

Elaine R. Ingham, PhD

Curriculum Vitae

Education

Positions Held

Director of Research and President, Soil Foodweb Inc., Corvallis, OR, August 1996 - present

Affiliate Professor, Graduate Research, South Cross University, Lismore, NSW, Australia, 2001 - present

Courtesy Research Associate Professor, Department of Forest Science, Oregon State University, July 1, 1999 - 2002

Associate Professor, Senior Research, Courtesy, Department of Botany & Plant Pathology, Oregon State University, Corvallis, July 1993 - June 1999

Assistant Professor, Department of Botany & Plant Pathology, Oregon State University, Corvallis, October 1989 - June 1993

Research Associate, Department of Botany & Plant Pathology, Oregon State University, Corvallis, July 1986 - September 1989

Consultant (half-time), Environmental Protection Agency, Corvallis, Oregon, February 1987 - May 1987

Research Associate, Institute of Ecology, University of Georgia, July 1985 - July 1986

Faculty Affiliate, Dept of Plant Pathology & Weed Science, Colorado State University, December 1983 - June 1985

Post-doctoral Fellow, Natural Resource Ecology Laboratory, Colorado State University, November 1981 - June 1985

Graduate Research Assistant, Colorado State University, 1977 - 1981

Graduate Teaching Assistant, Texas A&M University, 1975 - 1977

Tutor in Biology and Chemistry, St. Olaf College, 1973 - 1974

Principal Duties in Present Position

Soil Ecology Research

Continuing Education in Soil Ecology

Program Chair, Ecological Society of America

Instructional Summary

Credit Courses as a Research Professor, I have no regularly assigned courses. I have taught the following:

At Oregon State University:

- Compost Foodwebs (Bot 508) 34 to 50 students, 3 - 5 for credit through CHE, Winter, 1998; Winter 1999.
- Soil Ecology (Bot 508), 18 to 30 students, 3-5 for credit offered through Continuing Higher Education, Fall 1996, May 1997, Fall 1998.
- Special Topics in Botany: Rhizosphere Ecology (Bot 691b), 9 students plus audits, Winter 1996.
- Analysis of Environmental Issues (Bi 489/589), Spring 1994; Summer 1994, 1995.
- Methods in Soil Ecology (Bot 620X): 10 students Spring 1993; 8 students Spring 1994, Summer 1995.
- Ecology (BI 370), 105 students, Spring 1992; 150 students Fall 1993; 180 students, Spring 1995, 21 students, Summer 1995, 140 students, Spring 1996 (co-taught with Dr. K. Lajtha), 20 students, Summer, 1996, Summer 1997.
- Guest lectures (various years): Plant Ecology (Bi 374); Forest Ecology (Bi 41); Soil Biology (CSS 535).
- Introductory Biology (BI 202), one-half of course on ecology and evolution, 300 students, Winter 1992.
- Undergraduate Research: Tim Lair, Summer 1995 (1 cr); Troy Bachman, Spring 1994 (2 cr); Tamara Whitsett, Winter 1994 (1 cr).
- Reading & Conference (Bot 605), Methods in Soil Ecology, 2 students, Spring 1992; Effects of Intercropping on Soil Ecology, Fall 1994, Rhizosphere Ecology, Hua Chen, Fall 1995 (2 cr), Michael Holst, Winter 1996 (1 cr), The Soil Foodweb, Steve Scheurell and Veronica Nunez (Fall 1998) Special Topics in Mycology (BI 590), co-taught with Bill Denison, Winter 1991.
- Silviculture Institute, Forest Science, 1988-89.

At Colorado State University:

- Range Ecology, 2 lectures on microbial ecology, 1981.
- Grassland Ecosystems, lecture on soil food webs, Spring 1987.

At Texas A&M University:

- Introductory Microbiology (lab), 1975-77.
- General Physiology (lab), 1975.

Non-credit Courses and Calendar of Talks

In 1998, "The Soil Foodweb" as applied to various systems given in the following places:

