

# Cultural and Natural Assets for Willamette Basin, Oregon Sustainability

Courtland L. Smith, Oregon State University  
Jennifer Gilden, Oregon State University

**Abstract.** In this paper, we consider the transfer of environmental and cultural assets to the next generation as a potential measure of sustainability. We define “net assets” as the value of renewable and nonrenewable natural resources plus human-made, intellectual, social, and cultural capital, minus any debts. We apply this approach by first reviewing survey data reflecting how cultural capital may yield microbehaviors that add up to the macroresults of environmental protection and restoration. Second, we evaluate how human activities play out on the landscape. Rather than a dollar measure of assets, historical changes in land use are a proxy for asset change. A broad look at the Willamette Valley, Oregon’s most urban and industrial area, shows that capital in forest lands has shifted from significant loss to improvement, agricultural lands have decreased only slightly, and urban development has taken a relatively small share of the total landscape. However, sprawl is increasing despite efforts to contain urban growth. Looking at highly valuable ecological features for the future, we find that wetlands continue to be lost, important species are endangered, and the secondary impact of urbanization on the landscape is increasing.

**Keywords:** sustainability, natural capital, land use, cultural assets, Willamette Valley, Oregon

## 1. AN ASSETS VIEW ON SUSTAINABILITY

Since Earth Day in 1970, environmental values have favored greater protection of environmental resources threatened by development. If values result in behaviors to restore and protect natural resources, the impact should be seen on the landscape. The many microbehaviors favoring environmental protection and restoration should add up to macroresults. To test this hypothesis, we look at changing peoples’ values toward environmental protection and try to determine whether the results of these values can be detected on the landscape.

Economists typically look at improvements in well-being by measuring improvements in income. Social scientists are more likely to use self-assessments gleaned from interviews or surveys. Polling firms such as Gallop, Harris, and the National Opinion Research Center regularly measure values. Anthropologists have a long-term interest in human well-being, and use material measures such as house size, artifact accumulation, and amount of land or animals owned. The metric for judging the degree of improvement or degradation of the environment is subject to considerable debate.

Robert Solow (1992:6) says, “When it comes to measuring the economy’s contribution to the well-being of the country’s inhabitants, however, the conventional measures are incomplete. The most obvious omission is the depreciation of fixed capital assets.” If one economy generates income by depleting its resources and another produces the same income while maintaining its capital stock, which is more sustainable?

Following Solow, we measure change in societal well-being, by giving consideration to the level of capital. Some ecological and neo-classical economists define sustainability in terms of capital (Solow 1991, 1992; Costanza and Daly 1992; Ervin and Berrens 1993; Pearce 1993). Sustainability requires that capital be maintained. Where capital is depleted, the situation is not sustainable.

A broad definition of total capital (Ervin and Berrens 1993) is the sum of

- + nonrenewable resource capital, e.g., mined resources, such as oil, gas, or minerals;
- + renewable resource capital, e.g., natural resources, such as fish and forests;
- + human-made capital, e.g., manufacturing plants and equipment, new technologies; and
- + intellectual capital, e.g., acquired knowledge stored in narratives, libraries, and enculturation processes.

To this could be added:

- + social capital, e.g., communities, cooperatives, social networks, organizations, procedures for dealing with environmental problems; and
- + cultural capital, e.g., ethics, world views, values, the commitment people have for environmental or other actions.

A broad definition of total capital is the sum of all these elements, but this definition has two implications. First, substitutions between various forms of capital are possible to maintain a total capital stock equal or greater in future generations. Human-made capital may be substituted for renewable resource capital. From a land-use perspective, the substitution of development for natural landscapes is an increasing problem.

The second implication for the measurement of total capital is that social and cultural capital are especially difficult to measure monetarily. How do we add up natural, nonrenewable, human-made, intellectual, social, and cultural capital to get total capital? One approach has been to modify the calculation of gross domestic product (GDP) and develop other measures of human well-being like the Index of Sustainable Economic Welfare (Daly and Cobb 1989), the Human Development Index (UNDP 1999), and the Fordham Index (Miringoff and Miringoff 1999). Another is to sum the value of ecosystem services (Costanza et al. 1997). These are more akin to income than capital measures. Our approach is to see if changes occur to the landscape.

