Change detection in Askøy municipality from 1986 - 2019

Supervised pixel based classification of Askøy municipality from 30x30m resolution satellite data.

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Motivation

The overall objective with a image classification is to automatically categorize all the ground reflectance of a image into information classes, like water, vegetation, bedrock, etc. from training data. Different type of information classes perform different reflectance in wavelength.
A supervised classification method is fairly easy to use and can be useful to look at changes in a place from one year to another.
In my project I have chosen two Landsat satellite images and preformed a supervised classification and a accuracy assessment.

Study area - Askøy municipality

Located in western Norway, the island got its present municipality-borders in 1964 but the island has been settled for a long time before. From 1990s the population has increased to some extent more than before, possibly because the bridge "Askøybrua" was built in south of Askøy to connect the island to mainland in 1992 (Svendsen, 2019).

Since the opening of the bridge the population has grown from 18 510 to 29 553 in 2019 (SSB), which is a population increase of approximately 400 people each year. It is therefore obvious that a lot of housing and some industry must be build to cope with the development.

Outline of method

Perform classification

1. **Download Landsat 5 & 8 image.**

2. **Preprocess dataset for atmospheric correction I Qgis 3.12.1**

3. **Build virtual raster.**

4. **Add preprocessed data set into** *Arcmap 10.7*

5. **Selected training samples of different land cover types and made a signature file..**
I selected water, vegetation, bedrock, agriculture, industrial area and Developed area.
Looked at the plotting of spectral values in feature space.

6. **Performed a maximum likelihood classification.**
The pixel is classified as the class with the largest probability
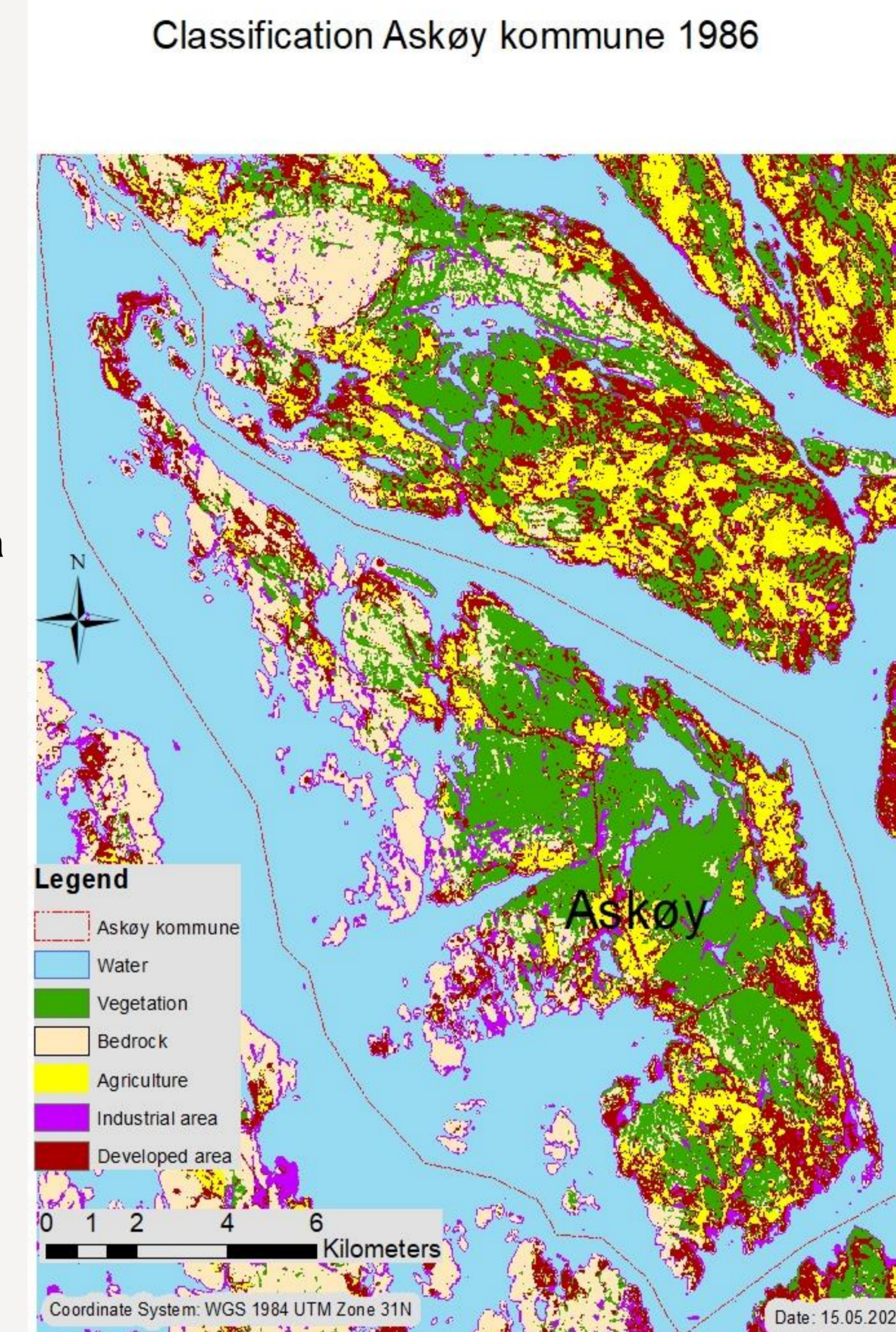The Askøy municipality border was set as extend**.**

