Didactic, Data-driven Dioramas

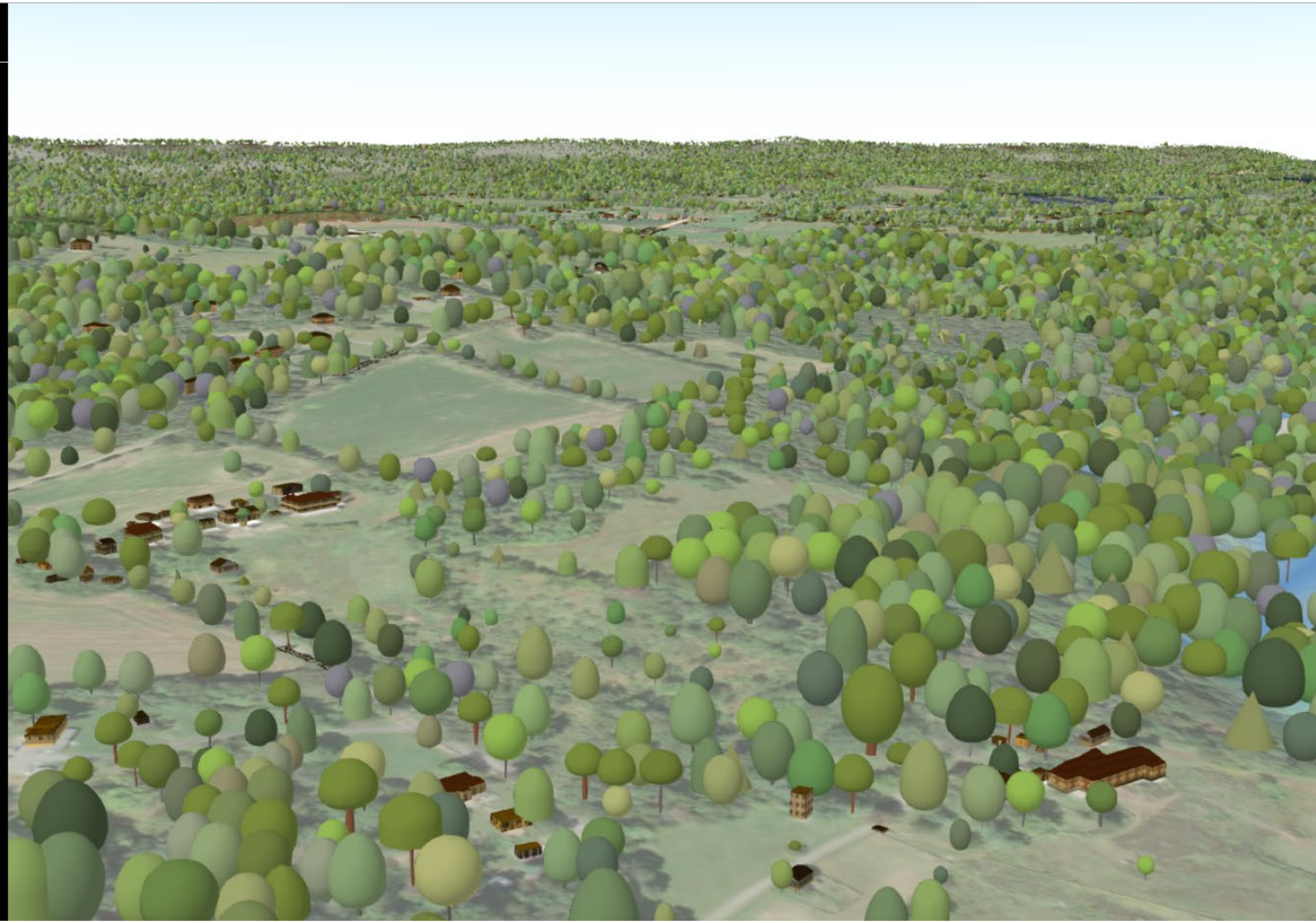
Landscape Visualization and Ecosystem Services in the Chesapeake Bay Watershed

Chesapeake Bay

- Largest of 130 estuaries in United States
- Approximately 200 miles long
- Produces about 500 million lbs of seafood each year
- Average depth is 21 feet

Chesapeake Bay Watershed

- 64,000 square mile watershed –



Didactic, Data-driven Dioramas

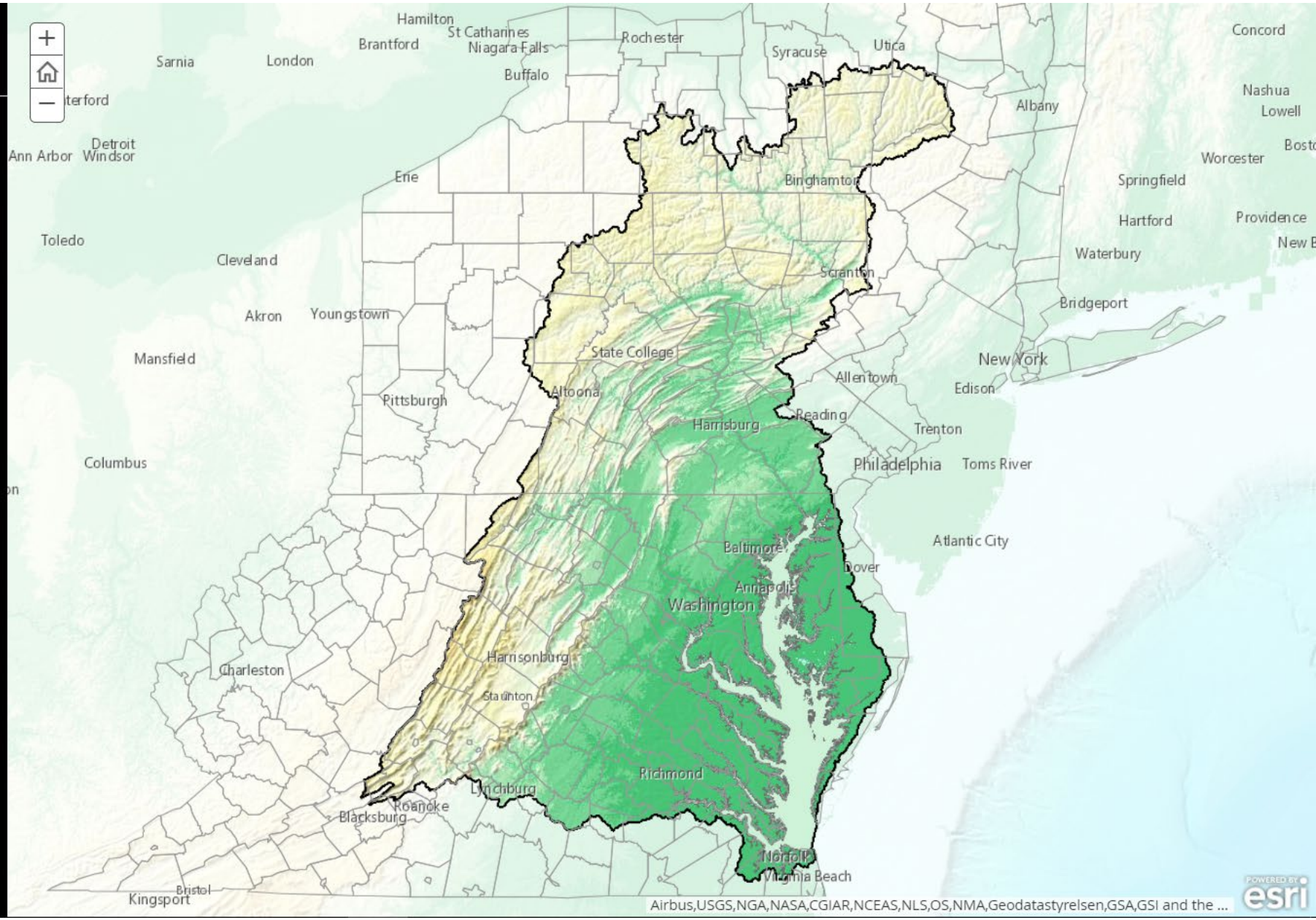
Chesapeake Bay and its Watershed

- Largest of 130 estuaries in the United States
- 64,000 square mile watershed – six states and D.C.
- 17+ Million people
- 150 major rivers and streams – Susquehanna contributes about 50% of all freshwater

2014 Agreement - Ten Goals and 31 Outcomes

Goal Categories:

- Sustainable Fisheries
- Vital Habitats
- Water Quality
- Healthy Watersheds
- Toxic Contaminants
- Climate Resiliency
- Land Conservation



Didactic, Data-driven Dioramas

2014 Agreement - Ten Goals and 31 Outcomes

Goal Categories:

- Sustainable Fisheries
- Vital Habitats
- Water Quality
- Healthy Watersheds
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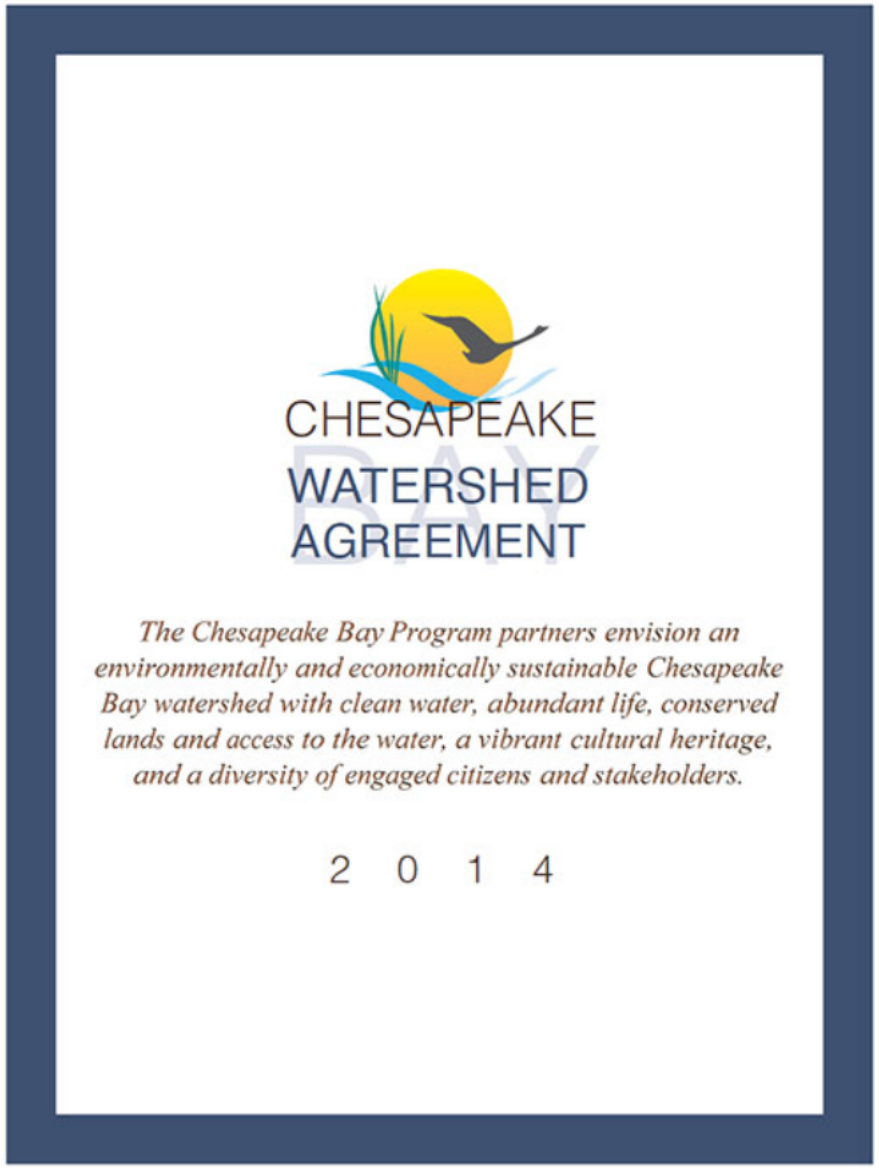
- Climate Resiliency
- Land Conservation
- Stewardship
- Public Access
- Environmental Literacy

