

## Matthew Vernon Thompson

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### A. Positions

#### *Degrees held:*

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|----------------------------|--|
| Ph. D., Biology            | November, 2002, Department of Organismic and Evolutionary Biology, Harvard University, Cambridge, Massachusetts. Dissertation title: “Hydraulic resistance and long-distance transport in the phloem tissue of plants” |
| B. S., Biological Sciences | June, 1994, Department of Biological Sciences, Stanford University, Stanford, California   |

#### *Interests:*

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|--------------------------------------|---|
| Phloem and whole-plant vasculature   | Dynamics of phloem transport in complex canopies – potassium recirculation between xylem and phloem – scaling of local measurements of plant vasculature to whole-plant processes – non-steady-state mathematical models of multi-solute phloem transport |
| Developmental biomechanics in plants | The root waving phenotype of <i>Arabidopsis thaliana</i> – tissue-level transduction of genetic networks during plant morphogenesis – the emergence of shape (cotyledon development, heart-stage) early in dicot embryogenesis                            |
| Ecophysiology of drought tolerance   | Salt tolerance of the Chilean Atacama desert perennial <i>Nolana mollis</i> (Solanaceae) – micrometeorology of this plant in its local habitat – the use of potassium salt excretion via salt glands to regulate transpirative water loss                 |

***Present position:***

- September, 2002, to August, 2003      **CORE Fellowship**, an advanced lectureship and postdoctoral position at Harvard University, in conjunction with the Holbrook Laboratory and the Dept. of Organismic and Evolutionary Biology. Courses taught:
- Instructor**, Fall, 2002 – **Biology 188r**, “**The History of Biological Form**”, a reading course for advanced undergraduates on the historical, methodological, and conceptual problems relating to morphogenesis.
- Science B-46, “Molecular Biology and the Structure of Life” (on teaching staff for George M. Whitesides, [gwhitesides@gmwgroup.harvard.edu](mailto:gwhitesides@gmwgroup.harvard.edu)).
- Science B-40, “The Biology of Trees and Forests” (head teaching fellow for Donald H. Pfister, [dpfister@oeb.harvard.edu](mailto:dpfister@oeb.harvard.edu)).

***Honors received:***

- May, 2002      Derek Bok Center, Harvard University, Award for Excellence in Teaching for work in Science B-16, “The History of Life”, under Stephen J. Gould.
- May, 1999      Nominated Joseph R. Levenson Memorial Teaching Prize by the Harvard-Radcliffe Undergraduate Council, for work in the Core Course, Science B-16, “The History of Life”, under Stephen J. Gould.
- May, 1998      Derek Bok Center, Harvard University, Award for Excellence in Teaching for work in Bio 19, “Ecology”, under William Bossert.
- September, 1995      Outstanding poster award at the First Annual IGBP GAIM Science Conference, Garmisch-Partenkirchen, Germany.
- June, 1994      Firestone Medal for outstanding undergraduate honors thesis in Biological Sciences, Stanford University.

**B. Experience*****Research Experience:***

- October, 2002, to present      Postdoctoral fellow in the Department of Organismic and Evolutionary Biology, Harvard University, laboratory of N. Michele (Missy) Holbrook, funded by the Core program, Harvard University
- June, 1996, to October, 2002      Graduate student in the Department of Organismic and Evolutionary Biology, Harvard University, laboratory of N. Michele (Missy) Holbrook ([holbrook@oeb.harvard.edu](mailto:holbrook@oeb.harvard.edu)).
- June, 1994, to September, 1996      Programmer of CASA biosphere model, under Harold A. Mooney ([hmooney@jasper.stanford.edu](mailto:hmooney@jasper.stanford.edu)) at Stanford University, Department of Biological Sciences, and Christopher B. Field ([chris@jasper.stanford.edu](mailto:chris@jasper.stanford.edu)) at the Carnegie Institution of Washington, Department of Plant Biology, Stanford, California.
- Spring/Summer 1993      Field work on Hawaiian Islands on nutrient cycling in montane rain forests, under Peter M. Vitousek ([vitousek@leland.stanford.edu](mailto:vitousek@leland.stanford.edu)), Stanford University, Dept. of Biological Sciences (led to establishment of honors thesis topic).