For this analysis we first look at cultural capital to see what kinds of landscape changes are advocated. Second, we evaluate land uses that appear related to the cultural capital changes being advocated. Cultural capital includes a society's environmental ethic and values. The public's willingness and enthusiasm to improve water and watershed quality, restore riparian habitats, and increase fish stocks all depend on its cultural capital. Public support for an action should result in investments to achieve the cultural goals. While cultural values are difficult to measure monetarily, the priority given to restoration is reflected in the tradeoffs that people are willing to make. For example, many surveys show people in the Pacific Northwest are willing to accept higher electricity rates if the money goes to restore salmon (Loomis and White 1996; Smith et al. 1997; WDFW 1997; OPB 1999).

The substitutions issue contributes to debates over the sustainability of systems where natural capital is being replaced by human-made capital. Solow (1991, 1992), for example, says that as long as total capital is equal or greater in the next generation, the system is sustainable. Costanza and Daly (1992) argue that sustainability only occurs when there is no decline in natural capital. The crux of this argument is how people view substitutions between natural and human-made capital (Folke et al. 1994). For example, is a hatchery salmon considered equal to a wild salmon?

Our focus is on the relation between human-made capital (the developed landscape) and renewable natural capital (the forest and farm landscape). In the Pacific Northwest support for protecting forests has grown stronger since the first Earth Day in 1970. Our hypothesis is that this should be reflected in the amount of forest lands protected. Pressure to protect forest lands grows as residents in the Pacific Northwest see other values for their forests. Old growth forests and salmon are indicators of environmental quality. Whitelaw (1995) shows environmental quality is important in drawing people to the region, who are willing to accept lower salaries to live in a higher quality environment.

If society's cultural capital—its environmental ethic—supports protection and restoration, will natural assets increase? First, we look at the values for protecting resources. Then we look at changes to the landscape that appear to have resulted from changing values.

## 2. EVIDENCE FOR CULTURAL CAPITAL

If cultural capital generates public commitment to preserve or restore natural resources and make them more sustainable for future generations, then we would expect this commitment to generate microbehaviors favoring protection and restoration. If the resources committed to restoration achieve societal goals, we should see evidence of macroresults on the landscape. The first step is to see how cultural capital with respect to natural resources is changing. To do this we look at survey data.

Long-term value measures of public attitudes are very limited. National polls show strong public support for the environment. The Gallup Earth Day 2000 poll found that two thirds of the respondents chose the phrase "Protection of the environment should be given priority, even at the risk of curbing economic growth" (Dunlap 2000:6). This is up from 58% in 1992. Since 1973, the National Opinion Research Center's General Social Survey (1999) has been asking whether spending on environmental issues has been "too little," "about right," "too much," or "don't know." Figure 1 tracks the answer of "too little" and "too much," showing a wide gap between the two.

Surveys frequently measure the tension between environmental and economic considerations. Table 1 presents data from several surveys exploring this question in Oregon and elsewhere. While balancing environment and economy has the highest plurality, the environment is clearly weighted over the economy. The general conclusion from these data is that the public's cultural capital strongly supports the environment.

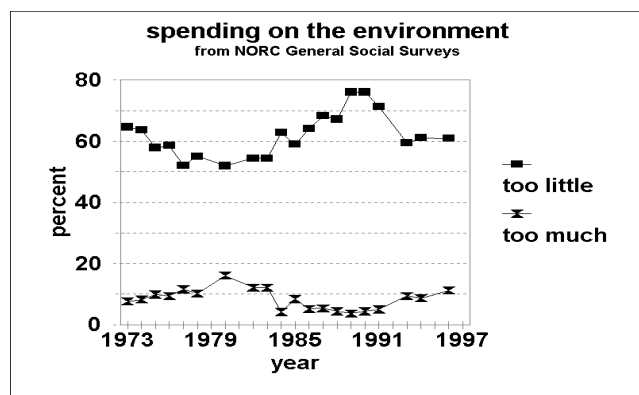


Figure 1. National Opinion Research Center data showing strong support for the environment.

Source: NORC 1999.

Table 1. Several surveys show similar patterns in the priority that should be given to environmental or economic considerations.

Survey	Priority to environmental considerations (%)	Environmental and economic factors should be equal (%)	Priority to economic considerations (%)
Oregon coastal (1996)	40	44	16
Oregon (1991)	37	44	19
National (1991)	42	47	11
Oregon Progress Board categories	Environmental protection over economic growth very or somewhat desirable	Neutral on environmental protection and economic growth	Environmental protection over economic growth very or somewhat undesirable
Oregon Progress Board (1993) results	54	15	28

Sources: Oregon Coastal (Smith et al. 1997); Oregon and National (Shindler et al. 1993, 1996; Steel et al. 1994); Oregon Progress Board (OPB 1996).

