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Report to the Western Water Policy Review Advisory Commission

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Policy Review Advisory Commission

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The Western Water Policy Review Advisory Commission

Under the Western Water Policy Review Act of 1992 (P.L. 102-575, Title XXX), Congress directed the President to undertake a comprehensive review of Federal activities in the 19 Western States that directly or indirectly affect the allocation and use of water resources, whether surface or subsurface, and to submit a report of findings to the congressional committees having jurisdiction over Federal Water Programs.

As directed by the statute, the President appointed the Western Water Policy Review Advisory Commission. The Commission was composed of 22 members, 10 appointed by the President, including the Secretary of the Interior and the Secretary of the Army, and 12 members of Congress serving *ex-officio* by virtue of being the chair or ranking minority member of the 6 congressional committees and subcommittees with jurisdiction over the appropriations and programs of water resources agencies. A complete roster is provided below.

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This is an Independent Report to the Commission

The report published herein was prepared for the Commission as part of its information gathering activity. The views, conclusions, and recommendations are those of the author(s) and are not intended to represent the views of the Commission, the Administration, or Members of Congress serving on the Commission. Publication by the Commission does not imply endorsement of the author's findings or recommendations.

This report is published to share with the public the information and ideas gathered and considered by the Commission in its deliberations. The Commission's views, conclusions, and recommendations will be set forth in the Commission's own report.

Additional copies of this publication may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia, 22161; phone 703-487-4650.

Contents

Page

Contents

Tables

Figures

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Executive Summary

The goal of this report is to lay out the land use context for Western water policy. Although water and land are obviously linked resources, the policy regimes are quite separate. So here we examine Western land use patterns and land use policy per se, stressing their interactions with water and water policy where appropriate.

This is a critical time in the evolution of Western land use. The region is developing rapidly, exhibiting, since the late-1980s the fastest population and economic growth rates in the nation. Most of this development is driven by the services and high-tech economy (retail, communications, professional services, recreation, etc.) instead of primary-resource extraction on which the West was historically founded. Tensions over land use (both public and private) have increased as the "traditional" and "new" economies adapt to one another, and as population growth, and demand for environmental protection, escalate with the region's development boom.

Policy Regimes

Direct land use policy operates chiefly at the local level; it is the purview of county and municipal government, though a few Western states practice more centralized, statewide land use planning and growth management. The federal role in land use, outside of the federal lands, is weak and mostly indirect, comprised chiefly of the second-order effects of national agricultural, environmental, transportation, and tax policies. Such policies can affect land use patterns (e.g., the home mortgage deduction and interstate highway program are widely held to have furthered suburbanization and urban sprawl), but, compared to local planning and zoning authority, the role of federal and (most) state government in private land use is quite weak.

Western Land Use Trends

As one would expect for an area whose population is growing faster than any other American region, land use in the American West is changing dramatically. The main trends are:

- Suburban sprawl and conurbation (the emergence of "urban corridors" or what Case and Alward (1997) call "urban archipelagos");

- An emerging pattern of "exurban" commercial and residential land use development in a ring out from the current urban fringe;

- Rural residential and commercial development (sometimes called "rural gentrification"), even in some deeply rural areas;

- Rapid small town and resort growth;

- Increased non-commodity use of federal lands, and greater conflict over federal land policy.

Western land development has resulted in a net conversion of agricultural land to residential, commercial, and infrastructural uses, and, as pointed out in other reports to the Western Water Policy Review Advisory Commission (WWPRAC), a net transfer of water from agriculture to municipal and industrial (M&I) uses.

Urban Development

The fundamentals of western urban growth do not bode well for water resources. Urban land and water use in the West is increasing rapidly and only a few western cities have something approaching effective growth management (e.g., Portland)—the rest are sprawling and, in the long tradition of economic boosterism, their leaders invite further rapid growth (e.g., Las Vegas). Even those cities with growth limits appear to be shifting land and water use pressure onto nearby communities. Most western cities have plans to increase their water supplies, and most also have plans for water conservation, though such plans do not include significant land use components. The net effect of these policies will be to reduce the per capita consumption of water in Western cities over the next few decades, perhaps slowing, but not permanently reducing, the increase in total urban water demand.

Exurban and Rural Development

While it is obvious that the West's urban growth has significant implications for water resources, less well recognized is the more recent Western pattern of "exurban" development, rapid small-town growth, and more deeply rural dispersed development—with somewhat different implications for water resource policy. Exurban and rural development puts pressure on agricultural land and puts more people and development in areas important to wildlife, open space, aquifer recharge, and other ecosystem services. Fragmented ecosystems, increased demands on public lands, and air and

water quality worsen as rural areas develop. Rural residential development often relies on individual wells and septic systems, and most Western counties report increasing demand for such permits.

This dispersed land use transformation is playing out in an unusual geography: roughly half of the land in eleven Western states is federal. Because public land ownership is important to overall land use patterns, the 17 western states of main interest to the WWPRAC can be divided between public lands states (AK, WA, OR, CA, ID, UT, AZ, MT, WY, and NM) and states with relatively little federal land (ND, SD, NE, KS, OK, and TX). The pattern of land ownership in the public lands states add a very strong signal to private land use and development: private land is chiefly valley-bottom, along riparian areas, and at lower elevation. Some Western mountain counties are less than a quarter private land, essentially all of which is valley-bottom or riparian. Thus, "build out" of these areas occurs faster than typical population growth statistics might suggest, and disproportionately affects critical wildlife habitat and lands associated with surface water resources.

The Federal Policy Role

Despite the presence of extensive federal lands, the federal government has little direct land use authority over private land use in the West. Attempts to pass comprehensive federal land use planning legislation failed in the 1970s and have not been revived (though some states, like Oregon, modeled their land use laws on the proposed federal legislation). A few federal policies aimed directly at land use can be identified (e.g., floodplain, Coastal Zone Management, soil conservation, etc.), and these are characterized mostly by voluntary, cost-sharing approaches as opposed to direct land use regulation.

It is routinely argued, however, that the federal government exerts private land use regulation through policies on endangered species, water quality (especially through non-point source standards), and through the federal-land planning process (e.g., forest plans, grazing permits, ski area permitting, etc.) which affects private land use in often subtle ways. While it is difficult in all but the most obvious cases to ascertain the influence of environmental policy on land values in different uses (and thus on the likelihood of land use change), landowners in the West make a strong case for the presumption that restrictions on land use in natural resources production adds to the cumulative pressure for alternative uses (often development).

Forces Affecting Land Use

Land use theory gives the dominant role in land use change to market forces, and strong real estate markets are driving the vast majority of land use conversions in the West, even on lands served by federal water projects or areas heavily affected by other federal actions. Where the land market demands conversion to residential and commercial land use, even in areas of relatively high-value agricultural production (e.g., in California's Central Valley), agricultural land conversion occurs at rates commensurate with population and economic growth. Few policy brakes appear to affect this pattern. Where the markets demand less land conversion (e.g., in the Upper Snake River), less change occurs.

Environmental policies are driving some very specific land use conversions on private lands (e.g., irrigated land and water purchased in the Truckee-Carson basin for wetland rehabilitation; land or easements to be purchased on the central Platte River for Whooping Crane habitat—which will still be used in agriculture). Changes in some federal land uses (e.g., reduced logging in the Pacific Northwest) and in agricultural policies (e.g., loss of the wool incentive program), have had economic and social effects on the West, but their affect on land use is not well studied. Logic dictates that policy changes that reduce the profitability of agriculture tend to push private land toward other uses.

On balance most federal policies affecting agricultural land use tend to support the continuation of agriculture. Even programs aimed specifically at reducing production have avoided permanent land retirement: soil bank and set-aside programs on the Great Plains have assiduously avoided permanent land retirement, allowing farmers to maintain "base acreage" while receiving payments not to plant certain crops, or providing cost sharing to reduce soil erosion and sediment yield from lands in production.

Still, some federal farm and resource policies contradict others, and can be seen as putting pressure on farmers and ranchers. For example, most western ranchers see the Department of the Interior's (DoI) "Range Reform" effort as anti-ranching. Farmers and ranchers throughout the West routinely cite federal species protection, wetlands, and clean water regulations as “anti-agriculture.” Additionally, as with many federal policies geared to specific economic sectors, the government's supportive role in agriculture is declining (e.g., loss of the National Wool incentive payment clearly hurt the sheep industry in the West; see Carande et al. 1995) and this role will continue to decline, opening the way for more market-driven changes in agricultural lands. Yet, others point out that agricultural land

conversion was a problem before recent environmental regulation and declining government supports for agriculture.

Water Markets and Land Use

Freer water markets in the West obviously portend greater conversion of agricultural lands. Cases like Crowley County, CO, which lost almost 50,000 acres of irrigation land in one set of water sales, show that the timing and geographical pattern of transfers can have significant negative effects on local economies; it is contingent on the agencies responsible for water management to assess and mitigate those effects. This point has been made many times by water analysts, but it is worth noting that the rate and pattern of land use change itself—which lands convert when—affects how the total social and ecological impacts play out. At the least, greater attention to land use effects of water sales is in order.

Purchases of land or conservation easements by private land trusts are an increasingly important part of the land use mix in the West. Hundreds of land trusts now exist specifically to protect agricultural lands and other open spaces. As more agricultural land comes under some form of protective easement, the need for secure water is increased. If agricultural land cannot be sold for residential or commercial use because the development rights have been donated or sold to local government or to a land trust, then agricultural water, which may not be expressly dealt with in the easement (beyond a simple accounting of water rights), becomes crucial to the success both of the agricultural enterprise and of the alternative values (open space) purchased in the easement. We need to know more about the rate and pattern of agricultural conservation easements in the West, especially on irrigated land.

Land Use Policy and Principles for the Changing West

Policy options and principles exist for lessening the social costs, and increasing the social benefits, of changing Western land use patterns. First, of course, "good planning" as it has evolved within the urban and regional planning profession deserves support from all levels of government, and especially from agencies seeking to meet changing demands on water resources.

While political trends now challenge the power of comprehensive, regulatory land use planning envisioned in traditional planning theory, local and state governments have a well-established legal obligation and authority to protect social welfare by providing an orderly, regulatory context for land development. Indeed, counties (and some states) in the West are now enlarging their land use planning and growth management efforts, even in the face of a strengthening property rights movement. Local planners will become increasingly important players in natural resource issues, from wildlife to water, and county plans will increasingly challenge the authority of other entities to take unilateral actions affecting a county's resources. Some states and counties in the West are not interested in better land use planning, and they will suffer the landscape and community degradation associated with unplanned development. It makes sense, though, for federal water agencies to support and cooperate with those local planning agencies that are engaged in effective land use planning. Local planners often do not participate in large-scale water planning, but they should be brought to the table.

The needed federal role here is to assess and mitigate the local land development effects of federal water policy and to coordinate and cooperate with local and state planners. Local planners have long complained that federal transportation policy often undercut local planning, and this problem was addressed in an effective way with the Intermodal Surface Transportation Efficiency Act (ISTEA, or "ice tea"). But, the effects of federal land and water policy on private land development have not been addressed sufficiently.

Of particular value in the water and land policy realm would be coordinated federal and state attention to the geographical pattern and land development effects of water system development, transfers, adjustment, re-habilitation, etc. Increased federal, state, and local attention is especially due to area-of-origin impacts, and effects on land owners who do not reap the benefits of transfers.

Additionally, agencies should pay attention to the growing use of conservation easements and land dedications (e.g., purchase of development rights) to protect Western agricultural land and open space. Agricultural land protection without commensurate protection of agricultural water, may be ineffective. The Federal Agricultural Improvement and Reform Act of 1996 (the 1996 "Farm Bill") included an enlarged Title II Farmland Protection Program (FPP) designed to purchase conservation easements on "prime farmland". Although the definition of prime land can include water

resources—and some lands already slated for protection under the program are irrigated—the FPP pays little attention to the sustainability of water supply on protected lands.

The American Farmland Trust, for example, has proposed in California's Central Valley that conservation easements be accompanied by some form of water use security: that is, that the agencies involved in agricultural water make a commitment (along with the farmers' commitment to stay in agriculture) to provide a "secure-affordable water supply" at least as long as the easement remains in effect. Since most land easements are developed at the local level, and water is more affected by state and federal policy, better cooperation is needed among local, state and federal water policies on specific parcels of land.

In all linked water and land use planning, well-developed land use planning principles must apply: the orderly phasing of projects, concurrency, location and design standards, impacts mitigation, and, above all, creation of a comprehensive plan that provides land owners a clear indication of current and planned land uses and regulations. All this must be underlain by a fair and rational planning and permitting process. While some planning tools are challenged by property rights advocates, the courts have upheld planning that is substantively fair in terms of impacts on property owners, clarity and consistency of regulations, and options for administrative relief (typically the "variance") and/or compensation.

Unfortunately, landowners who complain about multiple permits and changing regulations affecting their land or water uses often have a point. Land use falls under a complex set of regulations that are poorly coordinated and unclear. Although many claims of takings are overstated, certainly in many cases land owners are, indeed, surprised to find limits on their land use plans. They should not be allowed to be surprised. The three major "takings" cases affecting land use all involved building proposals that met code and were in areas already planned for such uses; so planners brought on the problems through actions that reasonable people (and the Supreme Court) could see as unfair. While land and water regulations may be sound, their joint application on particular parcel may be frustrating, and contradictory to the point of violating reasonable notions of fairness. Thus, coordinated water and land policy in geographically-specified areas, like watersheds, could reduce property owners reliance on the "takings" doctrine as grounds for relief from regulatory burden.

Good planning practice also would require local, state and federal governments not only to coordinate land and water policy, but to start to assess, and plan, the rate and pattern of future water transfers, rather than accepting what the market or conflicting government programs, demand. Land use planning practice and precedents clearly provide the logic and basis for such coordination, analysis, and guidance. Geographical pattern may be as important as rate—if certain geographically-situated water transfers have the ability to domino into larger land and water use conversions, then government entities have an obligation to assess the likely social results and to plan for their orderly progression.

Finally, a major effort to improve land use data is needed. We recognize some political sensitivities in archiving data on private land use at the state or federal level, but it simply makes no sense for Westerners to lack data on one of the most obvious, sometimes disturbing, changing geographical aspects of the region: land use.

Part I

Land Use and Land Use Policy

The West has long been considered a region of infinite opportunity and of unlimited land. But, land use issues in the West are at least as contentious, if not more so, than in the East for several reasons: much of the land in the West is federally owned; much of it is subject to significant resource constraints; and strong individualistic, property rights ideals have attached to settlement and land use in the West. Moreover, Western cities and suburbs have developed in an especially dispersed and sprawling manner that consumes large amounts of land per capita, and the region's agricultural land uses—outside the well-known concentrations of high-value crops—tend to return relatively low value per unit of land (e.g., even a modest ranch needs access to thousands of acres of range). Finally, the West is the fastest growing American region, with growth itself now a major public policy issue. In a sense, then, development of the West—land of wide-open spaces and "big sky"—is running up against land scarcity. This can only intensify as the region grows in population and develops into what some analysts expect to be the nation's most dynamic economic region during the first decades of the 21st century.

This report examines land use patterns and trends in the West and relates them to water resources and water policy. The goal is to lay out the land use context to western water policy. We seek to identify land use trends causing changes in water use, and thereby water policy, and vice versa, including several linkages among land and water use and policy:

- Land Use Trends affecting Water Uses
- Land Use Trends affecting Water Policies*

- Land Use Policies affecting Water Uses
- Land Use Policies affecting Water Policies*

- Water Use Trends affecting Land Use Trends
- Water Use Trends affecting Land Use Policies

- Water Policies affecting Land Use Trends*
- Water Policies affecting Land Use Policies*

We focus on the asterisked links. The main Western land use themes examined here include the evolving policy regime for land use, urban growth and sprawl, agricultural land conversion, and relationships between land and water uses. Because the direct federal role in land use, outside of the federal lands themselves, is weak, the main focus here is not on federal policy on land use per se, but rather on the interconnections of land use and water,

and on the trends and principles of land use management that will affect future Western development and how development affects water use.

What is "Land Use" and "Land Cover"?

Land use and land cover (LU/LC) are distinct but closely linked characteristics of the earth's surface. Agriculture, logging, grazing, and residential or commercial development are **land uses**; crops, forests, grasslands, and pavement and buildings are types of **land cover**, as are soil, ice, and water. Land use affects land cover, and changes in land cover affect land use (Meyer and Turner, 1992). LU/LC relationships vary across time and space. For example, a change from agricultural to recreational use may occur with no change in cover (say, on a grassland). Moreover, many uses are not exclusive, e.g., recreation and grazing. The most important changes in the American West, however, occur when wildlands and agricultural lands (both of which are included in a broader category of "open space") switch to residential, commercial, industrial, or infrastructural use. Though this conversion is typically thought of as occurring at the expanding edge of cities, the West exhibits land use conversions not only at the suburban fringe of its sprawling cities, but also further out from the city's edge ("exurbanization"), around small towns (especially resorts), and in more deeply rural areas (rural development or "rural gentrification").

Land use in the U.S. is usually defined and mapped by some variant of the Anderson system (urban, residential at different densities, commercial/industrial, agricultural—dryland and irrigated, etc.) or more detailed industrial classification systems for metropolitan areas. Land cover classification is less well codified, but generally uses large classes like forest, grassland, rock, built-up, etc. Various professional and research-based classification systems also exist, like the detailed wildlife habitat classes used by most wildlife agencies, land suitability classes applied by the USDA, and "prescriptions" used in National Forest land use planning.

Land use change can be considered as either: (a) a change in the intensity or other attributes within an existing category (e.g., when residential density increases); or (b) a change to another category (e.g., from agricultural to residential). Changes in land cover driven by such land use changes can be divided into two types: modification and conversion. Modification is a change of condition within a cover type (from, say, unmanaged forest to a forest managed by selective cutting). Conversion is a change from one cover type to another (e.g., deforestation to create cropland or grassland, paving, building).

Land use and cover change tend to occur simultaneously, and both can have important implications for water resources.

Definitional problems dog the entire field of land use analysis. Common terms such as "urban" or "built up" have no universal definition; many "urban" areas include significant open space and even agricultural uses.

Land use data are also poorly organized, are usually archived (if at all) at the local and county level, and are not available with much temporal depth. The U.S. Geological Survey started a major land use/cover mapping effort in the 1970s when it appeared that national land use legislation was imminent. But, the legislation failed, and, since then, much less attention has been paid to land use mapping and planning databases, except by municipalities, who must zone land into prescribed land use classes. Our experience suggests that the majority of Western counties do not have a detailed land use plan or even an accurate, up-to-date land use map.

Also in the 1970s, the Renewable Resources Planning Act of 1974 (RPA) required the U.S. Forest Service to assess land resource productivity on a regular basis (USFS, 1989), and the Soil and Water Resources Conservation Act of 1977 (RCA) required the U.S. Department of Agriculture to assess the agricultural productivity of the U.S. land base—the National Resources Inventory or NRI—with attention to land use issues such as cropland conversion to urban land, and loss of wetlands (USDA-NRCS, 1981). Although these assessment efforts do not allow us to track land use change at the parcel scale (NRI is based on a sampling system), they are providing new data and insights on broader trends and are used in this report. At this time there is no up-to-date national land use database (to compare to, for instance, the USGS 1970s data) that can be linked to actual ownership parcels or even to ecological mapping at a fine scale (e.g., 3 meters). The NRI appears to be emerging as the key national land use and cover database, but it is difficult to access and evaluate, and needs modification to make it into a land use database.

Land Use Theory

Much of the water-related interest in land use is associated with the process of conversion, especially from agricultural to residential and commercial use. Land use is typically described (and modeled) as a market equilibration of three factors: demand, location, and site characteristics, the latter including adjacent and nearby uses (with positive and negative effects on demand) and

natural characteristics judged in relation to intended use (e.g. soils for agriculture, topography and hazards for building, etc.). Land use change is conceptualized in two main ways: as an economic or as a geographical process.

The Economic Model of LU Change

Seen as a market phenomenon, land use change is depicted as a response to the changing balance of return on use and willingness to pay, established by supply and demand and locational attributes like distance from other important places, e.g., urban markets or resource sources (Abler et al., 1971). Landowners can trade their holdings on the market, and the trade transfers the full bundle of property rights (exclusive use, etc.) unless precise stipulations are explicated in the transfer.

Land use models in this vein are essentially spatial micro-economic models, and thus tend to assume economic growth: in theory all land tends toward intense urban and industrial uses as human populations and economies grow. The differentiation of cities from rural areas in this economic geography is explained by spatial "complementarity" (it makes sense to co-locate many economic activities), economies of scale, and strategic advantages (e.g., financial markets in New York or Hong Kong). In practice, most studies that try to explain land use patterns or to predict land use conversion deal only with land values (a function of demand), and location, and assume that all land is "in the market." Government regulation (through zoning, master planning, and ownership) is obviously important to actual use patterns—and to land value—but often neglected in land use models, which are typically framed in terms of urban economics and industrial location (Berry, 1967; Knox, 1994). Land "protected" from market-driven development by government action is exogenous to econometric land use models (and often referred to as an "empirical disturbance" along with physical constraints like mountains or deserts). The same applies to various land use stipulations: a ranch with deed restrictions (like a conservation easement) may trade at a lower value than one in which there remains speculative development value.

In theory, land value or "land rent" gravitates toward the point at which return on use approaches and exceeds investment necessary for that use (Alonso, 1960). Land use change is thus a process in which higher-return uses replace other uses over time. One would expect, in an efficient market, that land use conversion would occur soon after the marginal returns on a

new use exceed those for current use or for an added increment or intensification of current use.

Attempts to model urban land markets matured in the 1970s (Harris, 1985) but, by many accounts, these models were mostly research tools rather than planning tools (Batty, 1994). They were replaced by complex optimization and trade-off models (or decision-support models) now widely used by planners especially for joint transportation-land use planning and to plan services like schools and fire protection (Batty, 1994).

One problem with econometric models was that, in the real world, there is often a lag between the time when land rents point to new, usually more intense, uses, and actual land conversion, even beyond the lag expected due to transaction and development costs. Thus, land use models failed to model change over time very well. This is especially common in the process of great interest to the WWPRAC—agricultural land converting to non-agricultural use—because, many observers suggest, agricultural use is laden with more cultural and social values than other land uses. A countervailing force is land speculation, in which prices appear to outpace current reasonable development potential. Econometric models cannot readily incorporate social and cultural factors, especially those arrayed around agricultural and open space land uses in the West.

Another weakness of economic land rent models is lack of attention to government land ownership and land use policy. Both would be assumed to "deform" the land market in relatively small ways, but this surely is not the case in the West, where, at least in the eleven "public land" states, half the land is in federal ownership. Moreover, economists have not kept up with the evolution of an amenity-based market for ranchland in the West.

The Geographical (Spatial-Interaction) Model of LU Change

Geographically, the process of land use conversion is seen primarily as the spread of an urban fringe or pressure for intensified use in an urban dominated "hinterland". The most explicit geographical land use model was developed by von Thunen (see Berry, 1967), who postulated that the key constraint on land use was the distance between rural production and urban market locations. Von Thunen proposed "urban rings" of decreasing land use intensity (yielding, eventually, to dispersed agriculture), at increasing distance from city centers. As Abler et al. (1971) put it, land rent was equated with "the price of accessibility"—in this case access to the city.

These ideas have been applied to land uses as distinct as dairy farming and shopping centers. The nature of urban growth and unit area return on investment ensured, in such models, that agriculture was always displaced outward by industrial and residential uses, and the form of that displacement was shaped by geographical features affecting access (highways, terrain, etc.).

Modern geographical land use theory still holds to this general model but the distance decay functions have been lessened, such that land may developed in a leap-frog pattern anywhere within an "urbanizing region", and not necessarily at the suburban edge (this is clearly the pattern in places like the Colorado Front Range and California Central Valley). Still, many western cities, like Tucson and Albuquerque, reflect a rather traditional pattern of contiguous urban sprawl into the surrounding rural areas.

Perhaps the most surprising pattern of recent Western land use is the strong (speculation and amenity-based) land market for western ranchland, even land very far removed from urban areas or resorts. The value of ranchland, especially, say, in the Rocky Mountains, now far exceeds its agricultural value.

Geographical land use change is often modeled with little economic analysis. Population or job growth projections are converted into land use by arraying dwelling unit densities onto a landscape according to historical or postulated densities and distance effects of features like roads, attractive or noxious facilities, town nodes, or constraints like commuting distances and land use plans and zoning (The American Farmland Trust, 1995, did this for the Central Valley, as described in Part V; see also Wegner, 1994).

The long history and relative sophistication of urban and suburban land use change modeling (see Klosterman, 1994) stands in marked contrast to the state of rural land use modeling (Platt and Macinko 1983). Only a sparse literature offers some theoretical notions of rural land use (Birch 1968) outside of the more sophisticated farm-level decision-making models. Rural land use studies almost universally focus on areas of extensive crop farming (e.g., the Great Plains) and ignore mountain agriculture, grazing, or the isolated—but large—arid zone irrigation projects (those were, after all, created by government policy, not the market).

The Land Use Policy Regime

One overriding observation can be made at the outset: Western land and water resources are obviously and inextricably linked, but Western water policy, and Western land use policy, are two very separate realms. We here briefly review land use policy.

American Land Use Planning Traditions

Land use management can be considered almost any government action affecting land development, from building a highway to permitting a power station. But, land use planning as a public policy endeavor is the process through which government entities guide and regulate land development for the public good. Planning and zoning as a government responsibility and authority rests on three legal traditions: (1) the role of government in reducing harm and nuisances—this was the basis for urban zoning, essentially to separate residential from noxious industrial uses; (2) the need for government to provide for orderly timing of development and associated services ("financing and phasing"); and (3) the role of government in protecting public values (see Callies et al., 1994).

The word "planning" is often used to refer to general guides for private land use and detailed plans for public facilities like roads and schools. Plans both establish the need for facilities and timetables for their creation, and set principles for zoning and codes, which are then created by local ordinances. Virtually all planning and zoning regulations are based on models created by professional planning and city management organizations in the first half of this century (see Meck, 1996).

"Land use planning" typically refers to state and local government regulation of private land use and development—it is the main expression of government restriction on the unfettered use of private property. Federal land management can also be seen as land use planning, except that the owner, planner and regulator are the same. Government jurisdiction over private land use is relatively weak in the United States compared to Europe (Caldwell, 1987), though American land use planning is founded in English common law and was practiced in America from the time of the first European settlements (Platt, 1996).

The federal government, and, in most cases, even state government, play little direct role in routine private land use planning and regulation, having

passed this authority on to county and city (municipal) government (though, according to some planners, the state role re-emerged in the 1970s and has strengthened steadily since, see Callies, 1996). Land use planning is chiefly implemented by planning and/or zoning commissions, based on the work of professional staffs (Hoch, 1995) who answer to elected officials. Planning is a well-defined professional field with degree programs at many universities offering planning degrees accredited by the American Planning Association (though many local government professionals, from street engineers to economists, often play the role of professional planner, especially in smaller towns and counties).

Land use planning is effected through "general", "master" or "comprehensive" plans that express goals and limits on land use and development. Judicial action has upheld the authority of such plans, and, indeed, has made the existence of general plans a prerequisite for more detailed zoning, the principle being that land owners will be aware of, and the community will have expressed the public will through, the general plan, and thus land owners cannot claim surprise when actual zoning takes place. Most "comp plans" are advisory to planning commissions, and actual zoning, based on ordinances, requires formal, regulatory action by county commissions or town councils to create regulatory criteria for development (e.g., housing densities)—these are then applied to geographical areas in a zoning map. For example, the comp plan might include guidelines for development of agricultural land, but the actual zoning map would identify those lands affected by specified criteria. Thus, comp plans are often freer to reflect community goals and norms, and to express the planners' notion of desirable land use.

Perhaps most important to land use in regions experiencing population growth are subdivision and commercial "planned unit development" ordinances, that specify exactly how development will play out on the landscape. Again, these are developed at the local level, but also are often quite similar among counties because they are based on model ordinances created by professional organizations (e.g., model subdivision ordinances from the American Planning Association). Land use and zoning actions by local government have received long-standing support by the courts, and inasmuch as zoning usually protects property values, are widely accepted by land owners.

Still, land use ordinances and zoning, passed by local elected officials, often do not meet normative planning expectations. The Truckee-Carson River Basin Study (Clearwater Consulting Corporation, 1997) referred to this as:

"The repeating process of master planning an area and then amending the plan or worse ignoring the plan to accommodate immediate market needs of development" (p. 5-73). The authors obviously have some front-line, frustrating experiences of this process. All development proposals must receive permits based on local codes, and the permitting process may allow variances and exceptions for various reasons. This is nicely illustrated at any "first-Tuesday-night-of-the-month" planning commission meeting in most any county in the West, where the enduring tension between planning, public values, and private goals and rights, is made explicit.

The great tension, of course, in American land use planning lies between private property rights and public values—and the governmental imposition of those values (Strong, et al., 1996). Comprehensive land use planning to protect and enhance public values (a progressive era notion) strengthened in the U.S. right up into the 1970s. Many analysts now see it at least seriously challenged, if not weakened, by the rise of a modern property rights movement and the "takings" issue (discussed below).

The property rights tension is especially severe in the West: many Western counties don't even have building codes, much less comprehensive land use plans or zoning, and property rights advocates are fighting planning and zoning where it does exist. We'll discuss this further in the final section of this paper, but note now that how the growing tension between land use planning and private property rights plays out in the West over the next few decades is critical to how land and water will be used in the future.

Local Land Use Planning

Probably less than half of western counties have some form of growth management plan. These are required in Oregon and Washington, but are also cropping up in the other states (and sometimes quickly challenged, as in Flathead County, MT). Some state constitutions (e.g., Wyoming) actually inhibit county land use plans, while most require at least a minimal plan. Plans written before about the mid-1980s tend not to address growth limits, open space, agricultural land protection, or natural resources in any specific way. Most assume, explicitly or implicitly, that current agricultural land is simply land to be "up zoned" when the owner applies for subdivision. Municipalities are more specific, through zoning ordinances, about the need for water and other services on land to be developed (often requiring that new annexations bring with them sufficient water rights to provide for the residences and businesses planned).

Still, county planning is becoming more comprehensive and effective in the West, addressing issues not typically found in land use plans and zoning up through the 1980s: some plans now include open space, wildlife habitat, water and air quality, and agricultural land protection (for example, Summit and Eagle counties, Colorado, added wildlife overlays to their master plans). But comprehensive or master plans typically do not carry regulatory power, and detailed zoning and actual land use and building permitting processes still tend to allow development that violates "goals" and "principles" in the comp plans. A classic example of this in the West is the many comp plans that call for limiting "ridgetop" development; yet anyone driving through any of the rapidly growing mountain areas can attest to the ostentatious and quite visible crop of ridgetop homes.

Planning to reduce total population growth—one goal that would obviously affect the water resource situation—is rare in the West. A few places, notably Boulder, CO, and several California towns (see Landis, 1992) have tried to limit building, population, or even job growth by various means, but these efforts are seen by most analysts as having just shifted the growth to nearby communities and increased the cost of living in those communities. In essence, then, there is no reason to expect any significant non-market brakes on overall Western urban and rural development, though a few areas may actually limit local development. If the national and global economy continues to grow, then the West will continue to grow, probably at a faster rate!

The Special Cases of Open Space, Agricultural Land, and Wildlife Habitat.—Few land use plans for Western communities created before the 1980s include attention to maintenance of open space, agricultural lands, or wildlife habitat. This is especially true of the detailed zoning and subdivision ordinances, whereas master plans have at least voiced concerns for such land uses for some time. Open space, agricultural land protection, and wildlife habitat planning is becoming more prominent as master plans get revised in the 1990s.

Oregon, California, and Washington have provided local government with tools for open space and agricultural protection, and that's where we see the most action, but counties in most of the Western states have at least explored open land conservation since the growth boom started in the late-1980s. The mechanisms include:

- Agricultural or rural zoning;

- Master plan overlays that recommend development restrictions (like clustering of homes) when that property comes up for development;

- Outright land purchase (typically through tax programs that create open-space acquisition funds). Some of this land may be leased back for agricultural uses.

- Purchase or transfer of development rights, or of a conservation easement.

The first approach is the most widespread, but may be the weakest. Most agricultural zoning in Western counties experiencing growth is assumed to be a holding category for land eventually to be "up-zoned" to residential or commercial, or annexed into a municipality. If a county makes clear at some point its intention to permanently hold agriculturally-zoned land in that zoning, then many property owners will protest. The result has been either outright disapproval of the plan by court decision (e.g., in Flathead County, MT) or re-negotiation of flexible agricultural or "rural" zoning that allows for significant development (Coughlin, 1991); firm agricultural zoning is more common in the East.

Master plan “overlays” for viewsheds, natural hazards, wildlife habitat, etc., are showing up in many recent county master plans, and can be effective because they apply on top of zoning, but they may raise fairness issues by treating some properties in a zone differently than others.

Land purchase by local government is gaining ground as a land use tool throughout the West; even in some of the strongest property rights holdouts. It has the benefit of working within the private property regime, but costs public money and takes land off of the tax rolls. Only a few places (e.g., Boulder, CO) have created significant (say, on the order of several thousand acres) public open space, though we do not know how much land is involved Westwide.

The purchase or donation of agricultural land development rights or conservation easements, often by a "land trust" rather than government, is spreading in the West, and dealt with more in Part V.

