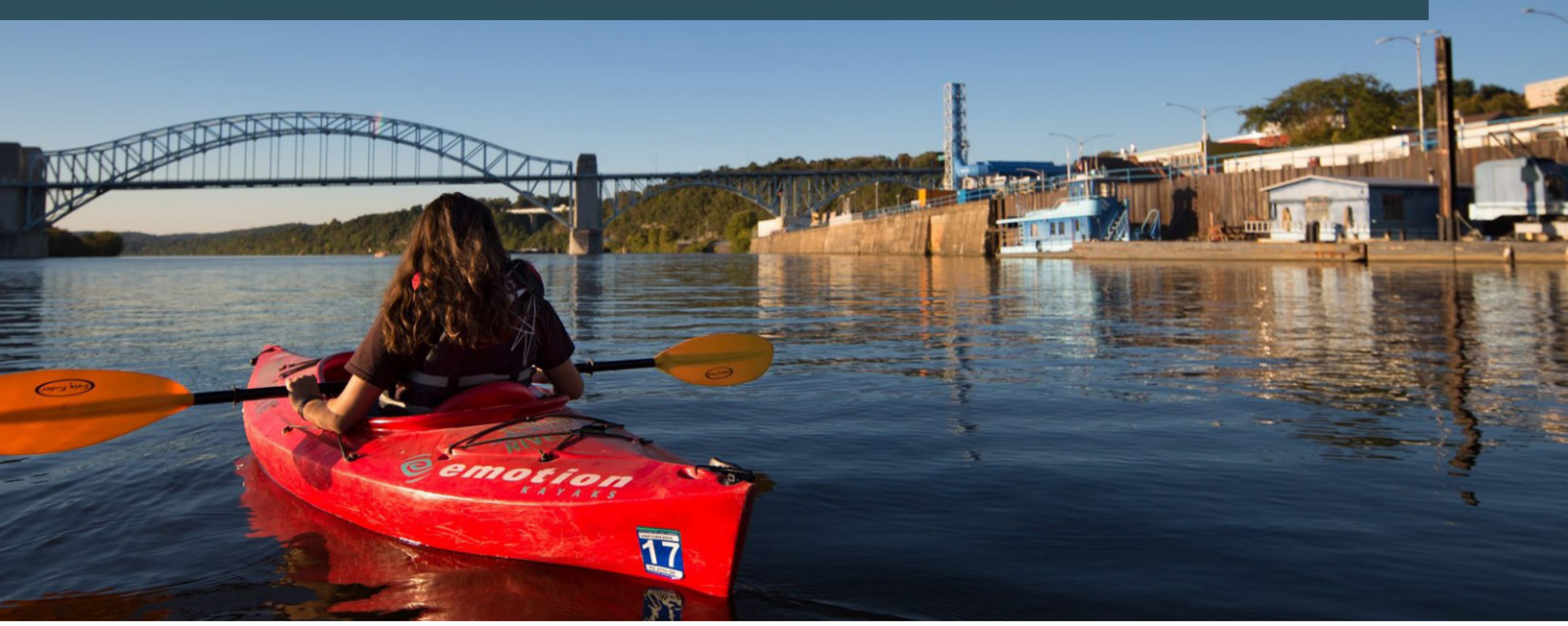
Nature's Value in the Ohio River Basin

MAKING INFORMED DECISIONS

2025



INTRODUCTION

In 2024, Earth Economics, with funding from the Kresge Foundation, supported the Ohio River Basin Alliance (ORBA) with a high-level valuation of co-benefits created by natural ecosystems in the Ohio River Basin. This study used a model that Earth Economics had previously developed for the Land Trust Alliance, which estimates the value of eleven services across nine ecosystems. For this effort, Earth Economics estimated the value of the Ohio River Basin's natural ecosystems, organized by Congressional District (119th Congress) to provide an evidence base for legislators to make informed decisions on allocating funding for protection and restoration of natural ecosystems.

The study found that natural ecosystems in the Ohio River Basin produce at least $50 billion in annual benefits, and $1.17 trillion in benefits over 30 years at a 2-percent discount rate.[1] This is a baseline estimate, using a model that estimates a general value for a limited number of ecosystems and services. The full economic value produced by the ecosystems of the Ohio River Basin is likely much greater.

Protecting and restoring natural ecosystems is essential for the long-term resilience and economic success of the Ohio River Basin. Legislators cannot make informed decisions without including the value of nature. This study supports ORBA's Restoration Plan, which calls on Congress to designate the Ohio River and its tributaries as a valuable water system, which should receive significant, sustained federal investment for restoration and protection.

