NATURAL CAPITAL VALUATION OF INTERIM ZONING OPEN SPACE PARCELS

CITY OF SOUTH BURLINGTON, VERMONT

APRIL 2020

AUTHORS

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The authors are responsible for the content of this report.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

Nature provides water, clean air, food, timber, and other vital ecosystem goods and services that support human well-being and sustain communities. Though their full value is not always reflected in market prices, ecosystem services are fundamental to a functioning economy. Knowing where to develop or invest—identifying cost-effective and resilient means of managing natural capital and protecting built infrastructure—requires the most complete economic information available. Recognizing the value of ecosystem services, the City of South Burlington has sought to account for the value nature provides. This study aims to assist decision-making in the City of South Burlington—regarding the City's interim zoning bylaw—by accounting for the value of natural capital for twenty parcels identified as top priorities for conservation by the City's Open Space Interim Zoning Committee (OSIZ) over the past year.

Overall, this study finds that the non-market value of ecosystem services provided by these open space interim zoning parcels falls between roughly $5 to $16 million in benefits each year. Since ecosystem services will provide an ongoing "flow" of value well into the future, the cumulative values over the next twenty years is conservatively estimated at $73 to $240 million with a 3% discount rate. Figure 1 highlights the values of individual OSIZ parcels and additionally highlights the grouping of parcels (OSIZ id. 34, 142, 35, 27, 146, 133) in the Great Swamp area.

FIGURE 1 *Summary of Natural Capital Values for the City's Open Space Interim Zoning Committee (OSIZ) Priority Parcels*

Priority Parcels	Range of Natural Capital Values in $/year ($ 2017)		Net Present Value Over 20 Years (Discount Rate of 3%)	
OSIZ No.	Low Estimate	High Estimate	Low Estimate	High Estimate
7	$143,000	$473,000	$2,186,000	$7,235,000
10	$180,000	$541,000	$2,747,000	$8,287,000
11	$366,000	$897,000	$5,596,000	$13,737,000
14	$446,000	$1,570,000	$6,831,000	$24,047,000
27	$156,000	$785,000	$2,382,000	$12,026,000
34	$1,205,000	$3,956,000	$18,459,000	$60,609,000
35	$61,000	$358,000	$920,000	$5,486,000
37	$60,000	$381,000	$919,000	$5,833,000
39	$218,000	$648,000	$3,335,000	$9,930,000
53	$205,000	$497,000	$3,130,000	$7,611,000
60	$154,000	$408,000	$2,358,000	$6,241,000
67	$78,000	$276,000	$1,195,000	$4,217,000
74	$165,000	$546,000	$2,527,000	$8,358,000
76	$366,000	$1,067,000	$5,602,000	$16,346,000
90	$416,000	$1,482,000	$6,366,000	$22,704,000
101	$101,000	$286,000	$1,547,000	$4,380,000
128	$30,000	$49,000	$453,000	$743,000
133	$16,000	$35,000	$241,000	$537,000
142	$264,000	$759,000	$4,039,000	$11,630,000
146	$111,000	$640,000	$1,700,000	$9,804,000
Great Swamp	$1,811,000	$6,532,000	$27,740,000	$100,090,000

INTRODUCTION

The Southeast Quadrant of South Burlington, Vermont encompasses are variety of natural capital assets, including forests, wetlands, streams, and agricultural lands. The open space ecosystems of South Burlington provide critical goods and services, including clean air and water, fish and wildlife, aesthetic beauty, and outdoor recreation opportunities. As the region's economy expands, so does the need to safeguard natural places. Understanding the contributions of natural capital to human well-being in the area will be critical to planning that succeeds in maintaining South Burlington's quality of life. The City of South Burlington has temporarily adopted an interim zoning bylaw to allow time to assess the costs and benefits of continued growth in various parts of the City, including the Southeast Quadrant.

While typical cost-benefit analyses exclude benefits and costs that are not captured by market prices, the non-market benefits produced by open space and natural capital assets—including environmental, recreational, and educational benefits—are *real* benefits, and should be incorporated into decision-making processes. A natural capital valuation of priority open space parcels within the City will provide a more comprehensive picture of what residents and officials of the City of South Burlington stand to gain or lose under different zoning and development scenarios. This project has produced a natural capital valuation of twenty parcels of land identified as top priorities throughout the City for conservation by the City's Open Space Interim Zoning Committee, to inform potential decisions about zoning and open space conservation.

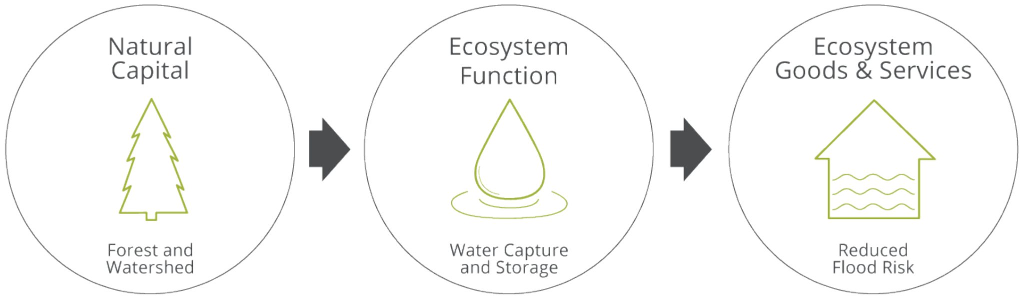
VALUING ECOSYSTEM SERVICES

Earth Economics has over twenty years of experience conducting comprehensive benefit-cost analyses that incorporate the non-market economic value of natural capital assets. Natural capital is defined as naturally occurring ecosystems such as wetlands, forests, and pastures, as well as the plant and animal communities they support. The benefits derived from the ecosystem functions produced by natural capital are known as ecosystem goods and services, such as water supply, carbon sequestration and storage, and flood-risk reduction (see Figure 2). Following the Millennium Ecosystem Assessment, twenty-one ecosystem services can be categorized into four main categories: provisioning services, regulating services, information services, and supporting services as described in Figure 3.

