Eastern Brook Trout Range-wide Conservation Portfolio and Focal Area Risk and Opportunity Analysis

EBTJV Review

May 1, 2017

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Acknowledgements

Funding

- National Fish and Wildlife Foundation

Data Providers

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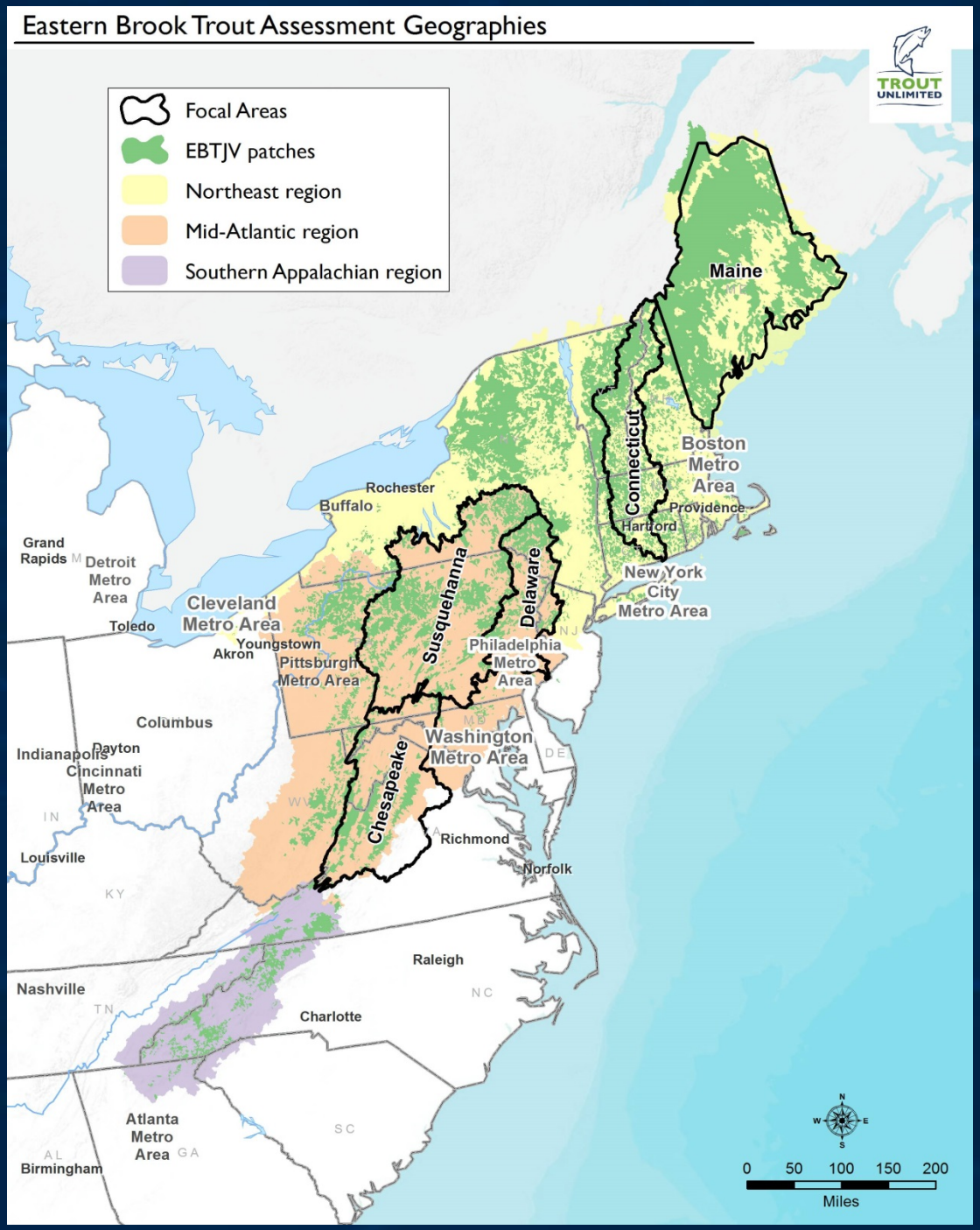
Review

- EBTJV, Dave Lawrence, Merry Gallagher, Diane Timmons, Jason Coombs, Ty Wagner, Mark Hudy, Steve Perry, Nat Gillespie, Alan Heft, Matt Kulp, Dave Kazyack, Tim King, Than Hitt, Amy Wolfe, Keith Curley, Jeff Reardon, Gary Berti, Dustin Wichterman, Seth Coffman, Colin Lawson, Erin Rodgers, Tracy Brown, Jake Bolin, Joseph Norton, Richard Biemiller

TU Brook Trout Assessments: Scales



BT Portfolio, Range-wide, and Focal Area Assessments

Conservation portfolio

Identify BT strongholds, persistent populations, and migratory life histories based on EBTJV data, stream habitat diversity, and BT habitat suitability

→ Identify critical and missing elements

Range-wide assessment

Characterize habitat integrity and future security of patches using widely available GIS datasets

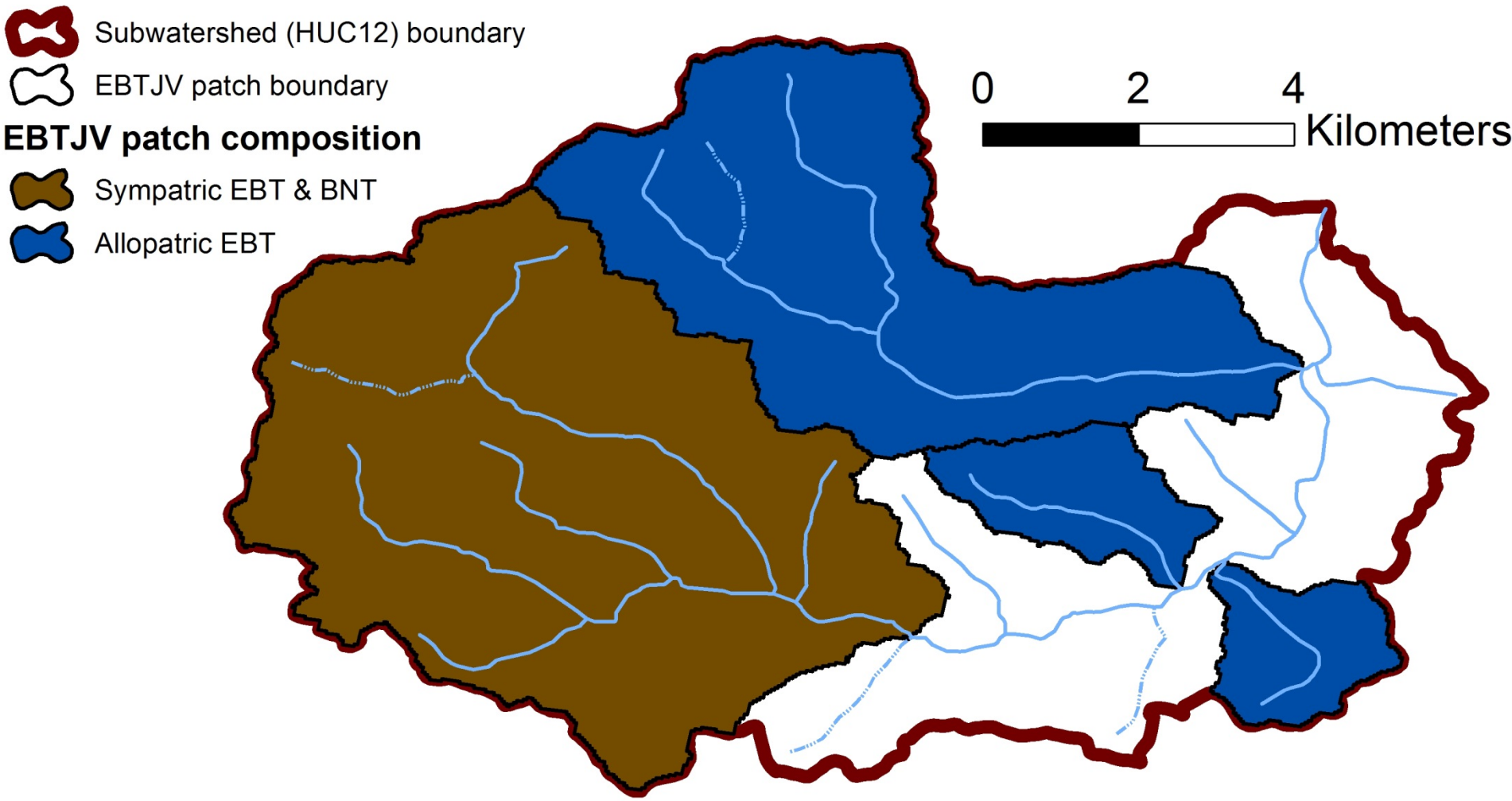
→ Determine conservation value and strategies

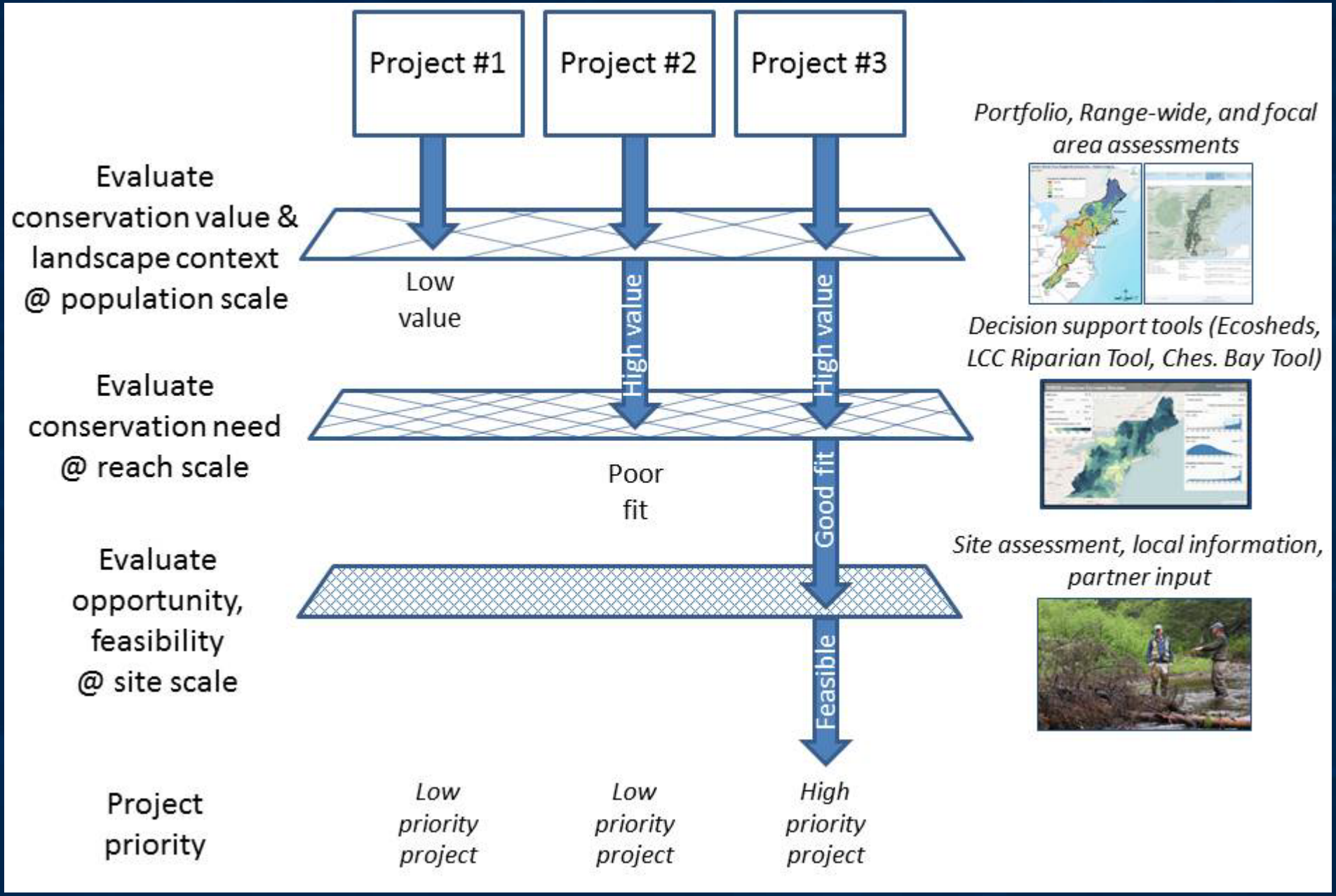
Focal area assessment

Characterize BT populations, habitat integrity, and future security of patches using focal area-specific GIS datasets + other data or plans

→ Refine conservation needs and strategies

Brook Trout Portfolio and RW Assessment: Scales

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Portfolio, Range-wide, and focal area assessments
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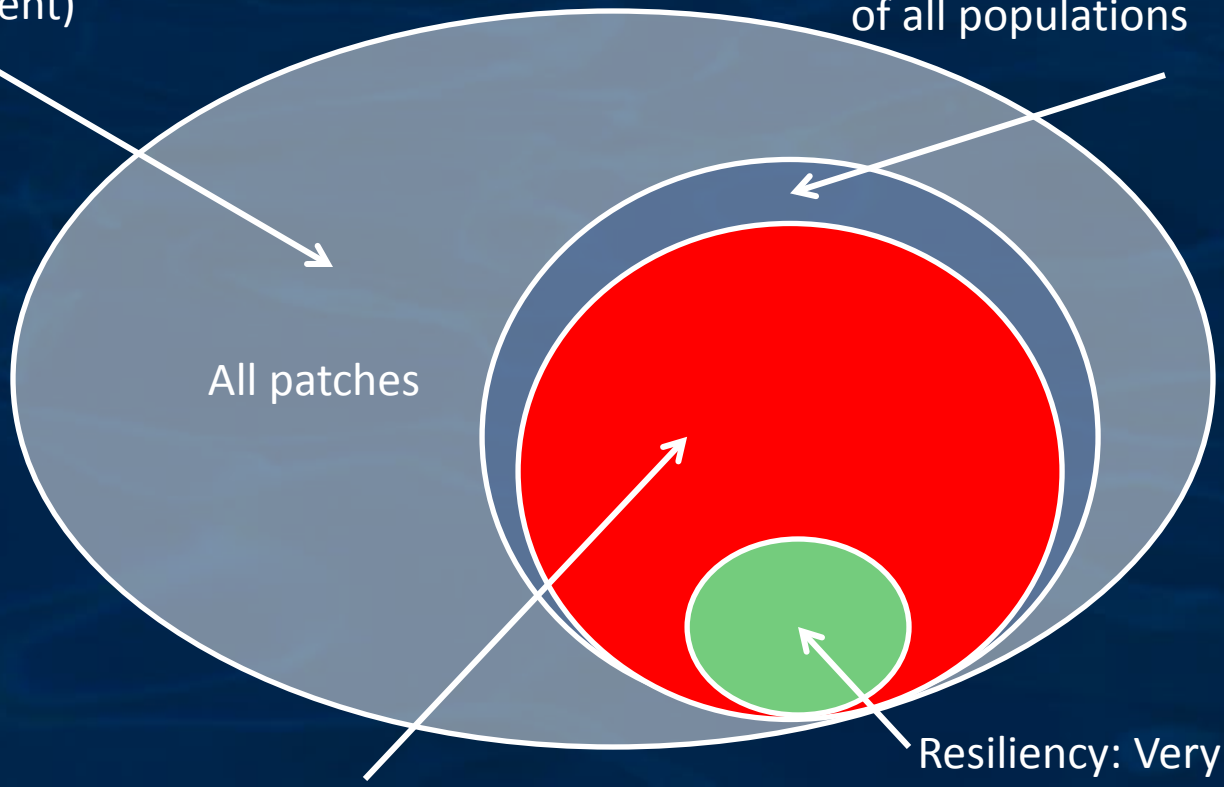
Site assessment, local information, partner input

"3-R" Framework: Diversity confers long-term viability in face of disturbances and environmental variability (Haak and Williams 2012)

(Other populations – small, resident)

Representation: Unique life histories (river, lake, sea-run migratory; small ponds in ME; alkaline streams) – 40% of all populations



Redundancy: Populations large enough to have demographic persistence - 35% of populations

Resiliency: Very large stronghold populations likely able to withstand environmental disturbance - 5% of populations

