Only the text in the *green italics* represents the consensus views of the SAB Committee on Valuing the Protection of Ecological Systems and Services and has been approved by the chartered SAB, All other text was provided by individual committee members and is offered to extend and elaborate the very brief descriptions provided in chapter 4 of the SAB Report, *Valuing the Protection of Ecological Systems and Service* and to encourage further deliberation within EPA and the broader scientific community about how to meet the need for an integrated and expanded approach for valuing the protection of ecological systems and services.

Replacement cost

Excerpt from the draft SAB Committee report, Valuing the Protection of Ecological Systems and Services: *One such method is replacement cost. Under this method, the value of a given ecosystem service is viewed as the cost of replacing that service by some alternative means. For example, some studies have valued clean drinking water provided by watershed protection by using the cost savings from not having to build a water filtration plant to provide the clean water (NRC, 2000 and 2004; Sagoff 2005). This type of cost savings can offer a lower-bound estimate of the value of an ecosystem service, but only under limited conditions (Bockstael et al., 2000). First, there must be multiple ways to produce an equivalent amount and quality of the ecosystem service. In the above example, the same quantity and quality of clean water must be provided by both the watershed protection and the filtration plant. Second, the value of the ecosystem service must be greater than or equal to the cost of producing the service via this alternative means, so that society would be better off paying for replacement rather than choosing to forego the ecosystem service. In the example, the value of the clean water provided must exceed the cost of providing it via the filtration plant. When these two conditions are met, it is valid to use the cost of providing the equivalent services via the alternative as a lower-bound estimate of the economic value of the ecosystem service.*

Further reading

Bartik, T.J. 1988. Evaluating the benefits of nonmarginal reductions in pollution using information on defensive expenditures." Journal of Environmental Economics and Management 15: 111-22.

Bockstael, N.E., A.M. Freeman, et al. 2000. On measuring economic values for nature. Environmental Science and Technology 34: 1384-1389.

Chichilnisky, G., and G. Heal. 1998. Economic returns from the biosphere. Nature 391: 629-630.

National Research Council. 2000. Watershed management for potable water supply: Assessing the New York City strategy. Washington, DC: National Academies Press.

National Research Council. 2004. Valuing ecosystem services: Toward better environmental decisionmaking. Washington, DC: National Academies Press.

Sagoff, M. 2005. The Catskills parable. PERC Report. Bozeman, MT: Political Economy Research Center.

Shabman, L.A., and S.S. Batie. 1978. The economic value of coastal wetlands: A critique. Coastal Zone Management Journal 4: 231-237.

Brief description of the method. This method, also called avoided cost, uses the cost of replacing ecosystem services with a human-engineered system as an estimate of the value of providing ecosystem services via protection of an ecosystem. For example, an estimate of the value of conserving an ecosystem that serves as a watershed that naturally provides clean drinking water could be derived by estimating the cost of building a water filtration plant that would provide the same quantity and quality of water. Replacement cost is exactly what it says: the cost of replacing an ecosystem service via some other means. Replacement cost is not a measure of the value of the ecosystem services themselves. Rather, it is the value of having one particular means of providing ecosystem services, and therefore not having to pay to replace services via some other means. Also, the replacement cost method should not be confused with applications of "averting behavior" based upon observed voluntary behavior on individuals (see revealed preference methods).

Status as a method. The method has been used to provide estimates of the value of protecting watersheds for the purpose of providing clean drinking water (NRC 2004). The most famous of such cases, and the example of valuing ecosystem services that is cited probably more than any other, is the case of protecting the Catskills watersheds that provide drinking water for New York City (Chichilnisky and Heal 1998, NRC 2000, 2004). New York City, faced with the possibility of being required by EPA to build a water filtration plant for water from the Catskills, opted to invest in greater watershed protection in the Catskills. New York City and EPA signed a Watershed Memorandum Agreement in 1997 that allowed New York City to pursue a watershed protection plan in lieu of building filtration. While commonly cited as a classic case of the value of protecting ecosystems, this case is not without controversy. It is not clear that protecting watersheds will ultimately be successful in maintaining drinking water quality, or that the protection of watersheds versus building a filtration plant will provide equivalent water quality in all dimensions (NRC 2004). Further, some analysts have suggested that the threat of building the filtration plant had more to do with government regulations than with real water quality issues (Sagoff 2005).

Another example using a replacement cost approach is the avoided cost of illness approach that EPA has used successfully to account for certain human health benefits of environmental regulations.

Strengths/Limitations. Replacement cost can be a valid measure of value if three conditions are met: a) the human-engineered system provides services of equivalent quality and magnitude; b) the human-engineered system is the least costly alternative; and c) individuals in aggregate would be willing to incur these costs rather than forego the service (Bockstael, et al. 2000, Shabman and Batie 1978). If these conditions are not met, then use of replacement cost is invalid. Even when these conditions are met, replacement cost, rather than being a value of ecosystem services themselves, is the value of having a means to produce the service via an ecosystem instead of through an alternative human-engineered system.

All valuation methods can be applied incorrectly and misinterpreted, but the replacement cost method requires special caution. Because there is great potential for abuse in using replacement costs to estimate the value of ecosystem services, it should be used with care. The loss of an ecosystem service does not necessarily mean that the public would be willing to pay for the least cost alternative. Similarly, a regulatory constraint requiring replacement in the event of loss of ecosystem service also does not guarantee that the public would be willing to pay to replace the service. If the value of the service does not exceed the cost of alternative means of providing the equivalent set of services, then use of replacement cost is invalid. Even when the benefits of the service exceed the least cost method of providing the service, replacement cost does not measure the willingness to pay for an environmental improvement or the avoidance of harm. It merely represents the value (avoided cost) of not having to provide the service via human engineered approaches. Still, if there are alternative ways of producing the same service, and if that service would be demanded if provided at the least cost human-engineered alternative method, then replacement cost is a valid measure of the change in value from loss of the service provided by the ecosystem.

Key References

Bockstael, N. E., A. M. Freeman, et al. (2000). "On measuring economic values for nature." Environmental Science and Technology **34**: 1384-1389.

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Shabman, L. A. and S. S. Batie (1978). "The Economic Value of Coastal Wetlands: A Critique." Coastal Zone Management Journal **4**(3): 231-237