Over the past half century, scholars specializing in environmental and natural resource economics have developed a diverse toolkit of primary valuation techniques to assess the economic contribution of ecosystem goods and services. In some instances, this value is partially captured by markets; consumers buy products directly provided by nature, such as water or fish. For these goods and services, formal markets can reflect their contribution to human well-being. Yet there are also benefits for which markets do not exist. To estimate the value of these "non-market" benefits (e.g., clean air, aesthetic appreciation), economists must apply other techniques, such as travel cost analysis, hedonic pricing, and contingent valuation.

Broadly speaking, ecosystem services describe the benefits people receive from natural capital. Natural capital refers to resources like plants, animals, soils, minerals, and energy resources. Like other forms of capital, natural capital provides a flow of goods and services. These goods and services are the basis of all other economic activity as they provide clean water, breathable air, nourishing food, flood risk reduction, waste treatment, climate stability, and other critical services. For example, during storm events, natural capital like grasses and trees capture and store excess storm water runoff, reducing flood risk to human life and property.

FIGURE 2 *Capital Functions*



CATEGORIES OF ECOSYSTEM SERVICES

Ecosystem services are often grouped into four categories:

PROVISIONING SERVICES which provide the physical materials which society uses. Community gardens grow food. Rivers provide drinking water as well as fish for food.

REGULATING SERVICES are benefits obtained from the natural control of ecosystem processes. Intact ecosystems provide regulation of climate, water quality and delivery, and soil erosion prevention. They also keep disease organisms in check.

SUPPORTING SERVICES provide the habitats which support food webs and all life on the planet.

INFORMATION SERVICES allow humans to interact meaningfully with nature. These services include providing spiritually significant species and natural areas, natural places for recreation, and opportunities for scientific research and education.

FIGURE 3 *Definition of Ecosystem Services Relevant to This Report*

ECOSYSTEM **SERVICES** BY DEFINITION

PROVISIONING	
Energy & Raw Materials	Can include fuel, fiber, fertilizer, minerals, and/or energy
Food	Can include crops, fish, game, and/or produce
Medicinal Resources	Can include traditional medicines, pharmaceuticals, and or assay organisms
Ornamental Resources	Resources for clothing, jewelry, handicrafts, worship, and decoration
Water Storage	Amount of surface or ground water held and its capacity to reliably supply water
REGULATING	
Air Quality	Ability to create and maintain clean, breathable air
Biological Control	Pest and/or disease control
Climate Stability	Ability to support a stable climate at global or local levels
Disaster Risk Reduction	Ability to prevent and mitigate natural disasters, including flood, fire, and drought
Pollination & Seed Dispersal	Include pollination and/or seed dispersal
Soil Formation	Soil creation for agricultural and/or ecosystem(s) integrity
Soil Quality	Soil quality improvement due to decomposition and pollutant removal
Soil Retention	Ability to retain arable land, slope stability, and coastal integrity
Water Quality	Water quality improvement due to decomposition and pollutant removal
Water Capture, Conveyance, & Supply	Ability to provide natural irrigation, drainage, supply, flow, and use of water
Navigation	Ability to maintain necessary water depth for recreational and commercial vessels
SUPPORTING	
Habitat	Ability to maintain genetic and biological diversity, and to promote species growth
INFORMATION	
Aesthetic Information	Enjoyment and appreciation of nature through the senses (sight, sound, etc.)
Cultural Value	Use of nature in art, symbols, architecture, and religious/spiritual purposes
Science & Education	Use of natural systems for education and scientific research
Recreation & Tourism	Can include hiking, boating, travel, camping, and more

ECONOMIC VALUE OF NATURAL CAPITAL

While the economic contribution and value of natural capital are critical to human well-being, decisions impacting the environment have historically overlooked the economic benefits of nature[1,2]. The language of budgets, costs, and return on investment is just beginning to incorporate these benefits into decision-making, but the effect has been significant. Because ecosystems are living systems, natural assets are often more resilient and less costly to maintain than built infrastructure. Without these systems, many of the benefits societies receive for free would need to be replaced by built infrastructure, at greater cost for construction and ongoing maintenance, as well eventual replacement[3,4]. Acknowledging the economic value of natural capital demonstrates the cost-effectiveness of nature-based solutions, while raising awareness of the long-term connections between people and these natural assets.

