Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
August 26-27, 2015

Agenda Item

Non-Market Values for Alternative Operation of Glen Canyon Dam Panel

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Action Requested

Information item only; we will answer questions but no action is requested.

Presenters

Lucas Bair**,** Grand Canyon Monitoring and Research Center – Moderator
Michael Hanemann, Arizona State University
Holly Doremus, UC Berkeley Law
John Duffield, University of Montana
Hank Jenkins-Smith, University of Oklahoma

Previous Action Taken

N/A

Relevant Science

The following describes the relevant research or monitoring on this subject:
Glen Canyon Environmental Studies completed a non-use value study in 1995. Non-use values are economic values attributed to goods or services that are not traded in a market setting. The National Park Service (NPS) is currently updating the non-use value study, and a recent University of Oklahoma study is investigating a broader set of non-market values, both within and outside the Glen and Grand Canyons, that may be affected by Dam operations.

Summary of Presentation and Background Information

The purpose of this panel is to review non-market values associated with the operation of Glen Canyon Dam. The panel will discuss the economic concept of non-market values, relevance from a legal and public policy perspective, and current studies that identify non-market values in and around Glen and Grand Canyons that are impacted by the operation of Glen Canyon Dam.

Dr. Michael Hanemann will review the economic concept of non-market values and their applicability to resources impacted by the operation of Glen Canyon Dam. Dr. Hanemann is a professor at Arizona State University, a member of the National Academy of Sciences and has published extensively on the economic theory of non-market valuation. Dr. Hanemann has reviewed socioeconomic research associated with the GCDAMP in the 1987 and 1990 National Research Council reviews of river and dam management and was part of an expert panel in 2009.

Dr. Holly Doremus will discuss the legal aspects of non-market values with an emphasis on the distinction between equity and efficiency. Dr. Doremus teaches environmental and natural resource law and is the co-director of the Center for Law, Energy and the Environment at UC Berkeley. She

has written extensively on the interrelationship of environmental law and science with specific emphasis on endangered species and adaptive management of natural resources.

Dr. John Duffield will present an update on the NPS non-use value study, identifying non-market values for resources in Glen and Grand Canyons. Dr. Duffield is an economist with extensive experience in survey research and applied valuation of natural resources throughout the western United States. Dr. Duffield is also actively involved in non-market valuation of recreation resources downstream of Glen Canyon Dam with GCRMC.

Dr. Hank Jenkins-Smith will present the methods and results of a recent pilot study identifying preferences for non-market resources in the Glen Canyon and Grand Canyon region. Dr. Jenkins-Smith is a professor of political science and the associate director of the Center for Applied Social Research at the University of Oklahoma. He has written extensively on non-market valuation and public perception of energy and the environment.

Nonmarket values and Glen Canyon Dam

Michael Hanemann

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Topics

- What is economic value?
- What is nonmarket value
- How do market and nonmarket values arise in connection with Glen Canyon Dam?
- Revisiting this issue
  - The 2009 Research review Panel
  - The two National Academy Committees

Economic value

- What is the economic value of a kilowatt hour of electricity, a gallon of gasoline, a loaf of bread?

- What do we mean by “economic value”? What is the criterion for economic value?
  - That is an ethical question.

What is the basis for value?

- Distinguish two alternative approaches

  Deontological view: nature has value in its own right.

  Anthropocentric view: nature has value only to the extent that (some) people value it.

It is the latter view that justifies the use of economics when discussing the value of the environment. Economics is inherently anthropocentric in its focus: it deals with how and why people behave.

Meaning of Economic Value

- The formal definition of ‘economic value’ has a somewhat long and tortuous history; it was not well settled until the 1970s
- The practical issue of measurement played key role: it was not until the 1970s that a practical method valuing *market* commodities was worked out
- The extension to non-market valuation was by then almost immediate

Does price measure economic value?