Two Oregon and national surveys completed in 1991 and 1993 show younger people consistently show more concern for the environment than older people (Smith and Steel 1997). Age differences were most striking for the statement “plants and animals exist primarily for human use,” where 80% of the 18-29 age group disagreed with the statement, compared to 37% of the 61+ age group (of whom 41% agreed). A question about plants and animals existing for human use also shows a clear gradation across generations.

In the early 1990s, a debate raged over protection of Pacific Northwest forests used by the spotted owl. The general public supported protection of owl habitat. A 1991 survey of Oregon (N=872, 76% response rate) and National (N=1,094, 68% response rate) publics found on twelve policy statements—half reflecting a basic commodities orientation and half with an ecosystem orientation—“None of the commodity-based policies was supported by a majority of either sample. . . Support for ecosystem-based policies among both groups was dramatic” (Shindler et al. 1993:38). In a 1994 poll, 82% of respondents agreed with the statement, “The primary purpose of managing public forests is to maintain a healthy environment” (Hammond 1994:11). Those who were found to be more biocentric “are more likely to support a ban on clear-cutting, establishment of more wilderness areas, greater protection for fish and wildlife habitats, and protection of the remaining ‘old growth’ forests” (Steel et al. 1994:148).

While the survey data are limited, they suggest public support for protecting and restoring natural resources. The surveys suggest regional support and even stronger national support for protecting salmon and critical habitat associated with salmon. National respondents had significantly stronger preferences for protecting fish, preserving endangered species laws, and protecting riparian habitats than did respondents from Oregon. Surveys revealed little support for setting aside endangered species laws to protect ranching and timber jobs.

Support for protecting threatened species of salmon is strong. A 1997 poll conducted for the *Oregonian* (12/7/1997:A1) newspaper found, “60 percent of residents think fish should come before commerce in managing the Columbia River system.” One of the key variables differentiating level of support for salmon is the urban and rural distribution of respondents. Brunson and Steel (1994) sent opinion surveys to random samples of the public in metropolitan Portland, Oregon; metropolitan Vancouver, Washington; rural Washington counties contiguous to the Gifford Pinchot National Forest; metropolitan Spokane and Seattle, Washington; and Prince George and metropolitan Vancouver, British

Columbia. All surveys were conducted between 1991 and 1993. While the purpose for each survey varied (e.g., forestry, environmental and contemporary policy issues), the same question concerning protection of salmon was included in each survey.

The results suggest agreement among all samples for giving “greater protection to fish such as salmon on federal/provincial forest lands.” A majority of respondents from each sample stated that greater efforts should be taken to protect salmon, ranging from over 57% for rural Prince George to 81% of urban Vancouver, British Columbia respondents. Clearly there is a strong mandate among the urban and rural publics examined here for protecting salmon and their habitat in the Pacific Northwest. Support is stronger among urban respondents than among rural ones (Smith and Steel 1997).

A number of studies have been conducted to determine people’s “willingness-to-pay” for salmon restoration. Olsen et al. (1992) summarize surveys giving a range of \$3 to \$9 per month (constant 1996 dollars) for salmon and steelhead in 1989. In 1996 the Oregon Progress Board found 26% willing to pay more than \$7 per month, while 22% said they would pay nothing (Oregon Progress Board, personal communication, 1996). A Washington survey found “Approximately 3/4 of the respondents would support such effort (greater protection for fish and wildlife) for an annual tax increase of \$100 or less; but the proportion drops significantly to approximately 2/3 for an annual tax increase of \$200” (WDFW 1996).

Research completed on Oregon coastal residents by Smith et al. (1997) found that more than a third would pay more than \$10 per month, with 17% willing to pay more than \$20 per month. Forty-seven percent were willing to volunteer a half-day or more per month, while a quarter of the respondents would both volunteer and pay. Many of the respondents who said they were unable to pay or volunteer were older people with fixed incomes and health limitations. In addition, many people said they had little faith in the ability of government to spend their money wisely. Some reserved their willingness to pay or volunteer until they knew what program was being proposed.

These data on cultural capital suggest the summing up of many microbehaviors to provide strong support for the environment and for restoration of forests and fish. The public is discussing more and more environmental restoration actions. These actions stem from the cultural capital favoring resource protection. Value change is one thing, but for ecosystem restoration to take place, support must be translated into practical actions that add up to macroresults. If the actions supported by this cultural capital improve natural habitats, we should see greater environmental awareness reflected in the landscape.