[1] All results presented in this report are in 2022 U.S. dollars unless stated otherwise.

PREPARED FOR

OHIO RIVER BASIN ALLIANCE

PREPARED BY

EARTH ECONOMICS

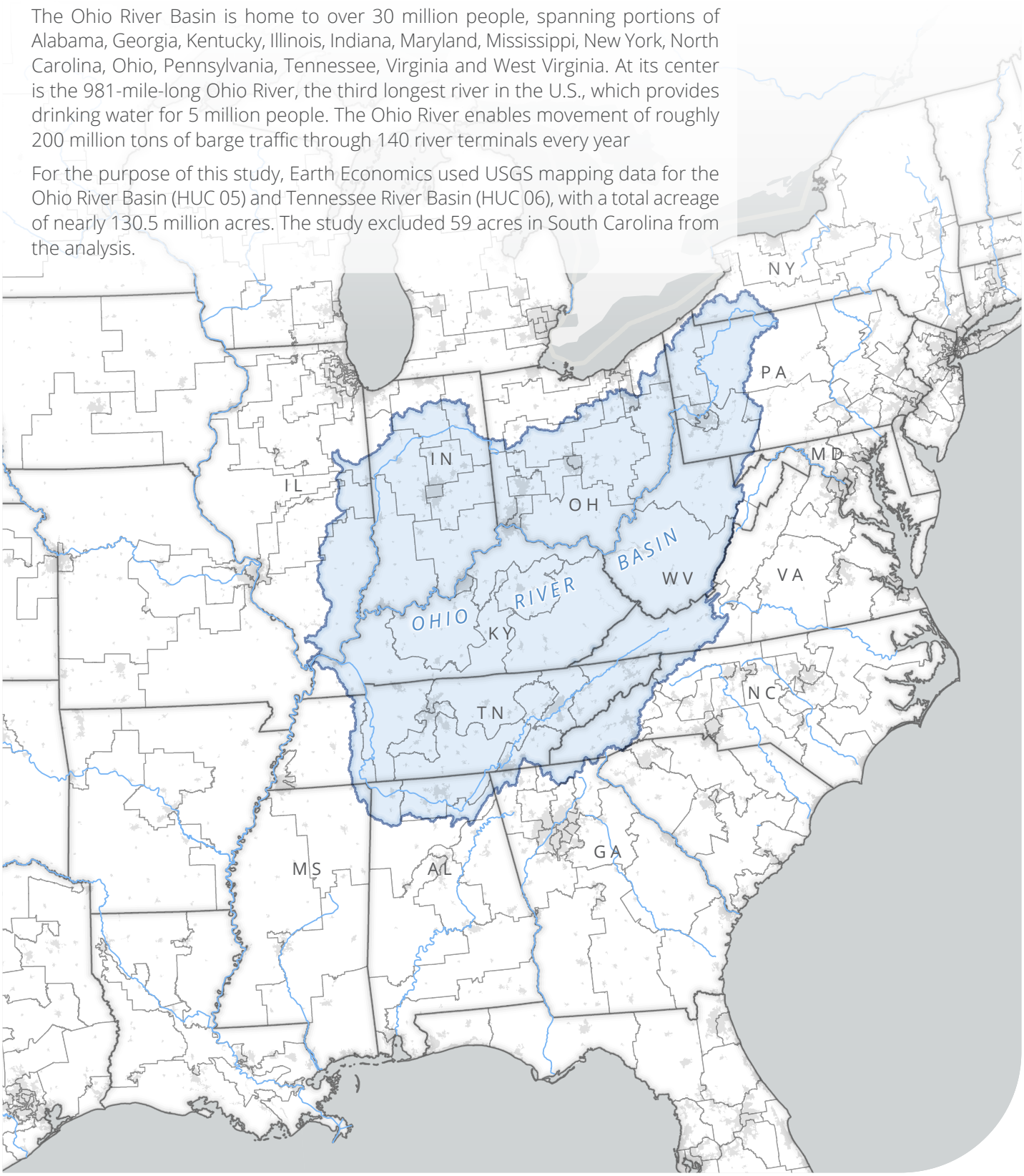
FUNDED BY: The Kresge Foundation

Earth Economics is a non-profit with over two decades of experience estimating the value provided by ecosystem services. Their mission is to quantify and value the benefits nature provides. They ensure ecosystem services are included in the decision-making process at all levels, so communities can mitigate risk, increase resilience, and protect their natural capital wealth. They are members of the USACE Network for Engineering with Nature, and have supported FEMA as it has included ecosystem services in its benefit-cost analysis framework.

