

CURRICULUM VITAE

EDITH BACH ALLEN

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Personal

Born: December 23, 1950, Germany (U.S. Citizen). Married: 1976 to Michael F. Allen

Education

Ph.D.	Botany	University of Wyoming	1979
M.S.	Botany	Rutgers University, NJ	1975
B.A.	Biology & German	Tufts University, MA (magna cum laude)	1973

Professional Experience

Professor Emerita, UC Riverside	2017-present
Professor of Plant Ecology and Natural Resources Extension Specialist	2002-2017
Assistant/Associate Professor and Natural Resources Extension Specialist	1993-2002
Adjunct Professor, Dept. Biology, San Diego State University	1988-1993
Research Asst. Professor, Dept. Range Science, and Director, Institute for Land Rehabilitation, Utah State University	1982-1988
Research Associate, Dept. of Plant Pathology, University of Nebraska	1981
Post-Doctoral Fellow, Dept Biology, New Mexico State University	1980
Research Assistant and Teaching Assistant, University of Wyoming	1975-1979
Teaching Assistant, Rutgers University	1973-1975
Research Aid, Max Planck Institutes for Chromosomal and Viral Research, Tübingen, Germany	1972

Major Research Interests

My research interests include plant community ecology, restoration ecology, invasive species ecology, and soil and mycorrhizal ecology. I have studied restoration in seasonal tropical forest, Mexico, and subarctic forest, Alaska, but my focus has been restoration of western US and California shrublands, grasslands and deserts that are invaded by exotic annual plants, impacted by anthropogenic nitrogen deposition, and are subject to frequent fire and urban disturbances. My research assessed levels of nitrogenous air pollutants for regulatory agencies to reduce exotic grass productivity, and thus reduce fire risk to restore native ecosystems. In addition, I have tested restoration techniques (weeding, mowing, grazing, herbicides, fire, biological control) to control invasive species, especially exotic annual grasses, followed by seeding, planting, and natural recovery from the seedbank of native species. Results contributed to basic understanding of these ecological systems and are used to support conservation and restoration management of wildlands. As a cooperative extension specialist, I have done outreach and research collaboration with private citizens, managers of private, city, county, state, and federal lands, and UC Agriculture and Natural Resources personnel.

Honors

Jake Sigg Award for Vision and Service, California Invasive Plant Council, Oct. 2017
Honorary Member, Sigma Delta Epsilon Graduate Women in Science, Aug. 2014
Fulbright Specialist Award, Sept. 2013
Selected as Fellow, American Association for the Advancement of Science, Oct. 2012
Professional Achievement Award, Soil Ecology Society, 2007
John Rieger Award for Service, Society for Ecological Restoration, 1999

Professional Activities

Member, EPA Clean Air Science Advisory Committee on NO_x and SO_x, 2015-2020
USGS Powell Center Working Group on Plant Diversity and Nitrogen Deposition,
Principal Investigator and Member, 2013-2018
Member, Board of Directors, California Invasive Plant Council, 2009-2013
President, Soil Ecology Society, 2002-2003
Chair, USFWS Quino Checkerspot Butterfly Recovery Team, 1999-2003
Member, USDA Western Research Coordinating Committee for Revegetation, 1996-
2000 (Chair 1997)
Member, ESA Committee on Future of Long Term Ecological Data, 1993-1995
Member, ESA Committee on Professional Ethics, 1989-1992
Member, AAAS Committee on Arid Lands, 1984-89
Board Member and Secretary, Society for Ecological Restoration, 1988-92
Western Section Chair, ASSMR, 1987, Board Member 1988
President, Utah State University Chapter of Sigma Xi, 1986-87

Editorships

Handling Editor, *Oecologia*, 2014-present
Associate Editor, *Invasive Plant Science and Management*, 2007-present
Associate Editor, *Functional Ecology*, 2009-2014
Editor-in-Chief, *Restoration Ecology*, 1999-2004
Associate Editor, *Restoration Ecology*, 1992-1999

Invited seminars (selected, recent)

USGS Fort Collins, 2015; University of Yucatan, seminar and workshop on mycorrhizae, 2015;
University of Cordoba, Argentina, workshop on mycorrhizae, 2013; International Conference on
Mycorrhizae, Flagstaff, AZ, 2015; Northwestern University, 2014; Soil Science Society of
America Annual Meeting, Longbeach, CA, 2014; California Polytechnic University, Pomona,
2006, 2013; National Institute of Ecology, South Korea, 2012; Chinese Academy of Sciences,
Lanzhou, China, 2012; Chinese Academy of Sciences, Changchun, China, 2012; UCSD 2009,
Consejo Superior de Investigaciones Científicas, Madrid, 2009; Western Mycorrhiza Gathering,
Bishop; ESA, 2010; Alabama A&M University, 2007; University of Vermont, Plant Biology
Department, 2007; University of Nevada, Reno, 2008; Southern California Academy of
Sciences, 2008; American Geophysical Union 2008; Pennsylvania State University, 2009; Forest
Service Critical Loads Conference, Riverside, 2005; Society for Ecological Restoration,
Zaragoza, Spain, 2005; Chicago Botanic Garden, Evanston, Ill, 2005; Interagency Critical Loads
Workshop, University of Virginia, 2006; California State University Fullerton, 2004; Mexican
Botanical Congress, Oaxaca, 2004; Universidad Nacional Autonoma de Mexico, 2004; Mojave
Desert Science Symposium, 2004; Archbold Research Station, Florida, 2004.

Grant Review Panels

Panel Member for

National Science Foundation EPSCoR (2019, 2014-2017), Ecosystems (2012), Ecology, Population and Evolution (2008), Committee of Visitors for Ecological Studies Programs (2002), Conservation and Restoration Ecology (1992, 1997), LTER Supplement (1994), Ecology (1988-1991);

UC Pacific Rim Grant Program (2013-2015);

UC President's Post-doctoral Fellowship (2013);

NSF/NASA/DOE/USDA Terrestrial Ecosystems (1998);

USGS BRD Global Change Research (1998);

USDOE, National Institute for Climate Change Research (2006);

EPA Ecosystem Restoration (1997);

EPA-STAR Graduate Fellowship Program (2015);

USDA-NRI Weed Science (1997); Ecosystem Ecology (1995).

