Narrative
Learning Together: Great Basin Science Delivery

1. Statement of need

Traveling across Northern Nevada on Interstate 80, the unbroken cheatgrass (*Bromus tectorum*) of the BLM's Winnemucca District passes in a golden blur. In only one generation, some 12,424 ha^2 (7,720 mi^2) of land managed largely by the BLM in the Great Basin have been transformed from native shrublands to a near-monoculture of cheatgrass (Bradley and Mustard 2005). The increase in the exotic annual grass has resulted in more continuous fuels and a cheatgrass-wildfire cycle that is characterized by a much shorter fire return interval than these ecosystems experienced historically (Brooks and Pyke 2001). Farther upslope, in mid to upper-elevation shrublands, expansion and progressive infilling of pinyon and juniper trees in sagebrush communities is causing loss of native understory, increases in woody fuels, and fires of greater frequency, size and intensity (Miller et al. 2008). Many sagebrush-associated species are declining, and approximately 20 percent of native sagebrush flora and fauna is at risk (Center for Science, Economics and Environment 2002). Countless communities across the Great Basin are facing increased risk to human life and property, high fire management costs, and loss of the resources upon which their economy is based. BLM is the largest, but not the only land management agency trying to cope with the altered fire regimes that now characterize much of the Great Basin.

Improving the effectiveness of fire, fuels, and post-fire management in the fire-ruled sagebrush biome is essential to protecting Great Basin resources. Fire and fuels-related research in the Great Basin is providing much of the information needed to improve management (e.g., http://www.firescience.gov). However, the penetration of this information to public land managers and its application on the ground is uneven and often limited. Fire frequency and size are increasing and the invasive species are gaining ground. Agency employees feel besieged. They cannot do everything they are asked to do, and many report low job satisfaction because they are unable to provide the quality of work that they believe is needed to be successful land managers (Rosenberg 2008).

Participants of the 2006 "Workshop on Collaborative Research and Management in the Great Basin", 2008 "Wildfire and Invasive Plants in American Deserts Conference" (Chambers et al. 2008, 2009) and the 111 land managers who participated in the science needs assessment conducted for this project provided direction about the kinds of science information they need and delivery mechanisms they are more inclined to use. Following a pilot study (Devoe, unpublished), we began the science needs assessment for this project with a training workshop to develop facilitators. The 16 participants were selected from across the Great Basin for their ability to mobilize their peers in subsequent phases of this project. Guided by an experienced participatory processes specialist, the participants designed a small-group, structured interview that was then used in 11 focus groups. Focus groups met in Salt Lake City, Boise, Reno, Burns, Cedar City, Winnemucca, Ely and Great Basin National Park. Phone conversations were held with individuals from FWS Ruby Marsh National Wildlife Refuge and the Nevada BLM Fuels Group. The agencies and number of participants included: BLM (64), USFS (27), NPS (10), Tribes (4), FWS (2), IDL (2), BIA (1), and USGS (1). Of these 111 participants, 77 were technical specialists and 34 were line managers. These seven questions were asked of each group:

- What sources of information do you use and how are you now getting this information?
- What are your critical unmet technical assistance needs for planning, implementation, and monitoring related to fire and fuels?
- What are the best ways, places, or media for delivering technical information?
- If you could spend a day with a technical expert, what topic would you discuss? What channels are needed to communicate with this expert?

- What do you need in order to effectively collaborate with other offices/agencies?
- What do you need to communicate with researchers?
- What one institutional hurdle needs to be broken down to improve technology transfer?

Key phrases of response were recorded on flip charts under each question. Questions 2-6 were used in a prioritization exercise, in which participants indicated their top three priorities for technical assistance. An "unpacking exercise" was used to detail what was meant by the phrases that received the most priority votes. Responses were categorized as Technical Assistance Needs or Desired Delivery Modes. Transcripts of the focus group sessions were used in a content analysis (Weber 1990). The most frequent phrases were grouped into broad categories (Figures 1 and 2).

