Evaluating Sentinel-2 Red-Edge Bands for Wetland Classification

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Contents

- Introduction
- Aim of Study
- Data and Methods
- Results
- Discussion
- Conclusion

Introduction

Wetlands are one of the most significant ecosystems on Earth, as they provide a number of ecological services and a number of valuable functions.

Due to the high spatial heterogeneity and temporal variability, wetlands are one of the most difficult ecosystems to observe using remote sensing data. The biggest challenge in the wetland mapping is separating the wetland class from the upland classes like forest and agricultural areas.

Aim of the Study

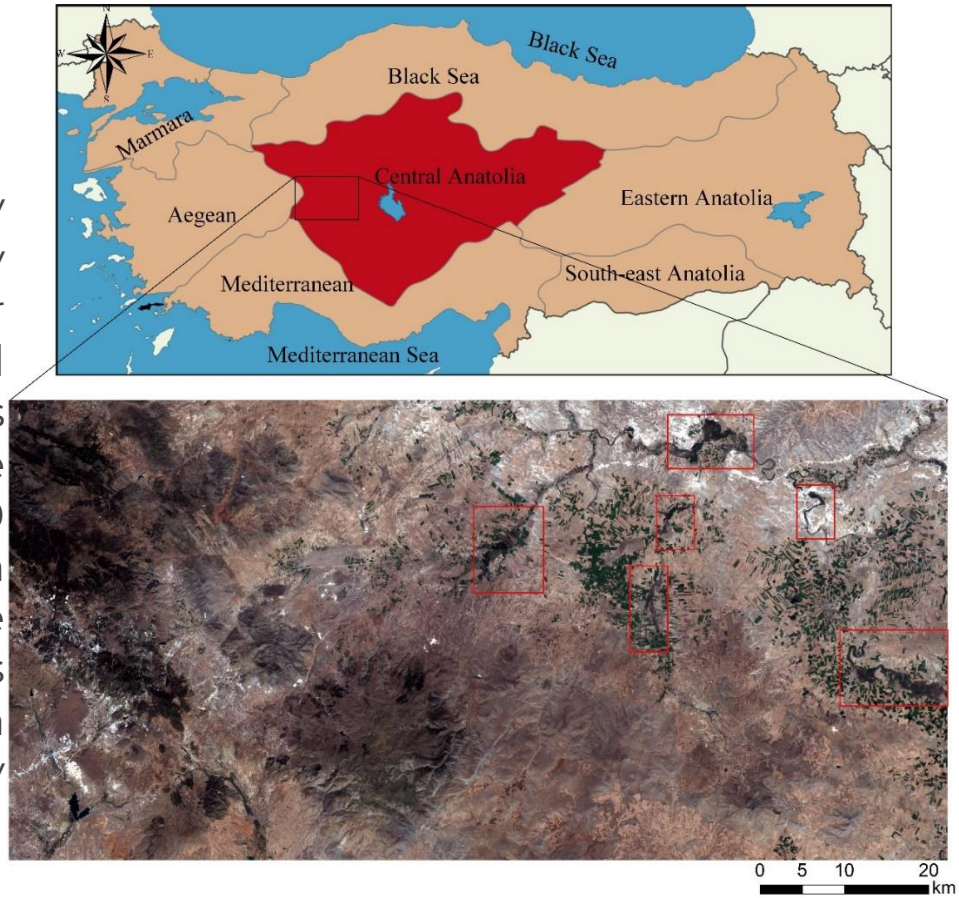
With the additional Sentinel-2 vegetation red-edge bands, an improvement of the vegetated classes classification is expected.

The aim of the study is to investigate the influence of the red-edge bands for wetland classification.

