Missouri Headwaters Riparian and Rangeland Tool
Self-Tutorial

Exercises

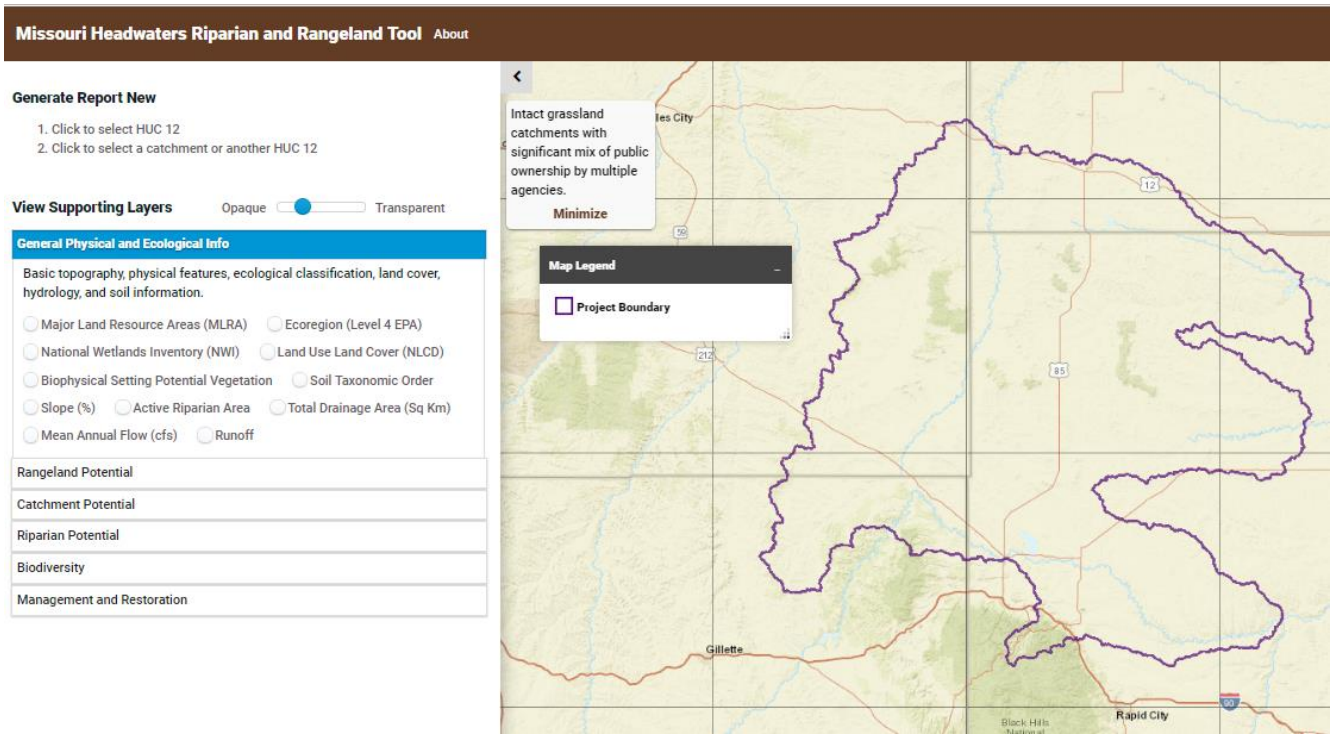
1. Getting Started
2. Exploring the Tool and Components
3. Generate a Report
4. Explore Management and Restoration Opportunities
5. Controls and Navigation Tips
6. Download the dataset

1. Getting Started

- Navigate to http://www.MissouriHeadwatersTool.org
- Scroll down (click on the “down” chevron at bottom of page) to view map interface and get started

2. Exploring the Tool and Components:

- Content Frame
  - Supporting Layers
  - Information
  - Menu: Metadata, Tutorial, Feedback form, and Data download
- Controls and Navigation Tips
  - Switch between Topographic, Street, and Aerial Imagery view
  - Zoom in or out
  - Export view
- Generate and Print Report

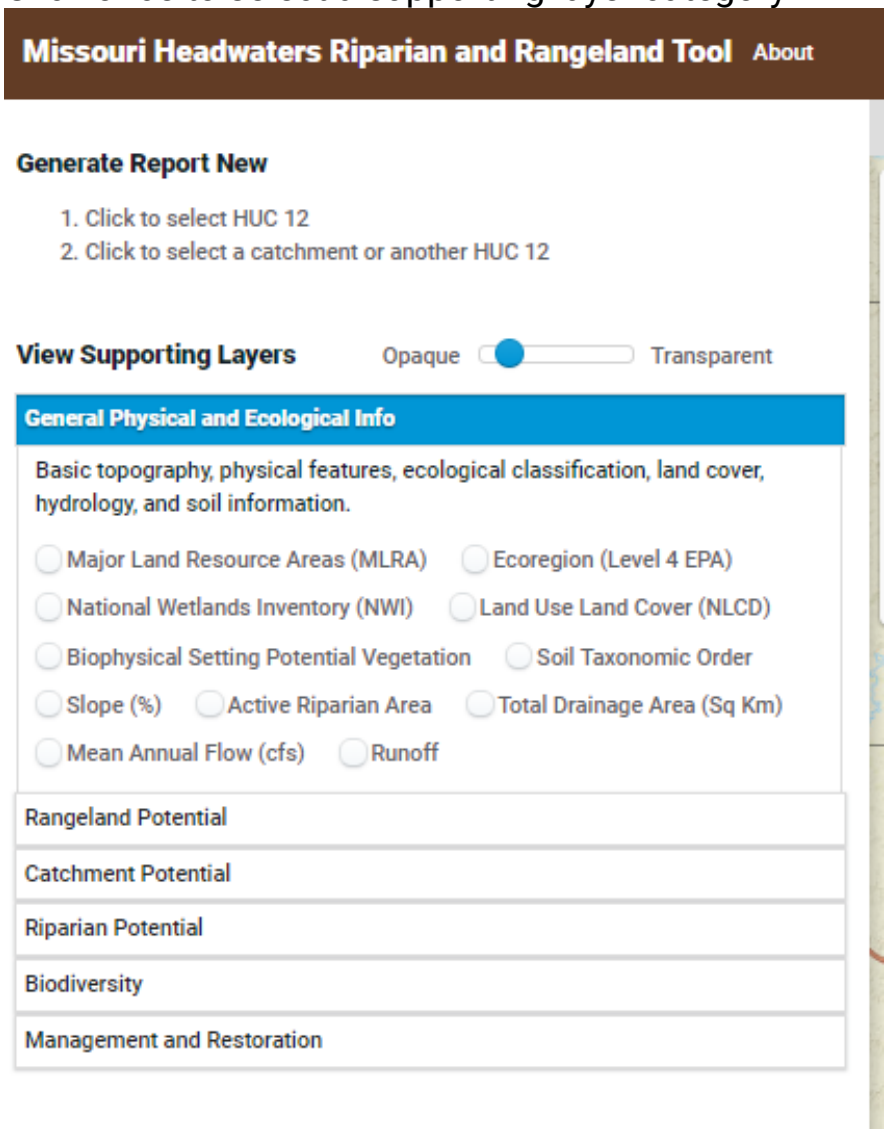


➢ Explore the tool

Supporting Layers

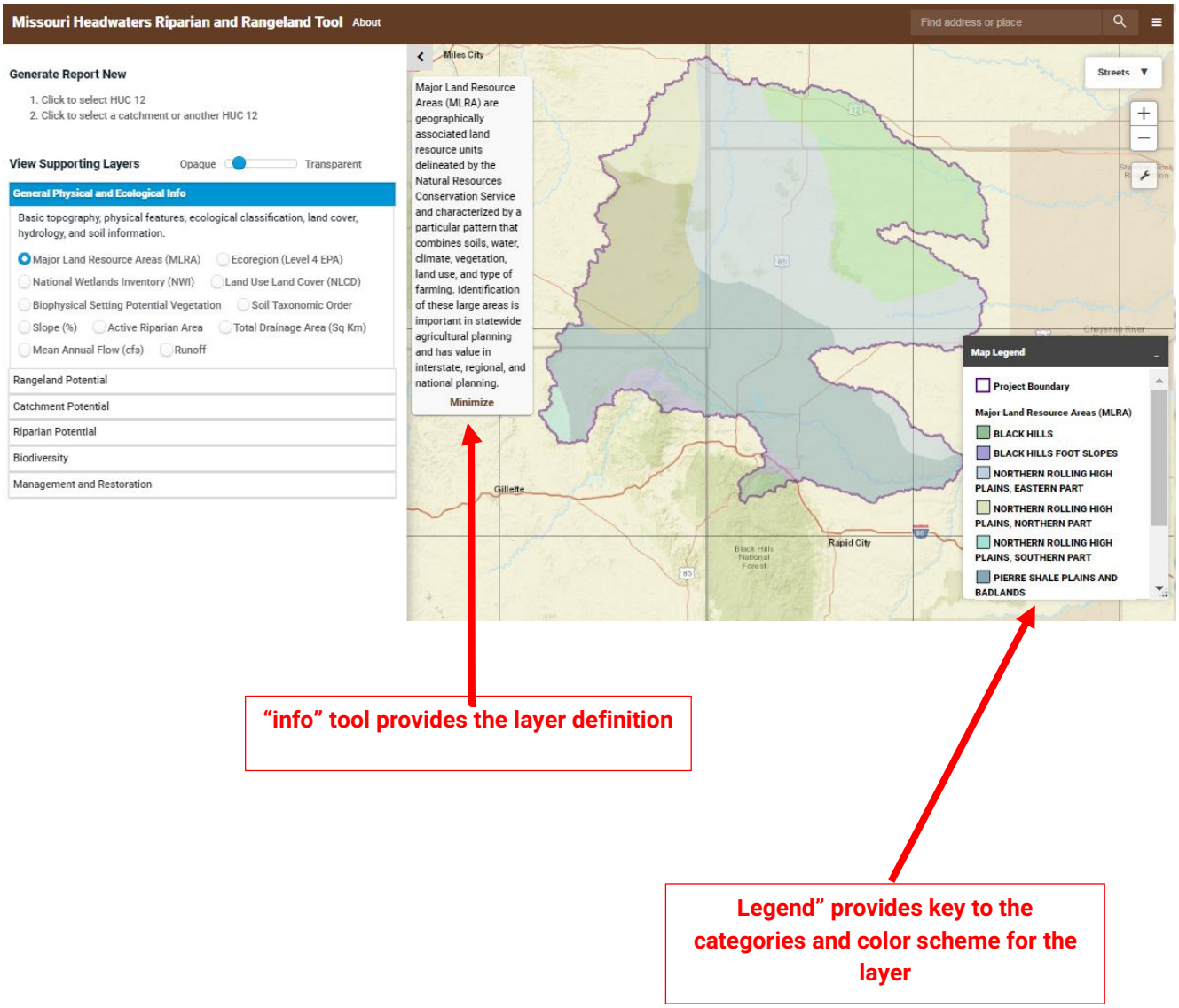
General Physical and Ecological Info
Rangeland Potential
Catchment Potential
Riparian Potential
Biodiversity
Management and Restoration

Click once to select a supporting layer category:



