Solar-passive residential suitability analysis for the Batlow region: A GIS-based multi-objective land allocation project

Timothy Robinson

1. Executive Summary

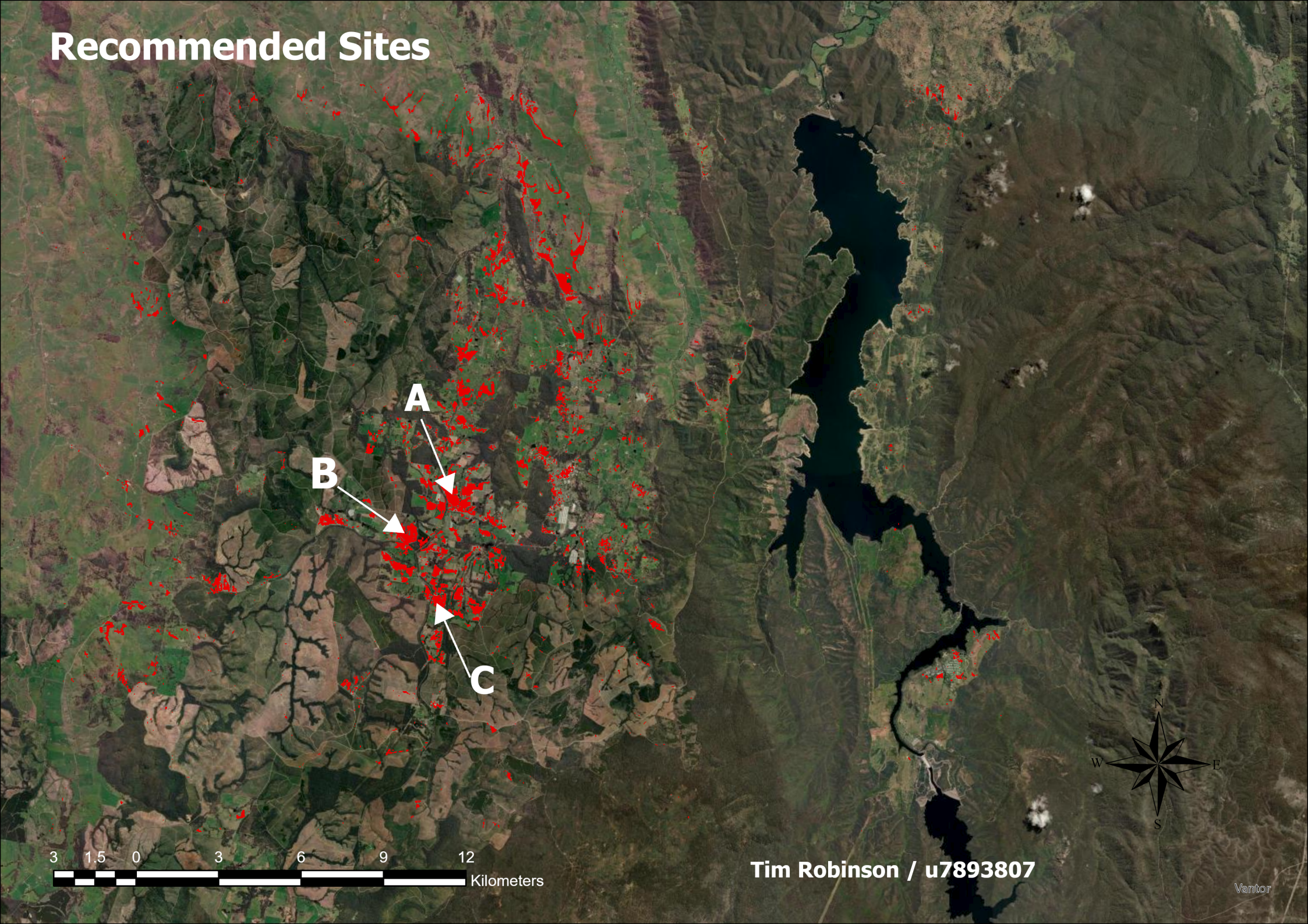
This project employs a GIS-based approach to identify suitable locations for a solar passive residential development in the Batlow region, near Canberra. The primary objective was to locate sites that balanced competing priorities of safety, conservation, and economic viability. Sunshine Industries outlined specific conditions for the development: incorporating solar-passive design principles, integrate agriculture and forestry options, avoid impacting biodiversity, and avoid areas prone to fire or flood. The project also aimed to maximise the economic viability of the development, possibly using income from agriculture and/or forestry operations to offset development costs.

To meet these competing objectives, we developed a suite of raster-based suitability models for building, agriculture, forestry, conservation, and Indigenous heritage. The building model balanced cost (slope and road accessibility) and value (view and aspect) to identify sites that are both inexpensive to build on and desirable to live in. Fire and flood hazard constraints were applied to ensure that development occurs in safe locations. Agricultural and forestry suitability models were built using soil, vegetation, and slope data to identify areas with the highest economic potential. The conservation and Indigenous heritage models sought to protect streams, roads, ecologically sensitive areas, and culturally significant sites. Each model was standardised and combined into a MOLA framework, which allowed competing land uses to be weighted and integrated into composite outputs.

The Batlow region enjoys rich agricultural lands and high-quality forestry resources, which is reflected in the local economy. By clustering residential development in a single area, the project achieves a balance between residential, agricultural, and forestry uses while preserving conservation and heritage values. Based on our analysis, the recommended sites for the residential cluster maximise solar exposure, minimise hazard risk, and maintain productive forestry and agricultural land.

