THE POLITICAL ECONOMY OF WATERSHED RESTORATION SERIES 2009

Economic Benefits of Watershed Restoration

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IN CONJUNCTION WITH THE NATIONAL FOREST RESTORATION COLLABORATIVE

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Acknowledgements

Funding to develop and produce this report was provided by the Ford Foundation (through a grant to the National Forest Restoration Collaborative) and the Page and Cinnabar Foundations (through grants to Wildlands CPR). Joe Kerkvliet, Thomas Power, and Bethanie Walder all provided important feedback on this report. Any remaining errors or lack of clarity are the sole responsibility of the author.

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Project Partners

The National Forest Restoration Collaborative is comprised of environmental and community-based forestry groups dedicated to providing national leadership to advance comprehensive forest and watershed restoration that is ecologically sound and benefits rural communities.

Wildlands CPR revives and protects wild places by promoting watershed restoration to improve fish and wildlife habitat, provide clean water and enhance community economies. We focus on reclaiming ecologically damaging, unneeded roads and on stopping off-road vehicle abuse.

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Cite this report as:
Hurd, Josh. 2009. Economic Benefits of Watershed Restoration. In *The Political Economy of Watershed Restoration Series*. Missoula, MT: Wildlands CPR.

This report is also available online at:
http://www.wildlandscpr.org/politicaleconomy/economics

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Abstract

The primary economic difficulty that watershed restoration faces is that there are relatively few markets for its products. In economic-speak, this is a market failure in the provision of watershed restoration. Because of this market failure, collective action, often in the form of government intervention, usually occurs in order to pay for restoration activities. Many government programs, and society at large, typically require the benefits of an activity to outweigh its costs. Thus it is important to quantify the economic benefits arising from watershed restoration. Measured by damage caused, willingness to pay, political referenda, averted expenditures, travel costs incurred, and changes in housing values, researchers consistently conclude that watershed restoration has significant economic benefits. Watershed restoration projects have other economic impacts as well, directly and indirectly employing many people, and potentially contributing to the long-term viability and growth of communities. However, restoration advocates face hurdles in justifying restoration on economic grounds due to the vague nature of nonmarket valuation, long timescales required for achieving a positive return on investment in certain restoration projects, and unknown incremental benefits of watershed restoration in increasing the natural amenity qualities of communities.

People often misunderstand watershed restoration as an activity with no product. This misunderstanding is predictable given the complex economic nature of restoration. Therefore, it is critical to understand both how restoration fits within an economic framework and the general economic benefits arising from restoration. This report first explains this framework, then describes the various types of quantitative and qualitative benefits of watershed restoration, and concludes with a discussion of the applicability of these results.

An Economic Framework for Watershed Restoration

Within the economic framework of the United States, healthy watersheds are a public good. Everything else builds on this foundation. Public goods have two defining characteristics. First, nobody can exclude others from their benefits. Second, additional people utilizing

Little incentive exists for individuals to restore watersheds on their own, because no single person reaps all the rewards or bears all the costs

public goods cannot diminish the utility of others.[1] A healthy watershed qualifies on both counts. These two characteristics make it difficult for public goods to be bought and sold on the open market.[2] This is both an asset and a liability to watershed restoration. The benefits of restoration accrue to all people inhabiting a watershed. However, little incentive exists for individuals to restore watersheds on their own, because no single person reaps all the rewards, though they could bear all the costs. In this case, the individual self-interest that guides economic markets in the United States leads to outcomes that can harm society. In economic-speak, this is a market failure. Market failures prevent the goods and services arising from watershed restoration from being bought and sold in traditional economic markets.[3] Market failures are what cause people to misunderstand watershed restoration as an activity with no product. It is not that watershed restoration has no product. Healthy

It is not that watershed restoration has no product; rather, no market exists for the products that watershed restoration produces

watersheds produce clear streams (and associated clean drinking water), healthy aquatic and terrestrial wildlife, and thriving forests (that among other things sequester carbon). Rather, few traditional markets exist for the products that watershed restoration produces. This usually forces collective action—such as government intervention—to provide for the societal demands for the public good.[4]

Public goods and market failures exist in many other public realms as well. For example, governments intervene in the provision of fire protection and street lighting, both of which are public goods. Fire protection provides important services to communities, as people value firefighting and the availability of that service. However, individuals do not provide fire protection on their own; no market for it exists—thus a market failure. Because of this, people come together, usually through government, to form fire protection services.

Government also intervenes in the provision of street lighting. Individuals left to their self-interest do not provide street lighting in public areas. If someone did, he could not exclude others from utilizing the light emitted from the lamp, as the services of the lamp benefit all, and thus he would have no way to benefit monetarily for providing the lighting. Therefore, a market failure exists. Private business does not provide for the optimal societal levels of street lighting because there is no profit motive.

The same holds true for watershed restoration. Private en-

[1] Callan, Scott J., and Janet M. Thomas. 2004. Environmental Economics and Management: Theory, Policy, and Applications. 3rd ed. Mason: Thomson South-Western.

[2] Many goods and services arising from healthy watersheds are technically impure public goods. For example, watersheds are tied to specific locations, therefore certain people benefit from their existence more than others. Also, water rights throughout the United States are highly privatized, so that even if a restored watershed improved water quality, people could be prevented from deriving utility from it.

[3] Ibid.

[4] Ostrom, Elinor. 1991. Governing the Commons: The Evolution of Institutions for Collective Action. Cambridge: Cambridge University Press. It should also be noted that creating property rights could solve the problem of market failures. However, due to the limited number of places where this could feasibly happen, and the political and societal difficulties in privatizing traditionally public goods and services, this option is not explored here.

terprise does not provide for healthy watersheds, despite the societal demand for the benefits accruing from them. This necessitates collective action, often in the form of government intervention. However, the public does not always recognize the importance of the environmental goods and services provided by healthy watersheds.[5] Without this recognition, collective action and government mobilization become much more difficult.[6]

Economic Valuation in the Public Realm

Many government programs and regulations undergo benefit-cost analysis (BCA) in order to optimize efficiency. Presidents Ronald Reagan, Bill Clinton, and George W. Bush have all issued executive orders supporting the use of BCA in federal decision-making.[7] These orders layout general BCA principles, such as that the government must prove the need for and consequences of proposed actions, and that only when the potential benefits to society outweigh the potential costs can it undertake proposed actions.[8] The Obama administration has yet to issue a formal statement on BCA, but it is most likely that BCA's use will continue.[9]

Given the importance of benefit-cost analysis, full recognition of the economic benefits associated with restoration is pivotal

Thus far, the government, environmental organizations, and the private sector have failed to adequately quantify the economic benefits associated with watershed restoration, and the trends that these numbers would reveal.[10] Because of this, BCA could undervalue the benefits, and the public could misunderstand the general societal worth of watershed restoration. This report attempts to quantify some incremental economic benefits arising from watershed restoration, so that stakeholders in the restoration process are adequately prepared to converse about the economic aspects of restoration activities.