➢ Click the box by the layer name to display the layer

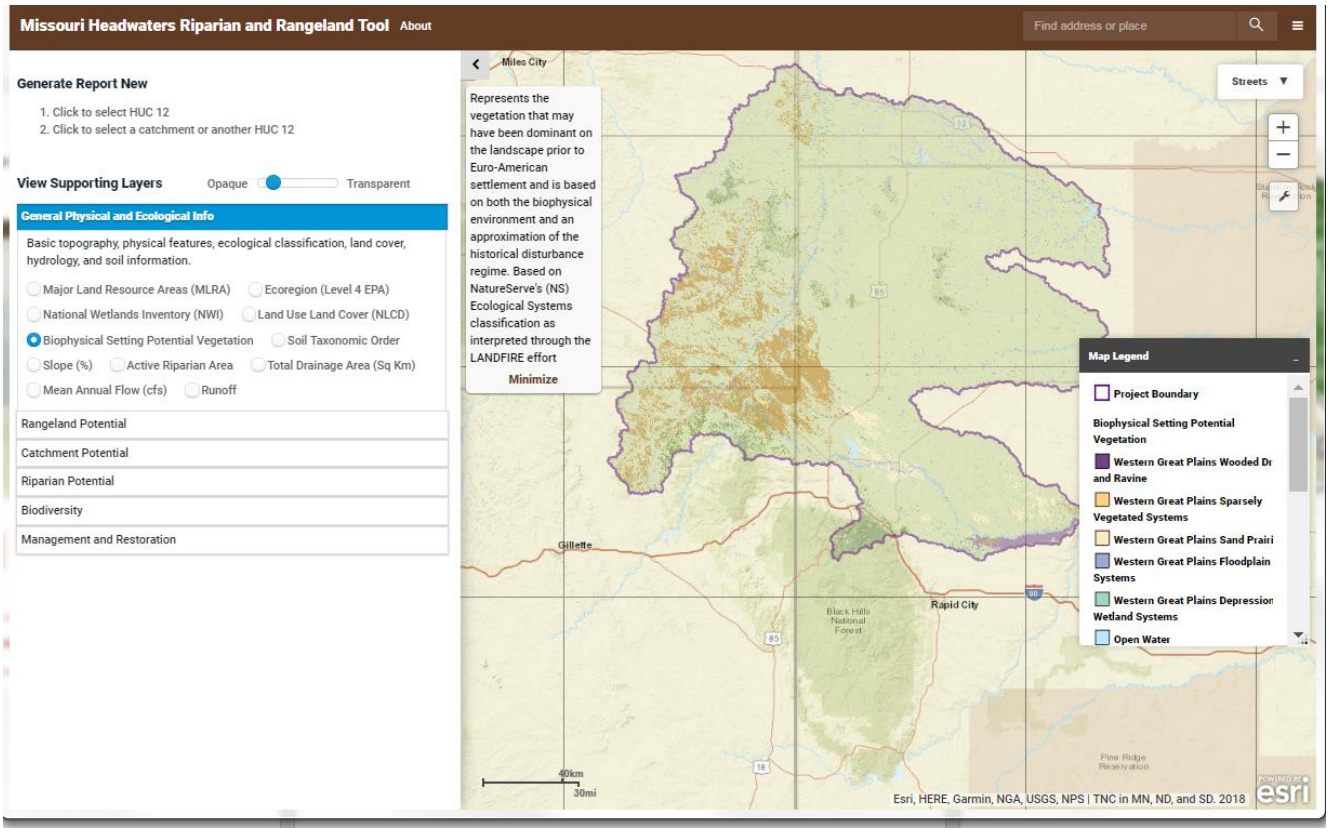
Example: Major Land Resource Areas



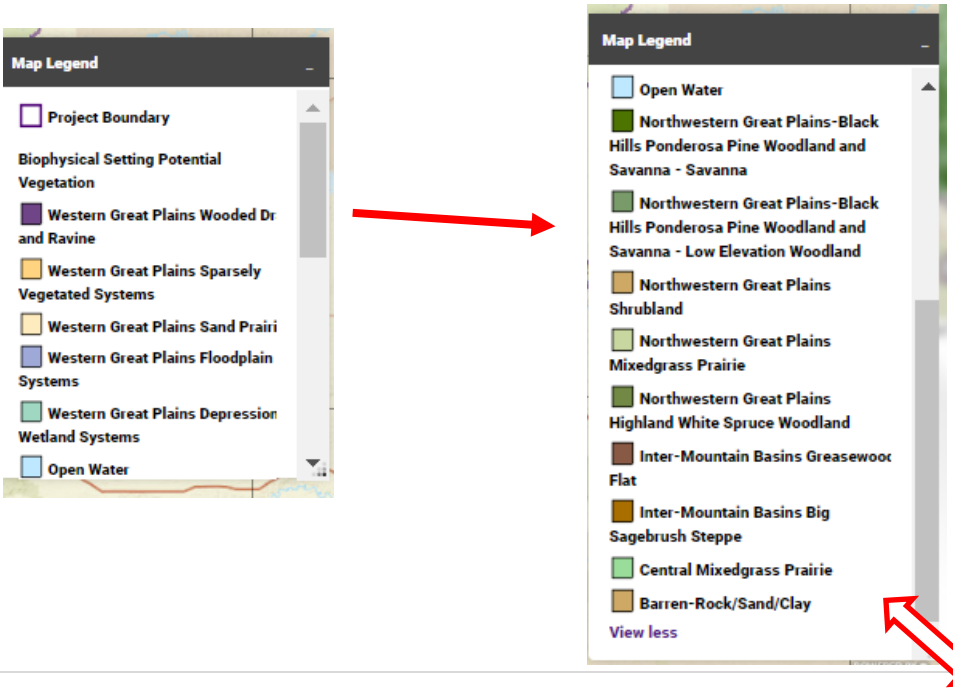
"info" tool provides the layer definition

Legend" provides key to the categories and color scheme for the layer

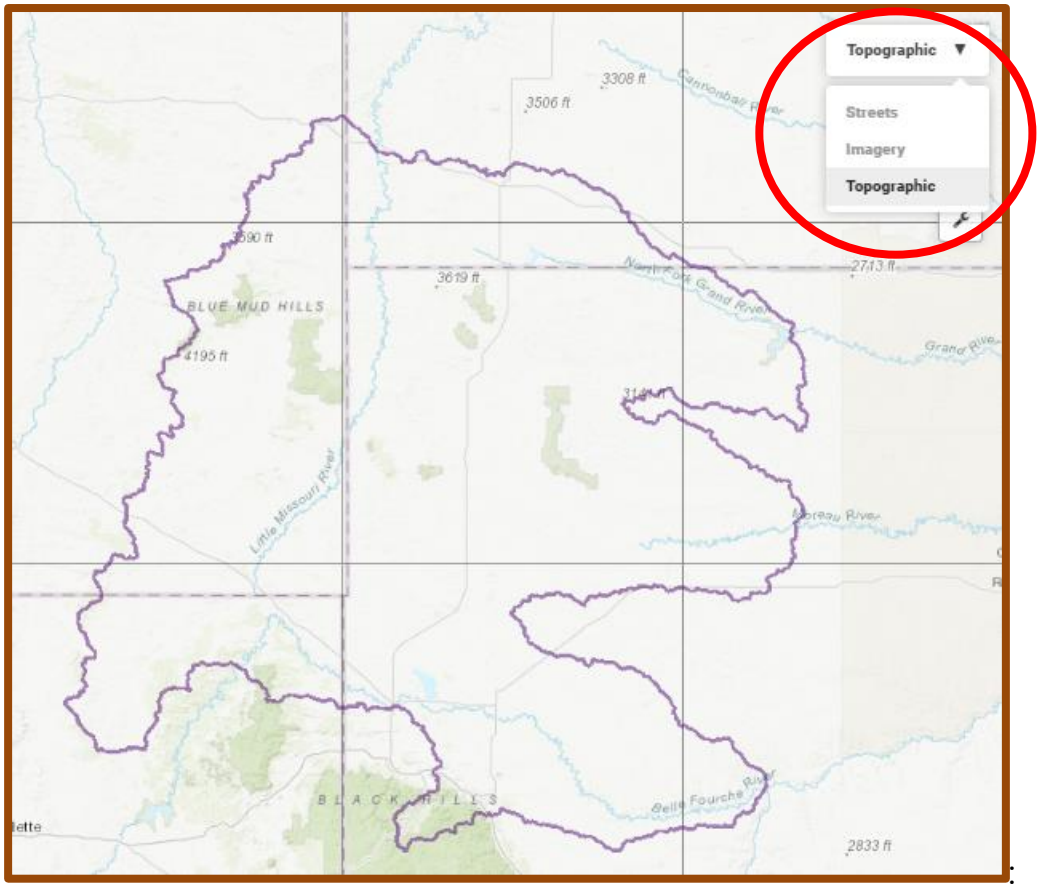
- Click a different box to display a different layer. Note that the previous layer automatically goes away, i.e. you cannot view overlapping layers.



- Scroll down in the legend box to view additional categories in the color scheme, or click and drag on the bottom right corner of the legend to expand the legend size to view more categories:



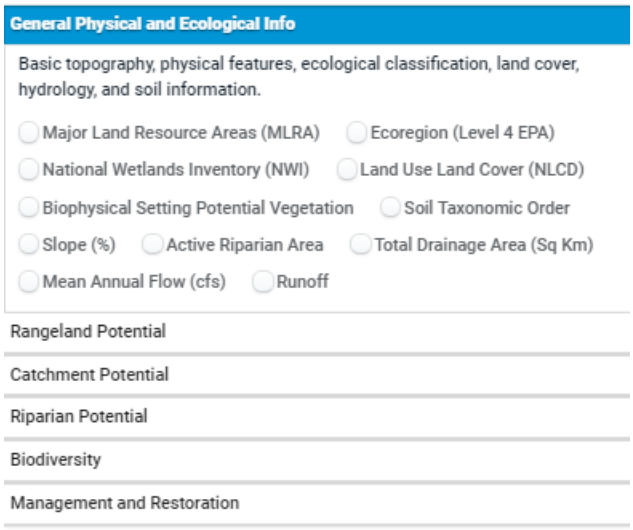
- Change the basemap from “Street View” to “Topographic” or Aerial Imagery”. Click on the arrow in the box on the upper right corner of the map view, and toggle/scroll to change the basemap



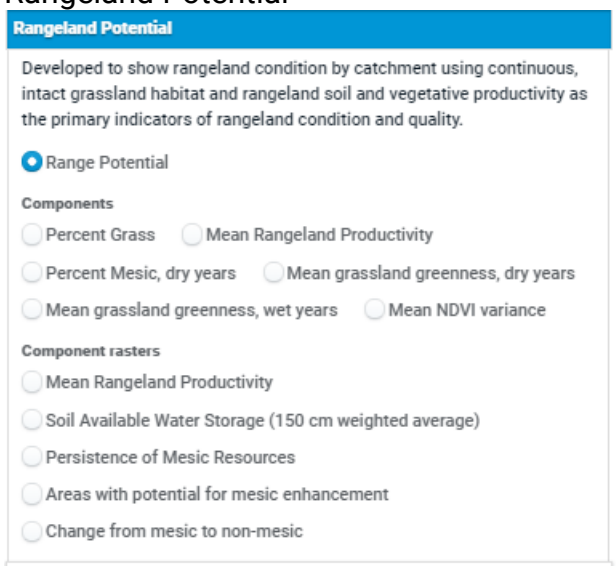
➢ Click to view each Explorer Module and Supporting Layers:

