



IONA ECOLOGICAL CONSERVATION

Utilizing Earth Observations to
Understand Landscape Patterns
and Assist in Wildlife Management in
Iona National Park, Angola

Emmanuel N. Aklie

Faith Macdonald

Lukka Wolff

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Georgia – Athens | Summer 2024



OUR TEAM



Wei Lun Tay



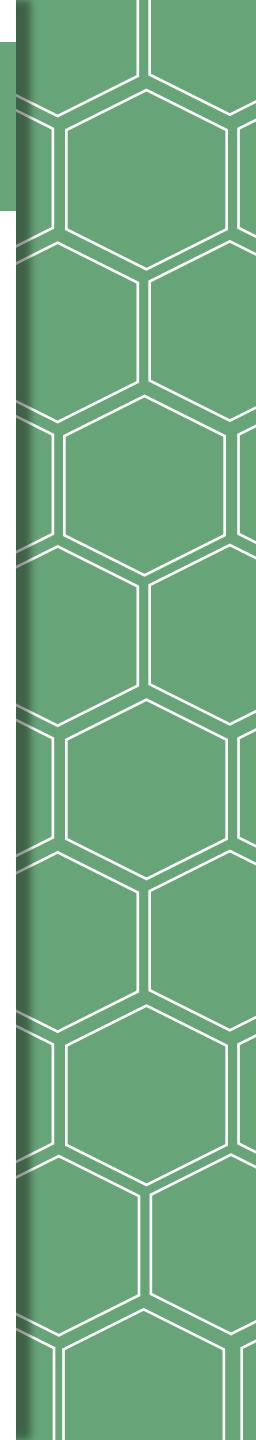
Emmanuel N. Aklie



Faith Macdonald



Lukka Wolff



PARTNERS

African Parks — Iona National Park Management



Daniel van de Vyver
Conservation Manager



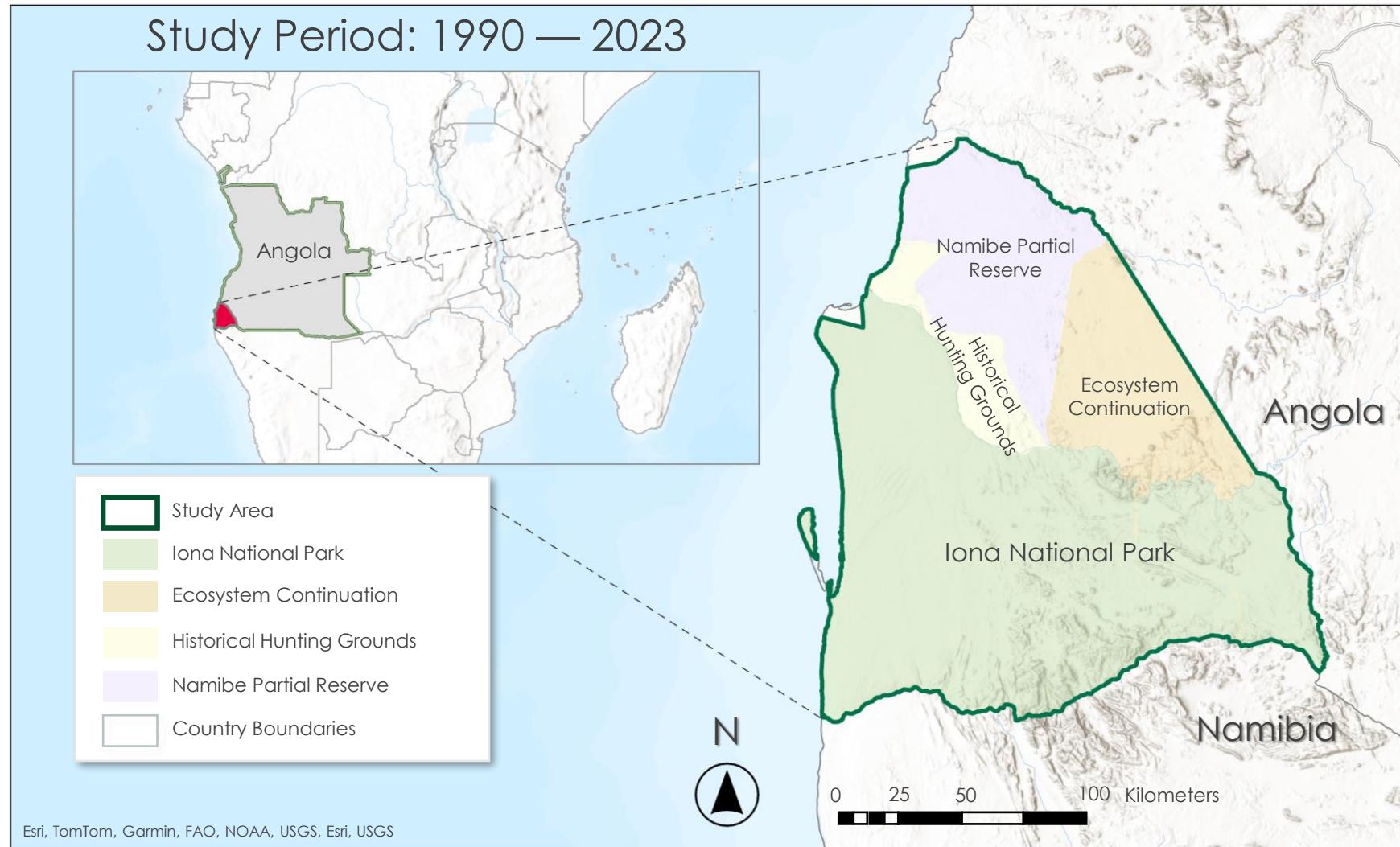
Pedro Monterroso
Park Manager



Priya Tekriwal
Funding and Reporting
Manager

STUDY AREA

Iona National Park, Namibe Preserve, & Associated Areas



COMMUNITY CONCERNS

Increased Human & Livestock Population



COMMUNITY CONCERNS

Drought between 2017 - 2024



COMMUNITY CONCERNS

Species Reintroduction

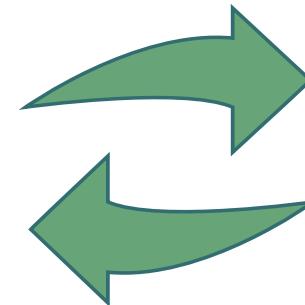


COMMUNITY CONCERNS

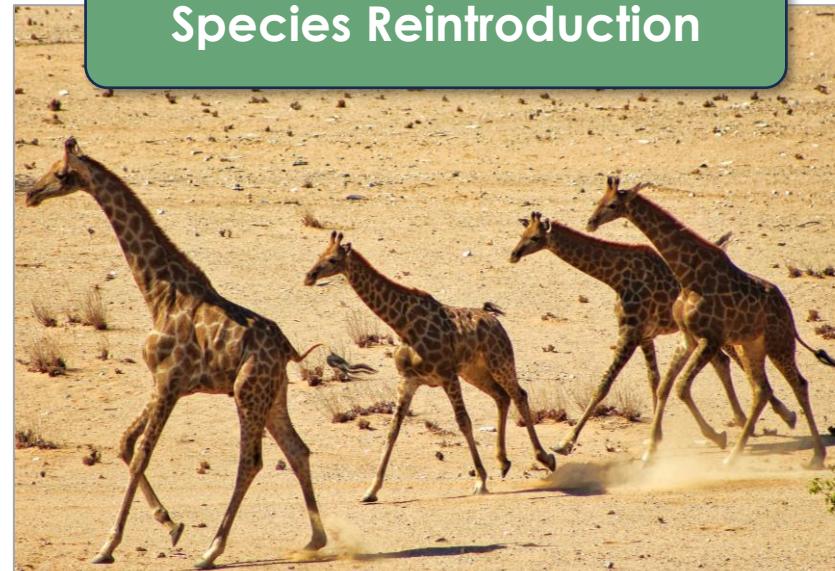
Drought between 2017 - 2024



Increased Human & Livestock Population



Species Reintroduction



OBJECTIVES



Objective 1: Map **Land Use/Land Cover (LULC)** with vegetation details for 2023

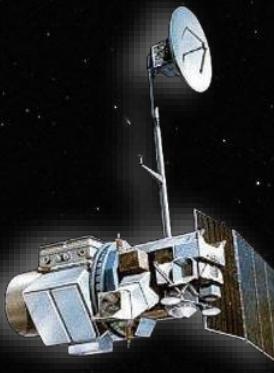


Objective 2: Generate a **time-series of LULC** maps between 1990-2023 that analyzes change overtime

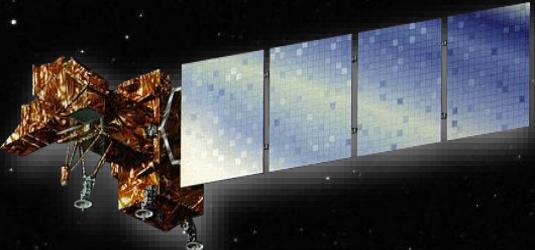


Objective 3: Produce a **short video** highlighting the importance of the project, methods, and results