- Pesticide Applicators Training, Yakima, WA, Jan 8, 1998
- BHN Grower's Meetings, Pasco, Mattawa, Moses Lake, Cooley City, WA, Jan 12 - 16, 1998
- Hobbs and Hopkins, Landscape Conference, Portland, OR, Jan. 22, 1998
- BHN Grower's Meeting, Burley, ID, Jan. 23, 1998
- San Jacinto Environmental Meeting, Houston, TX, Jan 29-30,
- 1998 Western Alfalfa Growers Conference, Reno, NV, Feb. 3, 1998
- Helena Chemical Company Meeting, Sparks, NV, Feb 5, 1998
- Agri-Energy Resources Grower's meeting, Princeton, IL, Feb 9-10, 1998
- Foundations of Forest Ecosystems Conference, Oregon State University, Feb. 26, 1998
- Northwest Research Station, Travers City, MI, March 13, 1998
- Forest Soil Organism Conference, Oregon State University, March 16-17, 1998
- Alamosa Potato Grower Groups, Monte Vista, and Center, CO, April 6-8, 1998
- Natural Resources Group, Fresno, CA, April 12-14, 1998
- Cherry Valley Golf Club, New York, New York, April 19-20, 1998
- Organica meeting, Philadelphia, PA April 21, 1998
- 20th Annual High Desert conference, Malheur, OR May 1- 3, 1998
- National Biocycle Conference, Kansas City, KS May 5-7, 1998
- Soil Quality Team Workshop, NRCS, May 18-21, 1998
- Seeds Research Growers Meeting, Corvallis, OR, June 20, 1998
- NSF Teacher's Institute, Portland, OR, June 23-25, 1998
- Biodevastation Meeting, St. Louis Greens, July 17-19, 1998
- United Nations Meeting, Montreal, Canada, August 16-21, 1998
- Suffolk County Commissioners, New York, Sept. 15, 1998
- Soil Foodweb Workshop, Sept. 21-24, 1998
- North Carolina Stewardship Program, Asheville, NC, Oct.2-16, 1998
- Pavich Family Farms Grower's Meeting, Monterey, CA Oct. 7-9, 1998
- Assoc. of Women in Landscaping, Seattle, WA Oct. 17, 1998
- Pesticide Conference, City of Seattle, Oct. 19, 1998
- USDA Extension Service and Outdoor Circle, Honolulu, Hawaii, Nov 7-11, 1998
- IPM Landscape Workshop, Seattle, WA, Nov. 17, 1998
- BHN Workshop, Bainbridge Island, WA, Nov 23, 1998

Organization of Meetings

- "Approaching global sustainability from the bottom up: Preserving the soil," Ecological Society of America Symposium, Madison, WI, 1993.
- "Functional significance and regulation of soil biodiversity," Michigan State University, East Lansing, 3-8 May 1993.
- "Approaching global sustainability from the bottom up: Preserving the soil," Ecological Society of America Symposium, Madison, WI, 1993.
- "Functional significance and regulation of soil biodiversity," Michigan State University, East Lansing, 3-8 May 1993.
- "Ecological effects of transgenic plants," Baltimore, MD, November 1992.
- Soil Ecology Society Meeting, Oregon State University, Corvallis, 3-8 April 1990.
- Soil Food Webs Symposium, Ecological Society of America, Columbus, OH, August 1987.
- International Synthesis Workshop on C,N,P, and S Interactions in Terrestrial Ecosystems, Sapelo Island, GA, April 1986.
- "Legacies, Limits, and Linkages: Bridging Borders", Ecological Society of America National Meeting, Spokane, WA, August 1999.
- "Approaching global sustainability from the bottom up: Preserving the soil," Ecological Society of America Symposium, Madison, WI, 1993.
- "Functional significance and regulation of soil biodiversity," Michigan State University, East Lansing, 3-8 May 1993.
- "Ecological effects of transgenic plants," Baltimore, MD, November 1992.
- Soil Ecology Society Meeting, Oregon State University, Corvallis, 3-8 April 1990.
- Soil Food Webs Symposium, Ecological Society of America, Columbus, OH, August 1987.
- International Synthesis Workshop on C,N,P, and S Interactions in Terrestrial Ecosystems, Sapelo Island, GA, April 1986.

Graduate Students and Post-Doctoral Trainees

Graduate Theses Directed

- Michael Holmes, PhD 1995, Ecological Effects of a Genetically Engineered Microorganism, *Klebsiella planticola*.
- Shannon Fitzpatrick, MS completed 1995, The Effect of Ozone on Wheat and the Soil Foodweb around Wheat.

Non-Thesis Students Directed

- Laurie McLellan-Penders, non-thesis MS completed 1992 in Ecological Effects of Mycorrhizal Fungi.

Graduate Committee Memberships

- Jeff Peterson, Zoology, MS 1989 James Entry, Forest Science, PhD 1989 Gaye Bradshaw, Forest Science, PhD 1991 Mark Azevedo, Botany & Plant Pathology, MS 1992 Randy Wogen, Botany & Plant Pathology, Non-thesis MS 1993 Stefan Seiter, Horticulture, MS 1993, PhD 1997 Jane Smith, Forest Science, PhD 1993 Tara Reed, Entomology, MS 1995 Edith Estrada-Venegas, Entomology, PhD 1996 Michael Holst, Teaching, M.S. 1996 Elizabeth Zoeller, Teaching, M.S., 1996 Marla Gillham, Forest Science, PhD expected 1997 Kathryn Johnson, Forest Science, PhD 1998 Nancy Baumeister, Entomology, Ph.D., expected 1999
- Veronica Nunez-Teran, Entomology, M.S., 1999

Graduate School Representatives

- Brenda Wiens, Zoology, PhD 1992 Teal Purrington, Range Science, MS 1992
- Thomas Silverstein, Crop Science, MS June 1994

Lab-Rotation Students

- Brent Hardy (1998-1999) Larry Stark (1996-1998) Roxanne Johnston (1994-1995) Amy Tuininga (1994-1995) Joe Telefici (1992) Karen Dunham (1992-1993) Bibit Traut (1992)
- Michael Holmes (1991)