Outcomes represent ***desired future conditions***

Research Questions



Didactic, Data-driven Dioramas

Research Questions

Role of 3D landscape visualization

Conceptual Diagrams

- Generic, conceptual landscapes
- Promote common visual understanding
- Can communicate multiple ecosystem attributes and stressors
- However … *not a real world reflection*

ESRI Local Government Solutions

3D Basemaps
- Basic Scene

*Is interactive 3D landscape visualization effective for **communication** and **educating** stakeholders of Chesapeake **conservation** and **restoration** issues?*

*Can it help stakeholders to understand how **landscape change** affects **ecosystem services**?*

Didactic, Data-driven Dioramas

Conceptual Diagrams

- Generic, conceptual landscapes
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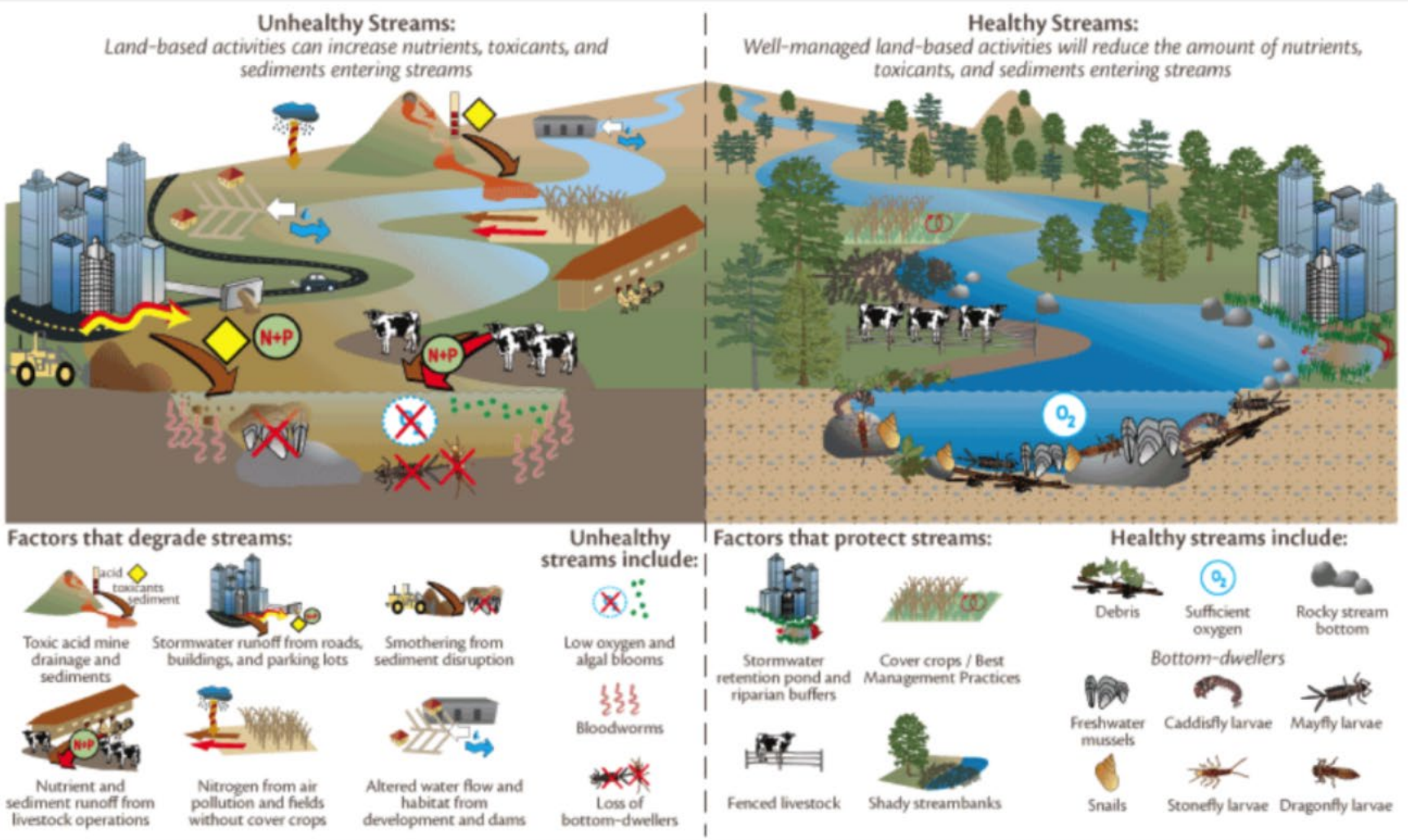
ESRI Local Government Solutions

3D Basemaps
- Basic Scene
- Schematic Scene
- Realistic Scene

3D Flood Impact

Proposed Developments



Didactic, Data-driven Dioramas

ESRI Local Government Solutions

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Proposed Developments

Data Requirements

- LIDAR (QL1 or QL2)
- Building Footprints
- High resolution (1 meter) land cover/land use
- Ancillary data (e.g. - Living Atlas) as appropriate

3D Web Scene

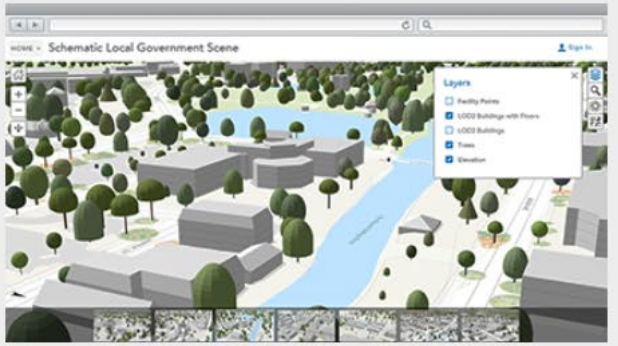
ArcGIS Solutions for Local Government | GALLERY | COMMUNITY | DOCUMENTATION | SEARCH | esri

Local Government 3D Basemaps

Home | Get Started

Overview

Local Government 3D Basemaps is an ArcGIS Pro project that can be used to author high-quality 3D scenes for your local government. These scenes are organized in different Levels of Detail (LOD) and derived from 2D operational data managed by a department or agency within a local government. Once authored, the 3D scenes are a foundation for 3D workflows and applications; and provide a consistent geographic context across local government departments and agencies.



REQUIREMENTS | WHAT YOU GET | WHAT'S NEW | VIEW SCENES

You may be interested in

ArcGIS Solutions for Local Government includes several related maps and apps that also can be configured in your organization:

- Review Proposed Developments
- Local Government Information Model

Didactic, Data-driven Dioramas

Data Requirements

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- Building Footprints
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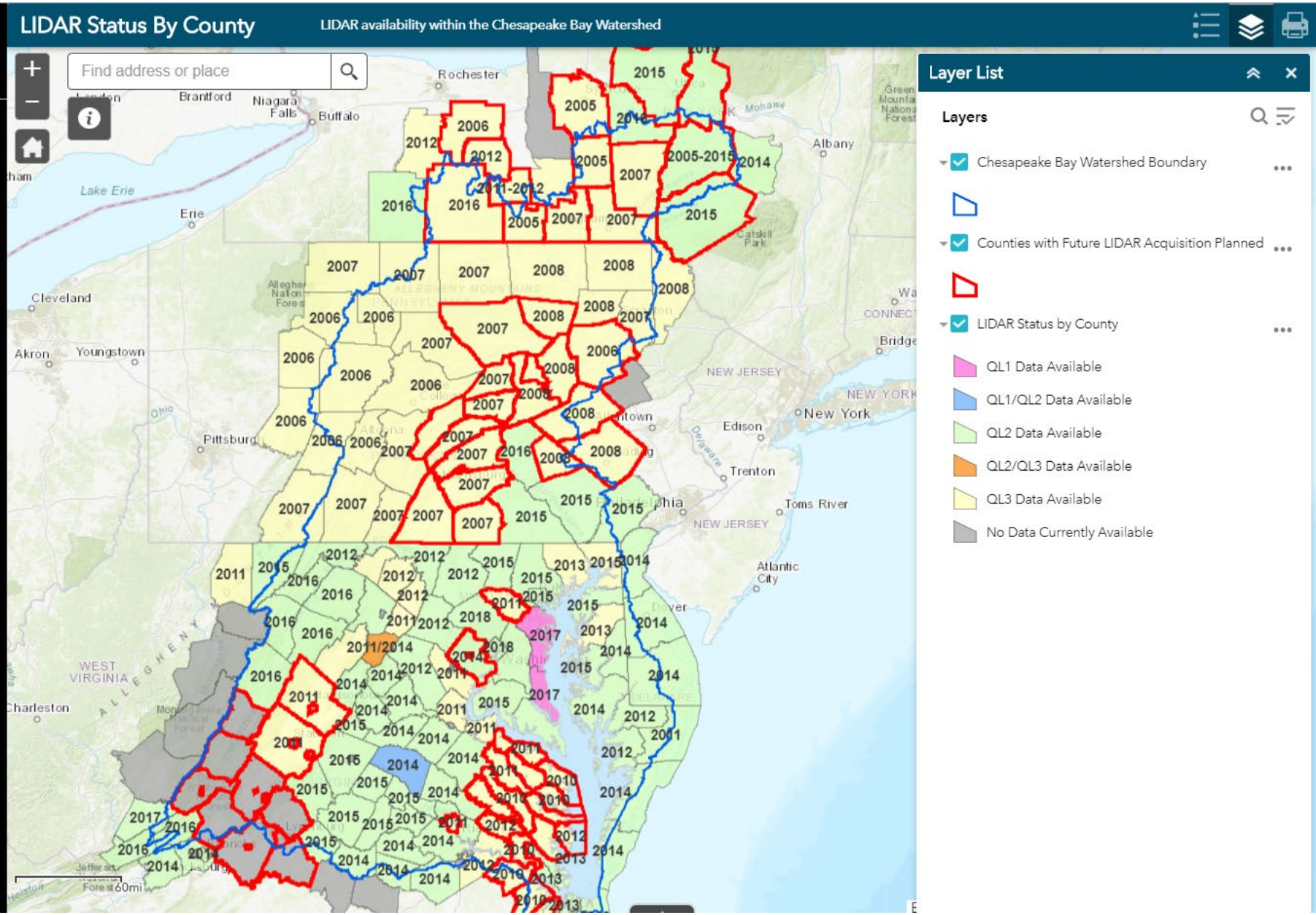
3D Web Scene

Loudon County, Virginia

Building Multipatch Features

Building footprints and DSM/DTM used to generate 3D buildings.