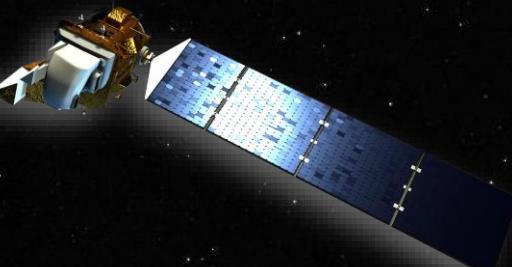
EARTH OBSERVATIONS



Landsat 5 TM



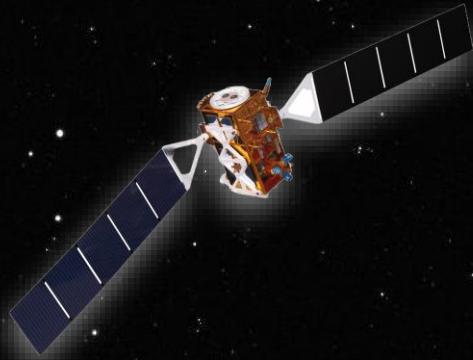
Landsat 7 ETM+



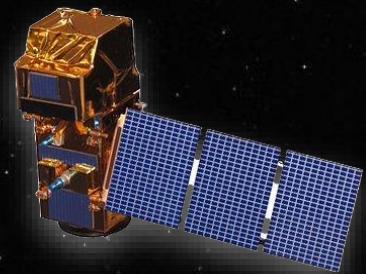
Landsat 8 OLI



Endeavour SRTM