The State Role

Historically, most states simply passed on land use regulation to local government through some form of "Planning and Zoning Enabling Acts" (Platt, 1996); these gave local government authority to zone and set subdivision regulations. But professional planners began to push, especially in the 1960s and 1970s, for a stronger state role as a way to achieve better coordination and that golden grail of planning: regional master planning that transcended fragmented local jurisdictions. This paralleled the emerging (though eventually unfruitful) push for federal land use planning. Platt (1996) cites the American Law Institute's "Model Land Development Code" as leading the charge for more comprehensive planning by the states, especially its Article 7, which called for state review of local land use decisions on: (1) lands of particular state concern; (2) large-scale developments; and (3) developments of regional benefit (like airports). It was assumed then, and has generally proved true, that the state would be more restrictive/protective in the first two categories (e.g., protecting farmland more than would counties eager for increased property taxes), and might use the third to override local veto of LULU's ("locally unwanted land uses") like prisons or sewer treatment plants (see Platt, 1996, p. 349).

An important problem in state land use planning is what the states don't allow the counties to do. Most states exempt the sub-division of lots above a certain size (35 acres in Colorado, 160 acres in Montana) from local subdivision regulations, thus enabling the spread of unregulated "ranchettes" across much of the western landscape (Riebsame et al., 1996; Theobald et al. 1996).

The re-emergence of state land use planning hit the books with strengthening of Hawaii's Land Use Law in the 1960s, and that state's creation of a statewide plan in 1979. Florida and Vermont followed suit, passing strong planning laws. In the West, Oregon set the pace with its 1973 land use law. The Western states run the gamut from those with little or no regulatory authority over local land use decisions (states with strong "home rule" traditions, like Colorado, Montana, and Idaho), and those taking on state-wide land use planning authority (Oregon, California, and Washington). Briefly:

Oregon.—Oregon has the strongest growth and land use management planning process at the statewide level of the Western states. It requires all municipalities to submit growth plans for approval, and it requires classification and mapping of all "natural resource lands" (basically all land

outside the towns). The most well-known aspect of the Oregon program is that towns and cities must set "urban growth boundaries" (UGB) and develop plans for staying within those boundaries (or, and some call this a loophole, for requesting UBG extensions). Overall, the Oregon law protects agricultural, forestry and other rural and open space land uses, and limits urban sprawl.

The state Land Conservation and Development Commission must approve all local plans, and can limit issuance of development permits, withhold state revenues, or go to court over a plan it finds out of conformance. A Land Use Board of Appeals was created in 1979, and the state is now the national focus of government land use planning innovation.

Entire books have been written on the Oregon experience (Abbott et al. 1994), and it can still be considered an experiment. A recent report by the 1000 Friends of Oregon, a group advocating strong state planning, especially for open space, worries that agricultural land is still being lost too fast, and that extensions of UGB's are really just standard old annexation in another guise (1000 Friends of Oregon, 1997).

Washington.—The State of Washington enacted Oregon-like growth management acts in 1990 and 1991, applying comprehensive planning to 19 "growth counties" (those with 50,000 or more people or 10-20 percent growth rates). The plan is similar to Oregon's, with urban growth boundaries, long-range growth management planning and significant provision for sensitive lands like wetlands, aquifer recharge areas, and wildlife habitat. It withholds state revenues for non-compliance.

In a newsworthy case, Chelan County officials challenged the Growth Management Act last year in state and federal court, claiming it violates counties' constitutional right to develop. The key argument was over the provision to protect agricultural lands, and the governor immediately withheld state funds; the crisis relaxed when county voters unelected one staunch anti-planning commissioner in September, 1996.

California.—California does not have comprehensive growth management planning like Oregon and Washington, but does require community growth plans and implemented a strong land use regulation process through the Coastal Zone Commission (established in 1976 under Proposition 20—the California Coastal Zone Conservation Act, and formalized in 1976 by the Coastal Act). The Commission has regulatory jurisdiction over private land

development in the coastal zone, but is now shifting that authority to local governments as they adopt approved development plans. The program includes cooperation with local government to create comprehensive development plans, and, through non-point source pollution standards and the California Environmental Quality Act, an extension of development permitting authority up into the coastal watersheds. The Commission can become involved in everything from land subdivision to home improvements (e.g., adding decks to beachfront homes). Perhaps more importantly, it affects coastal development by limiting state investment in infrastructure that attracts/allows development, like highways (the Commission specifically protects Highway 1 as a winding, narrow road) and funding for sewer and water treatment facilities. Of course, where localities can provide infrastructure themselves, this funding limitation matters less. Still, a recent analysis of two counties under intense development pressure found that the Coastal Conservation Act had indeed protected natural resources, reduced agricultural land loss and sprawl, and maintained beach access and aesthetics (Lester, 1996).

It is worth noting that a permit action by the Coastal Commission invoked perhaps the most important "takings" case: Nollan v. California Coastal Commission, in which the U.S. Supreme Court found that the Commission was improperly exacting a public value (a beach access easement) from the property owners.

California also has a long-established program, chiefly non-regulatory, to protect agricultural land. The Williamson Act (the California Land Conservation Act) provided special assistance and tax breaks to enrolled agricultural lands (it now covers over half of the state's entire agricultural land base). Farmers forego development during 10-year, renewable contracts, and receive lower taxation. The state partially compensates local government for the "lost" taxes. Local governments must first map large "agricultural reserves" before property owners can participate—thus creating "critical mass" areas of farmlands. Prime farmland gets priority, but scenic area, wetlands, and wildlife habitat now also qualifies. Perhaps most important, the state mounted a careful land use monitoring program (the Farmland Mapping and Monitoring Program) to help counties map their reserve areas, and to provide all interested parties with an objective view of land conversion. By some accounts this program has accomplished more than regulation and tax breaks because it raises concerns, and attracts partners in land protection (e.g., land trusts). Goodenough (1992) found that the Williamson Act not only protected farmland, but was effectively used by some

local government, in concert with other planning tools, as a growth management tool.

In the Middle Ground: Regional Planning Entities

Several sub-state, regional "council of governments" exist in the West (e.g., the Association of Bay Area Governments—ABAG, or the Denver Regional Council of Governments—DRCOG). These are local government coordinating forums and typically do not have regulatory authority over land use—they run the gamut from "discussion forums" to some with charters to act as more than conference groups. DRCOG is a deliberative organization chartered as a comprehensive planning organization for 45 county and municipal governments in the Colorado Front Range urban corridor. However, its decisions remain advisory, and it came close to dissolving itself this year over a growth-limitation plan. A similar entity, the Puget Sound Council of Governments did indeed vote to dissolve itself after friction over growth management and transportation elements of its Vision 2020 plan.

The most remarkable version of a more authoritative regional planning entity is the Tahoe Regional Planning Agency (TRPA). TRPA is really very unusual among Western planning and permitting entities: based on a 1969 interstate compact ratified by Congress (decidedly rare in land use planning), it crosses state, county and municipal boundaries, has regulatory and development authority, and can assess impact fees on development in the Tahoe area (impact fees have been defeated in many other Western counties).

One reporter wrote that TRPA is "said to wield more power than any other planning agency in the country" and that "Towns and counties in the West might well see it as test case for strong planning after decades of few controls...." (Christensen, 1997, p. 8). Also, TRPA has water—-or at least a lake—as its planning focus.

It took runaway development, grid-locked interest groups constantly suing one another, and a well-known "national treasure in trouble" according to Senator Harry Reid of Nevada, to get something like TRPA going. These are actually fairly typical conditions for many Western U.S. settings (from Yellowstone to the Arizona deserts), so perhaps such planning authorities can emerge elsewhere?

The Federal Role

The direct federal role in American land use policy is weak outside of the federal lands—that is, the federal government does not have regulatory authority over local land use planning like some of the states do. We examine the history of linked land and water federal planning efforts in Part II. The goal here is to briefly review federal efforts at land use planning, and the federal management of public lands.

Federal Policy on Land Use.—Many professional planners assumed, right into the late-1970s, that the federal government would eventually exert formal land use planning policy meant at least to coordinate the state and local process, as well as regulate certain aspects of local land use. As land use planning emerged as a key social issue during the 1930s, and again after World War II, professional planners realized the need for a supra-local entity to coordinate land use at the regional scale, as water planners had argued for years. The federal government would play this role, they assumed, with national standards and regulations, through regional organizations like TVA and the Appalachian Regional Commission, and/or through stronger strings attached to federal assistance for highways, urban development, and water resources. Many planners assumed that U.S. land use policy would eventually "mature" to the European model, with its strong national role in everything from urban design and architecture to countryside protection.

The ultimate legislative vehicle for this was the "Land Use Policy and Planning Assistance Act" passed by the Senate in 1973, but not the House. The act began:

> *The Congress hereby finds that there is a national interest in a more efficient system of land use planning and decision-making and that the rapid and continued growth of the nation's population, expanding urban development, proliferating transportation systems, large-scale industrial and economic growth, conflicts in patterns of land use, fragmentation of governmental entities exercising land use planning powers, and increased size, scale and impact of private actions have created a situation in which land use management decisions of wide public concern often are being made on the basis of expedience, tradition, short-term economic considerations, and other factors which too frequently are unrelated or contradictory to sound environmental, economic, and social land use considerations.* (Congressional Research Service, 1975, p.558).

The act would have created an Office of Land Use Policy Administration in the Interior Department, and envisioned grants-in-aid to state and local governments, a national land use database, coordinated federal and private land use planning, etc.

The move toward federal land use planning in the 1970s failed, and planning remained fragmented at the state and local level. The only federal land use planning law that did pass was the Coastal Zone Management Act, and it has had some influence on planing in places like California either through financial support for planning or as the basis for state legislation.

Though a few states took up the mandate for state-wide master planning (described above), many, especially the Interior West states, assiduously avoided any significant state role and passed most land use authority—itself limited by state law meant to protect private property rights—to towns and counties. Many planners would agree today with the sentiments expressed in the federal land use policy act's preamble, but most also assume that private land use planning authority is destined to remain local in most states and, if anything, could erode under pressure from property rights advocates.

Federal Policy for Federal Lands.—So much is written about federal lands planning that we will only briefly examine the issue here.

In contrast with its weak role in private land use, the federal land agencies have something like absolute land use authority over the federal lands. The National Forest Management Act and Federal Land Policy and Management Act essentially represent top-down "master planning" as professional planners envisioned it in the 1970s. Of course, federal land use planning operates in a similar pluralistic political environment as does local planning: interests groups and individuals press for decisions that meet their goals, and the notion that isolated "technocrats" wield absolute land use authority on the federal lands neglects the simple fact that all federal land use decisions are today hotly argued in multiple public arena (Nelson, 1994). In fact, most federal land policy analysts have concluded that the federal land use planning system is bogged down in public process that results in gridlock and an awkward status quo seemingly unsatisfying to most interests (Davis, 1997).

A simplistic, but reasonably accurate, assessment of the situation has "environmentalists" and environmental groups pressing for more land preservation and less commercial development and "Wise Use" advocates

calling for more resource use and land development. The latter tend to believe that they can get land use decisions more to their liking from local planning institutions (e.g., county planning boards) than from the federal agencies, and environmentalists feel the opposite, and tend to push for more federal regulation and authority over local land use decisions. Both groups use the courts liberally when the land use planning process does not meet their goals.

Further, we believe it fair to conclude that the federal government tends to disregard the private land use patterns resulting from federal land activities like forest planning, ski area permitting, and recreation planning. For example, although the ski area permitting process allows the USFS to assess the impact of the development on local communities and non-federal land, in practice this has been neglected, and it has been up to the counties to plan for and mitigate the effects of new ski areas or area expansions. This tendency is often explained as an effort not to interfere with the legitimate land use authority of counties and municipalities. In one of those strange convergences of policy advocacy, both environmentalists and "Wise Use" and "County Supremacy" movements have argued for more coordination of federal and local land use (the former to get the agencies to, say, consider off-site impacts of ski areas, and the latter to bring pressure on the agencies to make land use decisions better suited to local development interests).

The main exception to this federal "hands off" approach to private land use is the agencies' explicit goals of maintaining local economies based on grazing, timbering, or mining. The US Forest Service attempts to maintain "community stability"—typically through timber plans designed so that local mills have something close to a stable supply (Bates, 1993). In effect, this becomes a form of land use planning because it shapes the "timber communities" and other resource-dependent areas in ways that some analysts are now assessing as negative because it maintains boom-bust mono-economies. Even seemingly small federal-land decisions, like which forest roads to keep open all winter, can have important local land use implications. (In a recent case, anti-growth forces in Gunnison, CO, vigorously protested a USFS decision to allow a homeowner to plow the road to an in-holding.) But, the federal agencies have been shy of expressing any interest in local land use planning lest they be seen as impinging on local jurisdiction.

Property rights advocates, and many local governments in the West, regularly accuse the agencies of usurping land use authority through programs like "Ecosystems Management" and coordination among the

agencies—efforts meant to break down jurisdictional barriers that block effective landscape management.

One new trend in this regard is counties claiming jurisdiction over federal lands—the so-called county supremacy movement. Most of this comes from frustration with federal agencies applying environmental standards to extractive industries. However, in one innovative case, a county's concerns about too much development stopped a ski area that had received Forest Service approval.

Local Veto Over Federal Land Decisions?.—Eagle County, Colorado, recently killed a major ski resort by leveraging its power over private land use. All land use planners know that federal land use interacts with private land use, but this is the first major case in which a county managed to thwart a federal action not by claiming control over the federal land, but exploiting the simple fact that public and private land use almost always depend on each other in some way. The White River National Forest first permitted the proposed Adams Rib Ski Area in 1973, but the developer moved slowly, and, indeed, expanded the plan to include larger base area and residential developments (ski areas now make more money from real estate than from skiing). By the time the Adams Rib developer was ready to move ahead, attitudes in Eagle County, already host to three ski areas, including Vail, had shifted toward slow-growth. The commissioners, in 1995 and 1996, voted down large (up to 4,000 units) residential developments associated with the resort based on their statutory power over local land use. The developer, despite Forest Service approval, had no place to build his ski resort. (It is also worth noting that some of the delay in the developer's original time-frame was caused by a wetlands mitigation requirement added by the U.S. Corps of Engineers (COE) during the ski area impact assessment).

Eagle County is the scene of another important county action that affected federal land use and regional water development. Eagle County commissioners applied their 1401 powers (land use powers assigned by the state legislature) to Denver's water projects in the county, and won a court case when they refused to issue construction permits.

Clearly, as more western counties begin to question development, they will make decisions that can countervail federal land planning or use permits. This nexus of Western land use planning has not been explored very well—most federal land studies essentially ignore local government and nearby private land. Watch for further action in this area.

Federal Land Use Authority Through Environmental Law.—Even with the federal government mostly out of the direct land use planning picture, land use analysts and property rights advocates recognize that the federal government exerts land use restrictions through laws for clean water, species protection, etc.

The Endangered Species Act (ESA) is most often cited in this respect, and though many analysts point out that few actual land developments have been stopped by ESA, certainly ESA has complicated, slowed, and modified the land development process in some instances through myriad channels. Clean water, and the 404 permitting and wetlands protection programs are also routinely cited has having restricted land use, or limited the actions that, say, farmers and ranchers often need to take just to stay in business (e.g., modifying a stream channel during an unusually high flow for irrigation out-take, or changing irrigation that then affects a wetland).

Reports of U.S. Fish and Wildlife (USFWS) and National Marine Fisheries Service actions restricting private land use are numerous but mostly not well documented. We were told many such stories in meetings with ranchers and farmers in Colorado and Wyoming (some discussed below). Many land owner concerns are based on expectations of restrictions on their land use rather than actual regulatory actions, but this does not make their concerns less real—laws are designed to evoke compliance without the need for enforcement action in each and every case, so expectations count and affect land use.

The planning and land use literature does offer cases and anecdotes (see, for example, Tibbetts, 1995), and the various publications of the property rights and "wise use" movements offer lots of horrendous stories. Probably somewhere there is an objective database of such cases being developed, but we're not aware of it, and believe that an effort to track such cases would be valuable. The WWPRAC is well aware of the debates and issues, and a reader can get a good sense of the opposing arguments from Let the People Judge: Wise Use and the Private Property Rights Movement (Echeverria and Eby, 1995) on the environmental protection side, and from The Wise Use Agenda: The Citizen's Policy Guide to Environmental resource Issues (Gottlieb, 1989) on the property rights/wise use side.

Some administrative changes and modifications of the ESA legislation (in the 1982 revision, and proposed for the next authorization) change its potential effects on land use. We now have cooperative habitat conservation plans that allow some flexibility—even habitat loss—in the context of an approved

conservation plan, the 5 acre limit, "safe harbor" or alternative refugia principles, and the promise of certainty once a reasonable and prudent land or water use change or plan has been implemented (meaning that once resource owners accept an action, they, and their bankers and realtors, can expect no more demands or future surprises).

California's Natural Communities Conservation Planning Program, especially the South Coast gnatcatcher plan, presents an example of detailed land use planning—and restrictions on development—that appear to have achieved an acceptable balance among the interests. Colorado's MOU with Interior on endangered Colorado fish species offers another experiment at more "local" control of habitat protection, and certainly the Three States Agreement on Platte River Endangered Species is another important experiment at something approaching more cooperative state and local responses to ESA problems.

Some Environmental Protection Policy Cases

Land Use and Salinity Control in the Colorado River Basin

Irrigation-induced water quality problems—including salinity, selenium, and agricultural chemical contamination—are exerting pressure either to adjust land use practices or retire irrigated lands that contribute excessively to the problem. Few nonpoint source pollution problems have received significant policy attention to date, but the Colorado River Salinity Control Program represents an important exception. Irrigation leachates contribute 37% of the salinity load in the Colorado River by the time it reaches Imperial Dam. Over the past two decades, the Salinity Control Program has formulated and implemented land and water use adjustments to address this large-scale water quality problem. This case study briefly profiles their land use-water policy nexus.

Background.—The Colorado Salinity Control Act (PL 93-320) was passed in 1974 to meet the requirements of a 1972 water quality agreement with Mexico (IBWC, Minute 242) and to address salinity damages in the Lower Basin states (USBR, 1997, p. 3). Title I authorized projects on the Coachella canal, the Yuma desalting plant, and the Wellton Mohawk Irrigation and Drainage District. Title II authorized the Bureau of Reclamation (USBR) to construct four salinity control units above Imperial dam, including the Grand

Valley unit In Colorado, and to accelerate planning of twelve others. The act was amended in 1984 (PL 98-569) to authorize salinity reduction on Bureau of Land Management lands, and on-farm salinity control programs by the USDA (programs that were shifted to USDA's Environmental Quality Incentives Program in 1996 (PL 104-127)).

Bureau of Reclamation projects sought to improve water delivery and management on irrigation projects to reduce saline return flows. Because BLM lands generate "nonpoint source processes . . . responsible for the greatest share of salt contributions to the Colorado River system" (USBR, 1997 p. 45), BLM is emphasizing land use and grazing systems for riparian protection and nonpoint source control. Department of Agriculture projects focus on farming practices that reduce leachate transport to the river.

All of these programs can be seen as seeking to achieve water quality objectives with minimum impact on existing agricultural land use patterns. The Grand Valley project included cost sharing for canal and lateral lining, gated pipe, surge irrigation, land leveling, and irrigation scheduling (USBR, 1997, pp. 54ff). All of these improvements tended to maintain current land use acreage and cropping patterns while improving water management and farming practices.

Controversial options to retire irrigated lands that produce high leachate concentrations were authorized and carried out in the Wellton Mohawk unit, but they amounted to some 10,000 acres, of which only 4,600 acres were in crop production, out of a total 75,000 acres in the district. Land retirement was also addressed in the Westlands water district to reduce toxic selenium leachates into Kesterson reservoir (WSTB, 1989). But USBR (1997, pp. 56-8) reports that land retirement is not as cost effective as other measures, citing land purchase costs, wetlands replacement costs, and local costs in lost taxes, sales and income. However, USBR anticipates that some land retirement may make sense "on the end of long, leaky delivery systems", and may be effectively linked with mitigation of the wetland and wildlife impacts from salinity control projects (ibid., p. 58).

From the outset, water rights concerns have constrained adjustments in both water and land management to reduce salinity (Wescoat, 1986). Notwithstanding assurances that the programs would ". . . not alter amend, modify, or conflict with any existing water rights..." (USBR, 1983, p. 28), water rights holders worry about what they can and cannot do with "conserved water" and how that in turn affects their water rights. Water salvage, the right to sell conserved water to others, remains severely

constrained and fraught with uncertainties in most state and federal water laws.

An important water salvage exception has been underway between the Imperial Irrigation District (IID) and the Metropolitan Water District (MWD) of Southern California, whereby MWD finances improvements in IID's irrigation systems in exchange for the conserved water. But it is important to note that that agreement involved: 1) complaints by land owners within the Imperial valley who were affected by rising groundwater levels; 2) a state-ordered reduction in water "waste" by IID; 3) agreement among the small number of water contractors for the Colorado River water affected; and 4) support from the Secretary of Interior who is responsible for administering Lower Basin waters.

Even these exceptional circumstances and achievements appear to have their limits. A similar exchange planned between IID and the San Diego County Water Authority has prompted protests from the nearby Coachella Valley Water District which fears that its share of Colorado River water may be compromised and asserts that IID has no right to sell the water it "wastes" to other users (Levy, 1996). In Western water policy, "waste" and "injury" are key legal concepts that constrain changes in water and related land uses, including salinity control programs in the Colorado River basin. Federal cost-sharing programs have helped alleviate some of those constraints on adjustment (Zinn, 1995), as may other recent experiments with regional cooperation and economic incentives in the region (e.g., see Young and Congden, 1994).

A Look at the Big Sandy Unit/Eden Valley Area.—To get a more focused view of the salinity control program effect on agricultural land use we went to the Big Sandy River Unit in Wyoming. The Big Sandy Unit and Eden valley irrigation area has a rocky history. Irrigation started here in 1886, and was formalized as a Carey Act (1906) effort by the state to build a modest reservoir (Eden) and several miles of canals to support 9,000 irrigated acres. This system was up and running by 1910, but by all accounts was poorly managed and barely held up as a working system. The federal government stepped in during 1940, at the request of most of the project settlers: the Farm Security Administration (FSA) noted (in a 1942 lawsuit to collect O&M fees) that "its history has been a sad one. It has passed through three or four different water companies which have tried to make a success of it and have failed." The farmers, they claim, were "from time to time willing to do most anything if somebody would take over the project and assure them water."

The USBR developed a rehabilitation plan including a 35,000 acre foot increase in storage (the Big Sandy reservoir), and canal improvements. The federal plan for land use in the project was, like other irrigation schemes, remarkably detailed. It specified which lands could be irrigated, how many farms could be supported (145) and even demanded that some farmers reduce their land holdings to meet the 160 acre limit in the Reclamation Act (by selling at an appraised value reflecting conditions before the rehab project; see Smith, 1956). The work was approved as a Great Plains Project by President Roosevelt in 1940, but was slowed by the war and the estimated costs escalated from $2.445 million to $4.867 million after the war, especially because CCC and WPA labor and equipment were no longer available. Early plans assumed that even with the rehabilitation that farmers in the project would not be able to repay the $1.2 million allotted by Roosevelt at "normal" reclamation rates because the area did not offer very good crop growing conditions.

After the new reservoir came on line, the Eden project settled into a stable 15,700 irrigated acres of mostly hay serving some 84 farms of an average 174 acres from the 1950s through the 1960s. The project stayed out of the Western water limelight until 1976 when the first draft plan and impact study for meeting salinity control goals on the Colorado River identified it as an important source of salt. Flood irrigation water percolates to underlying marine shale formations and then makes it way to the Big Sandy River as an aquifer, contributing 133,850 tons of salt annually to the green/Colorado system (USDA-SCS, 1987).

The salinity control DEIS for the Big Sandy Unit recommended buying out the project entirely, concluding that a majority of the landowners in the project wanted the buy-out. Some of the current irrigators we talked to argued that this result was skewed by newer farmers who had made less of a success of it because of restrictions on land use in original federal plan or their inability to create a integrated livestock/irrigated hay operation. But, some project farmers protested, and, more importantly, the State of Wyoming objected to the buy-out, worried what it might mean for its share of Colorado River water.

The end result was the "Selected Plan" (USDA-SCS, 1988), that included voluntary irrigation improvements focused on sprinkler systems that would keep roughly the same amount of land in production, increase investment (with 70% cost share), and allow a switch to higher value crops.

The Platte River MOA

The three-state agreement on Platte River endangered species has been discussed in other reports to the WWPRAC, and is well known to the Western water community. It is important in the context of land use because it potentially affects land use in the basin, and because it offers another experiment in habitat protection agreements that give state government more control and certainty under ESA actions. It is probably fair to say that water agencies and users, especially irrigators, in the states are not "happy" with the agreement, but they do appreciate the level of certainty it provides and the at least temporary relief it gives from Section 7 consultations on water development in the basin.

The agreement includes contributions of cash, land and water from the states and federal government totaling $75 million. In Nebraska the agreement calls for restoration and protection of at least 10,000 acres of land (mostly wet meadows on the Middle Platte that are important whooping crane habitat), though purchase and/or conservation easements on private land.

In Colorado, the agreement requires projects to pass more water downstream, as well as (yet unspecified) monitoring and comprehensive planning to deal with the effects of population growth and urban development on the Front Range (Lochhead and Robotham, 1997). Colorado anticipates that Front Range development will take land out of irrigation (as it has in recent years), and that generally the change from irrigation to M&I use keeps addition water in the river. In this way, urban development appears to help Colorado meet its obligations under ESA!

The Northern Colorado Water Conservancy District accepted the MOA mainly because it craves relief from section 7 consultations, and the 10-13 years of regulatory certainty it affords (NCWCD, 1997). NCWCD entities projected that they could lose 9,600-acre feet of water (worth some $25 million) through mitigation measures imposed by USFWS if not for the MOA.

Some water users in the basin are unhappy with the MOA, and it left unspecified effects on depletions in North Park (Colorado's headwaters to the North Platte). We met with the Central Colorado Water Conservancy District (CCWCD) board of directors and got an earful of their concerns. Essentially they see the USFWS target flows and mitigation funds as a takings, arguing that if the federal government wants the water it should buy it, but not with money from water users. They fear that Colorado's share of

the fund ($410.8 million) will somehow come from water users, especially irrigators. They plan to push hard against the agreement during the EIS process and are seeking help with this fight from other water entities that disagree with the MOA.

In North Park, a group called the Coalition for Sustainable Resources, Inc. has filed notice of intent to commence a civil suit against the Secretary of Agriculture for violating the ESA by allowing too much forest growth in the Platte Drainage such that water flows have declined—thus endangering the Whooping Cranes and other species. They point out that the National Forests were created to protect water flows, that timber harvesting generally increases flows, and that recent forest plans have either reduced harvest or that harvest have not met the plans. Their technical logic is sound, and their argument that federal land use must be included in the activities affecting runoff also makes sense. Their use of ESA to achieve an increase in timber harvest and water flows is ironic. The Jackson County (North park) Water Conservancy District pretty much uses all of its decreed water and storage rights to irrigate 115-130,000 acres, but claims that ESA and federal land planning laws are limiting the flexibility of that use (e.g., building a stock watering pond) such that a takings is occurring.

The Upper Colorado Endangered Fish Recovery Plan

Squawfish, sucker, and chub recovery efforts in the Upper Colorado include several efforts to augment flows and change fish access, especially in the so-called 15-mile reach above Grand Junction (USFWS, 1995). One goal is to get enough water to flood some streamside lands during the high flow season. This brought land use-specific provisions into the plan: to recover some "historically flooded bottomland areas". The Flooded Bottomlands Restoration Program (funded by BOR capital improvements program) is now surveying potential recovery sites on 870 miles of the Colorado, Green, Gunnison, Yampa and White Rivers. Property owners have protected bottomlands from flooding chiefly by levees.

Although no action has been taken on private lands, the USFWS did initiate the first bottomland recovery at Old Charlie Wash on the Ouray National Wildlife Refuge in Utah. Obviously, landowners along the river are watching the inventory process, and are concerned about how floodplain and endangered fish habitat will be designated.

Part II

General Land Use Trends: Global, National, and Western U.S.

Data on land use/cover are highly variable in coverage and quality according to the area, time period, and purpose for which they are sought. The U.S. does not have a reliable, centralized land use database as it does for, say, population or climate, and the few national databases that do exist lack temporal depth, coverage, or consistency of approach. The USDA/NRCS Natural Resources Inventory (NRI) and US Dept. of Commerce Agricultural Census are the most accurate look at private agricultural land use, but both tend to lump non-agricultural uses into very broad categories like "urban." The County and City Data series from the Bureau of the Census offer little useful urban and suburban land use data, and the USGS attempt to map land use on its 1:250,000 scale sectional maps, starting in the 1960s, faltered after federal land use planning legislation failed to pass in the 1970s.

Data problems notwithstanding, some generalizations are possible about major forms and trends of land use/cover change, especially for cropland, forest, grassland, and settlement or urban area. We'll start globally and work to the Western states.

The Global Land Use Situation

Globally, cropland has expanded dramatically over the past three centuries, perhaps the most extensive and outstanding human transformation of the earth's surface (Table 1). Cropland comes from both forest land and grassland, and is the chief cause of deforestation. However, cropland has declined in parts of Europe and North America, allowing some forest expansion and illustrating how global or even national statistics can hide significant regional trends. For example, forests have expanded significantly in the Northeastern U.S. as farmland as gone out of production. World forest area has diminished some 15-20% in post-glacial times. The global trend since 1950 has been continued loss due to rapid clearance in the developing countries, and stability or increases in forest area in most of the developed countries.

United States forest cover as a whole, has experienced a modest decrease in forest cover since the 1950s, because significant forest re-expansion in the rural Northeast has been overshadowed by timber harvesting in the Northwest and clearance near cities in the East.

Table 1.—Global land use and cover changes (after Riebsame et al 1994a, and from Meyer and Turner, 1992)

Cover	Date	Area 10^6 km^2	Date	Area 10^6 km^2	Percent change
Cropland	1700	2.65	1980	15.01	+466
Irrigated cropland	1800	0.08	1989	2.00	+2400
Closed forest	<1700	46.28	1983	39.27	-15.1
Woodland	<1700	61.51	1983	52.37	-14.9
Grassland	1700	68.60	1980	67.88	-1
			Europe		-27
			North America		-27
			S.E. Asia		-26
			Africa		+10
			Latin America		+26
Urban			1985	2.47	

Globally, urban areas have grown in size, actually becoming less densely settled in affluent countries where suburbanization has taken place. Only some 2% of the earth's surface can be considered "urban", and perhaps only a tenth of this is densely "built-up" (Meyer and Turner, 1992). Yet this area now holds half the global population. U.S. cities (including those in the Western states) have also grown in size, and are much less dense than most of the world's other large cities.

U.S. Trends

The area of the U.S. devoted to residential, commercial, industrial, and infrastructural ("built-up") is expanding through the conversion of cropland, timberland and rangeland (Frey, 1984). Serious measurement problems attach to land use statistics for the U.S., as we argued earlier, and as Alig and Healy (1987) point out, one cannot easily assess temporal trends. All we

have to go on nationally is data from the Census and USDA-NRI assessments. Census data indicate an increase in "urban area" of about 1 million acres/year during 1960-1980. The NRI data are more detailed, and include "built-up" land outside of urban areas, but are not perfectly comparable over time. "Built-up" grew by roughly 1 million acres a year during 1957-1967, and by roughly 3 million/year during 1967-1977, rates that raised concerns over a "farmland crisis" (see Part V). Heimlich et al. (1991) argued that 1970s conversion rates were not unusually high nor a threat to food production. Greater attention to comparability went into the 1992 NRI assessment: it reports that built-up area increased 1.4 million/year during 1982-1992 (USDA-NRCS, 1995).

The "developed" land of 92.4 million acres comprised some 5% of the U.S. land base, and had increase 13.8 million acres (18%) between the 1982 and 1992 NRI assessments, with 4.2 million acres of this coming from cropland, and the rest from forest and rangelands (plus some "miscellaneous" lands). The increase in developed area is especially apparent in the Southeast and West (Figure 1). Developed or urbanized land in the U.S. is growing faster than population, yielding what is routinely called "urban sprawl." Land consumed per person runs from .5 acres in agricultural areas like the Midwest and Plains to a low of .18 acres in the urbanized and more concentrated Mid-Atlantic areas.

A much larger amount of cropland was converted to uses other than development (55.5 million acres), with 34 million acres of this converted to grassland or trees through the Conservation Reserve Program. And, surprisingly, some 250,000 acres of new cropland came out of the “developed land” base, according to the NRI.

Rangeland decreased by 10 million acres (2.4%) between 1982 and 1992, with 2 million of this having developed, and 5.7 going to cropland (while 2.1 million acres of cropland shifted to rangeland). Rangeland loss concentrated in Florida (to development) and the eastern Great Plains (to cropland), and showed concentrations around some Interior West cities (Las Vegas, etc.) as well as in small rural areas experiencing development (e.g., Teton County, Idaho; and Missoula County, MT (Figure 2). Rangeland increased in several Interior areas, mostly as a conversion from cropland (western Colorado).