PRIMARY VALUATION METHODS

In the same way that economists can determine the value of real estate as a private asset, economists can also determine the contribution of ecosystem goods and services as public assets. For instance, although timber is bought and sold in markets, those prices usually ignore the contribution that trees provide to nearby communities, such as water filtration, wildlife and pollinator habitat, or flood risk reduction. Such economic contributions are known as *non-market benefits*. Because the full benefits of a given resource are not always included in market prices, economic value must sometimes be assessed indirectly, using a range of valuation techniques. These include:

- **Replacement Cost:** The cost to replace services provided by functioning ecosystems with built infrastructure (e.g. levees and dams to replace natural floodplain protection).
- **Avoided Cost:** The losses which would be incurred if a natural ecosystem were removed or its function were significantly impaired (e.g. flood extent reduced by wetlands and riparian buffers).
- **Production Approaches:** Ecosystem services which enhance market outputs (e.g. moderate, regular rainfall can increase crop productivity).
- **Travel Cost:** Where benefiting from natural ecosystems requires travel, the willingness to incur such costs implies the level at which those services are valued (e.g., recreation and tourism).
- **Hedonic Pricing:** Property values vary by proximity to certain ecosystem services (e.g. homes with water views often sell for higher prices than similar homes without such views).
- **Contingent Valuation:** Estimates derived from surveys of the values assigned to certain ecosystem services (e.g., willingness-to-pay to protect water quality).

The valuation of most ecosystem services is well-understood and straightforward. However, for ecosystem services that are difficult to quantify or value, benefits are often better described qualitatively.

BENEFIT TRANSFER METHODOLOGY

To value ecosystem goods and services, Earth Economics employs the benefit transfer method (BTM), in which estimates of economic value are based on primary valuation studies of similar goods or services produced in comparable conditions (e.g., climate, terrain, soils, species). BTM is often the only practical, cost-effective option for producing reasonable estimates of the wide range of services provided by ecosystems.

The application of BTM begins by identifying critical attributes of a landscape that determine ecological productivity and expected benefits. Primary valuations of similar ecosystems, geographies, and communities are then identified and assessed for their comparability with land cover types within the South Burlington study area. Estimates from primary studies are then standardized (i.e., adjusted to common units, correcting for any inflation between the period of research and the present) to ensure "apples-to-apples" comparisons. In this sense, BTM is similar to a property appraisal, in which the features and pricing of similar properties nearby are used to estimate value prior to a sale. While each process has its limitations, they are rapid and efficient approaches to generating reasonable values for making investment and policy decisions.

Interest in certain ecosystem services and land cover types has generated a substantial body of research. Therefore, multiple estimates can be found for given combinations of land cover types and ecosystem services. In these instances, Earth Economics report both low and high per-acre value estimates. Other ecosystem services and land cover types are less well-researched. For cases where Earth Economics have been unable to identify a study suitable for transfer to the South Burlington study area, no value is included (see Figure 6). It is important to understand that this decision simply reflects the limitations of valuation research, not that those natural assets provide no value.

To apply BTM for a full set of ecosystem service/land cover type combinations, this analysis used Earth Economics' Ecosystem Service Valuation Toolkit (EVT). Studies within EVT have gone through multiple reviews and are standardized for use in BTM. Our analysts used several criteria to select appropriate primary studies for the South Burlington study area, including geographic location and the ecological and demographic characteristics of the original primary study sites.

STUDY OVERVIEW

STUDY AREA

The City of South Burlington Vermont in Chittenden County is adjacent to Lake Champlain and is a part of the larger Burlington metropolitan area. As shown in Figure 4, the twenty Open Space Interim Zoning Committee (OSIZ) selected parcels are distributed throughout South Burlington and include areas adjacent to the airport, major roads, Lake Champlain, housing developments, golf courses, the University of Vermont, and other conservation parcels. Over a total of 1040 acres, these parcels range in sizes from 22 to 181 acres. Estimated from recent land cover spatial data, the parcels contain around 307 acres of wetlands, 285 acres of forests, 415 acres of grassland and shrubland, and 34 acres of built and bare land. The steps below explain the procedures for estimating land cover areas and associated ecosystem service values.

STEP 1.

IDENTIFICATION AND QUANTIFICATION OF LAND COVER CLASSES WITHIN PRIORITY PARCELS

The first step in conducting a natural capital valuation is to identify the range of land cover classes found within the study area – in this case, the twenty priority open space parcels identified by the City's Open Space City of South Burlington. The project team first conducted an inventory of existing natural capital in the study area by quantifying the spatial extent of different land cover classes. The City of South Burlington provided a shape file and spreadsheet with information on the select parcels for the interim zoning ordinance.

Accessing recent high-resolution land cover data in the Vermont Open GeoData Portal[6], this study extracted Vermont-specific land cover data for the study area to calculate acreage of each land cover class present in the study parcels. Specifically, land cover values come from merging 2016 0.5-meter resolution rater base land cover data with wetland specific land cover vector data from rom a combination of 2013 - 2017 LiDAR and 2016 orthoimagery data, including emergent, forested, and shrub/scrub wetlands. Figure 5 shows the reclassified map of land cover areas utilized in this study[7,8]. As the combined land cover data shows, wetlands are abundant in the study area. Additionally, given that wetland values were the most abundant data sources for the study, this study calculated ecosystem service values according to emergent, scrub, and forested wetland land cover types. The land cover categories of buildings, roads, rail, bare soil, and other paved surfaces are not applicable to this analysis.