Post-Doctoral Supervision

- Michael Holmes April 1995 - April 1996 Ken Cullings, Jan 1994 - March 1994
- Thomas Forge, Nov 1993 - Nov 1994

Scholarship and Creative Activities

Research Interests and Activities

My overall goal is to understand soil foodweb structure and function in terrestrial ecosystems, from arctic to tropical climates, and in agricultural, grassland, and forest ecosystems. Current research includes determining biomass, activity and identification of bacteria, fungi, protozoa, nematodes and mycorrhizal fungi in soils. Current projects include:

1. Soil Foodweb Inc. provides enumeration of soil organism biomass and activity to researchers and commercial endeavors around the world. Between 1991 to 1995, about 20,000 soil samples were processed as part of a University service provided in the Department of Botany and Plant Pathology. From 1996 to present, Soil Foodweb Inc has assessed foodweb structure in some 100,000 soil samples.
2. "The Soil Primer" with the Natural Resource Conservation Service, Soil Quality Institute. A publication for the general public about complexity and soil food webs.
3. Work with graduate, undergraduate students and Research Institute affiliates on soil, compost, compost tea, and biological stimulants.

Honors and Awards

Departmental Honors in Biology, St. Olaf College, 1974

Phi Sigma Honor Society

Sigma Xi, Colorado State University

Technology Award, Biohumanetics Meeting, Phoenix, AZ, 1995.

Publications

Refereed Journal Articles

1. Ames, R.N., E.R. Ingham and C.P.P. Reid. (1982). Ultraviolet-induced autofluorescence of arbuscular mycorrhizal root infections: An alternative to clearing and staining methods for assessing infections. *Can. Jr. Microbiol.* 28:351-355.
2. Ingham, E.R. and D.A. Klein. (1982). Relationship between fluorescein diacetate-stained hyphae and oxygen utilization, glucose utilization and biomass of submerged fungal batch cultures. *Appl. Environ. Microbiol.* 28:351-355.
3. McClellan, J.F., D.C. Coleman, K.A. Horton and E.R. Ingham. (1982). The effect of chloroform on protozoa and other soil inhabitants. *J. Protozool.* 29:491.
4. Ingham, E.R. and D.A. Klein. (1984). Soil fungi: Relationships between hyphal activity and staining with fluorescein diacetate. *Soil Biol. Biochem.* 16:273-278.
5. Ingham, E.R. and D.A. Klein. (1984). Soil fungi: Measurement of hyphal length. *Soil Biol. Biochem.* 16:279-280.
6. Ames, R.N., C.P.P. Reid and E.R. Ingham. (1984). Rhizosphere bacterial population responses to root colonization by a vesicular-arbuscular mycorrhizal fungus. *New Phytol.* 96:555-563.
7. Ingham, E.R. and D.A. Klein. (1984). Phosphatase activity of *Penicillium citrinum* submerged batch cultures and its relationship to fungal activity. *Plant and Soil* 81:61-68.
8. Ingham, E.R. and D.C. Coleman. (1984). Effects of streptomycin, cycloheximide, fungizone, captan, carbofuran, cygon and PCNB on soil microbe populations and nutrient cycling. *Microbial Ecology* 10:345-358.
9. Ingham, R.E., J.A. Trofymow, E.R. Ingham and D.C. Coleman. (1985). Interactions of bacteria, fungi and their nematode grazers: Effects on nutrient cycling and plant growth. *Ecological Monographs* 55:119-140.
10. Ingham, E.R. (1985). Review of the effects of twelve selected biocides on target and non-target soil organisms. *Crop Protection* 4:3032.
11. Ingham, E.R., D.A. Klein and M.J. Trlica. (1985). Responses of microbial components of the rhizosphere to plant management strategies in semiarid rangeland. *Plant and Soil* 85:65-76.
12. Ingham, E.R., C. Cambardella and D.C. Coleman. (1986). Manipulation of bacteria, fungi and protozoa by biocides in lodgepole pine forest soil microcosms: Effects on organism interactions and nitrogen mineralization. *Can. J. Soil Sci.* 66:261-272.
13. Frey, J.S., J.F. McCellan, E.R. Ingham and D.C. Coleman. (1986). Filter-out grazers (FOG): A filtration experiment for separating protozoan grazers in soil. *Biol. Fert. Soil* 1:73-79.

