Chapter 2 : ASSESSMENT AREA

Selection of Assessment Boundaries

Any ecological assessment requires delineation of the spatial boundaries within which data will be collected and analyzed. These boundaries may be based on administrative or ecological criteria, or both, depending on objectives of the assessment. The choice of spatial boundaries ultimately will influence the utility of the results for land management planning (for example, planning based on ecological boundaries may not effectively use information gathered at administrative scales). To address both ecological and administrative extents in our study, we used as our primary analysis areas the Great Basin Ecoregion (hereafter referred to as Great Basin) and the State of Nevada (Fig. 2.1).

Ecoregions, based on similarities in biotic and abiotic factors, have gained favor during the last 20 years as a biologically meaningful spatial framework for resource management agencies and conservation organizations (Groves et al. 2000, McMahon et al. 2001). They have been adopted, for example, by The Nature Conservancy (TNC), World Wildlife Fund-United States (WWF-US), the U.S. Environmental Protection Agency (EPA), the USDA Forest Service, the U.S. Fish and Wildlife Service, and the USDA Natural Resources Conservation Service (NRCS) for such applications as regional conservation planning, biodiversity analysis, and agricultural census (McMahon et al. 2001). Several classification systems for ecoregions are in use today; 3 of the most common include (1) the hierarchical ecoregion maps of Bailey (Bailey 1995, 1998); (2) the Omernik system used by the EPA (Omernik 1987, 1995); and (3) the Major Land Resource Areas (MLRAs) of NRCS (U.S. Department of Agriculture 1997). For our prototype assessment, we chose the Great Basin Ecoregion as defined by The Nature Conservancy in its conservation blueprint for this ecoregion (Fig. 2.1; Nachlinger et al. 2001). By using the same boundary as that used by TNC, we provided additional analyses and summaries to complement those previously compiled by TNC and already in use for conservation planning in this ecoregion (Nachlinger et al. 2001). The Great Basin Ecoregion boundary used by TNC largely follows that of the Intermountain Semidesert and Desert Province of Bailey (1995) but was modified, among other reasons, to more closely match the southern boundary of the ecoregion with the northern limit of creosote bush dominance (see Nachlinger et al. 2001 for more details on the modification of this boundary). The ecoregion also closely matches the Central Basin and Range Level III Ecoregion of Omernik (U.S. EPA 2003) and the Great Basin Shrub Steppe Ecoregion of the World Wildlife Fund-U.S. (Ricketts et al. 1999).

The Great Basin encompasses more than 29 million ha, stretching from the eastern flank of the Sierra Nevada Mountains in California to central Utah east of the Great Salt Lake (Fig. 2.1). The ecoregion is located primarily in Nevada (69%), with only the northern and southern extremes of the state excluded from the ecoregion boundaries. The remainder of the ecoregion is in Utah (27%) and California (4%), with only a trace (<0.1%) in Idaho (Fig. 2.1). To address planning at administrative scales, we completed parallel summaries for the State of Nevada, an area equivalent in size to the Great Basin (Fig. 2.2). These summaries were intended to aid in land use planning by the Nevada State Office of the Bureau of Land Management.

To complement the state-wide results of our analyses, we also summarized results for the 8 BLM Field Offices within Nevada in a separate report (Rowland et al. 2003). Two of these offices, Eagle Lake and Surprise, are only partially contained in the state; however, the remaining 6 lie wholly within Nevada and range in size from 3.5 million ha (Carson City) to 5.4 million ha (Battle Mountain).

