

ASSESSING ECOSYSTEM SERVICES SUPPLY FOR RESTORATION

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By

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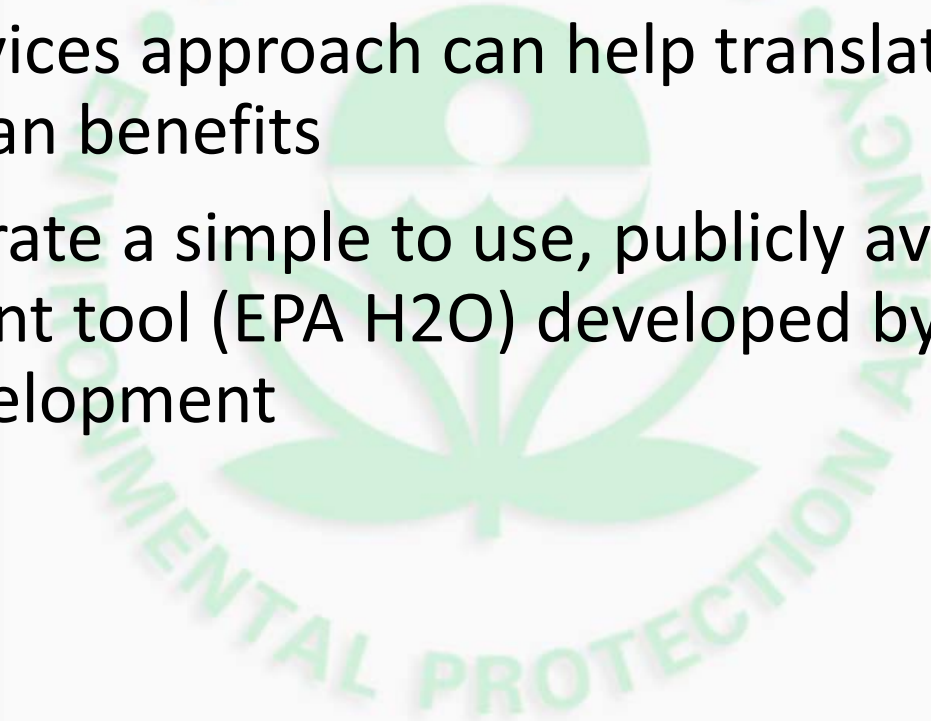
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Introduction

- Restoration efforts are sometimes challenged to adequately evaluate and communicate their value to the public
- An ecosystem services approach can help translate environmental changes into human benefits
- Here we demonstrate a simple to use, publicly available ecosystem services assessment tool (EPA H2O) developed by the US EPA Office of Research and Development



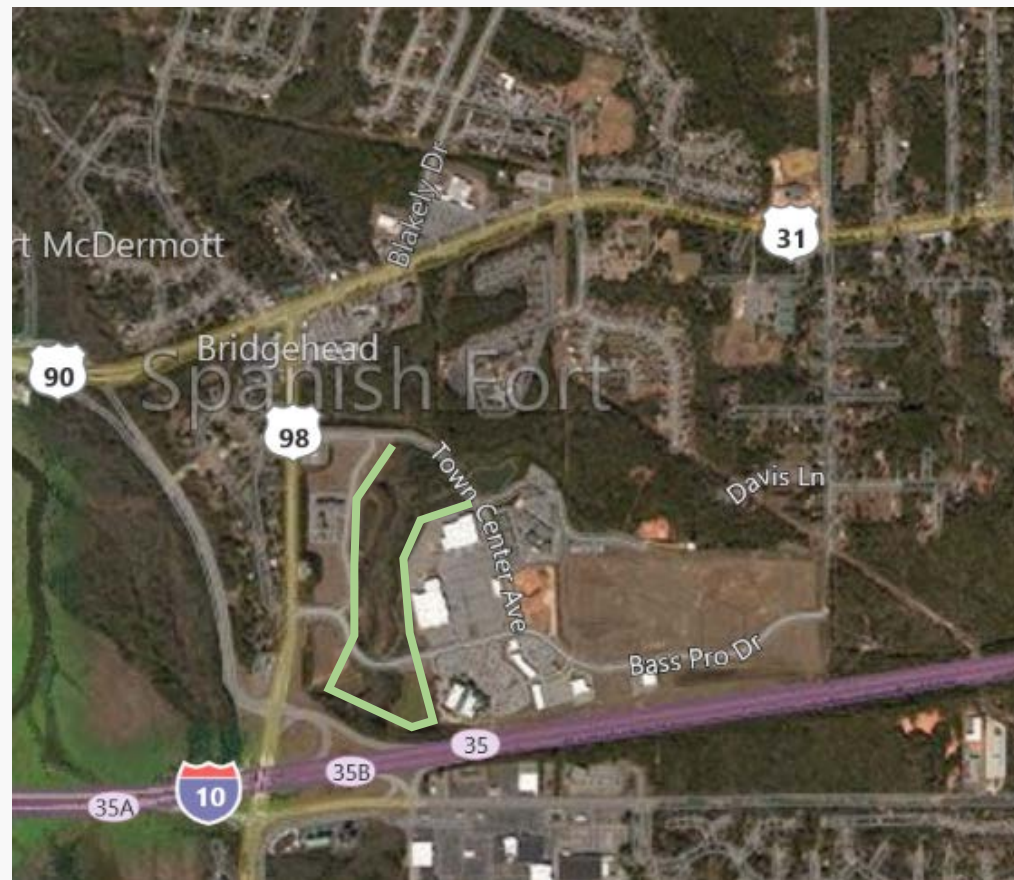
What is the EPA H2O tool for?