Check accuracy of Work

1. **Added new layerfile and added reference points (true value) in each class.**
The virtual raster is set at reference for checking purpose.

2. **Extract value to points**

3. **Frequency**

4. **Pivot table**
Exported to Microsoft ExCel for interpretation.
Error matrix so I can check accuracy
Overall accuracy= total true value/total sample value*100

Conclusion and Next Steps

My project has shown a change detection on Askøy from 1986 to 2019. In the visual inspection of the classifications it is easy to see that there has been a large increase in the "developed area" and "vegetation" class and a decrease in agriculture class. Water and bedrock have minor changes and the industrial class is more clustered in 2019 than 1986. The industrial class is somewhat incorrect classified in some areas around islands and water because of many reflectance values are the same in "bedrock" and "industrial area".

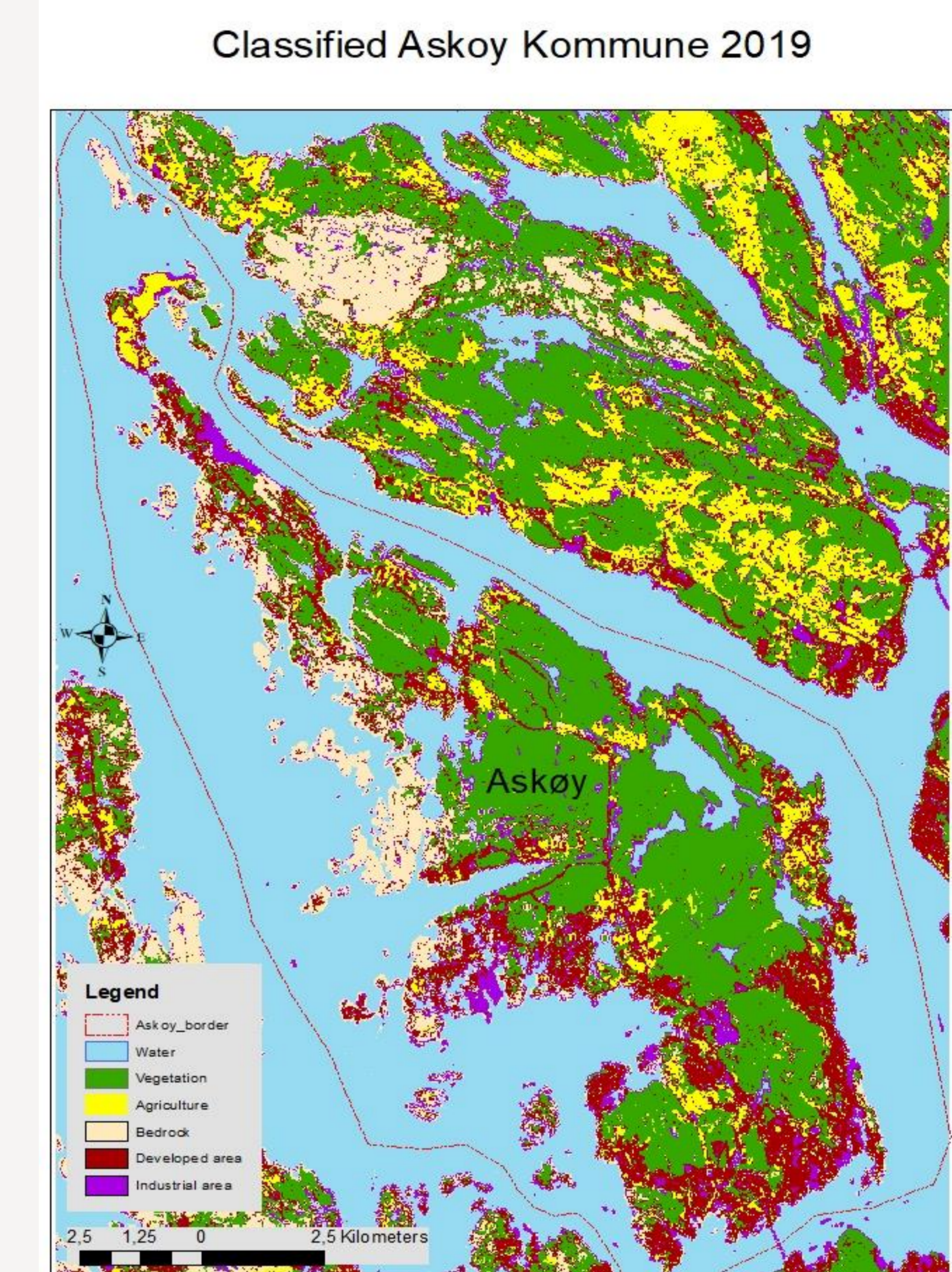For a improved classification I could use more training sample points and adjusted the thresholds.