Below, we have included our final recommendation for the location of the residential sites and the MOLA that was used to identify these locations. There are three primary sites, labelled A, B, and C. In addition to this primary recommendation, a total of seven MOLA scenarios are provided to illustrate different land-use strategies, allowing planners to explore trade-offs and optimise land allocation according to differing priorities. Biases were given to building, agriculture, and forestry, reflecting our prioritisation of these land uses. In the body of this report, we have included all suitability models and the constraints. We have explained our logic in arriving to a solution and given some context for each model. The methods section explains the techniques that were used to arrive at our solution. Finally, we have included an appendix with our calculations and metadata.

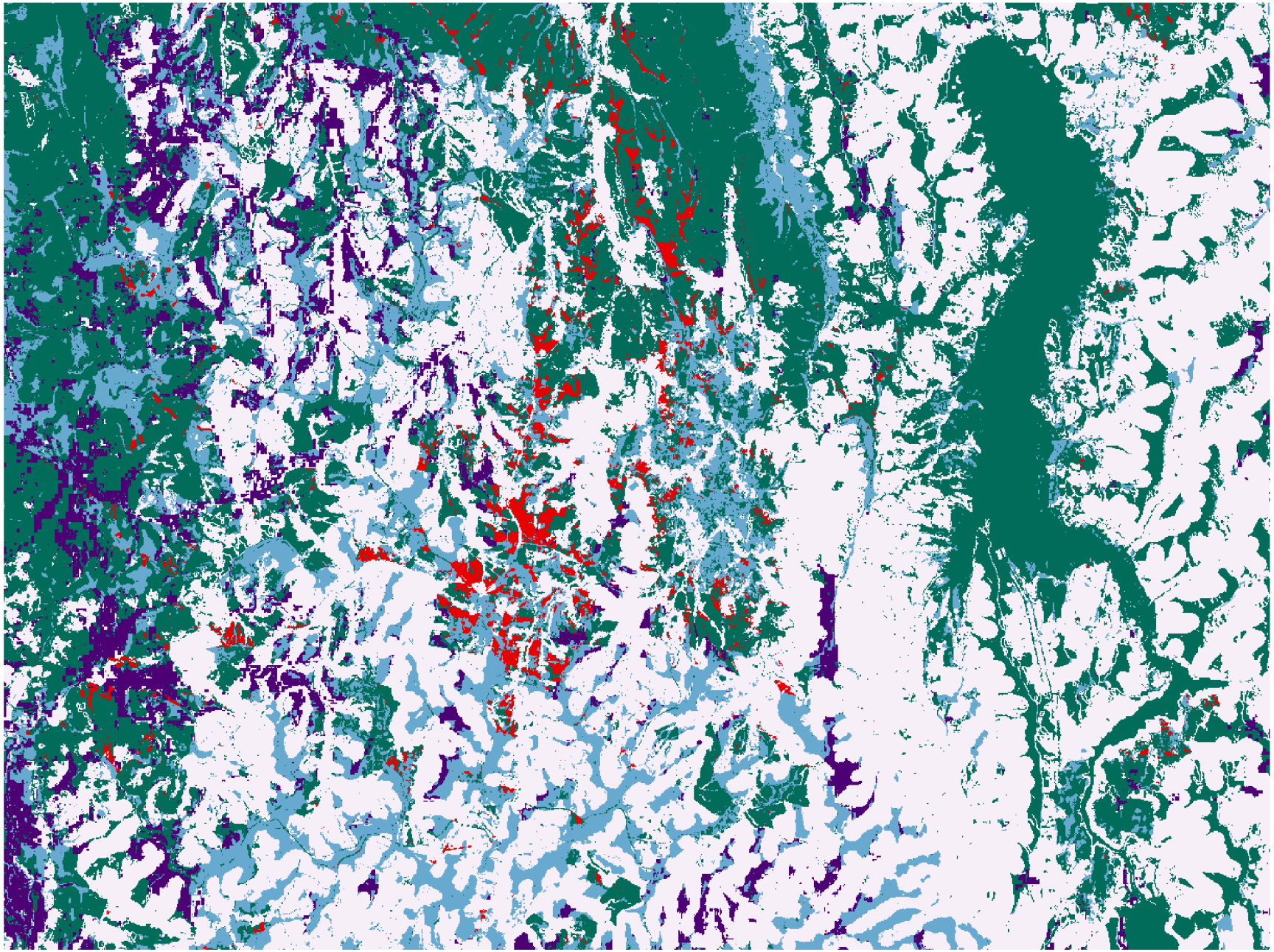
Overall, this project demonstrates the utility of GIS-based analysis in guiding land-use planning and development in the Batlow region. The final models provide a visual and quantitative foundation for assessing trade-offs between competing objectives, ultimately supporting planners and decision makers in selecting sites that align with their goals. We would like to sincerely thank the Board of Sunshine Industries for choosing us to be part of this important project.


