

The Shrub Sciences Laboratory at 25 Years: Retrospective and Prospective

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Abstract—The Shrub Sciences Laboratory celebrated its 25th anniversary with the symposium documented by these proceedings and a ceremony honoring people instrumental in its establishment: Mr. A. Perry Plummer represented Forest Service Research and Development and Dr. Howard C. Stutz represented Brigham Young University. The laboratory came into being because of the research foundation in Western shrub ecosystems generated by USDA Forest Service researchers and their colleagues and the need to carry on programmatic research in vast Western shrublands. Since establishment of the laboratory, dozens of scientists and professionals with technical and clerical support have conducted shrubland ecosystem research and development centered on shrubland ecosystem ecology and experimental range management, including winter livestock management on salt shrublands; seed quality testing and production and seed and seedbed ecology and adaptation; genetic variation, population biology, and systematics and taxonomy; breeding systems, hybridization, and hybrid zones; rangeland rehabilitation and restoration; equipment development, and cultural care of wildland species; soil/plant interactions, pathology, entomology, and mycorrhizae; nutritive quality, palatability, and wildlife habitat; and invasive weeds and weed biology. A continuing robust research program is anticipated that will build on previous research accomplishments, and will especially emphasize genetic variation and plant material development, fire susceptible ecosystems, invasive weed control and biology, and the ecology and restoration of ecosystems on the urban/wildland interface. Laboratory personnel and collaborators have published nearly 800 titles during the past quarter century; these are listed in the References section and in appendix A.

Origin of Laboratory

The Shrub Sciences Laboratory was officially opened with appropriate fanfare on November 4–6, 1975, with a shrub workshop for scientists and land managers; science sessions featuring contributed and invited presentations on shrub research (Stutz 1976); and a banquet, dedication, ribbon cutting, and open house. Some 350 people attended these activities, which were held at the laboratory and at the Wilkinson Student Center of Brigham Young University. Associate Deputy Chief of the Forest Service Warren T. Doolittle, Intermountain Forest and Range Experiment Station Director Roger R. Bay, and

Brigham Young University President Dallin H. Oaks presided at these functions that were cosponsored by the Station, Brigham Young University, Utah Division of Wildlife Resources, Utah State University, and the Utah Section of the Society for Range Management. The program steering committee included Howard C. Stutz, Professor, Department of Botany and Range Science, Brigham Young University; James P. Blaisdell, Assistant Director, Intermountain Forest and Range Experiment Station; Cyrus M. McKell, Professor, Department of Range Science, Utah State University; and Norman C. Hancock, Chief, Game Management, Utah Division of Wildlife Resources.

The need for a laboratory dedicated to shrubland ecosystem research had been evident for some time (Blaisdell 1972). The Intermountain Forest and Range Experiment Station (now part of the Rocky Mountain Research Station) had been conducting research on the shrublands of the Colorado Plateau, Great Basin, and associated mountains beginning as early as 1912. The Intermountain Station had established three experimental ranges in central and southern Utah, Great Basin, Desert, and Benmore (Astroth and Frischknecht 1984; Clary and Holmgren 1982; Keck 1972; Kitchen and McArthur 1996; McArthur and Monsen 1996), and had active research units dealing with shrubland ecosystem research topics housed in office space with inadequate laboratory and greenhouse facilities in Ephraim and Provo. Utah and Provo are centrally located in respect to the vast shrublands of Western North America setting near the juncture of the Rocky Mountain, Colorado Plateau, and Basin and Range physiographic provinces. Within the U.S. Department of Agriculture, Forest Service Research and Development network of laboratories, the Shrub Sciences Laboratory is unique in that it is the only location out of more than 60 total research locations that is dedicated to research on shrubland ecosystems. This is appropriate because up to 40 percent ($1.8 \times 10^6 \text{ km}^2$) of the conterminous 17 Western United States is shrubland (Küchler 1964; McArthur and Ott 1996).

The origin of the laboratory was documented, in part, in a letter written to me on March 17, 1985, by retired (January 1, 1966) Forest Service Deputy Chief for Research V. L. Harper, triggered by my presentation, “Building on Nature’s Diversity: Western Shrubs,” in the Forest Service Washington Office Seminar Series, 1984–1985, on February 26, 1985:

I was much interested in the item about this seminar by you in the 3-08 issue of *The Friday Newsletter*, published by the F.S.

Among other things, it recalled to mind some history of the Lab’s origin. I was doing a “Research Inspection” of the Intermountain Station (about 1960) and one of the research centers which Director Joe Pechanec and I visited was the work on shrub research. After listening to the Project Leader’s [A. Perry Plummer] presentation viewing some of the field experiments, I turned to Joe Pechanec and said in effect....

In: McArthur, E. Durant; Fairbanks, Daniel J., comps. 2001. Shrubland ecosystem genetics and biodiversity: proceedings; 2000 June 13–15; Provo, UT. Proc. RMRS-P-21. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

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“Joe, maybe we ought to amend the *Ten-year Research Program* to include a new laboratory at Provo—a lab featuring shrub research including genetics, etc.” Joe grinned broadly and said “I hoped you would see this need.” He then produced a memo outlining the justification for such a laboratory, hopefully to be located on the grounds of Brigham Young University. He further remarked, “I have prepared a speech, which I can now cut short, giving a big pitch for the lab.” I told Joe that I was personally acquainted with the president of the university [Ernest L. Wilkinson] ... and had dealings with him. “Why don’t we go to see him during this trip,” I said. Our visit with the president was friendly and very encouraging. He offered a long-term lease—free for the site for the building and other cooperative aspects. Amending this projected research plan was not difficult. I simply added the Provo location to the list of needed lab construction. The research plan used only an overall figure for construction and I felt we would not reach that figure anyway. From then on, while I was Chief of Research, it was on the list that I gave Senator Stennis, who in turn related it to the Senate in a speech and to the Appropriation Sub-committee, at the proper time.

I am glad the Shrub Sciences Laboratory, unlike some others that I got funds for from the Budget Bureau and/or Congress, has not been abandoned by the current Administration’s Budget cuts.

With the impetus generated by Deputy Chief Harper and Station Director Pechanec through Forest Service administrative circles and the Congress and backed up by strong Brigham Young University support, the laboratory became a reality but not without some vicissitudes, for example, annual appropriations for construction was impounded or sequestered by the Administration until 1974 when \$760,000 was authorized for construction; actual construction was begun in October 1974 (fig. 1). The Utah Congressional delegation of the time gave bipartisan support for the laboratory. Congressman Gunn McKay (D) was especially active on behalf of the establishment of the laboratory (fig. 2); Senators Frank Moss (D) and Wallace Bennett (R) and Congressmen Sherm Lloyd (R) and Wayne Owens (D) were supportive as well. The University was proactive in establishing the laboratory by providing the land for the laboratory, associated greenhouses, and support facilities both at the laboratory site on the south edge of campus (735 North

500 East) and an ancillary site at 1325 East on 820 North through long-term leases at the minimal legal cost of \$1.

Originally, the laboratory was to be called the Shrub Improvement Laboratory. However, Dr. Neil C. Frischknecht, a charter Range Scientist and Team Leader in the Mineland Reclamation Research Work Unit, raised the issue of the name of the laboratory in a June 1975 memo:

...inasmuch as shrub improvement is essentially plant breeding, it seems that one of the following titles would more nearly reflect the scope of the research that will be done at the new lab: ...Shrub Research Laboratory, Shrub Science(s) Laboratory, Shrub-Range Improvement Laboratory. ...I have learned that the FS plaque and letters “Shrub Improvement Laboratory” are already on hand. If a change is in order, it is far better to make it before the building is dedicated...

Dr. Frischknecht’s comment was recognized as meritorious, and the more holistic name, Shrub Sciences Laboratory, was selected and mounted on the front on the laboratory. Although my discipline is genetics, I believe it was a wise decision. The steel cast letters from “improvement” not used in “sciences” were presented to Dr. Blaisdell and Mr. Plummer by Director Roger Bay, with accompanying jocular comments, in a meeting that I remember attending.

Importance of Shrubs and Shrublands

The importance of shrub species and shrubland ecosystems in the Western United States and in other semiarid areas gained considerable impetus from the activities leading up to the establishment of the Shrub Sciences Laboratory. An international symposium (Wildland Shrubs—Their Biology and Utilization) was held in July 1971, at Utah State University in Logan, drawing researchers and land managers from many countries (McKell and others 1972). I insert a personal note: I was a postdoctoral research fellow at the University of Leeds in England at the time. I recall seeing an advertising flyer for the symposium and discussing with my mentor, Mr. David Harberd, that the subject area of the symposium was interesting and it would be nice to have an



Figure 1—Laboratory under construction (left) in February 1975 and in July 1999 (right). Photo on left by Howard C. Stutz, on right by E. Durant McArthur.

opportunity to pursue a career in that area. Such are the twists of fate that I had that opportunity shortly thereafter.

The symposium was followed several years later with a textbook, *The Biology and Utilization of Shrubs* (McKell 1989). The extent, adaptation, and use of shrubs and ecosystems that they dominate together with the prospects of a laboratory dedicated to shrub research that subsequently became a reality also stimulated, in part, a series of workshops, symposia, and publications in Utah and surrounding states and formation of the Shrub Research Consortium. The Wyoming Shrub Ecology Workshop under the leadership of Drs. Herbert G. Fisser and Kendall L. Johnson of the University of Wyoming ran for at least 17 years (1972 to 1988; Fisser 1990 lists all workshops). A similar Utah Shrub Ecology Workshop, under the leadership of Drs. Kendall L. Johnson and G. Allen Rasmussen of Utah State University ran from 1981 to 1991 (Johnson 1990 lists workshops up to that time; two subsequent workshops were held but the proceedings were not published). The Shrub Research Consortium formed in 1983 with five institutional charter members has expanded to a membership of 25 institutions (McArthur and others 1999b; Tiedemann 1984) and has sponsored 11 wildland shrub symposia (more are in the planning stages) with a diversity of wildland shrub biology themes.

Other period relevant publications include *Wyoming Shrubland Ecology, A Chronologic Supplemented Multiple Source Annotated Bibliography* (Fisser 1987), *Shrubs of the Great Basin, A Natural History* (Mozingo 1987), *The Sagebrush Ocean, A Natural History of the Great Basin* (Trimble 1989), *The Desert's Past, A Natural Prehistory of the Great Basin* (Grayson 1993), and *Natural History of the Colorado Plateau and Great Basin* (Harper and others 1994).

Twenty-Five Year Laboratory Celebration

Two men were honored at a bust unveiling at the beginning of the symposium and 25th year anniversary documented in this publication. Mr. A. Perry Plummer (fig. 3), long-time project leader of the Shrub Improvement and Revegetation Research Work Unit (now Shrubland Biology and Restoration RWU) of the Intermountain Forest and Range Experiment Station (now Rocky Mountain Research Station) located at the Great Basin Experimental Range (= Great Basin Research Center), Ephraim, Utah (McArthur 1991; Plummer 1972; 1977; Plummer and others 1968) for many years prior to the establishment of the Shrub Sciences Laboratory, represented the USDA Forest Service. Work by him and his group, including Utah Division of Wildlife Resources collaborators, on big game range rehabilitation, especially using native wildland shrubs, gave impetus and visibility to shrub research. Dr. Howard C. Stutz (fig. 4), Emeritus Professor of Botany and Range Science, Brigham Young University, represented the University. Dr. Stutz was untiring in his efforts as a liaison between the Utah Congressional delegation, the Forest Service, and the University during the period from the addition of the laboratory to the *Ten Year Research Program* in the early 1960s until the laboratory became a reality. Dr. Stutz has a distinguished career in



Figure 2—Representative K. Gunn McKay (left), Intermountain Station Director Roger R. Bay (center), and Brigham Young University President Dallin H. Oaks (right), on the site of the future Shrub Sciences Laboratory in 1974. Photo by Neil C. Frischkecht.

plant genetics including many contributions to shrub genetics, for example, Cutler 1996; Stutz 1978; Stutz and others 1975, 1979, 1987; Stutz and Sanderson 1979, 1984, 1998; Stutz and Thomas 1964.

Dr. Daniel J. Fairbanks, Professor of Botany and Range Science, Brigham Young University, sculpted the busts and unveiled them with assistance from Mrs. Blanche Plummer and her family, Dr. Howard Stutz and Mrs. Mildred Stutz and their family, Rocky Mountain Research Station Director Denver P. Burns, and Brigham Young University President Merrill J. Bateman at the 25-year anniversary ceremony at the beginning of the symposium. The busts are now displayed in the front entrance of the Shrub Sciences Laboratory. Director Burns and President Bateman honored the 25-year celebration of the laboratory and the contributions of Mr. Plummer and Dr. Stutz with appropriate remarks. An open house at the laboratory was held for those who attended the symposium as well as the general public.



Figure 3—Mr. A. Perry Plummer, Intermountain Research Station Project Leader, instrumental in establishment of Shrub Sciences Laboratory. Photo courtesy of Mrs. Blanche Plummer.



Figure 4—Dr. Howard C. Stutz, Brigham Young University Professor, tireless worker in behalf of establishment of Shrub Sciences Laboratory. Photo courtesy of Mrs. Mildred Stutz.

Staffing

At establishment time of the laboratory, the scientific staff included elements of three Forest Service Research Work Units (RWU): Shrub Improvement and Revegetation, Ecology and Management of Salt Desert Shrub Ranges, and Mined-Land Reclamation. The first two units were administered from the Shrub Sciences Laboratory, and the third was headquartered in the Forestry Sciences Laboratory in Logan, Utah, but had detached members (Neil C. Frischknecht and Robert B. Ferguson) stationed at the Shrub Sciences Laboratory until Dr. Frischknecht retired in 1980 and Mr. Ferguson in 1983. The Ecology and Management of Salt Desert Shrub Ranges RWU continued at the Shrub Sciences Laboratory until 1984, at which time the unit was discontinued. Members of the unit were reassigned to a new RWU—Riparian Stream Ecology and Management—and moved to the Forestry Sciences Laboratory in Boise, Idaho, except for Fred J. Wagstaff who remained at the Shrub Sciences Laboratory to manage the Desert Experimental Range (DER). Dr. Wagstaff and the

DER were transferred to administration of the Shrub Improvement RWU in 1986. The Shrub Improvement and Revegetation RWU changed its research emphasis to a more holistic and ecosystem approach in 1993 and captured that move with a new name—Shrubland Biology and Restoration. This unit's core work has been at the Shrub Sciences Laboratory since establishment of the lab in 1975, but some individual scientists have been in detached locations from time to time. Most notably this included Stephen B. Monsen and Nancy L. Shaw at the Boise Forestry Sciences Laboratory. Mr. Monsen transferred to the Shrub Sciences Laboratory in 1983; Dr. Shaw transferred to the Riparian Stream Ecology and Management RWU in 1986. The Shrubland Biology RWU has managed the Great Basin Experimental Range (GBER) in Ephraim Canyon of the Manti-La Sal National Forest as long as the unit and its predecessors have been in existence. At the opening of the laboratory, A. Perry Plummer and I were transferred from the Great Basin Experimental Range to the new lab, but the RWU has kept continued personnel presence at the GBER. Cooperating scientists and other personnel from the Utah Division of Wildlife Resources (UDWR) Wildlife

Habitat Restoration RWU had been closely integrated in their work assignments with the Forest Service RWU. Both units had been under the supervision of Mr. Plummer. The administration eventually separated, but coordinated research activities have continued. The UDWR Wildlife Habitat Restoration unit maintained their administrative operation in Ephraim but have also had personnel stationed at the Shrub Sciences Laboratory. Other agencies have had a presence at the lab since the beginning. Table 1 lists personnel who have been stationed at the Shrub Sciences Laboratory and its attached Desert and Great Basin Experimental Ranges during the 1975 to 2000 timeframe. The Benmore Experimental Range was deactivated as an experimental range in the early 1970s, and in any case, had no one stationed permanently on the experimental range site.

Research Accomplishments

Research at the laboratory has covered and continues to cover a broad range of topics related to wildland shrub ecosystems, which is readily apparent in the list of publications (appendix A). However, I believe that the research activities can be divided into nine principal areas of research that are briefly highlighted in this section. The literature citations for each research area are examples only and are not complete—the complete list of activities is best understood and documented by the publications listed in appendix A and summarized in table 2. These publications are principally inhouse, in other words, authored or coauthored by Shrub Sciences Laboratory personnel, but also include extramurally supported work including the integrated work of Utah Division of Wildlife Resource collaborators and a number of theses and dissertations funded and otherwise abetted by the laboratory.

Shrubland Ecosystem Ecology and Experimental Range Management

Research at the laboratory was given initial impetus by research activities on the experimental ranges and other experimental research and planting sites that preceded the establishment of the laboratory. The Great Basin Experimental Range, perhaps better known as the Great Basin Station with its ancillary outplantings and study plots, was established in 1912, and has featured research on plant adaptation, plant succession, nutrient cycling, revegetation, restoration ecology, watershed function, and game habitat improvement over its long history, including the time it has been administered out of the Shrub Sciences Laboratory (Clary and Tiedemann 1986; Keck 1972; Klemmedson and Tiedemann 1994, 1998b; McArthur and Monsen 1996; McArthur and others 1999a; Plummer and others 1968; Tiedemann and others 1987a; Tippets and Anderson 1991; Walker and others 1996). The GBER is located on the Manti-La Sal National Forest in and around the Ephraim (Cottonwood) Canyon Drainage in Sanpete County, Utah, and includes a diversity of vegetation communities over an elevational range from 6,800 to 10,000 feet.

The Desert Experimental Range was established in Pine Valley, Millard County, Utah, in 1933, with most of the

area in the salt desert shrub community type, although some areas extend to higher elevations into sagebrush and pinyon-juniper communities. Research at the DER has emphasized disturbance and successional processes in North American cold desert plant communities, winter sheep management in the cold desert, rodent ecology, pronghorn biology and management, cryptobiotic soil crust ecology, desertification, and avian and mammalian population dynamics (Alzerreca-Angelo and others 1998; Anderson and others 1982a,b; Blaisdell and Holmgren 1984; Clary and Beale 1983; Clary and Holmgren 1982; Harper and others 1996; Holmgren 1975; Kitchen and McArthur 1996; O'Neal and others 1987; Tew and others 1997; Whisenant and Wagstaff 1991).

The other experimental range administratively attached to the Shrub Sciences laboratory was the Benmore Experimental Range (BER) that was deactivated as an experimental range about the time the laboratory was opened and is administered by the Spanish Fork Ranger District of the Uinta National Forest. The BER was established in the middle 1930s in a sagebrush grass community in the southeast corner of Rush Valley, Tooele County, Utah, and emphasized crested wheatgrass (*Agropyron cristatum*) seedings and livestock husbandry and production (Astroth and Frischknecht 1984).

Aside from work performed on the experimental ranges, other community and ecosystem scale research has emphasized autecology and synecology of important species and baseline community ecology, emphasizing land areas and plant and animal species for which land managers needed information (Booth and others 1990; Davis 1990; Cibils and others 1998; Ferguson and Medin 1983; Frischknecht 1975; Goodrich 1984; Grover and DeFalco 1995; Harper and others 1990a, 1992; Hegerhorst and others 1988a; Holmgren 1984; Kitchen and others 1999a; Liedolf and others 2000; McArthur 1994; McArthur and others 1989a, 1995a; McArthur and Sanderson 1992a, 1999c; Medin 1984, 1986; Medin and others 2000; Meyer 1997b; Meyer and Kitchen 1994a; Monsen and Shaw 2000; Monsen and Stevens 1999b; Pendleton and others 1995; Webb 1999; Weber and others 1985; Welch 1999; Welch and others 1995; Wood and Brotherson 1986; Woodward and others 1984).

Another major ecological research effort headquartered at the Shrub Sciences Laboratory is the Utah Division of Wildlife Resources Range Trend Project. This effort has been managed at the Shrub Sciences Laboratory since 1992. The effort is both interagency (U.S. Department of Agriculture, Forest Service, Intermountain Region, and Utah National Forests; and the U.S. Department of the Interior, Bureau of Land Management, Utah State Office and Utah Field Offices) and intra-agency (Utah Department of Agriculture and Food) in scope. The Range Trend Program monitors over 700 permanent critical habitat big game study sites on a repeating 5-year rotation. A wide range of data is collected (nested frequency and cover of vegetation, rock, litter, cryptogamic crusts, and bare ground; nested frequency, quadrat frequency and cover of grasses and forbs; cover, density, form class and vigor of shrubs and trees; effective soil depth, average soil temperature, and chemical and textural analysis of soil) as well as close-up and general view photos. Annual reports including map direction to sites, narrative, and data are prepared

Table 1—Shrub Sciences Laboratory personnel, 1975 to 2000¹.

Personnel		
Forest Service scientists		
Philip A. Barker ²	Warren P. Clary ³	Robert B. Ferguson ⁴
Neil C. Frischknecht ^{2,3}	Ralph C. Holmgren ^{2,3}	E. Durant McArthur ^{2,3}
Dean E. Medin	Susan E. Meyer	Stephen B. Monsen
David L. Nelson ^{2,16}	Burton K. Pendleton	Rosemary L. Pendleton
A. Perry Plummer ^{2,3}	Arthur R. Tiedemann ³	Charles F. Tiernan ²
Fred J. Wagstaff	Bruce L. Welch ²	
Professionals		
A. Clyde Blauer ⁵	Sherel Goodrich	Stanley G. Kitchen
Carlos L. Lopez	Kelly L. Memmott	T. Blaine Moore ⁵
Darren Naillon	Stewart C. Sanderson	
Other agency professionals		
James N. Davis ^{3,6}	Mark Farmer ^{6,7}	Bruce C. Giunta ^{5,6}
Ashley Green ⁶	Kent R. Jorgensen ^{5,6}	Scott Jensen ^{5,6}
Richard D. Porter ⁸	Clare L. Poulsen ^{5,6}	Richard Stevens ^{3,5,6}
Jason L. Vernon ^{5,6}	Scott C. Walker ^{3,5,6}	
Clerical/facilities		
Steven F. Briggs ⁹	Eulala Bulow ⁵	Nancy Clark
Earl Daley	Roma Jones ¹	Pat Ford ¹⁰
Darlene Graham	Roberta Leslie ¹⁰	Norma Nielson ²
Carla Oskoei	Carolyn Osmond ^{5,6}	Charlotte Schuler
Ralph Sokolowski ¹⁰	Karen Vance ⁵	Chris Wade ^{5,6}
Mical Walker ¹⁰	Sally Wolsey	
Technicians		
Stephanie L. Carlson	Suzette Clement	Susan C. Garvin
Gary L. Jorgensen ⁵	John Kinney ¹¹	Nancy Mulligan
Ronald L. Rodriguez	Heather Schijf	Patti Schuttler
Temporaries		
Bethany Allred	David C. Anderson ¹¹	Kent Applegate ⁶
Ganene Auger	David G. Babbel	Ben Baldwin ⁶
Linda Bascom ¹	Maren C. Bauer	Juie Beckstead
Greg Begera	Barbara Behan	Wendy Bird
Rick Black ⁶	Mike Carter	Joy D. Cedarleaf
Jeanne C. Chambers ¹¹	Dorcas Cheschelly	Vearl Christensen
Richard Clark ⁶	Linda K. Cluff	Taylor Cox
Susan B. G. Debaene-Gill	Jeff Duda ¹¹	John Fairchild ⁶
Mark C. Grover	Derek B. Hall	Lorraine Hart ¹¹
Gary Holmberg ⁶	Jesse Hunter	Marie Jackson
Tracy L. C. Jacobson	Bethanee Johnson	David Kelley ⁶
Celeste Kennard	Sharlynn King	Kim Lamb
Julia Liao	Randell L. Leonard	Bill Masslich
Thomas A. Monaco	Joann Mudge	Kathy Musso
Steve Otero	Jeffery E. Ott	Max Pierce
C. Lorenzo Pope	Heidi Pullman	Alisa P. Ramakrishnan
Doug Ramsey	Alice Rhea	Neil Roberts
Heidi Robbins	Glade Sessions	Matt Simmons
Jeffery Skousen ⁶	Benton Smith	Karl Sorensen
Lans Stavast	Daniel Summers ⁶	David Tarkalson
Tyler Thompson ⁶	Bob Tuttle ⁶	Craig Walker
Steven D. Warren ⁶	Susan M. White	Amber Whitworth ⁶
Jerome Willy ¹¹	Dan Woodruff	Roy D. Woodward
Annie Lane J. Yazzie	Carrie York	
Visiting scientists and professionals		
Phil Allen ¹²	Humberto Alzerreca-Angelo ¹¹	Donald Beale ^{6,11}
Abdul H. Belal	Toupta Boguena	Dianne Delany
Max Dunford	John M. Emlen ¹¹	D. Carl Freeman ¹³
Chu Ge-lin	John H. Graham	Ron Hacker
Roy O. Harniss ⁵	Kimball T. Harper ^{5,11}	Mohamed Hassan
Dionne Maywald	Kathy Miglia	Gamel S. Mikel
Walter F. Mueggler ¹²	Hamid Narjisse	Mohamed A. Nasr
Brian E. Norton ¹¹	Jordan C. Pederson ⁶	Gisbert Rinschede

(cont.)

Table 1—Cont.

Personnel		
Stephen S. Rosenstock ⁶ Avi Schmida	Burns R. Sabey Courtney Smith ¹¹	Dave Stricklan ¹⁴ Han Wang
SCSEPs		
Geneva Ball	Horacio Bausset	Vergie Beaudoin
Doris Curtis	Abbie Francom	Julia Golding
Esther Humphries	Lloyd Migliaccio	Lorraine Mortensen
Brian Ruck	Charles Shaw	Dick Tennent ⁵
Shari Veteto		
Volunteers¹⁵		
Imna Alabos ¹¹	Monica M. Bennion	Ann Bickel
Cathleen Chamberlin-Graham	Jerry Dunifer	Scott Emlen ¹¹
Ursula Emlen ¹¹	Juan Escos ¹¹	Joel L. Kitchen
Ryan S. Kitchen	Mont E. Lewis ⁵	Curtis D. McArthur
Ted O. McArthur	David Miglia	Alex Parent
Lynden Porter	Bettina Schultz	Alan Smith
David Smith ⁵	Chatelaine Stavast	William A. Turner
Jeffery J. Vitale	Diane Wagstaff	Darren L. Welch
Michael B. Welch		
Institutional Volunteers		
Boy Scouts of America	Earthwatch	Utah Native Plant Society

¹The list of personnel is complete for permanent employees; some of the permanent employees started in temporary employee positions. For Temporary and Senior Community Service Employment Program (SCSEP) employees the list is not complete but lists those who worked for a year or more.

²Employees working at the Shrub Sciences Laboratory at the time it opened.

³Project Leaders.

⁴Bob Ferguson was transferred to the Shrub Sciences Laboratory within a month after it opened.

⁵Great Basin Experimental Range employees. Clyde Blauer and Blaine Moore were summer employees with permanent appointments at Snow College.

⁶Utah Division of Wildlife Resources employees.

⁷Utah Department of Agriculture and Food employee.

⁸U.S. Department of the Interior, Fish and Wildlife Service employee.

⁹Steve Briggs was a technician before he became the facilities manager.

¹⁰Business Managers.

¹¹Desert Experimental Range employees.

¹²Phil Allen was a UDWR technician before he became a visiting scientist from Brigham Young University.

¹³Carl Freeman was FS temporary before he became a visiting scientist from Wayne State University.

¹⁴Dave Stricklan was a Wildlife Biologist with the Uinta National Forest with special assignment for cooperation with Shrub Sciences Laboratory Personnel.

¹⁵Only those volunteers who contributed at least 250 hours of time are listed, many other volunteers have made substantive contributions.

¹⁶Since his retirement in 1996, David Nelson has contributed thousands of hours of work.

(Davis and others 1995a,b, 1996a,b,c,d, 1998a,b,c,d,e,f, 1999a,b, 2000a,b). The Range Trend Program data is also housed on a web page: <http://www.ag.state.ut.us/divisns/mkt&cons/range.htm>.

Seed Quality, Testing, and Production; Seed and Seedbed Ecology and Adaptation

A principal goal of work at the Shrub Sciences Laboratory has been to provide information about seeds of plants that are used to restore or rehabilitate degraded rangeland communities. To that end the laboratory has played and continues to play an important role in setting standards for the seeds in commerce used for wildland plantings (Allen and Meyer 1986; Currans and others 1997; Meyer 1999; Meyer and Kitchen 1995; Stevens and Meyer 1990; Young and others 1995; and many publications in the *Seed Technologists Newsletter* and *Newsletter of the Association of*

Official Seed Analysts senior authored by Allen, Kitchen, or Meyer). Other substantive work has emphasized seed germination, collection, storage, processing, production, and adaptation as well as seed and seedbed ecology for a wide range of shrubland ecosystem species, for example, sagebrush (*Artemisia*), saltbush (*Atriplex*), bitterbrush (*Purshia*), rabbitbrush (*Chrysothamnus*), penstemon or beardstongue (*Penstemon*), cheatgrass (*Bromus*) (Allen and Meyer 1990, 1998; Allen and others 1987, 1995; Beckstead and others 1996; Garvin and others 1996; Jacobsen and Welch 1987; Jorgensen and Davis 1984; Kitchen and Meyer 1991; Kitchen and Monsen 1994; McArthur and others 1978c, 1987a; McArthur and Young 1999; Meyer 1989, 1992; Meyer and Allen 1999a,b; Meyer and Kitchen 1992, 1994b; Meyer and Monsen 1991, 1992; Meyer and others 1987g, 1989b, 1990, 1995b, 1997, 1998; Meyer and Paulsen 2000; Meyer and Pendleton 2000; Mikhiel and others 1992; Monsen and Meyer 1990; Monsen and others 1985b; Noller and McArthur 1986; Noller and others 1984; Plummer and Jorgensen 1978; Plummer and Monsen 1977; Stevens and

Table 2—Summary of Shrub Sciences Laboratory publications, 1975 to 2000 (see appendix A for complete list).

Year	Total	Journal	Book chapter	Book	Government serial	Proceedings	Theses or dissertations	Extra-mural ¹
1975	14	6	3	1	0	3	1	2
1976	9	2	0	0	1	2	4	5
1977	14	4	2	0	3	1	4	2
1978	23	6	1	0	2	12	2	6
1979	20	6	1	0	3	8	2	9
1980	14	5	1	0	4	1	3	5
1981	33	16	0	0	3	9	5	8
1982	20	14	1	0	3	0	2	3
1983	53	11	1	3	9	24	5	7
1984	42	15	0	1	6	18	2	4
1985	41	17	0	1	6	15	2	8
1986	60	22	1	3	6	22	6	10
1987	47	21	2	2	2	17	3	4
1988	23	17	1	1	0	1	3	3
1989	35	18	4	2	4	7	0	2
1990	45	13	1	2	2	25	2	4
1991	12	11	0	0	1	0	0	2
1992	28	14	2	1	4	5	2	3
1993	21	7	3	0	3	7	1	4
1994	36	11	6	1	4	11	3	8
1995	34	11	1	1	4	12	5	7
1996	44	8	2	1	8	17	8	15
1997	16	8	1	0	2	2	3	3
1998	38	27	0	0	8	0	3	11
1999	48	11	1	2	4	30	0	14
2000	23	10	1	0	5	5	2	4
Total	793	311	36	22	97	254	73	152

¹Extramural = no Shrub Sciences Laboratory Forest Service personnel authorship. Some lab personnel, for example, Steve Monsen and Stewart Sanderson, had publications that are tied into the program prior to their assignment to the Shrub Sciences Laboratory and hence some of these publications are scored as extramural or are listed in the regular reference section rather than in appendix A.

