United States Environmental Protection Agency

Office of Water

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The Importance of Water to the U.S. Economy

Highlights Document

Introduction

Water is vital to a productive and growing economy in the United States, directly and indirectly affecting the production of goods and services in many sectors. Current economic literature provides some insights into the importance of water to various sectors – including agriculture, tourism, fishing, manufacturing, and energy production – but this information is dispersed and, in many cases, incomplete.

EPA is conducting a study on the importance of water to the U.S. economy to summarize existing knowledge about the role of water in the U.S. economy, provide information that supports private and public sector decision-making, and identify areas where additional research would be useful. EPA seeks more complete information on the complex interrelationships between the use of water in one sector of the economy and economic activity in others. EPA also wants to better understand how water resources contribute to economic activity at a local, regional or national level. EPA hopes the study will also be a catalyst for a broader discussion water's role in the U.S. economy.

As part of the study, EPA developed a background report that provides a baseline understanding of how water resources are used in the U.S. and the data and methods available to analyze the economic importance of water. EPA also supported the writing of a set of papers by experts to supplement existing information and to present current economic analyses. EPA held a technical workshop to discuss the literature review and the expert papers, and to gather feedback. EPA is producing a draft report that synthesizes all of this information. The following are some initial highlights from the study.

WATER IS ESSENTIAL TO THE ECONOMY

Access to water is critical to production in a number of economic sectors. It serves as an essential input in agriculture, and is used to extract energy and mineral resources from the earth, refine petroleum and chemicals, roll steel, mill paper, and produce uncounted other goods, from semiconductors to the foods and beverages that line supermarket shelves. It cools the generators and drives the turbines that produce electricity, and sustains the habitat and fish stocks that are vital to the commercial fishing industry.

Rivers, lakes and oceans provide a natural highway for commercial navigation, as well as places to swim, fish, and boat, helping to fuel economic activity in the recreation and tourism industry. **Nearly every sector of the economy is influenced in some way by water.**

But understanding the overall economic importance of water requires using a conceptual framework to illustrate how the most water-dependent economic sectors interact with the rest of the economy. The use of water is heavily concentrated in the extraction and processing mega-sectors of the economy, which includes agriculture, energy, manufacturing and utilities. These sectors produce output that supports economic activity in the delivery and information mega-sectors, which includes industries such as trade, transportation, real estate, recreation and tourism. Negative impacts to the quality and quantity of water used by the extraction and processing mega-sectors therefore have significant ripple effects throughout the economy.

THE ECONOMIC VALUE OF WATER IS SIGNIFICANT BUT ELUSIVE

A great deal is generally known about the economic importance of water. It is known that because water is essential to human life, its total economic value is without measure. It is also known that many sectors that serve as the foundation for the economy depend on water.

But understanding the economic importance of water is, in many ways, limited to these kinds of general observations. Some reasons why there is not more detailed information on the value of water include a lack of market transaction data, limited pricing data because water rights are only infrequently bought and sold, and altered prices because of subsidies.

It is also difficult to determine water's value because it depends upon multiple dimensions – the *volume* of water supplied, *where* the water is supplied, *when* it is supplied, whether the supply is *reliable*, and whether the *quality* of the water meets the requirements of the intended use.

There is also a lack of tools to evaluate the economic implications of changes in the availability and quality of water at a local, regional, or national level. This is a significant concern, especially because of increasing strain on water resources across the country. We also lack tools and information because the price charged for water fails to reflect the full cost of its use, which also increases the likelihood that the resource will be used inefficiently. The economic implications of inefficient use could be significant and will grow over time.

ESTIMATES OF WATER'S VALUE ARE INADEQUATE TO SUPPORT MANY MANAGEMENT DECISIONS

Estimates of the economic value of water vary greatly both within and across sectors, from as little as $1 up to $4,500 per acre-foot. This variability reflects their dependence on a number of factors, such as the scarcity of water in the region, the availability of substitutes for water, and the methods the calculations employ.

Here are some examples of the variability:

- Public supply and domestic self-supply (up to $4,500 per acre foot)
- Agriculture ($12 to $4,500 per acre foot).
- Manufacturing ($14 to $1,600 per acre foot).
- Electric power generation (thermoelectric cooling: $12 to $87 per acre foot; hydropower: $1 to $157 per acre foot)
- Mining & energy resource extraction ($40 to $500 per acre foot).

It is important to note that estimates typically are "average" values, not "marginal" values. They usually reflect the price of water as an input, not the value of the output generated by water and other inputs.

This further illustrates that current information on water's value is not sufficient to support improved decision-making about water management.

EVERYTHING IS CONNECTED

One major theme that emerges from the study of water's importance to the economy is that everything is connected. Though water is a local resource, water use is connected at a regional and national level through commerce, trade, and other economic linkages. **Changes to water use or impacts in one sector or region can produce ripple effects across the economy.**

The interconnectedness of water use and economic activity means that a system-level perspective is needed when considering water's economic importance and managing the resource. This allows a better understanding of the multiple connections and interactions that characterize how water is used to support economic activity and how economic activity might be affected by changes in water supply and quality. This kind of integrated, system-based, forward-looking perspective is vital to thinking strategically about how to maximize the economic value generated from use of the nation's water resources.

The interconnections described above also apply to other dimensions of a water supply, such as its quality. The discharge of pollution into water bodies can affect the quality of water available for other sectors of the economy. Though medium- or low-quality water can be appropriate for some uses, like thermoelectric cooling, the quality requirements for other uses, such as drinking water and high-tech manufacturing, are quite high.