### 3. RESULTS OF MICROBEHAVIORS FOR SUSTAINING RESOURCES

The discussion above demonstrates that there is public support for improving resource conditions, increasing sustainability, restricting harvest of forests, and protecting watersheds. Getting this public support for ecosystem action is a necessary first step, but is not enough to lead to action. Correcting ecosystem problems requires a summation of many micro decisions that ultimately add up to landscape change.

Environmental restoration is about increasing natural capital—the quality of forests, streams, fish runs, and wetlands. Restoration efforts, then, should be seen in changes that take place on the landscape. We examine changes in the landscape of Oregon’s Willamette Valley to see if changes are moving toward protection of natural capital. If natural capital is increasing, it is doing so through active or passive restoration. We hypothesize that constraining development and restoring natural capital leads to a more sustainable system.

The Willamette Valley is the most urbanized part of Oregon. In 2000, the population in the valley is estimated at 2.4 million, about 70% of the state’s population. The Valley is bordered on the north by the Columbia River; on the west by the Coast Range; on the east by the Cascade Mountains; and on the south, by the joining of the Coast and Cascade Mountains. The Valley contains over 7.3 million acres, 12% of the state’s land area.

Prior to the 1850s, Native Americans managed the Willamette Valley through intentional fires, which were set to improve gathering and hunting conditions. Our focus begins with the mid-1850s, when geopolitics led to the United States promoting settlement of the Valley.

We evaluate the acreage in various land uses at the time of settlement (1850), prior to the environmental movement (1965), and at times during the environmental movement (1981 and 1994, 1997, 1999). We review several sources that have evaluated change in forest, farm, and developed land use. Developed land is large and small tracts of built-up land, plus roads, railroads, and rights-of-way (USDA 1999:5). Table 2 gives the percentages of the Willamette Valley in each category for 1850 and 1999. The table shows that percentage of the valley was forested in 1850 and was not substantially different by 1999. The forest of 1850 was virgin uncut forest, while in 1999, all but 5% had been cut at least once. The table indicates that the land use was still forest, but the forest was not the same quality as in 1850. Most of the oak savanna and grassland prairie, wetlands, and riparian area lands became farm and urban lands.

Table 2. Land use percentages for the Willamette Valley 1850 and 1994.

Land Use	1850 (%)	1999 (%)
Forest	68.6	67.4
Savannah & Grassland	24.7	*
Open Water, Marsh, & Riparian	3.7	0.9
Farm	3.0	26.7
Developed	0.03	5.0
Total	100.0	100.0

\* Savannah and grassland areas went into private farm ownership. Some is in public lands and would appear under the “developed” category. A small amount is also in upland forest areas.

Source: Oregon Gap Analysis Program; Bowen 1978.

The next period of interest is from 1965 to 1994. During this time the Willamette Valley underwent rapid growth. The population nearly doubled. Land was being converted to urbanization and development. In the Willamette Valley between 1965 and 1994, 85,000 acres or 1% of the total Valley area changed to urban uses (Table 3).

In the 1960s, as Oregon grew rapidly, Governor Tom McCall brought greater attention to land use issues (Neal 1977:196-203). In 1969 under the leadership of McCall and State Senator Hector McPhearson, the Oregon Legislature passed Senate Bill 10, and later SB 100, which mandated and implemented land use planning for all cities and counties. If cities and counties failed to complete land use plans, the State Land Conservation and Development Commission would do it for them. One of the features of land use planning was an effort to concentrate urban growth within urban growth boundaries (UGBs), using up vacant lands within the UGBs before expanding growth onto productive farmland.

A major study conducted at the time provides a baseline upon which to make comparisons of changes over the last 30 years (Willamette Basin Task Force [WBTF] 1969). Comparing WBTF data for 1965 (Table 3), forested lands have remained constant in size, but have been subject to more restrictions on harvest (OFRI 2000:5). By 1994, a third of the forest lands had some form of harvest restriction. These harvest restrictions are for the purpose of protecting biodiversity, water quality, and ecosystem

processes. The restrictions also reduce sedimentation from logging roads, improve flood protection, and restore habitats for salmon.

Table 3. Willamette Valley land-use percentages showing growth of urban and suburban land use and declining agricultural land area.