Jorgensen 1994; Stevens and others 1986, 1996; Wagstaff and Welch 1991; Welch 1995, 1996, 1997b; Welch and others 1996).

Shrub Sciences Laboratory personnel have made substantive contributions to the new *Woody Plant Seed Manual* as principal authors of more than 20 included genera (Bonner and Nisley, in review). This work has not yet been published, but the material is being made available on a Web site as it is prepared: <<http://www.wpsm.net/>>.

Plant Materials Development and Plant Adaptation

Development of plant materials and their site adaptation was a principal reason for the establishment of the laboratory and has remained an important part of the research effort. Laboratory scientists were instrumental in establishing various classes of wildland plant materials, source identified, tested, selected, and cultivar for use in rehabilitation plantings (McArthur 1988; Young 1995; Young and others 1995; Welch 1994). We have formally released for commercial development and use, with cooperators—mainly the Utah Division of Wildlife Resources, Utah Crop Improvement Association, Upper Colorado Environmental Plant Center, and USDA Natural Resources Conservation Service—15 separate germplasm lines:

‘Appar’ blue flax (*Linum perenne*) (1980)
‘Rincon’ fourwing saltbush (*Atriplex canescens*) (1982)
‘Ephraim’ crested wheatgrass (*Agropyron cristatum*) (1983)
‘Paiute’ orchardgrass (*Dactylis glommarata*) (1983)
‘Immigrant’ forage kochia (*Kochia prostrata*) (1984)
‘Lassen’ antelope bitterbrush (*Purshia tridentata*) (1984)
‘Hatch’ winterfat (*Ceratoides lanata*) (1985)
‘Cedar’ Palmer penstemon (*Penstemon palmerii*) (1985)
‘Summit’ Louisiana sagewort (*Artemisia ludoviciana*) (1986)
‘Hobble Creek’ mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) (1987)
‘Gordon Creek’ Wyoming big sagebrush (*A. tridentata* ssp. *wyomingensis*) (1992)
‘Pine Valley Ridge’ black sagebrush (*A. nova*) (1994)
‘Timp’ northern sweet vetch (*Hedysarum boreale*) (1994)
‘Maybell’ antelope bitterbrush (*Prushia tridentata*) (1994)
‘Umatilla’ snow buckwheat (*Eriogonum niveum*) (1997)

Several other plant materials, under current evaluation, are candidates for release for various reclamation and restoration applications including bluebunch wheatgrass (*Pseudoroegneria spicata*) (Anatone, WA); Thurber’s needlegrass (*Stipa thurberiana*) (Boise, ID), Sandberg bluegrass (*Poa secunda*) (Mountain Home, ID), additional lines of forage kochia (*Kochia prostrata*), Lewis flax (*Linum perenne*) (Scipio, UT), plains silver sagebrush (*Artemisia cana* ssp. *cana*) (Sheridan, WY), a small burnet (*Sanguisorba*

minor) synthetic, sagebrush hybrids (*Artemisia* species and subspecies) (for fire tolerance), and several native forbs. Some of the key references for the plant material development and release are Carlson and McArthur 1985; Carlson and others 1991; Kitchen 1995; McArthur 1988; McArthur and others 1984b; Monsen and Stevens 1985; Shaw and Monsen 1986; Stevens and Monsen 1985b, 1988a,b; Stevens and others 1985a; Welch and others 1986a, 1992a, 1994; and unpublished data on file at the Shrub Sciences Laboratory.

In the process of evaluating plant materials and determining their potential for use in rehabilitation and restoration outplanting, adaptation and evaluation tests have been conducted, for example, Belal and others 1993; Davis 1983; Dewey and Plummer 1980; Ferguson 1983; Ferguson and Frischknecht 1985; Frischknecht 1983; Frischknecht and Ferguson 1984; McArthur 1981, 1983; McArthur and others 1983b, 1995b, 1996; McArthur and Welch 1982; Monsen 1983, 1987; Monsen and Anderson 1993; Monsen and Christensen 1976; Monsen and Plummer 1978; Plummer 1977; Shaw and Monsen 1983b; Tiedemann and Driver 1983; Welch and McArthur 1986a. Laboratory personnel and university colleagues have been involved with a series of studies on current and predictive adaptation as determined by physiological fitness by using measures of respiration, metabolism, and temperature (Criddle and others 1994; Frank and others 1986; Jones and others 1999; McArthur and others 1998a; Monaco and others 1996; Smith and others 1999).

Genetic Variation, Population Biology, and Systematics and Taxonomy

To better manage, protect, and use wildland shrub species (and associated nonshrub species), their taxonomic status and relationships need to be understood. Many of these species were poorly defined and their inter- and intrapopulation dynamics unknown in 1975. Much progress has been made to better understand these issues by work performed by laboratory personnel and collaborators, but much work remains to be done. Many new molecular-based techniques have become available in recent years (Judd and others 1999).

Cytological research by Shrub Sciences Laboratory personnel on big sagebrush and its relatives (= subgenus *Tridentatae* of *Artemisia*) (McArthur and others 1981; McArthur and Plummer 1978; McArthur and Sanderson 1999a); other *Artemisia* (McArthur and Pope 1979), the saltbushes (*Atriplex*) (Sanderson and Stutz 1994a; Stutz and others 1979; Stutz and Sanderson 1979, 1984, 1998), greasewood (*Sarcobatus*) (Sanderson and others 1999), and spineless hopsage (*Grayia brandegei*) (Stutz and others 1987) has documented intriguing polyploidy, some of it related to habitat conditions (McArthur and Sanderson 1999a; Sanderson and others 1989). Other substantive cytological research (first or most substantive records known for the groups) has been done for bitterbrush (*Purshia*), cliffrose (*Cowania*), Apache plume (*Fallugia*), mountain mahogany (*Cercocarpus*), and other rosaceous shrubs (McArthur and others 1983c; McArthur and Sanderson 1985).

Chemotaxonomic work based on macromolecules including phenolics, terpenoids, isoenzymes, and DNA have been used to clarify population biology, species and subspecies relationships among many plant groups (Leonard and

others 1981; McArthur and others 1998c) including the big sagebrush group (subgenus *Tridentatae* of *Artemisia*) (Hanks and others 1973; McArthur and others 1981, 1988b, 1998b,c; Stanton and others 2001; Stevens and McArthur 1974; Welch and McArthur 1981), rabbitbrush (*Chrysothamnus*) (Hanks and others 1975; McArthur and others 1978a; Hegerhorst and others 1987a), saltbush (*Atriplex*) (McArthur and others 1986b; Sanderson and others 1987, 1988, 1990; Sanderson and Stutz 1984), Gambel oak (*Quercus gambelii*) (Pendleton and others 1985), and rust fungi (Volger and others 1996).

Comparative studies of populations and individuals grown in uniform gardens have yielded results that have clarified variation and relationships and facilitated breeding and hybridization studies for several plant groups including sagebrush (Behan and Welch 1986; Criddle and others 1994; McArthur and Welch 1982; Welch and McArthur 1979b, 1981, 1986a), rabbitbrush (Hegerhorst and others 1987a,c; Bhat and others 1990a,b), bitterbrush and cliffrose (Criddle and others 1994; Pendleton and McArthur 1994; Welch and others 1983a), saltbush (McArthur and others 1983b; Pendleton and others 1992a, 1994; Welch and Monsen 1981, 1984), and forage kochia (Davis and Welch 1984, 1985; McArthur and others 1996; Pendleton and others 1992b; Welch and Davis 1984).

Laboratory personnel have been active in clarifying and popularizing taxonomic placement and values of shrubs and associated species in general terms in floras (Goodrich 1984; 1986a; 1986b; Goodrich and Neese 1986; Welsh and others 1987), for specific groups of plants, for example, composite (McArthur and others 1979a), chenopod (Blauer and others 1976; McArthur and Sanderson 1984; Sanderson and Stutz 1994b), and rose family (Blauer and others 1975) shrubs, willows (Goodrich 1983), sagebrush (McArthur 1979, 1983, 1994; McArthur and Goodrich 1986; McArthur and others 1981; Welch and McArthur 1990), rabbitbrush (McArthur and others 1978a; McArthur and Meyer 1987; Weber and others 1985, 1993), fourwing saltbush (Freeman and McArthur 1989), bearclaw poppies (Meyer 1997a), *Sphaeromeria* (McArthur and others 1989a, 1998c), and several other plant groups (Goodrich 1985, 1986; Goodrich and others 1985a).

Laboratory personnel have also formally named and otherwise systematically treated several plant taxa (Atwood and others 1984; Chu and others 1991; Goodrich and others 1985b; Goodrich and Welsh 1983; McArthur and others 1981; Stutz and others 1993, 1994, 1997, 1998; Stutz and Sanderson 1998; Winward and McArthur 1995).

A series of studies were performed to determine the extent and variation of resin and rubber products in rubber rabbitbrush (*Chrysothamnus nauseosus*). Populations and individuals were found to differ as were rubber and resin concentrations, on a seasonal basis (Bhat and others 1989, 1990b; Hegerhorst and others 1987b,c; 1988a,b; Weber and others 1985, 1989, 1993).

Breeding Systems, Hybridization, and Hybrid Zones

An important factor in the study of population biology, systematics, and natural hybridization and controlled hybridization is a clear understanding of breeding and

pollination systems. Work at the laboratory has been fundamental in clarifying and describing breeding systems in several ecologically important wildland shrub ecosystem species complexes including sagebrush (*Artemisia*), rabbitbrush (*Chrysothamnus*), saltbush (*Atriplex*), bitterbrush-cliffrose (*Purshia-Cowania*), blackbrush (*Coleogyne*), spiny hopsage (*Grayia spinosa*), beardstongue (*Penstemon*), and flax (*Linum*) (McArthur 1989a; Pendleton and others 1989).

The big sagebrush species complex (subgenus *Tridentatae* of *Artemisia*) is perhaps the vegetation icon of the Western United States inasmuch as members of this group are widespread, dominant, and woven into history and culture (Trimble 1989). Work performed by Shrub Sciences Laboratory personnel has demonstrated that taxa (populations, subspecies, species) of these plants outcross but are also self-fertile, that hybridization has been important in evolutionary development of the group, and that hybridization may be important in management and recovery (from fire and other degradation processes) of the group (McArthur and others 1979a, 1988b, 1998b). In a series of studies examining growth and fitness in narrow hybrid zones and hybridization dynamics, laboratory personnel and colleagues have shown the likelihood that hybridization processes are important in the diversification and success of this plant group (Byrd and others 1999; Freeman and others 1991, 1995, 1999a,b; Goodrich and others 1985b; Graham and others 1995, 1999, 2001; McArthur and Goodrich 1986; McArthur and others 1988b, 1998a; McArthur and Sanderson 1999b; Messina and others 1996; Smith and others 1999; Wang and others 1997, 1998, 1999; Weber and others 1994; Winward and McArthur 1995). This series of studies has provided strong support for a hybrid zone model, *Bounded Hybrid Superiority Hybrid Zone Model* (Arnold 1997; Moore 1977), that posits the superiority of hybrid plants over parental plants but only in the hybrid zone, in contrast to competing hybrid zone models. The model can account for the abundance and apparent stability of numerous *Tridentatae* hybrid zones.

The breeding systems of chenopod family shrubs are another area in which laboratory personnel and collaborators have made fundamental discoveries and contributions to the scientific literature. Like the sagebrushes, these plants are often landscape dominants or are prominent community members and include species with wide distributions that are often important species in land management issues. These plants are monocious or dioecious and wind pollinated (McArthur and Sanderson 1984). Laboratory personnel and collaborators have shown that many saltbush species, especially fourwing saltbush (*A. canescens*) have an adaptive breeding system that incorporates environmental factors, for example, moisture and temperature into a flexible, yet genetically controlled, sexual system that enhances reproductive fitness in a patchy environment (Freeman and McArthur 1982, 1984, 1989; Freeman and others 1984, 1993a,b; McArthur 1977; McArthur and Freeman 1982; McArthur and others 1992; Pendleton and others 1992a, 1994). Knowledge of these sexual systems has practical implications in terms of nutrition, palatability, and seed production issues for management (Cibils and others 1998; Maywald and others 1998; McArthur and others 1978c; Tiedemann and others 1987b). Spineless hopsage (*Grayia brandegei*) has been shown to have an unusual breeding system, heterodichotamy, that like the trioecious system of *Atriplex canescens* (McArthur and others

1992; Freeman and others 1993b) appears to be adaptive to a patchy, resource-poor environment and may be on an evolutionary pathway to dioecy (Pendleton and others 1988, 2000b). This system may be useful in better understanding general breeding patterns in a wider context as well (Freeman and others 1981, 1997).

Breeding systems of other plants have been studied to better understand, manage, and use important shrubland ecosystem species. These include rabbitbrush (*Chrysothamnus*) (McArthur and others 1978a; Meyer 1997b), bitterbrush and cliffrose (*Purshia/Cowania*) (Davis 1983; McArthur and others 1983c; Meyer and Pendleton 2000; Pendleton and McArthur 1994), blackbrush (*Coleogyne*) (Pendleton and Pendleton 1998), blue flax (*Linum perenne* and *L. lewisii*) (Kitchen 1995; Meyer and Kitchen 1994a; Pendleton and others 1993—References Section, not appendix A), and cheatgrass (*Bromus tectorum*) (Beckstead and others 1996; Hemming and others 1999; Meyer and Allen 1999a,b; Meyer and Ramakrishnan, unpublished data, Shrub Sciences Laboratory).

Rangeland Rehabilitation and Restoration, Equipment Development, and Cultural Care of Wildland Species

Techniques, demonstrations, and review for wildland rehabilitation and restoration including equipment development and use, application of herbicides, and cultural care of species used for wildland rehabilitation and restoration has been a major, continuing effort by Shrub Sciences Laboratory personnel and collaborators, especially the Utah Division of Wildlife Resources Habitat Restoration Unit. The principal efforts have been on disturbed sites such as minelands, domestic and big game rangelands, roadside disturbances, and so forth, and are documented and detailed in Blauer and others 1993; Clary and Johnson 1983; Clary and others 1985b,c,d; Davis and Harper 1990; Ferguson and Frischknecht 1981, 1985; Frischknecht 1978b; Frischknecht and Ferguson 1979; Giunta and others 1975; Hall and others 1999; Luke and Monsen 1984; McArthur and others 1978b, 1987b, 1990a, 1995b, 2000; McArthur and Sanderson 1996; Monsen 1978, 1984, 1987, 2000; Monsen and Kitchen 1994; Monsen and Meyer 1990; Monsen and Turnipseed 1990; Monsen and others 1985b, 1992, 1996; Monsen and Richardson 1984; Monsen and Shaw 1983a,b, 1986, 1996, 1999; Monsen and Stevens, in review (see References Section, not appendix A); Plummer 1976, 1977; Roundy and others 1995; Sabey and others 1990; Shaw and Monsen 1984, 2000; Skousen and others 1986; Stevens 1978, 1994, 1999a,b; Stevens and McArthur 1990; Stevens and Walker 1998; Tiedemann and Lopez 1983; Van Epps 1978; Walker and others 1995; Welch, in review (see References section, not appendix A); Whisenant and Clary 1986, 1987; and Whisenant and McArthur 1989.

Several studies have dealt with the economics of the rehabilitation processes. These have been of a general nature (Clary 1983a; Wagstaff 1983b,c,d; 1986d; Wagstaff and Pope 1987; Wagstaff and Reesman 1989) and more specific. Specific economic analyses have been presented for individual projects (Pope and Wagstaff 1987a,b), oakbrush (Wagstaff 1985), riparian (Wagstaff 1986c), pinyon and juniper (Clary and Wagstaff 1987; Wagstaff 1987), and

sagebrush community management (Wagstaff 1986a), as well as for prescribed fire application (Pope and Wagstaff 1990) and big game use on private lands (Nielsen and others 1985, 1986).

Soil/Plant Interactions, Pathology, Entomology, and Mycorrhizae

Plant interactions with fungi, insects, soil, and other factors have been a continuing area of study at the Shrub Sciences Laboratory. These interactions are often positive for plants but can be negative as well. A considerable amount of work on soil crusts and mycorrhizae has demonstrated many positive interactions with microorganisms and several shrubland ecosystem plant species; these interactions are often crucial to community health (Anderson and others 1982a; Belnap 1993, 1996; Belnap and Gardner 1993; Belnap and Harper 1995; Belnap and others 1996; Buttars and others 1998; Harper and Pendleton 1993; Pendleton 2000; Pendleton and others 1999, 2000a; Pendleton and Smith 1983; Pendleton and Warren 1996). Other studies performed on plant soil interactions include some with a community focus (Klemmedson and Tiedemann 1998a,b; Kitchen and Jorgensen 1999) and on Gambel Oak (*Quercus gambelii*) (Clary and Tiedemann 1986; Tiedemann and others 1987a) and big sagebrush (*Artemisia tridentata*) (Wang and others 1998, 1999; Welch 1997b; Welch and Jacobson 1988).

Nitrogen fixation in the semiarid systems dominated by wildland shrubs is an important ecological function provided by several species. The actinorhizal (*Frankia*) relationships with antelope bitterbrush (*Purshia tridentata*), Stansbury cliffrose (*Cowania stansburiana*), curlleaf mountain mahogany (*Cercocarpus ledifolius*), and buckbrush (*Ceanothus*) have been documented by Shrub Sciences Laboratory personnel and colleagues (Nelson 1983; Nelson and Lopez 1989; Nelson and Schuttler 1984; Wood and others 1989).

A sustained effort has been made in studying wildland shrub ecosystem disease and insect relationships. Research performed on plant diseases includes work on big sagebrush (*Artemisia tridentata*) (Hess and others 1985; Nelson 1987; Nelson and Krebill 1981; Nelson and Sturgess 1986; Sturgess and Nelson 1986; Welch and Nelson 1995), antelope bitterbrush (*Purshia tridentata*) (Nelson 1987), saltbushes (*Atriplex*) (Ramsey and others 1995), Utah juniper (*Juniperus osteospermus*) (Bunderson and others 1986a), pines (*Pinus*) (Nelson 1982; Nelson and Krebill 1982), and quaking aspen (*Populus tremuloides*) (Harniss and Nelson 1984). A new series of studies is exploring the feasibility of biological control of cheatgrass (*Bromus tectorum*) by exploiting the interactions of the headsmut, *Ustilago bullata*, with cheatgrass (Meyer and others 2000b, 2001—see Reference Section not appendix A). General relationships on wildland shrub insect interactions have been reviewed (Tiernan 1978, 1980), and a general index on wildland shrub insect relationships has been published (Haws and others 1988). Specific documentation on the insects of forage kochia (*Kochia prostrata*) (Moore and others 1982), the insect-induced galls of big sagebrush (*Artemisia tridentata*) (Graham and others 2001—see Reference section not

appendix A), rubber rabbitbrush (*Chrysothamnus nauseosus*) (McArthur 1986; McArthur and others 1979b), and curlleaf mountain mahogany (*Cercocarpus ledifolius*) (Tiedemann and Furniss 1985) defoliator have been provided.

Shrub die-offs, winter injury, and other environmental problems in managing and understanding wildland shrub ecosystems have been studied by laboratory personnel and collaborators. The primary causes of these phenomena are explored and documented (Haws and others 1990, 1993; McArthur and others 1988a; Nelson and others 1989, 1990a,b; Wallace and Nelson 1990; Walser and others 1990; Weber and others 1995, 1999; Van Epps 1975).

Nutritive Quality, Palatability, and Wildlife Habitat

One of the principal values of shrubs and shrubland ecosystems is habitat, including feed value for wildlife and domestic animals. Quantifying nutritive value and palatability of shrub species and other plants has been a substantive contribution of the research conducted at the Shrub Sciences Laboratory. Some early work quantifying the differential palatability of big sagebrush (*Artemisia tridentata* populations and subspecies) (Hanks and others 1971; Scholl and others 1977) stimulated followup documentation and hypothesis testing. Some general review and synthesis of nutritive quality in wildland shrub ecosystems are Belal and others 1993; Provenza and others 1987b; Tiedemann and others 1984a; and Welch 1981, 1989, 1994. Research on the preference and nutritive quality of big sagebrush to a number of consuming animals has been completed (Elderkin and others 1986; Hobbs and others 1986; Welch 1983a, 1999; Welch and McArthur 1979b, 1981, 1986b; Welch and others 1981, 1983b, 1987, 1991; Welch and Pederson 1981; White and others 1982a). The concern that essential oils (monoterpenoids) were a serious deterrent to digestion and compromised the nutritive quality of big sagebrush has been shown to be moot inasmuch as animals such as mule deer, pygmy rabbits, sage grouse, and other herbivores are able to ameliorate the high essential oil concentrations and thereby take advantage of the species' high nutrient content (Cedarleaf and others 1983; Clary and others 1988; Cluff and others 1982; Pederson and Welch 1982; Welch and others 1982, 1983a,c; 1989; White and others 1982b). Likewise the nutritive values of black sagebrush (*Artemisia nova*) have been documented (Behan and Welch 1985, 1986; Welch and others 1981). Other species and groups of plants that have been studied by laboratory personnel from a nutrition perspective include the saltbushes (*Atriplex canescens* and other *Atriplex* species) (Cibils and others 1998; Maywald and others 1998; Sanderson and others 1987; Welch 1978; Welch and Monsen 1981, 1984), rabbitbrush (*Chrysothamnus* species) (Hanks and others 1975; Bhat and others 1990b; Goodrich and others 1999a), and several other species (Davis and Welch 1985; Monsen and others 1990; Pendleton and others 1992c; Welch and Andrus 1977; Welch and Davis 1984; Welch and others 1983b; Welch and Wagstaff 1992).

A series of reports have dealt with quality of habitats for animals, for example, the Utah Division of Wildlife Resource *Range Trend Studies* (Davis and others, several references,

1995 to 2000), pronghorn antelope (Clary and Beale 1983), salt desert game ranges (McArthur and others 1978b), mule deer (Rosenstock and others 1989), domestic sheep and elk (Beck and others 1996a,b), cattle (Vallentine and Monsen 1990), and desert tortoise (McArthur and others 1994).

Invasive Weeds and Weed Biology

Invasive weeds are a serious problem on Western wildlands. These pests may well be the most serious problem facing land managers on Western public lands (Cronk and Fuller 1995; D'Antonio and Vitousek 1992). Shrub Sciences Laboratory personnel have contributed to the understanding of this problem and are seeking solutions and facilitating scientific exchange (Buchanan and others 1978; Harper and others 1996; Kitchen and Jorgensen 1999; McArthur and others 1990b; Monsen and Kitchen 1994; Monsen 1994b; Monsen and Shaw 1997). Research has been conducted on cheatgrass (*Bromus tectorum*), bur buttercup (*Ranunculus testiculatus*), halogeton (*Halogeton glomeratus*), rush skeleton weed (*Lygodesmis juncea*), squarrose knapweed (*Centaurea virgata*), and salt cedar (*Tamarix ramosissima*). The work on cheatgrass has employed competition (Giunta and others 1975; McArthur and others 1990a; Monsen and Turnipseed 1990) as well as biocontrol (Meyer and others 2000b, 2001, see Reference section and appendix A), herbicidal control (Shaw and Monsen 2000), and wide array of germination studies (Allen and others 1995; Bauer and others 1998; Beckstead and others 1995, 1996; Meyer and Allen 1999a,b; Meyer and others 1997) of cheatgrass. Other more general work on a variety of weed problems has emphasized control through competition (Davis and Harper 1990; Stevens and McArthur 1990) and herbicides (Stevens and Walker 1998).

Technology Transfer Activities

The Shrub Sciences Laboratory has been a leader in promoting scientific exchange by sponsoring and cosponsoring symposia, workshops, seminars, tours, discussions, and lectures, and by hosting short- and long-term visits of extramural personnel (table 2) as well as sending its personnel to participate in local, national, and international science meetings and to visit other research and management sites. Several outcomes of these activities are documented by publications of these proceedings:

Johnson 1983
Tiedemann and Johnson 1983
Monsen and Shaw 1983b
Wagstaff 1983e
Johnson 1984
Tiedemann and others 1984b
Carlson and McArthur 1985
Johnson 1985
McArthur and Welch 1986b
Johnson 1987
Provenza and others 1987b
Wallace and others 1989
Johnson 1990
McArthur and others 1990b

Clary and others 1992
Monsen and Kitchen 1994
Roundy and others 1995
Barrow and others 1996
McArthur and others 1999b
Monsen and Stevens 1999b

A perusal of the publications in appendix A demonstrates that Shrub Sciences personnel have participated in many widespread venues. The laboratory serves as the headquarters of two research consortia (Shrub Research Consortium and Intermountain Consortium for Arid Land Research) that foster coordinated research (Tiedemann 1984; McArthur 1991). Personnel have a continuing history of activity in professional societies, especially in the Society for Range Management and the Utah Native Plant Society, and in various other formal and informal outreach activities.

The Future

Currently, the Shrub Sciences Laboratory houses the Rocky Mountain Research Station Shrubland Biology and Restoration Research Work Unit. The unit's mission is to "develop knowledge, plant materials, and technology for successful long-term restoration of diverse shrubland plant communities to meet resource needs and values." Three research problems are identified and approved to accomplish this mission:

1. Develop basic knowledge about the genetic makeup, population dynamics, and biology of selected shrubland species deemed important for ecologically sound restoration efforts.
2. Develop and establish appropriate seed sources and effective techniques for establishing high diversity shrubland communities from seed.
3. Develop a better understanding of community-level consequences of past and present management practices and provide recommendations consistent with ecosystem management policies.

The unit accomplishes these goals, in part, with tight working relationships with Brigham Young University, where its scientists have adjunct faculty status, and with other universities and agencies. Especially close working relationships are in place with units of the National Forest System, the Bureau of Land Management, and the Utah Division of Wildlife Resources. Two units of the UDWR are close cooperators: the Range Trend Analysis Unit is collocated at the Shrub Sciences Laboratory, and UDWR Wildlife Habitat Improvement Unit in Ephraim, Utah, is collocated with the RMRS Great Basin Experimental Range.

As research work at the Shrub Sciences Laboratory moves into its second quarter century, the team of researchers anticipates that the research activities will build on the foundation of established research by continuing emphasis in plant materials research, restoring and rehabilitating damaged ecosystems, and documenting, capitalizing, and manipulating genetic variation. The team will be proactive in seeking new research opportunities and partnerships within the scope of its research mission and especially, in the

near term, will give added emphasis to work in fire susceptible ecosystems, on invasive weed control and biology, and on the ecology and restoration of ecosystems on the urban interface.

Acknowledgments

I thank my colleagues, especially Nancy Shaw, Stewart Sanderson, Stan Kitchen, and Richard Stevens, for review and proofreading. I tried to list all appropriate publications and personnel. If errors and omissions remain, they are mine.

References

- See appendix A for Shrub Sciences Laboratory references, 1975–2000.
- Arnold, M. L. 1997. Natural hybridization and evolution. New York: Oxford University Press. 215 p.
- Blaisdell, J. P. 1972. Needs and opportunities for shrub research in the Western United States. In: McKell, C. M.; Blaisdell, J. P.; Goodin, J. R., tech. eds. Wildland shrubs—their biology and utilization: an international symposium; 1971 July 2–16; Logan, UT. Gen. Tech. Rep. INT-1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 409–413.
- Bonner, F. T.; Nisley, R. G., comps. [In review]. Woody plant seed manual. Washington, DC: U.S. Department of Agriculture, Forest Service.
- Cronk, Q. C. B.; Fuller, J. L. 1995. Plant invaders, the threat to natural ecosystems. London: Chapman and Hall. 241 p.
- Cutler, S. N. 1996. BYU professor reclaims lost lands. Brigham Young Magazine. 50(3): 10–11.
- D'Antonio, D. M.; Vitousek, P. M. 1992. Biological invasions by exotic grasses, the grass-fire cycle, and global change. Annual Review of Ecology and Systematics. 23: 63–88.
- Fisser, H. G. 1987. Wyoming shrubland ecology. Science Monograph 49. Laramie: University of Wyoming, Wyoming Agricultural Experiment Station. 661 p.
- Fisser, H. G., ed. 1990. Wyoming shrublands: aspen, sagebrush, and wildlife management: proceedings of the seventeenth Wyoming shrub ecology workshop; 1988 June 21–22; Jackson, WY. Laramie: University of Wyoming, Department of Range Management. 76 p.
- Graham, J. H.; McArthur, E. D.; Freeman, D. C. 2001. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). XII. Galls on sagebrush in a reciprocal transplant garden. Oecologia. 126: 239–246.
- Grayson, D. K. 1993. The desert's past, a natural prehistory of the Great Basin. Washington, DC: Smithsonian Institution Press. 356 p.
- Hanks, D. L.; Brunner, J. R.; Christensen, D. R.; Plummer, A. P. 1971. Paper chromatography for determining palatability differences in various strains of big sagebrush. Res. Pap. INT-101. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 9 p.
- Hanks, D. L.; McArthur, E. D.; Stevens, R.; Plummer, A. P. 1973. Chromatographic characteristics and phylogenetic relationships of *Artemisia*, section *Tridentatae*. Res. Pap. INT-141. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 24 p.
- Harper, K. T.; St. Clair, L. L.; Thorne, K. H.; Hess, W. M., eds. 1994. Natural history of the Colorado Plateau and Great Basin. Niwot: University of Colorado Press. 294 p.
- Johnson, K. L., ed. 1983. Proceedings of the first Utah shrub ecology workshop; 1981 September 9–10; Ephraim, UT. Logan: Utah State University, College of Natural Resources. 50 p.
- Johnson, K. L., ed. 1984. Proceedings of the second Utah shrub ecology workshop; 1982 September 15–16; Fillmore, UT. Logan: Utah State University, College of Natural Resources. 37 p.
- Johnson, K. L., ed. 1985. Proceedings of the third Utah shrub ecology workshop; 1983 August 30–31; Provo, UT. Logan: Utah State University, College of Natural Resources. 61 p.
- Johnson, K. L., ed. 1987. Proceedings of the fourth Utah shrub ecology workshop, the genus *Chrysothamnus*; 1986 September 17–18; Logan, UT. Logan: Utah State University, College of Natural Resources. 59 p.
- Johnson, K. L., ed. 1990. Proceedings of the fifth Utah shrub ecology workshop, the Genus *Cercocarpus*; 1988 July 13–14; Logan, UT. Logan: Utah State University, College of Natural Resources. 105 p.
- Judd, W. S.; Campbell, C. S.; Kellogg, E. A.; Stevens, P. F. 1999. Plant systematics, a phylogenetic approach. Sunderland, MA: Sinauer Associates, Inc. 464 p.
- Keck, W. M. 1972. Great Basin Station—sixty years of progress in range and watershed research. Res. Pap. INT-118. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 48 p.
- Küchler, A. W. 1964. Manual to accompany the map, potential natural vegetation of the conterminous United States. Special Pub. 36. New York: American Geographical Society. 116 p plus 1:3,168,000 scale map.
- McKell, C. M., ed. 1989. The biology and utilization of shrubs. San Diego: Academic Press, Inc. 656 p.
- McKell, C. M.; Blaisdell, J. P.; Goodin, J. R., tech. eds. 1972. Wildland shrubs—their biology and utilization: an international symposium; 1971 July 12–16; Logan, UT. Gen. Tech. Rep. INT-1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 494 p.
- Meyer, S. E.; Nelson, D. L.; Clement, S. 2001. Evidence for resistance polymorphism in the *Bromus tectorum*—*Ustilago bullata* pathosystem: implications for biocontrol. Canadian Journal of Plant Pathology. 23: 1–9.
- Monsen, S. B.; Stevens, R., comps. [In review]. Restoring Western ranges and wildlands. [Publisher not determined].
- Moore, W. S. 1977. An evaluation of narrow hybrid zones in vertebrates. Quarterly Review of Biology. 52: 263–277.
- Mozingo, H. N. 1987. Shrubs of the Great Basin, a natural history. Reno: University of Nevada Press. 342 p.
- Pendleton, R. L.; Kitchen, S. G.; McArthur, E. D. 1993. Origin of the flax cultivar 'APPAR' and its taxonomic relationship to North American and European perennial blue flax. In: Abstracts, eighth wildland shrub symposium, arid land restoration; 1993 October 19–23; Las Vegas, NV. Provo, UT: Shrub Research Consortium: 23.
- Plummer, A. P. 1972. Selection. In: McKell, C. M.; Blaisdell, J. P.; Goodin, J. R., tech. eds. Wildland shrubs—their biology and utilization: an international symposium; 1971 July 12–16; Logan, UT. Gen. Tech. Rep. INT-1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 121–126.
- Plummer, A. P.; Christensen, D. R.; Monsen, S. B. 1968. Restoring big game range in Utah. Pub. 68-3. Salt Lake City, UT: Utah Division of Fish and Game. 183 p.
- Scholl, J. P.; Kelsey, R. G.; Shafizadeh, F. 1977. Involvement of volatile compounds of *Artemisia* in browse preference by mule deer. Biochemical Systematics and Ecology. 5: 291–295.
- Stanton, D. J.; McArthur, E. D.; Freeman, D. C.; Golenberg, E. M. 2001. No genetic substructuring in *Artemisia* subgenus *Tridentatae* despite strong ecotypic subspecies selection. Biochemical Systematics and Ecology. 29.
- Stevens, R.; McArthur, E. D. 1974. A simple field technique for identification of some sagebrush taxa. Journal of Range Management. 27: 325–326.
- Stutz, H. C., ed. 1976. Proceedings, symposium and workshop on the occasion of the dedication of the U.S. Forest Service Shrub Sciences Laboratory; 1975 November 4–6; Provo, UT. Provo, UT: Brigham Young University, College of Biology and Agriculture. 168 p.
- Stutz, H. C. 1978. Explosive evolution of perennial *Atriplex* in Western America. Great Basin Naturalist Memoirs. 2: 161–169.
- Stutz, H. C.; Melby, J. M.; Livingston, G. K. 1975. Evolutionary studies of *Atriplex*: a relic gigas diploid population of *Atriplex canescens*. American Journal of Botany. 62: 236–245.
- Stutz, H. C.; Sanderson, S. C. 1979. The role of polyploidy in the evolution of *Atriplex canescens*. In: Goodin, J. R.; Northington, D. K., eds. Arid land plant resources. Lubbock: Texas Tech University, International Center for Arid and Semiarid Land Studies: 615–621.
- Stutz, H. C.; Thomas, L. K. 1964. Hybridization and introgression in *Cowania* and *Purshia*. Evolution. 18: 183–195.

