



SOUTH AFRICA ECOLOGICAL CONSERVATION

Identifying and Mapping
Riparian Areas in South Africa
with Earth Observations

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California – JPL | Summer 2024



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Image Credit: Kerry Cawse-Nicholson

Introduction to Riparian Zones

Riparian Zones are lands that occur along the edges of rivers, streams, lakes, and other water bodies.

Benefits of these lands include:

Stream bank stabilization

Water filtration

Flood control

Habitat stability

Recreational space



Image Credit: Kerry Cawse-Nicholson

Selected Study Sites

North West Province



Northeast of Cape Town



Study Location: Western Cape and North West Province, South Africa

Study Period: Jan 2023 – Dec 2023

Objectives

INVESTIGATE transitional nature between stream bodies and riparian zones



IDENTIFY riparian areas that are not highlighted in prior map products



ESTABLISH methodology that can be used and applied to other areas in South Africa



Partners

South African National Biodiversity Institute (SANBI)

- Public access to biodiversity data
- Advancing policy
- Sharing information and knowledge
- Conserving biodiversity



Biodiversity Study of the Cape (BioSCape)



- Combines remote sensing and field data
- Progress understanding of biodiversity on land and water

Community Concerns

Lack of
cohesive
maps across
the area



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the area



Climate
change



Community Concerns

Lack of
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Climate
change



Conservation
planning

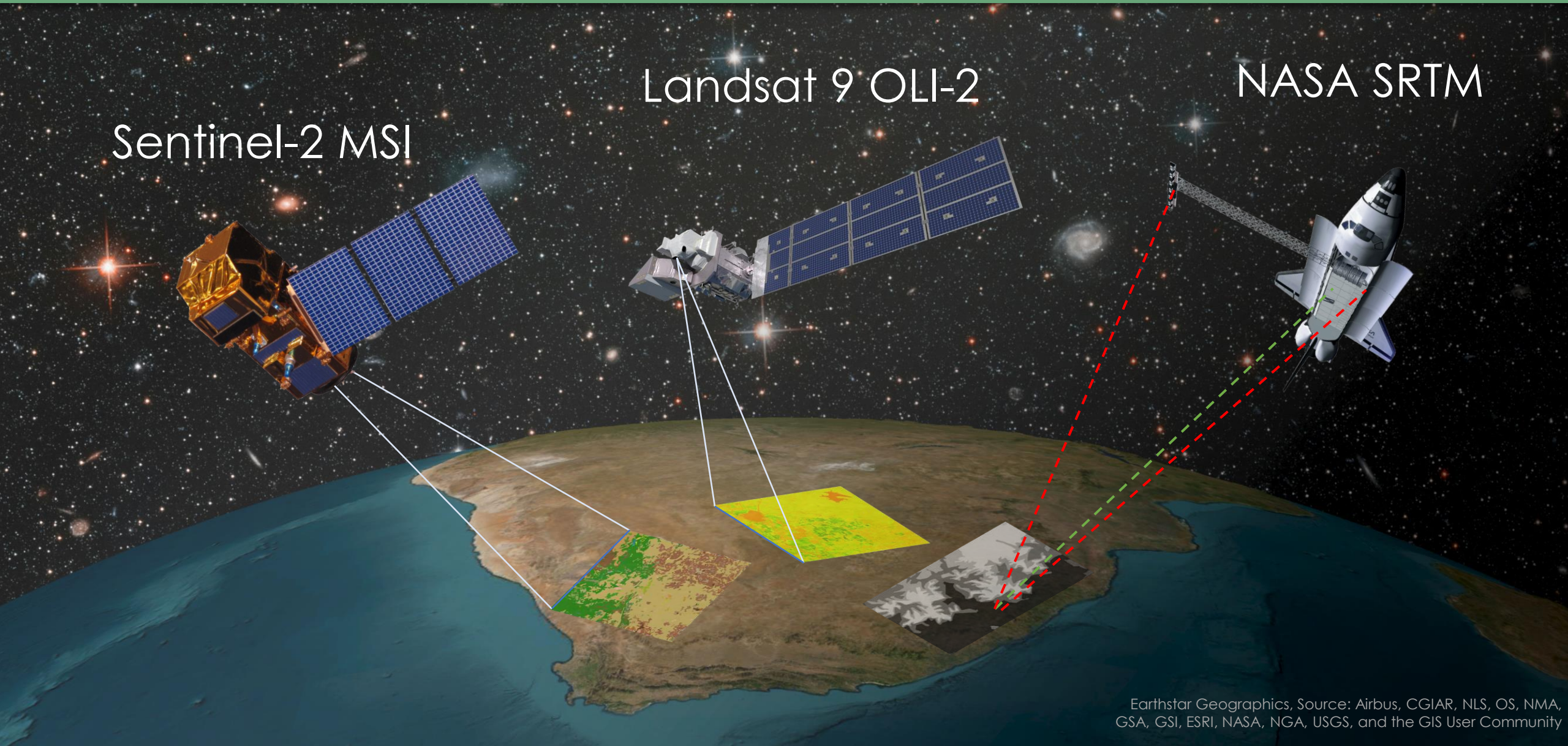


Earth Observations

Sentinel-2 MSI

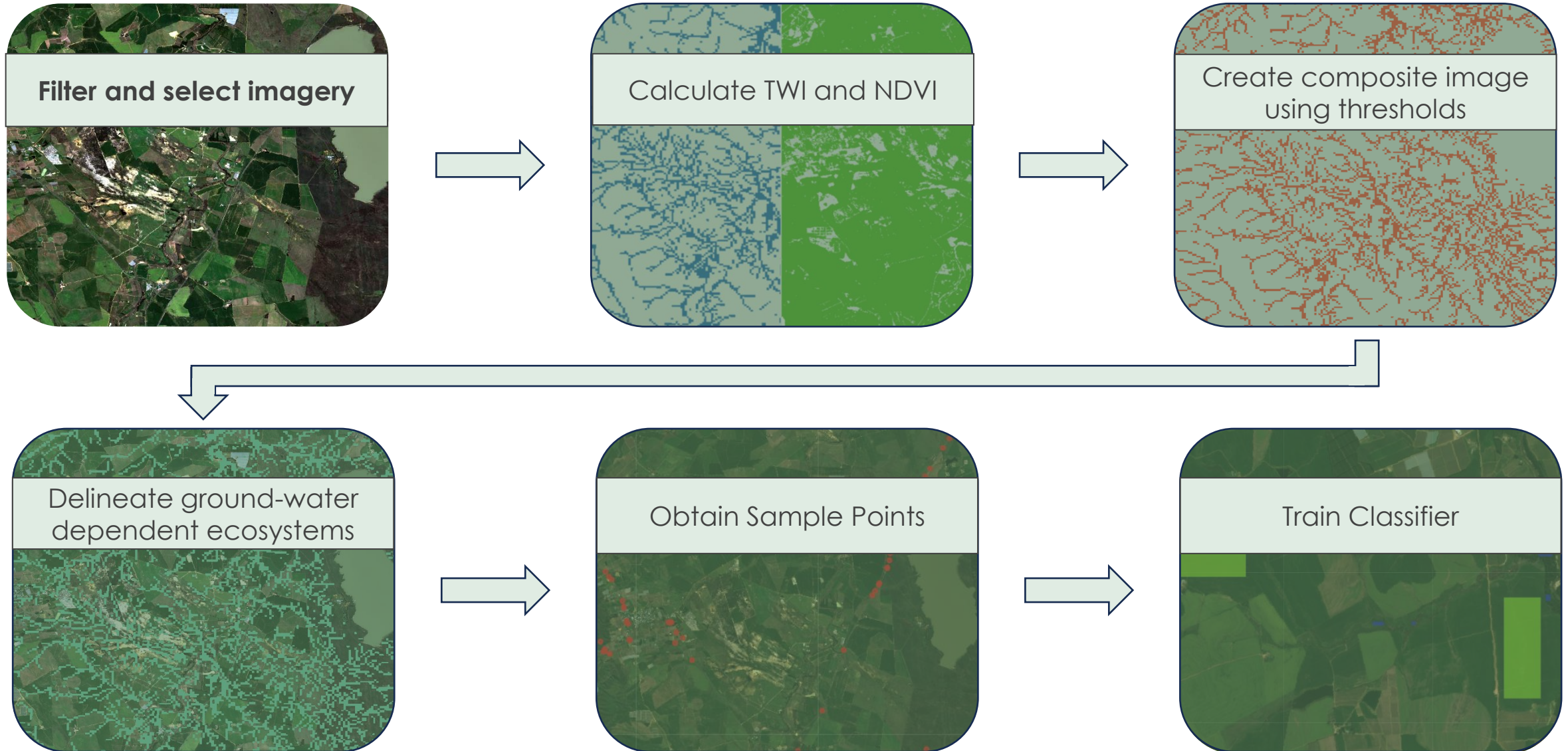
Landsat 9 OLI-2

NASA SRTM

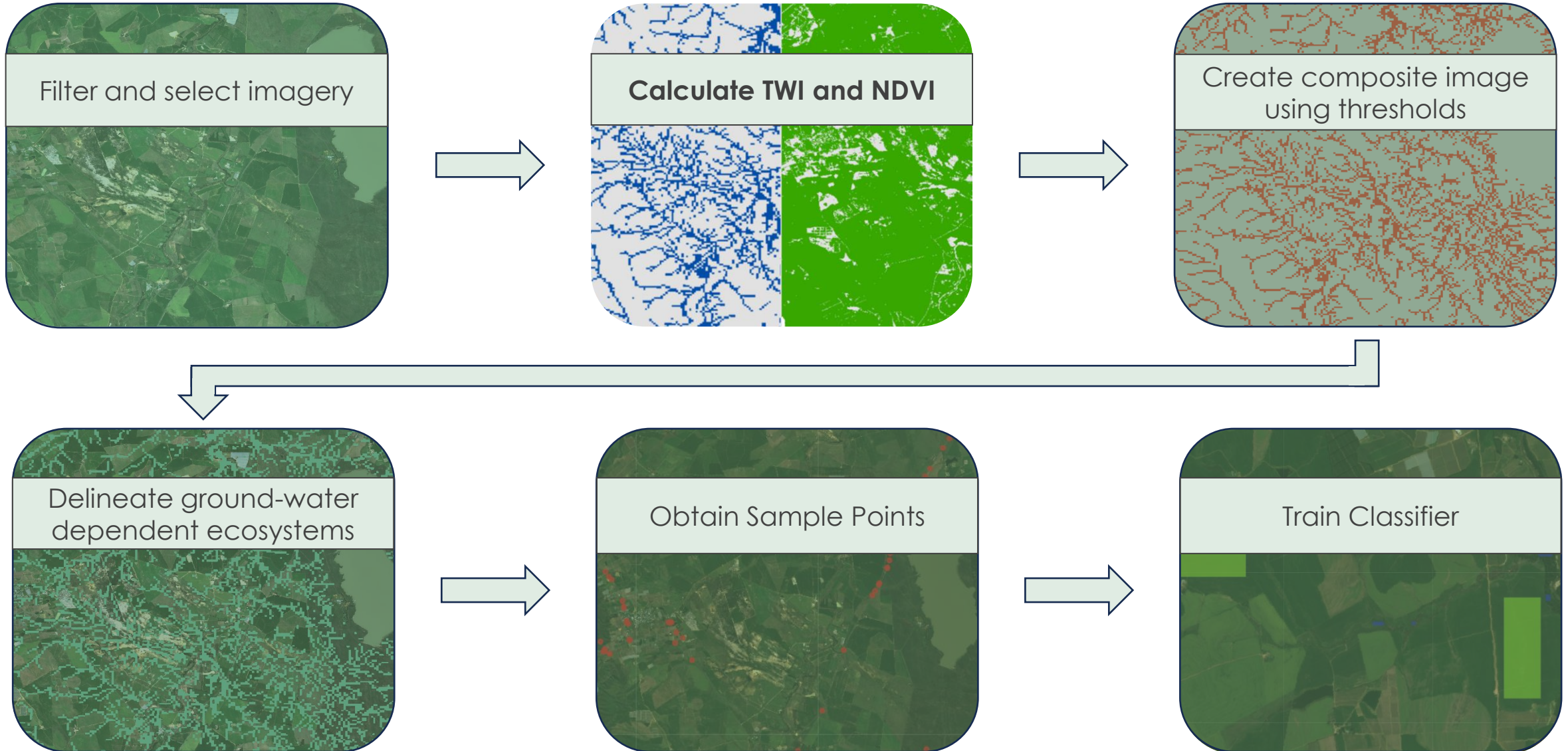


Methodology: Observed Riparian Vegetation

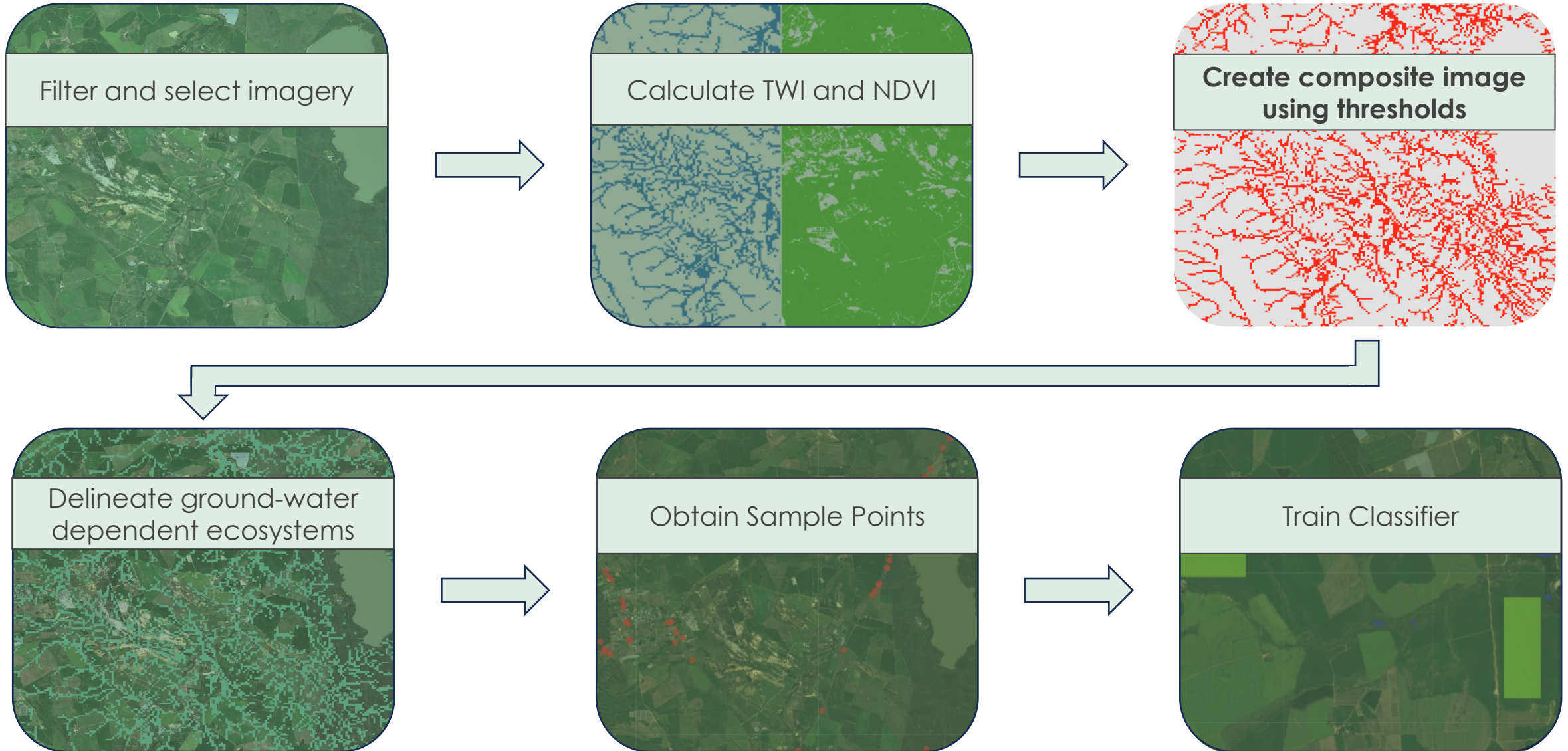
Methodology – Observed Riparian Vegetation