Description of the Ecoregion

The Great Basin encompasses a vast area most often defined by its unique hydrographic status, having no drainage outside the basin; that is, surface water within the basin drains inward (Trimble 1989, Brussard et al. 1998, Ricketts et al. 1999, Nachlinger et al. 2001). In addition to its unique hydrography, the region is distinguished by its basin-and-range topography, the result of block faulting. There are more than 300 isolated mountain ranges within the Great Basin, mostly oriented north-south, with narrow, intervening valleys and playas (Nachlinger et al. 2001). The highest peaks, in the White Mountains, stand >4,000 m, whereas the lowest valley floors are <325 m (Nachlinger et al. 2001). Trimble (1989:10) described the basin's key features: "a temperate desert, with cold snowy winters and hot dry summers, dominated in valleys by sagebrush and shadscale." The overwhelming dominance of federally managed lands—78% of the land base in the Ecoregion—also typifies the basin (Nachlinger et al. 2001). Although long believed to be a nothing but a "metaphorical sagebrush ocean" (Trimble 1989:94), the Great Basin is now recognized as a region not only rich in biodiversity, but also faced with pervasive and increasing threats to that biodiversity, including invasion by cheatgrass and other exotic plants, inappropriate grazing by domestic livestock and wild horses, and urbanization (Brussard et al. 1998, Ricketts et al. 1999, BLM 2000, Nachlinger et al. 2001, Stein 2002).

The climate in the Great Basin has changed dramatically during the Holocene Epoch, with the last 150 years characterized by warmer temperatures, reduced fire frequencies in much of the region, and increased CO_2 levels (Tausch and Nowak 2000). Currently, the Great Basin is considered arid, with an average annual precipitation of 216 mm. Although highly variable, most precipitation falls during winter or spring. Saline, and often alkaline, soils dominate in the poorly drained playas (Trimble 1989). Soils of this region are primarily Aridisols, which are low in humus and high in calcium carbonate. Mountain ranges are composed of granite and basalt in the western and southern portions of the Ecoregion, of rhyolite in the center of the Ecoregion, and limestone in the east (Nachlinger et al. 2001).

Sagebrush is a dominant cover type in the Great Basin (Brussard et al. 1998), with more than 25% of the Ecoregion composed of various sagebrush species (Table 3.3). Compared to other TNC ecoregions in the sagebrush ecosystem, the Great Basin ranks 2nd in abundance of sagebrush, surpassed only by the Columbia Plateau (see Table 1 in Wisdom et al. 2003). In addition to sagebrush, salt desert scrub communities also are abundant, supporting plants such as greasewood, creosote bush, fourwing saltbush, shadscale, and winterfat. Compared to the Great Basin Ecoregion, the State of Nevada has a higher proportion of sagebrush, owing to the high density of Wyoming and basin big sagebrush in the northern portion of the state that is not included in the Great Basin Ecoregion (Table 3.3). The very southern portion of Nevada, also outside the Ecoregion, is dominated by the xeric shrublands of the Mojave Desert.

The extremes of topography and climate in the Ecoregion have contributed to a rich assemblage of endemic plants and animals, as well as more common species (Brussard et al. 1998, Ricketts et al. 1999, Nachlinger et al. 2001, Stein 2002). Utah, with 3,892 species, ranked 10th in biodiversity among the 50 states in a recent compilation by NatureServe, while Nevada, with 3,872 species, ranked 11th (Stein 2002). Ricketts et al. (1999) evaluated conservation status of 116 terrestrial ecoregions across North America. The Great Basin Shrub Steppe Ecoregion was among the most diverse in both number (2,388-2,690 species) and endemism (151 species) of vascular plant species, as well as in richness and endemism of all taxa analyzed. The ecoregion also was classified as “bioregionally outstanding” (Ricketts et al. 1999). In identifying conservation targets for the Ecoregion, Nachlinger et al. (2001) noted that 362 species are imperiled, due to rarity or other factors. Among their 578 species-level conservation targets are 296 endemic species and 31 federally listed endangered, threatened, or candidate taxa, 16 of which are fish. Some species, although ranked as secure, are declining in numbers. The Great Basin serves as a stronghold for several such species, including pinyon jay, sage thrasher, and Brewer’s sparrow (Nachlinger et al. 2001, Sauer et al. 2003). Despite the great biodiversity of the ecoregion, the area is relatively understudied with regard to biological surveys. For example, Ertter (2000) noted the recent discovery of 19 plant species new to science in the Great Basin. The herpetofauna in particular has not been well-studied (Setser et al. 2002). (See Nachlinger et al. 2001 for more detailed descriptions of the ecology of the Great Basin.)

