Competition for Natural Resources in California's Sierra Nevada

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Abstract: The paper examines growing competition for natural resources in California's Sierra Nevada mountain region. Export demand for water, hydro-electric power and lumber from the region, and a large visitor industry over many years has been supplemented more recently by expanding demand for land and other resources within the region from exurbanites, retirees, second home owners, work-at-home professionals and service workers. Particular attention is directed to the evaluation of longstanding and recent policies to facilitate economic development and preserve environmental objectives applying concepts and criteria from welfare economics.

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1 Introduction

Background. California's Sierra Nevada mountains have participated in colorful and diverse historic events. First settled by American Indians 10,000 years ago, the region came to the attention of the world much later when gold discovered in the 1840s occasioned the first large scale wave of immigrants. More recently the mountain region's resources played an essential role in supporting settlements on the California coast, the Central Valley and in other parts of the United States and abroad. Elements of the colorful and productive past continue to the present, but remind one that "past is prologue." Current economic and social transformations, including inherent conflicts, are part of a continuing process which eventually retreats in history.

This paper emphasizes the development components in the Sierra Nevada during the last decades. California's population growth from 20 to 34 million in this period was largely concentrated in coastal regions. However, in time the most rapid rates of growth shifted from the coast first inland and more recently to the Sierra Nevada.

The Sierra Nevada although continuing to experience a low population density nevertheless is undergoing a transformation which in light of the demands for its limited and fragile resources has broad implications. One outgrowth has been a continuous public debate concerning the use and protection of those resources.

Intensive studies have examined and recommended policies to promote the Sierra Nevada's wilderness, recreational opportunities, economic opportunities, while at the same time supplying water and extractive resources. Of course, these objectives are often in competition with each other. Much research has revolved around the Sierra Nevada's ecology. Although this would seem to be an all embracing approach including the natural and manmade environment, conclusions and policy recommendations frequently lean toward the natural environment.

Definition of the Region. The Sierra Nevada extends for more than 700 kilometers in the eastern part of California covering an area of approximately 80,000 square kilometers. The Great Basin is on the east and California's Central Valley lies to the west. The mountainous areas, with Sequoia and Yosemite National Parks and Lake

Tahoe as reference points, are known as the High Sierra. However the larger region incorporates foothill areas especially on the west with gentle slopes including a subregion sometimes identified as Gold Country and also known as the "mother lode."

The Sierra Nevada encompasses fault block mountains shaped by the upward and downward tilting of major blocks of the earth's crust. On the west one finds a gentle tilt in the direction of the Central Valley and on the east are sharp breaks around faults in the earth and a steep rise in the mountains forming long escarpments. The crest of the mountain chain, with heights from 3,000-4,000 meters, presents a formidable barrier to east-west movement of people and goods. Year-round transportation routes across the Sierra Nevada are few and far apart. About 500 kilometers separates Walker Pass, near the southern boundary of the chain, from the highway and rail routes across Donner Pass. While the Sierra Nevada may be viewed as diverse and extensive, it is nevertheless considered to be a single region, due to commonalities including resource exports, recreational amenities, and emerging socioeconomic shifts. For purposes of this paper, and the presentation of data, we define the Sierra Nevada to include twelve counties: Alpine, Amador, Calaveras, El Dorado, Inyo, Mariposa, Mono, Nevada, Placer, Plumas, Sierra and Tuolumne.

Overview. In this paper we examine the human activities which have recently increased the pace of development and increased the competition for resources. The mineral and population boom of a long distant past continues to influence more recent events. The economic role of extractive resources, in a region with fragile fauna and flora, timber, minerals, pasture and croplands will be reviewed. Current developments include suburban and exurban settlements, retirement and second home communities, and buoyant visitor and recreational industries. The emergence of "lone eagles," working and residing in high amenity areas as they communicate and do business with the rest of the world is another development beginning toward the end of the twentieth century.

The role of the Sierra Nevada in California's complex water system is examined. This system includes continually changing water storage and distribution components. With over half of the State's water supply originating in the Sierra Nevada the water supply system and its management alone provide a basis for viewing the region as an integrated whole.

In the last section of the paper we focus on policy formation and implementation. We review and evaluate policies selectively in relation to water resources, growth management and recreational opportunities. Are the myriad of policies and actions conducive to desired long range sustainable developments and preservation of natural environments for future generations or do they just "postpone inevitable disaster," to borrow a phrase from diplomacy?

2 Natural and Extractive Resources

Wilderness and flora. The Sierra Nevada offers a rich and diversified natural environment, with variations which are significantly associated with time, climate, elevation, geographic location, and human settlement. The natural environment of the region has been researched in some detail and we apply a broad brush here, with references, to develop a background for later discussion.