Land Use	1965 (%)	1981 (%)	1994 (%)
Urban/Suburban	4.6	5.1	5.6
Ag & Rural Residential	24.8	22.8	22.5
Forest	70.6	72.1	71.9
Total	100.0	100.0	100.0

Source: WBTF (1969); Bernert et al. 1999

Urban and suburban development has taken relatively little land--1% of Willamette Valley land was converted to urban uses since the mid-1960s (Table 3). The total amount of land in forest use has remained constant since 1965. In 1965 less 1% of the forest lands had harvest restrictions on them. By 1994, lands with restricted uses were up to one third of the forest lands. This does not mean that no harvest occurs in these areas, but there are restrictions for riparian buffers, wilderness designation, and protection of critical habitats.

Urban development spread mainly onto farmlands. Even so, 2.3% of the Valley lands, about ten percent of the farmlands were lost to development. During this period, farmlands, like forests, did not remain constant. Higher valued, mainly export oriented, nursery, fruit, nut, wine, and grass seed crops were planted.

Oregon land-use planning objectives seek to increase the density of urban and suburban areas in order to preserve farm and forest lands. Table 4 shows how density in Oregon increases with urbanization. Urbanization, however, takes relatively little land in terms of overall acreage. Developed lands represent only 2% of Oregon's land mass. Between 1982 and 1992, 88,900 acres of Oregon farmland were converted to urban uses (U.S. Soil Conservation Service 1994). This is 0.14% of the total area of the State and 2% of the State's cropland.

Table 4. Oregon, Willamette Valley, Metropolitan Portland Urban Growth Boundary, and Portland City land use and density patterns in 1997.

Land Use	Oregon	Willamette Valley	UGB	Portland
Develop (%)	2	6	66	100
Agri (%)	24	29	30	0
Forest (%)	69	65	4	1
Population	3,217,000	2,251,900	1,209,589	508,500
Total (acres)	62,161,000	7,347,000	234,000	92,734
Density Pop/ac	0.05	0.30	5.10	5.48

Source: USDA 1999. Federal lands included as forest. Population data from Portland State University, Center for Population Research and Census.

One of Oregon's land-use planning objectives is to contain population growth to urban areas. While UGBs have been in effect for 20 years, they are only beginning to have their intended effects. Looking at the change in density within the metropolitan Portland UGB from 1979 to 1997 (Table 5) and projected to 2017 suggests that the Portland metro area UGB will contain more urban residents within its area, reducing sprawl and preserving farmland. While the objective is to increase the concentration of people within urban areas, they still depend on lands outside these areas for food, fiber, building materials, and recreation opportunities. Burke (2000), using footprint analysis, calculated that the agricultural area within the Willamette Valley would be sufficient to support the current population of the Valley without importing food from outside.

The ability for self-sufficiency is only one aspect. The imports and exports of the Willamette Valley need to be studied to evaluate whether Valley residents are exporting their problems to other areas. For example, garbage from the Portland metropolitan area is exported out of the valley. Electric power is imported. We do not evaluate the balance of inputs and outputs.

To see if the urban growth boundary concept is working, we compare Oregon's experience with other areas. Table 6 uses recently released data from the 1997 National Resources Inventory (USDA 1999). The first column shows that of the six states listed here, Oregon has the least percentage increase in developed lands from 1982 to 1997. It also has relatively low density on developed land

when compared with California, Pennsylvania, Virginia, and Washington. Pennsylvania is especially problematical, as developed land grew over 50% while the population increased just over 1%. Population in Washington and California grew most rapidly, with gains of over 30%. Sprawl is a problem in all cases. None of the five states increased the density of developed areas from 1982 to 1997. California, Washington, and Oregon did best at holding the rate of sprawl down, but sprawl continued and Oregon did not perform any better than California or Washington.

Table 5. Portland Metro Region urban growth boundary giving population, area, and density.

Metro	1979	1997	2017
Population	977,891	1,186,063	1,628,600
Area (acres)	232,670	232,670	251,249
Density (pop/ac)	4.2	5.1	6.5

Source: U.S. Bureau of the Census; Metro Regional Services 2000.

Table 6. Comparison of population density per developed acre 1982 and 1997 shows less density with development.

State	Percent Increase Developed 1982-1997	Pop/Devel-oped Acre 1982	Pop/Devel-oped Acre 1997	Percent Change in Density/Dev 1982-1997
California	35.7	5.9	5.7	-3.8
Oregon	32.1	2.7	2.5	-8.0
Pennsylvania	55.9	4.3	2.8	-35.1
Virginia	48.9	2.9	2.4	-17.6
Washington	40.5	2.7	2.5	-6.7
United States	39.5	3.1	2.5	-17.2

Source: USDA 1999.