Landsat-8 Bands	Central Wavelength (µm)	Wavelength (µm)	Resolution (m)	Sentinel-2 Bands	Central Wavelength (µm)	Wavelength (µm)	Resolution (m)
Band 1 - Coastal aerosol	0.443	0.435-0.451	30	Band 1 - Coastal aerosol	0.443	0.421-0.457	60
Band 2 - Blue	0.482	0.452-0.512	30	Band 2 - Blue	0.494	0.439-0.535	10
Band 3 - Green	0.561	0.533-0.590	30	Band 3 - Green	0.560	0.537-0.582	10
Band 4 - Red	0.655	0.636-0.673	30	Band 4 - Red	0.665	0.646-0.685	10
				Band 5 Red Edge	0.704	0.694-0.714	20
				Band 6 Red Edge	0.740	0.731-0.749	20
				Band 7 Red Edge	0.781	0.768-0.796	20
				Band 8 - NIR	0.834	0.767-0.908	10
Band 5 - NIR	0.865	0.851-0.879	30	Band 8A - Vegetation Red Edge	0.864	0.848-0.881	20
				Band 9 - Water vapour	0.944	0.931-0.958	60
Band 9 - SWIR Cirrus	1.373	1.363-1.384	30	Band 10 - SWIR Cirrus	1.375	1.338-1.414	60
Band 6	1.609	1.567-1.651	30	Band 11 - SWIR	1.612	1.539-1.681	20
Band 7	2.201	2.107-2.294	30	Band 12 - SWIR	2.194	2.072-2.312	20
Band 8	0.590	0.503-0.676	15				
Band 10	10.895	10.60-11.19	100-30				
Band 11	12.005	11.50-12.51	100-30				

Study Area

- The central Anatolian part of Turkey has a continental climate with very high temperatures during the summer days, and cool nights, and cold and hard winters. Central Anatolia is generally a region with low rainfall. The annual rainfall varies between 300-500 mm. When it comes to the distribution of precipitation according to the seasons, the summer season is generally dry, autumn is rainy, while in spring and winter there are heavy rains.



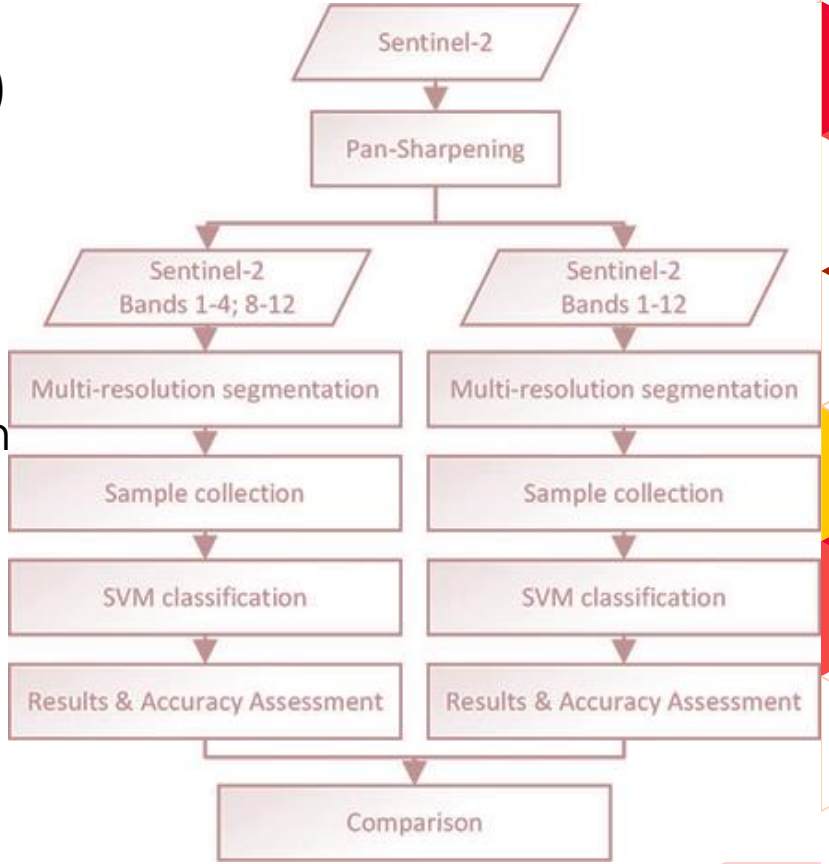
Data and Methods

- Sentinel-2 (10 August 2017)
- Two datasets

- Without red-edge (DS-1)
- S2 all bands (DS-2)