Panel Manager, USDA-NRI Managed Ecosystems (1999-2000)

Panel Chair, UC Invasives Species Research Program (2001-2004)

UCR University Service (selected, recent)

Vice-chair for Teaching, Botany & Plant Sciences (2010-2017)

Committee on Courses (2012-2015)

Committee on Academic Personnel (2004-2007)

Faculty search committees for Plant Physiological Ecologist (2005); Hydrologist (2006);

Functional Landscape Ecologist (2007); Director, Air Pollution Research Center (2007);

Entomology CE Specialist (2008); Dean, School for Public Policy (2013); Weed Scientist CE

Specialist (2013); Biogeochemist (2014); Microbial Invasive Species Scientist (2011);

Atmospheric Scientist (2012); Plant Community Ecologist (2013).

Other University Program Reviews

Review committee chair, Department of Natural Resource Management, South Dakota State University, 2018

Review committee chair, Department of Ecosystem Sciences and Management, Texas A&M University, 2015

Member, review committee. Environmental Sciences Program, University of Texas, San Antonio, 2014.

Member, USDA-CSREES review committee for University of Nevada, Dept. Natural Resources & Environmental Science, 2009.

Theses

Bach, E. 1975. Plant species removals and old-field community structure. M.S. Thesis, Rutgers University, New Brunswick, NJ. R.T.T. Forman, thesis advisor.

Allen, E. Bach. 1979. The competitive effects of introduced annual weeds on some native and reclamation species in the Powder River Basin, Wyoming. Ph.D. Dissertation, University of Wyoming, Laramie, WY. D.H. Knight, dissertation advisor.

Refereed Publications (contact edith.allen@ucr.edu for pdf copies)

- 1) Allen, E.B., and R.T.T. Forman. 1976. Plant species removals and old-field community structure and stability. *Ecology* 57:1233-1243.
- 2) Allen, E.B., and M.F. Allen. 1980. Natural re-establishment of vesicular- arbuscular mycorrhizae following stripmine reclamation in Wyoming. *Journal of Applied Ecology* 17:139-147.
- 3) Allen, E.B. 1982. Water and nutrient competition between *Salsola kali* and two native grass species (*Agropyron smithii* and *Bouteloua gracilis*). *Ecology* 63:732-741.
- 4) Allen, E.B. 1982. Competition and germination of *Salsola kali* and native C-3 and C-4 species under three temperature regimes. *Bulletin of the Torrey Botanical Club* 109:39-46.
- 5) Allen, E.B., and G.L. Cunningham. 1983. The effects of vesicular- arbuscular mycorrhizae on *Distichlis spicata* under three salinity levels. *New Phytologist* 93:227-236.
- 6) Allen, E.B., and D.H. Knight. 1984. The effects of introduced annuals on secondary succession in sagebrush grassland, Wyoming. *The Southwestern Naturalist* 29:407-421.
- 7) Allen, E.B., and M.F. Allen. 1984. Competition between plants of different successional stages: mycorrhizae as regulators. *Canadian Journal of Botany* 62:2625-2629.
- 8) Allen, M.F., E.B. Allen and P.D. Stahl. 1984. Differential niche response of *Bouteloua gracilis* and *Pascopyrum smithii* to VA mycorrhizae. *Bulletin of the Torrey Botanical Club* 111:361-365.
- 9) Allen, E.B. and M.F. Allen. 1986. Water relations of xeric grasses in the field: interactions of mycorrhizas and competition. *New Phytologist* 104:559- 571.
- 10) Waaland, M.E. and E.B. Allen. 1987. Relationships between VA mycorrhizal fungi and plant cover following surface mining in Wyoming. *Journal of Range Management* 40:271-276.
- 11) Allen, E.B., J.C. Chambers, K.F. Connor, M.F. Allen, and R.W. Brown. 1987. Natural reestablishment of mycorrhizae in disturbed alpine ecosystems. *Arctic and Alpine Research* 19:11-20.
- 12) Allen, E.B. and M.F. Allen. 1988. Facilitation of succession by the nonmycotrophic colonizer *Salsola kali* on a harsh site: effects of mycorrhizal fungi. *American Journal of Botany* 75:257-266.
- 13) Allen, M.F., E.B. Allen, N.E. West. 1988. Influence of parasitic and mutualistic fungi on temperate semi-desert shrubs during high precipitation peaks. *Bulletin of the Torrey Botanical Club* 114:272-279.
- 14) Jordan, W.R., R.L. Peters, and E.B. Allen. 1988. Ecological restoration as a strategy for conserving biodiversity. *Environmental Management* 12:55-72.
- 15) Allen, M.F., E.B. Allen and C.F. Friese. 1989. Responses of the nonmycotrophic plant *Salsola kali* to invasion by VA mycorrhizal fungi. *New Phytologist* 111:45-49.
- 16) Allen, E.B. 1989. The restoration of disturbed arid landscapes with special reference to mycorrhizal fungi. *Journal of Arid Environments* 17:279-286.
- 17) Allen, M.F. and E.B. Allen. 1990. Carbon source of VA mycorrhizal fungi associated with Chenopodiaceae from a semi-arid shrub-steppe. *Ecology* 71:2019-2021.
- 18) Ibrahim, M.A., W.F. Cambell, L.A. Rupp, and E.B. Allen. 1990. Effects of mycorrhizae on sorghum growth, photosynthesis, and stomatal conductance under drought conditions. *Arid Soil Research and Rehabilitation* 4:99-107.
- 19) Di, J.J. and E.B. Allen. 1991. Physiological responses of six wheatgrass cultivars to mycorrhizae. *Journal of Range Management* 44:336-341.
- 20) Allen, E.B., J.P. Cannon and M.F. Allen. 1993. Controls for rhizosphere microorganisms to study effects of VA mycorrhizae on *Artemisia tridentata*. *Mycorrhiza* 2:147-152.
- 21) Allen, E.B. and N.E. West. 1993. Nontarget effects of the herbicide tebuthiuron in sagebrush-semidesert. *Mycorrhiza* 3:75-78.