Vegetation Additions



Didactic, Data-driven Dioramas

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LiDAR DTM/DSM used to generate vegetation in non-developed land use classes.

Communicating Ecosystem Services through Landscape Visualization

Didactic, Data-driven Dioramas

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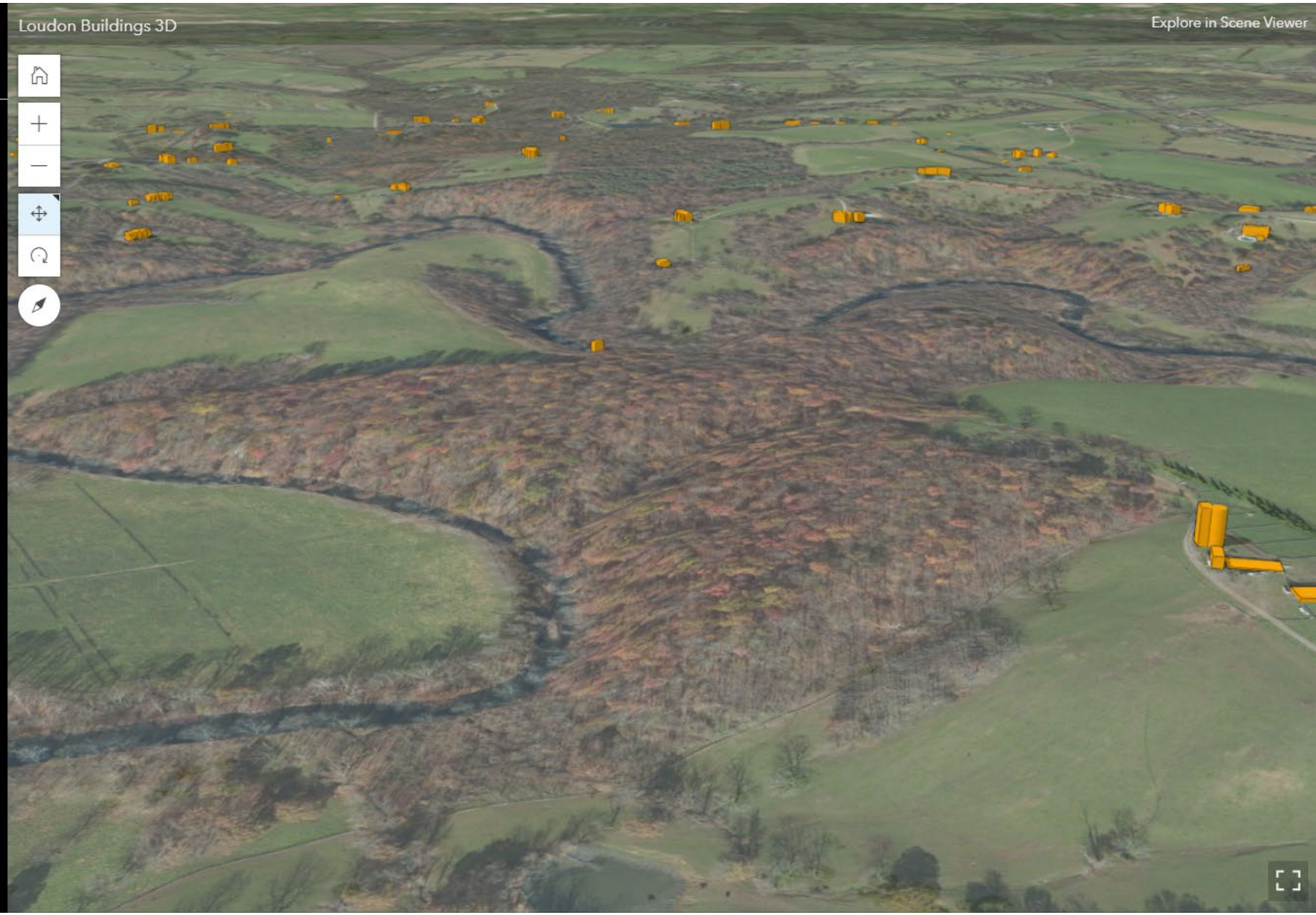
Communicating Ecosystem Services through Landscape Visualization

Phase 1 - *descriptive* approach to communicating ES
Phase 2 - *quantitative* approach to communicating ES (e.g. Geoplanner?)
Phase 3 - *assessing effectiveness* of



Didactic, Data-driven Dioramas

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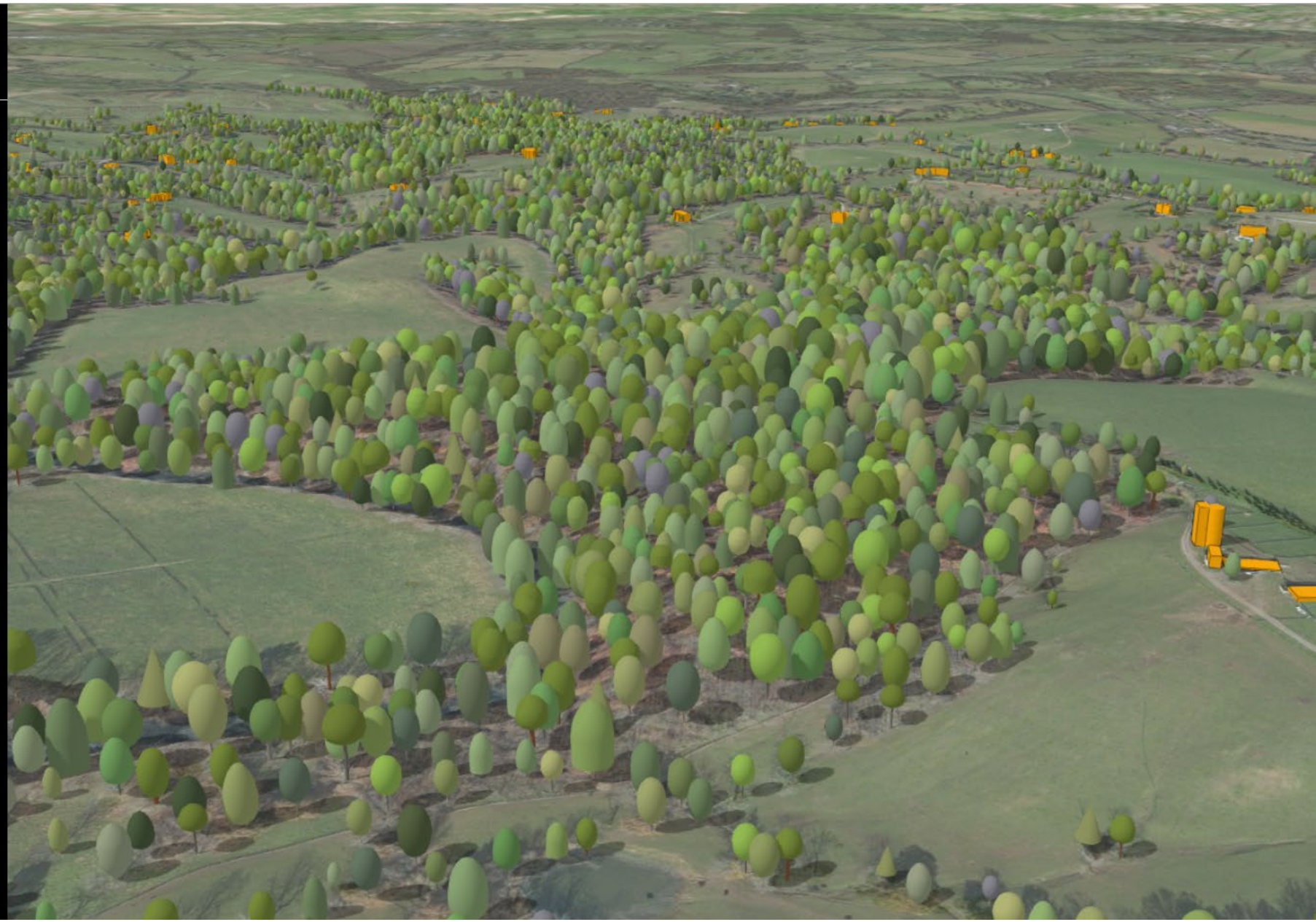
Chesapeake Watershed Applications



Didactic, Data-driven Dioramas

Chesapeake Watershed Applications

- Communicating Management Strategies
- Existing and Future Conditions
- With and Without Intervention

Chesapeake Watershed Applications

Climate Resiliency Outcome - Flood Mitigation

Chesapeake Watershed Applications

Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

Chesapeake Watershed Applications

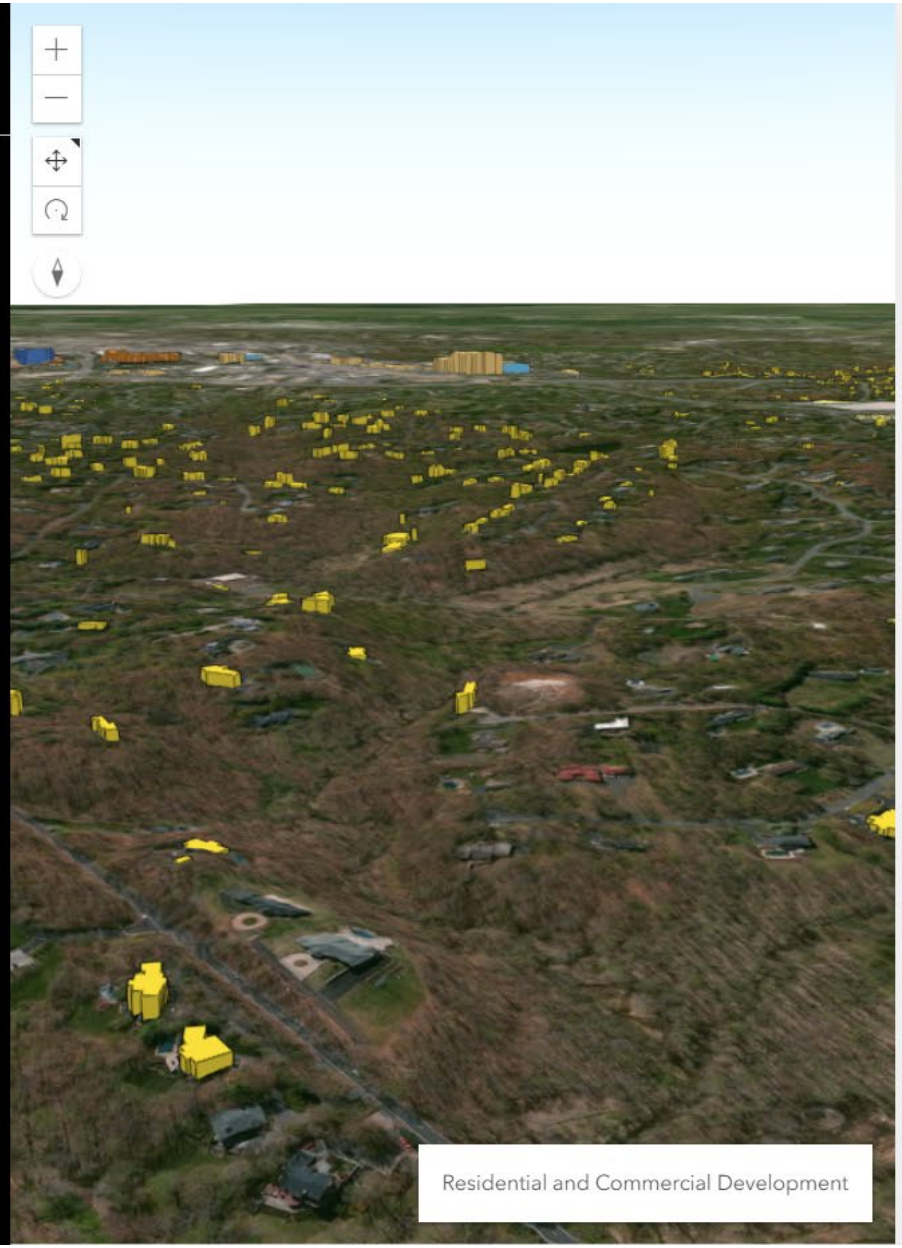
Climate Resiliency Outcome - Flood Mitigation