Recommended Sites
A
B
C
N
W
E
S
3 1.5 0 3 6 9 12
Kilometers
Tim Robinson / u7893807
Vantor

Study Site


study_site
Bounding_Box
N
W
E
S
3 1.5 0 3 6 9 12
Kilometers
Tim Robinson / u7893807
Vantor

Multi-Objective Land Allocation



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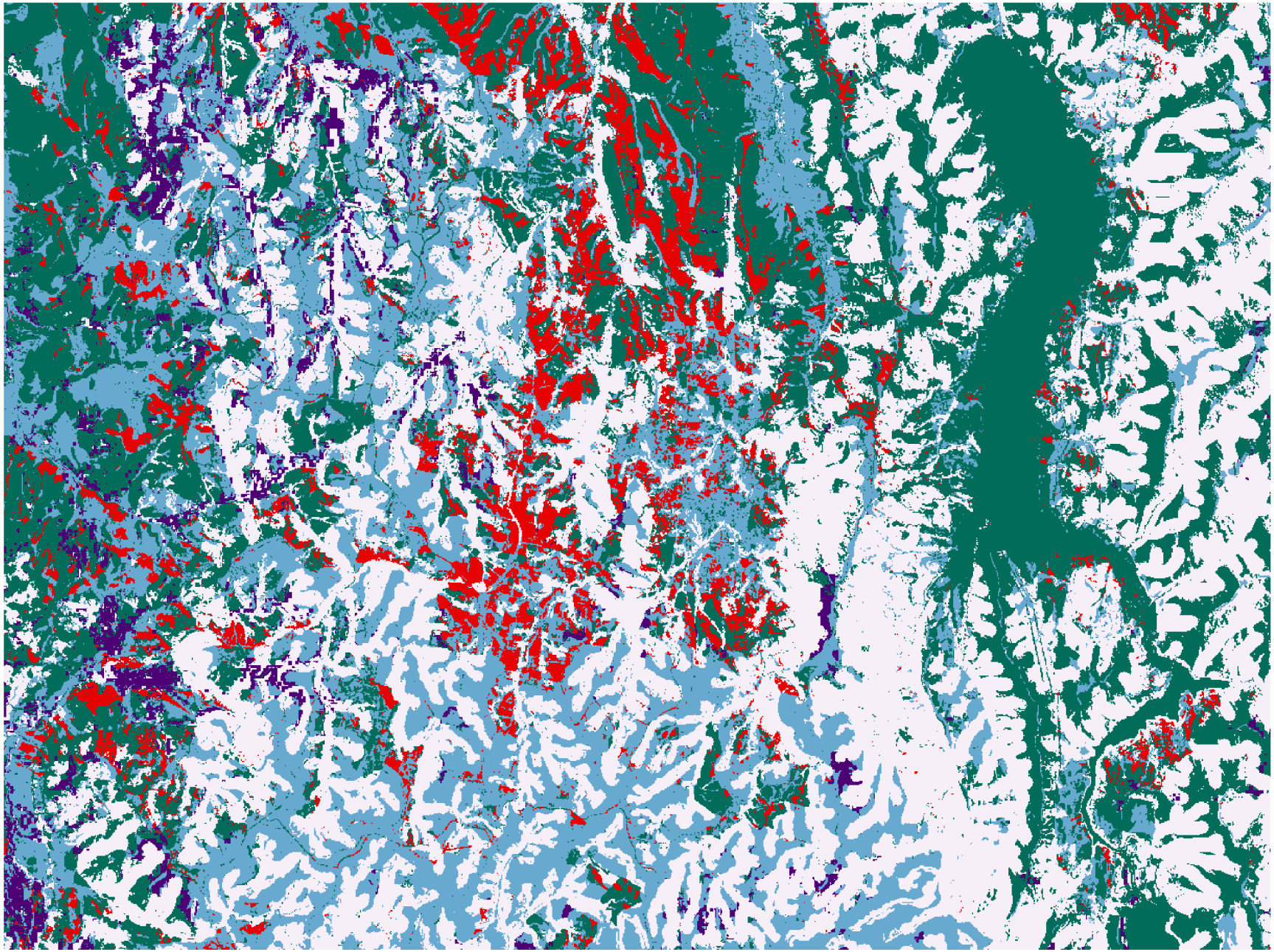
Multi-Objective Land Allocation



