Wildfire damage assessment using supervised (svm)-OBIA classification. Nowra, NSW, Australia.

This poster is showing how to do a wildfire damage asessment using remote sensing and GIS, and several methods for verifying the classificacion results.

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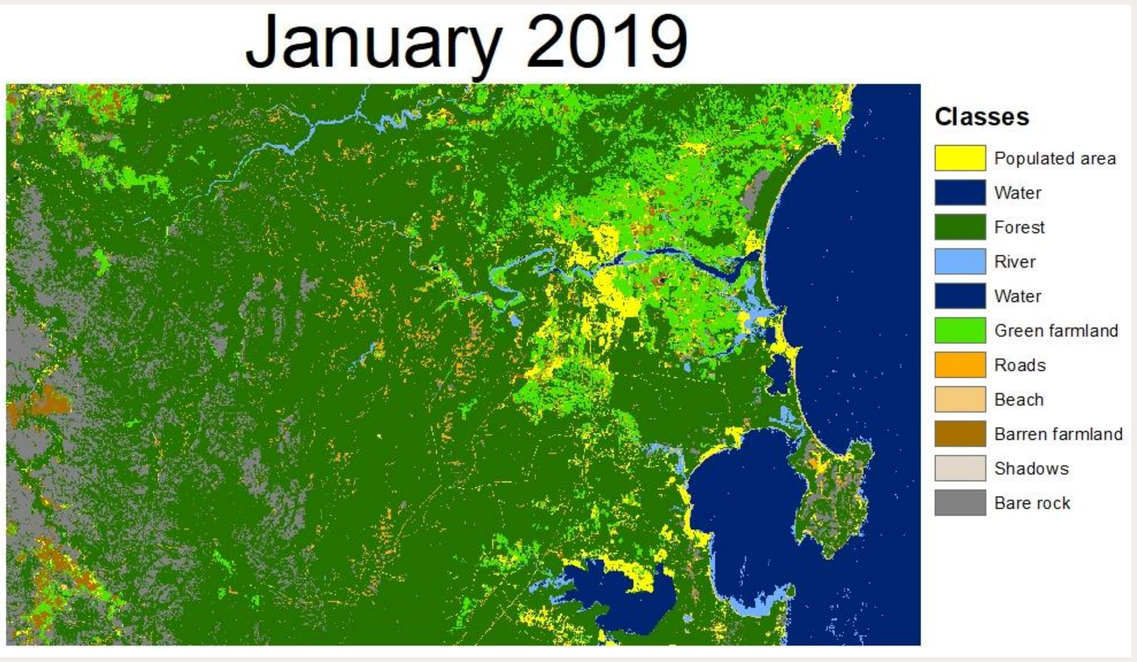
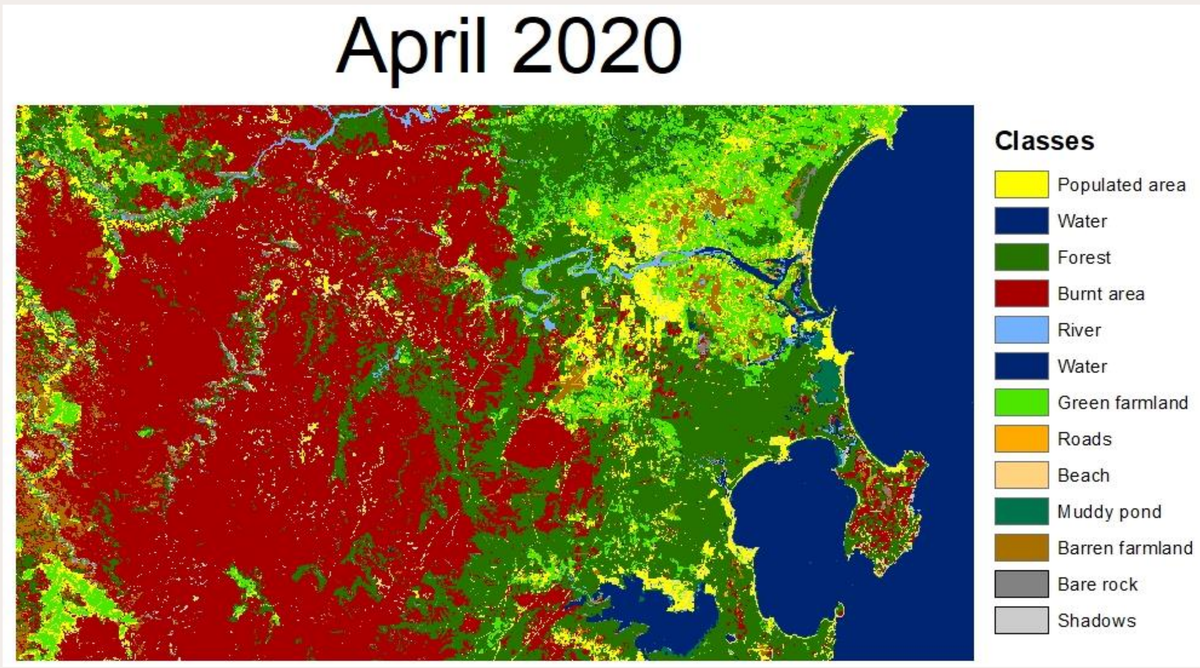