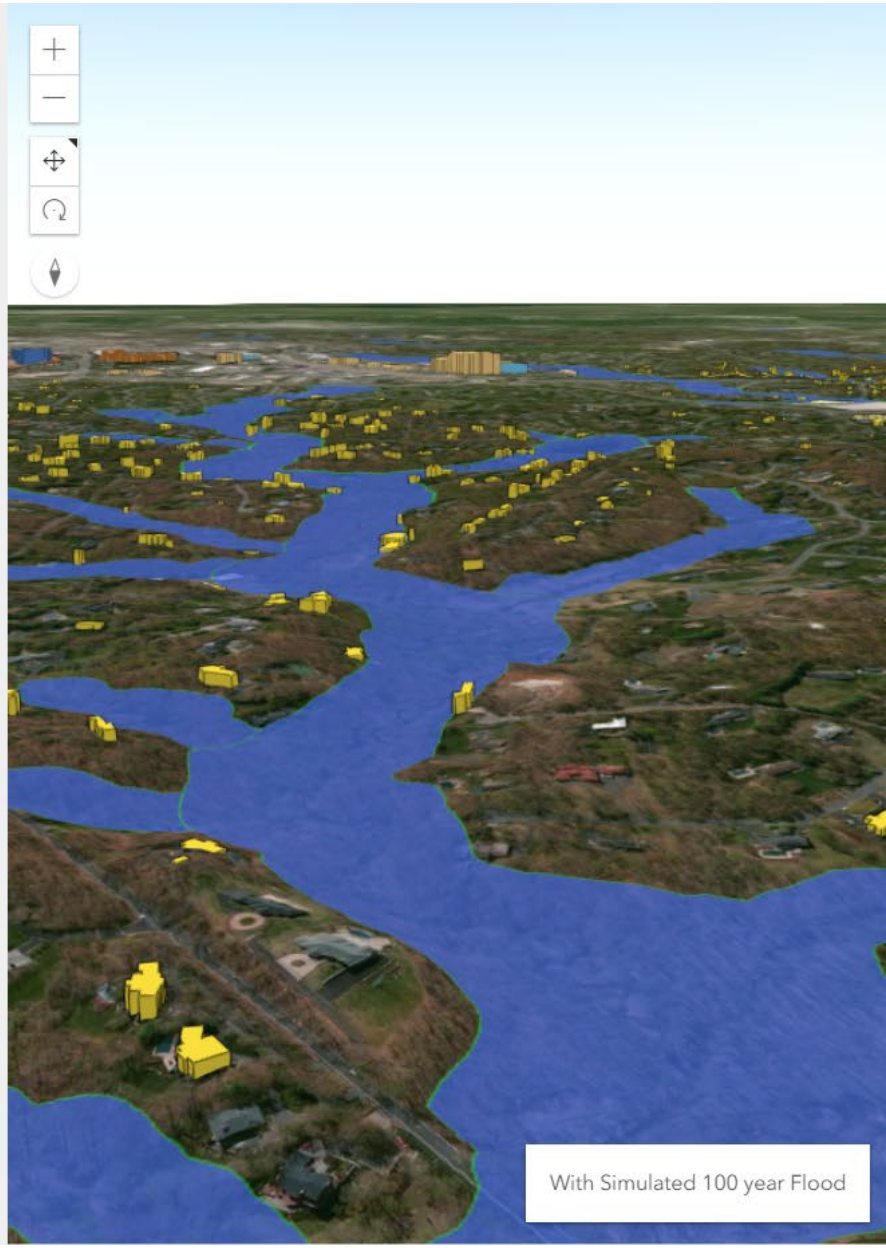
Chesapeake Watershed Applications

Land Use Methods and Metrics Outcome - Population Growth and Development

Chesapeake Watershed Applications

Climate Resiliency Outcome - Sea





Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

Chesapeake Watershed Applications

Land Use Methods and Metrics Outcome - Population Growth and Development

Chesapeake Watershed Applications

Climate Resiliency Outcome - Sea Level Rise

Chesapeake Watershed Applications

Watershed Implementation Plan

Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

Chesapeake Watershed Applications

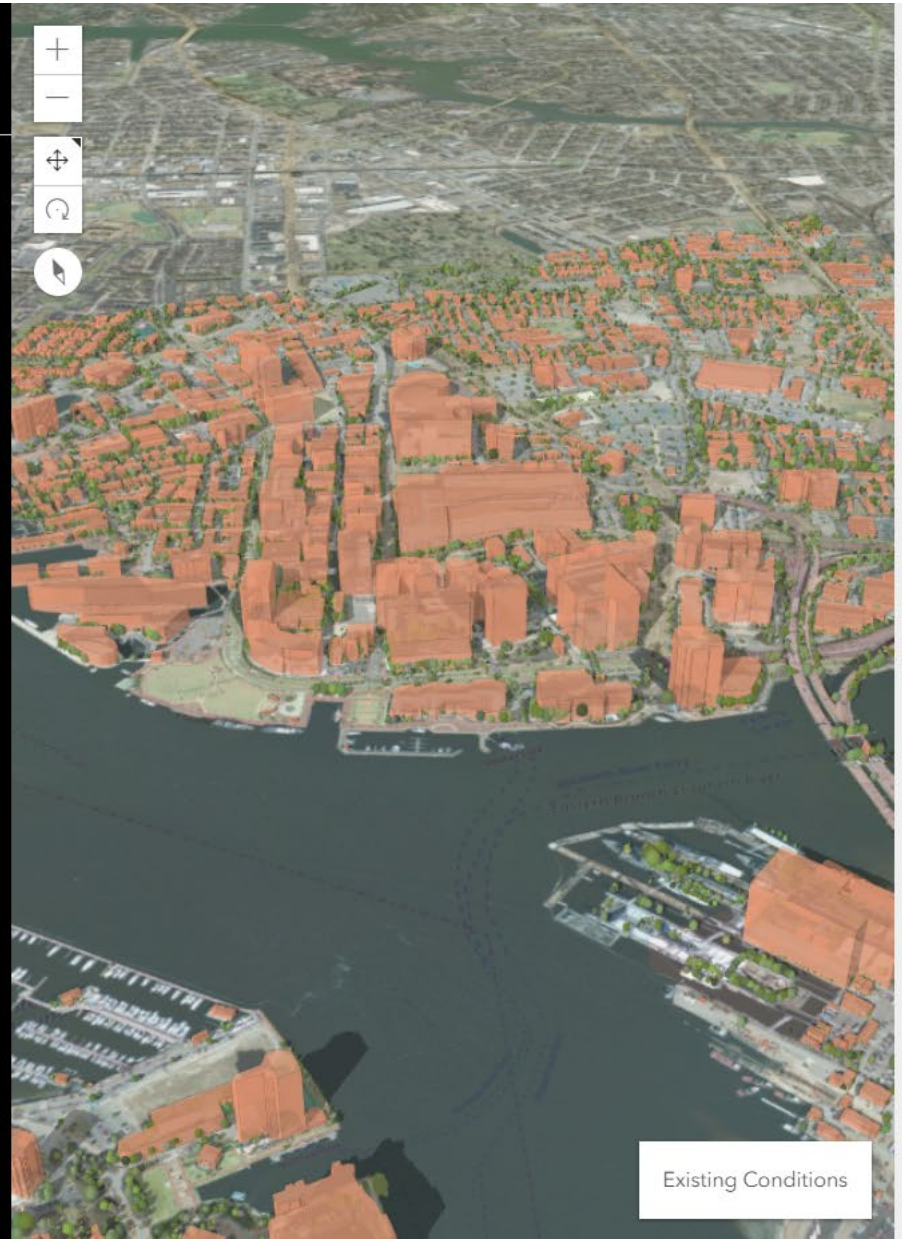
Climate Resiliency Outcome - Sea Level Rise