Brook Trout Portfolio

Range-wide data sources

- BT population characteristics – size & extent, trout community
  - EBTJV patch and catchment data (2015)
- Habitat diversity as a proxy for likely life history expression
  - TNC/Southern Appalachian LCC stream classification (2015)
  - TNC/North Atlantic LCC stream and lake/pond classification (2013, 2014)
  - NHD+ attributes
- Observed life history expression
  - Dauwalter et al. 2014 – coastal and anadromous brook trout
- Habitat suitability as proxy for population density
  - DeWeber and Wagner brook trout occupancy model and stream temperature (2015)

Unavailable range-wide data

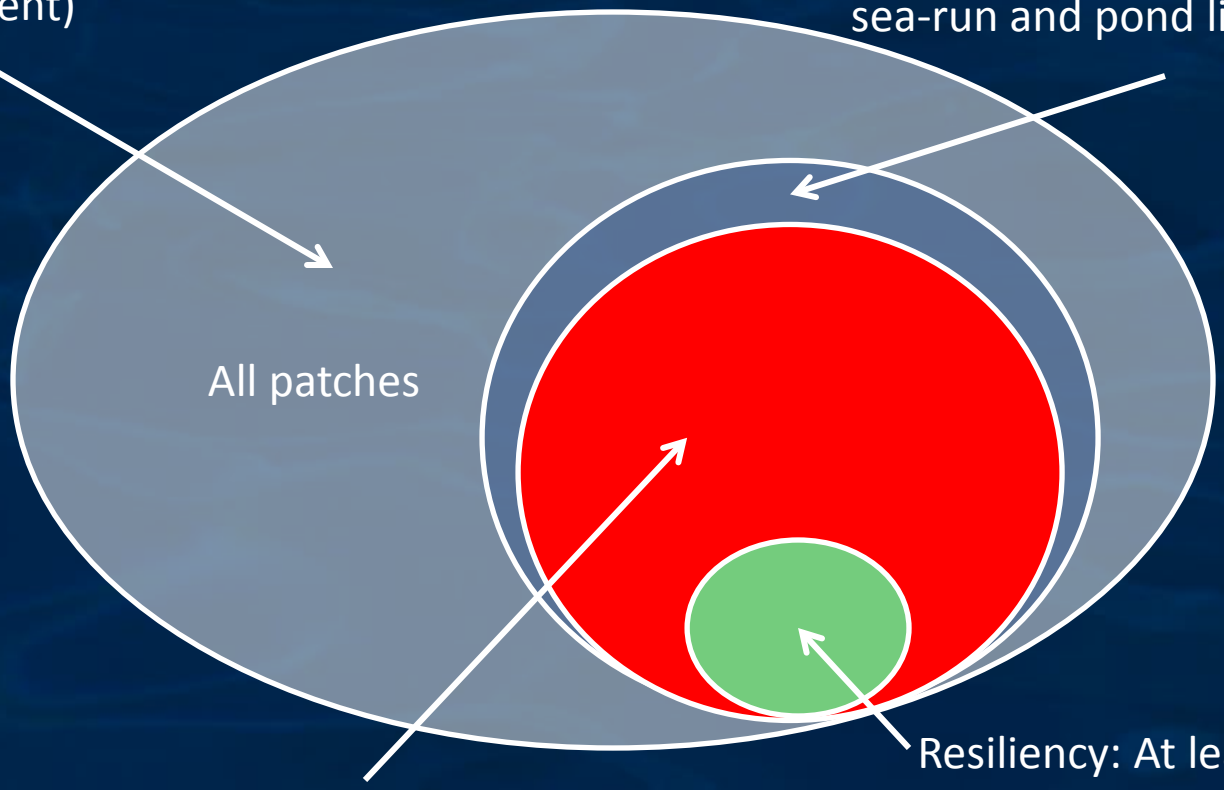
- BT population density
- BT historical distribution
- Genetic status

Our reliance these available stream habitat characteristics comes with the assumption that all potential habitat within designated patches is accessible to and used by at least some individuals within a population of brook trout and is therefore a *best case scenario*

"3-R" Framework: Diversity confers long-term viability in face of disturbances and environmental variability (Haak and Williams 2012)

(Other populations – small, resident)

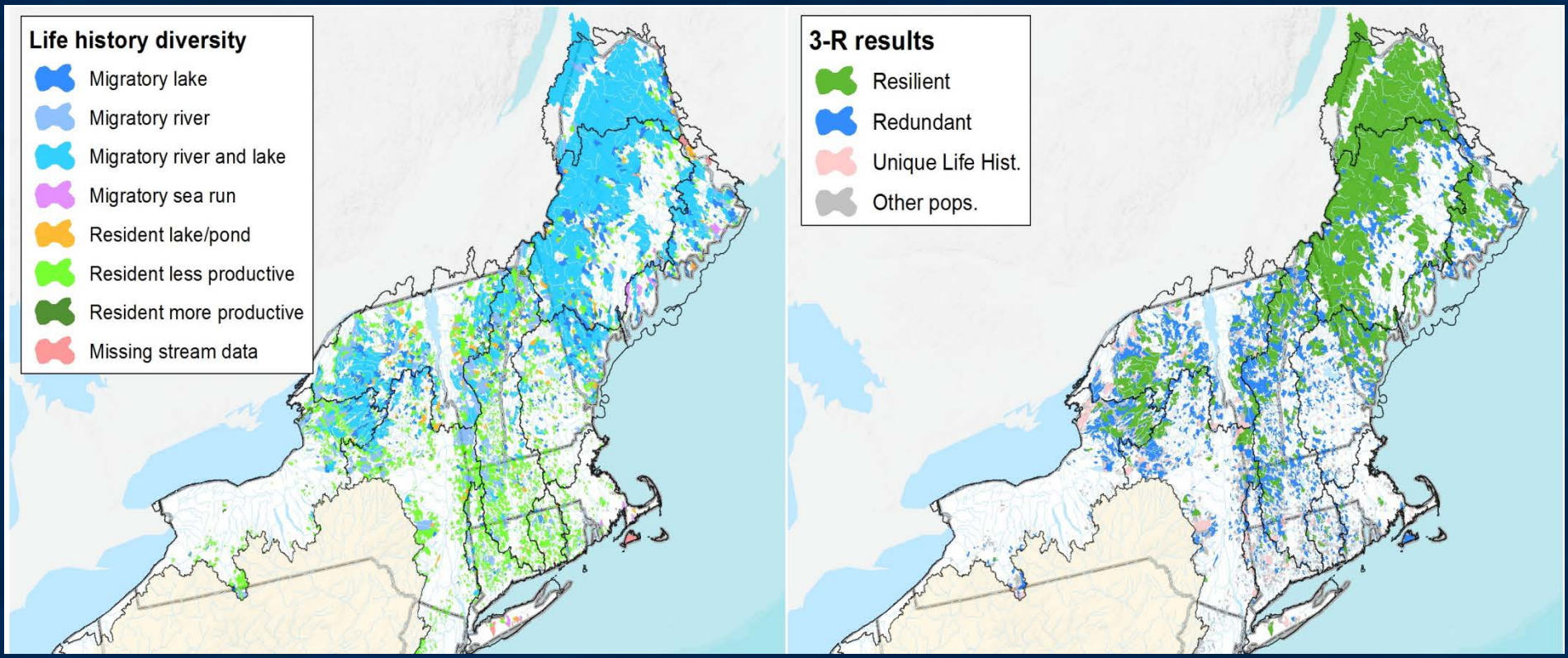
Representation: Based on stream size class, lake size, stream alkalinity class from TNC habitat mapping; observed sea-run and pond life histories



Redundancy: At least 25 km allopatric BT *OR* 5 – 25km and occurrence probability > 0.3 *OR* < 5km BT and occurrence probability > 0.5

Resiliency: At least 25km allopatric BT, 1 stream w/ at least 50km² drainage area

Portfolio Results – Northeast Region



Portfolio Results – Northeast Region

Subregion	Patch Size (Ha)		Populations		Representation									Resilient	Redundant
						Life History Diversity									
	Total	Ave.	All	Allo-patric	Geo. Div.	Mig-Lake	Mig-River	Mig-R&L	Mig-Sea	Res-↑Prod	Res-↓Prod	Res-Pond	No Data	Strong-hold pops.	Persistent pops.
Cape Cod	164,410	694	237	213	91	1	3	0	16	0	204	2	11	5	60
Saco-Merrimack	897,080	1,400	641	601	145	112	14	35	1	0	441	33	5	37	310
Total Coastal RI/MA/NH	1,061,490	-	878	814	236	113	17	35	17	0	645	35	16	42	370
Connecticut River	1,547,743	1,540	1,005	698	73	60	50	34	0	16	810	28	7	68	480
Total Connecticut River	1,547,743	-	1,005	698	73	60	50	34	0	16	810	28	7	68	480
Hudson River	1,152,275	1,419	812	385	0	75	24	17	0	18	615	50	13	23	236
Long Island Sound	515,502	863	597	380	149	17	13	2	7	1	530	7	20	8	130
Total Hudson/L.I. Sound	1,667,777	-	1,409	765	149	92	37	19	7	19	1145	57	33	31	366
Coastal Maine	761,195	3,368	226	226	147	63	6	23	16	0	90	20	8	37	150
Interior Maine	3,041,108	6,058	502	491	45	137	10	84	1	2	224	40	4	112	360
Northern Maine	1,783,679	17,660	101	100	0	23	4	28	0	1	26	7	12	37	68
Total Maine	5,585,982	-	829	817	192	223	20	135	17	3	340	67	24	186	578
Great Lakes	806,412	1,133	712	164	712	56	22	26	0	21	558	12	17	20	160
Saint Lawrence	1,769,823	2,493	710	249	0	125	38	53	0	14	409	66	5	54	303
Total St. Lawrence	2,576,234	-	1,422	413	712	181	60	79	0	35	967	78	22	74	463

Range-wide Assessment: Habitat Integrity

Primary factors (non-correlated, high data quality)

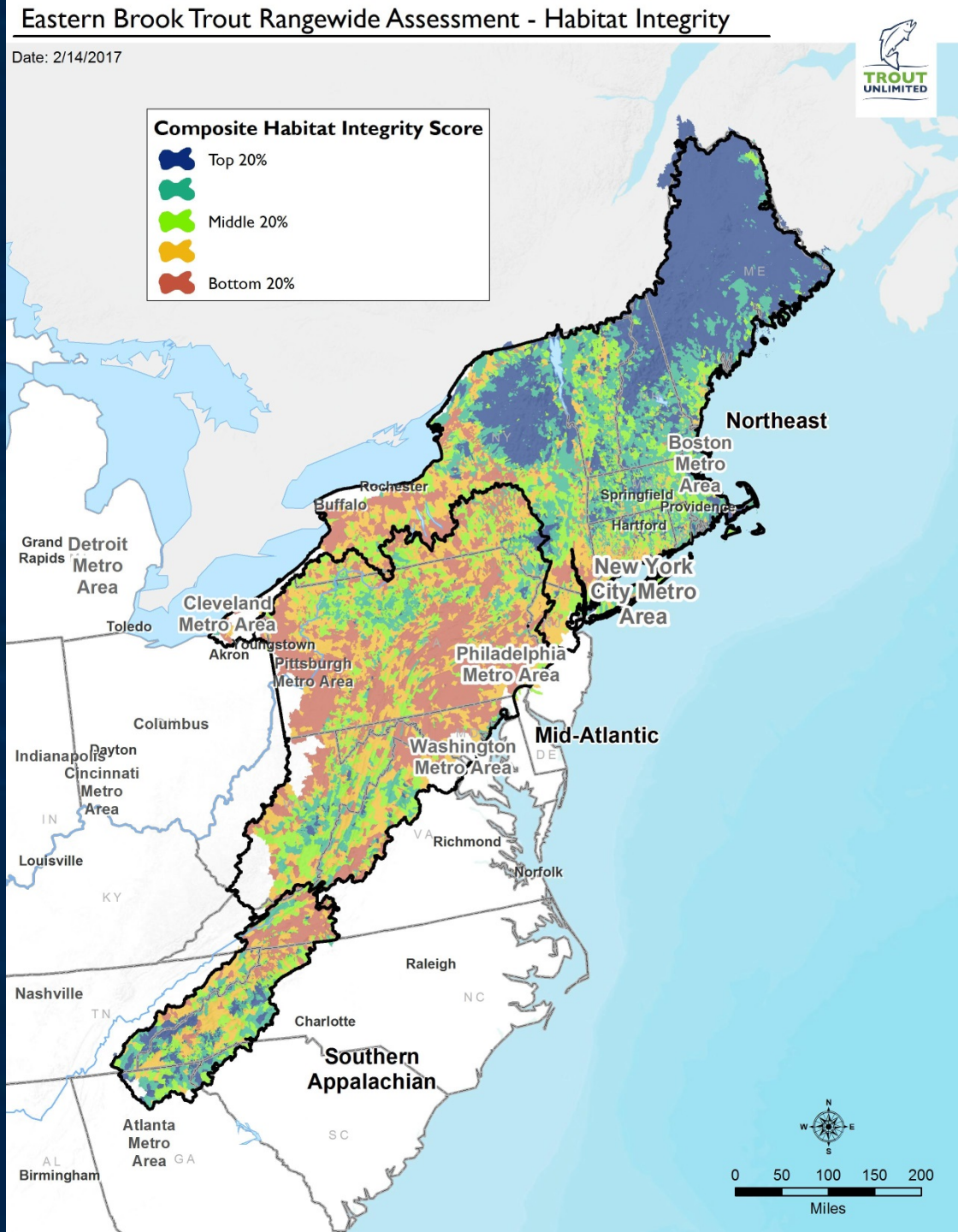
- **Land use:** % riparian forest, % agricultural land use
- **Fragmentation:** Road-stream crossing density, overall road density
- **Water quality:** Acid deposition

Secondary factors

- Include % forested watershed, dams, mines, oil/gas wells

All factors scored as percentile, composite score is average of primary factor percentile scores

Range-wide Assessment: Habitat Integrity



Range-wide Assessment: Future Security

Primary factors (non-correlated, high data quality)