General Physical and Ecological Info

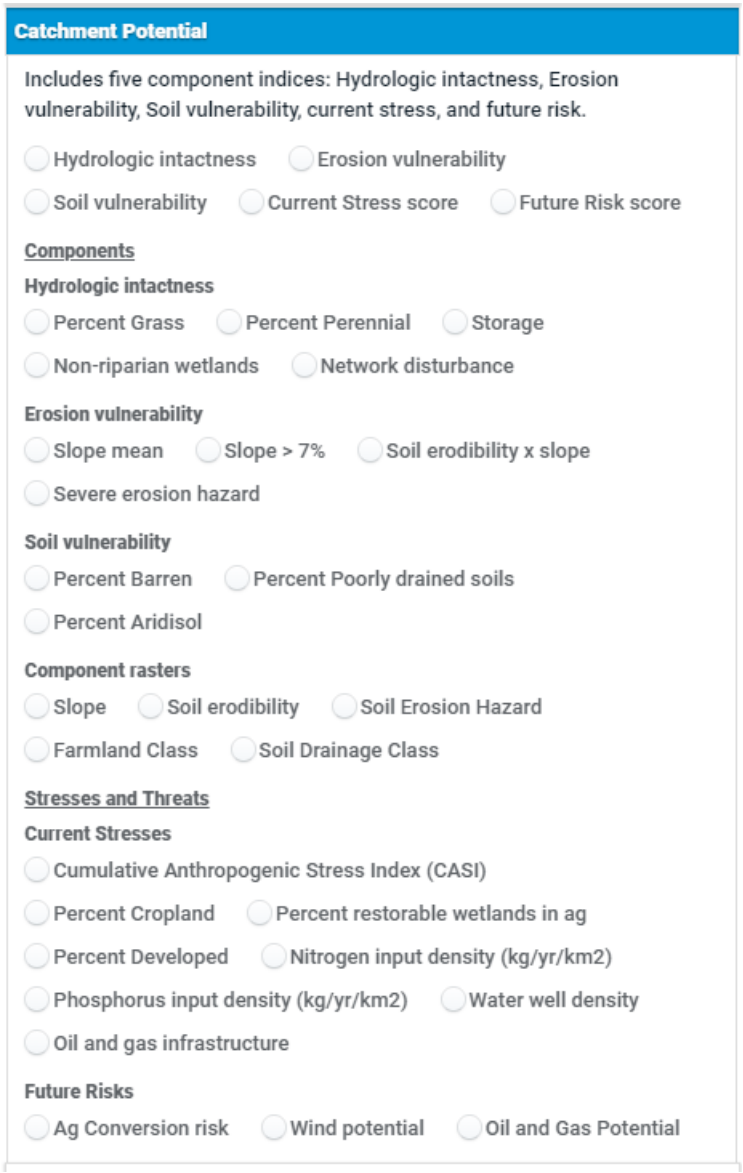
View Supporting Layers



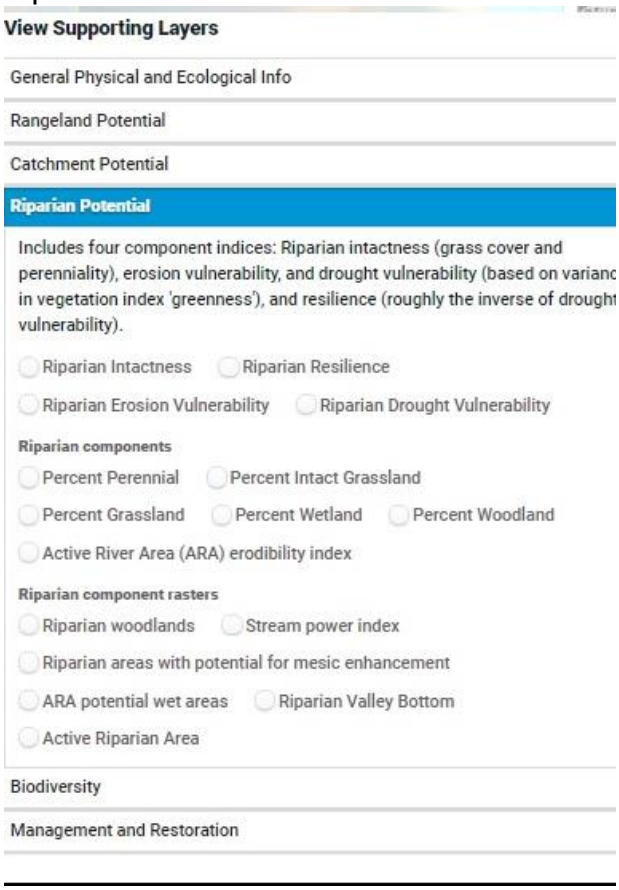
Rangeland Potential



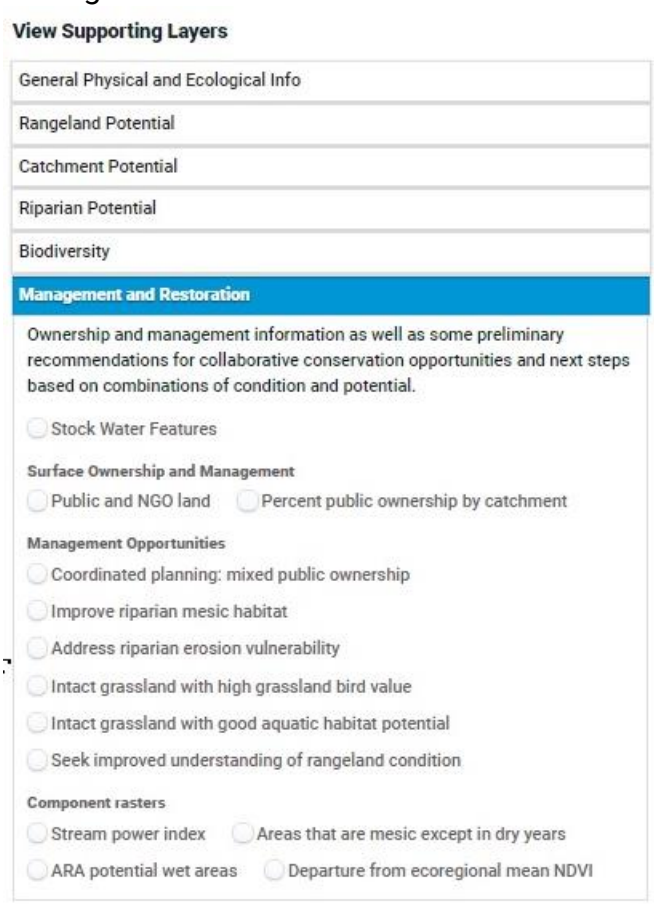
Catchment Potential



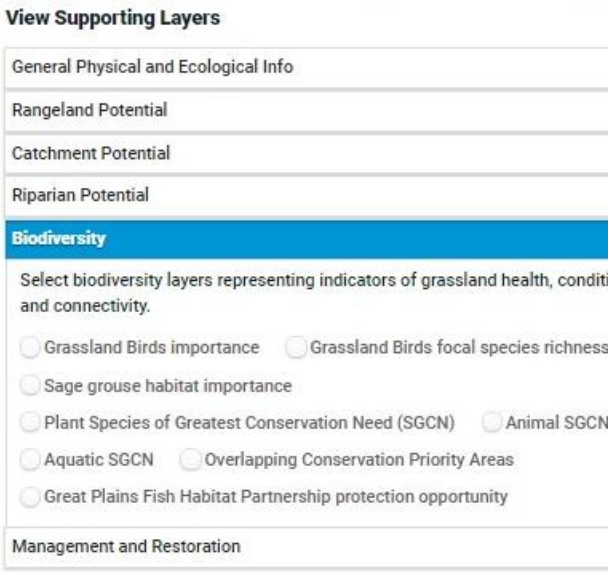
Riparian Potential



Management and Restoration

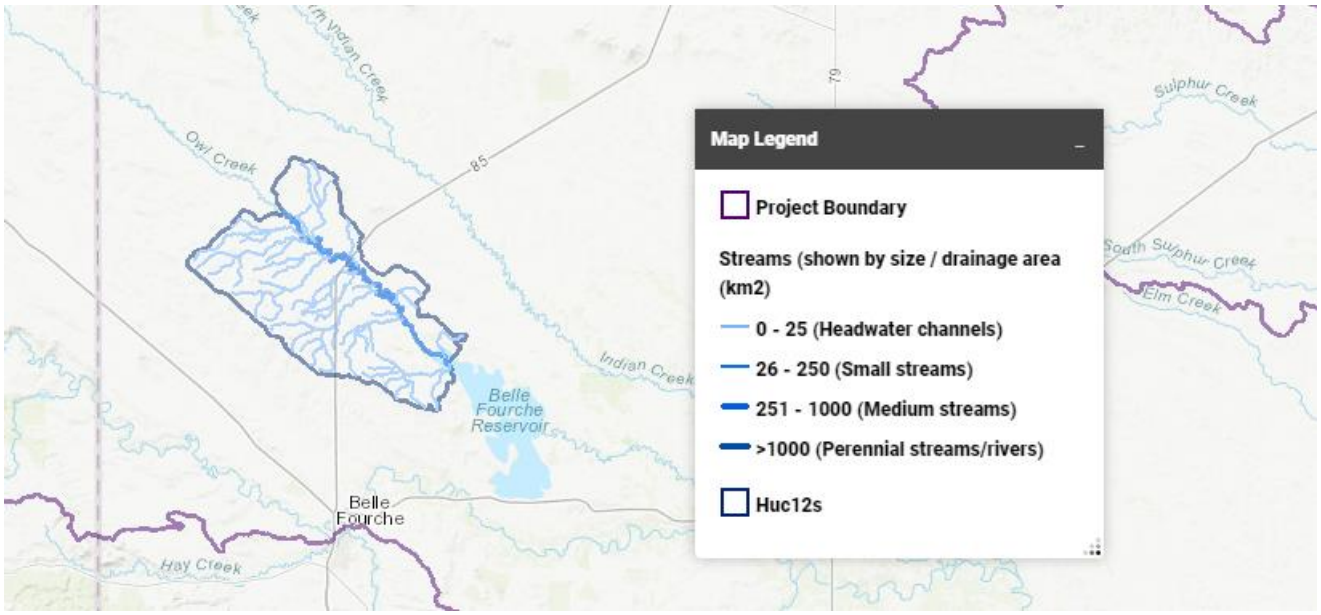


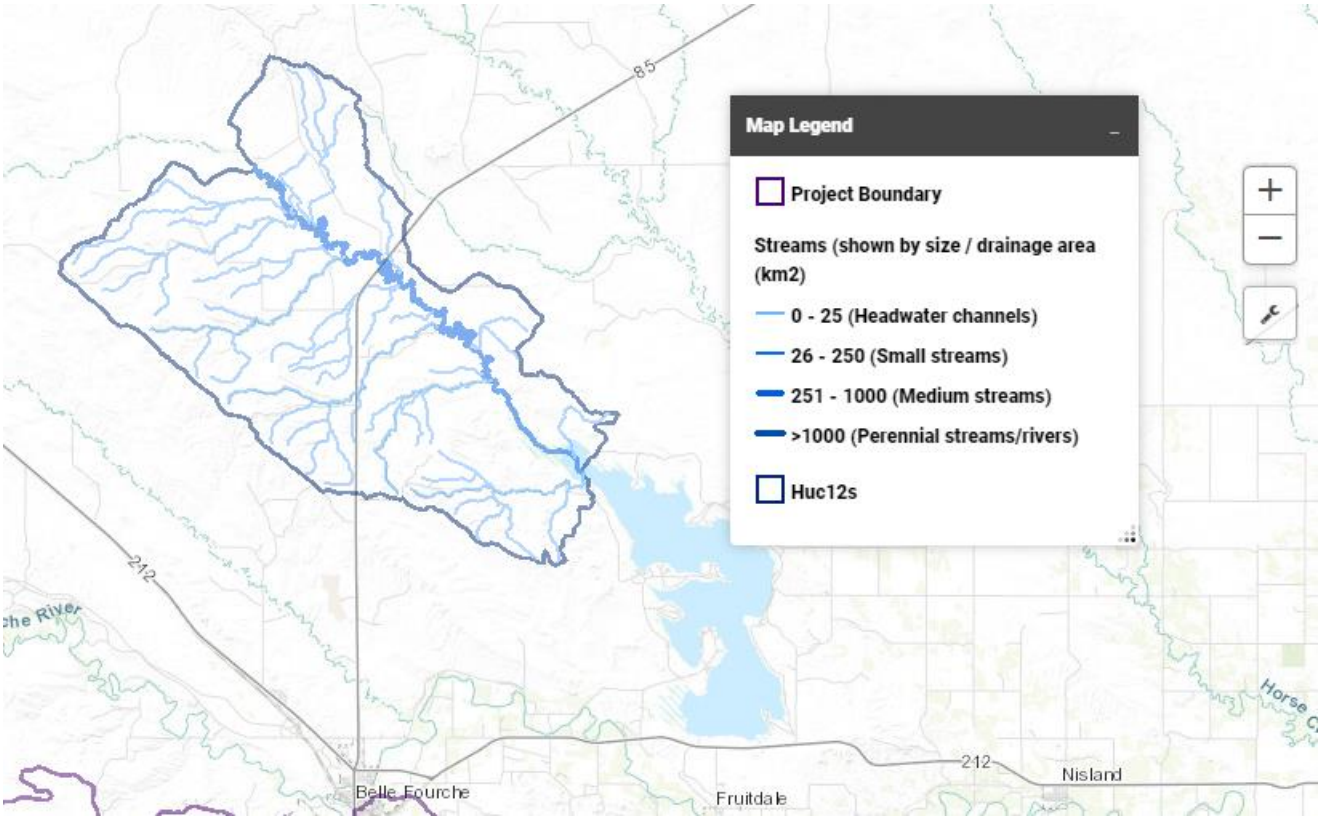
Biodiversity



- Zoom in on a Huc12 watershed (Click on the map and then click the “+” to Zoom in