14. Ingham, E.R., J.A. Trofymow, R.N. Ames, H.W. Hunt, C.R. Morley, J.C. Moore and D.C. Coleman. (1986). Trophic interactions and nitrogen cycling in a semiarid grassland soil. Part I. Seasonal dynamics of the natural populations, their interactions and effects on nitrogen cycling. *J. Applied Ecology* 23:597-614.
15. Ingham, E.R., J.A. Trofymow, R.N. Ames, H.W. Hunt, C.R. Morley, J.C. Moore and D.C. Coleman. (1986). Trophic interactions and nitrogen cycling in a semiarid grassland soil. Part II. System responses to removal of different groups of soil microbes or fauna. *J. Applied Ecology* 23:615-630.
16. Hunt, H.W., D.C. Coleman, E.R. Ingham, R.E. Ingham, E.T. Elliott, J.C. Moore, C.P.P. Reid and C.R. Morley. (1987). The detrital food web in a shortgrass prairie. *Biol. Fert. Soil* 3:57-68.
17. Moore, J.C., E.R. Ingham and D.C. Coleman. (1987). Inter- and intraspecific feeding selectivity of *Folsomia candida* (Willem) (Collembola, Isotomidae) on fungi: Method development and ecological consequences. *Biol. Fert. Soil* 5:6-12.
18. Ingham, E.R. and K.A. Horton. (1987). Bacterial, fungal and protozoan responses to chloroform fumigation in stored prairie soil. *Soil Biol. Biochem.* 19:545-550.
19. Coleman, D.C. and E.R. Ingham. (1988). Carbon, nitrogen, phosphorus and sulfur cycling in terrestrial ecosystems. *Biogeochemistry* 5:3-6.
20. Hunt, H.W., E.R. Ingham, D.C. Coleman, E.T. Elliott and C.P.P. Reid. (1988). Nitrogen limitation of decomposition and primary production in shortgrass, mountain meadow and lodgepole pine forest. *Ecology* 69:1009-1016.
21. Carpenter, S.E., M.E. Harmon, E.R. Ingham, R.G. Kelsey, J.D. Latin and T.D. Schowalter. (1988). Early patterns of heterotroph activity in conifer logs. *Proc. Roy. Soc. Edinburgh* 94B:33-43.
22. Ingham, E.R., M.V. Wilson and C.D. McIntire. (1988). Social and economic concerns with respect to the choice of critical terrestrial ecosystems. USEPA.
23. Cromack, K., Jr., B.L. Fichter, A.M. Moldenke and E.R. Ingham. (1989). Interactions between soil animals and ectomycorrhizal fungal mats. *Agric. Ecosyst. Environ.* 24:155-169.
24. Ingham, E.R., D.C. Coleman and J.C. Moore. (1989). Analysis of food-web structure and function in a shortgrass prairie, a mountain meadow and lodgepole pine forest. *Biol. Fertil. Soils* 8:29-37.
25. Stamatiadis, S., J.W. Doran and E.R. Ingham. (1990). Use of staining and inhibitors to separate fungal and bacterial activity in soil. *Soil Biol. Biochem.* 22:81-88.
26. Coleman, D.C., E.R. Ingham and J.C. Moore. (1990). An across ecosystem analysis of seasonal effects and faunal reduction on decomposition in a semiarid prairie, meadow, and lodgepole pine forest. *Pedobiologia* 34:207-219.
27. Ingham, E.R., R. Griffiths, K. Cromack and J.A. Entry. (1991). Comparison of direct versus fumigation incubation microbial biomass estimates in ectomycorrhizal mat and non-mat soils. *Soil Biol. Biochem.* 23:465-472.
28. Lodge, D.J. and E.R. Ingham. (1991). A comparison of agar film techniques for estimating fungal biovolumes in litter and soil. *Agric. Ecosyst. Environ.* 5:31-37.
29. Griffiths, R.P., E.R. Ingham, B.A. Caldwell, M.A. Castellano and K. Cromack, Jr. (1991). Microbial characteristics of ectomycorrhizal mat communities in Oregon and California. *Biology and Fertility of Soils* 11:14-20.

30. Ingham, E.R., D.C. Coleman, R. Parmelee and D.A. Crossley. (1991). Reduction of microbial and faunal groups following application of streptomycin and captan in Georgia no-till agroecosystems. *Pedobiologia* 35:297-304.
31. Ingham, E.R. (1993). The functional significance and regulation of soil biodiversity: An executive summary of the Soil Ecology Society meeting. *Soil Ecology Society Newsletter* 5:2-9.
32. Klopatek, C.C., E.G. O'Neill, D.W. Freckman, C.D. Bledsoe, D.A. Coleman, D.A. Crossley, Jr., E.R. Ingham, D. Parkinson and J.M. Klopatek. (1993). The sustainable biosphere initiative: A commentary from the U.S. Soil Ecology Society. *Bulletin of the Ecological Soc. of America*. 73:223-228.
33. Colinas, C., E. Ingham and R. Molina. (1994). Population responses of target and non-target forest-soil organisms to selected biocides. *Soil Biol. Biochem.* 26:41-48.
34. Ingham, E.R. 1994. Soil Organisms and Forest Health. Pages 12-15 in *Headwaters Journal*, Spring (1994).
35. Ingham, E.R., D.C. Coleman, and D.A. Crossley, Jr. (1994). Use of Sulfamethoxazole-Penicillin, Oxytetracycline, Carbofuran, Carbaryl, Naphthalene and Temik to Remove Key Organism Groups in Soil in a Corn Agroecosystem. *J. Sustain. Agric.* 4(3):7-30.
36. Ingham, E.R. and H. Massicotte. (1994). Protozoan communities around conifer roots colonized by ectomycorrhizal fungi. *Mycorrhiza*. 5:53-61.
37. Ingham, E.R., J.D. Doyle and C.W. Hendricks. (1995). Assessing interactions between soil foodweb and a strain of *Pseudomonas putida* genetically engineered to degrade 2,4-D. *Applied Soil Ecology*. 2:263-274.
38. Ingham, E.R. and W.G. Thies. (1996). Soil foodweb responses in the first year following clearcutting and chloropicrin application to a mature Douglas-fir forest to control laminated root rot. *Applied Soil Ecol.* 3:35-47.
39. Rygielwicz, P.T. and E.R. Ingham. (1997) *Soil Biology and Ecology*. IN Fairbridge, R.W. and D.E. Alexander (eds) *Encyclopedia of Environmental Science*. Van Nostrand Reinhold. NY.
40. Sances, F.V. and E.R. Ingham. (1997). Conventional and organic alternatives to methyl bromide on California strawberries: Effect of Brassica residues and spent mushroom compost following successive chemical fumigation. *Compost Science and Utilization*. 5: 23-37.
41. Griffiths, R.P., J.A. Entry, E.R. Ingham, and W.H. Emmingham. (1997). Chemistry and microbial activity of forest and pasture riparian-zone soils along three Pacific Northwest streams. *Plant and Soil* 190:169-178.
42. Ingham, E.R. and W. Thies. (1997). Changes in rhizosphere microflora and microfauna 10 years following Douglas-fir live tree injection with chloropicrin or methylisothiocyanate. *Can. Jr. For Res.* 27:724-731.
43. Hendricks, C.W., M.T. Holmes and E.R. Ingham. (1998). Foodweb methodology to assess ecological effects of anthropogenic stressors in soil. *Trends in Soil Science*. 2:181-189.
44. Massicotte, H.B., L.E. Takaberry, E.R. Ingham, and W.G. Thies. (1998). Ectomycorrhizae establishment on Douglas-fir seedlings following chloropicrin treatment to control laminated-root rot disease: Assessment of 4 and 5 years after outplanting. *Appl. Soil Ecol.* 10:117-126.