- 22) Huante, P., E. Rincon and E.B. Allen. 1993. Effect of vesicular arbuscular mycorrhizae on seedling growth of four tree species from the tropical deciduous forest in Mexico. *Mycorrhiza* 2:141-145.
- 23) Nelson, L.L. and E.B. Allen. 1993. Restoration of *Stipa pulchra* grasslands: effects of mycorrhizae and competition from *Avena barbata*. *Restoration Ecology* 1:40-50.
- 24) Allen, M.F., E. Rincon, E.B. Allen, P. Huante, J. Dunn. 1993. Observations of bromeliad roots from the canopies of a seasonal tropical forest, Chamela, Jalisco, Mexico. *Mycorrhiza* 4:27-28.
- 25) Allen, E.B., M.F. Allen, D.J. Helm, J.M. Trappe, R. Molina, and E. Rincon. 1995. Patterns and regulation of mycorrhizal plant and fungal diversity. *Plant and Soil* 170:47-62.
- 26) Cannon, J. P., E.B. Allen, M.F. Allen, L.M. Dudley, and J.J. Jurinak. 1995. The effects of oxalates produced by *Salsola tragus* on the phosphorus nutrition of *Stipa pulchra*. *Oecologia* 102:265-272.
- 27) Helm, D.J. and E.B. Allen. 1995. Vegetation chronosequence near Exit Glacier, Kenai Fjords National Park, Alaska. *Arctic and Alpine Research* 27:246-257.
- 28) Zink, T.A., M.F. Allen, B. I. Heindl-Tenhunen, E.B. Allen. 1995. The effect of a disturbance corridor on an ecological reserve. *Restoration Ecology* 3:304-311.
- 29) Weinbaum, B.S., M.F. Allen, and E.B. Allen. 1996. Survival of arbuscular mycorrhizal fungi following reciprocal transplanting across the Great Basin, U.S.A. *Ecological Applications* 6:1365-1372.
- 30) Allen, M.F., C. Figueroa, B.S. Weinbaum, S.B. Barlow, and E.B. Allen. 1996. Differential production of oxalates by mycorrhizal fungi in arid ecosystems. *Biology and Fertility of Soils*, 22: 287-292.
- 31) Sigüenza, C., I. Espejel and E.B. Allen. 1996. Seasonality of mycorrhizae in coastal sand dunes, Baja California. *Mycorrhiza* 6:151-157.
- 32) Marquez, V. and E.B. Allen. 1996. Ineffectiveness of two annual legumes as nurse plants for establishment of *Artemisia californica* in coastal sage scrub. *Restoration Ecology* 4:42-50.
- 33) Helm, D.J. and E.B. Allen. 1996. Mycorrhizal chronosequence near Exit Glacier, Alaska. *Canadian Journal of Botany* 74:1496-1506.
- 34) Eliason, S.A. and E.B. Allen. 1997. Competition as a mechanism for exotic grass persistence following conversion from native shrubland. *Restoration Ecology* 5:245-255.
- 35) Allen, E.B., W.W. Covington, and D.A. Falk. 1997. Developing the conceptual basis for restoration ecology. *Restoration Ecology* 5:275-276.
- 36) Allen, E.B., E. Rincón, M.F. Allen, A. Perez-Jimenez, and P. Huante. 1998. Disturbance and seasonal dynamics of mycorrhizae in a tropical deciduous forest in Mexico. *Biotropica* 30:261-274.
- 37) Helm, D.J., E.B. Allen and J.M. Trappe. 1999. Plant growth and mycorrhizal formation by transplants on deglaciated land near Exit Glacier, Alaska, USA. *Mycorrhiza* 8:297-304.
- 38) Padgett, P.E., E.B. Allen, A. Bytnerowicz, and R.A. Minnich. 1999. Changes in soil inorganic nitrogen as related to atmospheric nitrogenous pollutants in Southern California. *Atmospheric Environment* 33:769-781.
- 39) Allen, M.F., L.M. Egerton-Warburton, E.B. Allen and O. Karen. 1999. Mycorrhizae in *Adenostoma fasciculatum*: a combination of unusual ecto and endo- forms. *Mycorrhiza* 8:225-228.
- 40) Padgett, P. E. and E.B. Allen. 1999. Differential responses to nitrogen fertilization in native shrubs and exotic annuals common to mediterranean coastal sage scrub of California. *Plant Ecology* 144:93-101.
- 41) Stylinski, C.D. and E.B. Allen. 1999. Lack of native species recovery following severe exotic disturbance in southern California shrublands. *J Appl Ecol.* 36:544-554.
- 42) Egerton-Warburton, L. and E.B. Allen. 2000. Shifts in arbuscular mycorrhizal communities along an anthropogenic nitrogen deposition gradient. *Ecological Applications* 10:484-496.