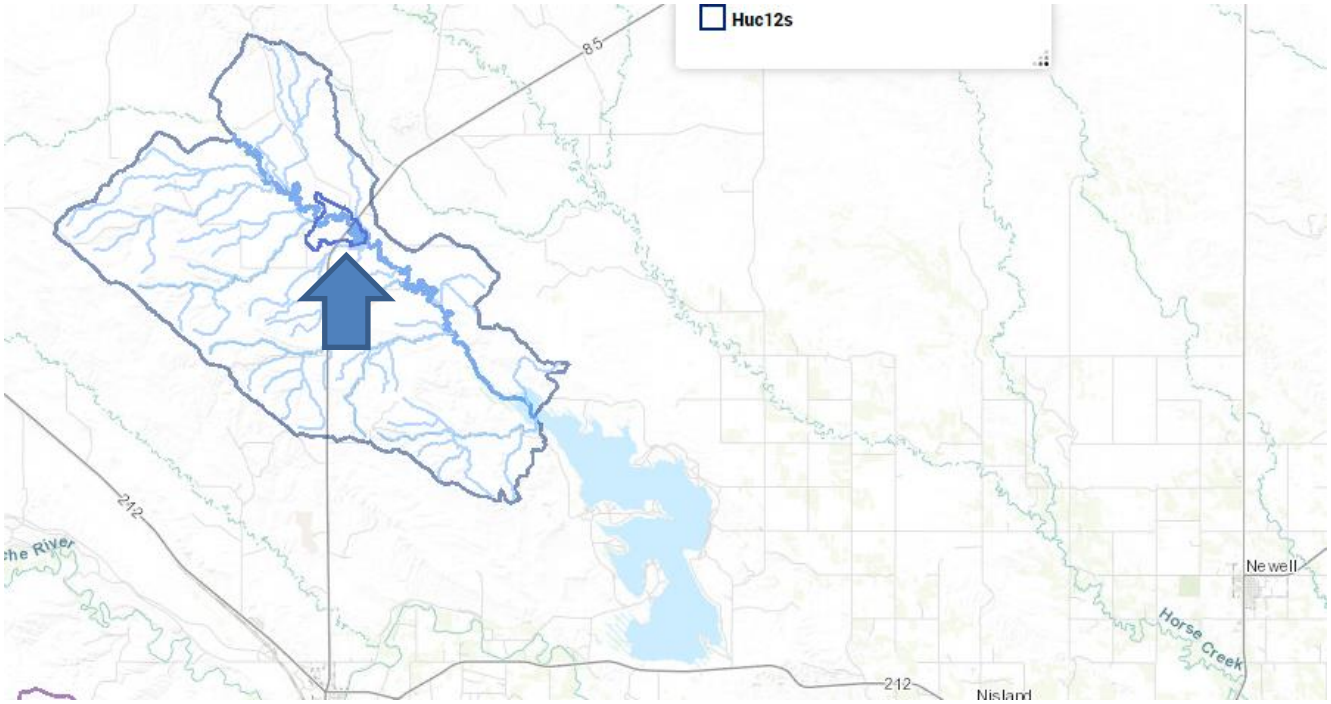
Note that once you click on the map, the Streams layer is displayed in the legend by size class, and shown within the Huc12 boundaries on the mapping tool





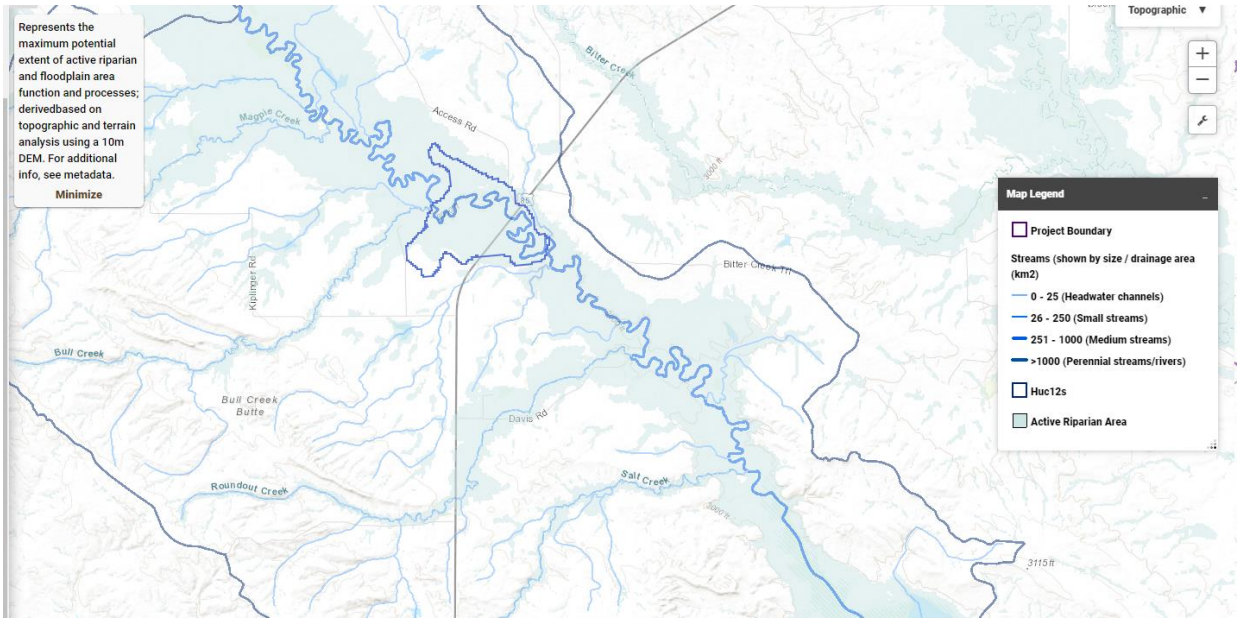
➢ Zoom in on a reach-scale catchment

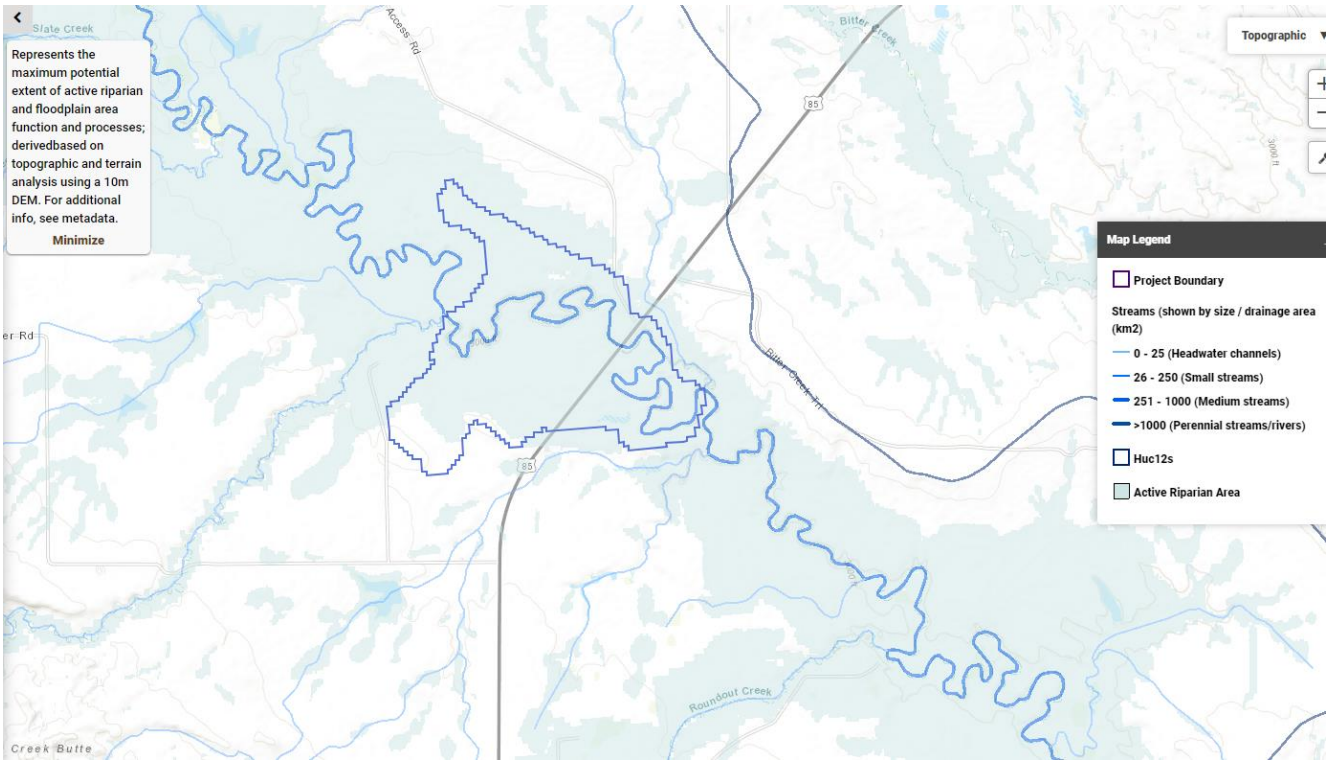
Click again on a reach of interest within the highlighted Huc12:



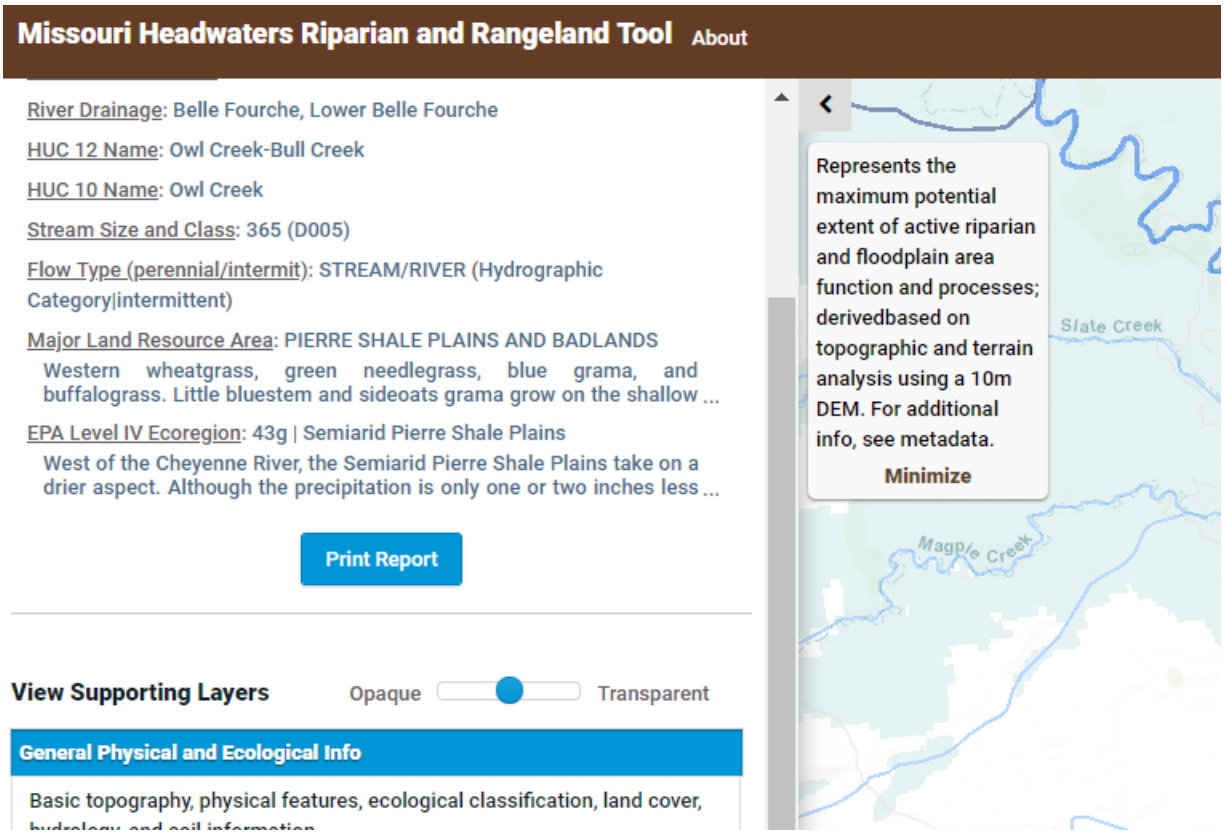
Then, turn supporting layers “on” or “off” or zoom in closer to see component rasters:

For example, this screen shot shows the Active Riparian Area on the topographic base map at the section of Owl Creek where it intersects Hwy 85:





Descriptive summary information for this catchment now appears in the menu bar on the left of the too, along with the option to “Print Report” (which we will do in a moment)l:



3. Generate a report

Click “Print Report” to generate a 2-3 page pdf or printed document summarizing the data for this reach.