WHAT IS THE OHIO RIVER BASIN?

The Ohio River Basin is home to over 30 million people, spanning portions of Alabama, Georgia, Kentucky, Illinois, Indiana, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia and West Virginia. At its center is the 981-mile-long Ohio River, the third longest river in the U.S., which provides drinking water for 5 million people. The Ohio River enables movement of roughly 200 million tons of barge traffic through 140 river terminals every year

For the purpose of this study, Earth Economics used USGS mapping data for the Ohio River Basin (HUC 05) and Tennessee River Basin (HUC 06), with a total acreage of nearly 130.5 million acres. The study excluded 59 acres in South Carolina from the analysis.



Sources: US Census Bureau, Natural Earth, esri

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MILES

ORBA'S ROLE IN PROTECTING THE BASIN

The Ohio River is polluted with farm runoff and industrial wastewater but has not been designated as a federally protected water system. Algal blooms and other water quality-related health concerns can prevent recreation and fishing periodically. The Ohio River Basin does not receive targeted federal funding like that of other large water systems (e.g. the Great Lakes).

ORBA serves as a collaborative, unified voice for Ohio River Basin stakeholders as they press for healthier ecosystems and river communities, and more vibrant water-dependent economies. ORBA provides a forum for addressing water resource issues in the Ohio River Basin.

ORBA's basin-wide priorities include:

- Abundant, clean water
- Healthy and productive ecosystems
- Knowledge and education to inform decision making processes
- The nation's most valuable river transportation and commerce corridor
- Reliable flood risk management
- World-class nature-based recreation opportunities

ORBA seeks to establish a structure for receiving federal funding to restore the Ohio River Basin. Member leaders from the National Wildlife Federation and ORSANCO are drafting an Ohio River Restoration and Protection Plan to restore, protect, and enhance ecosystems within the Ohio River Basin. The plan includes goals for securing water-related infrastructure improvements, ensuring adequate support of infrastructure projects, assessing high flood risk areas, and identifying priority projects for restoration and resilience.

In December 2024, the Ohio River Basin Congressional Caucus Co-Chairs introduced the Ohio River Restoration Program Act, endorsed by ORBA. It was not acted upon during the last legislative session but will be reintroduced in 2025 to the new Congress. If passed, this historic bill will establish an Ohio River National Program Office.

WHAT ARE NATURAL CAPITAL AND ECOSYSTEM SERVICES?

The wellbeing of all communities grows from nature. Healthy ecosystems—forests, wetlands, grasslands, rivers, and lakes—are physical assets, also known as natural capital. As components of natural capital interact, they produce streams of benefits known as ecosystem services. These include clean and accessible water, clean air, food, recreational opportunities, and other vital goods and services.

Natural ecosystems can also protect us: wetlands capture and store water during storms (reducing flood damages), and urban trees cool communities during heat waves.

Figure 1. Example of Natural Capital, Ecosystem Function, and Ecosystem Goods and Services

"If we've learned any lessons during the past few decades, perhaps the most important is that preservation of our environment is not a partisan challenge; it's common sense. Our physical health, our social happiness, and our economic well-being will be sustained only by all of us working in partnership as thoughtful, effective stewards of our natural resources."

President Ronald Reagan remarks on signing annual report of Council on Environmental Quality, July 11, 1984

Red River Gorge, Kentucky

WHAT IS VALUATION AND WHY IS IT IMPORTANT?

If efficiency is a goal of a decision, knowledge of economic values and decision impacts is necessary. Markets do not capture all economic impacts of transactions, only the expenses (money spent for labor, materials, transportation, etc. to make the product or provide the service), and the revenue (the money paid for the product or service). There often are other benefits (e.g., increased clients for restaurants near a new business) and costs (e.g., medical costs arising from pollution-related illnesses) that are not captured in the market transaction. These benefits and costs are none-the-less real and are referred to as externalities. Absent government action to prevent negative externalities through regulation, these costs are not borne by the business but by those impacted by the externality, (e.g., medical expenses), or by governments (e.g., expenditures for Superfund cleanups).

Similarly, natural ecosystems provide real value that are often not captured in market transactions. For example, outfitter businesses are enabled by nearby clean streams and rivers for fishing and kayaking. When ecosystems are damaged, for example by polluted waters generating harmful algal blooms, property values and recreation-related incomes decrease. Common sense tells us we need to include the value that natural systems provide in order to make wise decisions to allocate our limited resources efficiently and distribute resources justly.