- 43) Padgett, P.E., S.N. Kee and E.B. Allen. 2000. The effects of irrigation on revegetation of semiarid coastal sage scrub in southern California. *Environmental Management* 26:427-435.
- 44) Padgett, P.E., L. Vasquez and E.B. Allen. 2000. Seed viability and germination behavior of the desert shrub *Encelia farinosa* Torrey and A. Gray (Compositae). *Madroño* 46:126-133.
- 45) Yoshida, L.C. and E.B. Allen. 2001. Response to ammonium and nitrate by a mycorrhizal annual invasive grass and a native shrub in southern California. *American Journal of Botany* 88:1430-1436.
- 46) Allen, M.F., J. Lansing, and E.B. Allen. 2001. The role of mycorrhizal fungi in the composition and dynamics of plant communities: A scaling issue. *Progress in Botany* 63:344-367.
- 47) Egerton-Warburton, L., R.C. Graham, E.B. Allen, and M.F. Allen. 2001. Reconstruction of historical changes in mycorrhizal fungal communities under anthropogenic nitrogen deposition. *The Royal Society of London Proceedings B: Biological Sciences* 1484: 2479-2848.
- 48) Montalvo, A.M., P.A. McMillan, and E.B. Allen. 2002. The relative importance of seeding method, soil ripping and soil variables on seeding success. *Restoration Ecology* 10: 52-67.
- 49) Cione, N.C., P.E. Padgett, and E.B. Allen. 2002. Restoration of a native shrubland impacted by exotic grasses, frequent fire and nitrogen deposition in southern California. *Restoration Ecology* 10:376-384.
- 50) Corkidi, L., D.L. Rowland, N.C. Johnson, and E.B. Allen. 2002. Nitrogen fertilization alters the functioning of arbuscular mycorrhizas at two semiarid grasslands. *Plant and Soil* 240: 299-310.
- 51) Burger, J.C., R.A. Redak, E.B. Allen, J.T. Rotenberry, and M.F. Allen. 2003. Restoring arthropod diversity in coastal sage scrub. *Conservation Biology* 17:460-467.
- 52) Johnson, N.C., D.L. Rowland, L. Corkidi, L. Egerton-Warburton, and E.B. Allen. 2003. Nitrogen enrichment alters mycorrhizal allocation at five mesic to semiarid grasslands. *Ecology* 84:1895-1908.
- 53) Fenn, M.E., Baron, J. S., Allen, E.B., Rueth, H. M., Nydick, K. R., Geiser, L, Bowman, W. D., Sickman, J. O., Meixner, T., and Johnson, D. W. 2003. Ecological effects of nitrogen deposition in the Western United States. *Bioscience* 53:404-420.
- 54) Allen, E.B., M.F. Allen, L. Egerton-Warburton, L. Corkidi, and A. Gomez-Pompa. 2003. Impacts of early- and late-seral mycorrhizae during restoration in seasonal tropical forest, Mexico. *Ecological Applications* 13:1701-1717.
- 55) Yoshida, L.C. and E.B. Allen. 2004. ¹⁵N uptake by mycorrhizal *Artemisia californica* and the invasive *Bromus madritensis* of a N-eutrophied shrubland. *Biology and Fertility of Soil* 39:243-248.
- 56) Michalski, G., T. Meixner, M.E. Fenn, L. Hernandez, A.G. Sirulnik, E.B. Allen, M. Thiemens. 2004. Tracing atmospheric nitrate deposition in a complex semiarid ecosystem using D¹⁸O. *Environmental Science and Technology* 38:2175-2181.
- 57) Corkidi, L., E.B. Allen, D. Merhaut, M.F. Allen, J. Downer, J. Bohn, and M. Evans. 2004. Assessing the infectivity of commercial mycorrhizal inoculants in plant nursery conditions. *Journal of Environmental Horticulture* 22:149-154.
- 58) Gillespie, I. G. and E.B. Allen. 2004. Fire and competition in a southern California grassland: impacts on the rare forb *Erodium macrophyllum*. *Journal of Applied Ecology* 41:643-652.
- 59) Corkidi, L., E.B. Allen, D. Merhaut, M.F. Allen, J. Downer, J. Bohn, and M. Evans. 2005. Effectiveness of commercial mycorrhizal inoculants on the growth of *Liquidambar styraciflua* in plant nursery conditions. *Journal of Environmental Horticulture* 23:72-76.
- 60) Allen, M.F., E.B. Allen and A. Gomez-Pompa. 2005. Effects of mycorrhizae and nontarget organisms on restoration of a seasonal tropical forest in Quintana Roo, Mexico: factors limiting tree establishment. *Restoration Ecology* 13:325-333.

- 61) Andresen, E., L. Pedroza-Espino, E.B. Allen and D. R. Pérez-Salicrup. 2005. Selective vegetation thinning for accelerating secondary forest succession: Does it affect seed removal? *Biotropica* 37: 145-148.
- 62) Allen, E.B., R. D. Cox, T. Tennant, S. N. Kee and D. H. Deutschman. 2005. Landscape restoration in southern California forblands: Response of abandoned farmland to invasive annual grass control. *Israel Journal of Plant Sciences* 53:237-245.
- 63) Sigüenza, C., D.E. Crowley and E.B. Allen. 2006b. Soil microorganisms of a native shrub and exotic grasses along a nitrogen deposition gradient in southern California. *Applied Soil Ecology* 32:13-26.
- 64) Sigüenza, C., L. Corkidi and E.B. Allen. 2006a. Feedbacks of soil inoculum of mycorrhizal fungi altered by N deposition on the growth of a native shrub and an invasive annual grass. *Plant and Soil* 286:153-165.
- 65) Gillespie, I.G. and E.B. Allen. 2006. Effects of soil type and mycorrhizae from native and invaded vegetation on a rare California forb. *Applied Soil Ecology* 32:6-12.
- 66) DiTomaso, J.M., M. L. Brooks, E. B. Allen, R. Minnich, P. M. Rice, and G. B. Kyser. 2006. Control of invasive weeds with prescribed burning. *Weed Technology* 20: 535-548.
- 67) Wood, Y.A., T. Meixner, P.J. Shouse, and E.B. Allen. 2006. Altered ecohydrologic response drives native shrub loss under conditions of elevated N-deposition. *Journal of Environmental Quality* 35: 76-92.
- 68) Ramos-Zapata J.A., R. Orellana and E.B. Allen. 2006. Mycorrhizal dynamics and dependence of *Desmoncus orthacanthos* Martius (Arecaceae), a native palm of the Yucatan Peninsula, Mexico. *Interciencia* 31:364-370.
- 69) Ramos-Zapata J.A., R. Orellana and E.B. Allen. 2006. Establishment of *Desmoncus orthacanthos* Martius (Arecaceae): effect of inoculation with arbuscular mycorrhizae. *Revista de Biología Tropical* 54:65-72.
- 70) Sirulnik, A.G., E.B. Allen, T. Meixner, M.E. Fenn, M.F. Allen. 2007. Impacts of anthropogenic N additions on nitrogen mineralization from plant litter in exotic annual grasslands. *Soil Biology and Biochemistry* 39:24-32.
- 71) Sirulnik, A.G., E.B. Allen, T. Meixner, M.E. Fenn, M.F. Allen. 2007. Changes in N cycling and microbial N with elevated N in exotic grasslands of Southern California. *Applied Soil Ecology* 36:1-9.
- 72) Zimmer K., N.A. Hynson, G. Gebauer, E.B. Allen, M.F. Allen and D. J. Read. 2007. Wide geographic and ecological distribution of nitrogen and carbon gains from fungi in pyroloids and monotropoids (Ericaceae) and in orchids. *New Phytologist* 175: 166-175.
- 73) Egerton-Warburton, L.M., N.C. Johnson, and E.B. Allen. 2007. Mycorrhizal community dynamics following nitrogen fertilization: a cross-site test in five grasslands. *Ecological Monographs* 77:527-544.
- 74) Vargas, R., M.F. Allen, and E.B. Allen. 2008. Biomass and carbon accumulation in a chronosequence of a seasonally dry tropical forest. *Global Change Biology* 14:109-124.
- 75) Cox, R.D. and E.B. Allen. 2008. Composition of soil seed banks in southern California coastal sage scrub and adjacent exotic grassland. *Plant Ecology* 198: 37-46.
- 76) Cox, R.D. and E.B. Allen. 2008. Stability of exotic annual grasses following restoration efforts in southern California coastal sage scrub. *Journal of Applied Ecology* 45: 495-504.
- 77) Johnson, N.C., D.L. Rowland, L Corkidi and E.B. Allen. 2008. Characteristics of plant winners and losers during grassland eutrophication – importance of biomass allocation and mycorrhizal function. *Ecology* 89: 2868-2878.
- 78) Gillespie, I.G. and E.B. Allen. 2008. Restoring the rare forb *Erodium macrophyllum* to exotic grassland in southern California. *Endangered Species Research* 5: 65-72.
- 79) Rao, L. E., D. R. Parker, A. Bytnerowicz, and E. B. Allen. 2009. Nitrogen mineralization across an atmospheric nitrogen deposition gradient in southern California deserts. *Journal of Arid Environments* 73: 920-930.

