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UNIVERSITY of ARKANSAS

Eumycetozoa of the Big Thicket National Preserve: Continuing the Study of Slime Molds for the Thicket of Diversity

A Proposal Submitted to

Thicket of Diversity

Prepared by

Department of Biological Sciences

College of Arts and Sciences

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Submitted by
Board of Trustees

Katherine Winsett

Rosemary Ruff, Director
Research Support & Sponsored Programs

Eumycetozoa of the Big Thicket National Preserve: Continuing the study of Slime Molds for the Thicket of Diversity

Winsett, Katherine E.
Swanson, Andrew R.
Stephenson, Steven L.

Introduction

In keeping with the mission of the All Taxa Biodiversity Inventory (ATBI) at the Big Thicket National Preserve (BITH), the Thicket of Diversity (ToD), the Slime Mold Taxonomic Working Group (TWG) is conducting the effort to document the biodiversity of eumycetozoans (true slime molds) in the park and use the data to understand ecological processes within the diverse natural ecosystems of the Preserve and to understand the role of slime molds within these ecosystems.

An initial survey of myxomycetes (plasmodial slime molds) was conducted in June 2007. We sampled diverse aspects of the "biological crossroads", this region, which boasts ecotones associated with wetter forests on the east, drier savannah on the west, and lower elevation coastal plains to the south [10]. Our collecting sites represent the diverse mosaic of upland plant communities (remnant longleaf pine, mixed deciduous and bog) that has been carved by rivers, leaving seasonally flooded lowlands (hardwoods cypress sloughs, baygall thickets and mixed palmetto flats). Decaying wood from Hurricane Rita added to the complexity of substrate available for slime mold and fungal species. The first collections were found in the field and subsequent moist chamber analysis of vegetative substrate promises to extend the list of species for each site.

Eumycetozoans are small eukaryotic organisms whose role in soil nutrient cycling is thought to be ecologically significant yet is poorly understood [2,4,6]. These unique organisms occupy leaf litter, decaying vegetation, and the surface layers of soils, where they feed on bacteria and yeasts. The activities of slime molds help maintain soil health by stimulating microbial activity and increasing the availability of soil nutrients [4]. They may represent a significant portion of soil amoebae [3,4,6], thus documenting their contribution to soil systems is potentially invaluable for understanding the ecology of any terrestrial habitat.

Ecological study of these organisms is limited by our knowledge of their diversity and distribution. Global sampling efforts and databasing of known collections over the last five years, funded by the National Science Foundation's Planetary Biodiversity Inventory program (NSF PBI) have documented the most exhaustive data of distribution trends to date [1]. To sample the ecosystems of the United States for this effort, we are partnered with National Park Service units across the country including the original ATBI in the Great Smoky Mountains National Park. The data from ToD collections of eumycetozoa will, along with identifying local species assemblages, contribute to the global understanding of diversity and distribution of the group.

Diversity data for Eastern Texas is limited to that included in a statewide survey conducted 40 years ago. These data provide a list of species for the state and the region,

but they do not represent clear understanding of the true distribution of these species and any predictive or descriptive information about the assemblages of species in the variety of ecosystems represented in the Preserve. Because ecological study of eumycetozoa has only begun in the last 30 years, there are no data such as micro- and macroenvironmental information or exhaustive collecting efforts for slime molds available to elucidate understanding for the role of these organisms in the Preserve ecosystems.

We propose to continue study of the myxomycetes assemblages within the Preserve and to begin efforts to collect members of another group of slime molds, the dictyostelids (cellular slime molds), which has not yet been initiated.

Dr. Andrew Swanson, who has been researching the ecology and distribution of slime molds, and specifically dictyostelids, for 20 years, joins the slime mold team to lend expertise to the study of dictyostelids for BITH ToD. Part of this proposal includes funds to allow students in a 3-credit college course entitled "Eumycetozoans" currently offered at New College of Florida (NCF) in Sarasota, Florida, to participate in field research of slime molds.

