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Winthers, E., Fallon, D., Haglund, J., DeMeo, T., Nowacki, G., Tart, D., Ferwerda, M. Robertson, G., Gallegos, A. Rorick, A., Cleland, D.T. and Robbie, W. 2005. Terrestrial Ecological Unit Inventory Technical Guide. Washington, DC: U.S. Department of Agriculture, Forest Service, Washington Office, Ecosystem Management Coordination Staff. 245 p.

Wirth, T.A. and Pyke, D.A. 2006. Monitoring post-fire vegetation rehabilitation projects: A common approach for non-forested ecosystems. Washington,D.C. USGS.

Wondzell, S.M. and Ludwig, J.A. 1995. Community dynamics of desert grasslands: influences of climate, landforms, and soils. Journal of Vegetation Science 6:377-390.

Wondzell, S.M., Cunningham, G.L. and Bachelet, D. 1996. Relationships between landforms, geomorphic processes, and plant communities in the northern Chihuahuan Desert. Landscape Ecology. 11:351-362.

Yakowitz, D.S., Stone, J.J., Lane, L.J., Heilman, P., Masterson, J., Abolt, J. and Imam, B. 1993. A desision support system for evaluating the effects of alternative farm management practices on water quality and economics. Water Science and Technology 28:47-54.

Yao, J., Peters, D.P.C., Havstad, K.M., Gibbens, R.P. and Herrick, J.E. 2006. Multi-scale factors and long-term responses of Chihuahuan Desert grasses to drought. Landscape Ecology. 21:1217-1231.

XII. Past Accomplishments of Debra C. Peters, Research Ecologist (formerly Debra P. Coffin)

Education:

1981	Iowa State University, IA; Biology; B.S.
1983	San Diego State University, CA; Biology, M.S.
1988	Colorado State University, CO; Range Science, Ph.D.

Experience:

2002-present	Rangeland Ecologist, Range Management Research Unit, USDA, ARS, Las Cruces, NM
1998-2002	Rangeland Ecologist, Range Management Research Unit, USDA, ARS, Las Cruces, NM
1994-1997	Research Scientist, Colorado State University, Fort Collins, CO
1989-1993	Research Associate, Colorado State University, Fort Collins, CO
1988-1989	Postdoctoral Associate, Colorado State University, Fort Collins, CO
1984-1987	Graduate Research Assistant, Colorado State University, Fort Collins, CO

Accomplishment:
The scientist developed a spatially-explicit gap dynamics simulation model of interactions between woody and herbaceous species for arid and semiarid ecosystems. The scientist has been instrumental in generalizing this simulation model for other rangeland types within the US and abroad, and for making ecosystem simulation models readily available and easy to use by non-modelers and experienced modelers. The scientist's work on connecting pattern and process across multiple scales has lead to new studies by other investigators within the NSF supported Long Term Ecological Research (LTER) program. The scientist's explicit consideration of the role of spatial processes, such as seed dispersal and water redistribution, on generating patterns across landscapes has been adopted as a general conceptual model of rangeland dynamics by scientists at the Jornada and collaborating locations. The scientist initiated and conducted comparative experiments and simulation analyses among arid and semiarid LTER sites in the US and Hungary as part of a collaborative project.

Refereed publications (* Indicates publications resulting from prior project - 86 total)

Peters, D.P.C. 2000. Climatic variation and simulated patterns in seedling establishment of two dominant grasses at a semiarid-arid grassland ecotone. Journal of Vegetation Science. 11:493-504.

Goslee, S.C., Peters, D.P.C., Beck, K.G. 2001. Modeling invasive weeds in grasslands: the role of allelopathy in *Acroptilon repens* invasion. Ecological Modelling. 139:31-45.

* Peters, D.C. 2002. Recruitment potential of two perennial grasses with different growth forms at a semiarid-arid transition zone. American Journal of Botany. 89:1616-1623.

* Peters, D.P.C. 2002. Plant species dominance at a grassland-shrubland ecotone: an individual-based gap dynamics model of herbaceous and woody species. Ecological Modelling 152(1):5-32.

* Rastetter, E.B., Aber, J.D., Peters, D.C., Ojima, D.S., Burke, I. 2003. Using mechanistic models to scale ecological processes across space and time. Bioscience. 53:68-76.

* Symstad, A.J., Chapin, F.S., Wall, D.H., Gross, K.L., Huenneke, L.F., Mittelbach, G.G., Peters, D.C., Tilman, G.D. 2003. Long-term and large-scale perspectives on the relationship between biodiversity and ecosystem functioning. Bioscience. 53:89-98.

* Goslee, S.C., Havstad, K.M., Peters, D.C., Rango, A., Schlesinger, W. 2003. High-resolution images reveal rate and pattern of shrub encroachment over six decades in New Mexico, USA. Journal of Arid Environments. 54:755-767.

* Peters, D.C. 2004. Selection of models of invasive species dynamics. Weed Technology. 18:1236-1239.

* Peters, D.C., Pielke, R.A., Bestelmeyer, B.T., Allen, C.D., Munson-Mcgee, S., Havstad, K.M. 2004. Cross-scale interactions, nonlinearities, and forecasting catastrophic events. Proceedings of the National Academy of Sciences. 101(42):15130-15135.

* Peters, D.C., Urban, D.L., Gardner, R.H., Breshears, D.D., Herrick, J.E. 2004. Strategies for ecological extrapolation. Oikos. 106(3):627-636.

* Peters, D.C., Yao, J., Havstad, K.M. 2004. Insights to invasive species dynamics from desertification studies. Weed Technology. 18:1221-1225.

* Estell, R.E., Fredrickson, E.L., Peters, D.P.C. 2006. Introduction to special issue - Landscape linkages and cross-scale interactions in arid and semi-arid ecosystems. Journal of Arid Environments. 65:193-195.

* Goslee, S.C., Peters, D.P.C., Beck, K.G. 2006. Spatial prediction of invasion success across heterogeneous landscapes using an individual-based model. Biological Invasions. 8:193-200.

* Peters, D.P.C., Bestelmeyer, B.T., Herrick, J.E., Fredrickson, E.L., Monger, H.C., Havstad, K.M. 2006. Disentangling complex landscapes: New insights into arid and semiarid system dynamics. BioScience. 56:491-501.

* Peters, D.P.C., Gosz, J.R., Pockman, W.T., Small, E.E., Parmenter, R.R., Collins, S.L. and Muldavin, E. 2006. Integrating patch and boundary dynamics to understand and predict biotic transitions at multiple scales. Landscape Ecology 21:19-33.

* Peters, D.P.C., Havstad, K.M. 2006. Nonlinear dynamics in arid and semi-arid systems: Interactions during drivers and processes across scales. Journal of Arid Environments. 65:196-206.

* Peters, D.P.C., Mariotto, I., Havstad, K.M., Murray, L.W. 2006. Spatial variation in remnant grasses after a grassland-to-shrubland state change: Implications for restoration. 2006. Rangeland Ecology & Management. 59:343-350.

* Peters, D.P.C., Yao, J., Gosz, J.R. 2006. Woody plant invasion at a semi-arid/arid transition zone: importance of ecosystem type to colonization and patch expansion. Journal of Vegetation Science. 17:389-396.

* Yao, J., Peters, D.C., Havstad, K.M., Gibbens, R.P., Herrick, J.E. 2006. Multi-scale factors and long-term responses of Chihuahuan Desert grasses to drought. Landscape Ecology. 21:1217-1231.

* Peters, D.C., Sala, O.E., Allen, C.D., Covich, A., Brunson, M. 2007. Cascading events in linked ecological and socio-economic systems. Frontiers in Ecology and the Environment. 5:221-224.

XII. Past Accomplishments of Dean M. Anderson, Research Animal Scientist

Education:

1965-69	University of Southern Colorado, B.S. Biology, 1970.
1969-73	Colorado State University, M. S. Agronomy, 1972.
1973-77	Texas A&M University, Ph.D. Range Science, 1977.

Experience:

1977-present	Research Animal Scientist, USDA, Agricultural Research Service, Jornada Experimental Range, Las Cruces, NM.
1973-77	Graduate Research Assistant, Texas A&M University, College Station, TX.
1969-73	Graduate Research Assistant, Colorado State University, Fort Collins, CO.