Temperature, precipitation, earth movements and soil conditions in combination have exerted major influence on the region's diverse vegetation. The Sierra Nevada Ecosystem Project (SNEP, 1996) in its report to Congress, mentions, "more than 3,500 native species of plants, making up more than 50% of the plant diversity of California. Hundreds of rare species and species growing only in the Sierra Nevada (endemics) occupy scattered and particular niches of the range . . . " (SNEP, Vol. I, p.11). In the foothills, meadows, rangelands, woodlands including oaks and foothill pine are found interspersed with forests along streams and rivers. These are also the areas with growing human settlements experiencing potential threats to bio-diversity. Indeed, biodiversity is an important issue and explains why expanding human settlements in the Sierra Nevada should be scrutinized carefully especially when fragile resources serving the state and the nation are threatened and when these resources are not easily replaceable from others areas.

In moving from the hillsides to the higher elevations of the Sierra Nevada one witnesses the transition from chaparral to mixed conifer forests much of which has commercial value. At higher elevations the conifer forests gives way to white and red firs which eventually are replaced by subalpine and alpine species. On the eastside of the chain the transition is more abrupt. Variations in vegetation across small distances are significant and are the result of fire, storms, insects, soils, winds, long term climatic changes and other factors. Importantly, the Sierra Nevada forests have been the source of a large variety of distinct products and services for industry and consumers.

Forests, woodland and wildlife. Approximately 84 percent of the land in the Sierra Nevada is in the public domain or in public ownership, with private ownership of land concentrated in the central Sierra Nevada (Sierra Nevada Business Council, 1999). Lumber harvests have shown sharp fluctuations over the past twenty years, with the peak harvest in 1986 when residential production, a heavy user of lumber, attained a cyclical high. Timber harvests declined since then, especially on public lands where national policies are significant. A result of these developments has been decreased employment in the timber industries with a significant impact on selected counties, e.g., Alpine, Mono and Inyo, with limited alternative employment opportunities.

The interrelationships between healthy vegetation and animal life, of course, are a matter of continuing public concern. Of the approximately 400 animal species many occupy areas at different elevations depending on season or stages in the precipitation cycle over the years. Most of the species are not unique to the Sierra Nevada but occupy other niches on the Pacific Coast or throughout the West. One implication, however, is that loss of seasonal habitat has effects on other areas in the region. For example, the disappearance of certain migrating species in the High Sierra during, say, summers is associated with loss of foothill habitat in winter or spring due to human settlements. Only three species have become extinct in the Sierra Nevada during the modern period (SNEP, Volume I, pp. 79-83). These include the grizzly bear, the California condor and Bell's least vireo (a bird). Attempts to reintroduce species as, for example, the condor and bighorn sheep, have met varying success. Approximately 17% of the animal species are designated as endangered or their populations are small. The reasons for extinction or near extinction are manifold and often involve indirect as compared to direct effects of human settlements. Insecticides, introduction of non-native species, reductions in food supply, loss of habitat near streams or rivers due to water projects, power lines, diseases and declines in old growth forests as shelter are examples in point.

Mining. California's modern history has its roots in the Sierra Nevada beginning with the discovery of gold in 1848 along the American River in El Dorado County. Gold exploration and mining induced large scale migration and the establishment of a number of towns many of which had a brief life. Population rose rapidly from an original wave of 25,000 miners to perhaps 150,000-175,000 migrants in the years from 1848 to 1860. The in-migration of prospectors was associated with a precipitous decline of the native Indian population due to disease, starvation, warfare, resettlement and extermination. The early boom, involving placer mining, soon ended

as availability of surface deposits declined. Next, hydraulic mining, concentrated in fewer areas, resulted in scarring of the land and clogging and polluting of rivers. The conflicts arising from these methods led to legislation and regulations which curbed hydraulic mining practices. The effect on the land of mining, and scarring remains to this day. Other impacts of mining included denuding of woodlands and forests at lower elevations for fuel and construction of mines and communities. Much of this denuded land was converted to cropland, pastures and rangeland.

With the end of hydraulic mining and the gold rush, about 1880, the region experienced a temporary decline in population. Hard rock gold mining expanded at the beginning of the last century providing initially an economic base for a number of communities, such as Grass Valley and Nevada City, which in more recent years have attracted tourists, exurbanites, retirees and vacation housing. Other mining activities followed the gold boom on the west since the region is rich in ores. Over twenty different minerals have been found (SNEP, Volume II, p.15), including silver, lead, copper, chromite, tungsten, molybdite and others including nonmetallic minerals such as soda ash, trona and borax. Relatively few mines are in operation today and mining represents a small fraction of the Sierra Nevada's economic base.

