

Cindy Salo

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Sage Ecosystem Science
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Career Summary

Cindy Salo has over 20 years experience as a plant ecologist. She writes about science and natural resource issues for general and technical audiences. Cindy has investigated plant interactions and invasions in the Intermountain West, the Sonoran Desert, Senegal, and Mexico. She has conducted research at the University of Arizona and the U.S. Geological Survey and now works for herself at Sage Ecosystem Science in Boise, Idaho, where she provides sound research and clear writing.

Professional Experience

Sage Ecosystem Science, Boise, ID Jan. 2007-present
Chief Scientist and President

- Sage Ecosystem Science is a woman-owned and -operated business that provides research and writing about ecosystems of the Intermountain West
- Clients include: The Nature Conservancy, U.S. Geological Survey, the University of Idaho, Merlin Environmental, and Sound Science LLC.

Sound Science LLC, Boise, ID and New York, NY May 2008-July 2011
Associate Scientist

- Wrote series of white papers on natural resource management issues for the US Army Sustainable Range Program
- Described biological thresholds for sustainability and realistic training conditions on US Army training installations
- Developed documents to help US Army personnel recognize biological thresholds and use appropriate monitoring techniques

USGS Forest & Rangeland Ecosystem Science Center,
Snake River Field Station, Boise, ID Jan. 2003-Jan. 2007

Research Ecologist

- Established a research program focusing on restoration of sagebrush steppe. Initiated, designed, and carried out work in ID, OR, NV, and WY
- Studies included identifying thresholds for recovery of native vegetation after wildfire, determining effects of fuels management treatments on habitat for Greater Sage-Grouse, and evaluating the use of fire surrogate treatments to thin dense, single-aged stands of big sagebrush in order to increase understory species for wildlife
- Hired and supervised field crews and collaborated with other researchers, land managers, and stakeholders
- Analyzed data, prepared reports, and presented results and management implications at agency, professional, and public meetings

Institut des Sciences de l'Environnement,

Université Cheikh Anta Diop, Dakar, Senegal, West Africa

Mar. 2002 – Dec. 2002

Research Ecologist

- Conducted research on Fullbright Fellowship
- First to document the spread of introduced *Prosopis juliflora* and native *Acacia nilotica* var. *adansonia* in the Saloum region of Senegal
- Collaborated with researchers at a University in Dakar, designed the study, located research site, and carried out field research, all in Wolof, the local language

School of Renewable Natural Resources,

University of Arizona, Tucson, AZ

Aug. 1998 – Mar. 2002

Graduate Research Associate

- Investigated the effects of soil nitrogen level manipulations on interactions among red brome (*Bromus madritensis* subsp. *rubens*), a Mediterranean annual grass, and native annual species in the Sonoran Desert
- A separate study traced the introduction and spread of red brome in western North America
- These studies have produced three peer-reviewed publications

School of Renewable Natural Resources,

University of Arizona, Tucson, AZ

Oct. 2000-Dec. 2000

Graduate Teaching Associate

- Teaching assistant for Rangeland Inventory and Monitoring, a graduate and upper division under graduate course
- Evaluated and coached data interpretation and technical writing skills

School of Renewable Natural Resources,

University of Arizona, Tucson, AZ

Jan. 2000-May 2000

Jan. 1999-May 1999

Graduate Teaching Associate

- Teaching assistant for Range and Forest Management, a graduate and upper division under graduate course
- Prepared, presented and coordinated lecture and laboratory session and field trips throughout Arizona

Soil, Water & Environmental Science Department,

University of Arizona, Tucson, AZ

Oct. 1992 – Aug. 1997

Senior Research Specialist

- Developed guidelines and strategies for revegetating saline flue gas desulfurization (FGD) sludge disposal sites
- Designed laboratory, greenhouse, and field studies, analyzed data, published results in peer-reviewed journals, and presented to funding agency and at professional meetings
- Researched and wrote literature review and final project report, both published by Electric Power Research Institute (EPRI)

Education

- Graduate Certificate in Technical Communications** Boise State University, Boise, ID
- 48-credit program
 - Courses in writing, editing, and document production
- Ph.D. in Renewable Natural Resources** University of Arizona, Tucson, AZ
- Emphasis in Plant Ecology
 - Dissertation title: [Ecology and biogeography of red brome \(*Bromus madritnesis* subsp. *rubens*\) in the Sonoran Desert](#)
- M.S. in Soil and Water Science** University of Arizona, Tucson, AZ
- Emphasis in Soil Microbiology
 - Thesis title: [Competition between strains of rhizobia for nodulation of *Leucaena leucocephala*](#)
- B.S. in Animal Science** University of Minnesota, St. Paul, MN
- Awarded with high distinction
 - Additional work in Agronomy