As part of the laboratory component for this course, students are required to collect, identify, and determine the distribution patterns for dictyostelid slime molds from a given area. Big Thicket National Preserve provides an ideal area and an incredible opportunity for these students to participate not only in scientific inquiry, but also to introduce scientific skills and to provide these students with valuable experience through contribution to a real scientific endeavor with meaningful results.

The objectives for the Slime Mold TWG in 2008 are

1. to re-sample the 27 existing collecting sites established in June 2007. Because, myxomycetes show seasonality [5], species assemblages collected at field sites this spring may be different from the assemblages recorded at the time of the BioBlitz.
2. to begin the sampling effort for Dictyostelids in the Preserve. The Dictyostelids (or cellular slime molds) are one of the three groups of true slime molds, eumycetozoa. They are abundant in forest soils and must be cultivated in the laboratory to understand the distribution and local assemblages of these organisms.
3. to continue providing experience for undergraduate students in general field collection techniques for ecological study and specific techniques for eumycetozoan collection and study. Two Eastfield College NSF-STEP students made significant contributions to the first slime mold survey in 2007 through this research experience program and the Slime Mold TWG.
4. to update distribution and assemblage data to be included with and compared to the database for ToD and the database of worldwide collections from the NSF PBI [1].
5. to infer, using data collected through ToD, local ecological significance of the organisms based upon intensive sampling possibilities and comparison to data from other studies within the park and through the ATBI network as well as the impact of these data on global patterns as they are currently understood.

6. to develop outreach and educational materials for formal classrooms (K-12 and Higher Education) and informal educational environments on the topics of slime molds and biodiversity.

Methodology

In June 2007, the initial collecting effort for the slime mold TWG corresponded to the first BioBlitz at the Preserve. Twenty-seven sites were sampled for baseline distribution data of myxomycetes within the habitats of the Preserve. In March and June of 2008, we will return to each site to collect any fruiting bodies found at the field sites, substrate material for moist chamber culture (vegetative material processed in a Petri dish microcosm of its natural environment), and soil samples (approximately 10 g of soil per sample) for laboratory culture of dictyostelids from each site. All fructifications found in the field will be dried and preserved using common herbarium practices. Collecting and preserving samples for slime molds will follow the methods outlined in our permit application. Moist chamber cultures and dictyostelid cultures will be started in the laboratory at the University of Arkansas and New College of Florida respectively. All data will be collected and identified by September or October 2008. Any field collections and the fructifications collected from moist chamber culture will be housed at the University of Arkansas per the details of our permit. All data will be submitted to the ToD database as well as the global database through the NSF PBI.

LITERATURE CITED

1. [Anonymous]. 2008. The Eumycetozoan Project. http://slimemold.uark.edu.
2. Adl MS, Gupta VVSR. 2006. Protists in soil ecology and forest nutrient cycling. Can J For Res 36:1805-1817.
3. Feest A, Madelin MF. 1985. A method for the enumeration of myxomycetes in soils and its application to a wide range of soils. FEMS Microbiol Ecol 31:103-109.
4. Feest A. 1987. The quantitative ecology of soil mycetozoa. In: Progress in protistology. 2nd ed. Biopress Ltd. 331 p.
5. Ing B. 1994. Tansley review no 62: The phytosociology of myxomycetes. New Phytologist 126:175-201.
6. Madelin MF. 1990. Methods for studying the ecology and population dynamics of soil myxomycetes. In: Methods in microbiology. Academic Press Limited. 405 p.
7. McGraw, John Leon, Jr. 1968. A study of the myxomycetes of texas [PhD dissertation] Texas A&M University.
8. Stephenson, SL. 1988. Distribution and ecology of myxomycetes in temperate forests. I. patterns of occurrence in the upland forests of southwestern virginia. Can J Bot 66:2187-2207.
9. Stephenson SL. 1989. Distribution and ecology of myxomycetes in temperate forests. II. patterns of occurrence on bark surface of living trees, leaf litter, and dung. Mycologia 81(4):608-621.
10. Watson GE. 2006. Big thicket plant ecology: An introduction. Third ed. Denton, TX: University of North Texas Press. 136 p.