3/22/2019 Missouri Headwaters Riparian and Rangeland Tool |

Little Missouri Headwaters
Riparian and Rangeland Tool

Stream Reach Report

Stream Reach Name: **Owl Creek**
River Drainage: **Belle Fourche,Lower Belle Fourche**
HUC 12 Name: **Owl Creek-Bull Creek**
HUC 10 Name: **Owl Creek**

Ecological Classification

Stream Size and Class: **364.8447 (D005)**
Flow Type (perennial/intermit): **STREAM/RIVER (Hydrographic Category|intermittent)**
Major Land Resource Area: **PIERRE SHALE PLAINS AND BADLANDS**
Western wheatgrass, green needlegrass, blue grama, and buffalograss. Little bluestem and sideoats grama grow on the shallow soils. Big bluestem grows along streams, especially where an effective water table is present. Sand sagebrush grows on sandy soils and silver sagebrush on clayey soils in the west. The eroded walls and escarpments of the Badlands are devoid of vegetation
EPA Level IV Ecoregion: **43g | Semiarid Pierre Shale Plains**
West of the Cheyenne River, the Semiarid Pierre Shale Plains take on a drier aspect. Although the precipitation is only one or two inches less per year than in ecoregion 43f, successful yields for tilled crops occur more infrequently than they do further east. In this region the mixed-grass prairie has a predominance of shortgrass species, e.g., little bluestem and buffalograss.

Soils (SSURGO)

Categorical (dominant in catchment)
Soil taxonomic order: **Entisol**
Drainage class: **Well-drained**
Farmland capability class: **Not Prime Farmland**

Numeric (mean for catchment)
Kf-factor: **75**
Rangeland productivity score: **49**
Percent poorly drained: **1%**
Percent aridisol: **39%**
Percent severe risk of erosion: **3%**
Available Water Storage (150cm): **15**

Size and Texture Class

Size
Coarse: **0%**
Fine: **76%**
Very Fine: **19%**
Skeletal: **0%**

Texture
Loamy: **2%**
Sandy: **0%**
Silty: **4%**
Clayey: **1%**
Fragmental: **0%**

Sub texture
Over Sandy: **0**
Over Fragmental: **0**
Over Fine: **0**
Over Sandy-Skeletal: **0**

Relative Potential Summary

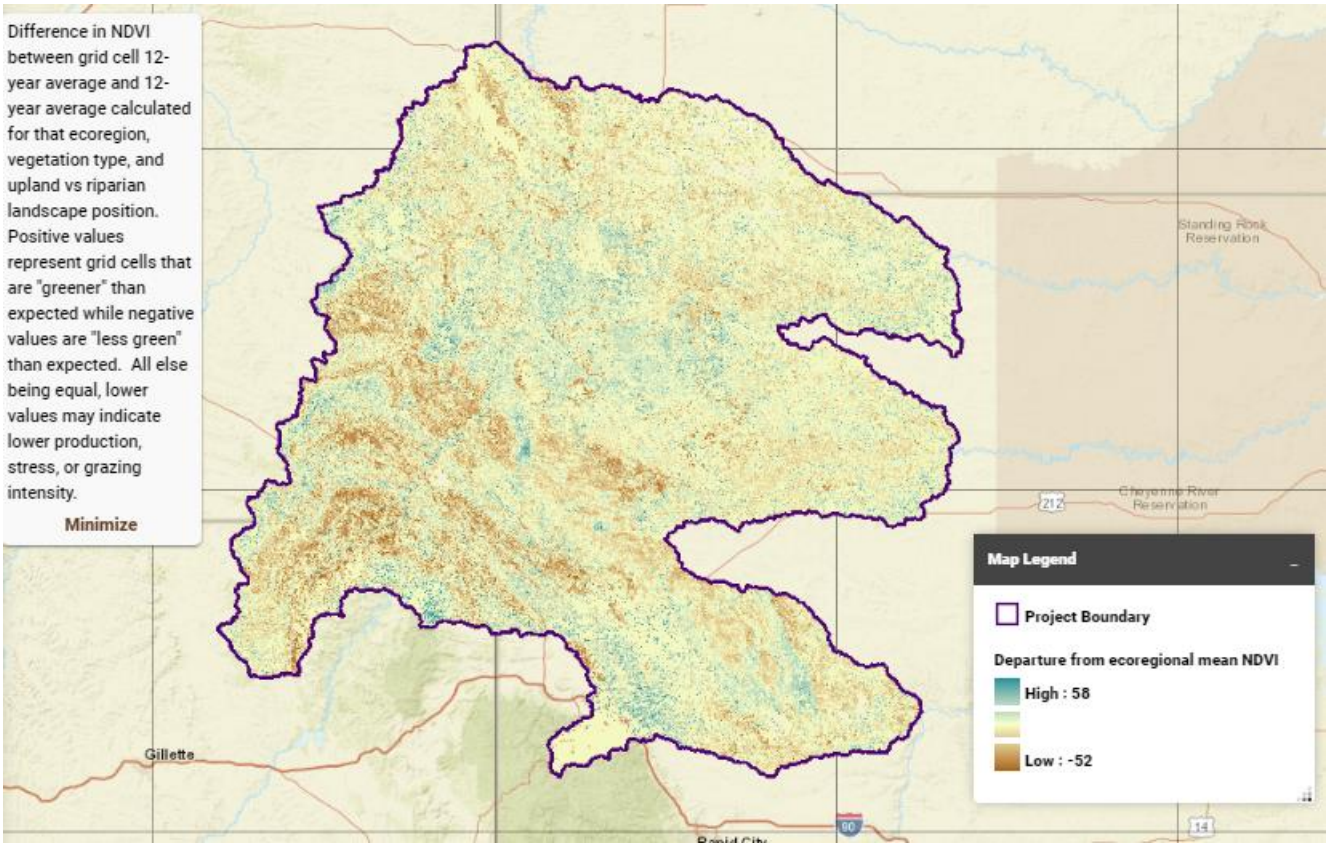
Rangeland	Catchment					Riparian			
Production Potential	Intactness	Erosion Potential	Drought Vulnerability	Current Stress	Future Risk	Intactness	Erosion Potential	Drought Vulnerability	Resilience
High	High	High	Highest	3	2	Highest	Low	Highest	Highest

Photo from Owl Creek, 3/2x/2017 (not included as part of report).

NOTE: An appendix describing in detail the ranges and additional information for each of the sections and variables included in the report is included as part of the “Metadata” document. *Not available yet as of 3/26/2019.*

- For more information on a variable, raster or component layer, source or methodology by which data were derived, click on “metadata” button from within the map window. This will bring up a pdf with greater detail on the methodology used to derive component layers, rasters, and individual variables. You will have the option then to download or print the pdf.

Example: Management and Restoration ➔ Component Rasters ➔ **Rangeland below ecoregional average NDVI**

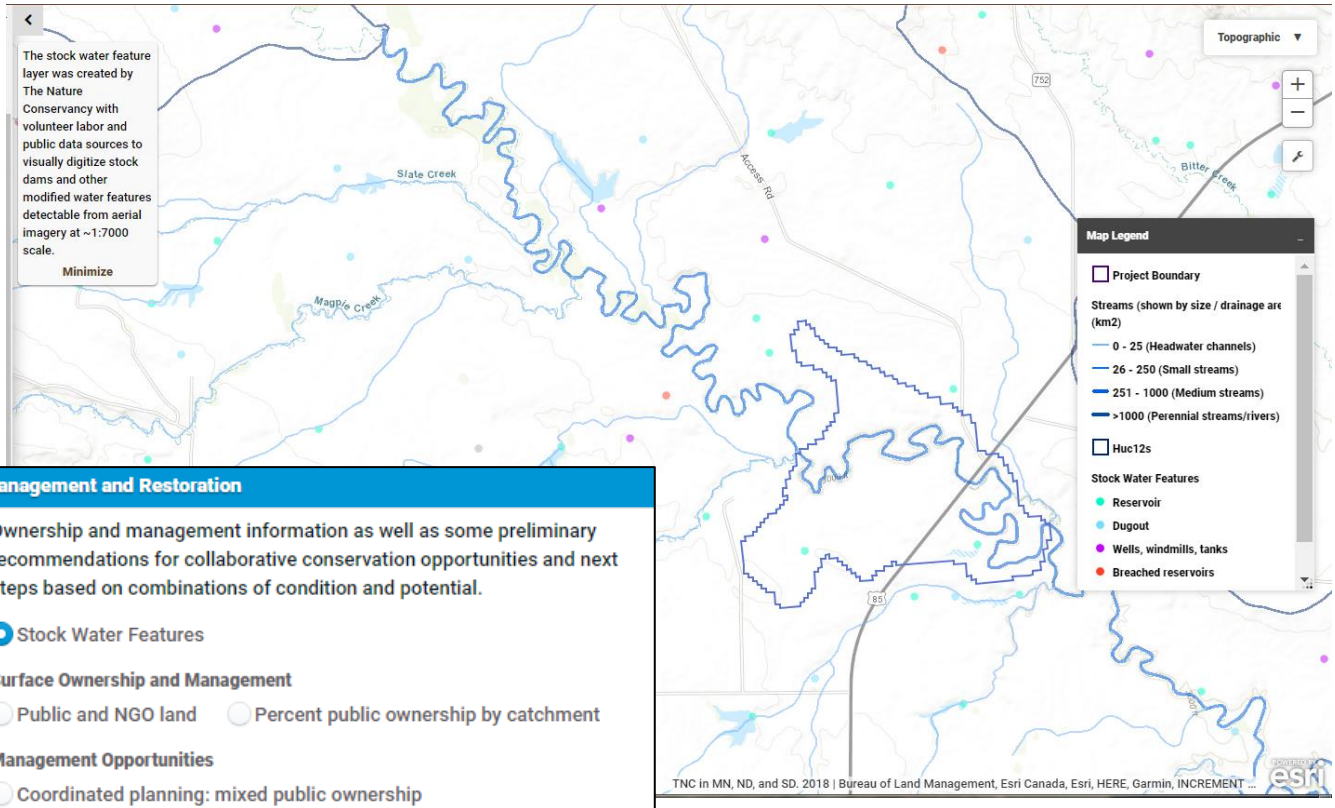


“Rangeland below ecoregional average NDVI”

Info tool definition: Difference in NDVI between grid cell 12-year average and 12-year average calculated for that ecoregion, vegetation type, and upland vs riparian landscape position. Positive values represent grid cells that are "greener" than expected while negative values are "less green" than expected. All else being equal, lower values may indicate lower production, stress, or grazing intensity. (See also methodology for NDVI processing)

Methodology described in detail in metadata document.

4. Use the tool to Explore Management and Restoration Opportunities



Management and Restoration

Ownership and management information as well as some preliminary recommendations for collaborative conservation opportunities and next steps based on combinations of condition and potential.