Threats to Ecosystems in the Great Basin

Threats to ecosystems in the Great Basin are diverse and often widespread, and include inappropriate grazing by livestock and wild horses, roads and fences, increasing urbanization, mine development, invasions of exotic species, and altered climatic regimes (Trimble 1989, Brussard et al. 1998, Ricketts et al. 1999, Nachlinger et al. 2001). Such threats may translate into risks to various species and their habitats. For example, in a recent summary of risks to biodiversity among each of the 50 United States, Stein (2002) reported that Utah was ranked 3rd and Nevada 4th for plants at risk. Similar results were reported in Utah for fish and Nevada for amphibians; each state ranked 3rd for risk to these species groups. In terms of overall risk, based on the percentage of a state’s plants and animals at risk of extinction, Nevada ranked 3rd, while Utah was 5th (Stein 2002). The Great Basin Shrub Steppe Ecoregion, as defined by WWF-US, was reported as having only 5-9% of its remaining habitat intact (Ricketts et al. 1999).

Among the many threats noted for the Great Basin, 2 in particular are consistently cited—invasions by exotic species, particularly cheatgrass, and altered fire regimes, both inextricably linked by recent changes in climate and historical patterns of livestock grazing (Young and Allen 1997, Knick 1999, West and Yorks 2002). Cheatgrass, a Eurasian species introduced to the United States in the 1800s, has become ubiquitous throughout much of the arid West (Mack 1981, Billings 1994, Pellant and Hall 1994). Because of its early germination as a winter annual, by mid-summer it forms an abundant fine fuel, often leading to catastrophic wildfires that eliminate the sagebrush overstory (Billings 1994). (See Chapter 4 for details on the risks posed to sagebrush and other shrubland ecosystems by cheatgrass.) The current shift to a warmer climatic regime (Tausch and Nowak 2000), coupled with the abundance of cheatgrass, has led to shorter fire return intervals and to wildfires of unprecedented magnitude in the Great Basin—more than 680,000 ha of public lands burned in 1999 alone (BLM 2000).

Although conclusive evidence is lacking, inappropriate grazing by domestic livestock also is implicated in the spread of cheatgrass through the removal of native perennial bunchgrasses, thereby allowing cheatgrass to compete more effectively (Billings 1994, BLM 2000, Nachlinger et al. 2001). Regardless of its role in the spread of cheatgrass, livestock grazing has had profound ecological and economic effects in the Great Basin (Ricketts et al.

1999, Nachlinger et al. 2001). Young and Sparks (2002:254) described the expansion of the cattle industry into the sagebrush grasslands of the Great Basin as follows: "The … result of the experiment was the destruction—within a mere forty years—of the sagebrush/grasslands vegetation born in the wild climatic fluctuations of the Pleistocene and scantily nurtured by the post-Ice Age aridity of the Intermountain area."

The rapid increase of woodlands, especially pinyon-juniper, beyond their historical range and density is an additional threat to sagebrush and other ecosystems invaded by these species (Tausch and Nowak 2000). Not only have these woodlands expanded to currently cover 3 times the area within their range in the Great Basin compared to the Little Ice Age (550 to 150 years BP), but trees within these woodlands have increased in dominance as fire frequencies have decreased (Tausch and Nowak 2000). (See Chapter 4 for further discussion about risks to sagebrush ecosystems from pinyon-juniper woodlands.)

Other threats in the Great Basin include increased rates of parasitism by brown-headed cowbirds of such species as Brewer's sparrows, a result of habitat change favoring cowbirds, and altered hydrologic regimes, especially diversion of water for agriculture (Brussard et al. 1998, Nachlinger et al. 2001). Last, the Great Basin is faced with a rapidly growing human population, with Nevada as one of the fastest growing states in the country, and Las Vegas as one of the fastest growing urban areas nationwide (Brussard et al. 1998).

LITERATURE CITED

Bailey, R. G. 1995. Description of the ecoregions of the United States. 2nd edition. U.S. Department of Agriculture Forest Service Miscellaneous Publication 1391.

Bailey, R. G. 1998. Ecoregions map of North America: explanatory note. U.S. Department of Agriculture Forest Service Miscellaneous Publication 1548.