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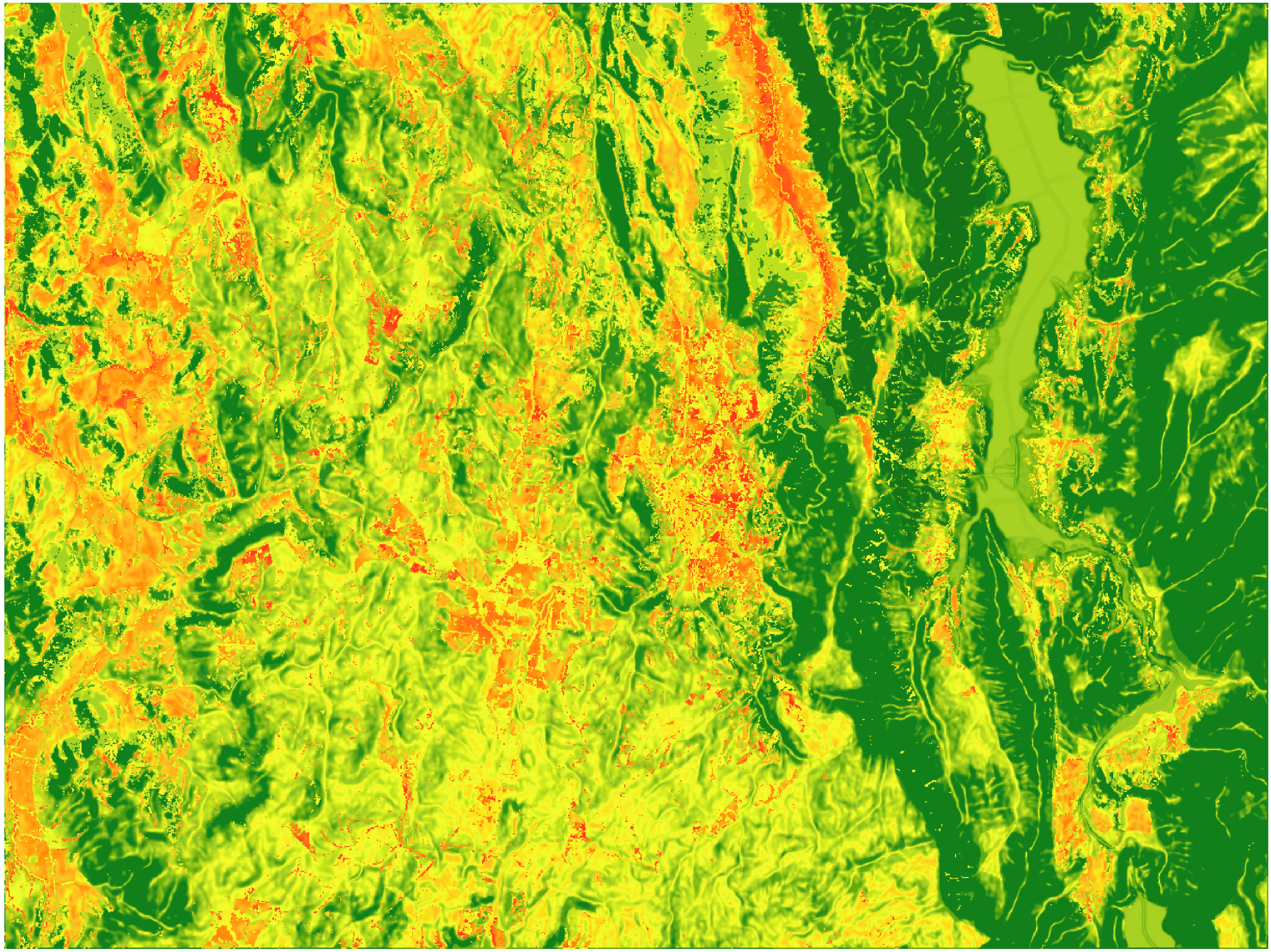
Agricultural



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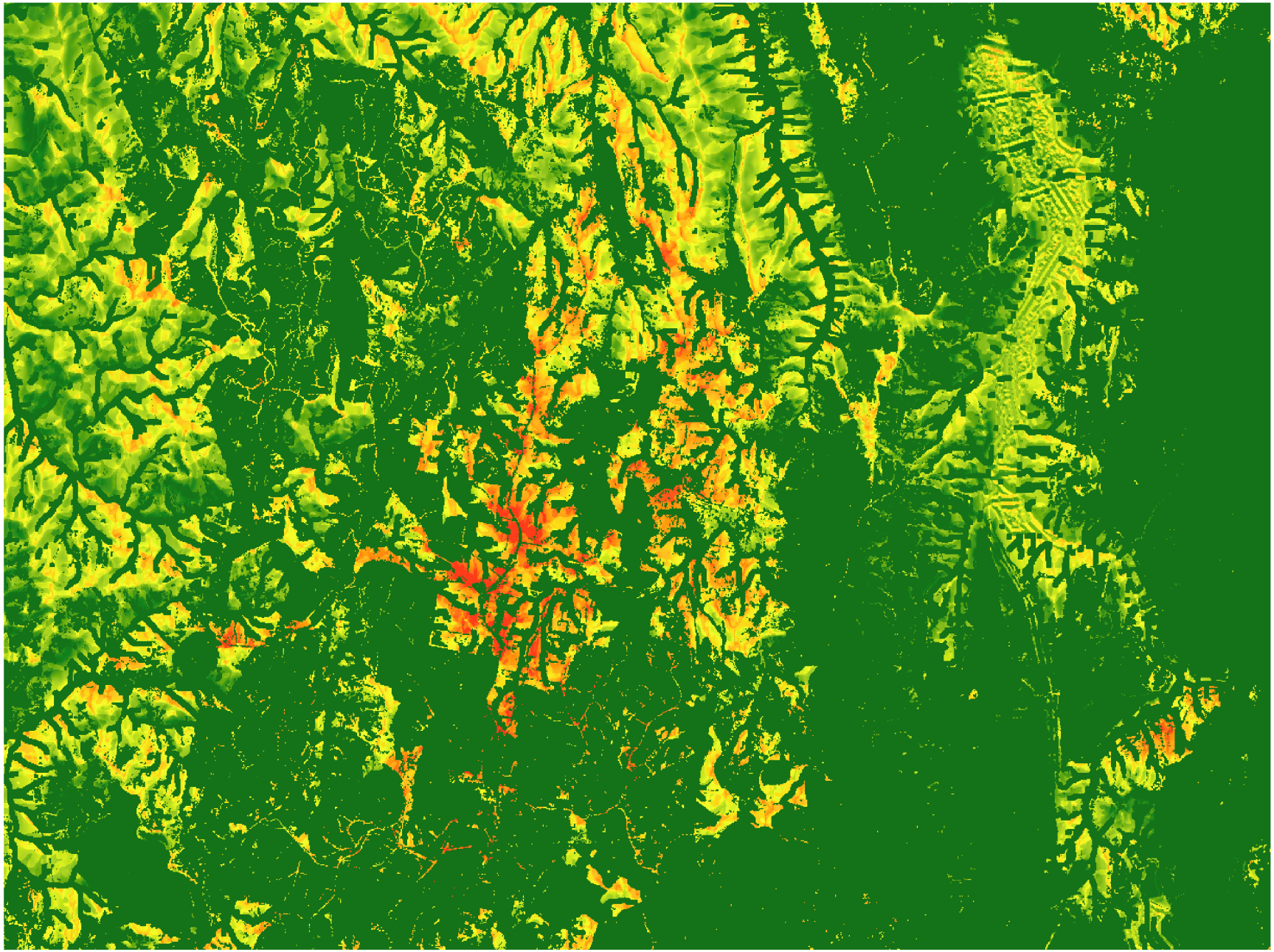
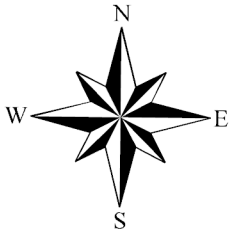
Building





