Case Study – Murray-Darling Basin, Australia – Eugene, OR

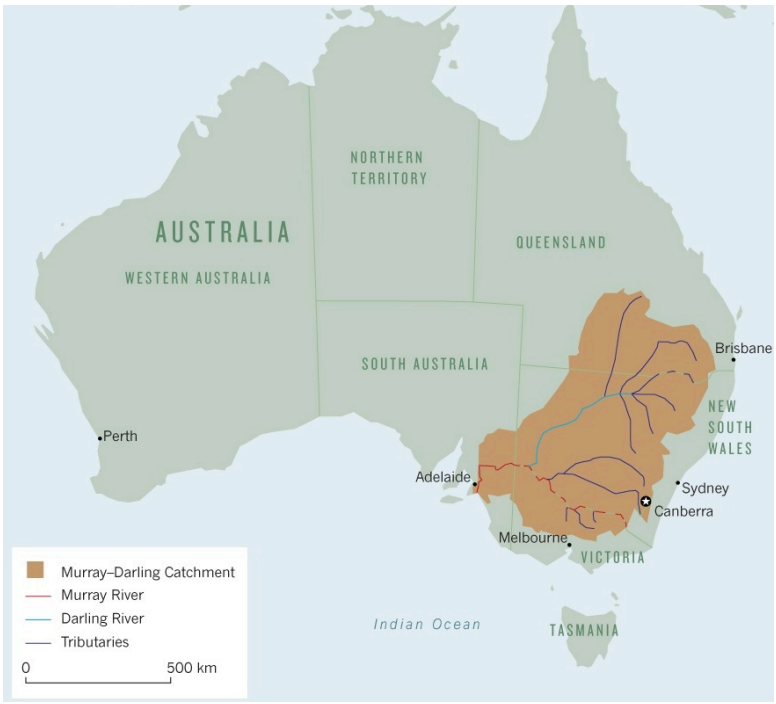
Valuing a Watershed's Natural Capital

The Academy's June 21, 2012 webinar, with guests Rosalind Bark, Resource Ecological Specialist at Australia's CSIRO Ecosystem Services and Karl Morgenstern, Drinking Water Source Protection Specialist for Eugene Water and Electric Board, addressed some key questions and issues for water utility managers, decision makers, and stakeholders about the practice and practicalities of how to value watersheds and the services they provide to downstream users.

Investment in watersheds expands the portfolio of risk management options available to utilities who face challenges to watershed health, many of which are exacerbated by climate change. Watershed valuation connects with steps 5 (appraising options) and 7 (implementing options) of the Academy's Integrated Risk Management Roadmap. In step 5, watershed valuation answers questions about: What services does the watershed provide and how do we account for them? What are the costs of providing for those services through some other mechanism? What costs can be avoided by investing in our watersheds? In step 7, watershed valuation can help determine how to fund and structure watershed investment programs.

Large-Scale River Basin Valuation: Australia's Murray-Darling

The Murray-Darling Basin in Australia shares many characteristics with Western U.S. basins, especially the Colorado River Basin: it's a large, populated basin; it's the most important irrigation area in the nation; it has a long history of water reform in response to over-allocation, especially for irrigation; and the basin experiences drought, including the decade-long "Millennium Drought" which ended in 2012. Water policy and management reform was crisis-driven and occurred incrementally. Reform included introduction of water markets, caps on diversions, a federal takeover of water management from the basin states, use of hydrologic indicators, and water allocation for ecosystems.



The Murray-Darling basin in southeast Australia covers 1/7 of the land mass and is home to approximately two million people. *Map: nature.com*

The Commonwealth Scientific and Industrial Research Organization (CSIRO), Australia's national science agency, was commissioned to report on the value of returning water to the environment in the basin, in support of prioritizing tradeoffs within the basin's official Environmental Watering Plan. Many ecosystem services in the Murray Darling are not presently valued, so decision makers often simply assume them to have zero value. A key aspect of the valuation study is that it used an ecosystem service framework that connected changes in hydrology, incremental ecological benefits and economic benefits. Other aspects that might be relevant to some applications in the U.S. are that the study was focused on assessing policy change at the scale of the entire basin and they used a scenario approach that compared a baseline scenario to 2800 variants that used policy to return up to 22% of irrigation water to the environment.

