Water Webs

Observing Water Flow Patterns on the Land

Skill Level
Intermediate, Advanced

Learner Outcomes
The learner will be able to:

- Identify drainage patterns and use terminology.
- Associate drainage patterns with observed features in aerial photos.

Educational Standard(s) Supported
See supplemental information.

Success Indicator
Learners will be successful if they:

- Match drainage pattern terms to diagrams.
- Work together in a team to complete the matching exercise.
- Recognize similarities and differences between drainage patterns and the drainage networks depicted in handouts.

Time Needed
45 minutes – 1.5 hrs

Materials List
Assortment of Tree Leaves
Crayons/Colored Pencils and Paper (optional)
Handouts (Worksheets, Images, Maps)
Dry Erase Markers

Introduction to Content

Students will take part in three small-group activities to build observation and reasoning skills using aerial imagery and maps depicting watershed drainage networks. In this lesson, students will begin by recognizing the need for common terminology to describe landscapes, then complete a matching competition in small groups, and finally complete a scavenger-hunt style desk activity involving math terms.

Introduction to Methodology

This lesson begins by using tree leaves as a similar representation for water channels in drainage networks. The students use observations to match drainage pattern terms with diagrams and then translate that new knowledge to real world landscapes.

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Prepared using research based practices in youth development and experiential learning.

Terms and Concepts Introduction

Similar to veins in tree leaves, a web of water channels exists in the landscape that drains water from the land and into rivers and eventually the ocean. This web of channels is called a drainage network and has a pattern that is created by the land topography, climate, and geology. Human activities, such as agriculture and urbanization, can also affect drainage patterns. Drainage pattern terminology reflects the appearance of the drainage network.

Setting the Stage and Opening Questions

Part 1 – Watershed drainage networks may be a hard concept to grasp for students since they are at a large, landscape scale. The goal of this activity is to provide an example of a network or web that the students can see and with which are familiar make a comparison to drainage networks. Bring in an assortment of different tree leaves that display a variety of vein patterns. Relate this common observation at a small scale to the way water channels weave across the earth in patterns at a larger scale. Point out how small veins converge to create larger and larger veins. Compare to local streams and rivers. For example, in Knoxville, the Holston and French Broad Rivers converge to form the Tennessee River, and Second and Third Creeks feed into the larger Tennessee River.

Part 2 – The goal is to show students how common terminology is needed so scientists may relate their work or setting to others. Ask students to find a partner and identify a "describer" and a "guesser." The describer gets one of the three drainage network images (A, B, or C) and keeps it hidden, and the guesser gets all three images. Students sit back-to-back, and then the describer tries to describe the drainage network they have to the guesser. The guesser submits their guess at which printout the describer has, and then the describer reveals whether or not they were correct. Regroup as a class and then ask the describers to discuss the difficulty they had in describing the image. This emphasizes the need for common terminology among scientists. Pass out the worksheet on drainage patterns. Ask students to match pattern name with the diagrams. Share answers as a group. Answers in order from left to right: Top row – EABG. Bottom row – CDF.

Tips for Engagement

Ask your students to bring in a variety of tree leaves from their homes, or take the class outside to collect leaves in the schoolyard. Use these leaves to set the stage of the activity.

For beginners, ask students to create a relief rubbing of their leaves using crayons or colored pencils. Compare their leaf relief maps to the drainage networks and ask them to identify similarities and

Experience

This is a small group competition where students work together to match aerial images with drainage networks, and the fastest team "wins." Divide students into teams (ideally 3-4 per team, as many groups as you have groups of handouts). Pass out packets of handouts containing aerial images and drainage network maps – aerial images are labeled with a letter and drainage network maps with a number. Students are to work as fast as they can to match an aerial image with its correct drainage network based on observations they make about the landscape and their prediction of how water would move across the land. Ask students to keep the stack together until your mark, and then raise their hands when they have their matches ready to check. Check teams as they indicate they have their matches. Allow all teams to work until they have found the correct matches. Matches: 1B 2F 3I 4D 5A 6J 7N 8G 9M 10C 11H 12L 13E 14K

Share

Ask students the following questions and discuss:

1) How did they approach the task? What was the first thing they did as a team?
2) What clues did they look for to help make matches?
3) Where there any features or situations that caused uncertainty or confusion, and how did they work it out to find the correct match?

Life Skill(s)

Observation
Comparison
Association
Team-Work
Communication
Interpretation

Process

After students shared their processes for successful matching, ask them to hypothesize about the locations of which the images and maps represent. Which do they think has the highest amount of rain? Which are the driest/most arid landscapes? Which areas have agriculture? The greatest human population? The least human population? The steepest topography? The flattest? Ask students if they used their drainage pattern terminology to help discuss among teammates. If not, ask if they think it would help if they had to describe any of these locations in terms of water to other students or scientists outside of class.

Generalize

Summarize by emphasizing the connection between land and climate characteristics and drainage pattern. Point out that wet climates often have an abundance of vegetation in the aerial image as well as water channels, and arid climates generally have less of both. Point out that radial or parallel patterns help identify areas of steep slopes despite the absence of topographic information or contour lines. Emphasize the role of human activities in changing the way water moves in drainage networks (e.g. straightening of channels – aka channelization, un-natural angles in networks affected by agriculture or urbanization).

Apply

Ask students in their teams to divide up the drainage network maps between them (each student should get 2-3 maps). Using a dry erase marker, ask students to circle patterns on their maps and label them with the correct pattern terminology. Students may have some initial difficulty in matching an idealized version of the drainage pattern to the real world. Express to students that real-world information (like these maps) are not always as straight forward, that there will often be several different drainage patterns contained within the land area depicted in the maps provided, and that sometimes the answer is somewhere in between two options. Allow students time to share their findings.

Revisit the leaf comparison. What kind of patterns do they see now in their leaves using their new terminology?

Supplemental Information
Educational Standards

6th Grade

7th Grade

8th Grade

Programs in agriculture and natural resources, 4-H youth development, family and consumer sciences, and resource development. University of Tennessee Institute of Agriculture, U.S. Department of Agriculture and county governments cooperating. UT Extension provides equal opportunities in programs and employment.

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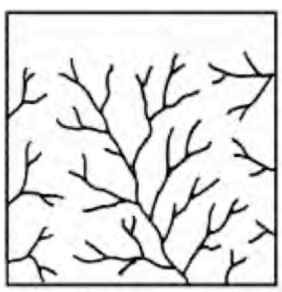
Student Handout

<u>Background</u>: Drainage pattern refers to the pattern made by water channels across the land affected by climate, topography, and geology. Pattern types include:

A. **<u>Dendritic</u>** – the most common pattern, forms many **small V-shapes** where channels combine, and looks like the branching pattern of tree roots.
B. **<u>Parallel</u>** – found in land with steep slopes, forms **elongated V-shapes**, and has channels that run **parallel** to each other before combining.
C. **<u>Trellis</u>** – found in mountainous areas that contain long ridgelines, has main channels with many small channels that intersect near **perpendicular angles**, and looks like a garden trellis (half ladders).
D. **<u>Angular</u>** – found in areas with underground geologic faults, and channels often make sharp bends and **right angles**.
E. **<u>Radial</u>** – develops around a central elevated point, like a mountain summit or volcano, where channels drain away radially from the central point.
F. **<u>Centripetal</u>** – the opposite of radial and where channels drain toward a central depression (like a lake or pond), which is often dry for part of the year.
G. **<u>Contorted</u>** – develops from natural or artificial disturbances, such as glaciers or human activities, and has odd, **non-repeating patterns**.

<u>Activity</u>: Each box below depicts a different drainage pattern. Based on the descriptions above, match the letter associated with the drainage pattern name with a depiction.


Letter: ______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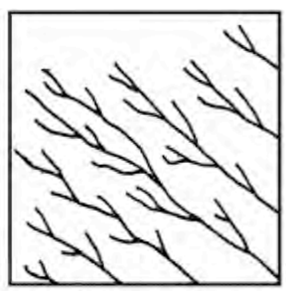
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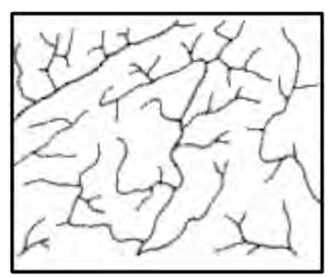
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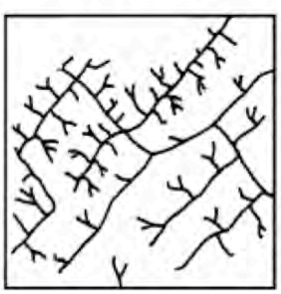
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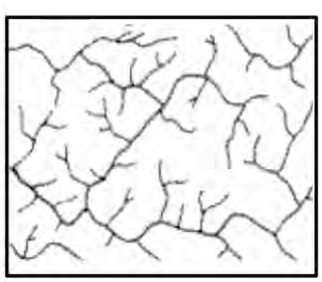
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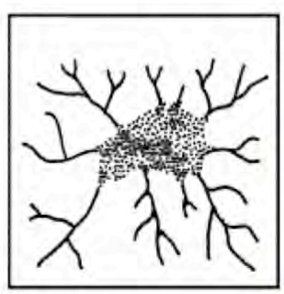
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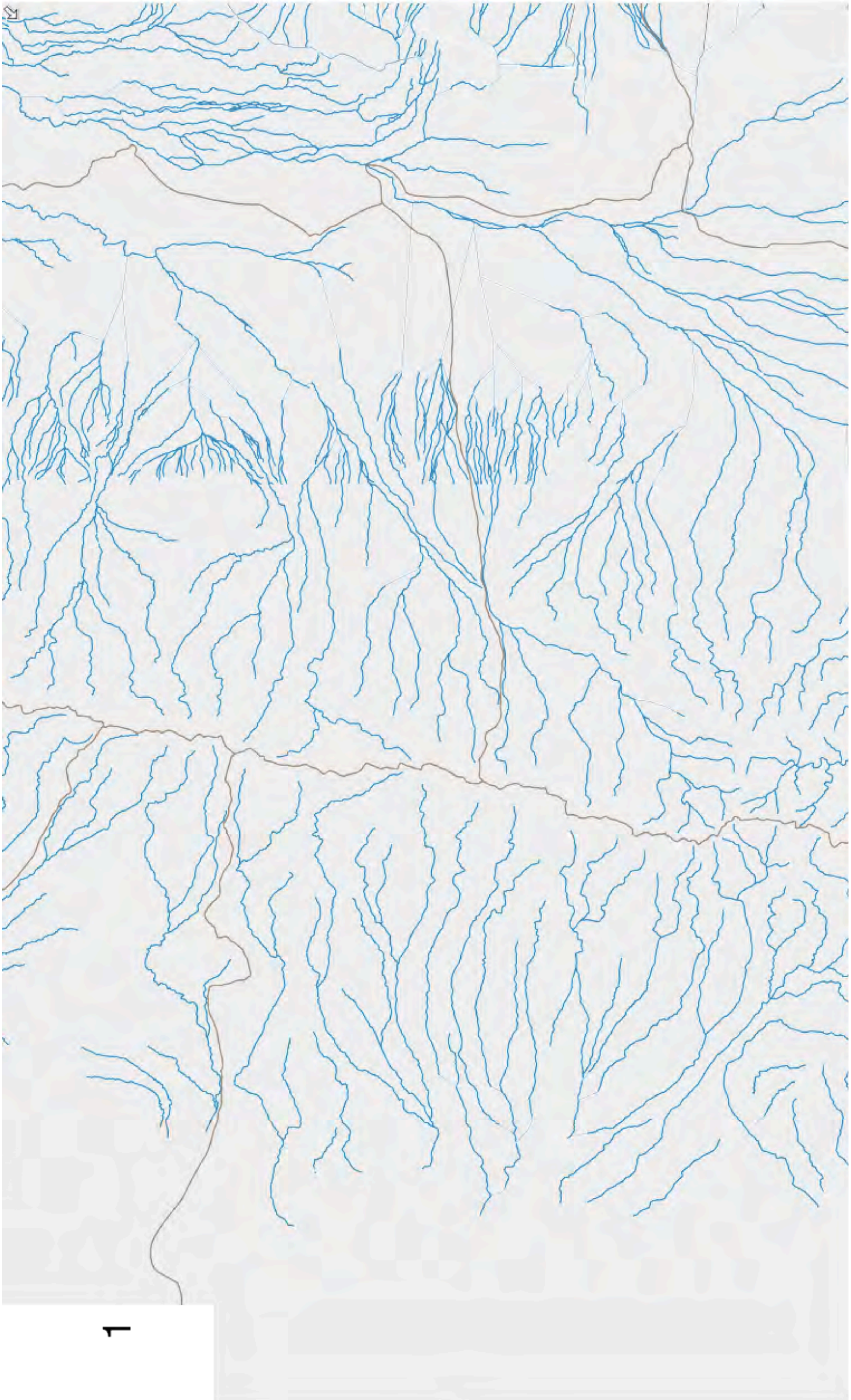
Sources:

Twidale, C.R. (2004), *Earth-Science Reviews*. Accessed: http://www.sciencedirect.com/science/article/pii/S0012825204000212

and Salaem State: http://w3.salemstate.edu/~lhanson/gls210/gls210_streams3.htm

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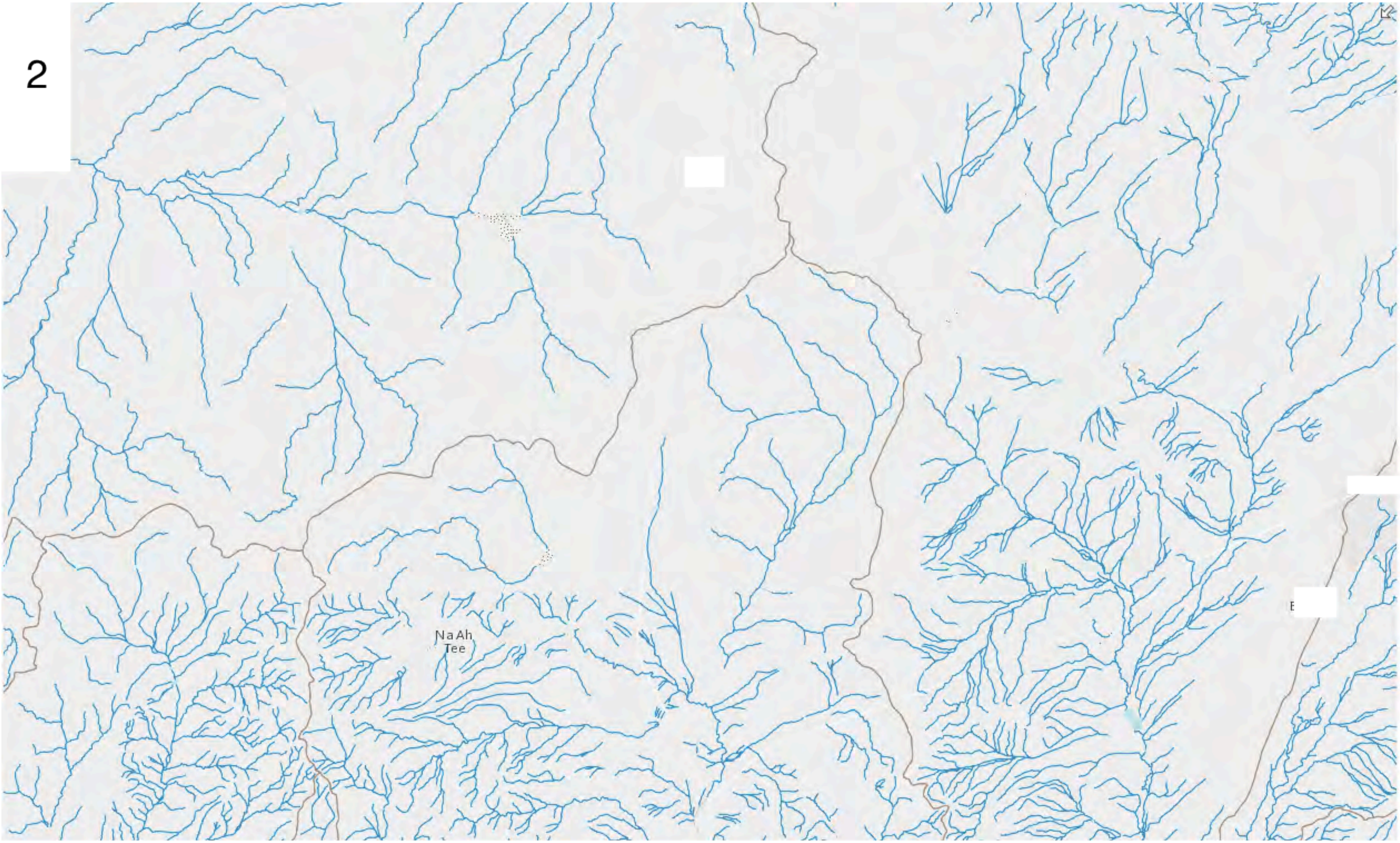

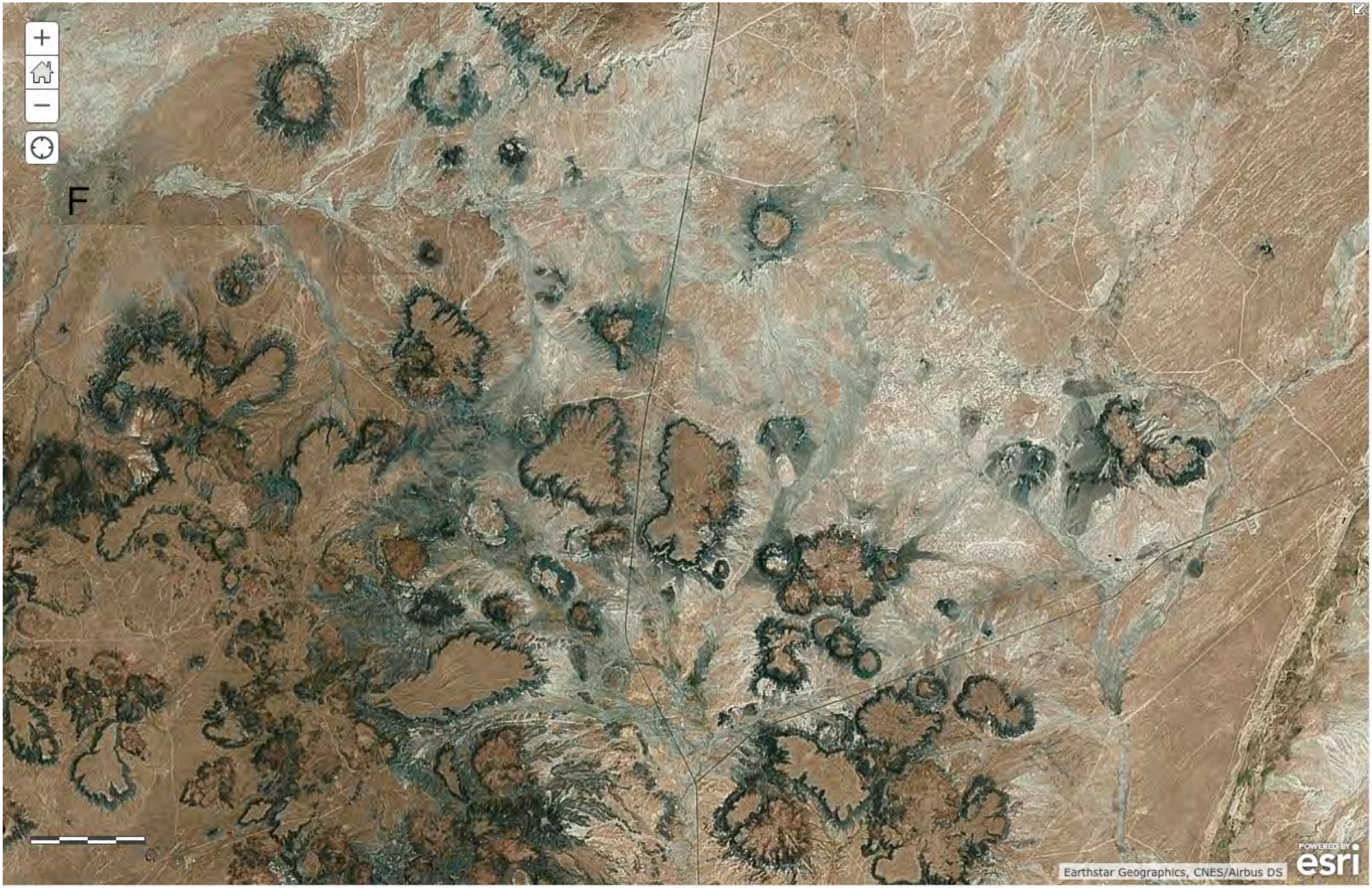
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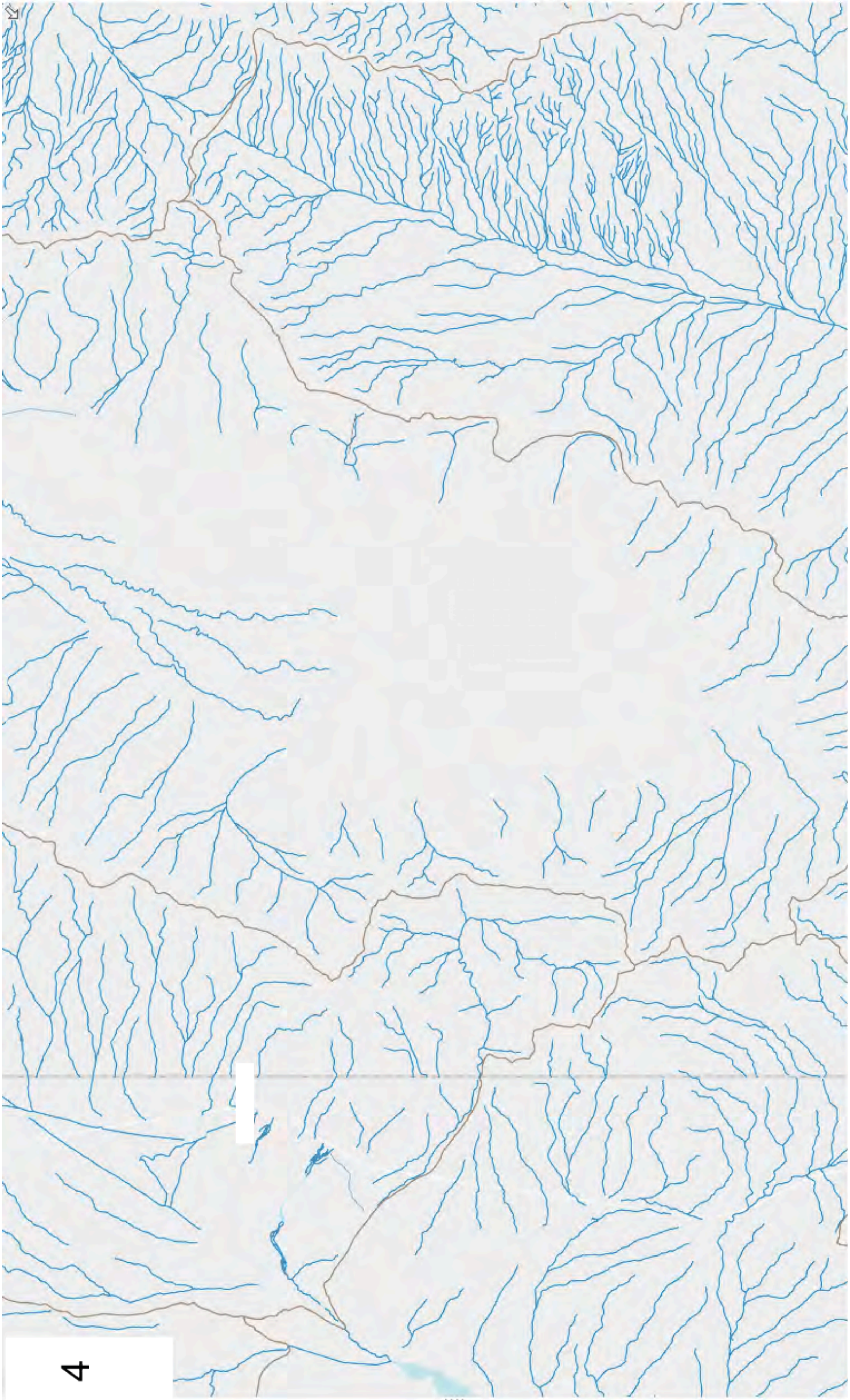