The relevant type of economic value is the incremental economic gain brought about by restoration, not the entire value of a healthy watershed.[11] It is not the entire value of the watershed that is important. Rather, what matters is the difference in value of the watershed before and after restoration. Because of the inherent nature of public goods, few direct measures exist to quantify these incremental benefits. Despite this, social scientists have devised numerous ways to ascertain approximate values through nonmarket valuation, which uses statistical methods to assess the value of goods that are not traded on markets. This report analyzes three general areas of watershed valuation: physical linkages that directly connect watershed health to economic markets, behavioral linkages that estimate economic gain based on observed or hypothetical human actions, and indirect economic impacts that arise from restoration, such as community growth or employment changes. As a note, because economic studies from multiple different years were used in this report, all monetary figures have been converted to 2008 United States Dollars.

It is the incremental economic gain brought about by restoration that is important, not the entire value of a healthy watershed

Damage Function Model[12]

The United States contains numerous damaged watersheds. For many of these, private and public parties must spend money to deal with the damage. The damage function model is an economic technique that quantifies the worth of potential improvements in environmental health by analyzing the economic damages caused in

[5] Cowling, R. M., S. M. Pierce, and A. M. Wigwela. 2007. Mainstreaming the Restoration of Natural Capital: A Conceptual and Operational Framework. In Restoring Natural Capital: Science, Business, and Practice, edited by J. Aronson, S. J. Milton and J. N. Blignaut. Washington DC: Island Press.

[6] Callan, Scott J., and Janet M. Thomas. 2004. Environmental Economics and Management: Theory, Policy, and Applications. 3rd ed. Mason: Thomson South-Western.

[7] Bush, George W. 2007. Executive Order 13422, Clinton, Bill. 1993. Executive Order 12866, Reagan, Ronald. 1981. Executive Order 12291.

[8] Reagan, Ronald. 1981. Executive Order 12291.

[9] Hamburger, Tom and Christi Parsons. 2009. Obama's Nominee for Regulatory Czar Faces Scrutiny. Los Angeles Times, January 26, 2009.

[10] Holl, Karen D., and Richard B. Howarth. 2000. Paying for Restoration. Restoration Ecology 8:260-267.

[11] Callan, Scott J., and Janet M. Thomas. 2004. Environmental Economics and Management: Theory, Policy, and Applications. 3rd ed. Mason: Thomson South-Western.

[12] This classification schema is based on the following work: Smith, Kerry V., and John V. Krutilla. 1982. Explorations in Natural Resource Economics. Baltimore: John Hopkins University Press.

similar and already-degraded ecosystems.[13] By quantifying the damage already borne on society from degraded watersheds, researchers can find certain monetary values for restored watersheds.

A variety of damage function research relevant to watershed restoration exist. For example, each year during spring runoff, unpaved forest roads contribute 520,080 to 681,200 tons of sediment to North Carolina's Little Tennessee River basin.[14] Municipalities in the area pay $2.76 per ton to manually remove sediment from the river, with per annum costs of $1,430,000 to $1,880,000.[15] In Trinity, California, removing sediment through specially designed collection ponds costs $29.80 per ton.[16] This equates to sedimentation costs of $29,227 to $315,570 per mile, based on removal costs of $2.76 per ton and $29.80 per ton, respectively.[17] This compares to average complete road removal costs of $8,775 to $11,700 per mile.[18] In most cases, removing roads is less expensive than cleaning up the sedimentation that they can cause. On the whole, erosion and sedimentation costs the U.S. economy approximately $63 billion per year, mostly from farms and rangelands.[19]

By quantifying the damage already borne on society by degraded watersheds, researchers can find certain values of watershed restoration

Fisheries are similarly impacted. The Canadian economy loses between $824,000 and $4,360,000 per year because of declining fishing, recreation, and tourism industries from degraded Coho salmon habitat.[20]

Mine reclamation provides an opportunity for economic gain through restoration, with the Eagle Mine in the Colorado Rockies providing one example. It causes damages estimated at $44,340,270 each year due to decreased property values and lost economic opportunities.[21] Of course, there are many economic benefits of the Eagle Mine. However, a full cost-benefit analysis is beyond the scope of this paper.

Not all damage function model research yields such supportive results, although it is important to note that damage function models only measure a narrow range of benefits. Occasionally, restoration-averted damage yields fewer measured benefits than the overall cost of restoration, such as the case with seagrass restoration in Chesapeake Bay.[22] Similarly, the measured societal benefits of fauna biodiversity in southern and western U.S. private timberlands is often less than the decreased revenue that the private landowners would receive due to decreased timber harvests.[23] Other times, the timeframe involved until the benefits of restoration outweigh the costs can be long, such as eliminating the tamarisk—a water-sucking invasive shrub—from the American southwest taking 17 years to pay off.[24] However, oftentimes the

People value many goods and services for more than they are worth in their monetary price alone

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[13] Callan, Scott J., and Janet M. Thomas. 2004. Environmental Economics and Management: Theory, Policy, and Applications. 3rd ed. Mason: Thomson South-Western.

[14] Niemi, E., and E. Whitelaw. 1997. Assessing Economic Tradeoffs in Forest Management. Washington, DC: USDA General Technical Report PNW-GTR-403 97-019.

[15] Niemi, E., and E. Whitelaw. 1997. Assessing Economic Tradeoffs in Forest Management. Washington, DC: USDA General Technical Report PNW-GTR-403 97-019.

[16] Center for Environmental Economic Development. 2003. Reinvestment in Jobs, Communities and Forests: The Benefits and Costs of a National Program for Road Removal on U.S. Forest Service Lands, a Preliminary Analysis. Missoula, MT: Wildlands CPR.

[17] Sack, Dorothy, and Silvino Da Luz. 2003. Sediment Flux and Compaction Trends on Off-Road Vehicle (Orv) and Other Trails in an Appalachian Forest Setting. Physical Geography 24 (6):536-554, Webb, Robert H., H. Craig Ragland, William H. Godwin, and Oennis Jenkins. 1978. Environmental Effects of Soil Property Changes with Off-Road Vehicle Use. Environmental Management 2 (3):219-233, Wilshire, Howard G., Susan Shipley, and John K. Nakata. 1978. Impacts of Off-Road Vehicles on Vegetation. Paper read at 43rd North American Wildlife and Natural Resources Conference. Conversion based on forest service road width of 23ft.

[18] Bagley, Scott. 1998. The Road Ripper's Guide to Wildland Road Removal. Missoula, MT: Wildlands CPR.

[19] Pimentel, David, C. Harvey, P. Resosudarmo, K. Sinclair, D. Kurz, and M. Mcnair. 1995. Environmental and Economic Costs of Soil Erosion and Conservation Benefits. Science 267 (5201):1117.

[20] Knowler, Duncan J., Brice W. Macgregor, Michael J. Bradford, and Randall M. Peterman. 2003. Valuing Freshwater Salmon Habitat on the West Coast of Canada. Journal of Environmental Management 69 (3):261.

[21] Rowe, Robert D., and William D. Schulze. 1987. Natural Resource Damages in the Colorado Mountains: The Case of the Eagle Mine. In AERE Session on Assessment of Natural Resource Damages Under CERCLA.