The problem of sprawl is troubling. However, one mitigating factor is that household size in the United States is decreasing. In 1970, average U.S. household size was 3.14 persons (U.S. Bureau of the Census 1999). By 1997 it was 2.65 persons. This is a 19% decline, which could account for some of the density decline in developed areas. However, larger house sizes in suburban areas, and large segments of urban areas that have been abandoned due to obsolete housing stocks, both promote sprawl.

Land-use planning is a relatively blunt tool to contain urban and suburban development. We have looked only generally at changes in Oregon's Willamette Valley acreages that are

forested, farmed, and developed. Many other environmental amenities are important. One of these is wetlands. Table 7 shows the change in each wetland type between 1981 and 1994. Only 0.6% of the wetland area was lost, but two of the most important and dominant wetland types—forested and marsh—continued to show declines.

Table 7. Table showing change by type of wetland from 1981 to 1994.

Type	1981 acres	1994 acres	Acres gained or (lost)	Percent of net gain or (loss)
<b>Ponds</b>	9,896	10,134	238	9
<b>Farmed</b>	73,871	73,893	22	1
<b>Riverine</b>	91,385	91,416	31	1
<b>Scrub</b>	16,299	16,178	(121)	(4)
<b>Forested</b>	91,301	90,310	(991)	(36)
<b>Marsh</b>	79,250	77,379	(1,871)	(68)
<b>Aquatic</b>	2,145	2,133	(12)	(0)
<b>Shallow</b>	183	136	(47)	(2)
<b>Reservoirs</b>	78,593	78,593	0	0
<b>Total</b>	442,922	440,171	(2,751)	0.6

Source: Bernert et al. 1999.

While forest harvests are more restricted and farmland is protected, wetlands are still being lost. The area of the 1850 Willamette Valley considered prairie and riparian (Table 2) was primarily winter wetlands that became dry prairies during the summer. These lands had been burned by the Kalapuya Indians to keep the area clear for game and camas, two of their most important foods. Between 1981 and 1994, a net of 2,751 acres of wetland was lost, mostly due to expanding farms. In 1994, wetlands represented 6% of the valley lands. While there were some wetland gains, they were mainly in the form of farm ponds. Although ponds are very popular with rural residential landowners, they are often stocked and planted with nonnative species and do not serve the same ecological purposes as other types of wetlands. Land-use planning laws attempt to protect farms from urban development. Wetland protection and mitigation programs are designed to protect wetlands from the expansion of farm and urban development.

#### 4. CONCLUSION

Public support can be thought of as cultural capital—the commitment people have for a particular action. This cultural capital is reflected in the landscape. The things people value get accumulated into assets like forests that produce biodiversity, clean water, fish habitat, flood protection, and timber.

Reviewing conditions in the Willamette Valley shows that the forested uplands have been retained in forest use. Current forest practice rules have reduced harvests and restricted about one third of forest lands, giving greater attention to uses other than harvest. Land-use planning laws try to protect forest and farm land from development. While only a small amount of agricultural land has been lost, sprawl has been the pattern over the last 15 years. Oregon's urban growth boundary experiment is just beginning to have an impact; the next 20 years will provide the test. Will the predicted growth be contained within urban growth boundaries?

Even with urban growth boundaries, other natural assets, such as wetlands, are still being lost. Further, when wetland areas are added, they often do not provide the natural services that people desire. Pressure for sustainability in forest lands has been greatest. Farmlands are being protected, but urban areas are expanding. Developed areas, which house the most people, require farm and forest lands to support those populations. Further, the Willamette Valley could be exporting many of its environmental problems by its inputs and outputs with other areas.

If, as many people believe, protecting forest and farm lands by constraining urban development will lead to future sustainability, then the many microbehaviors stimulated by cultural capital that emphasize a resource protection and restoration ethic add up to macroresults on the landscape. The big test will come as increasing urban densities put pressure on urban growth boundaries. If growth cannot be contained within urban growth boundaries, then the path toward improving sustainability will not continue.

#### 5. ACKNOWLEDGMENTS

Research for this paper was supported, in part, by the Environmental Protection Agency (EPA)/National Science Foundation (NSF) Partnership for Environmental Research Water and Watersheds, grant number 98-NCERQA-M1. This research does not reflect the opinions or policies of the EPA, NSF, or reviewers.