Nature provides these services for free, yet because they are rarely traded in markets, such benefits are often ignored in decision-making processes. While some market mechanisms are beginning to emerge (e.g. carbon markets, wetland banking), ecosystems are often assumed to provide little monetary value.

In recent decades, economists have developed a variety of means of estimating this "non-market" value. These include avoided costs (e.g. flood damages where wetlands are absent), willingness-to-pay for conservation or protection, and the degree to which nature supports market values (e.g. pollinator effects on agricultural yields).

Where natural capital is eroded and ecosystem services decline, engineered substitutes are often proposed (e.g. flood control structures, water treatment). Yet ultimately, these often prove more expensive to build, operate, and maintain when compared to protecting those ecosystems, especially considering that natural systems tend to repair and restore themselves over time, while built infrastructure needs periodic maintenance and replacement. As a result, both public and private decision makers are beginning to recognize the importance of capturing the full range of benefits and costs—including impacts on natural capital and ecosystem services.

Upper Waterfalls, Hocking Hills, Ohio

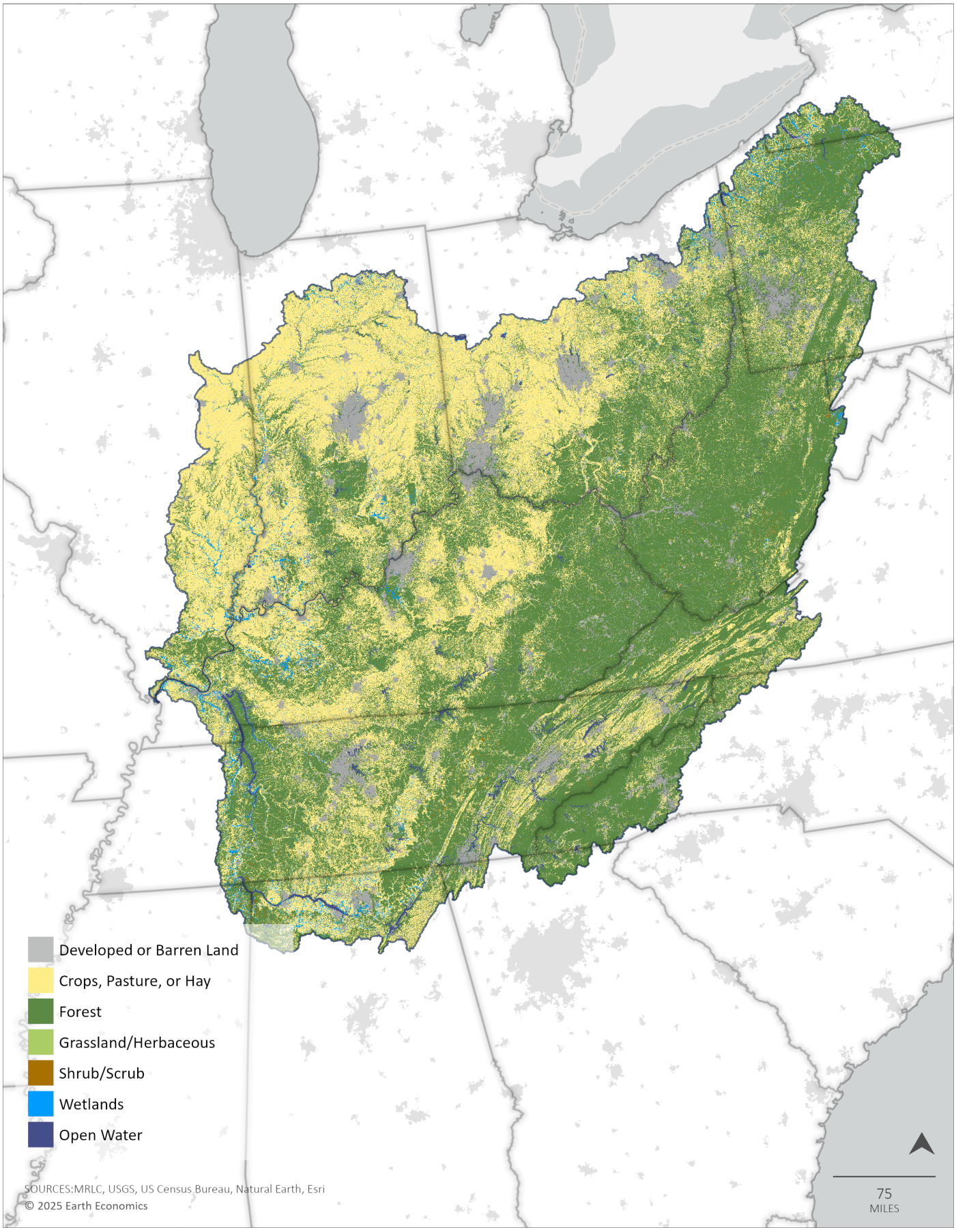
NATURAL ECOSYSTEMS IN THE OHIO RIVER BASIN