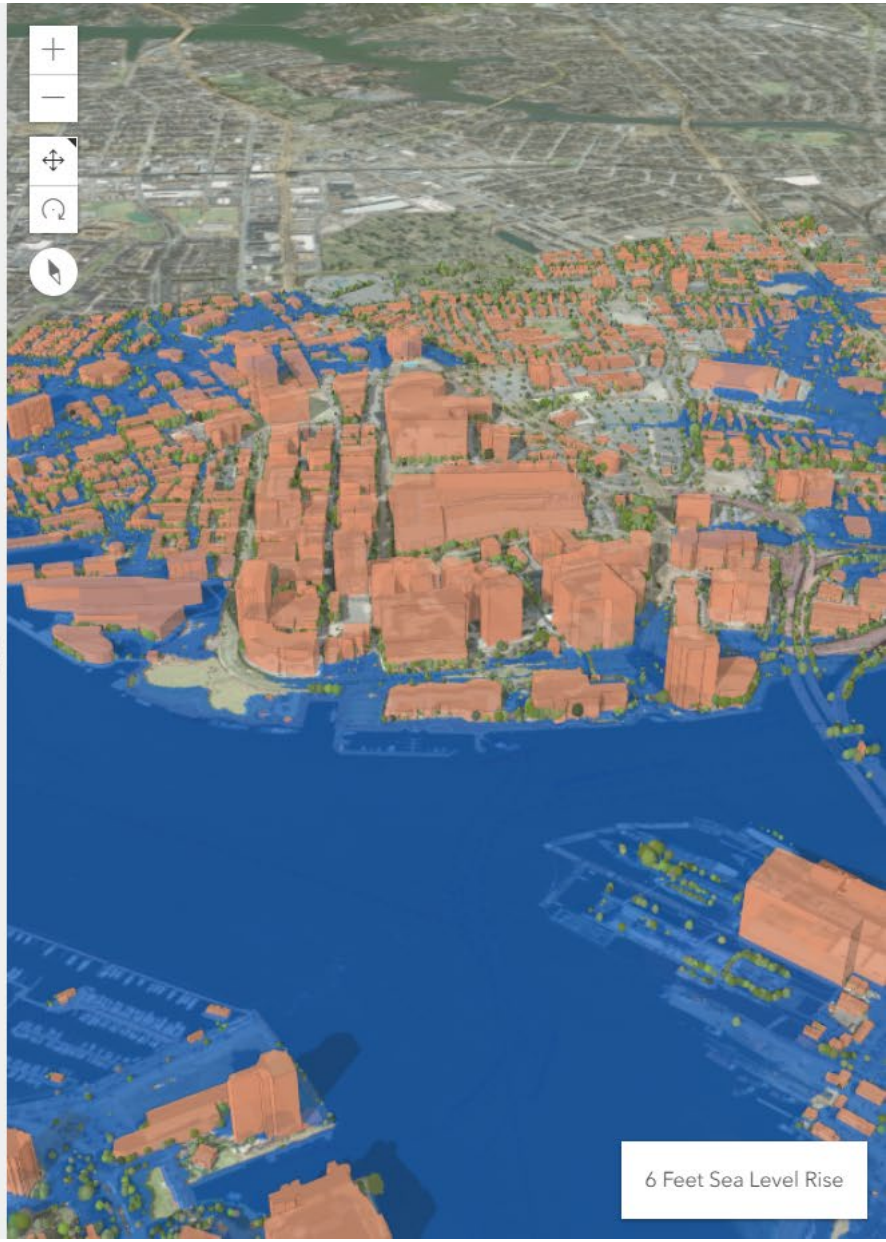
Chesapeake Watershed Applications

Watershed Implementation Plan Outcome - Reforestation

Chesapeake Watershed Applications

Watershed Implementation Plan Outcome - Riparian Forest Buffer





Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

Chesapeake Watershed Applications

Watershed Implementation Plan Outcome - Reforestation

Chesapeake Watershed Applications

Watershed Implementation Plan Outcome - Riparian Forest Buffer Plantings

Chesapeake Watershed Applications

Healthy Watersheds Outcome -

Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

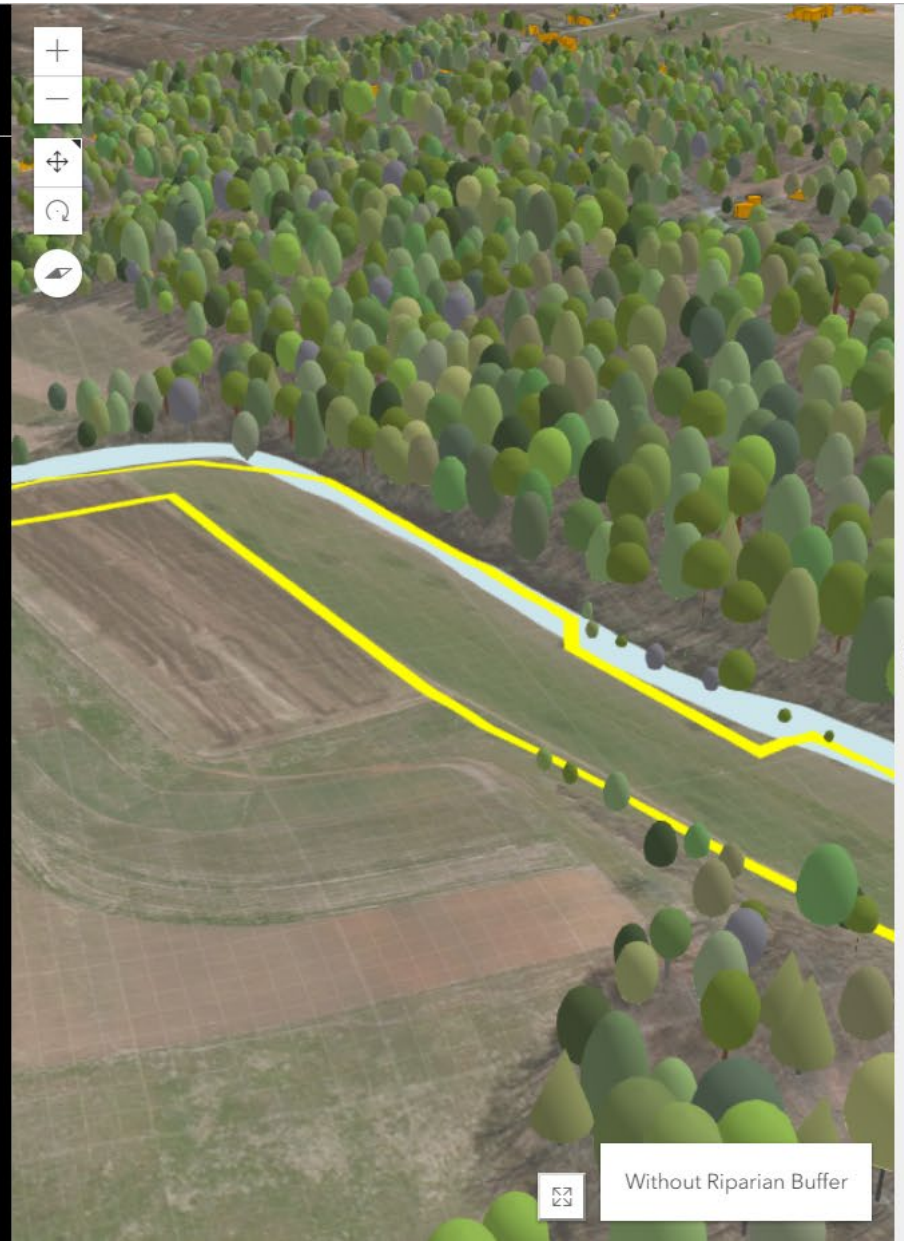
Chesapeake Watershed Applications

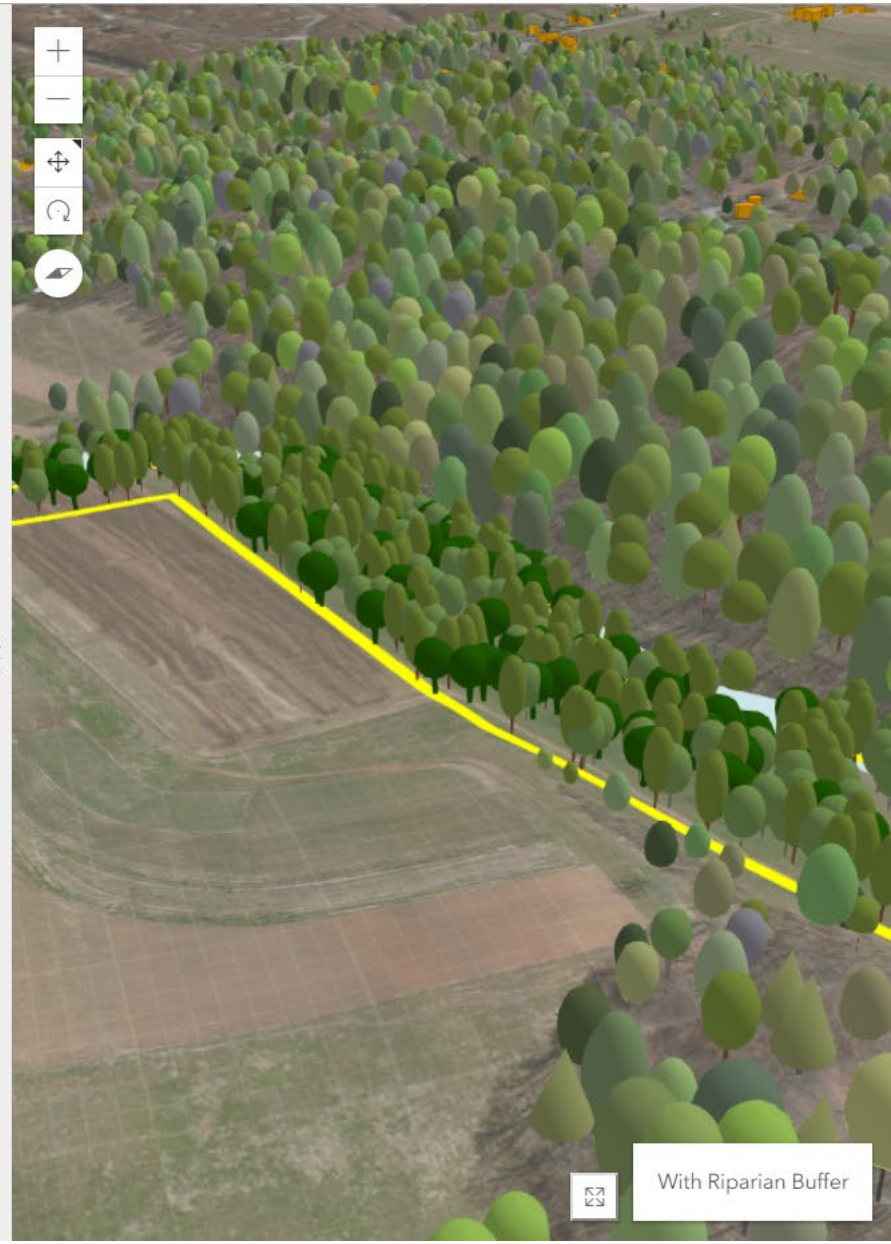
Watershed Implementation Plan Outcome - Riparian Forest Buffer Plantings

