

Urbanization and Changing Land Use in the Great Basin

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The Great Basin is defined for this issue paper as the 61.5 million ha (152 million acres) of land within 121 Level 6 Hydrologic Units ringed by Salt Lake City to the east, Boise to the north, Reno to the west, and to the south, Las Vegas, which is outside the study boundary (fig. 1).

More than a century ago, John Wesley Powell failed to convince Congress to use watershed boundaries as administrative jurisdictions, leaving us the legacy of different analysis units for ecological and human systems. Statistics on demography, economic activity, property ownership, land use and resource use reported below are compiled from accounts at the state (Utah, Idaho, Oregon, California, and Nevada), county (only 42 of the 88 Great Basin counties are entirely within the study area), and federal levels. Statistics from the U.S. Census are compiled by census block and aggregated to the “block

group” level. The Great Basin region contains 827 block groups (fig. 2).

The Great Basin’s leading economic sectors are public land management, military activity, local government administration, mining, cattle and hay production, and oil and gas extraction (Soulard 2006). Although currently less significant, manufacturing and the service sectors related to tourism, recreation, and retirement communities are growing by around 20 percent per annum (U.S. Bureau of Labor Statistics 2006). The imprecision of this figure stems from the lack of congruence between federal analysis units (states) and the study area boundary.

Direct and indirect anthropogenic degradation of native ecosystems and the consequent reduction of beneficial services from these systems result from a combination of population increase, unsustainable consumption, technological intensity, and lack of effective resource planning.

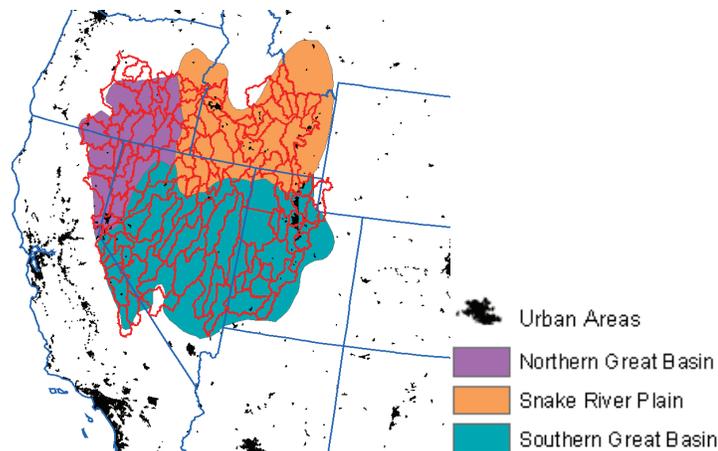


Figure 1—The Great Basin as defined for this paper includes three floristic units—Northern Great Basin, Snake River Plain, and Southern Great Basin. Level 6 Hydrologic Unit Codes (HUCs) are shown in red, urban areas in black.



Figure 2—Census blocks of the Western United States and, in grey, the Great Basin as defined for this paper.

Key Issues

Population expansion—Human population growth from immigration and births drives the expansion of housing, infrastructure, and commodity production and use. In 1990, the population of the region was 2.9 million with 9 million ha (22.6 million acres) uninhabited (zero population per km²/mile) (U.S. Census 2007b). By 2004, the population of the region had grown to 4.9 million with less than 1.2 million ha (3 million acres) uninhabited. Of the 4.9 million people living in the Great Basin in 2004, 2.6 million lived in metropolitan areas with a population greater than 50,000 (Salt Lake City, Ogden-Layton, Provo-Orem, Reno, Boise, Nampa, Logan, Idaho Falls, Pocatello, Carson City, and Bend). The largest rate of increase has been in the counties of Boise, ID, and Tooele, UT (123 percent), and the largest total population increases have occurred in Placer, CA (50,546), Utah, UT (49,877), Washoe, NV (45,000), and Salt Lake City, UT (41,000), counties (Geolytics 2007).

Clark County, which is just outside the study area, had a 2004 population of 1.7 million and a rate of increase over the previous 15 years of 203 percent. The Great Basin is surrounded by areas of much more dense population than the region itself. Populations of the adjacent areas

affect the Great Basin through use of common resources such as water, air, and wildlife, and through demand on west-wide infrastructure such as roads and air routes. The recreational qualities of the Great Basin are a large draw for visitors from adjacent states. Diverse activities, many with high direct and indirect impact such as golfing and all-terrain vehicle use, are increasing in popularity. Water demands from adjacent communities such as Las Vegas, with its burgeoning population, have potentially severe inter-basin consequences. The ecological impacts of population trends, and their synergistic interactions with socioeconomic trends, are not well understood.