- Preliminary assessments of benefits supplied from hydrologically connected landscapes to a defined area of interest.
 - Summarizes land cover/use types in areas supplying benefits to humans
 - Translates biophysical metrics into common currency suitable for tradeoff analyses
 - Informative for conservation, restoration and land use planning decisions
- Scenario analysis for comparing existing landscape's production of benefits to decision alternatives.
 - Landscape changes can be made on a parcel by parcel basis
 - Side by side comparisons summarized in an easy to share pdf report
 - Summaries focused on area of interest and upstream landscape

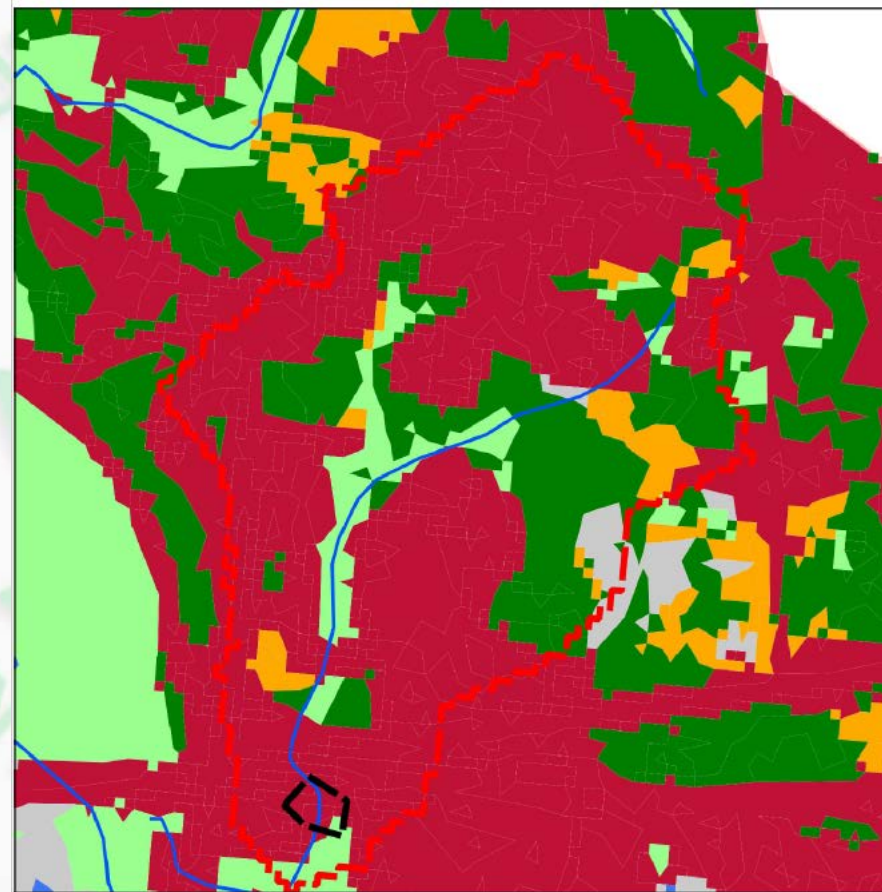
What does the tool address?

