Chapter 1 : INTRODUCTION

The sagebrush ecosystem encompasses 43 million ha of semi-arid, sagebrush-dominated lands in the western United States (Wisdom et al. 2003; Figure 1.1). This vast area constitutes one of the largest ecosystems in North America (Center for Science, Economics and Environment 2002). Although the sagebrush ecosystem remains large, it has been substantially reduced in area and quality. Causes for loss and degradation are many and varied. Invasion of exotic vegetation, altered fire regimes, road development and use, mining, energy development, climate change, encroachment of pinyon-juniper woodlands, intensive grazing by livestock, and conversion to agriculture, to urban use, and to non-native livestock forage all have contributed to the ecosystem's demise (Noss et al. 1995, Tausch et al. 1995, Knick 1999, Miller and Eddleman 2000, Bunting et al. 2002).

The combination of detrimental land uses and undesirable processes has prompted scientists to identify the sagebrush ecosystem as one of the most endangered in the United States (Noss et al. 1995); almost 20% of all plants and animals associated with sagebrush and other semi-arid and arid shrublands may be at risk of extirpation (Center for Science, Economics and Environment 2002). Millions of ha of the ecosystem have been altered or eliminated during the past century (Hann et al. 1997, West 1999), and <10% of the ecosystem remains unaltered by human activities (West 1999). Moreover, habitat loss and degradation on federal lands, where most native sagebrush remains, is increasing rapidly (Hemstrom et al. 2002).

As a consequence, federal land managers are increasingly concerned about the fate of the sagebrush ecosystem and its associated species. A variety of scientific assessments have documented the myriad problems in the ecosystem (Hann et al. 1997, West 1999, Miller and Eddleman 2000), yet efforts to halt or reverse habitat loss and degradation have been unsuccessful at large scales (West 1999, Hemstrom et al 2002). In particular, cheatgrass and other exotic plants continue to displace native sagebrush communities following intensive grazing and large, intense wildfires (Billings 1994, Hann et al. 1997, Bunting et al. 2002), and this form of habitat loss is accelerating on federal lands (Hemstrom et al. 2002). Calls for more intensive, sustained, and extensive conservation and restoration efforts in the ecosystem are growing, coupled with the realization that such efforts require monumental spatial and temporal scales of application to be effective (Knick 1999, Bunting et al. 2002, Hemstrom et al. 2002).

One of the more notable problems in the sagebrush ecosystem has been the substantial and continuing decline in habitats and populations of greater sage-grouse (Connelly and Braun 1997; Schroeder et al. 1999). Problems for sage grouse mirror the situation for many other plants and animals that are associated with sagebrush. Suring et al. (in prep.) identified 363 species of sagebrush-associated plants and animals of conservation concern in the sagebrush ecosystem (see Wisdom et al. 2003). Similar lists have been developed by State Natural Heritage Programs and by state and federal agencies.

Despite the long list of species of concern, few assessments have explicitly evaluated habitats for a comprehensive set of species associated with the sagebrush ecosystem. Exceptions include the regional assessments for vertebrates of concern in the Interior Columbia Basin (Wisdom et al. 2000, 2002, Raphael 2001) and regional assessments by The Nature Conservancy for biodiversity in the Great Basin and Wyoming Basins Ecoregions (Freilich et al. 2001, Nachlinger et al. 2001). Given the rapid loss and degradation of sagebrush habitats, additional regional assessments are needed to understand the potential effects of future threats on sagebrush-associated species of concern (Wisdom et al. 2003).

In response to the need for better scientific information about habitat conditions and threats at regional scales in the sagebrush ecosystem, Wisdom et al. (2003) developed procedures for regional assessment of sagebrush habitats for species of conservation concern. Objectives for developing these methods were to: (1) identify regional assessment procedures that can be used efficiently and credibly to evaluate conditions for a comprehensive set of species of conservation concern in the sagebrush ecoregions; (2) develop methods by which trade-offs between the needs of individual species versus a comprehensive set of species can be addressed systematically and defensibly at regional scales for land use planning; (3) demonstrate the use of regional assessment procedures with spatial data currently available as a continuous coverage across all sagebrush ecoregions; and (4) provide guidance regarding use of the procedures for effective multi-species planning at regional versus local scales as part of ecosystem management.