3 1.5 0 3 6 9 12

Kilometers

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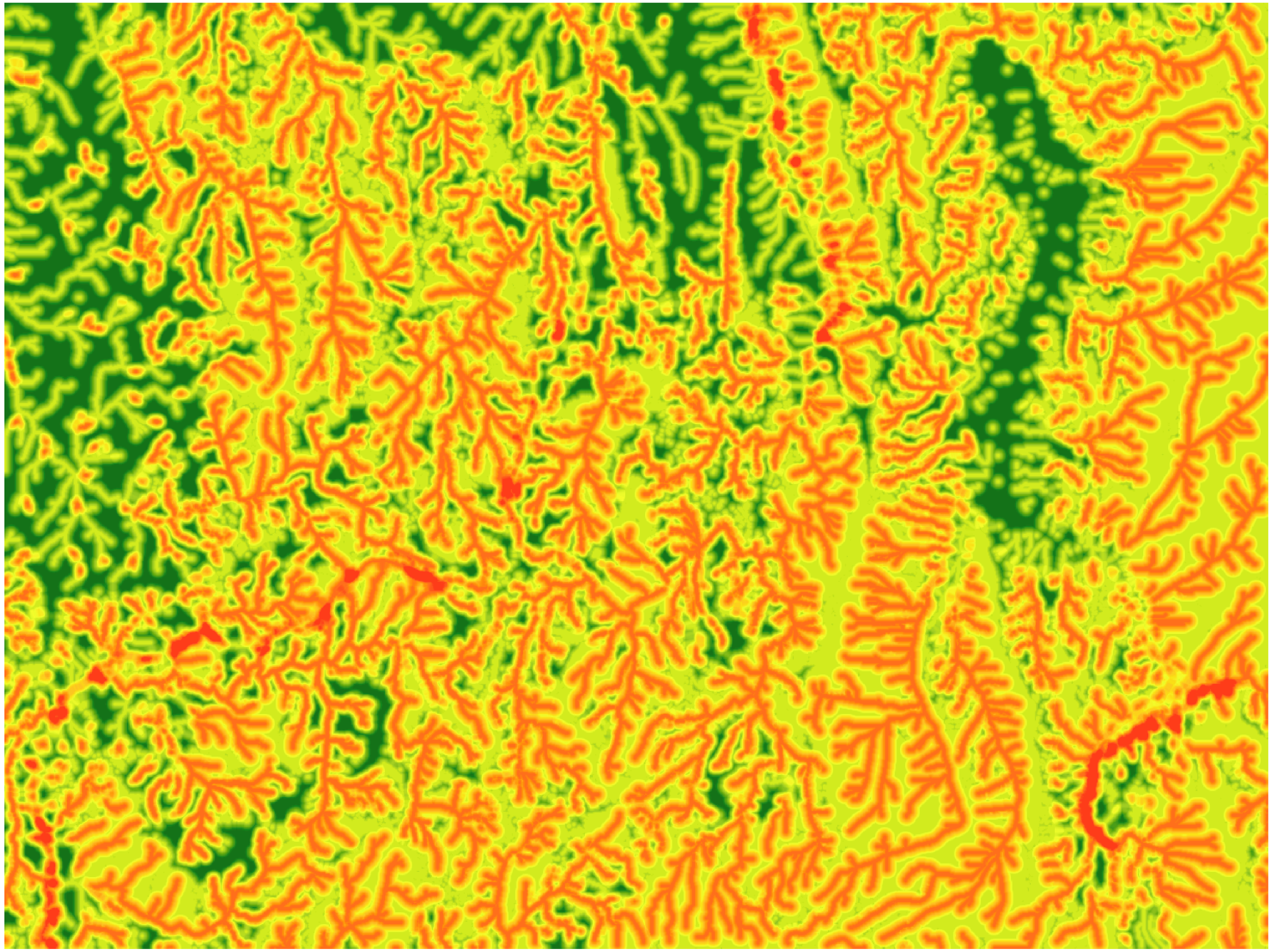
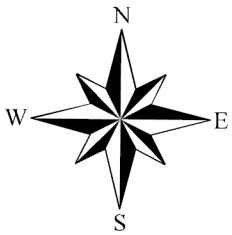
Conservation