- Trimble, S. 1989. The sagebrush ocean, natural history of the Great Basin. Reno: University of Nevada Press. 248 p.
- Welch, B. L. [In review]. Big sagebrush: a sea fragmented into lakes, puddles, and ponds. Gen. Tech. Rep. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.
- Young, S. A. 1995. Verification of germplasm origin and genetic status by seed certification agencies. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 292–295.

Appendix A: Publications of the Shrub Sciences Laboratory, 1975 to 2000

Publications included here are those of Shrub Sciences Laboratory personnel, work funded or otherwise substantially furthered by Shrub Sciences Laboratory resources, including work performed at the attached experimental ranges (Benmore, Desert, and Great Basin) and personnel working at those units.

1975

- Barker, P. A. 1975. Ordinance control of street trees. *Journal of Arboriculture*. 1: 212–216.
- Blauer, A. C.; Plummer, A. P.; McArthur, E. D.; Stevens, R.; Giunta, B. C. 1975. Characteristics and hybridization of important Intermountain shrubs. I. Rose family. Res. Pap. INT-169. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 36 p.
- Ferguson, R. B.; Ryker, R. A.; Ballard, E. D. 1975. Portable oscilloscope technique for detecting dormancy in nursery stock. Gen. Tech. Rep. INT-26. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 16 p.
- Frischknecht, N. C. 1975. Native faunal relationships within the pinyon-juniper ecosystem. In: Gifford, G. F.; Busby, F. E., eds. The pinyon-juniper ecosystem: a symposium; 1975 May 1–2; Logan, UT. Logan: Utah State University and Utah Agricultural Experiment Station: 55–65.
- Giunta, B. C.; Christensen, D. R.; Monsen, S. B. 1975. Interseeding shrubs in cheatgrass with a browse seeder-scalper. *Journal of Range Management*. 28: 398–402.
- Hanks, D. L.; McArthur, E. D.; Plummer, A. P.; Giunta, B. C.; Blauer, A. C. 1975. Chromatographic recognition of some palatable and unpalatable subspecies of rubber rabbitbrush in and around Utah. *Journal of Range Management*. 28: 144–148.
- Holmgren, R. C. 1975. The Desert Experimental Range. In: Hyder, D. N., ed. Arid shrublands, proceedings of the third workshop of the United States/Australia rangelands panel; 1973 March 26–April 5; Tucson, AZ. Denver, CO: Society for Range Management: 18–22.
- Martin, N. E.; Welch, B. L. 1975. Single dimension, multiple development thin-layer chromatography of sugars for densitometric quantification. Res. Note INT-192. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7 p.
- Monsen, S. B. 1975. Selecting plants to rehabilitate disturbed areas. In: Campbell, R. S.; Herbel, C. H., eds. Improved range plants. Denver, CO: Society for Range Management: 76–90.
- Shandruk, L. J. 1975. A comparison of three methods used to analyze pronghorn antelope diets. Logan: Utah State University. 109 p. Thesis.
- Stevens, R.; Giunta, B. C.; Plummer, A. P. 1975. Some aspects in the biological control of juniper and pinyon. In: Gifford, G. F.; Busby, F. E., eds. The pinyon-juniper ecosystem: a symposium; 1975 May 1–2; Logan, UT. Logan: Utah State University and Utah Agricultural Experiment Station: 77–81.

- Van Epps, G. 1975. Winter injury to fourwing saltbush. *Journal of Range Management*. 28: 157–159.
- Welch, B. L.; Martin, N. E. 1975a. Effects of *Cronartium ribicola* on soluble sugars in *Pinus monticola* bark. *Phytopathology*. 65: 1025–1026.
- Welch, B. L.; Martin, N. E. 1975b. Light and transmission microscopy of white pine blister rust canker. *Phytopathology*. 65: 681–685.

1976

- Anderson, D. C. 1976. The cytogamic flora of desert soil crusts in southern Utah. Provo, UT: Brigham Young University. 47 p. Thesis.
- Anderson, D. C.; Rushforth, S. R. 1976. The cryptogam flora of desert soil crusts in southern Utah, U.S.A. *Nova Hedwigia*. 28: 691–721.
- Blauer, A. C.; Plummer, A. P.; McArthur, E. D.; Stevens, R.; Giunta, B. C. 1976. Characteristics and hybridization of important Intermountain shrubs. II. Chenopod family. Res. Pap. INT-177. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 42 p.
- Davis, J. N. 1976. Ecological investigations in *Cercocarpus ledifolius* Nutt. communities of Utah. Provo, UT: Brigham Young University. 56 p. Thesis.
- Green, J. S. 1976. Influence of a dry wash habitat on distribution and movement of heteromyid rodents. Provo, UT: Brigham Young University. 27 p. Thesis.
- Monsen, S. B.; Christensen, D. R. 1976. Woody plants for rehabilitating rangelands in the Intermountain region. In: Stutz, H. C., ed. Proceedings: symposium and workshop; 1975 November 6; Provo, UT. Provo: Brigham Young University, College of Biology and Agriculture: 72–119.
- Plummer, A. P. 1976. Shrubs for the subalpine zone of the Wasatch Plateau. In: Zuck, R. H.; Brown, L. F., eds. Proceedings of high altitude revegetation workshop number 2. Fort Collins: Colorado State University: 33–40.
- Pope, C. L. 1976. A phylogenetic study of the suffrutescent shrubs in the genus *Atriplex*. Provo, UT: Brigham Young University. 277 p. Dissertation.
- Vickery, R. K., Jr.; Eldredge, F. A.; McArthur, E. D. 1976. Cytogenetic patterns of evolutionary divergence in the *Mimulus glabratus* complex. *American Midland Naturalist*. 95: 377–389.

1977

- Barker, P. A. 1977. A colorful mountaineer. *Mountainwest*. 3(4): 22, 25.
- Barker, P. A. 1977. Planting strips in street rights-of-way: a key public land resource. In: Andresen, J. W., ed. Trees and forests for human settlements. Toronto, Ontario: University of Toronto Press: 263–274.
- Deacon, J. M. 1977. Partitioning of space and time by the western jumping mouse, *Zapus princeps utahensis* Hall. Provo, UT: Brigham Young University. 24 p. Thesis.
- Freeman, D. C. 1977. Plant dioecy: ecology, evolution, and sex reversal. Provo, UT: Brigham Young University. 58 p. Dissertation.
- McArthur, E. D. 1977. Environmental induced changes of sex expression in *Atriplex canescens*. *Heredity*. 38: 97–103.
- McArthur, E. D.; Pope, C. L. 1977. Compositae. In: Löve, A. IOPB chromosome number reports. L. V. Taxon. 26: 107–109.
- McArthur, L. B. 1977. Utilization of nest boxes by birds in three vegetational communities with special reference to the American kestrel (*Falco sparverius*). Provo, UT: Brigham Young University. 44 p. Thesis.
- Plummer, A. P. 1977. Revegetation of disturbed Intermountain area sites. In: Thames, J. L., ed. Reclamation and use of disturbed land in the Southwest. Tucson: University of Arizona Press: 302–339.
- Plummer, A. P.; Monsen, S. B. 1977. Backpack seed collection. In: 31st annual report, vegetative rehabilitation and equipment workshop; 1977 February 13–14; Portland, OR. Washington, DC: U.S. Government Printing Office: 9–14.
- Plummer, A. P.; Monsen, S. B.; Stevens, R. 1977. Intermountain range plant names and symbols. Gen. Tech. Rep. INT-38. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 82 p.

- Pope, C. L.; McArthur, E. D. Chenopodiaceae. In: Löve, A. IOPB chromosome number reports. L. V. Taxon. 26: 107–109.
- Shepard, D. 1977. Prediction of sagebrush/grass biomass from growth ring analysis. Reno: University of Nevada—Reno. 52 p. Thesis.
- Stevens, R.; Giunta, B. C.; Jorgensen, K. R.; Plummer, A. P. 1977. Winterfat (*Ceratoides lanata*). Publ. 77-2. Salt Lake City: Utah Division of Wildlife Resources. 41 p.
- Welch, B. L.; Andrus, D. 1977. Rose hips—a possible high-energy food for wintering mule deer. Res. Note INT-221. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 6 p.

1978

- Anderson, D. C. 1978. Cryptogamic soil crusts: factors influencing their development in Utah deserts and their recovery from grazing on Utah winter ranges. Provo, UT: Brigham Young University. 79 p. Dissertation.
- Buchanan, B. B.; Harper, K. T.; Frischknecht, N. C. 1978. Allelopathic effects of bur buttercup tissue on germination and growth of various grasses and forbs *in vitro* and in soil. Great Basin Naturalist. 38: 90–96.
- Everett, R. L.; Meeuwig, R. O.; Stevens, R. 1978. Deer mouse preference for seed of commonly planted species, indigenous weed species, and sacrifice foods. Journal of Range Management. 31: 70–73.
- Frischknecht, N. C. 1978a. Effects of grazing, climate, fire, and other disturbances on long-term productivity of sagebrush-grass ranges. In: Hyder, D. N., ed. Proceedings of the First International Rangeland Congress; 1978 August 14–18; Denver, CO. Denver: Society for Range Management: 633–635.
- Frischknecht, N. C. 1978b. Use of shrubs for mined land reclamation and wildlife habitat. In: Proceedings of workshop on reclamation for wildlife habitat. Fort Collins, CO: Ecology Consultants: 1–14.
- Giunta, B. C.; Stevens, R.; Jorgensen, K. R.; Plummer, A. P. 1978. Antelope bitterbrush—an important wildland shrub. Publ. 78-12. Salt Lake City: Utah Division of Wildlife Resources. 48 p.
- Gutierrez-G., J. S. 1978. Potential for cattle grazing on sheep range in southwest Utah. Logan: Utah State University. 79 p. Thesis.
- Norton, B. E. 1978. The impact of sheep grazing on long-term successional trends in salt-desert shrub vegetation of southwestern Utah. In: Hyder, D. N., ed. Proceedings of the First International Rangeland Congress; 1978 August 14–18; Denver, CO: Society for Range Management: 610–613.
- McArthur, E. D.; Hanks, D. L.; Plummer, A. P.; Blauer, A. C. 1978a. Contributions to the taxonomy of *Chrysothamnus viscidiflorus* (Asteraceae, Compositae) and other *Chrysothamnus* species using paper chromatography. Journal of Range Management. 31: 216–223.
- McArthur, E. D.; Plummer, A. P. 1978. Biogeography and management of native western shrubs: a case study, section *Tridentatae* of *Artemisia*. Great Basin Naturalist Memoirs. 2: 229–243.
- McArthur, E. D.; Plummer, A. P.; Davis, J. N. 1978b. Rehabilitation of game range in the salt desert. In: Johnson, K. L., ed. Wyoming shrublands: proceedings of the seventh Wyoming shrub ecology workshop; 1978 May 31–June 1; Rock Springs, WY. Laramie: University of Wyoming, Agricultural Extension Service: 23–50.
- McArthur, E. D.; Plummer, A. P.; Van Epps, G. A.; Freeman, D. C.; Jorgensen, K. R. 1978c. Producing fourwing saltbush in seed orchards. In: Hyder, D. N., ed. Proceedings of the First International Rangeland Congress; 1978 August 14–18; Denver, CO. Denver: Society for Range Management: 406–410.
- Moden, W. L., Jr.; McKenzie, D. W.; Stevens, R. 1978. Interseeder for rocky and brushy terrain, a progress report. ED&T Project No. 2582. San Dimas, CA: U.S. Department of Agriculture, Forest Service, Equipment Development Center. 8 p.
- Monsen, S. B. 1978. Report of field trials with the scarifier/seeder. In: 32nd annual report, vegetative rehabilitation and equipment workshop; 1978 February 5–6; San Antonio, TX. Washington, DC: U.S. Government Printing Office: 17–19.
- Monsen, S. B.; Plummer, A. P. 1978. Plants and treatment for revegetation of disturbed sites in the Intermountain area. In: Wright, R. A., ed. The reclamation of disturbed arid lands. Albuquerque: University of New Mexico Press: 155–173.
- Plummer, A. P.; Jorgensen, K. R. 1978. Harvesting, cleaning, and storing seed of western shrubs. In: Nurseryman's conference and seed processing workshop; 1978 October; Eureka, CA. Eureka: Western Forest Nursery Council and Intermountain Nurseryman's Association: D65–D76.
- Stevens, R. 1978. Interseeder for rocky and brush areas. In: 32nd annual report, vegetative rehabilitation and equipment workshop; 1978 February 5–6; San Antonio, TX. Washington, DC: U.S. Government Printing Office: 6–10.
- Tiedemann, A. R. 1978. Regional impacts of fire. In: Mooney, H. A.; Bonnicksen, T. M.; Christensen, N. L., tech. coords. Proceedings of the conference: fire regimes an ecosystem properties; 1978 December 11–15; Honolulu, HI. Gen. Tech. Rep. WO-26. Washington, DC: U.S. Department of Agriculture, Forest Service: 532–556.
- Tiernan, C. F. 1978. The role of entomology in range management. In: Hyder, D. N., ed. Proceedings of the First International Rangeland Congress; 1978 August 14–18; Denver, CO. Denver: Society for Range Management: 477–478.
- Van Epps, G. A. 1978. Prototype seed harvester for fourwing saltbush. In: 32nd annual report, vegetative rehabilitation and equipment workshop; 1978 February 5–6; San Antonio, TX. Washington, DC: U.S. Government Printing Office: 13–14.
- Van Epps, G. A.; McKell, C. M. 1978. Major procedures for selecting and establishing range shrubs as rehabilitators of disturbed lands. In: Hyder, D. N., ed. Proceedings of the First International Rangeland Congress; 1978 August 14–18; Denver, CO. Denver: Society for Range Management: 352–354.
- Vickery, R. K., Jr.; McArthur, E. D.; Purcell, S. P. 1978. Scrophulariaceae. In: Löve, A. IOPB chromosome number reports. L. V. Taxon. 27: 223–231.
- Welch, B. L. 1978. Relationships of soil salinity, ash, and crude protein in *Atriplex canescens*. Journal of Range Management. 31: 132–133.

1979

- Chambers, J. C. 1979. The effects of grazing on salt desert shrub species survival during a period of below-average precipitation. Logan, UT: Utah State University. 101 p. Thesis.
- Clary, W. P. 1979. Variation in leaf anatomy and CO₂ assimilation in *Sitanion hystrix* ecotypes. Great Basin Naturalist. 39: 427–432.
- Clary, W. P.; Kruse, W. H. 1979. Phenology and rate of height growth of some forbs in the southwestern ponderosa pine type. Res. Note RM-376. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 8 p.
- Frischknecht, N. C. 1979. Biological methods: a tool for sagebrush management. In: The sagebrush ecosystem: a symposium; 1978 April 27–28; Logan, UT. Logan: Utah State University, College of Natural Resources: 121–128.
- Frischknecht, N. C.; Ferguson, R. B. 1979. Revegetating processed oil shale and coal spoils on semi-arid lands. EPA-600/7-79-068. Cincinnati, OH: U.S. Environmental Protection Agency, Office of Research and Development, Industrial Environmental Research Laboratory. 47 p.
- Jorgensen, K. R. 1979. Air amplifier seed collector. In: 33rd annual report, vegetative rehabilitation and equipment workshop; 1979 February 11–12; Casper, WY. Washington, DC: U.S. Government Printing Office: 17–18.
- McArthur, E. D. 1979. Sagebrush systematics and evolution. In: The sagebrush ecosystem: a symposium; 1978 April 27–28; Logan, UT. Logan: Utah State University, College of Natural Resources: 14–22.
- McArthur, E. D.; Blauer, A. C.; Plummer, A. P.; Stevens, R. 1979a. Characteristics and hybridization of important Intermountain shrubs. III. Sunflower family. Res. Pap. INT-220. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 82 p.
- McArthur, E. D.; Pope, C. L. 1979. Karyotypes of four *Artemisia* species: *A. carruthii*, *A. filifolia*, *A. frigida*, and *A. spinescens*. Great Basin Naturalist. 39: 419–426.
- McArthur, E. D.; Tiernan, C. F.; Welch, B. L. 1979b. Subspecies specificity of gall forms on *Chrysothamnus nauseosus*. Great Basin Naturalist. 39: 81–87.

- Monsen, S. B. 1979a. Air amplifier seed collector trials. In: 33rd annual report, vegetative rehabilitation and equipment workshop; 1979 February 11–12; Casper, WY. Washington, DC: U.S. Government Printing Office: 18–20.
- Monsen, S. B. 1979b. Rangeland interseeder field trials. In: 33rd annual report, vegetative rehabilitation and equipment workshop; 1979 February 11–12; Casper, WY. Washington, DC: U.S. Government Printing Office: 24–26.
- Rinschede, G. 1979. Veränderung der Natürlichen Vegetation durch Beweidung in den Westlichen U.S.A. (Change of natural vegetation by grazing in the western U.S.A.) Münster, Germany: Universität Munster. 283 p. Dissertation.
- Stevens, R. 1979a. Interseeder for rangelands. In: 33rd annual report, vegetative rehabilitation and equipment workshop; 1979 February 11–12; Casper, WY. Washington, DC: U.S. Government Printing Office: 22–24.
- Stevens, R. 1979b. Tree transplanter for transplanting shrubs into rangelands. In: 33rd annual report, vegetative rehabilitation and equipment workshop; 1979 February 11–12; Casper, WY. Washington, DC: U.S. Government Printing Office: 26–29.
- Stevens, R.; Moden, W. L., Jr. 1979. Interseeding and planting of forbs and shrubs in desert regions. Paper 79-408. St. Joseph, MO: American Society of Agricultural Engineers. 8 p.
- Stutz, H. C.; Pope, C. L.; Sanderson, S. C. 1979. Evolutionary studies of *Atriplex*: adaptive products from the natural hybrid, 6n *A. tridentata* x 4n *A. canescens*. American Journal of Botany. 66: 1181–1193.
- Welch, B. L.; McArthur, E. D. 1979a. Feasibility of improving big sagebrush (*Artemisia tridentata*) for use on mule deer winter ranges. In: Goodin, J. R.; Northington, D. K., eds. Arid land plant resources. Lubbock, TX: Texas Tech University, International Center for Arid and Semiarid Land Studies: 451–473.
- Welch, B. L.; McArthur, E. D. 1979b. Variation in winter levels of crude protein among *Artemisia tridentata* subspecies grown in a uniform garden. Journal of Range Management. 32: 467–469.
- West, N. E. 1979. Survival patterns of major perennials in salt desert shrub communities of southwestern Utah. Journal of Range Management. 32: 442–445.

1980

- Cluff, L. K. 1980. Concentration of monoterpenoids in the rumen ingesta of wild mule deer. Provo, UT: Brigham Young University. 16 p. Thesis.
- Dewey, D. R.; Plummer, A. P. 1980. New collections of range plants from the Soviet Union. Journal of Range Management. 33: 89–94.
- Ferguson, R. B. 1980. Potting media for *Atriplex* production under greenhouse conditions. Res. Note INT-301. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 7 p.
- Harberd, D. J.; McArthur, E. D. 1980. Meiotic analysis of some species and genus hybrids in the Brassicaceae. In: Tsunoda, S.; Hinata, K.; Gomez-Campo, C., eds. *Brassica* crops and wild allies: biology and breeding. Tokyo, Japan: Japan Scientific Societies Press: 65–87.
- Howard, C. G.; Jorgensen, K. R. 1980. 'APPAR' Lewis flax (*Linum lewisii*, Pursh.) description, adaptation, use, culture, management, and seed production. Aberdeen, ID: U.S. Department of Agriculture, Soil Conservation Service, Aberdeen Plant Materials Center. 6 p.
- Jorgensen, C. D.; Smith, H. D.; Garcia, J. R. 1980. Temporal activity patterns of a *Dipodomys ordii* population. Great Basin Naturalist. 40: 282–286.
- Leonard, R. L. 1980. Electrophoresis of isoenzymes of 16 western shrubs: technique development. Provo, UT: Brigham Young University. 30 p. Thesis.
- McKenzie, D. W.; Stevens, R.; Moden, W. L., Jr. 1980. Development of a rangeland interseeder for rocky or brushy terrain. Pap. 80-1552. St. Joseph, MO: American Society of Agricultural Engineers. 7 p.
- Medin, D. E.; Ferguson, R. E. 1980. A pilot planting trial on a southwestern Idaho deer winter range. Res. Pap. INT-261. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 13 p.
- Smith, A. D.; Beale, D. M. 1980. Pronghorn antelope in Utah: some research and observations. Publ. 80-13. Salt Lake City, UT: Utah Division of Wildlife Resources. 88 p.
- Tiedemann, A. R.; Lopushinsky, W.; Larsen, H. J., Jr. 1980. Plant and soil responses to a commercial blue-green algae inoculant. Soil Biology and Biochemistry. 12: 471–475.
- Tiernan, C. 1980. Bugs are fun! Instructor. 89(8): 92-93.
- Wagstaff, F. J. 1980. Impact of the 1975 Wallsburg fire on antelope bitterbrush (*Purshia tridentata*). Great Basin Naturalist. 40: 299-302.
- White, S. M. 1980. Interactions of pygmy rabbits and big sagebrush. Provo, UT: Brigham Young University. 37 p. Thesis.
- Barker, J. R. 1981. Genetic differences between large and small *Artemisia tridentata* plants in contiguous populations. Logan, UT: Utah State University. 113 p. Dissertation.
- Clary, W. P. 1981. Grazing, natural resource policy, and the biosphere reserves. In: Ffolliott, P. F.; Halffter, G., tech. coords. Proceedings: social and environmental consequences of natural resources policies with special emphasis on biosphere reserves; 1980 April 8–13; Durango, Mexico. Gen. Tech. Rep. RM-88. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 21–23.
- Clary, W. P.; Holmgren, R. C. 1981. Observations of pronghorn distribution in relation to sheep grazing on the Desert Experimental Range. In: Proceedings of the wildlife-livestock relationships symposium; 1981 April 20–22; Coeur d'Alene, ID. Moscow, ID: University of Idaho Forest, Wildlife, and Range Experiment Station: 581–592.
- Clary, W. P.; Jameson, D. A. 1981. Herbage production following tree and shrub removal in the pinyon-juniper type of Arizona. Journal of Range Management. 34: 109–115.
- Clary, W. P.; Jensen, C. E. 1981. Mathematical hypothesis for herbage production potential on pinyon-juniper areas. Res. Pap. INT-279. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 8 p.
- Everett, R. L.; Stevens, R. 1981. Deer mouse consumption of bitterbrush seed treated with four repellents. Journal of Range Management. 34: 393–396.
- Ferguson, R. B.; Frischknecht, N. C. 1981. Shrub establishment on reconstructed soils in semi-arid areas. In: Stelter, L. H.; DePuit, E. J.; Mikol, S. A., tech. coords. Shrub establishment on disturbed arid and semi-arid lands; 1980 December 2–3; Laramie, WY. Cheyenne, WY: Wyoming Game and Fish Department: 57–63.
- Freeman, D. C.; McArthur, E. D. 1981. A comparison of twig water stress between males and females of six species of desert shrubs. Forest Science. 28: 304–308.
- Freeman, D. C.; McArthur, E. D.; Harper, K. T.; Blauer, A. C. 1981. Influence of environment on the floral sex ratio of monoecious plants. Evolution. 35: 194–197.
- Frischknecht, N. C. 1981. Double-frequency sampling for inventorying vegetation on salt desert ranges. In: Arid land resource inventories: developing cost efficient methods; 1980 November 30–December 6; La Paz, Mexico. Gen. Tech. Rep. WO-28. Washington, DC: U.S. Department of Agriculture, Forest Service: 435–440.
- Goodrich, S. 1981. A floristic study of central Nevada. Provo, UT: Brigham Young University. 400 p. Thesis.
- Goodrich, S.; Neese, E.; Peteron, J. S.; England, L. 1981. Vascular plants of the Uinta Basin—a preliminary checklist. BLM-YA-PT-040-4412. Salt Lake City, UT: U.S. Department of the Interior, Bureau of Land Management, Utah State Office. 58 p.
- Halffter, G.; Ffolliott, P. F.; Clary, W. P. 1981. Visits to Mapimi and La Machila Biosphere Reserves. In: Ffolliott, P. F.; Halffter, G. tech. coords. Proceedings: social and environmental consequences of natural resources policies with special emphasis on biosphere reserves; 1980 April 8–13; Durango, Mexico. Gen. Tech. Rep. RM-88. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 52–53.
- Harvey, S. J. 1981. Life history and reproductive strategies in *Artemisia*. Bozeman, MT: Montana State University. 132 p. Thesis.