What is this poster about?

Between mid 2019 and until the first months of 2020 a wave of terrifying wildfires hit Australia. This poster is concentrating on the town Nowra in New South Wales, where a fire in Kangaroo Valley had its peak around December 2019.

This poster is showing the results of a supervised OBIA classification using Support Vector Machine. The purpose is to show how a burnt scar can be mapped, how to calculate what kind of landcover was stricken by the flames, and how to verify if the classification is accurate.

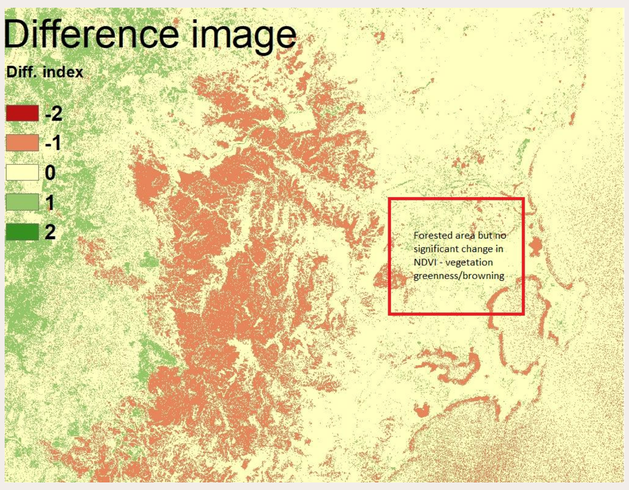
Methods and data

The analysis is based on Sentinel-2 data with 10m resolution. The two images are chosen with about 1 year difference so that a minimum change of landcover can be due to climate or seasonal change. Both images are pansharpened and atmospherically corrected with ATCOR in PCI Geomatica.

The images are made out of the bands RBG, nir, red egde (1-2-3) and Swirl1 & Swirl2. This allowed for making both an NDVI, NDWI and NBR2 (normalized burned ratio 2).

The supervised OBIA classification was chosen as method due to a wish of classifying the whole image to see what types of landcover was hit by the fire, and also because I prefer working with objects.

After classifying the two images a difference image was made comparing solely on NDVI. This was done to assure that vegetation had not changed mainly due to seasonal or climatic changes and to better understand how much land had been bare land also from before.



At the end a change matrix was produced in Excel by intersecting polygons of the classification and calculating the total areas that had changed from each class. Also an accurate assessment of the April2020-classification was made using reference samples from the original satellite image itself as ground truth data, but with more accuracy than the sampling done during the classification. The overall accuracy, Kappa coefficient, users/producers accuracy, omission and commission were all calculated in Excel.

Results and discussion

The difference image:

From the difference image it is clear that some areas with forest had no significant change in NDVI (red square). This makes it less likely that the changes mapped in the classification could be due to seasonal change. The OBIA-classification is likely to show an exaggerated burn scar also because bare rock or sparsely forested area was hard to distinguish visually from the burnt area. The difference image also helps showing where there has been no change due to the landcover being bare ground from before.