[22] Anderson, Eric E. 1989. Economic Benefits of Habitat Restoration: Seagrass and the Virginia Hard-Shell Blue Crab Fishery. North American Journal of Fisheries Management 9 (2):140-149, Hassett, Brooke, Margaret Palmer, Emily Bernhardt, Sean Smith, Jamie Carr, and David Hart. 2005. Restoring Watersheds Project by Project: Trends in Chesapeake Bay Tributary Restoration. Frontiers in Ecology and the Environment 3 (5):259-267.

[23] Alavalapati, J. R. R., G. A. Stainback, and D. R. Carter. 2002. Restoration of the Longleaf Pine Ecosystem on Private Lands in the Us South: An Ecological Economic Analysis. Ecological Economics 40:411-419, Dole, D. 1999. Implicit Valuation of Non-Market Benefits in Even-Aged Forest Management. Environmental and Resource Economics 13:95-105.

[24] Zavaleta, Erika. 2000. The Economic Value of Controlling an Invasive Shrub. AMBIO: A Journal of the Human Environment 29 (8):462-467.

Authors	Year	Who	What	Amount	Measurement
Crandall, K.B.	1991	Visitors of Hassayampa River Preserve, Arizona	Non-consumptive benefits of restoration of the streamside area of HRP to higher streamflow	$104.95	WTP for restoration project
Mannesto, Gregory; Loomis, John B.	1991	Boaters and anglers in Sacramento-San Joaquin Delta, California	WTP for current versus improved wetland situations	$76.91	WTP for improved wetland situation
Crandall, Kristine B.; Colby, Bonnie G.; Rait, Ken A.;	1992	Arizona residents visiting Hassayampa River Preserve in Arizona	Value of instream flow and recreation in riparian area	$100.34	WTP for improvement in instream flow from inadequate to adequate
Powell, John R.; Allee, David J.; McClintock, Charles	1994	Households within 12 rural communities in New York, Pennsylvania, and Massachusetts	WTP for implementation of water supply protection programs to increase groundwater protection	$89.95	WTP for increased groundwater protection
De Zoysa, A.D.N.;	1995	Households within Maumee River and Western Lake Erie basins, Ohio	Improve surface water and groundwater quality and preserve wetlands	$111.38	WTP for improved water quality
Loomis, J.B.	1996	Residents of Clallam County, Washington State	Non-market economic value for restoring Elwha River and its fisheries	$91.10	WTP for restoration
Poor, J.	1997	Nebraska households	Acquisition and management program for wetlands in Rainwater Basin Wetland Region	$4.53	WTP for acquisition and management program
Loomis et al.	1999	Homeowners along Platte River, Colorado	Restoration of 45 mile section of Platte River	$327.60	WTP for river restoration
Lichtkoppler, F.R.; Blaine, T.W.	1999	Households in Ashtabula County, Ohio	Dredging and disposal of contaminated sediments from Ashtabula River and Harbor	$48.75	WTP for decreased contaminents and sediments in river
Lindsey, G.; Knapp, G.;	1999	Property owners, renters, and county residents in Indianapolis, Indiana	Projects to improve quality of creek within city greenway	$8.55	WTP for improved creek quality
Farber and Griner	2000	Homeowners in Western Pennsylvania	Restoration of two creeks	$113.16	WTP for restoration of creeks
Georgiou, S.; Bateman, I.; Cole, M.; Hadley, D.;	2000	Local residents in Birmingham, UK	Water quality improvements in the river with both biodiversity and recreational opportunities on River Tame	$25.88	WTP for proposed water quality improvements
Egan, K.J.; Herriges, J.A.; Kling, C.L.; Downing, J.A.	2004	Iowa residents	Recreational value for restoring water quality in lakes	$239.25	WTP for restoration of all 128 lakes in study area to a pristine state
Banzhaf, S.; Burtraw, D.; Evans, D.; Krupnick, A.;	2004	New York State residents	Improvements in environmental quality as result of policy change for Adirondack Park, NY	$118.66	WTP for ecological improvements
Collins et al.	2005	Homeowners around Deckers Creek, West Virginia	Restoration of Deckers Creek	$186.24	WTP for creek restoration

Table 1: Summary of Contingent Valuation Method studies on wetland and creek restoration, or pollution abatement

specific measurement of environmental benefit, such as the economic gain of Chesapeake seagrass restoration to the blue crab fishery, does not account for other types of benefits, such as societal values for a healthier Chesapeake Bay. In these cases, the narrow range of benefits should not be viewed as total benefit. Many of the types of benefits not taken into account are non-use values, such as when people value a clean and healthy watershed for its existence. The contingent valuation method is a way to take these values into account.

Anglers consistently had a higher willingness to pay for restoration programs than non-anglers; however, they at times were more concerned about catching fish than ensuring the ecological integrity of the ecosystem

Contingent Valuation Method

People often value goods and services more than they are worth by their monetary price alone. For example, a family may value their working farm much more than the farm's value as real estate. This particularly holds true for watersheds. In order to ascertain these nonmarket values, researchers often use the contingent valuation method (CVM). CVM measures this value by surveying people, usually those who live within the area of restoration activities, about how much they would be willing to pay for restoration. Researchers often measure this willingness to pay (WTP) as a hypothetical per annum figure payable by households. CVM studies relevant to watershed restoration generally track WTP for three types of environmental goods and services: water quality, terrestrial and aquatic wildlife populations, and forest health.

Water quality studies analyze household WTP for wetland and creek restoration and pollution abatement. The mean household annual WTP of the 15 studies analyzed was $110, with a range of $5 to $328 (Table 1). Different types of water quality yielded different results. One study found that WTP was higher for surface

Authors	Year	Who	What	Amount	Measurement
Olsen, Darryll; Richards, Jack; Scott, R. Douglas	1991	Residents within Columbia River Basin	Existence and sport values for doubling size of salmon and steelhead runs	$80.05	WTP per year for doubling of fishery size
Pate, J.; Loomis, J.	1997	Households in CA, WA, OR, NV	Improving chinook salmon fishery on San Joaquin River, California	$191.18	WTP for wetland improvement program
MacDonald, D.H.	1998	Households in La Ronge, Saskatchewan	Restoration options for the non-sacred trout fishery	$68.80	WTP for restricting commercial fishery to recover trout
Douglas, A.J.; Taylor, J.G.	1999	Recreationists and households along California's Trinity River	Augmenting instream flows of river	$207.49	WTP for lowest diversion alternative
Kotchen, M.J.; Reiling, S.D.;	2000	Maine households	Establishment of statewide species protection fund	$32.70	WTP for establishing fund
Garber-Yonts, B.; Kerkvliet, J.; Johnson, R.	2004	Oregonians	Biodiversity conservation programs on Oregon Coast Range	$270.40	WTP for conservation programs
Spash, C.L.; Urama, K.; Burton, R.; Kenyon, W.; Shannon, P.; Hill, G.;	2008	Residents of Tummel catchment in Scotland, UK	Biodiversity improvements in Tummel catchment	$10.83	WTP for biodiversity improvements

Table 2: Summary of Contingent Valuation Method studies on terrestrial and aquatic wildlife restoration

water quality than wetland or groundwater quality.[25] In another study, WTP was higher for full restoration of lake quality than for partial restoration, despite higher household costs.[26]