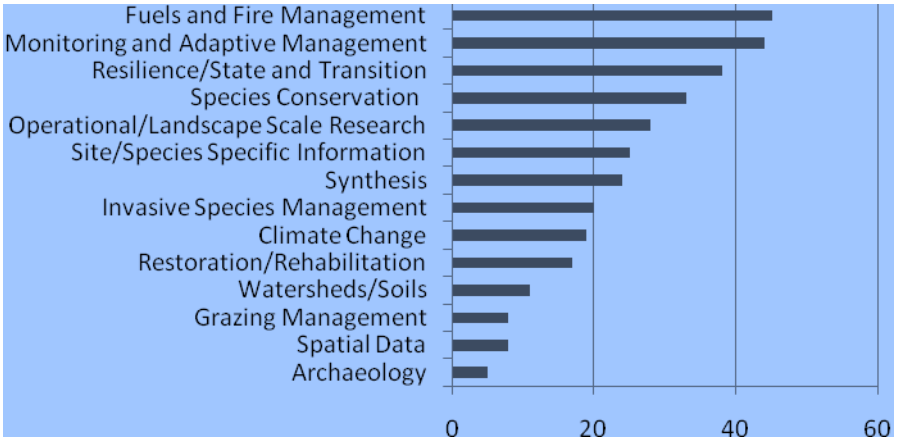

Figure 1. Technical assistance needs responses from focus groups.

Fuels and fire management was mentioned most frequently and included sub-topics like fire effects information and system-specific burn prescriptions. A close second was standardized and long-term monitoring of vegetation and wildlife responses to management treatments for inclusion in adaptive management. A highly ranked and related issue was increasing managers' understanding of community resilience, or the capacity of a community or landscape to return to the initial condition following perturbations like fire or management treatments, and incorporating resilience information into state-and-transition models. Closely linked topics were species conservation, invasive species management and adaptation to climate change, and information needs regarding restoration/rehabilitation, watersheds and soils, and grazing management. The need for more readily available spatial data, and for information on archeology in general and fire effects on archeological resources also were mentioned.

The most-mentioned mechanism for delivering science was the capacity to contact and work with experts on specific management issues. Such active learning modalities, in which the employees are the creators of their own information as well as recipients of others' knowledge and ideas, were the participants' highest priority. Next, they sought very specific technical information easily accessed and downloadable from the web. High on the list was a web-based clearinghouse that included a directory of experts, science locator, bibliography, and information about regional conferences. A related topic, online communication, was frequently mentioned. Many respondents were interested in developing cadres of experts whom the agencies could draw upon to provide technical training and assistance in specific areas like fire and fuels management and post-fire rehabilitation and restoration. A cross-cutting need

identified by the respondents was an interdisciplinary focus and coordination both among and within agencies. Frequently identified tools were technical guides, summary papers and publications as well as a land treatment database that could be used to access and track the results of vegetation management projects. Commonly identified delivery modes included training courses, field workshops and conferences. Two distinct items included the need to educate both the public and researchers about land management activities.

Figure 2. Desired delivery mode responses from focus groups.

An underlying theme across all of the focus groups was the need to empower field-level science users to be more effective. Participants expressed the desire to work collaboratively and in an adaptive management framework. In response, we seek to establish a culture of praxis (Freire 1970) within the land management agencies and with the scientific community in which employees are engaged in a cycle of activity and reflection, so that their experience directs their subsequent enquiry, learning, and activity. Praxis requires real collaboration, in which students and teachers are jointly engaged in learning and *all* are teachers *and* students. We believe this can be accomplished by:

- Creating an environment in which practitioners have easy access to technical expertise within and outside their own agencies; in which recourse to expertise is cultured as a norm; and in which relationships with technical experts remain sustaining and enriching throughout their careers;
- Embedding field level practitioners within a "community of practice", that is, peers and mentors with whom they share experience, issues, knowledge, information, and support; through and with whom innovation can be fostered and disseminated; and with whom they can collaborate to facilitate needed changes in their standard procedures and immediate working environments.

And by cultivating line manager support for professional development of field-level specialists through:

- Continuing to inform managers of technical issues and limitations, and office and agency-level impediments to superior performance, as we did in our consultation processes during the planning phase of this project;
- Keeping managers in the loop about emerging resource management issues and significant advances in relevant science with appropriate brief, focused communiqués to keep them on the same page with their technical specialists and pre-dispose them to support needed innovation in fire and restoration-related land management practice**s,** and
- Providing managers with on-call expertise when new technical issues emerge and require immediate response.

2. Geographic region

Figure 3. The floristic Great Basin and project area.

We will address fire science information needs in the floristic Great Basin (Figure 3) (Cronquist et al. 1986). This region encompasses a five-state area with similar sociological and ecological concerns that is managed largely by federal agencies with BLM (54%) and Forest Service (14%) being the major land administrators.