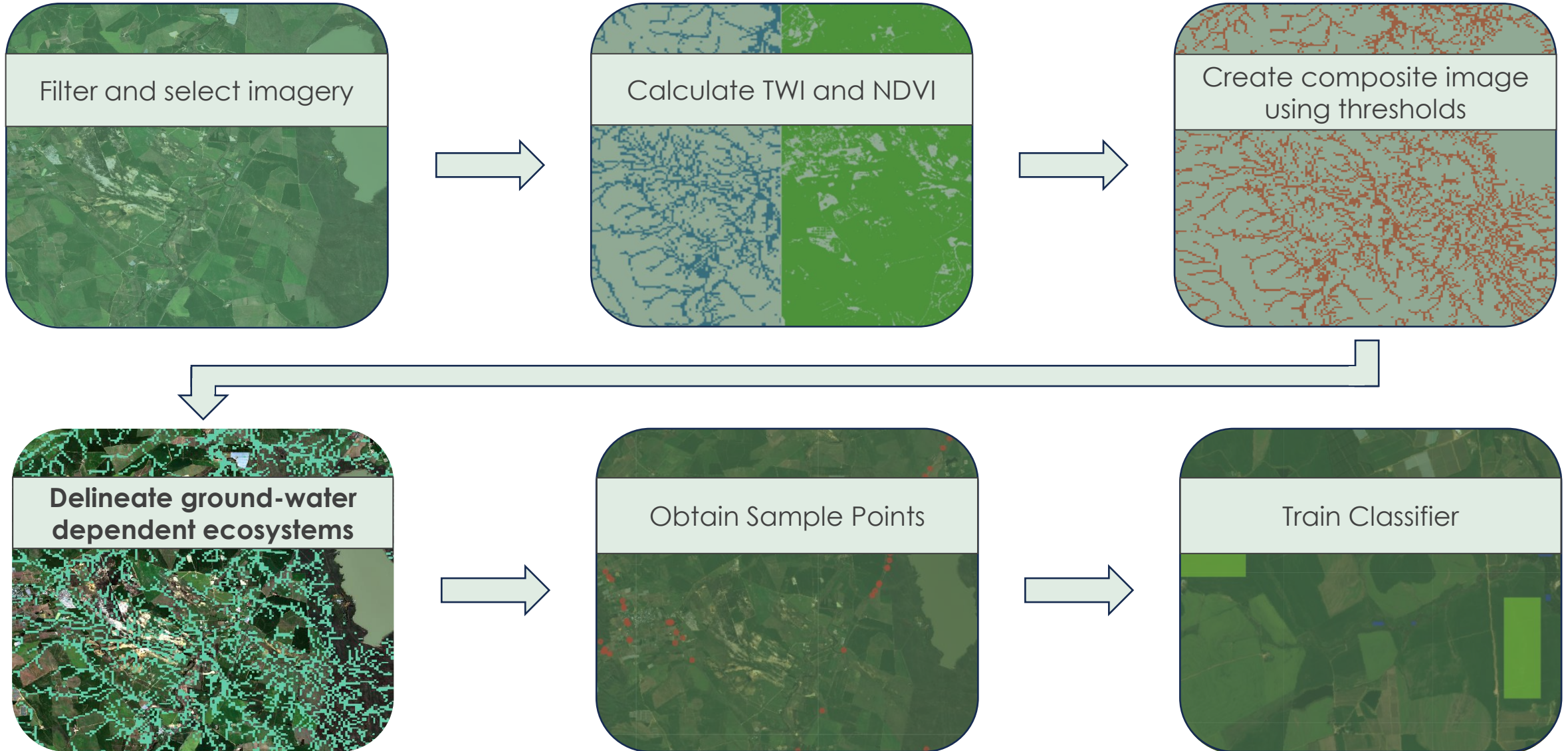
Methodology – Observed Riparian Vegetation



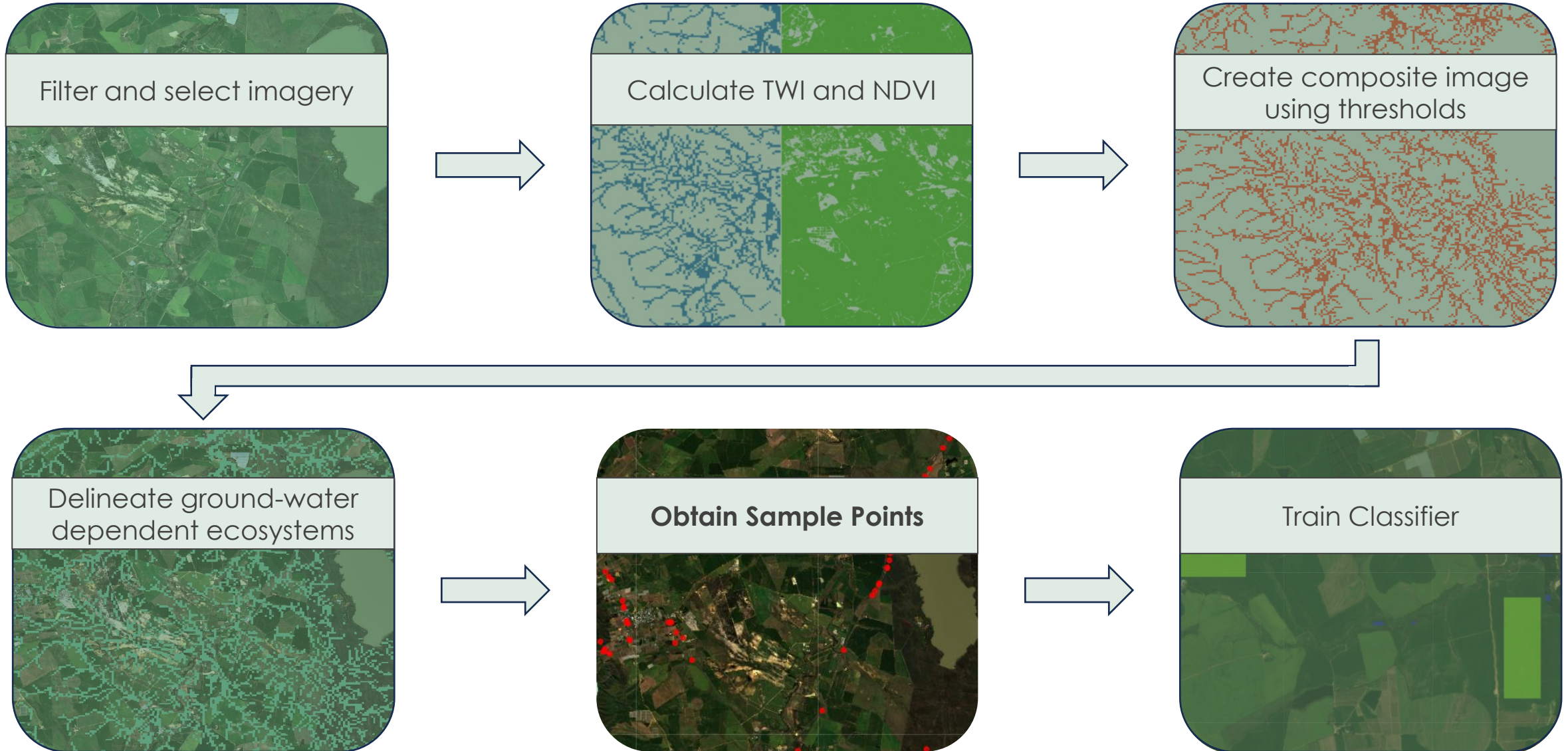
Methodology – Observed Riparian Vegetation