Terrestrial and aquatic wildlife population studies primarily analyze WTP for the protection of salmon and steelhead in the Pacific Northwest, although some analyze WTP for biodiversity and terrestrial animals as well. The mean household annual WTP of the seven studies analyzed was $123, with a range of $11 to $270 (Table 2). Many aspects of these studies are difficult to apply to actual watershed restoration. Household WTP for terrestrial animals varies depending on the species in question, which makes overall valuation of ecosystems difficult.[27] Also, anglers consistently had a higher WTP for restoration programs than non-anglers.[28] These anglers, however, at times were more concerned about catching fish than ensuring the ecological integrity of ecosystems.[29]

Fire and forest related CVM studies analyze WTP for forests with restored fire regimes. The mean household annual WTP of the three studies analyzed was $400, with a range of $184 to $751 (Table 3). This high amount is mostly caused by one study that questioned local homeowners on reductions in catastrophic fire threat through restoring natural fire regimes.[30] The other two studies analyzed household WTP for increased recreation demand in forests with natural fire regimes.[31]

Of the 25 CVM studies analyzed, the mean household annual WTP was $148, with a median of $105. The most important thing to understand from these studies is their assessment of how much people value incremental improvements in watershed health. However, it is difficult to translate the results from these studies into an overall value for ecosystems. A selection-bias exists in who chooses to respond to the surveys. Geographic distance from the area of restoration also affects people's WTP.[32] Applying results of geographically bound stud-

The value of these numbers lies in knowing about how much people value the incremental improvements in watershed health

[25] De Zoysa, A.D.N. 1995. A Benefit Evaluation of Programs to Enhance Groundwater Quality, Surface Water Quality and Wetland Habitat in Northwest Ohio, Ohio State University

[26] Egan, K.J., J.A. Herriges, C.L. Kling, and J.A. Downing. 2004. Recreation Demand Using Physical Measures of Water Quality. Faculty Series No. 04-Wp 372. Center for Agricultural and Rural Development, Iowa State University.

[27] Loomis, J. B., and D. S. White. 1996. Economic Benefits of Rare and Endangered Species: Summary and Meta-Analysis. Ecological Economics 18:197-206.

[28] Olsen, D , J Richards, and Rd Scott. 1991. Existence and Sport Values for Doubling the Size of Columbia River Basin Salmon and Steelhead Runs. Rivers 2 (1):44-56.

[29] Lupi, F., J.P. Hoehn, and G.C. Christie. 1995. Valuating Non-Indigenous Species Control and Native Species Restoration in Lake Huron. Ann Arbor: Great Lakes Fishery Commission, Boyle, K.J., M.F. Teisl, and S.D. Reiling. 1992. Qualitative and Economic Evaluations of Atlantic Salmon Fishing on the Penobscot River. Staff Paper No. 346. Department of Agricultural and Resource Economics, University of Maine.

[30] Kaval, P. 2004. Public Values for Restoring Natural Ecosystems: Investigation into Non-Market Values of Andromous Fish and Wildfire Management, Colorado State University.

[31] Englin, J., J. Loomis, Gonz, Aacute, Cab Lez, and A. N. 2001. The Dynamic Path of Recreational Values Following a Forest Fire: A Comparative Analysis of States in the Intermountain West. Canadian Journal of Forest Research 31:1837-1844, Jenkins, D. H., J. Sullivan, G. S. Amacher, N. S. Nicholas, and D. W. Reaves. 2002. Valuing High Altitude Spruce-Fir Forest Improvements: Importance of Forest Condition and Recreation Activity. Journal of Forest Economics 8:77-99.

[32] Pate, J., and J. Loomis. 1997. The Effect of Distance on Willingness to Pay Values: A Case Study of Wetlands and Salmon in California. Ecological Economics 20:199-207.

Authors	Year	Who	What	Amount	Measurement
Englin, J.; Loomis, J.; Gonzalez-Caban, A.	2001	Forest recreationists on national forests in Colorado, Idaho, and Wyoming	Recreation in naturally occuring fire-impacted landscape	$263.53	Consumer surplus for hiking trip in fire-impacted landscape
Jenkins, D.J.; Sullivan, J.; Amacher, G.S.	2002	Forest users in Southern Appalachians	Tree protection and conservation programs on high-altitude spruce-fir forests	$183.83	WTP per respondent for forest improvements
Kaval, P.	2004	People living near certain Colorado public forests	Restoration of natural fire regimes within ecosystems	$750.84	WTP for prescribed fire

Table 3: Summary of Contingent Valuation Method studies on forests with restored fire regimes

Year	Place	Item on Ballot	Amount	Measurement
1996	Nevada	Question 12	$33.13	One-time cost per housing unit for program
2002	Nevada	Proposal to Issue Bonds for Conservation and Resource Protection	$154.09	One-time cost per housing unit for program
2002	Oakland, California	Oakland Measure DD	$77.05	Per housing unit per year for restoration
2004	Rhode Island	Open Space, Recreation, Bay and Watershed Protection Bonds	$48.15	One-time cost per housing unit for program
2005	Pennsylvania	Growing Greener II	$127.53	One-time cost per housing unit for program
2006	Portland Metropolatin Area, Oregon	Metro Natural Areas Bond Measure 26-80	$53.71	Per housing unit per year cost in property taxes
2008	San Francisco, California	Clean and Safe Neighborhood Parks Bond	$123.00	One-time cost per housing unit for program

Table 4: Summary of political referenda on watershed restoration funding

ies to different states only occasionally works.[33] Furthermore, because of the geographic gradient of people's WTP for watershed restoration, when confined to one specific area CVM studies usually underestimate overall demand.[34] Even though generalizing CVM results is difficult, they still provide useful guides for overall trends in the perceived nonmarket values of watershed restoration. This usefulness lies not within the monetary value in and of itself, but rather in comparison to other valuations. This allows one to compare watershed restoration to other areas of importance to society, or one type of watershed restoration to another type. However, as shown in the next section, CVM valuation results can overestimate what people are actually willing to pay.

Political Referendum Model

The major hurdle for CVM studies is that they rely on hypothetical measurements of how much people value environmental goods and services. Those surveyed never actually pay the amount they declare that they would be willing to pay. However, comparing the CVM results to scenarios in which people actually pay for restoration puts them into perspective. One such method of comparison is through analysis of political referenda. Oftentimes, local and state governments put fundraising measures, such as general obligation bonds, in front of the public for approval. Occasionally, the public votes on measures to fund watershed restoration. By comparing these results to the CVM results, we can better understand the validity of the CVM numbers.

An analysis of nine political referenda that included watershed restoration projects yielded a mean household payment of $78, a median of $54, and a range of $33 to $154 (Table 4). This compares with a mean of $148, a median of $105, and a range of $5 to $751 for the CVM studies. In this analysis, the hypothetical CVM data consistently values WTP for watershed restoration about twice as much as do the actual political referenda data. This is to be expected, as when no real money is involved, people say that they are willing to pay more than they actually are.[35] However, complicating the results is the fact that people often do not know what exactly they are voting for nor how much they themselves would pay for increased governmental programs. Also, for many of the referenda included in this analysis, the

Hypothetical contingent valuation data can value willingness to pay for watershed restoration higher than political referenda

[33] Loomis, J.B., H.T. Le, and A. Bonzales-Caban. 2005. Testing Transferability of Willingness to Pay for Forest Fires Prevention among Three States of California, Florida and Montana. Journal of Forest Economics (11):123-140.