Mining operations in the Sierra Nevada over more than 150 years have fluctuated in response to new discoveries, the vagaries of price and cost movements, alternative supply sources, technological changes, innovations and other forces. The region continues to have a large potential supply of ores and related natural resources according to recent studies. For the time being mining plays a modest role in the regional economy, but this could well change in the future.

Grazing. Prior to and at the beginning of the gold rush, sheep and other livestock were introduced into the Sierra Nevada. Inexperience and lack of understanding of range management occasioned overgrazing by cattle and sheep. Moreover, most of the land was in the public domain and, as is common in collective goods, the costs of mismanagement are borne not by particular individuals but by the larger community (Mankiw, p. 235). Few incentives were present to conserve and use resources efficiently with long term objectives in mind.

Unregulated grazing practices were reduced around 1900 as limits were placed on the number of livestock by area and periods of grazing. The problem with overgrazing is that native plants are not given enough time to recover. If the land is given a rest the

grasslands may recover, but erosion of stream channels associated with overgrazing may take decades to repair. Non-native short season grasses and other species also may flourish and this often has the result of reducing foraging productivity. Measures to shift timing, duration and intensity of use of public grazing lands in the twentieth century brought further improvements toward sustainable activity

Beef in general and beef raised on rangeland remains a product much in demand in the United States notwithstanding that cereals providing the same nutritional value could be farmed on less land. Eventually, behavior may change. In the meantime a significant part of California's beef production has shifted to feed lots.

Farming. The hilly and mountainous terrain of the Sierra Nevada offers limited opportunities for the production of row crops on a large scale. However, dairy products as well as fruits and nuts play a role in this region, including vineyards and wineries. Most of the cultivated land in the Sierra Nevada is in private hands in contrast to rangelands, forests and woods. On the west slope, agricultural land often is in the path of human settlements and given the appetite for low density residences, may be transferred. The issue is that productive agricultural land, privately owned, is more likely to be transferred to urban use than non-productive or marginally productive public land.

Farms and other open lands in California are offered an incentive not to convert to urban use through legislation known as the Williamson Act. Owners of farms and open lands who agree to maintain the land in agriculture for 10 years will have the land assessed at current rather than potential use and property taxes will be reduced. Without such a contract, farmland may be valued for tax purposes according to its potential urban use, with consequently higher taxes. Nine out of twelve Sierra Nevada counties participate and approximately 3,200 square kilometers are enrolled. Since the program reduces local public tax revenues, the state in part compensates participating counties. Notwithstanding, much land continues to be transferred to urban uses in Sierra Nevada counties suggesting property owners participate in the Williamson Act selectively. Many who participate do not renew their contract when the benefits from transfer clearly outweigh the costs. Also, beneficiaries of the legislation include many who had no intention of transferring land to urban use.

The actual or potential loss of agricultural lands to urban development, although much deplored, probably is overrated. Some of the losses may be replaced by the

conversion of rangelands to cultivation in the Sierra Nevada. Also the crops grown in the past on urbanized lands in the region for the most part were not specialty foods but could be grown in many areas. Also, in California, about 80 percent of the water is used in agriculture and the transfer of farmland to urban areas does not impose large new net demands on the Sierra Nevada water supply.

3 Demographic and Economic Trends

Demographic characteristics. Table 1 presents the demographic characteristics of the Sierra Nevada region, based on 1990 and 2000 census data. In terms of population, the region expanded from 554.5 thousand in 1990 to 688.8 thousand in 2000, representing a ten-year growth rate of 24.2%. During this same period, housing units grew at an overall rate of 21.5%. Vacant units for seasonal use expanded by approximately 8,000 units, for a growth rate of 18.2% during the decade. In 2000, these seasonal units comprised nearly 18% of all units in the region. The housing unit growth rate for the Sierra region was similar to the population growth rate; while for California, the growth rate of population exceeded that for housing units.

TABLE 1
Population and Housing Trends
Sierra Nevada Region and California

	1990	2000	% Growth 1990-2000
Sierra Nevada Region			
Population	554,503	688,833	24.2%
Housing units	276,327	335,866	21.5%
Occupied	209,871	269,903	28.6%
Vacant for seasonal use	43,058	50,895	18.2%
Other vacant units	23,398	15,068	-35.6%
State of California			
Population	29,760,021	33,871,648	13.8%
Housing units	11,182,882	12,214,549	9.2%
Occupied	10,381,206	11,502,870	10.8%
Vacant for seasonal use	193,254	236,857	22.6%
Other vacant units	608,422	474,822	-22.0%
Sierra Nevada Share of California			
Population	1.9%	2.0%	n/a
Housing units	2.5%	2.7%	n/a
Occupied	2.0%	2.3%	n/a
Vacant for seasonal	22.3%	21.5%	n/a
Other vacant units	3.8%	3.2%	n/a

Source: U.S. Census Bureau, 1990 and 2000 Census of Population and Housing

Economic characteristics. While possessing many natural, cultural and historic assets and amenities, many counties in the Sierra Nevada region have experienced high and chronic unemployment, and have been characterized by a relatively low-skilled and low-earnings labor force. The Sierra region unemployment rate stood at 8.5% in 1985, while the statewide unemployment rate was 7.2%. By 2000, the statewide rate stood at 5.2%, with the Sierra Nevada region rate at 4.7%, reflecting the strong economic growth of the latter period of the 1990s.