Accomplishment:

The scientist pioneered the use of animal behavior to facilitate ecologically based free-ranging animal management. He designed a totally automated electromechanical system for obtaining individual animal liveweight and electronic identification data from free-ranging cattle at a remote location based on the animal's frequency to drink water. The scientist developed an imaginative and novel approach to manage mixed-species animal groups. Small ruminants (sheep and goats) were bonded to cattle as juveniles so as adults they would remain in the presence of cattle. This animal group was termed a flerd (flock + herd) and its behavior was atypical of small ruminants (flock) and cattle (herd) that are infrequently found together under free-ranging conditions. Flerds reduced the incidence of coyote predation among small ruminants, and they facilitated husbandry since all animal species are consistently found together. Most recently the scientist made public a means to control the location and directional movement of free-ranging cattle using radio frequency (RF) signals coming from navigational satellites. By capitalizing on an animal's innate behavior to move away from a novel cue, bilaterally applied sensory cues are administered through a patented method and device to maintain animals within virtual boundaries without the need for ground based conventional fencing. This approach to animal control will make it possible to control stocking density and animal distribution in real-time anywhere in the world.

Refereed publications (* Indicates publications resulting from prior project)

Danielson, T.L., Rayson, G.D., Anderson, D.M., Estell, R.E., Fredrickson, E.L., Green, B.S. 2003. Impact of filter paper on fluorescence measurements of buffered saline filtrates. Talanta. 59:601-604.

Hyder, P.W., Fredrickson, E.L., Remmenga, M.D., Estell, R.E., Pieper, R.D., Anderson, D.M. 2003. A digital photographic technique for assessing forage utilization. Journal of Range Management. 56:140-145.

Anderson, D.M. Directional Virtual Fencing [DVF (Trademark)]. 2004. Grassroots Newsletter of the Global Society of Southern Africa. 4(1):10-13.

Anderson, D. M. 2004. Flocks and herds or flerds - the choice is yours. Grassroots Newsletter of the Grassland Society of Southern Africa. 14(2):16-22.

Anderson, D.M. 2005. Virtual fencing - automated animal control in the 21st century. Livestock Horizons, CSIRO Livestock Industries Research Magazine. 1:13.

Estell, R.E., Fredrickson, E.L. Anderson, D.M. Remmenga, M.D. 2005. Effects of gamma-terpinene, terpinene, alpha-copaene, and alpha-terpinene on consumption of alfalfa pellets by sheep. Journal of Animal Science. 83:1967-1971.

Estell, R.E., Fredrickson, E.L., Anderson, D.M., Havstad, K.M., Remmenga, M.D. 2005. Effect of previous exposure to sheep to monoterpene odors on intake of alfalfa pellets treated with camphor or alpha-pinene. Small Ruminant Research. 58:33-38.

Anderson, D.M., Rayson, G.D., Obeidat, S.M., Ralphs, M.H., Estell, R.E., Fredrickson, E.L., Parker, E., Gray, P. 2006. Use of fluorometry to differentiate among clipped species in the genera, *astragalus, oxytropis* and *pleuraphis*. Rangeland Ecology and Management. 59:557-563.

* Danielson, T.L., Obeidat, S., Rayson, G.D., Anderson, D.M., Fredrickson, E.L., Estell, R.E. 2006. Photoluminescent distinction among plant life forms using phosphate buffered saline extract solutions. Applied Spectroscopy. 60:800-807.

Fredrickson, E.L., Estell, R.E., Laliberte, A., Anderson, D.M. 2006. Mesquite recruitment in the Chihuahuan Desert: Historic and prehistoric patterns with long-term impacts. Journal of Arid Environments. 65(2):285-295.

Bishop-Hurley, G.J., Swain, D.L., Anderson, D.M., Sikka, P., Crossman, C., Corke, P. 2007. Virtual fencing applications: implementing and testing an automated cattle control system. Computers and Electronics in Agriculture. 56:14-22.

Obeidat, S.M., Glasser, T., Landau, S.Y., Anderson, D.M., Rayson, G.D. 2007. Application of multi-way data analysis on excitation-emission spectra for plant identification. Talanta. 72:682-690.

Schwager, M., Anderson, D.M., Butler, Z., Rus, D. 2007. Robust classification of animal tracking data. Computers and Electronics in Agriculture. 56:46-59.

* Estell, R.E., Fredrickson, E.L., Anderson, D.M. Remmenga, M.D. 2007. Effects of eugenol, α-terpineol, terpin-5-ol, andmethyl eugenol on consumption of alfalfa pellets by sheep. Small Ruminant Research. (In Press)

* Anderson, D.M. 2007. Virtual fencing–past, present and future. The Rangeland Journal. 29:65-78.

XII. Past Accomplishments of Jerry R. Barrow, Research Geneticist

Education:

1960	B.S. University of Arizona
1962	M.S. University of Arizona
1967	Ph.D. Genetics, Washington State University

Experience:

1961-1963	Research Associate Vegetable Breeding, Yuma, Arizona.
1963-1967	Research Assistant and Ph.D. student at Washington State University.
1967-1983	Research Geneticist, USDA, ARS, Cotton Genetics Unit, Las Cruces, New Mexico.
1983-present	Research Geneticist, Jornada Experimental Range.

Accomplishment:

The scientist found that ecologically important grasses and shrubs are universally colonized with symbiotic fungi that differ from traditional mycorrhizal and pathogenic fungi. He developed an analytical method that defined the unique nature and mode of the association between the host plants and the fungus. He found that these fungi were structurally integrated with all cells and tissues not only of the host plant, but with cells in culture and in plants regenerated from embryonic meristem cells. He developed a method to transfer integrated fungal symbionts from cell cultures of native plants to non-host native and cultivated plants. Transferred fungi regulated root and shoot biomass, flowering, seed production and vigor in recipient host plants. Fungal transfers elicited varying responses in recipient host plant ranging from negative, neutral and in many cases increasing host performance several fold. Once transferred, fungi were found to be transferred by seed to succeeding generations. This information promises to offer an alternative means of improving native and crop plants in lieu breeding or genetic modification. It is also expected that the transfer of symbiotic fungi would enhance native plant performance for remediation of degraded or disturbed ecosystems. (US Patent applied for)

Refereed publications (* Indicates publications resulting from prior project)

Barrow, J. 2001. Unique atypical morphological variation of dark septate fungal endophytes in physiologically active roots of native grasses in arid southwestern USA rangelands. Mycorrhiza. 11:199-205.

Barrow J.R. 2001. Carbon Transport by Symbiotic Fungi in Fourwing Saltbush, *Atriplex canescens* (Pursh) Nutt. (2001) Proceedings-Symposium on Shrubland Ecosytem Genetics and Biodersity. p 291-294. Provo Utah.

Barrow, J.R., Osuna, P. 2002. Phosphorous solubilization and uptake by dark septate fungi in fourwing saltbush, *Atriplex canescens* (Pursh) Nutt. Journal of Arid Environments. 51:449-459.

Barrow, J.R**.** 2003. Atypical morphology of dark septate fungal root endophytes of *Bouteloua* in southwestern USA rangelands. Mycorrhiza. 13:239-247.

* Barrow, J.R., Aaltonen, R.E. 2004. A staining method for systemic endophytic fungi in plants. In: Lartey, R.T., Caesar A.J., editors. Emerging Concepts in Plant Health Management. Kerala, India: Research Signpost p. 61-67.

* Barrow, J.R., Osuna-Avila, P., Reyes-Vera, I. 2004. Fungal endophytes intrinsically associated with micropropagated plants regenerated from native Bouteloua eriopoda Torr. and Atriplex canescens (Pursh) Nutt. In Vitro Cellular and Developmental Biology - Plants. 40(6):608-612.

* Osuna, P., Barrow, J.R. 2004. The regeneration of black grama *Bouteloua eriopoda* Torr. Torr) plants via somatic embryogenesis. In Vitro Cellular and Developmental Biology - Plants. 40(3):299-302.

* Lucero, M.E., Barrow, J.R., Osuna, P., Reyes, I. 2006. Plant-fungal interactions in arid and semi-arid ecosystems: Large-scale impacts from microscale processes. Journal of Arid Environments. 65:276-284.