- 80) Marushia, R.G. and E.B. Allen. 2011. Control of exotic annuals to restore native forbs in abandoned agricultural lands. *Restoration Ecology* 19:45-54. DOI: 10.1111/j.1526-100X.2009.00540.x
- 81) Vargas, R., E. B. Allen, and M. F. Allen. 2009. Effects of vegetation thinning on above- and belowground carbon in a seasonally dry tropical forest in Mexico. *Biotropica* 41:302-311.
- 82) Barrows, C. W., E. B. Allen, M. L. Brooks, and M. F. Allen. 2009. Effects of an invasive plant on a desert sand dune landscape. *Biological Invasions* 11:673-686.
- 83) Allen, M. F., E. B. Allen, J. L. Lansing, K. S. Pregitzer, R. L. Hendrick, R. W. Ruess, and S. L. Collins. 2010. Responses to chronic N fertilization of ectomycorrhizal pinon but not arbuscular mycorrhizal juniper in a pinon-juniper woodland. *Journal of Arid Environments* 74:1170-1176.
- 84) Steers, R.J. and E.B. Allen. 2010. Post-fire control of invasive plants promotes native succession in a burned desert shrubland. *Restoration Ecology* 18: 334-343. doi: 10.1111/j.1526-100X.2009.00622.x
- 85) Rao, L.E. and E.B. Allen. 2010. Combined effects of precipitation and nitrogen deposition on native and invasive winter annual production in California deserts. *Oecologia* 62: 1035-1046. DOI 10.1007/s00442-009-1516-5
- 86) Rao, L.E., E.B. Allen, and T. Meixner. 2010. Risk-based determination of critical nitrogen deposition loads for fire spread in southern California deserts. *Ecological Applications* 20:1320-1335.
- 87) Vargas, R., N. Hasselquist, E.B. Allen, and M.F. Allen. 2010. Effects of a hurricane disturbance on aboveground forest structure, arbuscular mycorrhizae and belowground carbon in a restored tropical forest. *Ecosystems* 13: 118-128.
- 88) Fenn, M.E., E.B. Allen, S.B. Weiss, S. Jovan, L. Geiser, G.S. Tonnesen, R.F. Johnson, L.E. Rao, B.S. Gimeno, F. Yuan, T. Meixner, A. Bytnerowicz. 2010. Nitrogen critical loads and management alternatives for N-impacted ecosystems in California. *Journal of Environmental Management* 91:2404-2423.
- 89) Allen, M.F., Allen, E.B., Lansing, J.L., Pregitzer, K.S., Hendrick, R.L., Ruess, R.W., Collins, S.L., 2010. Responses to chronic N fertilization of ectomycorrhizal pinon but not arbuscular mycorrhizal juniper in a pinon-juniper woodland. *Journal of Arid Environments* 74, 1170-1176.
- 90) Steers, R.J., J. L. Funk and E. B. Allen. 2011. Use of carbon amendment to facilitate native dominance in a burned desert shrubland: can nitrogen-use plant traits predict species success in nitrogen reduced soils? *Ecological Applications* 21:1211-1224.
- 91) Rao, L.E., R.J Steers, and E.B Allen. 2011. Effects of natural and anthropogenic gradients on native and exotic winter annuals in a southern California Desert. *Plant Ecology* 212:1079-1089. DOI 10.1007/s11258-010-9888-5
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- 177) Bell, M.D. and E.B. Allen. 2015. Wind, earth, and fire: The impacts of anthropogenic air pollution on soils in Joshua Tree National Park. *Park Science* 32(2): 64-66.
- 178) Cleland, E. E., J. Funk, and E. B. Allen. 2016. Coastal Sage Scrub. Chapter 22. In H. Mooney and E. Zavaleta, editors. *Ecosystems of California*. University of California Press, Berkeley, pp 429- 448.
- 179) Bytnerowicz, A., M.E. Fenn, E.B. Allen, and R. Cisneros. 2016. Ecologically relevant atmospheric chemistry. Chapter 7. In H. Mooney and E. Zavaleta, editors. *Ecosystems of California*. University of California Press, Berkeley, pp 107-128.
- 180) Belnap, J., J. M. Stark, B. M. Rau, E.B. Allen and S. Phillips. 2016. Soil moisture and biogeochemical factors influence the distribution of annual *Bromus* species. Chapter 8 In