- Leonard, R. L.; McArthur, E. D.; Weber, D. J.; Wood, B. W. 1981. Electrophoresis of isoenzymes of 16 western shrubs: technique development. *Great Basin Naturalist*. 41: 377–389.
- McArthur, E. D. 1981. Shrub selection and adaptation for rehabilitation plantings. In: Stelter, L. H.; DePuit, E. J.; Mikol, S. A., tech. coords. Shrub establishment on disturbed arid and semi-arid lands; 1980 December 2–3; Laramie, WY. Cheyenne, WY: Wyoming Game and Fish Department: 1–8.
- McArthur, E. D.; Pope, C. L.; Freeman, D. C. 1981. Chromosomal studies of subgenus *Tridentatae* of *Artemisia*: evidence for autopolyploidy. *American Journal of Botany*. 68: 589–605.
- Nelson, D. L.; Krebill, R. G. 1981. A sagebrush wilt disease of unknown cause. *Great Basin Naturalist*. 41: 184–191.
- Pendleton, R. L. 1981. Studies on the occurrence of vesicular-arbuscular mycorrhizae: examination of natural and disturbed communities of Utah and the Colorado Roan Plateau. Provo, UT: Brigham Young University. 45 p. Thesis.
- Robinove, C. J.; Chavez, P. S., Jr.; Gehring, D.; Holmgren, R. H. 1981. Arid land monitoring using landsat albedo difference images. *Remote Sensing of Environment*. 11: 133–156.
- Stevens, R. 1981. Techniques for planting shrubs on wildland disturbances. In: Stelter, L. H.; DePuit, E. J.; Mikol, S. A., tech. coords. Shrub establishment on disturbed arid and semi-arid lands; 1980 December 2–3; Laramie, WY. Cheyenne, WY: Wyoming Game and Fish Department: 26–36.
- Stevens, R.; Jorgensen, K. R.; Davis, J. N. 1981a. Viability of seed from thirty-two shrub and forb species through fifteen years of warehouse storage. *Great Basin Naturalist*. 42: 274–277.
- Stevens, R.; Moden, W. L., Jr.; McKenzie, D. W. 1981b. Interseeding and transplanting shrubs and forbs into grass communities. *Rangelands*. 3: 55–58.
- Tiedemann, A. R. 1981. Stream chemistry, nutrient economy, and site productivity consequences wildland management and wild-fire. In: Baumartner, D. M., ed. Proceedings of a symposium: Interior West watershed management; 1981 April 8–10; Spokane, WA. Pullman, WA: Washington State University: 183–201.
- Welch, B. L. 1981. Nutritive value of big sagebrush and other shrubs. In: Stelter, L. H.; DePuit, E. J.; Mikol, S. A., tech. coords. Shrub establishment on disturbed arid and semi-arid lands; 1980 December 2–3; Laramie, WY. Cheyenne, WY: Wyoming Game and Fish Department: 9–22.
- Welch, B. L.; McArthur, E. D. 1981. Variation of monoterpenoid content among subspecies and accessions of *Artemisia tridentata* grown in a uniform garden. *Journal of Range Management*. 34: 380–384.
- Welch, B. L.; McArthur, E. D.; Davis, J. N. 1981. Differential preference of wintering mule deer for accessions of big sagebrush and for black sagebrush. *Journal of Range Management*. 34: 409–411.
- Welch, B. L.; Monsen, S. B. 1981. Winter crude protein among accessions of fourwing saltbush grown in a uniform garden. *Great Basin Naturalist*. 41: 343–346.
- Welch, B. L.; Pederson, J. C. 1981. In vitro digestibility among accessions of big sagebrush by wild mule deer and its relationship to monoterpenoid content. *Journal of Range Management*. 34: 497–500.
- Welsh, S. L.; Atwood, N. D.; Goodrich, S.; Neese, E.; Thorne, K. H.; Albee, B. 1981. Preliminary index of Utah vascular plant names. *Great Basin Naturalist*. 41: 1–108.
- White, S. M.; Welch, B. L. 1981. Paired comparisons; a method for ranking mule deer preference for various browse species. Res. Note INT-308. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 4 p.
- Woodward, R. A. 1981. An ecological consideration of the significance of cation exchange capacity of roots of some Utah range plants. Provo, UT: Brigham Young University. 29 p. Thesis.
- Young, J. A.; Evans, R. A.; Stevens, R.; Everett, R. L. 1981. Germination of *Kochia prostrata* seed. *Agronomy Journal*. 73: 957–961.
- Anderson, D. C.; Harper, K. T.; Rushforth, S. R. 1982b. Recovery of cryptogamic soil crusts from grazing on Utah winter ranges. *Journal of Range Management*. 35: 355–359.
- Blaisdell, J. P.; Murray, R. B.; McArthur, E. D. 1982. Managing Intermountain rangelands—sagebrush-grass ranges. Gen. Tech. Rep. INT-134. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 41 p.
- Cedarleaf, J. D. 1982. Seasonal variation of monoterpenoids in big sagebrush (*Artemisia tridentata*). Provo, UT: Brigham Young University. 15 p. Thesis.
- Clary, W. P.; Holmgren, R. C. 1982. Desert Experimental Range: establishment and research contribution. *Rangelands*. 4: 261–264.
- Cluff, L. K.; Welch, B. L.; Pederson, J. C.; Brotherson, J. D. 1981. Concentration of monoterpenoids in the rumen ingesta of wild mule deer. *Journal of Range Management*. 35: 192–194.
- Freeman, D. C.; McArthur, E. D. 1982. A comparison of water stress between males and females of four species of desert shrubs. *Forest Science*. 28: 304–308.
- Goodrich, S.; Lewis, M. F. 1982. Noteworthy collections: *Carex microglochin*, *C. parryana*, *Epilobium nevadense*, and *Kobresia simpliciuscula*. *Madroño*. 29: 57–61.
- McArthur, E. D.; Freeman, D. C. 1982. Sex expression in *Atriplex canescens*: genetics and environment. *Botanical Gazette*. 143: 476–482.
- McArthur, E. D.; Hassell, W. G.; Stevens, R.; Davis, J. N.; Stranathan, S. E.; Noller, G. L.; Tiedemann, A. R.; Goodrich, S. K. 1982. Notice of naming and release of 'Rincon' fourwing saltbush (*Atriplex canescens*) for wildlife and livestock range and disturbed land reclamation. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 5 p.
- McArthur, E. D.; Welch, B. L. 1982. Growth rate differences among big sagebrush (*Artemisia tridentata*) accessions and subspecies. *Journal of Range Management*. 35: 396–401.
- Moore, T. B.; Stevens, R.; McArthur, E. D. 1982. Preliminary study of some insects associated with rangeland shrubs with emphasis on *Kochia prostrata*. *Journal of Range Management*. 35: 128–130.
- Nelson, D. L. 1982. *Phalacroscia dispar* (Coleoptera: Palacridae) an element in the natural control of native pine stem rust fungi in the Western United States. *Great Basin Naturalist*. 42: 369–379.
- Nelson, D. L.; Krebill, R. G. 1982. Occurrence and effect of *Chrusomyxa pirolata* cone rust on *Picea pungens* in Utah. *Great Basin Naturalist*. 42: 262–272.
- Pederson, J. C.; Welch, B. L. 1982. Effects of monoterpenoid exposure on ability of rumen inocula to digest a set of forages. *Journal of Range Management*. 35: 500–502.
- Skousen, J. G. 1982. Evaluation of pinyon-juniper chainings for big game in central Utah. Provo, UT: Brigham Young University. 74 p. Thesis.
- U.S. Department of Agriculture, Forest Service. 1982. Wildlife user guide for mining and reclamation. Gen. Tech. Rep. INT-126. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 77 p.
- Welch, B. L.; Narjisse, H.; McArthur, E. D. 1982. *Artemisia tridentata* monoterpenoid effect on ruminant digestion and forage selection. In: Margaris, N.; Koedam, A.; Volou, C., eds. Aromatic plants: basic and applied aspects. The Hague, Netherlands: Martinus Nijhoff Publishers: 73–86.
- White, S. M.; Flinders, J. T.; Welch, B. L. 1982a. Preference of pygmy rabbits, *Brachylagus idahoensis*, for various populations of big sagebrush, *Artemisia tridentata*. *Journal of Range Management*. 35: 724–726.
- White, S. M.; Welch, B. L.; Flinders, J. T. 1982b. Monoterpenoid content of pygmy rabbit stomach ingesta. *Journal of Range Management*. 35: 107–109.

1982

- Anderson, D. C.; Harper, K. T.; Holmgren, R. C. 1982a. Factors influencing development of cryptogamic soil crusts in Utah deserts. *Journal of Range Management*. 35: 180–185.

1983

- Cedarleaf, J. D.; Welch, B. L.; Brotherson, J. D. 1983. Seasonal variation of monoterpenoids in big sagebrush (*Artemisia tridentata*). *Journal of Range Management*. 36: 492–494.
- Clark, R. A. 1983. The influence of environmental stress on male and female functions in two dioecious shrubs of Utah. Provo, UT: Brigham Young University. 31 p. Thesis.

- Clary, W. P. 1983a. Interfacing physical data and economics. In: Wagstaff, F. J., comp. Proceedings—range economics symposium and workshop; 1982 August 31–September 2; Salt Lake City, UT. Gen. Tech. Rep. INT-149. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 115–119.
- Clary, W. P. 1983b. Overstory-understory relationships: spruce-fir forests. In: Overstory-understory relationships in western forests. Western Regional Res. Publ. 1. Fort Collins, CO: Colorado State University, Colorado Agricultural Experiment Station: 9–12.
- Clary, W. P.; Beale, D. M. 1983. Pronghorn reactions to winter sheep grazing, plant communities, and topography in the Great Basin. *Journal of Range Management*. 36: 749–752.
- Clary, W. P.; Johnson, T. J. 1983. Land imprinter results in Utah. In: Vegetative rehabilitation and equipment workshop, 37th annual report; 1983 February 13–14; Albuquerque, NM. Missoula, MT: U.S. Department of Agriculture, Forest Service, Equipment Development Center: 23–24.
- Davis, J. N. 1983. Performance comparison among populations of bitterbrush, cliffrose, and bitterbrush-cliffrose crosses on study sites throughout Utah. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 38–44.
- Ferguson, R. B. 1983. Use of rosaceous shrubs for wildland plantings in the Intermountain West. In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 136–149.
- Ferguson, R. B.; Frischknecht, N. C. 1983. Revegetating processed oil shale in the upper mountain brush zone of Colorado. Res. Pap. INT-321. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 9 p.
- Ferguson, R. B.; Medin, D. E. 1983. Long-term changes in an ungrazed bitterbrush plant community in southwest Idaho. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 107–116.
- Ffolliott, P. F.; Clary, W. P. 1983. An annotated bibliography of understory—overstory vegetation relationships. Gen. Tech. Rep. INT-136. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 39 p.
- Frank, C. T. 1983. Photosynthesis and growth of different accessions of big sagebrush. Provo, UT: Brigham Young University. 22 p. Thesis.
- Frischknecht, N. C. 1983. Plants adapted to summer rangelands. In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 102–107.
- Goodrich, S. 1983. Utah flora: Salicaceae. *Great Basin Naturalist*. 43: 531–550.
- Goodrich, S.; Henderson, D.; Chokewa, A. 1983. Noteworthy collections—Idaho, *Astragalus gilviflorus* and *Hackelia davisii*. *Madroño*. 39: 63.
- Goodrich, S.; Welsh, S. L. 1983. New variety of *Stephanomeria tenuifolia* (Compositae) from Utah. *Great Basin Naturalist*. 43: 375.
- Grah, O. J. 1983. Spatial and temporal distribution of infiltration rates on a small subalpine watershed. Logan, UT: Utah State University. 172 p. Thesis.
- McArthur, E. D. 1983a. Important shrubs for wildland plantings, Compositae (Asteraceae). In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 150–157.
- McArthur, E. D. 1983b. Taxonomy, origin, and distribution of big sagebrush (*Artemisia tridentata*) and allies (subgenus *Tridentatae*). In: Johnson, K. L., ed. Proceedings of the first Utah shrub ecology workshop; 1981 September 9–10; Ephraim, UT. Logan: Utah State University, College of Natural Resources: 3–13.
- McArthur, E. D.; Hassell, W. D.; Stevens, R. 1983a. Naming and release of 'Rincon' fourwing saltbush (*Atriplex canescens*) for wildlife and livestock range and disturbed land reclamation. Plant Release Notice. Salt Lake City, UT: U.S. Department of Agriculture, Soil Conservation Service, Utah State Office. 5 p.
- McArthur, E. D.; Stevens, R. 1983. Briefing paper on perennial summer cypress. Tech. Notes, Plant Materials 44. Denver, CO: U.S. Department of Agriculture, Soil Conservation Service. 2 p.
- McArthur, E. D.; Stevens, R.; Blauer, A. C. 1983b. Growth performance comparisons among 18 accessions of fourwing saltbush (*Atriplex canescens*) at two sites in central Utah. *Journal of Range Management*. 36: 78–81.
- McArthur, E. D.; Stutz, H. C.; Sanderson, S. C. 1983c. Taxonomy, distribution, and cytogenetics of *Purshia*, *Cowania*, and *Fallugia* (Rosaceae). In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 4–24.
- Monsen, S. B. 1983. Plants for revegetation of riparian sites within the Intermountain Region. In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 83–89.
- Monsen, S. B.; Shaw, N. 1983a. Benefits of seeding legumes with grasses on western phosphate mine disturbances. In: Robertson, D. J., ed. Reclamation and the phosphate industry; 1983, January 26–28; Clearwater Beach, FL. Bartow, FL: Florida Institute of Phosphate Research: 464–478.
- Monsen, S. B.; Shaw, N., comps. 1983b. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 194 p.
- Monsen, S. B.; Shaw, N. 1983c. Reynolds Creek species adaptability plantings. In: Volume II—comprehensive report ARS/BLM cooperative studies: Reynolds Creek Watershed. Boise, ID: U.S. Department of Agriculture, Agriculture Research Service, Northwest Watershed Research Center: 5-16–5-27.
- Monsen, S. B.; Shaw, N. 1983d. Seeding antelope bitterbrush with grasses on south-central Idaho rangelands—a 39-year response. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 116–136.
- Nelson, D. L. 1983. Occurrence and nature of actinorhizae on *Cowania stansburiana* and other Rosaceae. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 225–239.
- Nelson, D. L.; Tiernan, C. F. 1983. Winter injury of sagebrush and other wildland shrubs in the Western United States. Res. Pap. INT-314. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 17 p.
- Pendleton, R. L.; Smith, B. N. 1983. Vesicular-arbuscular mycorrhizae of weedy and colonizer plant species at disturbed sites in Utah. *Oecologia*. 59: 296–301.

- Ramsey, R. D. 1983. Influence of tree overstory on understory production and composition in aspen forests of central Utah. Provo, UT: Brigham Young University. 27 p. Thesis.
- Shaw, N.; Monsen, S. B. 1983a. Non-leguminous forbs for rangeland sites. In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 123–131.
- Shaw, N. L.; Monsen, S. B. 1983b. Phenology and growth habits of nine antelope bitterbrush, desert bitterbrush, Stansbury cliffrose, and Apache-plume accessions. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 55–69.
- Stevens, R. 1983a. Selecting species mixtures for optimum habitat development on disturbed land. In: Proceedings of the third annual reclamation symposium, native plants; 1983 January 10–11; Salt Lake City, UT. Salt Lake City, UT: Native Plants, Inc.: 42–57.
- Stevens, R. 1983b. Species adapted for seeding: mountain brush, big, black, and low sagebrush in pinyon-juniper communities. In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 78–82.
- Stevens, R.; Monsen, S. B.; Shaw, N.; McArthur, E. D.; James, G.; Davis, G.; Jorgensen, K. R.; Davis, J. N. 1983a. Naming and releasing of 'Ephraim' crested wheatgrass for commercial production and marketing of seed. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 2 p.
- Stevens, R.; Monsen, S. B.; Shaw, N.; Welch, B.; James, G.; Jorgensen, K. R.; Davis, J. N. 1983b. Naming and release of 'Paiute' orchardgrass for commercial production and marketing of seed. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 3 p.
- Tiedemann, A. R. 1983. Response of bitterbrush and associated plant species to broadcast nitrogen, phosphorus, and sulfur fertilization. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 240–255.
- Tiedemann, A. R.; Driver, C. H. 1983. Snow eriogonum, a native half-shrub to revegetate winter game ranges. Reclamation and Revegetation. 2: 31–39.
- Tiedemann, A. R.; Johnson, K. L., comps. 1983. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 279 p.
- Tiedemann, A. R.; Lopez, C. F. 1983. Soil nutrient assessment of mine spoils. In: Aldon, E. F.; Oaks, W. R., eds. Reclamation of mined lands in the Southwest: proceedings of symposium; 1982 October 20–22; Albuquerque, NM. Albuquerque: Soil Conservation Service of America, New Mexico Chapter: 66–79.
- Wagstaff, F. J. 1983a. Economic incentives for managing quaking aspen in the Mountain West and evaluating proposed improvements of public rangelands. Provo, UT: Brigham Young University. 40 p. Dissertation.
- Wagstaff, F. J. 1983b. Economics as a tool for natural rangeland managers. Rangelands. 5: 121–122.
- Wagstaff, F. J. 1983c. Evaluating proposed improvements of public rangelands. Gen. Tech. Rep. INT-150. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 4 p.
- Wagstaff, F. J. 1983d. Externalities caused by multiple use on public rangelands. In: Wagstaff, F. J., comp. Proceedings—range economics symposium and workshop; 1982 August 31–September 2; Salt Lake City, UT. Gen. Tech. Rep. INT-149. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 82–85.
- Wagstaff, F. J., comp. 1983e. Proceedings—range economics symposium and workshop; 1982 August 31–September 2; Salt Lake City, UT. Gen. Tech. Rep. INT-149. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 151 p.
- Welch, B. L. 1983a. Big sagebrush: nutrition, selection, and controversy. In: Johnson, K. L., ed. Proceedings of the first Utah shrub ecology workshop; 1981 September 9–10; Ephraim, UT. Logan, UT: Utah State University, College of Natural Resources: 21–33.
- Welch, B. L. 1983b. Improving the nutritive value of winter range forage. In: Monsen, S. B.; Shaw, N., comps. Managing Intermountain rangelands—improvement of range and wildlife habitats: proceedings of a symposium; 1981 September 15–17; Twin Falls, ID; 1982 June 22–24; Elko, NV. Gen. Tech. Rep. INT-157. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 158–164.
- Welch, B. L.; McArthur, E. D. 1983. Briefing paper on sagebrush values. Tech. Notes, Plant Materials 45. Denver, CO: U.S. Department of Agriculture, Soil Conservation Service. 2 p.
- Welch, B. L.; McArthur, E. D.; Davis, J. N. 1983a. Mule deer preference and monoterpenoids (essential oils). Journal of Range Management. 36: 485–487.
- Welch, B. L.; Monsen, S. B.; Shaw, N. L. 1983b. Nutritive value of antelope and desert bitterbrush, Stansbury cliffrose, and Apache-plume. In: Tiedemann, A. R.; Johnson, K. L., comps. Proceedings: research and management of bitterbrush and cliffrose in Western North America; 1982 April 13–15; Salt Lake City, UT. Gen. Tech. Rep. INT-152. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 173–185.
- Welch, B. L.; Pederson, J. C.; Clary, W. P. 1983c. Ability of different rumen inocula to digest a set of range forages. Journal of Wildlife Management. 47: 873–877.

1984

- Astroth, K. A.; Frischknecht, N. C. 1984. Managing Intermountain rangelands—research on the Benmore Experimental Range, 1940–1984. Gen. Tech. Rep. INT-175. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 44 p.
- Atwood, N. D.; Goodrich, S.; Welch, S. L. 1984. New *Astragalus* (Leguminosae) from Goose Creek drainage, Utah-Nevada. Great Basin Naturalist. 44: 263–264.
- Blaisdell, J. P.; Holmgren, R. C. 1984. Managing Intermountain rangelands—salt-desert shrub ranges. Gen. Tech. Rep. INT-163. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 52 p.
- Bowden, D. C.; Anderson, A. E.; Medin, D. E. 1984. Sampling plans for mule deer sex and age ratios. Journal of Wildlife Management. 48: 500–509.
- Clary, W. P.; Tiedemann, A. R. 1984. Development of 'Rincon' fourwing saltbush, winterfat and other shrubs form seed following fire. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 273–280.
- Davis, J. N.; Welch, B. L. 1984. Seasonal variation in crude protein of *Kochia prostrata*. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 145–149.
- Freeman, D. C.; McArthur, E. D. 1984. The relative influences of mortality, non-flowering, and sex change on the sex ratios of six *Atriplex* species. Botanical Gazette. 145: 385–394.
- Freeman, D. C.; McArthur, E. D.; Harper, K. T. 1984. The adaptive significance of sexual lability in plants using *Atriplex canescens* as the principal example. Annals of the Missouri Botanical Garden. 71: 265–277.

- Frischknecht, N. C.; Ferguson, R. B. 1984. Performance of Chenopodiaceae species on processed oil shale. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 293–297.
- Goodrich, S. 1984. Checklist of vascular plants of the Canyon and Church Mountains. Great Basin Naturalist. 44: 277–295.
- Harniss, R. O.; Nelson, D. L. 1984. A severe epidemic of *Marssonina* leaf blight on quaking aspen in northern Utah. Res. Note INT-339. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 6 p.
- Holmgren, R. C. 1984. The Great Basin cold desert: some physical geography. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 108–113.
- Jorgensen, K. R.; Davis, J. N. 1984. A technique of retaining seed viability in *Kochia prostrata* (L.) Schrad. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 166–167.
- Luke, F.; Monsen, S. B. 1984. Methods and costs for establishing shrubs on mined lands in southwestern Wyoming. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 286–292.
- McArthur, E. D. 1984. Natural diversity of western range shrubs. In: Cooley, J. L.; Cooley, J. H., eds. Natural diversity in forest ecosystems: proceedings of the workshop; 1982 November 29–December 1; Athens, GA. Athens: University of Georgia, Institute of Ecology: 193–209.
- McArthur, E. D.; Blauer, A. C.; Noller, G. L. 1984a. Propagation of fourwing saltbush (*Atriplex canescens*) by stem cuttings. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 261–264.
- McArthur, E. D.; Sanderson, S. C. 1984. Distribution, systematics, and evolution of Chenopodiaceae—an overview. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 14–24.
- McArthur, E. D.; Stranathan, S. E.; Noller, G. L. 1984b. 'Rincon' fourwing saltbush—proven for better forage and reclamation. Rangelands. 6: 62–64.
- Medin, D. E. 1984. Breeding birds of an ancient bristlecone pine stand in east central Nevada. Great Basin Naturalist. 44: 272–276.
- Monsen, S. B. 1984. Use of shrubs on mine spoils. In: Murphy, P. M., comp. The challenge of producing native plants for the Intermountain area: proceedings, Intermountain Nurseryman's Association 1983 conference; 1983 August 8–11; Las Vegas, NV. Gen. Tech. Rep. INT-168. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 26–31.
- Monsen, S. B.; Richardson, B. Z. 1984. Seeding shrubs with herbs on a semiarid mine site with and without topsoil. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 298–305.
- Moore, T. B.; Stevens, R. 1984. Distribution and importance of the *Atriplex* case-bearing moth, *Coleophora atriplicivora* Cockerell, on some chenopod shrubs, especially *Atriplex canescens* (Pursh.) Nutt. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 220–225.
- Nelson, D. L. 1984. Toward producing disease-free container grown native wildland plants. In: Murphy, P. M., comp. The challenge of producing native plants for the Intermountain area: proceedings, Intermountain Nurseryman's Association 1983 conference; 1983 August 8–11; Las Vegas, NV. Gen. Tech. Rep. INT-168. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 32–38.
- Nelson, D. L.; Schuttler, P. L. 1984. Histology of *Cowanias burbanckiana* actinorhizae. Northwest Science. 58: 49–56.
- Noller, G. L.; Stranathan, S. E.; McArthur, E. D. 1984. Establishment and initial results from a 'Rincon' fourwing saltbush seed orchard. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 196–204.
- Pederson, J. D. 1984. Factors influencing nutrition, productivity, and mortality of mule deer in Utah. Provo, UT: Brigham Young University. 33 p. Dissertation.
- Platts, W. S.; Wagstaff, F. J. 1984. Fencing to control livestock grazing on riparian habitats along streams; is it a viable alternative? North American Journal of Fisheries Management. 4: 266–272.
- Roos, R. C. 1984. Heritable variation in *Sarcobatus vermiculatus*. Provo, UT: Brigham Young University. 41 p. Thesis.
- Sanderson, S. C.; Goodrich, S.; McArthur, E. D. 1984. Asteraceae, Chenopodiaceae, Fagaceae. In: Löve, A. IOPB chromosome number reports. LXXXV. Taxon. 33: 756–760.
- Sanderson, S. C.; Stutz, H. C. 1984. Flavonoid aglycones of diploid and polyploid *Atriplex confertifolia*. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 34–38.
- Shaw, N.; Monsen, S. B. 1984. Nursery propagation and outplanting of bareroot chenopod seedlings. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 251–260.
- Shaw, N. L.; Monsen, S. B.; Carlson, J. R. 1984. Notice of release of 'Lassen' antelope bitterbrush. Salt Lake City, UT: U.S. Department of Agriculture, Soil Conservation Service. 4 p.
- Stevens, R.; Jorgensen, K. R.; McArthur, E. D.; Davis, J. N. 1984. Notice of release of 'Immigrant' forage kochia. Salt Lake City, UT: U.S. Department of Agriculture, Soil Conservation Service. 3 p.
- Stevens, R.; Van Epps, G. A. Seeding techniques to improve establishment of forage kochia and fourwing saltbush. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 269–272.
- Stutz, H. C.; Sanderson, S. C. 1984. Evolutionary studies of *Atriplex*: chromosome races of *Atriplex confertifolia* (shadscale). American Journal of Botany. 70: 1536–1547.
- Tiedemann, A. R. 1984. Shrub Research Consortium formed. Great Basin Naturalist. 44: 182.
- Tiedemann, A. R.; McArthur, E. D.; Lopez, C. F. 1984a. Carbohydrate and nitrogen concentrations in leaves of three shrub species following microwave, autoclave, and air-drying treatments. Forest Science. 30: 113–116.

- Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. 1984b. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 309 p.
- Wagstaff, F. J. 1984. Economic considerations in use and management of Gambel oak for fuelwood. Gen. Tech. Rep. INT-165. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 8 p.
- Welch, B. L.; Davis, J. N. 1984. In vitro digestibility of *Kochia prostrata* (L.) Schrad. Great Basin Naturalist. 44: 296–298.
- Welch, B. L.; Monsen, S. B. 1984. Winter nutritive value of accessions of fourwing saltbush (*Atriplex canescens*) grown on a uniform garden. In: Tiedemann, A. R.; McArthur, E. D.; Stutz, H. C.; Stevens, R.; Johnson, K. L., comps. Proceedings—symposium on the biology of *Atriplex* and related chenopods; 1983 May 2–6; Provo, UT. Gen. Tech. Rep. INT-172. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station: 138–144.
- Woodward, R. D.; Harper, K. T.; Tiedemann, A. R. 1984. An ecological consideration of the significance of cation-exchange capacity of roots of some Utah range plants. Plant and Soil. 79: 169–180.
- ## 1985
- Behan, B.; Welch, B. L. 1985. Black sagebrush: mule deer winter preference and monoterpenoid content. Journal of Range Management. 38: 278–280.
- Bunderson, E. D.; Weber, D. J.; Davis, J. N. 1985. Soil mineral composition and nutrient uptake in *Juniperus osteosperma* in 17 Utah sites. Soil Science. 139: 139–148.
- Carlson, J. R.; McArthur, E. D., eds. 1985. Proceedings: selected papers presented at the 38th annual meeting of the Society for Range Management, range plant improvements in Western North America; 1985 February 14; Salt Lake City, UT. Denver, CO: Society for Range Management: 107–220.
- Clary, W. P.; Beale, D. M.; Holmgren, R. C. 1985a. Melanistic pronghorn fawns on the Desert Experimental Range. Southwestern Naturalist. 30: 159–162.
- Clary, W. P.; Goodrich, S.; Smith, B. M. 1985b. Response of broom snakeweed to application of tebuthiuron. Res. Note INT-350. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 4 p.
- Clary, W. P.; Goodrich, S.; Smith, B. M. 1985c. Response of Gambel oak to tebuthiuron in central Utah. Res. Note INT-351. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 4 p.
- Clary, W. P.; Goodrich, S.; Smith, B. M. 1985d. Response to tebuthiuron by Utah juniper and mountain big sagebrush communities. Journal of Range Management. 38: 56–60.
- Clary, W. P.; Tiedemann, A. R. 1985. Biomass distribution in northcentral Utah Gambel oak stands. In: Johnson, K. L., ed. Proceedings of the third Utah shrub ecology workshop; 1983 August 30–31; Provo, UT. Logan: Utah State University, College of Natural Resources: 9–12.
- Davis, J. N.; Welch, B. L. 1985. Winter preference, nutritive value, and other range use characteristics of *Kochia prostrata* (L.) Schrad. Great Basin Naturalist. 45: 778–783.
- Ferguson, R. B.; Frischknecht, N. C. 1985. Reclamation on Utah's Emery and Alton coal fields: techniques and plant materials. Res. Pap. INT-335. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 78 p.
- Goodrich, S. 1985. Utah flora: Saxifragaceae. Great Basin Naturalist. 45: 155–172.
- Goodrich, S.; Atwood, D.; Neese, E. 1985a. Noteworthy collections: Utah. Madroño. 32: 125.
- Goodrich, S.; McArthur, E. D.; Winward, A. H. 1985b. A new combination and a new variety in *Artemisia tridentata*. Great Basin Naturalist. 45: 155–172.
- Harper, K. T.; Wagstaff, F. J.; Kunzler, L. M. 1985. Biology and management of the Gambel oak vegetative types: a literature review. Gen. Tech. Rep. INT-179. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Forest and Range Experiment Station. 31 p.
- Hess, W. M.; Nelson, D. L.; Sturges, D. L. 1985. Morphology and ultrastructure of a snowmold fungus on sagebrush (*Artemisia tridentata*). Mycologia. 77: 637–647.
- Masslich, W. J. 1985. Aspen-beaver relationships in the Strawberry Valley of central Utah. Provo, UT: Brigham Young University. 38 p. Thesis.
- McArthur, E. D.; Sanderson, S. C. 1985. A cytotaxonomic contribution to the western North American rosaceous flora. Madroño. 32: 24–28.
- McArthur, E. D.; Welch, B. L.; Nelson, D. L. 1985. Developing improved cultivars of sagebrushes and other composite shrubs. In: Carlson, J. R.; McArthur, E. D., eds. Proceedings: selected papers presented at the 38th annual meeting of the Society for Range Management, range plant improvements in Western North America; 1985 February 14; Salt Lake City, UT. Denver, CO: Society for Range Management: 188–196.
- Monsen, S. B.; Davis, J. N. 1985. Progress in the improvement of selected western North American rosaceous shrubs. In: Carlson, J. R.; McArthur, E. D., eds. Proceedings: selected papers presented at the 38th annual meeting of the Society for Range Management, range plant improvements in Western North America; 1985 February 14; Salt Lake City, UT. Denver, CO: Society for Range Management: 201–209.
- Monsen, S. B.; McArthur, E. D. 1985. Factors influencing establishment of seeded broadleaf herbs and shrubs following fire. In: Sanders, K.; Durham, J., eds. Rangelands fire effects symposium; 1984 November 27–29; Boise, ID. Boise: U.S. Department of the Interior, Bureau of Land Management, Idaho State Office: 112–124.
- Monsen, S. B.; Stevens, R. 1985. 'Paiute' orchardgrass—forage species for semiarid range and wildland sites. Rangelands. 7: 114–115.
- Monsen, S. B.; Stevens, R.; James, G.; Jorgensen, K. R.; Oaks, W. R. 1985a. Naming and release of 'Hatch' winterfat for commercial production and marketing of seed and seedlings. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 7 p.
- Monsen, S. B.; Stevens, R.; Jorgensen, K. R. 1985b. Seed harvesters—an evaluation of existing machines and projected needs. In: 39th annual report, vegetative rehabilitation and equipment workshop; 1985 February 10–11; Salt Lake City, UT. Missoula, MT: U.S. Department of Agriculture, Forest Service, Equipment Development Center: 37–39.
- Nielsen, D. B.; Lytle, D. D.; Wagstaff, F. 1985. Who gains (or loses) when big-game uses private lands. Utah Science. 46(2): 48–51.
- O'Neal, G. T. 1985. Behavioral ecology of the Nevada kit fox (*Vulpes macrotis nevadensis*) on a managed desert rangeland. Provo, UT: Brigham Young University. 75 p. Thesis.
- Pederson, J. C.; Welch, B. L. 1985. Comparison of ponderosa pine as feed and nonfeed trees for Abert squirrels. Journal of Chemical Ecology. 11: 149–157.
- Pendleton, R. L.; Sanderson, S. C.; McArthur, E. D. 1985. Morphologic and enzymatic variability among Gambel oak clones in north-central Utah. In: Johnson, K. L., ed. Proceedings of the third Utah shrub ecology workshop; 1983 August 30–31; Provo, UT. Logan, UT: Utah State University, College of Natural Resources: 19–28.
- Stevens, R. 1985a. Depth of interseeding scalps can affect growth of seeded mountain big sagebrush. In: 39th annual report, vegetative rehabilitation and equipment workshop; 1979 February 10–11; Salt Lake City, UT. Missoula, MT: U.S. Department of Agriculture, Forest Service, Equipment Development Center: 25–27.
- Stevens, R. 1985b. Interseeding with a modified Sieco Fireplow can result in increased seedling numbers. In: 39th annual report, vegetative rehabilitation and equipment workshop; 1979 February 10–11; Salt Lake City, UT. Missoula, MT: U.S. Department of Agriculture, Forest Service, Equipment Development Center: 22–24.
- Stevens, R. 1985c. Ten commandments of range restoration. In: Proceedings—Cedar Valley conservation; 1985 January 21; Cedar Valley, UT. Logan: Utah State University Extension Service: 14–15.
- Stevens, R.; Davis, J. N. 1985. Opportunities for improving forage production in the Gambel oak types of Utah. In: Johnson, K. L., ed. Proceedings of the third Utah shrub ecology workshop; 1983