45. Ingham, E.R. and J.Barlow. (1998). Sustainable Agriculture and the Ecology of Soil. Perspectives on Business and Global Change. 12:31-42.
46. Ingham, E.R. (1998). Soil organisms and their role in healthy turf. Turf Grass Trends. 7:1-6.
47. Wilson, M.V. and E.R. Ingham. (1999). Mycorrhizal requirements of six wetlands herbaceous plant species. Mycorrhiza.
48. Ingham, E.R, Seiter, S., and R.D. William. (1999). Dynamics of soil fungal and bacterial biomass in a temperate climate alley cropping system. Appl. Soil Ecol. 12: 39-147.
49. Doyle, J.D., Hendricks, C.W., Holmes, M.T., and E.R. Ingham. (1999). Effects of *Klebsiella planticola* SDF20 on soil biota and wheat growth in sandy soil. Appl. Soil Ecol. Vol. 11, issue 1: 67-78.
50. Ingham, E. R. (1999). The Soil Biology Primer. Chapter 1. The Soil Food Web. NRCS Soil Quality Insitute, USDA. 48 pp.
51. Ingham, E. R. (1999). The Soil Biology Primer. Chapter 2. Soil Bacteria. NRCS Soil Quality Institute, USDA.
52. Ingham, E. R. (1999). The Soil Biology Primer. Chapter 3. Soil Fungi. NRCS Soil Quality Institute. USDA.
53. Ingham, E. R. (1999). The Soil Biology Primer. Chapter 4. Soil Protozoa. NRCS Soil Quality Institute. USDA.
54. Ingham, E. R. (1999). The Soil Biology Primer. Chapter 5. Soil Nematodes. NRCS Soil Quality Institute. USDA.
55. Ingham, E. R. (2004). The Soil Food Web: Itís Role in Ecosystems Health: The Overstory Book Cultivating Connections with Trees 2nd Edition; Editor Craig R. Elevitch.
56. Ingham, E. R. and M. D. Slaughter. (2005). The Soil Food Web ñ Soil and Composts As Living Ecosystems. International SoilACE Conference in Soil and Compost Eco-Biology. Leon, Spain. 1: 127-139.

Papers in Preparation

1. Holmes, M.T., E.R. Ingham, J.D. Doyle and C.W. Hendricks. (In press) Characterization and ethanol production of genetically engineered *Klebsiella planticola* and effects on plant growth. Applied and Environmental Microbiology.
2. Ingham, E.R. and W.G. Thies. (In revision) Soil foodweb responses in the second year following clearcutting and chloropicrin application to a mature Douglas-fir forest to control laminated root rot. Appl. Soil Ecol.
3. Ingham, E.R. and M. Olson. (In revision). Variability in soil foodweb structure in a homogeneous agricultural field. Biol. Fert. Soils.
4. Holmes, M.T. and E.R. Ingham. (in prep) Ecological effects caused by the release of genetically engineered *Klebsiella planticola* in native grassland soil. Soil. Biol. Biochem.
5. Ingham, E.R. and M. Olson. (in prep). Variability in soil foodweb structure in a gap as compared to a mature Douglas-fir forest in the Pacific Northwest. Applied Soil Ecol.
6. Kimble, S. F. and E.R. Ingham. (in prep) Changes in soil foodweb organisms as mediated by ozone impacts on plants. Biol. Fert. Soil.