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, compilers. Proceedings – ecology and management of annual rangelands. U.S. Department of Agriculture Forest Service General Technical Report INT-GTR-313.

Brussard, P. F., D. A. Charlet, and D. S. Dobkin. 1998. Great Basin-Mojave Desert Region. Pages 505-542 *in* Mac, M. J., P. A. Opler, C. E. Puckett Haeker, and P. D. Doran, editors. Status and trends of the nation's biological resources. Part 2 – Regional trends in biological resources. U.S. Department of the Interior, U.S. Geological Survey, Reston, Virginia, USA. Available online at: http://biology.usgs.gov/s+t/SNT/noframe/gb150.htm.

Bureau of Land Management. 2000. The Great Basin: healing the land. U.S. Department of the Interior Bureau of Land Management, Washington, D.C., USA. Available online at: http://www.fire.blm.gov/gbri/Healing.pdf.

Ertter, B. 2000. Floristic surprises in North America north of Mexico. Annals of the Missouri Botanical Garden 87:81-109.

Groves, C., L. Valutis, D. Vosick, B. Neely, K. Wheaton, J. Touval, and B. Runnels. 2000. Designing a geography of hope: a practitioner's handbook for ecoregional conservation planning. The Nature Conservancy, Arlington, Virginia, USA. Available online at www.conserveonline.org.

Knick, S. T. 1999. Requiem for a sagebrush ecosystem? Northwest Science 3:53-57.

Mack, R. N. 1981. Invasion of *Bromus tectorum* L. into western North America: an ecological chronicle. Agro-Ecosystems 7:145-165.

McMahon, G., S. M. Gregonis, S. W. Waltman, J. M. Omernik, T. D. Thorson, J. A. Freeouf, A. H. Rorick, and J. E. Keys. 2001. Developing a spatial framework of common ecological regions for the conterminous United States. Environmental Management 28:293-316.

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.

Omernik, J. M. 1987. Ecoregions of the conterminous United States. Annals of the Association of American Geographers 77:118-125.

Omernik, J. M. 1995. Ecoregions: a spatial framework for environmental management. Pages 49-62 *in* W. S. Davis and T. P. Simon, editors. Biological assessment and criteria: tools for water resource planning and decision making. Lewis Publishers, Boca Raton, Florida, USA.

Pellant, M., and C. Hall. 1994. Distribution of two exotic grasses on intermountain rangelands: status in 1992. Pages 109-112 *in* S. B. Monsen and S. G. Kitchen, compilers. Proceedings – ecology and management of annual rangelands. U.S. Department of Agriculture Forest Service General Technical Report INT-GTR-313.

Ricketts, T. H., E. Dinerstein, D. M. Olson, C. J. Loucks, W. Eichbaum, D. DellaSala, K. Kavanagh, P. Hedao, P. T. Hurley, K. M. Carney, R. Abell, and S. Walters. 1999. Terrestrial ecoregions of North America: a conservation assessment. Island Press, Washington, D.C., USA.

Rowland, M. M., L. H. Suring, M. J. Wisdom, L. Schueck, R. J. Tausch, R. F. Miller, C. Wolff Meinke, S. T. Knick, and B. C. Wales. 2003. Summary results for BLM Field Offices in Nevada from a regional assessment of habitats for species of conservation concern. 67 pp. Unpublished report on file at: USDA Forest Service, Pacific Northwest Research Station, 1401 Gekeler Lane, La Grande, OR 97850.

Sauer, J. R., J. E. Hines, and J. Fallon. 2003. The North American Breeding Bird Survey, results and analysis 1966 - 2002. Version 2003.1. U.S. Department of the Interior, U.S. Geological Survey, Laurel, Maryland, USA.

Setser, K., J. M. Meik, and D. G. Mulcahy. 2002. Herpetofauna of the southern Snake Range of Nevada and surrounding valleys. Western North American Naturalist 62:234-239.

Stein, B. A. 2002. States of the Union: ranking America's biodiversity. A NatureServe report, prepared for The Nature Conservancy. NatureServe, Arlington, Virginia, USA.

Tausch, R. J., and C. L. Nowak. 2000. Influences of Holocene climate and vegetation changes on present and future community dynamics. Journal of Arid Land Studies 10S:5-8.