* Barrow, J., Lucero, M.E., Reyes, I., Havstad, K.M. 2007. Endosymbiotic fungi structually integrated with leaves reveals a lichenous condition of C4 grasses. In Vitro Cellular and Developmental Biology – Plants. 43:65-70

* Lucero, M. Barrow, J.R., Osuna, P., and Reyes, I. Non-Mycorrhizal endophytes modify establishment and reproductive potential of native grasses. Rangeland Ecology and Management (Accepted).

* *Patent Application*
Barrow, J. R. and Lucero, M. E. Transfer and Incorporation of heritable Symbiotic Fungi Into Non-Host Plants. Application filed US Patent Office. PC.0080.05

XII. Past Accomplishments of Brandon T. Bestelmeyer, Research Ecologist

Education:

1990	University of California, Irvine; Biological Science; B.S.
1990	University of California, Irvine; Applied Ecology; B.A.
1994	Colorado State University, CO; Zoology, M.S.
2000	Colorado State University, CO; Ecology, Ph.D.

Work Experience:

2003-present	Research Ecologist, Range Management Research Unit USDA, ARS, Las Cruces, NM
2000-2003	Postdoctoral Ecologist, Range Management Research Unit USDA, ARS, Las Cruces, NM

Accomplishments:

The scientist developed protocols, guidance, and scientific studies for development and use of state-and-transition models and ecological site descriptions. These efforts have provided national guidance to federal agencies (Natural Resources Conservation Service, Bureau of Land Management) and local guidance to agency offices and non-governmental organizations for the use of landscape ecology and alternative state concepts in the development of assessment, monitoring, and management strategies. The concepts are also being applied internationally in China, Mongolia, and Argentina. Basic research to inform ecological site descriptions has focused on how the occurrence of vegetation states is related to management, soil, climate, and spatial properties across landscape and regional scales. This work has contributed to the idea that the occurrence of ecological thresholds can be detected and predicted using basic measurements and carefully-selected sampling designs. The scientist also contributes research on the effects of state-transitions on biodiversity patterns, a topic which is poorly understood but drives many management decisions. The biodiversity work has focused on how coupled changes in landscape pattern and energy flux associated with transitions reorganize animal communities as well as animal feedbacks to ecosystems.

Refereed publications (* Indicates publications resulting from prior project - 29 total)

Bestelmeyer, B.T., Wiens, J.A. 1996. The effects of land use on the structure of ground-foraging ant communities in the Argentine Chaco. Ecological Applications. 6:1225-1240.

Bestelmeyer, B.T., Wiens, J.A. 2001. Ant biodiversity in semiarid landscape mosaics: the consequences of grazing vs. natural heterogeneity. Ecological Applications .11:1123-1140.

Bestelmeyer, B.T., Wiens, J.A. 2001. Local and regional-scale responses of ant diversity to a semiarid biome transition. Ecography. 24:381-392.

* Bestelmeyer, B.T., Brown, J.R., Havstad, K.M., Chavez, G., Alexander, R., Herrick, J.E. 2003. Development and use of state-and-transition models for rangelands. Journal of Range Management. 56:114-126.

* Bestelmeyer, B.T., Miller, J.R., Wiens, J.A. 2003. Applying species diversity theory to land management. Ecological Applications. 13:1750–1761.

* Bestelmeyer, B.T., Wiens, J.A. 2003. Scavenging ant foraging behaviour and variation in the scale of nutrient redistribution in semiarid grasslands. Journal of Arid Environments. 53:373-386.

* Bestelmeyer, B.T., Brown, J.R., Herrick, J.E., Trujillo, D., Havstad, K.M. 2004. Land management in the American Southwest: a state-and-transition approach to ecosystem complexity. Environmental Management. 34(1):38-51.

* Peters, D.C., Pielke, R.A., Bestelmeyer, B.T., Allen, C.D., Munson-McGee, S., Havstad, K.M. 2004. Cross-scale interactions, nonlinearities, and forecasting catastrophic events. Proceedings of the National Academy of Sciences. 101(42):15130-15135.

* Bestelmeyer, B.T. 2005. Does desertification diminish biodiversity? Enhancement to ant diversity by shrub invasion in southwestern USA. Diversity and Distributions. 11(1):45-55.

* Beever, E.A., Swihart, R.K., Bestelmeyer, B.T. 2006. Linking the concept of scale to studies of biological diversity: evolving approaches and tools. Diversity and Distributions. 12:229-235.

* Bestelmeyer, B.T. 2006. Threshold concepts and their use in rangeland management and restoration: The good, the bad, and the insidious. Restoration Ecology. 14(3):325-329.

* Bestelmeyer, B.T., Trujillo, D.A., Tugel, A.J., Havstad, K.M. 2006. A multi-scale classification of vegetation dynamics in arid lands: What is the right scale for models, monitoring, and restoration? Journal of Arid Environments. 65:296-318.

* Bestelmeyer, B.T., Ward, J.P., Havstad, K.M. 2006. Soil-geomorphic heterogeneity governs patchy vegetation dynamics at an arid ecotone. Ecology. 87(4):963-973.

* Bestelmeyer, B.T., Ward, J.P., Herrick, J.E., Tugel, A.J. 2006. Fragmentation effects on soil aggregate stability in a patchy arid grassland. Rangeland Ecology & Management. 59:506-415.

* Herrick, J.E., Bestelmeyer, B.T., Archer, S., Tugel, A.J., Brown, J.R. 2006. An integrated framework for science-based arid land management. Journal of Arid Environments. 65:319-335.

* Herrick, J.E., Moya, E., Willms, W., Bestelmeyer, B.T., Sundt, P., Barnes, W. 2006. Arid and semiarid rangeland monitoring in North America. Secheresse. 17(1-2):235-241.

* Monger, H.C., Bestelmeyer, B.T. 2006. The soil-geomorphic template and biotic change in arid and semi-arid ecosystems. Journal of Arid Environments. 65:207-218.

* Peters, D.P.C., Bestelmeyer, B.T., Herrick, J.E., Fredrickson, E.L., Monger, H.C., Havstad, K.M. 2006. Disentangling complex landscapes: New insights into arid and semiarid system dynamics. BioScience. 56:491-501.

* Rango, A., Laliberte, A.S., Steele, C., Herrick, J.E., Bestelmeyer, B.T., Schmugge, T.J., Roanhorse, A., Jenkins, V. 2006. Using unmanned aerial vehicles for rangelands: Current applications and future potentials. Environmental Practice. 8:159-168.

* Bestelmeyer, B.T., Khalil, N.I., Peters, D.C. 2007. Does shrub invasion indirectly limit grass establishment via seedling herbivory? A test at grassland-shrubland ecotones. Journal of Vegetation Science. 18:363-370.

XII. Past Accomplishments of Richard E. Estell, Research Animal Scientist

Education:

1984	New Mexico State University, Animal Science, Ph.D.
1979	University of Tennessee, Animal Science, M.S.
1976	Purdue University, Agriculture, B.S.

Experience:

1989-Present	Research Animal Scientist, USDA, Range Management Research Unit, USDA, ARS, Las Cruces, NM
1984-1989	Research Assistant II, Animal Science Department, New Mexico State University, Las Cruces, NM

Accomplishment:
The scientist developed a program to examine the biochemical basis of diet selection. The scientist identified tarbush (a common unpalatable shrub) as a shrub model for exploring phytochemistry-herbivore relationships, and characterized its nutritional and toxicological attributes and secondary chemistry profile. The scientist demonstrated that livestock discriminate between individual plants when forced to consume tarbush, and this differential use was related to epicuticular wax concentration. The scientist showed that removal of compounds from tarbush with organic solvents increased consumption by sheep, and that crude fractions isolated from sequential extractions of tarbush with hexanes, ether, and ethanol all dramatically decreased consumption when applied to alfalfa pellets. This research indicated several compounds and classes are probably involved in intake suppression. The scientist identified relationships of specific mono- and sesquiterpenes to degree of use by livestock. The scientist established a protocol for a bioassay to test effects of specific chemicals on intake by sheep, and tested a series of terpenes. This research showed only four (camphor, α-pinene, camphene, and caroyphyllene oxide) of the 25 compounds tested to date reduced intake when applied individually to alfalfa pellets, with no effect of *cis*-jasmone, borneol, limonene, β-caryophyllene, *p*-cymene, 1,8-cineole, 3-carene, α-humulene, sabinene, myrcene, β-pinene, γ-terpinene, terpinolene, α-copaene, α-terpinene, eugenol, α-terpineol, terpin-4-ol, methyl eugenol, *cis*-β-ocimene, or *cis*-sabinene hydrate) on intake. The scientist tested the potential to desensitize against compounds that produced a negative effect on intake during previous studies. Lambs were exposed to aromas of compounds previously identified to affect intake (camphor and α-pinene) for several weeks while consuming alfalfa pellets. Conditioning lambs to odors of these two terpenes did not alter subsequent intake when applied to their diets.