[34] Loomis, J.B. 2000. Vertically Summing Public Good Demand Curves: An Empirical Comparison of Economic Versus Political Jurisdictions. Land Economics 76 (2):312-321.

[35] Lindsey, Greg, and Gerrit Knaap. 1999. Willingness to Pay for Urban Greenway Projects. Journal of the American Planning Association 65 (3):297 - 313.

watershed restoration component was only one part of a larger initiative.[36] Peer-reviewed studies that have thoroughly analyzed how political referenda and election results compare to willingness-to-pay studies conclude that the two figures are roughly similar for environmental issues.[37] Therefore, the political referenda numbers analyzed here could understate the value of watershed restoration to people.

Averted Expenditure Method

Another method of valuing the economic benefits of watershed restoration is through averted expenditures, which quantify how much money is saved by preventing future damage from occurring. Similar to the damage function method described above, this method quantifies the prevention of potential future damage, rather than the cleanup of preexisting damage. This section reviews three types of averted expenditures that researchers have documented: stream sediment reduction through road removal, water quality improvements through watershed protection, and wildlife habitat protection through the Conservation Reserve Program.

Watershed restoration through road removal can avert between $5 and $8 for each cubic yard of sediment prevented from entering streams

Researchers have documented how forest roads contribute large amounts of sediment to streams.[38] When roads fail, the cleanup cost is about $9.06 per cubic yard of sediment removed from streams in some ecosystems.[39] However, the costs of removing stream crossings and roads in order to prevent this cleanup are between $1.18 and $4.12 per cubic yard of sediment prevented.[40] This shows an averted expenditure of between $4.94 and $7.98 for each cubic yard of sediment prevented through road removal. To put this in perspective, one small road failure in the Olympic National Forest dumped around 30,000 cubic yards of sediment into a creek.[41] Important to note, however, is that not all sediment failures are cleaned up, so the simple benefit cost analysis presented here may not always hold true.

Protecting water quality through general watershed restoration is another area of averted expenditures. Many cities have started restoration initiatives in order to avoid costs associated with building complex water treatment facilities. The City of New York spent around $1.5 billion in order to restore Catskill watersheds that feed its reservoirs. This allowed New York to avoid $6-8 billion in expenditures on water filtration facilities.[42] The City of Seattle took similar actions in order to protect its water supply, which originates in the Cedar River watershed.[43] The city developed comprehensive management and restoration programs, including selective forest thinning and road removal. The project will cost Seattle about $6 million over 20 years,[44] but will prevent $50 million in costs of upgrading to conventional water treatment facilities.[45]

Another example of averted expenditures is the Conservation Reserve Program (CRP) of the U.S. Department of Agriculture. This program primarily addresses erosion through revegetation and removal of lands from cultivation, but also provides funding for habitat conservation work.[46] Through increasing habitat quality and preserv-

[36] For these cases where watershed restoration was part of a larger initiative, it was only the spending on restoration-related items that was analyzed and valued, not the initiative as a whole.

[37] Vossler, Christian, and Joe Kerkvliet. 2003. A Nonexperimental Test of the Contingent Valuation Method: Comparing Hypothetical and Actual Voting Behavior. Journal of Environmental Economics and Management 45:631-649, Vossler, C., J. Kerkvliet, S. Polasky, and O. Gainutdinova. 2002. Externally Validating Contingent Valuation: An Open-Space Survey and Referendum in Corvallis, Oregon. Journal of Economic Benavior and Organization 1485:1-17.

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[41] Bennon, Natalie Henry. 2008. Skokomish Watershed Action Team, November 2006 [cited November 29 2008]. Available from http://original.rlch.org/stories/skokomishwatershed.html.

[42] Swanson, C.S., and J.B. Loomis. 1996. Role of Nonmarket Economic Values in Benefit-Cost Analysis of Public Forest Management. General Technical Report Pnw-Gtr-361. Portland, OR: USDA Forest Service.

[43] Ihara, Dan, Steven Hackett, and John Manning. 2003. Reinvestment in Jobs, Communities and Forests: The Benefits and Costs of a National Program for Road Removal on U.S. Forest Service Lands, a Preliminary Analysis. Missoula, MT: Wildlands CPR.

[44] Ibid.

[45] National Council for Public-Private Partnerships. 2008. Ch2m Hill Omi Seattle Cedar Water Treatment Facility 2006 [cited November 29 2008]. Available from http://www.ncppp.org/cases/cedarwater.shtml.

[46] Nrcs. 2008. Conservation Reserve Program. USDA Natural Resource Conservation Service 2008 [cited November 2008]. Available from http://www.nrcs.usda.gov/programs/crp/.

Authors	Year	Who	What	Amount	Measurement
Niklitschek, M.; Leon, J.	1996	Households in metropolitan regions in South American urban coastal areas	Benefits of improving water quality of bay beaches	$88.08	Benefits of improved water quality of bay beaches
Loomis, John	2002	Recreationists on Lower Snake River, Idaho	Potential recreation benefit of dam removal to restore river	$482.74	Average consumer surplus per trip of restoration
Hesseln, H.; Loomis, J.B.; Gonzalez-Caban, A.; Alexander, S.;	2003	New Mexico hikers and bikers	Influence of fire-impacted landscape on number of trips to recreation site and welfare value of each trip	$165.24	Value per trip for hikers and bikers following a prescribed fire
Bergstrom, J.C.; Dorfman, J.H.; Loomis, J.B.	2004	Saltwater Anglers in Lower Atchafalaya River Basin estuary — Gulf of Mexico in Louisiana	Recreational fishing benefits of estuary restoration and protection	$826.42	Annual recreation benefits per angler
Starbuck, D.M.; Alexander, S.J.; Berrens, R.P.; Bohara, A.K.;	2004	Harvesting permit holders in New Mexico	Consumer surplus associated with harvesting special forest products like wild berries and mushrooms	$35.33	Surplus per harvester per year
Hesseln, H.; Loomis, J.B.; Gonzalez-Caban, A.;	2004	Users in Montana and Colorado National Forests	Determine changes in trips and consumer surplus under prescribed burn and crown fire scenarios	$28.66	Consumer surplus of recreating in area with prescribed burn versus crown fire

Table 5: Summary of Travel Cost Method research on watershed restoration

ing healthy ecosystems, the CRP keeps wildlife quality and quantity high. If the program were to stop, the decline in environmental health is estimated to cost the hunting and recreation industry $322 million per year.[47] However, the CRP itself will cost approximately $1.8 billion for fiscal year 2009.[48]

Travel Cost Method

The travel cost method (TCM) of environmental valuation determines economic values through analyzing people's travel expenses incurred in visiting natural areas. In theory, the societal value of a given natural resource is in part reflected in recreational demand for it. TCM uses economic analysis in order to isolate this demand, and thus determine the value of the environmental resources.[49] In the case of watershed restoration, it determines the difference in demands for restored versus unrestored ecosystems. However, because the TCM is completely based on recreation and tourism, it only values one aspect of environmental restoration.