	Budget					
Travel	Airfare	SRQ to HOU	5 people	$245.00	$1,245.00	
	Rental Vehicle			$90.00	$90.00	
	Fuel	Fayetteville, AR to Saratoga, TX	2 trips	$434.48	$868.96	Fed rate ($0.43/mile)
		Houston, TX to Saratoga TX	1	$34.25	$34.25	Fed rate ($0.43/mile)
	Lodging	Field Station	1 person/ 12 nights	$5/ night	$60.00	
			5 people/ 2 nights	$5/ night	$50.00	
	Meals/ Incidentals	Federal Per Diem rate= $39/day	1 person/13 days	$39.00	$507.00	
			5 people/ 3 days	$39.00	$117.00	
Supplies		pasteboard pill boxes		$72.11/ box of 72	$216.33	
		collecting bags			$10.00	
		petri dishes		$213.95/ box of 500	$213.95	
		plastic sampling bags			$15.00	
		filter paper		$4.45/ box of 100	$22.25	
		agar		$16.25/ 100g	$16.25	
					$3,465.99	**Total**

Katherine Elizabeth Winsett

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Education

Current: PhD. Department of Biological Sciences, University of Arkansas, Fayetteville AR 72701.

Dissertation: Intraspecific Variation in Two Species of Myxomycetes
Advisor: Dr. Steven L. Stephenson
Degree expected: May 2009

2004 B.S. in Biology, Department of Biology, University of Mississippi, Oxford, MS 38677.

Employment, Current and Previous:

2004- present: Graduate Assistant, University of Arkansas Department of Biological Sciences Dissertation research under the direction of Dr. Steven L. Stephenson is related to the National Science Foundation Planetary Biodiversity Inventory of Eumycetozoans (grant to SLS). I am developing molecular techniques for ecological studies of Eumycetozoans.

http://slimemold.uark.edu
Reference: Dr. Steven L Stephenson, slsteph@uark.edu

2002-04 (summer) Volunteer, Virgin Islands Environmental Resource Station (VIERS)
http://www.islands.org

2001-04 Pullen Herbarium (MISS)
http://herbarium.olemiss.edu

2000-04 University of Mississippi Field Station (UMFS)
http://baysprings.olemiss.edu

Teaching

University of Arkansas, Department of Biological Sciences, Fayetteville, AR 72701
2008 Teaching Assistant, General Botany
University of Mississippi, Department of Biology, Oxford, MS 38677
2003 BISC 161 Biological Sciences Laboratory I (for Biology majors)
2002-2003 BISC 103 Inquiry Into Life Laboratory I (for non-Biology majors)

Service

2007- Co-Leader, Slime Mold Taxonomic Working Group (TWG), Big Thicket National Preserve All Taxa Biodiversity Inventory http://www.thicketofdiversity.org

2007 Mentor, Eastfield College, National Science Foundation Science Talent Expansion Program (NSF-STEP) Big Thicket Summer Institute (Saratoga, TX)
http://www.eastfieldcollege.edu/rcd/NSF/index.htm

2005-2008 Judge, Northwest Arkansas Regional Science and Engineering Fair
2003 Judge, Mississippi Science and Engineering Region VII Fair

Special Training

Geographic Information Systems (GIS): ESRI ArcView and ArcMap software
Electron Microscopy, Transmission and Scanning EM
Microscopy, Stereo- and compound, including AutoMontage software

Grants and Awards

2005 C. J. Alexopolous Mentor Student Travel Award, Mycological Society of America
2005 3rd Place, Outstanding Graduate Research Paper, Arkansas Academy of Science Annual

Meeting

Professional Memberships

American Association for the Advancement of Science (2007 –)
African Mycological Association (2006 –)
Arkansas Academy of Science (2005 –)
International Society of Protistologists (2006)
Mycological Society of America (2005 –)
Mississippi Academy of Science (2003-2004)

Publications

Non-Refereed Articles

Winsett, Katherine E. 2007. An expedition to South Africa in search of slime molds. MycoAfrica: Newsletter of the African Mycological Association, 1(2): 3-4.

