DISAC: Precision spraying in onion fields

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Background and objective

Thistle (*Cirsium arvense*) is a mayor weed in onion cropping. Currently spraying happens in the whole field. It is desirable to go to a more selective spraying regime. This project aims to enable precision spraying using drone-images.

Activities

- Drone images were taken in fields close to Abbenes and Lelystad.
- Drones flew on different heights resulting in different resolutions.
- Thistles were marked in the field with RTK-GPS.
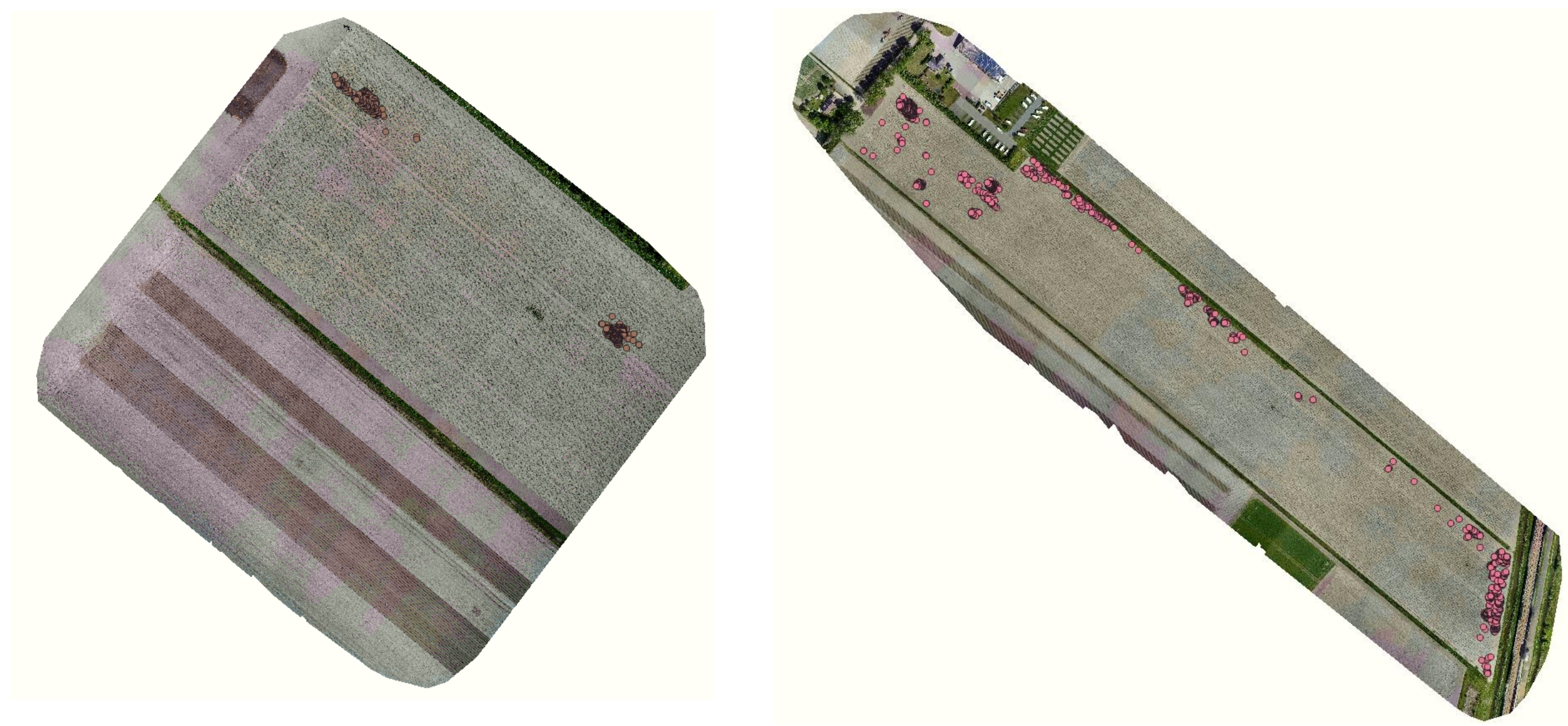
Drone images taken in May 2018 close to Abbenes. The left image is the same area as the top left corner of the right image. On the left image the drone flew about 22 m high, on the right image this was about 100m.

Deep learning approach to find thistle.

- A weakly supervised method was chosen.
- Tiles including thistle and not including thistle were cut.
- Tiles of the lower and higher resolution images were taken on exactly the same locations.