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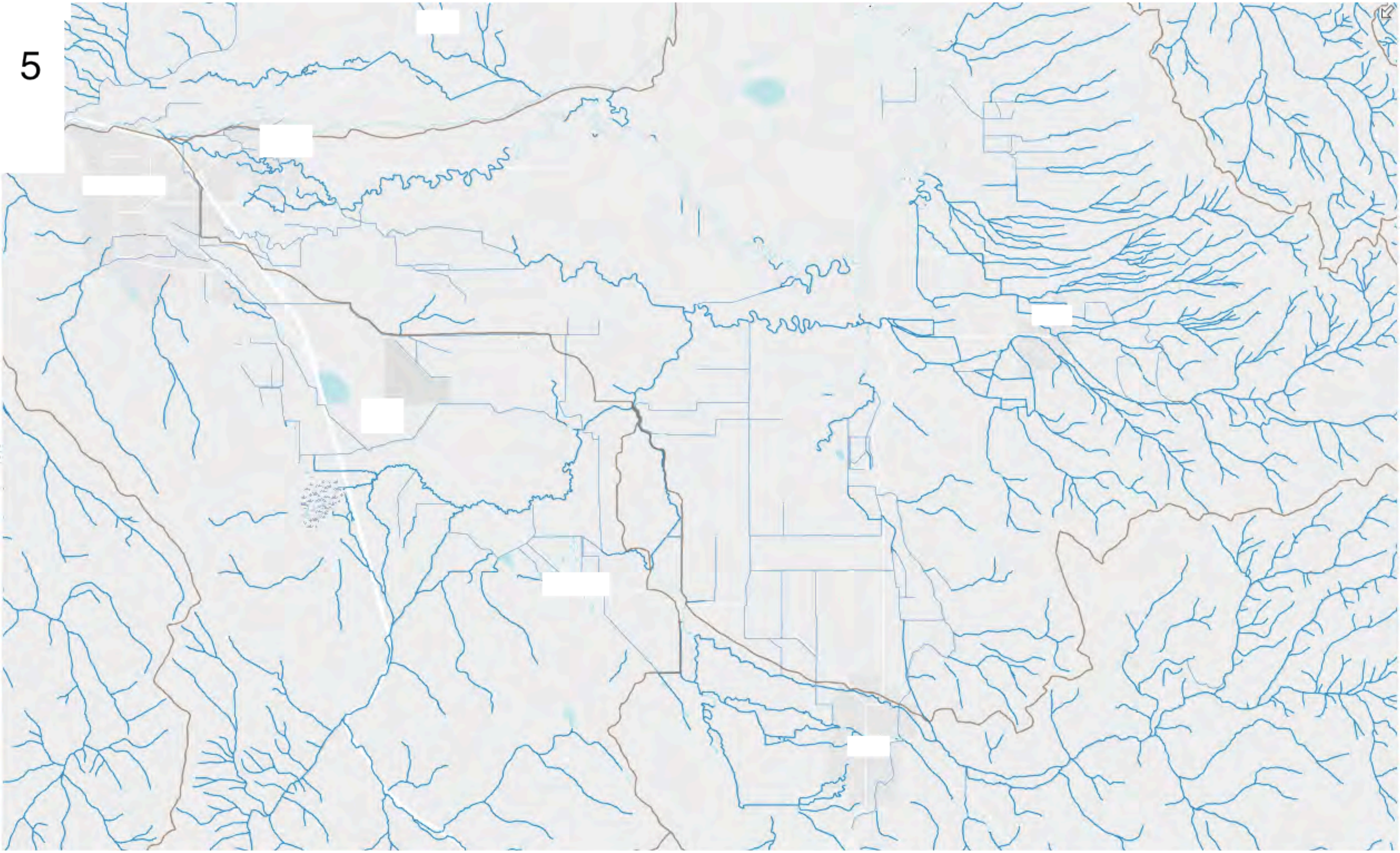

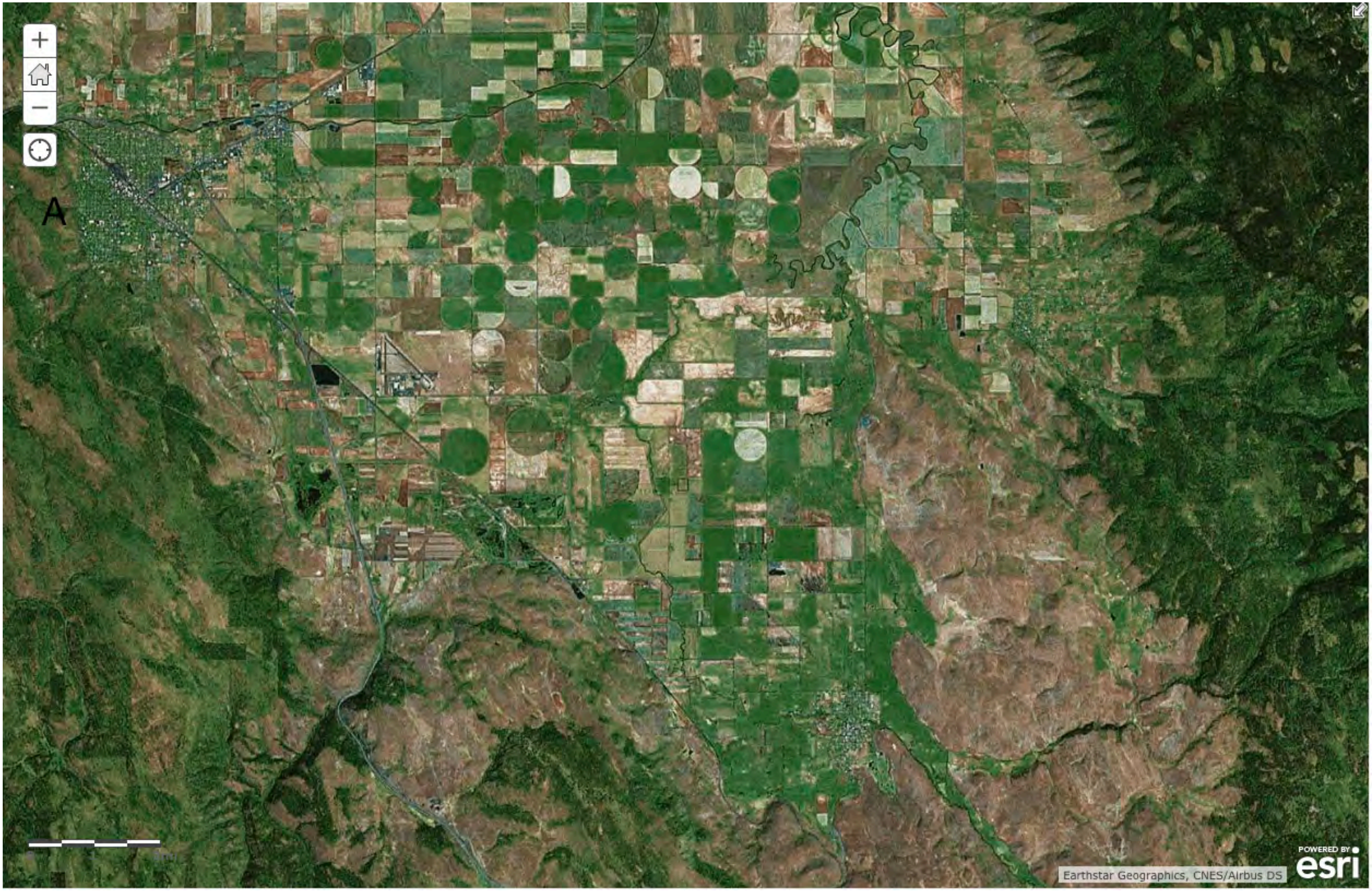
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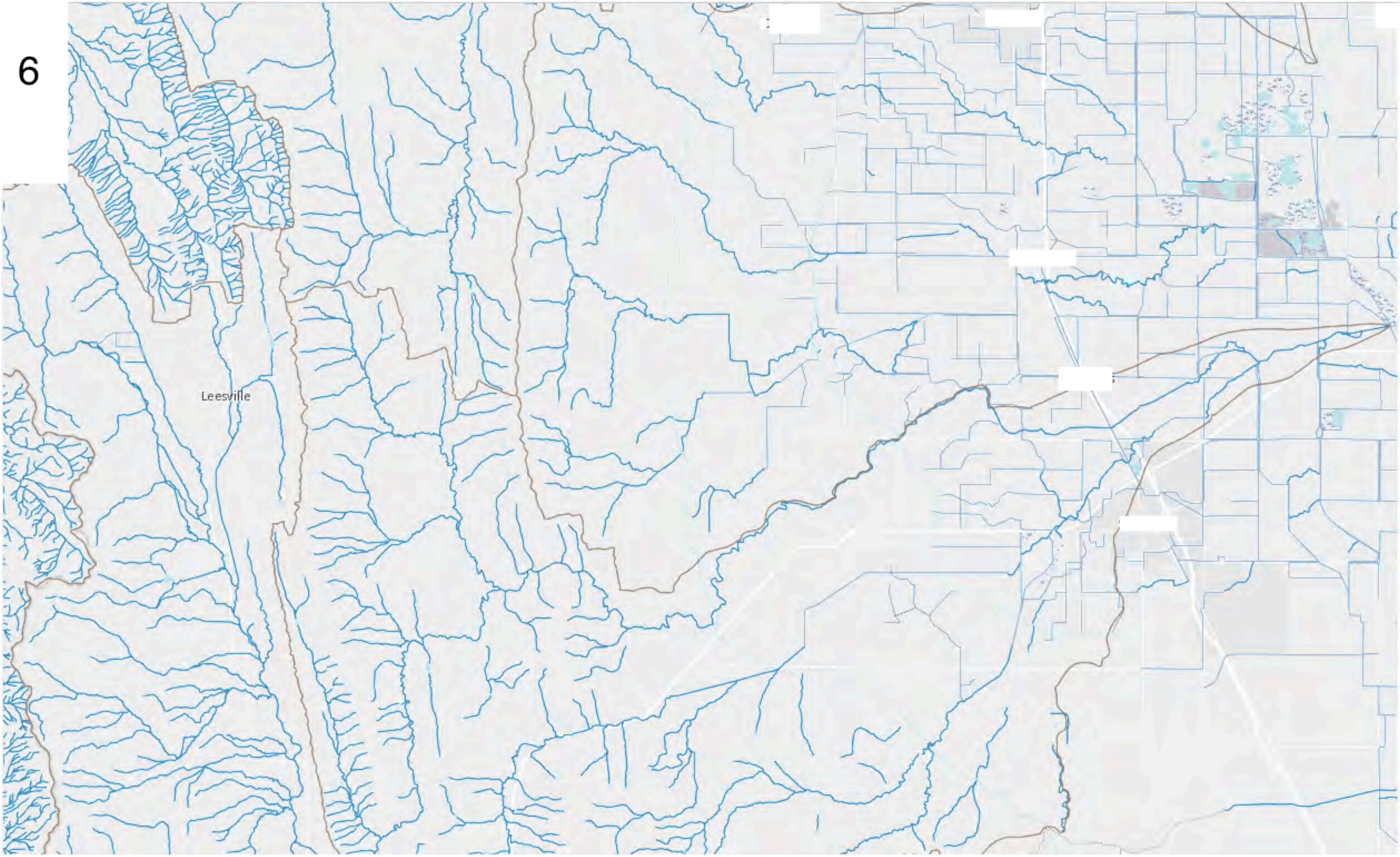