Data on intercounty commuting is available from the 1990 census, but no data are currently available for 2000. Nearly all parts of the Sierra Nevada region showed significant proportions of employed residents commuting outside the region. Up to 20-25% of workers in the Sierra Nevada commute to job locations in the Central Valley, primarily in the western portions of centrally located counties. This reflects an exurban pattern, with such Gold Country communities as Nevada City, Grass Valley, Placerville, Jackson, Sutter Creek, Ione, Sonora, Jamestown and Mariposa housing workers employed in Central Valley cities such as Sacramento, Stockton, Modesto and Merced.

The Sierra Nevada region also shows relatively high proportions of employed residents working at home. In 1990, some 4.8% of Sierra Nevada employed residents worked at home, compared with 3.2% statewide. By 2000, the Sierra Nevada ratio had increased to 6.1%, while the statewide ratio stood at 3.8%. In 2000, notably high proportions of home workers were exhibited in Calaveras County (7.0%), Nevada County (7.6%) and Mono County (7.5%). The phenomenon of working at home in the Sierra Nevada region includes farmers and ranchers. However, the nature of the increase leads one to believe that it also includes professionals and entrepreneurs, known as "lone eagles." The opportunities for such enterprises are often linked to innovations in communication and transportation, including the Internet, fax machines and rapid overnight delivery services, such as Federal Express.

Based on the labor force, commuting and workplace data, the Sierra Nevada region has potential for increasing diversity across industries. Table 2 presents payroll data on industry structure for the 1990s for all industry divisions except agriculture and mining, for which consistent data are unavailable. All industries show absolute expansion for the 1990-2000 period, with overall employment growth expanding by over 65%. Wholesale trade and services show rising shares of wage and salary jobs, reflecting increasing diversity and a widening economic base.

TABLE 2
California's Sierra Nevada Region
Employment Growth and Industry Structure, 1990-2000

	1990	2000	Percent Growth 1990-2000
Employment			
Construction	12,271	21,370	74.2%
Manufacturing	16,290	21,720	33.3%
Transportation, comm., util.	7,210	8,270	14.7%
Wholesale trade	3,530	7,320	107.4%
Retail trade	32,080	52,330	63.1%
Finance, insurance, real estate	7,480	11,470	53.3%
Services	34,570	70,060	102.7%
Government	34,220	51,910	51.7%
Total	147,651	244,450	65.6%
Industry Structure			
Percent of Total Employment			
Construction	8.3%	8.7%	
Manufacturing	11.0%	8.9%	
Transportation, comm., util.	4.9%	3.4%	
Wholesale trade	2.4%	3.0%	
Retail trade	21.7%	21.4%	
Finance, insurance and real estate	5.1%	4.7%	
Services	23.4%	28.7%	
Government	23.2%	21.2%	
Total	100.0%	100.0%	

Source: California Employment Development Department, Annual Average Labor Force and Employment, March 2002 Benchmark.

This shift in industry structure may be consistent with wider economic trends. For example, many wholesale trade activities are tied to internet trading, for which the business-to-business component is recognized as having the greatest potential. Regarding services, the category is very broad, and includes lodging and entertainment, as well as repair services, business services, including those to high technology industries, and medical, legal and other professional services.

These industry trends are also related to other economic forces, including the deconcentration of metropolitan employment, improved highway systems, and the use of information and telecommunications technologies in businesses, eliminating or reducing the need for a clustering of physical resources in many business sectors (SNEP, Vol. II, Ch. 11).

Visitor economy. A major component of the Sierra Nevada economy has been the visitor industry. Visitors from California, other parts of the United States, and abroad contributed over $3.2 billion in spending in 2000, as shown in Table 3. While substantial, these expenditures account for only about 5.5% of total visitor spending in California. Though showing an overall growth rate of over 52% over the 1992-2000 period (in current dollars), visitor spending in the Sierra Nevada continued to account for between 5% and 6% of statewide spending. Also, the region is a location for second homes, accounting for over 20% of such houses in California.