Contributed Presentations

Winsett, KE, SL Stephenson, JM Packard. 2007. Slime Molds of the Big Thicket National Preserve, Taxonomic Working Group of the All Taxa Biodiversity Inventory (ATBI). Mycological Society of America. Baton Rouge, LA.

Winsett, KE, SL Stephenson, J Cavender, N Cavender. 2007. Eumycetozoa of South Africa: Myxomycetes of Southern Africa. Mycological Society of America. Louisiana State University, Baton Rouge, LA.

Winsett, KE, SM Edwards, L Lindley, M McElderry, RK Nelson, SL Stephenson. 2006. Mycetozoans of the National Parks. Mycological Society of America. Quebec City, Canada.

Winsett, KE, JD Silberman, SL Stephenson. 2006. Internal Transcribed Spacers 1 and 2 as molecular markers for the study of genetic variation in populations of myxomycetes. Mycological Society of America. Quebec City, Canada.

Winsett, KE, SM Edwards, L Lindley, M McElderry, RK Nelson, FW Spiegel. 2006. Mycetozoans of the National Parks. Arkansas Academy of Science. Lyon College, Batesville, AR.

Winsett, KE, S Rajguru, JD Silberman, SL Stephenson. 2005. Genetic variation in local and widespread populations of the myxomycete *Didymium squamulosum*. 5th International Congress on the Systematics and Ecology of Myxomycetes. Tlaxcala, Mexico.

Winsett, KE. 2005. Myxomycetes of Mississippi. 5th International Congress on the Systematics and Ecology of Myxomycetes. Tlaxcala, Mexico.

Winsett, KE, J Fortney, SL Stephenson, GA Laursen. 2005. Myxomycetes associated with the litter microhabitat in high-latitude regions of Alaska and Sweden. 5th International Congerss on the Systematics and Ecology of Myxomycetes. Tlaxcala, Mexico.

Winsett, KE, S Rajguru, JD Silberman, SL Stephenson. 2005. Genetic variation in local and widespread populations of the myxomycete *Didymium squamulosum*. Mycological Society of America. Hilo, HI.

Winsett, KE. 2005. Myxomycetes of Mississippi. Arkansas Academy of Science. Hendrix College, Conway, AR.

Winsett, KE, LM McCook, S Vanderplank. 2004. Myxomycetes of Mississippi. Association of Southeastern Biologists. University of Memphis, Memphis, TN.

Winsett, KE, LM McCook, S Vanderplank. 2004. Myxomycetes of Mississippi: an Updated Checklist. Mississippi Academy of Science, Biloxi, MS.

Andrew R. Swanson

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Department of Natural Science
Manatee Community College
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Venice, Florida 34293
(941) 408-1494
swansoa@mccfl.edu
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Home Address:
4705 Mink Road
Sarasota, Florida 34235
(941) 360-0362
arswans@gmail.com (personal)

Date of Birth: 30 April, 1966; Lakewood, Ohio, USA

Current Positions: Assistant Professor of Biology, Manatee Community College
Adjunct Assistant Professor, New College of Florida
Microbiology Consultant, Breathe Easy Mold Remediation, Inc.