We conducted this regional assessment as a prototype, or working example, to demonstrate the application of the regional assessment procedures of Wisdom et al. (2003). We chose the Great Basin Ecoregion (Great Basin) and state of Nevada as examples of spatial extents for demonstrating the application of these procedures. Despite the accelerating loss and degradation of sagebrush habitats across western North America, the Great Basin in Nevada, Utah, and California encompasses 1 of the largest areas of sagebrush cover types that remain today (Fig. 1.1). Sagebrush cover types compose 8.8 million ha, or 30% of the Ecoregion. In Nevada, sagebrush cover types occupy 10.2 million ha, or 36% of the State. Consequently, management of these vast areas of sagebrush is likely to have strong bearing on the fate of many species associated with the sagebrush ecosystem as a whole.

Accordingly, the goals of our assessment were to estimate and map habitat conditions for sagebrush-associates species of concern in the Great Basin and Nevada, and to do so as a demonstration of the recently developed assessment procedures for sagebrush habitats (Wisdom et al. 2003). Our primary motivation was to provide information useful in maintaining or improving the probability of habitat and population persistence for species of conservation concern. Supporting objectives were to: (1) assess dominant threats to habitats for a comprehensive set of species of concern; (2) provide information useful for assessing trade-offs between the needs of individual species versus a comprehensive set of species, for efficient and credible land use planning at regional scales; (3) demonstrate the application of regional assessment procedures with spatial data currently available across the ecoregion; and (4) identify key management implications from the results, for effective multi-species planning at regional scales as part of ecosystem management.

Our assessment was designed to complement and support related work for sagebrush habitats and associated species. Such work includes the SAGEMAP Project (http://sagemap.wr.usgs.gov) led by USDI Geological Survey (USGS), the Great Basin Restoration Initiative led by BLM (USDI Bureau of Land Management 1999), ecoregion assessments by TNC (e.g., Freilich et al. 2001, Nachlinger et al. 2001), state-level conservation strategies for sage-grouse and associated habitats (e.g., Anonymous 1997; Canadian Sage Grouse Recovery Team 2001; Neel 2001), and local assessments underway by USDI Bureau of Land Management (BLM) and USDA Forest Service (FS). Use of results from our assessment may also help state agencies meet their goals related to management of sagebrush-associated species.

Literature Cited

Anonymous. 1997. Gunnison sage-grouse conservation plan. Gunnison Basin, Colorado. Bureau of Land Management, Gunnison, Colorado, USA.

Billings, W. D. 1994. Ecological impacts of cheatgrass and resultant fire on ecosystems in the western Great Basin. Pages 22-30 *in* S. B. Monsen and S. G. Kitchen, editors, Proceedings - ecology and management of annual rangelands. USDA Forest Service General Technical Report INT-GTR-313.

Bunting, S. C., J. L. Kingery, M. A. Hemstrom, M. A. Schroeder, R. A. Gravenmier, and W. J. Hann. 2002. Altered rangeland ecosystems in the interior Columbia Basin. USDA Forest Service General Technical Report PNW-GTR-553.

Canadian Sage Grouse Recovery Team. 2001. Canadian sage grouse recovery strategy. Canadian Sage Grouse Recovery Team. Saskatchewan Environment and Resource Management, Regina, Saskatchewan and Alberta Sustainable Resource Development, Edmonton, Alberta, Canada.

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 University Press, Cambridge, United Kingdom.

Comer, P., J. Kagan, M. Heiner, and C. Tobalske. 2002. Sagebrush vegetation in the western United States. Map 1:200,000 scale. USGS Forest and Rangeland Ecosystems Science Center, Boise, Idaho, and The Nature Conservancy, Boulder, Colorado, USA.

Connelly, J. W., and C. E. Braun. 1997. Long-term changes in sage grouse *Centrocercus urophasianus* populations in western North America. Wildlife Biology 3:229-234.

Freilich, J., B. Budd, T. Kohley, and B. Hayden. 2001. Wyoming Basins ecoregional plan. The Nature Conservancy, Boulder, Colorado, USA.

Hann, W. J., J. L. Jones, M. G. Karl, P. F. Hessburg., R .E. Keane, D. G. Long, J. P. Menakis, C. H. McNicoll, S. G. Leonard, R. A. Gravenmier, and B. G. Smith. 1997. Landscape dynamics of the basin. Pages 337-1055 *in* T. M. Quigley and S. J. Arbelbide, technical editors, An assessment of ecosystem components in the interior Columbia Basin and portions of the Klamath and Great Basins. Volume 2. USDA Forest Service General Technical Report PNW-GTR-405.