Chesapeake Watershed Applications

Healthy Watersheds Outcome - Land Conservation

Communicating Ecosystem Services through Landscape Visualization





Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

Chesapeake Watershed Applications

Healthy Watersheds Outcome - Land Conservation

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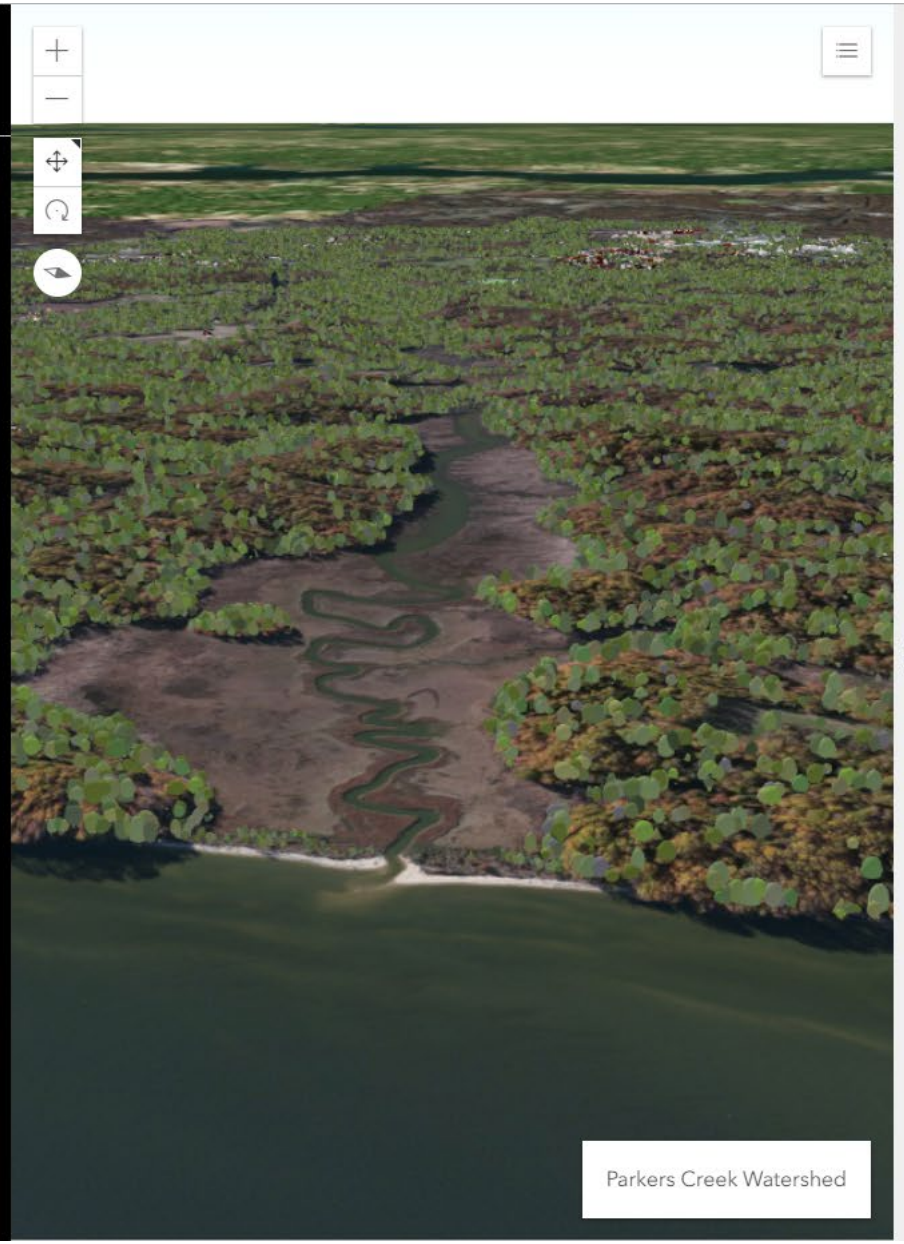
Ecosystem Services



Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

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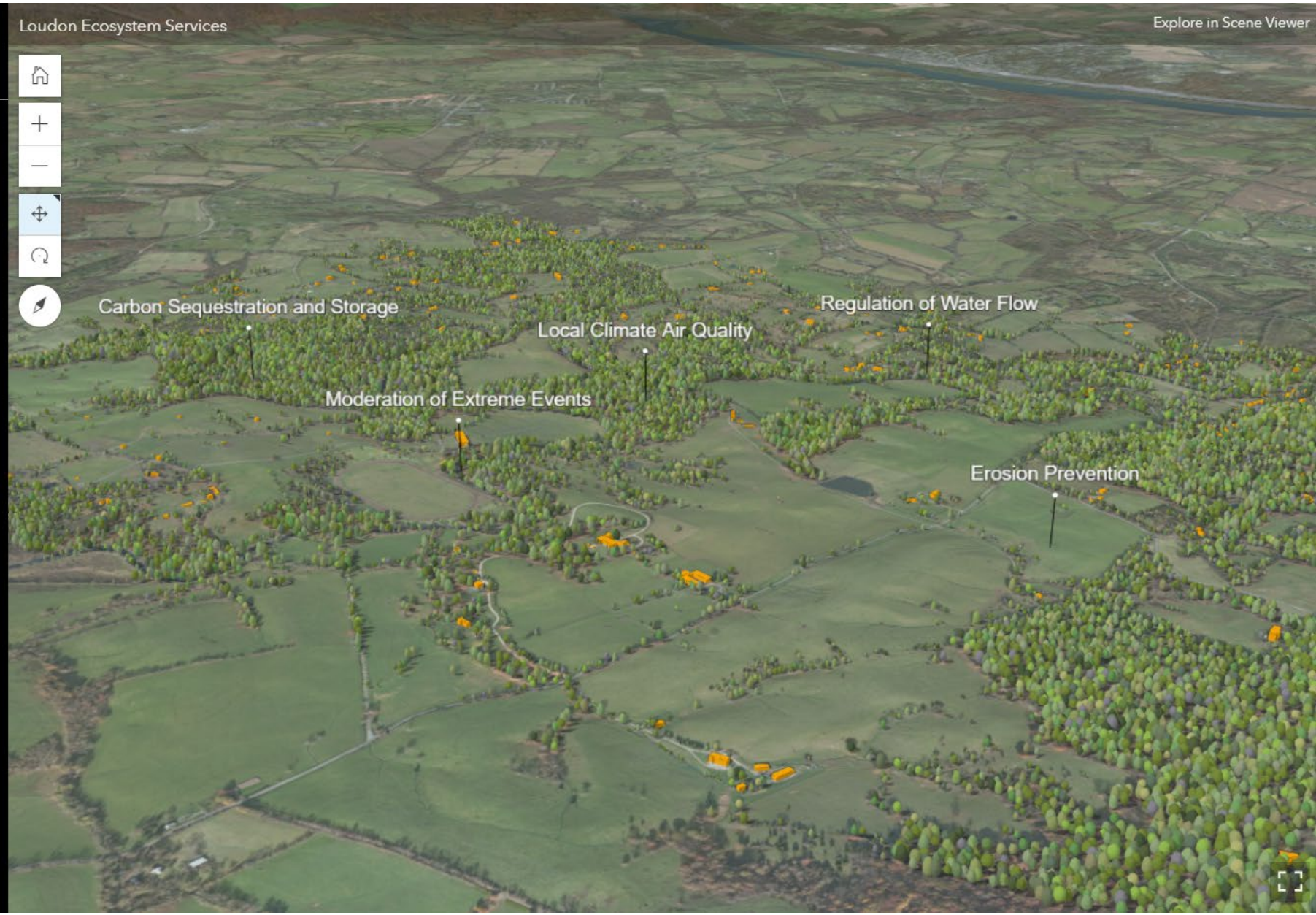
Ecosystem Services as a Common Currency

Four categories:

- Provisioning
- Regulating
- Supporting
- Cultural



Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

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Four categories:

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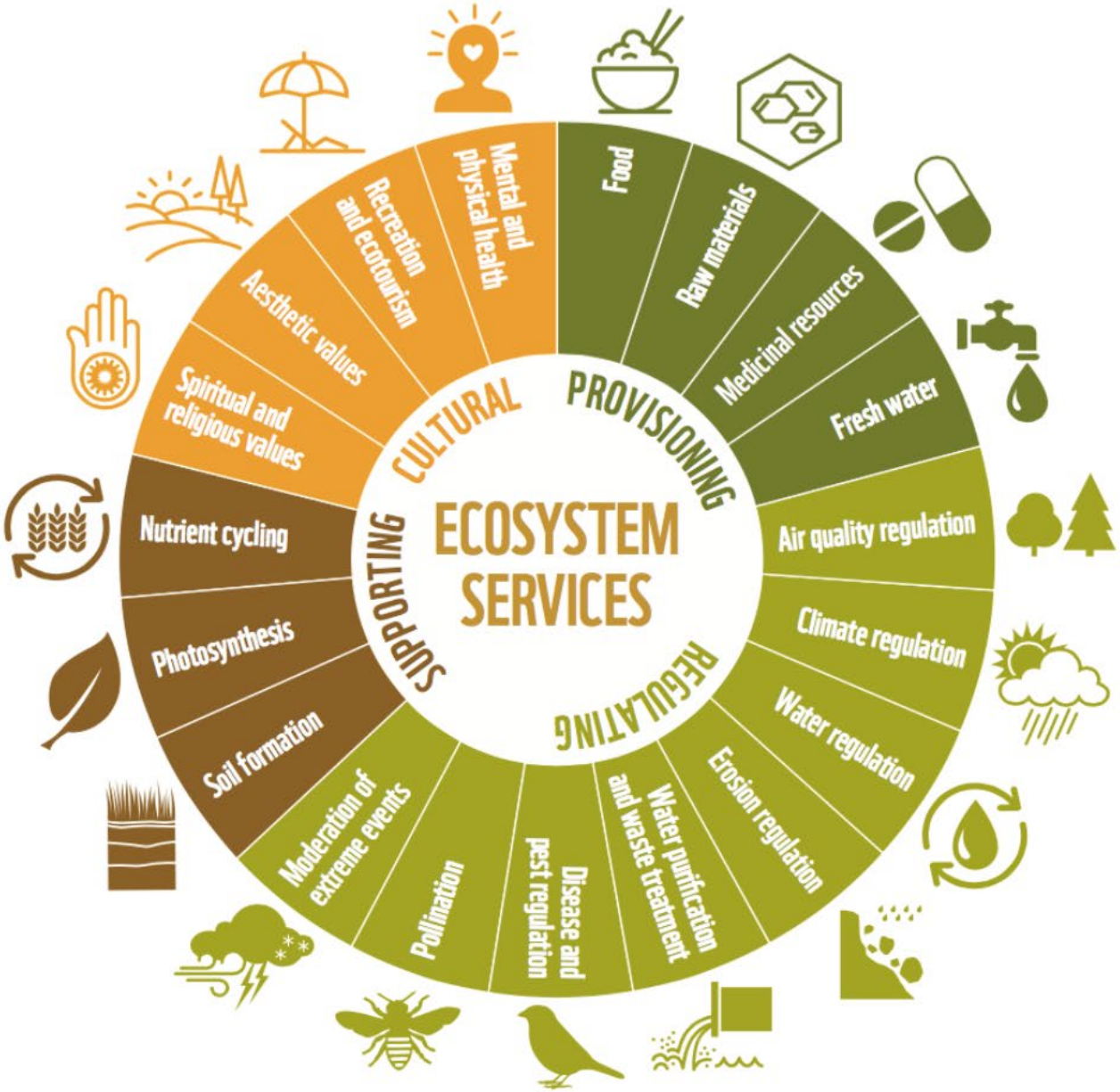
Communication Challenge
Mapping Challenge

Can place-based landscape visualization help address these challenges?