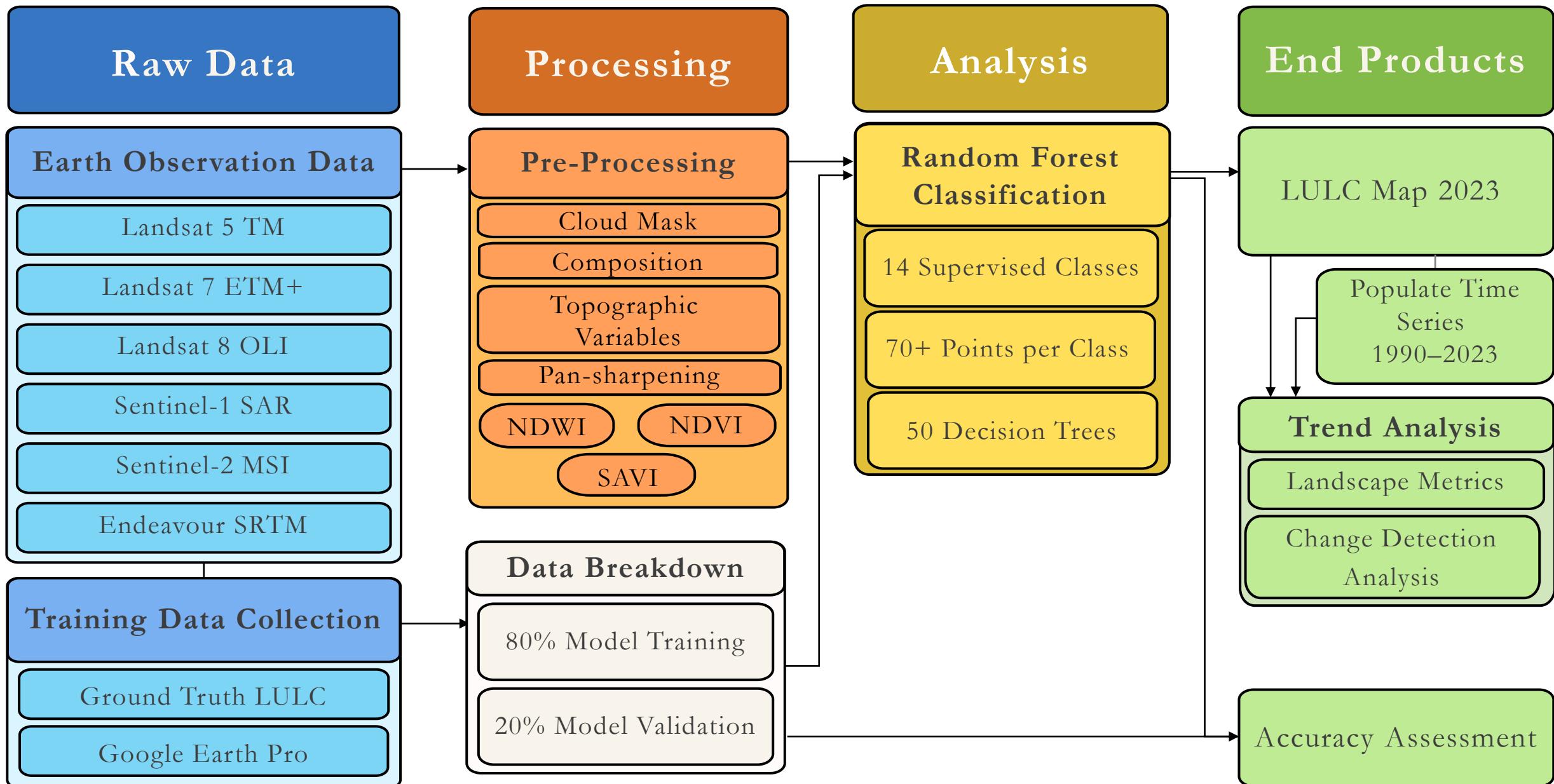
Sentinel-1 SAR



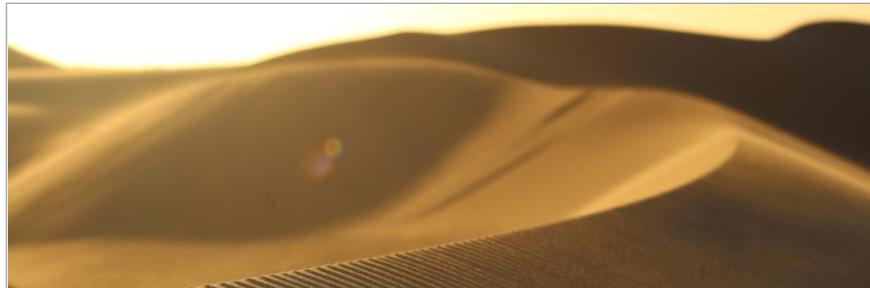
Sentinel-2 MSI



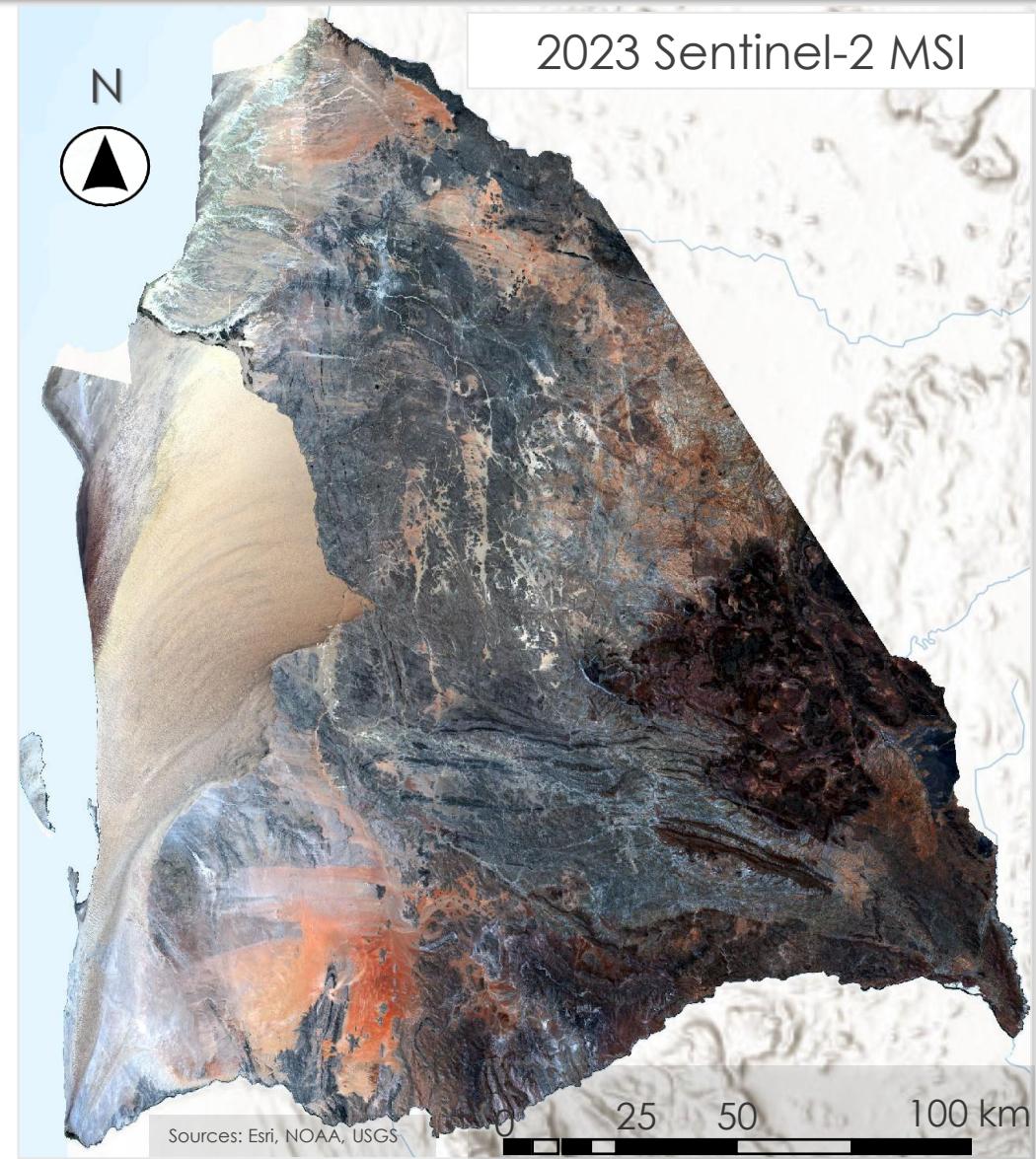
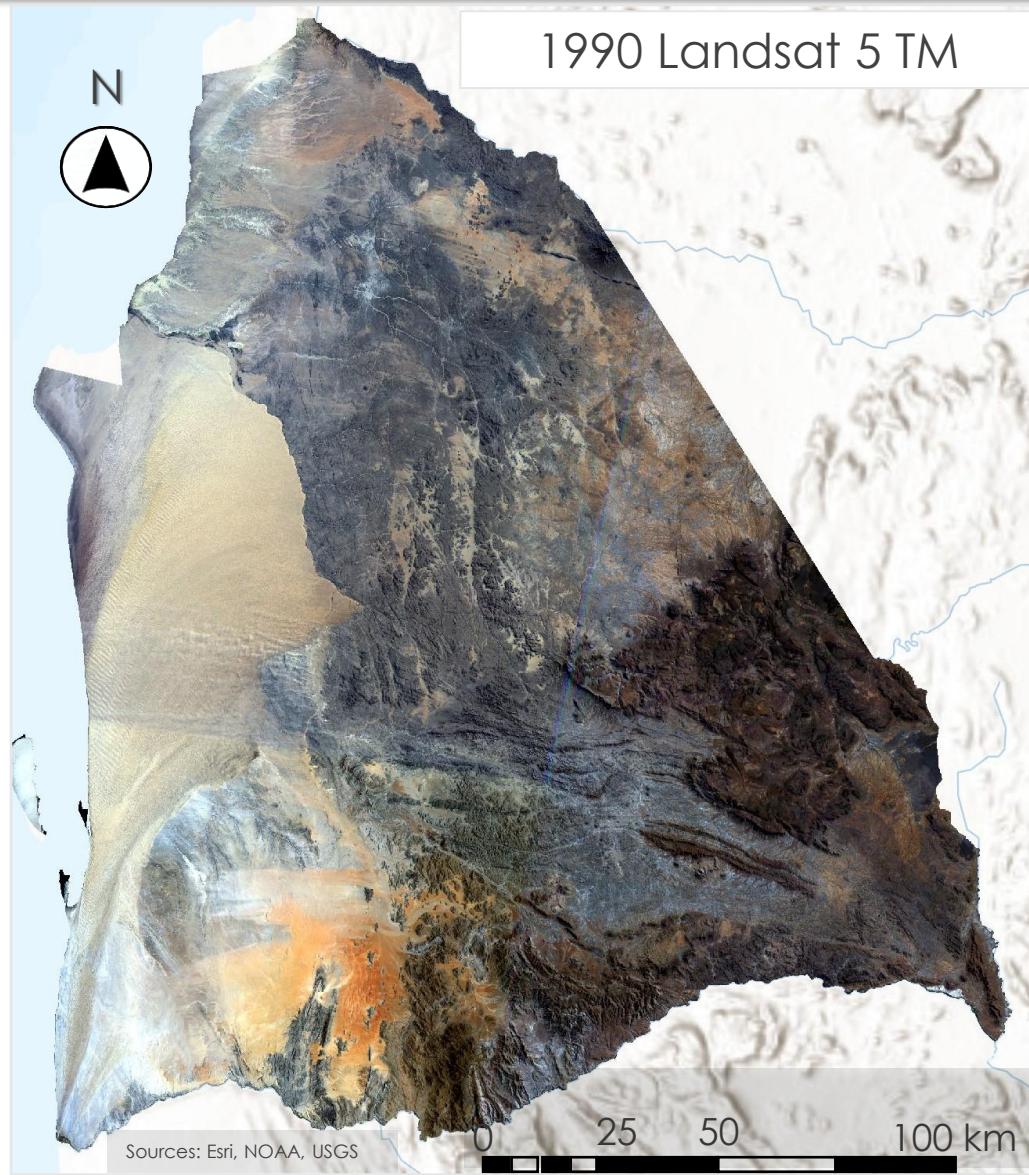
Methodology