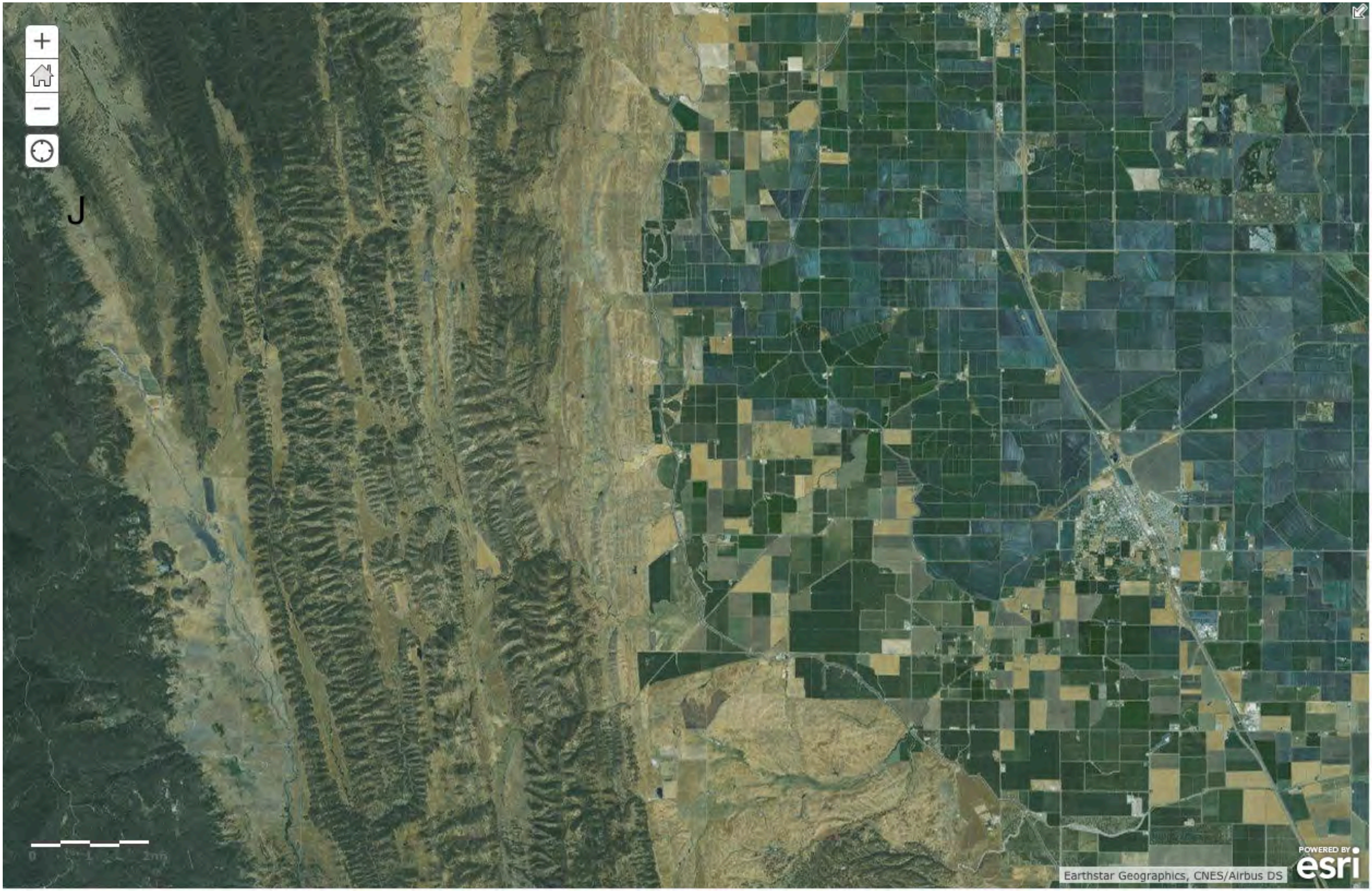
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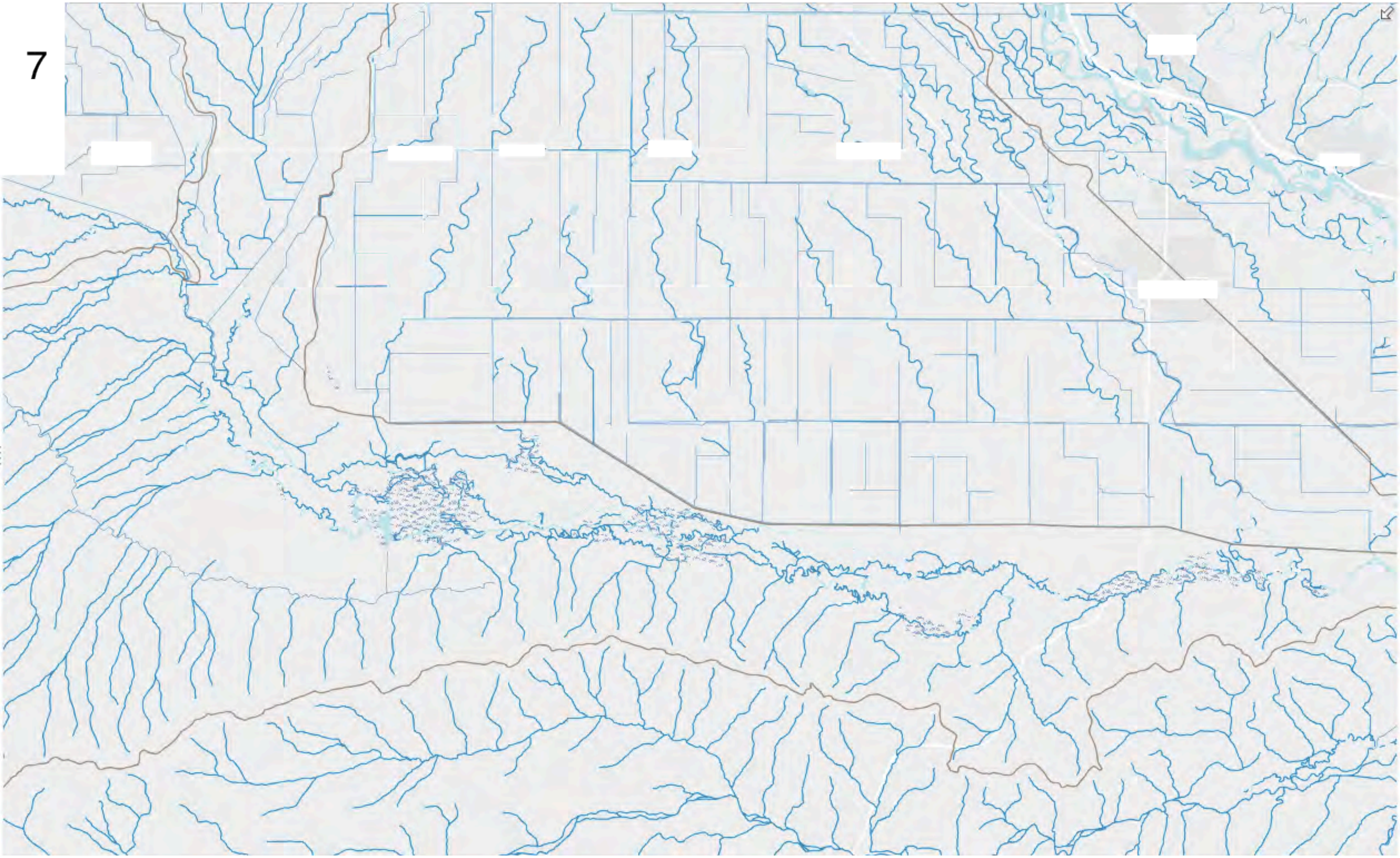