The Sierra Nevada region attracts substantial visitors from abroad, including Europe and Asia. These visitors see not only the scenic attractions such as Yosemite National Park, but also attend some of the lesser-known areas, including the Owens Valley and nearby Death Valley. Indeed European visitors to Lone Pine and Mount Whitney (the highest point in the 48 contiguous states) can constitute up to 40% of all visitors during the spring months, based on discussions with hoteliers in the area.

TABLE 3
California's Sierra Nevada Region
Travel Spending and Lodging Trends

	1992	2000	% Growth 1992-2000
Destination Travel Spending (millions of current dollars)			
Sierra Nevada Region	$2,108	$3,211	52.3%
State of California	$40,100	$65,999	64.6%
Sierra Region % of State	5.3%	4.9%	n/a
Sierra Nevada Lodging			
Number of establishments	136	141	3.7%
Number of rooms	10,074	12,207	21.2%
Rooms per establishment	74.1	86.6	16.9%
Average room rate (current dollars)	$68	$83	21.5%
Number of stars	2.6	2.7	2.6%
Lodging Rooms by Type			
First class hotel	745	894	20.0%
Bed & breakfast	29	207	613.8%
Historic hotel	255	313	22.7%
All others (e.g., motels, cabins)	9,045	10,793	19.3%
Percent of Lodging Rooms by Type			
First class hotel	7.4%	7.3%	n/a
Bed & breakfast	0.3%	1.7%	n/a
Historic hotel	2.5%	2.6%	n/a
All others (e.g., motels, cabins)	89.8%	88.4%	n/a

Source: Dean Runyon Associates, Destination Travel Spending by County: 1992-2000
American Automobile Association, California TourBook, 1992 and 2000

Table 3 also presents major lodging trends. Between 1992 and 2000 the number of rooms increased more rapidly than the number of establishments. Rooms per establishment rose from 74.1 in 1992 to 86.6 in 2000. The increases in rooms per establishment are associated with a quality increase attributed to the succession of older establishments. The lodging trends also show a transition in the mix of rooms with an increase in importance of first class hotels, bed & breakfast and historic hotels. This transition of lodging to include larger proportions of bed & breakfast and historic hotels meets the demands of a more diverse visitor base, engaging in a wide range of activities.

4 Water Rights and Supplies

Appropriative Rights and Riparian Rights. Water rights and use in California are influenced by several doctrines which have been codified and affirmed by the courts. The first of these, the appropriative right, came into existence during the gold rush and holds that "first-in-time, first-in-right." A party first diverting water enjoys a priority (senior) over others following with" junior rights." Among some of the elements of appropriative rights are a right to sell and transfer, divert and control water, and reasonable and beneficial use. A senior may not change water use if it damages juniors and the right can be enforced only if water is put to beneficial use.

The riparian right, based on English Common Law, concerns the right to use water by a property owner located next to the course of water (river, stream, lake, etc). The water used must be on the parcel along the water course and there is no priority of use. The concept of reasonable use is implied and rights are not lost by non-use. The seeming conflict between appropriative and riparian rights was resolved largely by the California Supreme Court many years ago which held that, with some exceptions, the riparian rights are superior if the use is reasonable. Later it was determined that to establish his claim, a riparian must show that an appropriative right user interferes with a riparian's reasonable use.

The dominance of the appropriative rights doctrine, when gold mining was intensive, was challenged with the introduction of hydraulic mining practices–a California innovation. One outcome was that approximately 1.1 billion cubic meters of debris accumulated in the Sierra Nevada streams and rivers. This created not only havoc for downstream users associated with deteriorating water quality and blockage of streams but increased the danger of flooding in the San Joaquin and Sacramento Valleys where farming was emerging as an important economic activity. A long judicial

battle ensued which after many years of litigation was resolved in favor of farming and in the process gave superiority to the riparian doctrine in legal disputes as long as all parties have reasonable claims.

Remnants of the turbulent past left their mark on the Sierra Nevada. In areas where minerals were mined an extensive system of ditches, flumes and reservoirs was built and many of the facilities remain and are in operation today even though mining has ceased. They serve communities and their surroundings whose population has increased in recent years, especially in the Gold Country. Also these facilities were incorporated in the region's hydroelectric power system which was developed to serve clients outside the region in northern California.