#### 6. REFERENCES

- Bernert, Joseph A., Joseph M. Eilers, Benn J. Eilers, Elaine Blok, Steven G. Daggett, and Kenneth F. Bierly. Recent wetlands trends (1981/82-1994) in the Willamette Valley, Oregon, USA, *Wetlands*, 19, 545-559, 1999.
- Bowen, William A. *The Willamette Valley: Migration and Settlement on the Oregon Frontier*. Seattle, WA: University of Washington Press, 1978.

- Brunson, Mark W. and Brent S. Steel, National public attitudes toward federal rangeland management. *Rangelands* 16, 77-81, 1994.
- Burke, Erik, *Historical Land-Use Change and Agricultural Production in the Marys River Basin, Oregon*. Masters Thesis, Department of Anthropology, Oregon State University, Corvallis, 2000.
- Costanza, R., R. d'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, S. Naeem, K. Limburg, J. Paruelo, R.V. O'Neill, R. Raskin, P. Sutton, and M. van den Belt, The value of the world's ecosystem services and natural capital, *Nature* 387, 253-260, 1997.
- Costanza, R., and H.E. Daly, Natural capital and sustainable development, *Conservation Biology*, 6, 37-46, 1992.
- Daly, Herman E. and John B. Cobb, *For the Common Good: Redirecting the Economy Toward Community, the Environment, and a Sustainable Future*. Boston, MA: Beacon Press, 1989.
- Dunlap, Riley E, The environmental movement at 30, in *The Polling Report*, 16(8), 1, 6-8, 2000.
- Dunlap, Riley E, and A. Mertig, The evolution of the US environmental movement from 1970 to 1990: an overview, in *American Environmentalism*, R.E. Dunlap and A. Mertig, eds. Philadelphia, PA: Taylor & Francis, 1-10, 1992.
- Ervin, D.E., and R.P. Berrens, *Critical Economic Issues in Ecosystem Management*. Corvallis, OR: Department of Agricultural and Resource Economics, Oregon State University, 1993.
- FEMAT (Forest Ecosystem Management Assessment Team), *Forest Ecosystem Management: An Ecological, Economic and Social Assessment*. USDA Forest Service; USDC National Oceanic and Atmospheric Administration, National Marine Fisheries Service; USDI Bureau of Land Management, Fish and Wildlife Service, National Park Service; Environmental Protection Agency, 1993.
- Folke, C., M. Hammer, R. Costanza, and A. Jansson. Investing in natural capital—why, what, and how? In *Investing in Natural Capital*, A. Jansson, C. Folke, and R. Costanza, eds. Washington, DC: Island Press, 1-20, 1994.
- Governor's Natural Resource Office, *The Governor's Coastal Salmon Restoration Initiative*. Salem, OR: The Governor's Natural Resource Office, 255 Capitol Street N.E.; <http://www.oregon-plan.org/>, 1997.
- Habron, Geoffrey, *Community-Based Adaptive Watershed Management*, Ph.D. Dissertation, Department of Fisheries and Wildlife, Oregon State University, Corvallis, OR, 1999.
- Hammond, Bruce, *Forest Service Values Poll Questions: Results and Analysis*, Washington, D.C., Kaset International, 1994.
- Loomis, John B., and Douglas S. White, Economic benefits of rare and endangered species: summary and meta-analysis, in *Ecological Economics*, 18(3), 197-206, 1996.
- Metro Regional Services, 1999, *Metro Regional Data Book*, Portland OR, 2000.
- Miringoff, Marc and Marque-Lusia Miringoff, *The Social Health of the Nation: How America Is Really Doing*, Oxford University Press, New York, NY, 1999.
- NORC (National Opinion Research Center), General Social Survey, Trend Table NATENVIR, [www.icpsr.umich.edu/GSS99/trend/natenvir.htm](http://www.icpsr.umich.edu/GSS99/trend/natenvir.htm) (July 13, 2000), 1999.
- Neal, Steve, *Tom McCall: Maverick*, Portland, OR: Binford and Mort, 1977.
- Olsen, M.E., D.B. Lodwick, and R. E. Dunlap. *Viewing the World Ecologically*. Boulder, CO: Westview Press.
- Oregon Department of Administrative Services, Office of Economic Analysis, *Oregon Economic and Revenue Forecast*, 18(4), 1998.
- Oregon Department of Environmental Quality, *Summary: Facts Sheets and Information on the 1998 Lists of Water Quality Limited Waterbodies*. Portland, OR, 1998.
- OFRI (Oregon Forest Resources Institute), *Forest Fact Book*, Portland, OR, 1999.
- OFRI (Oregon Forest Resources Institute), *Toward Sustainable Forestry*, Portland, OR, 2000.
- Oregon Progress Board, *Oregon Bench Marks: Data Directory*, Salem, OR, 1997.
- Oregon Progress Board. *The Oregon Plan for Salmon and Watersheds: Summary Progress Report*, Salem, OR: [www.oregon-plan.org/progress/](http://www.oregon-plan.org/progress/), 1998.
- PFMC (Pacific Fishery Management Council), Salmon Technical Team and Staff Economist, *Review of 1997 Ocean Salmon Fisheries*, Portland, OR: Pacific Fishery Management Council, 1998.
- PNERC (Pacific Northwest Ecosystem Research Consortium), *Willamette River Basin: a Planning Atlas*. Eugene, OR: 1999.
- Pearce, D.W., *Economic Values and the Natural World*. Cambridge, MA: The MIT Press, 1993.
- Shindler, Bruce, Peter List, and Brent Steel, Managing federal forests: public attitudes in Oregon and nationwide, in *Journal of Forestry*, 91(7), 36-42, 1993.
- Shindler, Bruce, Brent Steel, and Peter List, Public judgments of adaptive management: a response from forest communities, *Journal of Forestry* 94(4), 4-12, 1996.
- Smith, C.L., J.D. Gilden, J. S. Cone, and B. S. Steel, Contrasting Views of Coastal Residents and Coastal Coho Restoration Planners, in *Fisheries*, 22(12), 8-15, 1997.