Peer-Refereed Publications: (* Indicates publications resulting from prior project - 54 total)

Estell, R. E., Anderson, D. M., and Havstad, K. M. 1994. Effects of organic solvents on use of tarbush by sheep. Journal of Chemical Ecology. 20:1137-1142.

Estell, R. E., Havstad, K. M., Fredrickson, E. L., and Gardea-Torresdey, J. L. 1994. Secondary chemistry of the leaf surface of *Flourensia cernua*. Biochemical Systematics and Ecology. 22:73-77.

Fredrickson, E. L., Thilsted, J. P., Estell, R. E., and Havstad, K. M. 1994. Effect of chronic ingestion of tarbush (*Flourensia cernua*) on ewe lambs. Veterinary and Human Toxicology, 36:409-415.

Estell, R. E., Fredrickson, E. L., Anderson, D. M., Mueller, W. F., and Remmenga, M. D. 1994. Relationship of tarbush leaf surface secondary chemistry to livestock herbivory. Journal of Range Management. 47:424-428.

King, D. W., Fredrickson, E. L., Estell, R. E., Havstad, K. M., Wallace, J. D., and Murray, L. W. 1996. Effects of *Flourensia cernua* ingestion on nitrogen balance of sheep consuming tobosa. Journal of Range Management. 49:331-335.

Estell, R. E., Fredrickson, E. L., and Havstad, K. M. 1996. Chemical composition of *Flourensia cernua* at four growth stages. Grass Forage Science. 51:434-441.

King, D. W., Estell, R. E., Fredrickson, E. L., Havstad, K. M., Wallace, J. D., Murray, L. W. 1996. Effects of *Flourensia cernua* ingestion on intake, digesta kinetics, and ruminal fermentation of sheep consuming tobosa. Journal of Range Management. 49:325-330.

Tellez, M. R., Estell, R. E., Fredrickson, E. L., and Havstad, K. M. 1997. Essential oil of *Flourensia cernua* DC. Journal of Essential Oil Research. 9:619-624.

Estell, R. E., Fredrickson, E. L. Anderson, D. M., Havstad, K. M., and Remmenga, M. D. 1998. Relationship of leaf surface terpene profile of tarbush with livestock herbivory. Journal of Chemical Ecology. 24:1-12.

Estell, R. E., Fredrickson, E. L., Tellez, M. R., Havstad, K. M., Shupe, W. L., Anderson, D. M., and Remmenga, M. D. 1998. Effect of volatile compounds on consumption of alfalfa pellets by sheep. Journal of Animal Science. 76:228-233.

Estell, R. E., Fredrickson, E. L. Anderson, D. M., Havstad, K. M., and Remmenga, M. D. 2000. Effects of individual terpenes on consumption of alfalfa pellets by sheep. Journal of Animal Science. 78:1636-1640.

Fredrickson, E. L., Estell, R. E., Havstad, K. M., Shupe, W. L., and Murray, L. E. 2000. The effect of feeding ewe lambs a 15% tarbush (*Flourensia cernua* DC) pellet pre- and post-weaning on subsequent diet selection of tarbush. Journal of Arid Environments. 44:123-131.

Estell, R. E., Tellez, M. R., Fredrickson, E. L. Anderson, D. M., Havstad, K. M., and Remmenga, M. D. 2001. Extracts of *Flourensia cernua* reduce consumption of alfalfa pellets by sheep. Journal of Chemical Ecology. 27:2275-2285.

Estell, R. E., Fredrickson, E. L. Anderson, D. M., Havstad, K. M., and Remmenga, M. D. 2002. Effects of four mono- and sesquiterpenes on consumption of alfalfa pellets by sheep. Journal of Animal Science. 80:3301-3306.

* Estell, R. E., Fredrickson, E. L., Anderson, D. M., and Remmenga, M. D. 2005. Effects of γ-terpinene, terpinolene, α-copaene, and α-terpinene on consumption of alfalfa pellets by sheep. Journal of Animal Science. 83:1967-1971.

* Estell, R. E., Fredrickson, E. L., Anderson, D. M., Havstad, K. M., and Remmenga, M. D. 2005. Effect of previous exposure of sheep to monoterpene odors on intake of alfalfa pellets treated with camphor or α-pinene. Small Ruminant Research. 58:33-38.

Rogosic, J., Estell, R. E., Skobic, D., Martinovic, A., and Maric, S. 2006. Role of species diversity and secondary compound complementarity on diet selection of Mediterranean shrubs by goats. Journal of Chemical Ecology. 32:1279-1287.

Utsumi, S. A., Cilils, A. F., Estell, R. E., and Wang, Y. F. 2006. Influence of plant material handling protocols on terpenoid profiles of one-seed juniper saplings. Rangeland Ecology and Management. 59:668-673.

* Estell, R. E., Fredrickson, E. L., Anderson, D. M., and Remmenga, M. D. Effects of eugenol, α-terpineol, terpin-4-ol, and methyl eugenol on consumption of alfalfa pellets by sheep. Small Ruminant Research. (In press).

Rogosic, J., Estell, R. E., Skobic, D., and Stanic, S. Influence of secondary compound complementarity and species diversity on consumption of Mediterranean shrubs by sheep. Applied Animal Behavior. (In press).

XII. Past Accomplishments of Ed L. Fredrickson, Research Rangeland Management Scientist

Education:

1982-1985	Oregon State University, OR; Range Science; B.S.
1985-1987	Montana State University, MT; Range Science; M.S.
1987-1990	New Mexico State University, NM; Animal Science; Ph.D.

Experience:

2001-present	Research Rangeland Management Specialist, Jornada Experimental Range, Las Cruces, NM
1991-2001	College Assistant Professor, Jornada Experimental Range, New Mexico State University, Las Cruces, NM
1990-1991	Research Technician, Jornada Experimental Range, New Mexico State University, Las Cruces, NM
1987-1990	Research Assistant, Department of Animal and Range Sciences, New Mexico State University, Las Cruces, NM
1985-1987	Research Assistant, Department of Animal and Range Sciences, Montana State University, Bozeman, MT
1984-1985	Research Technician, Environmental Remote Sensing Applications Laboratory, Oregon State University, Corvallis, OR

Accomplishment:

The scientist documented differences in visceral energetic demand and grazing behavior among diverse beef cattle breeds differing in body size and milk production potential. The scientist also has examined the influence of ionophores and differing energy supplements on forage intake and ruminal digestion of rangeland forages. This work demonstrated the limited utility of supplementing monensin sodium via a ruminal delivery device to steers grazing low to medium quality forages. His work on energy supplementation has assisted in developing supplementation strategies to limit or promote forage intake while optimizing ruminal digestion of forages. He has conducted research on the nutritional and toxicological consequences of feeding cull onions to sheep. As a result of this research, he provided specific guidelines to sheep and beef cattle producers that have resulted in the use of cull onions as a commodity for animal feed. Additionally, the scientist has examined the nutritional and toxicological consequences of feeding tarbush (*Flourensia cernua*), a shrub increasing in dominance within Chihuahuan Desert grasslands, to sheep. Toxicosis was described and a model describing the effect of toxicosis on the dietary preferences of sheep published. The scientist has investigated the effect of terpenes in tarbush on the dietary preferences of sheep. Using both tarbush and creosotebush (*Larrea tridentata*), he has described processes by which the phytochemical components of invasive shrubs assist the plant in maintaining ecological dominance in desert environments. The scientist has documented the survival and ruminal passage of weed seed through the digestive tract of sheep and their eventual dissemination in the environment. These past accomplishments lead to the more current work on identification and characterization of arid land adapted beef cattle breeds with emphasis on the Spanish criollo breeds. Studies leading to the characterization of these breeds allow researchers to examine the effects of beef cattle prior to the early 1900's on historic vegetation changes while providing economic opportunities for livestock producers in arid environments.