Education:

- **Ph.D.** Biology, 2005, University of Arkansas, Fayetteville, Arkansas
- **Coursework**, Physics & Astronomy, 1997, Montana State University, Bozeman, Montana
- **M.S.** Botany, 1992, Ohio University, Athens, Ohio
- **B.S.** Field Biology, 1988, Ohio University, Athens, Ohio

Academic Positions Held:

- Assistant Professor of Biology, Manatee Community College, Venice, Florida (2006-present)
- Student Chair/Adjunct Assistant Professor, New College of Florida (2006-present)
- Adjunct Instructor, Manatee Community College, Bradenton, Florida (2003-2006)
- Research Assistant, University of Arkansas, Fayetteville, Arkansas (2003-2005)
- Teaching Assistant, University of Arkansas, Fayetteville, Arkansas (1999-2003)

Memberships:

Mycological Society of America (MSA)
Indoor Air Quality Association (IAQA)
National Association of Biology Teachers (NABT)

Teaching Experience:

Lectures: Eumycetozoans, Mycology (New College of Florida), Plant Biology (Arkansas); Non-majors' General Biology I & II, Majors' Fundamentals ofBiology I & II, Microbiology (Manatee C.C.); Natural Science I, Introduction to Biological Sciences, General Biology, Biological Sciences I & II (Columbus State C.C.); Spring Flora, Woody Plants (Ohio - Cambridge); Principles of Biology
(Ohio - Eastern).
Laboratories: Eumycetozoans, Mycology (New College of Florida), Plant Biology, Plant Physiology, Principles of Biology (Arkansas); General Biology I & II, Microbiology (Manatee C.C.); Natural Science I, General Biology, Biological Sciences I & II (Columbus State C.C.); Principles of Biology (Ohio – Eastern); Introductory Biology, Plants and People (Ohio).
Field Courses: Belize Field Course (Manatee C.C.); Spring Flora, Woody Plants (Ohio Cambridge); Integrative Tropical Botany (Ohio).
Guest Lectures: Slime Molds of Hawaii (New College of Florida); Mycetozoans (Rice University); Mycology, Protistology (Arkansas); Alternative Agriculture (Ohio).
Continuing Education Workshops: Slime Molds (Great Smoky Mountains Institute at Tremont); Medicinal Plants of Ohio (Ohio).

Publications:

1992. **Swanson, A.R.** *Distribution of Dictyostelid Cellular Slime Molds in Different Plant Community Sites of Belize and Northern Guatemala, C.A.*, M.S. Thesis, Ohio University, Athens, Ohio.
2000. Stephenson, S.L., Schnittler, M., Darrah, R.G., Rollins, A.W., Novozhilov, Y.K., Mitchell, D., Landolt, J.C., & **Swanson, A.R.** New records of mycetozoans from the Great Smoky Mountains National Park. *Proc. W. Virginia Acad. Sci.* 72(1):33-34.
2002. **Swanson, A.R**., Spiegel, F.W., & Cavender, J.C. Taxonomy, slime molds, and the questions we ask. *Mycologia* **94(6)**:968-979.
2004. **Swanson, A.R**., Shadwick, J., Hemmes, D.E., & Spiegel, F.W. Ecological succession of dictyostelid slime molds on the island of Hawai'i. *Syst. Geog. Pl.* **74**:67-79.
2004. **Swanson, A.R**. *A Guide to the Common Dictyostelid Slime Molds of Great Smoky Mountains National Park*. University of Arkansas, Fayetteville, Arkansas.
2005. **Swanson, A.R.** *Biogeography and Ecology of Hawaiian Dictyostelid Slime Molds.* PhD. Diss., University of Arkansas, Fayetteville, Arkansas.