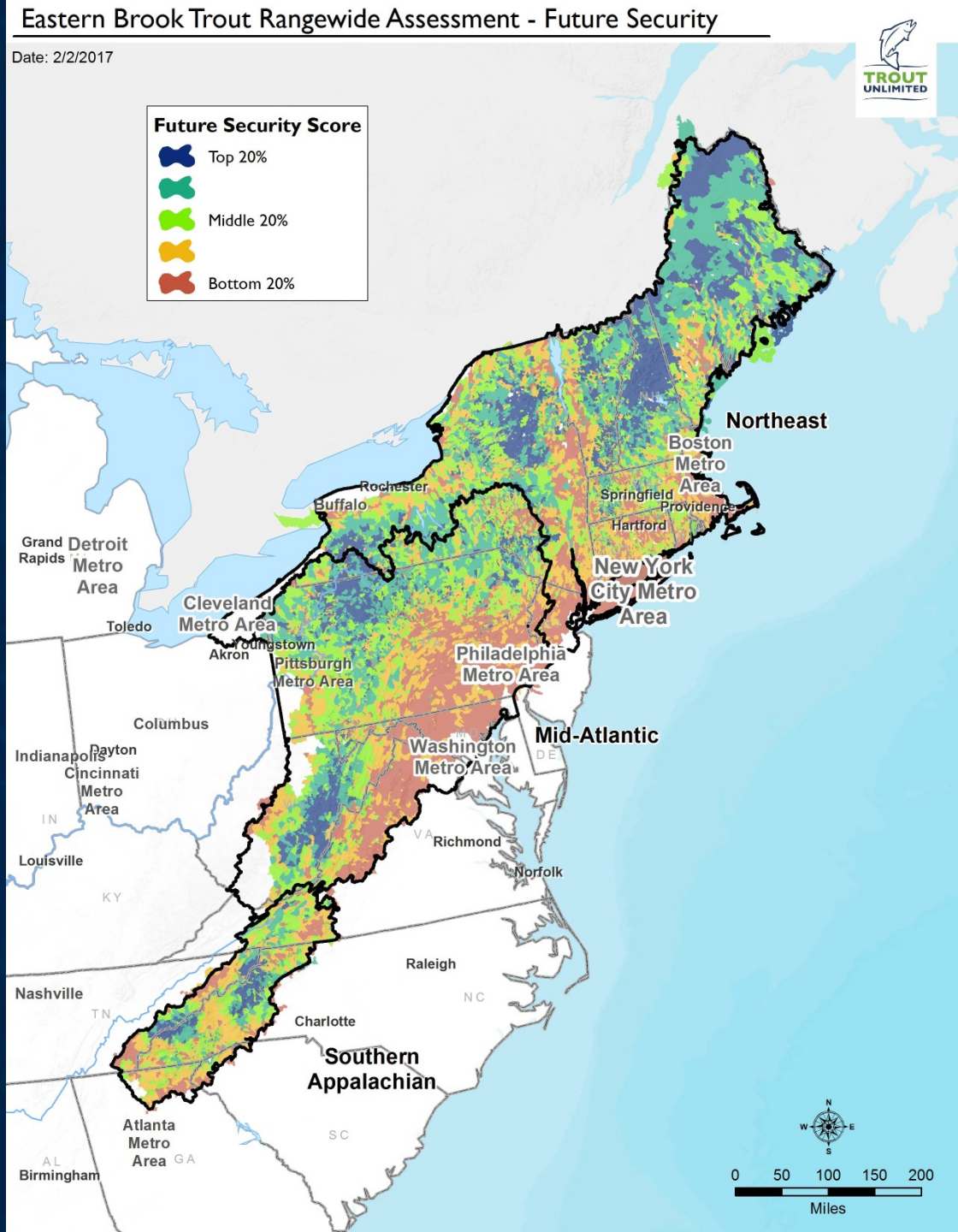
- **Climate**: Stream temperature

Secondary factors

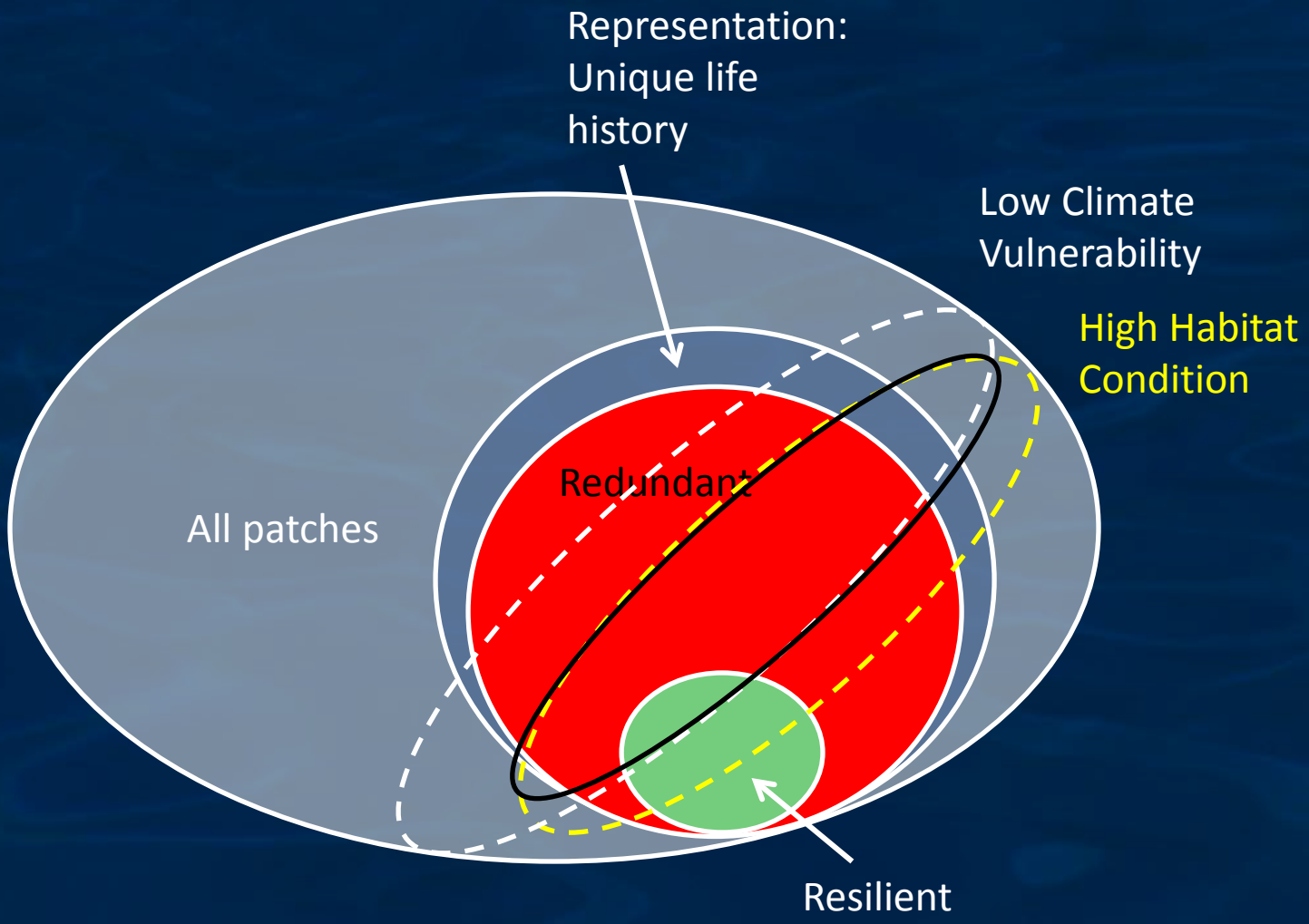
- Include forecast shale gas development, urbanization, karst geology, protected areas

All factors scored as percentile, composite score is average of primary factor percentile scores

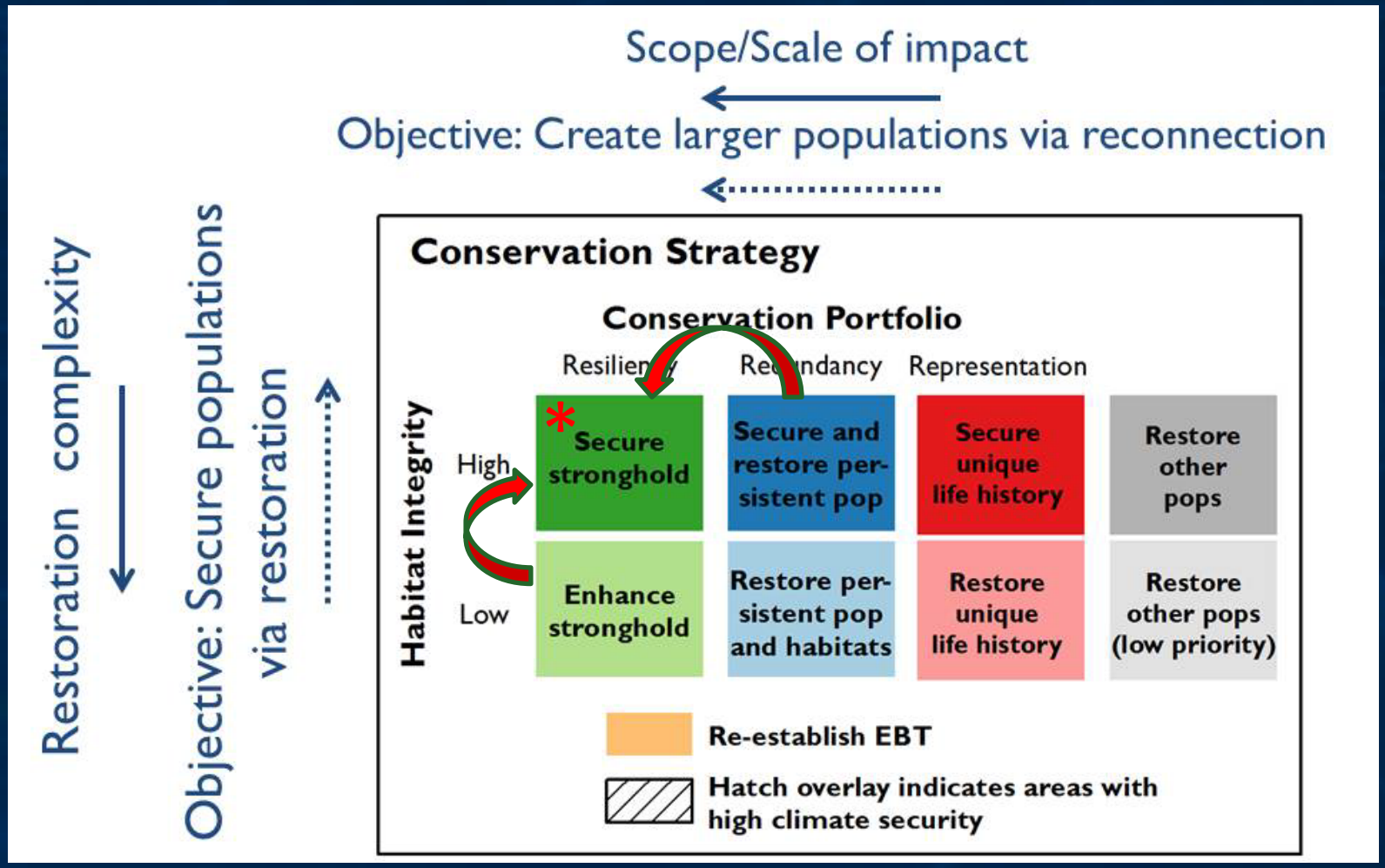
Range-wide Assessment: Future Security



Brook Trout Portfolio and Range-wide Assessment



Conservation Strategies based on Portfolio and Range-wide Assessment



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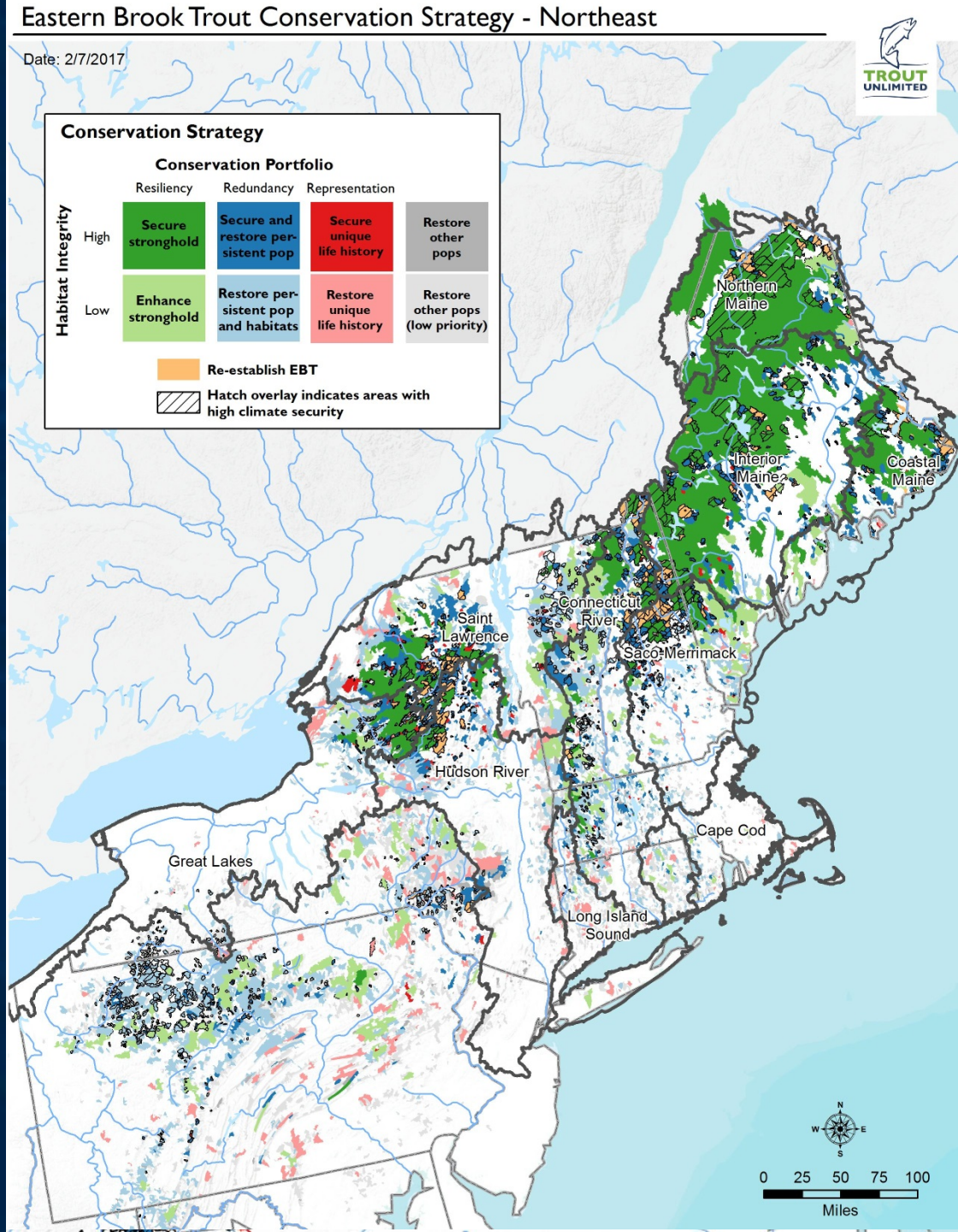
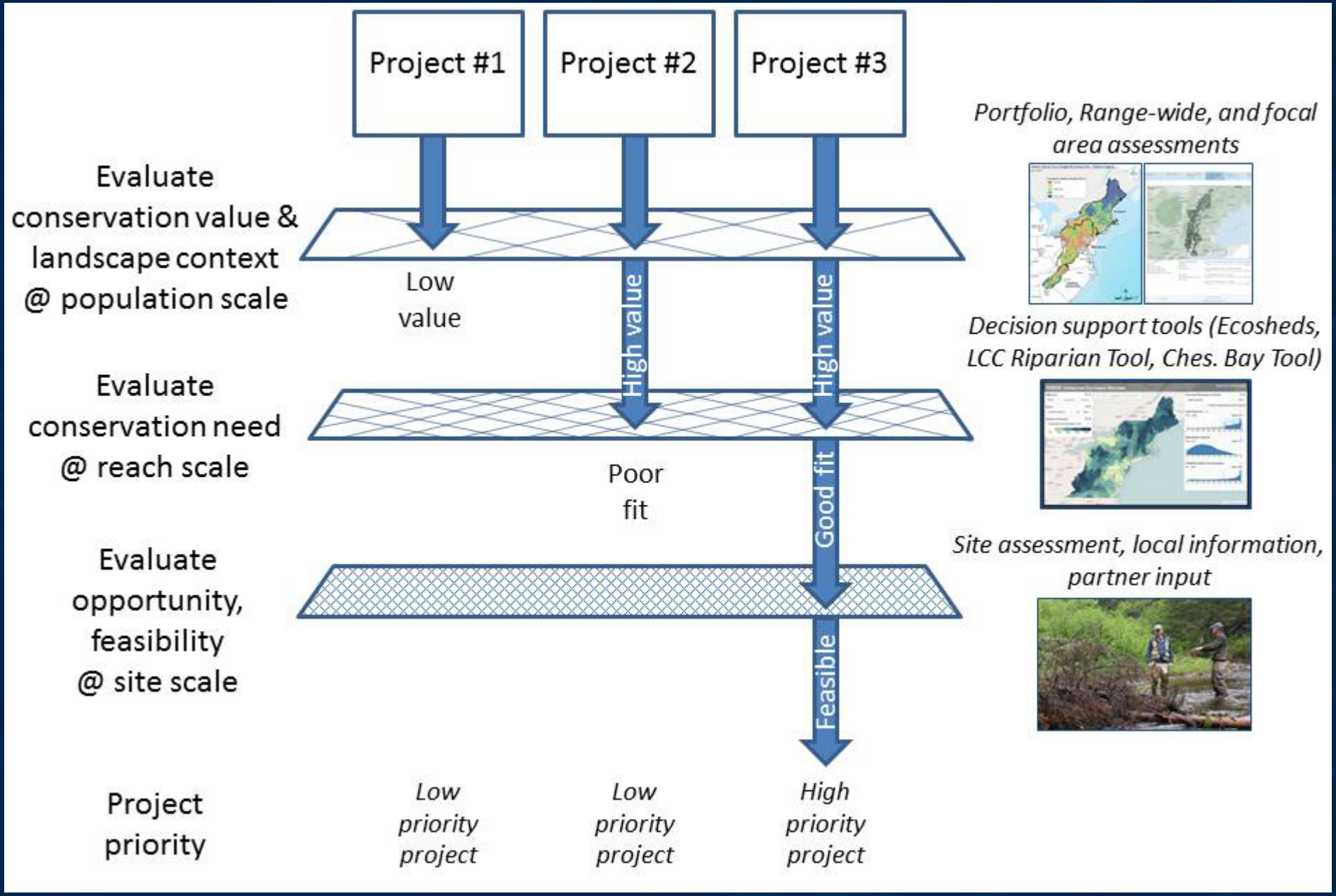