- August 30–31; Provo, UT. Logan: Utah State University, College of Natural Resources: 37–41.
- Stevens, R.; Jorgensen, K. R.; McArthur, E. D.; Davis, J. N. 1985a. 'Immigrant' forage kochia. *Rangelands*. 7: 22–23.
- Stevens, R.; Monsen, S. B. 1985a. 'Ephraim' crested wheatgrass—a rhizomatous grass. *Rangelands*. 7: 163–164.
- Stevens, R.; Monsen, S. B. 1985b. Recent plant releases for western wildlands. In: 39th annual report, vegetative rehabilitation and equipment workshop; 1985 February 10–11; Salt Lake City, UT. Missoula, MT: U.S. Department of Agriculture, Forest Service, Equipment Development Center: 34–36.
- Stevens, R.; Monsen, S. B.; James, G.; Jorgensen, K. R.; Davis, J. N.; Oaks, W. R. 1985b. Naming and release of 'Cedar' Palmer penstemon for commercial production and marketing of seed. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 9 p.
- Stevens, R.; Shaw, N.; Howard, C. G. 1985c. Important nonleguminous forbs for Intermountain range. In: Carlson, J. R.; McArthur, E. D., eds. Proceedings: selected papers presented at the 38th annual meeting, of the Society for Range Management, range plant improvements in Western North America; 1985 February 14; Salt Lake City, UT. Denver, CO: Society for Range Management: 210–220.
- Tiedemann, A. R. 1985. Description and discussion of field tour sites. In: Johnson, K. L., ed. Proceedings of the third Utah shrub ecology workshop; 1983 August 30–31; Provo, UT. Logan: Utah State University, College of Natural Resources: 59–61.
- Tiedemann, A. R.; Clary, W. P. 1985. Nitrogen distribution in north central Utah Gambel oak stands. In: Johnson, K. L., ed. Proceedings of the third Utah shrub ecology workshop; 1983 August 30–31; Provo, UT. Logan: Utah State University, College of Natural Resources: 13–18.
- Tiedemann, A. R.; Furniss, M. M. 1985. Soil and litter nutrient responses to looper defoliation of curlleaf mountain mahogany. *Forest Science*. 31: 382–388.
- Wagstaff, F. J. 1985. Economics of using Gambel oak for firewood. In: Johnson, K. L., ed. Proceedings of the third Utah shrub ecology workshop; 1983 August 30–31; Provo, UT. Logan: Utah State University, College of Natural Resources: 53–58.
- Weber, D. J.; Davis, T. D.; McArthur, E. D.; Sankhla, N. 1985. *Chrysothamnus nauseosus* (rubber rabbitbrush): multiple-use shrub of the desert. *Desert Plants*. 7: 172–180, 208–210.
- ## 1986
- Allen, P. S.; Davis, T. D. 1986. Determining seed quality of cicer milkvetch (*Astragalus cicer* L.). Newsletter of the Association of Official Seed Analysts. 60(1): 86–92.
- Allen, P. S.; Meyer, S. 1986. Developing procedures for testing wildland seed. Newsletter of the Association of Official Seed Analysts. 60(3): 26–28.
- Allen, P. S.; Meyer, S. C.; Wilson, G. R.; Davis, T. D.; Davis, J. N.; Stevens, R.; Jorgensen, K. 1986a. Proposal: addition of *Ceratoides lanata*—winterfat to the rules. Newsletter of the Association of Official Seed Analysts. 60(1): 15–17.
- Allen, P. S.; Meyer, S. C.; Wilson, G. R.; Davis, T. D.; Davis, J. N.; Stevens, R.; Jorgensen, K. 1986b. Proposal: addition of *Elymus cinereus*—basin wildrye to the rules. Newsletter of the Association of Official Seed Analysts. 60(1): 18–19.
- Allen, P. S.; Meyer, S. C.; Wilson, G. R.; Davis, T. D.; Davis, J. N.; Stevens, R.; Jorgensen, K. 1986c. Proposal: addition of *Kochia prostrata*—forage kochia to the rules. Newsletter of the Association of Official Seed Analysts. 60(1): 19–20.
- Allen, P. S.; Wilson, G. R.; Davis, T. D.; Davis, J. N.; Stevens, R.; Jorgensen, K. 1986d. Proposal: addition of *Astragalus cicer*—cicer milkvetch to the rules. Newsletter of the Association of Official Seed Analysts. 60(1): 13–14.
- Behan, B.; Welch, B. L. 1986. Winter nutritive content of black sagebrush (*Artemisia nova*) grown in a uniform garden. *Great Basin Naturalist*. 46: 161–165.
- Buman, R. A. 1986. Seed germination and seedling interspecific competition of mountain rye (*Secale montanum* Guss.), 'Hycrest' crested wheatgrass (*Agropyron cristatum* L. x *A. desertorum* Fisch.) and downy brome (*Bromus tectorum* L.). Laramie: University of Wyoming. 48 p. Thesis.
- Bunderson, E. D.; Weber, D. J.; Nelson, D. L. 1986a. Diseases associated with *Juniperus osteosperma* and a model for predicting their occurrence with environmental site factors. *Great Basin Naturalist*. 46: 427–440.
- Bunderson, E. D.; Welch, B. L.; Weber, D. J. 1986b. In vitro digestibility of *Juniperus osteosperma* (Torr.) Little from 17 Utah sites. *Forest Science*. 32: 834–840.
- Clary, W. P. 1986a. Black sagebrush response to grazing in the east-central Great Basin. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 181–185.
- Clary, W. P. 1986b. Fifty-year response to grazing in the low-shrub cold desert of the Great Basin, U.S.A. In: Joss, P. J.; Lynch, P. W.; Williams, O. B., eds. *Rangelands: a resource under siege: proceedings of the Second International Rangeland Congress*; 1985 May 13–18; Adelaide, Australia. Canberra, Australia: Australian Academy of Science: 37–38.
- Clary, W. P.; Tiedemann, A. R. 1986. Distribution of biomass within small tree and shrub form *Quercus gambelii* stands. *Forest Science*. 32: 234–242.
- Davis, J. N.; Stevens, R. 1986. Comparison of production in twenty-seven accessions of four sagebrush taxa. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 336–341.
- Delany, D. 1986. Natural variation of *Eriogonum niveum* and its relation to management of wildlife habitat. Seattle: University of Washington. 160 p. Thesis.
- Elderkin, R. L., Jr.; Dietz, D. R.; Welch, B. L.; Ralphs, P. M.; Czarnecki, J. K. 1986. Irrigation by mine discharge water and fertilization of big sagebrush: effects of nutritional composition, production, and mule deer use. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 140–145.
- Frank, C. T.; Smith, B. N.; Welch, B. L. 1986. Photosynthesis, growth, transpiration and ¹³C relationships among three subspecies of big sagebrush. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 332–335.
- Goodrich, S. 1986a. Utah flora: Apiaceae (Umbelliferae). *Great Basin Naturalist*. 46: 66–106.
- Goodrich, S. 1986b. Vascular plants of the Desert Experimental Range, Millard County, Utah. Gen. Tech. Rep. INT-209. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 72 p.
- Goodrich, S.; Neese, E. 1986. Uinta Basin flora. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 319 p.
- Hegerhorst, D. F. 1986. Chemical composition of *Chrysothamnus nauseosus*. Provo, UT: Brigham Young University. 346 p. Thesis.
- Hobbs, N. T.; Welch, B. L.; Remington, R. E. 1986. Effects of big sagebrush on in vitro digestion of grass cell walls. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 186–189.
- Larson, F. R.; Ffolliott, P. F.; Clary, W. P. 1986. Managing wildlife habitat. *Journal of Forestry*. 84: 40–41.
- McArthur, E. D. 1986. Specificity of galls on *Chrysothamnus nauseosus* subspecies. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 205–210.
- McArthur, E. D.; Goodrich, S. K. 1986. *Artemisia tridentata* ssp. *spiciformis*: distribution and taxonomic placement. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the

- biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 55–57.
- McArthur, E. D.; Monsen, S. B.; Blauer, A. C. 1986a. Inventory of and rehabilitation recommendations for sites disturbed by modern man's activities in Grand Teton National Park. In: University of Wyoming National Park Service Research Center Ninth Annual Report. Laramie: University of Wyoming National Park Service Research Center: 75–82.
- McArthur, E. D.; Sanderson, S. C.; Freeman, D. C. 1986b. Isozymes of an autopolyploid shrub, *Atriplex canescens* (Chenopodiaceae). Great Basin Naturalist. 46: 157–160.
- McArthur, E. D.; Welch, B. L. 1986a. Introduction: *Artemisia* and *Chrysothamnus*. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 2–5.
- McArthur, E. D.; Welch, B. L., comps. 1986b. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 398 p.
- Medin, D. E. 1986. Grazing and passerine breeding birds in a Great Basin low-shrub desert. Great Basin Naturalist. 46: 567–572.
- Meyer, S. E.; Allen, P. S.; Wilson, G. R.; Davis, T. D.; Davis, J. N.; Stevens, R.; Jorgensen, K. 1986a. Proposal: addition of *Atriplex canescens*—fourwing saltbush to the rules. Newsletter of the Association of Official Seed Analysts. 60(1): 14–15.
- Meyer, S. E.; Allen, P. S.; Wilson, G. R.; Davis, T. D.; Davis, J. N.; Stevens, R.; Jorgensen, K. 1986b. Proposal: addition of *Purshia tridentata*—fourwing saltbush to the rules. Newsletter of the Association of Official Seed Analysts. 60(1): 14–15.
- Monsen, S. B.; Shaw, N. 1986. Response of an alkali sagebrush/fescue site to restoration treatments. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 126–133.
- Neilsen, D. B.; Wagstaff, F. J.; Lytle, D. 1986. Big-game animals on private range. Rangelands. 8: 36–38.
- Nelson, D. L.; Sturges, D. L. 1986. A snowmold disease of unknown consequence. Phytopathology. 76: 946–951.
- Neville, W. M.; McArthur, E. D. 1986. Preliminary report on tissue culture propagation of big sagebrush (*Artemisia tridentata*). In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 397–398.
- Noller, G. L.; McArthur, E. D. 1986. Establishment and initial results from a sagebrush (*Artemisia tridentata*) mass selection garden. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 104–107.
- Pendleton, R. L. 1986. Studies in plant population biology: *Grayia brandegei* and *Quercus gambelii*. Detroit, MI: Wayne State University. 66 p. Dissertation.
- Richardson, B. Z.; Monsen, S. B.; Bowers, D. M. 1986. Interseeding selected shrubs and herbs on mine disturbances in southeastern Idaho. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 134–139.
- Shaw, N.; Monsen, S. B. 1986. 'Lassen' antelope bitterbrush: a browse plant for game and livestock ranges. Rangelands. 8: 122–124.
- Skousen, J.; Davis, J. N.; Brotherson, J. D. 1986. Comparison of vegetation patterns resulting from bulldozing and two-way chaining on a Utah pinyon-juniper big game range. Great Basin Naturalist. 46: 508–512.
- Smith, C. B. 1986. Grazing effects and site factors in relation to grazing use of salt desert shrub vegetation, Desert Experimental Range, Utah 1938–1974. Logan: Utah State University. 244 p. Thesis.
- Stevens, R. 1986a. Are live pinyon and Utah juniper trees on chaining sites a result of poor kill at chaining or from reproduction? Habitat Express 86-3. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 3 p.
- Stevens, R. 1986b. Population dynamics of two sagebrush species and rubber rabbitbrush over 22 years of grazing use by three animal classes. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 278–285.
- Stevens, R. 1986c. Seed quality testing standards are being established for wildlands. Habitat Express 86-3. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 3 p.
- Stevens, R.; Jorgensen, K. R.; Davis, J. N.; Monsen, S. B. 1986. Seed pappus and placement influences on white rubber rabbitbrush establishment. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 353–357.
- Stranthan, S. E.; Monsen, S. B. 1986. Selection of a cultivar of *Artemisia ludoviciana* for disturbed land plantings. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 108–113.
- Sturges, D. L.; Nelson, D. L. 1986. Snow depth and incidence of a snowmold disease on mountain big sagebrush. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 215–221.
- Upper Colorado Environmental Plant Center; U.S. Department of Agriculture, Forest Service, Intermountain Research Station; Utah Division of Wildlife Resources; Colorado Agricultural Experiment Station—Colorado State University; Utah Agricultural Experiment Station—Utah State University; and the U.S. Department of Agriculture, Soil Conservation Service. 1986. Notice of the naming and release of 'Summit' Louisiana sage (*Artemisia ludoviciana*). Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 4 p.
- Wagstaff, F. J. 1986a. Economic considerations in management of sagebrush ranges. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 146–150.
- Wagstaff, F. J. 1986b. Economic issues of grazing and riparian area management. In: Transactions of the 51st North American Wildlife and Natural Resources Conference; Washington, DC: Wildlife Management Institute: 272–279.
- Wagstaff, F. J., comp. 1986c. Range and ranch economics bibliography: 1968–1985. Gen. Tech. Rep. INT-216. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 30 p.
- Welch, B. L.; McArthur, E. D. 1986a. Growth rate of big sagebrush as influenced by accessions, sites, subspecies, and years. In: McArthur, E. D.; Welch, B. L., comps. Proceedings—symposium on the biology of *Artemisia* and *Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 342–246.
- Welch, B. L.; McArthur, E. D. 1986b. Wintering mule deer preference for 21 accessions of big sagebrush. Great Basin Naturalist. 46: 113–115.
- Welch, B. L.; McArthur, E. D.; Nelson, D. L.; Pederson, J. C.; Davis, J. N. 1986a. 'Hobble Creek'—a superior selection of low-elevation mountain big sagebrush. Res. Pap. INT-370. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 10 p.
- Welch, B. L.; Nelson, D. L.; McArthur, E. D. 1986b. Improvement of wildland shrubs through selection and breeding. In: Joss, P. J.; Lynch, P. W.; Williams, O. B., eds. Rangelands: a resource under siege: proceedings of the Second

- International Rangeland Congress; 1985 May 13–18; Adelaide, Australia. Canberra, Australia: Australian Academy of Science: 467–468.
- Whisenant, S. G.; Clary, W. P. 1986. Spatial distribution of tebuthiuron in soil following application of pellets. *Proceedings of the Western Society of Weed Science*. 39: 73–84.
- Winkel, V. 1986. Habitat differences between mountain big sagebrush and mountain silver sagebrush in the Strawberry Valley of central Utah. Provo, UT: Brigham Young University. 30 p. Thesis.
- Winward, A. H.; McArthur, E. D.; Kaffer, D. A.; Plummer, C. A.; Brackley, G. K. 1986. Another sagebrush in Nevada. *Tech. Notes TN-Range NV-44*. Reno, NV: U.S. Department of Agriculture, Soil Conservation Service. 2 p.
- Wood, B. W.; Brotherson, J. D. 1986. Ecological adaptation and grazing response of budsage (*Artemisia spinescens*) in southwestern Utah. In: McArthur, E. D.; Welch, B. L., comps. *Proceedings—symposium on the biology of Artemisia and Chrysothamnus*; 1984 July 9–13; Provo, UT. Gen. Tech. Rep. INT-200. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 75–92.
- ## 1987
- Allen, P. S.; Meyer, S. E.; Davis, T. D. 1987. Determining seed quality of winterfat (*Ceratoides lanata* [Pursh.] J. T. Howell). *Journal of Seed Technology*. 11: 7–14.
- Black, D. R. 1987. Correlation of leaf matrix potential, the stable isotope ¹³C and plant vegetation patterns to moisture gradients in sagebrush-grass communities of the Wasatch Mountains, Utah, U.S.A. Provo, UT: Brigham Young University. 41 p. Thesis.
- Clary, W. P. 1987. Herbage production and livestock grazing on pinyon-juniper woodlands. In: Everett, R. L., comp. *Proceedings—pinyon-juniper conference*; 1986 January 13–16; Reno, NV. Gen. Tech. Rep. INT-215. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 440–447.
- Clary, W. P.; Holmgren, R. C. 1987a. Difficulties in interpretation of long-term vegetation trends in response to livestock grazing. In: Provenza, F. D.; Flinders, J. T.; McArthur, E. D., comps. *Proceedings—symposium on plant-herbivore interactions*; 1985 August 7–9; Snowbird, UT. Gen. Tech. Rep. INT-222. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 154–151.
- Clary, W. P.; Holmgren, R. C. 1987b. Reversal of desertification on the low-shrub cold desert. In: Aldon, E. F.; Gonzales, V., Carlors, E.; Moir, W. H., tech. eds. *Strategies for classification and management of native vegetation for food production in arid zones*; 1987 October 12–16; Tucson, AZ. Gen. Tech. Rep. RM-150. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 138–142.
- Clary, W. P.; Tiedemann, A. R. 1987. Fuelwood potential in large-tree *Quercus gambelii* stands. *Western Journal of Applied Forestry*. 2: 87–90.
- Clary, W. P.; Wagstaff, F. J. 1987. Biological and economic effectiveness of several revegetation techniques in the pinyon-juniper-sagebrush zone. In: Everett, R. L., comp. *Proceedings—pinyon-juniper conference*; 1986 January 13–16; Reno, NV. Gen. Tech. Rep. INT-215. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 305–312.
- Davis, J. N. 1987. Seedling establishment biology and patterns of interspecific association among established seeded and non-seeded species on a chained juniper-pinyon woodland in central Utah. Provo, UT: Brigham Young University. 80 p. Dissertation.
- Harper, K. T.; Sanderson, S. C.; McArthur, E. D. 1987. Vegetation communities of Zion National Park. In: Eleventh annual report. Laramie: University of Wyoming, National Park Service Research Center: 191–196.
- Hegerhorst, D. F.; Weber, D. J.; McArthur, E. D. 1987a. Chemical analysis and comparison of subspecies of *Chrysothamnus nauseosus* and other related species. *Biochemical Systematics and Ecology*. 15: 201–208.
- Hegerhorst, D. F.; Weber, D. J.; McArthur, E. D. 1987b. Chemical components of *Chrysothamnus nauseosus*: a preliminary report. In: Provenza, F. D.; Flinders, J. T.; McArthur, E. D., comps. *Proceedings—symposium on plant-herbivore interactions*; 1985 August 7–9; Snowbird, UT. Gen. Tech. Rep. INT-222. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 93–98.
- Hegerhorst, D. F.; Weber, D. J.; McArthur, E. D. 1987c. Resin and rubber content in *Chrysothamnus*. *Southwestern Naturalist*. 32: 475–482.
- Jacobson, T. L. C.; Welch, B. L. 1987. Planting depth of 'Hobble Creek' mountain big sagebrush seed. *Great Basin Naturalist*. 47: 497–499.
- Kahn, M. A.; Sankhla, N.; Weber, D. J.; McArthur, E. D. 1987. Seed germination characteristics of *Chrysothamnus nauseosus* ssp. *viridulus* (Asteraceae, Asteraceae). *Great Basin Naturalist*. 47: 220–226.
- Kitchen, S. G.; Meyer, S. E.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987. Addition of *Hedysarum boreale*—northern sweetvetch to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 65–66.
- McArthur, E. D.; Meyer, S. E. 1987. A review of the taxonomy and distribution of *Chrysothamnus*. In: Johnson, K. L., ed. *Proceedings of the fourth Utah shrub ecology workshop: the genus Chrysothamnus*; 1986 September 17–19; Cedar City, UT. Logan: Utah State University, College of Natural Resources: 9–17.
- McArthur, E. D.; Meyer, S. E.; Weber, D. J. 1987a. Germination rate at low temperature: rubber rabbitbrush population differences. *Journal of Range Management*. 40: 530–533.
- McArthur, E. D.; Monsen, S. B.; Welch, B. L. 1987b. Shrubs and forbs for revegetation plantings in the sagebrush ecosystem. In: Onsager, J. A., ed. *Integrated pest management in rangeland: state of the art in the sagebrush ecosystem symposium*; 1984 March 27–28; Reno, NV. ARS-50. Washington, DC: U.S. Department of Agriculture, Agricultural Research Service: 28–39.
- Meyer, S. E.; Kitchen, S. G.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987a. Addition of *Amelanchier alnifolia*—Saskatoon serviceberry to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 66–68.
- Meyer, S. E.; Kitchen, S. G.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987b. Addition of *Elymus elmoides*—bottlebrush squirreltail to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 59–61.
- Meyer, S. E.; Allen, P. A.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987c. Addition of *Penstemon eatonii*—firecracker penstemon to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 61.
- Meyer, S. E.; Allen, P. A.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987d. Addition of *Penstemon palmeri*—Palmer penstemon to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 62.
- Meyer, S. E.; Allen, P. A.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987e. Addition of *Penstemon strictus*—Rocky Mountain penstemon to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 62–63.
- Meyer, S. E.; Allen, P. A.; Wilson, G. R.; Davis, J. N.; Stevens, R. 1987f. Addition of *Secale montanum*—Mountain wildrye to the rules. *Newsletter of the Association of Official Seed Analysts*. 61(1): 63–65.
- Meyer, S. E.; McArthur, E. D. 1987. Studies on seed germination biology of rubber rabbitbrush. In: Johnson, K. L., ed. *Proceedings of the fourth Utah shrub ecology workshop: the genus Chrysothamnus*. 1986 September 17–19; Cedar City, UT. Logan: Utah State University, College of Natural Resources: 19–25.
- Meyer, S. E.; McArthur, E. D.; Monsen, S. B. 1987g. Intraspecific variation in germination patterns of rangeland shrubs and its relationship to seeding success. In: Frasier, G. W.; Evans, R., eds. *Seed and seedbed ecology of rangeland plants: proceedings of symposium*; 1987 April 21–23; Tucson, AZ. Tucson, AZ: U.S. Department of Agriculture, Agricultural Research Service: 82–92.
- Monsen, S. B. 1987. Shrub selections for pinyon-juniper plantings. In: Everett, R. L., comp. *Proceedings—pinyon-juniper conference*; 1986 January 13–16; Reno, NV. Gen. Tech. Rep. INT-215. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 316–329.
- Monsen, S. B.; Stevens, R. 1987. Seed and seedling characteristics of rabbitbrush. In: Johnson, K. L., ed. *Proceedings of the fourth Utah shrub ecology workshop: the genus Chrysothamnus*; 1986

- September 17–19; Cedar City, UT. Logan: Utah State University, College of Natural Resources: 41–49.
- Nelson, D. L. 1987. Susceptibility of antelope bitterbrush to seedbed damping-off disease. In: Frasier, G. W.; Evans, R., eds. Seed and seedbed ecology of rangeland plants: proceedings of symposium; 1987 April 21–23; Tucson, AZ. Tucson, AZ: U.S. Department of Agriculture, Agricultural Research Service: 117–121.
- O'Neal, G. T.; Flinders, J. T.; Clary, W. P. 1987. Behavioral ecology of the Nevada kit fox (*Vulpes macrotis nevadensis*) on a managed desert rangeland. In: Genoways, H. H., comp. Current Mammology, volume 1. New York, NY: Plenum Publishing Corporation: 443–481.
- Pope, C. A., III; Wagstaff, F. J. 1987a. An economic evaluation of the Oak Creek Range Management Area, Utah. Gen. Tech. Rep. INT-224. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 14 p.
- Pope, C. A., III; Wagstaff, F. J. 1987b. Economics of the Oak Creek range management project. Journal of Environmental Management. 25: 157–165.
- Provenza, F. D.; Flinders, J. T.; McArthur, E. D. 1987a. Introduction: plant-herbivore interactions. In: Provenza, F. D.; Flinders, J. T.; McArthur, E. D., comps. Proceedings—symposium on plant-herbivore interactions; 1985 August 7–9; Snowbird, UT. Gen. Tech. Rep. INT-222. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 1.
- Provenza, F. D.; Flinders, J. T.; McArthur, E. D., comps. 1987b. Proceedings—symposium on plant-herbivore interactions; 1985 August 7–9; Snowbird, UT. Gen. Tech. Rep. INT-222. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 179 p.
- Sanderson, S. C.; Pendleton, R. L.; McArthur, E. D.; Harper, K. T. 1987. Saponin effect on small mammal forage preference in a planting of *Atriplex canescens*. In: Provenza, F. D.; Flinders, J. T.; McArthur, E. D., comps. Proceedings—symposium on plant-herbivore interactions; 1985 August 7–9; Snowbird, UT. Gen. Tech. Rep. INT-222. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 74–77.
- Sankhla, N.; Davis, T. D.; Weber, D. J.; McArthur, E. D. 1987. Biology and economic botany of *Chrysothamnus* (rabbitbrush): a potentially useful shrub for arid regions. Journal of Economic and Taxonomic Botany. 10: 481–496.
- Stevens, R. 1987. Thirty years of pinyon-juniper big game habitat improvement projects: what have we learned? In: Everett, R. L., comp. Proceedings—pinyon-juniper conference; 1986 January 13–16; Reno, NV. Gen. Tech. Rep. INT-215. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 558–571.
- Stutz, H. C.; Sanderson, S. C.; McArthur, E. D.; Ge-lin, C. 1987. Chromosome races of *Grayia brandegei* (Chenopodiaceae). Madroño. 34: 142–149.
- Thorderson, L. G. 1987. Restoring estimability in designs with missing cells: an application to the analysis of livestock grazing patterns in southwestern Utah. Provo, UT: Brigham Young University. 79 p. Thesis.
- Tiedemann, A. R.; Clary, W. P.; Barbour, R. J. 1987a. Underground systems of Gambel oak (*Quercus gambelii*) in central Utah. American Journal of Botany. 74: 1065–1071.
- Tiedemann, A. R.; McArthur, E. D.; Freeman, D. C. 1987b. Variations in physiological metabolites and chlorophyll in sexual phenotypes of 'Rincon' fourwing saltbush. Journal of Range Management. 40: 151–155.
- Wagstaff, F. J. 1987. Economics of managing pinyon-juniper lands for woodland products. In: Everett, R. L., comp. Proceedings—pinyon-juniper conference; 1986 January 13–16; Reno, NV. Gen. Tech. Rep. INT-215. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 168–172.
- Wagstaff, F. J.; Pope, C. A., III. 1987. Finding the appropriate forage value for analyzing the feasibility of public range improvements. Res. Pap. INT-378. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 4 p.
- Weber, D. J.; Hegerhorst, D. F.; Davis, T. D.; McArthur, E. D. 1987. Potential uses of rubber rabbitbrush (*Chrysothamnus nauseosus*). In: Johnson, K. L., ed. Proceedings of the fourth Utah shrub ecology workshop: the genus *Chrysothamnus*. 1986 September 17–19; Cedar City, UT. Logan: Utah State University, College of Natural Resources: 27–33.
- Welch, B. L.; McArthur, E. D.; Rodriguez, R. L. 1987. Variation in utilization of big sagebrush accessions by wintering sheep. Journal of Range Management. 40: 113–115.
- Welsh, S. L.; Atwood, N. D.; Goodrich, S.; Higgins, L. C., eds. 1987. A Utah flora. Great Basin Naturalist Memoir No. 9. Provo, UT: Brigham Young University. 894 p.
- Whisenant, S. G.; Clary, W. P. 1987. Tebuthiuron distribution in soil following application of pellets. Journal of Environmental Quality. 16: 397–402.

1988

- Buman, R. A.; Monsen, S. B.; Abernathy, R. H. 1988. Seedling competition between mountain rye, Hycrest crested wheatgrass, and downy brome. Journal of Range Management. 41: 30–34.
- Clary, W. P.; Welch, B. L.; Booth, G. D. 1988. In vitro digestion experiments: importance of variation between inocula donors. Journal of Wildlife Management. 52: 358–361.
- Haws, B. A.; Roe, A. H.; Nelson, D. L. 1988. Index to information on insects associated with western wildland shrubs. Gen. Tech. Rep. INT-248. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 296 p.
- Hegerhorst, D. F.; Bhat, R. B.; Weber, D. J.; McArthur, E. D. 1988a. Seasonal changes of selected secondary plant products in *Chrysothamnus nauseosus* ssp. *turbinatus*. Great Basin Naturalist. 48: 1–8.
- Hegerhorst, D. F.; Weber, D. J.; Bhat, R. B.; Davis, T. D.; Sanderson, S. C.; McArthur, E. D. 1988b. Seasonal changes in rubber and resin contents in *Chrysothamnus nauseosus* ssp. *hololeucus* and ssp. *turbinatus*. Biomass. 15: 133–142.
- Huang, J.; Hess, W. M.; Weber, D. J.; McArthur, E. D.; Meyer, S. E.; Seegmiller, R. 1988. Computer analysis of cross sections of leaves of *Chrysothamnus* taxa and their relation to environmental conditions. Great Basin Naturalist. 48: 334–347.
- Kitchen, S. G. 1988. Germination studies with fifteen species of Intermountain penstemons. Provo, UT: Brigham Young University. 82 p. Thesis.
- McArthur, E. D. 1988. New plant development in range management. In: Tueller, P. T., ed. Vegetation science applications for rangeland analysis and management. Handbook of Vegetation Science 14. Dordrecht, Netherlands: Kluwer Academic Publishers: 81–112.
- McArthur, E. D.; Blauer, A. C.; Sanderson, S. C. 1988a. Mule deer-induced mortality of mountain big sagebrush. Journal of Range Management. 41: 114–117.
- McArthur, E. D.; Welch, B. L.; Sanderson, S. C. 1988b. Natural and artificial hybridization between big sagebrush (*Artemisia tridentata*) subspecies. Journal of Heredity. 79: 268–276.
- Meyer, S. E.; Kitchen, S. G.; Wilson, G. R.; Stevens, R. 1988a. Proposal: addition of *Artemisia ludoviciana*—Louisiana sagewort to the rules. Newsletter of the Association of Official Seed Analysts. 62(1): 15–16.
- Meyer, S. E.; Kitchen, S. G.; Wilson, G. R.; Stevens, R. 1988b. Proposal: addition of *Artemisia nova*—(syn. *Artemisia arbuscula* subsp. *nova*) black sagebrush to the rules. Newsletter of the Association of Official Seed Analysts. 62(1): 16–17.
- Meyer, S. E.; Kitchen, S. G.; Wilson, G. R.; Stevens, R. 1988c. Proposal: addition of *Artemisia tridentata*—big sagebrush to the rules. Newsletter of the Association of Official Seed Analysts. 62(1): 17–18.
- Meyer, S. E.; Kitchen, S. G.; Wilson, G. R.; Stevens, R. 1988d. Proposal: addition of *Ephreda viridis*—green Mormon tea to the rules. Newsletter of the Association of Official Seed Analysts. 62(1): 17–18.
- Pendleton, R. L.; McArthur, E. D.; Freeman, D. C.; Blauer, A. C. 1988. Heterodichogamy in *Grayia brandegei* (Chenopodiaceae): report from a new family. American Journal of Botany. 75: 267–274.
- Rodriguez, R. L. 1988. Sage grouse habitat locations and soil-plant relationships in Strawberry Valley, Utah. Provo, UT: Brigham Young University. 50 p. Thesis.
- Sanderson, S. C.; Ge-lin, C.; McArthur, E. D.; Stutz, H. C. 1988. Evolutionary loss of flavonoids and other chemical characters in the Chenopodiaceae. Biochemical Systematics and Ecology. 16: 143–149.

- Scott, L. F. 1988. Investigation of vegetation overlaying an oil field using Landsat imagery. Salt Lake City: University of Utah. 138 p. Thesis.
- Stevens, R. 1988. Characteristics of major grasses and forbs and multi-species mixtures in disturbed land rehabilitation. In: Proceedings—elk, agriculture, and mining expo; 1988 March 10—11; Elko, NV. Reno: Nevada Department of Agriculture: 80–90.
- Stevens, R.; Monsen, S. B. 1988a. 'Cedar' Palmer penstemon: a selected penstemon for semiarid ranges. *Rangelands*. 10: 163–164.
- Stevens, R.; Monsen, S. B. 1988b. 'Hatch' winterfat: a quality shrub for ranges and wildlands. *Rangelands*. 10: 104–105.
- Welch, B. L.; Jacobson, T. L. C. 1988. Root growth of *Artemisia tridentata*. *Journal of Range Management*. 41: 332–334.
- Welch, B. L.; Pederson, J. C.; Rodriguez, R. L. 1988. Selection of big sagebrush by sage grouse. *Great Basin Naturalist*. 48: 274–279.