- This is what most people think: if an item has a price of $7, then that is its economic value.
- This means that only marketed commodities can have economic value. There can be no such thing as non-market valuation.
- Since 1879, economists have known that the answer is NO. But it took until 1970s for this to become well accepted in economics.

Why valuation matters: the distinction between demand and supply

- Demand has to do with what something is worth to people.
- Supply has to do with what is costs them to obtain it.

These are two entirely different issues.

Valuation deals with the former.

The Paradox of Value

- “Only what is rare is valuable, and water, which is the best of all things ... is also the cheapest.” (Plato)
- Adam Smith: Diamond and water paradox

- Implications if it were true that price measures value in economics:

- Items with no market price have no economic value

What we now understand

- If an item is on sale at a price, and if it is freely available and a consumer can freely adjust the quantity he buys,
- Then, the value to the consumer of the last unit of the item purchased (the marginal value) just equals the price.
- The other units purchased, prior to the last unit, are likely to be valued at more than its price – their marginal value is higher.
- The total value of all items purchased is likely to be *more than* the total amount being spent.
- Bottom line: for items purchased, value exceeds price.
- Using price to value market items understates their value to the consumer.

The definition of economic value for a market item

- Economic value is based on a tradeoff.
- The trade-off can be defined in two possible ways:
  - The most a person would be willing to pay to be able to consume the item rather than go without it (the WTP measure of value).
  - The minimum compensation a person would be willing to accept to forego the opportunity to consume the item (the WTA measure of value).

- In principle, those all measures of economic value take the form of either a WTP measure or a WTA measure.
- In some cases, the two measures have the same value; in other – well understood – cases, the two measures differ.
  - Typically the WTA measure would be larger than the WTP measure, but not always.
- When the two measures differ, the choice of which to use is a value judgment.
  - It can be tied to a value judgment regarding the property right.
    - If the person is entitled to the item, the WTA measure seems appropriate;
    - If not, the WTP measure seems appropriate.

Nonmarket value

- Non-market valuation measures in monetary terms the value people place on an items they may care for – regardless of whether those items are supplied through a market.
- Non-market valuation employs the same two concepts of value as market valuation, and subsumes market-valuation as a particular case.

Non-market value, continued

- For a non-market item, the two measures of economic value (the two ways of formulating a trade-off) are:
  - The most a person would be willing to pay to be able to consume the item, if he could obtain it by making a payment, rather than to go without it (the WTP measure of value).
  - The minimum compensation a person would be willing to accept to forego the item (the WTA measure of value).

- Market impacts
  - a change in income;
  - a change in the price of a market commodity or input;
  - a change in the quality of a market commodity or input; and
  - a change in availability other than price (a change in a fixed quantity available).
- Non-market impacts
  - the effects on human health and mortality,
  - the loss of amenity from the environment, and
  - impacts on ecosystems and species
  - Etc.

- Some items that once were seen as non-market are now recognized as market items.
  - For example, recreation at National Parks
    - In the 1940s, when there was no entrance fee for National parks, economists classified recreation there as a non-market item.
    - But, it was pointed out that most people still have to make expenditures to visit a national park even if there is no entrance fee.
    - By 1957, recreation at a national park was recognized as a market item that could be valued in the same manner as any other market commodity.
  - Recreation is an example of what is now called a use value.

Use and non-use value

- The notion underlying nonuse value is that some people would be willing to pay to preserve a wilderness area even if they knew that neither they nor their children would ever visit it because they obtain satisfaction from mere knowledge that it exists (Krutilla, 1967).
- Non-use value is the value people place on an item for motives unconnected with their own potential use of it.
- Non-use value cannot be measured by revealed preference approaches.
- Use value is private good; non-use value a public good.

Measuring economic value

- The concept of economic value – whether market or nonmarket – is based on a trade-off.
- Values of market items are found not by inspecting the price paid for those items but, rather, by elucidating the trade-off being made by the consumer of those items.
- One needs a trade-off to measure economic value , whether WTP or WTA.