- (●) Stock Water Features

Surface Ownership and Management

- ( ) Public and NGO land
- ( ) Percent public ownership by catchment

Management Opportunities

- ( ) Coordinated planning: mixed public ownership
- ( ) Improve riparian mesic habitat
- ( ) Address riparian erosion vulnerability
- ( ) Intact grassland with high grassland bird value
- ( ) Intact grassland with good aquatic habitat potential
- ( ) Seek improved understanding of rangeland condition

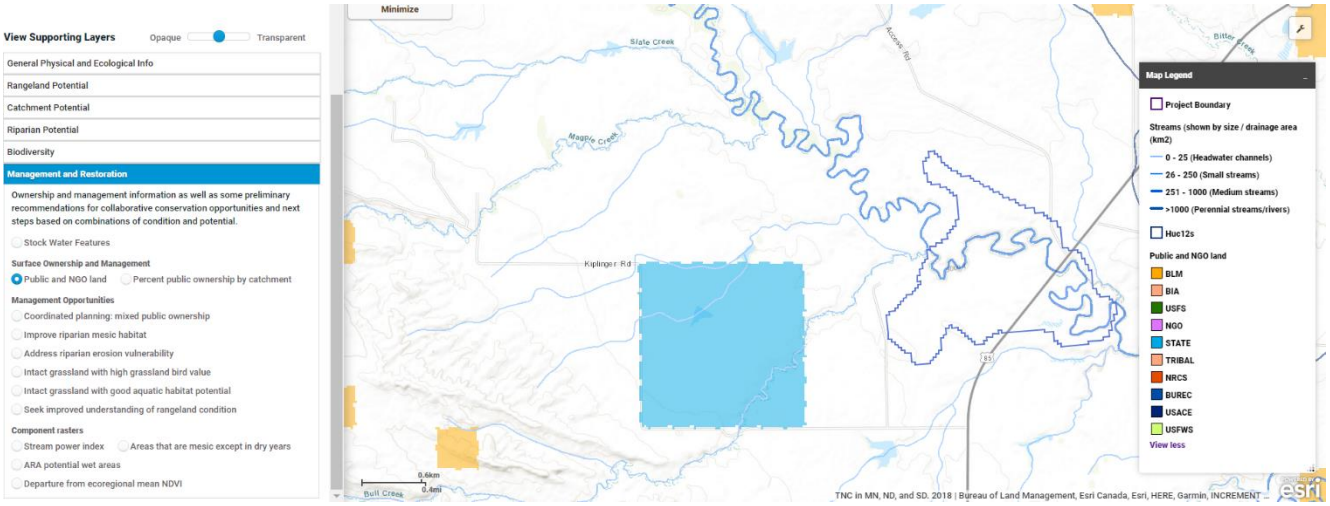
Component rasters

- ( ) Stream power index
- ( ) Areas that are mesic except in dry years
- ( ) ARA potential wet areas
- ( ) Departure from ecoregional mean NDVI

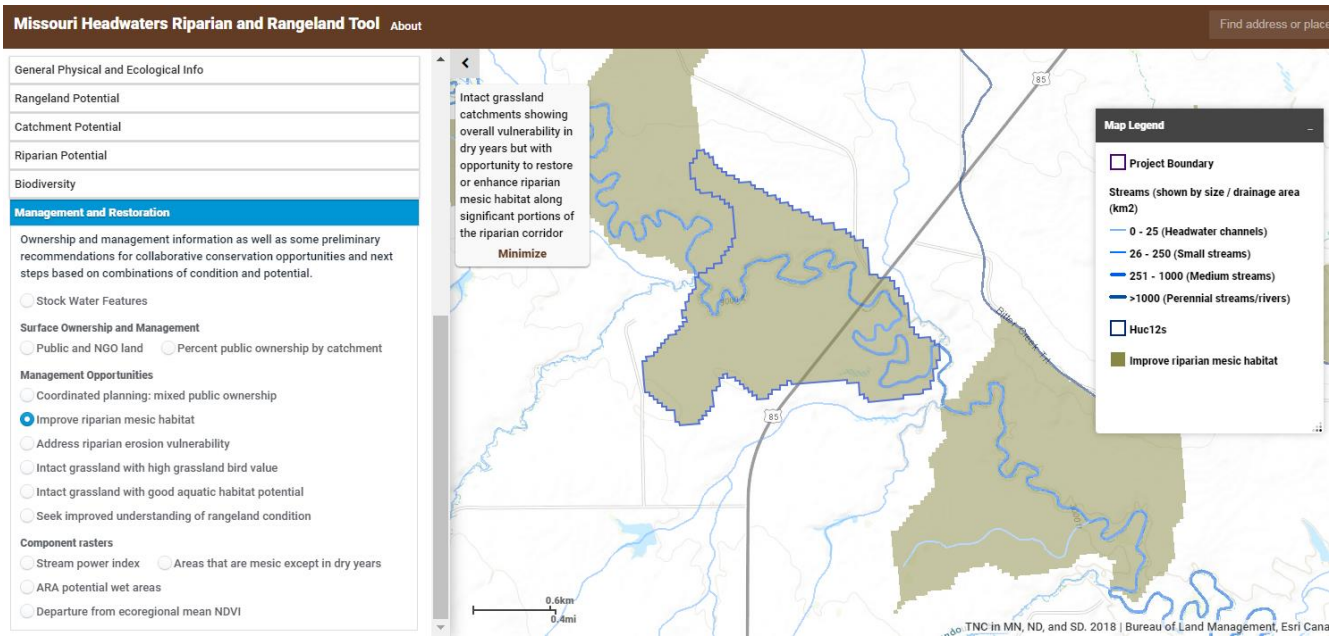
The stock water features layer was created for the study area by a volunteer in our Minneapolis office, who digitized apparent water features off a 1:7000 scale aerial imagery. The layer distinguishes between features that appear to be reservoirs vs dugouts, and also identifies other off-channel, In this view, you can see about 3 reservoirs in the study reach, plus a number of on-channel reservoirs in the drainage just to the south, and multiple features upstream both on and off channel.

This allows for some potentially very interesting analysis. We know that these are of interest as “anthropogenic” alterations of water storage that can have both positive and negative effects. For example, we found that about 80-90% of the stock dam features digitized are within 100m of a National Wetland Inventory feature in the wetland layer maintained by the US FWS. And about 1/3 of the NWI features are associated with a stock dam feature. In other cases, they may be helping to relieve the grazing pressure on riparian habitats by holding and storing water in upland areas of the grasslands. They may be functioning to help create upstream storage and wetland habitat and maybe even functioning somewhat like beaver dams in the landscape. Or in other cases they may be a resource concern from a water quality, water quantity, or prairie fish passage perspective. For example, about 10% of them are located on a main channel of a stream.

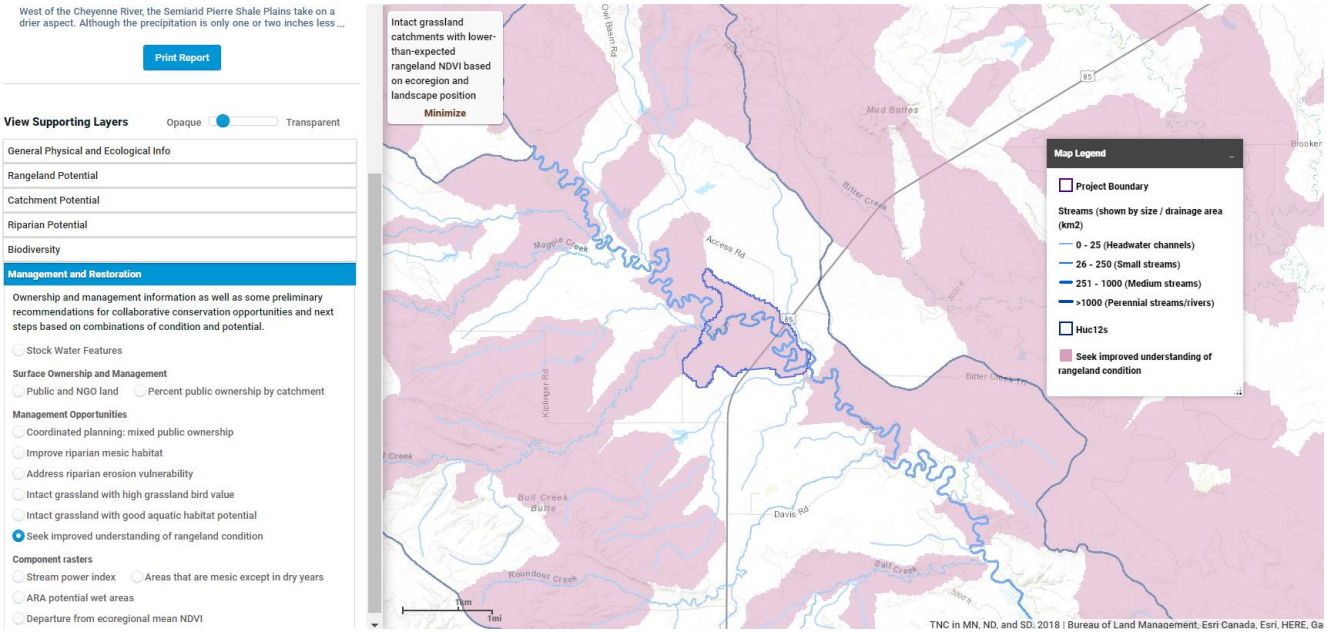
Other layers viewable in this “Module” include land ownership by public (federal, state, or local) entities or nongovernmental organizations; percent public ownership by catchment.



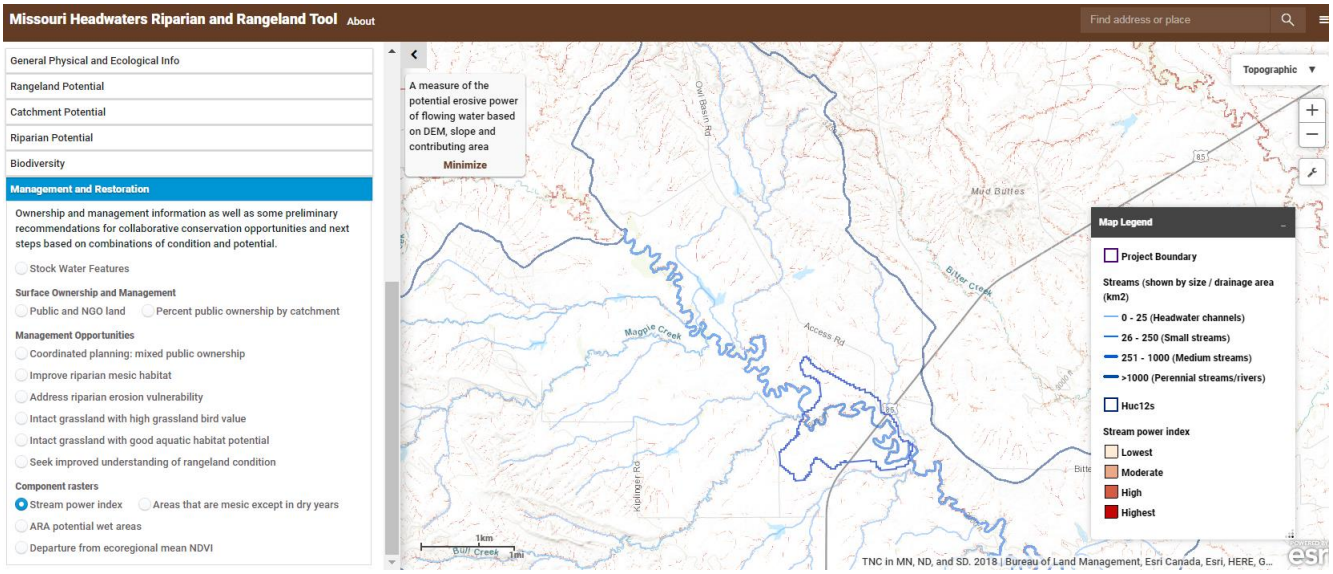
This catchment did meet the threshold criteria for opportunities to improve riparian mesic habitat:



It was also identified as an area suggested for “improved understanding of rangeland condition” due to having Intact grassland catchments with lower-than-expected rangeland NDVI stratified by ecoregion and landscape position.