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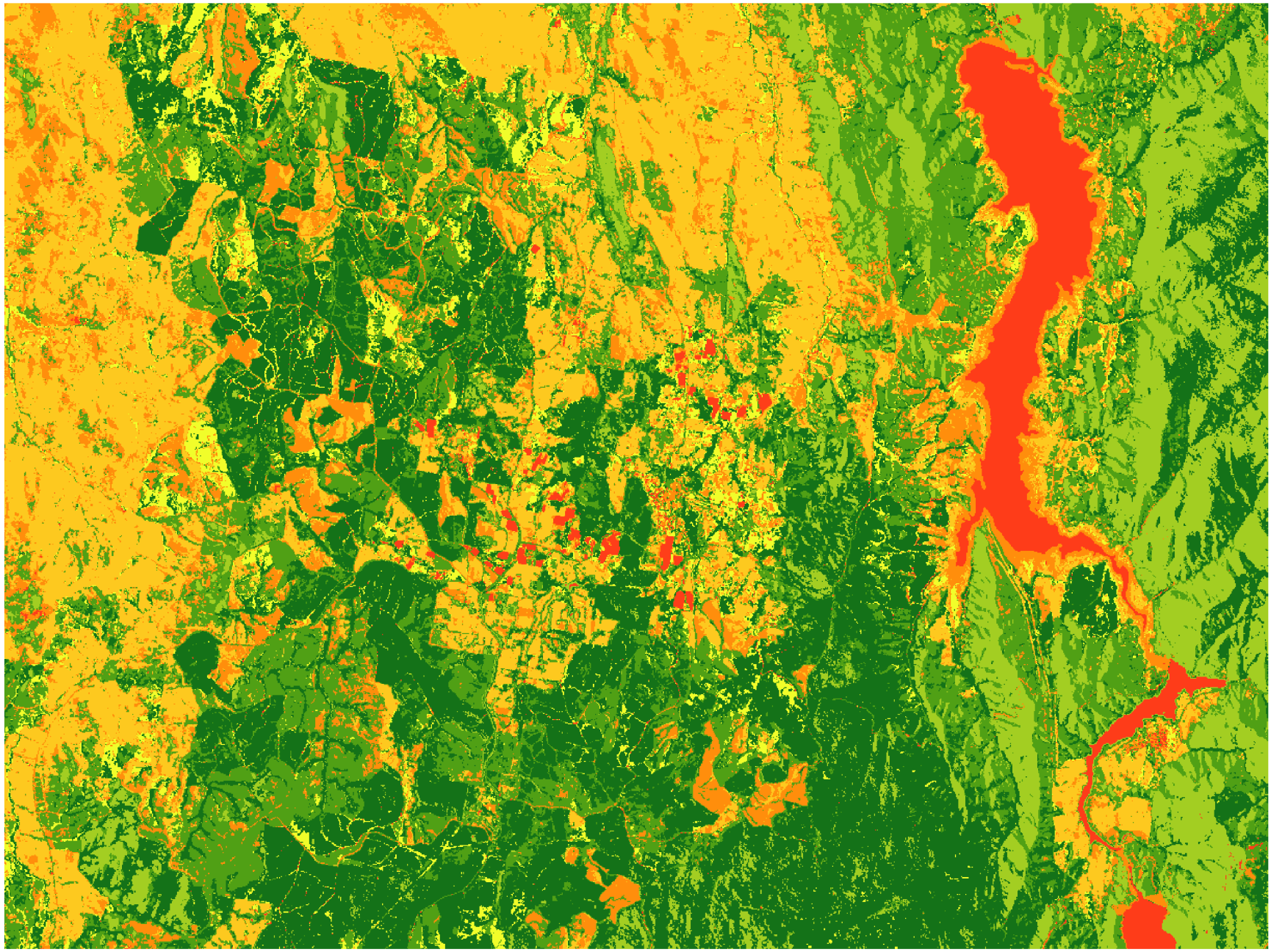
Forestry