Classification Askøy kommune 1986

Classified Askoy Kommune 2019

Accuracy assessment of Askøy 1986

Overall accuracy 87,93 %

Kappa coefficent 0,86

Classification	Water	Vegetation	Bedrock	Agriculture	Industrial area	Developed area	Ground truth total
Water	15	0	0	0	0	0	15
Vegetation	0	34	0	0	0	0	34
Bedrock	0	0	44	0	1	3	48
Agriculture	0	0	0	34	0	5	39
Industrial area	0	0	1	0	31	10	42
Developed area	0	3	0	0	5	46	54
Total	15	37	45	34	37	64	232

Producer accuracy			Percent		Users accuracy			Percent
Water	15	15	100,0		Water	15	15	100,0
Vegetation	34	37	91,9		Vegetation	34	34	100,0
Bedrock	44	45	97,8		Bedrock	44	48	91,7
Agriculture	34	34	100,0		Agriculture	34	39	87,2
Industrial area	31	37	83,8		Industrial area	31	42	73,8
Developed area	46	64	71,9		Developed area	46	54	85,2

Accuracy assessment of Askøy 2019

Overall accuracy 92,70 %

Kappa coefficent 0,91

Classification	Water	Vegetation	Bedrock	Agriculture	Industrial area	Developed area	Ground truth total
Water	57	0	0	0	0	0	57
Vegetation	0	68	0	0	0	0	68
Agriculture	0	0	40	0	0	3	43
Bedrock	0	0	0	46	3	0	49
Industrial area	0	0	0	4	105	8	117
Developed area	0	0	0	5	13	141	159
Total	57	68	40	55	121	152	493

Producer accuracy			Percent		Users accuracy			Percent
Water	57	57	100,0		Water	57	57	100,0
Vegetation	68	68	100,0		Vegetation	68	68	100,0
Bedrock	40	40	100,0		Bedrock	40	43	93,0
Agriculture	46	55	83,6		Agriculture	46	49	93,9
Industrial area	105	121	86,8		Industrial area	105	117	89,7
Developed area	141	152	92,8		Developed area	141	159	88,7

Source of error

- The quality of overall result is connected to the quality of the training data. In my project the resolution is 30x30 meter. If I had a better resolution data the result would have been more accurate.

- The reflectance of "bedrock" and "industrial area" pixels have in some places the same value, specially in the "Askøy 1986" the classification around the small islands outside western Askøy and some lakes on the island is incorrect classified.

REFERENCES
- Statistisk sentralbyrå (SSB) Askøy (Vestland)
https://www.ssb.no/kommunefakta/askoy
- Svendsen, Trond Olav; Thorsnæs, Geir: Askøy i Store norske leksikon på snl.no.
Hentet 15. mai 2020 fra https://snl.no/Ask%C3%B8y
Software used:
ESRI Arcmap 10.7.
QGIS 3.12.1

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