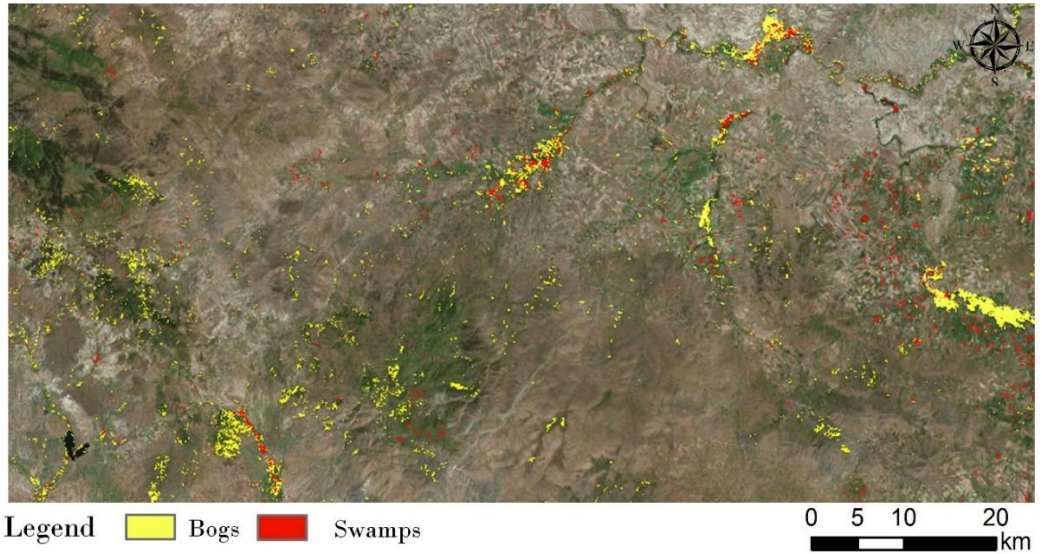
- Object-based classification
- SVM classification

- Classes:
- Bogs
- Swamps



Results

The visual comparison of the results indicates that low accuracy in classifying Swamp areas in the first dataset, while the accuracy of the second class, Bog, has shown that Bogs are being accurately classified, but their readability is significantly low.



Results

	DataSet-1		DataSet-2		
	Swamps	**Bogs**	Swamps	**Bogs**	
User Accuracy	46%	68%	73%	67%	User Accuracy
Producer Accuracy	50%	96%	80%	96%	Producer Accuracy

Disccusion

- Although the red-edge bands did not affect the bog classification, their influence in the swamp classification was very significant. The producer accuracy of the second dataset in the swamp class was 30% higher, and the user accuracy was about 27% higher than the first data set.
- The red-edge bands helped in separating the marsh from the green dense agricultural areas.
- For the investigation of the radar bands over partially decayed vegetated wetland areas such as bogs, further investigations are needed.

Conclusion

The influence of the red-edge bands over Swamp class showed improvement of the results for more than 27%. The complex structure of wetlands requires their classification in more than one class. While both bog and swamp are wetland areas, they have very different characteristics and different dataset should be used for their accurate mapping. Radar data have stronger backscatter signal from wetter surfaces than the one from drier surfaces. Thus, according to the results presented in this study, data obtained from Sentinel-2 are more suitable for marsh classification.

For future studies, we recommend investigating the influence of different data for different wetland classes, as well as multi-temporal data as an addition to the presented datasets in this study.

Thank you for your attention!

For any questions please contact us:
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