Land cover classification and change during mine reclamation in northeast Florida using multispectral imagery

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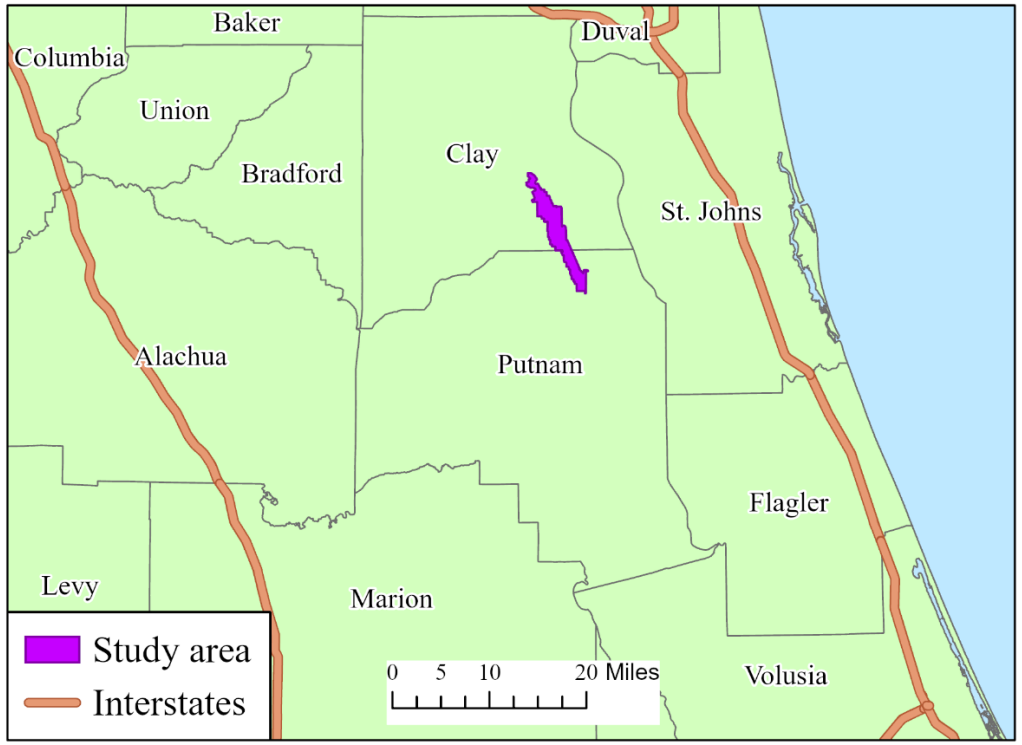
GEO 402: GIS Applications

Green Cove Springs Mine

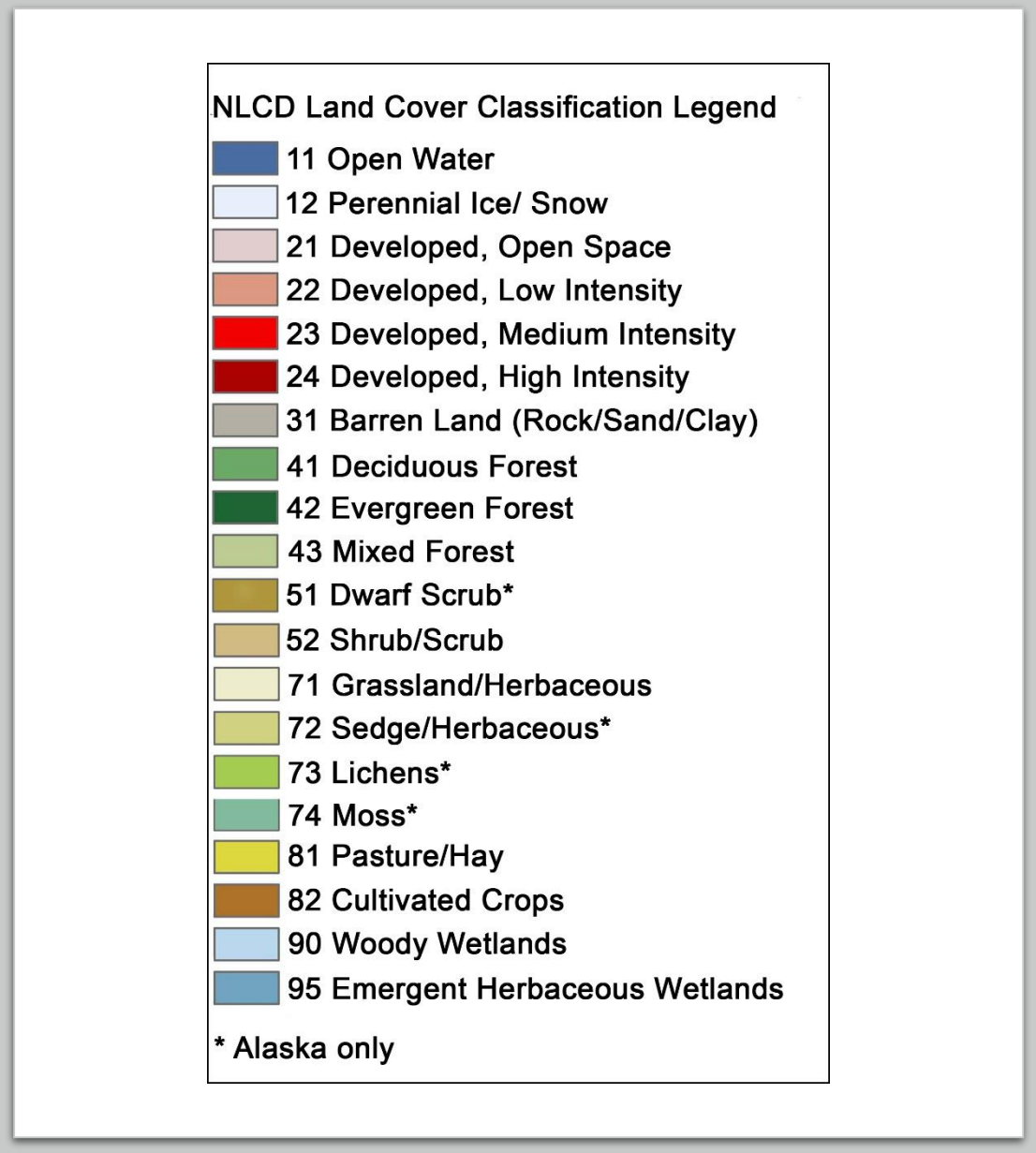
- Mine closed in 2009
- Since then: *reclamation*, or "reasonable rehabilitation", required by FL DEP
  - Piece-by-piece process
- **RQs: What are the dominant land cover types at GCSM? How have these changed from 2016 to 2022?**




WARNING
NO TRESPASSING
CONSERVATION AREA
ENVIRONMENTALLY
SENSITIVE AREA
PROTECTED BY FLORIDA STATUTE
NO
TRESPASSING
VIOLATORS
WILL BE
PROSECUTED
FLA. ST. STAT.
810.08

National Land Cover Database (NLCD)

- Land cover maps produced by USGS every three(ish) years
  - 2016 and 2019 (most recent)
- 30-meter spatial resolution
- 15 different LC types found in FL
  - We aggregated these down to five….