Irrigated land declined in the West and increased in Nebraska and some Eastern places (Figure 3). Western declines show up in the Lower Snake

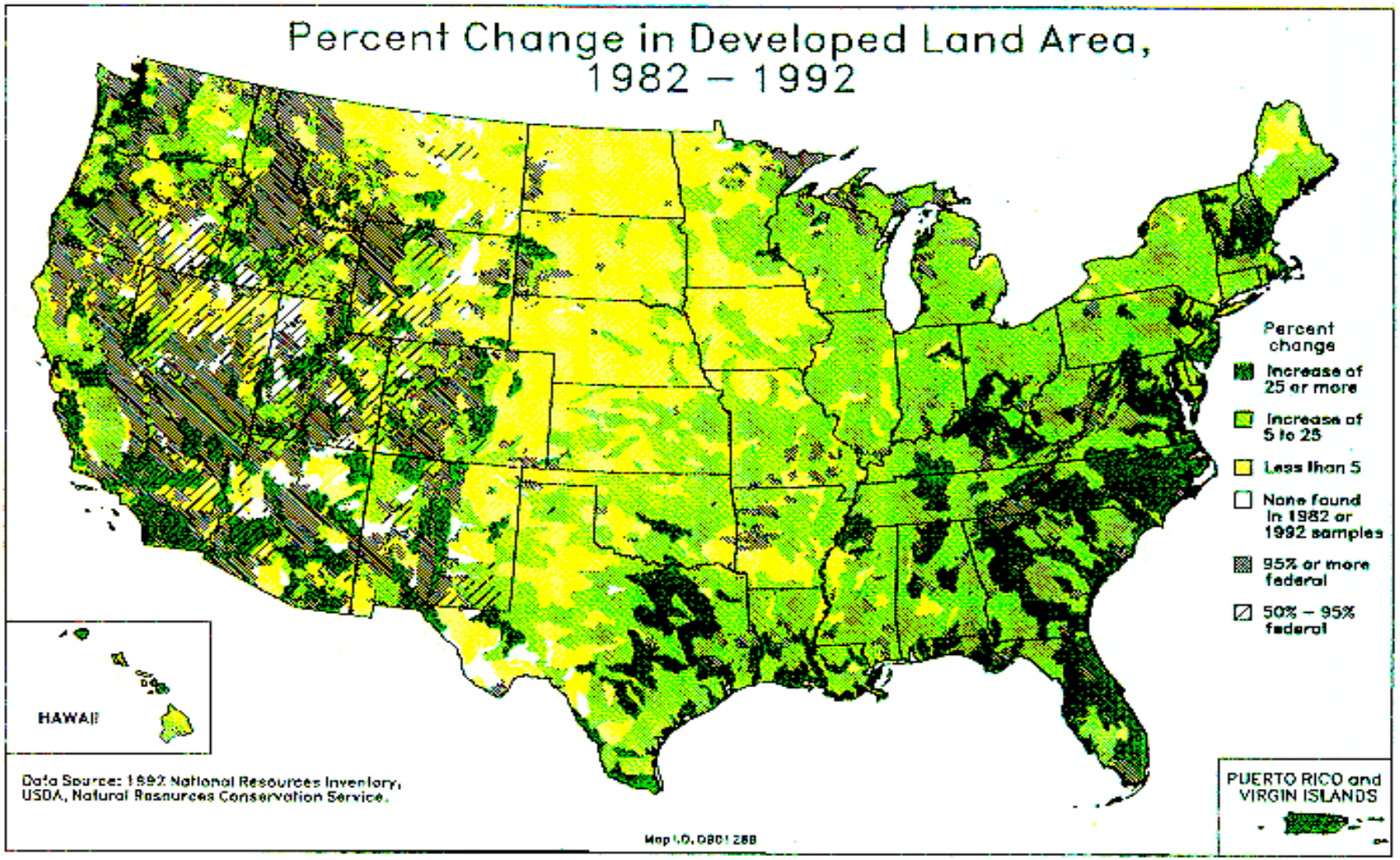


Figure 1.—Percent change in developed land area, 1982-1992.

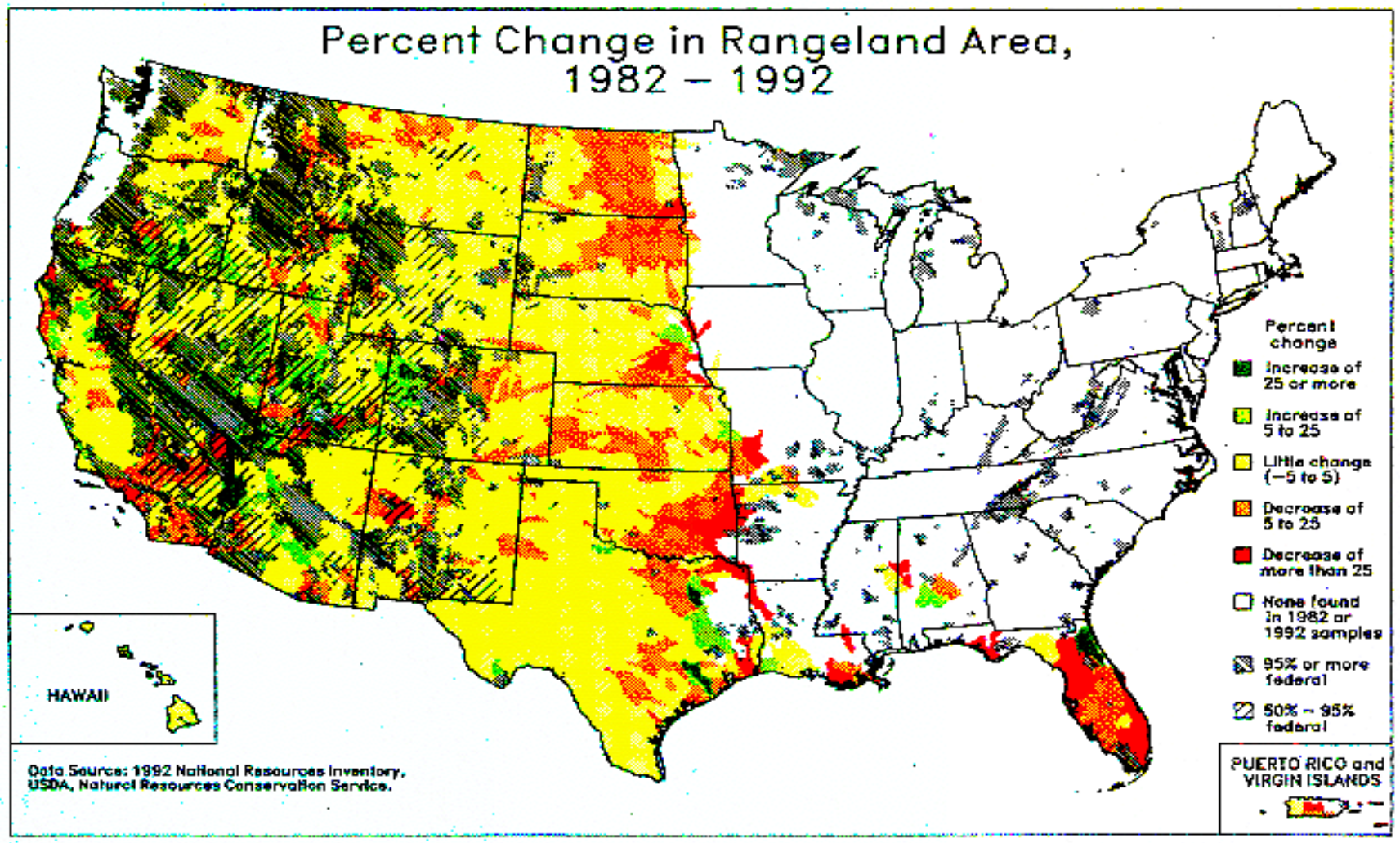


Figure 2.—Percent change in rangeland area, 1982-1992.

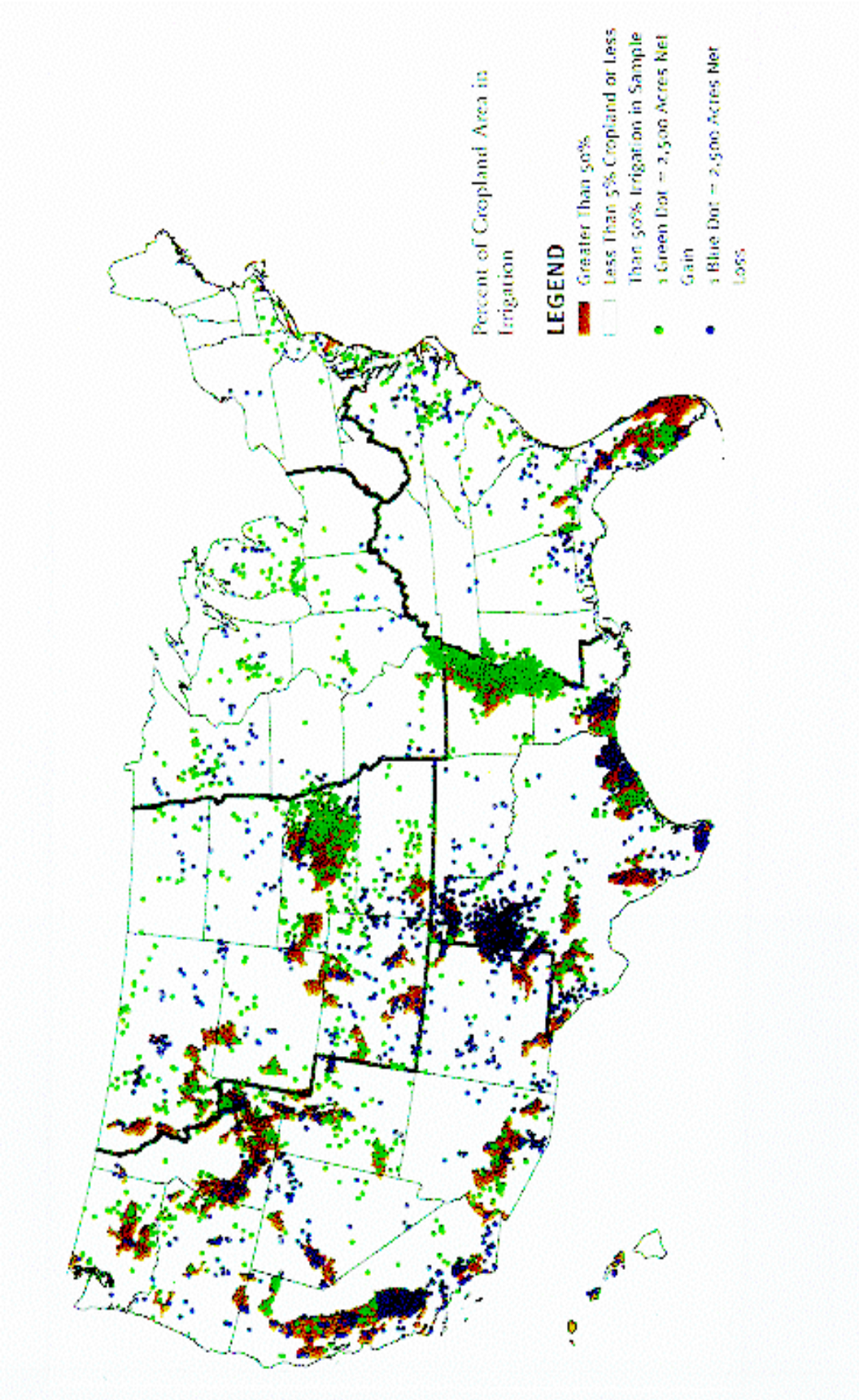


Figure 3.—Gains and losses in irrigated land, 1982-1992.

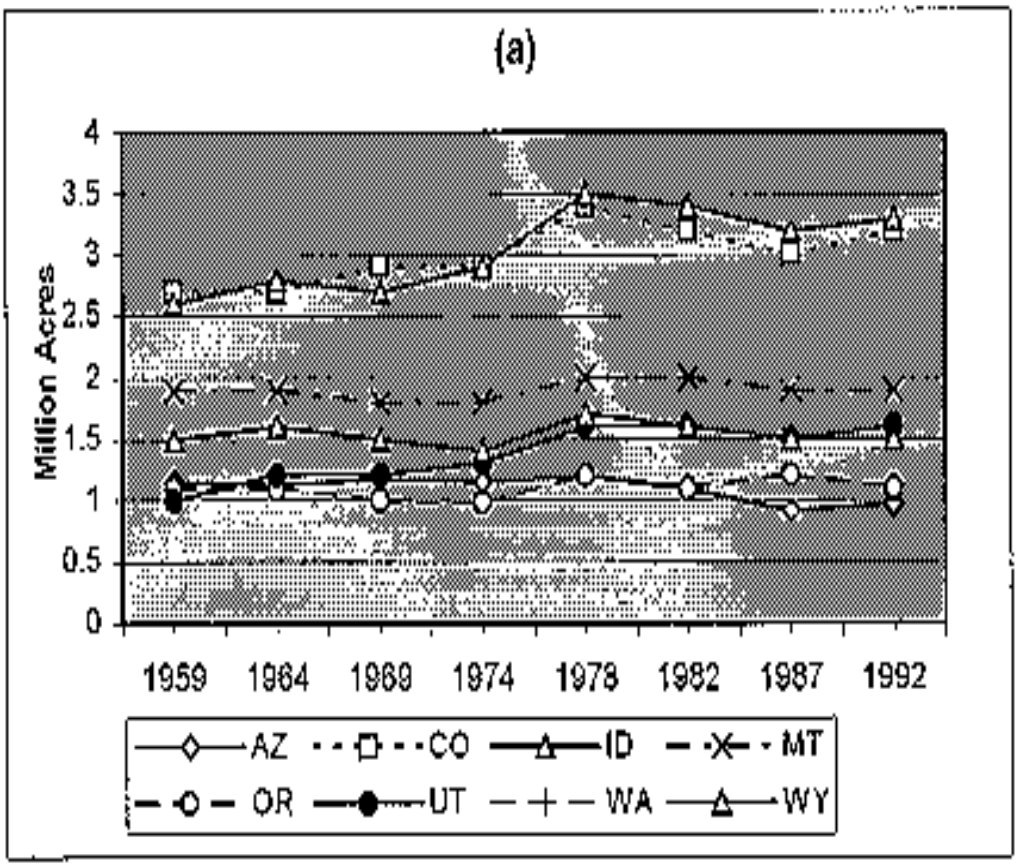
around Boise, the Truckee-Carson, and in the San Joaquin. Wetland losses during 1982-1992 were some 500,000 acres (50,000/year), which the USDA reports is mostly due to agricultural uses, but is much slower than previous decades: the USFWS estimated losses during 1974-1983 at 157,000/year.

Forest land cover and use is increasing overall, and though it declined in the Southeast and Northwest due to development and some timber practices considered to permanently deforest a parcel, U.S. Forest Service projections of forest (at least 10% tree cover, or formerly at least 10% and not yet converted to another use—e.g., recently clear-cut) and timber land area (lands with commercial timber) to 2040 (see U.S. Forest Service 1989-RPA Series et al. 1994a) showed a remarkably stable forest base in the U.S., with only a slight decline due to demand for residential and commercial land development. Rangeland increases slightly to 2040, as cropland reverts to grassland due either to economic forces or federal conservation programs. Perhaps the most striking result of this study is the projected stability of the natural resources land base. While some countries are converting forests to other uses by several percent per year, the U.S. projections are for only a 4% reduction in forest area and a 5% increase in rangeland over the next half-century.

Western U.S. Land Use and Cover Trends

Private land use tendencies in the Western U.S. include expanding urban and suburban areas, and residential uses expanding around small towns and in rural areas. All types of western agricultural land—dryland cropland, irrigated row crops, and irrigated mountain hay meadows—are experiencing conversion to other uses, chiefly residential, commercial, and infrastructure, though the rate, magnitude and geographical pattern of this land use conversion is poorly known. Although most reports indicate a net loss of irrigated land in the West, a closer look at Western states with at least 1 million irrigated acres suggests that some irrigation declined during the late 1980s (a drought period) and rebounded in some states since (Figure 4). Including Nebraska in any measure of "Western" irrigation certainly results in an increase through the 1980s as the state's farmers tapped more and more groundwater.

Most studies of recent agricultural land loss in the West rely on the NRI or Census data-points for 1982 and 1992, and during much of this period the Interior West states were stable or losing population. The rapid population growth now experienced throughout the West (and illustrated in Case and Alward's paper for the WWPRAC) began in the late-1980s and accelerated in



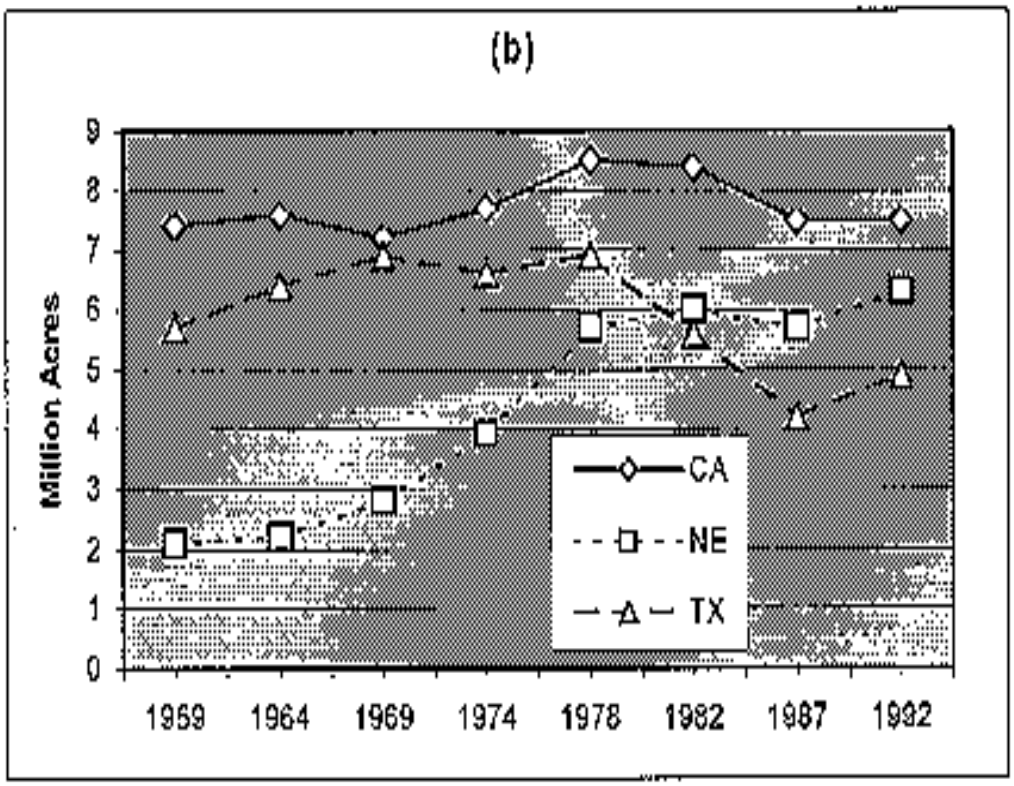


Figure 4.—Irrigated areas for selected states (U.S. Census Bureau).

the 1990s, so land development estimates probably understate rates of change through the mid 1990s. Some western states are especially concerned about agricultural land loss (see Part V).

According to the RPA assessment, there is minor deforestation of commercial timber lands underway (especially in the Pacific Northwest), including some loss in commercial forest land use area to development, but both are difficult to measure; and forest cover area is probably expanding in most areas, especially Pinon-Juniper woodlands invading shrub and grasslands, and expansion of lodgepole pine forests. This expansion does not necessarily extend forestry land use to these areas. Rangelands are declining in some Western areas due to a switch to cropping (the largest change), and to residential and other non-agricultural uses. However, rangeland increased in areas where cropland was retired so that the net change is small or even positive.

Some extractive uses (forestry and mining) are declining, while the most widespread Western land use, livestock grazing, remains relatively constant (Figure 5) in terms of animal units; the decrease in the 1990s is due chiefly to reduced sheep grazing (almost 10% for the BLM from 1990-96). Actual grazing may be less than authorized.

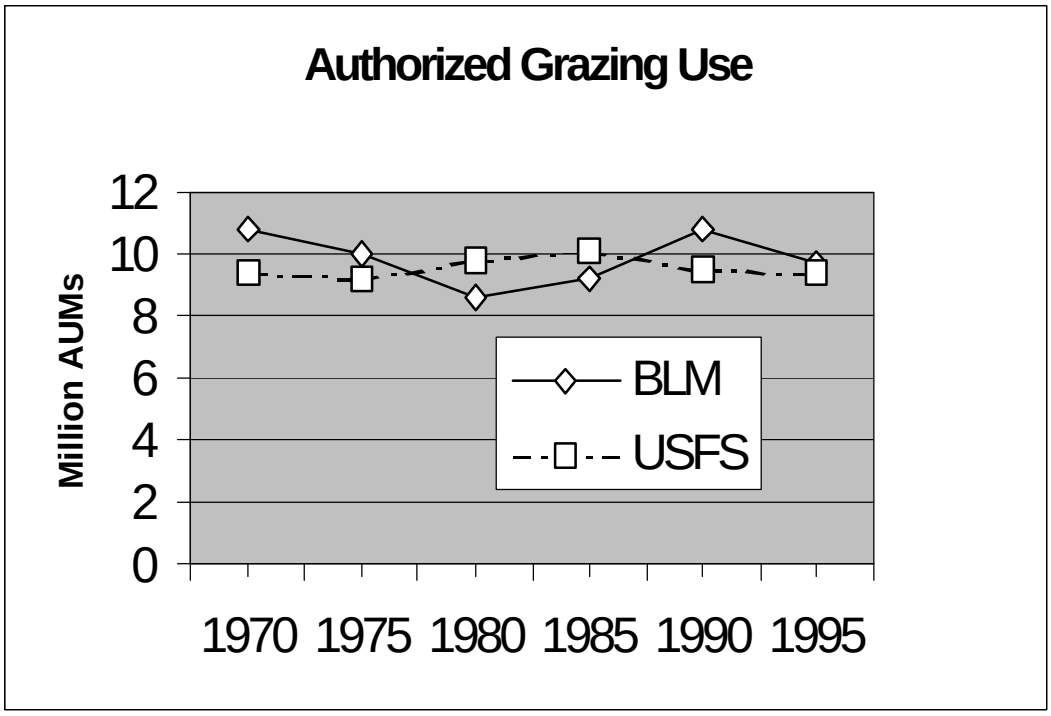


Figure 5.—Authorized grazing Animal Unit Months (AUMs) nationally (BLM and USFS).

More land is dedicated to recreational, open-space, and more purely preservation uses. These uses range across all cover types in the West: desert, shrub, grassland, forests, alpine tundra, rock, ice, and water. And more private land is now under some form of conservation easement, and much of this effort is specifically aimed at keeping land in agricultural use.

Other important regional trends occur on federal lands. Some commodity use (e.g., timber cutting) is declining on the public lands, while others are relatively stable (e.g., livestock production) or increasing (total mine output)—see U.S. Forest Service 1989-series. But, the most dramatic trend is increasing recreational use (e.g., Rasker 1994). The Southwestern Regional National Forests (in NM and AZ) project a near doubling (from 8 million to roughly 15 million annual recreational visitors days—RVD's) through 2025. But, a recent study suggests that the land base for dispersed recreation is declining and will decline over the next several decades, with a growing gap between supply and demand for recreation needing large areas of roadless land, especially in the Rocky Mountains (English et al. 1993).

Overall, the most important of these trends for this study is probably urban sprawl, exurbanization, and rural development—all of which constitute the conversion of agricultural land and other open spaces to residential, commercial or infrastructural uses. This conversion process is detailed in Part VI.

Part III

The Land and Water Nexus in the West

Close, yet ambivalent, relationships exist between Western land use and water policy. The land use trends discussed in the previous section generate new patterns of water demand, increased competition for water, and changes in water quality. Some western water policies, e.g., federal reclamation law, were designed to facilitate certain land use trends and to cope with their impacts, while others sought to constrain land use changes and their impacts, e.g., service areas for federal irrigation projects. Some land policies have anticipated water issues while others are poorly coordinated with them.

The situation is clouded by some persistent "myths" about water supply and land use (Wolman and Wolman, 1986). It is often said, for example, that "without water the land is worthless," which denies any value to dryland ecosystems and activities. Water was also thought to be a primary determinant of industrial and residential land use decisions. Economic research in the 1960's showed that, for better or worse, water has rarely been a major factor in municipal and industrial land use decisions (e.g., compared with access to transportation, employment, or markets) and current land use trends and policy continue this tradition.

The boundaries between land and water policy are not always clear, as for example in wetlands, floodplain, and watershed policies (FEMA, 1992; NRLC, 1996; WSTB, 1995). What is clear is that the relations between land use and water policy are dynamic. They involve conflicts between land and water owners and organizations—but also cooperation, e.g., in watershed planning—which provide useful insights for the western water policy makers.

This section surveys the interactions between land use and water policy. It presents a framework for distinguishing different types of interactions that occur. It discusses issues that seem pressing for western water policy, including the land use dimensions of non-point source pollution, endangered species protection, Native American land and water claims, and the future of irrigation. And it identifies experiments that seem especially promising for western water policy including watershed movements and landscape design innovations.

As one member of the Western Water Policy commission put it in a recent memo: "The conditions of waters and watersheds is merely a fingerprint of

human activity on the land. Integrate land use decision-making into the process." (WWPRAC, 1997). This section and Part VI address the challenges of "how" this might be accomplished.

Assessing the Land Use-Water Policy Nexus

The relations between Western land and water issues are so complex that it is useful to develop a framework for distinguishing and evaluating different types of issues. The framework employed here uses two variables: (a) Causal Processes and (b) Intended Effects.

Causal Processes

Under the heading of "causes" we want to distinguish when land use trends are causing changes in water use, and thereby water policy, and vice versa, keeping in mind the eight causal links described in the previous section:

- Land Use Trends affect Water Uses
- Land Use Trends affect Water Policies*

- Land Use Policies affect Water Uses
- Land Use Policies affect Water Policies*

- Water Use Trends affect Land Use Trends
- Water Use Trends affect Land Use Policies

- Water Policies affect Land Use Trends*
- Water Policies affect Land Use Policies*

The actual relationships among these processes are complex, involving chains of causes and effects among land and water use, and land and water policy. In addition, these processes often have additional social causes, such as population growth, economic development, and political restructuring. The causal relations marked with an asterisk are of particular concern to Western water policy debates and are therefore emphasized in this paper.

Intended Effects

Three major classes of intended effects may be considered:

- Policies intended to change resource patterns and trends, perhaps dramatically;

- Policies intended to maintain existing patterns and trends, or to minimize changes in them; and

- Policies intended to coordinate or integrate past patterns with emerging trends. These three policy aims often overlap with one another.

Moreover, each policy aims to "improve" land and water use, albeit in different ways. In each historical period, all three types of policies have been pursued, which accounts for some of the policy conflicts that have arisen. A water policy initially designed to transform land use may later strive to constrain further land use changes.

During this century, the balance of Western land and water policies has shifted away from dramatically changing Western land and water uses to policies that seek to coordinate further change, to policies that seek to reverse certain historical changes and to promote new types. Notwithstanding this general trend, it should be underscored that policies of land use change, maintenance, and coordination have shaped water policy in each historical period, as they do today.

Intended policy effects are emphasized in this paper, recognizing again that most policies have had multiple aims. The literatures on actual policy benefits and costs, as well as on unintended consequences, are in some cases too large to review here (e.g., the costs and benefits of reclamation and water quality policies) and in other cases too small, unresolved, or disputed (e.g., endangered species policies). While recognizing the importance of ex post assessment of existing policies, and citing some major examples, we seek here to outline the importance and logic of land use issues in western water policy. Using this framework, we review the evolving relations between land use and western water policy. For each major period, we identify water policies that have sought to change or maintain land use patterns and policies.

Evolving Relations Between Land Use and Water in the West

Water Policies Designed to Change Land Use

The Waterways and Land Settlement Tradition.—The earliest federal explorations of the West, from the Lewis and Clark expedition to John Wesley Powell's exploration of the Colorado River, followed river corridors for the access they provided to settlement frontiers and as means of opening up transportation corridors that would serve and extend those frontiers (Lewis, 1961; Nicollet, 1843; Powell, 1878). Land settlement and regional economic development were the first and most enduring aims of western water policy.

The landmark case of Gibbons v. Ogden (U.S. 1, 6 L.Ed. 23 [1824]), established a constitutional basis for federal involvement on navigable waterways, under the commerce clause of the U.S. Constitution. Federal construction works extended along riparian and floodplain corridors throughout the country, and the Army Corps of Engineers was reluctant to stray too far from its secure constitutional authority over navigable river channels. Perhaps the pinnacle of the "waterways" perspective, its broadest vision for land and water management occurred in the 1908 Preliminary Report of the Inland Waterways Commission (a final report was never issued).

Reclamation.—The most dramatic uses of water policy to effect land use changes have been the reclamation programs, first the federal Swamp Lands Acts in the Mississippi River basin (9 Stat. 519, 43 USC 981 et seq. [1849, 1850]), and later the irrigation program in the arid west. The Swamp Lands Acts transferred lands to the States to finance land drainage and settlement, though effective drainage rarely followed (WSTB, 1995).

After several false starts with the Carey Act and Desert Land Act, a national program of irrigation development was launched by the Reclamation Act of 1902. The federal Reclamation program represents the most extensive use of a water policy to intentionally and dramatically alter land use, and more specifically to increase crop and pasturelands in the West. By 1992, federal reclamation projects supplied 20% of all surface water irrigation in the United States (Moore, Mulville and Weinberg, 1996; WSTB, 1996). Four volumes of reclamation laws record the story of making "the desert bloom as a rose"—up to the advent of the environmental era (Pelz, 1972-89).

But reclamation trends encompassed diverse irrigation patterns and practices in the West. While over 80% of all cropland is irrigated in the southwestern states, less than 5% is irrigated in the northern plains (Bajwa, et al., 1992). USBR projects supply 70% of all irrigation water withdrawn in Washington state but only 2% in Kansas where private groundwater development prevails (WSTB, 1996). While irrigation agriculture is increasing in some humid states, it has not increased since the 1970's in most of the arid West (though irrigation of urban and recreational areas is expanding) (WSTB, 1996). Over the same period, average irrigation application rates appear to have declined from 25 to 22 inches per acre nationwide (WSTB, 1996).

As trends toward non-agricultural land and water uses accelerated in the 1960's, and support for farm policies diminished, the Reclamation program which had been a force for dramatically transforming Western land uses found itself fighting to "maintain" both its own mission and the land use patterns of its constituents, a situation discussed in greater detail in the "Policy Cases" below. Reclamation continued to fight for new project starts, but by the 1980's, it began to bill itself as a "management" rather than "development" agency. This transition from land and water development to management has not been easy, nor are its implications for land use readily apparent.

Federal Acquiescence and Related State Policies.—Notwithstanding the scale of its early water and land policies, the federal government acquiesced to state control over many aspects of water and land development. Acts of 1860 and 1870 signaled a policy of federal "acquiescence" to state control over western water resources, even on federal public lands (cited in Tarlock, et al., 1993). Early state water policies, however, also sought to maximize land use conversion to irrigated agriculture. Coffin v. Left Hand Ditch (Colo., 1882) allowed for diversion of water out of riparian corridors, and indeed out of the basin, to anywhere in the state. Large-scale transbasin diversions, particularly from the Colorado River basin, supported land development trends in southern California, the Front Range of Colorado, central Utah, and central California. Federal and State interests in constraining these water and land development processes were later reasserted, e.g., in "reserved water rights," which are discussed after the following sections on policies which have sought to coordinate water and land development.

Policies That Seek to Coordinate Land and Water Development

Problems of coordinating local land and water management were recognized at least by the mid-19th century (Marsh, 1864). But large-scale water development in the 20th century ushered in national efforts to coordinate land and water policies. Many if not most western land and water policies would claim to seek some sort of "coordination", but that only became a major policy aim during the first half of the 20th century.

River Basin Planning.—The river basin has been the primary context for "coordinated" or "integrated" planning. The first irrigation surveys used hydrographic boundaries (U.S. Geological Survey, 1889, 1890). In its early years, the reclamation movement was affiliated with the forest conservation movement, and the Forest Service was established in part to protect upstream watersheds from flooding, erosion, and fire. The first director of Forest Service, Gifford Pinchot, enlisted urban groups in watershed planning to protect municipal water quality (e.g., in the controversial case of San Francisco and Yosemite National Park).

Beginning in the 1910's and 1920's, watershed planners expanded from an initial focus on multiple-means flood protection, using a river channel engineering and land management approaches, to comprehensive river basin development (Morgan, 1951). Although located in the eastern US, the Tennessee Valley Authority (TVA) was envisioned as a possible model for the rest of the country, including the Columbia and Missouri basins. TVA initially included land classification, watershed management, community planning, and agricultural extension activities within its scope, though it encountered stiff political resistance and practical difficulties on all fronts (Creese, 1990; Hargrove, 1994; Hargrove and Conkin, 1983; Hudson, 1936; Selznick, 1949). "Joint investigations" in the Rio Grande basin, pursuant to interstate compact negotiations, included assessment of actual and potential land uses (U.S. Natural Resources Committee, 1938). Another comprehensive effort occurred on the Columbia Basin project, a reclamation scheme located in the Columbia River basin (U.S. Bureau of Reclamation, 1941). Its studies ranged in scope from conventional water supply and irrigation studies to land use, demographic, and infrastructural issues.

New Deal Planning.—Many of the river basin projects noted above were associated with a broader range of planning activities during the New Deal era, which included State land use planning. New Deal planners experimented with four institutional means of coordination:

- Inter-agency Coordinating Committees
- Federal Corporations (e.g., TVA)
- Special-Purpose Commissions Created by Executive Order (e.g., the Mississippi Valley Committee, the Natural Resources Committee, and National Resources Planning Board).
- Coalitions of Rural Resource Agencies (e.g., Soil Conservation Service, Rural Electrification Agency, and Forest Service [see, for example, Person, 1936]).
- Each of these institutional approaches revealed its strengths and weaknesses, ranging from inadequate authority to top-down centralized authority with tenuous political support.