In theory, the societal value of a given natural resource is reflected in the demand in recreational visits to it

Of the six TCM studies that are relevant to watershed restoration, the mean value was $271 per person per visit, the median $127, and the range $29 to $826 (Table 5). These values represent the incremental travel costs incurred to visit a restored natural area over an unrestored natural area. The studies that measure the recreation val-

[47] Aronson, James, Andre F. Clewell, James N. Blignaut, and Sue J. Milton. 2006. Ecological Restoration: A New Frontier for Nature Conservation and Economics. Journal for Nature Conservation 14 (3/4):135-139.

[48] Humphrey, Kerry. 20009. Usda Issues $1.8 Billion in Conservation Reserve Program Rental Payments. United States Department of Agriculture 2008 [cited April 1 20009]. Available from http://www.usda.gov/wps/portal/!ut/p/_s.7_0_A/7_0_1OB/.cmd/ad/.ar/sa.retrievecontent/.c/6_2_1UH/.ce/7_2_5JM/.p/5_2_4TQ/.d/1/_th/J_2_9D/_s.7_0_A/7_0_1OB?PC_7_2_5JM_contentid=2008%2F10%2F0251.xml&PC_7_2_5JM_parentnav=LATEST_RELEASES&PC_7_2_5JM_navid=NEWS_REL.

[49] Callan, Scott J., and Janet M. Thomas. 2004. Environmental Economics and Management: Theory, Policy, and Applications. 3rd ed. Mason: Thomson South-Western.

ues of improved fisheries had higher values, with anglers willing to pay $655 more per year for restored fisheries, primarily because of higher catch rates and larger fish.[50] People were also willing to spend more in travel costs to visit forest ecosystems that had restored natural fire regimes, or recently prescribed burns, with a mean willingness to pay of $97 per visit over the travel costs to visit a forest with unnatural fire history.[51] This figure is significantly less than the mean WTP of $224 for similar CVM studies. This difference, however, is similar to the difference between the CVM studies and the political referendum studies. Only one TCM study measured water quality improvements. It showed increased travel expenses of $88 per person per year for general recreationists to visit areas with higher water quality.[52] This is a similar figure to the mean WTP within CVM water quality studies of $110.

People spent more to visit forest ecosystems that had restored fire regimes or recently prescribed burns

Hedonic Price Method

The last method of environmental valuation is the hedonic price method (HPM). This technique assumes that the implicit societal value for environmental amenities is manifested in housing prices. As such, after taking into account all other factors, a house in a location with a certain environmental amenity would hypothetically be worth more than a house without it. Various studies show how incremental increases in environmental quality affect housing prices. The studies generally fit into two categories: pollution abatement and environmental amenity quality.

Pollution abatement studies show that decreased pollution and the resulting increased water quality can lead to higher home values. In a study of housing prices in the Chesapeake Bay, researchers concluded that increased water quality has a significant effect on property values, with home values increasing 1.5 percent for every 100 fecal coliform counts removed per 100mL of water.[53] Similarly, a study of homes within Maryland's St. Mary's Watershed showed that home values increase $1,086 for every milligram per liter decrease in total suspended solids, and $17,642 for every milligram per liter decrease in dissolved inorganic nitrogen.[54] A study of homes in southwestern Connecticut established an $11,503 average revealed value of coastal wetland restoration and environmental amenities.[55]

Many HPM studies also look at environmental amenity improvements. In Hamilton Harbor, Ontario, harbor and water quality improvements, including island and park restoration, were associated with an $11,287 rise in inflation-adjusted property values between 1983 and 1994.[56] Increased land fragmentation and land use diversity was consistent with lower selling prices of houses in Patuxet Watershed, Maryland.[57] Proximity to woodlands and water was significantly correlated with increased housing prices of seven percent and five percent, respectively, in Gloucestershire, United Kingdom.[58] Research-

After taking into account all other factors, a house in a location with a certain environmental amenity could hypothetically be worth more than a house without it

[50] Bergstrom, John C., Jeffrey H. Dorfman, and John B. Loomis. 2004. Estuary Management and Recreational Fishing Benefits. Coastal Management 32:417-432, Loomis, J. 2002. Quantifying Recreation Use Values from Removing Dams and Restoring Free-Flowing Rivers: A Contingent Behavior Travel Cost Demand Model for the Lower Snake River. Water Resources Research 38 (6).

[51] Hesseln, H., J. Loomis, and A. Gonzalez-Caban. 2004. Comparing the Economic Effects of Fire on Hiking Demand in Montana and Colorado. Journal of Forest Economics 10 (1):21-35, Hesseln, H., J. B. Loomis, A. Gonzalez-Caban, and S. Alexander. 2003. Wildfire Effects on Hiking and Biking Demand in New Mexico: A Travel Cost Study. Journal of Environmental Management 69:359-368.

[52] Niklitschek, M., and J. Leon. 1996. Combining Intended Demand and Yes/No Responses in the Estimation of Contingent Valuation Models. Journal of Environmental Economics and Management 31:387-402.

[53] Leggett, C. G., and N. E. Bockstael. 2000. Evidence of the Effects of Water Quality on Residential Land Prices. Ibid. 39:121-144.

[54] Poor, P. Joan, Keri L. Pessagno, and Robert W. Paul. 2007. Exploring the Hedonic Value of Ambient Water Quality: A Local Watershed-Based Study. Ecological Economics 60 (4):797-806.

[55] Earnhart, Dietrich. 2001. Combining Revealed and Stated Preference Methods to Value Environmental Amenities at Residential Locations. Land Economics 77 (1):12-29. Rephrased in December 2009 to clarify number.

[56] Zegarac, M., and T. Muir. 1998. The Effects of Rap Related Restoration and Parkland Development on Residential Property Values: A Hamilton Harbour Case Study. Environment Canada. Great Lakes Environment and Economics Office. A pre-December 2009 version of this report cited the number incorrectly.

[57] Geoghegan, J., L. A. Wainger, and N. E. Bockstael. 1997. Spatial Landscape Indices in a Hedonic Framework: An Ecological Economics Analysis Using Gis. Ecological Economics 23:251-264.

[58] Garrod, G.C., and K.G. Willis. 1992. Valuing Goods' Characteristics: An Application of the Hedonic Price Method to Environmental Attributes. Journal of Environmental Management 34 (1):59-76.

ers also showed that improving fish habitat, acquiring land, establishing an education trail, stabilizing stream banks, and reducing flood damage in three California counties significantly affected property value, with an average increase in price of $63,778.[59]

While the above HPM studies show a trend of watershed restoration being correlated with increased housing values, this does not always occur. Proximity of houses to wetlands in Gloucestershire, UK was associated with a 18 percent decrease in property values,[60] and a study of the Mohawk Watershed in Oregon showed that each square foot of waterfront containing trees decreased property value by two dollars.[61] Thus HPM results must be used with caution. What holds in one area does not necessarily hold in another. Furthermore, no study can account for all factors going into home prices, especially considering recent peaks and valleys in home prices nationally. As with the other studies, these results should be viewed as a guide, with explicit mention to correlations, not causations.