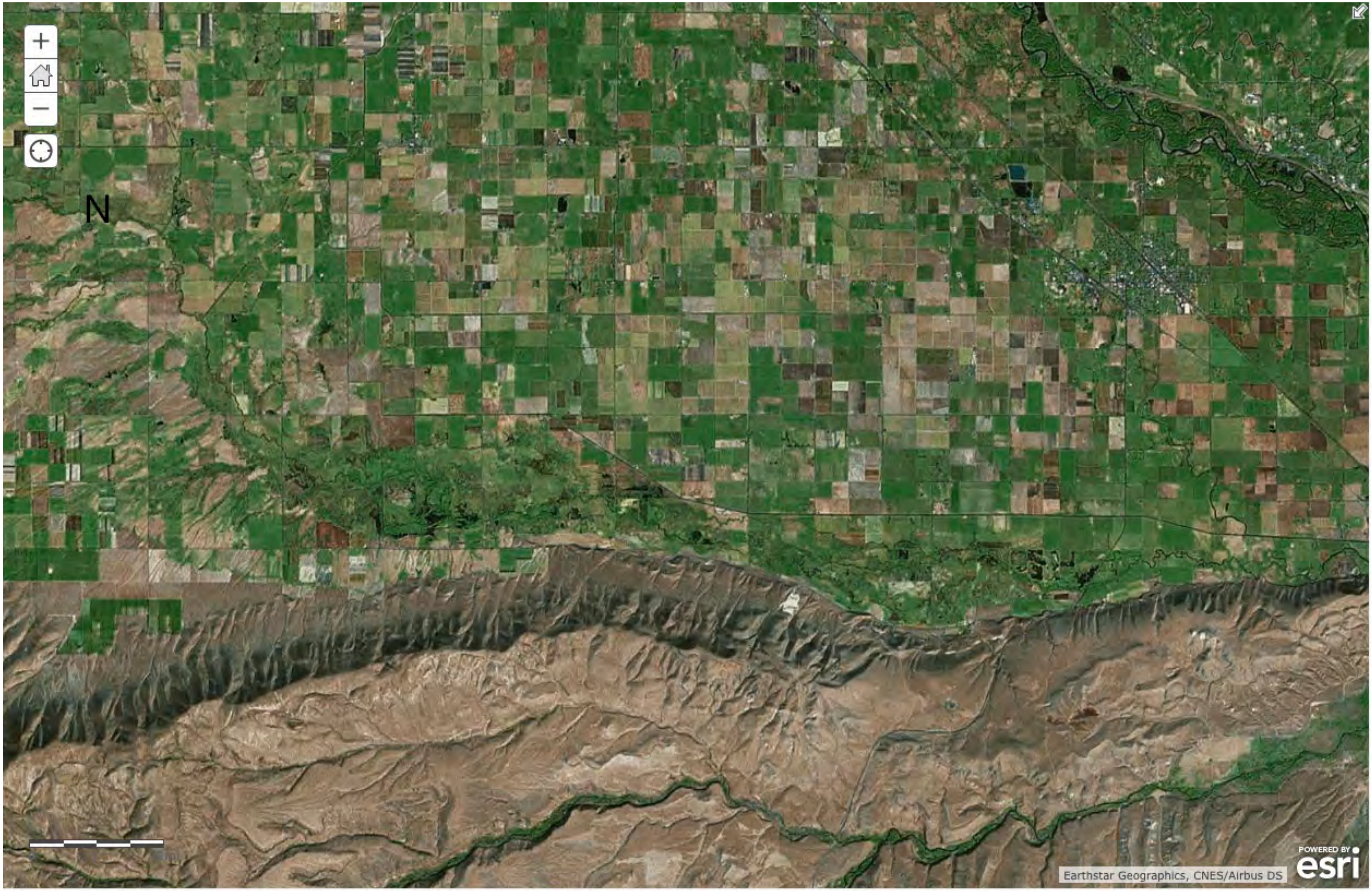
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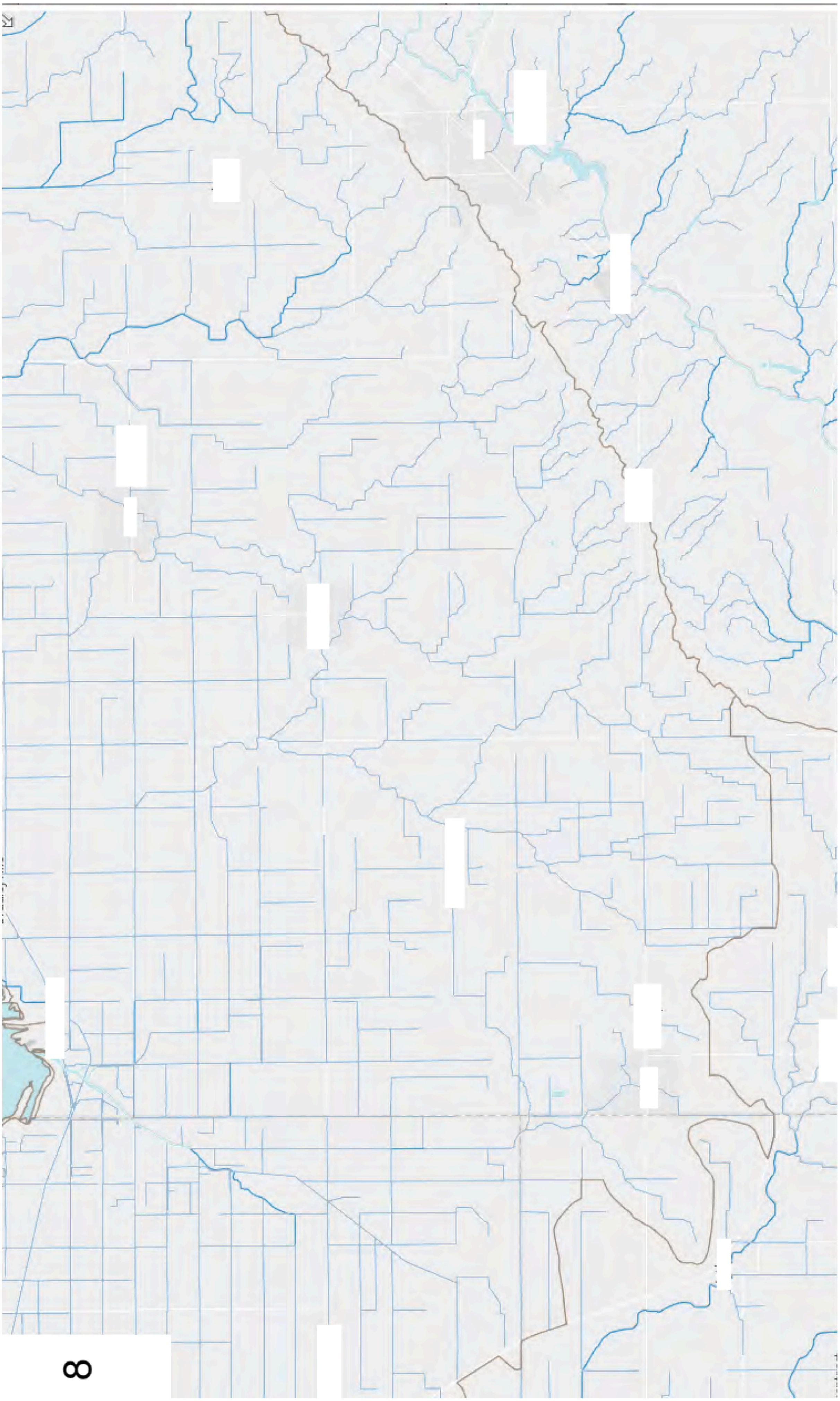

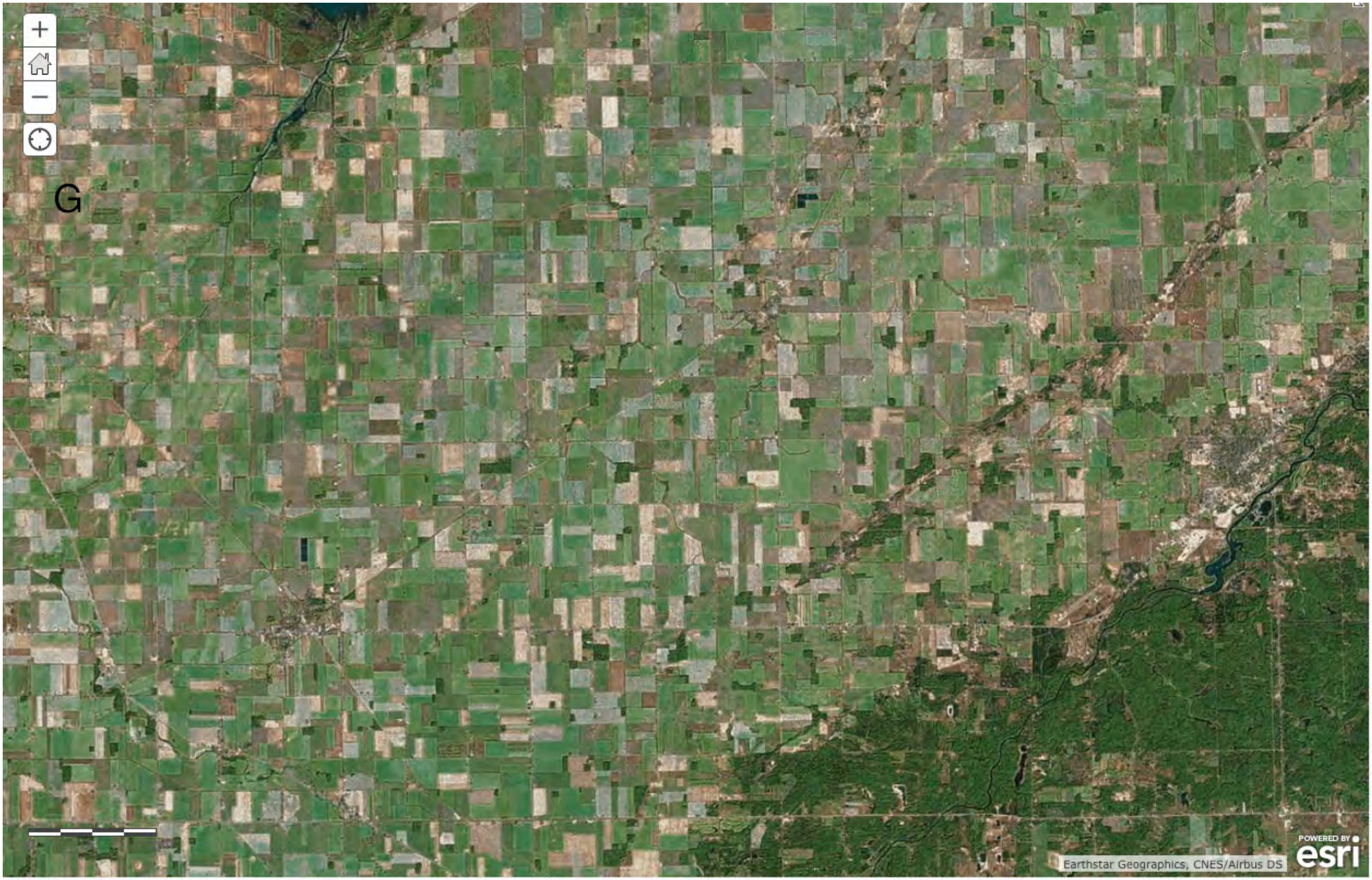
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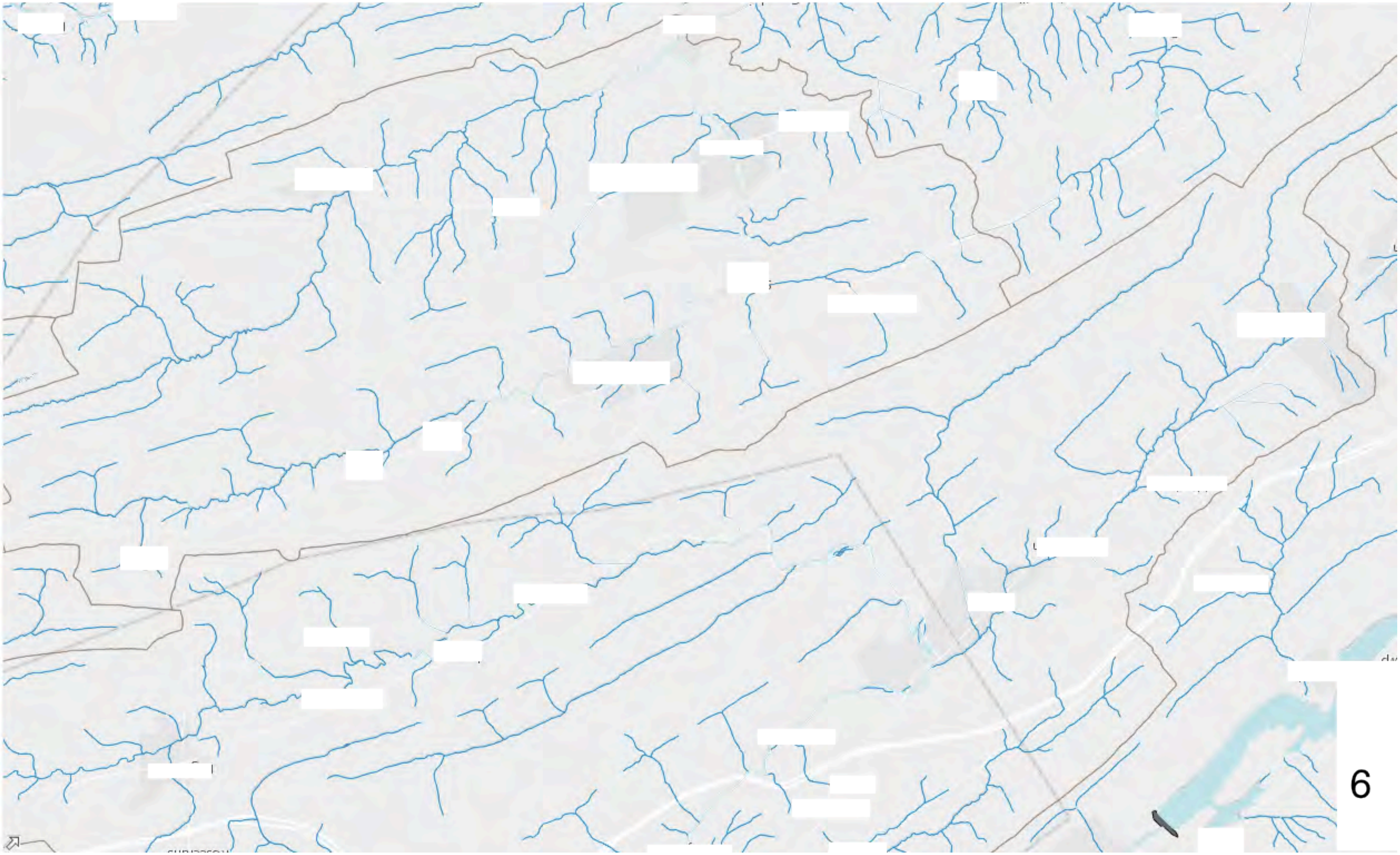