Although forward-looking in their aims, most of these studies actually followed public works construction, which made them contingent upon and reactive to large-scale land and water development from the New Deal through the early post-war period. Interstate and federal-state river basin commissions had limited authority beyond data compilation and public communication. Enduring divisions developed between large-scale river engineering approaches of the Army Corps of Engineers and Bureau of Reclamation, on the one hand, and smaller scale conservation programs of the Soil Conservation Service, on the other. From 1936 to the present, the Agricultural Conservation Program and related programs have provided cost sharing and technical assistance for local land and water conservation projects (Zinn, 1995). Decentralized rural land and water conservation approaches also remain the dominant institutional approach in regions that rely on groundwater irrigation such as the Great Plains (Kromm and White, 1992; White and Kromm, 1995).

Water and Related Land Resources.—The Water Resources Planning Act of 1965 ushered in a new era of water policy that also encompassed related land resources. The Act established a Water Resources Council to formulate national water plans, and regional river basin commissions. It led to the

formulation of "Principles and Standards for Planning Water and Related Land Resources" in 1973 which were to be used by all federal agencies (Federal Register, Sept. 10, 1973, 38:174, pp. 24778-869). The Principles and Standards employed four "accounts": National Economic Development, Regional Economic Development, Environmental Quality, and Other Social Effects.

Multi-volume data inventories and plans were produced for most basins in the U.S. These were the most comprehensive resource assessments since the New Deal, and have not been matched since. These studies coincided with less successful efforts to initiate national land use planning in the 1970's. It was a time of widening hopes for "integrated land and water management" (e.g., Mulder, 1979), though that concept had been inherent in agricultural watershed planning and conservation programs for decades (Pereira, 1973).

Although systematic in organization and scope, the Water Resources Council and its Principles and Standards encountered stiff opposition from federal agencies, Congress, and local groups affected by its top-down approach. The Council was abolished in 1981, and the Principles and Standards became "Principles and Guidelines." After those events, regional water planning declined, replaced in recent years by smaller-scale watershed planning initiatives (see below). Now, as then, the challenge for basin planning is to link federal jurisdiction over "navigable waters" with state and local jurisdictions over land areas that do not follow basin boundaries.

Floodplain Management.—A more decentralized approach evolved to coordinate floodplain land and water uses. The extension of federal responsibility to encompass flood control in the 1920's recognized but had difficulty addressing floodplain management to reduce flood damages. Eventually, federally supported programs of local floodplain management and insurance were adopted, though their implementation and benefits have been slow to develop (Federal Emergency Management Agency, 1992). Local implementation with coordination and assistance from state floodplain managers has helped these policies avoid the fate of river basin planning (Association of State Floodplain Managers, 1994).

Water Policies that Constrain Land Use Changes

Reclamation.—Although initially seeking to transform western land use, early reclamation law also included constraints on land use change, which became increasingly important or problematic over time. Most full service reclamation projects, for example, had "appurtenancy" and "acreage" limitations. The appurtenancy rule, which also existed in some early state water laws, limits transfers of project water from one parcel of land to another, which is a source of difficulty in urbanizing project areas (WSTB, 1992). Even reclamation projects that were able to rapidly convert land and water uses, such as the Salt River and Colorado-Big Thompson projects, have faced increased management requirements and shareholder representation pressures.

The Reclamation Act of 1902 also included an acreage limitation and residency requirement, which stipulated that only owner-occupied farms of less than 160 acres in size could receive water from reclamation projects. This policy targeted middle-class farmers and sought to create a land use pattern of small, community-based, farming economies. In many parts of the West, the acreage limitation was implemented with little difficulty, but in other regions (most notably California) the policy did not fit the economics or scale of farming, and many exceptions and deceptions occurred (Pisani, 1984). The gap between policy and practice became so large, again primarily in California, that "reclamation reform" movements sought to either enforce or eliminate the acreage limitation in the Imperial and Central valleys in the 1970's and 80's (Bryant v. Yellen, 444 U.S. 978; LeVeen and Goldman, 1978; Martin, 1978; Seckler and Young, 1978; Taylor, 1983). The Reclamation Reform Act of 1982 relaxed but did not completely eliminate acreage limitations (P.L. 97-293; 43 USCA 390 et seq.; 43 CFR 426 et seq.).

Reserved Rights.—Reserved rights are viewed as a constraint on water development on public lands, though they may cut both ways—toward water and land development in the case of Indian water rights (under the Winters doctrine), perhaps the last major impetus for new reclamation in the West, and against water and land development in most other cases of reserved rights for public lands.

The record of the reserved rights doctrine in either driving or restricting development is limited to date. Few tribes have quantified water rights let alone "wet water" irrigating tribal lands (Checchio and Colby, 1993). Nor have extensive water rights been removed from development on the public

lands. Recent case law indicates that reserved rights for federal public lands are limited to the original purpose for which the land was reserved and cannot be extended to the broader functions for which those lands subsequently have been currently used (Rice, 1992). Thus, reserved rights operate as a source of uncertainty about water and land use development.

Basin, County, and Area-of-Origin Constraints.—At the state and local levels, water policies have sometimes sought to restrict the place of water use to lands in the county or basin from which the water is withdrawn. MacDonnell and Howe (1986) review these policies and identify economic impacts and forms of compensation that should be considered. Area-of-origin policies run counter to longstanding water policies, exemplified by Coffin v. Left Hand Ditch and other precedents that maximize flexibility and economic development by prohibiting restrictions on the place of use.

If proposed water transfers cross-state boundaries, they may run up against the interstate commerce clause of the U.S. Constitution (WSTB, 1992). In practice, however, water politics exercise at least as strong a constraint on water transfers for regional land development as do water laws.

Water Quality and Wetlands.—We have already mentioned federal environmental regulations that affect land use, but briefly further examine them from a water perspective.

Conflicts over the water quality impacts of western land use date back at least to the era of hydraulic mining in California, which created massive sedimentation, water quality, and water flow problems for farmers in the Sacramento-San Joaquin delta (Hagwood, 1981; Mitchell, 1994). Today, water quality policies are widely perceived as constraints on agricultural land use, in particular, non-point source pollution control and wetlands protection policies.

After years of exemptions and limited attention, non-point source pollution control is now a top water quality priority. NPS was addressed in part by the Areawide planning requirement (sec. 208) of the Clean Water Act (P.L. 95-217 [1977]). Section 319 requires states to identify where non-point source pollution control is necessary to meet ambient water quality standards. Although useful as exercises, the section 208 and 319 policies have rarely had much impact on land use practices or ambient water quality. Many agricultural land practices have been exempt from regulations governing

drainage, filling, and the disposal of dredge spoil material under section 404 of the Clean Water Act.

The courts have interpreted section 404 broadly to include "the navigable waters of the U.S.", "all adjacent wetlands", and certain "isolated wetlands" (WSTB, 1995; Priolo, 1995; key cases regarding the spatial extent and limits of regulatory authority include—NRDC v. Callaway 392 F. Supp. 685 (1975); United States v. Riverside Bayview Homes 474 U.S. 121 (1985); Leslie Salt Co. v. United States, 896 F.2d 354 (9th Cir. 1990); and Hoffman Homes v. EPA, 999 F.2d 256 [7th Cir. 1993]). Wetlands protection under section 404 hinges, again, on the interstate commerce clause of the Constitution, which has been interpreted to include wetlands' contributions to flood abatement, water quality protection, migratory waterfowl habitat, and interstate recreational activity. Related policies established wildlife refuges for aquatic waterfowl, beginning in the early 20th century; endangered species protection, beginning in the 1973, and "swampbuster provisions of the 1985 Food Security Act (99 Stat. 1504) and Food, Agricultural, Conservation and Trade Act of 1990 (104 Stat. 3587) which prohibit federal agricultural loans or assistance to those who convert wetlands to other land uses (with exemptions for cases of "undue hardship" "minimal effect," "prior converted cropland"). These policies represent water policy constraints on land use change.

Confusion among the wetlands regulations of the Army Corps of Engineers, Environmental Protection Agency, Fish and Wildlife Service, and National Resource Conservation Service led to a reappraisal of the scientific and administrative bases for wetlands regulation in 1993 (WSTB, 1995). The WSTB compared agency approaches from a scientific standpoint, focusing on three main variables—water, substrate (soil), and vegetation. It found that the approaches varied by as much as 50% as to which lands were included as wetlands. It noted that while wetlands "adjacent" to the "waters of the United States" were included under existing policy, the following "controversial cases" relevant to western water policy remain unclear:

(1) riparian ecosystems (important for biodiversity, especially in the semiarid west);

(2) phreatophytic and exotic vegetation, e.g., tamarisk and Russian olive;

(3) headwater and isolated wetlands;

(4) shallow and intermittently flooded wetlands;

(5) agricultural and artificial wetlands created by human activity.

Finally, the Wetlands report discussed methods for "regionalization" and "mapping" the land-water nexus from scientific and administrative perspectives.

Endangered Species and Habitat Protection.—There are growing concerns about the effect of the Endangered Species Act of 1973 (ESA) on irrigation agriculture in the West, especially Indian water rights that are either unquantified on undeveloped (Checchio and Colby, 1993; Hansen, 1995; McGuire, Lord and Wallace, 1993). The most significant land use impacts of ESA could be on lands that are not yet developed (e.g., tribal lands) rather than on irrigated lands that could be retired to meet ESA requirements.

Irrigation alters and depletes streamflows, modifies aquatic and riparian habitats, and can accelerate invasion by exotic species and phreatophytes. Irrigation return flows alter stream quality through sediment, salinity, and agricultural chemical discharge. Irrigation systems may also create artificial wetlands and beneficial habitats.

Moore et al., (1996) report that 50 of 68 endangered fish problems in western US are attributed at least in part to agricultural causes. Some 235 counties draw irrigation water from streams that have endangered species. The most frequent problems occur in the Colorado River Basin and in Southern California, which have the highest levels of water withdrawals and consumptive use. Although the ESA requires consultative activities for western water projects that contribute to endangerment, many observers feel that they have had little overt effect on projects and land use (Moore et al., 1996). Potential policy adjustments include: redefining agency responsibilities to balance ESA and irrigation concerns; voluntary water transfers, conservation, and land retirement, e.g., through the Central Valley Project Improvement Act; and facilitating salmon recovery in the northwest by purchasing water from willing sellers. Current research in the fish recovery program in the Upper Colorado River basin may also help identify the land use adjustments for aquatic habitat and species recovery (Bolin, 1993). Clearly one of these adjustments will affect floodplains and other near-stream land uses.

Part IV
Western Urban, Suburban, and Exurban Land Use and Water

The fundamentals of western urban growth do not bode well for western water resources. Urban and suburban land and water use is in the West is expanding rapidly. Western cities dominate the list of fastest growing in the country during the first half of this decade (1990-94 growth), led by Las Vegas:

1.	Las Vegas, Nevada	26.2%
2.	Laredo, Texas	2.4%
3.	McAllen, Texas	0.2%
4.	Yuma, Arizona	9.4%
5.	Boise City, Idaho	17.6%
6.	Naples, Florida	16.0%
7.	Brownsville, Texas	15.2%
8.	Fayetteville, Arkansas	15.0%
9.	Las Cruces, New Mexico	14.7%
10.	Richland, Washington	14.6%

The larger urban areas, like Phoenix and Denver, are growing fast too, but some of their growth is occurring just outside the metro area as defined by the Census Bureau.

Most of the river basin case studies prepared for the WWPRAC cite urban and suburban growth as an important element of water problems in the basins. For example, the Truckee-Carson case cites a 32% population growth in the Reno-Sparks area during 1980-1990; further downstream Carson City is also acquiring water from irrigators to support its growth (Clearwater Consulting Corporation, 1997). The Truckee-Carson report also notes a little recognized problem at the expanding suburban fringe: the first, low density residential developments use wells and septic systems, and thus complicate the control of both surface and groundwater, as well as the maintenance of water quality, as the suburban in-fill occurs. The study also concludes that while "rational" land use planning and management could make a big difference in regional water problems, the land use policy regime in the West, with its strong property rights ideology, essentially blocks effective land use planning.

As we noted in Part I on Land Use Policy, California has relatively strong land use planning traditions, but even here the policy links between residential land development and water are weak. McClurg (1997) noted that a bill requiring cities or counties to submit new development plans to a water

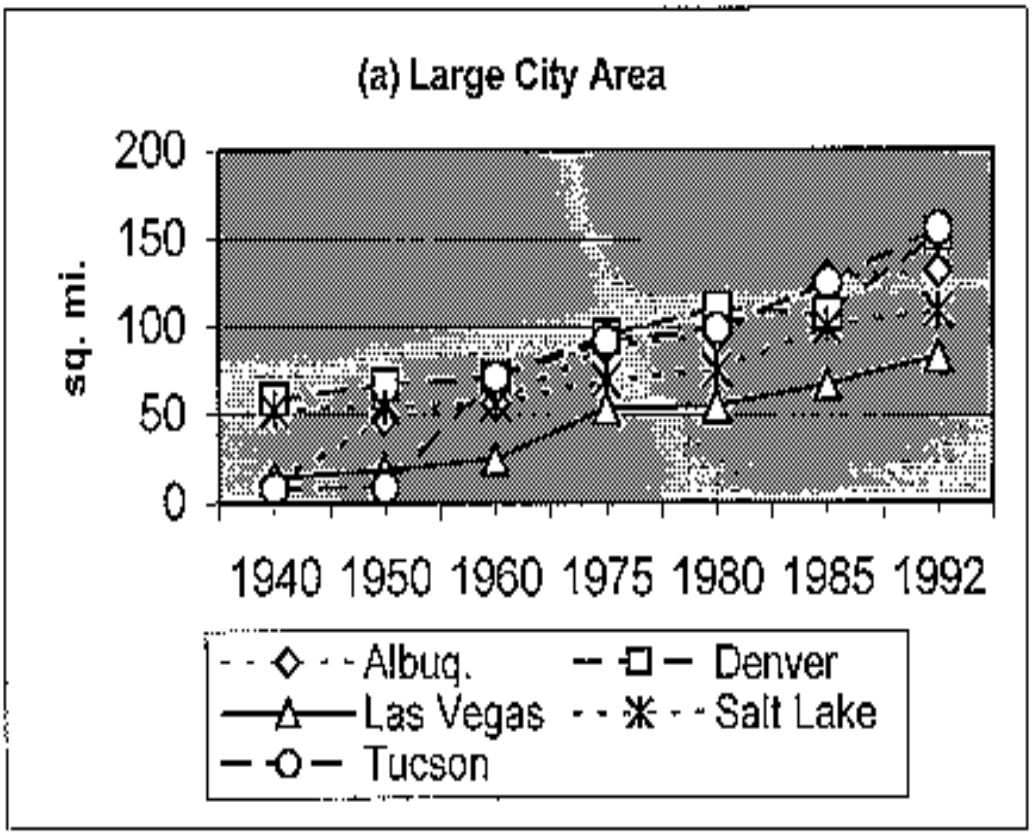
agency for approval died. The state assembly did pass SB 901 in 1995 which allowed water agencies to use California Environmental Quality Act provisions to challenge local land use plans they feel have made insufficient provision for water resources. Still, planning boards can over-ride the water district, or can reformulate the plan with sufficient water.

The attitude toward land development is positive in most western areas, and only a few western cities or counties have something approaching effective growth control (e.g., San Diego and Portland, and a few smaller cities like those in Oregon affected by state land use laws, and richer, white-collar communities like Boulder and La Jolla)—the rest are sprawling, and unless regional population growth stabilizes or declines, will continue to do so. Even places with effective growth limits (e.g., Boulder, CO or Davis, CA) find it difficult to coordinate with nearby communities and thus land and water use pressure merely shifts to those communities. Most western cities have plans for enlarging their water supplies to meet growth (even those with strong growth controls, like Boulder), and current urban growth patterns are driving the lion's share of water transfers in the West. In a pattern well known to planners, M&I water uses grow as fast, and in many cases faster, than population unless concerted conservation programs are in place. According to Maddock and Hines (1995), public water supply withdrawals and per capita consumption have grown at roughly twice the national rate in the Southwest during 1965-90, and, by most indications, this rate of growth quickened during the first half of the 1990s, though per capita consumption may be stabilizing in a few cities.

Most western cities also have plans for enhanced water conservation, but the net effect of these efforts probably will be to reduce per capita consumption of water, but not the ultimate total increase in urban water demand, though the rate of increase in total use should slow a bit as conservation programs take effect.

Western Urban and Suburban Land Use Patterns

Western cities exhibit archetypal American urban sprawl. As the country's newer urban areas, they were designed around the automobile—Los Angles practically invented and perfected the auto-based city, and others like Phoenix, Salt Lake, and Denver have followed suit. Figure 6 shows that sprawl (urban area expansion and decreased population density, that is, in



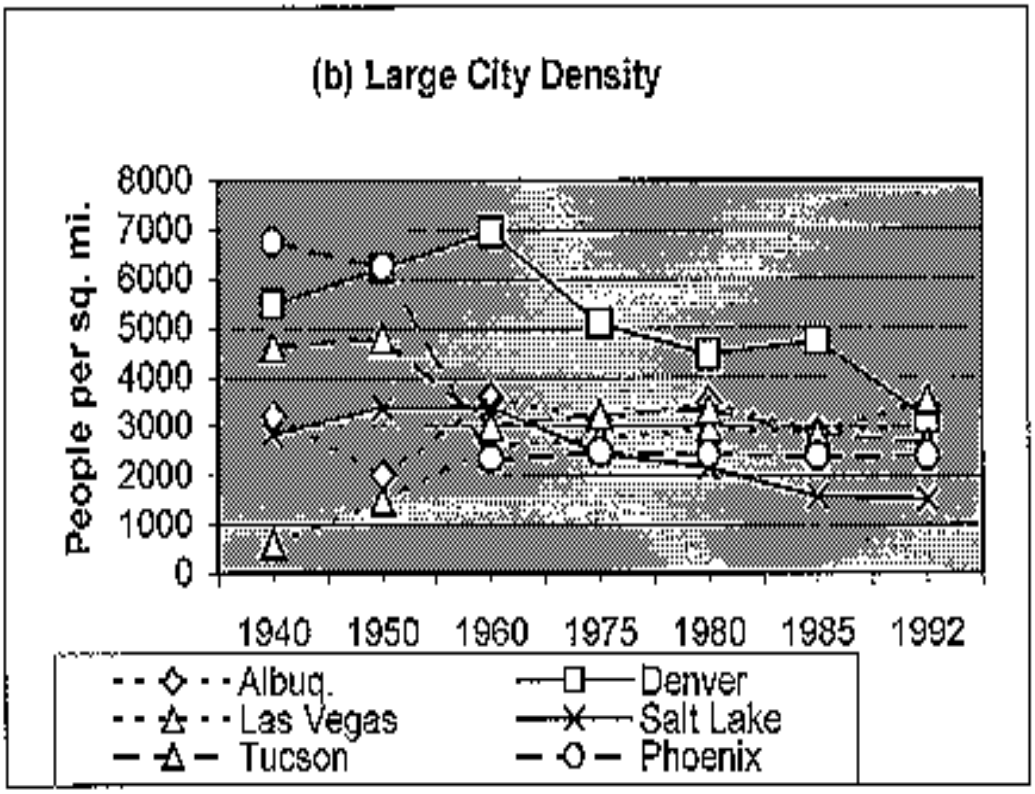
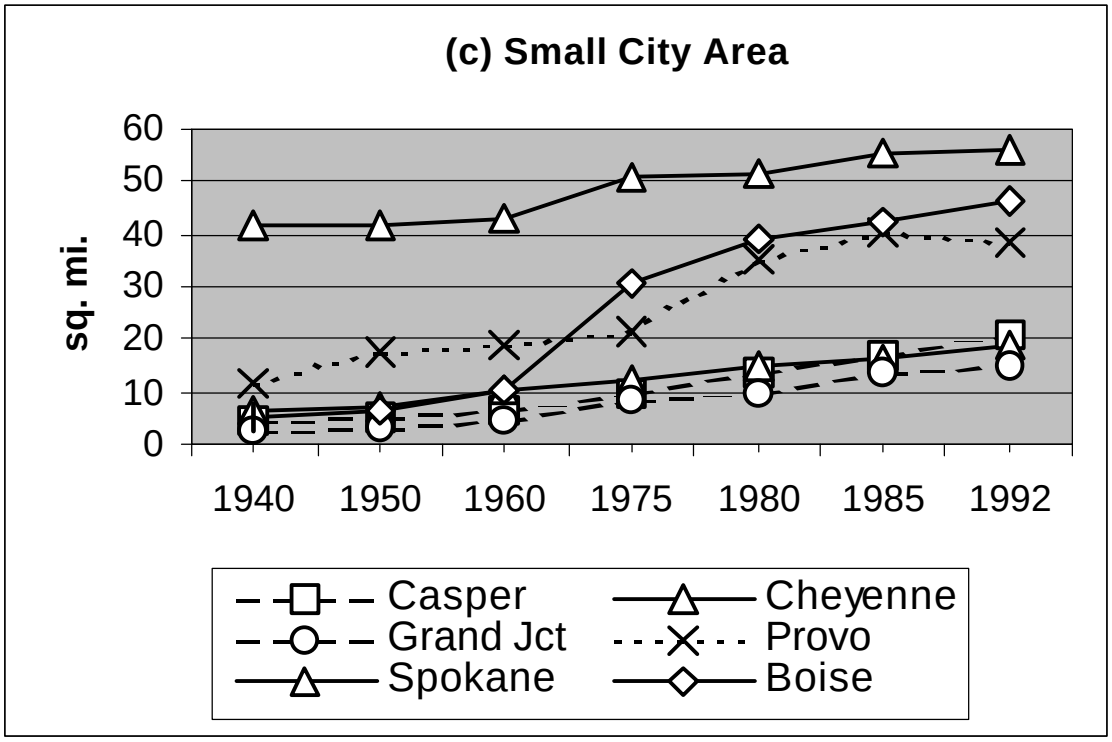


Figure 6.—Area (a) and population density (b) of large western cities.



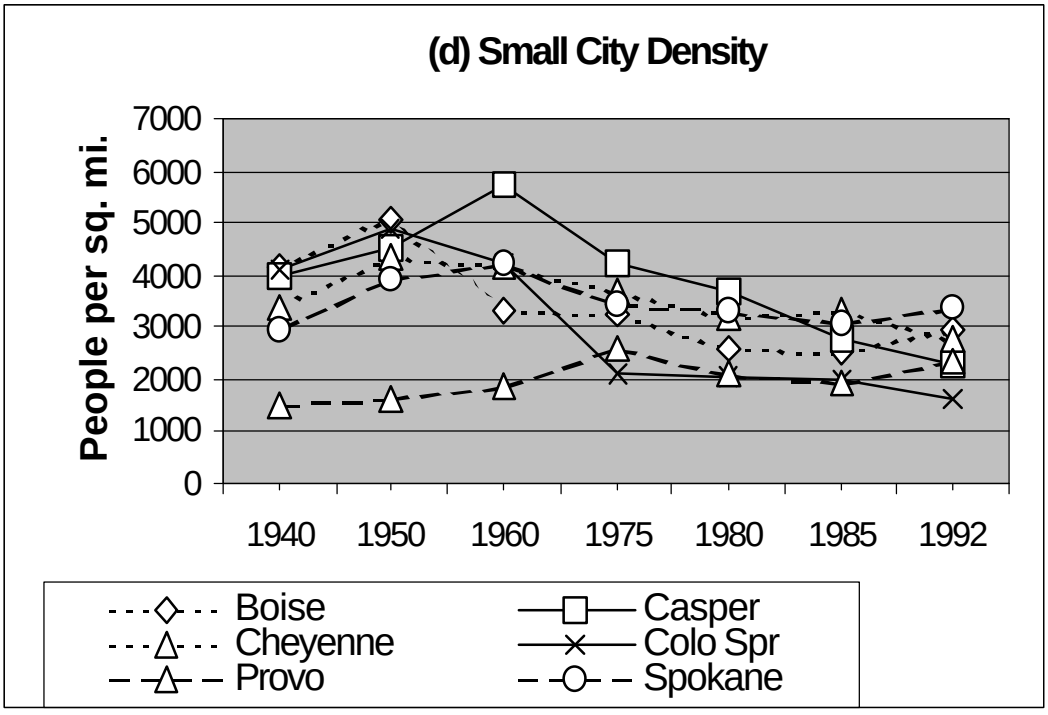


Figure 6 (continued).—(c) area and (d) population density for small western cities.

other words, increased per capita urban land use) occurs in most of the large and small cities in the West. Some that appear to be concentrating rather than sprawling (e.g., Provo) may actually simply be exporting population to "exurbs" that are not included in the Census Bureau's definition of that city's urbanized area, though detailed land use analysis would be needed to determine this.

Most land in Western cities is in residential use (Table 2), so raw population growth and residential development directly consumes more land than commercial or industrial development. Sprawling residential growth tends to require road and other infrastructural enlargements that are proportionately larger than the population or dwelling-unit growth rate.

Table 2.—Percentage of land uses for some Western cities

City	Residential land (%)	Commercial land (%)	Industrial land (%)	Public/Infrastructural land (%)
Albuquerque, NM	57	15	5	23
Austin, TX	48	7	5	38
Reno, NV	36	8	5	51
Tempe, AZ	41	8	10	41
Tucson, AZ	48	10.7	7	35
Average	46%	9%	7%	35%

A package of land use policies exacerbates the sprawl of western cities: liberal annexation laws (that favor municipal land over county unincorporated land), few effective growth limitation policies, ineffective regional government entities (most, like the Denver Regional Council of Governments—DRCOG, have very limited power over their constituent municipalities and counties), and urban ability to out-vote and out-maneuver rural interests simply because so much of the western population is urban, as Case and Alward (1997) point out in their paper for the Commission. Even the most concerted anti-sprawl efforts have failed. A bench-mark historical study of Albuquerque and Tucson showed, simply, that even well-organized anti-sprawl campaigns fail in the face of the political power of urban growth boosters (Logan, 1995).

Forced by increasing citizen complaints about rapid growth, many Western towns and states tried in the 1990s to implement some form of "growth control." These have all pretty much failed because Western governments simply cannot make growth limits politically acceptable enough that they encompass entire regions, so any community limiting growth may simply be shifting it to nearby places. When Colorado Governor Roy Romer started a growth limit program, he eventually backed off to calling it "Smart Growth", meaning that he would do little to limit growth outright, but would try to make growth "better." When his efforts at even modest statewide planning were shot down by the legislature, he told the Washington Post: "You feel a little bit like Don Quixote. The free market ethic is powerful music to politicians." (February 27, 1997, p. A1). The Washington Post story also described Gallatin County, Montana's similarly unsuccessful attempt to curb development. This year, after supporting a study on how to limit urban sprawl, DRCOG barely survived dissolution by its own members, and remains powerless to implement effective growth controls. The Puget Sound Council of Governments completed its "Vision 2020" plan for growth management in this fast-growing area, and immediately voted to disband, after friction over land use mounted during the study and Seattle threatened to pull out. Logan (1995) summed up the multi-decade battle against sprawl in Albuquerque and Tucson succinctly: "one side prevailed [the city boosters], but not without a fight." (p. 9). The moral of his story, and those of other western cities, as far as growth is concerned, seems to be captured in the words of the Borg on Star Trek: The Next Generation: "resistance is futile."

Still, it takes a lot of people to account for significant agricultural land conversion. For example, according to NRI statistics, New Mexico lost 1.4 million acres of rangeland, either to cropping or to suburbanization and rural development between 1982 and 1992. If all of this went to suburbanization—at densities common now in the suburbs of western cities—we would have to assume that an addition of roughly 4 million New Mexicans occurred! However, the effect of raw population growth on land use can be enlarged if cities continue to diffuse outward, and may be especially pronounced in rural areas if more people begin to live on multiple-acre rural residential lots, as appears to be occurring (see, for example, Lamm et al. 1994).

What About Exurban and Rural Growth?

A major question for future land use in the region is what proportion of population growth occurs in existing cities and their suburbs, and how much

rural development goes on. A growing literature on "exurbia" suggests that American demographic patterns will continue to sprawl and further insinuate suburban-like residential and commercial patterns into rural areas—what has come to be called "exurban" development for lack of a better word. Studies suggest that residential development is not as spatially linked to the city as in the past (McMillen, 1989), and several enabling factors encourage exurban development: jobs have shifted from CBD's to the suburban fringe (what Joel Garreau called "edge cities" in his book by the same title). Because commuting distances are somewhat inelastic, people are willing to drive an hour to work whether it is across town or through the countryside: an hour on rural highways can take the commuter quite far into the countryside. Additionally, more American workers can telecommute from home.

Although Case and Alward (1997) feel that urban growth will dominate the West, we believe that significant rural development will also occur, and believe that this is an important land use phenomenon for Western land and water policy.

Many land use observers feel that the West is undergoing significant dispersed exurban and rural development (e.g., Lamm et al. 1993; Gersh, 1996; Williams and Jobes 1990). This is certainly happening around the National Parks and other amenity-rich locations; the most well studied case is Yellowstone (see Rasker 1993 and 1994; Power 1991), where rural sprawl and "ranchette" development is consuming the limited private lands available for development (since most Yellowstone-area counties are half or more federal land). This is also occurring in other Western mountain and desert areas. Similar patterns show up on the Colorado Plateau (Hecox and Ack, 1996). Several rural counties in Colorado were among the nation's fastest growing counties during 1990-95, an effect of resort town growth and secondary impacts on smaller towns as workers are displaced outward from increasingly expensive and affluent communities (see Riebsame et al., 1996; Ringholz 1992; Culbertson et al. 1993).

In previous research (see Riebsame et al., 1996) we studied rural land development in the Colorado mountains, where ranchland is under great pressure for residential development (Rocky Mountain ranchland can fetch real estate prices that are 10 or more times what the land is worth for agriculture). Details from one study area where ranchland is subdividing and switching to other uses are given in Part VI on agricultural land conversion.

The forces driving population growth in the small-town and rural mountain and desert West are actually well understood. Fuguitt and Zuiches (1975),

and Williams and Jobes (1990) have shown that a mixture of economic and quality-of-life considerations attracts people to amenity-rich areas, from Bozeman to St. George to Sedona. Jobes (1988 and 1993) studied immigrants to Montana's Gallatin Valley for two decades, concluding that natural amenities and recreation opportunities, and not necessarily job prospects, attracted both rich and poor. Population is also leaking from the West's cities into rural hinterlands as people already living in the region take advantage of new residential mobility to seek improved quality of life. Davis et al. (1994) showed how cities with charismatic hinterlands (their case study was the coastal city of Portland, Oregon), develop an "exurban" zone of countryside dwellers, some of whom maintain their suburban jobs and others who eventually wean themselves of the city completely. A significant literature also documents the retirement component of this so-called amenity-migration (e.g., Cuba, 1989; McHugh, 1990)—more than a quarter of Interior West immigration may be retirement-based, and demographic trends point to a large retirement boom starting in the next two decades.

Western Urban Water Use

The land use and fiscal effects of Western urban sprawl, as opposed to raw population growth itself, are well known on facilities like roads and services like schools and snowplowing, but the effect on water use is less well documented. Since up to half or more of city water use in the drier Western cities goes to landscaping (a third in a wetter city like Seattle), it can be assumed that a sprawling city uses more water per capita than a dense/compact city: landscaped area is almost certainly greater per person and per household in less dense settlement patterns. Many of the current urban water conservation plans (examples discussed below) target landscape uses (residential lawns, public parks and other landscaped areas like road medians, and golf courses), but it is worth noting that many suburbs, like Highlands Ranch near Denver (which was recently featured in National Geographic, as an example of sprawl), enforce covenants for minimum area of green lawn and even require that grass be kept green (meaning the homeowner can be fined for letting the grass brown up during the height of summer heat). So, city conservation plans and suburban lifestyles—written into neighborhood covenants—are often clearly at odds.

We used the Maddock and Hines (1995) survey of Southwestern city water use, and then contacted several cities to get up-dated water conservation plans as well as to look at cities not examined by Maddock and Hines (e.g., Seattle). Here are some results:

Las Vegas

Las Vegas is the king of American urban growth, but because the city was laid out in a dispersed manner originally, it is both spreading out and becoming more densely populated (Figure 6). Nevada was the fastest growing state in the country during 1980-1995, due mostly to growth in Las Vegas and Reno. Some 5,000 or more people move to the Las Vegas area (or what is often referred to, for planning purposes, as Southern Nevada) each month (Feather et al., 1992). The city grew 14% in two years (1990-92); Clark County grew 37%, reaching a million by April 1995.

Las Vegas is a fascinating case because elected officials there are less involved in agonizing debates over growth limits than most other fast-growing Western towns. "We encourage economic development of all types," says the Clark County Planning Director; "We're trying to accommodate growth rather than limit, control, or cap it in any way" (quoted in Clayton, 1995). The city has extremely low taxes, high job growth (11 percent in 1994), and many attractions. It also ranked highest as a retirement town, and perhaps a fourth of newcomers are retirees. According to Clayton, the county planning commission is solidly pro-growth (it was chaired by a homebuilder during 1991-94, a potential conflict of interest frowned on in other places). Zoning requests and use permits come into the Las Vegas planning department at the astronomical rate of 15,000/month, up to 1,500 of them new building permits. The schools are on double and year-round session and $1 billion behind in school construction, the valley has been designated a "serious" non-attainment area by EPA (due mostly to dust), and traffic doubled in about 6 years.

Even as the fastest growing city in the country, and a desert city, Las Vegas leaders and planners do not feel that water will be a serious limit on development. The city will consume all of its Colorado River allotment in less than 15 years, but has proposed several far-flung projects to meet growing demand. For example, in 1993 the city proposed building a reservoir in Colorado (on Roan Creek) so that it could lease (for 50 years at some $200 an acre foot) upper basin water (Maddock and Hines, 1995). (Colorado officials who even hint to openness to such plans face severe political backlash.)