Urban Demands for Sierra Nevada Water. The demands for Sierra Nevada water came from southern and northern California cities. Plans for accessing and transporting water began in the early years of the twentieth century. The Hetch Hetchy reservoir is located in Yosemite National Park and water did not become available to San Francisco from this source until 1934. However, this vast project includes a supply of water and electricity to areas inside and outside the city. Concerning Los Angeles, the first 370-kilometer aqueduct, on the east slope of the range in Owens Valley and completed in 1913, was extended to the Mono Basin in 1941 and supplemented by a parallel aqueduct. Both ventures required the collaboration of the federal, state and local governments. The negative effects within the Sierra Nevada region included flooding of the scenic Hetch Hetchy Valley and the preemption of irrigated agriculture in the Owens Valley. These effects reflect the demands of the large populations and politically more powerful forces in California's two major urban areas.

The two urban oriented water projects drawing on the Sierra Nevada were precursors for two later massive projects with a strong agricultural orientation. Cycles of drought followed by floods and increases in irrigated lands of California's farm areas, plus reduction in the groundwater table, created demands for greater stability and increased supply of water. This provided an impetus for the Central Valley Project (CVP) started by the State of California, and taken over later by the United States Bureau of Reclamation during the 1930s . Large construction projects in or at the edge of the Sierra Nevada included dams, reservoirs, and canals at Shasta, New Melones, Folsom, Friant as well as smaller projects in other areas. Contracts with water districts and farmers for water were generous and amounted to handsome

subventions which only in recent years have been subject to correction. Among some of the consequences of low water prices in the past were excess quantities of water demanded and inefficiencies in its utilization

Even before the CVP came on stream in the 1940s and 1950s pressures were exerted for a State Water Project serving areas not in the CVP. California voters eventually approved what became known as the Feather River Project including a very large dam at Oroville. One of its features is an aqueduct system on the west of the Central Valley which extends all the way to southern California. This system in part is a replacement for water from the Colorado River, serving California that has been reallocated substantially, by the courts, in favor of Arizona. No large water projects drawing on the Sierra Nevada resources have been initiated in the last twenty years. Public opinion, policies and legal decisions have been running in the other direction as concerns to protect the environment and project costs have come to center stage. Action has been taken to raise the level of Mono Lake because its lowering threatened wildlife. New requirements also require the wetting of Owens Lake for control of particulate air pollution. Construction of a dam at Auburn was halted, several rivers were added to the national wild and scenic river system and other measures have been taken that in the long run benefit Sierra Nevada residents at the cost of other regions.

5 Policies for the Sierra Nevada

Policy Orientation. Social and economic priorities at different times have substantially influenced the formation, implementation, evaluation and revision of policies affecting the Sierra Nevada. Our emphasis will be on public policies,
" . . defined as the sum of law, regulation, administrative programs and public projects together with their funding and implementation . . ."(SNEP, Vol. 2, p. 146). However, we are sensitive to the role of policy development in the private sector taking the form of covenants, contracts and agreements with no or limited input from the public sector. The appropriative rights doctrine relating to water is an outgrowth of practices in the mining industry that eventually were codified. As time progressed policy emphases shifted. Early attention on the extractive industries was followed by concerns over the allocation of water to urban areas. Later, farming and ranching, the timber industries, recreation and more recently environmental quality and sustainability of the natural environment have received emphasis in that order. However, emphasis should not be confused with exclusive emphasis. To illustrate, Yosemite National Park was established in 1890 by the United States Congress, but had become a California park by 1864.

The economic criterion for public policies is that as a consequence of action taken everyone or some should benefit and no one should disbenefit. This may be regarded as an impossibility theorem and an alternative criterion is that if policies benefit some, but disbenefit others, the beneficiaries should compensate the losers so they be no worse off than before. Essentially, the goal is Pareto optimality with the Kaldor-Hicks amendment (R.G.D Allen, p. 722). One may strengthen the criterion by postulating that net benefits to society should be maximized. An assumption is that commensurate measures of benefits and costs can be determined which for obvious reasons is not easy when dealing with intangibles. Minimally, intangible benefits and costs should be identified and, if possible, measured in non-commensurate terms.

Water Policy Issues. Water issues perhaps have been the most consistent and continuing subject of public policy applying to the Sierra Nevada in modern times. The negative externality of debris clogging rivers and streams downstream and inhibiting farming led to the decision to restrain hydraulic mining. In retrospect it enhanced agricultural development in the Central Valley which in terms of the present value of the net benefits over the long run probably exceeded the value of long run losses in mining operations. However, miners and mine owners were not compensated, but one cannot ignore the possibility that some miners eventually turned to ranching and farming in the region or adjacent areas.

In comparison the acquisition of water rights and the construction of storage and distribution facilities to serve Los Angeles city and the San Francisco area clearly benefited the growing populations in these urban areas. The modest compensation by Los Angeles to property owners in the Owens Valley and redirection of the water supply from others without compensation remained a bone of contention throughout much of the past century. The actions also prevented a potential project by the U.S. Bureau of Reclamation. Over the years policy has shifted and the city of Los Angeles can no longer acquire and move water without considering the environmental impacts as in the cases of Mono Lake and "barren" Owens Lake.