- Smith, C.L. and B. S. Steel, Values in Valuing Salmon, in *Pacific Salmon and Their Ecosystems: Status and Future Options*, Deanna J. Stouder, Peter A. Bisson, and Robert J. Naiman, eds. New York, NY: Chapman & Hall, 599-616, 1997.
- Smith, C.L., B. S. Steel, P. C. List, and S. Cordray, Making forest policy: integrating GIS, in *Journal of Forestry*, 93(5), 31-36, 1995.
- Solow, R.M., *Sustainability: an Economist's Perspective*, J. Seward Johnson Lecture, Woods Hole, MA: Woods Hole Oceanographic Institution, Marine Policy Center, 1991.
- Solow, R.M., *An Almost Practical Step Toward Sustainability*, Washington, DC: Resources for the Future 40<sup>th</sup> Anniversary Lecture, 1992.
- Steel, Brent, Peter List, and Bruce Shindler, Conflicting values about federal forests: a comparison of national and Oregon publics, in *Society and Natural Resources*, 7, 137-153, 1994.
- Sustainable Portland Commission, *Workshop on Household Attitudes and Behavior*, Portland, OR, 1999.
- Tockhammer, Engelbert, Harald Hochreiter, Bernard Obermayr, and Klaus Steiner, The index of sustainable economic welfare (ISEW) as an alternate to GDP in measuring economic welfare: the results of the Austrian (revised) ISEW calculation 1955-1992, in *Ecological Economics*, 21, 19-34, 1997.
- UNDP (United Nations Development Programme), *Human Development Report 1999*, Oxford University Press, New York, NY, 1999.
- U.S. Bureau of the Census, *Statistical Abstract of the United States: 1999 (120<sup>th</sup> Edition)*, Washington, D.C., 1999.
- USDA (U.S. Department of Agriculture. Natural Resources Conservation Service), *Summary Report 1997 National Resources Inventory* [www.nhq.nrcs.usda.gov/NRI/1997/summary\\_report/report.pdf](http://www.nhq.nrcs.usda.gov/NRI/1997/summary_report/report.pdf), 1999.
- USDA (U.S. Department of Agriculture, Soil Conservation Service), *Natural Resource Inventory*, unpublished, 1994.
- WBTF (Willamette Basin Task Force), *Comprehensive Study of Water and Related Land Resources*, Pacific Northwest River Basins Commission, Vancouver, WA, 1969.
- WDFW (Washington Department of Fish and Wildlife), *Washington Department of Fish and Wildlife Opinion Survey*, Olympia, WA, 1997.
- Whitelaw, W. Ed, *The Columbia River and the Economy of the Pacific Northwest*, Portland, OR: Lewis & Clark Law School Water Law Project and the Sierra Club Legal Defense Fund, 1995.