Book Chapters

1. Ingham, E.R. and R. Molina. 1991. *Interactions between mycorrhizal fungi, rhizosphere organisms, and plants*. Pages 169-197 in *Microorganisms, Plants and Herbivores*, P. Barbosa (ed). John Wiley and Sons, NY.
2. Ingham, E.R. and R. Molina. 1991. *Interactions between mycorrhizal fungi, rhizosphere organisms, and plants*. Pages 169-197 in *Microorganisms, Plants and Herbivores*, P. Barbosa (ed). John Wiley and Sons, NY.
3. Ingham, E.R. 1994. *Soil Protozoa*. Agronomy Society of America. In *Methods in Agronomy*, P. Bottomley (ed). Agronomy Soc. Am.
4. Ingham, E.R. and A. Moldenke. 1995. *Microflora and Microfauna on Stems and Trunks: Diversity, Food Webs and Effects on Plants*. pp. 241-256. in Gartner, B. *Plant Stems*. Academic Press, NY.
5. Ingham, E.R. 1998. *Soil Protozoa*. Pages 114-131 in *Principles and Applications of Soil Microbiology*, in Sylvia, D. and Hartel, P. *Soil Microbiology: Environmental and Agricultural Perspectives*. Oxford University Press.
6. Edmonds Institute (10 authors). 1998. *The Biosafety Handbook*. Edmonds Institute, Bellingham, WA

Books

1. Ingham, E. R. and M. Alms. 1999 *The Compost Tea Handbook 1.1*
2. Ingham, E. R. 2000 *The Compost Tea Brewing Manual*, Sustainable Studies Institute, Eugene, OR. 60 pp
3. Ingham, E. R. 2001 *The Compost Tea Brewing Manual Second Edition*, Soil Foodweb Inc, Corvallis, Oregon 68pp
4. Ingham, E. R. 2002 *The Compost Tea Brewing Manual Third Edition*, Soil Foodweb Inc, Corvallis, Oregon 78pp
5. Ingham, E. R. 2003 *The Compost Tea Brewing Manual Fourth Edition*, Soil Foodweb Inc, Corvallis, Oregon 88pp
6. Ingham, E. R. 2004 *Compost Tea Quality: Light Microscope Methods*, Soil Foodweb Inc, Corvallis, Oregon 47pp
7. Ingham, E. R. 2004 *The Field Guide for Actively Aerated Compost Tea (AACT)*, Soil Foodweb Inc, Corvallis, Oregon 178pp
8. Ingham, E. R. 2005 *The Compost Tea Brewing Manual, Edition 5*, Soil Foodweb Inc, Corvallis, Oregon 79pp

Reports

Refereed Reports

1. Wilson, M.V., E.R. Ingham, C.D. McIntire and M.L. Scott. 1988. Report on the selection of several potentially critical terrestrial systems. USEPA.
2. Ingham, E.R., M.V. Wilson and C.D. McIntire. 1989. A general model of biotic interactions. Special Report to the USEPA, CR-813570-01-0, 36 pp.
3. Thies, W.G., M.A. Castellano, E.R. Ingham, D.L. Luoma and A.R. Moldenke. 1991. Bioresponse of nontarget organisms resulting from the use of chloropicrin to control laminated root rot in a northwest Conifer forest.

4. Installation of study. pp. 81-84. USEPA Special Publ.
5. Ingham, E.R., W.G. Thies, D.L. Luoma, A.R. Moldenke and M.A. Castellano. 1991. Bioresponse of nontarget organisms resulting from the use of chloropicrin to control laminated root rot in a northwest Conifer forest.
6. Evaluation of bio-responses. pp. 85-90. USEPA Special Publ.
7. Linder, G., E.R. Ingham, C.J. Brandt and G. Henderson. 1992. Evaluation of terrestrial indicators for use in ecological assessments at hazardous waste sites. USEPA/600/r-92/183.
8. Ingham, E.R. 1993. Use of soil foodweb structure and function to assess superfund sites. USEPA Ecological Site Assessment Program. Corvallis Environmental Research Lab.
9. Ingham, E.R. 1995. Standard Operating Procedure for Microbial Population Dynamics. USEPA Global Climate Change Program. Corvallis Environmental Research Lab.
10. Ingham, E.R. 1994. Standard Operating Procedure for Total Bacteria. USEPA Global Climate Change Program. Corvallis Environmental Research Lab.
11. Ingham, E.R. 1995. Standard Operating Procedure for Nematode Population and Community Structure. USEPA Global Climate Change Program. Corvallis Environmental Research Lab.
12. Ingham, E.R. 1995. Standard Operating Procedure for Protozoan Populations and Community Structure. USEPA Global Climate Change Program. Corvallis Environmental Research Lab.

Technical Reports (Not Refereed)

1. Ingham, E.R. and M. Holmes. 1995. Biosafety Regulations: A critique of existing documents. The Edmonds Institute, Edmonds, WA.
2. Ingham, E.R. 1995. Biosafety Regulation. Edmonds Institute, Edmonds, WA.