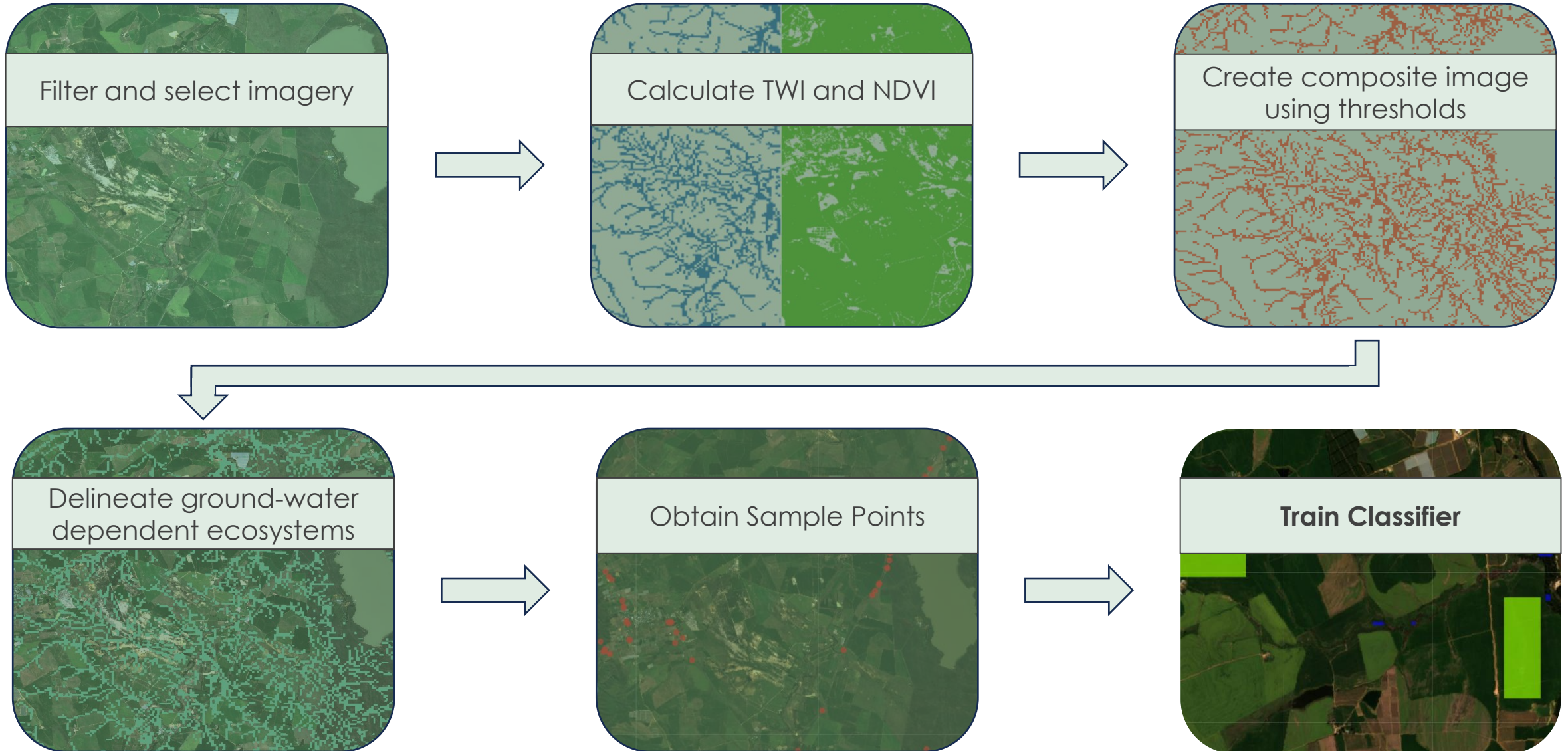
Methodology – Observed Riparian Vegetation