Relating Land Cover to Ecosystem Services

Land cover classes are scored based on values to individual services



Landscape Visualization and Ecosystem Services

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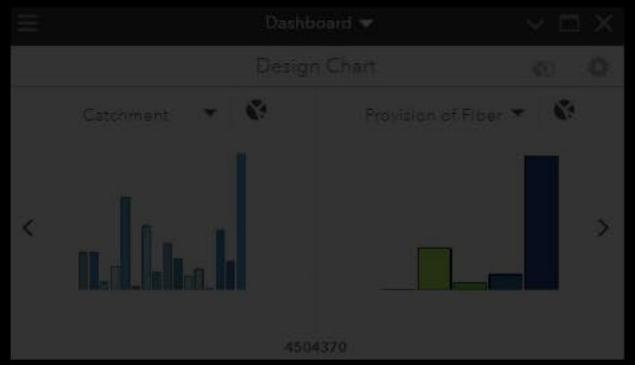
Ecosystem Services Mapping

Place-based Visualization of Ecosystem Services

Provision of Fiber example



Ecosystem Services

Normalized Scores

Land Uses

Land Uses	Regulating services	Global climate regulation	Local climate regulation	Air quality regulation	Water flow regulation	Water purification	Nutrient regulation	Erosion regulation	Natural hazard regulation	Pollination	Pest and disease control	Regulation of waste	Provisioning services	Crops	Biomass for energy	Fodder	Livestock (domestic)	Fibre	Timber	Wood Fuel	Fish, seafood & edible algae	Aquaculture	Wild foods & resources	Biochemicals & medicine	Freshwater	Mineral resources*	Abiotic energy sources*	Cultural services	Recreation & tourism	Landscape aesthetics & inspiration	Knowledge systems	Religious & spiritual experience	Cultural heritage & cultural diversity	Natural heritage & natural diversity
Green urban areas		2	2	2	2	2	2	2	1	2	2	2		0	0	0	0	0	0	0	0	0	0	0	0	0	0		3	3	1	0	2	1
Sport and leisure facilities		1	1	1	1	1	1	1	0	0	1	1		0	0	0	0	0	0	0	0	0	0	0	0	0	0		5	1	0	0	1	0
Non-irrigated arable land		1	2	1	2	0	1	0	1	1	2	2		5	5	5	0	5	0	0	0	0	1	3	0	0	2		1	1	2	0	3	0
Permanently irrigated land		1	3	1	1	0	1	0	1	1	2	2		5	1	2	0	4	0	0	0	0	1	3	0	0	1		1	1	2	0	3	0
Ricefields		0	2	1	1	0	1	0	0	1	1	2		5	1	2	0	0	0	0	0	0	0	0	0	0	0		1	1	2	0	3	0
Vineyards		1	1	1	1	0	1	1	0	1	1	1		4	1	0	0	0	0	1	0	0	0	0	0	0	0		3	2	3	0	5	0
Fruit trees and berries		2	2	2	2	1	2	2	2	2	3	2		4	1	0	0	0	2	2	0	0	0	2	0	0	0		3	2	2	0	4	1
Olive groves		1	1	1	1	1	1	1	1	1	2	2		4	1	0	0	0	2	2	0	0	0	2	0	0	0		2	2	2	0	4	0
Pastures		2	1	0	1	0	1	1	1	0	2	2		0	1	5	5	0	0	0	0	0	0	0	0	0	5		2	2	2	0	3	1
Annual and permanent crops		1	2	1	1	0	1	2	1	1	2	2		4	2	4	1	5	0	0	0	0	1	1	0	0	2		1	1	2	0	3	0
Complex cultivation patterns		1	2	1	1	0	1	1	1	2	3	2		4	2	2	1	4	0	1	0	0	1	2	0	0	1		2	2	2	0	3	0
Agriculture & natural vegetation		2	3	2	2	2	2	2	1	2	3	2		3	3	2	2	4	1	1	0	0	2	1	0	0	1		2	2	3	1	3	3
Agro-forestry areas		2	2	2	2	2	2	3	1	3	3	3		2	3	2	3	2	3	3	0	0	2	1	0	0	0		2	2	2	0	3	2
Broad-leaved forest		5	5	5	3	5	5	5	4	4	4	4		0	1	1	0	1	5	5	0	0	5	3	0	0	0		5	5	5	3	4	5

Burkhard, B., Kandziora, M., Hou, Y., & Müller, F. (2014). Ecosystem Service Potentials, Flows and Demands – Concepts for Spatial Localisation, Indication and Quantification. *Landscape Online*, 1–32. https://doi.org/10.3097/LO.201434

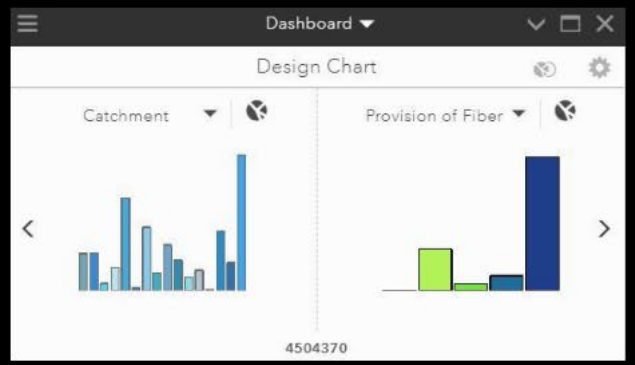
Landscape Visualization and Ecosystem Services

Didactic, Data-driven Dioramas

Ecosystem Services Mapping

Place-based Visualization of Ecosystem Services

Provision of Fiber example



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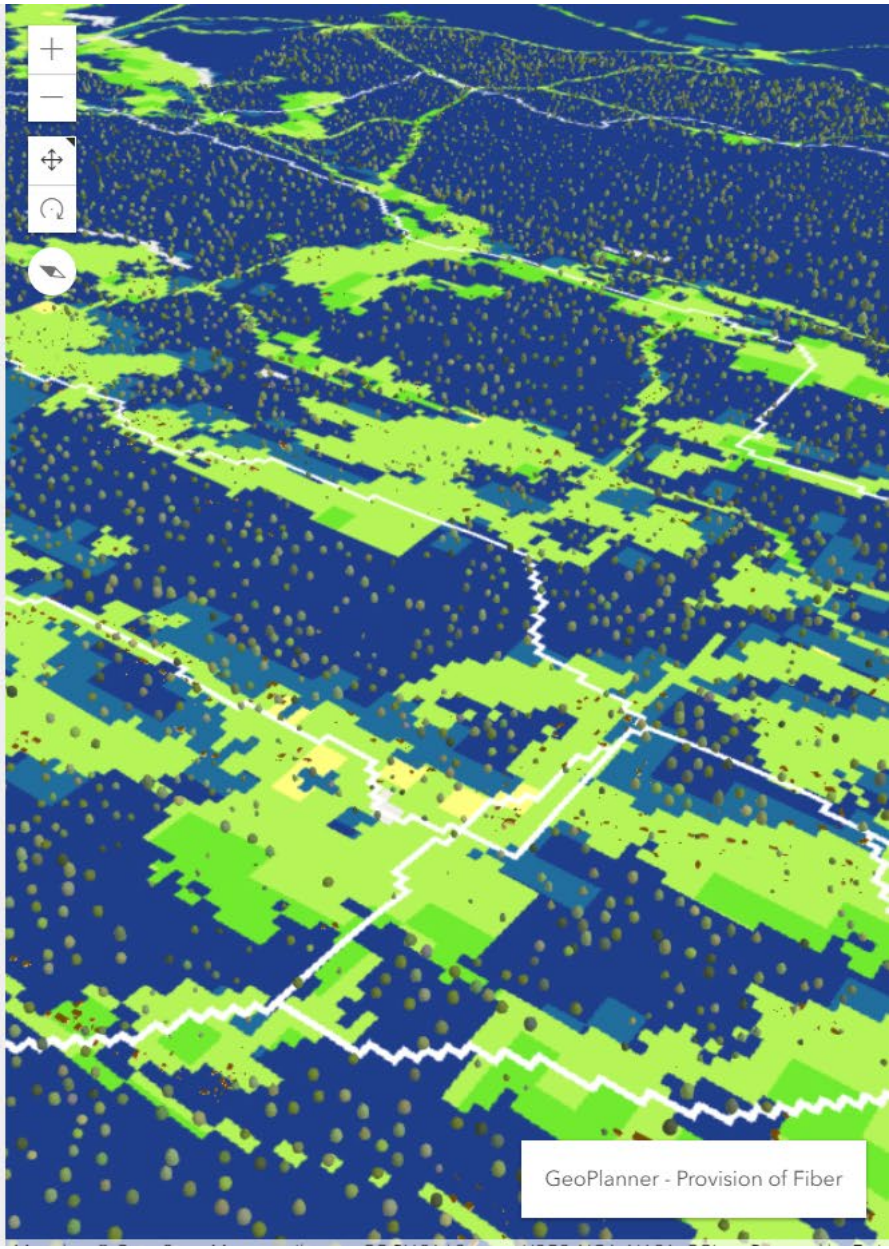

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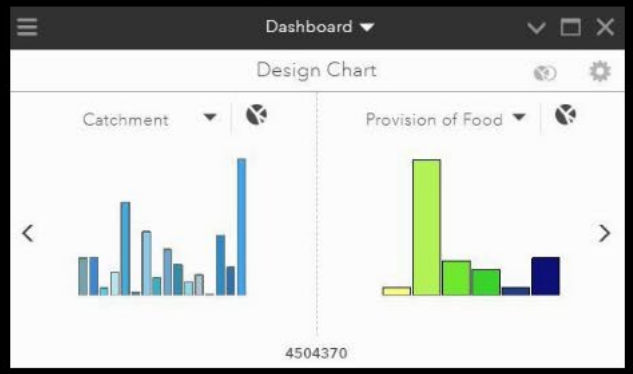
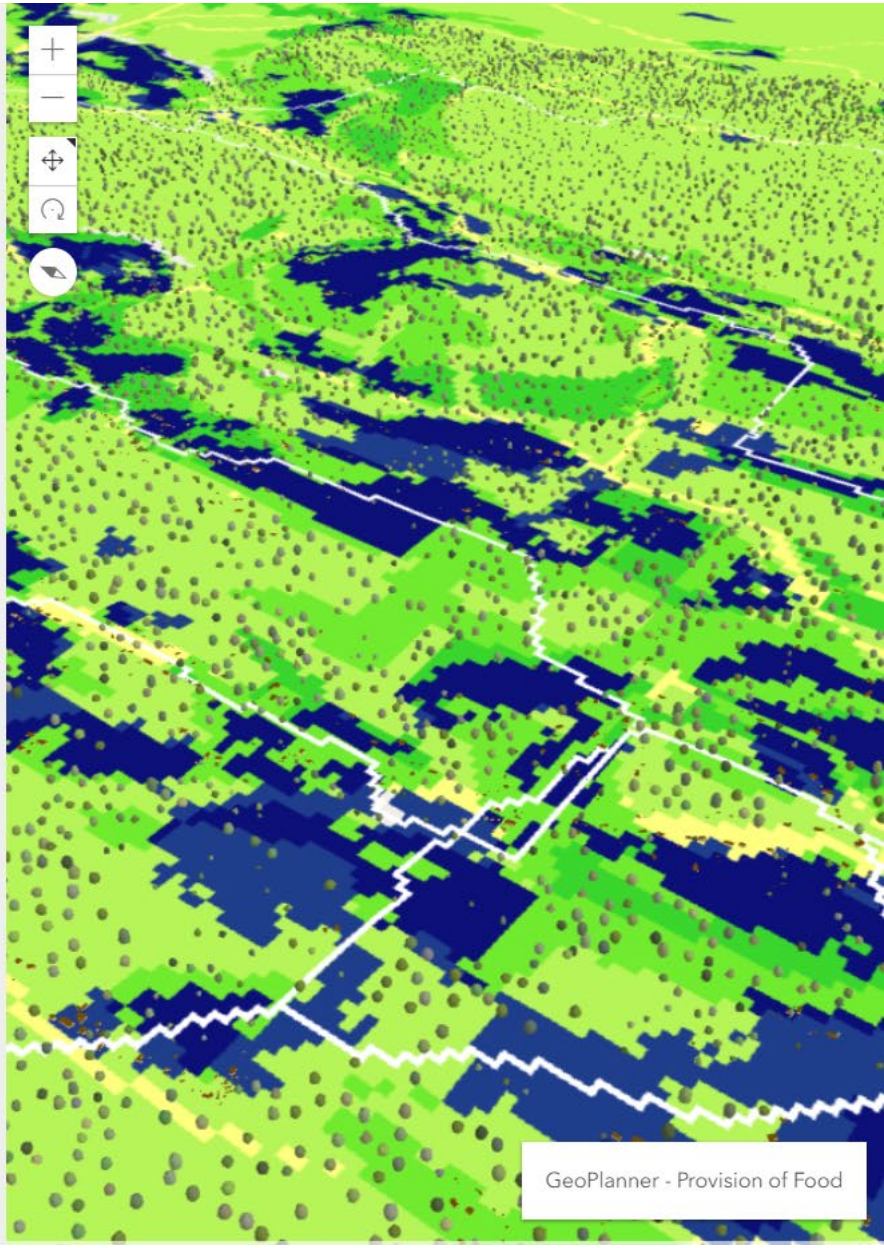