Water

Land cover types we're interested in

Water

Low vegetation

Land cover types we're interested in

Water

Low vegetation

Barren

Land cover types we're interested in

Water

Low vegetation

Barren

Forest

Land cover types we're interested in

Water

Low vegetation

Barren

Forest

Wetland

Land cover types we're interested in

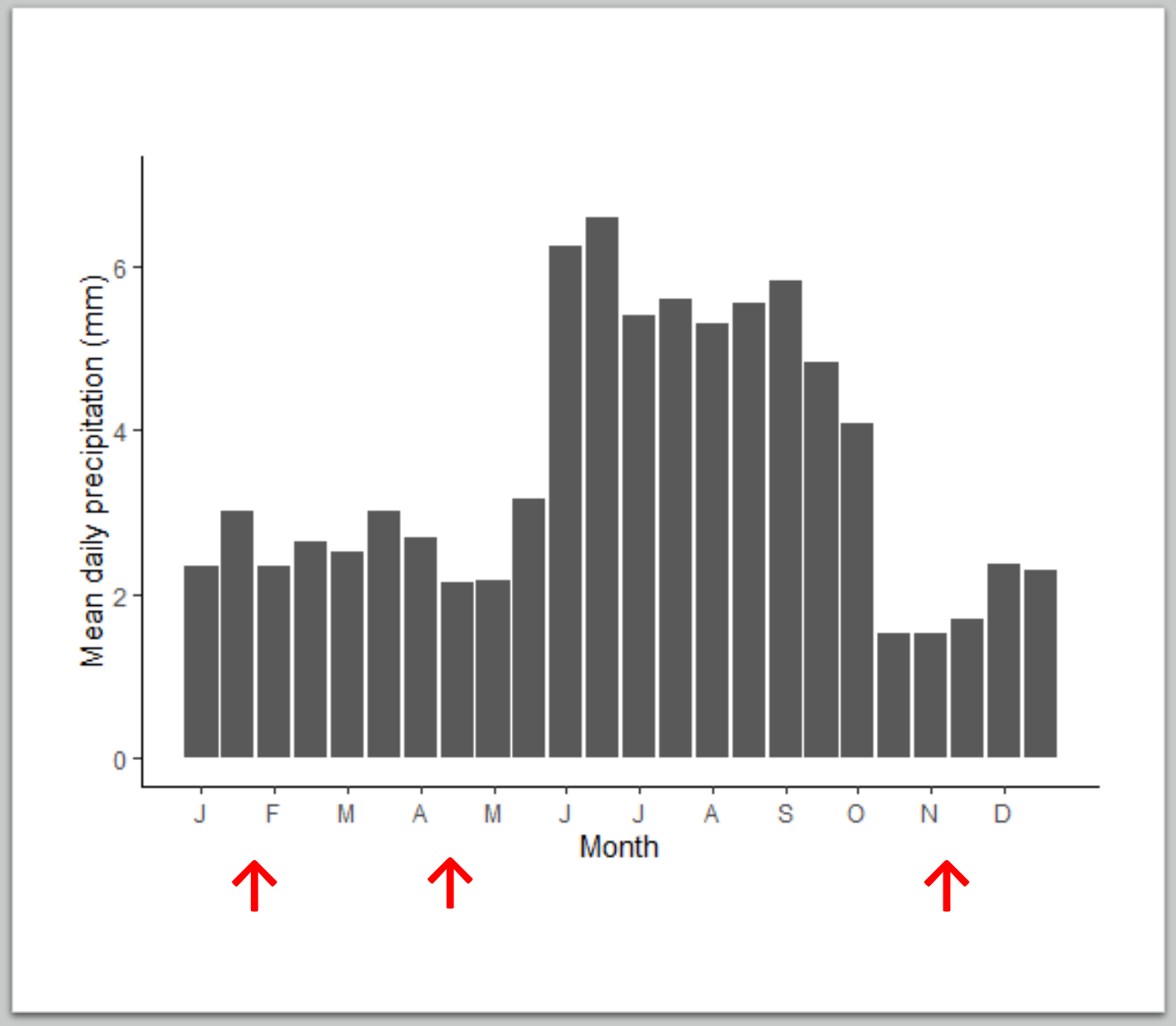
Methods

- Created three *trajectories* (time series) using satellite images obtained from 2016 to 2022