Methodology – Observed Riparian Vegetation

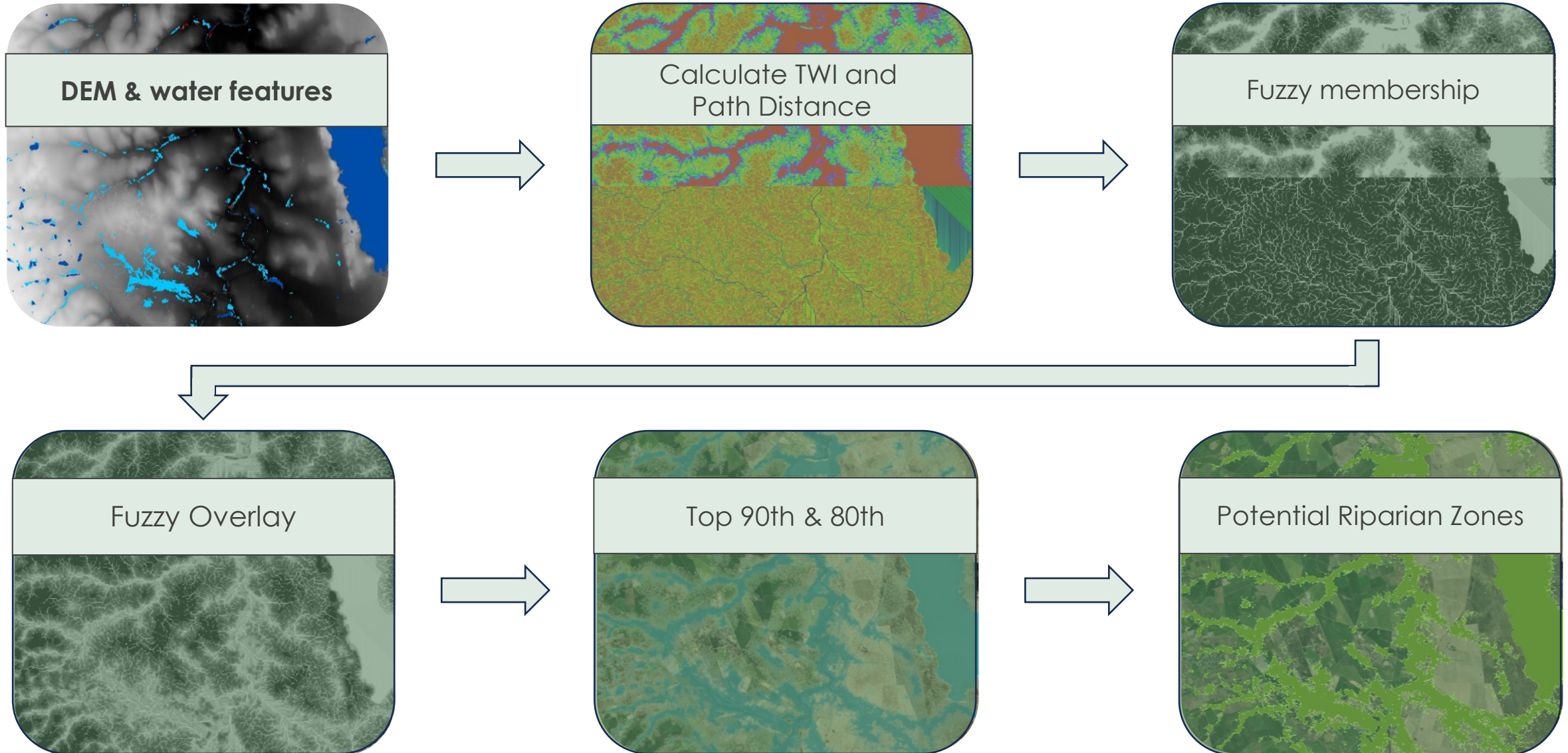


Methodology – Observed Riparian Vegetation

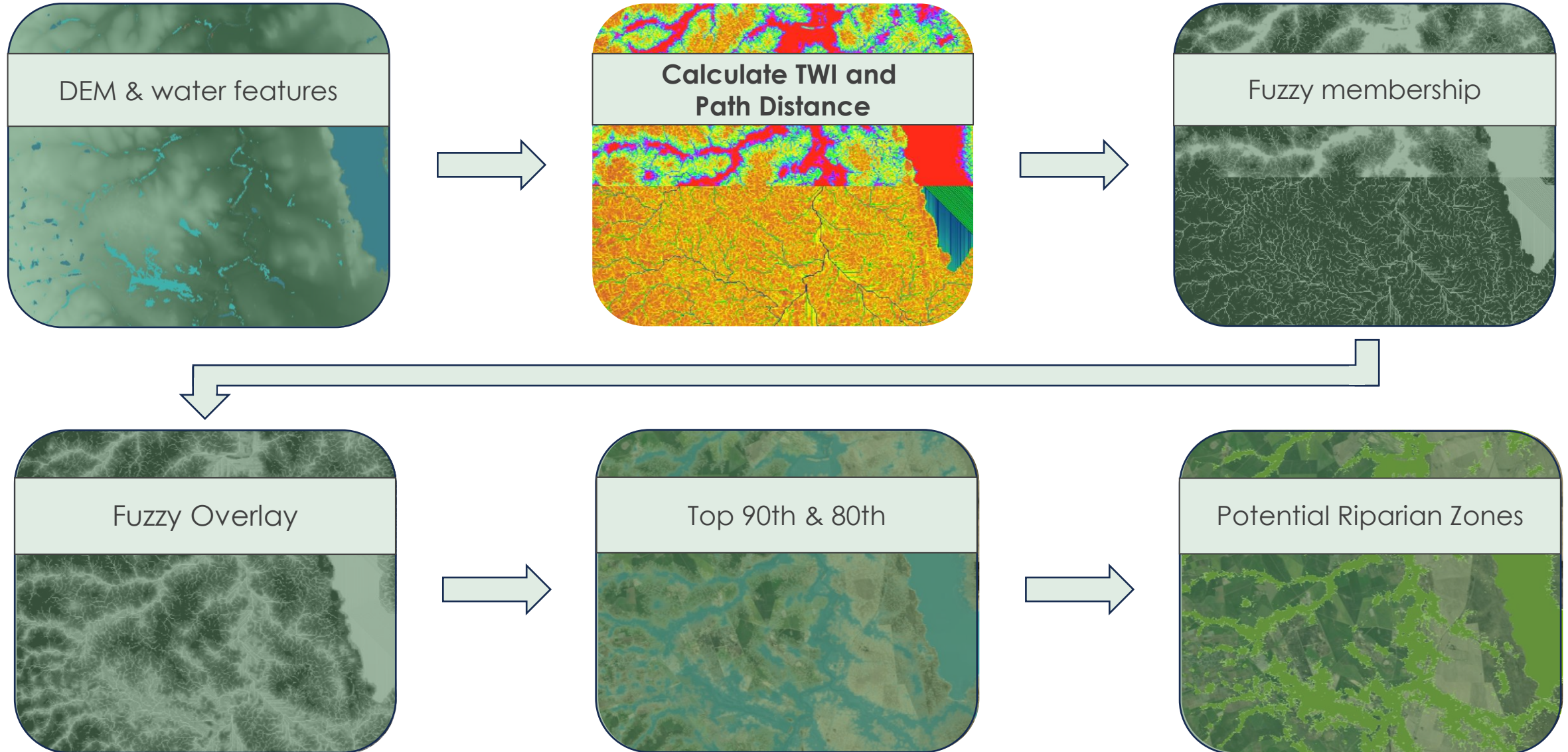


Methodology: Potential Riparian Vegetation

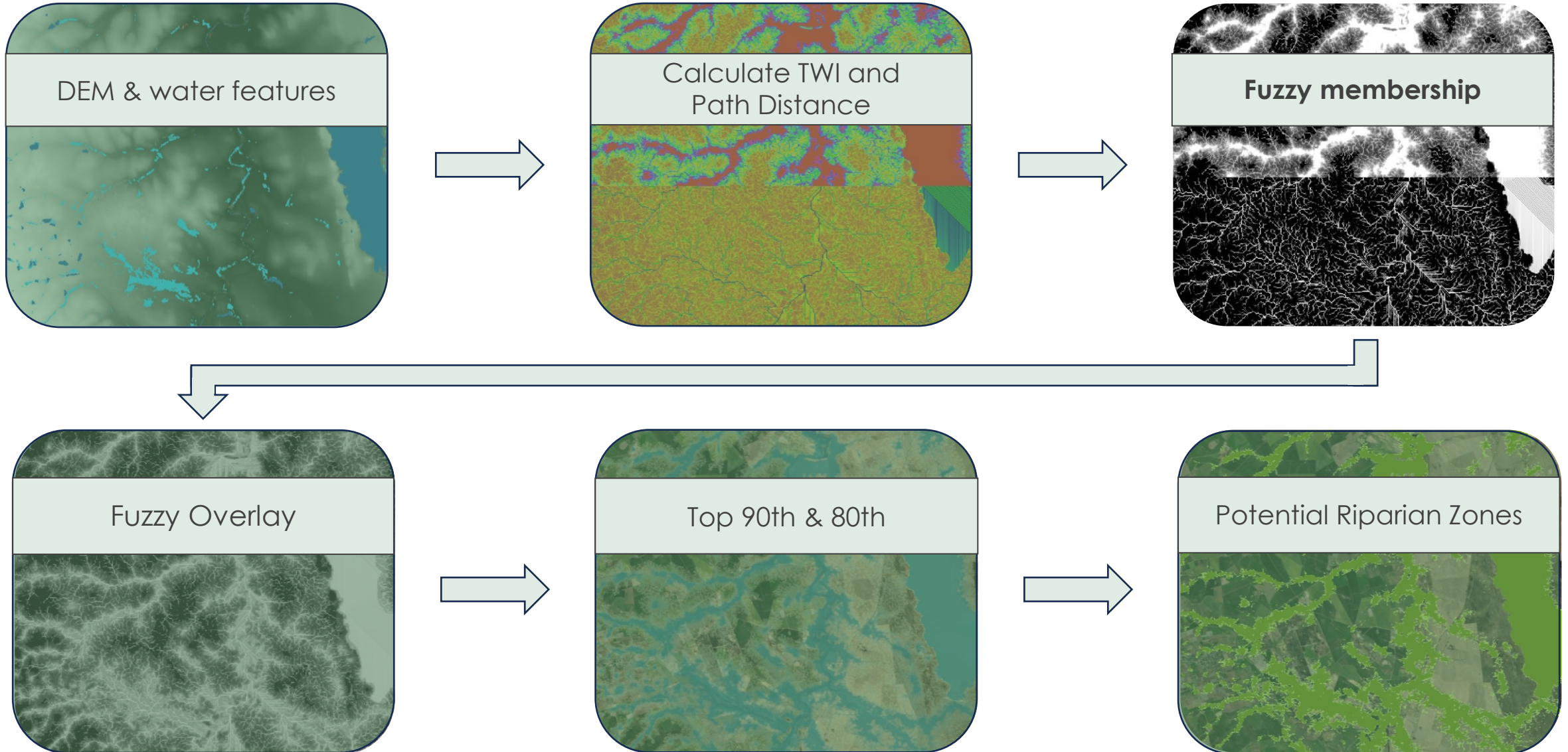
Methodology – Potential Riparian Vegetation



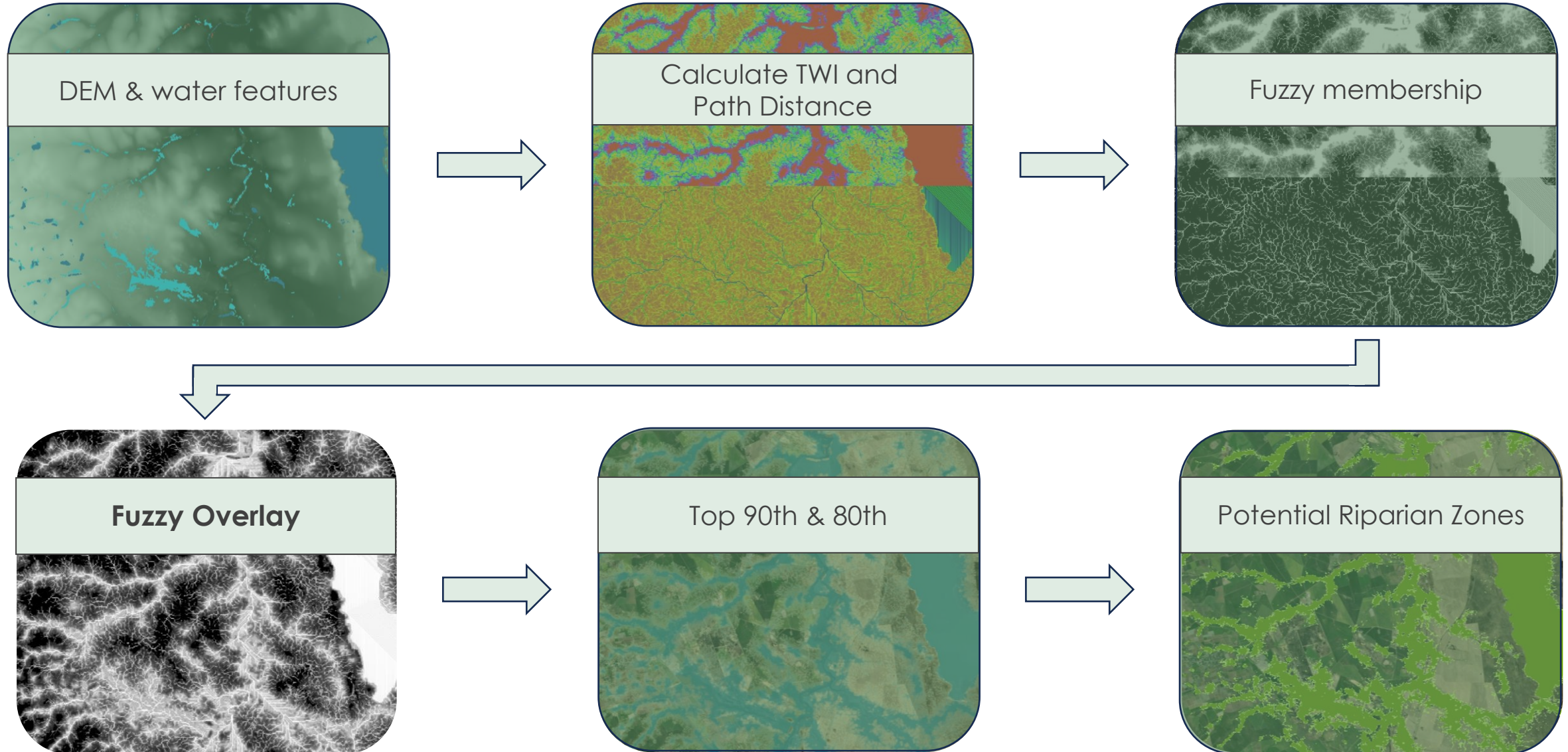
Methodology – Potential Riparian Vegetation