Focal Area Assessments (Upper Connecticut, Delaware, Susquehanna, and Chesapeake Basins)

Goal: Take approach of range-wide assessment, but use regionally available or local datasets and present within a visualization tool with emphasis on restoration strategies

Datasets:

- BT occupancy and stream temperature models produced by as part of the Spatial Hydro-Ecological Decision System project (Ecosheds 2016) and BT occupancy models and habitat quality and total stress indices produced by Downstream Strategies in the Chesapeake Bay (Clingerman et al. 2015)
- Regional conservation priorities, including Delaware River Basin Initiative (The Nature Conservancy 2011) and Connect the Connecticut (North Atlantic Landscape Conservation Cooperative 2016).
- State-specific designations, including exceptional waters and trout water designations.
- Regional tools, including the Riparian Restoration Decision Support Tool (Coombs and Nislow 2014).
- Regional condition and threat datasets, including North Atlantic Aquatic Connectivity Collaborative barriers, abandoned mine lands, proposed natural gas pipelines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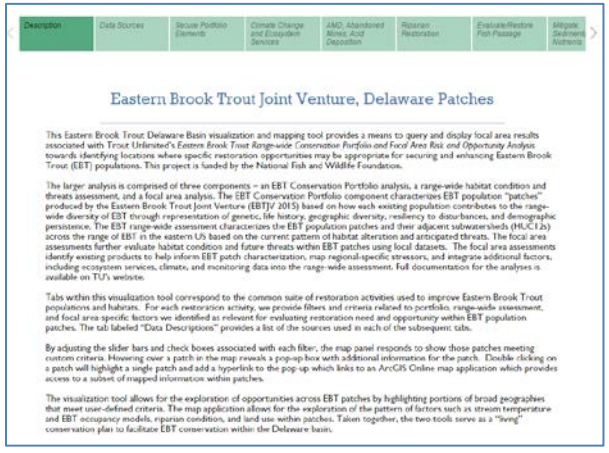
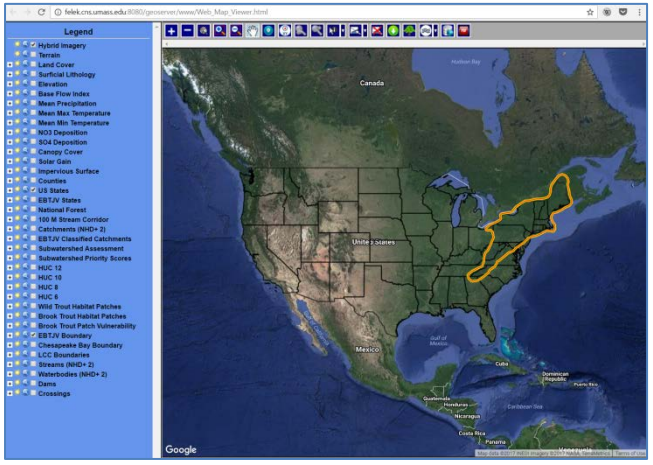
Example 1: Identifying priority BT populations requiring a specific restoration activity – riparian restoration – within a focal geography

In this example, brook trout populations in the Delaware basin are prioritized based on riparian restoration need using the DE basin focal area visualization tool, and on-the-ground opportunities are evaluated within one priority population using the Riparian Restoration Decision Support Tool viewer.

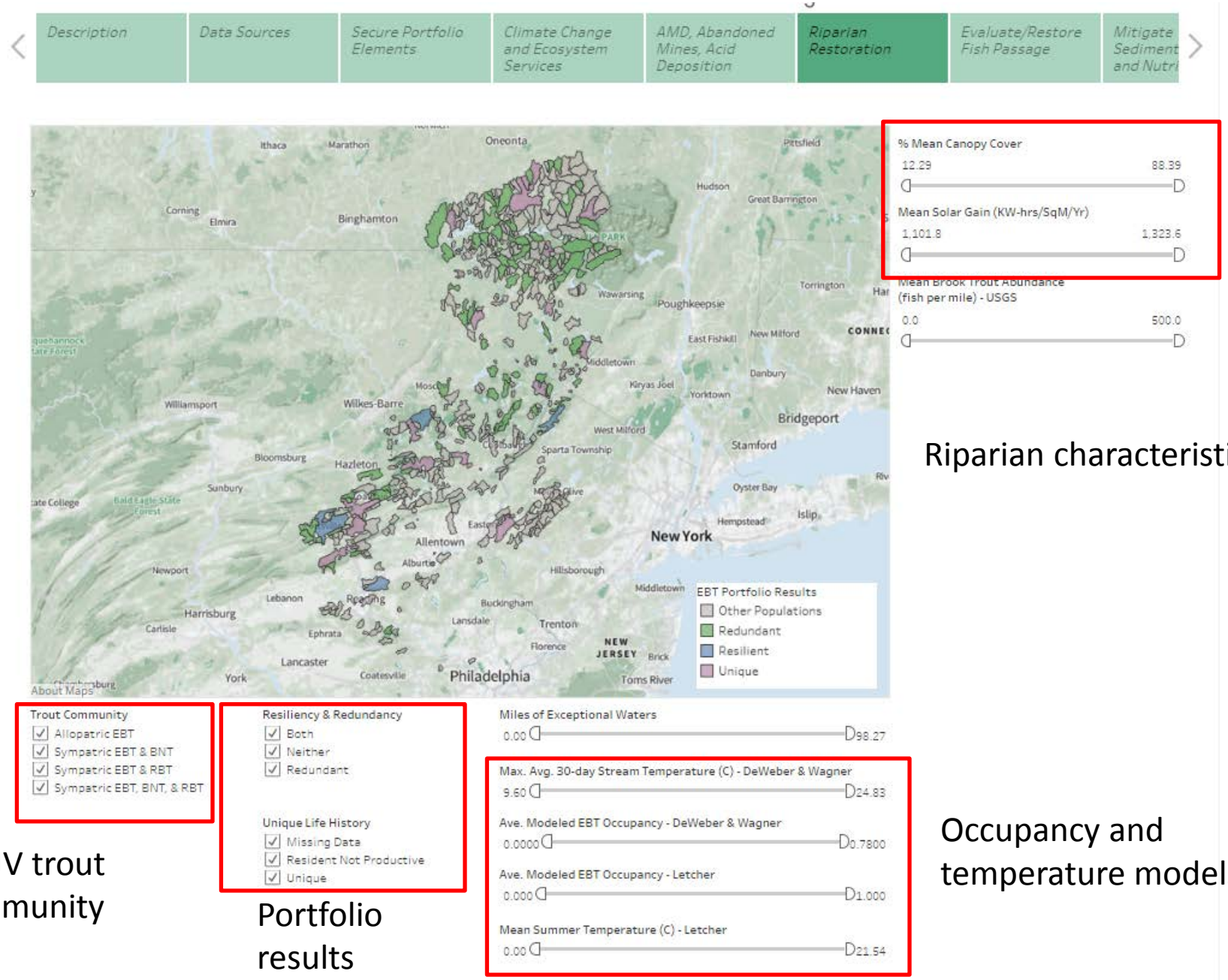
Criteria for prioritizing riparian restoration at the basin-scale:

- Patch has coldwater habitat likely to remain viable under future climate scenarios (Mean summer temperature in Letcher (Ecosheds) model < 17 °C)
- Patch has some riparian restoration need (% mean canopy cover range is 60-80%)
- Patch is high value brook trout population (is resilient or redundant)





Focal Area Data Visualization Tool



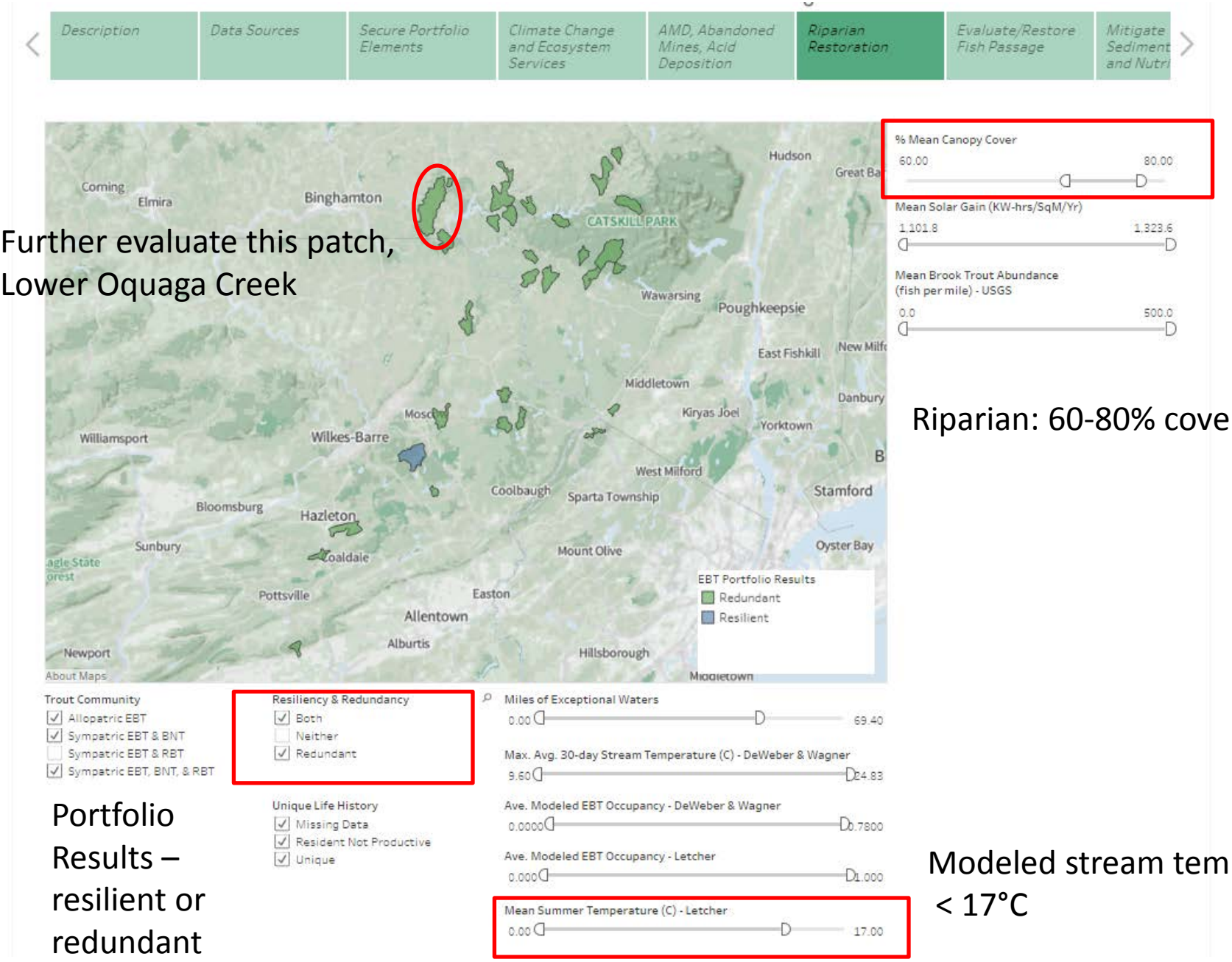
Riparian characteristics

EBTJV trout community

Portfolio results

Occupancy and temperature models

Focal Area Data Visualization Tool



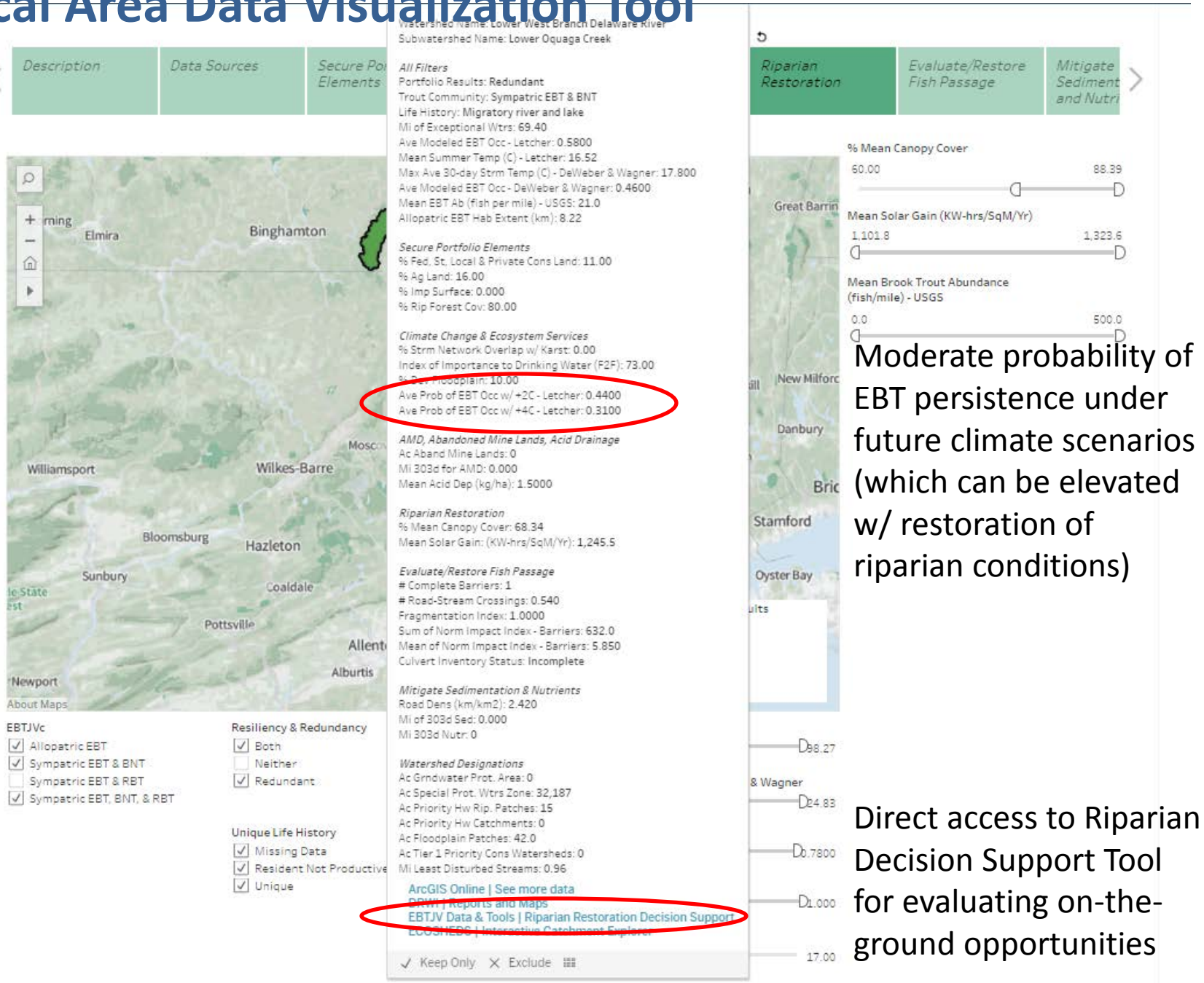
Further evaluate this patch, Lower Oquaga Creek