Magazine Column in BioCycle

Monthly column including discussions of: Anaerobic Bacteria and Composting, The Good, the Bad and Facultative Anaerobes, What Organisms are in Compost?, What is Compost Tea?, Methyl Bromide Alternatives, Fungi and Disease-Suppression, Vermicompost versus Compost - What's the Difference?

Numerous other magazine and newspaper publications since 1999.

Book reviews

1. Ingham, E.R. 1983. Advances in Agricultural Microbiology by N.S. Subba Rao (ed). ASM News 49:475-476.
2. Ingham, E.R. 1995. Soil Protozoa by J. Darbyshire (ed). Soil Science.

Citations

Papers related to soil organisms and foodweb interactions

- Abbasi, P. A., J. Al-Dahmani, F. Sahin, H. A. J. Hoitink, and S. A. Miller. 2002. Effect of compost amendments on disease severity and yield of tomato in conventional and organic production systems. *Plant Disease* **86**:156-161.
- Bulluck III, L. R. a. J. B. R. 2002. Effect of synthetic and organic soil fertility amendments on southern blight, soil microbial communities, and yield of processing tomatoes. *Phytopathology* **92**:181-189.
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Professional Meetings

(1-17 published between 1976-1990; since 1991, listed below)

1. Ingham, E.R. and W.G. Thies. 1991. Response of non-target organisms to the use of chloropicrin to control laminated root rot in a northwest conifer forest. Ecological Society of America, San Antonio, TX, 3-8 August.
2. Ingham, E.R., H. Massicotte, and D. Luoma. 1991. Protozoan communities around conifer roots colonized by ectomycorrhizal fungi. Soil Ecology Society, Corvallis, OR, 2-6 April.
3. Ingham, E.R. 1991. Integrated aboveground, root, and detrital foodweb conceptual models of a corn agroecosystem. Soil Ecology Society, Corvallis, OR, 2-6 April.
4. Ingham, E.R. 1991. Biological interactions in the rhizosphere. Pacific Division AAAS, Logan, UT, 26 June 26.
5. Ingham, E.R. 1991. Nutrient transformations in the rhizosphere. Soil Biota Conference, Wageningen, The Netherlands, 24-28 November.
6. Ingham, E.R. and W.G. Thies. Non-target organism responses to chloropicrin for control of laminated root rot. SETAC, Seattle, WA, 2-5 November.
7. Ingham, E.R. and W.G. Thies. 1992. Soil foodweb responses to chloropicrin. Forestry Conference, Oregon State University, Corvallis, 16-17 November.
8. Ingham, E.R., R. Griffiths and K. Cromack. 1993. Symposium on Microbial Responses to Forest Gaps. Ecological Society of American, Madison, WI, 31 July - 4 August, 1993.

9. Ingham, E.R. 1994. The Phyllosphere Foodweb. NSF Workshop on Surfaces of Plant Function of Stems and Trunks. Newport, OR, 17 February 1994.
10. Ingham, E.R. 1994. Microorganisms, unseen allies in maintaining soil productivity. Farming for Profit and Stewardship. Portland, OR, 18-19 February 1994.
11. Ingham, E.R. 1994. Control of aboveground vegetation in forests by soil organisms. Ecological Society of America, Knoxville, TN, 31 July - 4 August 1994.
12. Holmes, M. and E.R. Ingham. 1994. Effects of *Klebsiella planticola* on soil foodweb responses. Ecological Society of America, Knoxville, TN, 31 July - 4 August 1994.
13. William, R.D., E.R. Peachey, J. DeAngelis, E.R. Ingham, J. Luna, and P. Kenagy. 1994. Multiple pest suppression with cereal cover crops in vegetable cropping systems. Weed Science Society of America.
14. Seiter, S., E.R. Peachey, R.D. William, E.R. Ingham, and W.R. Horwath. 1994. Annual and perennial cover crops modify soil ecosystems. Weed Science Society of America.
15. Holmes, M. and E.R. Ingham. 1995. Biosafety and GEM release: Ecological effects following addition of *Klebsiella planticola* to soil. Friends of the Earth Symposium, Brussels, Belgium. February 2-6, 1995.
16. E.R. Ingham. 1995. General Soil Ecology. Applied Insect Ecology Society. Santa Barbara, CA. February 6-9, 1995.
17. Olson, M.L., P.T. Rygielwicz and E.R. Ingham. 1995. Responses of soil foodweb organisms to global climate change in Douglas-fir mesocosms. Soil Ecology Society. Fort Collins, CO March 12-15, 1995.
18. Tuininga, A.R. and E.R. Ingham. 1995. Can we predict outcomes of interspecific fungal interactions in vitro from fungal growth patterns? Soil Ecology Society. Fort Collins, CO March 12-15, 1995.
19. Johnston, R. and E.R. Ingham. 1995. Restoration of desert grasslands through control of soil foodweb structure. Soil Ecology Society, Fort Collins, CO. March 12-15, 1995.
20. Holmes, M. and E.R. Ingham. 1995. Ecological effects following addition of *Klebsiella planticola* to soil. Soil Ecology Society, Fort Collins, CO. March 12-15, 1995.
21. Seiter, S., E.R. Peachy, R.D. William, E.R. Ingham, and W.R. Horwath. 1995. Annual and Perennial Cover Crops Modify soil Ecosystems. Presented at the Weed Science Society of America Meetings, Seattle, WA, Jan 30 - Feb 2, 1995.
22. Ingham, E.R., A.J. Tugel and M.D. Hubbs. 1996. Soil Foodweb Structure and Soil Quality Agronomy Society of America. November 3-7, 1996.
23. Sances, F.V. and E.R. Ingham. 1996. Alternative Organic Management Outproduces Methyl Bromide in California Strawberry Production. International Methyl Bromide Conference, Orlando, FL. November 4-6, 1996.
24. Ingham, E.R., A. Moldenke, and A. Tugel. A National Program for Soil Education. Soil Ecology Society. May, 1997.
25. Ingham, E.R., A. Moldenke, and A. Tugel. Soil Alive: A National Campaign. Ecological Society of America. August, 1997.
26. Ingham, E.R. 1997. "Soil foodweb structure and function in forests: A comparison of conifer, deciduous, riparian and managed forests." International Union of Forestry Research Organizations. September, 1997.
27. Ingham, E.R. 1998. "Soil foodweb structure and function in forests." Soil Organisms in Forests Workshop, LaSells-Stewart Center, Oregon State University, April 16-18, 1997.