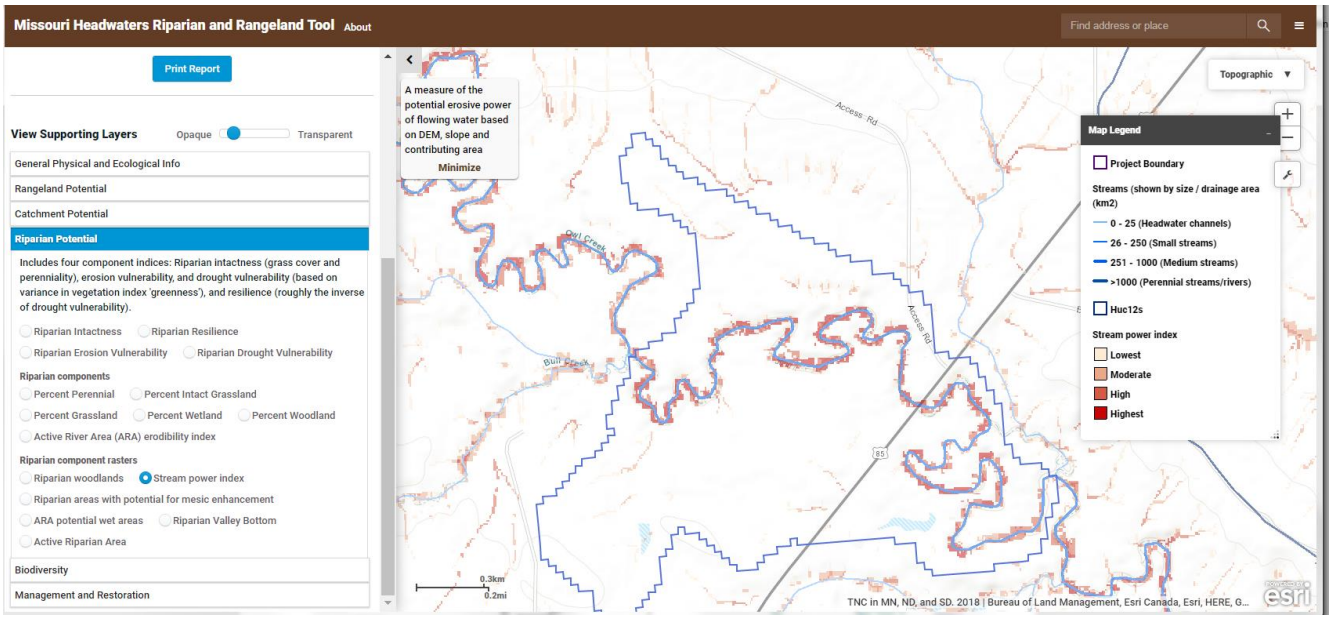


To better understand what’s going on here, we can look at the component NDVI rasters. It doesn’t appear to be an especially erodible reach based on the stream power index (raster shown below; we can also review the riparian erosion vulnerability from the riparian potential for the catchment mean score):

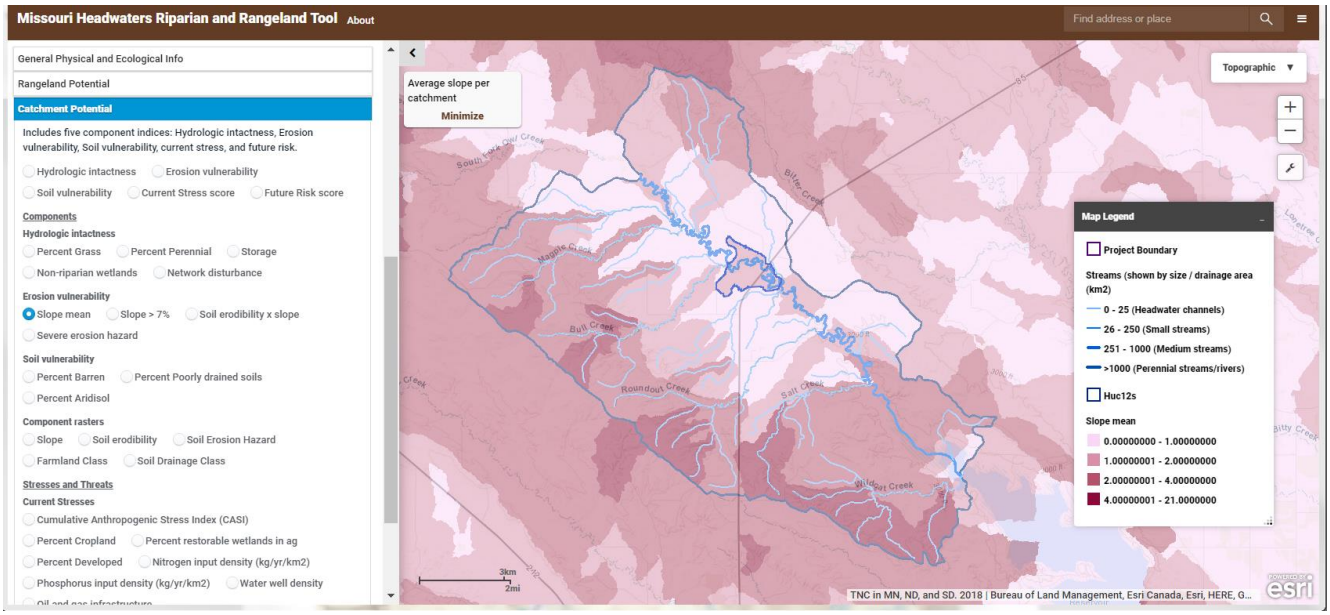


However, zooming in to the reach scale and panning along the stream channel in this and upstream reaches, there is a lot of dark red (areas of "highest" stream power) within the immediate riparian area (30-100m) in this reach compared with the reaches immediately upstream.

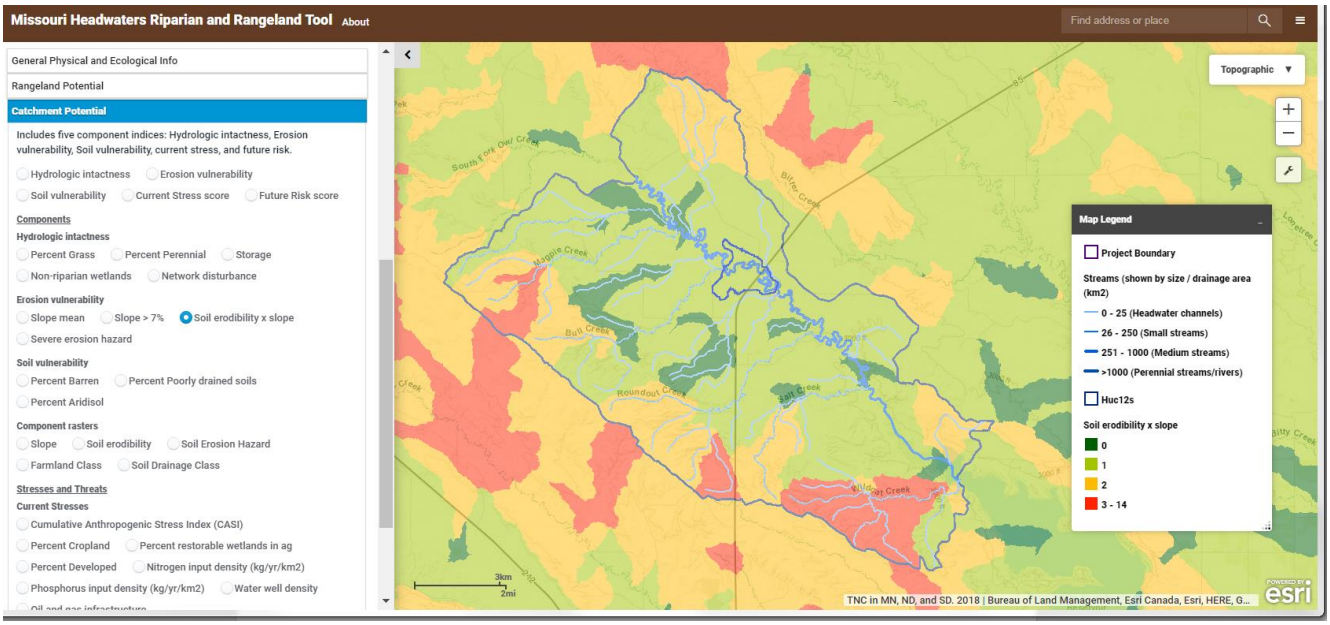
- EXERCISE: Use your mouse to turn on the Stream Power Index layer, click and pan up and down the channel at this scale.



The riparian zone of this reach scores low to moderate in terms of Riparian Erosion Vulnerability, but the Catchment slope is relatively higher for this reach and the one downstream than the surrounding reaches:



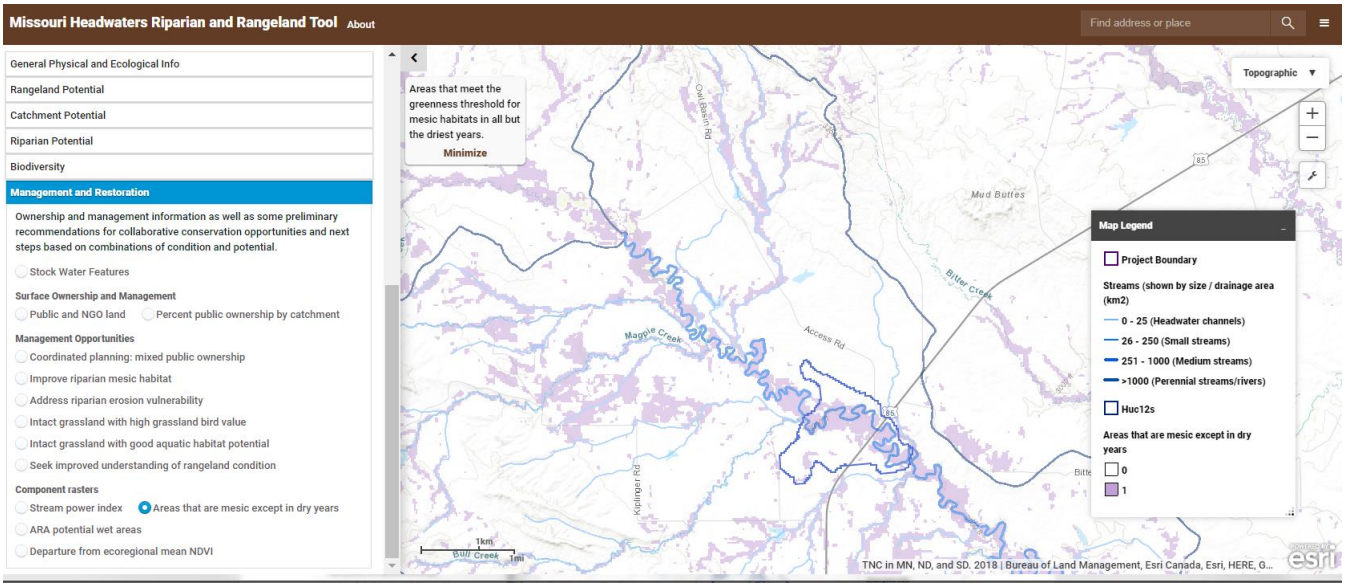
Looking at a number of the other erosion vulnerability layers under Catchment Potential, we can see that this reach is downstream of some headwater reaches within the Huc12 that do have some higher vulnerability factors to erosion.



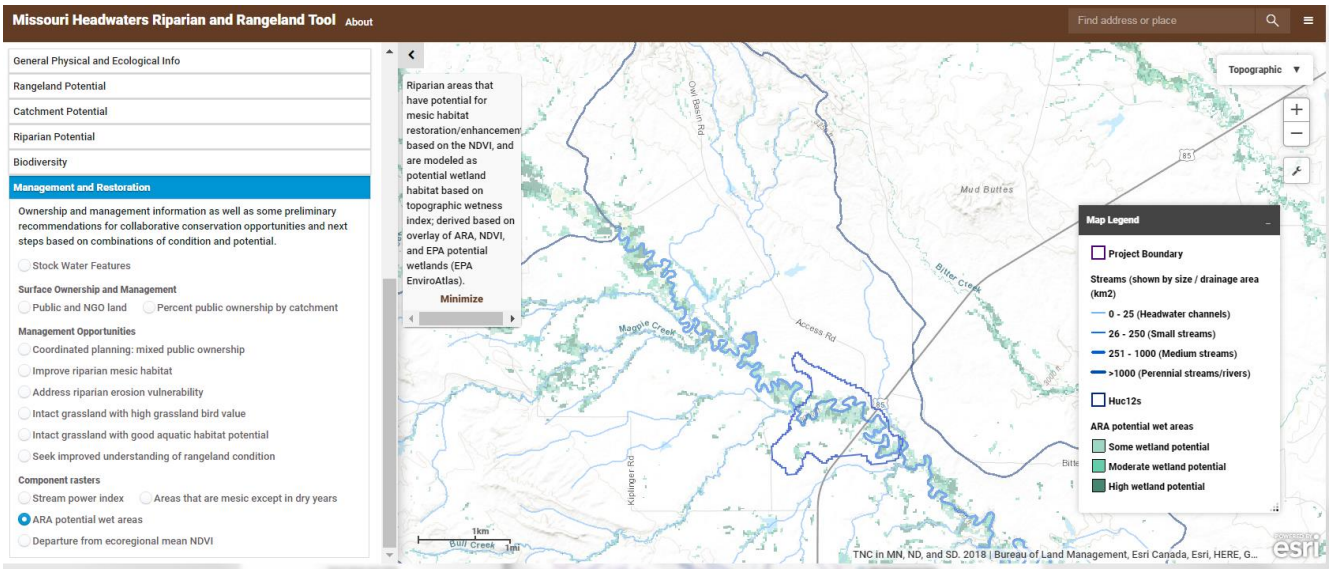
We now have some landscape context for trying to understand what sort of erosional and channel dynamics we might be observing on the ground in this reach. (We also have the reach report print out, which provides additional information on existing and potential land cover, upstream stress scores, etc.) Based on this, we might not be completely surprised to see some signs of channel erosion and instability in this reach.