Refereed publications (* Indicates publications resulting from prior project)

Fredrickson, E.L., Havstad, K.M. Estell, R.E. Hyder, P.W. 1998. Perspectives on desertification: southwestern United States. Journal of Arid Environments. 39:101-207.

Fredrickson, E.L., Anderson, D.M., Estell, R.E., Havstad, K.M., Shupe, W.L., Remmenga, M.D. 2001. Pen confinement of yearling ewes with cows or heifers for 14 days to produce bonded sheep. Small Ruminant Research. 40:291-297.

* Hyder, P.W., Fredrickson, E.L., Estell, R.E., Lucero, M.E. 2002. Transport of phenolic compounds from leaf surface of creosotebush and tarbush to soil surface by precipitation. Journal of Chemical Ecology. 28:2469-2476.

* Danielson, T.L., Rayson, G.D., Anderson, D.M., Estell, R.E., Fredrickson, E.L., Green, B.S. 2003. Impact of filter paper on fluorescence measurements of buffered saline filtrates. Talanta. 59:601-604.

* Hyder, P.W., Fredrickson, E.L., Remmenga, M.D., Estell, R.E., Pieper, R.D., Anderson, D.M. 2003. A digital photographic technique for assessing forage utilization. Journal of Range Management. 56:140-145.

* Estell, R.E., Fredrickson, E.L. Anderson, D.M. Remmenga, M.D. 2005. Effects of gamma-terpinene, terpinene, alpha-copaene, and alpha-terpinene on consumption of alfalfa pellets by sheep. Journal of Animal Science. 83:1967-1971.

* Estell, R.E., Fredrickson, E.L., Anderson, D.M., Havstad, K.M., Remmenga, M.D. 2005. Effect of previous exposure to sheep to monoterpene odors on intake of alfalfa pellets treated with camphor or alpha-pinene. Small Ruminant Research. 58:33-38.

* Hyder, P.W., Fredrickson, E.L., Estell, R.E., Lucero, M.E., Remmenga, M.D. 2005. Loss of phenolic compounds from leaf litter of creosotebush *Larrea tridentata (Sess. & Moc. ex DC.) Cov*. and tarbush (*Flourensia cernua DC*). Journal of Arid Environments. 61(1):79-91.

* Anderson, D.M., Rayson, G.D., Obeidat, S.M., Ralphs, M.H., Estell, R.E., Fredrickson, E.L., Parker, E., Gray, P. 2006. Use of fluorometry to differentiate among clipped species in the *genera, astragalus, oxytropis and pleuraphis*. Rangeland Ecology and Management. 59:557-563.

* Danielson, T.L., Obeidat, S., Rayson, G.D., Anderson, D.M., Fredrickson, E.L., Estell, R.E. 2006. Photoluminescent distinction among plant life forms using phosphate buffered saline extract solutions. Applied Spectroscopy. 60:800-807.

* Estell, R.E., Fredrickson, E.L., Peters, D.P.C. 2006. Introduction to special issue - Landscape linkages and cross-scale interactions in arid and semi-arid ecosystems. Journal of Arid Environments. 65:193-195.

* Fredrickson, E.L., Estell, R.E., Laliberte, A., Anderson, D.M. 2006. Mesquite recruitment in the Chihuahuan Desert: Historic and prehistoric patterns with long-term impacts. Journal of Arid Environments. 65(2):285-295.

* Havstad, K.M., Fredrickson, E.L., Huenneke, L.F. 2006. Grazing livestock management in an arid ecosystem. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure

and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 266-277.

* Laliberte, A., Rango, A., Fredrickson, E. 2006. Rangeland mapping; ease classification with an object-oriented approach and satellite imagery. Earth Imaging Journal. 3(1):30-32.

* Lucero, M.E., Fredrickson, E.L., Estell, R.E., Morrison, A.A., Richman, D.B. 2006. Volatile composition of *Gutierrezia sarothrae* (Broom Snakeweed) as determined by steam distillation and solid phase microextraction. Journal of Essential Oil Research. 18:121-125.

* Peters, D.P.C., Bestelmeyer, B.T., Herrick, J.E., Fredrickson, E.L., Monger, H.C., Havstad, K.M. 2006. Disentangling complex landscapes: New insights into arid and semiarid system dynamics. BioScience. 56:491-501.

* Bestelmeyer, B.T., Brown, J.R., Havstad, K.M., Fredrickson, E.L. 2006. A holistic view of an arid ecosystem: a synthesis of research and its applications. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 354-368.

* Laliberte, A., Rango, A., Herrick, J.E., Fredrickson, E.L., Burkett, L.M. 2007. An object-based image analysis approach for determining fractional cover of senescent and green vegetation with digital plot photography. Journal of Arid Environments. 69:1-14.

* Laliberte, A.S., Fredrickson, E.L., Rango, A. 2007. Combining decision trees with hierarchical object-oriented image analysis for mapping arid rangelands. Journal of Photogrammetric Engineering and Remote Sensing. 73:197-207.

XII. Past Accomplishments of Kris M. Havstad, Supervisory Research Rangeland Management Scientist

Education:

1975	Oregon State University, Corvallis, OR; Range Science; B.S.
1977	New Mexico State University, Las Cruces, NM; Range Science; M.S.
1981	Utah State University, Logan, UT; Range Science; Ph.D

Experience:

1989-present	Supervisory Range Scientist, USDA, ARS, Jornada Experimental Range, Las Cruces, NM
1987-present	Adjunct Professor, New Mexico State University, Las Cruces, NM
1985-1988	Associate Professor, Montana State University, Bozeman, MT
1981-1985	Assistant Professor, Montana State University, Bozeman, MT

Accomplishment:
The scientist has quantified influences of cattle genetic and rangeland environment interactions on forage intake and production efficiencies. The scientist has characterized winter grazing behaviors of rangeland cattle in northern latitudes in response to cold temperatures and revised characterization of lower critical ambient temperatures. The scientist has co-developed a new conceptual model for revegetation of degraded arid rangelands. The scientist was a member of a team that was engaged in quantifying long term ecological dynamics in arid environments and applying that knowledge to management technologies applicable for desert rangelands. The scientist was a member of a team that applied knowledge of basic ecological processes to the development of indicators for monitoring and assessing rangelands.

Refereed publications (* Indicates publications resulting from prior project – 160 total)

* Brown, J.R., Havstad, K.M. 2004. Monitoring to detect change on rangelands: physical, social, and economic/policy drivers. African Journal of Range and Forest Science. 21(2):115-121.

* Laliberte, A.S., Rango, A., Havstad, K.M., Paris, J.F., Beck, R.F., McNeely, R., Slaughter, A.L. Object-oriented image analysis for mapping shrub encroachment from 1937-2003 in southern New Mexico. Remote Sensing of Environment. 93:198-210.

* Peters, D.C., Pielke, R.A., Bestelmeyer, B.T., Allen, C.D., Munson-McGee, S., Havstad, K.M. 2004. Cross-scale interactions, nonlinearities, and forecasting catastrophic events. Proceedings of the National Academy of Sciences. 101(42):15130-15135.

* Peters, D.C., Yao, J., Havstad, K.M. 2004. Insights to invasive species dynamics from desertification studies. Weed Technology. 18:1221-1225.

* Gibbens, R.P., McNeely, R.P., Havstad, K.M., Beck, R.F., Nolen, B. 2005. Vegetation changes in the Jornada basin from 1858 to 1998. Journal of Arid Environments. 61(4):651-668.

* Havstad, K.M. 2005. Selected essays on science, rangelands, and roles of the Society for Range Management. Rangelands. 27(6):24-28.

* Herrick, J.E., Van Zee, J.W., Havstad, K.M., Burkett, L.M., Whitford, W.G. 2005. Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems. Volume II: Design, Supplementary Methods, and Interpretation. Tucson, Arizona: University of Arizona Press. 200 p.

* Rango, A., Huenneke, L., Buonopane, M., Herrick, J.E., Havstad, K.M. 2005. Using historic data to assess effectiveness of shrub removal in southern New Mexico. Journal of Arid Environments. 62(1):75-91.

