Mapping wetland characteristics using temporally dense Sentinel-2 data in Poyang lake

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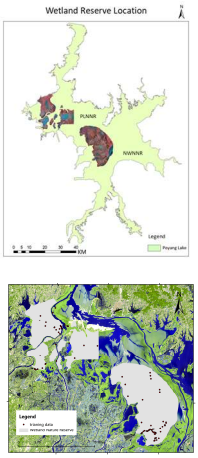
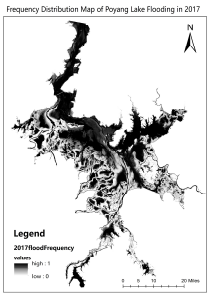
1.Abstract

Landscape dynamics of wetland are critical for understanding Lake ecosystem health and sustainability. The paper characterizes the spatiotemporal dynamics of the wetland landscape in the Poyang lake during 2017–2018 to reveal the spatially explicit influential indicators. Time-series Sentinel images are used to investigate the spatial-temporal image characters variation for different wetland vegetation in growing season. NDVI, IRECI. Random Forest is used to classify the time-series images. The results showed that NDVI and IRECI were the main factors to decide the accuracy of the map. Carex and Nandi are the main communities for Poyang lake wetland. The landscape of the wetland vegetation partially change during 2017-2018 since the high dynamic hydrological changes. The amount of Zizania community is increasing greatly with the water level decreasing. Furthermore, the water level decreasing played an important role to accelerate the swampiness of the Lake wetland.



Overview of the Study Area

2.Data and Method



2.1.Data

- Sentinel-2A data

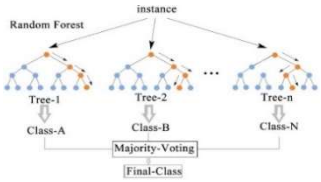
The Sentinel-2A data provides 3 vegetation red-edge bands, which can provide more effective information than other satellites, and have strong imaging capabilities with a spatial resolution of 10 meters, which meets the requirements for monitoring the vegetation communities in the Poyang Lake wetland.

- Flooding frequency data

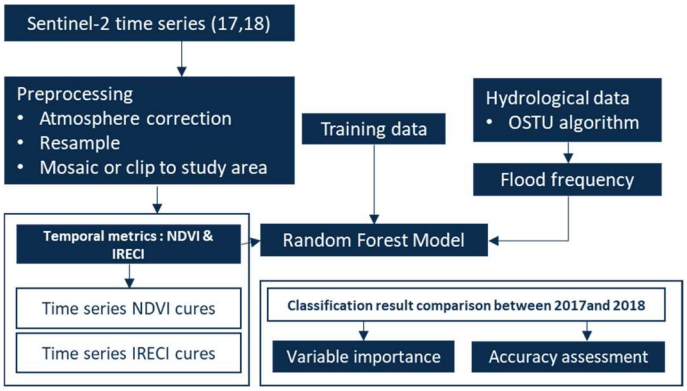
2.2.Method

- Random Forest model

All classifications were done within R using Random Forests, a non-parametric supervised machine learning algorithm Random Forests have proven their use for classifications with the large amounts of data in satellite images, mainly because they can handle the large differentiation within land cover classes and noise data can be neutralised.

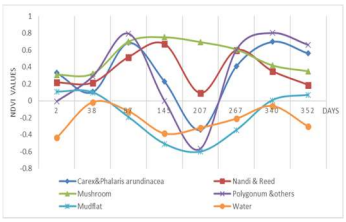


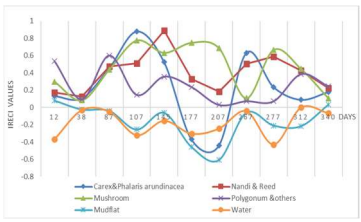
3. Flow Chart



This is the overview of the data preprocessing and classification.

4.Temporal Distribution



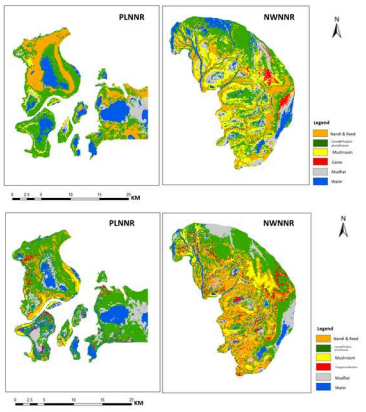


Based on the sample points, the NDVI index and IRECI index of all different vegetation types from 2017 to 2018 are analyzed in time series to check the changes of NDVI and IRECI of different vegetation communities.

(1) The changing trend of NDVI : The change trend of NDVI of vegetation communities other than rice: the overall trend is roughly "M", and the curve of rice is relatively gentle.

(2) The changing trend of IRECI : The fluctuations of vegetation communities are relatively severe, but still show an obvious "M"-shaped trend, and the peak value of Carex and Phalaris is higher than that of other communities.

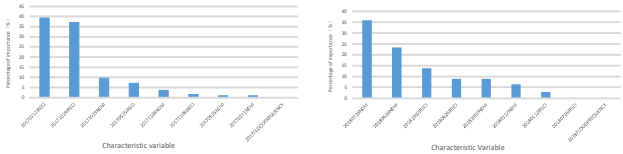
5.Spatial Distribution



The overview of the data preprocessing and classification Of 2017 and 2018

Comparing the two-year distribution results, due to differences in hydrological conditions, the vegetation distribution results have changed significantly.

In terms of space, plant communities generally present a relatively obvious ring-shaped or arc-shaped distribution pattern along the distance from the lake shore. At the same time, affected by the hydrological environment or topography, various plant communities on the beaches often appear to be of different sizes. Patchy distribution and staggered distribution characteristics.



Characteristic importance distribution

6.Conclusion

Type	Nandi & Reed	Carex&Phalaris arundinacea	Mushroom	Polygonum &others	Mudflat	Water
Accuracy	70%	55.6%	75%	45%	46%	100%

Table of accuracy assessments

Based on Sentinel-2 remote sensing data to extract multi-temporal spectral features, red edge index, vegetation index combined with the frequency of flooding, the main conclusions are as follows:

Sentinel-2A has abundant image bands and is suitable for data source for wetland vegetation community processing and analysis. Due to their respective ecological characteristics, the spectral characteristics of different vegetation communities show different laws at different time series. From this, the spatial distribution of wetland vegetation communities is obtained. At the same time, for this study, the wetland information contribution rate **red edge index> vegetation index> flooding Frequency**, different time will have a slight difference.

Data Source: https://scihub.copernicus.eu/dhus/#/home

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