Revealed preference & stated preference

- Where purchase behavior is observed, one can use economic analysis to infer the trade-off being made, and thereby to estimate the trade-off value (WTP or WTA).
    - Revealed preference, travel-cost method of recreation demand modeling
- Where no purchase behavior is observed, one can create a trade-off through a survey or an experiment. By observing the response, one directly measures the trade-off value.
    - Stated preference, contingent valuation, choice experiments

Glen Canyon Dam

- What economic values come into play in connection with the operation of Glen Canyon Dam?
- Market values
  - Hydropower
  - Recreation (fishing, boating, ect
- Non-market values
  - Preservation of an iconic area in a natural condition

Socioeconomic Research Review Panel

- Convened in December 2009 by USGS with four members:
  - Myself
  - Joel Hamilton

  Professor Emeritus of Agricultural Economics and Statistics
  University of Idaho, Moscow, Idaho
  - John Loomis

  Professor of Agricultural and Resource Economics
  Colorado State University, Fort Collins, Colorado
  - Lon Peters

  Northwest Economic Research, Inc., Portland, Oregon
- I presented a report on our findings to an AMWG meeting in August 2010. I'll repeat some of what I said then.

Context

- The socioeconomic analyses conducted by the Glen Canyon Environmental Studies (GCES) Program, and GCAMP, has been the subject of four major reviews by the National Academy of Science/National research Council (NRC) since 1984.
- These led to four books:

- National Research Council, *River and Dam Management: A Review of BoR's GCES* (1987).
- National Research Council, *Colorado River Ecology and Dam Management* (1991).
- National Research Council, *River Resource Management in the Grand Canyon* (1996).
- National Research Council, *Downstream: Adaptive Management of Glen Canyon Dam and the Colorado River Ecosystem* (1999).
- Also:
- National Research Council, *Analytical Methods and Approaches for Water Resources Project Planning (*2004)
- National Research Council, *Valuing Ecosystem Services: Toward Better Environmental Decision-Making (*2004)

- The NRC reviews of GCES and GCAMP reached essentially similar conclusions:
  - The economic analysis is unduly restricted to hydropower and recreation.
  - The hydropower economic analysis is not a realistic reflection of conditions in the Western power grid, and significantly overstates the economic cost associated with changes in flow regime.
  - The recreation analysis is not well integrated with the operations analysis. It significantly understates the economic benefits associated with changes in flow regimes.
- In December, the Review Panel found that the same conclusions apply to GCAMP today.

Power Economics

- Glen Canyon is 78% of the total CRSP capacity, but CRSP is a small fraction of the entire Western power grid. Analysis needs to consider GCD as part of the Western grid in which, for periods of time, there is surplus power. (NRC 1987, 1991, 1996)
- WAPA's long-term power contracts should not be taken as exogenous to the analysis. They are subject to periodic renegotiation, and conditions reflecting operational changes can and should be incorporated into the contracts. (NRC 1987, 1991, 1996)

Recreation

NRC 1987:

- Effect of some flow regimes on recreational rafting values was assessed, but this was not integrated with the operations analysis.
- Impacts on non-water based recreation in Grand Canyon needs to be assessed.
- Impact on non-use values needs to be assessed.

NRC 1996:

- “Questions about the effects of dam operations on the total value of the resources downstream from Glen canyon dam are appropriate because federal law requires consideration of the economic implications of alternatives.”
- “Nonuse value seems particularly relevant in the case of the Grand Canyon”
- “The nonuse value results are an important contribution of GCES and deserve full attention as decisions are made regarding dam operations.”
- “Since expenditures made by recreationists reflect the costs of participation, they are not considered benefits from the national point of view and are not included in the calculation of net economic value.”