1989

- Bhat, R. B.; Hegerhorst, D. F.; Weber, D. J.; Smith, B. N.; McArthur, E. D.; Chrominski, A. 1989. Microwave methods for rapid extraction of rubber and resin from plant tissue. *Phyton*. 49: 23–29.
- Clary, W. P. 1989. Test of RPA production coefficients and local assumptions for the pinyon-juniper ecosystem in central Utah. Res. Pap. INT-403. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 11 p.
- Emlen, J. M.; Freeman, D. C.; Wagstaff, F. J. 1989. Interaction assessment: rationale and test using desert plants. *Evolutionary Ecology*. 3: 115–149.
- Fang, N.; Mabry, T. J.; Sanderson, S. C. 1989. Isolation and identification of some flavonoids from canned spinach. *Revista Latinoamericana de Quimica*. 20: 42–44.
- Freeman, D. C.; McArthur, E. D. 1989. *Atriplex canescens*. In: Halevy, A. H., ed. CRC handbook of flowering, volume 4. Boca Raton, FL: CRC Press, Inc.: 75–86.
- Harper, K. T.; Sanderson, S. C.; McArthur, E. D.; Tuhy, J. S. 1989. Vegetation communities of Zion National Park. In: Twelfth annual report, 1988. Laramie: University of Wyoming, National Park Service Research Center: 207–214.
- Horton, W.; Bammer, R.; Gibbs, G.; Monsen, S. B.; Page, D.; Petersen, M.; Simper, T.; Stevens, R.; Whitesides, R.; Winward, A. H. 1989. Interagency forage and conservation planting guide for Utah. Circular EC 433. Logan: Utah Agricultural Experiment Station, Utah State University. 67 p.
- Kitchen, S. G.; Meyer, S. E.; Wilson, G. R.; Stevens, R. 1989a. Proposal: addition of *Cercocarpus ledifolius*—curlleaf mountain-mahogany to the rules. Association of Official Seed Analysts Newsletter. 63(1): 26–28.
- Kitchen, S. G.; Meyer, S. E.; Wilson, G. R.; Stevens, R. 1989b. Proposal: addition of *Cercocarpus montanus*—true mountain-mahogany to the rules. Association of Official Seed Analysts Newsletter. 63(1): 28–30.
- McArthur, E. D. 1989a. Breeding systems in shrubs. In: McKell, C. M., ed. The biology and utilization of shrubs. San Diego, CA: Academic Press: 341–361.
- McArthur, E. D. 1989b. Research consortium sponsors wildland shrub symposium. *Diversity* 5(2&3): 51–52.
- McArthur, E. D.; Sanderson, S. C.; Harper, K. T. 1989a. Expansion of the known distribution of the rare Zion tansy, *Sphaeromeria ruthiae* (Asteraceae). *Southwestern Naturalist*. 34: 441–443.
- McArthur, E. D.; Wallace, A.; Haferkamp, M. R. 1989b. Introduction: shrub ecophysiology and biotechnology. In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 1–3.
- Meyer, S. E. 1989. Warm pretreatment effects on antelope bitterbrush (*Purshia tridentata*) germination response to chilling. *Northwest Science*. 63: 146–153.
- Meyer, S. E.; Garcia-Moya, E. 1989. Plant community patterns and soil moisture regime in gypsum grasslands of north central Mexico. *Journal of Arid Environments*. 16: 147–155.
- Meyer, S. E.; Kitchen, S. L.; Wilson, G. R.; Stevens, R. 1989a. Proposal: addition of *Cowania mexicana*—cliffrose to the rules. Association of Official Seed Analysts Newsletter. 63(1): 24–25.
- Meyer, S. E.; McArthur, E. D.; Jorgensen, G. L. 1989b. Variation in germination response to temperature in rubber rabbitbrush (*Chrysothamnus nauseosus*: Asteraceae) and its ecological implications. *American Journal of Botany*. 76: 981–991.
- Meyer, S. E.; Monsen, S. B. 1989. Seed germination biology of antelope bitterbrush (*Purshia tridentata*). In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 147–157.
- Meyer, S. E.; Wilson, G. R.; Stevens, R. 1989c. Proposal: addition of *Chrysothamnus nauseosus*—rubber rabbitbrush to the rules. Association of Official Seed Analysts Newsletter. 63(1): 30–32.
- Nelson, D. L.; Harper, K. T.; Boyer, K. C.; Weber, D. J.; Haws, B. A.; Marble, J. R. 1989. Wildland shrub dieoffs in Utah: an approach to understanding the cause. In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 119–135.
- Nelson, D. L.; Lopez, C. F. 1989. Variation in nitrogen fixation among populations of *Frankia* sp. and *Ceanothus* sp. In: Actinorhizal association. *Biology and Fertility of Soils*. 7: 269–274.
- Pendleton, R. L.; Pendleton, B. K.; Harper, K. T. 1989. Breeding systems of woody plant species in Utah. In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 5–22.
- Rodriguez, R. L.; Welch, B. L. 1989. Effects of heavy grazing by mule deer on 'Hobble Creek' mountain big sagebrush seed stalk production. In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 141–143.
- Rosenstock, S. S.; Monsen, S. B.; Stevens, R.; Jorgensen, K. R. 1989. Mule deer diets on a chained central Utah pinyon-juniper range. Res. Pap. INT-410. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 4 p.
- Rosenstock, S. S.; Stevens, R. 1989. Herbivore effects on seeded alfalfa at four pinyon-juniper sites in central Utah. *Journal of Range Management*. 42: 483–489.
- Sanderson, S. C.; McArthur, E. D.; Stutz, H. C. 1989. A relationship between polyploidy and habitat in western shrub species. In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 23–30.
- Scott, L. F.; McCoy, R. M.; Wullstein, L. H. 1989. Anomaly may not reflect hydrocarbon seepage: Patrick Draw Field, Wyoming, revisited. *American Association of Petroleum Geologists Bulletin*. 73: 925–934.
- Stevens, R.; McArthur, E. D.; Winward, A. H. 1989. Identification characteristics of major sagebrush taxa and species adapted to areas inhabited by each. *Habitat Express* 89-1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 10 p.
- Wagstaff, F. J.; Reesman, D., comps. 1989. Multiple users-multiple products. Proceedings of a symposium, 42nd annual meeting of the Society for Range Management; 1989 February 21; Billings, MT. Corvallis, OR: Western Regional Coordinating Committee on Range Economics SRCC-55. 262 p.
- Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. 1989. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 183 p.

- Weber, D. J.; Hegerhorst, D. R.; Bhat, R. B.; Davis, T. D.; McArthur, E. D. 1989. Physiological changes in *Chrysothamnus nauseosus* in relation to rubber and resin products. In: Wallace, A.; McArthur, E. D.; Haferkamp, M. R., comps. Proceedings—symposium on shrub ecophysiology and biotechnology; 1987 June 30–July 2; Logan, UT. Gen. Tech. Rep. INT-256. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 173–183.
- Welch, B. L. 1989. Nutritive value of shrubs. In: McKell, C. M., ed. The biology and utilization of shrubs. San Diego, CA: Academic Press: 405–424.
- Welch, B. L.; Pederson, J. C.; Rodriguez, R. L. 1989. Monoterpenoid content of sage grouse ingesta. *Journal of Chemical Ecology*. 15: 961–969.
- Whisenant, S. G.; McArthur, E. D. 1989. Triclopyr persistence in northern Idaho forest vegetation. *Bulletin of Environmental Contamination and Toxicology*. 42: 660–665.
- Wood, S. M.; Newcomb, W.; Nelson, D. L. 1989. Fine structure of the microsymbiont of the actinorrhizal root nodules of mountain mahogany (*Cercocarpus ledifolius*, family Rosaceae). *Canadian Journal of Botany*. 67: 116–120.
- ## 1990
- Allen, P. S.; Meyer, S. E. 1990. Temperature requirements for seed germination of three *Penstemon* species. *HortScience*. 25: 191–193.
- Bhat, R. B.; Weber, D. J.; Hegerhorst, D. F.; McArthur, E. D. 1990a. Rubber and resin content in natural and uniform-garden populations of *Chrysothamnus nauseosus* subspecies. *Phyton*. 51: 35–42.
- Bhat, R. B.; Welch, B. L.; Weber, D. J.; McArthur, E. D. 1990b. Mid-winter protein, phosphorus, and digestibility of *Chrysothamnus nauseosus* subspecies. *Journal of Range Management*. 43: 177–179.
- Booth, G. D.; Welch, B. L.; Jacobson, T. L. C. 1990. Seedling growth rate of 3 subspecies of big sagebrush. *Journal of Range Management*. 43: 432–436.
- Davis, J. N. 1990. General ecology, wildlife use, and management of the mountain mahoganies in the Intermountain West. In: Johnson, K. L., ed. Proceedings of the 5th Utah shrub ecology workshop: the genus *Cercocarpus*; 1988 July 13–14; Logan, UT. Logan: Utah State University, College of Natural Resources: 1–13.
- Davis, J. N.; Harper, K. T. 1990. Weedy annuals and establishment of seeded species on a chained juniper-pinyon woodland in central Utah. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 72–79.
- Fairchild, J. A. 1990. Plant community and shrub vigor responses to one-way and two-way chaining of decadent big sagebrush on a critical mule deer winter range in southeastern Utah. Provo, UT: Brigham Young University. 70 p. Dissertation.
- Harper, K. T.; Sanderson, S. C.; McArthur, E. D. 1990a. Vegetation communities in Zion National Park. In: Thirteenth annual report, 1988. Laramie: University of Wyoming, National Park Service Research Center: 234–240.
- Harper, K. T.; Wagstaff, F. J.; Clary, W. P. 1990b. Shrub mortality over a 54-year period in a shadscale desert, west-central Utah. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 119–126.
- Haws, B. A.; Bohart, G. E.; Nelson, C. R.; Nelson, D. L. 1990. Insects and shrub dieoff in Western States: 1986–1989 survey results. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 127–151.
- Kitchen, S. G.; Meyer, S. E. 1990. Seed dormancy in two species of mountain mahogany (*Cercocarpus ledifolius* and *Cercocarpus montanus*). In: Johnson, K. L., ed. Proceedings of the 5th Utah shrub ecology workshop: the genus *Cercocarpus*; 1988 July 13–14; Logan, UT. Logan: Utah State University, College of Natural Resources: 27–41.
- McArthur, E. D. 1990. Introduction: cheatgrass invasion and shrub die-off. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 1–2.
- McArthur, E. D.; Blauer, A. C.; Stevens, R. 1990a. Forage kochia competition with cheatgrass in central Utah. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 56–65.
- McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, P. T., comps. 1990b. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 351 p.
- Medin, D. E. 1990a. Birds of a shadscale (*Atriplex confertifolia*) habitat in east central Nevada. *Great Basin Naturalist*. 50: 295–298.
- Medin, D. E. 1990b. Birds of an upper sagebrush-grass zone habitat in east-central Nevada. Res. Pap. INT-433. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 7 p.
- Meyer, S. E. 1990a. Places in the sun: story of Capitol Reef plants. Salt Lake City, UT: Lorraine Press. 75 p.
- Meyer, S. E. 1990b. Seed source differences in germination under snowpack in northern Utah. In: 5th Billings symposium on disturbed land rehabilitation: volume 1: hardrock waste, analytical and revegetation; 1990 March 25–30; Billings, MT. Bozeman: Montana State University, Reclamation Research Unit: 184–191.
- Meyer, S. E.; Monsen, S. B. 1990. Seed-source differences in initial establishment for big sagebrush and rubber rabbitbrush. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 200–208.
- Meyer, S. E.; Monsen, S. B.; McArthur, E. D. 1990. Germination response of *Artemisia tridentata* (Asteraceae) to light and chill: patterns of between-population variation. *Botanical Gazette*. 151: 176–183.
- Meyer, S. E.; Pendleton, R. L. 1990. Seed germination biology of spineless hopsage: between-population differences in dormancy and response to temperature. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 187–192.
- Monsen, S. B.; Meyer, S. E. 1990. Seeding equipment effects on establishment of big sagebrush on mine disturbances. In: 5th Billings symposium on disturbed land rehabilitation: volume 1: hardrock waste, analytical and revegetation; 1990 March 25–30; Billings, MT. Bozeman: Montana State University, Reclamation Research Unit: 192–199.
- Monsen, S. B.; Turnipseed, D. 1990. Seeding forage kochia into cheatgrass-infested rangelands. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 66–71.
- Monsen, S. B.; Vallentine, J. F.; Hoopes, K. H. 1990. Season dietary selection by beef cattle grazing mixed crested wheatgrass-forage kochia pastures. Proceedings, Western Section, American Society of Animal Science. 41: 300–303.

- Nelson, C. R.; Haws, B. A.; Nelson, D. L. 1990a. Mealybugs and related Homoptera of shadscale: possible agents in the dieoff problem in the Intermountain West. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 152–165.
- Nelson, D. L.; Weber, D. J.; Garvin, S. G. 1990b. The possible role of plant disease in the recent wildland shrub dieoff in Utah. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 84–90.
- Pendleton, B. K. 1990. Common garden studies of *Atriplex canescens*: effects of genetics and environment on growth, reproduction, and life history features. Detroit, MI: Wayne State University. 61 p. Dissertation.
- Pendleton, R. L.; Meyer, S. E. 1990. Seed germination biology of spineless hopsage: inhibition by bract leachate. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 181–186.
- Pope, C. A., III; Wagstaff, F. J. 1990. Economics of range improvement with prescribed fire. In: Baumgartner, D. M.; Grever, D. W.; Zamora, B. A.; Neuenschwander, L. F.; Wakimoto, R. H., comps. Prescribed fire in the Intermountain Region; forest site preparation and range improvement, symposium proceedings; 1986 March 3–5; Spokane, WA. Pullman: Washington State University, Conferences and Institutes: 117–121.
- Sabey, B. R.; Pendleton, R. L.; Webb, B. L. 1990. Effect of municipal sewage sludge application on growth of two reclamation shrub species in copper mine spoils. *Journal of Environmental Quality*. 19: 580–586.
- Sanderson, S. C.; Stutz, H. C.; McArthur, E. D. 1990. Geographic differentiation in *Atriplex confertifolia*. *American Journal of Botany*. 77: 490–498.
- Shaw, N. L.; Monsen, S. B. 1990. Use of sagebrush for improvement of wildlife habitat. In: Fisser, H. G., ed. Wyoming shrublands: aspen, sagebrush, and wildlife management, proceedings of the 17th Wyoming shrub ecology workshop; 1988 June 21–22; Jackson, WY. Laramie: University of Wyoming, Department of Range Management: 19–35.
- Stevens, R.; McArthur, E. D. 1990. 'Immigrant' forage kochia competition with halogeton following various seedling techniques. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 175–180.
- Stevens, R.; Meyer, S. E. 1990. Seed quality testing for range and wildland species. *Rangelands*. 12: 341–346.
- Stevenson, D. N.; Valcarce, R. V.; Smith, G. G.; Haws, B. A.; McArthur, E. D.; Welch, B. L.; Stutz, H. C. 1990. Multivariate statistical pattern recognition of curie-point pyrolysis-gas chromatographic fingerprints from rangeland shrubs. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 325–335.
- Stutz, H. C.; Chu, G.-L.; Sanderson, S. C. 1990. Evolutionary studies of *Atriplex*: phylogenetic relationships of *Atriplex pleiantha*. *American Journal of Botany*. 77: 364–369.
- Vallentine, J. F.; Monsen, S. B. 1990. Browse advantages. *Utah Cattleman*. 34 (10): 18.
- Van Pelt, N. S.; Stevens, R.; West, N. E. 1990. Survival and growth of immature *Juniperus osteosperma* and *Pinus edulis* following woodland chaining in central Utah. *Southwestern Naturalist*. 35: 322–328.
- Wagstaff, F. J.; Welch, B. L. 1990. Rejuvenation of mountain big sagebrush on mule deer winter ranges using on site plants as a seed source. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 171–174.
- Wallace, A.; Nelson, D. L. 1990. Wildland shrub dieoffs following excessively wet periods: a synthesis. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 81–83.
- Walser, R. H.; Weber, D. J.; McArthur, E. D.; Sanderson, S. C. 1990. Winter cold hardness of seven wildland shrubs. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 115–118.
- Weber, D. J.; Nelson, D. L.; Hess, W. M.; Bhat, R. B. 1990. Salinity and moisture stress in relation to dieoff of wildland shrubs. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 91–102.
- Welch, B. L.; McArthur, E. D. 1990. Big sagebrush—its taxonomy, origin, distribution, and utility. In: Fisser, H. G., ed. Wyoming shrublands: proceedings of the 14th Wyoming shrub ecology workshop; 1985 May 29–30; Rock Springs, WY. Laramie: University of Wyoming, Department of Range Management: 3–19.
- Welch, B. L.; Wagstaff, F. J.; Jorgensen, G. L. 1990a. 'Hobble Creek' mountain big sagebrush seed production. In: McArthur, E. D.; Romney, E. M.; Smith, S. D.; Tueller, Paul T., comps. Proceedings—symposium on cheatgrass invasion, shrub die-off, and other aspects of shrub biology and management; 1989 April 5–7; Las Vegas, NV. Gen. Tech. Rep. INT-276. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 167–170.
- Welch, B. L.; Wagstaff, F. J.; Williams, R. L. 1990b. Sage grouse status and recovery plan for Strawberry Valley, Utah. Res. Pap. INT-430. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 10 p.

1991

- Carlson, J. R.; Cunningham, R. A.; Everett, H. W.; Jacobsen, E. T.; Lorenz, D. G.; McArthur, E. D. 1991. Conservation tree and shrub cultivars in the United States. *Agric. Handb.* 692. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service. 50 p.
- Chu, G.-L.; Stutz, H. C.; Sanderson, S. C. 1991. Morphology and taxonomic position of *Suckeya suckleyana* (Chenopodiaceae). *American Journal of Botany*. 78: 63–68.
- Davis, J. N.; Brotherson, J. D. 1991. Ecological relationships of curlleaf mountain-mahogany (*Cercocarpus ledifolius* Nutt.) communities in Utah and implications for management. *Great Basin Naturalist*. 51: 153–166.
- Freeman, D. C.; Turner, W. A.; McArthur, E. D.; Graham, J. H. 1991. Characterization of a narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). *American Journal of Botany*. 78: 805–815.
- Kitchen, S. G.; Meyer, S. E. 1991. Seed germination of Intermountain penstemons as influenced by stratification and GA₃ treatments. *Journal of Environmental Horticulture*. 9: 51–56.
- McArthur, E. D. 1991. Intermountain consortium for arid lands research formed. *Great Basin Naturalist*. 51: 300.

- Megahan, W. F.; Monsen, S. B.; Wilson, M. D. 1991. Probability of sediment yields from surface erosion on granitic roadfills in Idaho. *Journal of Environmental Quality*. 20: 53–60.
- Meyer, S. E.; Monsen, S. B. 1991. Habitat-correlated variation in mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*) seed germination patterns. *Ecology*. 72: 739–742.
- Tippets, D.; Anderson, V. J. 1991. Partnership preserves historic range research sites. *Rangelands*. 13: 121–124.
- Wagstaff, F. J.; Welch, B. L. 1991. Seedstalk production of mountain big sagebrush enhanced through short-term protection from heavy browsing. *Journal of Range Management*. 44: 72–74.
- Welch, B. L.; Wagstaff, F. J.; Roberson, J. A. 1991. Preference of wintering sage grouse for big sagebrush. *Journal of Range Management*. 44: 462–465.
- Whisenant, S. G.; Wagstaff, F. J. 1991. Successional trajectories of a grazed salt desert shrubland. *Vegetatio*. 94: 133–140.

1992

- Byrd, D. W. 1992. Biochemical assessment of the hybrid zone formed by *Artemisia tridentata tridentata* and *Artemisia tridentata vaseyana* using an automated gas chromatography-data system and statistical methods. Detroit, MI: Wayne State University. 57 p. Thesis.
- Clary, W. P.; McArthur, E. D. 1992. Introduction: ecology and management of riparian shrub communities. In: Clary, W. P.; McArthur, E. D.; Bedunah, D.; Wambolt, C. L., comps. Proceedings—symposium on ecology and management of riparian shrub communities; 1991 May 29–31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 1–2.
- Clary, W. P.; McArthur, E. D.; Bedunah, D.; Wambolt, C. L., comps. 1992. Proceedings—symposium on ecology and management of riparian shrub communities; 1991 May 29–31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 232 p.
- Gunasekaran, M.; Weber, D. J.; Sanderson, S. C.; Devall, M. M. 1992. Reanalysis of the vegetation of Been Branch Gorge Research Natural Area, a hemlock-beech community on the Warrior River Basin of Alabama. *Castanea*. 57: 34–45.
- Harper, K. T.; Sanderson, S. C.; McArthur, E. D. 1992. Riparian ecology in Zion National Park, Utah. In: Clary, W. P.; McArthur, E. D.; Bedunah, D.; Wambolt, C. L., comps. Proceedings—symposium on ecology and management of riparian shrub communities; 1991 May 29–31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 32–41.
- Kitchen, S. G.; Meyer, S. E. 1992. Temperature-mediated changes in seed dormancy and light requirement for *Penstemon palmeri* (Scrophulariaceae). *Great Basin Naturalist*. 52: 53–58.
- McArthur, E. D. 1992. In memoriam—A. Perry Plummer (1911–1991): teacher, naturalist, range scientist. *Great Basin Naturalist*. 52: 1–10.
- McArthur, E. D.; Freeman, D. C.; Luckinbill, L. S.; Sanderson, S. C.; Noller, G. L. 1992. Are trioecy and sexual liability in *Atriplex canescens* genetically based: evidence from clonal studies. *Evolution*. 46: 1708–1721.
- McArthur, E. D.; Sanderson, S. C. 1992a. A comparison between xeroriparian and upland vegetation of Beaver Dam Slope, Utah. In: Clary, W. P.; McArthur, E. D.; Bedunah, D.; Wambolt, C. L., comps. Proceedings—symposium on ecology and management of riparian shrub communities; 1991 May 29–31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 25–31.
- McArthur, E. D.; Sanderson, S. C. 1992b. Great Sand Dune National Monument vegetation patterns. In: 15th annual report, 1991. Laramie: University of Wyoming, National Park Service Research Center: 185–189.
- Medin, D. E. 1992. Birds of a Great Basin sagebrush habitat in east-central Nevada. Res. Pap. INT-452. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 4 p.
- Megahan, W. F.; Monsen, S. B.; Wilson, M. C.; Lozano, N.; Haber, D. F.; Booth, G. D. 1992. Erosion control practices applied to granitic roadfills for forest roads in Idaho: cost effectiveness evaluation. *Land Degradation and Rehabilitation*. 3: 55–65.
- Meyer, S. E. 1992. Habitat correlated variation in firecracker penstemon (*Penstemon eatonii* Gray: Scrophulariaceae) seed germination response. *Bulletin of the Torrey Botanical Club*. 119: 268–279.
- Meyer, S. E.; Kitchen, S. G. 1992. Cyclic seed dormancy in the short-lived perennial *Penstemon palmeri*. *Journal of Ecology*. 80: 115–122.
- Meyer, S. E.; Monsen, S. B. 1992. Big sagebrush germination patterns: subspecies and population differences. *Journal of Range Management*. 45: 87–93.
- Mikhiel, G. S.; Meyer, S. E.; Pendleton, R. L. 1992. Variation in germination response to temperature and salinity in shrubby *Atriplex* species. *Journal of Arid Environments*. 22: 39–49.
- Monsen, S. B.; Meyer, S. E.; Carlson, S. C. 1992. Sagebrush establishment enhanced by snowfencing. In: U.S. Department of Agriculture, Forest Service, 1992 annual report, Rangeland Technology Equipment Council; 1992 February 9; Spokane, WA. Missoula, MT: U.S. Department of Agriculture, Forest Service, Missoula Technology and Equipment Development Center: 6–8.
- Nasr, M. A.; Monsen, S. B.; Meyer, S. E.; Belal, A. H. 1992. Effects of salt and temperature on germination of cheatgrass and small burnet. *Egyptian Journal of Applied Science*. 7(2): 1–10.
- Pendleton, B. K.; Freeman, D. C.; McArthur, E. D.; Pendleton, R. L. 1992a. Life history features of three sexual morphs of *Atriplex canescens* (Chenopodiaceae) clones grown in a common garden. *American Journal of Botany*. 79: 376–382.
- Pendleton, R. L.; Frischknecht, N. C.; McArthur, E. D. 1992b. Long-term survival of 20 selected plant accessions in a Rush Valley, Utah, planting. Res. Note INT-403. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 7 p.
- Pendleton, R. L.; Wagstaff, F. J.; Welch, B. L. 1992c. Winter nutrient content and deer use of Gambel oak twigs in north central Utah. *Great Basin Naturalist*. 52: 293–299.
- Stevens, A. R. 1992. Establishment and distribution of forage kochia seedlings within crested wheatgrass stands. Provo, UT: Brigham Young University. 38 p. Thesis.
- Stevens, R.; McArthur, E. D.; Davis, J. N. 1992. Reevaluation of vegetative cover changes, erosion, and sedimentation on two watersheds—1912–1983. In: Clary, W. P.; McArthur, E. D.; Bedunah, D.; Wambolt, C. L., comps. Proceedings—symposium on ecology and management of riparian shrub communities; 1991 May 29–31; Sun Valley, ID. Gen. Tech. Rep. INT-289. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 123–128.
- Weber, D. J.; Nelson, D. L. 1992. Die-off of Utah juniper: Natural Bridges National Monument. In: 15th annual report, 1991. Laramie: University of Wyoming, National Park Service Research Center: 205–208.
- Welch, B. L.; Nelson, D. L.; Young, S. A.; Sands, A. R.; Wagstaff, F. J.; Nelson, D. L. 1992a. 'Gordon Creek'—a superior, tested germplasm of Wyoming big sagebrush. Res. Pap. INT-461. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 7 p.
- Welch, B. L.; Wagstaff, F. J. 1992. 'Hobble Creek' big sagebrush vs. antelope bitterbrush as a winter forage. *Journal of Range Management*. 45: 140–142.
- Welch, B. L.; Young, S. A.; Shields, P. W. 1992b. 'Hobble Creek' mountain big sagebrush. In: *Habitat Express* 92-1. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Region. 6 p.
- Yorks, T. P.; West, N. E.; Capels, K. M. 1992. Vegetation differences in desert shrublands of western Utah's Pine Valley between 1933–1989. *Journal of Range Management*. 45: 569–578.

1993

- Allen, P. S.; Debaene, S. B. G.; Meyer, S. E. 1993. Regulation of grass seed germination under fluctuating moisture regimes. In: Dome, D.; Corbinau, F., eds. Fourth international workshop on seeds, basic and applied aspects of seed biology; 1992 July 20–14; Anger, France. Paris, France: Universite Pierre et Marie Curie: 387–392.
- Anderson, V. J.; Thompson, R. M. 1993. Chemical and mechanical control of false hellebore (*Veratrum californicum*) in an alpine

- community. Res. Pap. INT-469. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 6 p.
- Baskin, C. C.; Baskin, J. M.; Meyer, S. E. 1993. Seed dormancy in the Colorado Plateau shrub *Mahonia freemontii* (Berberidaceae) and its ecological and evolutionary implications. *Southwestern Naturalist*. 38: 91–99.
- Belal, A. H.; Rammah, A. M.; Hopkin, M. S.; Hansen, L. D.; McArthur, E. D. 1993. Studies of salt-tolerance and chemical analysis of fodder shrubs in Egypt and Utah (USA). In: Lieth, H.; Al Massoom, A., eds. *Towards a rational use of high salinity tolerant plants*, volume 2. Dordrecht, Netherlands: Kluwer Academic Publishers: 213–220.
- Belnap, J. 1993. Recovery rates of cryptobiotic crusts: inoculum use and assessment methods. *Great Basin Naturalist*. 53: 89–95.
- Belnap, J.; Gardner, J. S. 1993. Soil microstructure in soils of the Colorado Plateau: the role of cyanobacterium *Microcoleus vaginatus*. *Great Basin Naturalist*. 53: 40–47.
- Blauer, A. C.; McArthur, E. D.; Stevens, R.; Nelson, S. D. 1993. Evaluation of roadside stabilization and beautification plantings in south-central Utah. Res. Pap. INT-462. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 65 p.
- Chambers, J. C.; Norton, B. E. 1993. Effects of grazing and drought on population dynamics of salt desert shrub species on the Desert Experimental Range, Utah. *Journal of Arid Environments*. 24: 261–275.
- Freeman, D. C.; McArthur, E. D.; Sanderson, S. C.; Tiedemann, A. R. 1993a. Influence of topography on cumulative pollen flow of fourwing saltbush. Res. Note INT-413. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 9 p.
- Freeman, D. C.; McArthur, E. D.; Sanderson, S. C.; Tiedemann, A. R. 1993b. The influence of topography on male and female fitness components of *Atriplex canescens*. *Oecologia*. 93: 538–547.
- Harper, K. T.; Pendleton, R. L. 1993. Cyanobacteria and cyanolichens: can they enhance availability of essential minerals for higher plants. *Great Basin Naturalist*. 53: 59–72.
- Haws, B. A.; Bohart, G. E.; Nelson, C. R.; Nelson, D. L. 1993. Insects and their relationship to widespread shrub-dieoff in the Intermountain West of North America. In: Gaston, A.; Kenick, M.; Le Honérou, eds. *Proceedings of the Fourth International Rangeland Congress; 1991 April 22–26; Montpellier, France*. Montpellier, France: Association Francaise de Pastoralisme: 474–478.
- McArthur, E. D. 1993. Shrub genetic diversity and development. In: Gaston, A.; Kenick, M.; Le Honérou, eds. *Proceedings of the Fourth International Rangeland Congress; 1991 April 22–26; Montpellier, France*. Montpellier, France: Association Francaise de Pastoralisme: 392–396.
- Meyer, S. E.; Monsen, S. B. 1993. Genetic considerations in propagating native shrubs, forbs, and grasses from seed. In: Landis, T. D., tech. coord. *Proceedings, Western Forest Nursery Association; 1992 September 14–18; Fallen Leaf, CA*. Gen. Tech. Rep. RM-221. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station: 47–54.
- Monsen, S. B.; Anderson, V. J. 1993. A 52-year ecological history of selected introduced and native grasses planted in central Idaho. In: *Proceedings of the XVII International Grassland Congress; 1993 February 8–21; Palmerston North, New Zealand*. Palmerston North, New Zealand: Keeling & Mundy (1983) Ltd.: 1740–1741.
- Pellant, M.; Monsen, S. B. 1993. Rehabilitation on public rangelands in Idaho, USA: a change in emphasis from grass monocultures. In: *Proceedings of the XVII International Grassland Congress; 1993 February 8–21, Palmerston North, New Zealand*. Palmerston North, New Zealand: Keeling & Mundy (1983) Ltd.: 778–779.
- Stutz, H. C.; Chu, G.-L.; Sanderson, S. C. 1993. Resurrection of the genus *Endolepis* and clarification of *Atriplex phyllostegia* (Chenopodiaceae). *American Journal of Botany*. 80: 592–597.
- Walker, S. C. 1993. Effects of cattle and big game on the secondary succession of aspen-conifer understory following fire. Provo, UT: Brigham Young University. 44 p. Thesis.
- Weber, D. J.; Hegerhorst, D. F.; Bhat, R. B.; McArthur, E. D. 1993. Rubber rabbitbrush (*Chrysothamnus nauseosus*), a multi-use desert shrub. In: Lieth, H.; Al Massoom, A., eds. *Towards a rational use of high salinity tolerant plants*, volume 2. Dordrecht, Netherlands: Kluwer Academic Publishers: 343–350.
- Weber, D. J.; Nelson, D. L. 1993. Die-off of Utah Juniper: Natural Bridges National Monument. In: *Sixteenth annual report, 1992*. Laramie: University of Wyoming, National Park Service Research Center: 167–171.
- Welch, B. L. 1993. Strategies for maintenance and restoration of soil, water, flora, and fauna resources in a cold temperate rangeland. I. Grass is not always king; manage for diversity. In: *Proceedings of the XVII International Grassland Congress; 1993 February 8–21; Palmerston North, New Zealand*. Palmerston North, New Zealand: Keeling & Mundy (1983) Ltd.: 1775–1777.