- J.C. Chambers, M.J. Germino, and C. S. Brown, eds. Exotic Brome-Grasses in Arid and Semi-Arid Ecosystems of the Western US: Causes, Consequences, and Management Implications. Environmental Management Series, Springer Science, pp 227-256.
- 181) Germino, M.J., J. Belnap, J.M. Stark, E.B. Allen and B.M. Rau. 2016. Ecosystem Impacts of Exotic Annual Invaders in the Genus *Bromus*. Chapt. 3 In J.C. Chambers, M.J. Germino, and C. S. Brown, eds. Exotic Brome-Grasses in Arid and Semi-Arid Ecosystems of the Western US: Causes, Consequences, and Management Implications. Environmental Management Series, Springer Science, pp. 61-95.
- 182) Allen, M.F. and E.B. Allen. 2017. Mycorrhizal mediation of soil fertility amidst nitrogen eutrophication and climate change. Chapt. 12 In N.C. Johnson, C. Gehring and J. Jansa, eds. Mycorrhizal Mediation of Soil: Fertility, Structure, and Carbon Storage. Elsevier Press, Amsterdam. pp 213-231.
- 183) Aburto-Oropeza, O. A.F. Johnson, M. Agha, E. B. Allen, M.F. Allen, and 88 other authors. 2018. Harnessing Cross-border Resources to Confront Climate Change. Environmental Science & Policy (87):128-132.
- 184) Allen, E.B., K. Williams, J. L. Beyers, M. Phillips, S. Ma and C. M. D'Antonio. 2018. Chaparral Restoration. Chapter 13. Pages 347-384 in Underwood, E.C., H. D. Safford, J. E. Keeley, N. Molinari and J. J. Hooper, eds. Valuing Chaparral: Ecological, Socio-Economic, and Management Perspectives. Springer International Publishing.
- 185) Murphy, S.D., E.B. Allen and R.J. Hobbs. 2018. Editorial: Restoration Ecology at 25 years: the editors reflect on how we got here. Restoration Ecology 26:1009-1012 doi.org/10.1111/rec.12885
- 186) Allen, E.B., C. McDonald and B. E. Hilbig. 2019. Long-term Prospects for Restoration of Coastal Sage Scrub: Invasive Species, Nitrogen Deposition, and Novel Ecosystems. In M. Narog, technical coordinator. Pages 1-18 in Proceedings of the Chaparral Restoration Workshop, Arcadia, CA, June 17-20, 2013. U.S. Department of Agriculture, Forest Service Pacific Southwest Research Station Albany, California General Technical Report PSW-GTR-265. <https://www.fs.usda.gov/treeearch/pubs/58509>

Classes Taught

USU 1982-1988: Restoration Ecology (4 cr. yearly); Graduate seminars (2-4 cr. yearly): Plant competition; Physiology and Ecology of Mycorrhizae; Philosophical Approaches to Ecological Research; Landscape Ecology; International Problems in Range Ecology and Management; Deserts and Desertification.

SDSU 1990-1993: Restoration Ecology (4 cr. yearly)

UCR 1993-present: Restoration Ecology (4 cr. yearly); Plant Ecology (4 cr. biannual); graduate seminars (mycorrhizal ecology, invasive species ecology)

Graduate Students Supervised as Major Professor

Marco E. Waaland. 1985. Correspondence of VA mycorrhizae with seral vegetation in southwestern Wyoming. M.S. thesis, Utah State University. Environmental consulting (deceased).

Di Jian Jun. 1988. Occurrence of VA mycorrhizae in degraded rangelands and physiological responses of six cultivars of *Agropyron* to infection. M.S. thesis, Utah State University. Environmental consulting.

Laura E. Nelson. 1991. Restoration of *Stipa pulchra* grasslands: effects of mycorrhizae and competition from *Avena barbata*. M.S. thesis, San Diego State University. Ecologist, National Park Service.

Joseph P. Cannon. 1993. The effects of oxalates produced by *Salsola iberica* on the phosphorus nutrition of *Stipa pulchra*. M.S. thesis, San Diego State University. Ecologist, National Parks and Conservation Association.

- Leslie D. Hickson. 1993 . The effects of vesicular-arbuscular mycorrhizal fungi on the light harvesting, gas exchange, and architecture of sagebrush (*Artemisia tridentata* ssp. *tridentata*) M.S. Thesis, San Diego State University.
- Cathlyn M. Stylinski. 1994. Succession in California shrub communities following anthropogenic mechanical disturbance. M.S. thesis, San Diego State University. Ph.D., UC Davis. Tenured faculty, University of Maryland.
- Viviane J. Marquez. 1995. Restoration of coastal sage scrub: the effect of annual legumes on the growth and establishment of *Artemisia californica*. M.S. thesis, San Diego State University. Environmental consulting
- Scott A. Eliason. 1995. Competition between *Artemisia californica*. and Mediterranean annual grasses M.S. thesis, San Diego State University. USFS Botanist, San Bernardino National Forest.
- Gillian P. Schultz. 1996. Seedling establishment and competition in coastal sage scrub and annual grassland. M.S. thesis, University of California Riverside. Ph.D. 2001, UCR. Community college instructor, state of Washington.
- Lidia C. Yoshida. 1994 -1999. Ammonium and nitrate additions to a mycorrhizal annual invasive grass, *Bromus madritensis* and *Artemisia californica* in coastal sage scrub: greenhouse and field experiments. Ph.D. dissertation, University of California Riverside. Program Director, NSF Division for Undergraduate Research.
- Concepcion Sigüenza. 1996- 2000. Nitrogen deposition and soil microorganisms of *Artemisia californica* and exotic grasses in southern California. Ph.D. dissertation, University of California Riverside. Self-employed, France.
- Nancy Storms. 1997- 1999. Restoration of a native shrubland in an area of frequent disturbance and high nitrogen deposition. M.S. thesis, University of California Riverside. Environmental consulting
- Ian G. Gillespie. 1999-2003. Ecology and restoration of *Erodium macrophyllum*. Ph.D. dissertation, UCR. IGG Software development, self-employed
- Abby G. Sirulnik. 1999-2004. Nitrogen deposition alters nitrogen cycling and exotic annual grass litter decomposition in southern California. Ph.D. dissertation, UCR. Professor, Saddleback Community College.
- Robert D. Cox. 2000-2006 Ecology and management of rare plants following exotic invasions in Riverside County, California. Ph.D. dissertation, UCR. Currently . Professor, Texas Tech U.
- Brooke Hillard Lyons 2001- 2004. Restoration of *Nassella pulchra* grasslands. M.S., UCR
- Robert J. Steers. 2003-2008. Invasive plants, fire succession and restoration of creosote bush scrub in southern California. Ph.D. dissertation, UCR. Vegetation manager, National Park Service; currently data manager, private industry.
- Leela E. Rao. 2003-2008. Nitrogen deposition and it effects on soils, vegetation, and fire risk in southern California deserts. Ph.D. dissertation, UCR. Research Scientist, California Air Resources Board.
- Heather E. Schneider. 2005-2010. From seed banks to communities: effects of plant invasions and nitrogen deposition on desert annual forbs. Ph.D. dissertation, UCR. Rare Plant Biologist, Santa Barbara Botanic Garden.
- Sara Jo M. Dickens. 2005-2010. Invasive plant-soil feedbacks and ecosystem resistance and resilience: a comparison of three vegetation types in California. Ph.D. dissertation, UCR. Environmental consulting, Utah.
- Kristin Weathers. 2006-2013. Restoration of shrublands impacted by exotic forbs. Ph.D. dissertation UCR. Current, Home parenting.
- Michael D. Bell. 2007-2012. Nitrogen deposition and invasive species patterns and vegetation impacts in two national parks. Ph.D. dissertation, UCR. Biologist, National Park Service.