NRC 1999:

- “The limited commitment to socioeconomic analysis, the magnitude of its responsibilities under the Cultural Resources Program, and the limited staffing levels of these programs are troubling.”
- “The 1988 Strategic Plan limits consideration of ‘economics’ to recreation and hydropower. Limiting the scope of ‘economics’ to two narrowly defined sources of benefits and costs associated with management decisions is disproportionate with the level of scrutiny of physical and biological effects associated with alternative management strategies.”
- “The effect of changes on the welfare of all stakeholder constituencies is represented only by an incomplete measure of recreational user value and the market costs of hydropower.”
- “This strategy fails to anticipate the types of social scientific knowledge needed for adaptive management.”

Socioeconomic Review Panel

- Reviewing GCAMP in December 2009, nothing seems to have changed.
- The concerns expressed by the Panel are the same as those expressed by NRC in 1987, 1991, 1996 and 1999.

No Progress in Economics

- Since 1995, the only economic analysis that has moved forward has been the power analysis. So far, this remains flawed by the same conceptual errors that were noted by NRC in 1987, 1991 and 1996, which significantly overstated the economic impact on power users.
- No progress has been made by GCES/GCAMP since 1995 with regard to economic analysis of the natural, recreational or cultural resources of Grand Canyon National Park and Glen Canyon.

Regional recreation expenditures

- These *were* being measured.
- These are *not* recognized by the Office of Management & Budget, or the federal Principles and Guidelines, or by any other economic authority, as a valid measure of net economic benefit.
- In addition, they have consistently been calculated incorrectly because of the failure to control for economic leakage.
- Even if leakage were accounted for, they would not be a meaningful economic metric. The correct economic metric is net benefit. GCAMP currently seems to have no plan to measure this.

Adaptive Management

- For adaptive management to be meaningful there needs to be a way to *tie* changes in flows to changes in what recreational and cultural users experience.
- The need for a recreational value model component in adaptive management that makes this connection was demonstrated by Walters et al., *Ecosystem Modeling for Evaluation of Adaptive Management* (2000)

Recreational value

- A flow change can affect
  - The number of recreational trips
  - The user satisfaction per trip
- For some recreational activities (day-use rafters, white water rafters) the number of trips is regulated and cannot change.
- But the satisfaction per trip can and will change as flows change. This needs to be monitored.
- The information currently available on how recreational user satisfaction might be affected by changes in flows is outdated and not acceptable now.

Information on link between flow changes and user satisfaction

- Fishing below Glen Canyon Dam
  - Measured in 1985
- Day Use Rafting
  - Measured in 1985
- White Water rafting
  - Measured in 1985 and 1998-99
- Diamond Creek to Lake Mead
  - Not measured

Non-use including cultural value

- Measured for Glen Canyon in 1995.
- Not incorporated in 1995 EIS. Apparently not included in current GCAMP work-plan.
- “To neglect total values in favor of more narrowly defined use values would be to leave a major gap in the economic studies under GCES. This would be unjustifiable given that nonuse values can be estimated.” (NRC, 1996)
- Endorsed in NRC Reports (2004a, b)
- “Does [OMB] permit or encourage the use of methods of “contingent valuation” when quantifying the benefits and costs of environmental rules? Answer: Yes.” (OMB 2003).

Tribal social & cultural impacts

- Native Americans account for a significant portion of the total population most directly affected by Glen Canyon (NRC 1996).
- “In terms of cultural and historic traditions and beliefs and practices, the Native American peoples are the population at risk relative to dam operations.” (NRC 1996)
- NRC 1996 finds that Tribes have received inadequate consideration in the GCES studies.
- The Review Panel’s recommendations are an attempt to rectify this.

My concluding observations in August 2010

- GCAMP has made more progress in monitoring camping *beaches* than visitor *experience*.
- Review Panel identifies flaws that have been present since 1986.
- Current plan lacks a way to tie changes in flows to recreational and cultural values.
- This is not consistent with any meaningful form of adaptive management.
- This can hardly withstand sustained scrutiny.