Professional Presentations:

- Dictyostelids of Hawaii: where are the tropical species?, Mycological Society of America Annual Meeting, Burlington, Vermont, 2000.
- A phylogenetic analysis of Dictyostelid slime molds using morphological characters, Mycological Society of America Annual Meeting, Burlington, Vermont, 2000.
- Using a Geographic Information System to characterize the distribution patterns of slime molds in Hawaii, Mycological Society of America Annual Meeting, Salt Lake City, Utah, 2001.
- Ecological succession of Dictyostelid slime molds on the island of Hawai'i. 4th International Congress on Systematics & Ecology of Myxomycetes, Brussels, Belgium, 2002.
- Surfing with slime molds: investigations of Hawaiian Dictyostelids, Rice University, Houston, Texas, 2004.
- Investigations into the biogeography, distribution, and ecology of Dictyostelid slime molds on Hawai'i, Mycological Society of America Annual Meeting, Asheville, North Carolina, 2004.
- The primary habitat for Dictyostelid slime molds on Hawai'i, Mycological Society of America Annual Meeting, Asheville, North Carolina, 2004.
- A phylogenetic analysis of dictyostelid slime molds based on taxonomically-informative morphological characters, Annual Eumycetozoan PEET (Partnership for Enhancing Expertise in Taxonomy) meeting, Fayetteville, Arkansas, 2005.

Professional Service:

- Referee for professional journals: *Journal of Biogeography*, *Mycologia.* (2000-present)
- State of Florida Advisory Committee on Environmental Education (1998-1999)

Community Service:

- Judge, Northwest Arkansas Regional Science and Engineering Fair (2000-2003)
- Organizer, Earth Day educational booth on Arkansas' ecosystems (2001)

Steven L. Stephenson
Principal Investigator

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Education:

Lynchburg College (Lynchburg, Virginia), B.S. in Biology (*cum laude*), June 1968
University of Virginia Mountain Lake Biological Station, graduate courses in 1971 and 1974
Virginia Polytechnic Institute and State University (Blacksburg, Virginia), M.S. in Botany, June 1970; Ph.D. in Botany, June 1977

Appointments and Professional Experience:

Research Professor, Department of Biological Sciences, University of Arkansas, 2003-present
William Evans Visiting Fellow, University of Otago (New Zealand), 2002
Visiting Professor, Division of Forestry, West Virginia University, 1995-2002 (summers)
Visiting Scientist, Manaaki Whenua Landcare Research (New Zealand), January-May 1998
Visiting Scientist, Australian Antarctic Division (Australian National Antarctic Research Expedition to Macquarie Island), January-May 1995
Fulbright Visiting Scholar, Himachal Pradesh University (Shimla, India), 1987
Professor, Fairmont State College (Fairmont, West Virginia), 1976-2003

Five Publications Relevant to the Proposed Research:

Stephenson SL. 1988. Distribution and ecology of myxomycetes in temperate forests. I. Patterns of occurrence in the upland forests of southwestern Virginia. Canadian Journal of Botany 66:2187-2207.
Stephenson SL. 1989. Distribution and ecology of myxomycetes in temperate forests. II. Patterns of occurrence on bark surface of living trees, leaf litter, and dung. Mycologia 81:608-621.
Stephenson SL, I Kalyanasundaram and TN Lakhanpal. 1993. A comparative biogeographical study of myxomycetes in the mid-Appalachians of eastern North America and two regions of India. Journal of Biogeography 20:645-657.
Stephenson SL and H Stempen. 1994. Myxomycetes: a Handbook of Slime Molds. Timber Press, Portland, Oregon. 183 pp. (Reprinted as a paperback edition in 2000.)
Stephenson SL, JC Landolt, and DL Moore. 1999. Protostelids, dictyostelids, and myxomycetes in the litter microhabitat of the Luquillo Experimental Forest, Puerto Rico. Mycological Research 103:209-214.

Five Other Significant Research Publications:

Stephenson SL and JC Landolt. 1995. The vertical distribution of dictyostelids and myxomycetes in the soil/litter microhabitat. Nova Hedwigia 62:105-117.
Stephenson SL and JC Cavender. 1996. Dictyostelids and myxomycetes. Pages 91-101 in GS Hall, Methods for the Examination of Organismal Diversity in Soils and Sediments. CAB International, Oxon, United Kingdom.
Stephenson SL, Y Novozhilov and M Schnittler. 2000. Distribution and ecology of myxomycetes in high-latitude regions of the northern hemisphere. Journal of Biogeography 27:741-754.