Riparian: 60-80% cover

Portfolio Results – resilient or redundant

Modeled stream temps < 17°C

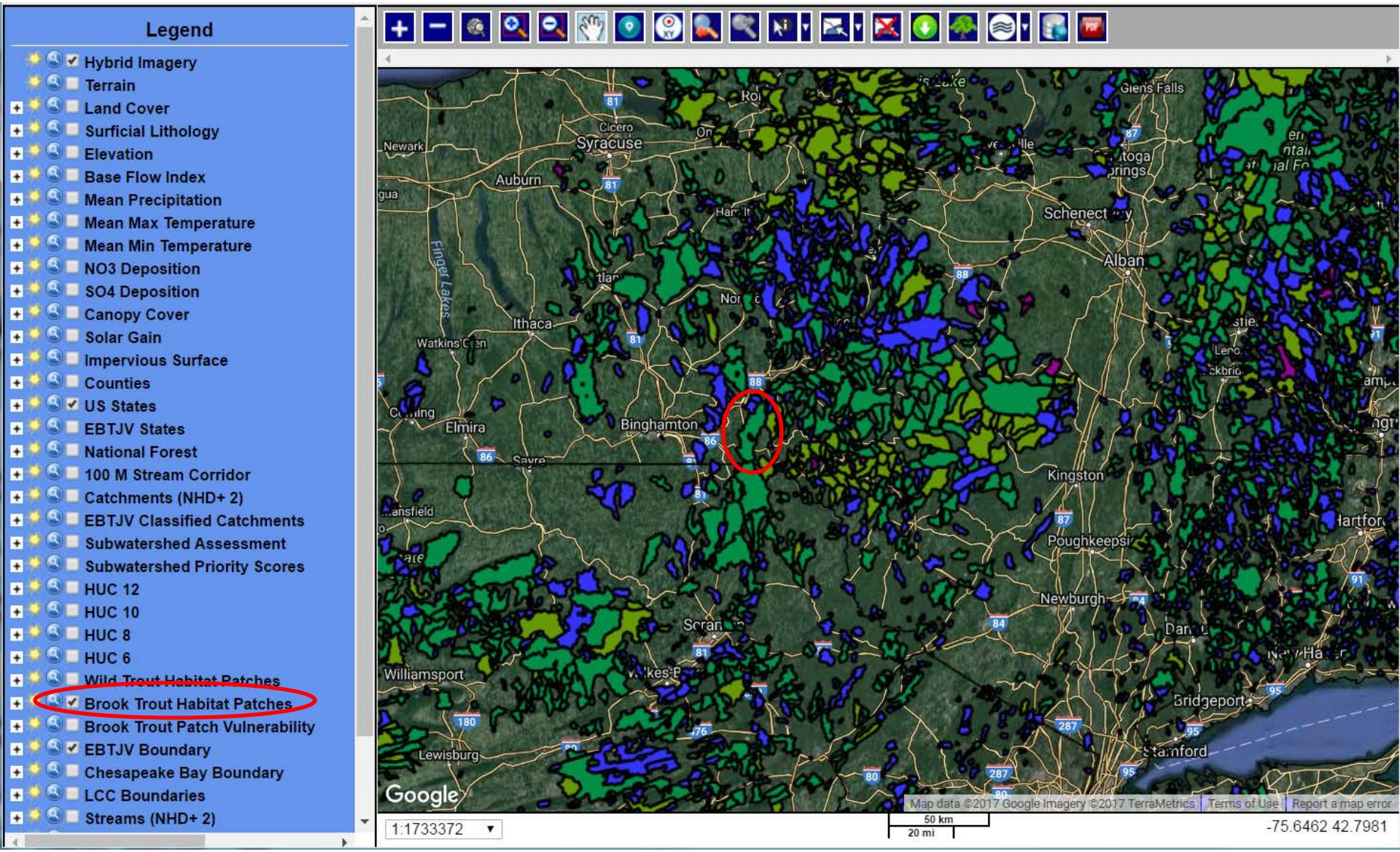
Focal Area Data Visualization Tool



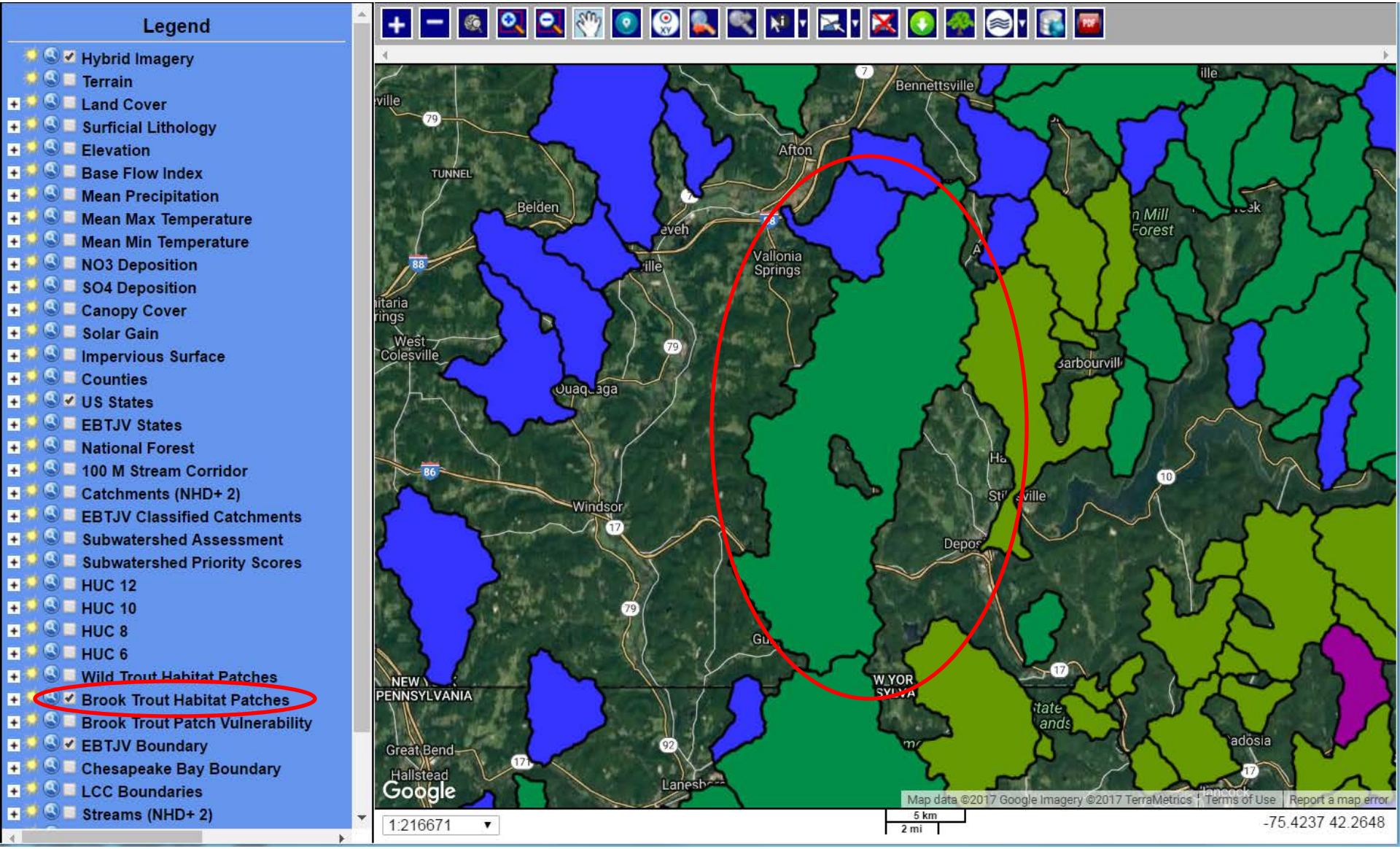
Moderate probability of EBT persistence under future climate scenarios (which can be elevated w/ restoration of riparian conditions)

Direct access to Riparian Decision Support Tool for evaluating on-the-ground opportunities

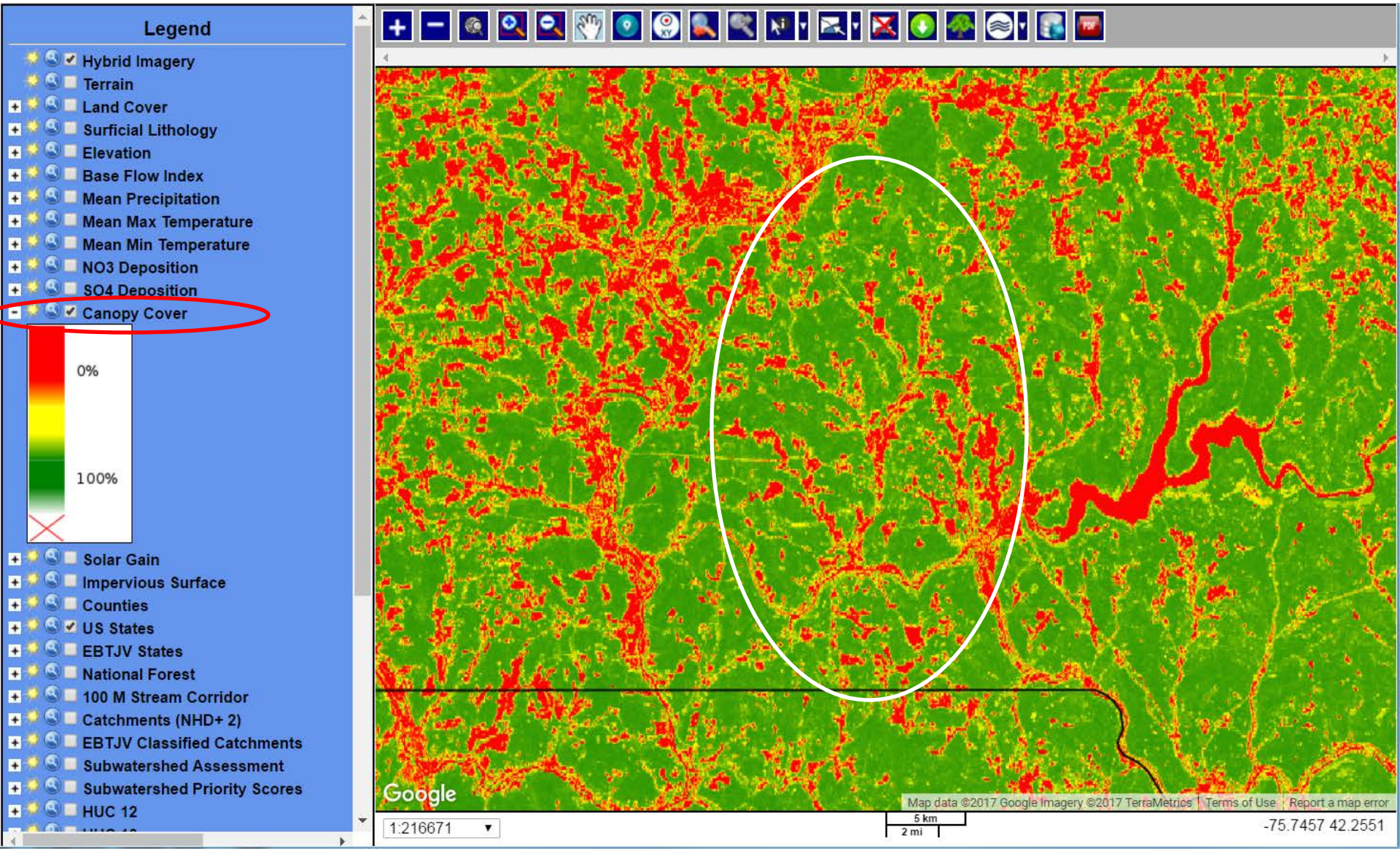
Locate patch of interest in EBTJV Decision Support Tool