- 1) November

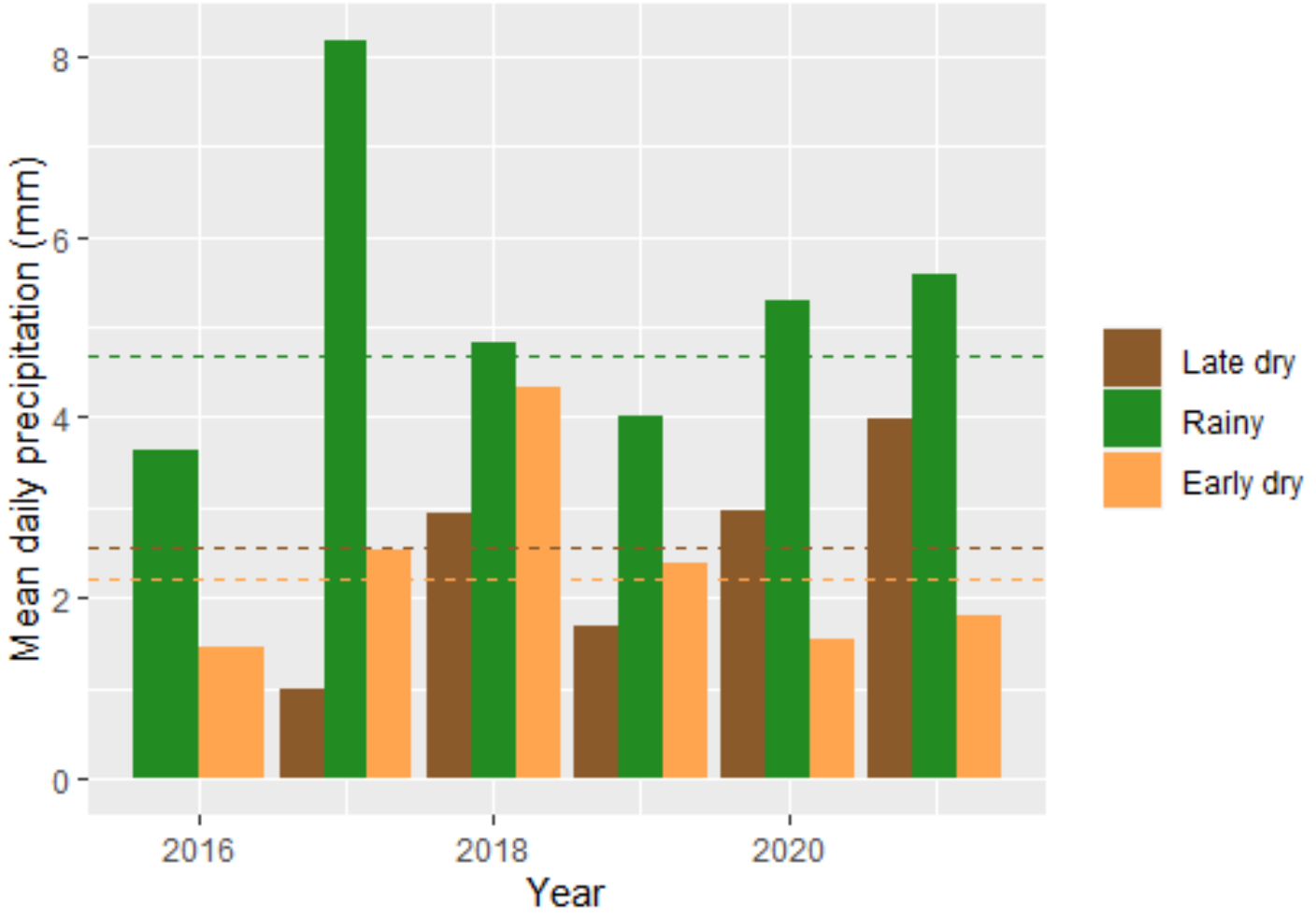
- 2) Late January and early February

- 3) April



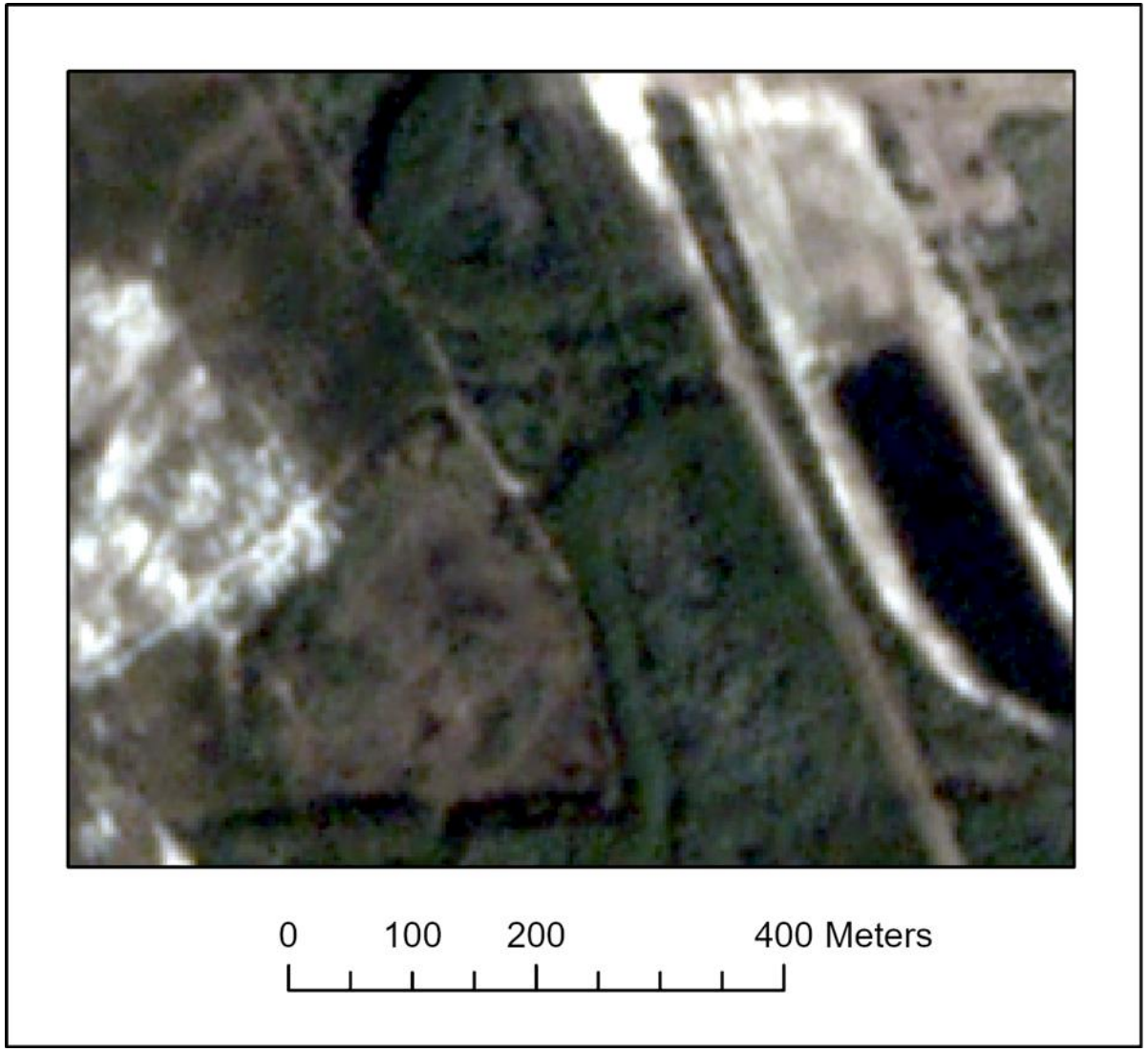
Observed precipitation during study period

- Generally near climatic normal
- Exception: Hurricane Irma, September (rainy season) 2017
- Could Irma have affected LC?