Clark County's population is expected to grow from 925,000 in 1993 to over 2.5 million by 2035. The Las Vegas Planning and Management Department expects its water supply needs to grow from .29 bgd to .5 bgd by 2030, and has set a goal of 20% reduction in per capita use during that period. Like many western cities, the Las Vegas water conservation plan focuses on limits on

residential and recreational turf (lawns and golf courses), and low flow plumbing. However, like most other western cities, the plan does not include altered land use planning or comprehensive growth limits and, thus, water conserved through lower per capita use is expected to be consumed by a growing population. So, the city is looking for significantly larger supply.

The Las Vegas Valley Water District (LVVWD) sent a land use shock wave into its rural hinterlands with its Cooperative Water Project, which proposal to phase in, over two decades, pumping of up to .22 bgd from some 200 rural basins north of the city. Water providers in the area then formed the Southern Nevada Water Authority to create a comprehensive water plan and avoid fragmented projects. The Authority's plan (Southern Nevada Water Authority, 1997) gives priority to meeting future needs with additional Colorado River water rather than the Cooperative Water Project or new deliveries from the Virgin River—but the plan makes clear that the providers will "continue to aggressively pursue long-term resources." The Authority can meet demands through 2007 with careful conservation and Nevada's unused Colorado apportionment. After that the Authority might seek access to Arizona's "unused apportionment" in the Colorado River. Experts on the Colorado compact can judge the likelihood of this. Whatever it does, the plan definitely makes it very clear that the Authority will meet rapidly growing demand with firm supplies, meaning it will continue to consider all options.

The Authority's member agencies have already made significant conservation gains through plumbing, pricing, irrigation efficiencies, and re-use requirements for golf courses. Indeed, the 1997 report claims an 11% conservation reduction since 1991. They propose further "voluntary" conservation (in quotes because they cite pricing that way and because Clark County's golf course re-use program is mandatory), but still expect deficits after 2025, when the least preferred projects may be needed.

Denver Metro Area

The Denver Metropolitan, eight-county, 4,000 sq mi region contains some 2 million people. By 2020, DRCOG (1994) projects an additional population of 900,000 (+45%) and that current patterns of sprawling, dispersed development would add 360 sq mi (230,400 acres) of developed land (+71%), 230 miles of highway (principal arterial, regional arterial, and freeway—+19%) and a doubling (+100%) of vehicle miles traveled by 2020. DRCOG also estimates that current water supply is inadequate for this 2020

population. The Denver Water Board's latest plan calls for increasing its supply from some 345,000 acre-feet today to 445,000 acre-feet by 2020.

Any discussion of the Denver water situation must first mention Two Forks Dam. The "Denver Metropolitan Water Supply EIS" drafted in 1986 by the "Metropolitan Water Providers" (over 40 local governments led by the Denver Water Board), and the U.S. Army Corps of Engineers (COE) approved building the 1.1 million acre foot reservoir on the South Platte above Denver, based on the water providers' projections of population growth and water demand (COE, 1986). The dam, however, was stopped in 1990 when EPA refused to issue a permit under the Clean Water Act. So much has been said and written about the battle over Two Forks that little need be repeated here. But, it is instructive to compare the arguments then to the situation now. For example, some Two Forks critics argued that population projections—based on the energy boom years of the mid- and late-1970s—were way too high, noting the slowing of Denver's growth in the mid-1980s. It's worth noting that growth has rebounded to levels close to (though still a bit lower than) the early-1980s projections made by the Providers.[1]

Secondly, critics claimed the plan included too little attention to water conservation. The original plan included metering Denver, possible (but ill-defined) lawn size restrictions modeled after those in Arvada, and assumed rates of replacement of inefficient plumbing fixtures. Yet, it seems fair to say that the Providers did not propose conservation restrictions anywhere nearly as strict as those now routinely envisioned in western city water plans, nor reasonably feasible even then.

After Two Forks was denied, many of the "Providers" set out on their own, and by obtaining new water (some of it from the C-BT/Northern Colorado Water Conservancy District) and conserving what they had, many have positioned themselves with sufficient water for the foreseeable future (e.g., 30-50 years). However, the DRCOG "Metro Vision 2020" study concludes that the overall metropolitan demand will exceed supplies by 2020 (they do not specify assumed use rates). DRCOG also argues that the current, post-Two Forks "every provider for themselves" approach to Denver area water supply planning is inefficient and will prevent the region from developing in a way that maximizes effective use of water; in particular they cite competition that

[1] The Two Forks EIS projected 2.58 million people in the service area by 2010, and 3 million by 2035. The DRCOG "Metro Vision 2020" study projected 2.46 people by 2010, and 2.77 by 2020. If one interpolated between 2010 and 2035 in the Two Forks EIS, their estimate for 2020 would have been somewhere near 2.86.

results in some districts or municipalities having quite large supplies with others already short and falling behind. The report asked, hypothetically (meaning the report writers suggested to the Council) whether some form of growth direction should be implemented to take advantage of where the water is. Logical ideas like these have gone over like the proverbial lead balloon in the multi-jurisdictional Denver area.

Perhaps the most noteworthy land use implications of the pattern of water transfers to the Denver metro area (or the Front Range overall), is the tendency of the cities, under Colorado law and precedent, to seek to develop and transfer distant sources first, rather than dry up local agriculture (Committee on Western Water Management, 1992). Thus we have Front Range towns buying ranches and farms hundreds of miles away, and, in a sense, banking water for future use.

The current Denver area water plan calls for adding roughly 100,000 acre feet of supply and/or savings over the next 20-30 years.

Phoenix

Probably no western city's water and land use has been more studied than Phoenix. Its population of 2,473,000 (1994) places it at the top of the Interior West cities, and its per capita water use is relatively high, at somewhere around 230-250 gpcd, depending on how use is defined (some estimates run over 300, but include many classes of uses). Phoenix has a long history of efforts to reduce water use, especially through an effective inverted rate structure that reduces peak demand. But Phoenix also demonstrated the well-known national phenomenon that indoor water use was relatively inelastic: it took a 10% price increase to yield a 1% drop in use. Outdoor use dropped 5% for a 10% price increase (Phoenix Water Services Department, 1997). This response pattern, and political feasibility of various conservation alternatives, pushed Phoenix and other western cities to focus on plumbing retrofit as the key conservation approach in addition to rate structures. Other projects included restrictions on irrigation of large turf areas (golf courses and parks), and a suite of incentive programs for everything from xeriscaping to best available commercial/industrial technologies.

Phoenix did begin restricting lawn size to 50% of the landscapable area in 1987, and claims good results. But, like most western cities, Phoenix, has no effective growth or sprawl limitation policies in force, and does not include

significant land use or population growth components (other than the lawn restrictions) in its water conservation plan. Phoenix can be expected to grow at least another 1.5 million people by 2025.

In a 1995 study, the city found that per capita demand had dropped markedly since 1989 and was well below historic rates—roughly 220-223 gpcd in 1992 and 1993 (Chesnutt and McSpadden, 1995). If this was permanent, then the city could both easily meet state-mandated gallons per capita per day (gpcd) standards and save considerable investment in supply and treatment facilities. Yet, the analysis suggested that both economic recession and cooler weather had a lot to do with the decline, and it could not be counted on to continue without further strong conservation efforts.

Other Cases

El Paso.—The City of El Paso expects continued, rapid population growth (from 550,000 in 1991 to 1.2 million in 2040) and an increase in public water supply demand from .10 bgd to .26 bgd in 2040. Thus, their estimates project a small increase in per capita use over the next 50 years as the city becomes more affluent. According to a review by Maddock and Hines (1995), the city's water plan includes integrated efforts in water re-use, efficiency, and importation, but tends to neglects efforts to reduce individual or household consumption.

Seattle.—This "well watered" Northwest city began worrying about meeting peak summer demand over a decade ago, and instituted conservation efforts in 1980 (Seattle Water Department, 1996). Most of this was educational and voluntary (e.g., showerhead replacement), but by the late-1980s the city got more concerned about meeting future demand and began to require water conserving plumbing. It lobbied to have the state building code changed to require efficient plumbing, and got clarification of its authority to debt-finance water conservation as part of supply. Watering restrictions during 1987's hot, dry summer further evoked conservation, and the state departments of Health and Ecology began to require conservation in water system plans in 1989. When Seattle-area population began to increase dramatically in the late-1980s and early 1990s (as it did in most Western areas outside of California), the regional system managed to absorb almost a 20% population increase with essentially no increase in water use.

The City supplies 600,000 residents directly, and another 670,000 through 26 associated water purveyors (all users are metered), with about 157 million gpd (124 gpcd). The region expects 120,000 new residents (9%) between 1995 and 2005, the earliest it counts on new supplies. The current plan is to allow no increase in total use until at least 2004, when a new system linking Seattle and Tacoma will add about 25 mgd to the supply. The largest savings will come from indoor residential and industrial efficiency improvements. Only 3 mgd of the 35 mgd savings the city wants to achieve during 1995-2005 come from landscape uses, and those are achieved by rate changes and education on irrigation practices and low-water-need plants. Still, summer landscape watering can increase demand 30% above the average, and double it on some hot days. Landscape code changes may be considered after more research, but are not now planned.

Summary

As expected, the Western cities examined here are growing rapidly, expect to continue to grow, and are seeking more water supplies while simultaneously getting serious about conservation. Conservation focuses chiefly on plumbing and lawn and golf course/park irrigation. A few jurisdictions (e.g., Phoenix and Arvada) have implemented lawn size restrictions for new development, but most of the suburban jurisdictions associated with the above cities have no such restrictions; indeed, many subdivisions actually have minimum, rather than maximum, lawn area covenants. Also as expected, urban land use limits and/or growth management are not a significant component of most cities' land or water development plans. The Denver Metro Area comes closest among the areas discussed above in setting limits on urban sprawl, but even though DRCOG formally accepted the urban growth boundary for compact development, this remains a guideline to the Council members' land use planning efforts—and there is little reason to believe the region can act as a whole when it comes to land use, or to acquiring water supplies, as suggested in the Part V. However, the urban land use scene does offer some rays of optimism in water use.

New Urban Landscapes of Land and Water Use

Because we found most of the effective action on land use and water in the urban section focused on landscaping, it seemed reasonable to look at trends in this micro-scale element of land use. Although much is made of current land use trends and their potential implications for water policy, little

attention is given to land development trends as a source of potential solutions to problems. Nor have water policy analysts considered how "landscape analysis" in the scientific, cultural, and design senses of that term might generate fresh alternatives to resource problems (WSTB, 1996, ch 2; White, 1995; Wilkinson, 1992).

Here we focus on innovations in landscape design that link land and water use in the West and that may have broader relevance for water policy (see Litton, 1974; and Lyle, 1993). For example, certain recreational land uses, such as golf courses and ski areas, have a reputation for aggravating water problems (e.g., water demand, non-point source pollution, groundwater contamination, etc.), but here there is room for optimism. The more creative facilities and associated professional organizations have developed promising solutions to some of those problems. The golf course industry has sponsored breeding of drought tolerant grasses, low input turfgrass management methods, and wastewater irrigation (Schroeder and Sprague, 1994; Snow, 1994; Thompson, 1996).

The xeriscape movement is changing residential landscape design tastes from high to low water use plantings, which in turn is stimulating horticultural production and breeding of drought-adapted species (Arizona, 1996; Kopolow, 1994). Land developers, landscape designers, and contractors are beginning to work with water utilities on water conservation plans and programs (e.g., see "Waterwiser" web site, http://www.waterwiser.org). Landscape architects and designers are working with water and wastewater utilities on the design of their facilities for broader educational and social purposes (Leccese, Jan. 1997), and with local governments on stream restoration and greenways systems (Leccese, October, 1996 November 1996; Restoration and Management Notes, passim). These trends include places that have had a record of extravagant water displays, such as Las Vegas.

Outside the West, one of the most significant breakthroughs in urban-regional cooperation is an agreement whereby New York City will finance local landscape design and land use planning in upstate communities to meet drinking water quality standards in its watershed and to avoid the much larger costs of filtration (Strutin, 1996).

Although no attention has been given to them from a landscape perspective (at least that we are aware of), tribal landscapes may be a source of design innovations in view of their different laws and traditions regarding the legal, economic, and more broadly cultural relationships between land use and water policy.

Part V

Agricultural Land Loss in the West

We know that a net land use conversion from agriculture to other uses (chiefly residential, commercial, and transportation) is underway in the U.S., and in the American West. Between 1982 and 1992 the net conversion totaled some 1.5 million acres in the Western states (Figure 7). The conversion is not geographically homogenous: the Great Plains region is not losing nearly as much agricultural land to urban, suburban and exurban development as are places like the Colorado Front Range, mountain and desert resort areas, or California's Central Valley. The Colorado Task Force on Agriculture Lands (1996) estimates that the state loses 90,000 acres of farmland per year. And most of the basin case studies prepared for the WWPRAC at least mention agricultural land and water conversion, or increased demand for M&I water supply, as key geographical trends affecting water and water policy in the basins. Here we provide an overview of this land use change process, and explore the role of government policies in this conversion. Specifically, we ask whether water policy is propelling farm and ranch land conversion to residential or commercial use.

What Kind of a Problem is Agricultural Land Loss?

First, it is worth discussing just what kind of a problem is agricultural land conversion, since people perceive it differently. Rapid agricultural land conversion in the 1970s and 1980s, along with the world food crisis in the 1970s, raised widespread concern that the productive capacity of American agriculture was a risk. The USDA embarked on a major effort to assess farmland loss, the National Agricultural Lands Study (NALS), and researchers around the country conducted case studies (e.g., Dillman and Cousins, 1982). The results were described in the popular press as indicating a "farmland crisis," and this concern remains alive today. Yet, most agricultural economists were never very concerned about food production per se, and have, since the mid-1980s, "discount[ed] any threat to food and fiber production capacity from continued urbanization" (Vesterby and Heimlich, 1991, p. 279). A look at the world food situation, or the "food security" of the U.S., is beyond the scope of this paper.

Despite the generally-optimistic sense among American agricultural economists, one can still find dire assessments: Lester Brown and researchers at the Worldwatch Institute still raise concerns about world food supply, but they, like many other analysts, also now focus on the environ-mental effects of high-tech, high-input agriculture and on the equity issues

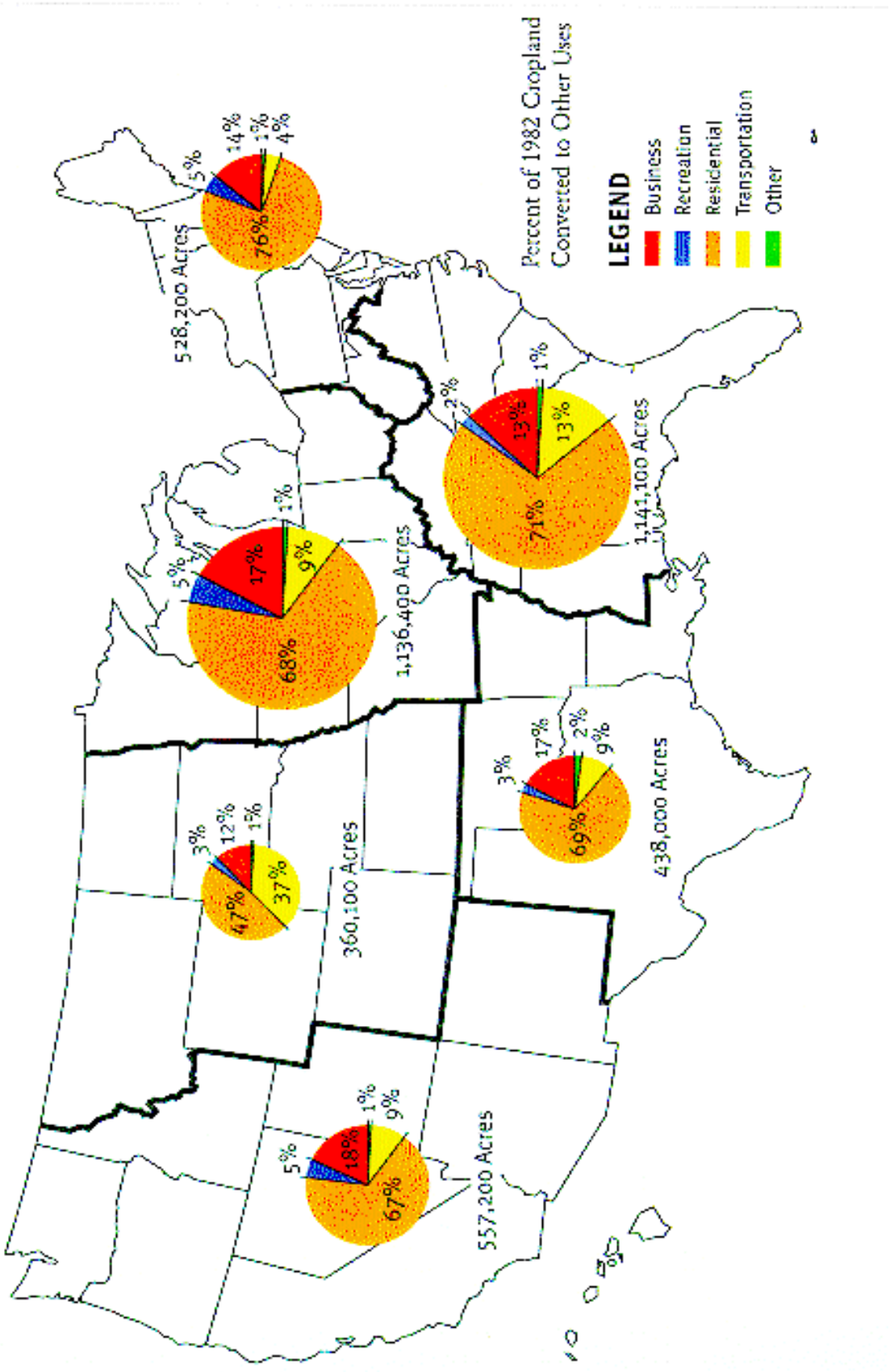


Figure 7.—Percent of 1982 cropland converted to other uses

.associated with national food security and food as a basic human right (Brown, 1996). They also raised concerns over the inefficiency and environmental effects of livestock production (Durning and Brough, 1991) and of limitations on, and competition for, water in irrigated agriculture, including irrigation in the western U.S. (Postel, 1989), though much of their work focuses on Third World settings.

Brown et al. include the expansion of urban land in the roster of negative global trends, but tend not to see it as a major threat to agricultural production. However, they have pointed out one of the same problems that the WWPRAC is addressing: the magnitude and economic power of urban demand vs. irrigation water uses. Their "worst case" scenarios of global population and agricultural production include declining irrigated area as one cause of the coming Malthusian imbalance as world population increases (Brown 1988; 1996). Brown argues that the world food situation in the early-1990s is as bad or worse than the 1970s crisis years.

We choose not to get into this long-standing debate here, except to note that it, in effect, has little to do with domestic agricultural or agricultural land policy. Many agricultural economists simply do not buy the "worst case" thinking, especially with regard to land as a factor in U.S. production (Vesterby and Heimlich, 1991). Indeed, research on the threat of agricultural land loss in terms of overall food production virtually disappeared from the technical literature after the mid-1980s. In their 1991 national assessment of renewable natural resources, Resources for the Future (RFF) concluded that the most notable aspect of the national cropland base was how stable it was in spite of competing demands for land and resources (Crosson, 1991). This and most studies conclude that productivity increases have all but swamped land loss. The RPA and NRI assessments used in this report emerged in part because of the 1970s concern about supply of food and fiber: by most accounts those continuing studies have allayed policy-maker concerns over the raw food supply, and NRI results have reduced fears about soil erosion and other land degradation problems. Finally, most agricultural policy-makers, and many farmers, are still more mindful of the negative land value and credit effects left over from the expansionary supply policies of the mid-1970s. They are less concerned with current global food security, and it appears very unlikely that policies to expand or even to retain farmland will be based on attempts to affect global food supplies.

Still, agricultural land conversion remains a newsworthy public policy issue in the U.S., even as federal programs seek to reduce crop production. What

happened, we think, is that the food security issue was replaced with a host of other valid concerns, concerns that were probably driving local perceptions of the problem all along:

- Loss of local agricultural production/economy;
- Loss of specialty crops;
- Loss of open space and wildlife habitat, plus other ecological effects;
- Loss of agricultural lifestyle and landscapes.

This is not to say that agricultural advocacy groups have stopped raising concerns over raw food supply. In the latest national assessment of farmland loss, the American Farmland Trust (AFT) concludes that "in the worst case scenario, within the next 60 years, the United States could become a net food importer instead of a net food exporter" because of farmland loss (Sorensen et al., 1997, p. 2). And, food security was at least mentioned (though given less prominence than the issues listed above) in the Farmland Protection Program in the 1996 farm bill. But, we believe it is fair to say that the above-listed concerns now drive agricultural land protection efforts, and even the AFT concludes that regardless of whether farmland loss is a food problem per se, "the loss of open space, wildlife habitat, groundwater recharge areas and other benefits attributable to farmland are reason enough" (our emphasis) to protect agricultural lands. Americans seem eager to support "family farmers" and the rural cultural values associated with them, though they are not sure what national policy options would best achieve this goal (Strange, 1988). Still, organizations like the Family Farm Alliance and the American Farmland Trust are gaining support from suburban Americans, especially when those Americans lose the nice views afforded by farmlands.

These arguments—open space, rural lifestyle—are much more powerful today, and have evoked agricultural land protection efforts—mostly at the local level—across the country. (e.g., Coughlin, 1991; Lapping, 1995; Duncan, 1995). Though federal researchers and the resource monitoring and assessment programs allayed fears over supply, concern over farm and ranchland loss in the West is increasing. Many states western states (especially California, Oregon, and Colorado), and many counties and municipalities, now see agricultural land use loss as a major land use problem (e.g., Goodenough, 1992; Task Force on Agricultural Lands, 1996), especially given studies indicating that land conversion cost more in services than it returns in enhanced property taxes (the now well-documented fact that suburban development does not pay for itself, see Burchell, 1996, for a review of this phenomenon).

In short, the farmland loss issue in the U.S. is now just that—a land use issue—rather than a food issue per se. And, all levels of government, from federal to local, have initiated policies to protect/preserve agricultural land. We describe these in detail below, but first want to address the root causes of problem.

The Agricultural Land Use Conversion Process

Market vs. Policy Forces

The basic premise of land economics is that private land use and land use change is chiefly a market phenomenon, subject to some guidance by government policy (especially planning and zoning). The net agricultural to residential conversion underway in the West is, ipso facto, related to the region's remarkably robust real estate market. Moreover, farmland value studies indicate that urban and suburban demand wins out over agricultural use pretty much everywhere in the nation. Alig and Healy (1987) used farmland price as a variable in a national land use change assessment, assuming that high value crops in at least a few of their sample areas would restrict urban growth. They concluded that:

> *The farmland price variable was not significantly related to land consumption in any of the regressions, at either the urbanized area or state levels. This finding appears to indicate that built-up uses are so dominant in general over agricultural uses in the land market that the level of farmland price has no measurable influence on built-up land consumption. (p. 222).*

Their work contradicts a previous study of several urban areas, so note that the researchers are not of one mind on this issue.

But, if we accept the simple land rent theory of land use conversion, then any owner would be irrational to do other than what the markets dictate. Yet economists find that agricultural land and water is particularly "sticky"—that is, the conversion tends to occur well past the point where economics indicate it should—so there exist powerful non-economic reasons for keeping land and water in agriculture even when economic returns on those uses decline in absolute terms or relative to alternative uses.

Much of the agricultural land economics literature, (for example, models created by Robert Young at CSU specifically for irrigated farms in

northwestern Colorado), cite government policies as a major source of this stickiness or delay in land use conversion. Federal programs in particular have, over the decades, supported agricultural land use, through direct payments, disaster relief, low income loans, cost-share for conservation practices, marketing support, etc.

Other supports come from state government, including predator control programs and marketing assistance, and, of course, agriculture property tax rates. The literature on agricultural property tax structures, though offering somewhat ambivalent results, indicates that the widespread application of use-value tax rates (as opposed to highest-use rates) delays agricultural land use conversion, even at the urban fringe (see, for example, Anderson, 1993, who offers a brief literature review and a case study).

Where government policy does function measurably in the land market, then, agriculture is often given special protection. Similarly, most analysts of western water cite government regulations as a brake on water transfers out of agriculture (Committee on Western Water Management (1992), and routinely call for lessening the barriers to more "efficient" water markets and the presumed added social values of easier transfers.

Indeed, as the Committee on Western Water Management (1992) grappled with the need to balance market forces with non-market social values and costs in water transfers, they worried that current policies, mostly barriers to water transfers, result in sub-optimal water allocation, especially with regard to growing urban and environmental uses. They warned, in the Central Valley case study, that it is:

> *. . . important to recognize that disinvestment in unprofitable industries is one of the ways by which mixed free market economies maintain their vitality. If the economy of the West is to remain vibrant, and if national and world demands for food and fiber produced in the West do not substantially in coming decades, disinvestment in irrigated agriculture is probably inevitable and efforts to forestall it are likely to be counterproductive in the long run. (p. 231)*

Economist Thomas Power at the University of Montana rather boldly argues, in recent case studies of western grazing, irrigation, and water projects like the CAP in his book Lost landscapes and Failed Economies (Island Press, 1996), that federal policies overly-subsidize western agriculture and distort

the region's economy in unhealthy ways. Power's arguments are not well received by western ranchers and farmers. His quantification of subsidies, and of the decreasing importance of agriculture in the western economy, have been derided and denied, but, in our opinion, not refuted. We expect soon to see efforts by state agencies and others to refute his work now that it has gained regional and national attention.

In sum, pro-agricultural government policy and benefits, and less well-studied or quantified lifestyle and family values, create inertia in agricultural land use—the land stays in agriculture after pure market forces encourage conversion. This is one reason that more than half of farmer and rancher income in the U.S. comes from non-farm activities.

Yet, every farmer or rancher we talked to in preparing this paper cited government policy (especially federal environmental policies), as hastening the demise of western agriculture, adding to the pressure on agricultural land to convert to other uses. Government policy, in this view, is increasing the cost of doing business (thus reducing returns on investment), reducing the perceived security of tenure in land and water resources necessary to farming and ranching, and simply making it more unpleasant to farm or ranch in the West (through "crack downs" on, say, grazing allotment management plans, return-flow water quality, etc.).

We expected to be able to cast some light on this argument from the agricultural and land use literature, and from work on the economics of regulation, but have to say now that we've come up short. Morse (1996), in a major review article, concluded that: "Little information is available in the scientific literature to identify the impacts of environmental regulations on livestock producers' resources (economic, labor, equipment, and land)." (p. 3103). The cost of regulation is rarely mentioned in the agricultural land literature, and appraisers we talked to suggested that whether regulations made a 10% or so difference in the agricultural value of land hardly mattered in the West's real estate markets. When land does sell for non-agricultural uses it tends to sell for very much more (twice to ten times) its agricultural value.

Still, some researchers assert that environmental regulations increase the cost of agricultural production, though they may not have quantified it (Morse, 1996). And the big difference between perceptions among western farmers and ranchers and the arguments in the land and agricultural

economics literature as well as stated findings in federal plans,[2] deserves attention and should raise concern.

We approach this first by examining agricultural land use conversion from a slightly different perspective: cumulative pressure.

Cumulative Policy Pressure on Agricultural Land Use

Anecdotal evidence suggests that farmers and ranchers convert their land for a variety of reasons, not just economic. We reviewed the agricultural land conversion bibliography compiled by the American Farmland Trust, as well as other sources, and found this roster of the factors in land use conversion:

- Simple real estate values and speculation (the market), which may not demand conversion but at least "enable" it;

- Farm family dynamics, especially at the point of inter-generational turn-over; If the real estate market allows it, then either the need to retire with economic security, or problems sorting out different interest in agricultural land among siblings (some wanting to continue in ag, others not), tends to push the land owner toward liquidation of land assets because money is more easily divided among heirs than property, especially agricultural property that must remain whole to function as an agricultural unit.

- State and federal tax laws, specially related to estate taxes (related to family turn-over), which further push for liquidation so as not to pass on undue financial burdens to heirs;

- Various "squeezes" in urbanizing and suburbanizing environments: nuisance complaints from suburban neighbors, loss of community support, and related businesses like feed, equipment, transport, and commodity sales, and thinning of the agricultural fabric that simply makes it less pleasant, and maybe less possible, to farm in a given place.

[2] For example, the DOI's DEIS on Range Reform, concluded that the proposed grazing fee increases and greater enforcement of rangeland condition goals would cause only small impacts on family ranches.

- Failure of local planning authorities (county or city government) to respect agricultural land uses in various ways;

- Regulation, especially for environmental protection, labor, and safety.

Again, we know that ranchers and farmers routinely cite this last factor (environmental regulations and government actions on everything from health and safety to labor to immigration to wetlands protection) as placing burdens on agriculture that result in land use conversion (they did to us repeatedly in several interviews and discussions conducted for this paper), but it does not now appear in the research literature as a significant factor in land use change. Regulatory compliance certainly adds to the cost of doing business, but we have not found quantification of its affect on land use per se.

Is Environmental Regulation Increasing Farm and Ranchland Conversion?

Despite the lack of quantitative analysis of the role of government regulation as a spur to agricultural land conversion, its anecdotal strength clearly recommends including it in a more realistic "Cumulative Pressure" model of agricultural land conversion. In this vein we hypothesize that agricultural land converts when markets and other social-cultural forces build up to overcome the "stickiness" observed in more purely economic models. Some event—like owner/operator retirement or inter-generational transfer (passing on the ranch to the kids), an added regulation or threat of regulation (e.g., DoI's Range Reform), reduced AUMs on a federal permit, etc.—acts as the "tripping mechanism." In this model, the "perceived" and "real" pressure of federal water policy—especially policies aimed at reducing water pollution or providing water for endangered species—might be the tripping mechanism.

There is certainly a growing wave of concern among agriculturalists about the role of water-related environmental policy in land use, especially focused on:

- Non-point source pollution, and recent interpretation of the clean water laws to apply total daily maximum loads (TDML) criteria to non-point, agricultural sources. The recent Oregon case on grazing allotment plans heightens this.

- Restrictions on physical alterations of streams, especially the need to get permits, and perceptions that permits will not be issued, to manage channel morphology, and the location and attributes of water diversion points and structures;

- Wetlands protection, including the persistent fear that wetlands created by agricultural operations cannot be de-created, thus limiting land use flexibility;

- Endangered species protection: Western farmers and ranchers cite several cases, including the Colorado River Fish Recovery Program; the Platte River species three-state agreement, etc.;

- Federal water rights: the threat of reserved rights, "by pass" flows, and other policies well-known to the WWPRAC. Another frequently-cited threat was the original goal in Range Reform for the federal government to file for and hold water rights for public rangeland water improvements.

Even if it is difficult to cite cases where these regulatory pressures made a rancher or farmer sell land for non-agricultural use, two hypotheses still make sense: First, economic models of land use are based on profitability or return on investment, and environmental regulation that reduce returns thus plays a role in land conversion. That role has not been well quantified (as far as we can tell) and is presumed to be relatively small compared to other factors like production costs and prices. The incremental costs of regulation are certainly small compared to the difference between agricultural land values and competing land values in many of the West's rapidly growing areas. For example, Rocky Mountain ranches might be worth, to other ranchers, roughly $1,500 to maybe $2,000 per animal unit. But, land values in the Rocky Mountain exurbs and many rural areas exceed this by a factor of two (in rural areas away from resorts) to a factor of ten or more in places within commuting distance of larger cities, or close to resorts like Jackson, Wyoming or Sun Valley, Idaho. Thus, the added burden of government regulation would hardly show up in econometric models of land use change—they might show up, however, in a more qualitative model based on cumulative pressure.

It is important to keep in mind that much of the agricultural land in the West (outside of the Great Plains where demand for land is less), is under market pressure to convert, so farmers and ranchers have this on their mind, and

could be said always to be near the economic threshold of conversion. Thus the situation is ripe for regulatory pressure to act as the tripping mechanism. Some of this pressure could be seen as involuntary weakening of security of tenure in land and water.

Second, farmers and ranchers worry and complain a lot about government regulation, and this complex set of perceptions/experiences (everything from paper work to run-in's with the agencies, even if resolved in the farmer's favor), beliefs and attitudes, would logically reduce their perceived security of tenure in land and other resources. Finally, it is worth placing all these perceived pressures on agricultural land use into the context of reduced government support. Simply stated, almost every major government action vis-a-vis agriculture today—exemplified in the 1996 Farm Bill—reflects decreased funding for programs that support agriculture. So, farmers are in a historically unique policy situation: they can logically expect that the current suite of policy supports will be absent, or at least much reduced, in the next decade or so. Clearly, they are expressing a deeply-felt sense of abandonment and unfair pressure, a breaking, if you will, of the American "social contract" with agriculture, created over the decades by everything from Homestead and Reclamation Acts to the long train of comprehensive and supportive farm bills (up until, that is, the last decade).

To put the Western agricultural land situation in perspective, we examined agricultural development and land use change in several regions: major irrigation projects in Idaho and the Colorado Front Range, California's Central Valley, and a Colorado mountain ranching valley.

A Look at Some Western Agricultural "Situations"

Stability and Success? The Minidoka Project and the Upper Snake River

The Upper Snake River Plain is of interest for several reasons: it is home to one of the West's earliest and largest Reclamation projects; it is one of the most intensively irrigated regions in the interior West; and, though portions of the Upper Snake River Plain have been identified by advocates for agricultural lands protection as among the nation's most threatened by land use conversion for urban development, by most accounts the Minidoka Project is one of the most successful and stable of the federal irrigation projects. So, in this first irrigation area case, we look for trends in irrigated land and problems related to agricultural land conversion and water use.