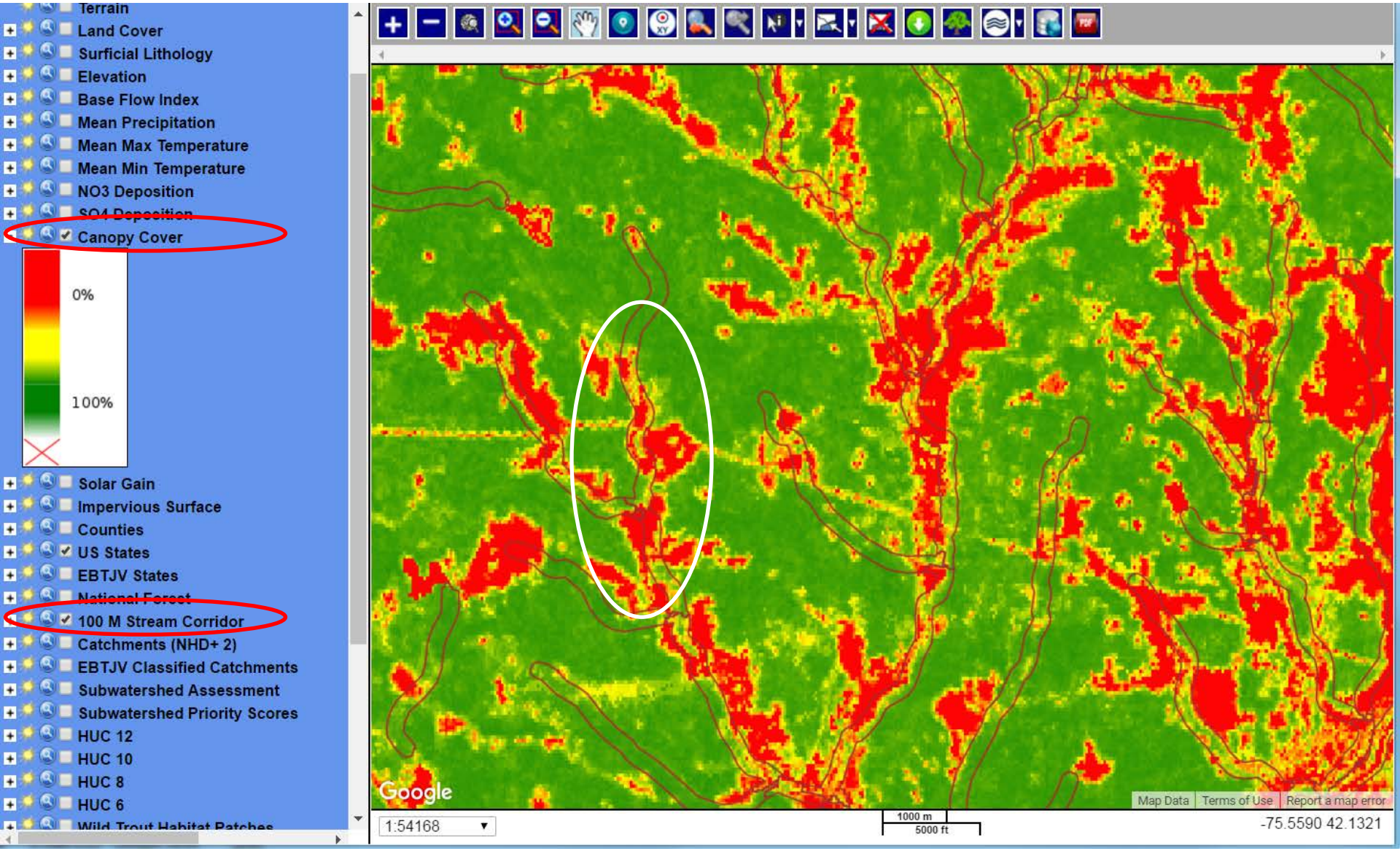
Locate patch of interest



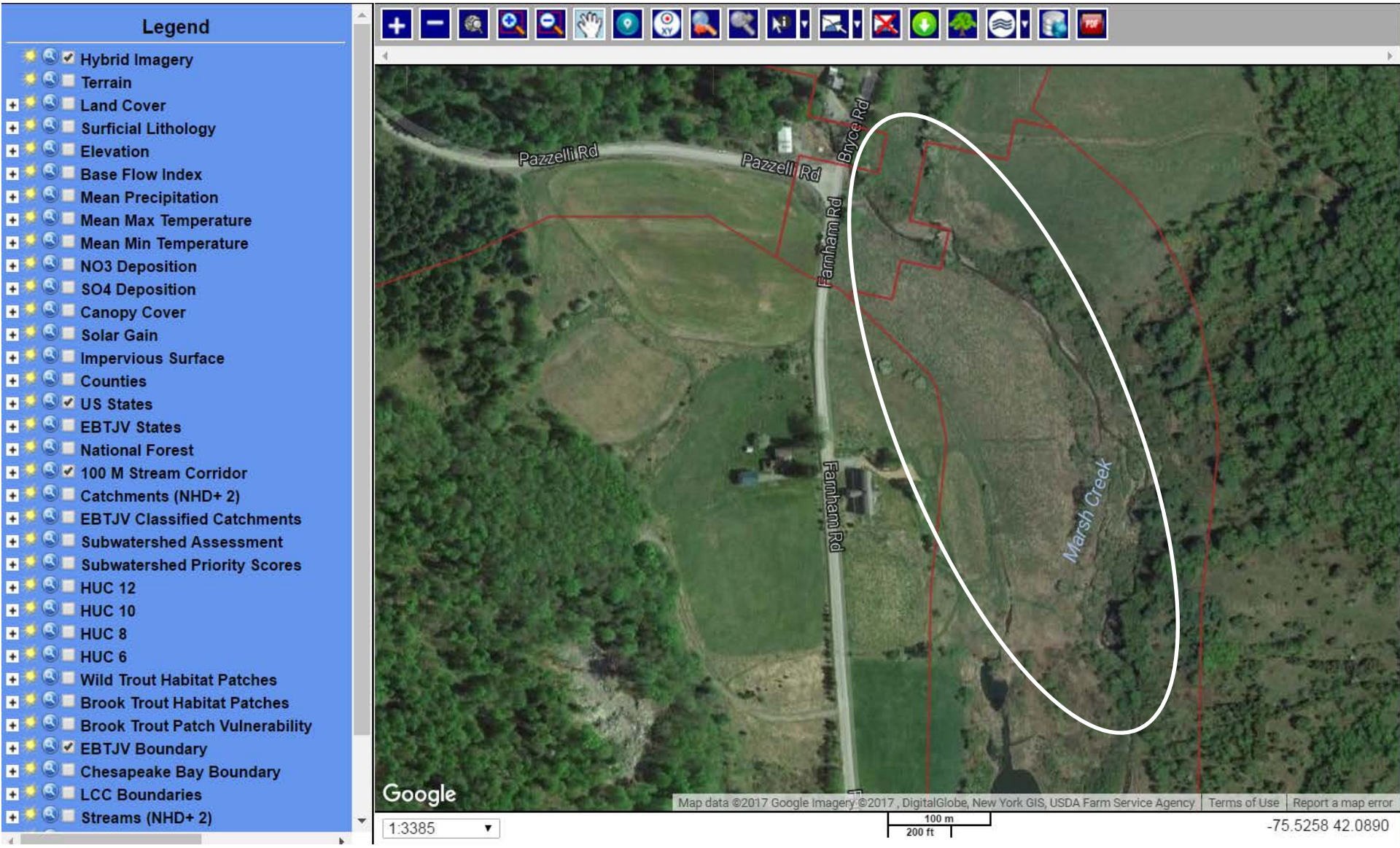
Turn on canopy cover layer



Turn on stream corridor, zoom to area with low canopy cover in corridor



Turn off canopy cover and explore aerial imagery

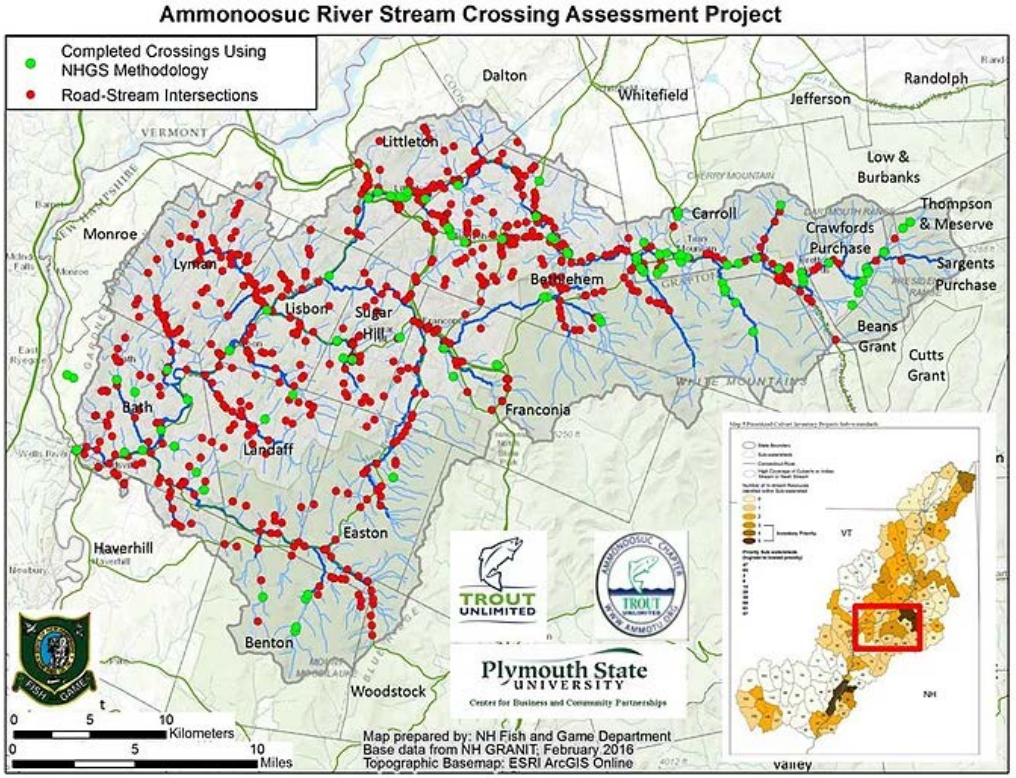


Example 2: Placing a local restoration effort within a range-wide brook trout context

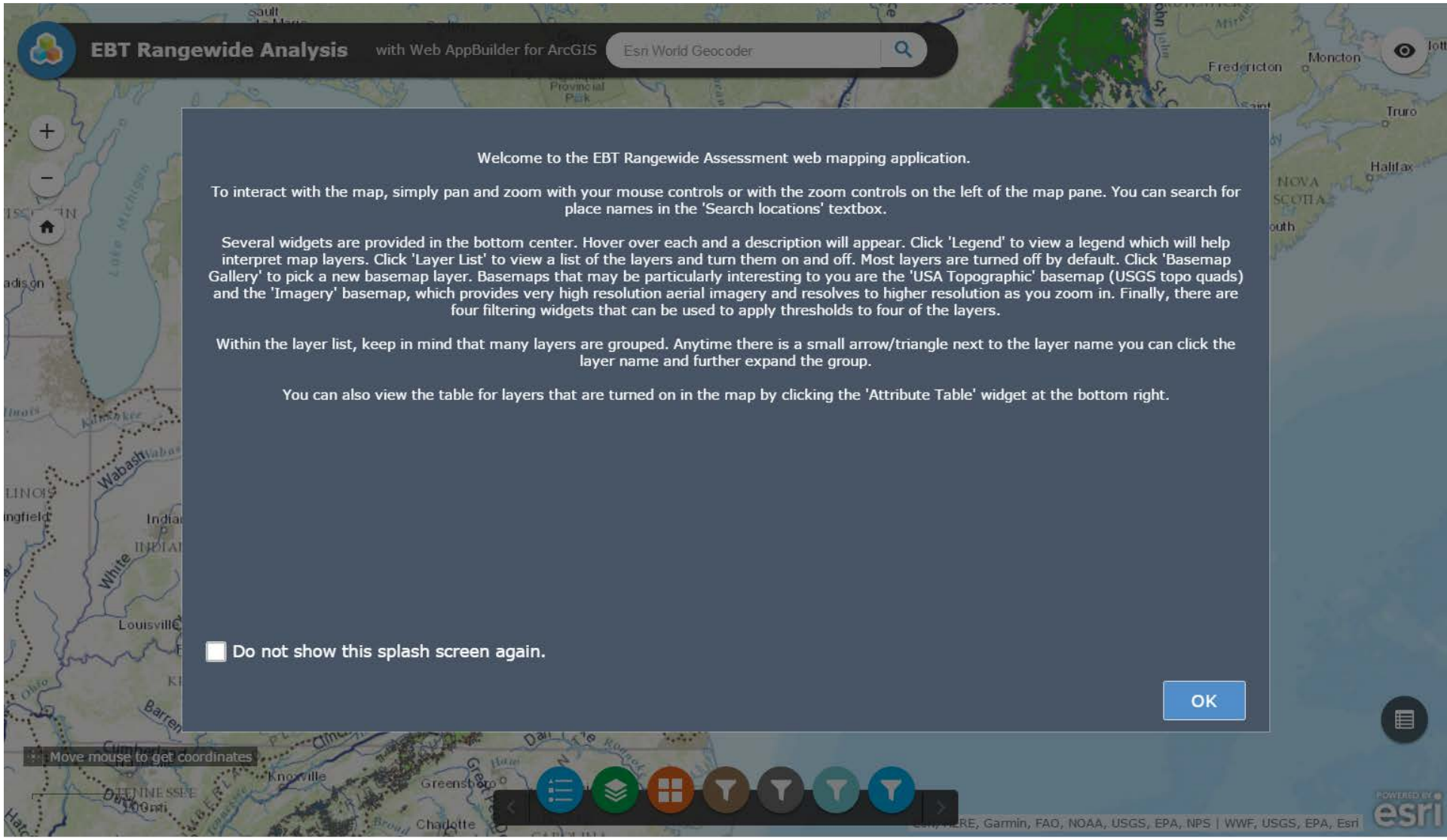
In this example, we evaluate several potential culvert removal projects in the Ammonoosuc River basin of NH and show how the conservation portfolio and range-wide assessment results can be used to articulate project value to brook trout. This process may assist entities that conduct culvert replacement work (such as towns or counties) in accessing information about local brook trout fisheries values.

Process:

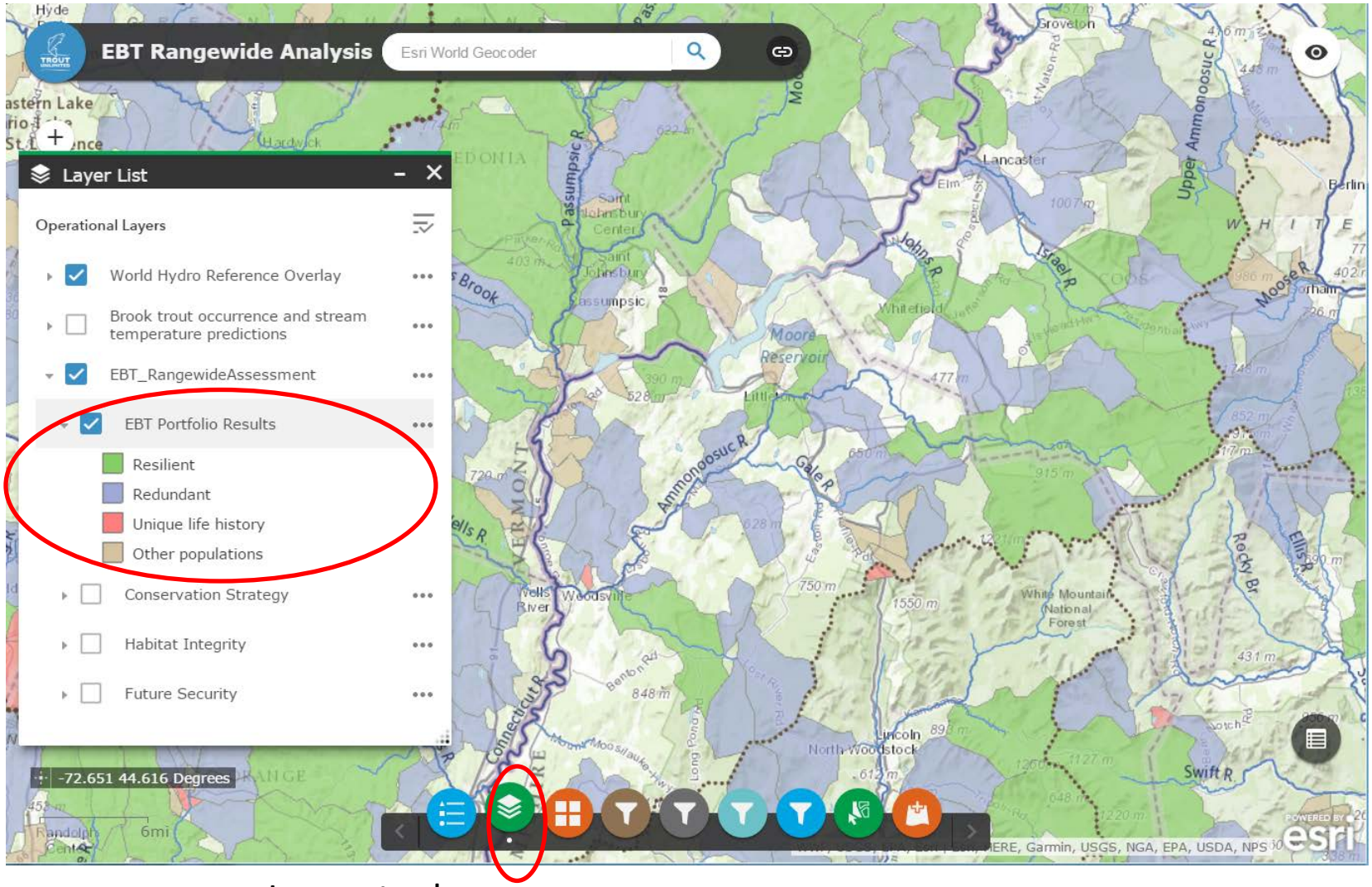
- Use conservation portfolio and range-wide assessment map viewer to overlay a recent barrier survey to place a local restoration opportunity within a broader brook trout conservation context using patch habitat condition and future security percentile scores.



Portfolio and Range-wide Assessment webmap

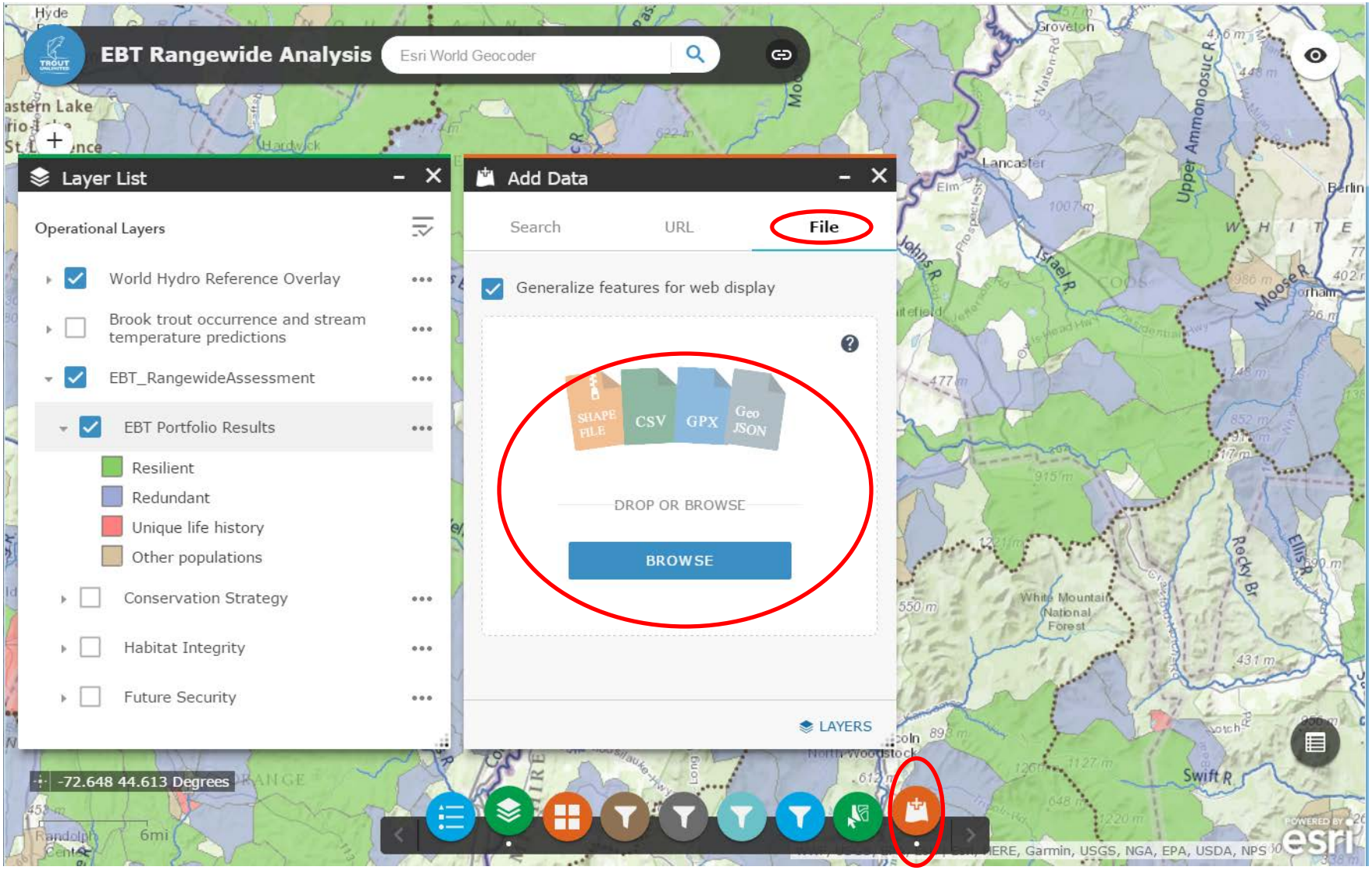


Zoom to the Ammonoosuc River basin and change the visible layer in the layer list to show the portfolio results – resilient (green) and redundant (blue) brook trout populations are populations that TU has identified as highly likely to be viable in the long-term based on the amount of connected habitat available to populations based on the Conservation Portfolio analysis.