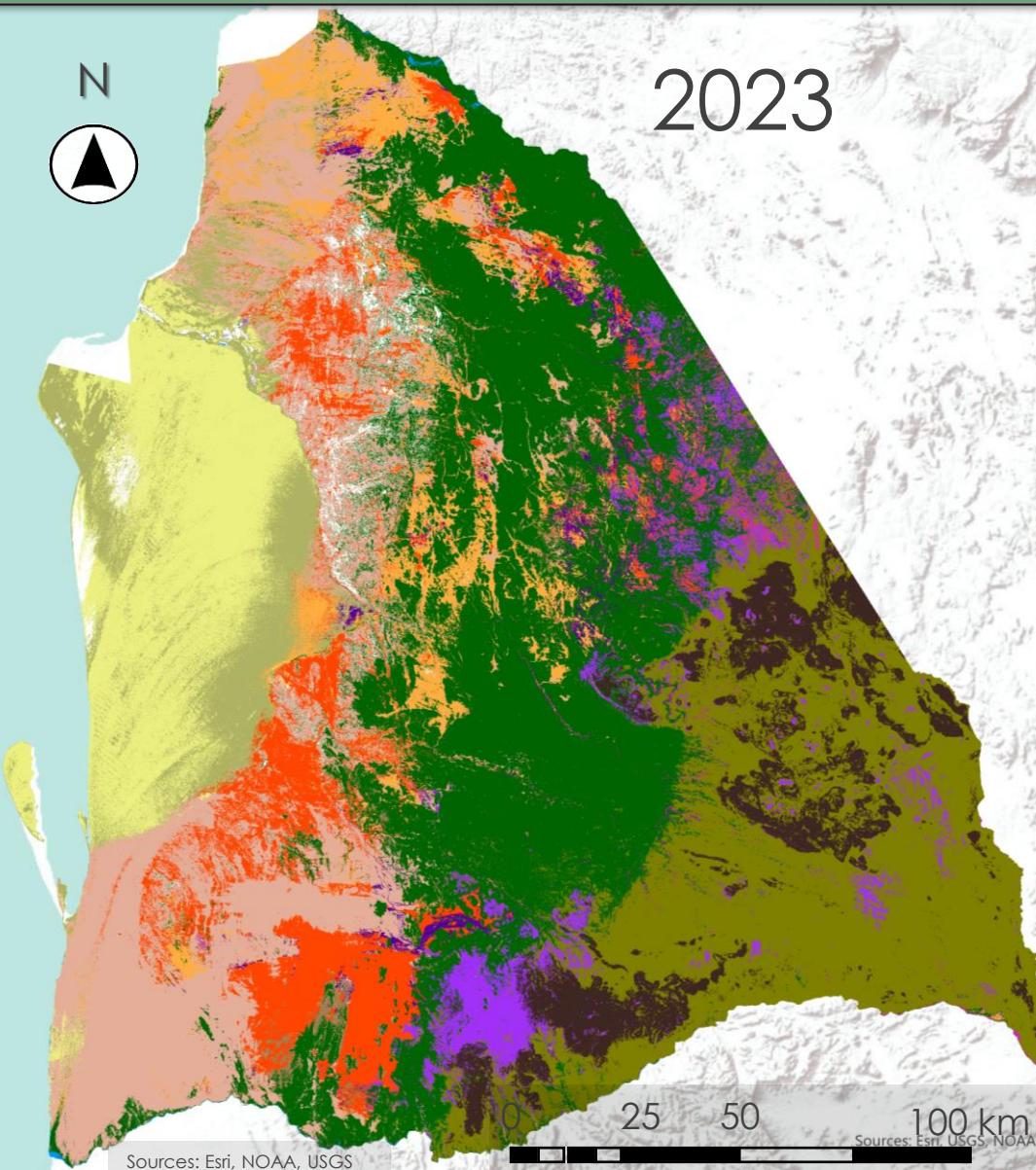
Methodology

Broad Class	Narrow Class	
Drainage Lines	Mixed vegetation Mopane dominated <i>Vachellia</i> dominated	
Dunes	Bare Oases Vegetated	
Mountains	Bare Vegetated	
Plains	Grasslands Gravel Mopane dominated	
Shrublands	Mopane- <i>Commiphora</i> <i>Vachellia</i> - <i>Commiphora</i>	
Marsh/River		

1990 & 2023 Raw Imagery



Results: LULC Time Series 1990-2023

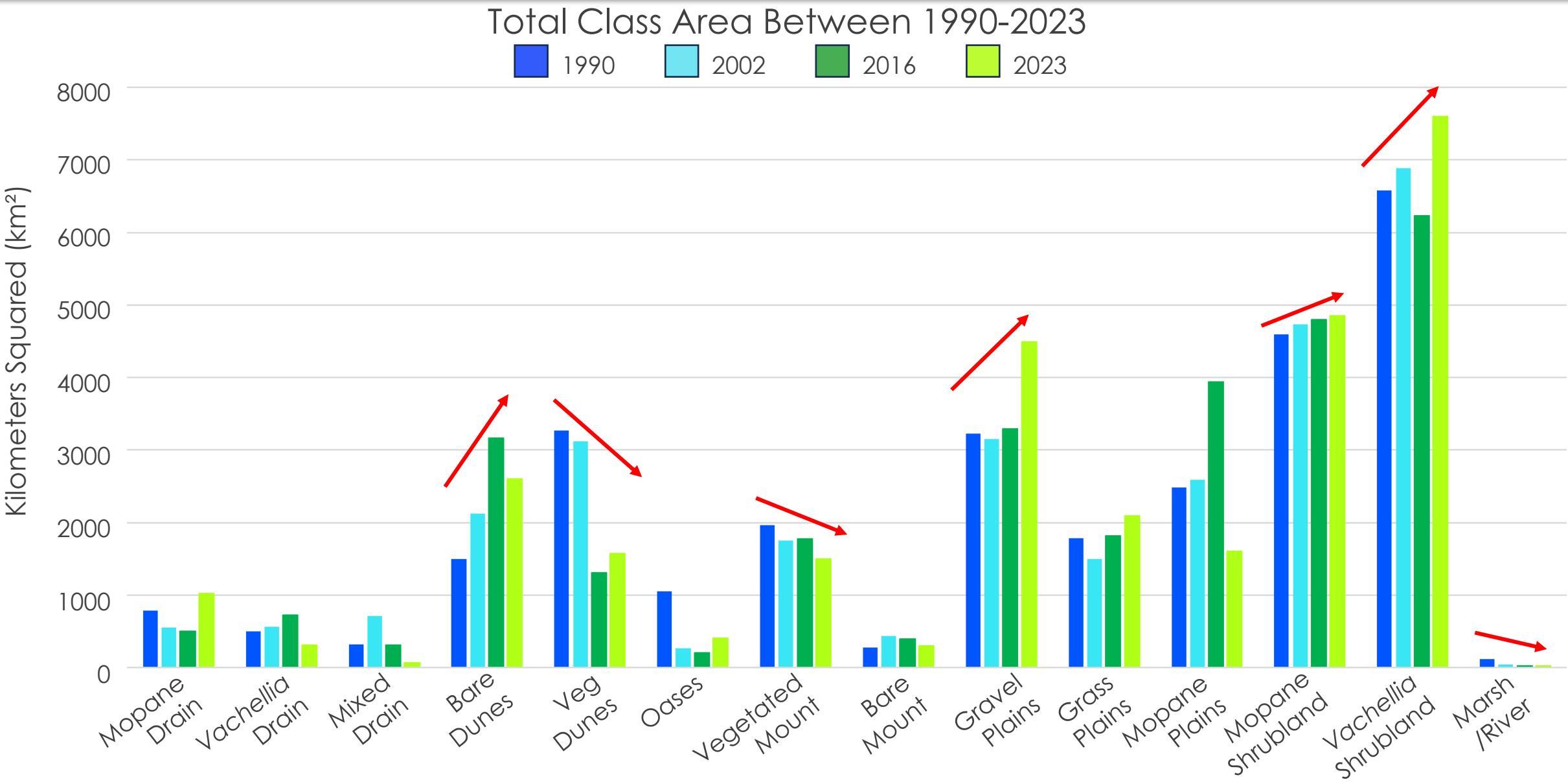


Landcover Classes:

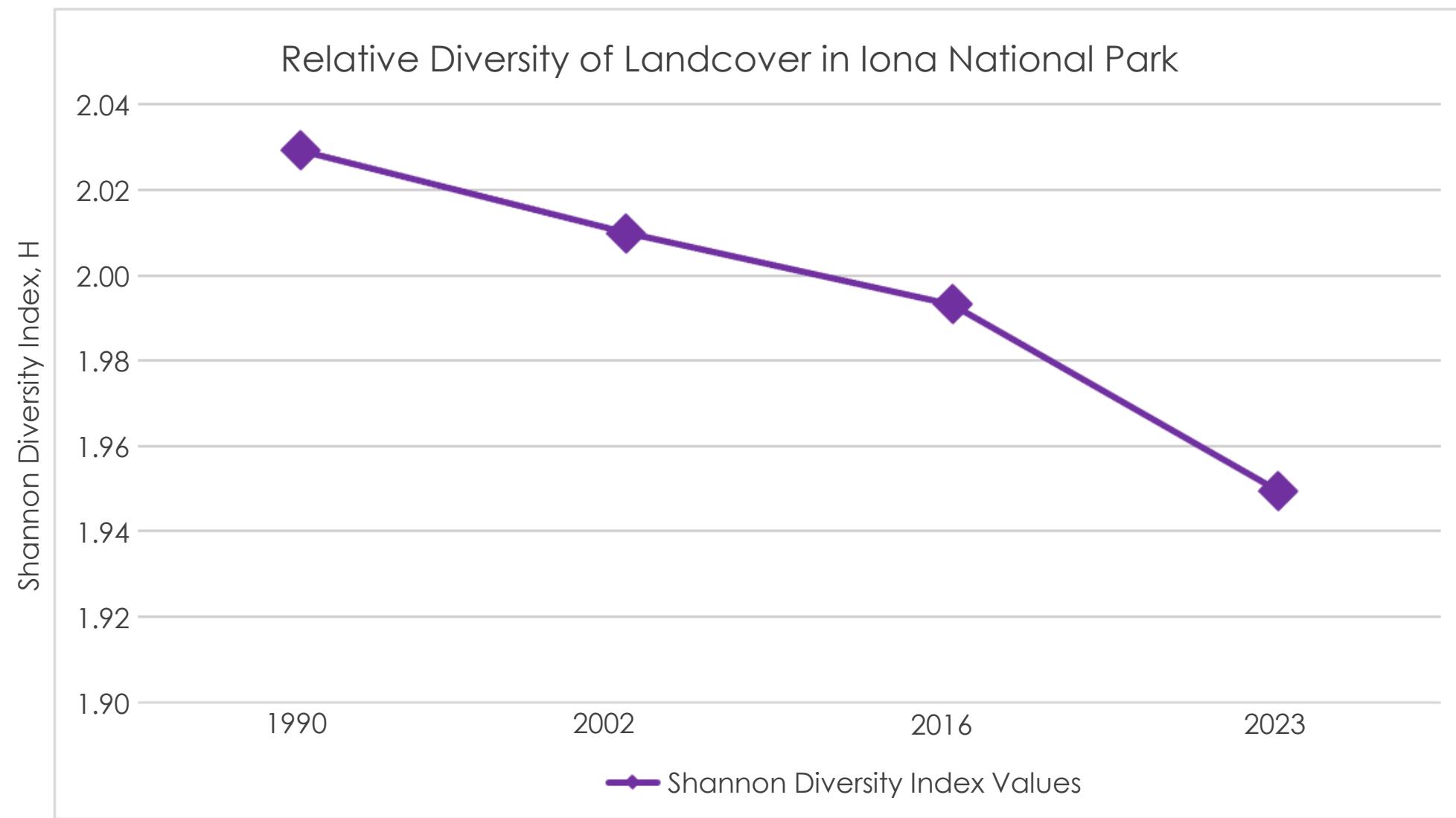
- Mixed Drainage
- Mopane Drainage
- Vachellia Drainage
- Bare Dunes
- Vegetated Dunes
- Oases
- Bare Mountains
- Vegetated Mountains
- Grasslands
- Gravel Plains
- Mopane Plains
- Mopane Shrublands
- Vachellia Shrublands
- Marsh/River

- Overall Accuracy: 92.5% (2020)
- Four broad regions emerge on a west to east gradient: Dunes, Plains, Vachellia Shrubland, & Mopane Shrubland
- General loss of Vegetated Dunes over time, as well as Marsh/River