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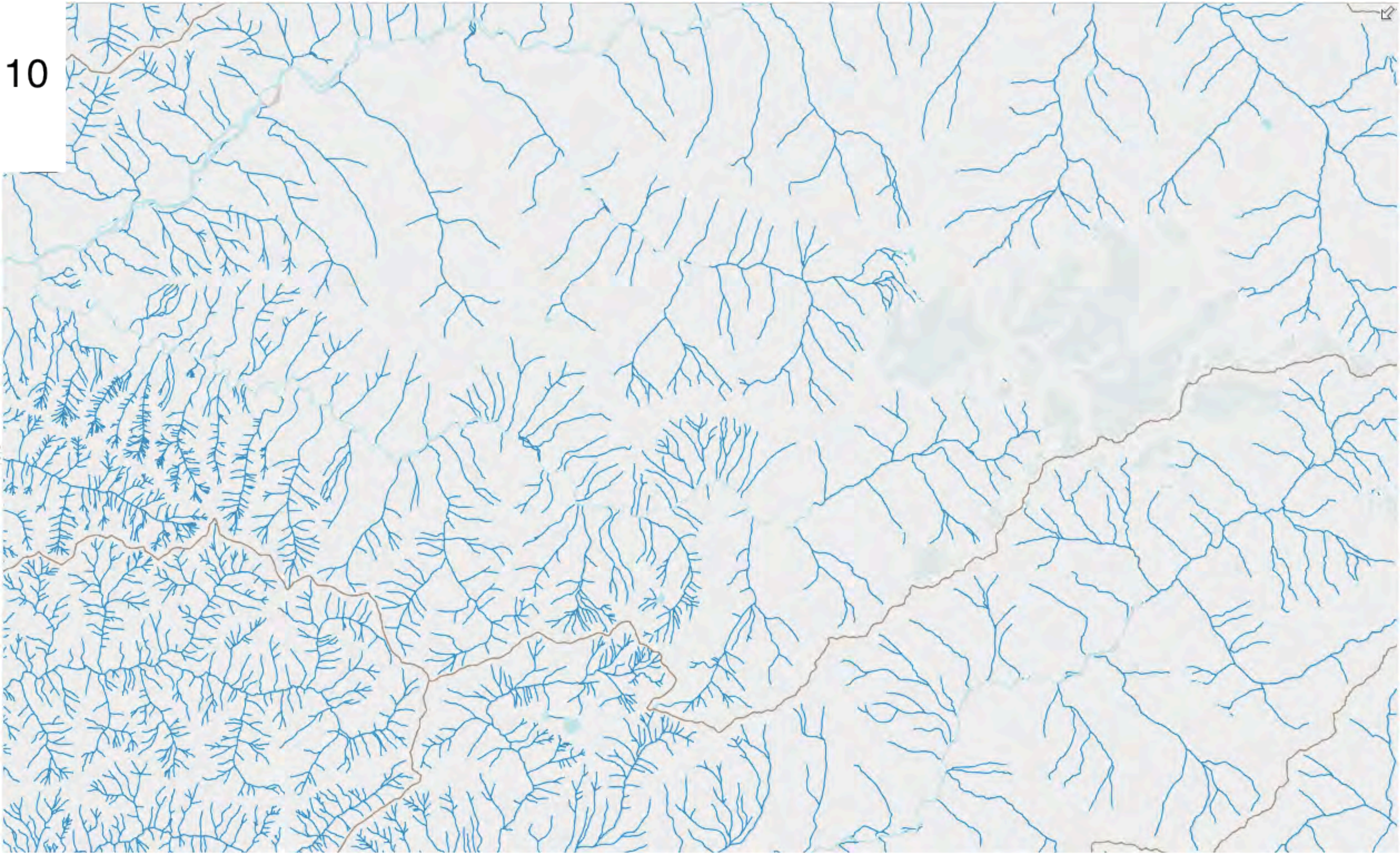


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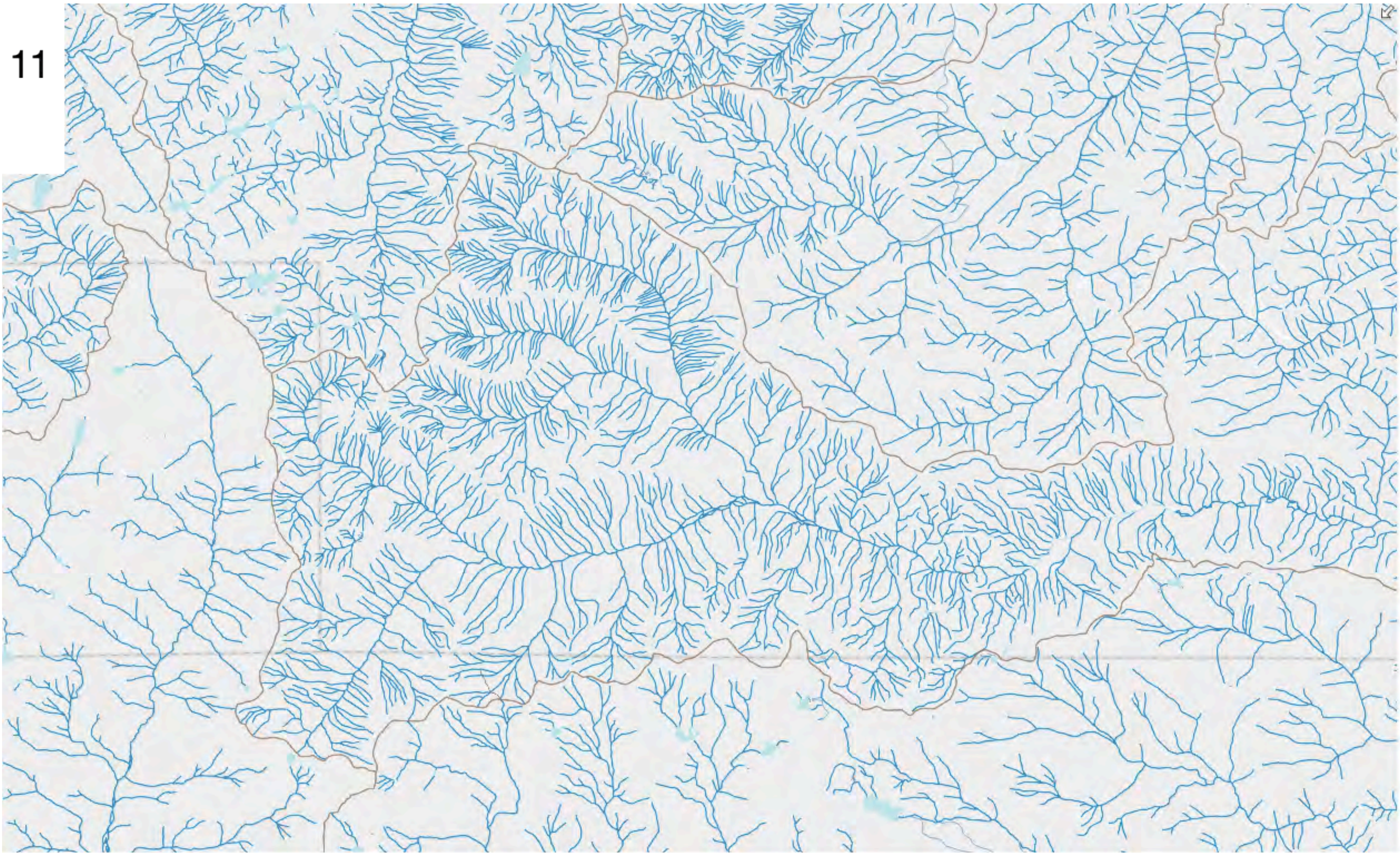