FIGURE 4 *Conservation Parcels*[5]

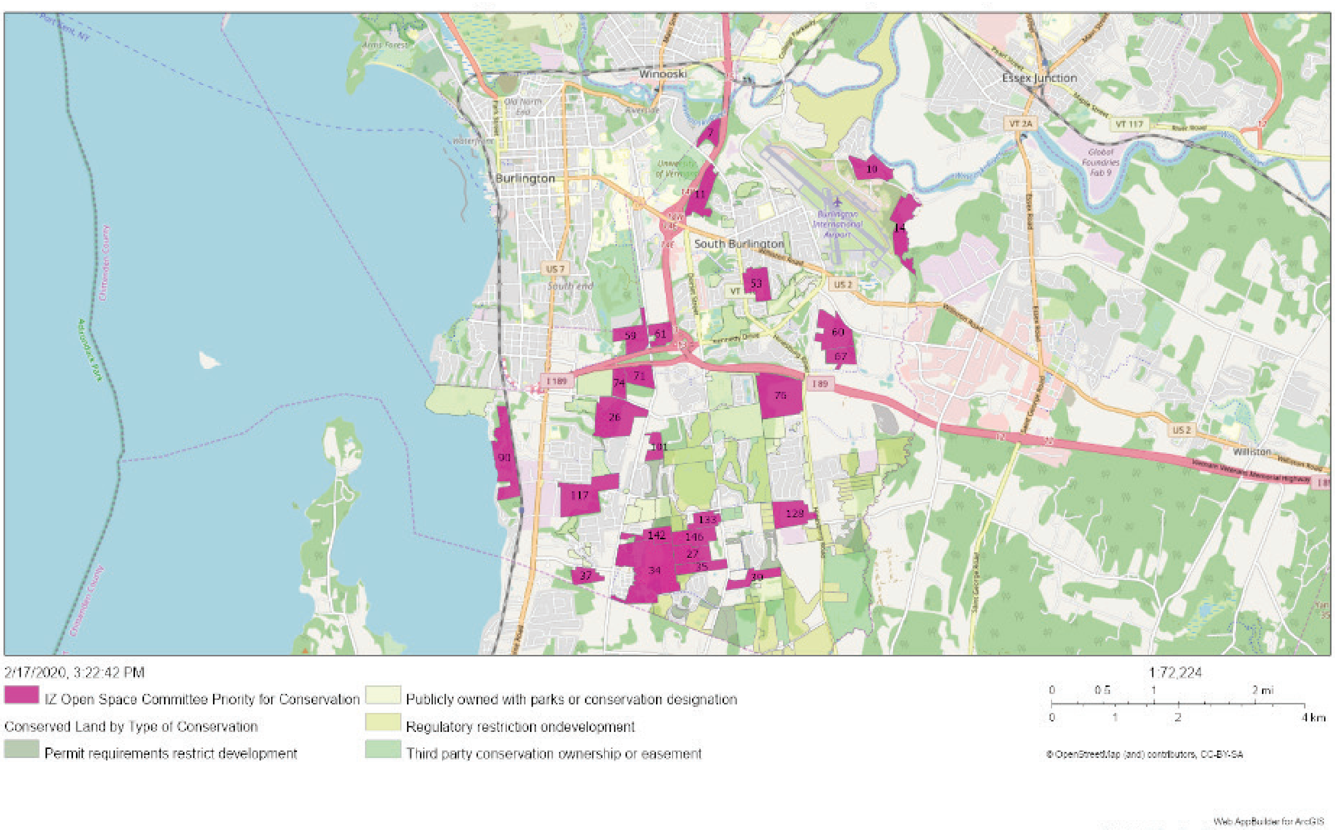
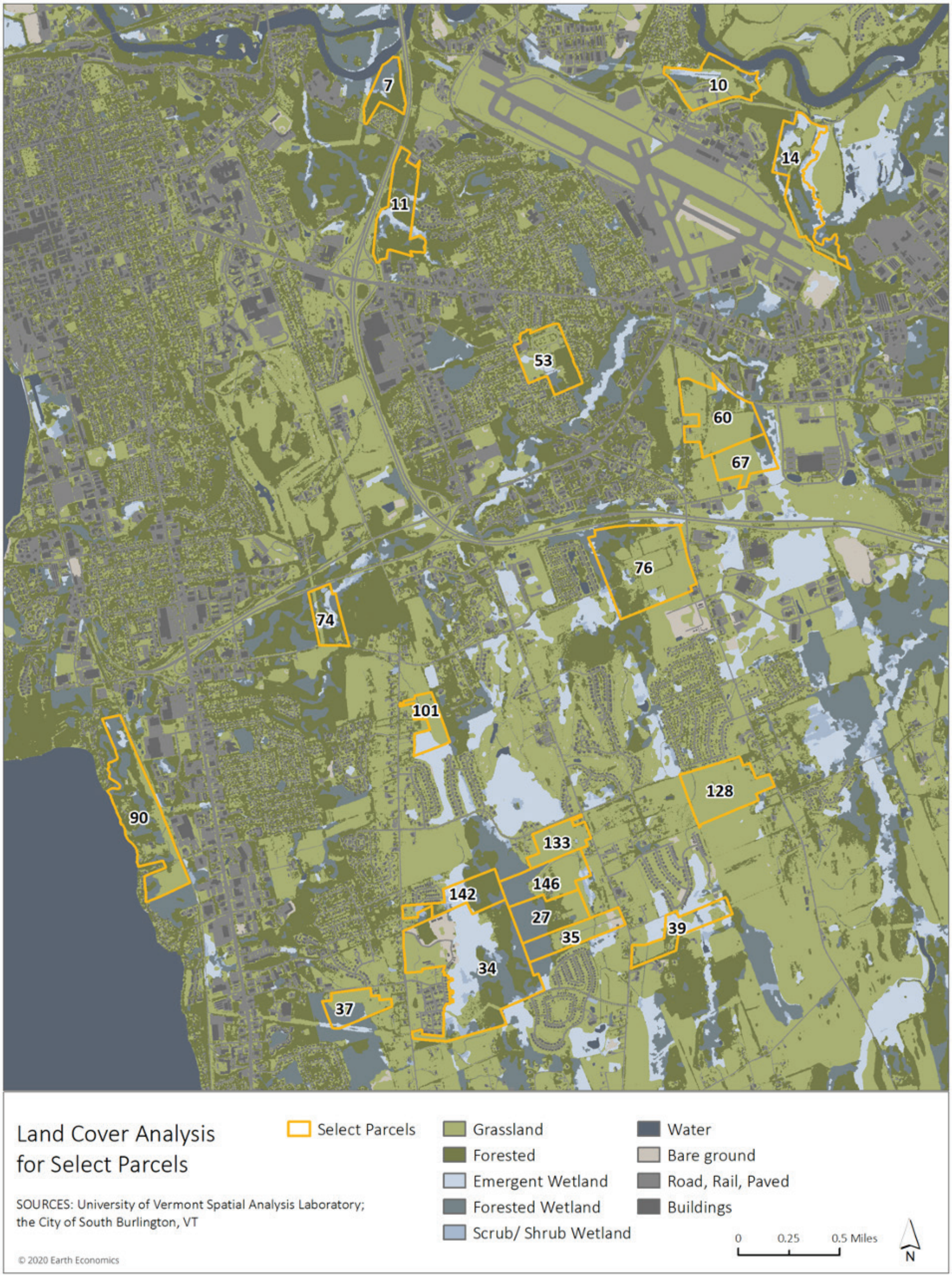