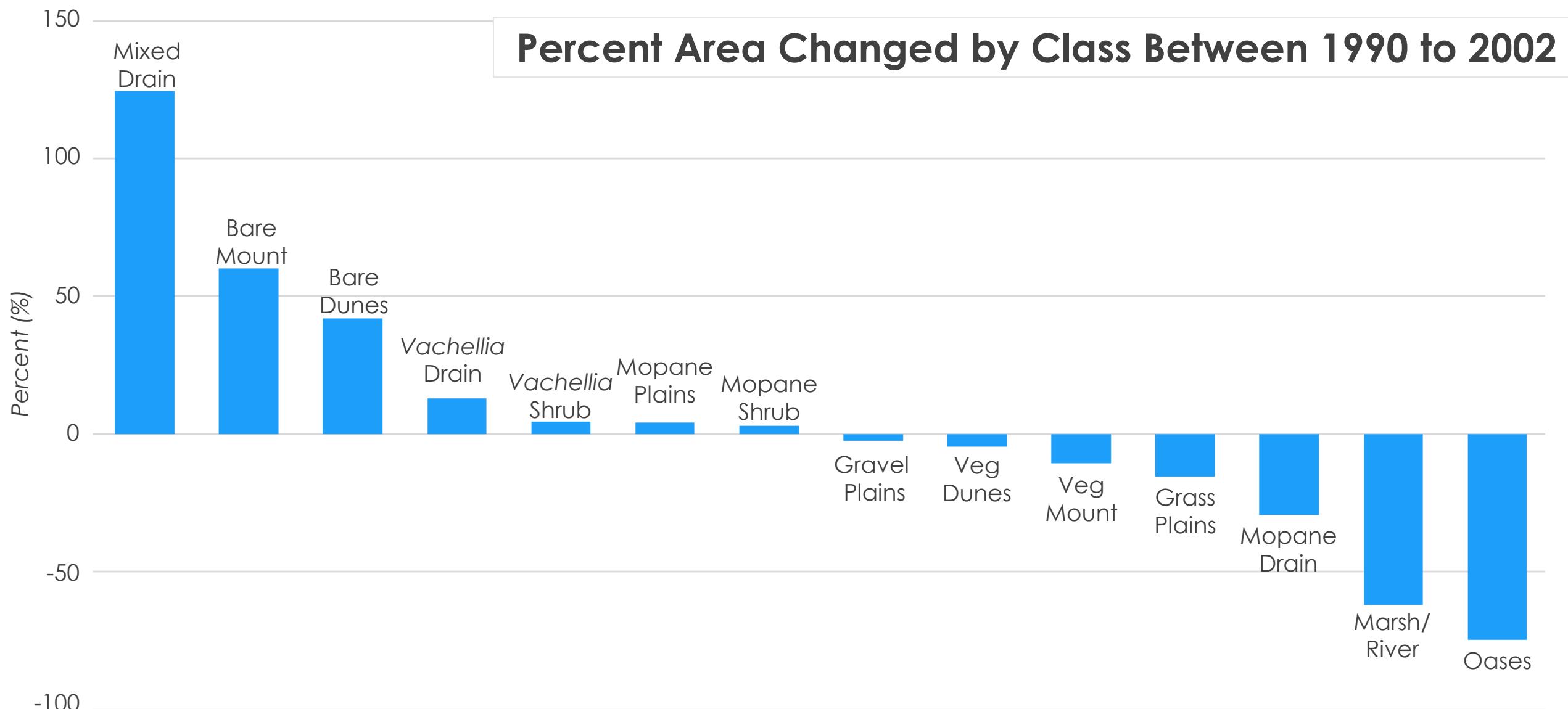
Results - Landscape Metrics



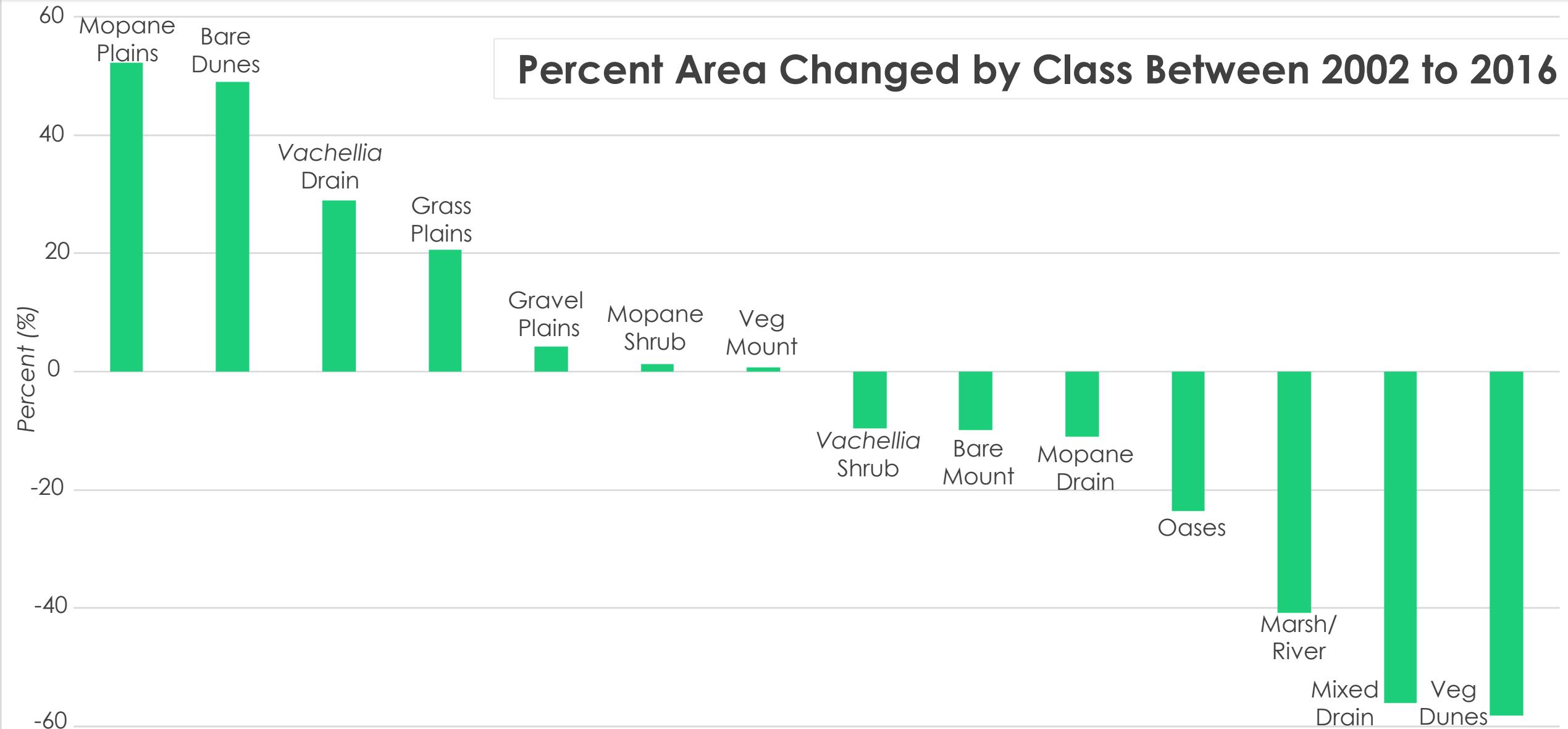
Results – Shannon Diversity Index



Results - Change Detection Analysis

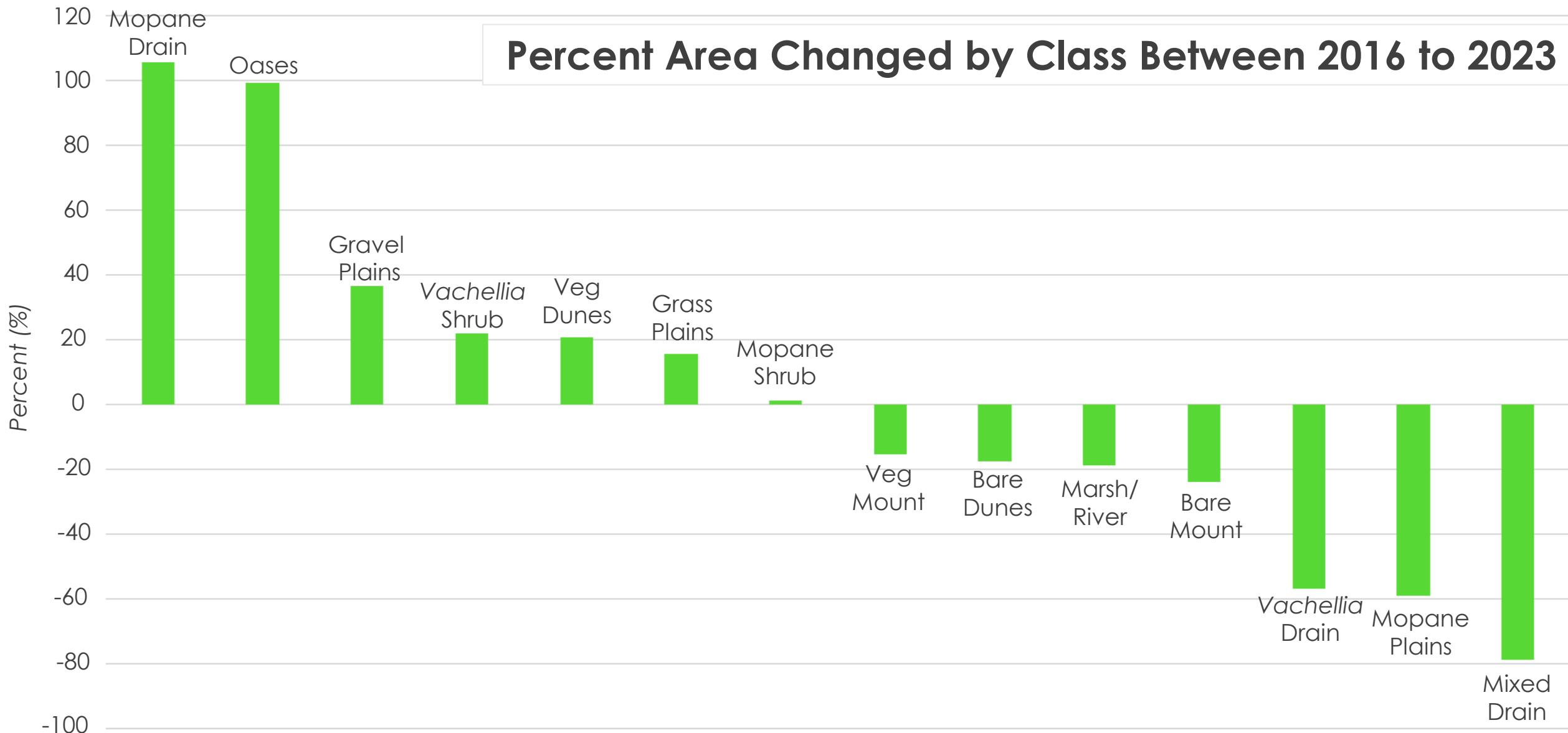


Results - Change Detection Analysis



Results - Change Detection Analysis

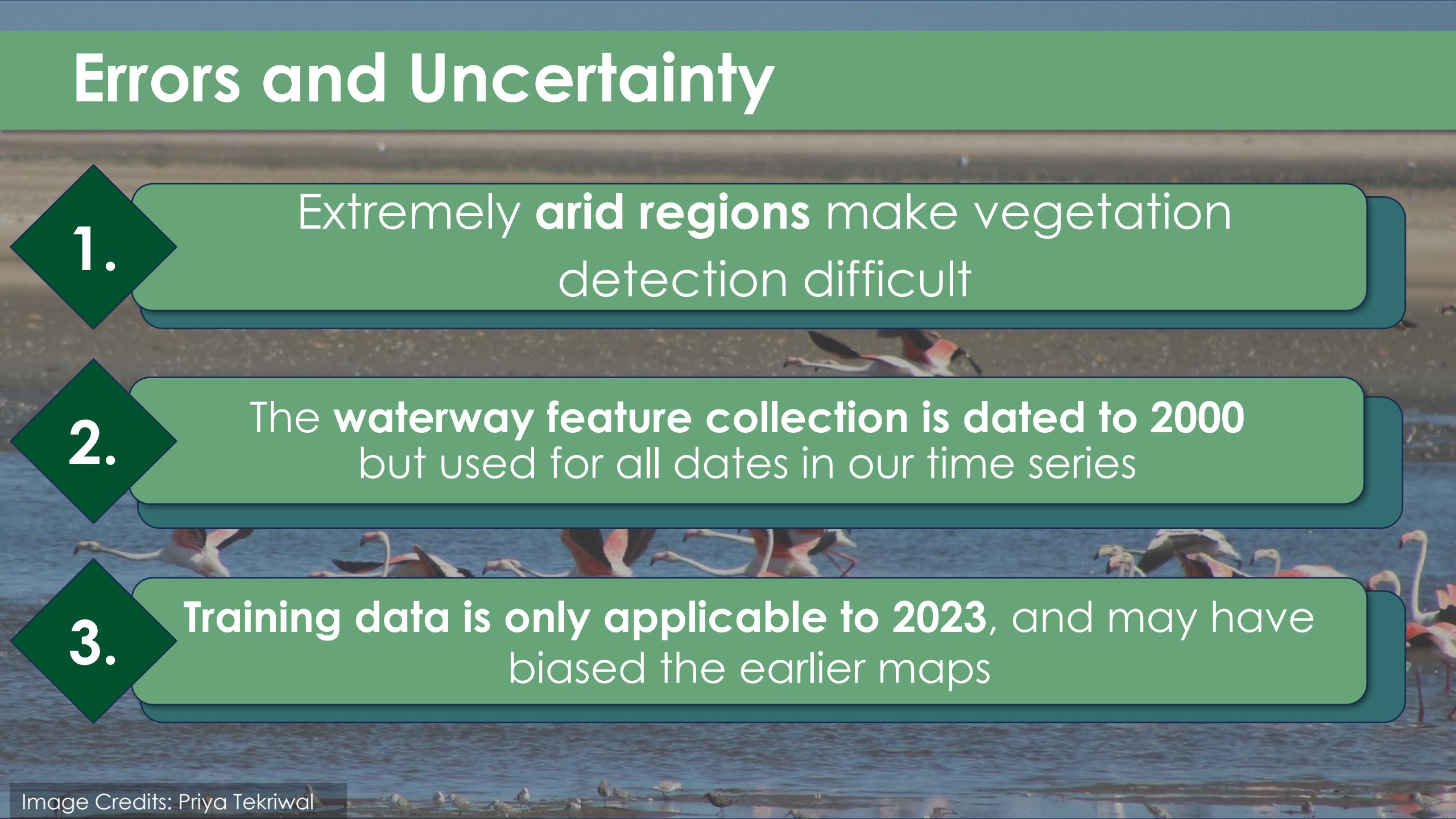
Percent Area Changed by Class Between 2016 to 2023



Limitations

1. **Lack of available cloud free imagery** prior to 1990 prevented additional analyses
2. **Spectral inconsistencies** in satellite data quality
3. **Limited time and spatial resolution** to assess the impacts of human activities (herding) within the park

Errors and Uncertainty

- 
- A photograph of a wetland area with a flock of flamingos in the background. In the foreground, several small birds, possibly sandpipers or shorebirds, are standing on the water's edge.
1. Extremely **arid regions** make vegetation detection difficult
 2. The **waterway feature collection is dated to 2000** but used for all dates in our time series
 3. **Training data is only applicable to 2023**, and may have biased the earlier maps

Feasibility & Partner Implementation



Feasible



Provide new ways to **observe** the present and to **understand** the past of the park.

Communicate with policy makers and individuals to further invest in INP and its rehabilitation

Conclusion



Model **successfully classified** fine scale landcover types with high accuracy



Diversity **decreased** across the study period

Limited time series made change analysis data difficult to interpret

Acknowledgments



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"This material contains modified Copernicus Sentinel data 2016, 2022, 2023, processed by ESA."

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