Because research conducted outside the Great Basin is relevant to this project and aspects of this project apply to other regions, our science delivery efforts will be coordinated with those of adjacent regions and beyond as serves our objectives. The region with the greatest overlap with the Great Basin is the Pacific Northwest and that science delivery team and ours will exchange members in an advisory capacity to coordinate programs. We also have links to the California and Northern Rockies Science Delivery Consortiums.

3.Consortium partners and roles of investigators

Regional Collaborative Organizations include the Great Basin Cooperative Ecosystem Studies Unit (GBCESU), Great Basin Research and Management Partnership (GBRMP) and Great Basin Restoration Initiative (GBRI) and their member organizations. We are collaborating on this project and share the same geographic boundary (Figure 3). CESUs (http://www.cesu.psu.edu/) are consortia of federal agencies and research providers operating under assistance agreements that provide a forum and mechanism for universities to address federal agency research, technical assistance, and educational needs. All the land management and research partners in this program are Great Basin CESU members. They will join in planning and participating in science delivery activities. The GBRMP is inclusive of all organizations working on fire and fuels management issues within the Great Basin including federal and state research labs and management agencies, universities, local agencies, tribal governments and NGOs and both local and regional collaborations. It promotes comprehensive, complementary research and management collaborations to sustain ecosystems, resources and communities in the Great Basin. GBRMP will foster information-sharing about and participate in science delivery activities through its Science Delivery Working Group and Website. It also will support the web-based clearinghouse of information. The GBRI implements proactive restoration and management strategies to maintain intact native plant communities and strategically restore degraded lands. Integrating science into public lands restoration is a major GBRI emphasis. GBRI will lead the development of the first agency mentors and cadres focused on fire and fuels management and on restoration. Other regional collaborative organizations like the Great Basin Environmental Program and the Nevada and Utah Partners for Conservation and Development are invited to participate in science delivery project activities.
Land management agencies (BLM, FS, FWS, NPS) set the agenda for this project. They are engaged with project staff in on-going definition of their technical assistance needs and priorities. In collaboration with technical experts, the land management partners will apply and test scientific information when

implementing land management activities and use adaptive management to reach land management objectives. They will contribute to developing syntheses of scientific and agency information, developing and maintaining a network of internal and external experts, and co-hosting field workshops and other science delivery activities.

Research agencies (ARS, RMRS, USGS) and universities in the Great Basin have numerous experts in fire science and related fields. We will draw from this pool to synthesize existing information around priority issues, populate cadres of managers and scientists, develop field workshops, and participate in other science delivery activities. University of Idaho (U of I) and University of Nevada, Reno (UNR) will work together to develop web-based training on focal fire science issues.

Land-grant universities (OSU, U of I, UNR, USU) have Cooperative Extension programs with community-based educators who produce and disseminate fire science information. Because they collaborate with research scientists, end users of research products and the public, extension educators provide a bridge between researchers and science users. UNR Cooperative Extension will coordinate with the extension programs in the other Great Basin states and JFSP Science Delivery consortia and ensure that science delivery activities and products are made available to staff in federal and state agencies, NGOs and the public. They will ensure Great Basin participation in the development of eXtension (http://about.extension.org), an internet-based collaborative environment where Land Grant University content providers exchange objective, research-based knowledge to solve real challenges in real time.

Regional Research and Management Projects, many funded by JFSP, develop information and provide syntheses, field tours and outreach activities related to fire and fuels management. SageSTEP (http://www.sagestep.org) is an example of a highly effective partnership of researchers and agency employees in which scientist/manager teams have been actively engaged in designing and evaluating fire and fuels management treatments for sagebrush ecosystems. We will collaborate with Jim McIver, Leader of the SageSTEP research team, and Mark Brunson, Utah State University Professor and Science Delivery Lead for SageSTEP, to provide program-specific (fuels, fire, emergency stabilization and rehabilitation, range management, wildlife) research results that can be applied immediately to land management in the Great Basin. We have identified 19 additional research and management projects that also can provide hands-on, case-specific learning for federal agency employees.

Personnel	Role	Responsibility
Mike Pellant	PI	Overall program administration, BLM. Lead development of agency mentors and cadres.
Jeanne Chambers	Co-PI	Steering Committee, USFS RMRS, R4 & Humboldt Toiyabe National Forest. GBRMP, USGS, ARS liaison. Lead web-based clearinghouse.
Kurt Pregitzer	Co-PI	Steering Committee, U of I. Coordination with academic partners; lead web-based training.
Brad Schultz	Co-PI	Steering Committee, UNR Cooperative Extension. NRCS liaison. Coordination with extension throughout the Great Basin; lead program effectiveness assessments.
Elizabeth Leger	Co-PI	Steering Committee, UNR. Coordination with academic partners; lead syntheses development.
Randy Sharp	Co-PI	Steering Committee, USFS, H-T National Forest. USFS liaison. Lead field workshops.
Eugénie Montblanc	Project Coordinator	Project coordination and management. Organize science delivery activities, create research-management linkages, provide technical information.