* Bestelmeyer, B.T., Brown, J.R., Havstad, K.M., Fredrickson, E.L. 2006. A holistic view of an arid ecosystem: a synthesis of research and its applications. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 354-368.

* Bestelmeyer, B.T., Trujillo, D.A., Tugel, A.J., Havstad, K.M. 2006. A multi-scale classification of vegetation dynamics in arid lands: What is the right scale for models, monitoring, and restoration? Journal of Arid Environments. 65:296-318.

* Bestelmeyer, B.T., Ward, J.P., Havstad, K.M. 2006. Soil-geomorphic heterogeneity governs patchy vegetation dynamics at an arid ecotone. Ecology. 87(4):963-973.

* Drewa, P.B., Peters, D.C., Havstad, K.M. 2006. Population and clonal level responses of a perennial grass following fire in the northern chihuahuan desert. Oecologia. 150:29-39.

* Havstad, K.M., Fredrickson, E.L., Huenneke, L.F. 2006. Grazing livestock management in an arid ecosystem. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 266-277.

* Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. 2006. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. 492 p.

* Havstad, K.M., Schlesinger, W.H. 2006. Introduction. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 3-14.

* Peters, D.P.C., Bestelmeyer, B.T., Herrick, J.E., Fredrickson, E.L., Monger, H.C., Havstad, K.M. 2006. Disentangling complex landscapes: New insights into arid and semiarid system dynamics. BioScience. 56:491-501.

* Peters, D.P.C., Havstad, K.M. 2006. Nonlinear dynamics in arid and semi-arid systems: Interactions during drivers and processes across scales. Journal of Arid Environments. 65:196-206.

* Peters, D.P.C., Mariotto, I., Havstad, K.M., Murray, L.W. 2006. Spatial variation in remnant grasses after a grassland-to-shrubland state change: Implications for restoration. 2006. Rangeland Ecology & Management. 59:343-350.

* Peters, D.P.C., Yao, J., Huenneke, L.F., Havstad, K.M., Herrick, J.E., Rango, A., Schlesinger, W.H. 2006. A framework and methods for simplifying complex landscapes to reduce uncertainty in predictions. In: Wu, J., Jones, B., Li, H., Loucks, O.L., editors. Scaling and Uncertainty Analysis in Ecology: Methods and Applications. The Netherlands: Springer, Dordrecht. p. 131-146.

* Yao, J., Peters, D.C., Havstad, K.M., Gibbens, R.P., Herrick, J.E. 2006. Multi-scale factors and long-term responses of Chihuahuan Desert grasses to drought. Landscape Ecology. 21:1217-1231.

* Havstad, K.M. Peters, D.C., Skaggs, R., Brown, J. Bestelmeyer, B., Fredrickson, Ed., Herrick, J., and Wright J. 2007. Ecological services to and from rangelands of the United States. Ecological Economics. (in press).

XII. Past Accomplishments of Jeffrey E. Herrick, Research Soil Scientist

Education:

1985	Swarthmore College, PA; Biology; B.A.
1987	Lincoln College, New Zealand; Agricultural Science; Diploma
1993	Ohio State University; Agronomy; Ph.D.

Experience:

1998- Present	Soil Scientist, Range Management Research Unit, USDA-ARS, Las Cruces, NM
1994 to 1998	Postdoctoral Research Associate, New Mexico State University, Las Cruces, NM
1988-1993	National Science Foundation Graduate Research Fellow and Graduate Research Assistant, Ohio State University, Columbus, OH

Accomplishment:
The scientist has developed in a diverse, highly integrated research program on basic soil and ecosystem processes that has resulted in the generation and international adoption of a number of rangeland assessment, monitoring, and remediation tools. The scientist wrote the first review paper on the role of soil biota in rangeland soil hydrology and organized the first international workshop to address the challenge of quantifying changes in soil aggregation in poorly structured rangeland soils. The scientist developed and implemented the first long-term, landscape-level experiment to define the relationship between soil surface disturbance, soil properties, and vegetation change; co-led the development of an internationally applied rangeland assessment protocol; developed the first rangeland monitoring manual which effectively integrates plant community dynamics and dynamic soil properties to address basic ecosystem functions rather than a single, use-dependent value; and developed innovative approaches to rangeland remediation. The assessment and monitoring protocols are being applied nationally through the NRCS National Resource Inventory program and have been independently translated into Spanish and Chinese. Several of the associated tools have been commercialized. The scientist has fostered greater communication among ecologists, managers and policymakers by initiating collaborative research projects and by organizing conferences, workshops, and symposia, including an international conference on ecology and globalization.

Refereed publications: (* Indicates publications resulting from prior project - 75 total)

Herrick, J.E., Whitford, W.G., de Soyza, A.G., Van Zee, J.W., Havstad, K.M., Seybold, C.A. and Walton, M. 2001. Soil aggregate stability kit for field-based soil quality and rangeland health evaluations. CATENA. 44:27-35.

* Herrick, J.E. and Jones, T.L. 2002. A Dynamic cone penetrometer for measuring soil penetration resistance. Soil Science Society of America Journal. 66:1320-1324.

* Herrick, J.E., Brown, J.R., Tugel, A., Shaver, P.L. and Havstad, K.M. 2002. Application of soil quality to monitoring and management: paradigms from rangeland ecology. Agronomy Journal. 94:3-11.

* Bird, S.B., Herrick, J.E., Wander, M.M. and Wright, S.F. 2002. Spatial heterogeneity of aggregate stability and soil carbon in semi-arid rangeland. Environmental Pollution. 116: 445-455.

* Pyke, D.A., Herrick, J.E., Shaver, H P. and Pellant, M. 2002. Rangeland health attributes and indicators for qualitative assessment. Journal of Range Management. 55:584-597.

* Spaeth, K.E., Pierson, F.B. Herrick, J.E., Shaver, P.L., Pyke, D.A., Pellant, M. Thompson D. and Dayton, R. 2003. New proposed National Resources Inventory protocols on nonfederal rangelands. Journal of Soil and Water Conservation. 53:18A-23A.

* Ritchie, J.C., Herrick, J.E. and Ritchie, C.A. 2003. Variability in soil redistribution in the northern Chihuahuan Desert based on ^{137}Cesium measurements. Journal of Arid Environments. 55: 737-746.

* Bestelmeyer, B.T., Herrick, J.E., Brown, J.R., Trujillo, D.A. and Havstad, K.M. 2004. Land management in the American Southwest: a state and transition approach to ecosystem complexity. Environmental Management. 34:38-51.

* Gutierrez, L.R., Herrick, J.E. and Donart, G.B. 2004. Gully seeder for reseeding rangeland and riparian areas. Journal of Range Management. 57:399-401.

* Pellant, M., Shaver, P., Pyke, D. and Herrick, J.E. 2005. Interpreting indicators of Ragneland Health. Version 4. Interagency Technical Reference 1734-6. U.S. Department of the Interior, Bureau of Land Management, National Science and Technology Center, Denver, CO. BLM/WO/ST-00-001+1734/REV05. 122 pp.

* Tugel, A., Herrick, J.E., Brown, J.R., Mausbach, M.J., Puckett W. and Hipple K. 2005. Soil change, soil survey, and natural resources decision making: A blueprint for action. Soil Science Society of America Journal. 69:738-747. Errata: Soil Science Society of America Journal. 2006 70:p.1416.

* Herrick, J.E., Van Zee, J.W., Havstad, K.M., Burkett, L.M. 2005. Monitoring Manual for Grassland, Shrubland, and Savanna Ecosystems. Volume I. 63 pp.; Design, Supplementary Methods and Interpretation.Volume II. 200 pp. Tucson, Arizona: University of Arizona Press. 200 p.

* Herrick, J. E., Bestelmeyer, B. T., Archer, S., Tugel, A. and Brown, J. R. 2006. An integrated framework for science-based arid land management. Journal of Arid Environments. 65:319-335.

* Okin, G.S., Gillette, D.A. and Herrick, J.E. 2006. Multiscale controls on and consequences of aeolian processes in landscape change in arid and semiarid environments. Journal of Arid Environments. 65:253-275.