There is no single best way to assess valuation, so CSIRO used several different approaches, all linked to specific hydrologic and ecological thresholds, including stated preferences (asking people), revealed preferences (looking at recreation and travel costs), and avoided cost approaches. The monetary value of benefits were dominated by habitat ecosystem services. The non-use values, like those for healthy habitat, were valued at ~$3-8 billion. Other large value benefits (~$2 billion) included carbon sequestration, aesthetic appreciation, recreation connected to water quality, and avoided costs associated with ecosystem service losses.

The ecosystem valuation framework is a useful approach because it:

- Forces scientists to consider the chain that connects hydrology to ecology to values
- Provides a way to catalog incremental change
- Results in a scorecard of which ecosystems services you were able to compute valuations for and which still need some sort of analysis in future studies
- Breaks benefits into component parts, and clarifies how those parts are connected to the overall system through interactions and interdependencies
- Identifies whether uncertainties are connected to uncertainties in ecological science or in identification of values

The study team found that in dealing with decision makers and stakeholders, it's important to start early to identify and prioritize which data, including ecological material (ecological response models, thresholds, data) and economic material (categories of values such as hydropower, recreation, water purification, ecological use, and applicable benefit transfer studies) falls within your study scope. It's more efficient to build on previous research that has something in common with your situation. It's also good practice to scope the study so that it includes multiple types of benefits (for example, not just related to water supply, but also water quality), and to consider multiple versions for the design and implementation of any policies you are considering as possible options. They found that while many people don't understand the concept of valuation or ecosystem services, communication can be effective when presented in terms of management outcomes like water quality.

Rapid Valuation Study Helps Eugene, OR Protect the McKenzie River

The McKenzie River is the sole source of drinking water for about 200,000 people in the Eugene, Oregon area. The Eugene Water and Electric Board (EWEB) used watershed valuation to identify the value of the McKenzie River watershed's natural capital and then design programs to protect that capital.

The McKenzie River provides drinking water to the Eugene, OR area. *Photo: Lara Katherine Mountain Colley*

There are a variety of land-use threats above Eugene's water intake on the McKenzie, including forestry and agricultural activities that threaten water quality from use of chemicals. EWEB's goal is to increase the economic viability of these land uses while also reducing chemical use in key watershed areas and increasing the ability to buffer chemical applications. Forestry and agriculture are preferred land uses in the basin because they are relatively more flexible and manageable than urban land use. Urban uses produce more polluted runoff, industrial process outflows, and hazardous material spills. Once in place, these urban uses can be of such high economic value that natural capital values can't compete, forcing water managers to adjust their operations to deal with whatever conditions urban uses produce – an oftentimes expensive proposition.

To mitigate the damage of the transition from undeveloped lands to urban uses, EWEB is focusing on taking care of their existing natural capital. Healthy riparian forests and floodplains provide critical water quality functions, including water filtration, sediment control, flood control, nutrient cycling, shallow groundwater uptake from septic systems, and shading and cooling of water temperatures. While there had never been any explicit accounting of those services, it was clear to EWEB that it would cost millions of dollars to duplicate those services through built infrastructure. To build the case for preserving and protecting those upstream services, EWEB wanted to use watershed valuation to:

- Assign some sort of value to the natural capital of the McKenzie watershed
- Prioritize areas that have the highest values in making EWEB investments
- Acquire better cost/benefit analyses that can be compared to engineered structures
- Understand "lost values" that have resulted from past impacts and degradation
- Focus and coordinate mitigation efforts required under different regulatory programs

The EWEB approach had three phases:

1. Complete a rapid assessment using external studies to develop initial values,
2. Add local studies to refine values and gain local buy-in from landowners and decision makers,
3. Focus investments within their programs.

{Table Caption} EWEB worked with an outside group, Earth Economics, to identify a variety of methods that could be used to value ecosystem services.

Valuation Method	Example
Market Pricing	Price of timber harvested
Hedonic Pricing	The difference in value between houses next to the riparian areas versus elsewhere
Production Values	Salmon catch
Replacement Costs	Cost of a water filtration plant
Avoidance Costs	Reduced flood damages

From a variety of available valuation methods, EWEB chose those they thought would resonate most with their customers. Then, using GIS maps, they identified, and quantified where possible, the services provided by different land uses in the watershed. The analyses considered specific services provided under four main categories:

- Production services (water supply, food, raw materials)
- Regulatory services (soil retention, water quality, nutrient regulation)
- Habitat services (biodiversity, nursery)
- Information services (aesthetics, cultural, spiritual and historic, recreation)

The resulting scorecard identified where valuation studies have been done elsewhere and could provide initial dollar values for these services. They adapted past study values to the McKenzie watershed to provide an initial range of ecosystem services of different types. For example, the value of riparian buffers, which provide many types of services, was identified as providing $1000-$6700/acre/year in the McKenzie watershed. They then compared the total natural asset values for each of the land cover types in the watershed. Agricultural land and grasslands had the lowest natural asset values (~$600-$700/acre/year), while wetlands had the highest (>$34,000/acre/year). At $6700/acre/year, riparian buffers had the third highest natural asset values of the 7 general land cover types considered.