Methods

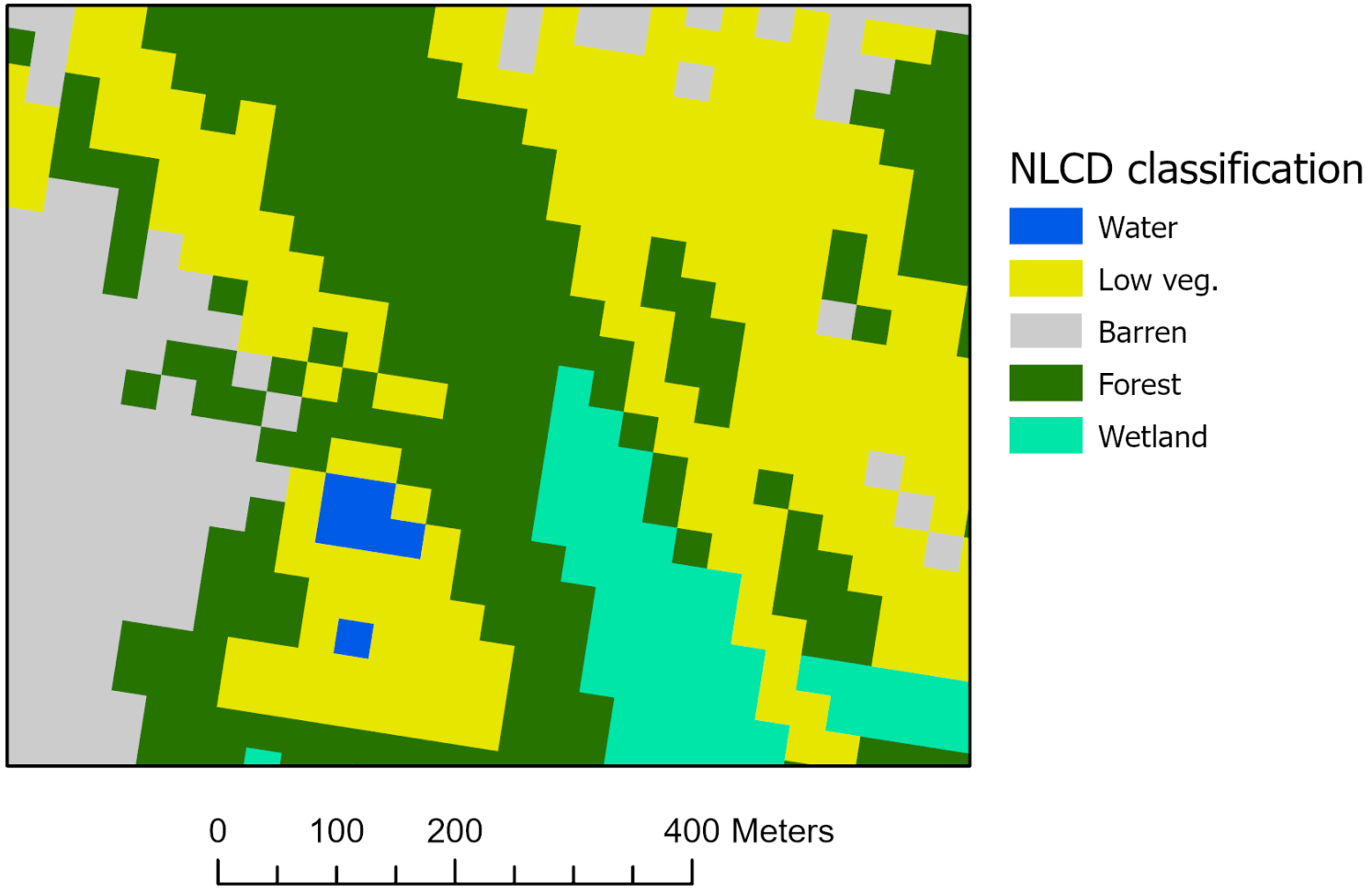
- Classified images into five LCs of interest using a support vector machine (SVM)
- 2016-17 through 2018-19 dry seasons: used random points within study area that did not change LC type in NLCDs 2016 and 2019
- 2019-20 through 2021-22 dry seasons: identified 75% of random points (above) that changed RGBN reflectivity the least since corresponding 2018-19 images (Nov to Nov; J/F to J/F; Apr to Apr)
- For all images: used 75% of points for training, remaining 25% to test agreement with NLCD