* Herrick, J.E., Schuman, G.E. and Rango, A. 2006. Monitoring ecological processes for restoration projects. Journal of Nature Conservation 14:161-171.

* Peters, D.P.C., Bestelmeyer, B.T., Herrick, J.E., Fredrickson, E.L., and Monger, H.C. 2006. Disentangling complex landscapes: new insights to forecasting arid and semiarid system dynamics. Bioscience. 56:491-500.

* Duniway, M., Herrick, J.E., and Monger, H.C. 2007. The high water-holding capacity of petrocalcic horizons. Soil Science Society of America Journal. 71:812-819.

* Reynolds, J.F., Stafford Smith, D.M., Lambin, E.F., Turner II, B.L., Mortimore, M., Batterbury, S.P.J., Downing, T.E., Dowlatabadi, H., Fernandez, R.J., Herrick, J.E., Huber-Sannwald, E., Jiang, H., Leemans, R., Lynam, T., Maestre, F.T., Ayarza, M., and Walker, B. 2007. Global desertification: building a science for dryland development. Science. 316:847-851.

* Bird, S.B., Herrick, J.E., Wander, M.M., and Murray, L. 2007. Multi-scale variability in soil aggregate stability: implications for understanding semi-arid grassland degradation. Geoderma. 140:106-118.

* Herrick, J.E. and Sarukhan, J. 2007. A strategy for ecology in an era of globalization. Frontiers in Ecology and the Environment. 5:172-181.

XII. Past Accomplishments of Mary Lucero, Research Molecular Biologist

Education:

1986 New Mexico State University, NM; Agricultural and Extension Education; B. S.
1988 New Mexico State University, NM; Curriculum and Instruction; M.A.
1997 New Mexico State University, NM; Molecular Biology Ph. D.

Experience:

2005-Present Research Molecular Biologist, Range Management Research Unit, USDA-ARS, Las Cruces, NM
1999 to 2005 Postdoctoral Research Chemist, Range Management Research Unit, USDA-ARS, Las Cruces, NM
1997 to 1999 Postdoctoral Research Associate, New Mexico State University, Las Cruces, NM
1992 to 1997 Graduate Research Assistant, New Mexico State University, Las Cruces, NM
1987 to 1992 Science Teacher, Picacho Middle School, Las Cruces, NM.

Accomplishment:

The scientist co-authored and filed a patent for the transfer of uncultured endophytes to non-native hosts, and has worked with local growers and educators to demonstrate the impact of co-cultivating crops with endophyte-laden native plant species. The scientist has isolated and identified three previously undescribed microorganisms from in-vitro propagated plants, raising questions about the purity of plant genetic information, and has demonstrated the inefficiency of standard PCR methods for detection of uncultured fungi in plant systems. The scientist has demonstrated the potential of co-cultivated desert shrubs to enhance vigor of crops from eleven botanical families, and demonstrated the utility of co-cultivation as a mechanism for enhancing native grass establishment. The scientist has published novel essential oil profiles from four previously undescribed desert plant species.

Refereed publications: (* Indicates publications resulting from prior project)

Lucero, M.E. , Mueller, W., Hubstenberger, J., Phillips, G., O'Connell, M.A. 1999. Tolerance to nitrogenous explosives and metabolism of TNT by cell suspensions of Datura innoxia. In Vitro Cellular Development Biology - Plant. 35:480–486.

* Hyder, P.W., Fredrickson, E.L., Estell, R.E., Lucero, M.E. 2002. Transport of phenolic compounds from leaf surface of creosotebush and tarbush to soil surface by precipitation. Journal of Chemical Ecology. 28:2469-2476.

* Lucero, M.E., Estell, R.E., Fredrickson E. L. 2003. The essential oil composition of *Psorothamnus scoparius* (A. Gray) Rydb. Journal of Essential Oil Research. 15:108

* Hyder, P.W., Fredrickson, E.L., Estell, R.E., Lucero, M.E., Remmenga, M.D. 2005. Loss of phenolic compounds from leaf litter of creosotebush [*Larrea tridentata* (Sess. & Moc. ex DC.) Cov] and tarbush (*Flourensia cernua* DC.). Journal of Arid Environments. 61:79-91.

* Medina, A.L., Lucero, M.E., Holguin, F.O., Estell, R.E., Posakony, J.J.,Simon, J., O'Connell, M.A. 2005. Composition and antimicrobial activity of *Anemopsis californica* leaf oil. Journal of Agricultural and Food Chemistry. 53:8694-8698.

* Lucero, M.E., Estell, R.E. and Sedillo, R. 2005. The composition of *Dalea formosa* oil determined by steam distillation and by solid phase microextraction." Journal of Essential Oil Research. 17: 645-647.

* Lucero, M.E., Fredrickson, E.L., Estell, R.E., Morrison, A.A., Richman, D.B. 2006. Volatile composition of *Gutierrezia sarothrae* (Broom Snakeweed) as determined by steam distillation and solid phase microextraction. Journal of Essential Oil Research. 18:121-125.

* Lucero, M.E., Barrow, J.R., Osuna, P., Reyes, I. 2006. Plant-fungal interactions in arid and semi-arid ecosystems: Large-scale impacts from microscale processes. Journal of Arid Environments. 65:276-284

* Barrow, J., Lucero, M.E., Reyes, I., Havstad, K.M. 2007. Endosymbiotic fungi structually integrated with leaves reveals a lichenous condition of C4 grasses. In Vitro Cellular and Developmental Biology – Plants. 43:65-70.

* *Patent Application*
Barrow, J. R. and Lucero, M.E. Transfer and Incorporation of heritable Symbiotic Fungi Into Non-Host Plants. Application filed US Patent Office. PC.0080.05.

XII. Past Accomplishments of Albert Rango, Research Hydrologist

Education:

1965 Pennsylvania State University; Meteorology; B.S.
1966 Pennsylvania State University; Meteorology; M.S.
1969 Colorado State University; Watershed Management; Ph.D.

Experience:

2001-present Research Hydrologist, USDA – ARS, SPA, Jornada Experimental Range, Las Cruces, NM
1994-2001 Research Hydrologist, USDA, ARS, HL, Beltsville, Maryland
1983-1994 Hydrologist and Research Leader, USDA/ARS/BA/NRI/HL, Beltsville, Maryland
1972-1983 Hydrologist and Branch Head, Hydrological Sciences Branch
1969-1972 Assistant Professor of Meteorology, Pennsylvania State University

Accomplishment:

The scientist led development of visual and digital methods for extracting snow covered area from a variety of satellite sensors. The scientist conceived and designed the satellite snow cover version of the Snowmelt Runoff Model (SRM) which is used for simulations, forecasts, and climate change evaluations. SRM is currently being adapted to the Rio Grande basin for operational forecasts. The scientist developed the first techniques for analyzing satellite microwave data over large areas and developed a means for estimating snow water equivalent and depth on flat, high prairies and in large mountain basins. The scientist developed a formalized algorithm as part of SRM for evaluating hydrologic response to climate change and has used it to evaluate river basin responses under varying conditions of climate change. The scientist is the principal investigator for the JORNEX project (now a formalized part of the Jornada Basin LTER) and in the role directs the field experiments, integrates the various data being collected, and coordinates the joint cooperative investigations under the JORNEX umbrella. The scientist has assembled historic research records along with historic aerial photography of rangeland remediation treatments in the Jornada Basin to assess their effects on rangeland condition and ecosystem stability. The scientist has developed hyperspatial remote sensing (<5 cm resolution) using simple digital cameras mounted on autonomous Unmanned Aerial Vehicles (UAVs).

Refereed publications (* Indicates publications resulting from prior project – 200 total)

* Devries, A.C., Kustas, W.P., Ritchie, J.C., Klaassen, W., Menenti, M., Rango, A., Prueger, J.H. 2003. Effective aerodynamic roughness estimated from airborne laser altimeter measurements of surface features. International Journal of Remote Sensing. 24:1545-1558.

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* Rango, A., Foster, J., Josberger, E.G., Erbe, E.F., Pooley, C.D., Wergin, W.P. 2003. Rime and graupel: description and characterization as revealed by low temperature scanning electron microscopy. Scanning. 25:121-131.

