Mapping of land surface cover and winter forage in Southland

environment SOUTHLAND REGIONAL COUNCIL
Te Taiao Tonga

Manaaki Whenua
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Winter forage crops in Southland are grown over summer and autumn and used to fill the winter 'feed gap' when pasture growth is slow. Areas of winter forage crops vary in time and space from year to year across Southland. Crops include kale, swede, fodder beet and cereal species.

Problem

During winter months, areas of forage crops are intensively grazed by livestock. Break-feeding allows stock to access the crop in stages. Feeding in this way usually results in complete crop removal and significant soil disturbance by animal treading.

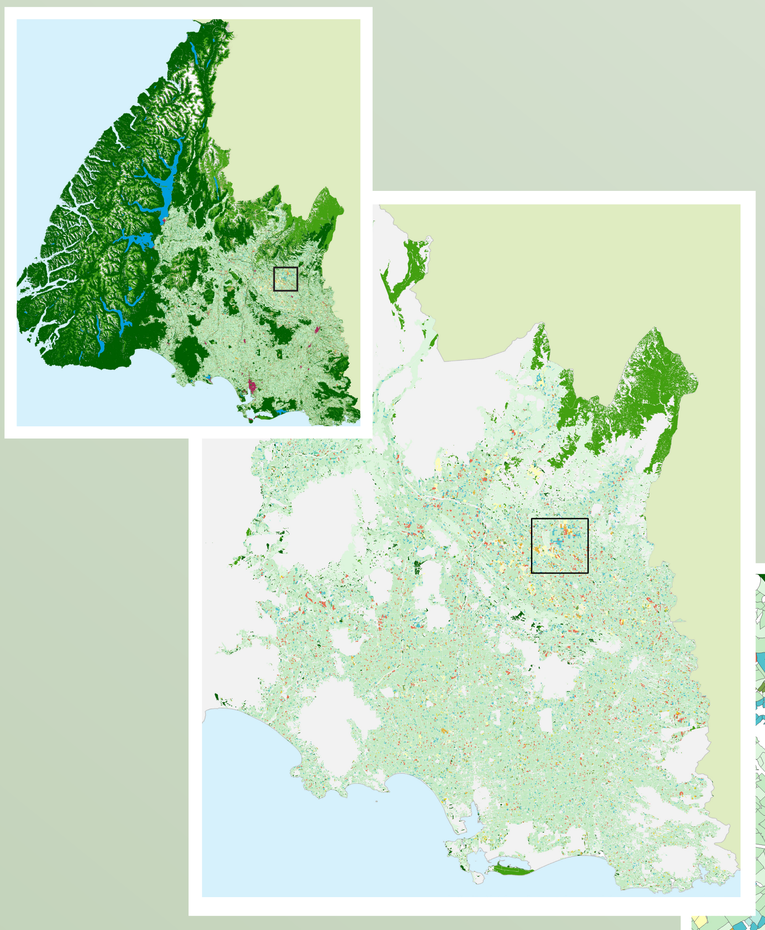
Grazed areas can result in excess sediment, nitrogen, phosphorus and pathogens reaching nearby waterways and compromising ecosystem health.

Rules for grazed forage crops

To help reduce the risk of contaminants from areas of grazed forage crops entering waterways, Environment Southland has notified rules for restricting the area and location of grazed forage crops.

Objectives

To investigate the use of satellite imagery to evaluate the onground changes to grazed winter forage crops regimes.



Methods and Results

Sentinel-2 and Landsat-8 images were acquired between February and October 2017 and re-projected to the New Zealand Transverse Mercator (NZTM) map grid as 10 m pixels. The imagery was radiometrically calibrated to produce a topographically 'flattened' product that minimised brightness variations in hilly areas (Shepherd & Dymond 2003).