True color (RGB) satellite image

February 2017

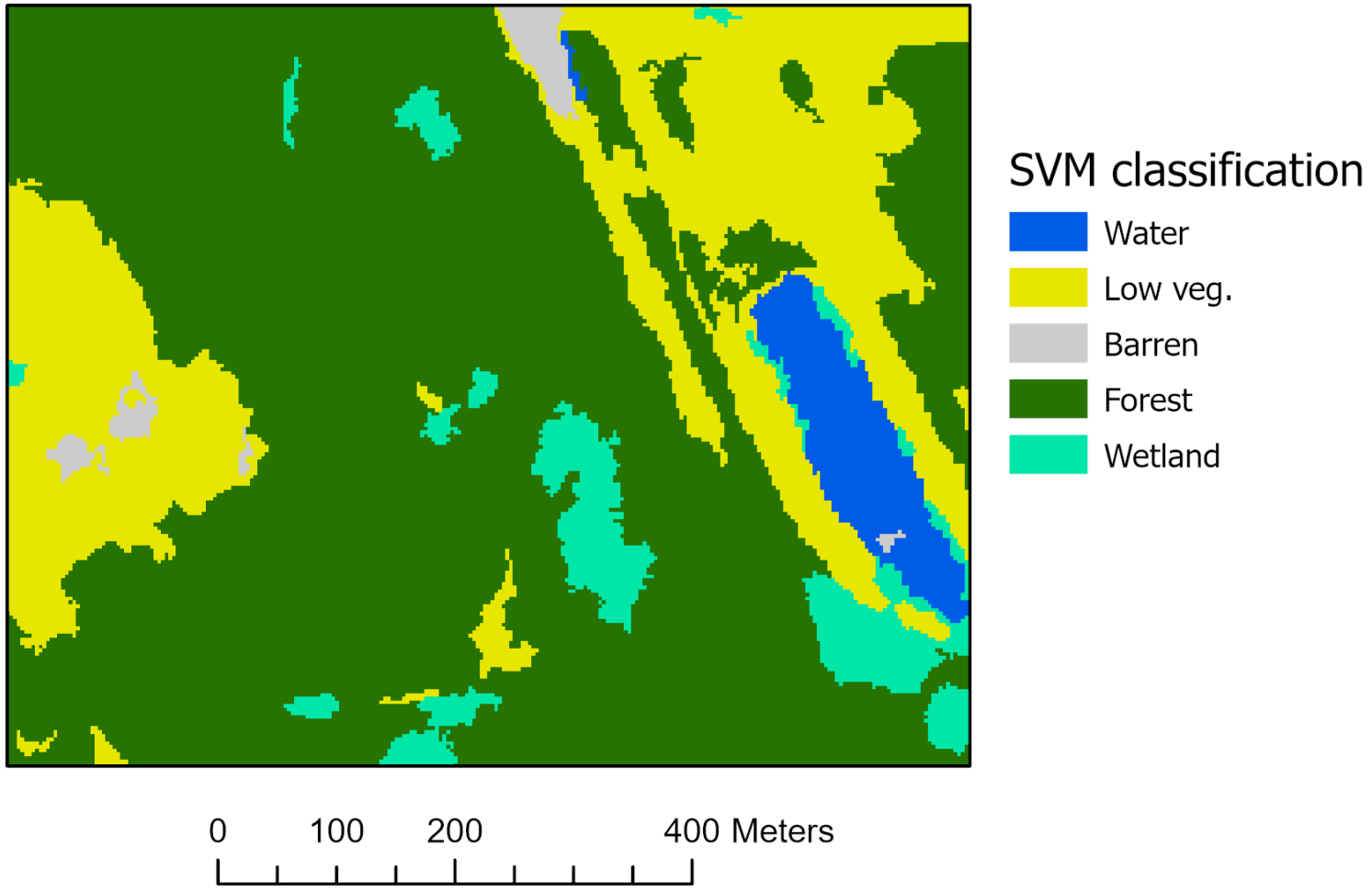
3-meter resolution



NLCD classification

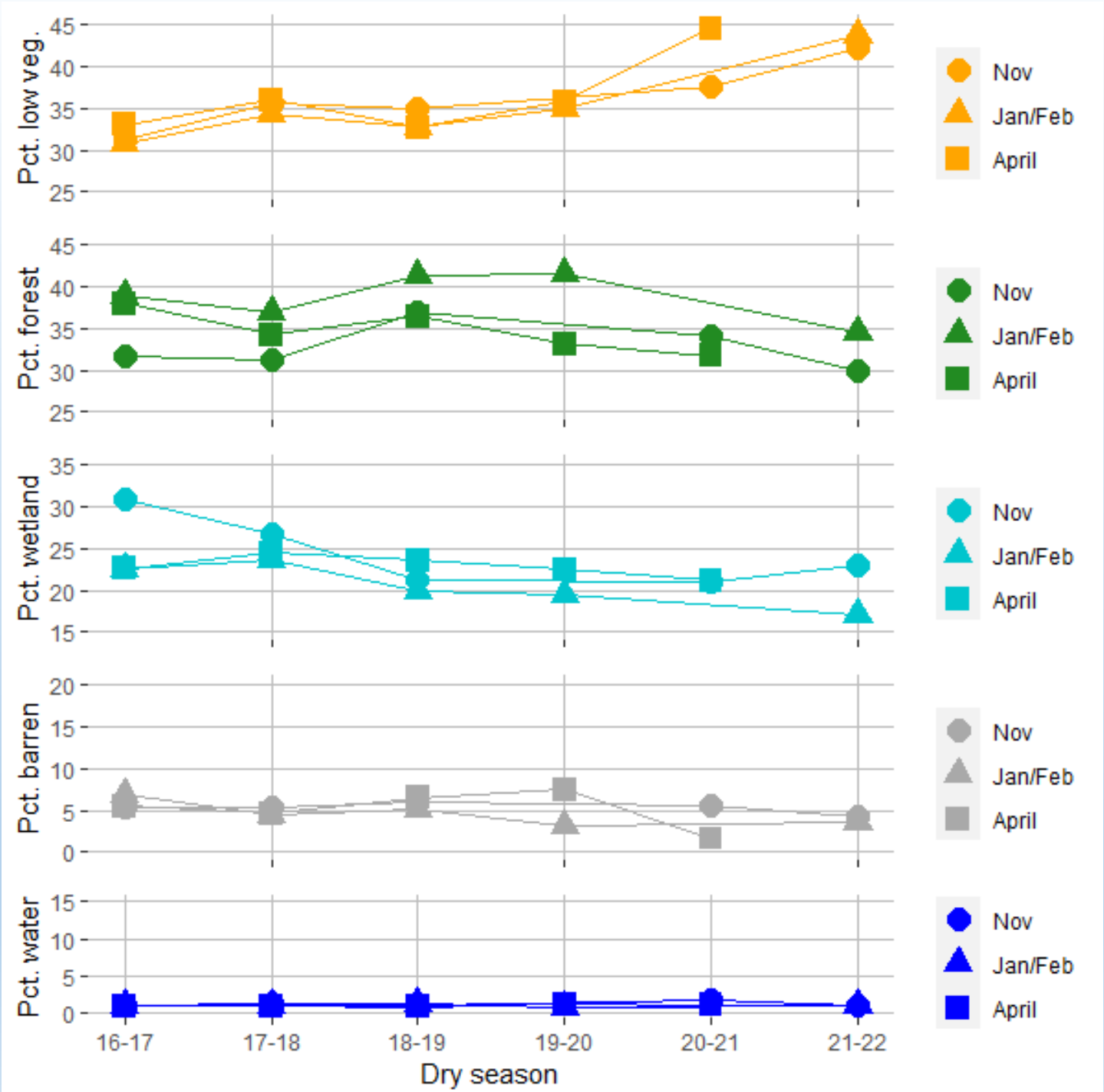
2016

30-meter resolution



SVM classification

3-meter resolution

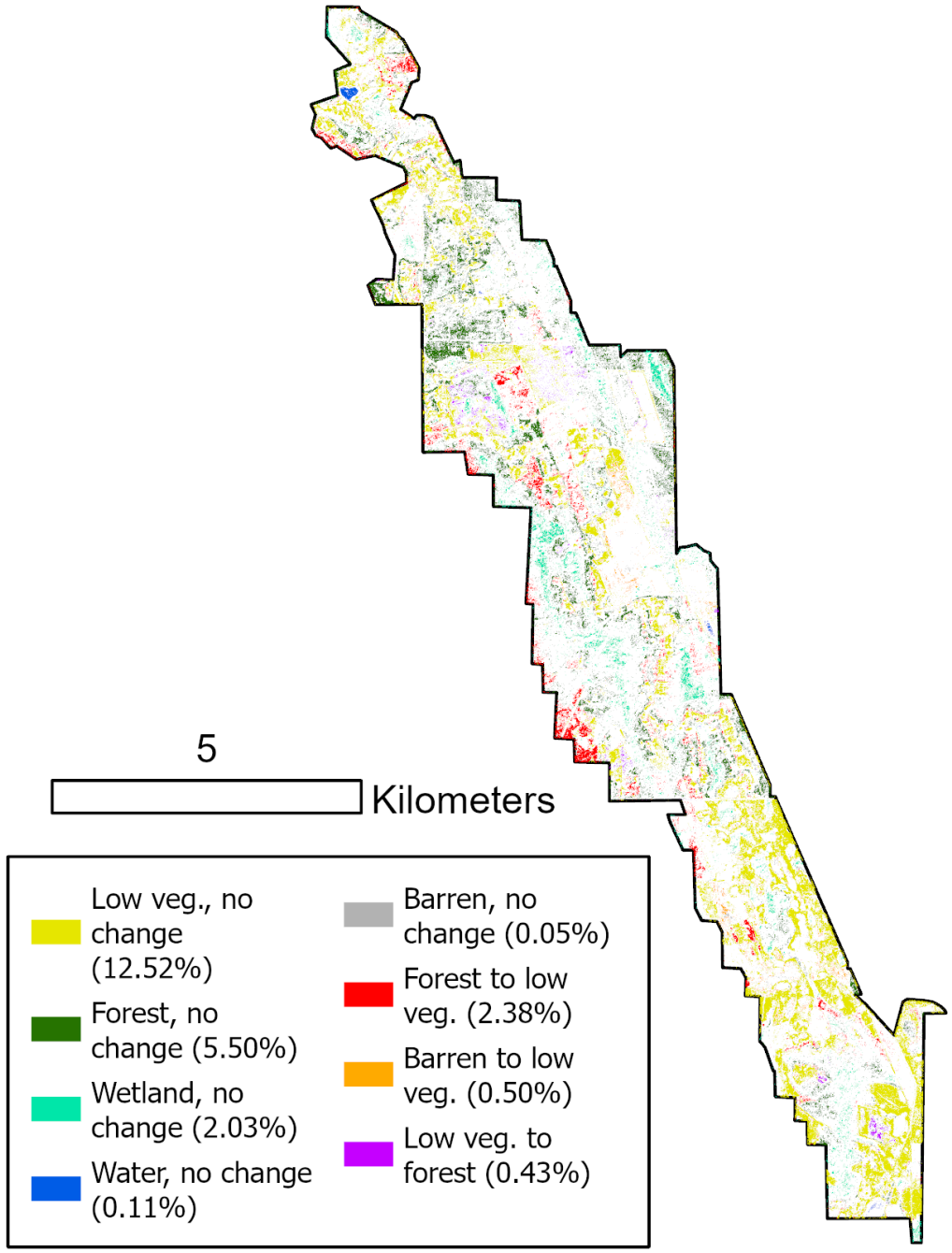