This study assessed the value of the nonmarket services produced by ecosystems spanning 58 congressional districts across 14 states, a total of 207 million acres, with 130 million acres (63 percent) falling within the basin. Of these, this analysis focused on the 68 million acres of natural ecosystems. Because it focused on natural ecosystems, this study excluded developed and agricultural lands from consideration.

Table 1. Natural ecosystems by extent, with largest state contributions by landcover type

LANDCOVER	DEFINITION	ACRES	STATES
Deciduous Forest	Most trees shed foliage each autumn	55,109,886	1. KY (21%) 2. WV (18%) 3. TN (17%)
Mixed Forest	Neither deciduous nor evergreen species are dominant	7,292,417	1. TN (26%) 2. KY (18%) 3. PA (12%)
Evergreen Forest	Most trees maintain their leaves year-round	1,661,909	1. TN (48%) 2. AL (11%) 3. KY (8%)
Woody Wetland	Saturated soils with dominant woody growth	1,551,174	1. IN (19%) 2. KY (16%) 3. AL (14%)
Lake	Open water surrounded by land	1,086,105	1. TN (37%) 2. KY (17%) 3. AL (15%)
Grassland	Primarily grasses not subject to intensive management	774,123	1. TN (32%) 2. WV (18%) 3. KY (14%)
River	Areas of naturally flowing water	720,121	1. KY (35%) 2. IN (16%) 3. OH (11%)
Shrubland	Shorter woody growth, including young or stunted trees	531,701	1. TN (30%) 2. WV (18%) 3. KY (13%)
Herbaceous Wetland	Saturated soils where grasses or forbs dominate	231,283	1. IN (25%) 2. KY (20%) 3. TN (17%)

Figure 2. Landcover in the Ohio River Basin



THE VALUE OF NATURAL CAPITAL IN THE OHIO RIVER BASIN

Earth Economics found that the 68 million acres of natural ecosystems in the Ohio River Basin provide at least $50 billion in public benefits every year. Projected over 30 years and discounted at 2 percent, this amounts to an asset value of $1.17 trillion (also known as Net Present Value, or NPV).

This analysis also found that the population and GDP of each state heavily influenced the results. This is because ecosystem services are understood as nature's benefits for people—where there are more people, nature provides greater marginal value. Therefore, a single tree in the middle of a city provides greater value to society than a single tree in a national forest distant from centers of population.

Table 2. Total area of natural ecosystems within the Ohio River Basin (ORB) and their total annual value, per-acre annual value, and net present value, by state.

STATE	AREA WITHIN BASIN (ACRES)	ECOSYSTEMS IN BASIN (ACRES)	AVERAGE ANNUAL VALUE ($M/YEAR)	AVERAGE UNIT VALUE ($/ACRE/YEAR)	NET PRESENT VALUE* ($B)
AL	4,368,089	2,148,355	$2,000.06	$931	$46.79
GA	957,967	698,019	$772.39	$1,107	$18.07
IL	7,101,507	1,508,981	$1,653.34	$1,096	$38.68
IN	18,949,765	5,103,328	$3,586.48	$703	$83.91
KY	25,027,412	13,713,079	$7,446.95	$543	$174.23
MD	267,096	186,517	$56.00	$300	$1.31
MS	269,278	197,904	$181.22	$916	$4.24
NC	3,987,117	3,198,403	$3,553.32	$1,111	$83.14
NY	1,232,402	864,082	$11,336.84	$13,120	$265.24
OH	18,949,940	7,397,453	$4,248.95	$574	$99.41
PA	9,996,060	6,566,204	$2,212.26	$337	$51.76
TN	21,517,347	13,046,029	$10,941.83	$839	$256.00
VA	4,608,277	3,191,519	$767.75	$241	$17.96
WV	13,218,067	11,138,847	$1,251.54	$112	$29.28
TOTAL	**130,450,325**	**68,958,774**	**$50,008.97**	**$725**	**$1,170.03**

*Net present value is projected over 30 years at a 2% discount rate.