Publications

For general audiences:

- Salo, C.** 2011. Land Lines: [Meat with a Story](#) . Rangelands 33(6)25-28.
- Salo, C.** 2011. Land Lines: [Big sagebrush: fine variations on a winning theme](#) . Rangelands 33(5)45-48.
- Salo, C.** 2011. Research Spotlight: [Researchers find an unusual type of hybrid origin in a rare plant](#). Boise State University Division of Research and Economic Development, Boise, ID.
- Salo, C.** 2011. Land Lines: [Waves of the Future: Radar LiDAR, and GRACE](#). Rangelands 33(4)75-77.
- Salo, C.** 2011. Land Lines: [The Cheatgrass that Wasn't There](#). Rangelands 33(3)60-62.
- Salo, C.** 2011. Research Spotlight: [Boise State researcher studies link between ants and rare plants](#). Boise State University Division of Research and Economic Development, Boise, ID.
- Salo, C.** 2004. Are any trees better than no trees? Mesquite from Central America is spreading in Senegal. In: Ecology – A Science That Matters, poster for secondary schools in West Africa, British Ecological Society.
- Salo, L.F.** 2001. [The grassland threat](#). Sunday guest opinion, Arizona Daily Star, May 6, 2001.

Refereed research publications:

- Washington-Allen, R.A., D.D. Briske, H.H. Shugart, and **L.F. Salo**. 2010. [Catastrophic thresholds, perspectives, definitions, and applications: An introduction](#). Ecology and Society 15(3):38.
- Salo, L.F.** 2005. Red brome (*Bromus rubens* subsp. *madritensis*) in North America: possible modes for early introductions, subsequent spread. Biological Invasions 7:165 - 180.
- Salo, L.F.**, G.R. McPherson, and D.G. Williams. 2005. [Sonoran Desert winter annuals affected by density of red brome and soil nitrogen](#). The American Midland Naturalist 153:102-116.
- Salo, L.F.** 2004. Population dynamics of red brome (*Bromus madritensis* subsp. *rubens*): times for concern, opportunities for management. Journal of Arid Environments 57:291-296.
- Salo, L.F.**, J.F. Artiola, and J.W. Goodrich-Mahoney. 1999. Revegetation of a saline flue gas desulfurization sludge pond. Journal of Environmental Quality 28:218-225.

- Barlas, S.A., J.F. Artiola, **L.F. Salo**, and J.W. Goodrich-Mahoney. 1999. Sulfur transformations related to the revegetation of flue gas desulfurization sludge. *Communications in Soil Science and Plant Analysis* 30:1403-1416.
- Salo, L.F.**, J.F. Artiola, and J.W. Goodrich-Mahoney. 1997. Selected species and amendments for revegetating saline flue gas desulfurization sludge: Greenhouse study. *Journal of Environmental Quality* 26:1176-1181.
- Salo, L.F.**, J.F. Artiola, and J.W. Goodrich-Mahoney. 1996. Plants for revegetation of a saline flue gas desulfurization sludge pond. *Journal of Environmental Quality* 25:802-808.

Major research reports:

- Sage Ecosystem Science.** 2009. [Relationship between livestock trampling and slickspot peppergrass \(*Lepidium papilliferum*\) abundance](#). Submitted to US Fish and Wildlife Service as part of comments on listing of slickspot peppergrass under the Endangered Species Act.
- Salo, L.F.** and J.F. Artiola. 1999. Revegetation of a High-Volume Combustion By-Product and Low-Volume Utility Waste Disposal Area: A Southwestern Site. EPRI TR-113939 Electric Power Research Institute, Palo Alto, CA.
- Salo, L.F.** and J.F. Artiola. 1994. Revegetation of Flue Gas Desulfurization Sludge Pond Disposal Sites. EPRI TR-103312. Electric Power Research Institute, Palo Alto, CA.

Other research publications:

- Salo, C.** 2010. [Owyhee Initiative Science Panel Minority Report](#). Report of the First Owyhee Initiative Science Panel to the University of Idaho.
- Rimbey, N., T. Hoffman, **C. Salo**. 2009. Legal Issues Facing the Bureau of Land Management's Boise District: Exploring the Issues and Searching for Solutions. Report to the BLM Boise District's Resource Advisory Committee. July, 2009.
- Washington-Allen, R.A. and **L.F. Salo**. 2007. Symposium Review: Icons and Upstarts and the Detection of Thresholds: Definitions, Perspectives, and Methods. *Ecological Society of America Bulletin* April, pp. 219-225.
- Salo, C.** and D.A. Pyke. 2003. Thresholds of cheatgrass dominance. pp. 27-28 In: 2003 Intermountain Restoration Coordination Meeting, Boise State University, Boise Idaho, March 31 & April 1, 2003. Unpublished Report, US Geological Survey.