1994

- Allen, P. S.; Debaene-Gill, S. B.; Meyer, S. E. 1994. Regulation of germination timing in facultatively fall-emerging grasses. In: Monsen, S. B.; Kitchen, S. G., comps. *Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID*. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 215–219.
- Austin, D. D.; Stevens, R.; Jorgensen, K. R.; Urness, P. J. 1994. Preferences of mule deer for 16 grasses found on Intermountain winter ranges. *Journal of Range Management*. 47: 308–311.
- Beckstead, J. 1994. Between-population differences in the germination ecophysiology of cheatgrass (*Bromus tectorum*) and squirreltail (*Elymus elmoides*) during after-ripening. Provo, UT: Brigham Young University. 101 p. Thesis.
- Belnap, J.; Harper, K. T.; Warren, S. D. 1994. Surface disturbance cryptobiotic soil crusts: nitrogenase activity, chlorophyll content, and chlorophyll degradation. *Arid Soil Research and Rehabilitation*. 8: 1–8.
- Criddle, R. S.; Hopkin, M. S.; McArthur, E. D.; Hansen, L. D. 1994. Plant distribution and the temperature coefficient of metabolism. *Plant, Cell, and Environment*. 17: 233–243.
- Davis, J. N. 1994a. Curlleaf mountain-mahogany: SRM 415. In: Shiflet, T. N., ed. *Rangeland cover types of the United States*. Denver, CO: Society for Range Management: 54–55.
- Davis, J. N. 1994b. Littleleaf mountain-mahogany: SRM 417. In: Shiflet, T. N., ed. *Rangeland cover types of the United States*. Denver, CO: Society for Range Management: 56.
- Davis, J. N. 1994c. Mountain-mahogany types. In: Shiflet, T. N., ed. *Rangeland cover types of the United States*. Denver, CO: Society for Range Management: 54.
- Davis, J. N. 1994d. True mountain-mahogany: SRM 416. In: Shiflet, T. N., ed. *Rangeland cover types of the United States*. Denver, CO: Society for Range Management: 55–56.
- Hall, D. B. 1994. Shrub recruitment inhibition in different herbaceous understories. Provo, UT: Brigham Young University. 58 p. Thesis.
- Harper, K. T.; McArthur, E. D. 1994. Gambel oak: SRM 413. In: Shiflet, T. N., ed. *Rangeland cover types of the United States*. Denver, CO: Society for Range Management: 51–53.
- Katzner, T. E. 1994. Winter ecology of the pygmy rabbit (*Brachylagus idahoensis*) in Wyoming. Laramie: University of Wyoming. 125 p. Thesis.
- Kitchen, S. G. Perennial forb life-history strategies on semiarid rangelands: implications for revegetation. In: Monsen, S. B.; Kitchen, S. G., comps. *Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID*. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 342–346.
- Kitchen, S. G.; Monsen, S. B. 1994. Germination rate and emergence success in bluebunch wheatgrass. *Journal of Range Management*. 47: 145–150.
- Klemmedson, J. O.; Tiedemann, A. R. 1994. Soil and vegetation development in an abandoned sheep corral on degraded subalpine rangeland. *Great Basin Naturalist*. 54: 301–312.
- McArthur, E. D. 1994. Ecology, distribution, and values of sagebrush within the Intermountain region. In: Monsen, S. B.; Kitchen, S. G., comps. *Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID*. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 347–351.
- McArthur, E. D.; Sanderson, S. C.; Webb, B. L. 1994. Nutritive quality and mineral content of potential desert tortoise food plants. Res.

- Pap. INT-473. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 26 p.
- Meyer, S. E. 1994. Germination and establishment ecology of big sagebrush; implications for community restoration. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 244–251.
- Meyer, S. E.; Kitchen, S. G. 1994a. Life history variation in blue flax (*Linum perenne*: Linaceae): seed germination phenology. *American Journal of Botany*. 81: 528–535.
- Meyer, S. E.; Kitchen, S. G. 1994b. Habitat-correlated variation in seed germination response to chilling in *Penstemon* section *Glabri* (Scrophulariaceae). *American Midland Naturalist*. 132: 349–365.
- Monsen, S. B. 1994a. Selection of plants for fire suppression on semiarid sites. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 363–373.
- Monsen, S. B. 1994b. The competitive influences of cheatgrass (*Bromus tectorum*) on site restoration. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 43–50.
- Monsen, S. B.; Kitchen, S. G., comps. 1994. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 416 p.
- Mudge, J. 1995. A genetic map of *Saccharum officinarum* (La Purple) using RAPD single-dose markers. Provo, UT: 33 p. Thesis.
- Pendleton, B. K.; Freeman, D. C.; McArthur, E. D.; Pendleton, R. L. 1994. Growth, reproduction, and life history features of fourwing saltbush grown in a common garden. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 136–139.
- Pendleton, R. L.; McArthur, E. D. 1994. Reproductive biology of bitterbrush: interaccessional hybridization grown in a common garden. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 268–270.
- Sanderson, S. C.; Stutz, H. C. 1994a. High chromosome numbers in Mojavean and Sonoran Desert *Atriplex canescens* (Chenopodiaceae). *American Journal of Botany*. 81: 1045–1053.
- Sanderson, S. C.; Stutz, H. D. 1994b. Woody chenopods useful for rangeland reclamation in Western North America. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 374–378.
- Stevens, R. 1994. Interseeding and transplanting to enhance species composition. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 300–306.
- Stevens, R.; Jorgensen, K. R. 1994. Rangeland species germination through 25 and up to 40 years. In: Monsen, S. B.; Kitchen, S. G., comps. Proceedings—ecology and management of annual rangelands; 1992 May 18–21; Boise, ID. Gen. Tech. Rep. INT-GTR-313. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 257–265.
- Stutz, H. C.; Chu, G.-L.; Sanderson, S. C. 1994. *Atriplex asterocarpa* (Chenopodiaceae), a new species from southern Utah and northern Arizona. *Madroño*. 41: 199–204.
- Upper Colorado Environmental Plant Center; Utah Division of Wildlife Resources: Colorado Agricultural Experiment Station—Colorado State University; Utah Agricultural Experiment Station—Utah State University; U.S. Department of Agriculture, Forest Service, Intermountain Research Station—Shrub Sciences Laboratory; U.S. Department of Agriculture, Agricultural Research Service—Forage and Range Research Laboratory; U.S. Department of Agriculture—Soil Conservation Service—Ecological Sciences Division. 1994. Notice of naming and release of 'Timp' Utah sweetvetch (*Hedysarum boreale* Nutt.) for soil improvement and early spring forage for both wildlife and livestock. Meeker, CO: Upper Colorado Environmental Plant Center. 4 p.
- Weber, D. J.; Gang, D. R.; Halls, S. C.; Smith, B. N.; McArthur, E. D. 1994. Inheritance of hydrocarbons in subspecific big sagebrush (*Artemisia tridentata*) hybrids. *Biochemical Systematics and Ecology*. 22: 689–697.
- Welch, B. L. 1994. Rangeland shrubs. In: Arntzen, C. J., ed. *Encyclopedia of agricultural science*, volume 3. San Diego, CA: Academic Press: 575–586.
- Welch, B. L.; Briggs, S. F.; Young, S. A. 1994. Pine Valley Ridge source—a superior selected germplasm of black sagebrush. Res. Pap. INT-474. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 9 p.
- Welsh, S. L. 1994. New taxa and new nomenclatural combinations in the Utah flora. *Rhodora*. 95: 392–421.
- Yorks, T. P.; West, N. E.; Capels, K. M. 1994. Changes in pinyon-juniper woodlands in western Utah's Pine Valley between 1933–1989. *Journal of Range Management*. 47: 359–364.

1995

- Allen, P. S.; Meyer, S. E.; Beckstead, J. 1995. Patterns of seed after-ripening in *Bromus tectorum*. *Journal of Experimental Botany*. 46: 1737–1744.
- Beckstead, J.; Meyer, S. E.; Allen, P. S. 1995. Effects of after-ripening on cheatgrass (*Bromus tectorum*) and squirreltail (*Elymus elmoides*) germination. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 165–172.
- Belnap, J.; Harper, K. T. 1995. Influence of cryptobiotic soil crusts on elemental content of tissue of two desert seed plants. *Arid Soil Research and Rehabilitation*. 9: 107–115.
- Davis, J. N.; Vernon, J. L.; Smith, B. H.; Applegate, C. K.; Farmer, M. E.; Kinnard, C.; Scott, J. 1995a. Utah big game range trend studies, 1990. Publ. 95-11. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 655 p.
- Davis, James N.; Vernon, J. L.; Farmer, M. E. 1995b. Utah big game range trend studies, 1991. Publ. 95-22. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 563 p.
- Farmer, M. E. 1995. The effect of anchor chaining pinyon-juniper woodland on watershed values and big game animals in central Utah. Provo, UT: Brigham Young University. 46 p. Thesis.
- Freeman, D. C.; Emlen, J. M. 1995. Assessment of interspecific interactions in plant communities: an illustration from the cold desert saltbush grasslands of North America. *Journal of Arid Environments*. 31: 179–198.
- Freeman, D. C.; Graham, J. H.; Byrd, D. W.; McArthur, E. D.; Turner, W. A. 1995. Narrow hybrid zone between two subspecies of big sagebrush, *Artemisia tridentata* (Asteraceae). III. Developmental instability. *American Journal of Botany*. 82: 1144–1152.
- Graham, J. H.; Freeman, D. C.; McArthur, E. D. 1995. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). II. Selection gradients and hybrid fitness. *American Journal of Botany*. 82: 709–716.
- Grover, M. C.; DeFalco, L. A. 1995. Desert tortoise (*Gopherus agassizii*): status-of-knowledge outline with references. Gen. Tech. Rep. INT-GTR-316. U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 134 p.
- Hall, D. B.; Monsen, S. B.; Anderson, V. J. 1995. Influence of herbaceous understory on native shrub recruitment. *Rangelands*. 17: 12–14.
- Kitchen, S. G. 1995. Return of the native: a look at select accessions of North American Lewis flax. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 321–326.

- McArthur, E. D.; Blauer, A. C.; Monsen, S. B.; Sanderson, S. C. 1995a. Plant inventory, succession, and reclamation alternatives on disturbed lands in Grand Teton National Park. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 343–358.
- McArthur, E. D.; Stevens, R.; Monsen, S. B. 1995b. Adaptation and success of big sagebrush and rubber rabbitbrush on disturbed lands. In: Shuman, G. E.; Vance, G. F., eds. Proceedings of the 12th annual national meeting of the American Society for Surface Mining and Reclamation; 1995 June 3–8; Gillette, WY. Princeton, WV: American Society for Surface Mining and Reclamation: 811–823.
- McArthur, E. D.; Tausch, R. J. 1995. Genetic aspects of the biodiversity of rangeland plants. In: West, N. E., ed. Biodiversity on rangelands. Logan: Utah State University, College of Natural Resources. Natural Resources and Environmental Issues. IV: 5–20.
- Memmott, K. L. 1995. Seasonal dynamics of forage shrub nutrients and season grazing impact on cryptogamic crusts. Provo, UT: Brigham Young University. 42 p. Thesis.
- Meyer, S. E.; Beckstead, J.; Allen, P. S.; Pullman, H. 1995a. Germination ecophysiology of *Leymus cinereus* (Poaceae). International Journal of Plant Science. 156: 206–215.
- Meyer, S. E.; Kitchen, S. G. 1995. First the seed: a restorationist's perspective. Hortus Northwest. 6(2): 4–8, 42–43.
- Meyer, S. E.; Kitchen, S. G.; Carlson, S. L. 1995b. Seed germination timing patterns in Intermountain *Penstemon* (Scrophulariaceae). American Journal of Botany. 82: 377–389.
- Monsen, S. B.; McArthur, E. D. 1995. Implications of early Intermountain range and watershed restoration practices. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 16–25.
- Moore, K. D. 1995. Effects of seed size on germination and emergence of burnet (*Sanguisorba*) Scop. (Rosaceae) and variation in drought tolerance within and among ecotypes of small burnet (*Sanguisorba minor*) Scop. (Rosaceae). Provo, UT: Brigham Young University. 76 p. Thesis.
- Pendleton, B. K.; Meyer, S. E.; Pendleton, R. L. 1995. Blackbrush ecology: insights after three years of a long-term study. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 223–227.
- Ramsey, T.; Stutz, H. C.; Nelson, D. L. 1995. Seeding failure in *Atriplex* (Chenopodiaceae) due to "damping-off". In: Shuman, G. E.; Vance, G. F., eds. Proceedings of the 12th annual national meeting of the American Society for Surface Mining and Reclamation; 1995 June 3–8; Gillette, WY: 757–761.
- Roundy, B. A.; McArthur, E. D. 1995. Introduction: wildland shrub and arid land restoration. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 1–2.
- Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. 1995. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 384 p.
- Shaw, N. L.; Monsen, S. B. 1995. 'Lassen' antelope bitterbrush. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 364–371.
- Thacker, R. K. 1995. Comparison and use of four techniques for censusing three sub-species of kit fox. Provo, UT: Brigham Young University. 71 p. Thesis.
- Walker, S. C.; Stevens, R.; Monsen, S. B.; Jorgensen, K. R. 1995. Interaction between native and seeded introduced grasses for 23 years following chaining of juniper-pinyon woodlands. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 372–380.
- Weber, D. J.; Gang, D.; Halls, S.; Nelson, D. L. 1995. Juniper decline in Natural Bridges National Monument and in Canyonlands National Park. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 358–262.
- Welch, B. L. 1995. Beyond twelve percent purity. In: Roundy, B. A.; McArthur, E. D.; Haley, J. S.; Mann, D. K., comps. Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19–21; Las Vegas, NV. Gen. Tech. Rep. INT-GTR-315. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 126–129.
- Welch, B. L.; Cox, C. L.; Sales, T. K. 1995. Strutting sounds and strutting posturing of two Utah sage grouse populations. Res. Pap. INT-RP-485. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 8 p.
- Welch, B. L.; Nelson, D. L. 1995. Black stem rust reduces big sagebrush seed production. Journal of Range Management. 48: 398–401.
- Winward, A. H.; McArthur, E. D. 1995. Lahontan sagebrush (*Artemisia arbuscula* ssp. *longicaulis*): a new taxon. Great Basin Naturalist. 55: 151–157.
- Young, S. A.; Kitchen, S. G.; Armstrong, G.; Watson, V. 1995. AOSCA approves certification guidelines for wild land collected seed. Seed World 133(1): 20–21.

1996

- Alzerreca-Angelo, H. 1996. Spatial and temporal dynamics of plant populations in salt-desert shrub vegetation grazed by sheep. Logan: Utah State University. 292 p. Dissertation.
- Applegate, C. K. 1996. Allocation of forage among elk and cattle and vegetative composition of several joint elk-cattle use ranges in eastern Utah. Provo, UT: Brigham Young University. 66 p. Thesis.
- Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. 1996. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 275 p.
- Beck, J. L. 1996. Elk and domestic sheep interactions in an aspen-dominated ecosystem: use of, and impact on vegetation, habitat, and minerals, as well as implications for ecosystem management. Provo, UT: Brigham Young University. 396 p. Thesis.
- Beck, J. L.; Flinders, J. T.; Nelson, D. R.; Clyde, C. L. 1996a. Dietary overlap and preference of elk and domestic sheep in aspen-dominated habitats in north-central Utah. In: Evans, K. E., comp. Sharing common ground on Western rangelands: proceedings of a livestock/big game symposium; 1996 February 26–28; Sparks, NV. Gen. Tech. Rep. INT-GTR-343. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 81–85.
- Beck, J. L.; Flinders, J. T.; Nelson, D. R.; Clyde, C. L.; Smith, H. D.; Hardin, P. J. 1996b. Elk and domestic sheep interaction in a north-central Utah aspen ecosystem. Res. Pap. INT-RP-491. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 114 p.
- Beckstead, J.; Meyer, S. E.; Allen, P. S. 1996. *Bromus tectorum* seed germination: between-population and between-year variation. Canadian Journal of Botany. 74: 875–882.
- Belnap, J. 1996. Soil surface disturbances in cold deserts: effects on nitrogenase activity in cyanobacterial-lichen soil crusts. Biology and Fertility of Soils. 23: 362–367.
- Buttars, S. M. 1996. Pelletized cyanobacterial soil amendments: laboratory testing for survival, escapability, and nitrogen fixation. Provo, UT: Brigham Young University. 43 p. Thesis.
- Christensen, M.; Meyer, S. C.; Allen, P. S. 1996. A hydrothermal time model of seed after-ripening in *Bromus tectorum* L. Seed Science Research. 6: 155–163.

- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Applegate, C. K. 1996a. Utah big game range trend studies, 1993. Publ. 96-18. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 118 p.
- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Kelley, D. C. 1996b. Utah big game range trend studies, 1992. Publ. 96-10. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 513 p.
- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Kelley, D. C.; Baldwin, B. D.; Green, A. D. 1996c. Utah big game range trend studies, 1994, volume 1. Publ. 96-23. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 475 p.
- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Kelley, D. C. 1996d. Utah big game range trend studies, 1994, volume 2. Publ. 96-24. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 348 p.
- Emlen, J. M.; Freeman, D. C.; Escos, J. M.; Alados, C. L. 1996. Interaction assessment: predicting the impacts of alternate range management actions. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 178–181.
- Freeman, D. C.; Emlen, J. M.; Graham, J. H.; Mara, R. L.; Tracy, M.; Alados, C. L. 1996. Developmental instability as a bioindicator of ecosystem health. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 170–177.
- Garvin, S. C.; Meyer, S. E.; Carlson, S. L. 1996. Seed germination studies in *Atriplex confertifolia* (Torr. & Frem.) Wats. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 165–169.
- Harper, K. T.; Van Buren, R.; Kitchen, S. G. 1996. Invasion of alien annuals and ecological consequences in salt desert shrubs of western Utah. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 58–65.
- Kitchen, S. G.; Hall, D. B. 1996a. Community stability in a salt-desert shrubland grazed by sheep: the Desert Experimental Range story. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 102–107.
- Kitchen, S. G.; Hall, D. B. 1996b. Diversity and sheep grazing-induced compositional shifts in salt-desert communities (USA). In: West, N. E., ed. Rangelands in a sustainable biosphere, proceedings of the Fifth International Rangeland Congress; 1995 July 23–28; Salt Lake City, UT. Volume 1. Denver, CO: Society for Range Management: 292–293.
- Kitchen, S. G.; McArthur, E. D. 1996. Desert Experimental Range. In: Schmidt, W. C.; Friede, J. L., comps. Experimental forests, ranges, and watersheds in the Northern Rocky Mountains: a compendium of outdoor laboratories in Utah, Idaho, and Montana. Gen. Tech. Rep. INT-GTR-334. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 15–21.
- Kitchen, S. G.; Monsen, S. B. 1996. Arrowleaf balsamroot (*Balsamorhiza sagittata*) seed germination and establishment success (Utah). Restoration & Management Notes. 14: 180–181.
- Liao, J. 1996. Phenological development and seed germination characteristics of rush skeletonweed in southwestern Idaho. Provo, UT: Brigham Young University. 57 p. Thesis.
- McArthur, E. D.; Monsen, S. B. 1996. Great Basin Experimental Range. In: Schmidt, W. C.; Friede, J. L., comps. Experimental forests, ranges, and watersheds in the Northern Rocky Mountains: a compendium of outdoor laboratories in Utah, Idaho, and Montana. Gen. Tech. Rep. INT-GTR-334. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 23–30.
- McArthur, E. D.; Ott, J. E. 1996. Potential natural vegetation in the 17 conterminous Western United States. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 16–28.
- McArthur, E. D.; Sanderson, S. C. 1996. Twist Hollow: a Mojave Desert restoration project. In: West, N. E., ed. Rangelands in a sustainable biosphere, proceedings of the Fifth International Rangeland Congress; 1995 July 23–28; Salt Lake City, UT. Volume 1. Denver, CO: Society for Range Management: 350–351.
- McArthur, E. D.; Sanderson, S. C.; Davis, J. N. 1996. Adaptation of forage kochia accessions across an environmental gradient in Rush Valley, Utah. Arid Soil Research and Rehabilitation. 10: 125–138.
- Messina, F. J.; Richards, J. H.; McArthur, E. D. 1996. Variable responses of insects to hybrid versus parental sagebrush in common gardens. Oecologia. 107: 513–521.
- Meyer, S. E. 1996. Native versus native: an ecologist's perspective. In: Keammerer, W. R., ed. High altitude revegetation workshop 12; 1996 February 21–23; Fort Collins, CO. Information Series 83. Fort Collins, CO: Colorado State University, Colorado Water Resources Research Institute: 48–55.
- Monaco, T. A. 1996. Use of dark respiration to determine optimal adaptability in native Great Basin plant species. Provo, UT: Brigham Young University. 74 p. Thesis.
- Monaco, T. A.; Smith, B. N.; Hemming, D.; Hansen, L. D.; Monsen, S. B.; Carlson, S. L. 1996. Dark respiration comparisons of forbs and grasses from common gardens. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 210–213.
- Monsen, S. B.; Shaw, N. L. 1996. Interseeding fourwing saltbush (*Atriplex canescens*) with crested wheatgrass (*Agropyron cristatum*) for winter livestock grazing. In: West, N. E., ed. Rangelands in a sustainable biosphere, proceedings of the Fifth International Rangeland Congress; 1995 July 23–28; Salt Lake City, UT. Volume 1. Denver, CO: Society for Range Management: 381–382.
- Monsen, S. B.; Stevens, R.; Walker, S. C. 1996. The competitive influence of seeded smooth brome (*Bromus inermis*) and intermediate wheatgrass (*Thinopyron intermedium*) within aspen-mountain brush communities of central Utah. In: West, N. E., ed. Rangelands in a sustainable biosphere, proceedings of the Fifth International Rangeland Congress; 1995 July 23–28; Salt Lake City, UT. Volume 1. Denver, CO: Society for Range Management: 379–380.
- Pendleton, R. L.; Nelson, S. D.; Rodriguez, R. L. 1996. Do soil factors determine the distribution of spineless hopsage (*Grayia brandegei*)? In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 205–209.
- Pendleton, R. L.; Warren, S. D. 1996. Effects of cryptobiotic soil crusts and VA mycorrhizal inoculation on growth of five rangeland plant species. In: West, N. E., ed. Rangelands in a sustainable biosphere, proceedings of the Fifth International Rangeland Congress; 1995 July 23–28; Salt Lake City, UT. Volume 1. Denver, CO: Society for Range Management: 436–437.
- Ruas, C. de F. 1996. Cytogenetic and molecular studies in the genus *Atriplex*. Provo, UT: Brigham Young University. 113 p. Dissertation.
- Stevens, R.; Jorgensen, K. R.; Young, S. A.; Monsen, S. B. 1996. Forb and shrub seed production guide for Utah. Logan, UT: Utah State University Extension Service. 51 p.
- Stevens, R.; Walker, S. C. 1966. Juniper-pinyon population dynamics over 30 years following anchor chaining. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment;

- 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 125–128.
- Tiedemann, A. R.; Clary, W. P. 1996. Nutrient distribution in *Quercus gambelii* stands in central Utah. Great Basin Naturalist. 56: 119–128.
- Vogler, D. R.; Cobb, F. W., Jr.; Geils, B. W.; Nelson, D. L. 1996. Isozyme diversity among hard pine stem rust fungi in the Western United States. Canadian Journal of Botany. 74: 1058–1070.
- Walker, S. C.; Mann, D. K.; McArthur, E. D. 1996. Plant community changes over 54 years within the Great Basin Experimental Range, Manti-La Sal National Forest. In: Barrow, J. R.; McArthur, E. D.; Sosebee, R. E.; Tausch, R. J., comps. Proceedings: shrubland ecosystem dynamics in a changing environment; 1995 May 23–25; Las Cruces, NM. Gen. Tech. Rep. INT-GTR-338. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 66–68.
- Wang, Z. 1996. Ecological analysis of a stable hybrid zone between two big sagebrush subspecies (*Artemisia tridentata* ssp. *tridentata* and *A. t.* ssp. *vaseyana*) in Utah. Detroit, MI: Wayne State University. 132 p. Dissertation.
- Welch, B. L. 1996. Effects of humidity on storing big sagebrush seed. 1996. Res. Pap. INT-RP-493. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 5 p.
- Welch, B. L.; Briggs, S. F.; Johansen, J. H. 1996. Big sagebrush seed storage. Res. Note INT-RN-430. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 3 p.

1997

- Currans, S. P.; Kitchen, S. G.; Lambert, S. M. 1997. Ensuring identity and quality of native seeds. In: Shaw, N. L.; Roundy, B. A., comps. Proceedings: using seed of native species on rangelands; 1997 February 18; Rapid City, SD. Gen. Tech. Rep. INT-GTR-372. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station: 17–20.
- Freeman, D. C.; Lovett Doust, J.; El-Keblawy, A.; Miglia, K. J.; McArthur, E. D. 1997. Sexual specialization and inbreeding avoidance in the evolution of dioecy. Botanical Review. 63: 65–92.
- Jones, A. R. 1997. Calorimetric studies of stress effects on the respiration and growth of radish, small burnet, and alfalfa. Provo, UT: Brigham Young University. 74 p. Thesis.
- Meyer, S. E. 1997a. *Arctomecon*. In: Flora of North America, North of Mexico, Volume 3. New York: 312–313.
- Meyer, S. E. 1997b. Ecological correlates of achene mass variation in *Chrysothamnus nauseosus* (Asteraceae). American Journal of Botany. 84: 471–477.
- Meyer, S. E.; Allen, P. S.; Beckstead, J. 1997. Seed germination regulation in *Bromus tectorum* (Poaceae) and its ecological significance. Oikos. 78: 475–485.
- Monsen, S. B.; Shaw, N. L. 1997. Persistence of cheatgrass (*Bromus tectorum*) amid bunchgrass/shrub steppe communities. In: Proceedings of the XVIII International Grassland Congress; 1997 June 8–19; Winnipeg, Manitoba and Saskatoon, Saskatchewan, Canada: 21–27–21–28.
- Randall, P. F. 1997. Sex determination in dioecious species of *Atriplex* L. Provo, UT: Brigham Young University. 48 p. Thesis.
- Stevens, A. R. 1997. Squirreltail (*Elymus elymoides*) establishment and competition with cheatgrass (*Bromus tectorum*). Provo, UT: Brigham Young University. 57 p. Dissertation.
- Stutz, H. C.; Chu, G.-L.; Sanderson, S. C. 1997. *Atriplex erecticaulis* (Chenopodiaceae): a new species from south-central California. Madroño. 44: 89–94.
- Tew, R. K.; Kitchen, S. G.; Holmgren, R. C. 1997. Soil survey—Desert Experimental Range, Utah. Gen. Tech. Rep. INT-GTR-347. Ogden, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station. 22 p.
- Tiedemann, A. R.; Lambert, S. M.; Carlson, J. R.; Perry, C. J.; Shaw, N. L.; Welch, B. L.; Driver, C. H. 1997. 'Umatilla' snowbuckwheat for rangeland restoration in the Interior Pacific Northwest. Rangelands. 19: 22–25.
- Upper Colorado Environmental Plant Center; U.S. Department of Agriculture, Natural Resources Conservation Service; U.S. Department of Agriculture, Forest Service, Intermountain Research Station; Colorado Agricultural Experiment Station. 1997. Release notice of 'Maybell Source' antelope bitterbrush, *Purshia tridentata* as a unique low-growing ecotype for wildlife and rangeland use. Meeker, CO: Upper Colorado Environmental Plant Center. 5 p.
- Wang, H.; McArthur, E. D.; Sanderson, S. C.; Graham, J. H.; Freeman, D. C. 1997. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). IV. Reciprocal transplant experiments. Evolution. 51: 95–102.
- Welch, B. L. 1997a. Comment: big sagebrush pro versus con. Journal of Range Management. 50: 322–323.
- Welch, B. L. 1997b. Seeded versus containerized big sagebrush plants for seed-increase gardens. Journal of Range Management. 50: 611–614.

1998

- Alados, C. L.; Emlen, J. M.; Wachocki, B.; Freeman, D. C. 1998. Instability of development and fractal architecture in dryland plants as an index of grazing pressure. Journal of Arid Environments. 38: 63–76.
- Allen, P. S.; Meyer, S. E. 1998. Ecological aspects of seed dormancy loss. Seed Science Research. 8: 183–191.
- Alzerreca-Angelo, H.; Schupp, E. W.; Kitchen, S. G. 1998. Sheep grazing and plant cover dynamics of a shadscale community. Journal of Range Management. 51: 214–222.
- Ayre, K. K. 1998. Xylem cavitation and tolerance to freezing and water stress in sagebrush. Salt Lake City, UT: University of Utah. 162 p. Dissertation.
- Bauer, M. C.; Meyer, S. E.; Allen, P. S. 1998. A simulation model to predict seed dormancy loss in the field for *Bromus tectorum* L. Journal of Experimental Botany. 49: 1235–1244.
- Bradford, D. F.; Franson, S. E.; Neale, A. C.; Heggem, D. T.; Miller, G. R.; Canterbury, G. E. 1998. Bird species assemblages as indicators of biological integrity in Great Basin rangeland. Environmental Monitoring and Assessment. 49: 1–22.
- Buttars, S. M.; St. Clair, L. L.; Johansen, J. R.; Sray, J. C.; Payne, M. C.; Webb, B. L.; Terry, R. E.; Pendleton, B. K.; Warren, S. D. 1998. Pelletized cyanobacterial soil amendments: laboratory testing for survival, escapability, and nitrogen fixation. Arid Soil Research and Rehabilitation. 12: 165–178.
- Cibils, A. F.; Swift, D. M.; McArthur, E. D. 1998. Plant-herbivore interactions in *Atriplex*; current state of knowledge. Gen. Tech. Rep. RMRS-GTR-14. Ogden, UT: Rocky Mountain Research Station. 31 p.
- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Kelley, D. C.; Whitworth, A. J. 1998a. Utah big game range trend studies, 1995. Publ. 98-1. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 692 p.
- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Green, A. D.; Kelley, D. C.; Thompson, T. W.; Whitworth, A. J. 1998b. Utah big game range trend studies, 1996, volume 1. Publ. 98-9. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 602 p.
- Davis, J. N.; Farmer, M. E.; Vernon, J. L.; Green, A. D.; Kelley, D. C.; Thompson, T. W.; Whitworth, A. J. 1998c. Utah big game range trend studies, 1996, volume 2. Publ. 98-10. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 491 p.
- Davis, J. N.; Vernon, J. L.; Farmer, M. E.; Green, A. D.; Kelley, D. C.; Thompson, T. W.; Whitworth, A. J. 1998d. Utah big game range trend studies, 1997, volume 1. Publ. 98-16. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 651 p.
- Davis, J. N.; Vernon, J. L.; Farmer, M. E.; Green, A. D.; Kelley, D. C.; Thompson, T. W.; Whitworth, A. J. 1998e. Utah big game range trend studies, 1997, volume 2. Publ. 98-21. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 711 p.
- Davis, J. N.; Vernon, J. L.; Farmer, M. E.; Kelley, D. C.; Green, A. D. 1998f. Utah big game range trend studies, North Book Cliffs. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 110 p.
- Glenn, E.; Moore, D.; Sanderson, S. C.; Brown, J. J.; Lash, D.; Nelson, M. 1998. Comparison of growth and morphology of *Atriplex canescens* varieties *occidentalis* and *angustifolia*. Southwestern Naturalist. 43: 176–182.
- Kitchen, S. G. 1998. Seed dormancy and germination requirements for needle-and-thread grass (*Hesperostipa comata*). The Seed Technologist Newsletter: 72(2): 20.