Trimble, S. 1989. The sagebrush ocean: a natural history of the Great Basin. University of Nevada Press, Reno, Nevada, USA.

U.S. Department of Agriculture. 1997. Land resource regions and major land resource areas of the United States (MLRA). Digital map and attributes formerly known as NATSGO. U. S. Department of Agriculture Natural Resources Conservation Service, National Soil Survey Center, Lincoln, Nebraska, USA.

U.S. Environmental Protection Agency. 2003. Level III ecoregions map. Available online at http://www.epa.gov/wed/pages/ecoregions/level_iii.htm.

West, N. E., and T. P. Yorks. 2002. Vegetation responses following wildfire on grazed and ungrazed sagebrush semi-desert. Journal of Range Management 55:171-181.

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, 1401 Gekeler Lane, La Grande, OR 97850.

Young, J. A., and F. L. Allen. 1997. Cheatgrass and range science: 1930-1950. Journal of Range Management 50:530-535.

Young, J. A., and B. A. Sparks. 2002. Cattle in the cold desert (expanded edition). University of Nevada Press, Reno, Nevada, USA.

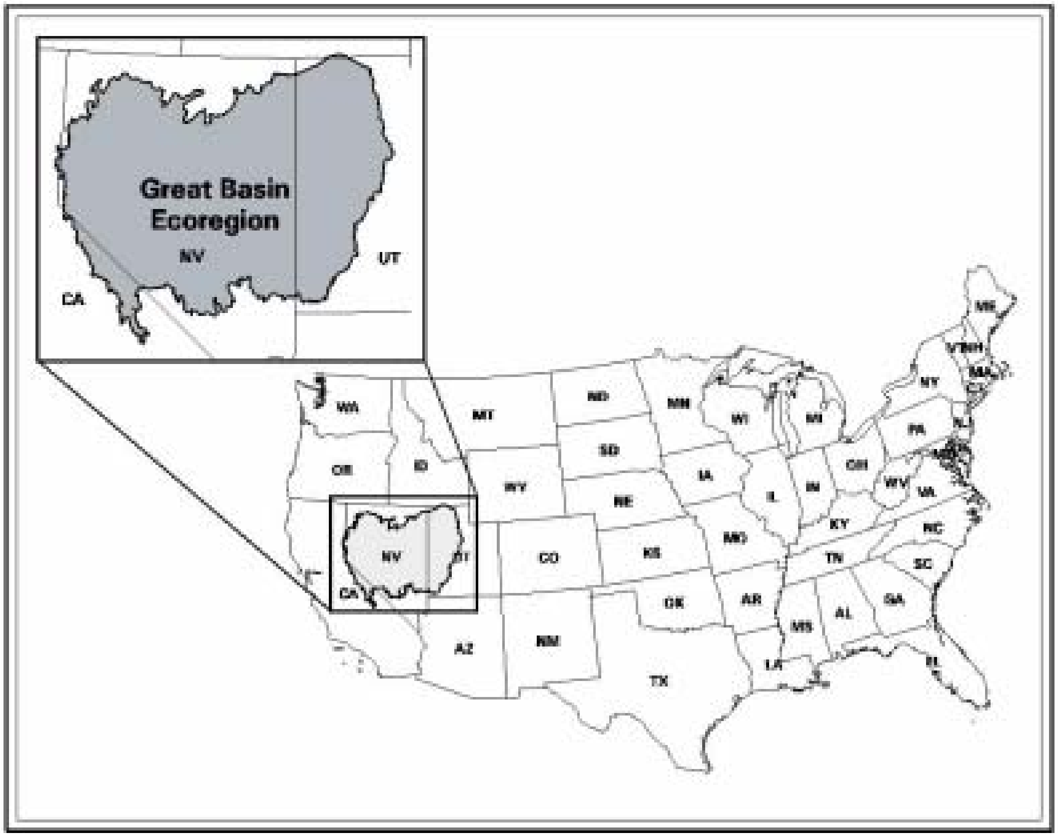

Figure 2.1. The Great Basin Ecoregion, as defined for the prototype assessment of habitats for species of conservation concern. (The ecoregional boundary follows that used by The Nature Conservancy for their assessment of this area [see Nachlinger et al. 2001].)