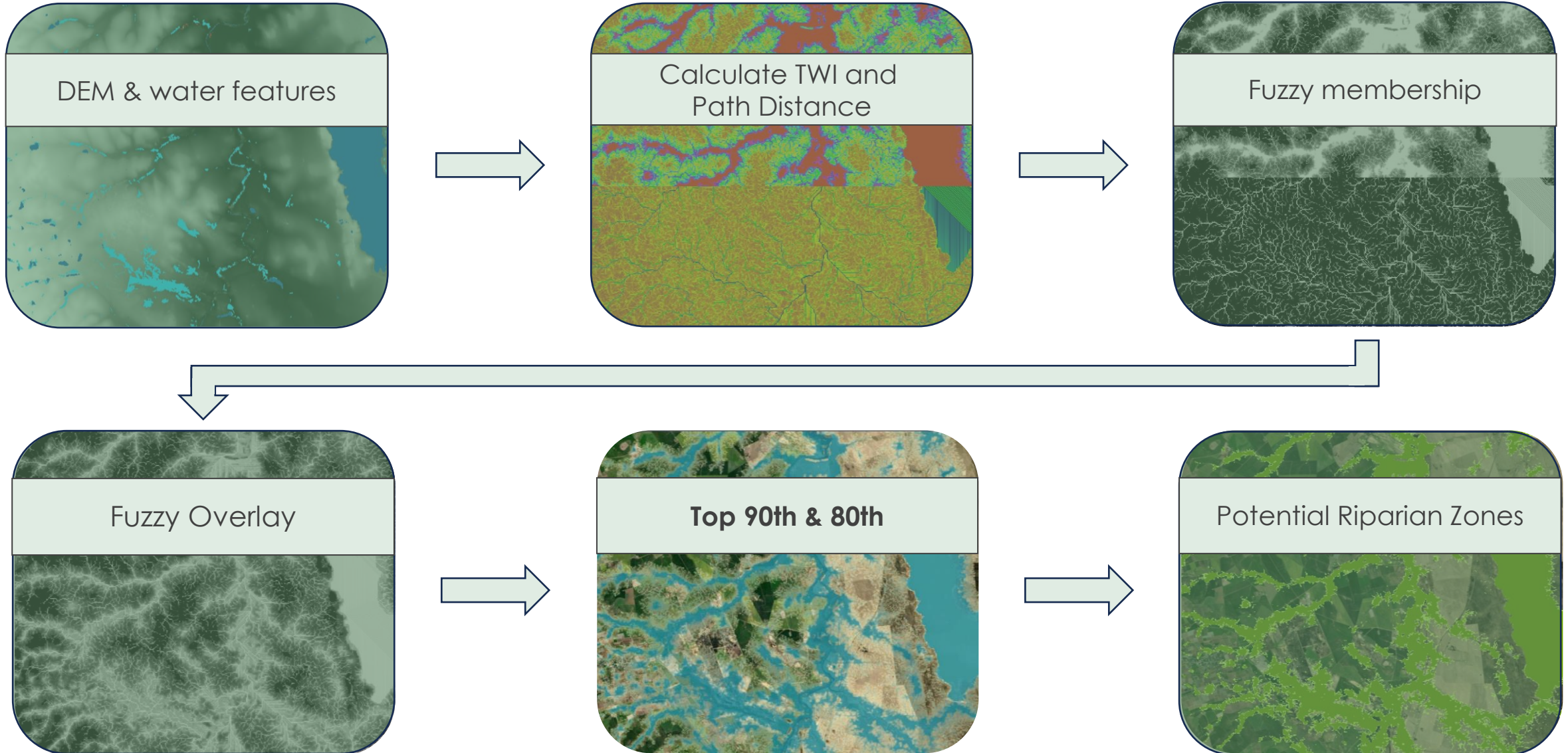
Methodology – Potential Riparian Vegetation



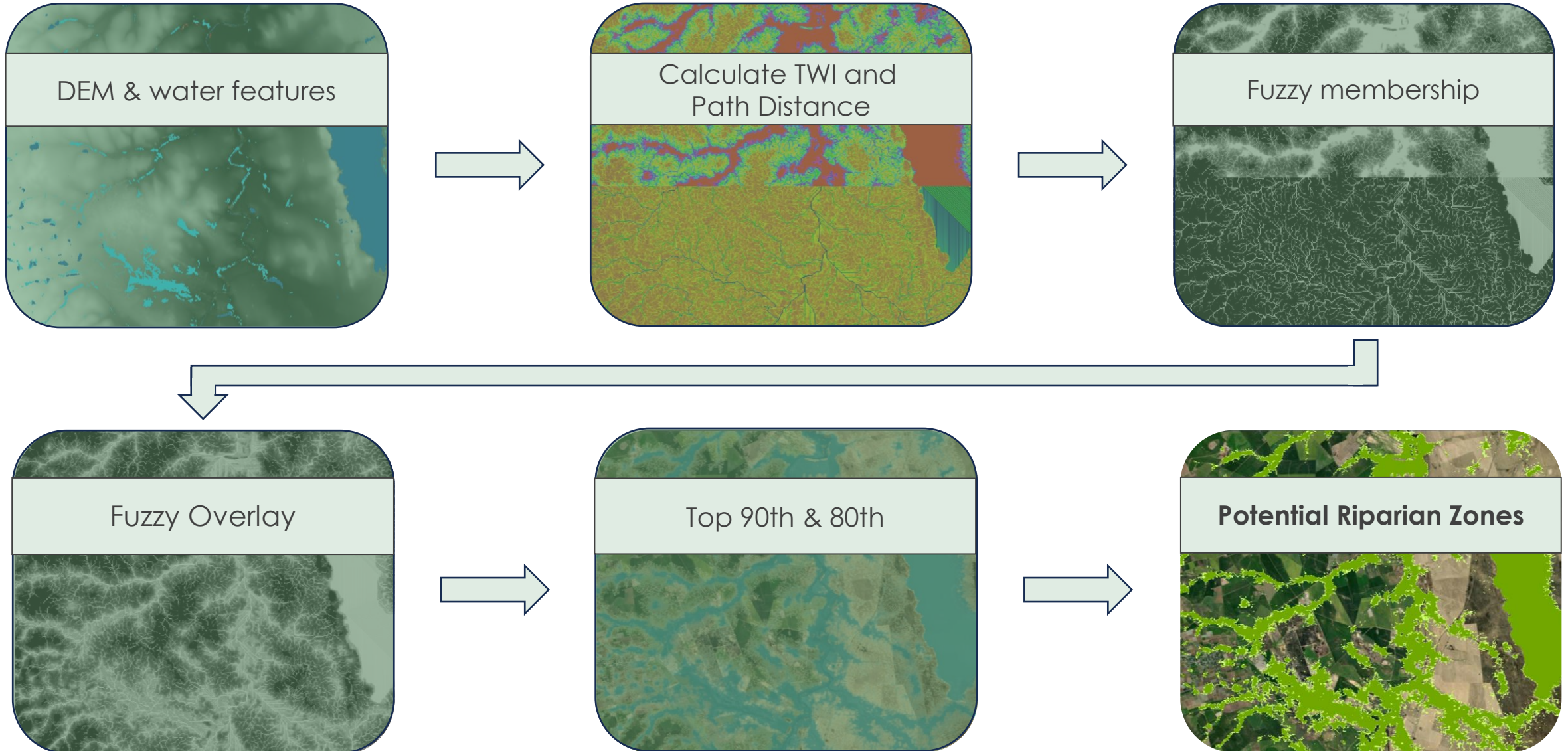
Methodology – Potential Riparian Vegetation