Employment Impacts

Restoring watersheds affects those doing the restoration work. Whether removing a road, upgrading a culvert, or stabilizing a stream bank, restoration activities are labor-intensive.[62] These jobs contribute to the socioeconomic conditions of the communities in which the restoration occurs, and this linkage of job creation to environmental conservation can powerfully motivate people to support restoration activities.[63]

Restoration activities are labor-intensive

Humboldt County in northern California has undertaken millions of dollars in restoration activities, primarily in response to declining salmon runs and fewer timber jobs. Between 1995 and 2000 $65 million for restoration work went into the county's economy, and by 2002 this investment directly maintained approximately 240 jobs.[64] This investment in restoration spreads out to other sectors, such as restoration workers spending money to go out to dinner or remodel their homes. This creation of additional economic activity from the original restoration activity is called a multiplier effect. Due to this multiplier effect, between 1995 and 2000, restoration investment created an estimated total economic contribution of $133 to $166 million.[65] Taking into account the multiplier effect on employment, these restoration efforts created or sustained an estimated 270 to 480 jobs in 2002.[66] Restoration activities also supported an additional 45 restoration jobs in the public sector, and 11 jobs for the Yurok Tribe.[67] Of the private sector jobs, 70 were in consulting and business, 105 in contracting, and 65 in nonprofits. Not all of these jobs were fulltime, however.

About 15 jobs economy-wide are supported for every one million dollars invested in road maintenance and removal

A second report analyzed road removal's economic impacts on employment. That research concluded that about 15 jobs economy-wide are supported for every one million dollars invested in road maintenance and removal.[68] However, this figure is slightly below the investment and employment estimates for Humboldt County.[69] Regardless, nationwide road maintenance and

[59] Streiner, C.V. 1995. Estimating the Benefits of the Urban Stream Restoration Program Using the Hedonic Pricing Method, Department of Agricultural and Resource Economics, Colorado State University.

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[62] Nielsen-Pincus, Max, and Cassandra Moseley. 2009. A Preliminary Estimate of Economic Impact and Job Creation from the Oregon Watershed Enhancement Board's Restoration Investments. In Ecosystem Workforce Program Briefing Paper #13. Eugene, OR: Institute for a Sustainable Environment.

[63] Cowling, R. M., S. M. Pierce, and A. M. Wigwela. 2007. Mainstreaming the Restoration of Natural Capital: A Conceptual and Operational Framework. In Restoring Natural Capital: Science, Business, and Practice, edited by J. Aronson, S. J. Milton and J. N. Blignaut. Washington DC: Island Press.

[64] Baker, Mark. 2004. Socioeconomic Characteristics of the Natural Resources Restoration System in Humboldt County. Alliance for Sustainable Jobs and the Environment.

[65] Ibid.

[66] Ibid.

[67] Ibid.

[68] Center for Environmental Economic Development. 2003. Reinvestment in Jobs, Communities and Forests: The Benefits and Costs of a National Program for Road Removal on U.S. Forest Service Lands, a Preliminary Analysis. Missoula, MT: Wildlands CPR. Jobs figure from report modified by Joe Kerkvliet, Resource and Environmental Economist, The Wilderness Society, in 2008, from 33 to 14.5 per million dollars spent, due to increased wages and inflation.

[69] $14 million was spent on restoration in 2002, which at an estimated 15 jobs per million dollars comes to 210 jobs. This inline with the 270 to 480 jobs estimated in Baker 2004.

removal would support an estimated 272 to 1,350 jobs, depending on how much money the federal government chooses to invest in this form of watershed restoration.[70] However, only between five and 20 percent of each dollar goes directly to wages, because much of the costs of restoration activities are comprised of heavy machinery operations and upkeep.[71]

Another study analyzed leafy spurge eradication programs. It came to the conclusion that a national control program would have a total economic benefit of $75.75 million. The program would also create or support an estimated 876 jobs economy-wide.[72] An analysis of the Oregon Watershed Enhancement Board's restoration programs showed that a $40 million investment in watershed restoration would support 600 jobs, for an estimate of 15 jobs per million dollars spent on restoration.[73]

Community Growth

Watershed restoration can also have economic impacts on cities and counties. Much like infrastructure development, which consistently yields positive returns on investment,[74] watershed restoration may create long-term benefits like population growth and business creation because of enhanced natural amenities.[75] A few studies have documented the potential monetary effects of restoration on communities. For example, researchers concluded that restoring 1000-hectares of wetlands along the Illinois River would yield a net benefit of $1.99 million to the economy, and another study showed a $476 million economy-wide benefit from a 45-percent increase in water quality within the Klamath River Basin of northern California. However, just as important as the numeric values of the economic impact are the qualitative effects of restored ecosystems to the communities in which they occur.

Natural amenities can positively affect population and business growth. Population growth rates are often highest in high amenity areas, such as Montana's Bitterroot Valley, near mountains, parks, and national forests.[76]

Watershed restoration potentially can create long-term benefits like population growth and business creation to communities because of increased natural amenities

Similarly, new business growth within the Greater Yellowstone area is correlated with natural amenities.[77] Public lands used for conservation, instead of industrial development purposes, are correlated with longer-term and more sustained economic growth,[78] and high-amenity rural counties have three-times the rate of job growth than low-amenity rural counties.[79] Businesses frequently move to these high-amenity areas because of their scenic beauty and environmental quality.[80]

Applying these results to watershed restoration assumes that restoration can have a large incremental benefit to the overall natural amenity value. It also assumes that the results are transferable across different geographic regions. In addition, while these results show how environmental quality is important to town and county growth, many other qualities are actually necessary.[81] Businesses need both an educated workforce to employ and access to large population centers via an airport with regular

[70] Center for Environmental Economic Development. 2003. Reinvestment in Jobs, Communities and Forests: The Benefits and Costs of a National Program for Road Removal on U.S. Forest Service Lands, a Preliminary Analysis. Missoula, MT: Wildlands CPR. Jobs figure from report modified by Joe Kerkvliet, Resource and Environmental Economist, The Wilderness Society, in 2008, from 33 to 14.5 per million dollars spent, due to increased wages and inflation.

[71] Ibid.

[72] Bangsund, D. A., and F. L. Leistritz. 1999. Assessing Economic Impacts of Biological Control of Weeds. Journal of Environmental Management 56 (1):35.

[73] Nielsen-Pincus, Max, and Cassandra Moseley. 2009. A Preliminary Estimate of Economic Impact and Job Creation from the Oregon Watershed Enhancement Board's Restoration Investments. In Ecosystem Workforce Program Briefing Paper #13. Eugene, OR: Institute for a Sustainable Environment.

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[78] Rasker, R. 2006. An Exploration into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands. Society and Natural Resources 19:191-207.

[79] Mcganahan, D. A. . 1999. Natural Amenities Drive Rural Population Change: Agricultural Economic Report 781. Washington, DC: Food and Rural Economics Division, Department of Agriculture.

[80] Johnson, J. 1995. The Role of Economic and Quality of Life Values in Rural Business Location. Journal of Rural Studies 11 (4):405-416.

[81] Rasker, R., M. Haggerty, J. Haggerty, and J. Van Den Noort. 2008. The Economy of the Gila Region. Bozeman: Headwaters Economics.

flights or an Interstate Highway.[82] Therefore, while natural amenities are important, they are neither necessary nor sufficient. The incremental contribution of watershed restoration to natural amenities is unknown, and other factors are required before environmental quality becomes significant in facilitating economic growth.