**Teaching Experience:**

Fall/Spring, 2002-2003	<b>CORE Fellow</b> , Harvard University, see above. Received <i>Certificate of Distinction in Teaching</i> from the Derek Bok Center for Teaching and Learning and the Office of the Dean of Undergraduate Education, May, 2003.
Spring, 2001-2002	Teaching fellow, Science B-16, "The History of Life," Harvard University, Prof. Stephen J. Gould. Received <i>Certificate of Distinction in Teaching</i> from the Derek Bok Center for Teaching and Learning and the Office of the Dean of Undergraduate Education, September, 2002.
Fall, 1999, to Summer, 2001	Non-resident tutor in Life Sciences at Mather House, Harvard University.
Spring, 2000-2001	Teaching fellow, Science B-16, "The History of Life," Harvard University, Prof. Stephen J. Gould.
Spring, 1998-1999	Teaching fellow, Science B-16, "The History of Life," Harvard University, Stephen J. Gould, Nominated Joseph R. Levenson Memorial Teaching Prize.
Fall, 1998-1999	Teaching fellow, BS 2, "Organismic and Evolutionary Biology," Harvard University, Prof. Otto Solbrig.
Spring, 1997-1998	Teaching fellow, Bio 19, "Ecology," Harvard University, Prof. William Bossert, Received <i>Certificate of Distinction in Teaching</i> from the Derek Bok Center for Teaching and Learning and the Office of the Dean of Undergraduate Education, September, 1998.
Fall, 1997-1998	Teaching fellow, Bio 120, "Plant Physiology," Harvard University, Prof. N. M. Holbrook.
Fall, 1996-1997	Teaching fellow, BS 2, "Organismic and Evolutionary Biology," Harvard University, Prof. Otto Solbrig.
Spring, 1993-1994	Teaching assistant, Bio 33, "Plant Biology and Ecology," Stanford University, Prof. Peter Vitousek.

**Certifications Held:**

February, 1996, to present	Private Pilot, Single-Engine Land aircraft.
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**Languages Spoken:** Spanish (fluent) and German (some reading proficiency)

**Other Academic Activities:**

1999-2000	<b>Founded and Organized</b> OEB Graduate Student Seminar Series.
1997-1998 and 1998-1999	Graduate Student Representative to the Faculty of the Department of Organismic and Evolutionary.

**Personal Interests:**

Marathon running

## C. Grants and Fellowships

- July, 2000, to July, 2002      Stipend paid from work on wavy root phenotype of *Arabidopsis thaliana*, National Aeronautics and Space Administration Grant 99-HEDS-02/03-168, “Biomechanics of *Arabidopsis thaliana* wavy root development” under N. Michele Holbrook, PI.
- July, 1999, to June, 2001      Chilean research work funded by the National Science Foundation Grant INT-9901329, “Dissertation Research: Making Dew in the Atacama: Extreme Drought Tolerance and Salt Utilization of *Nolana flaccida* (Solanaceae)” under N. Michele Holbrook, PI, Doctoral Dissertation Improvement Grant.
- 1996-1999                      National Science Foundation Graduate Student Fellowship Recipient.

## D. Publications (published, in press, submitted, or in preparation)

**Published:**

- Thompson, M. V. and N. M. Holbrook. 2003. Application of a single-solute non-steady-state phloem model to the study of long-distance assimilate transport. *Journal of Theoretical Biology* **220**:419-455.
- Thompson, M. V. and J. T. Randerson. 1999. Pulse response functions of terrestrial carbon models: method and application. *Global Change Biol.* **5**: 371-394.
- Thompson, M. V. and P. M. Vitousek. 1997. Asymbiotic nitrogen fixation and litter decomposition on a long soil-age gradient in Hawaiian montane rain forest. *Biotropica* **29**:134-144.
- Thompson, M. V., J. T. Randerson, C. M. Malmström and C. B. Field. 1996. Change in net primary production and heterotrophic respiration: how much is necessary to sustain the terrestrial carbon sink? *Global Biogeochem. Cycles* **10**: 711-726.
- Field, C. B., Y. Luo, C. M. Malmström, J. T. Randerson, A. Ruimy and M. V. Thompson. 1996. VEMAP: model shootout at the sub-continental corral. *Trends in Ecology and Evolution* **11**: 313-314.
- Fung, I. Y., C. B. Field, J. A. Berry, M. V. Thompson, J. T. Randerson, C. M. Malmström, P. M. Vitousek, G. J. Collatz, P. J. Sellers, D. A. Randall, A. S. Denning, F. Badeck and J. John. 1997. Carbon-13 exchanges between the atmosphere and biosphere. *Global Biogeochem. Cycles* **11**: 507-533.
- Malmström, C. M., M. V. Thompson, G. P. Juday, S. O. Los, J. T. Randerson and C. B. Field. 1997. Interannual variation in global-scale net primary production: testing model estimates. *Global Biogeochem. Cycles* **11**: 367-392.
- Randerson, J. T., M. V. Thompson, and C. B. Field. 1999. Linking <sup>13</sup>C-based estimates of land and ocean sinks with predictions of carbon storage from CO<sub>2</sub> fertilization of plant growth. *Tellus* **51B**: 668-678.
- Randerson, J. T., M. V. Thompson, T. J. Conway, I. Y. Fung and C. B. Field. 1997. The contribution of terrestrial sources and sinks to trends in the seasonal cycle of atmospheric carbon dioxide. *Global Biogeochem. Cycles* **11**: 535-560.
- Randerson, J. T., M. V. Thompson, C. M. Malmström, C. B. Field and I. Y. Fung. 1996. Substrate limitations for heterotrophs: implications for models that estimate the seasonal cycles of atmospheric CO<sub>2</sub>. *Global Biogeochem. Cycles* **10**: 585-602.
- Zwieniecki, M. A., L. Hutyra, M. V. Thompson and N. M. Holbrook. 2000. Dynamic changes in petiole specific conductivity in red maple (*Acer rubrum* L.), tulip tree (*Liriodendron tulipifera* L.) and northern fox grape (*Vitis labrusca* L.). *Plant Cell Environ* **23**: 407-414.