- Bridget E. Hilbig. 2010-2015. The Use of Competitive Hierarchies to Restore and Stabilize Invaded Plant Communities. Ph.D., UCR. Associate Professor, Weber State University, Denver.
- Justin M. Valliere 2011-2016. Nitrogen deposition impacts on coastal sage scrub plants and soils and their restoration. Ph.D. dissertation, UCR. Assistant Professor, CSU Dominguez Hills.
- Amanda C. Swanson 2012-2017. Microbial contribution to carbon biogeochemistry of desert caliche. Ph.D. dissertation, UCR. Orange County Reserve Manager, California Dept. of Fish and Wildlife
- Michala L. Phillips 2014-2019. Invasion in the Chaparral: Uncovering Soil Microbial and Plant Physiological Mechanisms. Ph.D. dissertation, UCR. Post-doctoral fellow, USGS, Moab, UT.

Post-doctoral Fellows

- Pamela Padgett. 1994-1997. Nitrogen nutrition of coastal sage scrub under N eutrophication. (currently Research Scientist, USFS Fire Lab, Riverside)
- Louise Egerton-Warburton. 1995-97, 1998-2000. Effects of N deposition on mycorrhizal fungi. (currently research scientist, Chicago Botanic Garden and Professor, Northwestern University)
- Lea Corkidi 1997-1999 Effects of nitrogen on mycorrhizal fungi, NSF cross-site experiment. (currently research specialist, UCANR, Sand Diego)
- Jamie Rotenberg 2001-2003. Birds as indicators of restoration in seasonal tropical forest, Mexico (currently Prof., North Carolina State U., Raleigh)

Research Grants

- The Competitive Effects of Introduced Annual Weeds on Some Native and Reclamation Species. (1979-1980) U.S. Department of Energy, \$20,000, (with Dennis H. Knight, principal investigator).
- The Role of Mycorrhizae in Competition between Weeds and Rangeland Grasses (1983-1985) U.S.D.A. Competitive Grants Program, \$70,000, E. B. Allen, M. F. Allen
- The Role of Mycorrhizae in Reversing Desertification (1983-1985) U.S.D.A. Antidesertification Program, \$79,899, E. B. Allen, M. F. Allen.
- VA Mycorrhizae of Disturbed Alpine Ecosystems (1983-1985). U.S. Forest Service, \$9,000, E. B. Allen, J. C. Chambers, M. F. Allen, R. W. Brown.
- Interactions of VA Mycorrhizae and Weeds: Mechanisms of Reduced Stress on Rangeland Grasses. (1985-1987) U.S.D.A. Competitive Grants Program, \$90,000, E. B. Allen and M. F. Allen.
- Interactions of Range Grasses, Weeds, and VA Mycorrhizae: Carbon Balance and Competition. (1985-1987) USDA Rangeland Research Program, \$63,196, E. B. Allen, M. F. Allen.
- Monitoring Changes in Mycorrhizal Fungi of Shrubs in Parachute Canyon (1986-1988). Exxon Co. U.S.A. \$10,390, E.B. Allen.
- Mechanisms of P Uptake and Competition of Nonmycotrophic with Mycotrophic Plants (1988-1990) U.S.D.A. Environmental Stress Program, \$60,000, E.B. Allen, M.F. Allen.
- Reciprocal Relationships of Distant Sagebrush Communities with their Mycorrhizal Fungi (1989-1992). National Science Foundation, \$270,000, E.B. Allen, M.F. Allen, L.M. Shultz.
- Influence of Rhizosphere-Mycosphere Chemistry on Phosphorus Dynamics in an Arid Ecosystem (1989-1992). National Science Foundation \$331,494, L. M. Dudley, J.J. Jurinak, E.B. Allen, M.F. Allen.

Roadside Restoration: Alternative Techniques for Restoration of *Stipa* Grassland and Chaparral (1989-1990). California Department of Transportation, \$56,000, E.B. Allen, M.F. Allen.

Restoration of Mesquite Dunes at Ocatillo Wells State Vehicular Recreation Area (1989-1990). California Department of Parks and Recreation, \$9775, E.B. Allen.

Minimum Critical Moisture Requirements for Establishment of *Stipa pulchra* (1991-1992). California Department of Transportation, \$92,100, E.B. Allen.

Patch formation and mycorrhizal colonization on glacial till (1991-1995). National Science Foundation, \$131,468, D.J. Helm, E.B. Allen.

Restoration of coastal sage scrub vegetation (1992-1995). California Department of Transportation, \$239,000, E.B. Allen.

Harbingers of anthropogenic ecosystem stress: mycorrhizal fungi and weedy plants (1992-1994). Environmental Protection Agency, \$126,581, M.F. Allen, E.B. Allen, C.N. Dahm.

The Interactions of Nitrogen Eutrophication and Fire on Invasive Annuals in California Coastal Sage Shrublands (1994-1996). National Science Foundation, \$50,000, REU Supplement \$9,718, E. B. Allen, R. A. Minnich, A. Bytnerowicz.

Mycorrhizae of Tropical Rain Forest in Mexico (1994-95), UCR-Mexico Collaborative Research and Training Grant. \$1000, E.B. Allen.

Characterizing the habitat of spineflower (1995-1996), California Department of Fish and Game, \$22,000, E.B. Allen, S.G. Wells.

Alternative stable states in Rangelands: Regulation by Nitrogen Eutrophication (9/95-8/99), USDA-NRI Range, Forest and Ecosystems Program, \$300,000, E.B. Allen, A. Bytnerowicz, M.F. Allen.

Mycorrhizal Responses to Nitrogen Eutrophication at Five Mesic to Semiarid Sites (1/96-12/99), NSF-DEB, Longterm Research Program, \$99,956, E.B. Allen, N.C. Johnson.