Of the states partially within the Great Basin, projected population increases from 2000 to 2030 include 114 percent for Nevada, 56.1 percent for Utah, 52.2 percent for Idaho, 41.3 percent for Oregon, and 37.1 percent for California. The national projected rate of increase for the same period is 29.2 percent (U.S. Census Bureau, 2007c).

Land use—To a large extent, property ownership determines land use. Seventy percent of the land (46 million-ha/114 million acres) in the Great Basin is public. The Department of Interior (DOI) manages 34 million ha (84 million acres) (51 percent). The Bureau of Land Management is the DOI unit responsible for the largest areas (31.6 million ha/78 million acres). At the federal level, regulations and mandates created through a complex system of political processes and legislative authority direct land management.

Federally administered lands are subject to a variety of uses. About 2.2 million ha (5.5 million acres) (3.6 percent) have protection of natural resources as their primary use. Multiple-use mandates require agencies such as the Bureau of Land Management (BLM) and the USDA Forest Service to provide for grazing, mineral extraction, motorized recreation, and other uses with potentially significant ecological costs. In Nevada, 69 percent of the BLM-administered land that is vegetated is under grazing allotments. For the Great Basin portions of California, 81 percent of BLM-administered land is under grazing allotments. This does not mean that all of the land within allotments is actively grazed at any given time, but it does mean that the land is available for grazing.

Mineral extraction has a small footprint by comparison, but the local ecological effects can be extreme. Motorized recreation on public land has degraded specific locales and the affected area is expanding rapidly. Energy development on Great Basin public lands is also expanding rapidly. Perhaps the most extreme example of potential ecological consequences of public land use is the proposed nuclear waste repository on Department

of Energy land at Yucca Mountain, 145 km (90 miles) northwest of Las Vegas near the Great Basin perimeter. While a remote possibility, many people are concerned that leakage from the high-level radioactive waste to be stored on the site could devastate surrounding areas.

A related issue is the sale or exchange of public lands. The benefits of relinquishing small parcels of public lands surrounded by a large matrix of developing lands (to consolidate highly fragmented public lands) was a driving force behind the Southern Nevada Public Lands Management Act 1998 (SNPLMA). This Act authorized the sale by auction of 20,000 ha (50,000 acres) of BLM-administered land around Las Vegas. Since SNPLMA was enacted, similar legislation has been passed or proposed for four Great Basin counties. These bills or laws make public land available for development, often while protecting other lands under special congressional designations, such as wilderness. How such legislative activity continues to unfold and the support it garners could influence the ecological integrity of public lands in the Great Basin.

An intricate mix of county and city general planning shapes private property use. The urban footprint (which does not include extra-urban development occurring outside incorporated municipal limits nor the infrastructure to maintain urban dwellers) covered 340,000 ha (840,000 acres) with 1.1 million households in 2000, growing to 1.7 million households in 2004. In 1997, USDA-NASS counted 42,000 farms with 3.7 million ha (9.1 million acres) of croplands in the region. Although not property owners per se, ranchers holding grazing allotments and water rights on federal lands are an influential constituency (USDA NASS 2005).

Sprawl—The most common development pattern has become rural sprawl (Hanson and Brown 2005). As telecommuting becomes a viable employment option, more people choose to live in more isolated areas within a few hours of urban centers. Housing units at the wildland-urban interface are vulnerable to hazards such as fires and flooding. Risk mitigation activities undertaken to protect these homes from fire, floods, and landslides compromise wildlife habitat. Expanding housing drives wildlife to more marginal habitats. The cost of sprawl is increasingly a burden to municipalities providing infrastructure such as roads, utilities, schools, and social services to the developments they approve. These costs have prompted formation of coalitions between “environmentalists” and “fiscal conservatives” to arrive at alternative development patterns.

Sprawl is also an issue of expanding cities and suburbs (Burchfield and others 2006). The Great Basin remains

one of the least developed areas in the United States, but the trend is toward rapid development. In a study of the largely but not entirely overlapping Central Basin and Range ecoregion, the U.S. Geological Survey documented an expansion of developed areas of 43 percent between 1973 and 2000, mostly along Interstates 80 and 15 and U.S. Highway 395 (Soulard 2006). The land converted to development was mostly grassland and shrubland – 583 km² out of a total conversion of 649 km², or 0.2 percent of the Central Basin and Range ecoregion. In 1999, the Nevada legislature passed measures for coordinated planning across jurisdictions for land use, air pollution, and transportation. However, statutes to modernize the 1926 U.S. Department of Commerce State Zoning Act to allow local comprehensive planning requirements to include concerns regarding affordable housing, benefit versus cost of rural development, or environmental protection have not passed (Salkin 2002, Cobb 1998).