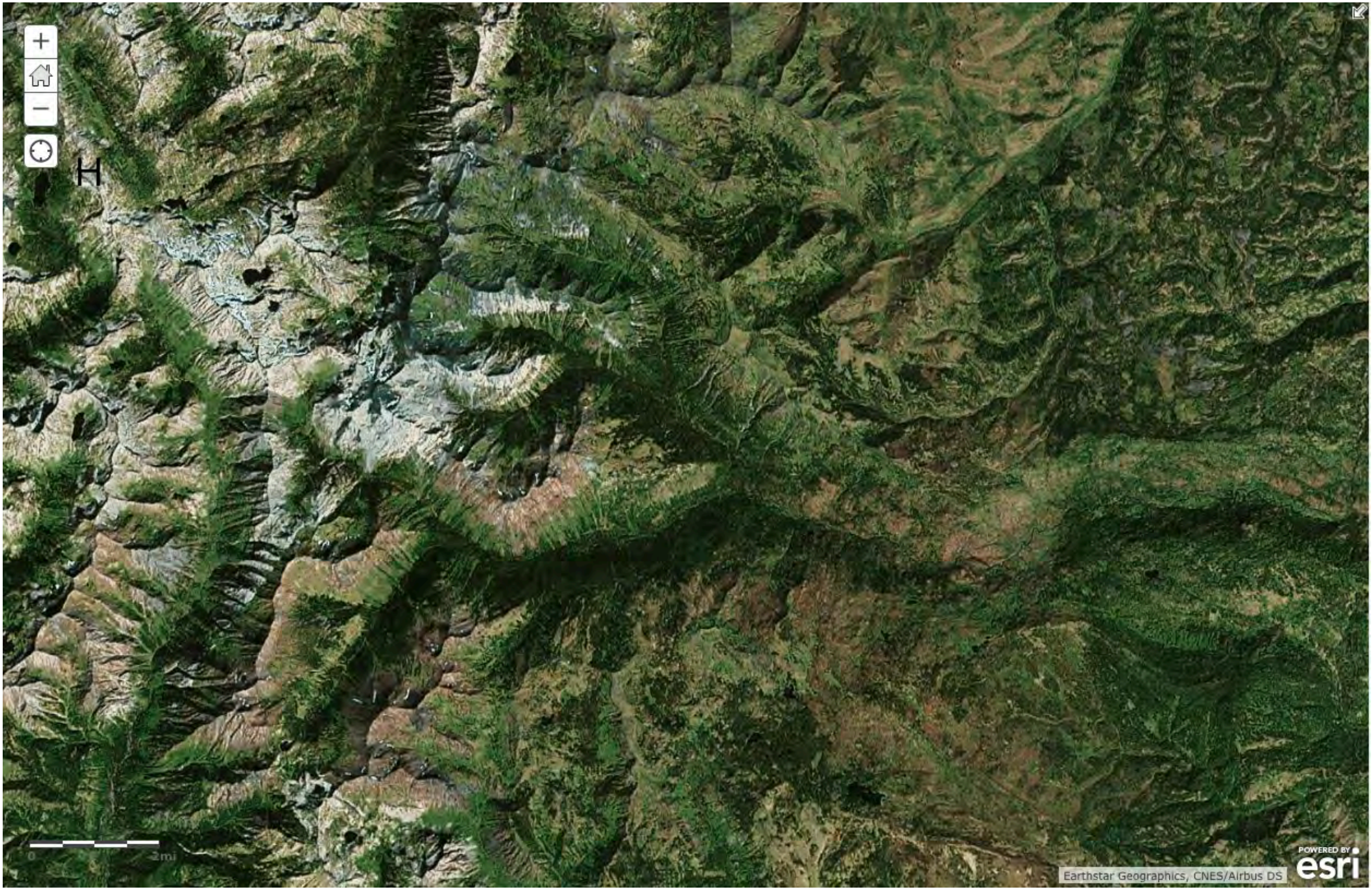
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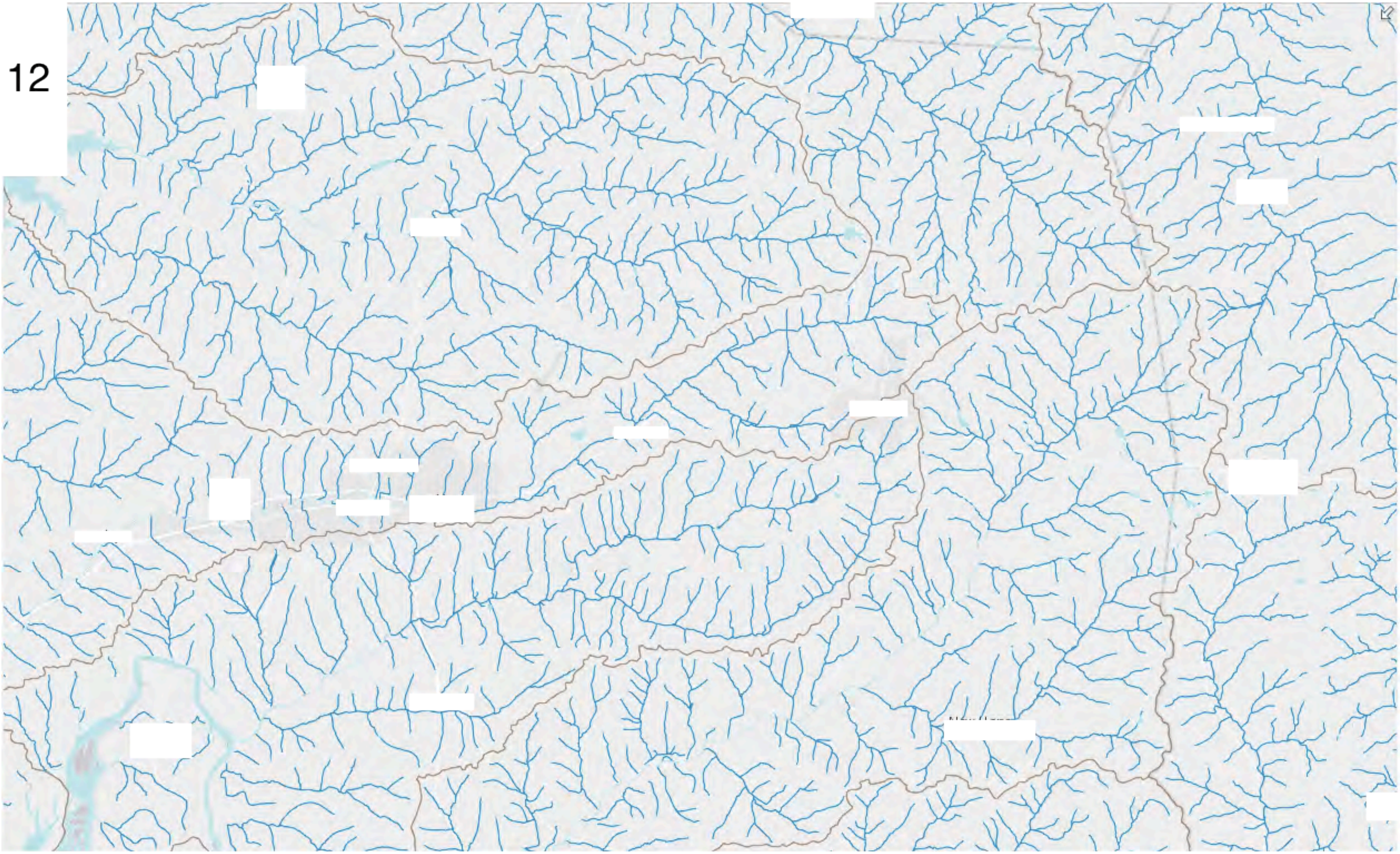


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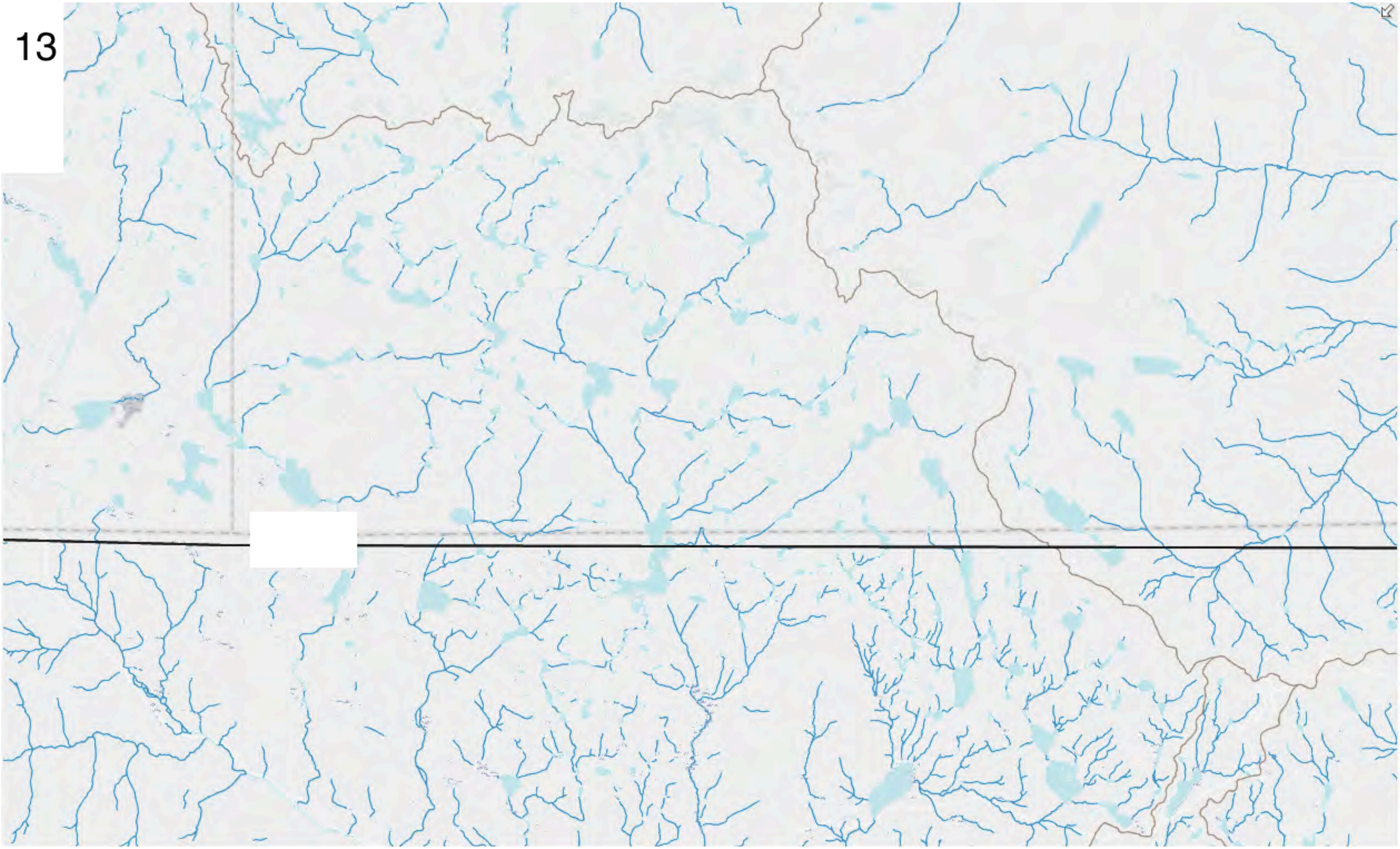

