Forest Canopy Structure.” C. Schaaf, P. Boucher, A. Strahler, D. Orwig, I. Paynter, Z. Li, A. Elmes, F. Peri, and M. Disney.

2019. Poster presented: Fall Meeting, AGU, San Francisco, CA. “The potential for the detection of the hemlock woolly adelgid infestation from space.” P.B. Boucher, S. Hancock, D.A. Orwig, L. Duncanson, J. Armston, B. Cook, K. Krause, A. Elmes, F. Peri, Z. Li, I. Paynter, and C.B. Schaaf.

2021. Poster presented: Ecological Society of America virtual meeting, “High rainfall is a potential driver of regional hemlock woolly adelgid decline in the northeastern U.S.” J.L. Chandler, J.S. Elkinton, and D.A. Orwig.

2022. Invited talk, East Quabbin Land Trust, Barre, MA. “Celebrating the woods in your backyard.”

### **Ph.D. Students**

Anthony D’Amato	University of Massachusetts	2007
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### **Ph.D. Committees**

Neil Pederson	Columbia University	2005
Kenn Clark	University of Massachusetts	2010
Poliana Raymer	Boston University	2012
Peter Boucher	University of Massachusetts, Boston	2020

### **Master’s Students**

Matthew Kizlinski	Harvard University	2002
Aaron Kimple	Bard College	2003
Sarah Parker	Antioch University	2004
David Kay	Antioch University	2004
Richard Schulhof	Harvard University	2007
Diane Torres	Antioch University	2007
Doug Williams	Antioch University	2007
Mailea Miller-Pierce	University of Rhode Island	2010

Relena Ribbons	University of Massachusetts	2011
Jason Aylward	University of Massachusetts	2016
Ryan Crandall	University of Massachusetts	2019