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* Chopping, M.J., Su, L., Rango, A., Maxwell, C.J. 2004. Modelling the reflectance anisotropy of Chihuahuan Desert grass-shrub transition canopy-soil complexes. International Journal of Remote Sensing. 25(14):2725-2745.

* Gomez-Landesa, E., Rango, A., Bleiweiss, M. 2004. An algorithm to address the MODIS bowtie effect. Canadian Journal of Remote Sensing. 30:644-650.

* Laliberte, A.S., Rango, A., Havstad, K.M., Paris, J.F., Beck, R.F., McNeely, R., Slaughter, A.L. 2004. Object-oriented image analysis for mapping shrub encroachment from 1937-2003 in southern New Mexico. Remote Sensing of Environment. 93:198-210.

* Rango, A., Huenneke, L., Buonopane, M., Herrick, J.E., Havstad, K.M. 2005. Using historic data to assess effectiveness of shrub removal in southern New Mexico. Journal of Arid Environments. 62:75-91.

* Chopping, M., Su, L., Laliberte, A., Rango, A., Peters, D.P.C., Kollikkathara, N. 2006. Mapping shrub abundance in desert grasslands using geometric-optical modeling and multi-angle remote sensing with CHRIS/PROBA. Remote Sensing of Environment. 104:62-73.

* Chopping, M.J., Su, L., Laliberte, A.S., Rango, A., Peters, D.C., Martonchik, J.V. 2006. Mapping woody plant cover in desert grasslands using canopy reflectance modeling and MISR data. Geophysical Research Letters. Vol. 33, L17402, doi:10.129/2006GL027148.

* Herrick, J.E., Havstad, K.M., Rango, A. 2006. Remediation research in the Jornada basin: past and future. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 278-304.

* Herrick, J.E., Schuman, G.E., Rango, A. 2006. Monitoring ecological processes for restoration projects. Journal of Nature Conservation. 14(3-4):161-171.

* Laliberte, A., Rango, A., Fredrickson, E. 2006. Rangeland mapping; ease classification with an object-oriented approach and satellite imagery. Earth Imaging Journal. 3(1):30-32.

* Rango, A. 2006. Snow: the real water supply for the Rio Grande basin. New Mexico Journal of Science. 44:99-118.

* Rango, A., Laliberte, A.S., Steele, C., Herrick, J.E., Bestelmeyer, B.T., Schmugge, T.J., Roanhorse, A., Jenkins, V. 2006. Using unmanned aerial vehicles for rangelands: Current applications and future potentials. Environmental Practice. 8:159-168.

* Rango, A., Ritchie, J., Schmugge, T., Kustas, W., Chopping, M.J. 2006. Applications of remotely sensed data from the Jornada basin. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 305-320.

* Rango, A., Tartowski, S.L., Laliberte, A., Wainwright, J., Parsons, A. 2006. Islands of hydrologically enhanced biotic productivity in natural and managed arid ecosystems. Journal of Arid Environments. 65:235-252.

* Laliberte, A., Rango, A., Herrick, J.E., Fredrickson, E.L., Burkett, L.M. 2007. An object-based image analysis approach for determining fractional cover of senescent and green vegetation with digital plot photography. Journal of Arid Environments. 69:1-14.

* Laliberte, A.S., Fredrickson, E.L., Rango, A. 2007. Combining decision trees with hierarchical object-oriented image analysis for mapping arid rangelands. Journal of Photogrammetric Engineering and Remote Sensing. 73:197-207.

* Su, L., Chopping, M.J., Rango, A., Martonchik, J.V., Peters, D.C. 2007. Support vector machines for recognition of semi-arid vegetation types using MISR multi-angle imagery. Remote Sensing of Environment. 107:299-311.

XII. Past Accomplishments of Sandy Tartowski, Range Scientist

Education:

1999	Cornell University, NY, Ecology and Evolutionary Biology, Ph.D.
1979	University of Wisconsin-Green Bay, Environmental Science, B.S. *cum laude*

Experience:

2003-Present	Rangeland Management Specialist, USDA, ARS Jornada Experimental Range, Las Cruces, NM
2000-2002	Post-Doctoral Associate, Biogeochemistry and Environmental Change, Cornell University, Ithaca, NY
1997-2000	Research Associate, Ecology and Evolutionary Biology, Cornell University, Ithaca, NY
1997-1999	Instructor, Ecosystem Ecology, Graduate School of Environmental Studies, Bard College (summer), Annandale-on-Hudson, NY
1994-1997	Post-Doctoral Associate, Institute of Ecosystem Studies, Millbrook, NY

Accomplishment:
The scientist established a research program to investigate the constraints and opportunities for the remediation of arid rangelands. The scientist demonstrated that desirable perennial grasses such as black grama could be established from seed in severely degraded sites, without irrigation. The scientist documented that small water retention dikes increased the cover of vegetation and that these effects remained for 25-30 years. The scientist demonstrated that biocontrol by livestock is a potential alternative to the use of chemical and mechanical methods to control invasive plant species such as saltcedar. Quantifying the impact of goat browsing on saltcedar and understory vegetation was particularly useful to land managers and public agencies in designing saltcedar control and ecosystem restoration programs. The scientist demonstrated that alteration of the event size and frequency of summer rainfalls, as predicted for climate change scenarios, can change the availability of nitrogen for plants and may influence the potential for rehabilitation of degraded rangeland.

Refereed publications (* Indicates publications resulting from prior project)

* Schlesinger, W.H., Tartowski, S.L., Schmidt. S.M. 2006. Nutrient cycling within an arid ecosystem. In: Havstad, K.M., Huenneke, L.F., Schlesinger, W.H., editors. Structure and Function of a Chihuahuan Desert Ecosystem. The Jornada Basin Long-Term Ecological Research Site. Oxford, NY: Oxford University Press. p. 133-149.

* Rango, A., Tartowski, S.L., Laliberte, A., Wainwright, J., Parsons, A. 2006. Islands of hydrologically enhanced biotic productivity in natural and managed arid ecosystems. Journal of Arid Environments. 65:235-252.

* Synder, K.A., Tartowski, S.L. 2006. Multi-scale temporal variation in water availability: Implications for vegetation dynamics in arid and semi-arid ecosystems. Journal of Arid Environments. 65(2):219-234.

XIII. Health, Safety, and Other Issues of Concern Statement

Animal Care: All research projects involving livestock are reviewed and approved by the Institutional Animal Care and Use Committee at New Mexico State University prior to initiation.

National Environmental Policy Act: "On the basis that this federal project is being conducted for the sole purpose of conducting research, this project is categorically excluded in accordance with regulations for the National Environmental Policy Act."

Human Study: Not relevant Endangered Species: not relevant

Laboratory Hazards: Although no serious laboratory hazards are anticipated relative to this project proposal, employees receive safety training prior to using laboratories. Under the direction of the Location Collateral Duty safety Officer the research unit has an active safety committee, safety manual, chemical hygiene plan, and hazardous waste disposal plan. All laboratory safety training requirements are augmented through an agreement with the Safety Officer at NMSU to provide routine training to employees through on line testing and evaluations.

Occupational Safety and Health: Although no serious safety and health issues are expected regarding this proposal, employees review safety and health manual and receive training on issues such as “right to know” and how to read Material Safety Data Sheets.

Recombinant DNA: Recombinant DNA procedures used in this proposal (Level 1 Biosafety) were approved by the New Mexico State University Institutional Biosafety Committee (Approval # D0207060101; 3/30/06).

Homeland Security: not relevant

Intellectual Property: Patents developed in accord with ARS policies. Intellectual property collaborations are covered under guidelines in established Specific Cooperative Agreements.

Existing Specific Cooperative Agreements: listed at: http://www.ars.usda.gov/research/projects/projects.htm?ACCN_NO=406494. No agreements involve “pass through” of appropriated base funds.

While preparing the Project Plan, I (Debra C. Peters, Lead Scientist) have carefully examined all aspects of the planned research to ensure that appropriate safety concerns are addressed, all necessary permits have been identified, and that environmental issues have been considered in making the National Environmental Policy Act (NEPA) decision documented in the statement. All permits are in hand or have been requested. Documentation supporting NEPA decision is in the MU project file and available for review upon request.

I (James R. Coppedge) certify that the proposed research conforms to current regulations and guidelines regarding the above issues and concerns.

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James R. Coppedge Date
Associate Area Director