Presentations

Invited presentations:

- Johnson, B. and **Salo, C.** 2009. How RTLA facilitates the preparation of RECs and the NEPA process. US Army Sustainable Range Program Workshop, July 6-10, Indianapolis, IN.
- Salo, C.** and B. Unnasch. 2009. *Lepidium papilliferum*: CCA+CDC=HIP... what can we learn from the data? Vth annual Intermountain Native Plant Summit, Mar. 23-25, Boise, ID.
- Salo, L.F.** and M.E. Rhodes. 2007. [Sweet success? Sucrose application for wildfire rehab](#). Society for Range Management Annual Meeting, Feb. 9-16, Reno, NV.
- Salo, C.** 2007. [Anchoring the Sagebrush Sea: Readin', writin', and ranchers](#). Idaho Section Society for Range Management Annual Meeting and Symposium, Jan. 16-17, Boise, ID.
- Salo, L.F.** and S.E. Hanser. 2006. [Introduction and spread of red brome in North America: the past, present... future](#). Ecology and Management of Red Brome Symposium, May 16-17, Mesa, AZ.
- Salo, C.** 2006. Anchoring the Sagebrush Sea: to seed or not to seed? Intermountain Native Plant Summit, Mar. 27-29, Boise, ID.

- Salo, C.** 2005. [Rethinking Rangeland Sustainability: Rangeland states and transitions](#). On the Cutting Edge, a Symposium and Workshop of New Ideas and Tools for Rangeland Stewardship, Nov. 7-9, Boise, ID.
- Salo, C.** and D. Pyke. 2005. Restoration of damaged lands in the Intermountain West. US Geological Survey / Fish and Wildlife Service Coordination Meeting, May 18-19, Boise, ID.
- Salo, C.** 2005. Anchoring the Sagebrush Sea: chaos at sea? Annual Idaho Rare Plant Conference, Feb. 15-16, Boise, ID.
- Salo, C.** 2005. Nurturing the Mother Continent: natural resources in Senegal. Research Across Disciplines seminar, Dept. of Renewable Resources, University of Wyoming, Feb. 4, Laramie, WY.
- Salo, C.** 2004. Thresholds of Cheatgrass Dominance. Department of Interior Science Seminar, USGS Water Resources, April 17, Boise, ID.

Other presentations:

- Salo, C.** 2009. Management implications of invasive species in shrub steppe. Conservation Biology class guest lecture, Boise State University, Mar. 5, Boise, ID.
- Salo, C.** 2007. Forces of Nature: What causes range ecosystems to change or remain the same? Science on the Range Training for Teachers, Apr. 20-21, Challis, ID.
- Salo, C.** 2007. Invasive species in shrub steppe. Conservation Biology class guest lecture, Boise State University, Mar. 1, Boise, ID.
- Salo, C.** 2007. Are any trees better than no trees? Environmental issues in Senegal, West Africa. Environmental Science class guest lecture, Emmett High School, Mar. 2, Emmett, ID.
- Salo, C.** 2007. Nurturing the Mother Continent: Old grasses, new trees. International Connections bag lunch, University Libraries, Boise State University, Jan. 18, Boise, ID.
- Washington-Allen, R.A. and **L.F. Salo**, organizers. 2006. Symposium: Icons and Upstarts and the Detection of Thresholds: Definitions, Perspectives, and Methods. Ecological Society of America Annual Meeting Aug. 6-11, Memphis, TN.
- Salo, C.** 2006. Reaping local rangeland knowledge. University of Idaho field tour, April 22, Emmett, ID.
- Salo, C.**, M.E. Rhodes, and D.A. Pyke 2006. Anchoring the sagebrush sea: to seed or not to seed? Northwest Scientific Association Annual Meeting, Mar. 6-8, Boise, ID.
- Salo, L.F.**, S.E. Hanser, R.S. Unnasch, and D.A. Pyke. 2006. [Extreme makeover, habitat edition: Fuels management treatments and Greater Sage-Grouse](#) (poster). Society for Range Management Annual Meeting, Feb. 12-17, Vancouver, B.C., Canada.
- Salo, L.F.**, M.E. Rhodes, and D.A. Pyke. 2005. [Chaos on the Sagebrush Sea: catastrophe theory and rangeland vegetation change](#). Ecological Society of America Annual Meeting, Aug. 7-12, Montreal, Quebec, Canada.
- Salo, L.F.**, R.S. Unnasch, and D.A. Pyke. 2005. Anchoring the Sagebrush Sea: thresholds for recovery of Wyoming big sagebrush communities. Society for Range Management Annual Meeting, Feb. 5-11, Ft. Worth, TX.
- Salo, C.** and D.A. Pyke. 2004. Thresholds of cheatgrass dominance: research update. Coordinated Intermountain Restoration/Integrated Restoration Strategies Research Update Meeting, Dec. 1-2, Reno, NV.
- Salo, L.F.**, D.A. Pyke, and M. Pellant. 2004. [Anchoring the Sagebrush Sea: thresholds for recovery of Wyoming big sagebrush communities](#) (poster). Ecological Society of America Annual Meeting, Aug. 1-6, Portland, OR.
- Salo, L.F.** and M. Zielinski. 2004. [Cheatgrass dieoffs: of drought, cutworms, and bears?](#) (poster). Society for Range Management Annual Meeting, Jan. 24-30, Salt Lake City, UT.