4. Consortium structure and governance

The PIs form the project steering committee and are responsible for program planning, implementation, effectiveness monitoring and reporting, and for communication and coordination with target agencies. Also, each PI is responsible for one of the planned activities in section 6. The project coordinator is responsible for coordination of the different science delivery activities, communication both within the project and with the end-user communities, budgeting and office administration. She reports to PI Brewer and Co-PI Pregitzer.

The Steering Committee is guided by an Advisory Committee, which consists of senior managers from the agencies and universities, and of respected scientists in subject areas critical to project success. Members include Ron Wenker, BLM NV State Director; Sue Steward, FS R4 Acting Director of Fire and Aviation; Randy Sharp, Humboldt-Toiyabe National Forest, Natural Resources Staff Officer; Rick Kearney, FWS Climate Change Coordinator; Sue Phillips, USGS Aridlands Research Manager; Nat Frazer, USU Dean College of Natural Resources; and Rick Miller, OSU Fire Ecology. The Advisory Committee will assist the Science Delivery Program with information dissemination within their own organizations and advise the Steering Committee on project direction and activities.

5. End-user communities

The primary targets for our Science Delivery Project are field-level technical specialists in the BLM, USFS, NPS and FWS who design and implement land management treatments related to fire, fuels, emergency stabilization and rehabilitation, hydrology and soils, range management, invasive species and wildlife. We emphasize an interdisciplinary approach because of the importance of fire use and wildland fire effects on multiple resource values. However, it is not our intention in any way to be exclusive. Results from our focus groups indicate that the target individuals are mostly the younger segment of the agency workforce. They are more likely to need assistance in developing a community of practice within and outside their offices, and they represent the best possible return on technology transfer investment through career-long application. Rapid turnover in the federal workforce (Bureau of Labor Statistics 2009) has created a crisis in institutional memory. Our goal is to work with early career employees to build cadres of experts who will lead the uptake and application of fire science in their respective agencies and base future decision-making on current science. Because fuels and fire management typically crosses multiple land tenures, we envision that these cadres will be composed of individuals from all of the relevant agencies and stakeholders (NGOs, Bureau of Indian Affairs, state agencies, private individuals, etc.). To maintain the necessary administrative support, we intend to fully engage upper and mid-level management in all aspects of this process.

6. Planned activities

We have developed a model for science delivery that is based on the information collected in the planning phase (section 1) and that is structured to cultivate agency capacity (Figure 4). Our model focuses on the most highly ranked items in Figure 2. The information content for all of these products and activities will be based on the ecological role of fire and managing and using fire in Great Basin ecosystems.

To create a technology transfer environment in which the knowledge of all the participants is accessible, we will use the principles of PAME, participatory assessment, monitoring, and evaluation (Davis-Case 1990). The assumption that all the knowledge or the most important knowledge lies with outsiders creates barriers to effective information transfer. PAME focuses on what insiders need to know, rather than on what outsiders have to tell. The outsiders have an important role in helping the insiders formulate their own questions, as well as in supplementing their knowledge and in assisting them in the creation of

their own information. However, the perspectives of the insiders remain paramount. PAME encourages, supports, and strengthens the insiders' existing abilities to identify their own needs and objectives and to measure delivery against their own evaluation criteria.

Priority issues and technical needs. We will focus initially on the highest ranked items in Figure 1. Identification of needs will be an on-going, interagency process. Based upon periodic assessments of issues and needs (see section 7), we will modify the content of delivery activities. We also will update our delivery model and planned activities based upon these assessments. The information from the needs assessment will be used to help establish research priorities for the agencies.

Syntheses of scientific and agency information will be produced that include agency data and information to the degree possible. These syntheses will be used to provide information content for delivery activities. They also will identify data gaps for future research and monitoring. Products include not only peer-reviewed publications, but also white papers and technical summaries for managers. We include a science writer for this purpose in the budget.