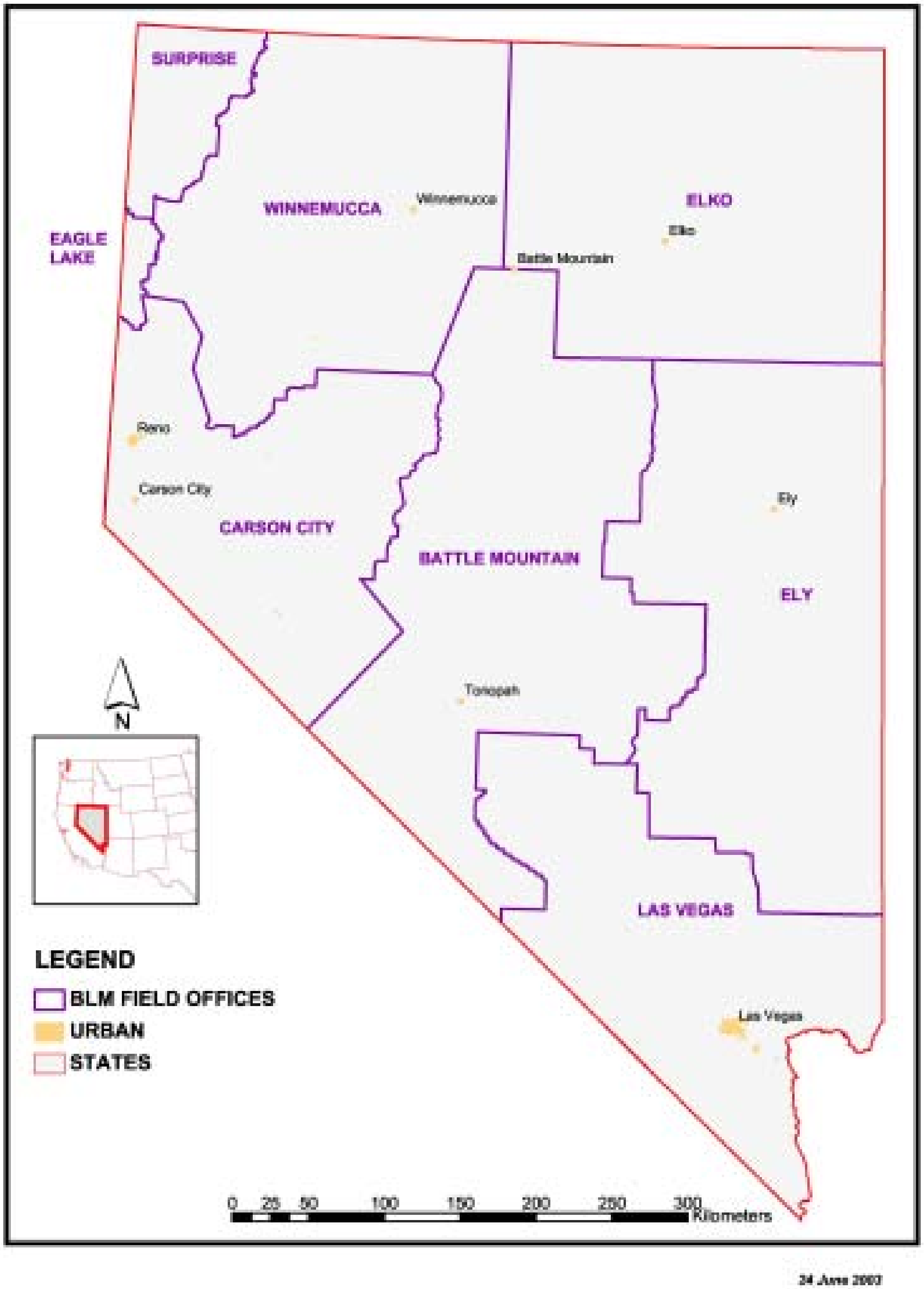

Figure 2.2. Field Offices of the Bureau of Land Management within the State of Nevada.