While natural amenities are important, the incremental contribution of watershed restoration to them is unknown, and other factors are more consequential

Framing Economic Benefits

When using market and non-market valuation to better understand the economic benefits accruing from watershed restoration it is important to know the limitations of the economic data, of which there are many. This section lays out these limits, exploring the role of benefit-cost analysis, employment-related data, and use of economic valuation as a means of public persuasion.

Benefit-cost analysis (BCA) has a mixed history of ensuring environmental quality because it can both strengthen and weaken environmental regulations. The problem lies in how researchers measure the benefits of a clean and healthy environment. Given that few markets exist to adequately construct a monetary figure of environmental benefits, the benefits often are unreasonably low.[83] Furthermore, the data presented in this paper is not an accurate reflection of what watershed restoration is actually worth, because restored watersheds do not have a "true" monetary value. BCA is best used to prioritize narrow options when action is necessary, not to rank broad public preferences.[84] For example, the proper role for economic valuation of watershed restoration is not in choosing whether to restore a watershed or build a new fire department, but rather in choosing between different watersheds to restore, or to what degree they should be restored, after an entity has already decided to implement watershed restoration.

The ultimate reason for undertaking watershed restoration should not be its employment impacts, but rather its increasing ecological health and societal welfare on the whole

The data in this report should not be interpreted as an accurate reflection of what watershed restoration is worth, because restored watersheds do not have a "true" monetary value

Similarly, employment and job-related figures are both beneficial and troublesome. By using these figures, watershed restoration enters the "Chamber of Commerce" mentality, and thus must play by the business interests' terms of debate.[85] No doubt watershed restoration often competes favorably thanks to its "green jobs" component. However, situations exist in which restoration activities could reduce overall employment in the long-term, once the most intensive initial activities are completed. In this case, the very arguments that are used for watershed restoration can be used against it.[86] Furthermore, different types of restoration have vastly different employment implications. Labor-intensive jobs like planting and removing weeds employ many people, but at low pay and without broad economic impacts.[87] Conversely, equipment-intensive restoration, such as streambank stabilization, generates fewer jobs, but with higher wages and greater total economic activity.[88] What would be best in the long-run for a community is likely the latter. The former, however, is what yields maximum employment. Therefore, the ultimate reason for undertaking watershed restoration should not just be its employment potential, but rather its capacity to increase

[82] Mcganahan, D. A. . 1999. Natural Amenities Drive Rural Population Change: Agricultural Economic Report 781. Washington, DC: Food and Rural Economics Division, Department of Agriculture, Rasker, R. 2006. An Exploration into the Economic Impact of Industrial Development Versus Conservation on Western Public Lands. Society and Natural Resources 19:191-207, Rasker, R., M. Haggerty, J. Haggerty, and J. Van Den Noort. 2008. The Economy of the Gila Region. Bozeman: Headwaters Economics.

[83] Power, Thomas. February 25, 2009. University of Montana Economics Professor. Interview with Author.

[84] Callan, Scott J., and Janet M. Thomas. 2004. Environmental Economics and Management: Theory, Policy, and Applications. 3rd ed. Mason: Thomson South-Western.

[85] Power, Thomas. February 25, 2009. University of Montana Economics Professor. Interview with Author.

[86] Ibid.

[87] Nielsen-Pincus, Max, and Cassandra Moseley. 2009. A Preliminary Estimate of Economic Impact and Job Creation from the Oregon Watershed Enhancement Board's Restoration Investments. In Ecosystem Workforce Program Briefing Paper #13. Eugene, OR: Institute for a Sustainable Environment.

[88] Ibid.

ecological health and societal welfare on the whole.

Nonmarket valuation of watershed restoration can confuse the general public because no money exchanges hands and the commercial economy is not involved. For example, if a community were to hear that a restored watershed is worth $20 million per year, which outweighs the current resource extraction within the degraded watershed at $10 million per year, then they may think that $20 million will actually enter the economy, without realizing that the figure is just a representation, in monetary terms, of how much people value the restored watershed. It does represent real gains in well being, but it does not represent the market economy. When the public realizes this, they can feel betrayed and confused, which can result in opposition to watershed restoration.[89] Because of this potential, one should use caution when presenting nonmarket valuations of watershed restoration in the public realm. This does not hold as much for market valuation of watershed restoration, such as through the averted expenditure and damage function models, though. In these measurements, actual money can change hands, and therefore an actual cash flow component to the monetary figures exists.

The numbers prove that, on some level, people value watershed restoration, and that this value extends beyond just the monetary realm

What then is the importance of economic valuation of watershed restoration? Just because the numbers are only of limited use in a public debate does not mean they are unimportant. The numbers provide evidence that, on some level, people value watershed restoration. Furthermore, the numbers are indicative of the many values of watershed restoration beyond just those recognized by commercial markets. For example, hedonic price method studies on housing values indicate how closely quality of life is tied to environmental restoration in a given area. Contingent valuation studies show how different types of people value watershed restoration differently, such as how anglers place a higher value on restored watersheds than non-anglers. Also, averted expenditure and damage function studies show actual monetary benefits of watershed restoration, and thus are incredibly useful. A comprehensive and multi-faceted economic valuation of watershed restoration provides very important tools for activists and decision-makers.

At the same time, one must balance economic and non-economic evidence. To avoid confusion among the general public, restoration advocates should only use nonmarket valuation of watershed restoration, such as with contingent valuation method studies, when they are explained in a way that nobody could misunderstand what the numbers mean. Restoration advocates should focus on a physical expression of the numbers that explains their actual impacts. Advocates should explain economic arguments, especially employment impacts, in terms of societal welfare. They should meet people on their own terms, with restoration framed in a way that matters to them.[90] The specific use of benefit-cost analysis and nonmarket valuation is most appropriate when comparing relatively narrow decisions after finalizing primary decisions regarding the broader choice for action.

In the public realm, a physical expression of the economic numbers should be given, framing restoration in a way that matters to people

Conclusion

Economic valuation of the benefits of watershed restoration is important to understand. As predominantly a government-initiated activity, restoration exists in the realm of benefit-cost analysis, where monetary numbers are the rule of the game. In this sense, the above synthesis of nonmarket valuations of watershed restoration yields important evidence. Watershed restoration can avert billions of dollars in potential water quality damages, grow tourism revenues in local communities, increase housing values, provide inherent quality of life improvements, supply well-paying jobs, and facilitate long-term growth. However, due to watershed restoration's inherent public good nature, these numbers only mean so much in the public realm. Emphasis on a restored watersheds' monetary worth, in which a dollar value is assigned to a given

[89] Power, Thomas. February 25, 2009. University of Montana Economics Professor. Interview with Author.

[90] Ibid.

area, can counterproductively distract the public. Furthermore, the employment implications of watershed restoration only measure one aspect of societal welfare. For example, if a restoration initiative increased overall

Only those people who have a deep understanding of what the economic figures mean, and the implications of their use, should employ them to justify watershed restoration

community well being but decreased net employment, the public might still legitimately oppose it. Because of these realities, only those people with a deep understanding of what the economic figures mean, and the implications of their use, should employ them to justify watershed restoration.

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