Agreement with NLCD:

November: 52.47%

Jan/Feb: 56.71%

April: 54.04%



Pixels that all three trajectories classified the same in the first (2016-17) and last (2021-22) available images

Forest

+

Wetland

→ “Wooded”

Barren

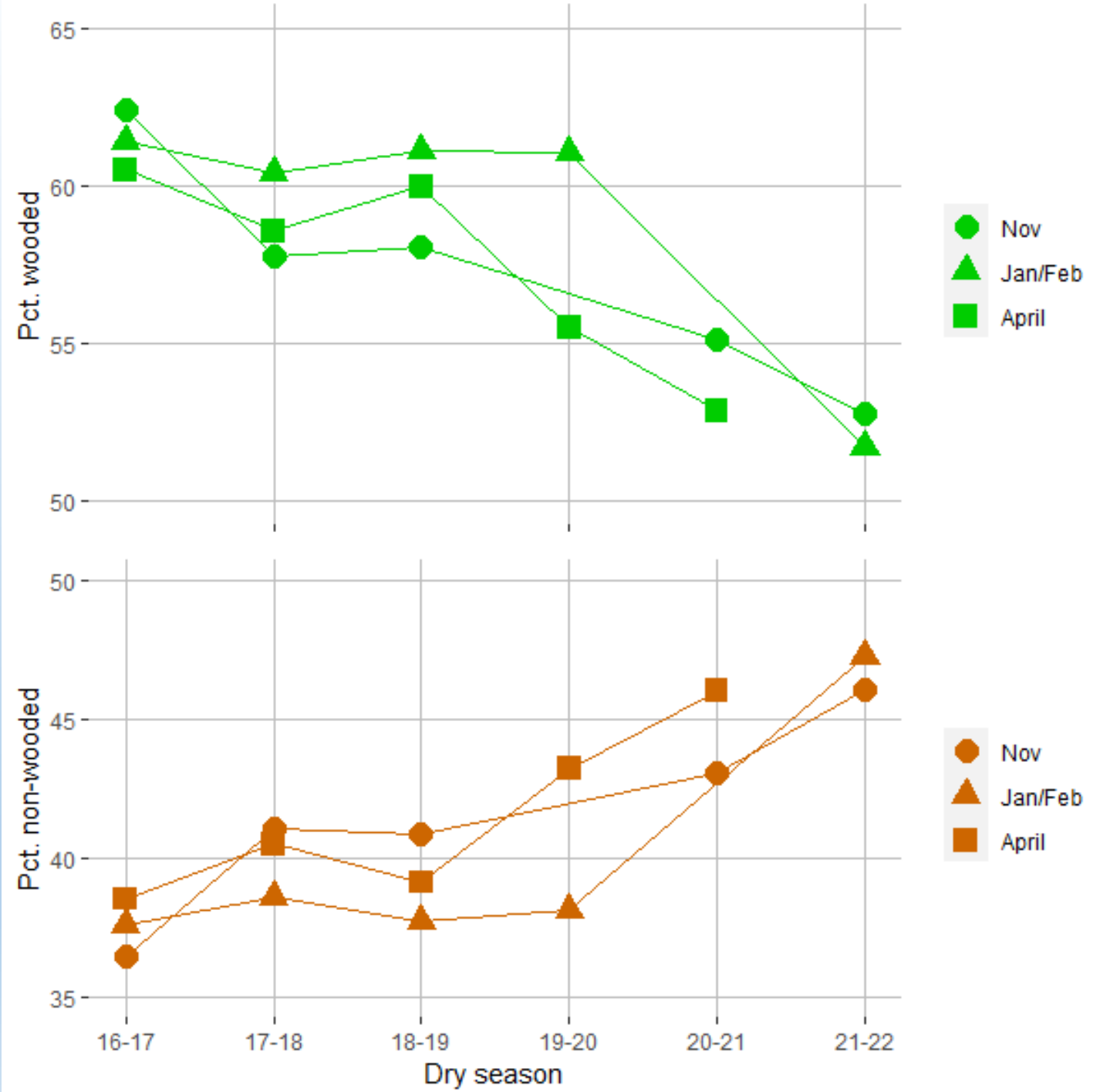
+

Low vegetation

→ “Non-wooded”