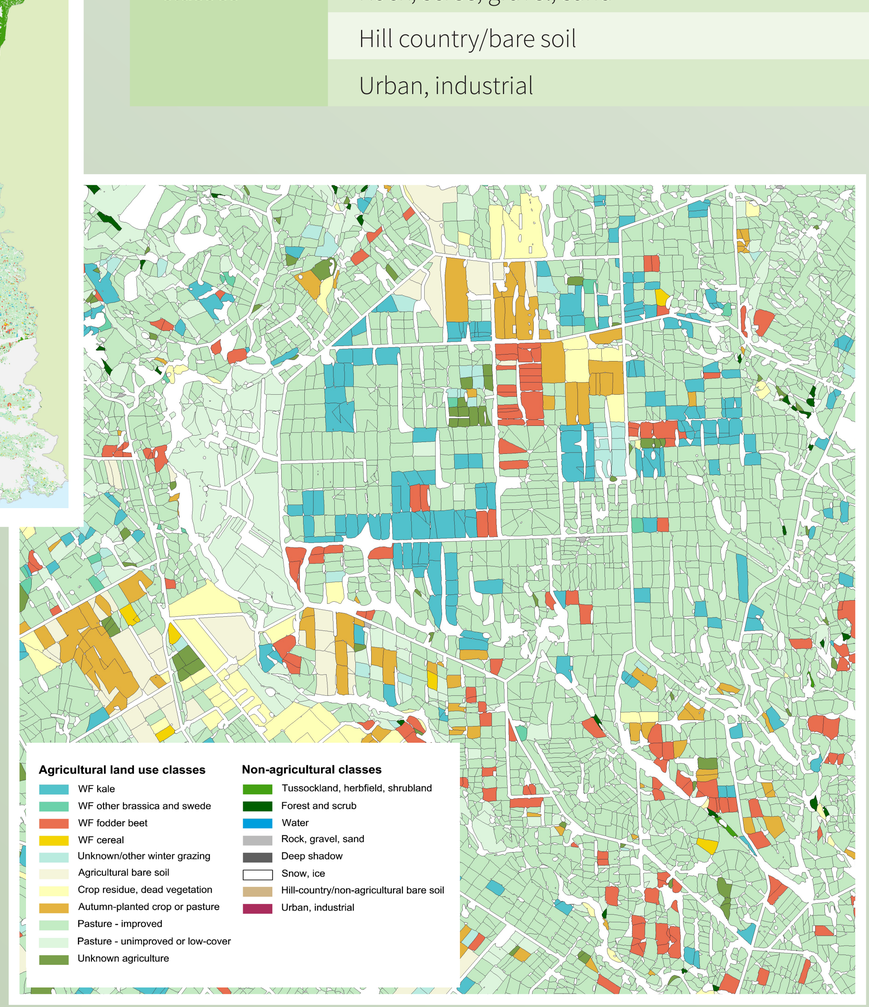
Cloud, haze and cloud-shadow were masked from 31 images, which were then classified into 10 key agricultural and 7 non-agricultural land cover types.

We then developed multi-temporal rules to compose a single per-pixel (raster) of winter forage and other land covers between February and October 2017.

A novel algorithm was used to map paddock boundaries, which were then imposed on the per-pixel land use map. Additional rules were used to assign crop and pastures paddock to polygons for the observed season. Total areas of polygons were summed for the classified land cover types (Table 1).

Table 1: Agricultural and non-agricultural land use classes for Southland

	CLASS	AREA(HA)	% AREA OF TOTAL AGRICULTURAL CLASSES
Agricultural land use classes	Winter forage – kale	23,772	2.9%
	Winter forage – other brassica and swede	8,413	1.0%
	Winter forage – fodder beet	19,428	2.3%
	Winter forage – cereal	2,725	0.3%
	Unknown/other winter grazing	5,211	0.6%
	Agricultural bare soil (April–July)	5,559	0.7%
	Crop residue, dead vegetation (April–July)	8,877	1.1%
	Autumn-planted crop/pasture	6,206	0.7%
	Pasture – improved	558,596	67.3%
	Pasture – unimproved/poor quality/low cover	182,415	22%
	Unknown agriculture	8,629	1.0%
	Total:	**829,831**	
Non-agricultural land use classes	Forest and scrub	10,814	
	Tussockland, herbfield, alpine shrubland	65,541	
	Water	49	
	Snow, ice	905	
	Rock, scree, gravel, sand	432	
	Hill country/bare soil	48	
	Urban, industrial	2	



Example of mapped land use classes, showing extensive areas of winter forage crops.

Future work

Total areas of winter forage crops from 2017 will be compared with those from 2014 also estimated from satellite imagery (Pearson, Couldrey and Rodway, 2016).

Analysis of the 2017 data is in progress and Environment Southland intends to continue to gather this or similar land cover information for monitoring the effect of rules and for investigating sources of agricultural pollutants.

References

Shepherd JD, Dymond J*R 2003. Correcting satellite imagery for the variance of reflectance and illumination with topography. International Journal of Remote Sensing* 24: 2503–3514.

Pearson L, Couldrey M, Rodway E 2016. *Spatial analysis of winter forage cropping in Southland and implications for water quality management.*