We've already noted that the immediate catchment area does not have significant amount of mixed public ownership. However, because the catchment is bisected by the highway, any channel erosion concerns observed in the immediate vicinity (upstream or downstream of the road crossing) might be addressed productively by engaging in discussions with the appropriate entity responsible for road management, e.g. exploring opportunities for restoration or improvements that could be coordinated with scheduled road maintenance. Road crossings and culverts are a well-known source of impacts to streams. In addition to erosion caused by headcuts and downcuts--initially caused by improperly sized culverts or channel constriction during high flows--culverts and road crossings on smaller channels can create barriers to connectivity for aquatic organisms, or function as berms that hold water at certain times of year.

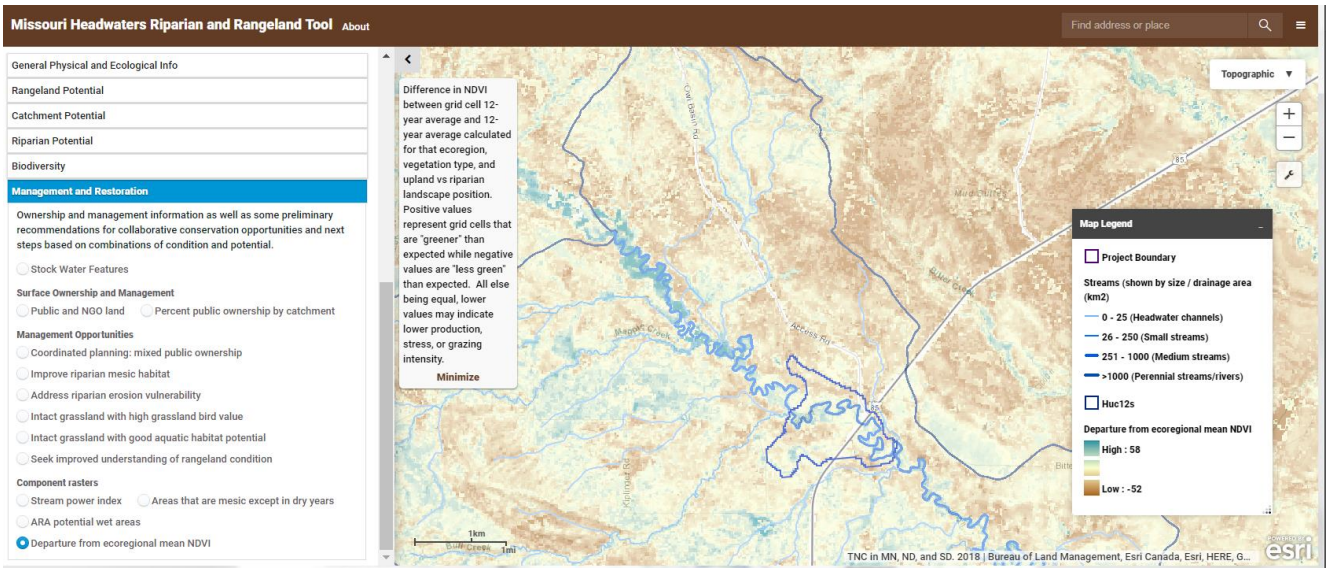
Returning to the “Management and Restoration” module to view additional component rasters, we can see that significant portions of the riparian corridor meet the mesic threshold in wet years but not in dry years:



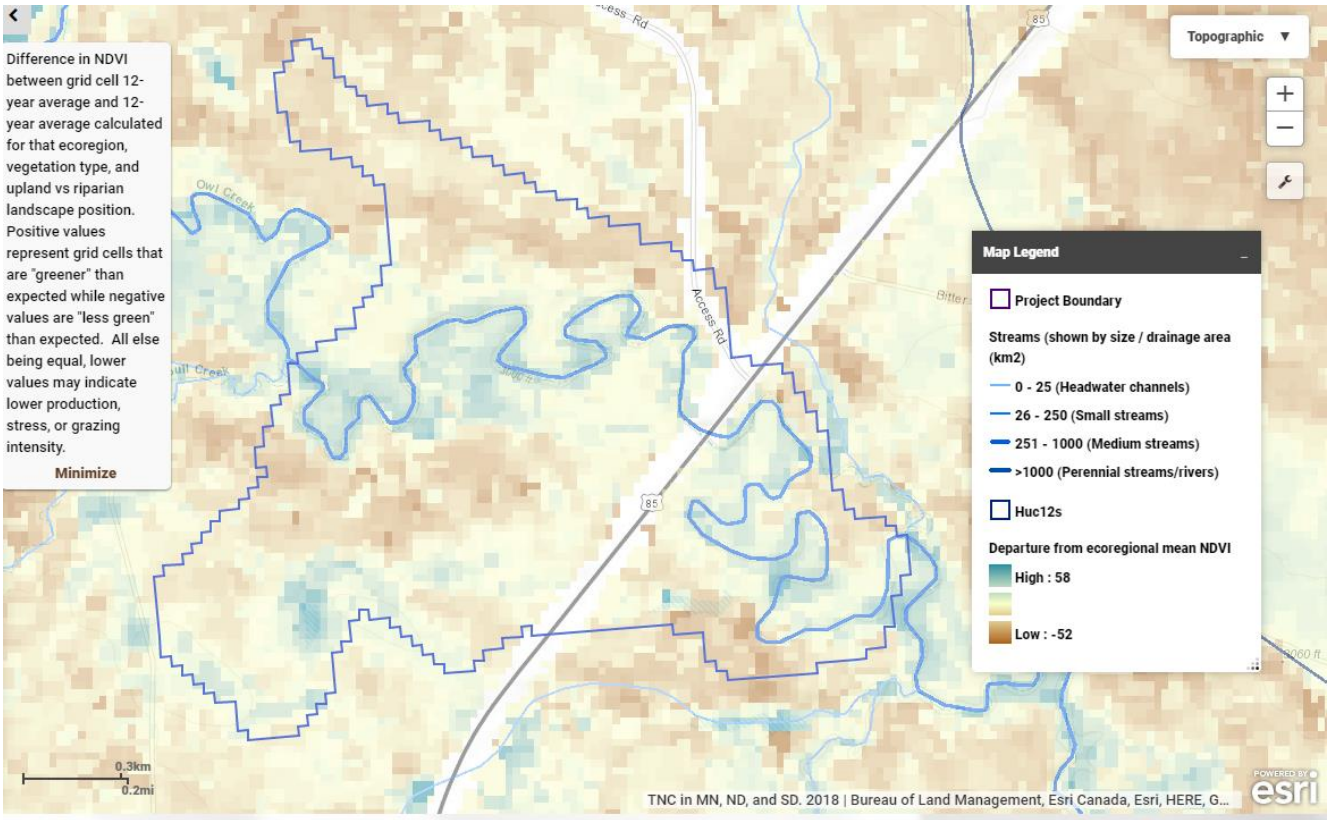
Looking at the ARA potential wet areas, we can see the areas in darker green that are the most likely to have more mesic or wetland habitat in general:



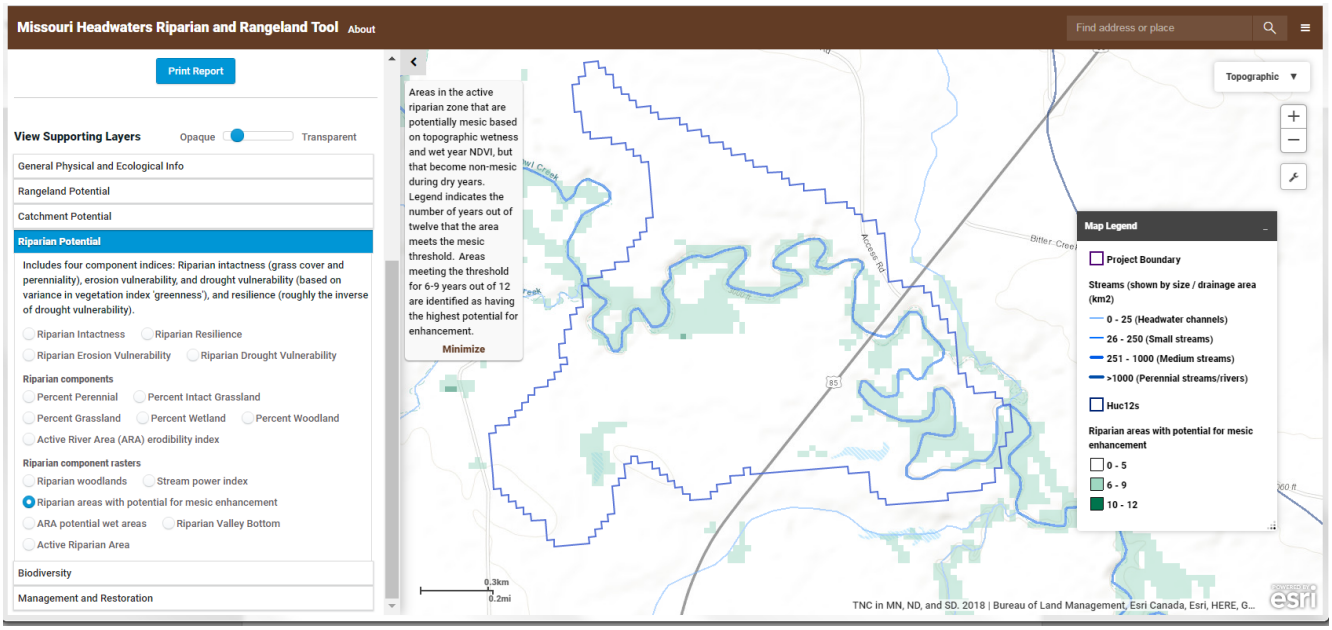
The selected reach appears to be more representative of ecoregional mean NDVI. The ARA of upstream reaches exhibit significantly higher values for NDVI (shown in blue), whereas upland areas in brown have significantly lower values than the (negative departure from the mean ecoregional NDVI, in other words less "green" and likely drier.



We can zoom in even closer to see this reach at higher resolution:



Staying zoomed in and switching to the Riparian Potential module to view the raster showing “Riparian areas with potential for mesic enhancement”, we see that few areas in the riparian corridor meet the mesic threshold in the driest years (dark green for mesic 10-12 out of 12 years), but most areas do meet the mesic threshold for between 6-9 years (i.e., average and wet year conditions). Because this reach has a medium sized drainage area of 365 km^2, developing on-channel storage might be inappropriate here; however, management practices in the uplands could be designed to increase infiltration and storage.



5. **Navigation Tips and Controls**
6. **Download the dataset**

Congratulations! You've come to the end of our initial tutorial. We know there is a lot here to explore and understand, and we recognize that there are probably a lot of improvements we could make to improve the function and appearance of the tool to make it more useful to you. We are continuing to try to make improvements, fix bugs, incorporate suggestions as we make the final edits to bring the project to completion.

Send questions and feedback to southdakota@tnc.org