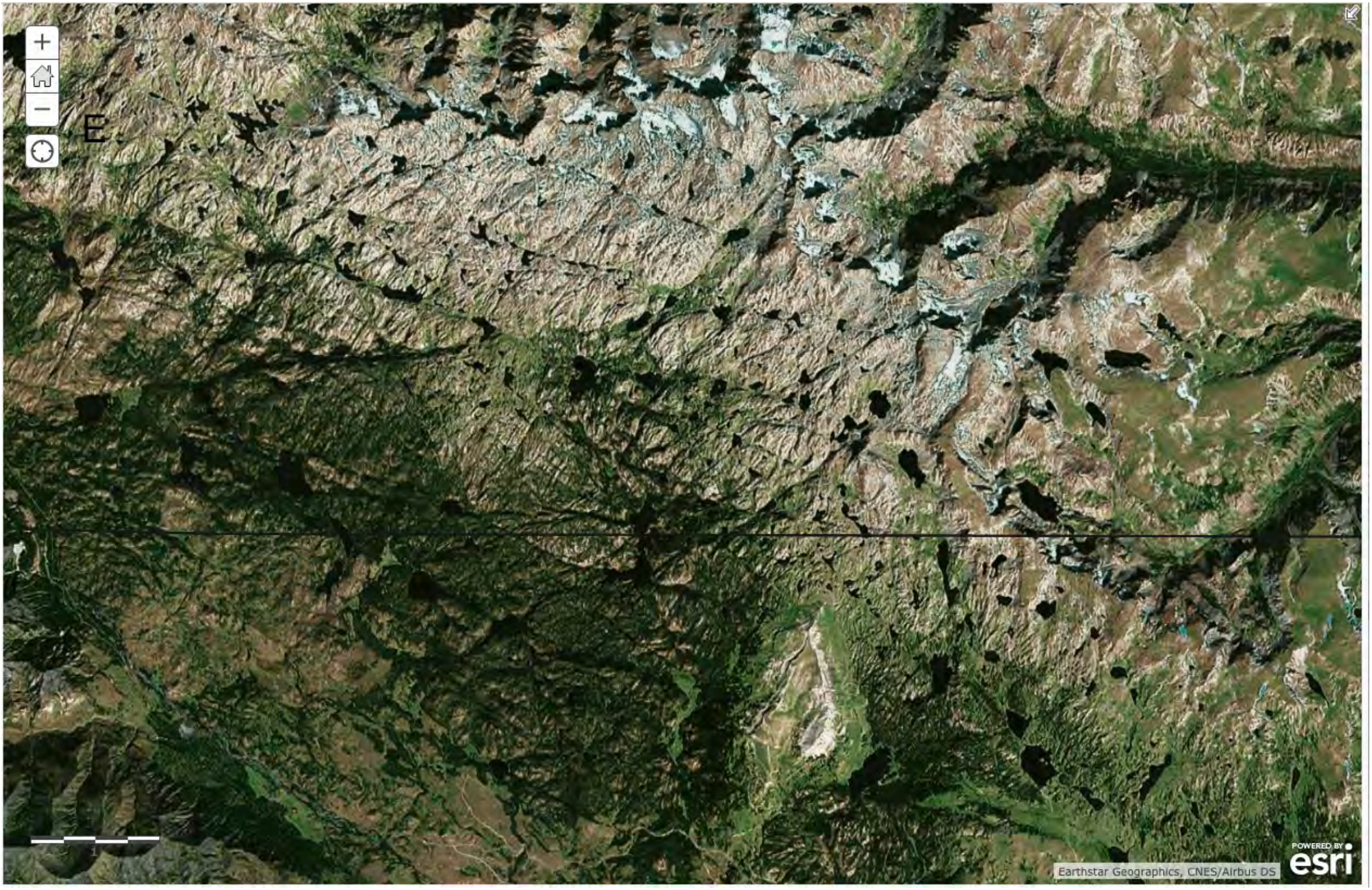

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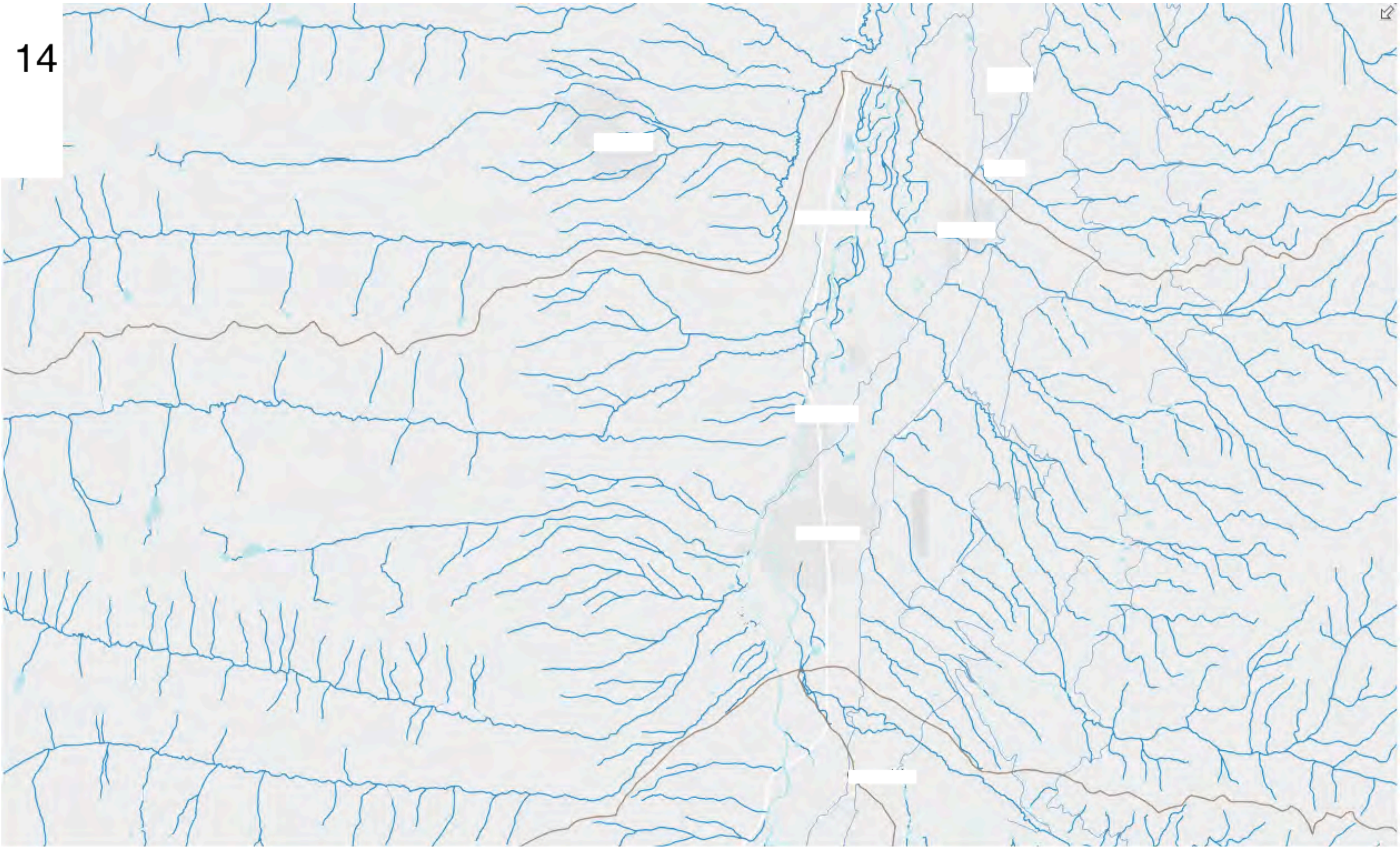

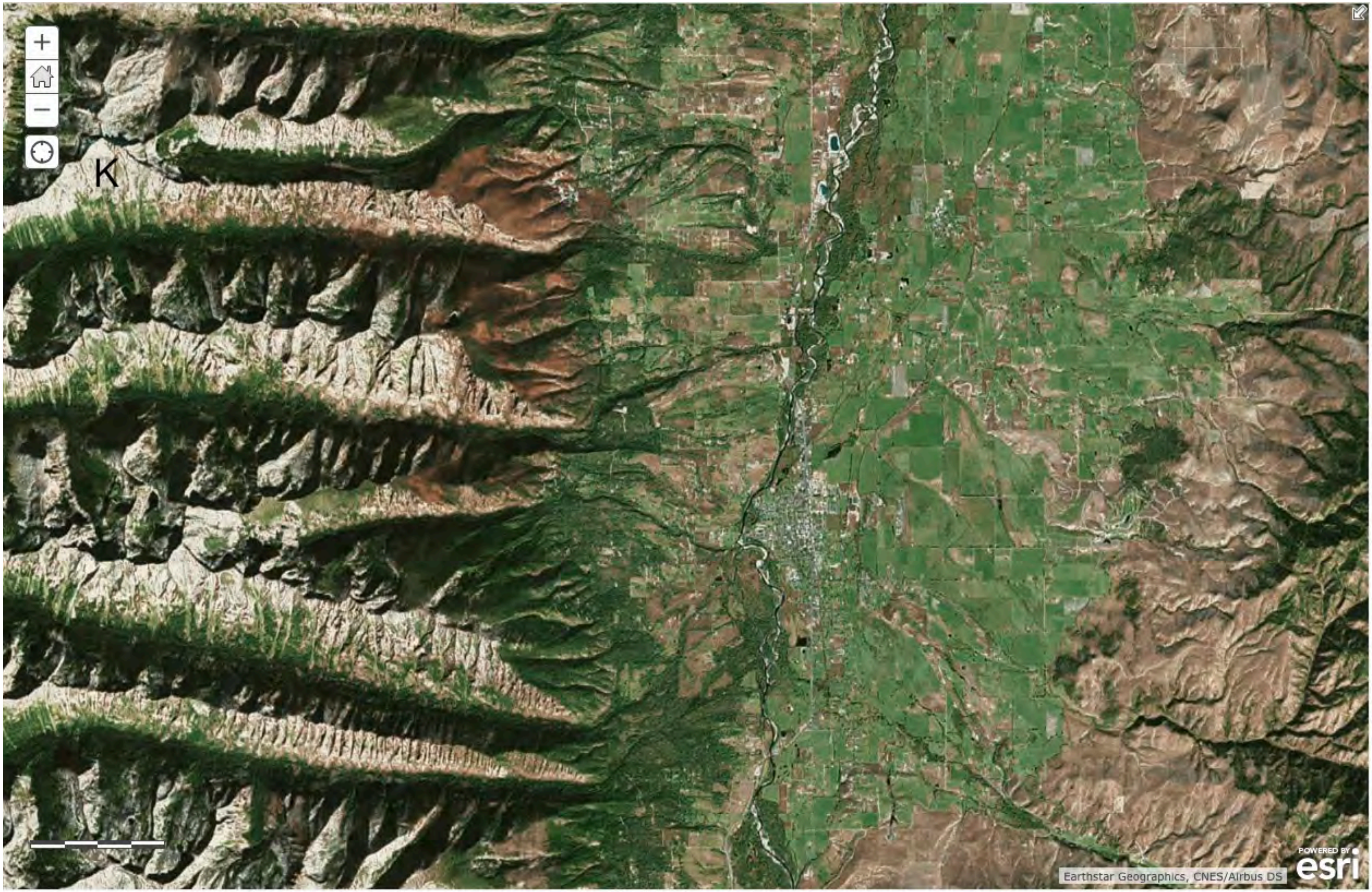
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