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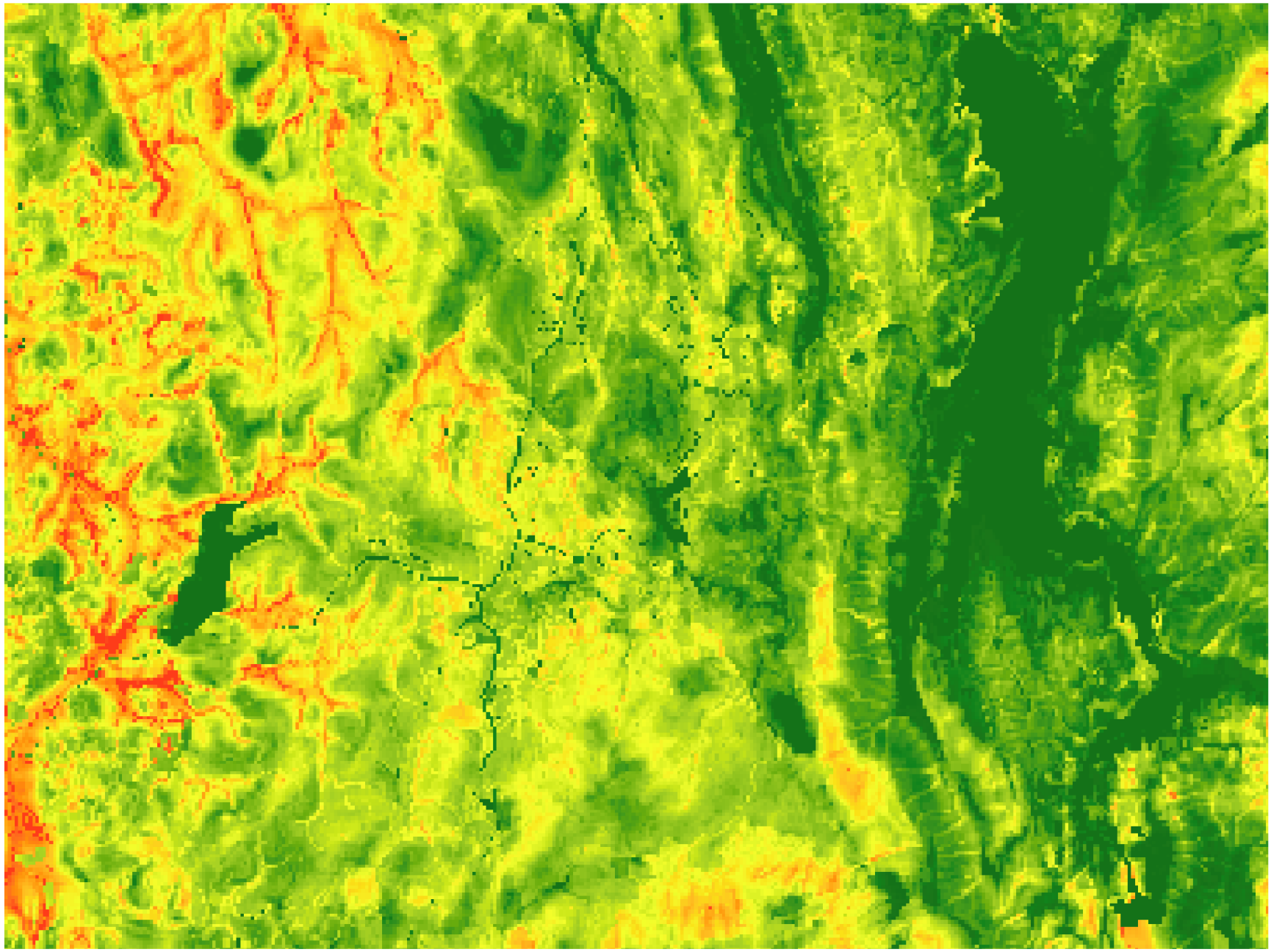
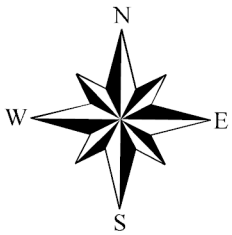
Indigenous Heritage





3 1.5 0 3 6 9 12
Kilometers

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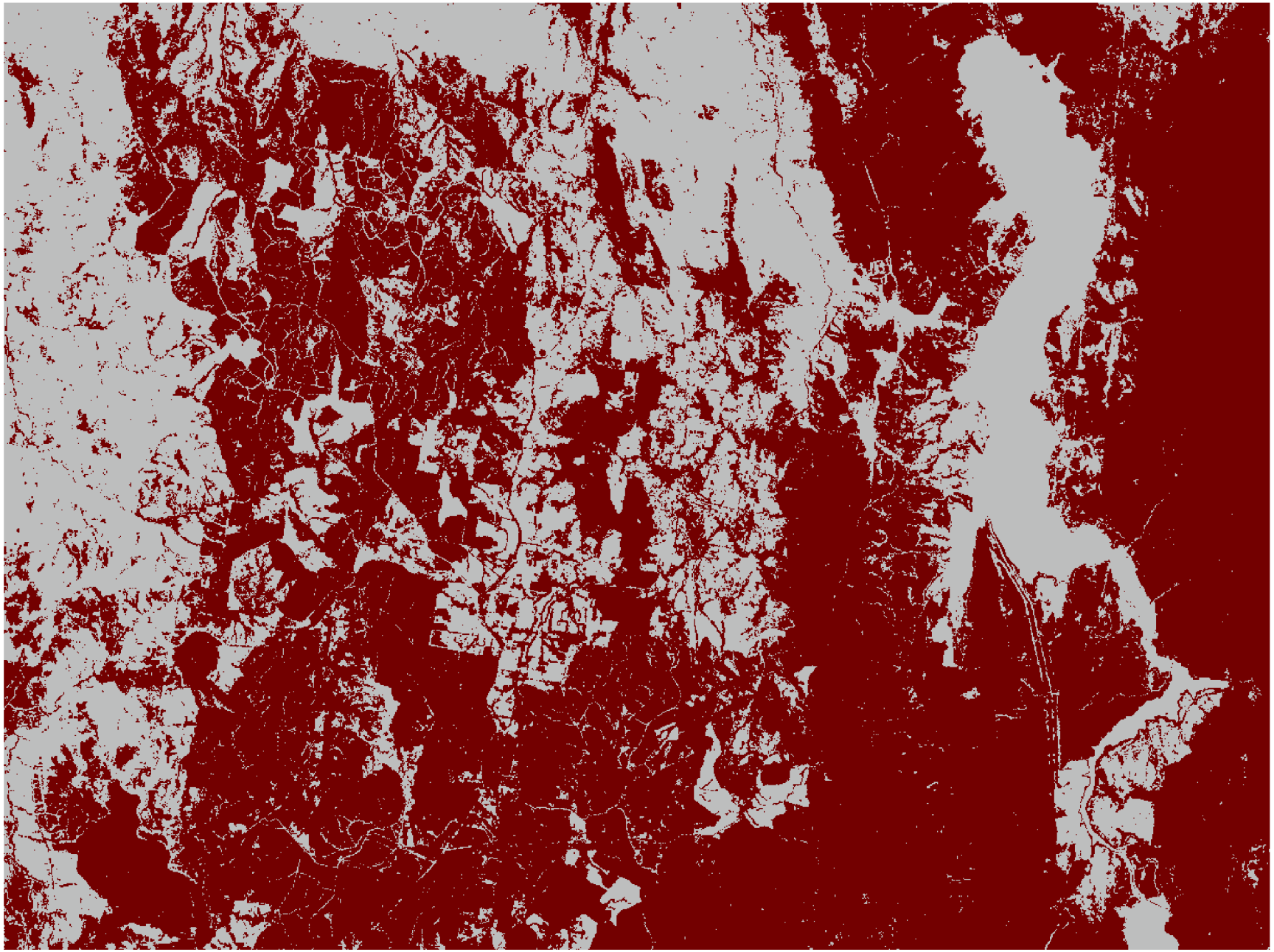
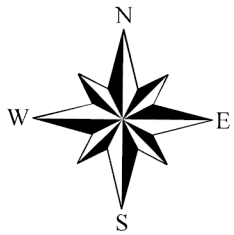
Fire Constraint