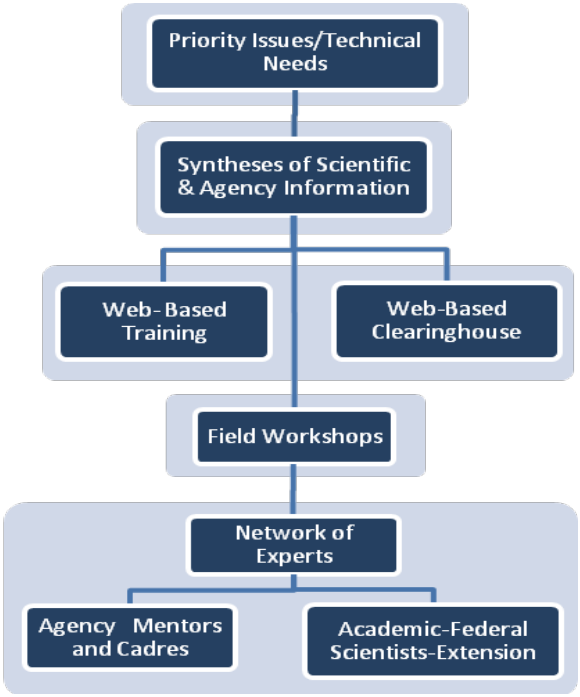

Figure 4. Model for science delivery.

Web-based training will be developed that specifically addresses Great Basin fire science needs. Courses will be designed to address current management needs and to train the next generation of professionals. We will work with Drs. Penny Morgan and Steve Bunting at the University of Idaho (U of I) to adapt existing web-based courses on fire ecology and management and fuels inventory and management and to integrate these courses into their Academic Certification Program. We also will work with Co-PI Mike Pellant in developing a course on Great Basin restoration/rehabilitation that can be offered for academic credit at U of I and other universities.

A Web-based clearinghouse of information is being developed in cooperation between the Great Basin Research and Management Partnership and the USGS National Biological Information Infrastructure, Great Basin Information Project - *http://greatbasin.wr.usgs.gov/GBRMP/index.html*. It will serve as the clearinghouse for our science delivery project. Services provided by the website include directories of experts and collaborative organizations, a bibliography, science and management project locator, metadata server, upcoming meetings and links, and a collaborative sharing tool.

Field workshops will be organized by the project coordinator to connect training and syntheses to local issues and solutions. They will supplement and be an integral part of the web-based training for the Great Basin. They also will be used to help develop cadres of experts and to provide direct contact between field-level specialists and scientists.

Networks of experts will be developed and will include two primary elements. First, cadres of appropriate early-career resource and fire specialists will be trained and mentored by experienced specialists from within and outside their respective agencies. In return, they will provide technical support for their home offices and on an interagency/regional basis as needed. Cadre members will be selected based upon professional criteria and initiative and supported by their agencies with dedicated time and resources to grow professionally and function as internal experts on fire/restoration ecology, with strong connections to the broader scientific community. This effort will be led by Co-PI Pellant with the assistance of the project coordinator. Second, experienced agency specialists, academic and federal scientists and extension specialists will be identified and recruited to serve as technical experts for and with the agencies. They will be invited to assist in developing syntheses, participate in agency cadres, lead workshops, and become technical experts that agency personnel can contact regarding specific needs/issues. This effort will be orchestrated by the project coordinator.

7. Program effectiveness

Program evaluation will occur in two critical areas: program structure and program content. The evaluation of program structure will be iterative and will focus on whether the program's organizational and physical structure effectively meets the needs of our end-user community – field level technical specialists within the target agencies. That is, has the program developed an effective suite of mechanisms for delivering content to its user community? Content evaluation will assess whether the actual materials developed meet the needs of the users. Throughout the duration of this program, we will solicit input and feedback from our target audience to assess if the materials they receive provide appropriate information (technology) in a useful format.

The basic concepts of the logic model will be used to execute our program evaluation (Evans et al. 2009). Dr. Loretta Singletary from University of Nevada Cooperative Extension will conduct the program evaluation in collaboration with Co-PI Schultz and in consultation with the Steering Committee . Dr. Singletary has experience assessing programs and needs at state and national levels (Singletary and Smith 2004, Singletary et al. 2007). A suite of assessment tools, instruments and/or approaches based on the program's ultimate goals will identify and define short-, mid- and long-term metrics of program effectiveness and impact. We will evaluate user participation in project activities by tabulating the number and type of project contacts (e.g., web use, web-based training, field workshops) with the user community. We also will tabulate the number of products directed at federal land managers (e.g., fact sheets, extension pamphlets, posters, journal articles). However, the approaches and instruments used in our evaluation will move beyond simple counts of products delivered. Surveys, focus group input, individual interviews and other assessment methods will be used to document not only user satisfaction with program activities and products, but specific changes in knowledge, actions and conditions. For example, changes in management techniques for fuels treatments, post-fire restoration, and design of fuel breaks resulting from program activities provide a powerful indication of program effectiveness. Assessment instruments will be developed to evaluate these types of changes. These instruments will be test-piloted as necessary to ensure that they provide the intended information.