Economic development—Development is shaped in part by municipalities searching for increased tax revenue and individual wealth-seeking behavior. Revenue is generated from commodities derived from ranches, farms, extractive industries (hard rock mining, oil drilling), manufacture of consumer goods, and from services including tourism and recreation (U.S. Census Bureau, 2007a).

Vehicular traffic—The impact of vehicular use ranges from physical and chemical disturbance in the immediate area to indirect long-term effects of expanding access to adjacent lands (Watts 2006). In 2001, for Nevada alone, 110 million liters (29 million gal) of gasoline were consumed for non-highway use and 3,577 million liters (945 million gal) for highway use. Over 9 million vehicle km (6 million mi) were traveled on 107,800 km (67,000 mi) of rural roads and 19.3 million km (12 million mi) were traveled on 20,900 km (13,000 mi) of urban roads and highways (U.S. Department of Transportation 2001). Rural vehicle miles are increasing as rural sprawl accelerates (Hansen and Brown 2005).

Non-point source pollution—Pollution from agriculture has had the greatest impact on the quality of the Basin’s waters. Urban drainage systems also contribute nutrients, heavy metals, and organic loads to the non-point-source load. In addition, persistent organic pollutants, such as polyaromatic hydrocarbons and endocrine disruptors, are entering streams and water bodies through urban runoff and wastewater treatment plant discharges. To address these issues, Non-point Source Programs administered by the States are targeting the main pollutants of concern, principally heat, pH-altering substances, nutrients, salts, metals, and suspended solids. Increasing populations

and increasingly affluent populations contribute greater pollutant loads, consume more energy and materials, and pave and fragment more open space as time goes on.

Management Challenges

The capacity of the Great Basin to sustain the diverse expectations and desires of both its occupants and its visitors will lessen without effective management from the primary caretakers, federal agencies, states, counties, and municipalities. Paradoxically, effective management will only be possible with the support of the minority private landowners, visitors, and the public. Creative collaboration, community involvement, and greater common knowledge of the risks associated with non-sustainable land use practices will be needed.

Research and Management Questions

Assessment, Modeling, and Prediction

What is the current extent of urban, suburban, and exurban development and what are the rates of change and trends for the future? What are the impacts of existing and projected development on the natural resources of the Great Basin?

What are the status and trends for the economic sectors in the Great Basin?

What are the impacts of roads on natural resources? What is the extent of off-road trails and where are they? How much and what type of vehicular use occurs on roadways and for what purposes? What is the impact of this use on the resources in the immediate and adjacent areas? What is the cumulative impact of vehicular traffic?

What is the relationship between demographic variables and environmentally sustainable values?

What are the future demographic trends? How do these relate to economic and land use trends?

What are the effects of current regulations and policies and how might they be improved?

What is the cumulative effect on natural resource sectors from urban/suburban/exurban development?

What are the relationships between the economic sectors in the Great Basin and the impact of activity to natural resources in these sectors?

Planning and Collaboration

What are the barriers to effective land use planning?

What is the nexus between local natural resources and national interests in those resources?

What strategies, in addition to those currently being implemented, such as conservation easements and public-private partnerships, can improve the ecological prognosis?

What are the existing social networks of stakeholders (agencies, academia, community groups, and special interest groups) and what mechanisms work best to engage in effective land use decision-making activities? What collaboration strategies are effective?

Existing Programs and Resources

U.S. Geological Survey, Land Cover Institute, Land Cover Trends Project. Geographic Status and Trends Reports to be produced every 5 years. A Central Great Basin and Range report was prepared in 2006 and will be augmented in 2007 with a report on the Northern Great Basin and Range. <http://landcover.usgs.gov/index.php> [2007, July 17]

DOI Secretary's Cooperative Conservation Initiative provides matching funds to landowners and cooperators at state, tribal, and local levels to work collaboratively to manage natural resources. <http://cooperativeconservation.gov/> [2007, July 17]

Sagebrush Steppe Treatment Evaluation Project (SageSTEP), funded by the Joint Fire Sciences Program, is a multidisciplinary research effort that includes two social acceptability and stakeholder evaluation studies <http://www.sagestep.org> [2007, July 17]:

Assessing trade-offs and decision process by agency professionals and key stakeholder groups in the Great Basin, Mark Brunson and Jennifer Peterson, Utah State University <http://www.sagestep.org/pdfs/tradeoffs.pdf> [2007, July 17]

Social Acceptability of Alternative Management Practices, Bruce Shindler and Ryan Gordon, Oregon State University. http://www.sagestep.org/pdfs/progress/citizen_survey_summary.pdf [2007, July 17]