FIGURE 5 *Study Area Land Cover Values*



STEP 2.

IDENTIFICATION AND VALUATION OF ECOSYSTEM SERVICES GENERATED BY PRIORITY PARCELS

The next step in the process analyzed the ecosystem services provided by each land cover identified within the study area. The project team identified ecosystem services relevant to each land cover type found within each parcel of the study area and then assigned those ecosystem services an economic value, using the benefit transfer method (BTM). BTM is a well-established approach within the field of ecological economics for indirectly estimating the values of ecological goods and services by utilizing existing data on ecosystem services from other areas and applying them to a study area. The team used Earth Economics' proprietary ecosystem service valuation toolkit (EVT) to conduct a benefit transfer analysis (BTM) of the identified lands. BTM begins with the identification of peer-reviewed valuation studies for locations similar to the study site of South Burlington, Vermont. Earth Economics has been analyzing and cataloguing relevant studies into our Ecosystem Valuation Toolkit (EVT) for over a decade, which today includes more than 4,900 ecosystem service value estimates, each tagged with a specific subset of more than 100 contextual variables (e.g., climate, elevation, urban proximity). Figure 6 presents a gap analysis of existing transferrable EVT values for the South Burlington study site.

FIGURE 6 *Gap Analysis of Ecosystem Service Values for Each Land Cover Type*

ECOSYSTEM SERVICES BY LAND COVER TYPE	AGRICULTURE	FORESTS	WATER	WETLANDS	GRASSLANDS
PROVISIONING					
Energy & Raw Materials	○	○	○	○	○
Food	○	●	○	○	○
Medicinal Resources	○	○		○	○
Ornamental Resources	○	○	○	○	○
Water Storage	○	○	○	●	○
REGULATING					
Air Quality	○	○	○	○	○
Biological Control	○	●	○	○	○
Climate Stability	○	●	○	●	○
Disaster Risk Reduction		○	○	●	○
Pollination & Seed Dispersal	○	○		○	○
Soil Formation	○	○	○	○	○
Soil Quality	○	○	○	○	○
Soil Retention	○	●	○	○	○
Water Quality	○	●	○	●	●
Water Capture, Conveyance, & Supply	○	●	○	●	○
Navigation			○		
SUPPORTING					
Habitat	○	○	○	●	○
INFORMATION					
Aesthetic Information	○	●	○	●	○
Cultural Value	○	○	○	○	○
Science & Education	○	○	○	○	○
Recreation & Tourism	○	○	○	●	○

● ECOSYSTEM SERVICE IS PRODUCED BY LAND COVER TYPE AND HAS BEEN VALUED IN THIS ANALYSIS

○ ECOSYSTEM SERVICE IS PRODUCED BY LAND COVER TYPE BUT CANNOT BEEN VALUED IN THIS ANALYSIS

BLANK INDICATES ECOSYSTEM SERVICE IS NOT PRODUCED BY THIS LAND COVER TYPE

STEP 3.

ASSESSMENT OF ANNUAL VALUE AND TOTAL ASSET VALUE OF PRIORITY PARCELS

This study calculated annual ecosystem service values by land cover and reported those services as a per-acre/per-year value where data is available. The annual value of ecosystem services represents the flow of benefits derived from natural assets each year. To calculate the total annual value for the twenty priority parcels, all ecosystem service values were summed by land cover type and then multiplied by the area of the twenty parcel study area. These total annual values by land cover are then aggregated, generating a total dollar value associated with ecosystem services provided by the open space parcels per year. This total annual value is presented in a disaggregated table, to allow for parcel-by-parcel analysis.