The change matrix:

This is confirmed also by the change matrix. Almost as much forest as bare rock has been classified as a burnt scar on the April 2020 image. Other interesting things are that one can see that also farmland and roads were affected by the fires. The change matrix reveals some high numbers that are clearly due to imperfect classification, like river becoming forest, but it also shows a high amount of low numbers where classification of unchanged area indeed have been overlapping.

Overall accuracy: 0.744461

Kappa coefficient: 0.713392

User accuracy mean: 76.35

Producer accuracy mean: 72.08

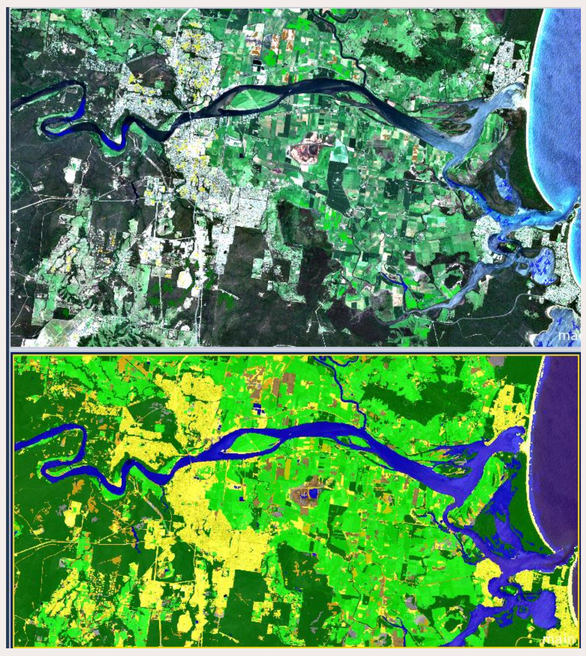
These are not bad results.

Reflections:

If I were to do the task again I would also consider pixeled based classification, as the area is quite big and consists of many weirdly shaped objects that fall into each other. The lines in nature are not always easily distinguished.

There was probably also no need for classifying as detailed for this task as it lead to more confusion, for example a mix between road, shadows, bare rock and burnt area. If I had time I could have corrected small areas manually.

The classification was done based on the mean of every band, it could have helped having also an nDSM and used some thresholdbased classification combined with the supervised. But I think it was an acceptable result for a first time try and several technical problems.



REFERENCES
Data: https://copernicus.nci.org.au/sara.client/#/home
Calculations:
https://www.youtube.com/watch?v=FaZGAUS_Nlo
https://www.youtube.com/watch?v=D2UTdli1KoA

January landcover 2019 in square kilometers	March landcover 2020 in squere kilometers												
		Populated area	Water	Forest	Burnt area	River	Water	Green farmland	Roads	Beach	Muddy pond	Barren farmland	Shadows	Bare rock
	Populated area	x	0.02	24505.00	2.80	0.30	0.33	480611.00	2.91	20301.00	0.06	597806.00	31300.00	200707.00
	Water	0.04	x	0.06	0.01	0.46	x	0.00	0.04	0.20	384801.00	0.00	0.05	0.11
	Forest	3302650.00	0.00	x	16539783.00	642603.00	330705.00	4600439.00	86105.00	0.09	0.03	2721229.00	4444928.00	211712.00
	River	0.66	x	1527005.00	1.56	x	x	0.14	0.99	23901.00	1337602.00	0.45	58202.00	0.22
	Water	0.09	x	0.19	0.00	x	x	0.01	0.57	0.83	1093507.00	0.07	0.08	0.06
	Green farmland	4818642.00	0.00	704708.00	77602.00	15000.00	0.18	x	0.54	0.10		1369719.00	11801.00	30801.00
	Roads	228916.00	0.00	71108.00	1207030.00	0.21	0.05	406505.00	x	0.01	0.01	84505.00	0.46	31103.00
	Beach	38002.00	0.02	0.18	0.07	0.22	0.11	0.08	0.49	x	242700.00	0.07	0.03	0.40
	Barren farmland	760508.00		0.46	1.01	0.03	0.01	425518.00	0.45	0.02		x	0.03	0.17
	Shadows	0.07	0.00	0.13	0.26	0.05	0.00	0.02	0.02	0.00		0.08	x	0.03
	Bare rock	985212.00	0.01	867218.00	19302989.00	0.22	0.08	170702.00	3.98	0.02	0.00	3865034.00	3.13	x