Hemstrom, M. A., M. J. Wisdom, M. M. Rowland, B. Wales, W. J. Hann, and R. A. Gravenmier. 2002. Sagebrush-steppe vegetation dynamics and potential for restoration in the Interior Columbia Basin, USA. Conservation Biology 16:1243-1255.

Knick, S. T. 1999. Requiem for a sagebrush ecosystem? Northwest Science 73:53-57.

Miller, R. F., and L. L. Eddleman. 2000. Spatial and temporal changes of sage-grouse habitat in the sagebrush biome. Oregon State University Agricultural Experiment Station Technical Bulletin 151, Oregon State University, Corvallis, Oregon, USA.

Nachlinger, J., K. Sochi, P. Comer, G. Kittel, and D. Dorfman. 2001. Great Basin: an ecoregion-based conservation blueprint. The Nature Conservancy, Reno, Nevada, USA.

Neel, L. A., editor. 1999. Nevada Partners in Flight bird conservation plan. Carson City, Nevada, USA. Available at http://www.blm.gov/wildlife/plan/pl-nv-10.pdf.

Noss, R. F., E. T. LaRoe III, and J. M. Scott. 1995. Endangered ecosystems of the United States: a preliminary assessment of loss and degradation. National Biological Service Biological Report 28, National Biological Service, Washington, D.C., USA.

Raphael, M. G., M. J. Wisdom, M. M. Rowland, R. S. Holthausen, B. C. Wales, B. M. Marcot, and T. D. Rich. 2001. Status and trends of habitats of terrestrial vertebrates in relation to land management in the Interior Columbia River Basin. Forest Ecology and Management 153:63-88.

Reid, M., P. Comer, H. Barrett, S. Caicco, R. Crawford, C. Jean, G. Jones, J. Kagan, M. Karl, G. Kittel, P. Lyon, M. Manning, E. Peterson, R. Rosentreter, S. Rust, D. Tart, C. Williams, and A. Winward. 2002. International classification of ecological communities: terrestrial vegetation of the United States. Sagebrush vegetation of the Western United States. NatureServe, Arlington, Virginia, USA.

Schroeder, M. A., J. R. Young, and C. E. Braun. 1999. Sage-grouse (*Centrocercus urophasianus*). A. Poole and F. Gill, editors. Number 425, The birds of North America, The Academy of Natural Sciences, Philadelphia, Pennsylvania and The American Ornithologists' Union, Washington, D.C., USA.

Suring, L. H., M. J. Wisdom, M. M. Rowland, and B. C. Wales. In Preparation. Determining species of potential conservation concern associated with sagebrush ecosystems in the western United States. Unpublished report on file, Pacific Northwest Research Station, La Grande, Oregon, USA.

Tausch, R. J., J. C. Chambers, R. R. Blank, and R. S. Nowak. 1995. Differential establishment of perennial grass and cheatgrass following fire on an ungrazed sagebrush-juniper site. Pages 252-257 *in* B. A. Roundy, E. D. McArthur, J. S. Haley, and D. K. Mann, compilers, Proceedings: wildland shrub and arid land restoration symposium. USDA Forest Service General Technical Report INT-GTR-313.

USDI Bureau of Land Management. 1999. The Great Basin Restoration Initiative: out of ashes, an opportunity. USDI Bureau of Land Management, National Office of Fire and Aviation, Boise, Idaho, USA.

West, N. E. 1999. Managing for biodiversity of rangelands. Pages 101-126 *in* W. W. Collins and C. O. Qualset, editors, Biodiversity in agroecosystems. CRC Press, Boca Raton, Florida, USA.

Wisdom, M. J., R. S. Holthausen, B. C. Wales, C. D. Hargis, V. A. Saab, D. C. Lee, W. J. Hann, T. D. Rich, M. M. Rowland, W. J. Murphy, and M. R. Eames. 2000. Source habitats for terrestrial vertebrates of focus in the interior Columbia basin: broad-scale trends and management implications. USDA Forest Service General Technical Report PNW-GTR-485.

Wisdom, M. J., M. M. Rowland, B. C. Wales, M. A. Hemstrom, W. J. Hann, M. G. Raphael, R. S. Holthausen, R. A. Gravenmier, and T. D. Rich. 2002. Modeled effects of sagebrush-steppe restoration on Greater Sage-Grouse in the interior Columbia Basin, USA. Conservation Biology 16:1223-1231.