Finally, Earth Economics estimated the total asset value for each of the twenty parcels. The asset value of built capital, such as a road, levee, home, or business, can be calculated as the net present value of its expected future benefits. In the same way that a home holds value year after year, natural capital also provides value over time. The annual flow of ecosystem services generated by the open space parcels will continue into the future. As such, analogous to built capital, the study calculated the asset value of the priority open space parcels. The asset value is a snapshot of current land cover and available valuation literature and provides a measure of the expected benefits flowing from the study area's natural capital over twenty years, assuming the open space parcels are preserved. The net present value of the open space parcels was computed using an agreed upon 3% discount rate (see Figure 7).

VALUATION RESULTS

Figure 7 summarizes the natural capital values for each parcel and the value of those parcels over the next twenty years with a 3% discount rate. Values (calculated in 2017 dollars) for parcels range from $16,000 to $3,956,000. To account for the combined natural capital of adjacent parcels as one larger open space, this study additionally considers the collective value of parcels (OSIZ no. 34, 142, 35, 27, 146, 133) which are clustered together in the Great Swamp area.

ADDITIONAL CONSIDERATIONS

The results of this study underestimate the value of ecosystem services provided by each parcel given gaps in the literature and classification of land cover types (see Figure 6). Given the GIS data analyzed and gaps in the EVT database, this study did not calculate the ecosystem services of agricultural lands and agricultural soils. As outlined below, adjacency[9], connectivity[10], social cohesion and well-being[11,12], and equity[13] which are associated with, and extend from, the ecosystem services of the priority parcels provide additional consideration for decision-making that are beyond the scope of this study.

ADJACENCY AND CONNECTIVITY

This study recognizes that OSIZ parcels are adjacent to conserved lands, open spaces, parks and trails, and other landscape features with additional ecosystem service values, which are beyond the scope of this analysis. Figure 7 provides a basic qualitative summary of parcel adjacency. This study also recognizes the connectivity of OSIZ parcels ecosystems to broader ecosystem services, for example those associated with lakes, streams, rivers, and riparian areas that extend through or along the boundaries of parcels. Several parcels are also part of larger forest blocks, corridors for wildlife, and surface water protection areas. Figures 9 and 10, for example, show the OSIZ parcels in relation to surface water protection areas and BioFinder priority areas, which identify "Vermont's lands and waters that support important ecosystems, natural communities, habitats, and species.[14]"

FIGURE 7 *Summary of Natural Capital Values for the OSIZ Parcels*

Priority Parcels		Range of Natural Capital Values in $/year ($ 2017)		Net Present Value Over 20 Years (Discount Rate of 3%)	
OSIZ No.	Parcel ID	Low Estimate	High Estimate	Low Estimate	High Estimate
7	1290-00600	$143,000	$473,000	$2,186,000	$7,235,000
10	1380-00000	$180,000	$541,000	$2,747,000	$8,287,000
11	1810-01076	$366,000	$897,000	$5,596,000	$13,737,000
14	1460-00000	$446,000	$1,570,000	$6,831,000	$24,047,000
27	0570-01575	$156,000	$785,000	$2,382,000	$12,026,000
34	1640-01840	$1,205,000	$3,956,000	$18,459,000	$60,609,000
35	0570-01675	$61,000	$358,000	$920,000	$5,486,000
37	0040-00201	$60,000	$381,000	$919,000	$5,833,000
39	0085-00197	$218,000	$648,000	$3,335,000	$9,930,000
53	0860-00160	$205,000	$497,000	$3,130,000	$7,611,000
60	1260-00200F	$154,000	$408,000	$2,358,000	$6,241,000
67	0860-RR750	$78,000	$276,000	$1,195,000	$4,217,000
74	1700-00150	$165,000	$546,000	$2,527,000	$8,358,000
76	0860-00835	$366,000	$1,067,000	$5,602,000	$16,346,000
90	1540-01195	$416,000	$1,482,000	$6,366,000	$22,704,000
101	1640-01340	$101,000	$286,000	$1,547,000	$4,380,000
128	0860-01499	$30,000	$49,000	$453,000	$743,000
133	0570-01475	$16,000	$35,000	$241,000	$537,000
142	1640-01720	$264,000	$759,000	$4,039,000	$11,630,000
146	0570-01505	$111,000	$640,000	$1,700,000	$9,804,000
Great Swamp	OSIZ # 34, 142, 35, 27, 146, 133	$1,811,000	$6,532,000	$27,740,000	$100,090,000

SOCIAL COHESION

Analysis of an exit poll from South Burlington 2018 midterm elections[16] found that 80% of respondents indicated they would be willing to pay an extra $100 in property taxes for supporting the construction of more affordable housing and for permanently preserving more open and undeveloped land. The same study analyzed 78 responses about changes in the Southeast Quadrant and found that 50 referenced dislike around "too many houses," "too much growth," "too much sprawl," or "loss of open spaces" in the Southeast Quadrant.