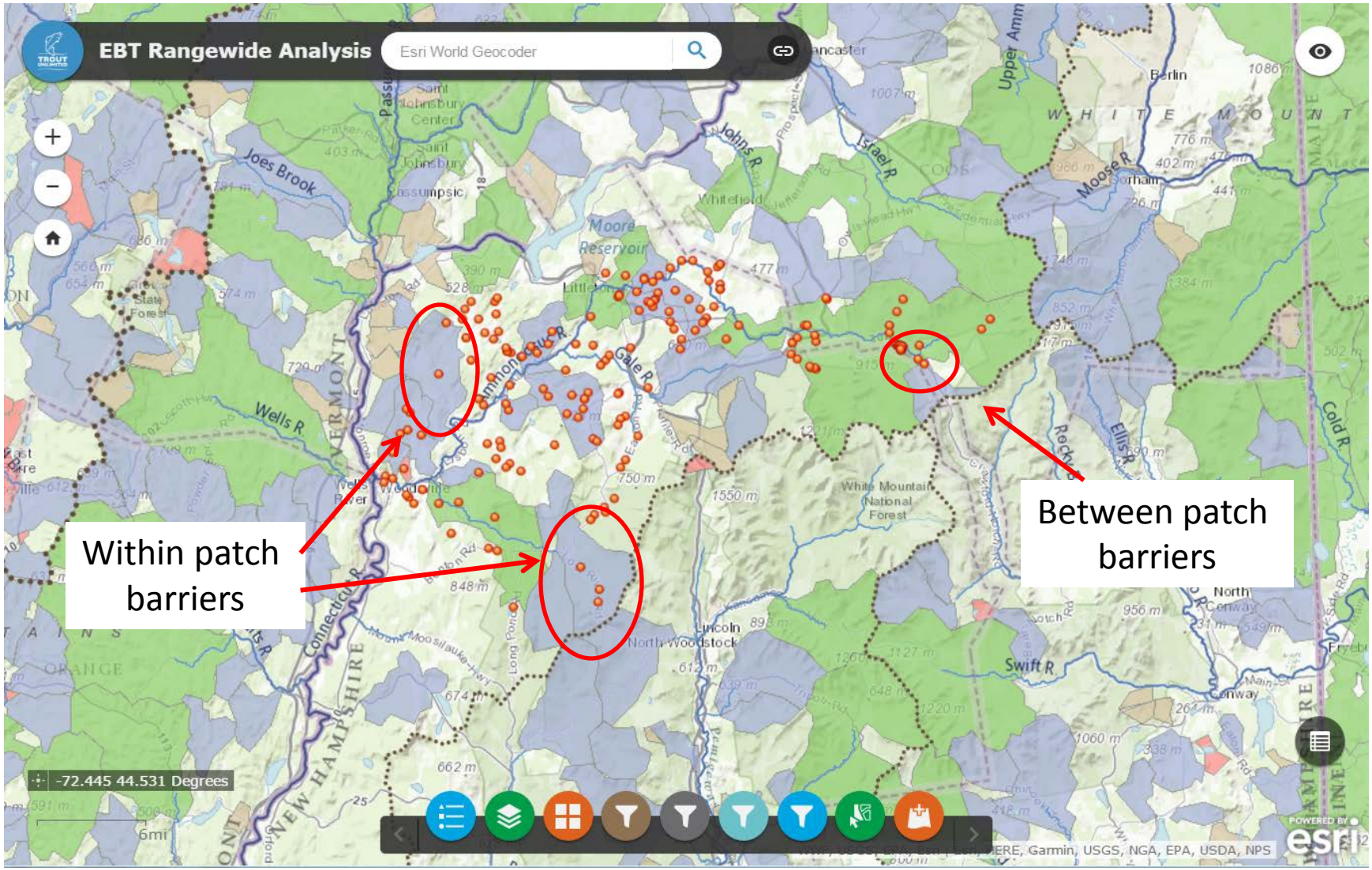


Layers tool

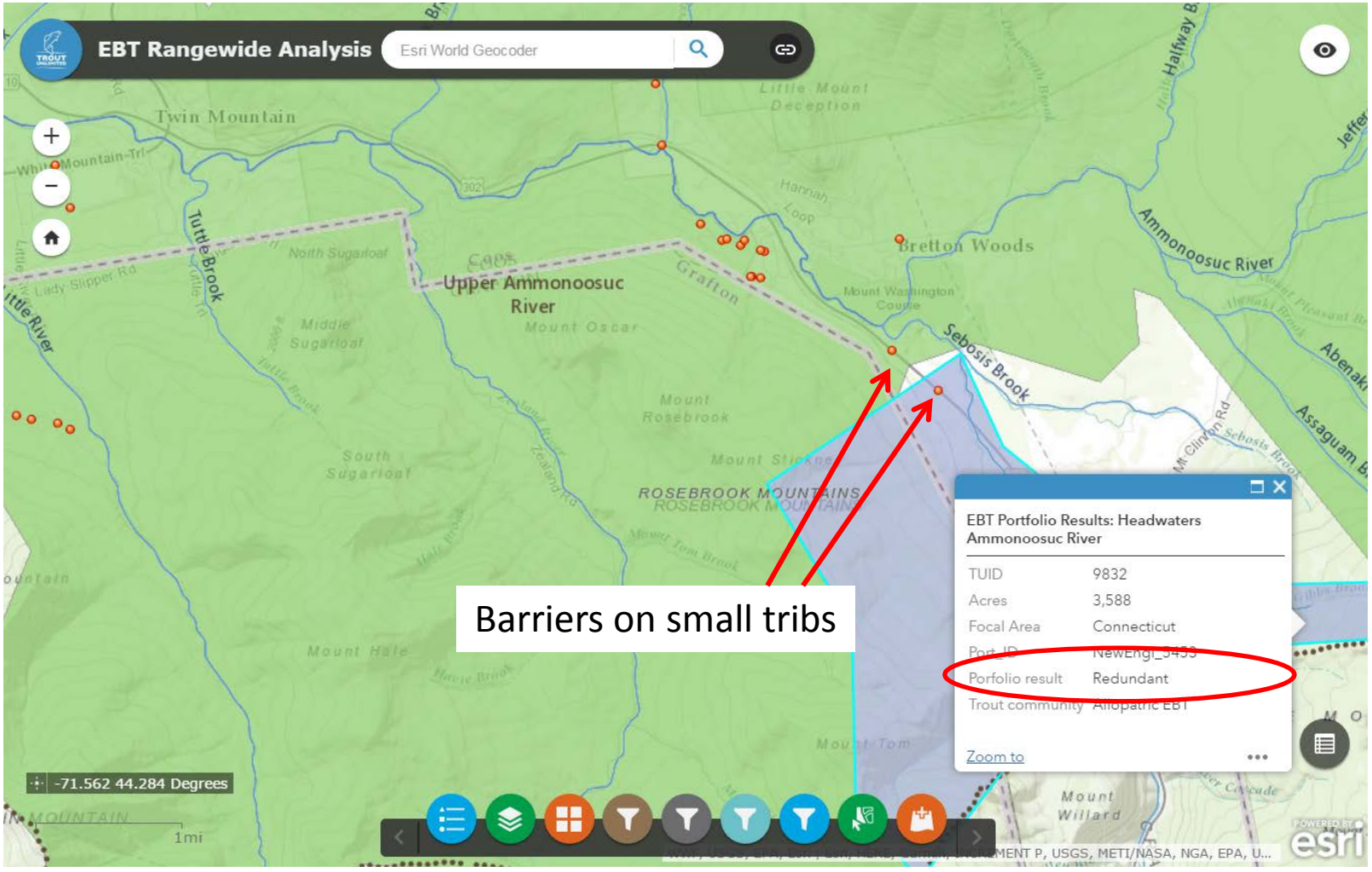
Add a local barrier survey dataset. The dataset we are using was provided as an excel spreadsheet – to make it visible in the map and limit the amount of data shown, filter the dataset to just show crossings with “Reduced AOP” status, save the dataset as a .csv file, and drag onto the map.



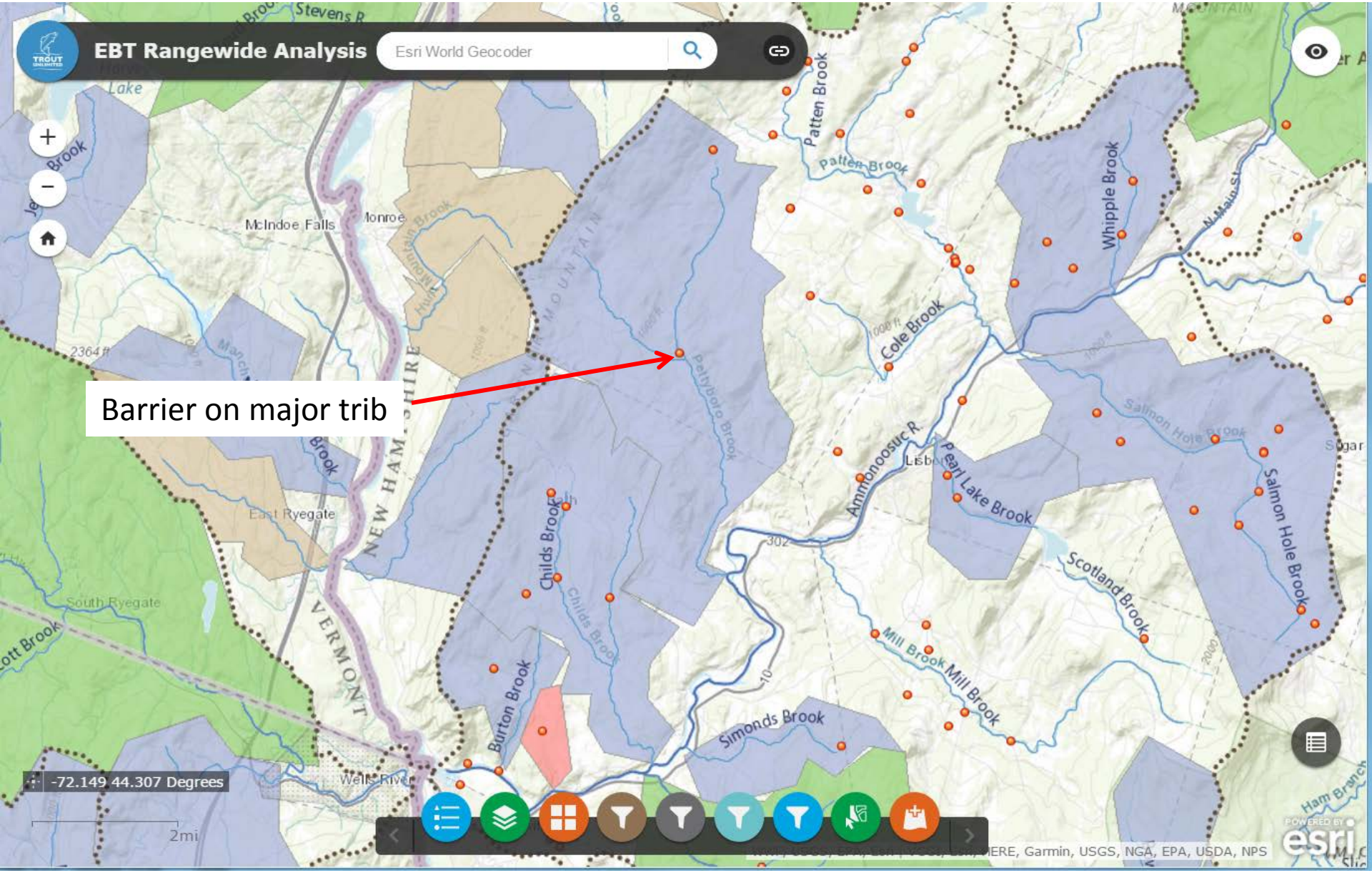
A quick scan of the map reveals several types of critical barriers – those that appear to fall within existing population patches (and were not accounted for in the patch delineation process) and those that appear to be at the downstream extent of patches and fall between patches.



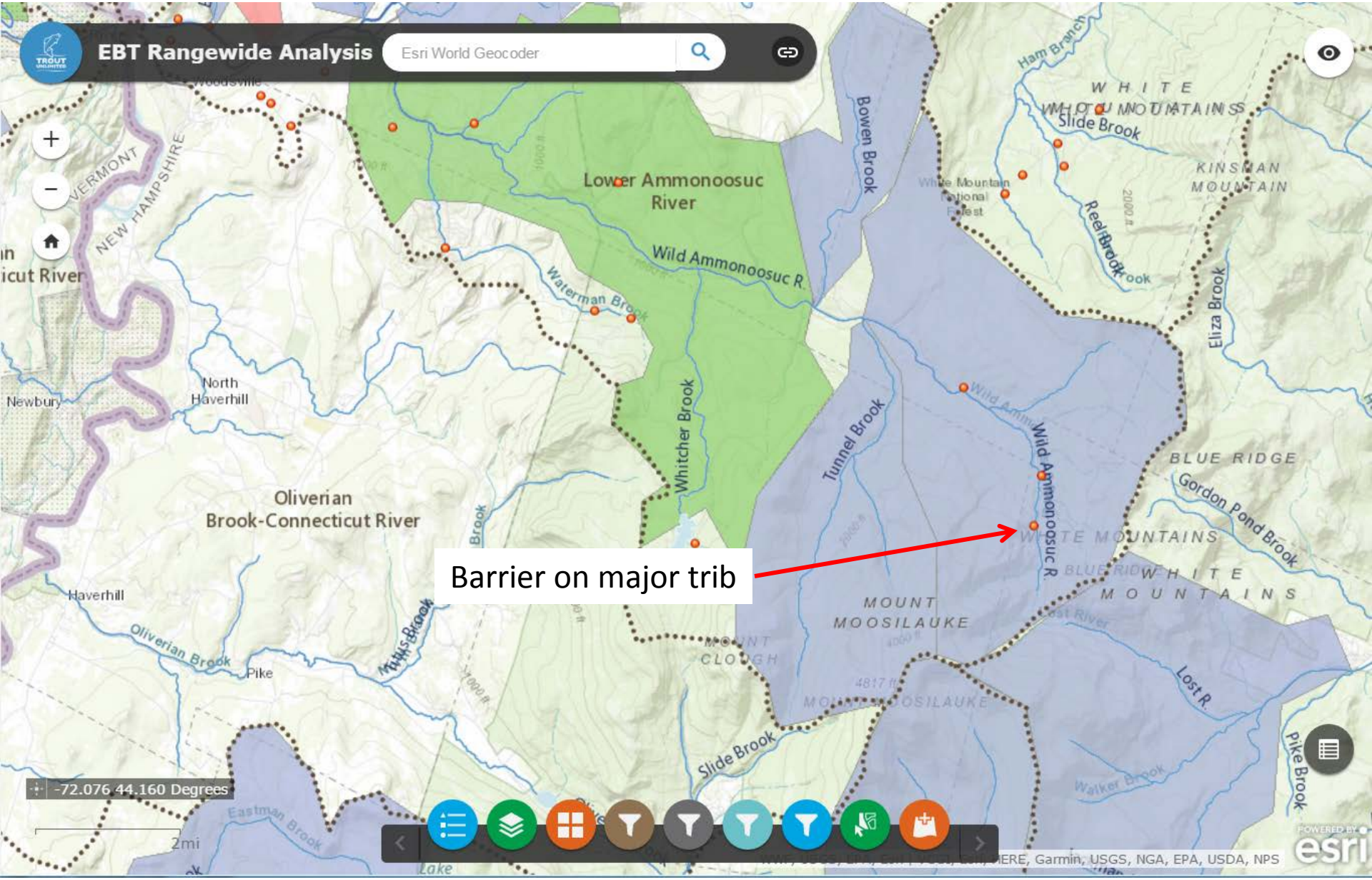
Zooming into the map shows that the between patch barriers are actually road crossings on smaller tributaries within the patches – not significant obstacles to stream connectivity. Even if the barriers were between patches, clicking on the map shows that the adjacent trout communities differ – the redundant patch (blue) is brook trout-only, while the downstream patch is mixed brook trout and brown or rainbow trout – given the competitive interaction of brook trout and brown trout, reconnecting the brook trout-only patch to downstream brown trout would not be a brook trout priority.