The Upper Snake River Basin.—The boundaries of the Upper Snake River Basin have been defined in a number of different ways, most commonly as the section of the river upstream from King Hill (near Bliss, ID, Figure 8). The Bureau of Reclamation commonly refers to the upper basin as the reach from Milner Dam upstream. The Upper Snake River Basin also corresponds with the State of Idaho's Water District 01 (from Milner Dam upstream). The upper basin includes the stretch of the Snake in which the majority of water diversions for irrigation from the river itself take place.

We looked at a seventeen-county area on this wide, irrigated plain, stretching from Twin Falls county in the west to Fremont and Clark counties in the northeast (see Figure 9). These are counties that border the river, include major tributaries, and contain most of land irrigated with water diverted from the upper stretch of the river—including the heart of the Minidoka Project.

Development.—Water extraction from the Snake and its tributaries for irrigation began in the Upper Snake River Basin in the late 19th Century. The area was settled primarily because of its rich soils, flat lands and abundant water. Several large diversion projects and canals were built in the 1890s and early 1900s under the 1884 Carey Act (e.g., the Aberdeen-Springfield Canal and the Twin Falls Canal). These early facilities, however, could not meet the rapidly growing demand for expansion of irrigated land as the region developed as part of what might the called the Mormon irrigation phenomenon (early Mormon culture, concentrated from Southern Utah up through the Salt Lake Valley and into Southern Idaho, was based on irrigated agrarianism). Thus additional storage facilities were developed under the 1902 Reclamation Act: Minidoka Dam in 1904 and Jackson Lake Dam in 1907. Today, there are six BOR dams in the upper basin (Minidoka, American Falls, Palisades, Jackson Lake, Grassy Lake, and Island Park) primarily used for irrigation, and a seventh dam (Ririe) primarily for flood control and recreation. Figure 8 shows the location and size of these facilities, as well as dams owned and operated by other agencies and organizations.

The Bureau of Reclamation manages its upper basin facilities out of the Snake River Area Office (East) which is located in Burely, Idaho. This operation is often refereed to as the Minidoka Project after the original project authorization in 1902; however, technically there are

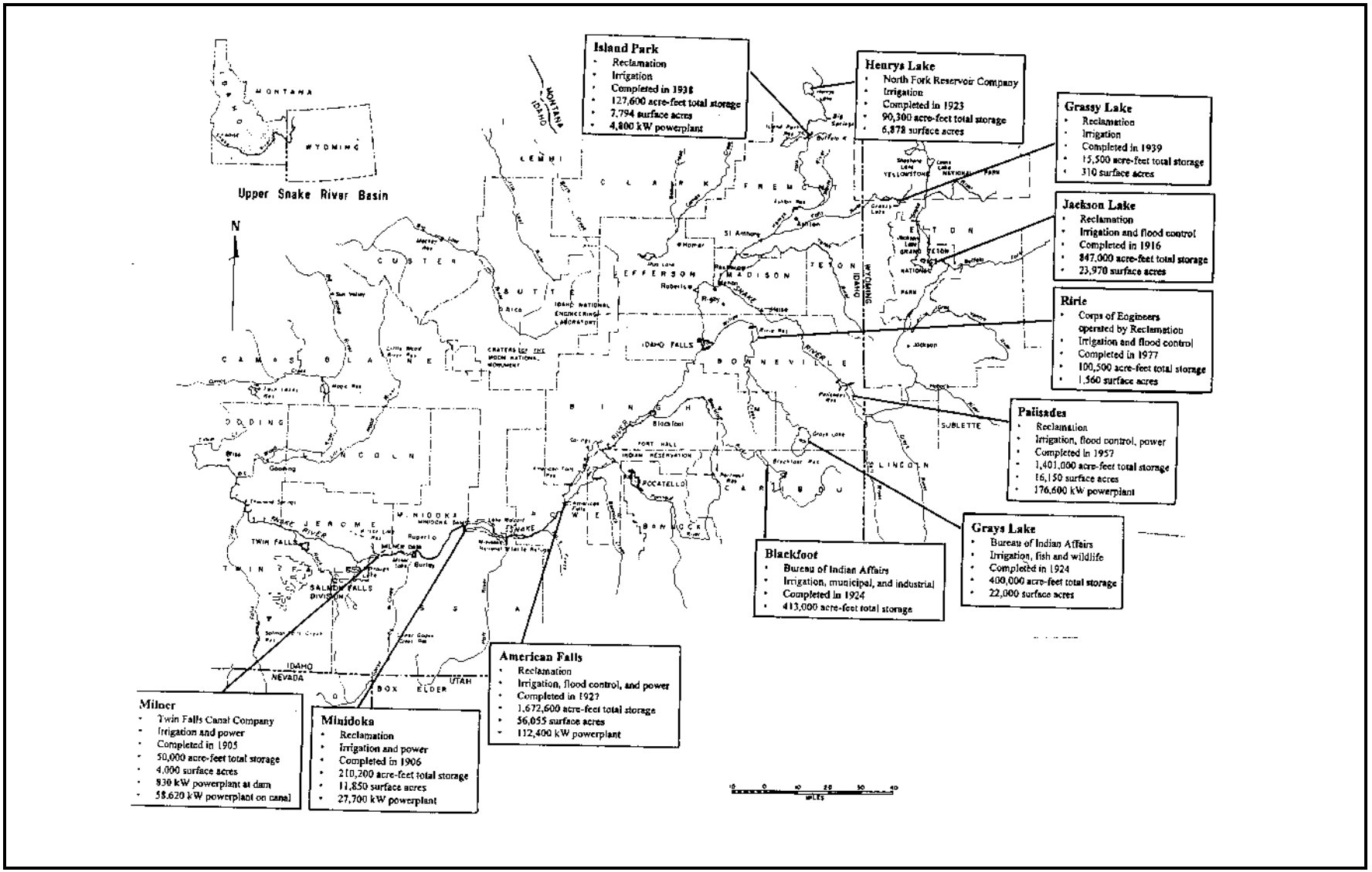


Figure 8.—The Upper Snake River Basin, showing major water projects (from: U.S. Bureau of Reclamation).

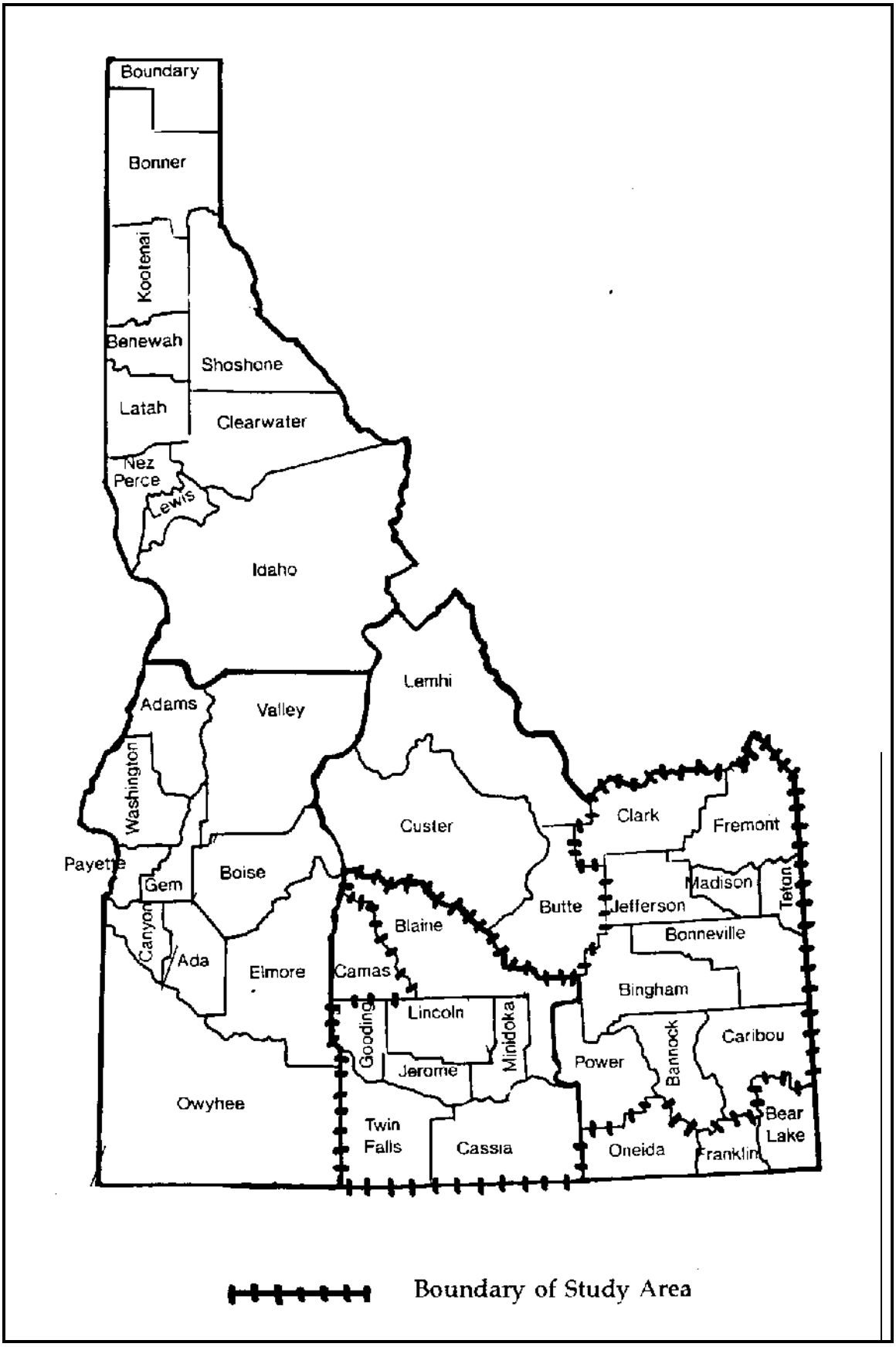


Figure 9.—Seventeen-county study area in the Upper Snake River Basin.

five project authorizations in the upper basin. The Minidoka Project includes Minidoka Dam, Jackson Lake Dam, Island Park Dam, Grassy Lake Dam, and American Falls Dam. The Bureau of Reclamation operates it primarily for irrigation. The Palisades Project includes Palisades Dam operated primarily for irrigation and flood control. Michaud Flats is a small BOR irrigation project near American Falls. The Ririe Project is a dam operated primarily for flood control. And the Fort Hall Indian Project, including Blackfoot Reservoir and Grays Lake, is operated by the Bureau of Indian Affairs for irrigation on the Fort Hall Reservation. This report is primarily interested in the Reclamation irrigation projects (Minidoka, Palisades, and Michaud Flats). These projects provide active storage for almost 4 million acre-feet of water, which is used to irrigated almost 1.1 million acres of land. For most of the land this water is supplemental, as in the Colorado-Big Thompson project, but 210,000 acres depend solely on Reclamation water for irrigation (USBR, 1996).

Two other important impoundments on the Upper Snake River provide water to irrigated land. The Twin Falls Canal Company owns Milner Dam, located downstream from Burley and constructed in 1905. Milner is the diversion point for several major canals. Henrys Lake Dam is located in Fremont County and is owned by the North Fork Reservoir Company. It provides irrigation water to lands in the upper basin.

Land Use and Water in the Upper Snake River Basin.—

Irrigation.—The primary use for water storage and diversion projects in the Upper Snake River Basin is irrigation. Estimates of irrigated acreage in the upper basin range between 2.2 and 2.7 million acres. According to the USBR (1996), about 1.1 million acres of the 2.5 million acres irrigated in the upper basin receive water from Reclamation reservoirs. But, documenting the amount of land irrigated in the Upper Snake River Basin is, like efforts to track other land uses, not easy. Complete data sets are rare, and significant differences appear among published estimates. The BOR (1996) estimates total irrigated land in the upper basin at about 2.5 million acres in 1990. A recent report from the Idaho Water Alliance (1997) estimates irrigated acreage in the upper basin at 2.3 million acres in 1990. Data derived from the Agriculture Census for the region indicate about 2.25

million acres under irrigation in 1992 (Table 3). And NRI data for 1992 show about 2.75 million acres irrigated in the seventeen-county region.[3]

Table 3.—Total irrigated acres in the Upper Snake River Basin 1974-1992

County	1974	1978	1982	1987	1992
Bannock	50,645	45,262	41,170	40,829	39,574
Bingham	269,820	303,541	292,939	306,187	307,812
Blaine	89,039	60,213	63,005	54,441	64,283
Bonneville	135,321	152,052	148,911	147,285	153,314
Caribou	64,616	81,357	70,269	65,980	70,201
Cassia	203,478	246,812	266,526	237,169	252,012
Clark	17,060	36,993	50,004	71,416	48,428
Fremont	75,631	105,537	109,576	106,397	130,845
Gooding	84,994	111,636	108,137	107,793	115,398
Jefferson	139,613	195,494	199,331	170,453	183,956
Jerome	131,518	147,893	151,088	135,272	150,444
Lincoln	51,410	71,299	80,646	64,764	59,694
Madison	90,260	109,874	111,812	116,924	127,851
Minidoka	161,627	170,841	157,221	145,670	157,516
Power	80,808	90,815	88,861	93,889	102,892
Teton	37,225	66,791	68,363	55,392	51,358
Twin Falls	260,155	289,218	278,114	272,367	231,351
Total	1,945,194	2,287,606	2,287,955	2,194,215	2,248,921

Note: Based on data derived from the U.S. Census of Agriculture.

The US Census of Agriculture, taken every five years, offers reasonably sound and consistent data set for tracking changes in irrigated acreage in the Upper Snake River Basin over time (Figure 10).[4] According to Census data, total irrigated acreage in the upper basin ranged from a low of just under 2

[3] The NRI data were provided by Hal Swenson of the USDA, Natural Resources Conservation Service office in Boise, Idaho.
[4] We would have preferred to have detailed irrigated lands data from BOR, but found it difficult to collect in the short time available for this study.

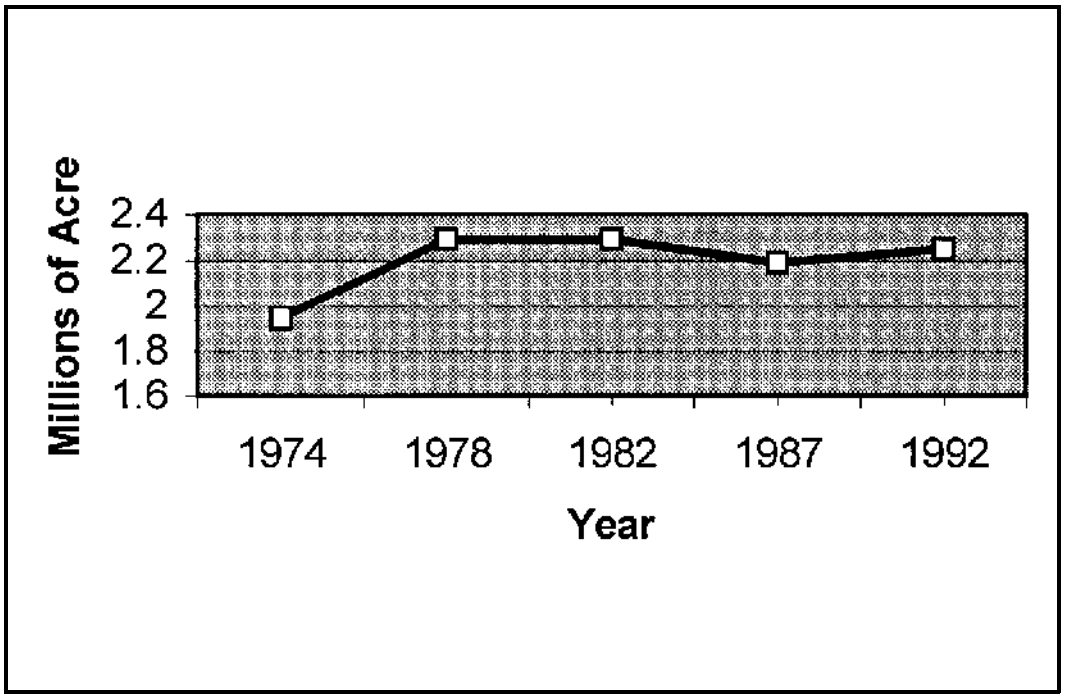


Figure 10.—Irrigated land area in the Upper Snake River.

million acres in 1974 to a high of almost 2.29 million acres in 1982. Irrigated acreage drops after that most likely due to persistent drought conditions in the region, and then increases again by the 1992 census.

The Idaho Agricultural Statistics Service, run by the U.S. Department of Agriculture, provides a crop-by-crop perspective for tracking changes in irrigated acreage for the Upper Snake River Basin.[5] Statistics Service personnel and county agents collects data each year for individual crops by county. Table 4 offers Statistics Service data for the eight major crops grown in the seventeen-county Upper Snake River Basin region for 1992. For wheat, barley, and hay, the Statistics Service differentiates between irrigated and non-irrigated acreage. Only the irrigated acreage is reported in Table 4. The Statistic Service does not distinguish among the other five crops; however, it can be assumed that these crops are irrigated.[6] According to these data, total irrigated acreage in the upper basin for 1992 was

[5] The Idaho Agricultural Statistics Service office in Boise provided the author with Idaho County Estimate sheets for eight crops covering part or all of the period 1985 through 1996. The Idaho County Estimate sheets provided data on a variety of crop characteristics including acreage planted and harvested.

[6] Bill Hazen (Lincoln County Extension Educator) explained in an interview that all potatoes, sugarbeets, oats, corn, and beans in the Upper Snake River Plain are irrigated.

Table 4.—1995 irrigated acreage by crop and county for the Upper Snake River Plain

	Wheat	Barley	Hay	Potatoes	Oats	Sugarbeets	Corn	Beans	Totals
Bannock	13,100	5000	15200	4,000	1,700	0	0	0	39,000
Bingham	133,300	26,500	50,000	63,500	1,200	11,500	500	0	286,500
Blaine	2,400	18,000	19,500	2,000	5,000	2,700	0	0	49,600
Bonneville	39,500	48,000	31,400	38,000	1,500	0	0	0	158,400
Caribou	11,900	29,500	17,700	5,500	700	0	0	0	65,300
Cassia	90,100	28,400	54,000	33,000	4,800	32,100	4,500	6,300	253,200
Clark	15,500	900	15,000	13,500	1,200	0	0	0	46,100
Freemont	7,000	31,000	14,100	27,500	1,300	0	0	0	80,900
Gooding	19,000	3,900	41,000	12,000	1,100	3,400	12,000	3,000	95,400
Jefferson	45,200	49,500	92,000	27,000	3,100	0	1,400	0	218,200
Jerome	33,300	17,800	41,300	19,600	2,800	13,900	8,300	16,500	153,500
Lincoln	12,700	9,000	20,200	5,000	5,800	6,800	3,500	0	63,000
Madison	25,800	47,500	17,500	35,500	0	0	0	0	126,300
Minidoka	54,100	43,500	20,800	25,000	1,400	42,400	1,600	7,900	196,700
Power	66,500	2,900	7,700	32,500	900	10,100	0	0	120,600
Teton	4,400	18,000	13,000	8,500	0	0	0	0	43,900
Twin Falls	46,600	34,500	53,000	15,400	6,300	17,100	11,500	46,600	231,000
Totals	620,400	413,900	523,400	367,500	38,800	140,000	43,300	80,300	2,227,600

Note: Based on data provided by the Idaho Agricultural Statistics Service.

2.14 million acres, or some 100,000 acres below the Census of Agriculture data. The reason for the difference is not immediately apparent, but may be due to differences in reporting techniques or crops surveyed. The Statistics Service data are particularly useful because they provide perhaps the most current picture for the Upper Snake River Basin. Total irrigated acreage for the upper basin in 1995 was almost 2.3 million acres, an increase of over 150,000 acres over 1992.

Finally, the NRI data can be considered more detailed and perhaps more reliable, but the NRI sampling approach is difficult to assess and only two data points are readily available (1982 and 1992). NRI data put the region's irrigated land at 2,738,300 acres in 1982 and 2,760,700 irrigated acres in 1992. That is a remarkably small difference for an area hat some cite as suffering agricultural land conversion. Indeed, our main conclusion is that all the data point to remarkable stability in irrigated area, with only small variation over the past several decades. (Total irrigated acreage for the Upper Snake River Basin has remained relatively constant since about 1960, fluctuating between a low of 2.2 million acres in 1960 and a high of 2.5 million acres in 1980).

Thus, the Minidoka Project would appear, according to statistics and our interviews there, not only quite stable, but quite successful by most measures. The farmers there grow relatively high value crops, make money in most years, enjoy rather reliable water supplies (with some belt-tightening during droughts in the 1980s), and are not under pressure to convert land to other uses. By BOR accounting the project is solvent and paid off.

Ground Water Pumping, Sprinkler Irrigation, and Aquifer Recharge.— Perhaps the most significant land use change in the Upper Snake River Basin since 1960 is not increases or decreases in irrigated acreage, but the introduction of sprinklers and increased use of ground water. All irrigation in the Upper Snake River Basin was accomplished through gravity or flood irrigation in 1960, while over half of the acreage is now irrigated by sprinkler. In part, the spread of sprinkler systems was due to the increase in the use of ground water. The use of ground water and sprinklers has had several important impacts.[7] It has led to increases in yield by expanding the length of the irrigation season in some cases and allowing for additional plantings of some crops such as hay. It has also meant that less water is diverted from the Snake River. The Idaho Water Alliance (1997) cites a 1995 report from District 01 watermaster Ron Carlson indicating that 1 million acre feet less is diverted from the Snake River today than was diverted in 1950. Palmer (1991) estimates that the water savings from the switch to sprinkler irrigation is close to 2 million acre-feet, but argues that this savings has not really translated into meaningful increases in instream flows. (Recall that Palmer is highly critical of Snake River Plain irrigation overall; he argues that irrigators have a strong incentive to protect their water rights through wasteful use even if they need less water).

Increased "water spreading" would appear to be another effect of increased ground water and sprinkler use. Spreading refers to the use of water on land other than authorized project land. The Bureau of Reclamation (1996) recognizes spreading as a serious concern, and is reviewing strategies for addressing the problem. Jim Johnson of the Idaho Department of Water Resources believes that spreading is taking place, but notes that it is difficult to estimate how many acres are involved.[8] Spreading may account for some of the variation in the different estimates for total acreage under irrigation in the Upper Snake River Basin (e.g., the difference between the NRI data and

[7] Information provided in an interview with Jim Johnson, Idaho Department of Water Resources.
[8] Information provided in an interview with the author.

the U.S. Census of Agriculture data for 1992). The goal of mentioning this is not to address the problem of water spreading associated with BOR projects—though it is certainly an interesting land use phenomenon—but simply to suggest that rather than declining under the pressure of urban and environmental demands, irrigated land use in the Upper Snake is probably increasing, perhaps more than the statistics suggest!

The Minidoka and associated projects are not only agricultural successes by typical measures, but are becoming more efficient over time.

Briefly, though, it is worth noting these efficiencies are causing a "problem" that farmers like to point out as evidence that irrigation has created more than just agricultural values, and that water used in irrigation is used again, and again downstream. Ground water pumping and the conversion to sprinkler irrigation has apparently depressed the Snake River Plain Aquifer. One "benefit" of the old system of canals and flood irrigation was that they partly created and recharged the large aquifer underlying much of the Upper Snake River Plain. Thousand Springs is a major source of water for the middle reach of the Snake River, and its discharge is a good proxy of the condition of the Snake River Plain Aquifer (Figure 11). Markedly increased flows from the springs since the 1910s have been attributed to ground water recharge from irrigation. In recent years, however, the flows have dropped. This drop has been attributed to several factors: the drought of the late-1980s, increased ground water pumping, and the conversion to sprinkle irrigation which has meant that less water is moving though the old canal system (Idaho Water Alliance 1997). According to BOR (1996), the Snake River Plain aquifer reached an all-time low in 1994, down from a record high level set in the early 1950s. Efforts at managed recharge of the aquifer have had little effect so far (Idaho Water Alliance 1997).

Agricultural Land Conversion.—The American Farmland Trust (1997) recently identified the Central Snake River Plain as the 13th most threatened agricultural area in the US in its "Farming on the Edge" study[9]. A threatened agricultural area is one in which the amount of "prime farmland" is above the statewide average, and conversion of farmland for urban development was above the statewide average, with at least 1,000 acres of

[9] The American Farmland Trust (1997) defines the Central Snake River Plain as including Elmore, Gooding, Jerome, Lincoln, Minidoka, and Twin Falls Counties. Only Elmore County is not included the region covered by this report.

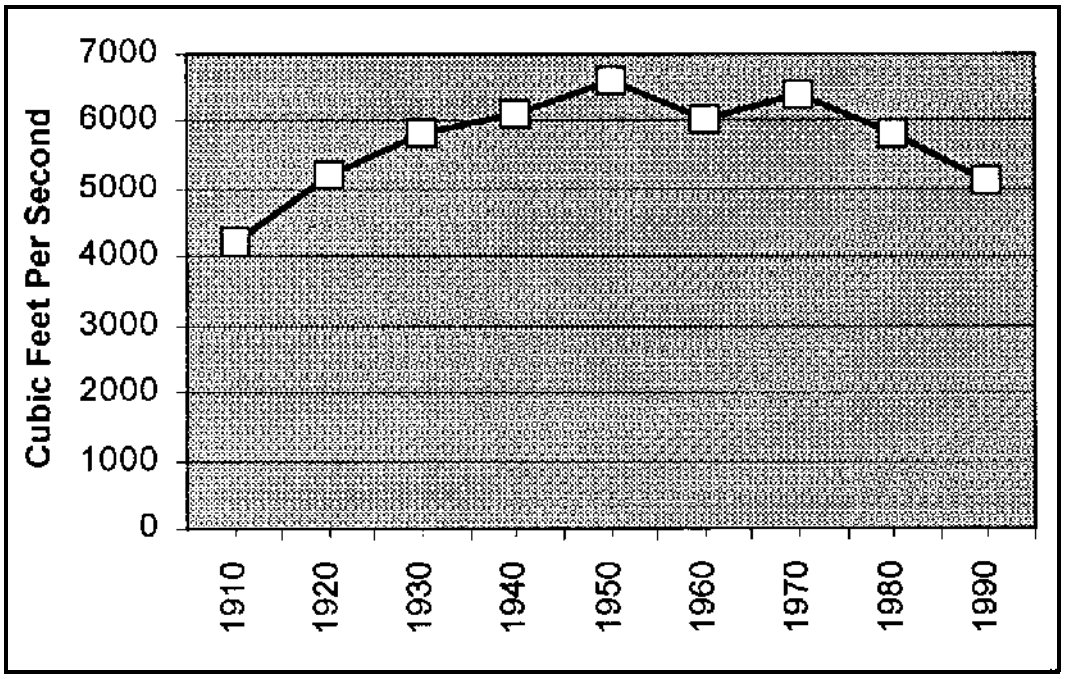


Figure 11.—Annual mean discharge of Thousand Springs (source: Bureau of Reclamation).

farmland switched to urban uses. The American Farmland Trust based their assessment on their joint efforts with the USDA to assess prime farmland, and Major Land Resource Areas (MLRAs) data from the NRI for 1982 to 1992. The AFT does not claim that its study measures farmland loss in a spatially-explicit way, but rather offers it as a way to screen for trouble spots.

Our assessment of the land use situation in the Upper Snake does not fully support the AFT designation. The area is growing in population, as is much of Idaho and the West. And thus there is some reason to expect that expanding urban development has and will affect irrigated agriculture in the Upper Snake. Population for the seventeen counties of the upper basin grew by a healthy 10 percent during 1990-96 (Table 5), a period in which most of the Interior West is growing rapidly; however, Idaho overall grew at a phenomenal rate of 15 percent over this period, placing it first or second spot among all states in most years this decade. In fact, only two counties in the region (Teton and Blaine) grew at a rate higher than the state average. Growth in these two counties is due to expanding resort communities.

The U.S. Census of Agriculture data also do show a drop in irrigated acreage from 1982 to 1987, but this had rebounded by 1992. Furthermore, more

Table 5.—Population growth in the Upper Snake River Plain 1990-1996

County	1990	1996	% change
Bannock	66,026	73,608	10
Bingham	37,583	41,366	9
Blaine	13,552	16,975	20
Bonneville	72,207	79,670	9
Caribou	6,963	7,398	6
Cassia	19,532	21,482	9
Clark	762	830	8
Fremont	10,937	11,594	6
Gooding	11,633	13,335	13
Jefferson	16,543	18,903	12
Jerome	15,138	17,339	13
Lincoln	3,308	3,777	12
Madison	23,674	23,458	-1
Minidoka	19,361	20,756	7
Power	7,086	8,234	14
Teton	3,439	5,168	33
Twin Falls	53,580	60,403	11
Total	381,324	424,296	10
State	1,006,749	1,189,289	15

Note: U.S. Census Bureau.

recent data from the Idaho Agricultural Statistics Service seem to indicate that irrigated acreage is on the increase from 1992 levels. County-level data from the U.S. Census of Agriculture lend more support to the American Farmland Trusts findings (note that they include areas downstream from our study area that might logically be under more urbanization pressure). Two counties in the Central Snake Plain region (Twin Falls and Lincoln) show a significant decline in irrigated acres from 1982 to 1992. Others show small declines. Idaho Agricultural Statistics Service data from 1992 to 1995, however, indicate increases in all of these counties except for Lincoln County, and in some counties (e.g., Twin Falls) the increase is significant. Table 6 shows changes in irrigated acreage in Twin Falls County from 1989 to 1995. Irrigated acreage is lowest in 1992 and highest in 1995. The drought of the late 1980s and early 1990s is, according to our interviews in the area, a key

Table 6.—Irrigated acreage in Twin Falls County 1989-1995

Crop/year	1989	1990	1991	1992	1993	1994	1995
Wheat	32,200	36,500	25,400	42,800	40,600	42,300	46,600
Barley	21,500	21,000	25,500	23,500	25,000	27,500	34,500
Hay	49,500	58,200	58,300	41,000	46,500	47,400	53,000
Potatoes	8,000	12,000	10,700	9,500	12,500	14,300	15,400
Oats	2,000	1,800	2,800	2,100	4,900	4,800	6,300
Sugarbeets	16,100	15,700	15,200	16,100	16,700	16,800	17,100
Corn	16,500	9,700	11,100	9,300	10,500	10,000	11,500
Beans	72,100	73,000	61,000	37,400	50,700	54,500	46,600
Total	217,90	227,900	210,000	181,700	207,400	217,600	231,000

Note: Id Ag Statistics Service.

factor causing the decline in irrigated acreage into 1992, and the increase since then would suggest a resilient system that is not experiencing a net conversion to non-agricultural use.

Most of the officials interviewed for this report expressed more concern about urban growth around Boise than in the Upper Snake River Plain. The two counties (Ada and Canyon) that make up the greater Boise urban area grew at a rate of 21 percent from 1990 to 1996 (from 295,851 to 372,587). Suburban sprawl around Boise is expanding into agricultural areas, and, by most accounts, causing significant problems, but we do not address the Boise area this in this paper.

Rather than the outright loss of total farmland in the Upper Snake River, officials are more concerned about other disruptions caused by the spread of suburban development into agricultural areas. Bill Hazen (University of Idaho Agricultural Extension Agent for Lincoln County) noted that subdivisions and individual lots and owners have disrupted the water distribution system or made it more difficult to maintain.[10] Hazen further believes that land use regulations designed to encourage development have contributed to the inappropriate spread of subdivisions in farming areas as well as the relaxed way that new residents treat water and the water distribution system. Jim Johnson (Idaho Department of Water Resources) notes that water distribution problems can occur when land that traditionally draws irrigation water from a canal system no longer needs

[10] Information provided in an interview with author.

that water.[11] The story here has a familiar ring to it (one we found in the other case studies): According to Johnson, the canal system is designed to deliver that water whether it is needed or not, and it must be routed around new developments. Perhaps the biggest concern stemming from growth and changes in land and water use in the Upper Snake River Plain is the problem of ground water recharge. Almost every community relies on ground water for domestic use. Depression of the aquifer in recent years has many of these communities worried about their long-term water supply.[12]

One other affect of urban growth was noted. Jim Johnson (Idaho Department of Water Resources) said that some cropland in the Snake River region is being lost to expanding dairy operations. Livestock data indicate that the number of dairy cattle in this region more than doubled between 1989 and 1997, accounting for almost all of the growth in Idaho's dairy herd for this period.[13] The distribution logistics of dairy products typically demand an increase in dairy operations wherever urban and suburban populations increase. This has increased the demand for feed in the region, urging some farmers to plant more alfalfa, and created some problems with disposal of animal waste.

Land Conversion and Water Rights Transfers.—The macro-institutional structure around in the Upper Snake River Basin is like most of the other large western Reclamation projects: the Federal Government sells storage rights in Bureau of Reclamation reservoirs and manages and maintains those facilities, the State of Idaho administers all water rights, and canal companies and irrigation districts own and operate a variety of diversion facilities.

Water rights in Idaho are appurtenant to the land, and developed in the traditional Western manner, as water was diverted from a stream and put to a beneficial use. After 1971, new water rights have been established through a permitting process. The water right is treated like real property, and can be transferred with the approval of the Idaho Department of Water Resources as long as no other water users are injured and the original right

[11] Information provided in an interview with author.
[12] Information provided in an interview with Bill Hazen, Lincoln County Extension Educator.
[13] Data derived from Idaho County Estimates reports prepared by the Idaho Agricultural Statistics Service, USDA.

is not enlarged (Idaho Water Resources Board 1992; Idaho Department of Water Resources 1995). The rights to use the water stored behind the Minidoka and Palisades Project facilities are owned by approximately 64 contractors (e.g., canal companies, irrigation districts). Storage rights, like natural flow rights, are usually based on a priority system determined by the date the right was established, but storage rights tend to be junior to natural flow rights. The Bureau of Reclamation operates its Upper Snake River facilities through a system of spaceholder contracts. A spaceholder contract is for a specific amount of space, not a specific amount of water, and a spaceholder contract may or may not fill in a given year based on its priority and the amount of water naturally available to the system that year. Water can be held over from one year to the next, but a contractor cannot exceed the amount of storage authorized by their contract (Bureau of Reclamation 1996).