- EPA H2O is designed to assess the production of four ecosystem services humans benefit from:
 - Nutrient removal (via Denitrification)
 - Atmospheric pollution removal (PM10, ozone, etc.)
 - Greenhouse gas removal (via Carbon sequestration)
 - Flood protection (soil precipitation retention)
- Transportation module also assesses driving or walking travel times from any user defined point to areas of interest such as parks, facilities, water access etc.
 - Scenario building function allows user to modify the transportation network and assess changes in travel times which can be used for travel cost estimates

Demonstrate Need for Past Restoration Efforts – Joe's Branch, AL 2000-2010



2018



2001

Legend

- NHD_flowlines
- Upstream Area Of Interest
- Area Of Interest
- Scenario-FutureUrbanization
- FLUCCS Classifications
 - Urban and Built-Up
 - Agriculture
 - Rangeland
 - Woodlands
 - Water
 - Wetlands
 - Barren Land
 - Utilities and Transportation
 - Tidal Flats
 - Seagrass and Algae Beds

Water Quality

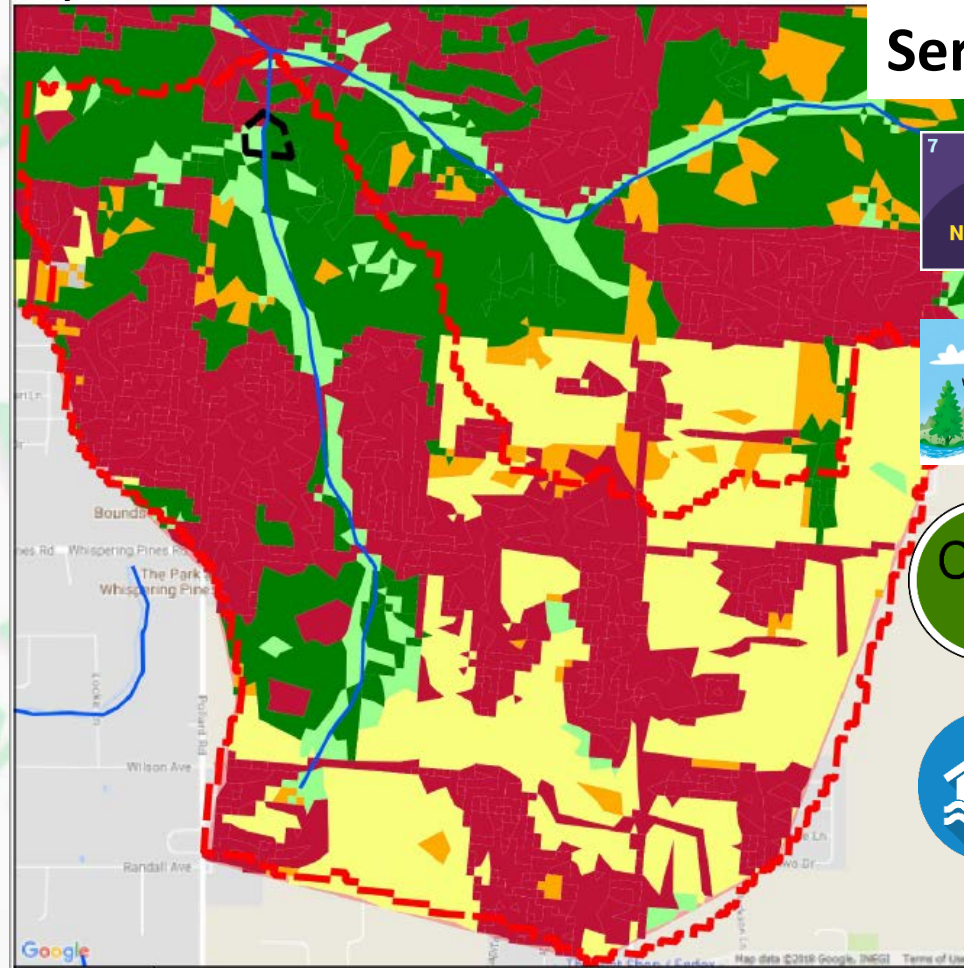
- Nitrogen: 14.00 yr^{-1}
- CO₂ yr^{-1}

Inform Restoration Planning in Context of Past Changes (2001-2011)