To simplify…

→ “Water”

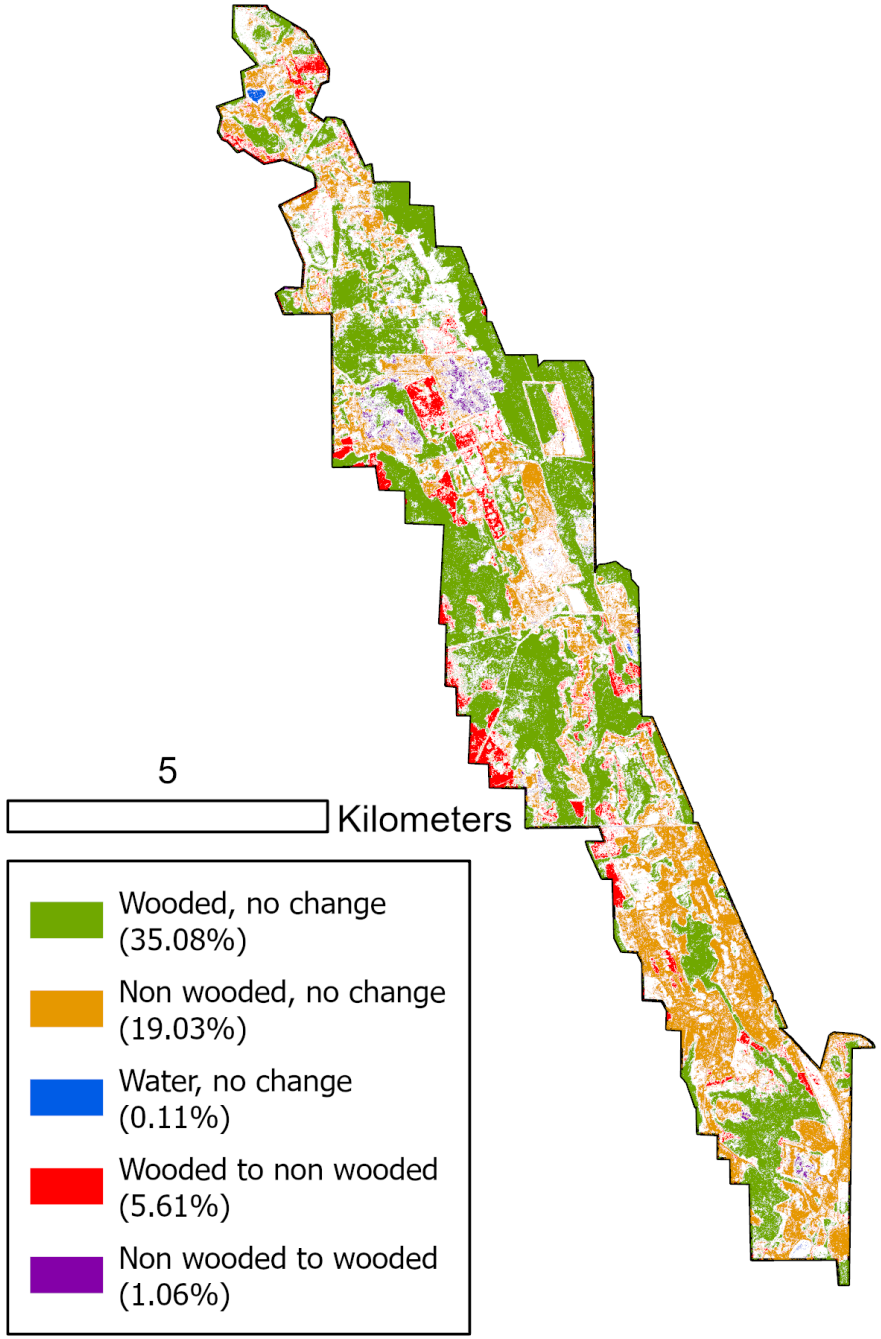


Agreement with NLCD:

November: 80.53%

Jan/Feb: 80.79%

April: 81.13%



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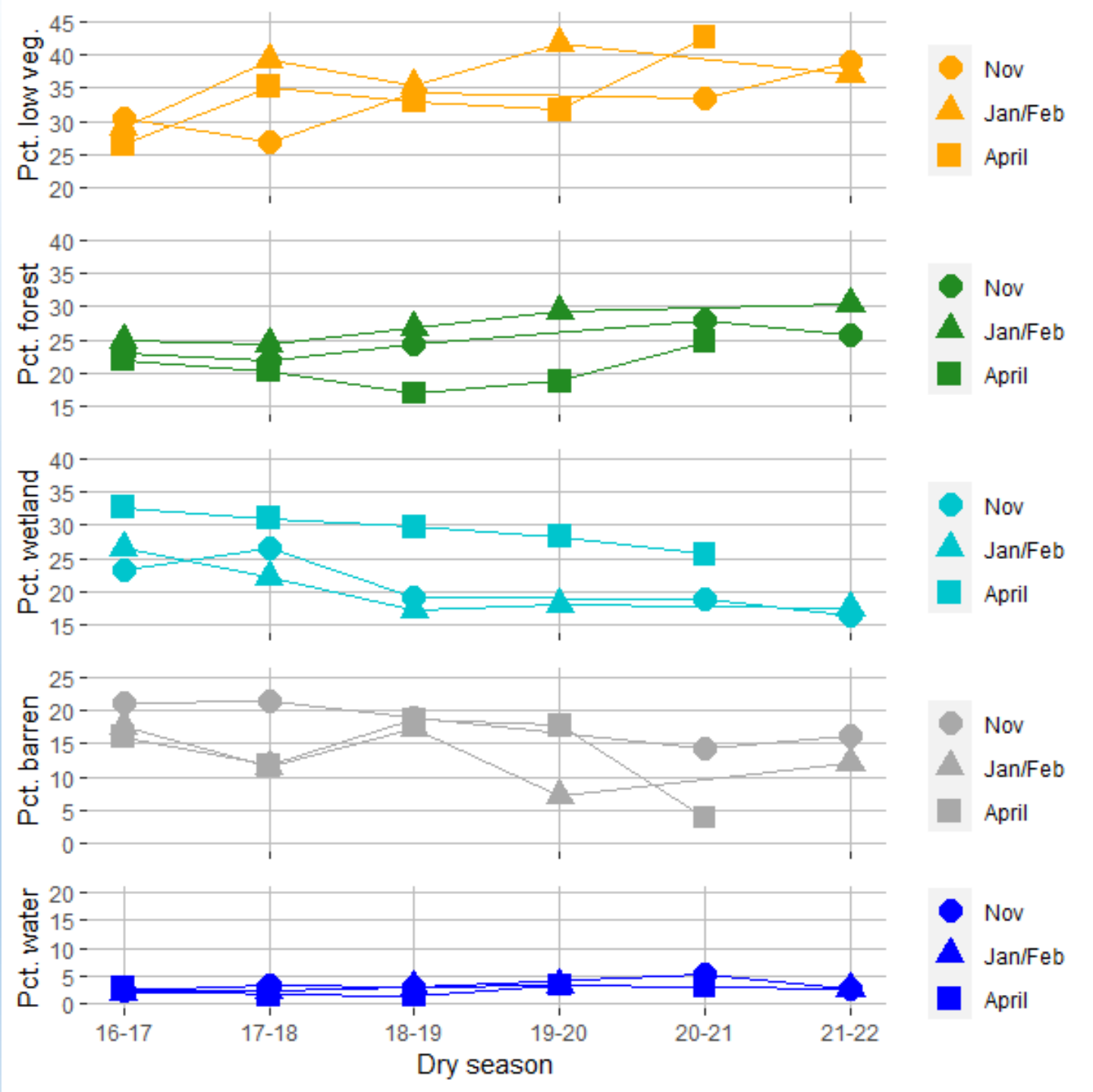
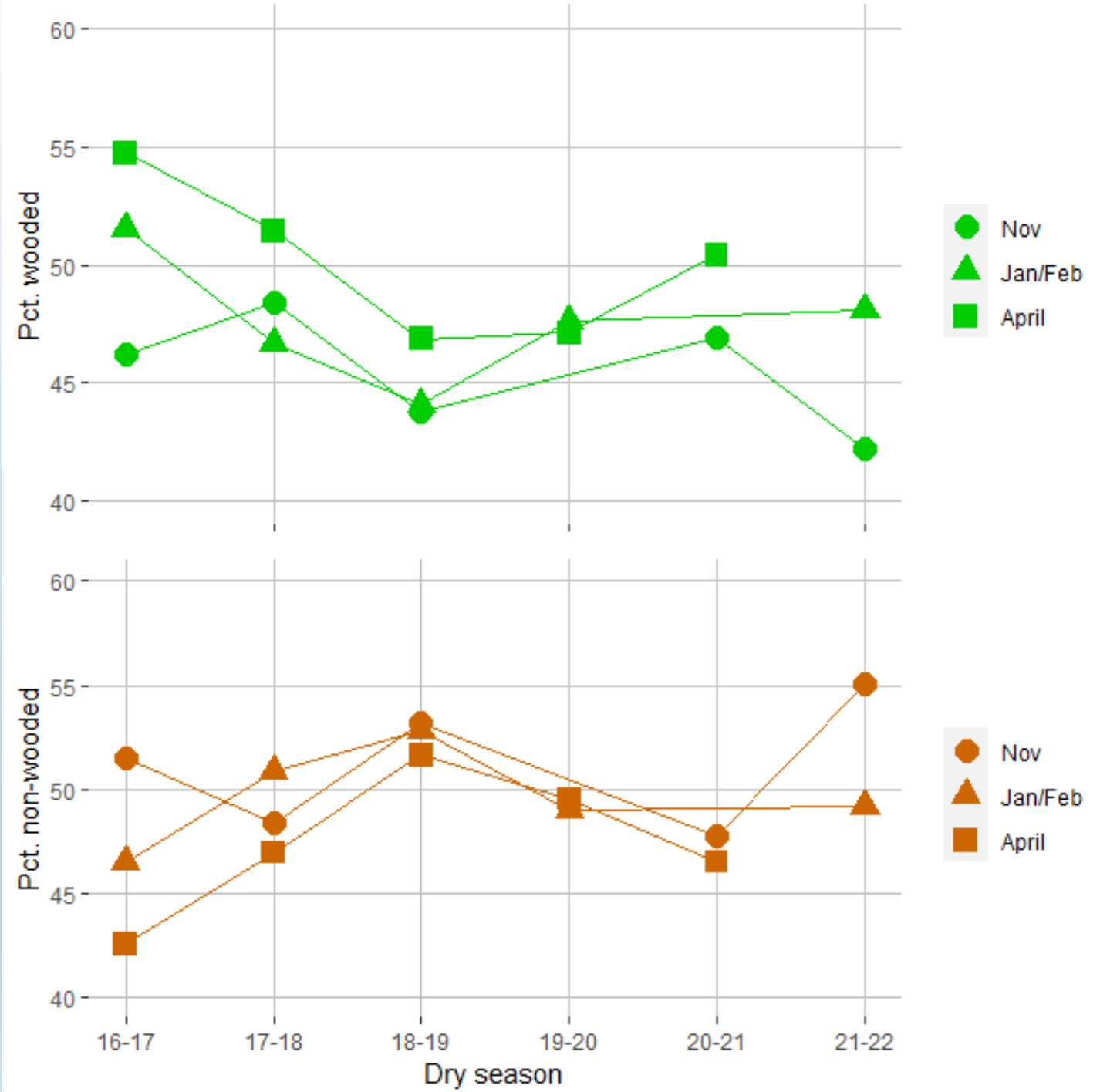


In **non-timber** parcels, overall **increases** in **low vegetation** and **forest**, **decreases** in **wetland** and **barren**



As with whole study area, LC changes in non-timber parcels trend toward **non-woody** LCs

- *RQ: What are the dominant land cover types at GCSM?*
- As of 2021-22 dry season, **low vegetation (40-45%)** and **forest (30-35%)** are most common, followed by wetland (23-27%). Similar pattern in non-timber parcels, but relative proportions differ.

- *RQ: How have these changed since 2016-17?*
- **Low vegetation** has **increased** by about 10% (4.6 sq km) of total study area. **Decreases** in **forest** and **wetlands**. Pixels exhibiting change were most likely forest to low vegetation. Probably result of **pine harvest. Non-timber** parcels have seen **increases** in **forest** and **low vegetation**.

- *Other notes of interest:*
- NLCD (30-m) and SVM (3-m) agreement about 55% with five LCs; about 80% with three LCs. Forest/wetland agreement higher later in dry season. Irma effects on LC minimal relative to other factors (timber harvest).

Conclusions