1000 Friends of Oregon. This is a project funded by the Hewlett Foundation to work with ranchers, environmentalists, land use planners, and others. <http://www.friends.org/> [2007, July 17]

NatureServe Vista, a biodiversity land use planning software package with a growing community of users. <http://www.natureserve.org/prodServices/vista/overview.jsp> [2007, July 17]

Orton Family Foundation. <http://www.orton.org/> [2007, July 17]

SmartGrowthAmerica. <http://www.smartgrowthamerica.org/> [2007, July 17]

Millennium Ecosystem Assessment/ Sustainable Rangeland Roundtable. <http://www.millenniumassessment.org/en/index.aspx> [2007, July 17]

Strategic Plans

General Plans are required of all municipalities receiving federal funding. In addition, state wildlife agencies are required to develop comprehensive wildlife resource plans, which usually include an identification of anthropogenic threats. Several branches of the U.S. military have a variety of strategic plans that affect Great Basin military lands: U.S. Army Environmental Center Strategic Plan for Environmental Support to Ranges and Munitions; Defense Environmental Restoration Program (DERP); Installation Restoration Program (IRP); and the Encroachment-Compatible Use Sustainability Plan. Several federal-agency strategic plans will also affect the Great Basin, such as that of the Federal Highway Administration, which provides aid to states to plan, construct, and improve the transportation network and that of the Federal Lands Highway Program, which funds access to public lands including Defense Access roads.

Land management agencies produce periodic plans for administrative units in the Great Basin, such as the forest plan for the Humboldt-Toiyabe National Forest and the Resource Management Plans of BLM field offices. These allocate lands among various uses and define the uses to which lands may be put.

References

- Burchfield, M.; Overman H.G.; Puga, D.; Turner, M. A. 2006. Causes of Sprawl: A Portrait from Space. *Quarterly Journal of Economics*. 121(2): 587-633.
- Cobb, Rodney. 1998 "Toward Modern Statutes: A Survey of State Laws on Local Land-Use Planning." *Growing Smart Working Papers Vol. 2*, American Planning Association.
- Hansen, A.J.; Brown, D.G. 2005. Land-Use Change in Rural America: Rates, Drivers, and Consequences. *Ecological Applications*. 15(6): 1849-1850.
- Geolytics, Inc. 2007. Census CD. 1980 Long Form and 1990 Long Form. East Brunswick, NJ. [Homepage Geolytics, Inc.], [Online]. Available: <http://www.geolytics.com/USCensus,Census-1980,Products.asp> [2007, July 17].
- Salkin, Patricia, Esq. 2002. From Euclid to Growing Smart: The Transformation of the American Local Land Use Ethic into Local Land Use and Environmental Controls. *Pace Environmental Law Review*. Vol 20, no. 109. Available: http://www.governmentlaw.org/files/PELR-from_euclid_growing.pdf [2007, July 17].
- Soulard, C. E. 2006. Land Cover Trends of the Central Basin and Range Ecoregion: Reston, Virginia, U.S. Geological Survey. Scientific Investigations Report 2006.
- U.S. Bureau of Labor Statistics. 2006. U.S. Department of Labor. [Homepage of U.S. Department of Labor, Bureau of Labor Statistics], [Online]. Available: <http://www.bls.gov/> [2007, July 17].
- U.S. Census Bureau. 2007a. Economic Report Series 2002. [Homepages of the U.S. Census Bureau, [Online]. Available: <p://www.census.gov/econ/census02/> [2007, July 17].
- U.S. Census Bureau. 2007b. Census 2000, Summary File 3 (SF 3). [Homepage of the U.S. Census Bureau [Online]. Available: <http://www.census.gov/main/www/cen2000.html> [2007, July 17].
- U.S. Census Bureau. 2007c. Census 2000, Census of Population and Housing, Table 1: Interim Projections: Census 2000 and Projected 2030 State Population and Change: 2000 to 2030. [Homepage of the U.S. Census Bureau], [Online]. Available: <http://www.census.gov/population/projections/PresTab1.xls> [2007, July 17].
- U.S. Department of Agriculture. 2005. National Agricultural Statistical Service (NASS): United States Department of Agriculture, National Agricultural Statistics Service, Research and Development Division, Geospatial Information Branch.
- U.S. Department of Transportation 2001. Federal Highway Administration, Highway Statistics 2001, Publication No. FHWA-PL-02-020 Washington D.C., 2001. Available: <http://www.fhwa.dot.gov/ohim/hs01/index.htm> [2007, July 17].
- Watts, R. 2006. National Overview Road Metrics (NORM) Dataset. U.S. Geological Survey, Geographic Analysis and Monitoring Program, Fort Collins Science Center. Fort Collins, CO.