	High resolution	Low resolution
Containing thistle		
Not containing thistle		
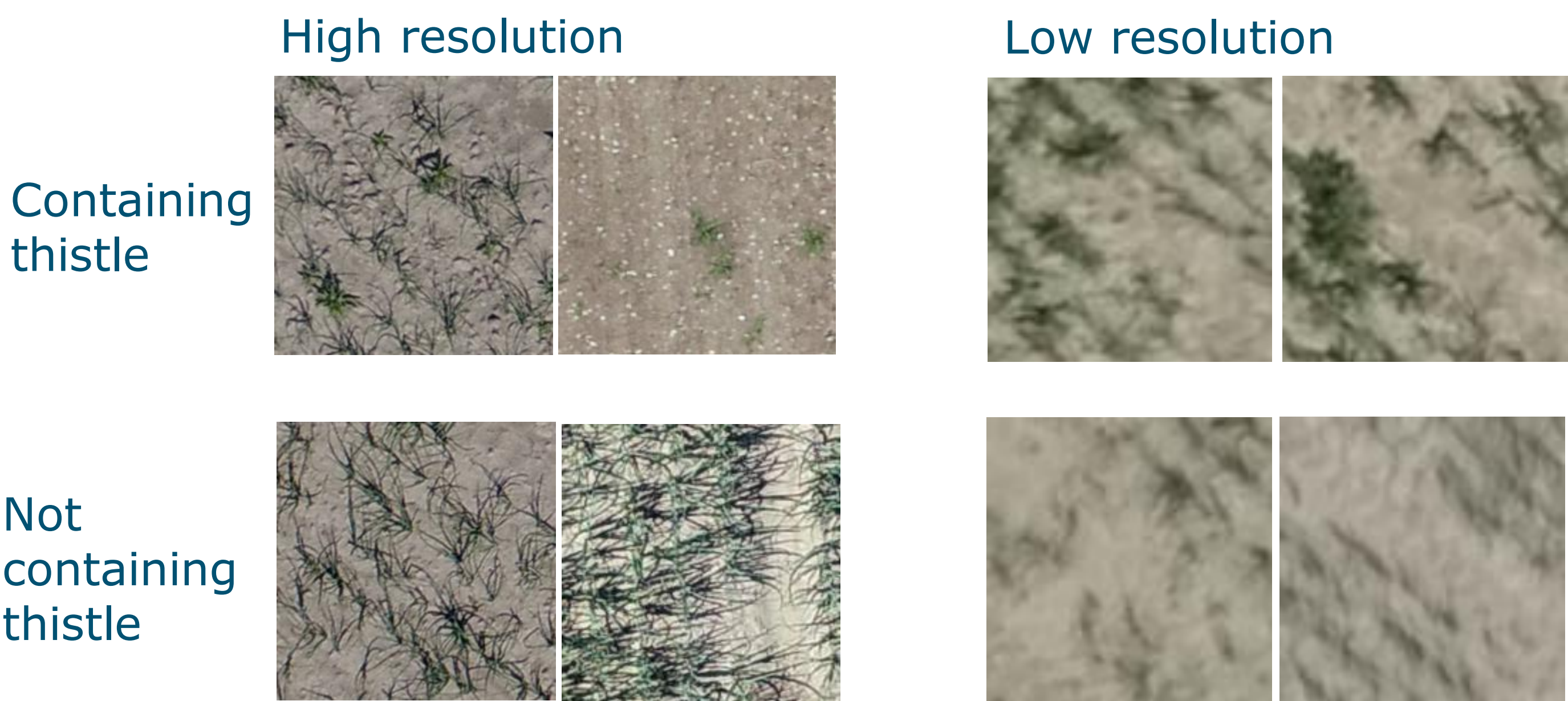
Examples of tiles used for the learning algorithm, both of the higher resolution image, were the drone flew lower, and the lower resolution image.

Algorithm

Transfer learning using Resnet18 was used to generate a neural network that could identify thistle.

		Actual	
		Thistle	Not Thistle
Predicted	Thistle	189	2
	Not Thistle	0	292

		Actual	
		Thistle	Not Thistle
Predicted	Thistle	189	5
	Not Thistle	0	287

Confusion matrices of the models trained on high (left) and low resolution data of 2018.

|		Actual	
		Thistle	Not Thistle
Predicted	Thistle	404	7
	Not Thistle	31	694

Confusion matrices of the model trained on high resolution data from 2018 and 2019.