Interests of irrigators in the Upper Snake River Basin are represented by the Committee of Nine, composed of representatives from the major canal companies and irrigation districts. The Committee of Nine is officially recognized by the State of Idaho and by all Minidoka/Palisades spaceholder contracts as an advisory body. The Bureau of Reclamation consults regularly with the Committee of Nine and the watermaster for District 01 (who is also an official advisor to the Committee) when making management decisions. The District 01 watermaster is elected by the irrigators and is responsible for the accounting and allocation of natural flow rights. Right now the District 01 watermaster is also the head of the eastern regional office of the Idaho Department of Water Resources. Finally, in addition to its advisory role noted above, the Committee of Nine is the official decision making authority for the water rental pool (water bank) for District 01. The rental pool is used to transfer water via leases among irrigators in the District (Bureau of Reclamation 1996). We describe this administrative framework because critics (e.g. Palmer, 1991) see the relationship among the BOR, the Committee of Nine, and the Watermaster as an “iron triangle” that protects agricultural interests in the area, at the cost of other values. Yet, clearly these close working relationships have functioned to maintain a stable, profitable farming system in the Upper Snake.

Indeed, the Minidoka is often cited as a model BOR project, one that paid for itself. According to BOR (1996) statistics, the original construction costs for these facilities have been repaid (excepting some recent expenses for upgrading facilities), and current payments are principally for operation and

maintenance.[14] The Bureau of Reclamation is currently considering transferring title to some of facilities in the Upper Snake to irrigators. These include pumping plants and canals in the Burley area, and the Cross Cut Diversion Dam and Canal in Fremont and Madison Counties.[15] A few years ago the Bureau engaged in some discussion about transferring title to Island Park Dam, but this idea drew many complaints and was dropped.

While we did not find that land conversion was a big problem in the Upper Snake River Basin, it is worth tracking what happens to water on land that is converted from irrigation to other uses (mainly suburban development). Under Idaho law water rights typically transfer with the land, and Idaho does not experience the same far flung demand for water elsewhere as in Colorado or California; nor the precedents for large, private water transfers as strong. However, Idaho water rights can be transferred to other lands and uses upon application. Our interviews (with, for example, Vince Alberdi, General Manager of the Twin Falls Canal Company) indicated that where subdivisions were added to Twin Falls and other towns in the area over recent years, the water rights were transferred to other agricultural lands. In the case of those lands served by the Twin Falls Canal Company, the water was transferred to agricultural lands that have not received Twin Falls Canal Company water in the past, but may have had water from another source (e.g., ground water). This is partly because the city systems are mostly based on groundwater, and, in this way, subdivision in the Central and Upper Snake River plain may not affect agriculture as much as elsewhere (say, around Boise, and on the Colorado Front Range, as described below). But Alberdi also noted another, more recent pattern: owners of some new, larger houses on several acre lots are choosing to retain their water rights in order to irrigate horse pasture or to water lawns.[16]

For the most part, officials interviewed for this study did not feel that water right transfers on lands converted to residential use in the Upper Snake River Plain was an issue of great concern at the present time.

One problem on the horizon is illustrated by a plan by Twin Falls to ask developers to transfer the water rights associated with land in new

[14] Palmer (1991), and many other western water analysts, are critical of BOR project repayment accounting methods. He argues that often too small a share of capital costs are credited to irrigation, major reconstruction costs are rarely fully accounted for, and little or no account is taken of externalities such as pollution or loss of fish and wildlife habitat.
[15] Information provided in a telephone interview with author.
[16] Information provided in a telephone interview with author.

subdivisions to the city so that it can use that water to recharge the aquifer, an idea that has farmers worried—they believe that water diverted from the Snake River and put to land uses other than irrigated agriculture sets a bad precedent.[17]

Salmon and Instream Flows.—Perhaps the key environmental management problem in the Upper Snake is the need for it to provide a share of water for salmon protection. Under its agreement with the National Marine Fisheries Service and the U.S. Fish and Wildlife Service, the BOR provides 427,000 acre feet of water for salmon flow augmentation (Bureau of Reclamation 1996), and approximately 260,000 acre feet of this water derives from storage in the Upper Snake River Basin. BOR has purchased 22,400 acre feet of storage in the upper basin for salmon flow augmentation, and derived other water from improved systems operations. As far as we can ascertain, this salmon water has not affected irrigated land uses in the Upper Snake.

BOR also faces growing pressure to increase instream flows in the Snake River to improve fish and wildlife habitat in the Upper Basin itself. Sections of the Henrys Fork and the South Fork are some of the finest trout fisheries in the U.S., and the Henry's Fork Coalition, as well as several other groups, have at least raised the possibility of reallocating water from irrigation to fisheries and other habitat uses. (See Palmer, 1991, for a critical assessment of impacts of the current water management system on the area's fish and wildlife habitat and riparian ecosystem). As the Natural Resources law Center study of western watershed coalitions indicates, such discussions in the Upper Snake are in quite early stages, but they make the farmers, who can boast of a very stable and productive irrigation system, nervous.

Summary

The Upper Snake River Plain is one of the most intensively irrigated regions in the Western U.S. It is also home to one of the West's oldest Reclamation efforts—the Minidoka Project. Data for the past several decades indicate that, despite some fluctuation, irrigated land use can be considered remarkably consistent in the area. Loss of farmland to urban development and other uses has occurred in a few localized areas near the growing towns

[17] Information provided in an interview with Bill Hazen, Lincoln County Extension Educator.

(especially Twin Falls), but has not yet evoked much concern nor had significant impact on land use. M&I use in the area is chiefly groundwater-based, and the major future water/land use conflict in the area will probably focus on aquifer recharge, and the strategy of cities to buy surface rights to recharge groundwater.

Adjusting to Urban Demand: The Colorado-Big Thompson Project and the Northern Colorado Water Conservancy District

Unlike the Upper Snake, the irrigated area served by the Colorado-Big Thompson Project (CBT), through the Northern Colorado Water Conservancy District (NCWCD), is indeed experiencing a net loss of irrigated land, and water held by agriculturalists, due to pressure for M&I development. The area is set-up for further transformations because the Front Range cities from Colorado Springs to Fort Collins are growing rapidly and because municipal systems there rely mostly on surface water for M&I supply (as opposed to groundwater used in the Upper Snake). Indeed, the CBT was chartered as a mixed agriculture and urban supply project, though many observers reckon that urban demand is larger than expected and may be larger than is healthy for the system, especially for a project designed to provide "supplemental" water for irrigated crops. And, despite the ever-present tension over salmon in the Columbia-Snake basin, it may be fair to say now that species protection has become a bigger and more contentious factor in land and water served by the CBT.

Development.—The NCWCD was created in 1937 as the local agency to contract with the BOR for construction of the CBT. It serves a project area of roughly 1.5 million acres in seven counties and dozens of municipalities with a population approximating roughly 530,000 people, delivering 230,000 acre feet of water annually for agriculture, municipal, and industrial uses. Though the common criticism of western irrigation is that it is applied to "low value crops", this criticism, like a lot of conventional wisdom, demands more detail explication. Alfalfa is, indeed, the most widely irrigated crop in the NCWCD's service area, but beans, sugar beets and other higher value crops like onions also make up a significant portion of the land (Table 4). Alfalfa itself offers higher returns on investment than native "grass hay", but it may be more important to recognize that the higher value crops require greater investments of labor, fertilizers, pesticides, and energy, and thus, in any

simple land use model, would not be expected to account for as large an area as crops fetching lower prices.

C-BT is the largest of several trans-montane water diversions that move Colorado River water to the Platte River Basin. It includes 12 reservoirs, 35 miles of tunnels (including the main, 13-mile Alva B. Adams tunnel under the continental divide), and 95 miles of canals. Some cities receiving CBT water, lead by Broomfield, a northern suburb of Denver, recently built a pipeline to move water further south along the Front Range, and voters in Fort Morgan approved a bond issue to extend the eastern pipeline. CBT development included replacement of Colorado River water through construction of Green Mountain Reservoir on the Blue River, and irrigation improvements on the west slope paid for by CBT revenues. CBT also agreed (in 1961) to minimum streamflows below Lake Granby to maintain the a trout fishery. Water users, both agricultural and urban, own shares or units of C-BT water, and the amount actually delivered per unit is declared each year by the NCWCD board of directors. The water is "supplemental", meaning that users are supposed to have a firm base supply, which they supplement with C-BT water. The definition of supplemental has come into play in policy decisions about urban water demand.

Population Growth and Urban Sprawl.—Unlike in the Upper Snake, urban sprawl is an obvious and well-known phenomenon along the Colorado Front Range—and the area has come to be known as the Front Range Urban Corridor (or what Pam Case would refer to as an urban archipelago). Much of this sprawl attends the Denver area outside of the CBT/NCWCD service area, but the towns and counties in the area have grown as fast or faster than any in the U.S. during the past three decades.

The cities in the service area have anticipated, and planned for, significant population growth for over three decades. They formed a municipal subdistrict within NCWCD in 1969 (after several years of fragmented effort) to add the Windy Gap Unit to C-BT to increase the supply moved to the Front Range. Like the other trans-basin diversions of Colorado River water, this one raised hackles among Colorado basin users, and the Colorado River Water Conservation District (CRWCD) sued BOR over its carriage contract with NCWCD's municipal subdistrict, claiming it violated NEPA and the Administrative Procedures Act. Thus began almost 25 years of litigation and argument. The court ruled in favor of Windy Gap's carriage contract after three years, and then CRWCD appealed to the Colorado Supreme Court over

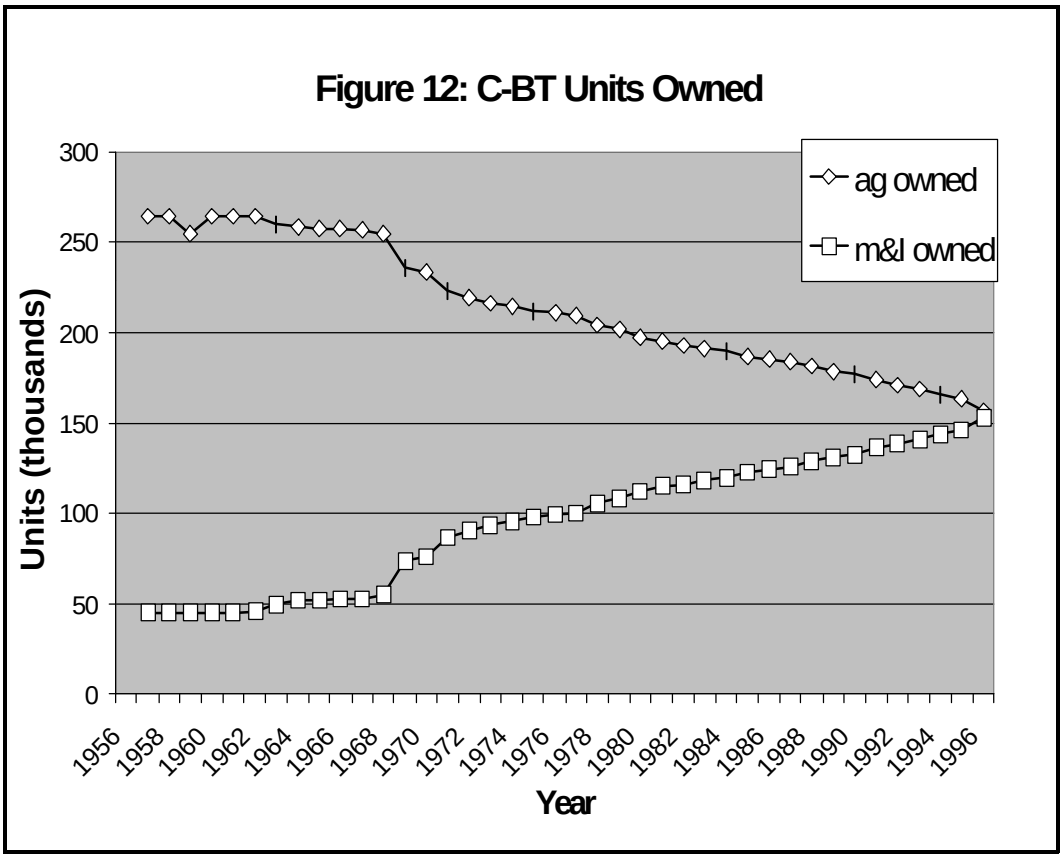


Figure 12.—C-BT units owned.

the Subdistrict's application for conditional water rights, and, under legislation requiring transbasin diversions to protect rights within the source basin, the Subdistrict agreed to mitigate the transfer, including, among other things, building the new Wolford Mountain Reservoir (which began storing water in 1995 and filled this year).

Environmental and slow-growth (or anti-growth) groups on the Front Range then fought delivery of the Windy Gap water to the original six-city coalition that founded the Subdistrict, particularly by trying to block construction of the Southern Water Supply Pipeline Project. They argued that everything from sprawl to air pollution would get worse if the water was indeed delivered. They lost. A small irony in this urban-transfer case is that one of the cities, Boulder, is known nationally as the leader in growth control. Yet, even Boulder cannot seem to cap its population growth and sprawl in a significant way (or, at least, cannot limit the spill-over effects to surrounding suburbs and towns) and, like any other municipality, realizes that it had better have sufficient water for its citizens.

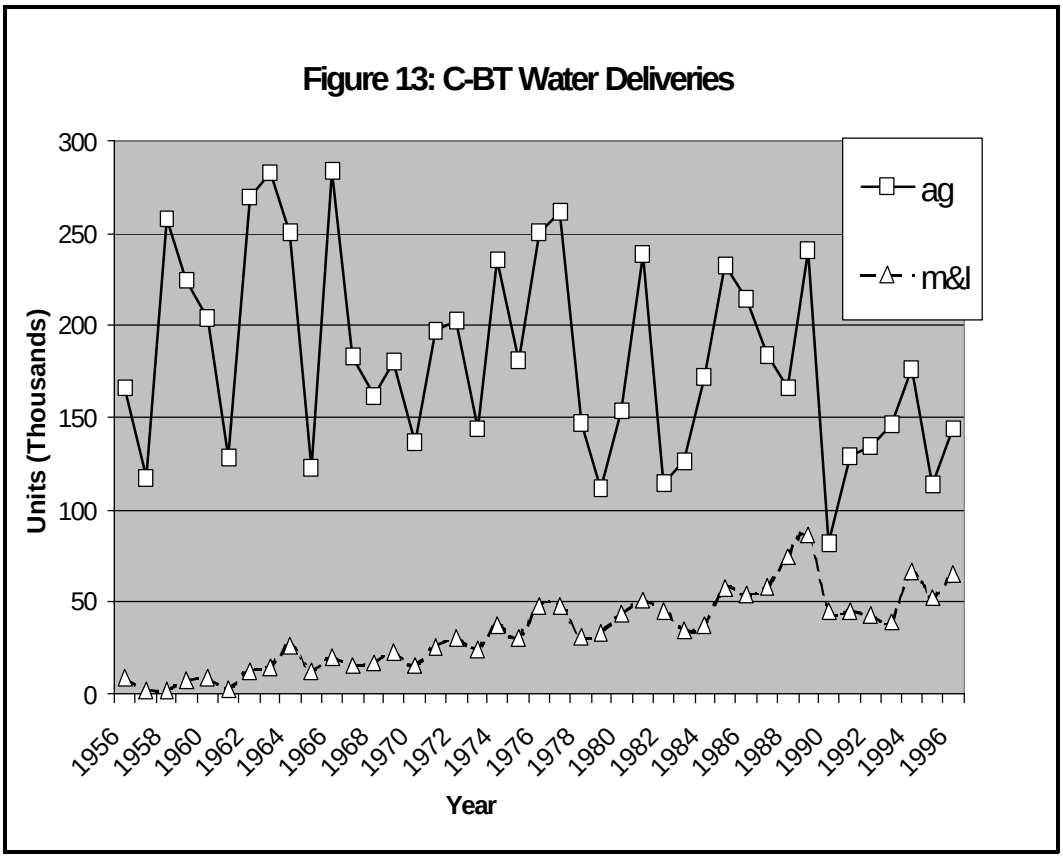


Figure 13.—C-BT water deliveries.

From Agriculture to Cities.—In this context, C-BT agricultural water units have sold to municipal and industrial users at a fast pace, especially since the early 1970s (Figure 12). Total shares now roughly divide equally between agricultural and urban owners. Actual delivery, though, lags behind as the M&I water unit purchasers lease water back to agriculture until they need it (Figure 13). Still, irrigated land is declining.

The project's irrigated area (Figure 14) showed the first declines associated with transfers to M&I use in the early 1970s. The roughly 15% decline in irrigated acreage is perhaps more significant than it might seem since these data show all irrigated acreage in the District, and reduced irrigated area is not just land losing its supplemental C-BT water, but land dried up. It is not easy to disentangle the causes of this decline in irrigated area; sale of C-BT units do not necessarily require dry up of the land, since the water was supplemental in the first place. Certainly, though, a combination of water sales with irrigation dry-up, and suburban development of agricultural land, account for most of the land removed from irrigation.

The NCWCD board, according to our discussions with the district's PIO, can be considered generally supportive of and sympathetic to agriculture. And, wile trying to avoid violating the rights of the cities and water holders to conduct transactions, they have recently begun to push harder the principle that buyers must show that they have a "base" supply, which the CBT water is supplementing. This is a squishy concept applied for cities acquiring water they do not now use, and some of which—like Fort Collins—are known for acquiring enough water to meet large population growth rates for decades to come, what some might call speculation. In a significant move that could affect the shape of Front Range urban development, the NCWCD Board adopted an "Interim Base Water Supply Policy" designed mainly to slow the rate of C-BT water acquisition by cities. The board specifically said that one of its goals was to "preserve the] agricultural component of the C-BT Project in the face of increasing amounts of C-BT water being transferred from agricultural to municipal and industrial use." (NCWCD, 1997, p. 7). Specifically, the interim policy disallows the replacement of non-C-BT water transferred out of the district, with C-BT water. In effect, this reduces the ability of urban purchasers to acquire both non-C-BT base water (which many Denver-area suburbs want badly) as well as C-BT water units, thus retaining water for agricultural uses in northern Colorado. The Board has also tried to dampen demand for urban water among towns in the District, specifically challenging additional acquisitions by Fort Collins, which some analysts claim is acquiring water it won't need for decades.

These actions come on the heels of a defeat in water court. The District and several other northern Colorado water entities had fought the City of Thornton's plans to acquire some 50,000 acre feet of Northern Colorado water to be shipped through an elaborate system to the rapidly growing suburb. Thornton now holds 78,000 people, but wants to be able to supply 379,000 by
2050. Thornton, frustrated with slow progress on the Two Forks Dam, began quietly buying farms in Larimer County (smack in the middle of the NCWCD), eventually purchasing 103 farms totaling 21,000 irrigated acres. The project, which would begin moving water in 2002, would dry up 18,000 acres. Thornton formally revealed their plans when they applied for change of use of the water rights in 1986, and 49 objectors (including the NCWCD) filed statements of opposition. The water court upheld Thornton's right to transfer the water ruling that Thornton's claim was not speculative or exaggerated; the Colorado Supreme Court further upheld Thornton on appeal. Several restrictions were added, including re-vegetation of the dried up land, but, overall, Thornton showed that the principles laid down in Coffin

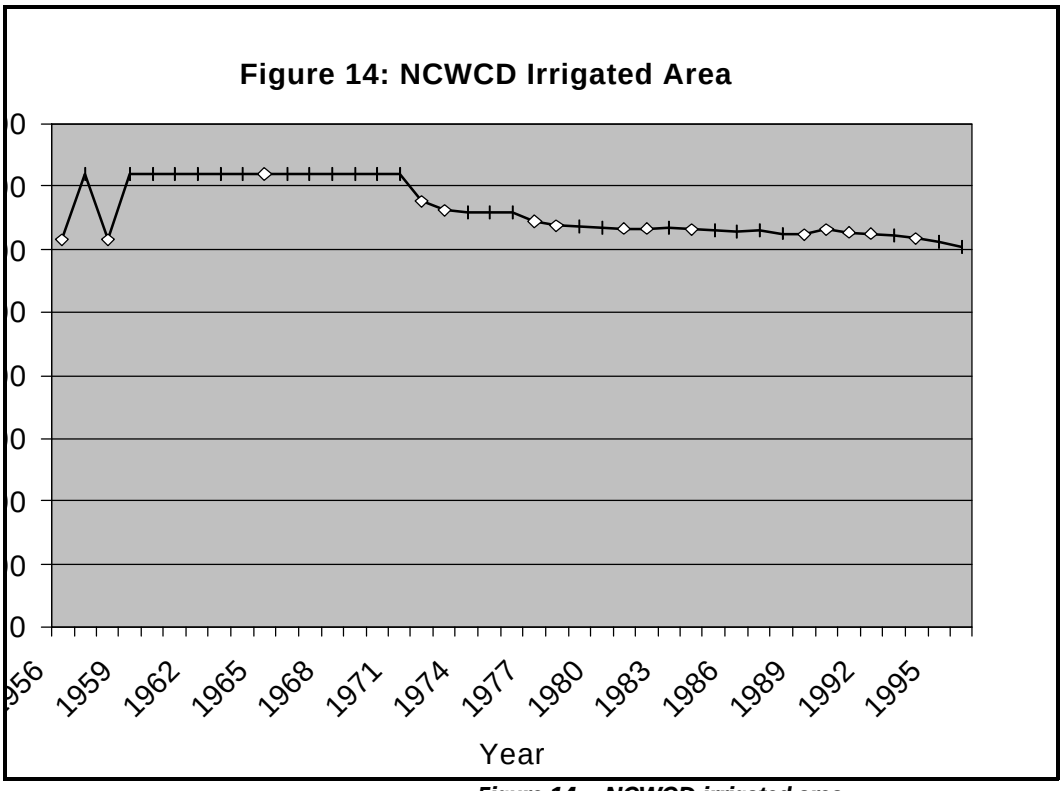


Figure 14.—NCWCD irrigated area.

vs. Left Hand—that Colorado water can be moved far from it stream of origin to be put to beneficial use. Many of the objectors, fearing a major shift in the agricultural landscape and economy of Northern Colorado, have formed a coalition to begin fighting further water transfers. One of the participants, Weld County, is considering using it county land use jurisdiction to stop water transfers.

California's Central Valley: Acreage Limits, Urbanization

The Great Central Valley of California encompasses the West's largest irrigated area, and the country's most productive agricultural area, with 11 key agricultural counties in the Valley producing some $13 billion in crops annually. Irrigated land in the Central Valley is served by BOR's biggest project, the Central Valley Project (CVP), as well as the State Water Project (SWP). The valley holds a sixth of all irrigated land in the U.S. (3/4ths of California's irrigated land). The CVP got its start as a state project, authorized in 1933 and based on the state's first water plan (completed in 1923), which, among other improvements, envisioned two large canals for transferring Sacramento water to the San Joaquin Valley. The state couldn't

finance the system and, after a few false starts, the project was authorized in 1937. Details of the project and the Central Valley need not be repeated here: Instead, the area attracts attention as a land use issue for a couple of reasons: it incubated the key debates over the 160 acre limitation, and, to the surprise of many observers, the Valley's population is now growing faster than the state overall.

Small Farms and the Right Role of Government.—Smaller farms in the Valley and their advocates began organizing just after World War II to fight what they saw as misappropriation of government support by big, corporate operators. They formed the Central Valley Project Conference and argued that "small, working farmers" deserved better service from the Project, as well as protection from big-farmer bullying. They supported the residency requirement, envisioning a landscape of Jeffersonian yeoman small-holders (well-served by a non-Jeffersonian government bureaucracy). Their critics called them communists because of their fondness for government control and the 160 acre limitation expressed (but not always enforced) by the Reclamation Act (Stene, 1997). The Reclamation Reform Act of 1982 increased the acreage limit to 960 acres and abolished the residency requirement.

Growth and Suburban Sprawl in the Central Valley.—Now the Central Valley's main land use action is urban sprawl. The American Farmland Trust (AFT, 1995) conducted what is certainly the most detailed land use change assessment for any Western irrigated area. They were attracted to the region because of its national importance and remarkably rich agricultural resources. Its non-agricultural population is growing quickly and the valley is developing in the traditional Californian (and Western) style of sprawling suburbanization. AFT studied 11 key Central Valley counties, using population projections from the California Department of Finance to drive a GIS-based land use model.

The region is growing faster than the state average, and should more than double its 1992 population by 2020 (from 4.29 million to 8.46 million people), and almost triple it by 2040 (to 12.24 million). AFT's "low density" scenario (3 dwelling units per acre of all non-agricultural or open space lands, or roughly an average lot size of .25 acres, similar to the valley's historic average) would consume some 1.04 million acres of farmland by 2040 (Figure 15 a and b). Slightly more than half of this, some 614,000 acres, is "prime farmland" according to NRCS criteria, or "farmland of statewide

importance" according to the California Farmland Mapping and Monitoring Project. This might best be called a "worst case" scenario because though it might reflect historic growth patterns, it would violate some land use planning restrictions now in place and allows for no urban in-fill. The high-density or compact development scenario assigns densities roughly

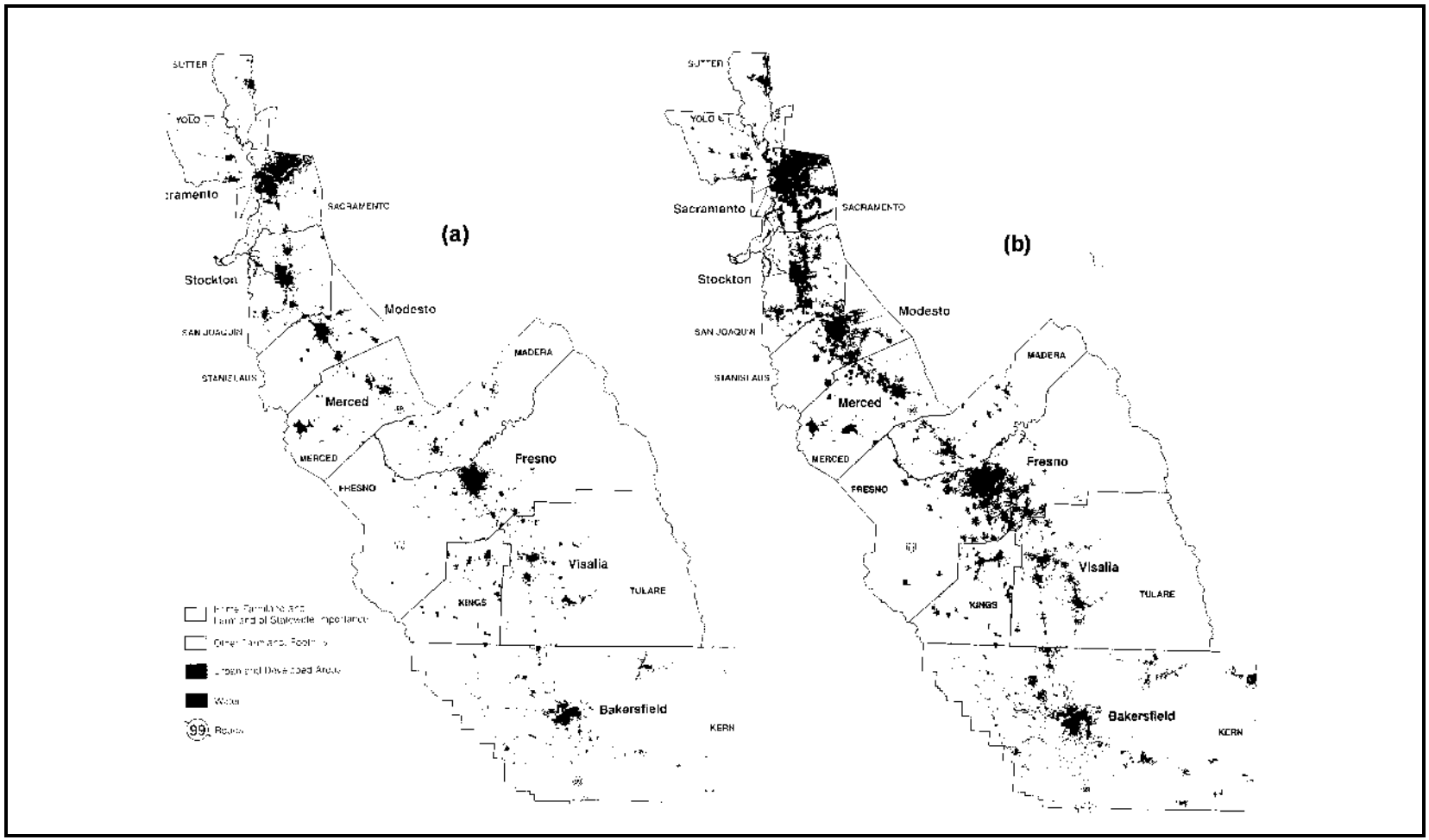


Figure 15.—Urban and developed areas in California's central valley: (A) Current (b) Projected for 2040. From: the American Farmland Trust (1995). Original in color; this black-and-white version is used to illustrate the spread of development.

equivalent to contemporary subdivisions in the area (6 units per developed acre), and consumes only 474,00 acres of farmland (226,00 of which are prime or of statewide importance). Area planners who reviewed the study felt that the low-density pattern was not pre-ordained, but that the compact pattern would be very difficult to achieve.

Their maps of Central Valley urbanization illustrate a "linear city" forming along the backbone of Highway 99 from Bakersfield on the south to Sacramento on the north. Even though their GIS model is "trained" to locate future development near roads and other facilities (airports, golf courses, etc.), the current infrastructure in the Valley encourages a dispersed pattern. In a sense, non-agricultural residential and commercial development arrays itself on the infrastructure developed for agriculture: small market towns become nodes of gentrified small-town development, and farm-to-market roads become commuting corridors.

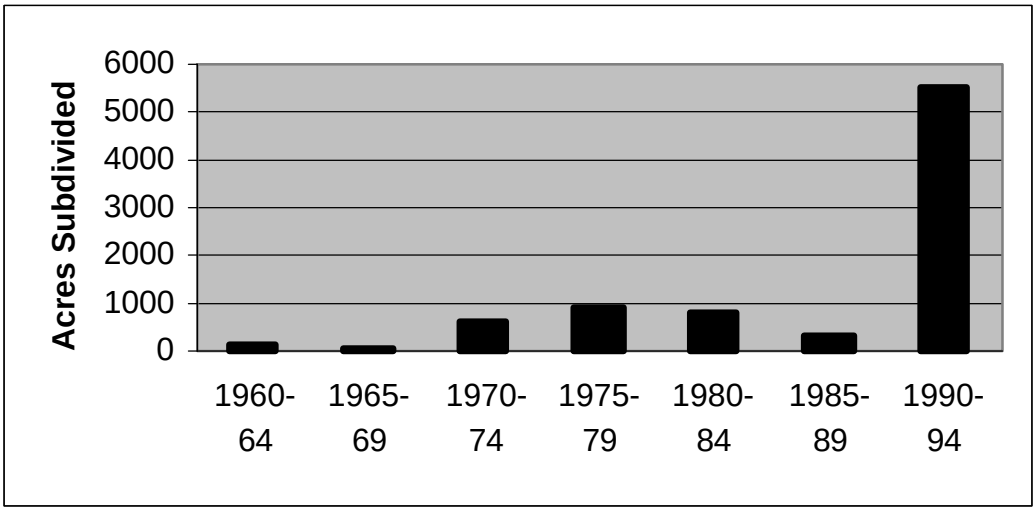


Figure 16.—Land subdivided in the East River valley, Colorado (from Theobald et al., 1996).

Rocky Mountain Ranchlands

One study area, the east River Valley below Crested Butte ski resort reflects patterns in many of the amenity-rich mountain valleys under pressure for development throughout the West. Subdivision action intensified in the early 1990s (Figure 16). The pattern of subdivision shown in Figure 17 is especially problematic because it is concentrated in the valley-bottom meadows and near-riparian areas. Building focused first on riparian areas and then moved up-slope to the conifer forest zone (Figure 18). The overall

pattern of valley-bottom development in the West is due to the pattern of public and private land in the Rockies (Figure 19), in which the developable and is in valley bottoms. The negative effects of development in a pattern like this, for water and wildlife, are obvious.