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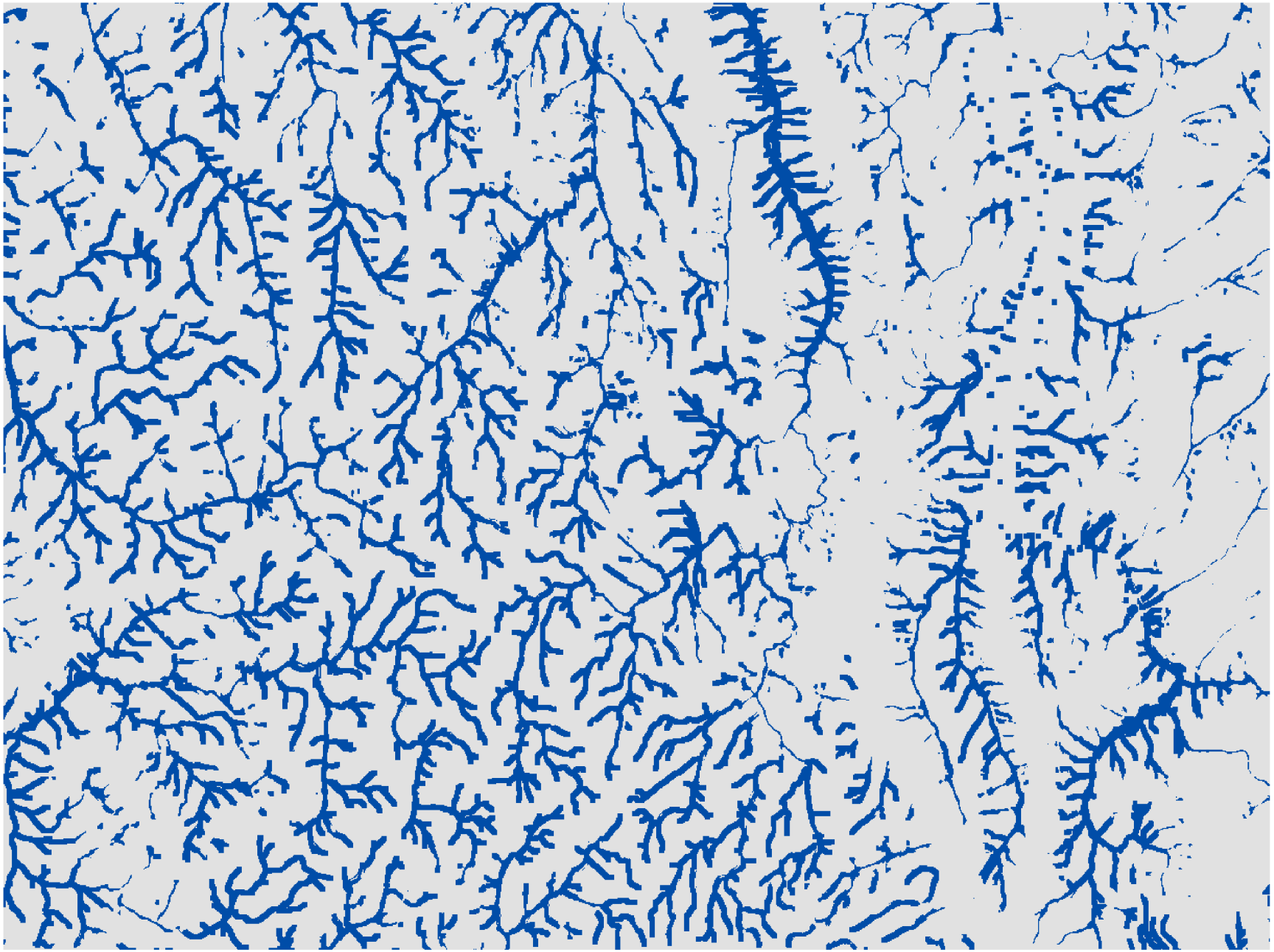
Flood Constraint



floodrisk_4

Value

Flood risk

No flood risk

N

W E

S

3 1.5 0 3 6 9 12

Kilometers

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