Potential Research



Didactic, Data-driven Dioramas

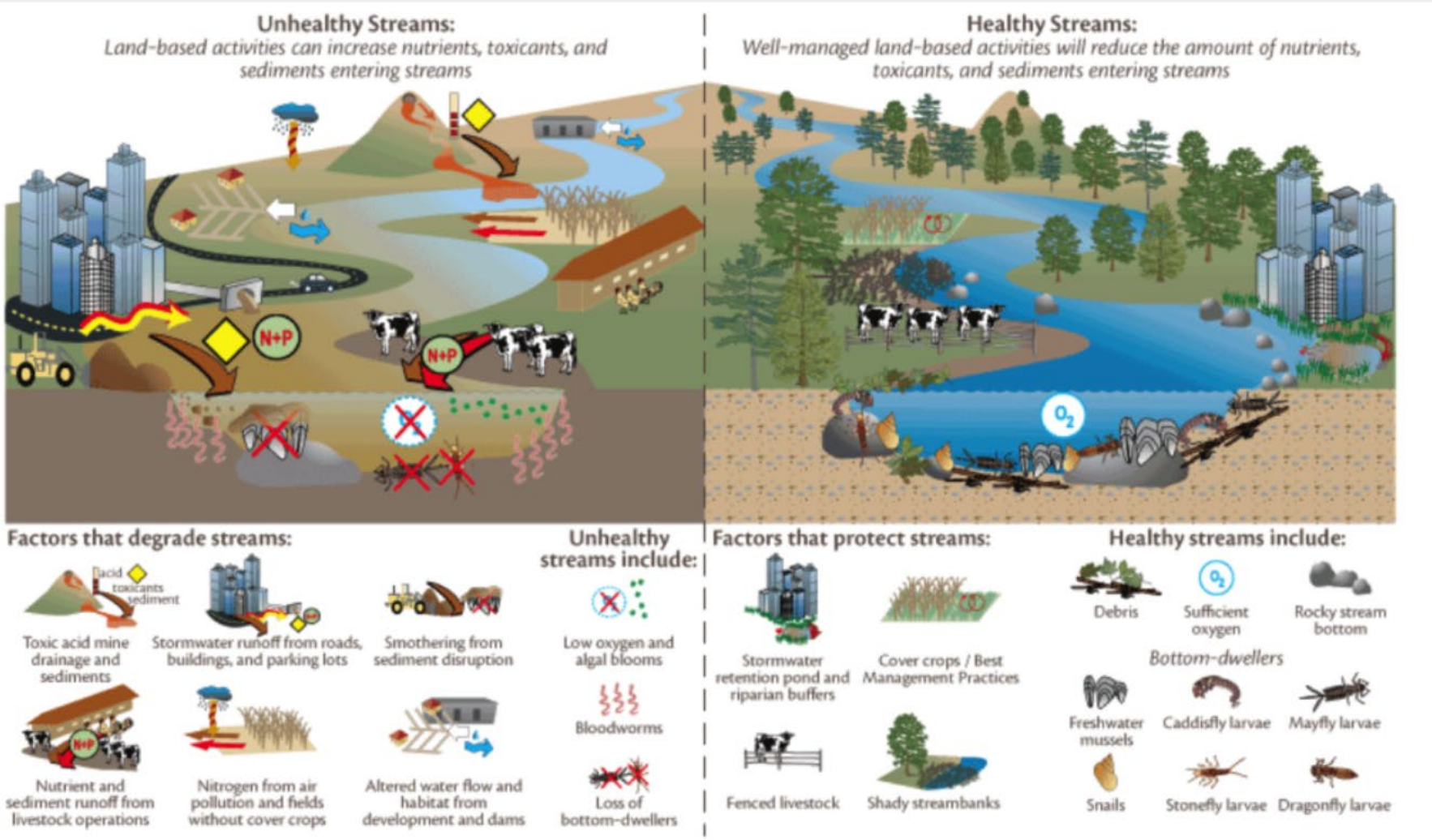
Potential Research Questions

How might Geodesign be used to envision alternative future scenarios for these Outcomes as a result of (1) changing ecological conditions (e.g. - climate change) or (2) implementation of management actions?

Potential Research Questions

How effective are 3D landscape visualizations for communicating Chesapeake Bay Outcomes among different audiences?

- Resource Management Professionals
- Local Stakeholders
- Undergraduate Environmental Sustainability Students



Didactic, Data-driven Dioramas

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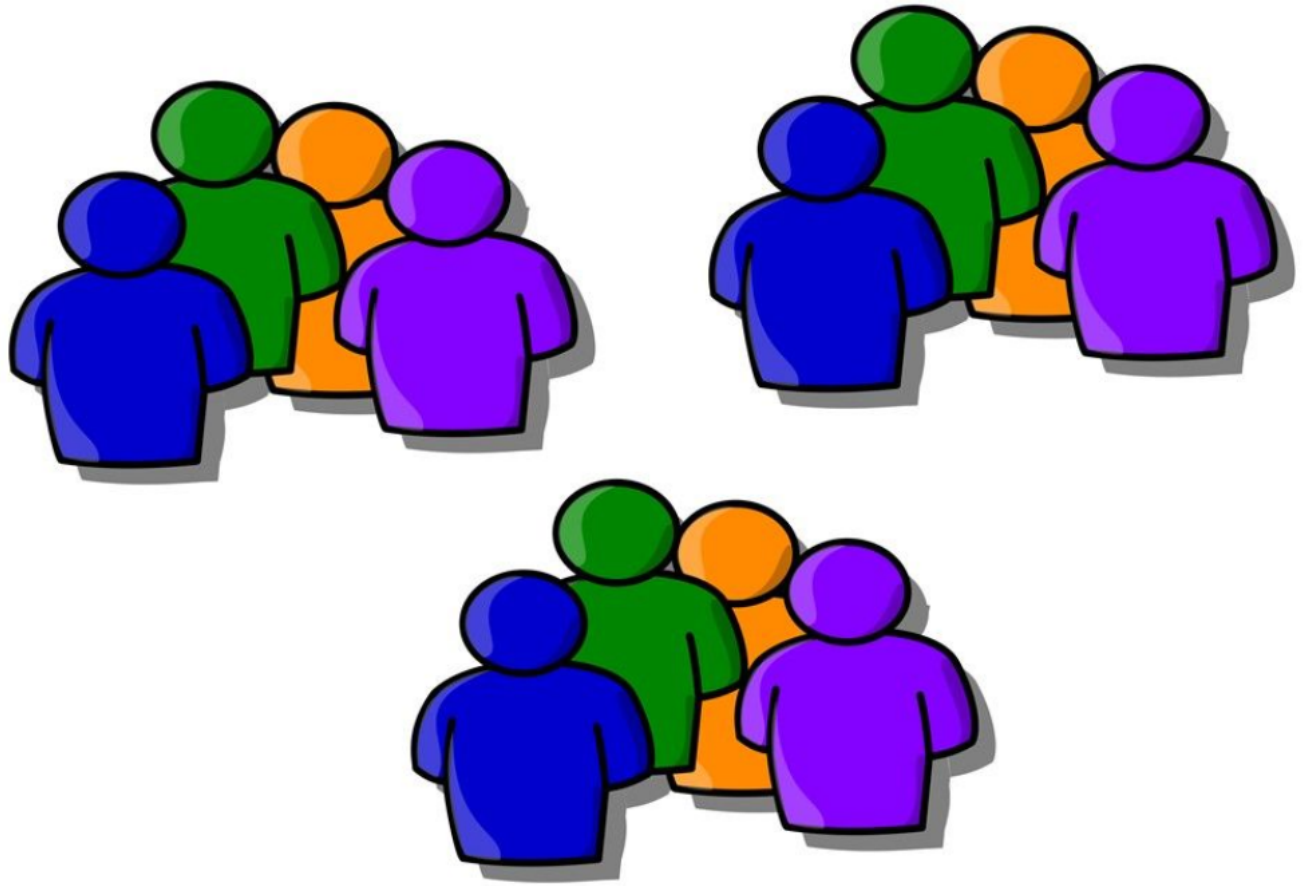

Didactic, Data-driven Dioramas

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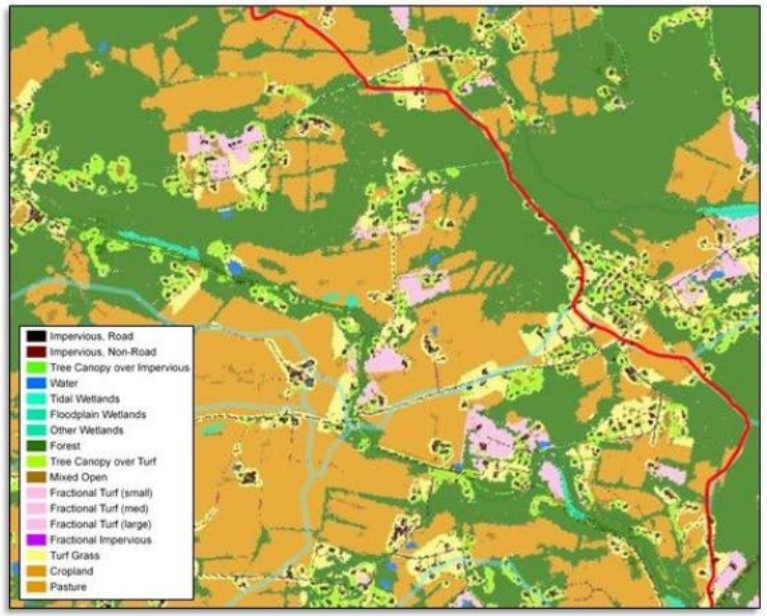
Thank you!

John Wolf

University of Baltimore
john.wolf@ubalt.edu



2D Map

3D Scene

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