Workshop: Developing the Conceptual Basis for Restoration Biology, NSF-DEB \$28,000, (January 1996-June 1996), E.B. Allen, W.W. Covington, D.A. Falk.

Principal Investigator "Restoration of Plants and Mycorrhizae in Mexican Seasonal Tropical Forest" \$180,000 (Aug 1996-Dec 1999), E.B. Allen, A. Gomez-Pompa, M.F. Allen, E. Rincon.

Cattle Grazing in Relation to Vegetation, Soils and the Desert Tortoise: A Study of Grazing Enclosures in the Mojave Desert \$29,000, (July 1996-June 1997), UC Division of Agriculture and Natural Resources, R. Larsen, E.B. Allen.

Scientific review, monitoring, and research on the MWD Eastside Reservoir Landscaping Project, \$184,861 (Sept 1997-Aug 1998), Metropolitan Water District, E.B. Allen, T. Scott, A. Montalvo, et al.

Experimental Evaluation of Cost Effective Seed Planting Methods for the Eastside Reservoir Project, \$27,134, (1/26/98-6/30/99), Metropolitan Water District of Southern California, A. Montalvo, E.B. Allen.

Scientific review, monitoring, and research on the MWD Eastside Reservoir Landscaping Project." \$232,646, (Sept 1998-Aug 1999), Metropolitan Water District, A. Montalvo, E.B. Allen.

Comparison of Site-Specific and Exotic Mycorrhizal Inoculum in the Production and Field Planting of Container Grown Plants, \$91,132, (Sept. 1998 to Jun 2000), Metropolitan Water District, E.B. Allen, A. Montalvo, J. Menge.

Testing Techniques for Weed Control at the Shipley Reserve, \$122,091, Dec 1998-Nov 2001, Metropolitan Water District, E.B. Allen.

Abiotic Controls on Invasive Species and Biodiversity: Comparison of Forest and Shrubland, Environmental Protection Agency, \$448,122, 7/15/01 - 6/14/04, T. Meixner, E.B. Allen, M. E. Fenn

Assessing the Effectivity of Commercial Mycorrhizal Inoculum, Horticulture Research Institute, \$10,000, 1/1/02 - 12/31/02, E.B. Allen, D. Merhaut, M.F. Allen, J. Downer.

Restoring Seasonal Tropical Forests in Mexico: Using Designer Communities to Direct Succession, National Science Foundation, \$251,500, 9/1/00 - 8/31/04 E.B. Allen, A. Gomez-Pompa, M. F. Allen,

Enhancing Forest Succession in a Seasonally Dry Tropical Forrest in the Northern Yucatan Peninsula, Mexico, UC MEXUS/CONACYT, \$11,662, 7/1/01 - 12/31/02, Diego Perez, E.B. Allen.

Thresholds of Vegetation Change Following N Deposition in Southern California Ecosystems \$1,999,579 (2005-2011) NSF Biocomplexity Program. E.B. Allen (PI), B.-L. Li, T. Meixner, R.A. Minnich, G.S. Tonnesen (co-PI's), M.F. Allen, A. Bytnerowicz, M.E. Fenn, P. M. Sadler, J. Simunek, collaborators

Quino Checkerspot Restoration Research, California Dept Fish & Game, 3/15/2004-9/30/2006, \$40,984, E.B. Allen

Nitrogen Eutrophication in Xeric Wildland and Agricultural Systems: Symposium, USDA/NRICGP, 1/15/2005-1/14/2006, \$12,613, E.B. Allen and L. Wu

Impacts of Anthropogenic Deposition on Weed Invasion, Biodiversity & Fire Cycle, Prescribed burn and non-native plant density effects on soil characteristics in CA grassland, UCR College of Natural and Agricultural Sciences, 7/1/2006-6/30/2007, \$6,859, E.B. Allen

USDI National Park Service, 11/1/2002-9/30/2006, \$49,529, E.B. Allen, R. Minnich, M.F. Allen

Impacts of Anthropogenic Deposition on Weed Invasion, Biodiversity & Fire Cycle, USDI National Park Service, 10/1/2006-9/30/2009, \$99,890 E.B. Allen.

Longterm effects of nitrogen fertilizer on coastal sage scrub vegetation at Lake Skinner, UCR College of Natural and Agricultural Sciences, 7/1/2006-6/30/2007, \$13,694, E.B. Allen

Invasive Annuals in the Mojave Desert: Interactions of N Deposition and Soil Type, UC-IPM Exotic Pest & Diseases Research Program, 9/1/2004-8/31/2005, \$79,854, E.B. Allen

Critical Levels of Nitrogen for Growth, Litter Persistence, and Germination of Invasive and Native Plants at Joshua Tree National Park, USDI-NPS, 3/1/07 -9/31/10 \$99,546, E.B. Allen

Alien Invasion: Effects of Atmospheric Nitrogen Deposition on Sagebrush Steppe Vegetation Dynamics at Upper Columbia Basin Network Parks, USDI-NPS, 10/09-12/13, \$100,000, E.B. Allen

Understanding and controlling invasions: comparing plant-soil feedbacks of invasive annual grasses in California with their Mediterranean origins, \$50,000, 10/11-9/13, UC-ANR, E.B. Allen, M.F. Allen, and others.

Restoration of Invaded Plant Communities at Lake Matthews, Riverside County Habitat Conservation Authority, \$40,000, 1/10-6/13, E.B. Allen

Atmospheric Nitrogen Deposition Assessment in the Santa Monica Mountains NRA and the Effects on Weed Invasion USDI-NPS, \$160,000.00, 9/15/2011 – 12/31/2017, E.B. Allen

Biological Control of Invasives in Southern California for Restoring Forb/Shrubland Communities. Riverside County Habitat Conservation Agency \$100,000, 2/1/2013-6/30/2017, E.B. Allen.

Changes in above- and below-ground phenological relations across type-converted invaded grasslands in southern California, CNAS Shipley-Skinner Endowment, \$19,987, 7/1/2015 – 6/30/2016, E.B. Allen, J.M. Valliere

Do tradeoffs between water-use efficiency and growth explain plant community response to nitrogen deposition? NSF \$19,749 7/1/2016 - 6/30/2017, E.B. Allen, J.M. Valliere