The last piece of the project transformed the asset values into priorities within a watershed investment fund that reflected the values of those assets. The Watershed Investment Fund combines a variety of income streams, such as from federal programs, rate payer funds, tax revenues, mitigation funds, and grants, into a single fund for a portfolio of programs.

Expenditures would then be prioritized by the valuation studies and regulatory requirements. Programs include funding restoration projects, operations services (monitoring, agreement compliance assurance, accounting), and dividend payments for riparian landowner stewardship. By combining resources and focusing efforts on priorities, EWEB can "get to scale" on the protection of their water resources, rather than have piecemeal implementation.

To implement their riparian buffer dividend program, EWEB used LiDAR data at the tax-lot level to identify which lots meet the threshold of sufficient riparian forest health and the total acreage that could potentially qualify for dividends. Through a Voluntary Incentives Program, an annual dividend fund allotment is apportioned out among the highest quality lots enrolled in the program or rolled over, with payouts adjusted each year until the total payouts meet a pre-determined portion of the annualized natural capital valuation. After that, dividends are available for the next highest priority within the watershed investment program.

EWEB was able to initiate their watershed investment fund and dividend program without waiting for perfect watershed valuation studies. They are now working to complete a full watershed valuation, which will re-evaluate the rapid assessment's external valuation studies and data, incorporate more local valuation data, and adjust for degraded land cover types identified through their LiDAR monitoring program. EWEB is establishing the Watershed Investment Fund and implementing a pilot for the Voluntary Incentives Program, with the help of the Freshwater Trust, to invest in protecting the natural capital of healthy riparian forests at several pilot study locations along the McKenzie. While the current dividend program is aimed at private landowners, EWEB is interested in using watershed valuation studies to think about how public lands are managed and what investments would yield the most benefit on those lands.

The Bottom Line

Watershed valuation has many potential applications beyond those discussed in these two case studies, including:

- Developing ecosystem service markets or payment for services arrangements
- Identifying multiple benefit outcomes
- Structuring thinking about ecosystem services
- Designing restoration programs
- Developing and assessing policy options
- Prioritizing and attracting investment funds
- Aligning multiple agency and organization priorities for investments

Watershed valuation studies are an important communication tool. While they certainly can't make an apples-to-apples comparison of natural functioning ecosystems and built infrastructure,

they can help decision makers, rate payers, and other stakeholders make sense of the sometimes abstract concept of “natural capital” with respect to something they understand – their pocketbooks.

Tools

Data Tools:

Institute of Water Resources (IWR) Planning Suite. This tool was developed by the U.S. Army Corps of Engineers in collaboration with the USDA Natural Resources Conservation Service. This is a tool to support cost effectiveness and incremental cost analysis for environmental planning. The analysis has three dimensions:

- measurable environmental outputs (e.g., species diversity, forest productivity, water quality),
- costs (e.g., implementation costs, costs of lost opportunities, incidental benefits), and
- management actions (i.e., incremental versions of potential policies and management plans).

The analysis highlights those combinations that score the highest for different objectives that you may select (e.g., cost effectiveness). The tutorials and manual are good, and tool development is ongoing to incorporate multi-criteria analysis and an uncertainty module. http://www.pmcl.com/iwrplan/SoftwareInfo_1_0_11_0.asp

StreamBank. Developed and patented by The Freshwater Trust, StreamBank is an innovative web tool that enables restoration professionals to efficiently recruit, plan, implement and monitor restoration projects. With StreamBank, time-consuming processes are standardized and automated, ensuring consistent quality and making it easier for local restoration professionals, like watershed councils, to put projects on the ground. http://www.thefreshwatertrust.org/monitoring-analytics-team/streambank-web-platform-how-it-works/.

Report:

Nature’s Value in the McKenzie Watershed: A Rapid Ecosystem Service Valuation. 2012 http://eweb.org/public/documents/water/EarthEconomics.pdf