- Kitchen, S. G.; Meyer, S. E.; Stevens, R.; Wilson, G. R. 1998a. Proposal: addition for a generalized rule for the genus *Penstemon*—beardtongues, proposal #52. The Seed Technologist Newsletter. 72(1): 134–138.
- Kitchen, S. G.; Meyer, S. E.; Stevens, R.; Wilson, G. R. 1998b. Proposal: change in the rule for *Penstemon eatonii*—firecracker penstemon, proposal #51. The Seed Technologist Newsletter. 72(1): 131–133.
- Kitchen, S. G.; Stevens, R.; Wilson, G. R. 1998c. Proposal: addition of *Achnatherum thurberianum*—Thurber needlegrass to the rules, proposal #54. The Seed Technologist Newsletter 72(1): 144–148.
- Kitchen, S. G.; Stevens, R.; Wilson, G. R. 1998d. Proposal: addition of *Balsamorhiza sagittata*—arrowleaf balsamroot to the rules, proposal #55. The Seed Technologist Newsletter. 72(1): 149–152.
- Kitchen, S. G.; Stevens, R.; Wilson, G. R. 1998e. Proposal: addition of *Hesperostipa comata*—needle-and-thread grass to the rules, proposal #53. The Seed Technologist Newsletter. 72(1): 139–143.
- Kitchen, S. G.; Stevens, R.; Wilson, G. R. 1998f. Proposal: change in the rule for *Kochia prostrata*—forage kochia, proposal #56. The Seed Technologist Newsletter. 72(1): 153–155.
- Klemmedson, J. O.; Tiedemann, A. R. 1998a. Lithosequence of soils and associated vegetation on subalpine range of the Wasatch Plateau, Utah. Res. Note PNW-RN-524. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. 16 p.
- Klemmedson, J. O.; Tiedemann, A. R. 1998b. Soil-vegetation relations of recovering subalpine range of the Wasatch Plateau. Great Basin Naturalist. 58: 352–362.
- Maywald, D.; McArthur, E. D.; Jorgensen, G. L.; Stevens, R.; Walker, S. C. 1998. Experimental evidence for sex-based palatability variation in fourwing saltbush. Journal of Range Management. 51: 650–654.
- McArthur, E. D.; Freeman, D. C.; Graham, J. H.; Wang, H.; Sanderson, S. C.; Monaco, T. A.; Smith, B. N. 1998a. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). VI. Respiration and water potential. Canadian Journal of Botany. 76: 567–574.
- McArthur, E. D.; Mudge, J.; Van Buren, R.; Andersen, W. R.; Sanderson, S. C.; Babbie, D. G. 1998b. Randomly amplified polymorphic DNA analysis (RAPD) of big *Artemisia* subgenus *Tridentatae* species and hybrids. Great Basin Naturalist. 58: 12–27.
- McArthur, E. D.; Van Buren, R.; Sanderson, S. C.; Harper, K. T. 1998c. Taxonomy of *Sphaeromeria*, *Artemisia*, and *Tanacetum* (Compositae, Anthemideae) based on randomly amplified polymorphic DNA (RAPD). Great Basin Naturalist. 58: 1–11.
- Memmott, K. L.; Anderson, V. J.; Monsen, S. B. 1998. Seasonal grazing impact on cryptogamic crusts in a cold desert ecosystem. Journal of Range Management. 51: 547–550.
- Meyer, S. E.; Carlson, S. L.; Garvin, S. C. 1998. Seed germination regulation and field seed bank carryover in shadscale (*Atriplex confertifolia*: Chenopodiaceae). Journal of Arid Environments. 38: 255–267.
- Pendleton, B. K.; Pendleton, R. L. 1998. Pollination biology of *Coleogyne ramosissima* (Rosaceae). Southwestern Naturalist. 43: 376–380.
- Stevens, R.; Walker, S. C. 1998. Salt cedar control. Rangelands. 20: 9–12.
- Stewart, A. 1998. 'Immigrant' forage kochia (*Kochia prostrata*) seed germination and viability as affected by commercial seed practices. Provo, UT: Brigham Young University. 61 p. Thesis.
- Stutz, H. C.; Chu, G.-L.; Sanderson, S. C. 1998. *Atriplex longitrichoma* (Chenopodiaceae), a new species from southwestern Nevada and east-central California. Madroño. 45: 128–130.
- Stutz, H. C.; Sanderson, S. C. 1998. Taxonomic clarification of *Atriplex nuttallii* (Chenopodiaceae) and its near relatives. Sida. 18: 193–212.
- Tarkalson, D. D. 1998. Mycorrhizal colonization and plant nutrition of three crops grown in untreated and manure-treated subsoils and topsoil. Provo, UT: Brigham Young University. 82 p. Thesis.
- Tarkalson, D. D.; Pendleton, R. L.; Jolley, V. D.; Robbins, C. W.; Terry, R. E. 1998. Preparing and staining mycorrhizal structures with dry bean, sweet corn, and wheat using a block digester. Communications in Soil Science and Plant Analysis. 29: 2263–2268.
- Wang, H.; Byrd, D. W.; Howard, J. L.; McArthur, E. D.; Graham, J. H.; Freeman, D. C. 1998. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). V. Soil properties. International Journal of Plant Science. 159: 139–147.

1999

- Byrd, D. W.; McArthur, E. D.; Wang, H.; Graham, J. H.; Freeman, D. C. 1999. Narrow hybrid zone between two subspecies of big sagebrush, *Artemisia tridentata* (Asteraceae). VIII. Spatial and temporal patterns of terpenes. Biochemical Systematics and Ecology. 27: 11–25.
- Davis, J. N.; Vernon, J. L.; Farmer, M. E.; Green, A. D.; Thompson, T. W. 1999a. Utah big game range trend studies, 1998, volume 2. Publ. 99-07. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 580 p.
- Davis, J. N.; Vernon, J. L.; Farmer, M. E.; Green, A. D.; Thompson, T. W.; Whitworth, A. J. 1999b. Utah big game range trend studies, 1998, volume 1. Publ. 99-03. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 658 p.
- Farmer, M. E.; Harper, K. T.; Davis, J. N. 1999. The influence of anchor-chaining on watershed health in a juniper-pinyon woodland in central Utah. In: Monsen, S. B.; Stevens, R., comps. Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 299–301.
- Freeman, D. C.; Miglia, K. J.; McArthur, E. D.; Graham, J. H.; Wang, H. 1999a. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). X. Performance in reciprocal transplant gardens. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 15–24.
- Freeman, D. C.; Wang, H.; Sanderson, S. C.; McArthur, E. D. 1999b. Characterization of a narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*, Asteraceae). VII. Community and demographic analyses. Evolutionary Ecology Research. 1: 487–502.
- Gardner, P. A.; Stevens, R.; Howe, F. P. 1999. A handbook of riparian restoration and revegetation for the conservation of land birds in Utah with an emphasis on habitat types in middle and lower elevations. Publ. UDWR-99-38. Salt Lake City, UT: Utah Division of Wildlife Resources. 48 p.
- Goodrich, S.; McArthur, E. D.; Huber, A.; Ott, J. E. 1999a. Ungulate browsing of two populations of rubber rabbitbrush. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 196–199.
- Goodrich, S.; McArthur, E. D.; Winward, A. H. 1999b. Sagebrush ecotones and average annual precipitation. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 88–94.
- Graham, J. H.; Freeman, D. C.; Wang, H.; McArthur, E. D. 1999. Ecological analysis of the big sagebrush hybrid zone. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 11–14.
- Hall, D. B.; Anderson, V. J.; Monsen, S. B. 1999. Competitive effects of bluebunch wheatgrass, crested wheatgrass, and cheatgrass on antelope bitterbrush seedling emergence and survival. Res. Pap. RMRS-RP-16. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 7 p.
- Harper, K. T.; Davis, J. N. 1999. Biotic, edaphic, and other factors influencing pinyon-juniper distribution in the Great Basin. In: Monsen, S. B.; Stevens, R., comps. Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden,

- UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 51–54.
- Hemming, D. J. B.; Meyer, S. E.; Smith, B. N.; Hansen, L. D. 1999. Respiration characteristics differ among cheatgrass (*Bromus tectorum* L.) populations. *Great Basin Naturalist*. 59: 355–360.
- Jones, A.; Smith, B. N.; Hansen, L. D.; Monsen, S. B.; Stevens, R. 1999. Calorimetric study of the effects of water and temperature on the respiration and growth of small burnet and alfalfa. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 134–137.
- Kitchen, S. G.; Jorgensen, G. L. 1999. Annualization of rodent burrow clusters and winterfat decline in a salt-desert community. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 175–180.
- Kitchen, S. G.; McArthur, E. D.; Jorgensen, G. L. 1999a. Species richness and community structure along a Great Basin elevational gradient. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 59–65.
- Kitchen, S. G.; Walker, S. C.; Wilson, G. R. 1999b. Addition of *Ephedra nevadensis*—Nevada ephedra to the rules, proposal 9. *The Seed Technologist Newsletter*. 73(1): 4 p.
- Kitchen, S. G.; Walker, S. C.; Wilson, G. R. 1999c. Addition to the revised procedures for *Heterostipa comata*—needle-and-thread grass to the rules, proposal 8. *The Seed Technologist Newsletter*. 73(1): 6 p.
- Kolb, K. J.; Sperry, J. S. 1999. Differences in drought adaptation between subspecies of sagebrush (*Artemisia tridentata*). *Ecology*. 80: 2373–2384.
- McArthur, E. D.; Monsen, S. B.; Stevens, R. 1999a. Field trip report: shrubland ecotones. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 293–299.
- McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. 1999b. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 299 p.
- McArthur, E. D.; Sanderson, S. C. 1999a. Cytogeography and chromosome evolution of subgenus *Tridentatae* of *Artemisia* (Asteraceae). *American Journal of Botany*. 86: 1754–1775.
- McArthur, E. D.; Sanderson, S. C. 1999b. Ecotones: introduction, scale, and big sagebrush example. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 3–8.
- McArthur, E. D.; Sanderson, S. C. 1999c. Great Sand Dunes National Monument vegetation base study. In: Schenk, C. J., ed. *Hydrologic, geologic, and biologic research at Great Sand Dunes National Monument and vicinity, Colorado—proceedings of National Park Service research symposium No. 1*; 1992 November 5; Mosca, CO. Denver, CO: U.S. Department of the Interior, United States Geological Survey: 195–214.
- McArthur, E. D.; Young, S. A. 1999. Development of native seed supplies to support restoration of pinyon-juniper sites. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 327–330.
- Meyer, S. E. 1999. Genecological considerations in grassland restoration using wild-collected seed. In: Buchanan-Smith, J. G.; Bailey, L. D.; McCaughley, P., eds. *Proceedings of the XVIII International Grassland Congress, volume 3, invited papers*; 1997 June 8–17; Winnipeg and Saskatoon, Saskatchewan, Canada. Calgary, Alberta, Canada: Transaction Reporting Service, Association Management Center: 299–304.
- Meyer, S. E.; Allen, P. S. 1999a. Ecological genetics of seed germination regulation in *Bromus tectorum* L. I. Phenotypic variance among and within populations. *Oecologia*. 120: 27–34.
- Meyer, S. E.; Allen, P. S. 1999b. Ecological genetics of seed germination regulation in *Bromus tectorum* L. II. Reaction norms in response to water stress gradient imposed during seed maturation. *Oecologia*. 120: 35–43.
- Monsen, S. B.; Shaw, N. L. 1999. Re-establishing cool-season grasses on the sagebrush steppe, USA. In: Eldridge, D.; Fridenberger, D., eds. *People and rangelands: building the future; proceedings of the VI International Rangeland Congress*; 1999 July 19–23; Townsville, Queensland, Australia. Aitkenvale, Queensland, Australia: VI International Rangeland Congress, Inc.: 583–584.
- Monsen, S. B.; Stevens, R.; 1999a. Symposium on pinyon and juniper ecology, restoration, and management: introduction. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 3–4.
- Monsen, S. B.; Stevens, R., comps. 1999b. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 411 p.
- Naillon, D.; Memmott, K. L.; Monsen, S. B. 1999. A comparison of understory species at three densities is a pinyon-juniper woodland. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 72–75.
- Pendleton, R. L.; Pendleton, B. K.; Warren, S. D. 1999. Response of blackbrush (*Coleogyne ramosissima*) seedlings to inoculation with arbuscular mycorrhizal fungi. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 245–251.
- Poulsen, C. L.; Walker, S. C.; Stevens, R. 1999. Soil seed banking in pinyon-juniper areas with differing levels of tree cover, understory density and composition. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 141–145.
- Sanderson, S. C.; Stutz, H. C.; Stutz, M.; Roos, R. C. 1999. Chromosome races in *Sarcobatus* (Sarcobataceae, Caryophyllales). *Great Basin Naturalist*. 59: 301–314.
- Shaw, N. L.; Saab, V. A.; Monsen, S. B.; Rich, T. D. 1999. *Bromus tectorum* expansion and biodiversity loss on the Snake River Plain, southern Idaho, USA. In: Eldridge, David; Freudenberger, David, eds. *People and rangelands: building the future: proceedings of the VI International Rangeland Congress*; 1999 July 19–23; Townsville, Queensland, Australia. Aitkenvale, Queensland, Australia: VI International Rangeland Congress, Inc.: 586–588.
- Smith, B. N.; Eldredge, S.; Moulton, D. L.; Monaco, T. A.; Jones, A. R.; Hansen, L. D.; McArthur, E. D.; Freeman, D. C. 1999. Differences in temperature dependence of respiration distinguish subspecies and hybrid populations of big sagebrush: nature versus nurture. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. *Proceedings: shrubland ecotones*; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 25–28.
- Stevens, R. 1999a. Mechanical chaining and seeding. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 281–284.
- Stevens, R. 1999b. Restoration of native communities by chaining and seeding. In: Monsen, S. B.; Stevens, R., comps. *Proceedings: ecology and management of pinyon-juniper communities within the Interior West*; 1997 September 15–18; Provo, UT. Proc.

- RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 285–289.
- Stevens, R.; Walker, S. C.; Wooley, S. 1999. Regrowth of 'Ladak' alfalfa on pinyon-juniper rangelands following various timing and types of spring use. In: Monsen, S. B.; Stevens, R., comps. Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 352–354.
- Stewart, A.; Anderson, V. J.; Kitchen, S. G. 1999. 'Immigrant' forage kochia (*Kochia prostrata*) seed germination as affected by storage conditions. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 290–282.
- Turley, D.; Roundy, B. A.; Walker, S. C. 1999. Twig demography of true mountain mahogany (*Cercocarpus montanus* Scop.). In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 168–170.
- Walker, S. C. 1999. Species compatibility and successional processes affecting weeding of pinyon-juniper types. In: Monsen, S. B.; Stevens, R., comps. Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 331–337.
- Walker, S. C.; Turley, D. 1999. Characteristics of mountain mahogany (*Cercocarpus*) species and hybrids in Utah hybrid zone. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 32–34.
- Wang, H.; McArthur, E. D.; Freeman, D. C. 1999. Narrow hybrid zone between two subspecies of big sagebrush (*Artemisia tridentata*: Asteraceae). IX. elemental uptake and niche separation. *American Journal of Botany*. 86: 1099–1107.
- Webb, G. M. 1999. Occurrence of birds on a Great Basin-Mohave Desert ecotone in southwestern Utah. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 35–39.
- Weber, D. J.; Bunderson, E. D.; Davis, J. N.; Nelson, D. L.; Hreha, A. 1999. Diseases and environmental factors of the pinyon-juniper communities. In: Monsen, S. B.; Stevens, R., comps. Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15–18; Provo, UT. Proc. RMRS-P-9. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 118–120.
- Welch, B. L. 1999. Add three more to the list of big sagebrush eaters. In: McArthur, E. D.; Ostler, W. K.; Wambolt, D. C., comps. Proceedings: shrubland ecotones; 1998 August 12–14; Ephraim, UT. Proc. RMRS-P-11. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station: 171–174.
- Kitchen, S. G.; Meyer, S. E.; Walker, S.; Wilson, G. R. 2000a. Rule change proposal no. 3: to amend instructions for paired tests to include non-woody species and multiple prechill treatments. The Seed Technologist Newsletter. 74(1): 79–80.
- Kitchen, S. G.; Meyer, S. E.; Walker, S.; Wilson, G. R. 2000b. Rule change proposal no. 4: addition of *Penstemon eatonii*—fire-cracker penstemon and *Penstemon palmerii*—Palmer penstemon to table 1 of the rules. The Seed Technologist Newsletter. 74(1): 81–83.
- Leidolf, A.; Wolfe, M. L.; Pendleton, R. L. 2000. Bird communities of Gambel oak: a descriptive analysis. Gen. Tech. Rep. RMRS-GTR-48. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 30 p.
- Liao, J. D.; Monsen, S. B.; Anderson, V. J.; Shaw, N. L. 2000. Seed biology of rush skeltonweed in sagebrush steppe. *Journal of Range Management*. 53: 544–549.
- McArthur, E. D. 2000. Sagebrush systematics and distribution. In: Entwistle, P. G.; DeBolt, A. M.; Kaltenecker, J. H.; Steenhof, K., comps. Proceedings: sagebrush steppe ecosystem symposium; 1999 June 23–25; Boise, ID. BLM/ID/PT-001001+1150. Boise, ID: U.S. Department of the Interior, Bureau of Land Management, Idaho State Office: 9–14.
- McArthur, E. D.; Kitchen, S. G.; Uresk, D. W.; Mitchell, J. E. 2000. Applicability of Montreal process criterion 2—productive capacity—to rangeland sustainability. *International Journal of Sustainable Development and World Ecology*. 7: 97–106.
- Medin, D. E.; Welch, B. L.; Clary, W. P. 2000. Bird habitat relationships along a Great Basin elevational gradient. Res. Pap. RMRS-RP-23. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 22 p.
- Meyer, S. E.; Debaene-Gill, S. B.; Allen, P. S. 2000a. Using hydrothermal time concepts to model seed germination response to temperature, dormancy loss, and priming effects in *Elymus elymoides*. *Seed Science Research*. 10: 213–223.
- Meyer, S. E.; Nelson, D. L.; Clement, S.; Paulsen, A. 2000b. Exploring the potential for biocontrol of cheatgrass with the headsmut pathogen. In: Entwistle, P. G.; DeBolt, A. M.; Kaltenecker, J. H.; Steenhof, K., comps. Proceedings: sagebrush steppe ecosystem symposium; 1999 June 23–25; Boise, ID. BLM/ID/PT-001001+1150. Boise, ID: U.S. Department of the Interior, Bureau of Land Management, Idaho State Office: 70–72.
- Meyer, S. E.; Paulsen, A. 2000. Chilling requirements for seed germination of 10 Utah species of perennial wild buckwheat (*Eriogonum* Michx. [Polygonaceae]). *Native Plants Journal*. 1: 18–24.
- Meyer, S. E.; Pendleton, R. L. 2000. Genetic regulation of seed dormancy in *Purshia tridentata* (Roseaceae). *Annals of Botany*. 85: 521–529.
- Monsen, S. B. 2000. Establishment of big sagebrush (*Artemisia tridentata*) in semiarid environments. In: Entwistle, P. G.; DeBolt, A. M.; Kaltenecker, J. H.; Steenhof, K., comps. Proceedings: sagebrush steppe ecosystem symposium; 1999 June 23–25; Boise, ID. BLM/ID/PT-001001+1150. Boise, ID: U.S. Department of the Interior, Bureau of Land Management, Idaho State Office: 81–86.
- Monsen, S. B.; Shaw, N. L. 2000. Big sagebrush (*Artemisia tridentata*) communities—ecology, importance and restoration potential. In: 2000 Billings land reclamation symposium; 2000 March 20–24, Billings, MT. Reclamation Research Unit Publ. 00-01. Bozeman: Montana State University: 255–270.
- Pendleton, R. L. 2000. Pre-inoculation by an arbuscular mycorrhizal fungus enhances male reproductive output of *Cucurbita foetidissima*. *International Journal of Plant Science*. 161: 683–689.
- Pendleton, R. L.; Pendleton, B. K.; Howard, G. L. 2000a. Effects of microbiotic soil crust organisms and mycorrhizal fungi on seedling growth of blackbrush (*Coleogyne ramosissima*). CERL Tech. Rep. 99/108. Champaign, IL: Department of the Army, Construction Engineering Research Laboratory, Corps of Engineers. 26 p.
- Pendleton, R. L.; Freeman, D. C.; McArthur, E. D.; Sanderson, S. C. 2000b. Gender specialization in heterodichogamous *Grayia brandegei* (Chenopodiaceae): evidence for an alternative pathway to dioecy. *American Journal of Botany*. 87: 508–516.
- Shaw, N. L.; Monsen, S. B. 2000. Controlling annual grasses with Oust® herbicide. In: Entwistle, P. G.; DeBolt, A. M.; Kaltenecker, J. H.; Steenhof, K., comps. Proceedings: sagebrush steppe ecosystem symposium; 1999 June 23–25; Boise, ID. BLM/ID/PT-001001+1150. Boise, ID: U.S. Department of the Interior, Bureau of Land Management, Idaho State Office: 66–69.

2000

- Allen, P. S.; Meyer, S. E.; Kahn, M. A. 2000. Hydrothermal time as a tool in comparative germination studies. In: Black, M.; Bradford, K. J.; Vázquez-Ramos, J., eds. Seed biology: advances and applications. Cambridge, United Kingdom: University Press: 401–410.
- Davis, J. N.; Farmer, M. E.; Green, A. D. 2000a. Utah big game range trend studies, 1999, volume 1. Publ. 00-01. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 574 p.
- Davis, J. N.; Farmer, M. E.; Green, A. D. 2000b. Utah big game range trend studies, 1999, volume 2. Publ. 00-02. Provo, UT: Utah Division of Wildlife Resources, Shrub Sciences Laboratory. 609 p.
- Green, Ashley D. 2000. A comparison of small mammal abundance, richness, and diversity in relation to habitat variables in chained and native pinyon-juniper woodlands. Provo, UT: Brigham Young University. 42 p. Thesis.

- Sherwin, R. E.; Stricklan, D.; Rogers, D. S. 2000. Roosting affinities of Townsend's big-eared bat (*Corynorhinus townsendii*) in northern Utah. *Journal of Mammalogy*. 81: 939–947.
- Vernon, J. L. 2000. The response of native species after two-way chaining and seeding in Utah. Provo, UT: Brigham Young University. 49 p. Thesis.

Appendix B: Reports

These are unpublished reports on file at the Shrub Sciences Laboratory documenting extramural research agreements. These documents are not included in the table 2 totals.

- Beck, J. L.; Flinders, J. T.; Smith, H. D. 1995. Ecosystem management in relationship to elk and domestic sheep interactions in aspen-dominated habitat: Willow Creek Demonstration Area, Uinta National Forest; final research report. Provo, UT: Brigham Young University. Submitted to U.S. Department of Agriculture, Forest Service, Uinta National Forest and Central Region, Utah Division of Wildlife Resources, Provo, UT. 380 p.
- Harper, K. T.; McArthur, E. D.; Sanderson, S. C.; Tuhy, J. 1993. Final report: Zion National Park vegetation summary. Provo, UT: Brigham Young University. Submitted to U.S. Department of the Interior, National Park Service, Zion National Park, UT. 246 p.
- Haws, B. A. 1991. Final technical report for Project 22-c-6-INT-124, the role of insects in causing the recent widespread dieoff of wildland range shrubs, and technical report for Project INT-872821, incidence, biology and relationship of the shadscale mealybug to widespread shrub death. Logan, UT: Department of Biology, Utah State University. Submitted to U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, UT. 344 p.
- Kitchen, S. G. 1997. An investigation of seed dormancy and germination requirements for needle-and-thread (*Stipa comata*); a progress report submitted to the Association of Official Seed Analysts (AOSA) Seed Testing Standardization Research Funding Committee. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory. 6 p.
- Kitchen, S. G. 1998. An investigation of seed dormancy and germination requirements in four globemallow (*Sphaeralcea*) species; a progress report submitted to the Association of Official Seed Analysts (AOSA) Seed Testing Standardization Research Funding Committee. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory. 4 p.
- Kitchen, S. G.; Meyer, S. E. 1999. Seed dormancy and germination requirements for three *Eriogonum* (wild buckwheat) species; a progress report submitted to the Association of Official Seed Analysts (AOSA) Seed Testing Standardization Research Funding Committee. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory. 5 p.
- Kitchen, S. G.; Meyer, S. E.; Walker, S. C. 1999. Development of standards and rules for testing seed quality of plant species used in range and wildlands rehabilitation; a progress report for contract #97-0635 for the Utah Department of Agriculture and Food. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory. 12 p.
- Kitchen, S. G.; Stevens, R. 1997. Development of standards and rules for testing seed quality of plant species used in range and wildlands rehabilitation, a final report for contract #97-0635 for the Utah Department of Agriculture and Food. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory. 9 p.
- Kitchen, S. G.; Stevens, R.; Walker, S. C. 1998. Development of standards and rules for testing seed quality of plant species used in range and wildlands rehabilitation, a progress report for contract #97-0635 for the Utah Department of Agriculture and Food. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory. 11 p.
- McArthur, E. D. 1992. Final report: MIPR 92-248. Propagation and biology of cryptobiotic crusts. Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to Construction Engineering Laboratory, U.S. Army Corp of Engineers, Champaign-Urbana, IL. 133 p.
- McArthur, E. D.; Blauer, A. C.; Monsen, S. B. 1986. Final report: history of and rehabilitation recommendations for sites disturbed by modern man's activities in Grand Teton National Park. Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to U.S. Department of the Interior, National Park Service, Grand Teton National Park, WY. 46 p.
- McArthur, E. D.; Pendleton, R. L.; Pendleton, B. K. 1993. Final report: MIPR E5292N159, propagation and biology of cryptobiotic crusts 93. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to Construction Engineering Laboratory, U.S. Army Corp of Engineers, Champaign-Urbana, IL. 144 p. + video.
- McArthur, E. D.; Pendleton, R. L.; Pendleton, B. K. 1995. Final report: MIPR 94N077, microphytic crust biology and propagation. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to Construction Engineering Laboratory, U.S. Army Corp of Engineers, Champaign-Urbana, IL. 145 p.
- McArthur, E. D.; Sanderson, S. C. 1992. Final report: desert tortoise habitat studies. Interagency agreement INT-89402-IA (UT-910-IA-87). Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, UT. 388 p.
- McArthur, E. D.; Sanderson, S. C. 1992. Final report: vegetation patterns: 1960–1990, Great Sand Dunes National Monument, Interagency Agreement 1268-19105, Project Number GRRSA-RR91-0170. Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to U.S. Department of the Interior, National Park Service, Rocky Mountain Regional Office, Denver, CO. 262 p.
- Monsen, S. B.; Kitchen, S. G. 1990. Annual report 1990: a summary of activities and progress corresponding to Interagency Agreement Number ID910-IA8-04: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 17 p.
- Monsen, S. B.; Kitchen, S. G. 1991. Annual report 1991: a summary of activities and progress corresponding to Interagency Agreement Number ID910-IA8-04: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 34 p.
- Monsen, S. B.; Kitchen, S. G. 1992. Annual report 1992: a summary of activities and progress corresponding to Interagency Agreement Number ID910 between USDI, Bureau of Land Management and USDA, Forest Service, Intermountain Research Station: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 62 p.
- Monsen, S. B.; Kitchen, S. G. 1993. Annual report 1993: summary report of progress related to Interagency Agreement Number ID910 between USDI, Bureau of Land Management and USDA, Forest Service, Intermountain Research Station: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 41 p.
- Monsen, S. B.; Kitchen, S. G. 1994. Annual report 1994: summary report of progress related to Interagency Agreement Number ID910 between USDI, Bureau of Land Management and USDA, Forest Service, Intermountain Research Station: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 45 p.
- Monsen, S. B.; Kitchen, S. G.; Shaw, N. L.; Naillon, D. G. 1995. Progress report 1995: Interagency Agreement Number ID910

- between USDI, Bureau of Land Management and USDA, Forest Service, Intermountain Research Station: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 39 p.
- Monsen, S. B.; Kitchen, S. G.; Shaw, N. L.; Naillon, D. G. 1996. Annual report 1996: Summary report of progress related to Interagency Agreement Number ID910 between USDI, Bureau of Land Management and USDA, Forest Service, Intermountain Research Station: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory, Provo, UT. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 52 p.
- Monsen, S. B.; Naillon, D.; Memmott, K. L.; Kitchen, S. G.; Carlson, S. L. 1998. Intermountain Greenstrip Research Project, cooperative research studies, Agreement number ID910: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Shrub Sciences Laboratory, Provo, UT, 1989–1998 and U.S. Department of the Interior, Bureau of Land Management, Idaho State Office. Submitted to U.S. Department of the Interior, Bureau of Land Management, Idaho State Office, Boise, ID. 285 p.
- Nelson, D. L. 1990. Studies on a wildland shrub dieoff occurring in the Great Basin 1983–1985. A report on a cooperative research project between U.S. Department of Agriculture, Bureau of Land Management, Utah State Office; U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory; Utah State University; Brigham Young University; Utah Department of Agriculture; and Utah Division of Wildlife Resources. Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, UT. 106 p.
- Ott, J. E.; McArthur, E. D.; Sanderson, S. C. 1998. Fire rehabilitation monitoring of BLM lands affected by 1996 fires: a preliminary report of interagency agreement J910A70026. Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, UT. 50 p.
- Ott, J. E.; McArthur, E. D.; Sanderson, S. C. 1999. Fire rehabilitation monitoring of BLM lands affected by 1996 fires: second year report of interagency agreement J910A70026. Provo, UT: U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to U.S. Department of the Interior, Bureau of Land Management, Utah State Office, Salt Lake City, UT. 48 p.
- Pendleton, R. L.; Pendleton, B. K. 1995. Final report: MIPR W2V5AA51113582 microphytic crust biology. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to Construction Engineering Laboratory, U.S. Army Corp of Engineers, Champaign-Urbana, IL. 32 p.
- Pendleton, R. L.; Pendleton, B. K. 1996. Final report: MIPR W52EU260390969 benefit of microphytic crust inoculation and arbuscular mycorrhizal fungi on productivity of VAM-dependent forbs. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to Construction Engineering Laboratory, U.S. Army Corp of Engineers, Champaign-Urbana, IL. 67 p.
- Pendleton, R. L.; Garvin, S. C.; Pendleton, B. K. 1998. Final Report: MIPR W52EU270930412 microphytic crust biology: evaluation algal inoculation effectiveness. U.S. Department of Agriculture, Forest Service, Intermountain Research Station, Shrub Sciences Laboratory. Submitted to Construction Engineering Laboratory, U.S. Army Corp of Engineers, Champaign-Urbana, IL. 34 p.
- Thacker, R. K.; Flinders, J. T.; Blackwell, B. H.; Smith, H. D. 1995. Comparison and use of four techniques for censusing three subspecies of kit fox; a cooperative contract study between Wildlife Section, Utah Division of Wildlife Resources, Brigham Young University. Submitted to Utah Division of Wildlife Resources, Salt Lake City, UT. 71 p.