WHAT ARE THE NEXT STEPS?

This study reports high-level estimates of the value provided by natural ecosystems in the Ohio River Basin. Such estimates can inform policy decisions where elected officials are seeking efficiency as a goal. Knowing the value of ecosystem service also helps communities throughout the basin advocate for policies to protect and conserve critical ecosystems. There are myriad local, regional, state, and federal initiatives and programs influencing Ohio River Basin ecosystems. By underscoring the economic value provided by ecosystem services, this study serves as a useful tool to communicate the value of natural capital to policymakers and stakeholders.

Furthermore, the spatial nature of this analysis means that these results can be focused to specific contexts and viewed at multiple scales. Thus, communities can better understand the importance of local wetlands to their wellbeing, while states can appreciate the value of larger, multi-state forests to their residents.

HOW WERE ECOSYSTEM BENEFITS ESTIMATED?

Because field research is expensive and time-consuming, it is not practical to estimate the value of all ecosystem services produced across the Ohio River Basin through primary research. Instead, a well-established alternative is to apply Benefit Transfer Methods (BTM), by which value produced at an initial (primary) location is formulated as a unit value (e.g. dollar/acre/year) and transferred to secondary sites sharing similar ecological and social characteristics, scaling by the extent of the equivalent landcover at the second site. Meta-analyses are a form of BTM that assess the contribution of specific contexts and features based on multiple primary studies and have been identified as offering higher accuracy over point-to-point transfers.

In 2023, the Land Trust Alliance commissioned Earth Economics to develop the Ecosystem Services Valuation Tool (ESVT), a meta-analysis of eleven ecosystem services produced by nine ecosystem types. The model includes contextual variables such as state GDP per capita, population density, and EPA region, and can be used to estimate the value of ecosystem services produced by these ecosystems throughout the United States. The ESVT has been found to perform similarly to other meta-analyses published in the literature.

The ESVT is based on 1,467 values across 181 studies sourced from Earth Economics' SERVES database, one of the world's largest repositories of ecosystem service valuation studies. Earth Economics' multi-stage review and tracking processes ensure consistency, accountability, and auditability for each valuation estimate.

The ESVT estimates the value produced by the following ecosystems: woody wetlands, herbaceous wetlands, evergreen forests, deciduous forests, mixed forests, rivers, grasslands, shrublands, and lakes. For each, it values the following services: aesthetic value, air quality, climate stability, disaster risk reduction, forage production, habitat provision, non-use value, recreation, stormwater regulation, water quality, and water supply.

The ESVT generates high-level estimates of the value of ecosystem service benefits suitable for awareness-raising, but like all tools, the estimates also have limitations. These include:

- It reports the total value of benefits, not individual services
- It does not account for variations in ecosystem quality or condition
- Some landcovers and ecosystem services have been excluded, due to limited supporting research
- It does not consider synergies or tradeoffs across landcover types
- It does not directly quantify biophysical characteristics

HOW WAS THE ESVT APPLIED?

Earth Economics applied the following steps to calculate nature's value in the Ohio River Basin:

1. The Ohio River Basin study area was identified from the USGS Watershed Boundary Dataset Subregions Map and Ohio and Tennessee watersheds
2. Congressional Districts (119th Congress) were overlapped with the Ohio River Basin
3. Calculated the extent of each Congressional District intersecting with the Ohio River Basin and the proportion of each District falling within the basin
4. Identified the extent of nine ecosystems wetlands (herbaceous and woody), forests (evergreen, deciduous, and mixed), grasslands, shrublands, rivers, and lakes based on the National Land Cover Dataset (30-meter resolution)
5. Excluded other landcover types (e.g. perennial snow/ice, barren land, hay/pasture, cultivated crops, developed)
6. Identified publicly accessible recreation lands based on the Protected Areas Database (USGS)
7. Identified grazing lands based on a U.S. Forest Service rangeland dataset. Areas classified in the NLCD as rangeland (but not shrub/scrub or herbaceous) were excluded
8. Identified riparian areas based on the U.S. Forest Service National Riparian Areas Base Map
9. Urban areas were identified based on the U.S. Census Urban Areas
10. Ecosystem services produced by natural lands identified above were valued using the ESVT, a meta-analytic function transfer model based on 1,467 valuation estimates conducted within the United States

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