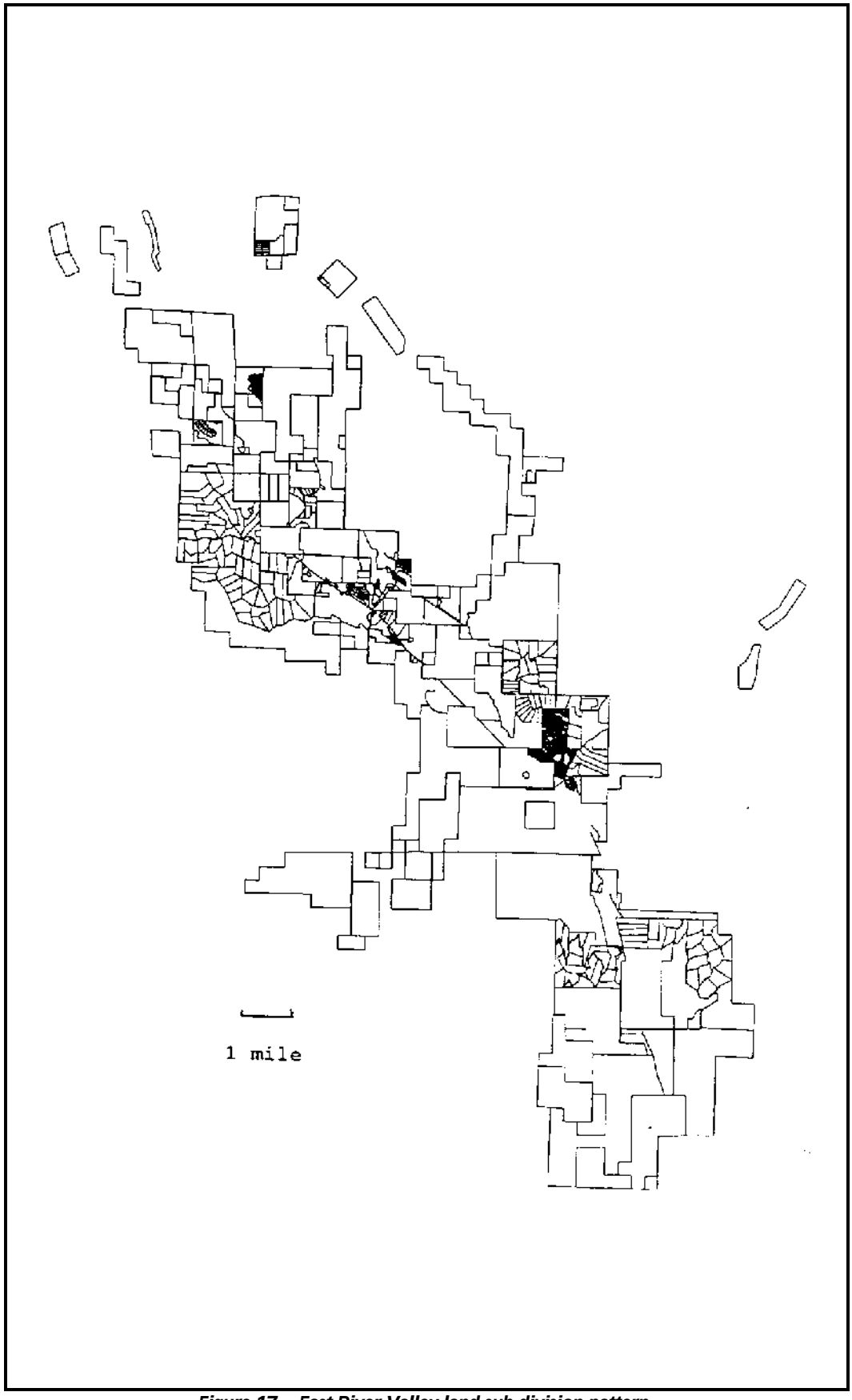


Figure 17.—East River Valley land sub-division pattern.

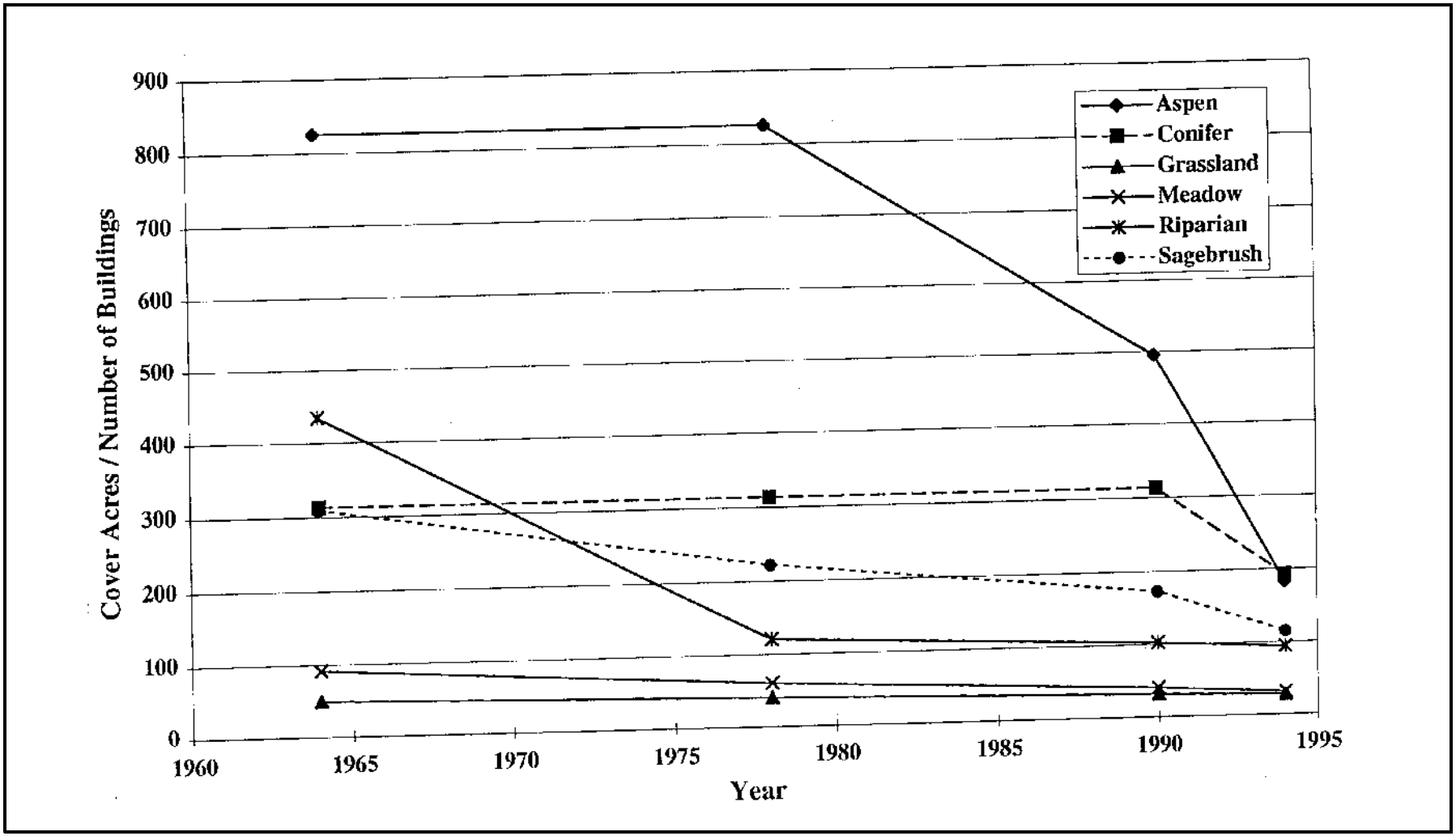


Figure 18.—Area of land cover per building in the East River Valley.

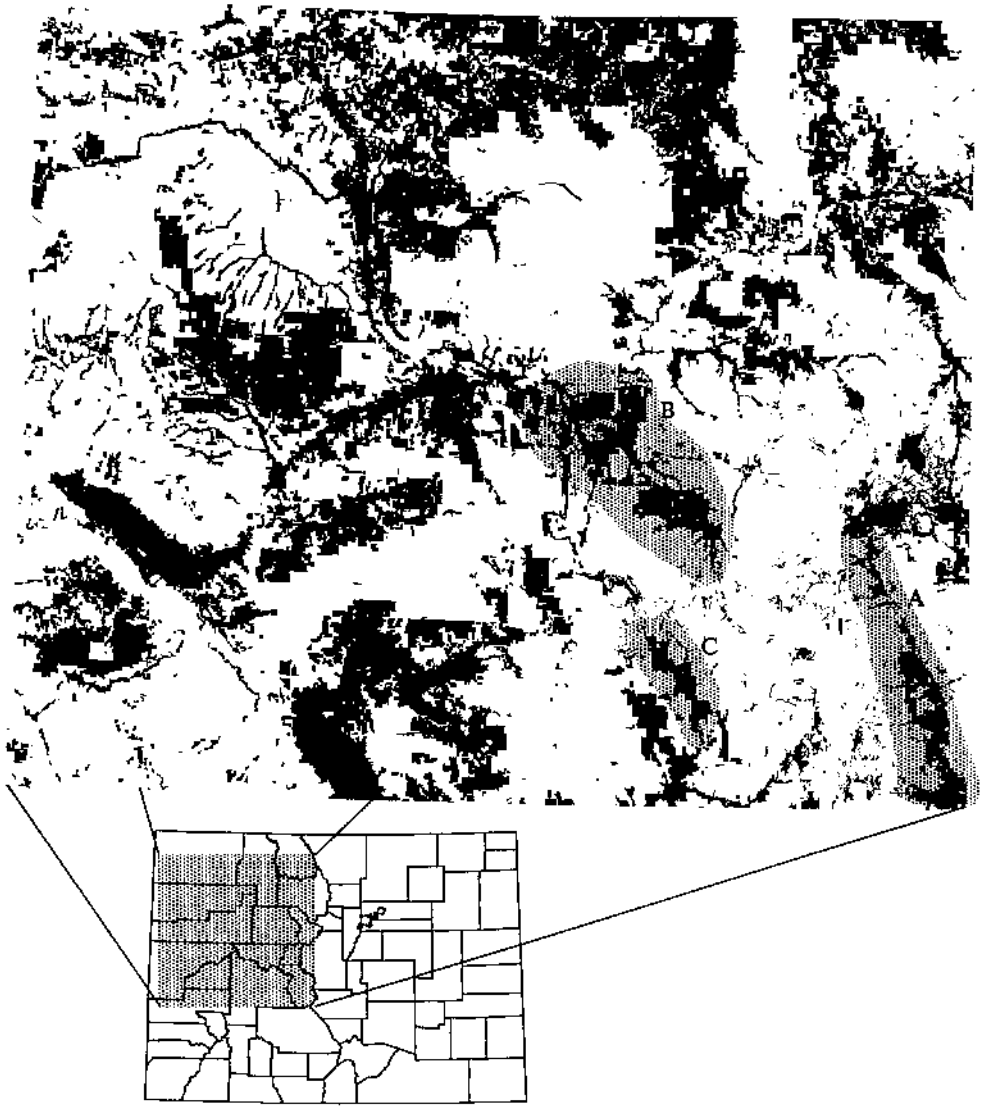


Figure 19.—Colorado mountain land ownership pattern. Black is private land, white is public land.

Part VI

Trends and Recommendations

Our overriding conclusion is that though water and land are inextricably linked resources, their policy regimes are quite separate. Still, land use planning offers principles and legal bases for federal, state and local governments to guide the rate, pattern and effects of water and land use changes so that human landscapes evolve in an orderly fashion. Here we re-examine the evolving land use policy regime in the West with regard to the balance of public and private values, the emerging scales of linked land and water resources management, and the land use principles that should come into play as Western water uses change.

Trends in Land Use Governance

Growing Limits on Land Use Planning?

While the chief logic and legal basis for land use planning today is protection of public values, this is also the logic most frequently challenged by anti-planning, private property rights advocates (Strong et al., 1995). Though the courts recently have struck down claims of county supremacy over federal lands planning, they are placing limits on government restrictions on private land use. In the well known "takings" cases the courts have tended to support the constitutionality of the theory of land use planning and zoning, but criticized application that is unfair, or causes significant uncompensated loss of value. In 1987 Nollan vs. California Coastal Commission, Scalia held for the majority that:

> *The Commission may well be right that [the public interest will be served by a continuous strip of publicly accessible beach along the coast] but that does not establish that the Nollans (and other coastal residents) alone can be compelled to contribute to its realization. Rather, California is free to advance its "comprehensive program," if it wishes, by using its power of eminent domain for this "public purpose" ...but if it wants an easement across the Nollans' property, it must pay for it. (quoted in Platt, 1996, p. 265.*

Other important precedents restricting governments' ability to extract a public good from private property by regulation were set in Lucas v. South Carolina Coastal Council (also 1987). More recently, courts have struck down unreasonable "impact fees" and exactions, like demanding that a developer devote a certain amount of space to a public park.

A few cases even threaten general land use planning and zoning. For example, a "wise use" coalition successfully brought suit recently to strike down the Kalispell County, Montana, comprehensive plan, claiming it violated private property rights because it attempted to retain agricultural lands in their less developed status, even though, by most planning standards, the plan was not particularly radical in its treatment of agricultural zoning.

Even the well-founded effort by counties and towns to control the rate, and guide the geographical dimensions, of development, to achieve what planners call "concurrency" (that is, to have schools, sewers, roads, etc. developed in tandem with residential and commercial property development), is seen by some developers and property owners as undue regulation. This is especially true in the Western states where land use policy, at all levels of government, has traditionally focused on quick rather than timed development.

Finding the New Public/Private Balance

The West is witnessing an important challenge to the power of government to regulate private land use. Yet, most planners feel that the foundations of land use regulation remain sound. Kayden (1996) concluded that "while the Court's rhetoric may from time to time burnish the mantle of private property rights, its actual rulings give ample breathing room to government regulations in furtherance of land use and environmental goals." (p. 304). Platt (1996) takes a slightly different view:

> *...the importance of [takings cases] may not lie so much in [their] narrow legal significance, but in what [they are] thought to represent, namely a broadening of property owner rights in relation to public land use regulations. This perception, whether or not strictly justified by the decisions themselves, may become a self-fulfilling expectation if political bodies ...are persuaded that the pendulum is swinging in the direction of private rather than public interests. (p. 269).*

In a review aimed at land use planners, Strong et al. (1996) agree that perception of the problem may cause some self-imposed limits on land use regulation, but they argue, as do most planners, that traditional land use planning, done carefully, will pass judicial muster. Key elements of successful land use planning include a master plan properly passed through the public review process, and its efficient and consistent application. Strong

et al. even argue that plans must change to meet changing conditions, and that land owners can be expected to expect changes and cannot claim to be surprised by every zoning change. Thus, they argue, there is no reason for planners to avoid down-zoning or new land use restrictions just because of the takings issue. Rather, if the plan makes sense, is reasonable, is fairly applied, and can be backed up with analysis linked to stated community goals, then it will stand up. This is especially true in new development planning and growth management where many takings claims are based on speculative land values.

We think that most Western planners are working under this assumption, and so we will also suggest that takings does not significantly alter the ability of land use planning and zoning to achieve desirable community outcomes with regard to linked land and water resources.

In their assessment of Western water transfers, the Committee on Western Water Management (1992) grappled with the need to balance market forces with non-market social values and costs. Land use planners face the same problem. In his review of large-scale urban planning models, Harris (1994) concluded that:

> *It is now widely agreed that many aspects of development are best managed through market mechanisms, and that planning should facilitate and not usurp the role of those mechanisms. But it is well known (at least to urban planners) that there are many aspects of development which for various reasons the market cannot manage to good effect.*
>
> *...it is more important than ever to determine the appropriate allocation of present and future planning decisions between government and the market. (p. 33)*

While some planners yearn for the notion of the 1970s that rational land use planning could only broaden its authority to guide land use toward social optimality, planners must be more diligent in applying well-founded principles, or we will witness a net loss of government land use planning authority. So, the reassessment of the public and private balance needed in Western water must also come in Western land use. In this way, the two policy fields, though quite distinct, are on parallel tracks and should be in more touch.

Two Types of County Activism

A related but separate Western land use tension resides around the power of counties to control land use on public lands.

"County Supremacy" and "Custom and Culture".—So much has been written about the so-called “Wise Use” movement that we need not reiterate it here. But, as part of the Wise Use movements, many Western counties, especially ones containing federal lands, are at least considering formal actions to assert control over public lands and to block federal environmental protection actions. In "county supremacy" and "custom and culture" resolutions or ordinances they declare federal land ownership unconstitutional and assert their own land management authority. Utah's Uintah County land use plan opens:

> *We, the people of Uintah County, State of Utah, accept, support and sustain the Constitutions of the United States and of the State of Utah. We have demanded through our elected legislature and governor that the federal government comply with the Constitution, Article One, Section Eight, which limits the authority of the federal government to specific lands. We hereby reaffirm our demand that all lands in Uintah County not so specifically designated be relinquished to the citizens thereof.....We declare that all natural resource and land use planning decisions affecting Uintah County shall be guided by the principles of protecting private property rights, sustaining valuable natural resources, protecting local custom and culture, maintaining traditional economic structures...and opening new economic opportunities though reliance on free markets.*

Catron County, New Mexico, did not claimed local control of public lands but defined its "custom and culture" as ranching and logging on the National Forest. The Nye County ordinance recently failed a court challenge, but, like “takings”, it is too early to tell how important county supremacy will be to future Western land and water use. But it does seem clear that counties heading for such approaches are not eager to practice “land use planning” as it is considered in this paper. Some others in the West, however, do seem willing and able to extend their influence more broadly in a way that will affect water policy.

County Assertion of Land Use Planning Powers Over Water Projects.—The recent battle over Eagle County's ability to block the Homestake water project perhaps foreshadows a more important trend in the West because it might stand up to judicial scrutiny. It thus bears more attention here.

The Denver Water Board sued both the Grand and the Eagle County commissioners in 1988 because the commissioners refused to give Denver permits to build water supply collection systems in their unincorporated areas. The counties acted under guidelines they had created based on the Local Government Land Use Control Enabling Act. The Act establishes a category of "areas and activities of statewide interest." When invoked, this gives local government permit authority over actions by other another government entity with distant implications. Many Western counties have such authority and include water projects in their guidelines. Denver claimed that it was immune as another "home rule" governmental entity (and under other provisions of the Act), but lost. Although the notion of "state interest" seems counter-intuitive, because it gives a locality the ability to block a land use that others in the state may want, the provision was indeed meant to give counties more rights in land use control when, for example, public facilities or possibly noxious facilities were to be located in their jurisdiction, by private parties of other governments. Colorado's West Slope counties have a jaundiced view of the Denver Water Board, and have made sure that their guidelines for water projects under the enabling act are ready for court scrutiny, because many of them plan to try to limit further water diversions.

In this case Denver also claimed the counties were violating its water rights. The court again disagreed, arguing that the counties were merely applying local land use and building codes to construction and associated activities. Indeed, the court supported the notion that the regulations, as far as water projects were concerned, were "reasonably designed to regulate the manner of appropriation or diversion", not the right or amount.

The effective extension of local land use control over construction associated with water projects, especially projects moving water elsewhere, could shift the balance of power in Western water development, adding area-of-origin protection not linked to water law per se.

In summary, it would appear that the West is comprised of states and counties actively seeking to guide land use for social and ecological benefits, and states and counties not at all interested in such actions. The latter will

suffer the landscape and community degradation associated with unplanned development. The former deserve support from the federal government and it would make sense for federal water polices and agencies to work closely with the progressive states and counties.

Scales of Land and Water Planning: The "New Riparianism" Meets "Area of Origin" (Becomes "Place-of-Origin") Meets "Bioregionalism"

It is an over-used term, but "grassroots" efforts around land and water issues in the West are intensifying and gaining credibility and political power. The Natural Resource Law Center study (Kenney and Rieke, 1997) described the watershed coalitions quite well, and examined the fuller concept of watershed management, so we won't examine that here. But we see grassroots developments below and above the watershed scales that bear watching.

New Riparianism.—Some trends in western water policy bear comparison with the "riparian" traditions in the Eastern, Great Plains and Pacific Coast states (Tarlock, 1990). At the local level, stream and river protection organizations have the avowedly riparian aim of managing the channel and the land in tandem, maintaining the relationships among natural channels, floodplains, and wetlands, and protecting the land associated with those hydrologic systems (e.g., River Network, 1994). The Greenways movements would link those riparian corridors with a larger network of open spaces, parks, and other natural areas and corridors—and to the larger plans based on watershed management (Fabos and Ahern, 1996). As this "new riparianism" coalesces with the watershed movement, it also feeds up in scale to overlay with "area-of-origin" protection efforts, and eventually meets with landscape ecology or bioregional approaches to entire landscape and regional protection schemes.

Area-of-Origin as "Place".—Although "area-of-origin" water policies have not been widely adopted in a formal sense, they reflect a widespread sentiment in places confronted with large-scale transbasin diversions (WSTB, 1992). Interstate water transfers, e.g., those from aquifers in New Mexico to El Paso, also generate intense opposition from citizens who fear losing what they regard as "their" resource endowment regardless of the principles of free access to and commerce in water.

The failed law suit against Thornton, Colorado's purchase of farms and water in northern Colorado evoked a new area-of-origin interest group—the Northern Regional Water Coalition—now examining its options for protecting the area's farmland and irrigation water in several ways. The group, mostly water users and water agencies, is already talking as much about place and landscape and lifestyle as it is about water and water transfer; they are also talking about making strategic alliances with environmentalists on the issues of water transfers and farmland protection.

We believe that the "local control" movement in Western land and water policy, and the strengthening community movement in Western planning and growth management, will continue and strengthen. Thus, basin-of-origin thinking might begin to evolve into "place-based" resource protection and management, with or without a hydrologic basis.

Water transfers are evoking more "place" and community consciousness in the West. The High Country Citizens Alliance in Gunnison County, CO, was created as an alliance of environmentalists and ranchers against water transfers to the Front Range. It continued, after the water fight died down, to become an important player in the reformulation of Secretary Babbitt's Range Reform initiative.

The "watershed" movement described so well by Kenney and Rieke (1997) has a strong "place" basis. Inasmuch as community and localism become increasingly important in the "New West," regarding even federal lands management (see, for example, Snow and Baden, forthcoming), then it will affect future Western water management through at least the simple effect of adding more friction to transfers. But there is also a strong place-centered activism emerging, especially around places like Yellowstone and Grand Canyon National Parks (The Greater Yellowstone Coalition, and Grand Canyon Trust). These two examples are essentially acting as NGO planning organizations, conducting detailed land use and economic change studies, and feeding them to local, state and federal agencies.

Bioregionalism.—At the largest scale, environmentalists committed to keeping nature whole are mapping a vision for the West based on large-scale protected ecosystems and landscapes. Their landscape plan is tethered to the few remaining wild parts—congressionally-designated wilderness areas and parks, plus less protected, but not yet developed, public tracts that harbor many indigenous species. But these remaining wildlands are not big enough

to function as healthy, biotic refuges: animals and plants must migrate, share genes, and adjust to patterns of drought, fire or even global warming. So, the bioregionalists are working on grand schemes, applying the latest principles of conservation biology and GIS techniques to try to keep whole ecosystems going. Their goal is: "nothing less than the re-wilding of North America."

In the Rocky Mountains these environmental visionaries draw great circles around the remaining wild cores—the Yellowstone country, Central Idaho, and pockets of wilderness in Colorado—and sketch corridors connecting them via fragments of undisturbed forests and grassland. Thus was born the Northern Rockies Ecosystem Protection Act (NREPA), and similar plans for the Southern Rockies. NREPA was introduced in Congress during 1993 as H.R. 2638, proposing to protect some 20 million acres of public lands in the Northern Rockies; designate five major "core" ecosystems like Glacier and Yellowstone national parks; create additional wilderness areas and two new national parks (Hells Canyon and Flathead); create a new system of "biological linkage corridors" to reduce habitat fragmentation; initiate a program of "wildland recovery areas" where degraded land would be improved by tree-planting, and removing facilities that hurt wildlife, like roads and campgrounds; create a new branch of the U.S. Forest Service: the Wildlands Recovery Corps, to manage the recovery areas; and create an inter-agency, inter-governmental team to oversee the entire eco-region.

The bioregionalists are essentially creating master land use plans for the entire West. In the Rockies their corridors, to be used by migrating animals and plants, reconnect the entire Rocky Mountain ecosystem from north to south. The connecting swaths follow public lands as much as possible, but they also inevitably cross private lands and there's the rub. Roads, houses, and shopping malls bar wildlife migration and must be modified—and the bioregionalists have no link to local planning, and little recognition of their plans or their planning status, in state or local land use planning authorities. This makes such ideas somewhat equivalent to watershed notions—good ideas without a firm governmental base of operations.

Back to the Basin?

Two central tenets of water planning over the decades have been: (1) that basin-wide, rather than jurisdictionally-fragmented, planning is necessary (an argument made by several WWPRAC members and commission

consultants), and (2) that land water use should be planned and managed in coordination.

In reality, water and land use in the West have been coordinated mostly only in the engineering and infrastructure sense. For example, most municipal annexations require that sufficient water supply come along with the annexed land to meet future M&I requirements (since most modern annexations come with at least general estimates if not detailed PUD plans for development, the amounts can be estimated rather accurately). Some local planning and zoning ordinances may require additional increments in water and wastewater systems with each development, though the idea that the developer must pay up-front for these infrastructural enlargements (so-called "impact fees") is still controversial and receiving rather negative judicial scrutiny; typically, the city or county simply counts on the increased tax base to pay for water systems.

Water may be addressed in county comprehensive plans—including plans for increased supply and wastewater treatment—such plans are almost universally silent on land and water issues outside the county boundaries. Counties, western counties in particular, are hesitant to even hint at coordinated or regional planning, not wishing to suggest that they are willing to give up some land use control or to even hint at wishing to influence other counties' planning.

The "comprehensive" and "basin-wide" planning often called for has thus far focused almost exclusively on water and not on land use per se. Even land use plans for irrigation project areas cannot be considered planning or "zoning" in the sense that the district has legal control over land use per se beyond its control over water and water use. The counties in which project areas reside have regulatory control over land use, and, as discussed earlier, most Western counties (and states) do not practice comprehensive land use planning and regulation except in the traditional realm of development zoning and building permits, and statewide transportation planning.
The emerging bioregional organizations are not especially concerned about hydrologic basins—the two discussed above, the Greater Yellowstone Coalition and the Grand Canyon Trust must work across several major and minor watersheds.

Does this mean that the river basin, perhaps the principal conceptual framework for integrating water and related land uses in the 20th century, is not useful given the geo-political realities of Western land use ? Hard to say.

The river basin approach is now in a dormant phase, but watershed coalitions are proliferating (Doppelt et al., 1993; Natural Resources Law Center, 1996; Sullivan, 1995; and Wescoat, forthcoming). Without re-iterating ground so well covered in NRLC's detailed paper for the WWPRAC (Kenney and Rieke, 1997), we note a few points relevant to the land use dimension.

Current watershed experiments vary enormously in origins, aims and structure, but we think they share a commitment to linking water resources issues with their surrounding landscape and land use conditions. The vitality of local involvement in watershed movements stands out as their most distinguishing and promising characteristic (Lavigne and Coyle, 1995). Like river basin planning, local watershed protection dates back to the Progressive Era. It has had several periods of growth and decline, during which time it focused, for example, either on flood hazards, erosion control, or forest management (Buie, 1979; Helms, 1992). In each case, there was probably a closer link between watershed planning and land use planning, than between river basin planning and land use planning; i.e., the watershed has been the important scale and context for rural land use management issues.

In each period, the achievements, and limits, of local, small-scale, modestly-financed activities have become apparent. Unresolved is the problem of coordinating and integrating local and larger-scale regional resource planning. Although often framed as a problem of competing agency politics, the scale and scaling problems hinge as much on land use issues, i.e., the barriers to state and regional land planning, as they do on the fragmentation of water planning. The question now becomes whether the bottom-up track is more powerful, and can ultimately become more fruitful, than the top-down approach of past basin planning efforts.

Watershed planning at both the local and regional scales depends upon various types of government support (e.g., for information, funding, technical assistance). NRCS and EPA are currently supporting watershed initiatives (USEPA, 1991, 1995). The key challenge, as described in the NRLC paper, will be to determine which types of government involvement best support local land and water management, and which types of support facilitate its coordination with larger-scale regional resource management.

The local land use authority—the county planning office—so far shows up rarely in this mix. This may be because the planners have their hands full

with standard land use issues, or because they have been encouraged—by the entire constellation of water law, tradition, and politics—to stay away from water issues except for the routine ones that cross their counters (raps, well and septic permits, etc.). Our sense is that the county planners have kept a low profile in the watershed movement, and they're outright avoiding the bioregionalists whenever they can. Clearly, though, the logic of linking land and water resources means that local planners must become more involved in cross-jurisdictional issues.

The state-level land use planning activities we reviewed in Part I generally pay little attention to water and watersheds per se. However, if state-level land use planning strengthens in coming decades, as many professional planners want and expect (American Planning Association, 1996), then water and watershed issues could become more directly incorporated into planning structures. In any case, it is important that local planning agencies, though not organized by watersheds, be fully involved in any watershed-based reformulation of water policy.

Agricultural Land Preservation

Whether one thinks of agricultural land preservation as a food issue or an open space issue, there is little doubt that it is a growing part of the land use regime in the West. Zoning, purchase of development rights, and grants of conservation easements will protect agricultural lands. The Federal Farmland Protection Program in the 1996 farm bill plans to purchase conservation easements or other instruments for somewhere between 170,00 and 340,000 acres of farmland in cooperation with states, local government and land trusts. This is a small amount of land overall, and we do not have good statistics on just how much land is already thus protected. Organizations like the American Farmland Trust (AFT) are quite active, and land trusts are sprouting up throughout the West. Colorado is using gambling funds to purchase development rights on thousands of acres of land, especially in the mountain areas subject to intense real estate pressure. Routt County, CO, recently passed a tax mill levy to buy development rights, aimed especially at preserving irrigated meadows in the Yampa Valley floor. Colorado has over 30 private land trusts, including the West's first Livestock Association trust (Covert, 1997). Again, we don't know how much land is now protected from development, but we know it is growing and that it is often, by strategy, very important and more productive land.

A great question for the farmland protection movement is whether lands placed under easements or other instruments that prevent, in perpetuity, their development, can be farmed or ranched in perpetuity. The big unknown, of course, is whether the land can be used profitably in agriculture, or will simply go out of use. In the latter case, and given the geographical setting of most lands under some form of conservation easement, one might assume that local government would step in and buy the remaining rights in the land for dedicated open space.

As more agricultural land come under some form of protective easement, the need for secure water is increased. If agricultural land cannot be sold for residential or commercial use because the development rights have been donated or sold to local government or to a land trust, then agricultural water, which may not expressly dealt with in the conservation instrument, becomes crucial to the success both of the agricultural enterprise and of the alternative values (open space) purchased in the easement. We need to know more about the rate and pattern of agricultural conservation easements in the West.

An issue for the WWPRAC, and state and federal agencies, then, is whether policy will ensure that the resources, especially water, will continue to be available to lands under easements. In theory, of course, water is as secure as the title and the easement. But agricultural protection groups are worried. The AFT is now developing a set of principles for "secure and sustainable water supply" for agricultural properties of interest in the Central Valley. At the least, the growing presence of agricultural and open space easements on private agricultural lands throughout the West should be assessed for what it might mean in water transfers and in management and planning actions by irrigation projects and districts.

A Technical Need: Land Use Data

Briefly, a more mundane need: We think water is much better monitored than land, and if some attention is to be paid to their joint analysis, land use and cover databases need improvement. The USDA's National Resources Inventory is beginning to fill the vacuum left by the USGS and other entities that, at one time or another, sought to provide a national land use data. But, NRI was not designed for this mission, its main goal still to assess land suitability and productivity as a guide to USDA policy. It is difficult to access and use as a land use database, and though the staffs involved are working

as this is written to get more of the 1992 NRI data available to more users, the system has a long way to go if it is to become the country's default land use database.

A major effort to improve our land use data bases is needed. The older databases, like the USGS land use maps, either should be updated or that waning effort merged with the NRI. Finally, the states should consider creating at least basic databases by drawing on county land use data where they exist. Our experience has been that a few counties maintain detailed, parcel-level data; some of it is digitized, much is not. But this is the exception, and only those states with central land use laws have something approaching spatially-explicit land use databases. We recognize some political sensitivities in archiving private land use at the state or federal level, but it simply makes no sense for Westerners to lack data on one of the most obvious, sometimes disturbing, changing geographical aspects of the region: land use.

Conclusions: Principles for Coordinated Land and Water Planning in the West

The WWPRAC has expressed a great interest in the potential for stronger watershed and basin-level resource planning and coordination of all types. The basin is offered as the most appropriate scale for land and water resources planning and management. We and many others have argued that integrated, or at least coordinated, land and water use planning makes good policy sense, and have pointed out some of the successes and failures along these lines. Perhaps surprisingly, we find that water resources planning and management is much better practiced and integrated across scales than is land use planning. The reason may be as simple (and as profound) as the fact that the physical nature of water means that water planning and management must be integrated across jurisdictions and landscapes simply to get the job done, while land can be compartmentalized—walled off if you will—given its nature as a fixed asset.

The question begging then becomes: If we succeed in fostering more basin-wide water management and policy (or even simply the coordination of activities, like budget planning, among agencies operating in a basin), might there arise a similar, congruent land use policy and management process?

The prognosis is mixed, but not very promising. Land use planning in the West runs the gamut from the well-integrated statewide programs in Oregon and Washington to almost fully dis-aggregated processes in most other Interior states. Even in Oregon, though, the main land use planning power resides with counties and municipalities, so we stand by the earlier conclusion that Western land use planning is a dis-aggregate, localized process that mitigates against integrated planning across scales and landscapes. This is what Planning Professor Thomas Clark refers to as: "the autonomous and disjointed actions of disparate and uncoordinated jurisdictions" (Clark, 1997). This can be said even for many counties with so-called comprehensive plans: actual land development tends to occur in a piecemeal and often unplanned manner, especially during boom times like the 1990s in the West.

Still, good planning practice requires state and federal governments to start to assess, and plan, the rate and pattern of future water uses and transfers, rather than accepting what the market demands, or what a single program or interest group advocates. Land use planning practice and precedents clearly provide the logic for such analysis, as well as the legal basis for actions that modify the timing and pattern of water use changes, even those driven by purely market forces. Geographical pattern may be as important as rate—if certain geographically-situated water transfers have the ability to domino into larger land and water use conversions, then government entities have an obligation to assess the likely social results and to plan for their orderly progress.

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