San Francisco not only received permission to build the Hetch Hetchy project in a National Park, but also was assisted by the federal government in its construction. Water is not only available to the citizens of San Francisco but the city sells surplus water to surrounding communities. The flooding of a scenic valley in a National Park clearly has been a disbenefit to potential visitors and some groups in recent years have called for the demolition of this project on the grounds that an alternative supply is

available from the Feather River. Probably the urban water projects and increments over the years have contributed to the growth of the Los Angeles and San Francisco areas by way of more jobs, residents and land development. Water agencies often were reluctant to view the problem in this fashion. A common assumption was that growth would occur anyway and without an increased supply of water a growing population would be left high and dry. In part, this type of reasoning is related not only to water agents' role as public servants but also their concern about the viability and survival of their agencies. The problem was further aggravated because future projections of water demands were made without reference to water prices. The position that higher water prices would curb demand or that lower prices would create excess demand was neglected. As long as low water prices prevailed the results were projections for handsome additional storage and distribution facilities.

A related issue concerns the desire by agricultural interests for increased water supplies in order to expand irrigated farm output not so much for regional or even national consumption but for export abroad. Production of crops requiring large amounts of water and inefficient use of water in farming were among some of the problems.

The Central Valley Project (CVP) is an example in point involving submarket water prices to assist "family farms" with less than 160 acres. The subterfuge of related individuals each owning 160 acres working together in operating large corporate farms was a common practice. Only during the 1990s were adjustments made in water prices and to permit, within guidelines, transfer of water in water markets. The California State Water Project initiated during the 1950s and 1960s, drawing on one of the last large unallocated river supplies, found that the energy costs of moving water over long distances and consequent price structures reduced excess demand. No large new supplies including storage and distribution systems have come on stream recently. However, water from the Sierra Nevada is used in producing crops that, were it not for low water prices, would be raised in other areas of the nation or the world. This raises questions concerning efficiency, equity and optimality.

The conflicts surrounding water allocations in California continue notwithstanding the profligate use in many areas and economic sectors. New residential developments of 500 units or more must show where they obtain the water for prospective residents. Since few untapped or unallocated supplies are available this presents opportunities for opposition to projects or reallocation of water from other areas.

The latter is sought out by northern California communities who are invoking the "area of origin" laws passed in the wake of southern California's acquisition of most of the Owens River water (Vogel, 2002). The law was to give priority for water to communities near the "area of origin," as contrasted to those far distant–e.g., southern California– once the nearby communities reached a threshold in growth and an additional water supply was needed. In fact one Sierra Nevada county recently was successful in staking its claim in the face of opposition from environmental groups who preferred less growth within the region to retaining the water supply. Other northern California communities around San Francisco claim that being 150 kilometers from the Sierra Nevada water supply places them within the "area of origin" whereas more distant communities in southern California and the Central Valley are outside the area. Decision makers, or to be more specific the State Water Resources Control Board, have the unenviable task of defining an "area of origin" as a matter of policy.

Growth Management Policies. Water issues substantially involve the distribution or redistribution of wealth and resources between the Sierra Nevada and other regions. Human settlement policies have similar effects but also raise questions on what types of settlement are stimulated or discouraged in the Sierra Nevada and where. When human settlements involve land conversion the effects on fauna and flora include (a) reduced habitat; (b) fragmentation of habitat; (c) isolation of habitats by barriers – roads, fences etc; (d) harassment or destruction of wildlife by pets; and (e) invasion by non-native species. (SNEP, Vol. II pp.329-333). In addition a series of indirect effects on surface and underground water among others also play a role. The policy responses to these perceived problems include a myriad of regulatory tools, mitigation, taxation (sometimes a form of compensation), and prohibition. Recently, the U.S. Supreme Court reached a decision in the Lake Tahoe area asserting that a temporary moratorium on a planned retirement/vacation home development was not a form of taking by a public agency requiring compensation in accordance with the U.S. Constitution (Savage, 2002). The purpose of the moratorium was to facilitate initiation of measures which would avoid further pollution of Lake Tahoe. On the face the decision seems reasonable except the moratorium had been in place for many years and questions are raised on the meaning of "temporary." It illustrates some of the difficulties in policy analysis of fragile environments. In part, growth management is a relatively recent approach, but often represents an alliance between public servants at various levels of government who must walk a fine line between

divergent goals in satisfying the needs of the community and current residents convinced that land development will impair their life quality. Current residents in attractive growth areas usually neglect that they may have contributed to perceived or prospective environmental problems when in-migrating in the past, but they are convinced of their role as gatekeepers in guarding the future against newcomers.