Spiegel FW, SL Stephenson, HW Keller, DL Moore and JC Cavender. 2004. Mycetozoans. Pages 547-576 in GM Mueller, GF Bills and MS Foster (eds.), Biodiversity of Fungi: Inventory and Monitoring Methods. Academic Press, Amsterdam.

Stephenson SL, M Schnittler, and C Lado. 2004. Ecological characterization of a tropical myxomycete assemblage—Maquipucuna Cloud Forest Reserve, Ecuador. Mycologia 96:488-497.

Synergistic Activities:

• Developed undergraduate courses in Plant Taxonomy, Tropical Studies, Global Ecology, and Terrestrial Ecology for the biology curriculum at Fairmont State College, graduate/under-graduate courses for the Division of Forestry at West Virginia University (Vegetation of West Virginia) and the Department of Biological Sciences at the University of Arkansas (The Mycetozoans, Forest Ecology, and Myxomycetes).

• Organized symposia at several different meetings, the most recent of which was a special symposium on Mycetozoan Biodiversity held as part of the Fifth International Congress on the Systematics and Ecology of Myxomycetes (which took place in Tlaxcala, Mexico, in August of 2005).

• Developed, with the help of a former student (Denise Binion), a web site (www.myxoweb.com) that serves as a general introduction to the myxomycetes. Much of the information on the web site was derived from a book ("Myxomycetes: a handbook of slime molds" by Stephenson and Stempen) that represented, when it was published by Timber Press in 1994, the first true field guide to this group of organisms. The book has been translated into Spanish and ultimately will be made available in Spanish-speaking countries of Latin America.

Collaborators and Research Associates: Scientists with whom I have had a long-term association and/or with whom I have collaborated on some paper or project within the last 48 months are Dr. Harold S. Adams (Dabney S. Lancaster Community College, Virginia), Dr. Jim Clark (University of Kentucky), Dr. Ronald Fortney (West Virginia University), Dr. Peter R. Johnston (Manaaki Whenua Landcare Research, New Zealand), Dr. John C. Landolt (Shepherd College, West Virginia), Dr. Gary A. Laursen (University of Alaska, Fairbanks), Dr. Donna L. Moore (Corning Community College, New York), Dr. Rodney D. Seppelt (Australian Antarctic Division), Dr. Fred Spiegel (University of Arkansas), Dr. David Orlovich (New Zealand), Dr. Larissa Vasilyeva (Russia) and Dr. Susan M. Studlar (West Virginia University).

Graduate and Post Doctoral Advisors: My graduate advisers were Drs. E. Fred Benfield, Orson K. Miller, Jr., Robert A. Paterson, Duncan M. Porter and Dr. Richard W. Rhoades. Dr. Rhoades was my major professor.

Thesis Advisor and Postgraduate-Scholar Sponsor: I am currently the primary advisor to four graduate students (Katerine Winsett, Carlos Rojas, Adam Rollins and Lillis Urban). Postdoctoral scholars I have hosted are Dr. Indira Kalyanasundaram of the University of Madras (in India) [October 1990 to January 1991], Dr. Ashok Kumar (Oilseeds Research Station in Kangra, India) [August 1992 to November 1992], Dr. Rajendra Bhatt (Garhwal University in India) [September to December 1992], Dr. Yura Novozhilov (V. L. Komarov Botanical Institute, St. Petersburg, Russia) [September to November 1997 and June to July 1998], Dr. Martin Schnittler (Federal Agency for Nature Conservation, Germany) [September 1998 to October 2000], and Dr. Larissa Vasilyeva (Far East Branch of the Russian Academy of Sciences, Vladivostok, Russia [March 2002 and September 2002].