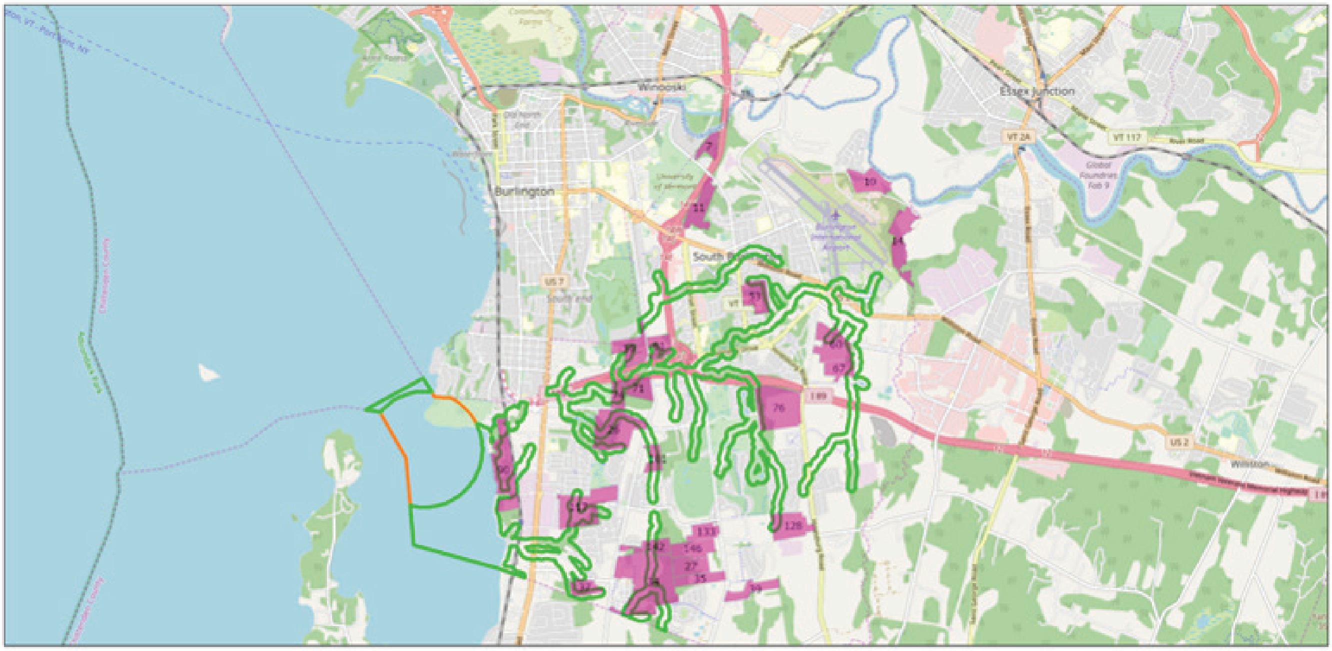
EQUITY

The City is working to balance concerns over the availability of affordable housing and the need to conserve open space. The City has a population of around 19,486 with 94.1% of the population percent of persons above the poverty and a median household income of $71,017[17]. In South Burlington and Chittenden County, access to affordable housing is lacking in part due to a lack of availability. As a 2014 study found, "The high share of area residents paying a disproportionately high share of their income towards housing costs is likely due to a lack of affordable housing.[18]"

***FIGURE 8** Adjacency Considerations*

Priority Parcels		Considerations
OSIZ No.	Parcel ID	
7	1290-00600	Within Muddy Brook and the Winooski River watershed.
10	1380-00000	Within Muddy Brook and the Winooski River watershed. Adjacent to Muddy Brook Park.
11	1810-01076	Within Muddy Brook and the Winooski River watershed. Adjacent to Centennial Woods.
14	1460-00000	Within Muddy Brook and the Winooski River watershed
27	0570-01575	Within the Great Swamp. Contains Muddy Brook. Conserved areas adjacent.
34	1640-01840	Within the Great Swamp. Conserved areas adjacent
35	0570-01675	Within the Great Swamp. Conserved areas adjacent.
37	0040-00201	Trails adjacent. Contains Bartlett Brook.
39	0085-00197	Conserved areas adjacent.
53	0860-00160	Resurrection Park Cemetery. Contains Potash Brook.
60	1260-00200F	Contains Potash Brook.
67	0860-RR750	Contains Potash Brook.
74	1700-00150	Contains Potash Brook
76	0860-00835	Contains Potash Brook. Adjacent to Wheeler Park.
90	1540-01195	Adjacent to Shelburne Bay/ Lake Champlain and Red Rocks Park.
101	1640-01340	Contains Potash Brook
128	0860-01499	Adjacent to a pond and golf course
133	0570-01475	Within the Great Swamp. Conserved areas adjacent.
142	1640-01720	Within the Great Swamp. Conserved areas adjacent.
146	0570-01505	Within the Great Swamp. Conserved areas adjacent.

FIGURE 9 *Surface Water Protection Areas*[15]



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IZ Open Space Committee Priority for Conservation