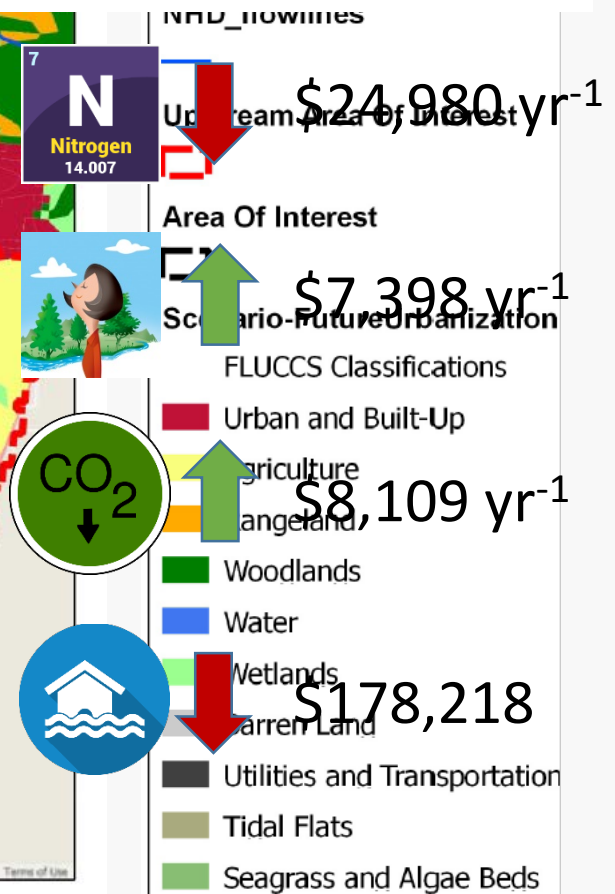
Watershed Ecosystem Service Assessment



2018

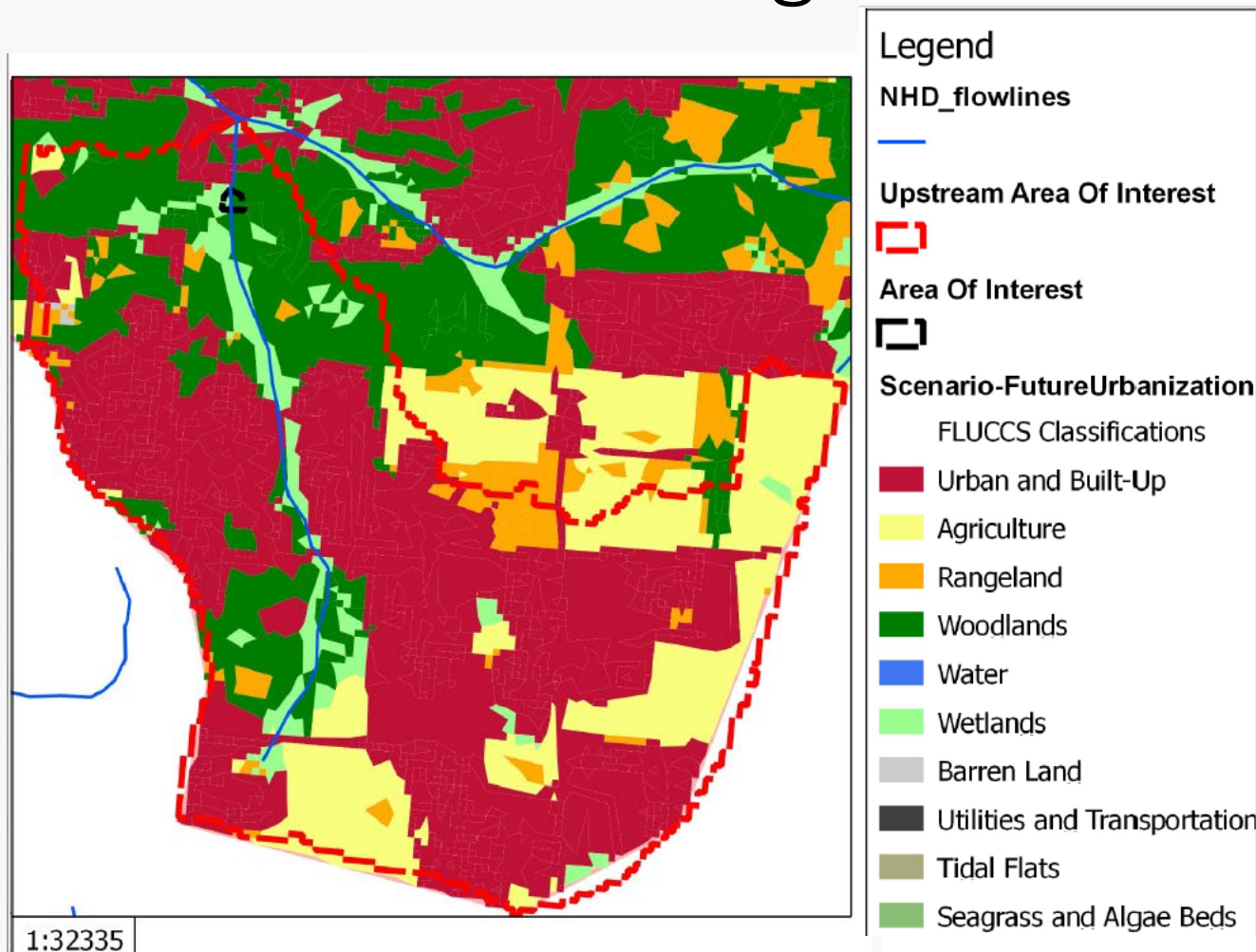


2001

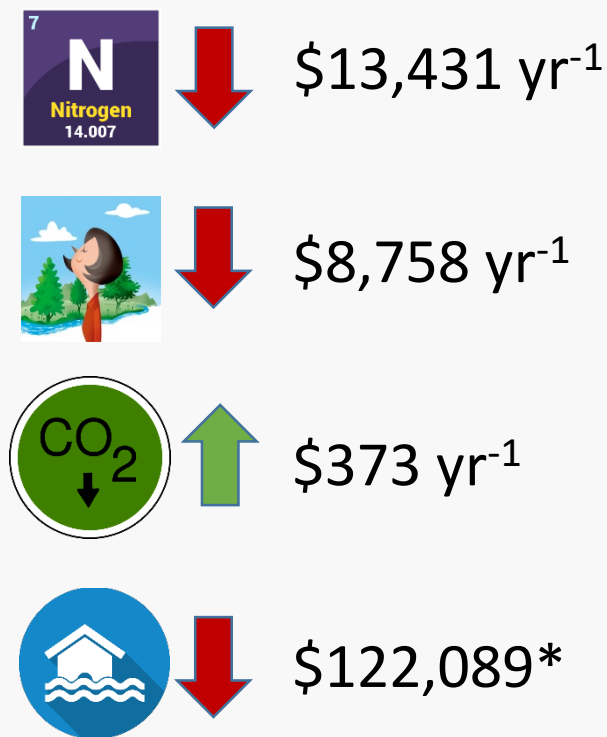


Future Scenario of Neighborhood Buildout

2011



Watershed Ecosystem Service Assessment



*Reduction in soils ability to retain water when ag converted to medium density residential is only ~15% due to fairly impermeable soil types in this area

How is tool output tailored for decision makers?

- Translates landscape production into relatable benefit terms:
 - Changes in health care costs
 - Waste water treatment costs
 - Social cost of carbon emissions
 - Stormwater infrastructure costs
- Hydrological delivery pathways automatically accounted for upstream production of nutrient removal and flood water retention
- Results summarized as an easy to read pdf report with descriptions for each result and a convenient reference map of summarized area

Accessibility and Expandability of Tool

- EPA H2O was developed as an extension of the open source, freely available QGIS software package
 - Packaged for easy download and installation with example database
 - User interface simplified for most users
 - Full functionality of QGIS available for advanced users
 - Databases generated using only publically available data layers
 - Benefit functions enter tool as simple look up tables based on default peer reviewed studies which can be easily adjusted to account for local data if available
- Tool is ready for development of modules for assessing more ecosystem benefits as methods and data layers become available

Challenges

- Power of the tool is limited by the availability and resolution of publically available landscape data layers
 - National Land Cover Database (NLCD) available nationally
 - Further resolved state or local based land use datasets are not consistent across state, county, or municipal borders
- Peer reviewed landscape specific rates also may be scarce
- Databases for areas not part of EPA pilot studies need to be developed
 - Requires some GIS technical skills
- Addition of landscape attributes specifically valued by local community will require further collaboration with stakeholders

Opportunities

- US government was being encouraged to increase the incorporation of ecosystem service assessments into their decision making – 2015 Memo from OMB/CEQ/OSTP to Federal Agencies
- Quick assessment tools such as EPA H2O provide decision makers preliminary information about how ecosystem functions and their related benefits to humans may change under different land use management strategies
- EPA H2O is freely available so all stakeholders can leverage the same information as they engage with the decision making process

Contact information

- Tool developed for Tampa Bay Ecosystem Services Demonstration Project by Marc Russell and others at NHEERL's Gulf Ecology Division
- Russell.marc@epa.gov
- EPA H2O tool can be downloaded at:
- <https://www.epa.gov/water-research>