Wisdom, M. J., M. M. Rowland, L. H. Suring, L. Schueck, C. Wolff Meinke, B. C. Wales, and S. T. Knick. 2003. Procedures for regional assessment of habitats for species of conservation concern in the sagebrush ecosystem. March 2003 Report, Version 1, Pacific Northwest Research Station, La Grande, Oregon, USA.

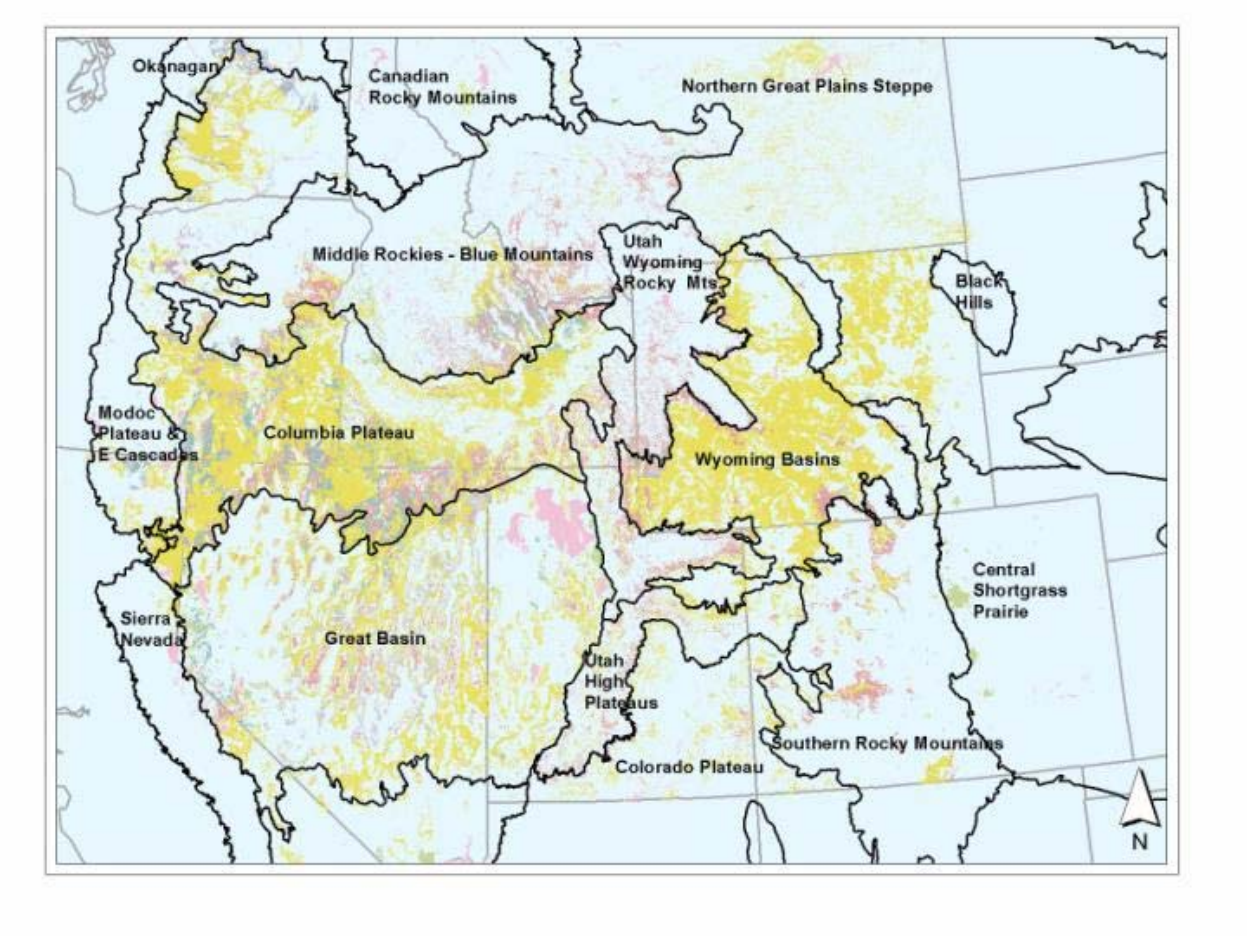

Figure 1.1. Ecoregions containing sagebrush and adjacent ecoregions of the western United States. Ecoregions are described and defined in detail by The Nature Conservancy (e.g., Nachlinger 2001). Colored pixels are sagebrush cover types, based on the 90-m sagestitch map (Comer et al. 2002), using the national classification system of cover types (Reid et al. 2002).