Scanning the fields

Using the models developed some software was developed to scan drone images to scan for thistle.

Transfer to task map.

We translated the locations of the thistle found on the map to a task map. Using such a map the spraying machine can be set to only spray where necessary.

Rate [l/ha]
400
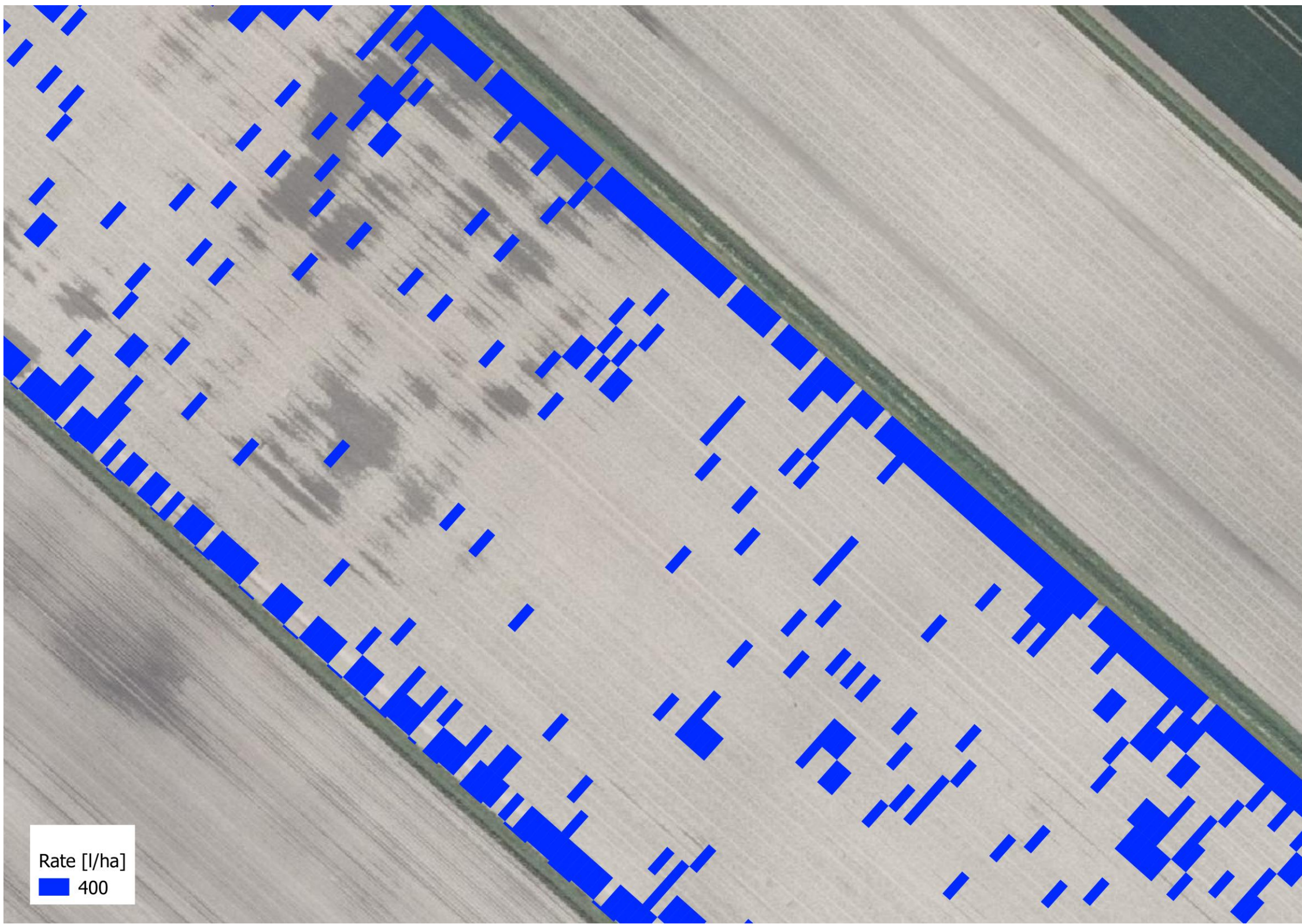
Task map for the fields of Abbenes.

Next steps

Evaluate the low density images of 2019, and get some more images in the growing season of 2020 to validate the models.

Acknowledgements