Furthermore, understanding the water quality impacts of economic activity is crucial to capturing the importance of water to in-stream uses – both those that directly contribute to the market economy (e.g., commercial fishing and water-based recreation and tourism) and those that contribute indirectly (i.e., ecosystem services). Water quantity and water quality both connect economic systems to ecosystems which in turn generate goods and services that support economic activity.

THE ENERGY-WATER-FOOD NEXUS IS FUNDAMENTAL

Agriculture, energy production and the public supply of water account for more than 90 percent of off-stream water use in the U.S. Because the energy, food and public water sectors are essential to economic activity in other sectors, decisions made in these sectors will significantly affect the economic value created by the nation's water resources.

Furthermore, interactions among these sectors have given rise to an energy-water-food nexus. Use of water in energy, in agricultural production and for public consumption cannot be viewed in isolation, since changes in one sector can influence the demand for and availability of water to others.

The Importance of Infrastructure: Whether one speaks of reservoirs and aqueducts used to store and transport large quantities of water, treatment plants used to remove contaminants from water before and after residential use, or locks and dams used to maintain the navigability of key waterways, infrastructure is crucial to managing water used in the energy-water-food nexus.

The Role of Institutions: Institutions play an important role in determining how water resources are used in economic activity. By determining who has the right to use water, influencing the pricing of water (by regulating public supply pricing or through subsidies), and setting water quality standards, institutions affect how water is supplied, traded, used in production processes and consumed. Improving the efficiency of water use in the agriculture, energy, and public supply sectors, and reducing their impacts on water quality, is an important challenge. **Institutions can play a large role in supporting efficient and sustainable decision-making within and between these key sectors.**

WATER QUALITY CAN IMPACT VALUE

The impact of water quality on the value of water varies significantly by sector. Some users of water – like commercial shipping – are typically not affected by water quality. Sectors that use water as a processing input – such as thermoelectric cooling, mining and energy resource extraction, and manufacturing – generally have less stringent water quality needs. Many other users, however, are very sensitive to the level of water quality and require clean water to support their economic activity. Uses that involve human consumption or contact – such as drinking water, food and beverage manufacturing, or recreation – need to meet water quality standards designed to protect human health.

Water quality is also a critical consideration in the commercial and recreational fishing industries, as well as tourism. Water that is poor quality is of diminished value to these sectors and can impose substantial costs on society if it is harmful to human health. Finally, any understanding of the economic importance of water must account for the ways that different economic activities affect the quality of water available for other uses. If one use of water pollutes a nearby water body, then others incur treatment costs required to restore water quality downstream to suitable levels.

DEMAND FOR INFORMATION IS INCREASING

The types of information needed to make decisions about water use and management vary by economic sector and the nature of the decision being made. **The increasing costs of inefficient water use and negative impacts on water quality, as well as the positive economic opportunities involving water, are driving demand for more information about how water contributes to the economy**, particularly in regions that already face water scarcity. Meeting this demand will require comprehensive information, both to discover opportunities to increase economic efficiency through management of water resources and to find ways in which the institutions that govern water use can be supportive.

Those involved in using water for activities such as resource extraction, agriculture and manufacturing are likely to be concerned primarily with efficiency in production. They also are likely to be concerned with the adverse impact of potential disruptions in water supplies and managing associated business risks. Information on the return on water-related investments or the likelihood of water supply fluctuations can help companies manage supply chains more efficiently, compete more effectively in output markets, and minimize losses during times of scarcity. Some users in these sectors – those with significant long-term water needs – may recognize the need to think strategically about sustainable use of water resources and may see benefits in collaborating with others to economize and take advantage of synergies in their water use.

Public water supply systems, electric power generators, and water resource management agencies make decisions that may affect the allocation of water resources across different uses. Decision-makers in these sectors are likely to consider economic efficiency from a broader perspective, and will focus on optimizing water use and managing economic risks across multiple sectors producing a wider range of goods and services.

COLLECTIVE ACTION IS NEEDED TO FILL INFORMATION GAPS

The gap between the current state of information about water's importance to the U.S. economy and the information needed to move forward to support optimal use of water resources is large. Generating information of good quality and developing analytical tools will require a collective effort.

Some possible next steps include:

- Investing in opportunities to work with the U.S. Geological Survey in developing the National Water Census. The census will address the current availability of water resources; significant trends affecting water availability, including documented or projected impacts as a result of global climate change; the withdrawal and use of surface water and groundwater by various sectors; significant trends relating to each water use sector; significant water use conflicts or shortages that have occurred or are occurring; and each factor that has caused, or is causing, a conflict or shortage.

- Supporting the development of integrated environmental-economic modeling.
    - Economic and resource flows between sectors, ecosystems.
    - How value is added along supply chains and at final consumption.
    - Tradeoffs and opportunities to increase economic and environmental productivity.

- Expanding the use of water "footprint" analysis to estimate the virtual water content of different products.
    - Would help private sector producers evaluate tradeoffs between the use of different inputs (e.g., water-energy) and help reduce costs of production.
    - Would inform consumers about the water "footprint" of products they purchase.

- Facilitating regional multi-sector or watershed-wide planning efforts to evaluate the readiness to withstand anticipated water supply shocks.

- Integrating water quantity and quality tools and water planning into multiple areas, including facilities, watersheds and sectors of the economy.

It is important to continue and expand the dialogue with technical experts and decision-makers across the public and private sectors. Such a dialogue is essential to understanding the types of data or analytic tools that may be needed to reduce key uncertainties, evaluate the economic implications of management actions, and support decisions that take into account efficient and effective use of the nation's water resources.