- Salo, L.F.**, G.R. McPherson, and D.G. Williams. 2004. [Red brome and Sonoran Desert winter annuals affected by soil nitrogen level](#) (poster). Intermountain Native Plant Summit, Jan. 28, Salt Lake City, UT.
- Tartowski, S., **L. Salo**, and J. Herrick. 2003. Manipulation of resource heterogeneity in restoration of arid grasslands and shrublands. Society for Ecological Restoration Annual International Conference, November 19-22, Austin, Texas.
- Salo, L.F.** 2003. [Introduced \(*Prosopis juliflora* and *Azadirachta indica*\) and native \(*Acacia nilotica* subsp. *adansonii*\) trees spreading in Senegal, West Africa](#) (poster). Ecological Society of America Annual Meeting, Aug. 3-9, Savanna, GA.
- Salo, L.F.**, G.R. McPherson, and D.G. Williams. 2002. Sonoran Desert winter annuals affected by density of red brome (*Bromus rubens*) and soil nitrogen (poster). Ecological Society of America Annual Meeting, Aug. 4-9, Tucson, AZ.
- Salo, L.F.**, G.R. McPherson, and D.G. Williams. 2000. Biogeography of red brome (*Bromus rubens*) in the Sonoran Desert (poster). Ecological Society of America Annual Meeting, Aug. 6-10, Snowbird, UT.
- Salo, L.F.**, G.R. McPherson, and D.G. Williams. 1999. Biogeography of red brome (*Bromus rubens*) in the Sonoran Desert (poster). Natural Areas National Conference, Oct. 13-16, Tucson, AZ.
- Salo, L.F.** and J.F. Artiola. 1996. Revegetation of a saline flue gas desulfurization sludge pond (poster). American Society of Agronomy National Meetings, Oct. 30-Nov. 8, Indianapolis, IN.
- Salo, L.F.** and J.F. Artiola. 1994. Evaluation of plants and amendments for revegetation of saline flue gas desulfurisation sludge (poster). American Society of Agronomy National Meetings, Nov. 13-18, Seattle, WA.
- Kopec, D.M., P.W. Brown, C.F. Mancino, D.C. Slack, and **L.F. Salo**. 1988. Desert turfgrass crop coefficients. American Society of Agronomy National Meetings, Nov. 27 - Dec. 2, Anaheim, CA.

Grants, Awards, and Fellowships

2006. Forest and Rangeland Ecosystem Science Center, **US Geological Survey STAR award**, for field crew safety.
- 2005-2007. **Science Support Partnership Grant**, US Geological Survey / US Fish and Wildlife Service. Thresholds of recovery: cheatgrass dominance in Wyoming big sage-brush communities after fire and fire surrogate treatments. With Rachelle Huddleston-Lorton, Hart Mountain National Antelope Refuge, Plush, OR.
2005. First place winner: Digital Division, 30th Annual **US Geological Survey National Photographic Competition**.
2002. **Percy Sladen Memorial Fund Field Research Grant**, Linnean Society of London, England. Spread of *Prosopis juliflora* in the Saloum Region of Senegal.
- 2001-2002. **Fulbright Fellowship** to Senegal, West Africa, US State Department. Spread of *Prosopis juliflora* in the Saloum Region of Senegal.
2000. **Springfield Travel Scholarship**, School of Renewable Natural Resources, University of Arizona. Biogeography of red brome (*Bromus rubens* L.) in the Sonoran Desert.
- 1999-2000. **Final Project Fund Award**, Graduate College, University of Arizona. Ecology and Biogeography of red brome (*Bromus rubens* L.) in the Sonoran Desert.
1999. **Student Travel Grant**, Institute for the Study of Planet Earth, University of Arizona. Biogeography of red brome (*Bromus rubens* L.) in the Sonoran Desert.
- 1997-1998. **Small Projects Grant**, Small Grants Program, Office of the Vice President for Research, University of Arizona. Phytoremediation Potential of *Astragalus amphioxix*, a Boron Accumulator.