We recognize that knowledge acquisition is only one barrier faced by our end user community. Other barriers (e.g., laws, policy, financial limitations, etc.) may prevent the translation of new knowledge and

technology into actions that change resource conditions. Thus, our assessment instruments and protocols will be designed to identify potential barriers that prevent the transfer of short-term knowledge gains into mid-term actions and long-term changes in resource conditions. The results of all program assessments will be summarized in peer-reviewed Extension publications (or the Journal of Extension if appropriate), provided directly to our end user communities, and made publicly available on program and Extension websites.

8. Budget

	2010		2011		
Budget Item	Requested	Contributed	Requested	Contributed	**TOTAL**
LABOR	122,586	60,234	145,734	60,234	388,788
TRAVEL	40,162		40,162		80,324
Materials and Supplies	8,375		5,375		13,750
Total Direct Costs	171,123		191,271		**362,394**
Indirect Costs	28,771		32,297		**61,069**
Total Contributed		**60,234**		**60,234**	**120,468**
Total Requested	**199,894**		**223,568**		**423,463**

9. Literature cited

Bradley, B. A. and J. F. Mustard. 2005. Identifying land cover variability distinct from land cover change: cheatgrass in the Great Basin. Remote Sensing of Environment 94: 204-213.

Brooks, M. L. and D. A. Pyke. 2001. Invasive plants and fire in the deserts of North America. In: Galley, K. M.; Wilson, T. P., eds. Proceedings of the Invasive Species Workshop: the Role of Fire in the Control and Spread of Invasive Species. Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management. November 27-December 1, 2000; San Diego, CA. Misc. Publ. No.11, Tallahassee, FL: Tall Timbers Research Station: 1-14.

Bureau of Labor Statistics. 2009. Retirement projections – FY2009-2018. http://www.opm.gov/feddata/retire/Retirement_Projections_and_Eligibility_For_NSFTP_09.pdf

Chambers, J. C, N. Devoe and A. Evenden. 2008. Collaborative management and research in the Great Basin - examining the issues and developing a framework for action. Gen. Tech. Rep. RMRS-GTR-204. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 66 pp.

Chambers, J. C., E. Leger and E. Goergen. 2009. Cold Desert Fire and Invasive Species Management: Resources, Strategies, Tactics and Response. Rangelands 31:14-20.

Center for Science, Economics and Environment. 2002. The state of the nation's ecosystems: measuring the lands, waters and living resources of the United States. Cambridge, United Kingdom: Cambridge University Press. 288 p.

Cronquist, A., A. H. Holmgren, N. E. Holmgren, and J. L. Reveal. 1986. Intermountain Flora. Vascular Plants of the Intermountain West, U.S.A. Volume One. New York Botanical Garden. Bronx, NY. 270pp.

Davis-Case, D. 1990. The Community's Toolbox. The Ideas, Methods and Tools for Participatory Assessment, Monitoring, and Evaluation in Community Forestry. FAO, Rome.

Freire, P. 1970. Pedagogy of the Oppressed. Herder and Herder, New York.

Miller, R. F., R. J. Tausch, D. E. McArthur, D. Johnson, and S. C. Sanderson. 2008. Development of post-settlement piñon-juniper woodlands in the Intermountain West: A regional perspective. USDA Forest Service, Rocky Mountain Research Station, Research Paper RP-69, Fort Collins, Colorado, USA.

Rosenberg, A. 2008. Report shows mixed progress on federal employee job satisfaction. http://www.govexec.com/dailyfed/1208/122308ar1.htm.

Singletary, L., and M. Smith. 2004. Nevada 4-H statewide impact assessment. Reno, NV: University of Nevada Cooperative Extension, EB-04-01, 1-110.

Singletary, L., M. Smith, G. Hill, S. Daniels, S. Smutko, J. Ayres, and K. Haaland. 2007. Strengthening Extension's Capacity to Conduct Public Issues Education Programs: Results of a National Needs Assessment. Journal of Extension 45(3). Available at: http://www.joe.org/joe/2007june/a1.php.

Weber, R. P. (1990). Basic Content Analysis, 2nd ed. Newbury Park, CA.