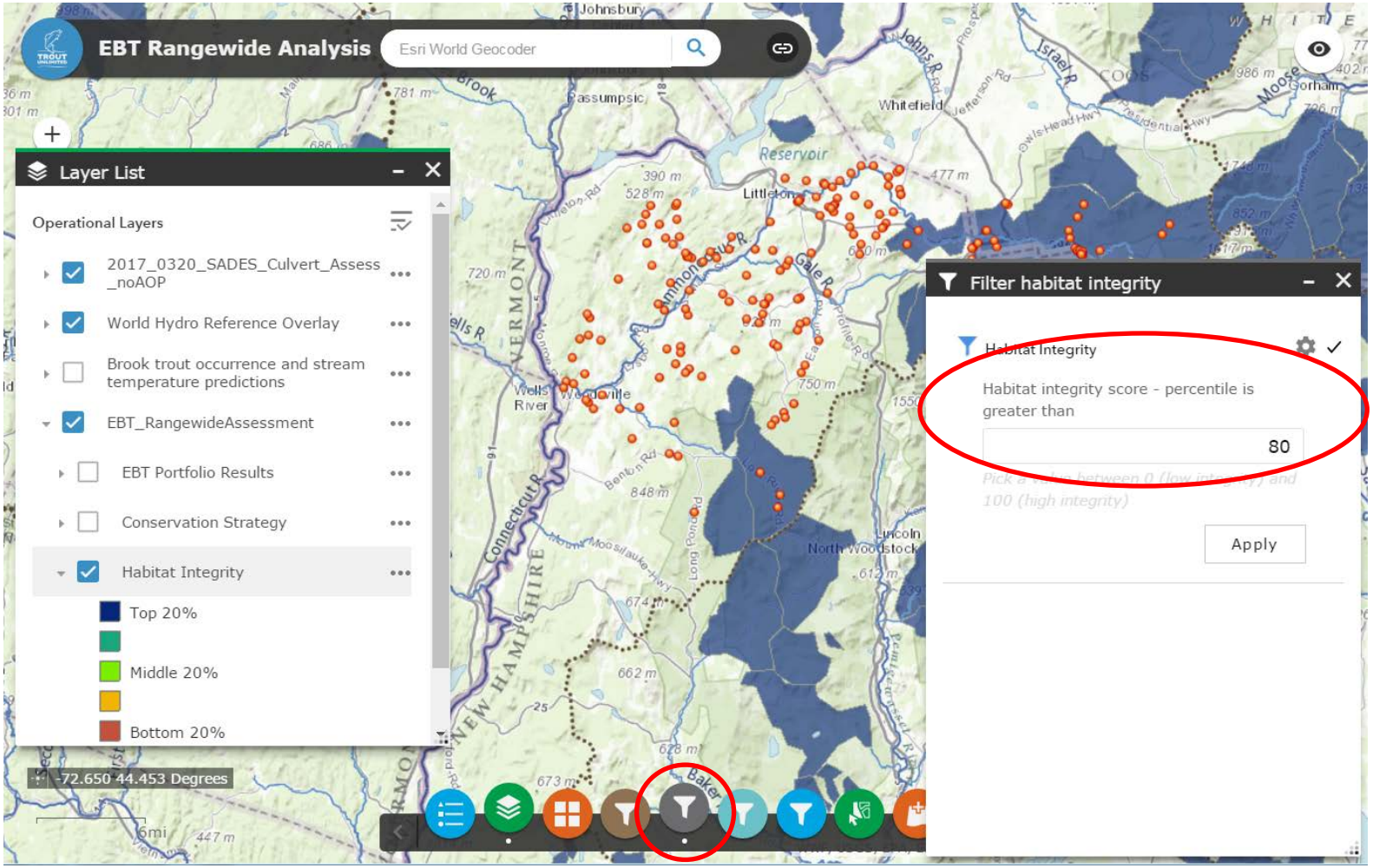
Zooming into the map to explore the within patch barriers shows that both fall on major streams – Pettyboro Brook.



Zooming into the map to explore the within patch barriers shows that both fall on major streams - Upper Wild Ammonoosuc River.

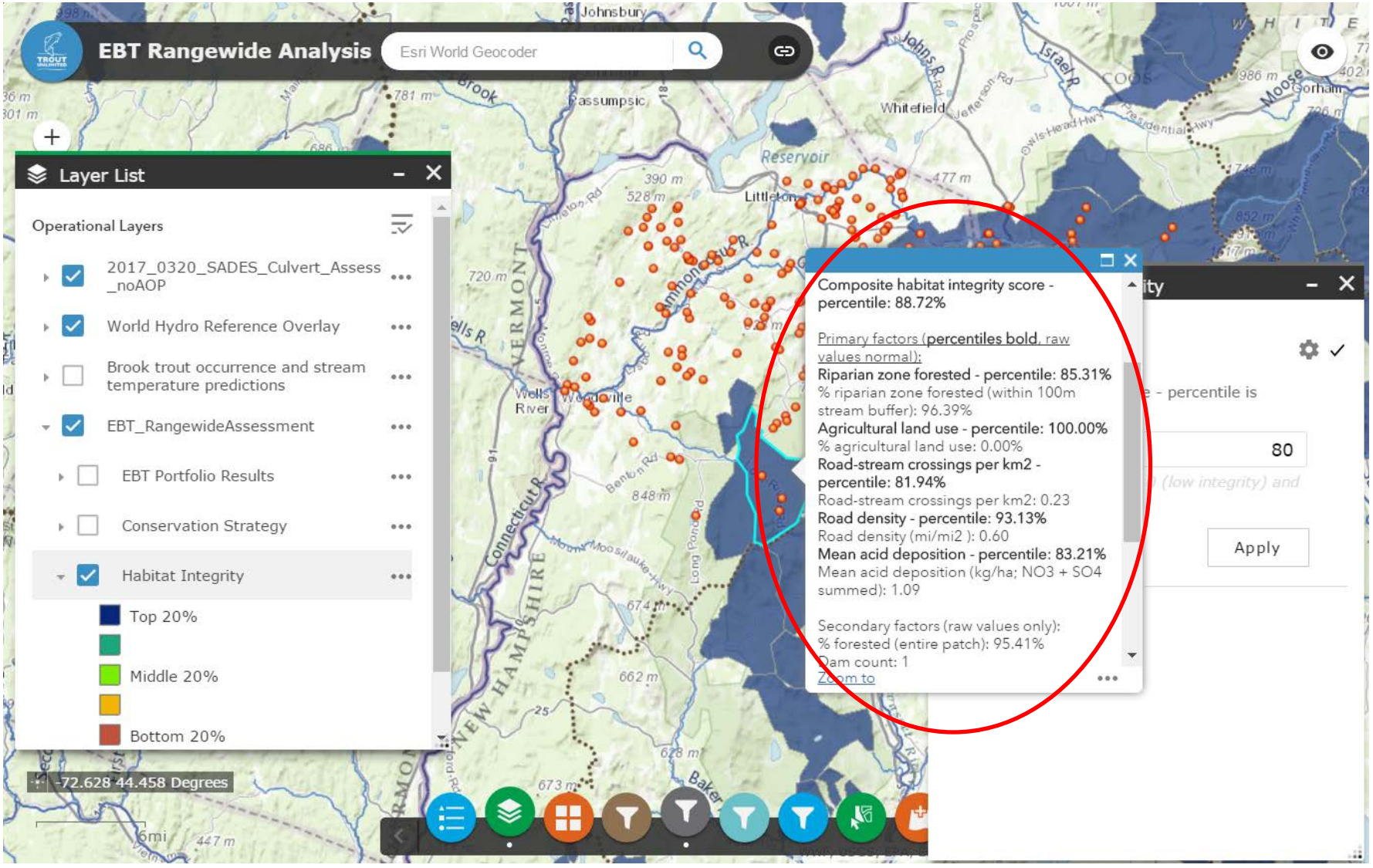


To further evaluate the potential benefit of the two potential project areas, filter the habitat integrity results show only those habitat patches with average habitat condition percentile scores of 80 or higher. The habitat condition score is based on agricultural land use, riparian forest cover, road density, road x stream crossing density, and acid deposition within patches. The patches remaining on the map are among the top 20% least impaired watersheds in brook trout range in the eastern US. Of the 2 populations, only the Upper Wild Ammonoosuc population has very high condition.

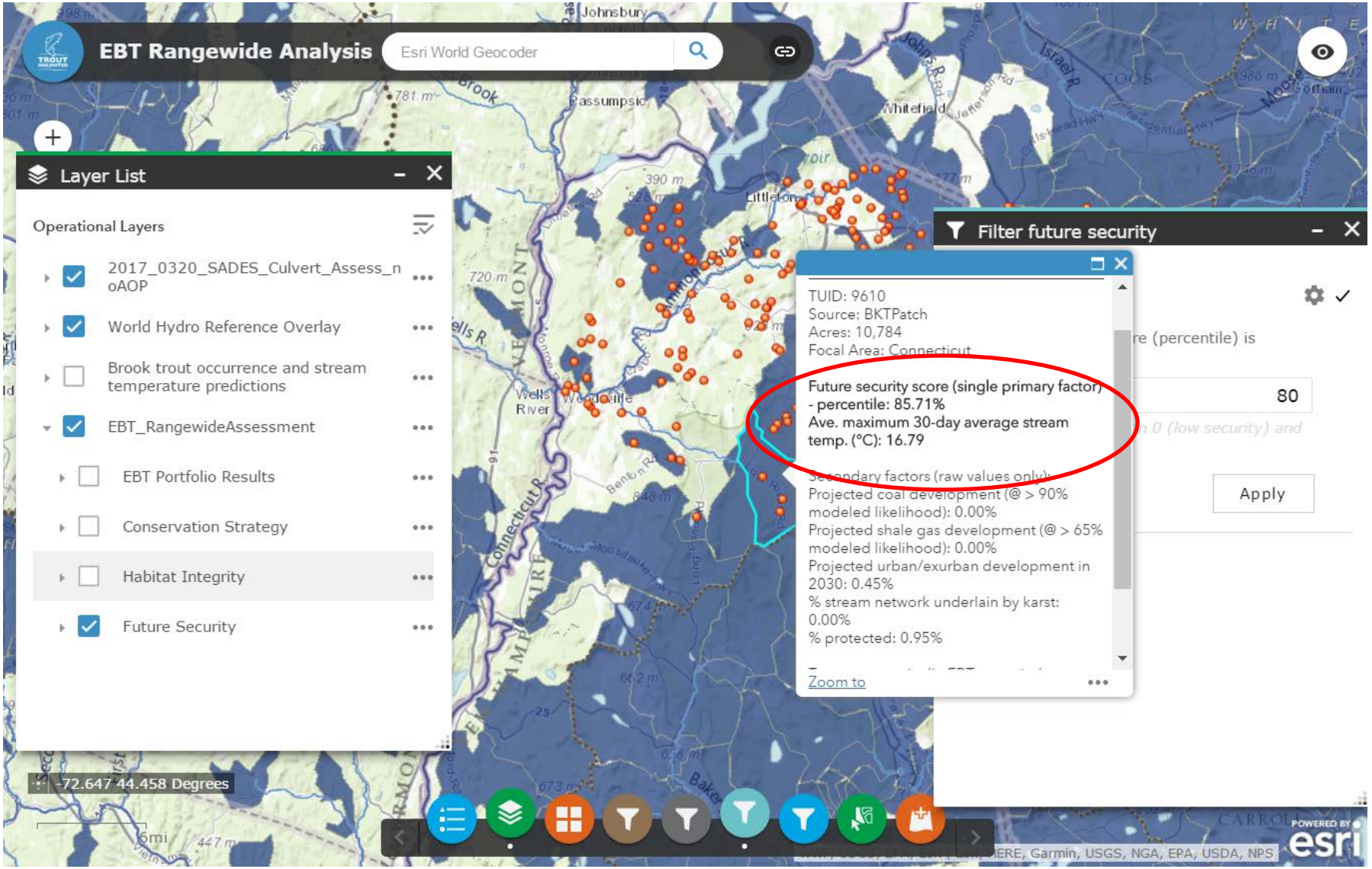


Habitat integrity filter tool

Click on the Upper Wild Ammonoosuc River patch to learn about the scores for that population. This population is in the 88th percentile for overall habitat integrity and in the 80th percentile or higher (among the top 20% of brook trout populations) for agricultural land use, road densities, acid deposition, and riparian forest cover. These numbers suggest that these populations have high habitat integrity relative to other brook trout populations.

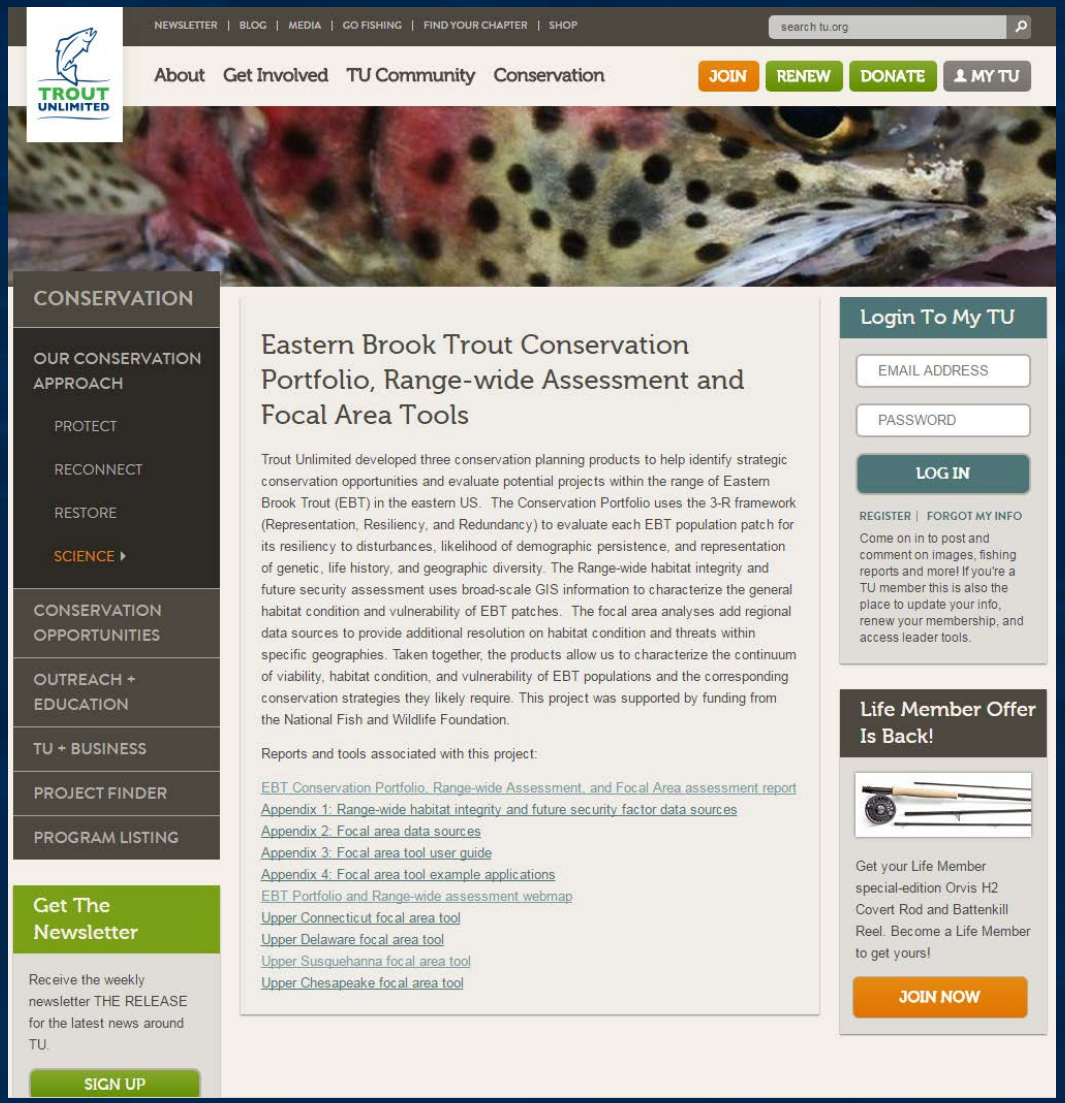


Repeat these steps for the future security layer. The future security factor is based on stream temperature within patches. The Upper Wild Ammonoosuc River population has very high percentile scores – 85.7%, placing it within the top 15% coldest watersheds in brook trout range in the eastern US.



More information:

www.tu.org/ebt-portfolio-rwa



Full report

Data sources

User guide

Example applications

Webmap

Visualization tools