Research Grants

- Growing Solutions
1999-2000: Factors Influencing Production of Compost Tea Quality.
- Helena Chemical Corporation
1998 - 1999: Effects of biological control products on the soil foodweb.
- Natural Resource Conservation Service
1995-1997: Database development for soil organisms
1995-1997: Primer development for soil organisms
- EPA/Agriculture in concert with the Environment Program
1994-1997: Influence of Cover Crop and Non-Crop Vegetation on Symphytan (Scutigereella immaculata) Density in Vegetable Production Systems in the Pacific Northwest
- EPA/Intergovernmental Personnel Agreement
1991-1993: Agreement between OSU and ERL-Corvallis for interaction between Ecotoxicology Branch and E.R. Ingham.
- EPA/Co-operative Agreements/Research Grants/Contracts/Training Grants
1993-1996: Ozone Program: Assessment of Impacts of Ozone on Soil Organisms
1994-1996: Terracosm Assessment of Soil Foodweb Organisms
1992-1995: Two training grants with (1) Ozone and (2) GPEP groups
1991-1993: Ecological test protocols for the assessment of impact at terrestrial superfund sites, E.R. Ingham, P.I.
1991-1993: Effects of genetically engineered organisms on the soil foodweb
1989-1990: Development of ecosystem specific scenarios for the terrestrial ecosystem exposure assessment models; E.R. Ingham and M.V. Wilson, P.I.'s
- U.S. Forest Service
1995-1996: Impacts of thinning treatments on soil foodweb structure in coastal Douglas-fir forests.
1994: Eastside Assessment Program: Assessment of state of knowledge of soil bacteria, fungi, protozoa, nematodes and rotifers in the Columbia River Basin.
1994: Contract, Assessment of Distance from Downed Logs/Thinning, Burn Intensity and Grazing on Soil Foodweb Organisms
1994: Contract, Effects of Compaction on Soil Foodweb Organisms in the Deschutes Forest.
1994-1996: Competition between flying squirrels and nematodes for fungal biomass in thinned forests in the PNW.
1993-1995: Assessment of soil foodweb responses to chloropicrin.
1991-1992: Impact of chloropicrin on live tree rhizosphere foodwebs.
1990-1991: Assessment of bacterial and fungal biomass in soil.
- National Agricultural Pesticide Impact Assessment Program
1989-1993: Evaluation of the ecological impacts resulting from the use of chloropicrin to control laminated root rot in Northwest conifer forests.
- NSF Research Experiences for Undergraduates (each year for three years)
1989-1992: Awarded to Oregon State University, Joseph J. Beatty, Principal Investigator, 16 interdisciplinary co-operators (Presented seminars to students all 3 years. Advised 3

students in 1989; Co-advised 1 student in 1990; Advised Christine Ramirez in 1991; Advised Nicole Petty in 1992).

- National Science Foundation

1988-1991: Microbial ecology of ectomycorrhizal mats in a Douglas-fir ecosystem; awarded to Oregon State University, K Cromack, R. Griffiths, B. Caldwell, M. Castellano, E. Ingham, and R. Morita

1986: International Synthesis Workshop on C, N, P and S Interactions in Terrestrial Ecosystems; awarded to the University of Georgia; held at Sapelo Island, Georgia, 13-18 April 1986; D.C. Coleman, E.R. Ingham, C.P.P. Reid, and H.W. Hunt, P.I.'s

1984-1985: A cross-ecosystem analysis of decomposition, nutrient cycling and primary production in semiarid environments; awarded to Colorado State University, D.C.

Coleman, P.I. (post-doctoral fellowship) National Science Foundation - SOS

1974: Effects of fire on Red Pine forests in northern