Growth management today includes the establishment of growth boundaries, inducing higher densities in growth areas or generally requirements for lower densities among others. Most of the tools have an impact on land values and housing prices with taxes sometimes on "betterment" values and usually uncompensated "worsenment." If growth management tools selected reduce development and protect selected species' habitat this will be a benefit to society.

Current owner-occupant residents will benefit not only, given access, from improved environmental quality, but probably will also enjoy higher property values which they may capitalize on at time of sale. Those inhibited from development will lose or pay a higher price for entry into the market. A question arises on how some of the redistributive effect may be mitigated. Taxes on those enjoying unintended benefits are one approach, but there are others. Where feasible modest development may be permitted at the same time as measures are taken to integrate human settlement with habitat protection or to establish new preserves. Caution has to be applied that the approaches selected are not counterproductive. An illustration here is a common local approach namely to require larger lot sizes for homes. This induces the establishment of "ranchettes," a type of gentleman's farm, whose owner-occupants may grow crops but for the most part have little commitment to be efficient. The approach also redistributes income and wealth in favor of upper income and wealthy populations since it essentially inhibits modest income populations from moving in or requiring them to consume and maintain a great deal more land than they desire. Most important large lots consume more rather than less land and are likely to aggravate rather than reduce environmental pollution. Planners are averse to ranchette-type developments because they are typically built under existing zoning and require no developer fees to provide urban infrastructure, especially roads and intersection improvements.

Importantly, growth management policies are substantially within the authority of local jurisdictions. They will be applied in regulating development and land use on private lands, but not when land is owned by the State or the Federal government. To

be sure, state and federal laws concerning environmental quality and wildlife are overriding. Considerable discretion, however, remains in the hands of local authorities and their support of or opposition to land development varies. Their policies may produce positive or negative neighborhood effects but they are usually not compensated or charged. This is a pervasive issue in the United States, but may be especially problematic when dealing with a complex environmental system evidencing extraordinary diversity and complexity over short distances by height and terrain as in the Sierra Nevada.

Recreation in a Policy Framework. Recreational and leisure time activities and industries play an important role in the Sierra Nevada. Its unique natural resources and intriguing history attract visitors from throughout the world. However, in view of the relatively large number of retirees living in the region and others relying on transfer payments, demand for recreational and leisure time activities from this source is also consequential. The strong demand exists both during the winter and summer seasons. Recreational and leisure activities and industries are often considered benign, but to say they are a mixed bag would be more appropriate. The volume of traffic generated along the Sacramento/Lake Tahoe axis is particularly heavy because it includes tourists, commuters and interstate travelers whereas traffic in the direction of Yosemite National Park, also a high volume axis, includes primarily tourists. The construction and maintenance of fast and safe highways, the associated air pollution, and occasionally fire, problems plus necessary service facilities add to environmental pollution. This is not to mention the hordes of visitors and their impact on attractive sites and vistas.

Today's tourists desire urban services in and around tourist attractions and notwithstanding a love of nature their behavior is akin to the tragedy of the commons – nature and wildlife are collective goods, belong to all of us and are treated accordingly. Since the mission of public agencies includes facilitation and support of visitors as, for example, the U.S. Forest Service and National Park Service, they must develop policies to protect and conserve fragile environments at the same time as they establish facilities and service for tourists. With around 15 percent of the regions' payroll serving tourism as compared to 3 percent for all of California a strong vested interest also exists to maintain the viability of the industry (Sierra Business Council, 1999, pp 64-65). The difficult choices are illustrated by Yosemite National Park. Its visitors declined from 4.2 million in 1996 to 3.5million in 2001 (Craft, 2002). A serious flood in 1997 may have contributed since it washed away some overnight

facilities. Another factor was the closing of the gates to cars in 1996, but not thereafter, which received widespread news coverage and may have discouraged potential visitors. This followed after restrictions on driving and parking imposed in earlier periods. The National Park Service has tried to encourage walking and the use of shuttle buses, but is now concerned about the loss of visitors since it matters also to the concessionaires who provide services at a price.

In view of the mixed experiences of managers of tourist facilities and enterprises a cautious and less doctrinaire note has crept into the debate about the role of recreation in recent years. Managers have become sensitive to the variety of voices and goals in discussions. This position is an outgrowth of the finding that much uncertainty and riskiness surrounds decision making in recreation as well as in other respects. Scientists, managers and the general public are seen as participants in an integrated approach to problem solving designated as "adaptive management". It involves continuous input from and consultation with participants and, hopefully, mutual respect. In the final analysis careful scientific research is viewed as just one component. In many ways "adaptive management" amounts to what used to be known as muddling through and this may be the destiny of the 21st century.

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