Surface Water Source Protection Area

ZONE 1

ZONE 2

1:72,224

0 0.5 1 2 mi

0 1 2 4 km

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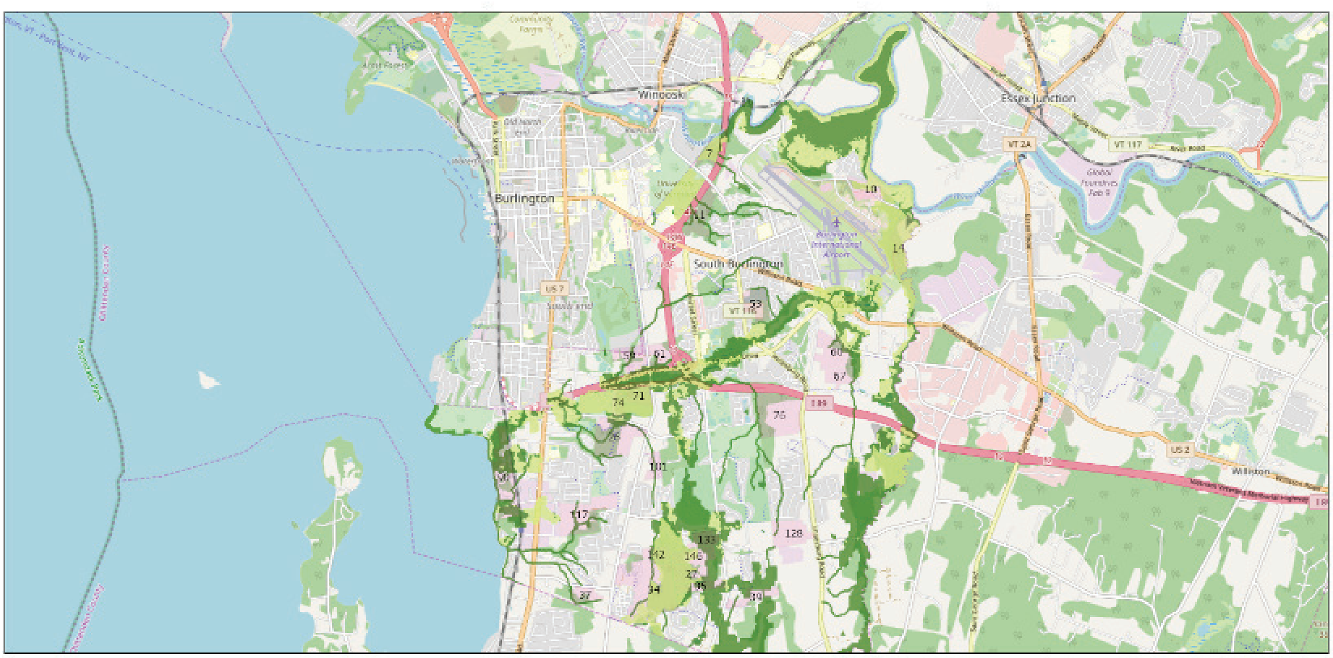
FIGURE 10 *BioFinder Priority Areas*



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IZ Open Space Committee Priority for Conservation

Biofinder Landscape Scale Overall Priority

Highest Priority

Highest Priority

Priority

1:72,224

0 0.5 1 2 mi

0 1 2 4 km

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CONCLUSION

The City of South Burlington has sought to acknowledge the economic value of natural capital of identified priority open spaces. Using Earth Economics' proprietary ecosystem service valuation toolkit (EVT), this study conducted a benefit transfer analysis (BTM) of the land cover areas in open space interim zoning parcels. Through this ecosystem service valuation, Earth Economics found that the non-market value of ecosystem services provided by these priority parcels, amounts to between $5 to and $16 million in benefits per year. These benefits provide an annual flow of value and will do so well into the future, as such, Earth Economics estimates that the cumulative values over the next twenty years of ranges from $73 to $240 million. Figure 7 summarizes the natural capital values for each priority parcel. Given gaps in the analysis, there are additional ecosystem service values within and extending from ecosystems in the parcel areas that are not accounted for in this study.

APPENDIX A
STUDY LIMITATIONS

The benefit transfer method (BTM), used in this study to value ecosystem services, has limitations. Yet, these limitations should not detract from the core finding that ecosystems produce significant economic value for society. Some limitations include:

- Every ecosystem is unique; per-acre values derived from another location may be of limited relevance to the ecosystems under analysis.
- Even within a single ecosystem, the value per acre depends on the size of the ecosystem; in most cases, as the size decreases, the per-acre value is expected to increase, and vice versa. (In technical terms, the marginal cost per acre is generally expected to increase as the quantity supplied decreases; a single average value is not the same as a range of marginal values).
- Gathering all the information needed to estimate the specific value for every ecosystem within the study area is not currently feasible. Therefore, the full value of all of the shrubland, grassland, et cetera in a large geographic area cannot yet be ascertained. In technical terms, far too few data points are available to construct a realistic demand curve or estimate a demand function.
- The prior studies upon which calculations are based encompass a wide variety of time periods, geographic areas, investigators, and analytic methods. Many of them provide a range of estimated values rather than single-point estimates. The present study preserves this variance; no studies were removed from the database because their estimated values were deemed too high or too low. In addition, only limited sensitivity analyses were performed. This approach is similar to determining an asking price for a piece of land based on the prices of comparable parcels ("comps"): Even though the property being sold is unique, realtors and lenders feel justified in following this procedure to the extent of publicizing a single asking price rather than a price range.
- In response to the study by Costanza et al. (1997) of the value of all of the world's ecosystems, critics objected to the absence of imaginary exchange transactions. However, including exchange transactions is not necessary if one recognizes the purpose of valuation at this scale—a purpose that is more analogous to national income accounting than to estimating exchange values.[19]

This report displays study results in a way that allows one to appreciate the range of values and their distribution. It is clear from viewing the tables that the final estimates are not precise. However, they are much better estimates than the alternative of assuming that ecosystem services have zero value, or, alternatively, of assuming they have infinite value. Pragmatically, in estimating the value of ecosystem services, it is better to be approximately right than precisely wrong.

APPENDIX B
VALUE TRANSFER STUDIES

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