Methodology – Potential Riparian Vegetation



Methodology – Potential Riparian Vegetation



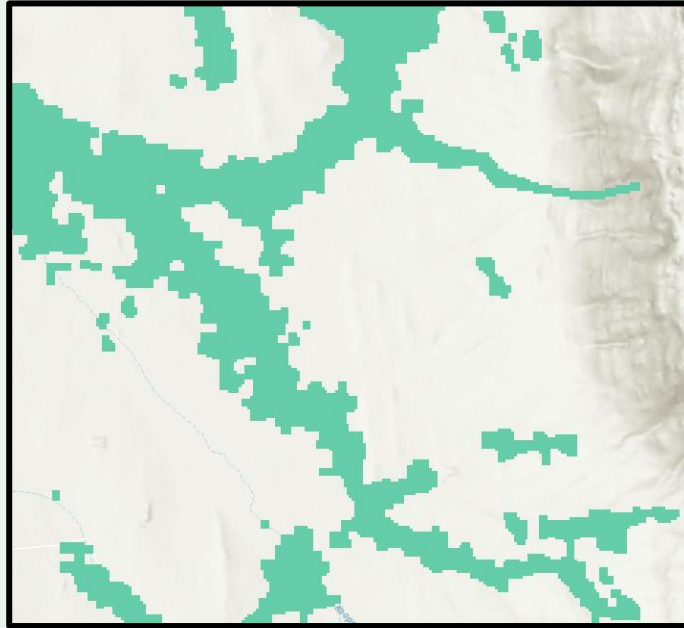
Methodology: Actual Riparian Vegetation

Methodology – Actual Riparian Vegetation

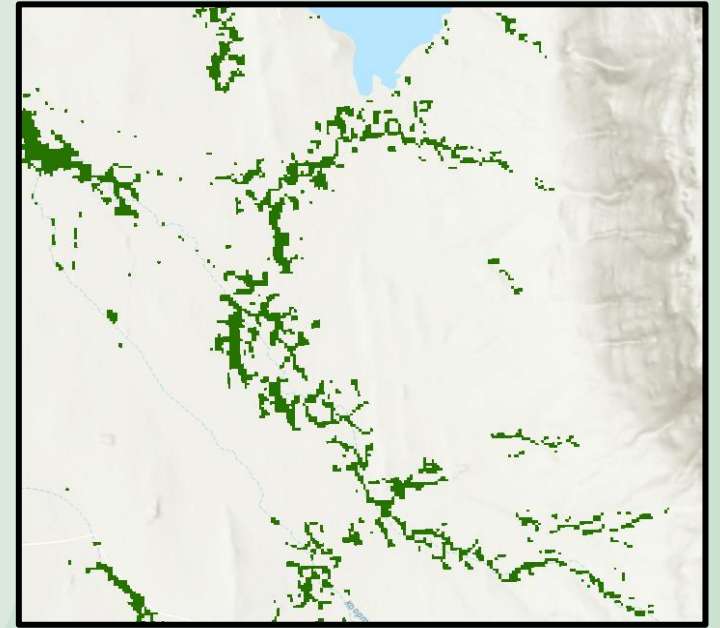
Observed Riparian Zones



Potential Riparian Zones



Actual Riparian Vegetation



+

=

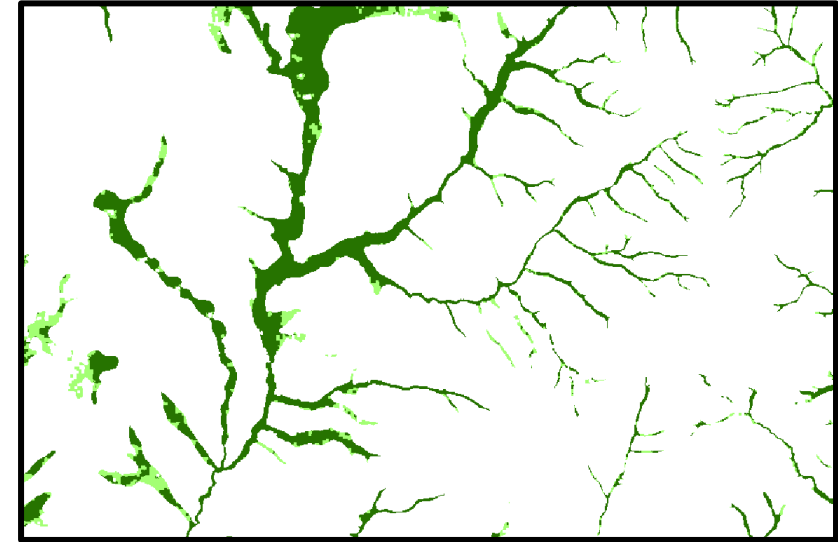
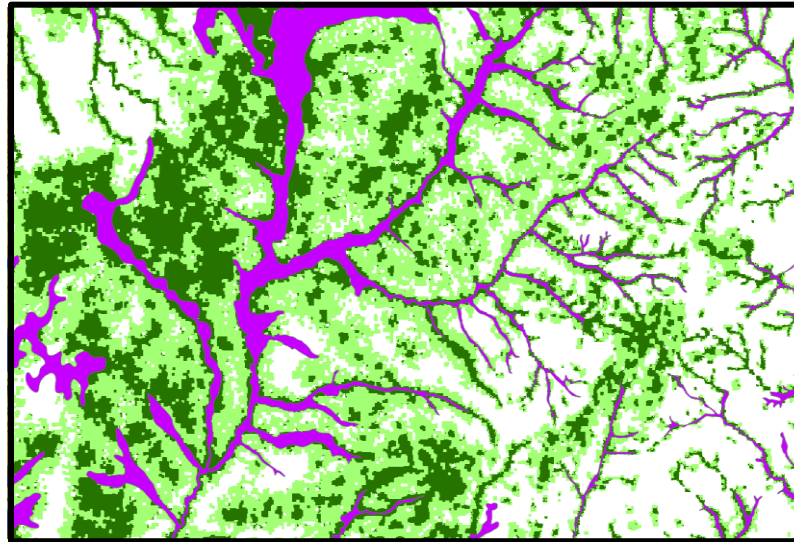
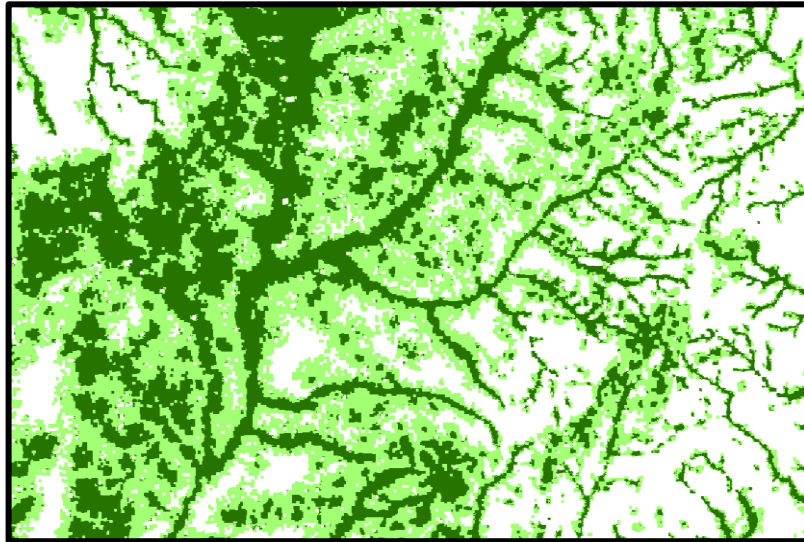
2KM