- 1997-1998. **Graduate Registration Scholarship**, Arid Land Resource Sciences, University of Arizona.
- 1993-1994. (With Janick F. Artiola) Phase I: Research and Engineering, **Revegetation of RICRA Closed Land Disposal Units**, Hughes Missile, Tucson, AZ, with J. F. Artiola, University of Arizona.
1983. **Tinker Field Research Grant**, Tinker Foundation, Inc. Collection of rhizobia bacteria nodulating *Leucaena leucocephala* in Vera Cruz and Yucatan, Mexico.

Professional Service

- 2010-2011. Finance Co-chair, Annual Meeting Committee, Society for Range Management.
- 2007-2011. Treasurer, Idaho Section, Society for Range Management.
2009. Panel member, UD Dept. of Defense and US EPA Strategic Environmental Research and Development Program (SERDP).
2009. Student presentation judge, Society for Range Management Annual Meeting, Feb. 9-12, Albuquerque, NM.
2007. Served as ecological site description expert during breakout session, Ecological Site Descriptions as a Management Tool Workshop, Oct. 24, Park City, Utah.
2007. Student presentation judge, Society for Range Management Annual Meeting, Feb. 12-15, Reno, NV.
2006. Buell-Braun student presentation judge, Ecological Society of America Annual Meeting, Aug. 6-11, Memphis, TN.
2006. Panel member, US Dept. of Agriculture Cooperative State Research, Education and Extension Service (CSREES), National Research Initiative (NRI) Competitive Grants Program, Washington, DC.
2006. Student presentation judge, Society for Range Management Annual Meeting, Feb. 12-17, Vancouver, B.C., Canada.
2005. Strategies for Ecology Education, Development, and Sustainability (SEEDS) Mentor, Ecological Society of America Annual Meeting, Aug. 7-12, Montreal, Quebec, Canada.
2005. Reviewed Greater Sage-Grouse Conservation Assessment and Strategy for Oregon, prepared by the Oregon Department of Fish and Wildlife.
2005. Student presentation judge, Society for Range Management Annual Meeting, Feb. 5-11, Ft. Worth, TX.
2004. Reviewed red brome (*Bromus rubens*) profile for Global Invasive Species Database (GISD), produced by the Invasive Species Specialist Group of the IUCN. <http://www.issg.org/database>.
2003. Buell-Braun student presentation judge, Ecological Society of America Annual Meeting, Aug. 3-9, Savanna, GA.
2003. AgroEcosystems Session Chair. Ecological Society of America Annual Meeting, Aug. 3-9, Savanna, GA.

Training Courses Completed

2011. **Santa Fe Science Writing Workshop**, May 31-June 4, Santa Fe, NM.
2009. **NEPA Cumulative Impacts: Analysis and Documentation**, Oct. 20-21, Salmon, ID.
2009. **Applying the NEPA Process and Writing Effective NEPA Documents**, Aug. 11-4, Las Vegas, NV.
2007. **Resolving Land Use Disputes**, Lincoln Institute of Land Policy, Oct. 2-3, Salmon, ID.
2006. **Using the Vegetation Dynamics Development Tool (VDDT) to Simulate Vegetation Change on the Landscape**, L. Frid, Society for Range management Annual Meeting. Feb. 16, 2006, Vancouver, B.C., Canada.

2004. **Structural Equation Modeling**, J. Grace and S. Scheiner, Ecological Society of America Annual Meeting. Aug. 1, Portland, OR.
2004. **Eco-Informatics Training for Ecologists**, Long Term Ecological Research Network Office, University of New Mexico. Jan. 4-9, Sevilleta, NM.
2003. **Interpreting and Measuring Indicators of Rangeland Health**, D. Pyke, J. Herrick, P. Shaver, M. Pellant, BLM Interagency Training Course. June 24-27, Boise, ID,.
2000. **Intermediate Wildland Fire Behavior**, Tucson, AZ.
2000. **Basic Wildland Firefighting**, Tucson, AZ.

Manuscripts Reviewed for

American Journal of Botany
Environmental Management
Journal of Arid Environments
Plant Ecology
Restoration Ecology

Ecological Applications
Journal of Applied Ecology
Journal of Environmental Quality
Rangeland Ecology and Management
Weed Technology