***In press:***

- Thompson, M. V., and N. M. Holbrook. Scaling phloem transport: Water potential equilibrium and osmoregulatory flow. *Plant, Cell and Environment*, in press.
- Thompson, M. V., B. Palma, J. T. Knowles and N. M. Holbrook. 2003. Climate and perennial plant distribution in Parque Nacional Pan de Azúcar, Atacama desert, Chile. *Revista Chilena de Historia Natural*, **76**: 163-182.
- Zwieniecki, M. A., M. V. Thompson and N. M. Holbrook. Understanding the hydraulics of porous pipes – tradeoffs between water uptake and root length utilization. *Journal of Experimental Botany*, in press.

***Submitted:***

- Thompson, M. V., and N. M. Holbrook. Scaling phloem transport: “Information” transmission and response to change. *Plant, Cell and Environment*, submitted.

***In preparation:***

- Thompson, M. V., and N. M. Holbrook. Mechanical buckling and root waving in *Arabidopsis thaliana*.
- Thompson, M. V. A “real” biology: biological systems as supergenomic and multiply contingent.
- Thompson, M. V., and N. M. Holbrook. The temporal dynamics and regulation of multi-solute phloem transport.
- Thompson, M. V., and N. M. Holbrook. Sieve plate anatomy and long-distance transport in the phloem.
- Thompson, M. V., and N. M. Holbrook. Sieve tube wall elasticity.

**E. Presentations**

- Thompson, M. V. “The integrated control of xylem and phloem transport by potassium recirculation.” Guest lecturer for Prof. Scott Gleeson, Department of Biology, University of Kentucky, March 31, 2003, for the course Biology 575 “Plant Anatomy and Morphology.”
- Thompson, M. V., and M. A. Zwieniecki. Hydraulic resistance and potassium recirculation in plants. Talk, Workshop on the integration of long-distance transport processes in plants, Harvard Forest, Petersham, Massachusetts, October 10-12, 2002.
- Thompson, M. V., and N. M. Holbrook. Mechanical buckling and root waving in *A. thaliana*. Poster presentation, Botanical Society of America (BSA), Madison, Wisconsin, August, 2002.
- Thompson, M. V., M. A. Zwieniecki, P. J. Melcher, and N. M. Holbrook. The potential biophysical role of potassium in phloem transport. Oral presentation, Ecological Society of America (ESA), Madison, Wisconsin, August, 2001.
- Thompson, M. V. *Nolana mollis* in the Atacama desert of Chile. Oral presentation, Arnold Arboretum, Jamaica Plain, Massachusetts, August, 2000.
- Thompson, M. V., N. M. Holbrook, M. A. Zwieniecki, and L. Mahadevan. The biomechanical basis of root waving in *Arabidopsis thaliana*. Poster presentation, International Botanical Congress (IBC), St. Louis, Missouri, August, 1999.
- Thompson, M. V., N. M. Holbrook, B. Palma, P. W. Rundel, H. A. Mooney, and J. Ehleringer. Unusually high NaCl concentrations observed in the xylem sap of the northern Chilean desert shrub *Nolana mollis*. Oral presentation, Ecological Society of America (ESA) Annual Meeting, Baltimore, Maryland, August, 1998.
- Thompson, M. V., and J. T. Randerson. The pulse-cohort simplification of carbon biogeochemistry models. Oral presentation, American Geophysical Union (AGU) Fall Meeting, San Francisco, California, December, 1996.
- Thompson, M. V., J. T. Randerson, C. M. Malmström, and C. B. Field. Change in net primary production and heterotrophic respiration: how much is necessary to sustain the terrestrial carbon sink? Poster presentation, First GAIM Meeting, Garmisch-Partenkirchen, Germany, September, 1995.

## F. Society Membership and Activity

Ecological Society of America, since June, 1997.

Botanical Society of America, since July, 1997.

American Society of Plant Biologists, since September, 2001.

## G. Evaluators

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