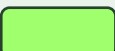
Results: Potential Riparian Zones (PRZ)

*40% of pixels high confidence
60% of pixels moderate confidence*

*Tended to overclassify
riparian zones**

*75% agreement when
compared to reference
riparian zone data*



 High Confidence PRZ >90
 Moderate Confidence PRZ >80

25KM

 Reference Riparian Zones

**Based on the assumption that
Reference Riparian Zones are correct*

Results: Actual Riparian Vegetation

- **141,967 Hectares of Riparian Vegetation in Study Sites**
- **High correlation with forested areas and agricultural zones**



Actual (Mapped)
Riparian Zones



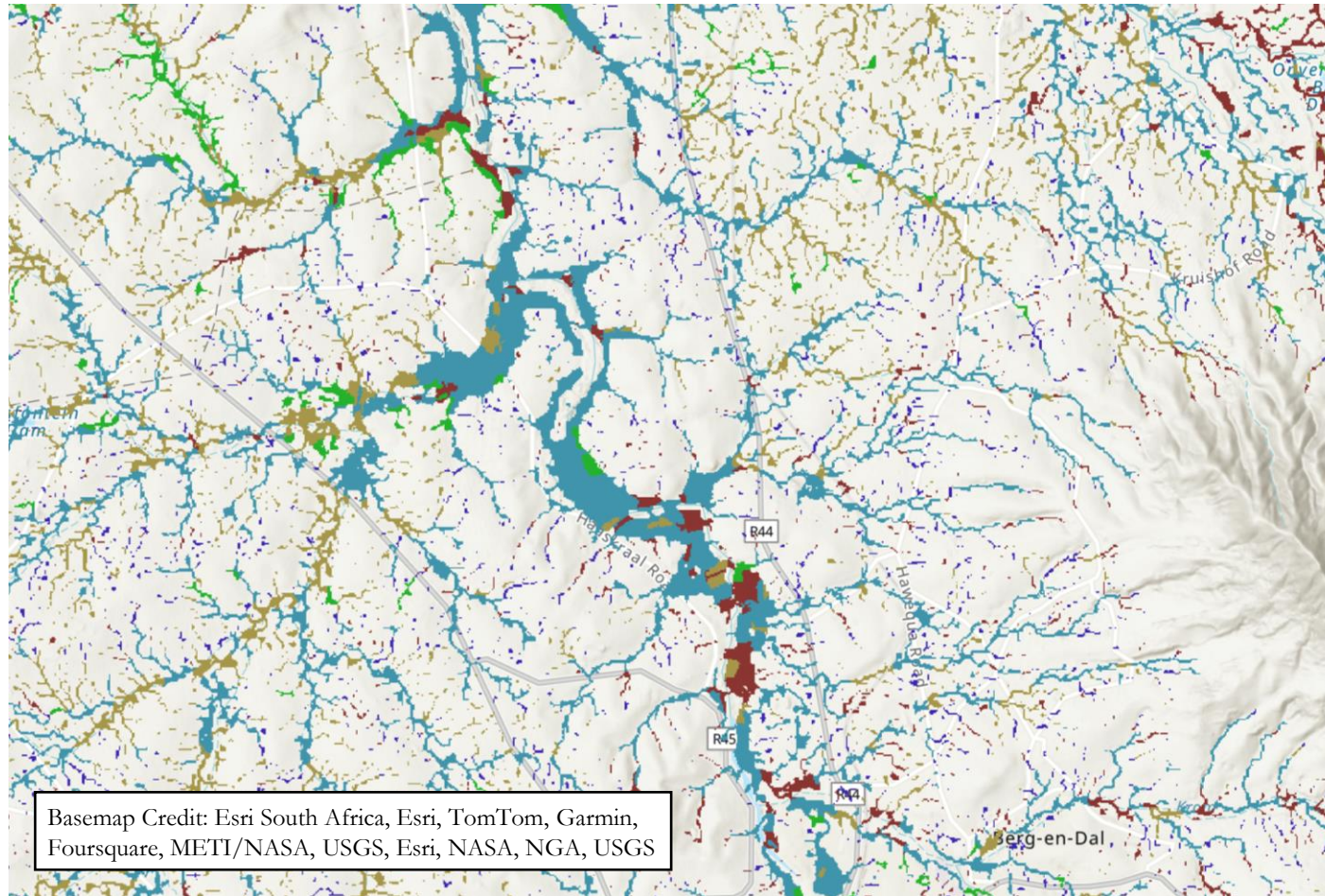
Results: Riparian Vegetation Classification

Overall Accuracy 97.3%

| | Riparian 1 | Riparian 2 | Riparian 3 | Riparian 4 | Riparian 5 |
|------------|------------|------------|------------|------------|------------|
| Riparian 1 | 1,006 | 0 | 13 | 3 | 8 |
| Riparian 2 | 0 | 419 | 0 | 3 | 0 |
| Riparian 3 | 19 | 0 | 946 | 7 | 13 |
| Riparian 4 | 3 | 7 | 26 | 991 | 0 |
| Riparian 5 | 14 | 0 | 8 | 0 | 974 |

Confusion Matrix

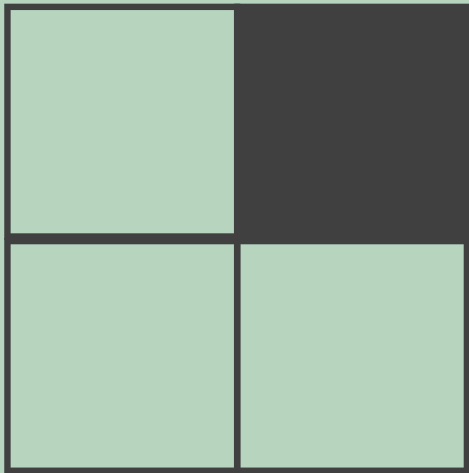
Results: Unsupervised Classification



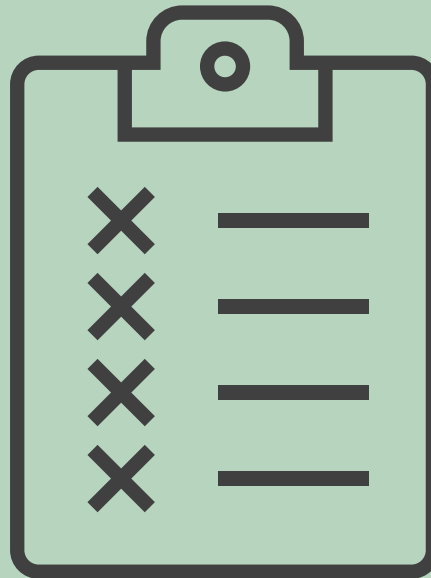
- Riparian 1
- Riparian 2
- Riparian 3
- Riparian 4
- Riparian 5

Errors and Uncertainties

Low spatial
resolution



Lack of validation
and training data



Computational
abilities



Conclusions

Two-pronged approach showed promise in accurate riparian vegetation mapping across South African landscapes



Detected riparian vegetation numbered near 141,000 hectares.



Resulting data will foster science-based decision making in local communities.



Feasibility and Future Work

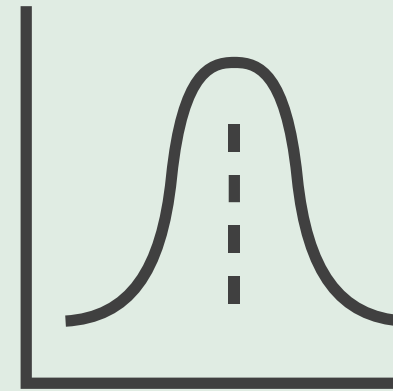
Feasibility for
furthering analysis:

Successful use of open
source data for study
sites of different scales



Future Work should
take note of:

Refining methodology for
larger data sizes



Acknowledgements

Team Members



Mina Nada
(Project Lead)

Madison Elowitt



Katya Beener

Andrew Saah



Advisors

Dr. Kerry Cawse-Nicholson (NASA Jet Propulsion Laboratory, Caltech)
Dr. Arnaud Cerbelaud (NASA Jet Propulsion Laboratory, Caltech)
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Michael Pazmino (NASA DEVELOP – JPL)
Jane Zugarek (NASA DEVELOP – JPL)