
Photograph supplied by Wayne Andrewes

Distinguishing kikuyu (Pennisetum clandestinum) and other sub-tropical grasses from temperate grasses in Northland.

Landcare Research
Manaaki Whenua

Heather North & Stella Belliss
Landcare Research, P.O. Box 40, Lincoln 7640
NorthH@landcareresearch.co.nz
Bellisss@landcareresearch.co.nz

Introduction

Kikuyu is a sub-tropical C4 grass that was introduced into Northland around 100 years ago. Properly managed, it is a beneficial pasture species; without management, it is a weed. It also causes occasional serious toxicity after rainfall in excess of 20mm, grass temperatures above 14 degrees C., and invasion of pasture by army worms. Land cover mapping in the 1980s found kikuyu was dominant in around 25% of Northland pastures. It is believed that it is now much increased and that it is also moving south.

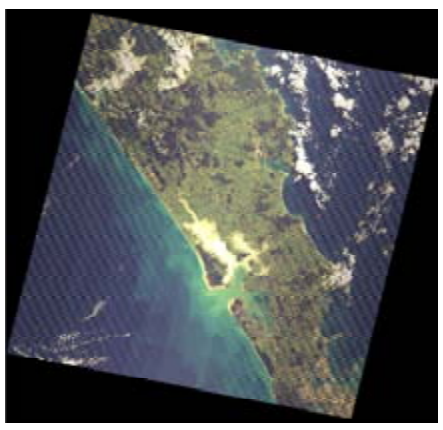
Northland Regional Council wishes to know the current kikuyu extent as an input to nutrient management strategies on farms, to erosion and sediment discharge risk assessment, and as an environmental indicatior for climate warming impacts.

Mapping method

Winter 2006 saw Northland experience several frosts, including a severe one on 27 June which affected all the Far North. Sub-tropical grasses were frost-damaged throughout the region, causing them to change colour from light green to yellow and light brown. Temperate grasses, especially ryegrass, were unaffected.

A fortuitous remote sensing satellite overpass captured the big frost at 10 a.m. on 27 June, and a second fortuitous, and partially cloud-free pass on 5 July followed. We have attempted to map the two pasture types in Northland by using their spectral differences in the second image, 8 days after the frost affected the kikuyu. Sub-tropical grasses should have changed from light green to yellow or brown between the two dates; temperate grasses should have remained green.

Local knowledge specifying areas with a kikuyu component, and areas dominated by ryegrass, was provided by a Northland farm consultant and this was used to guide the classification.

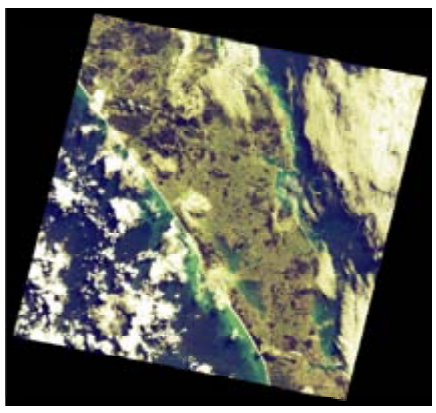


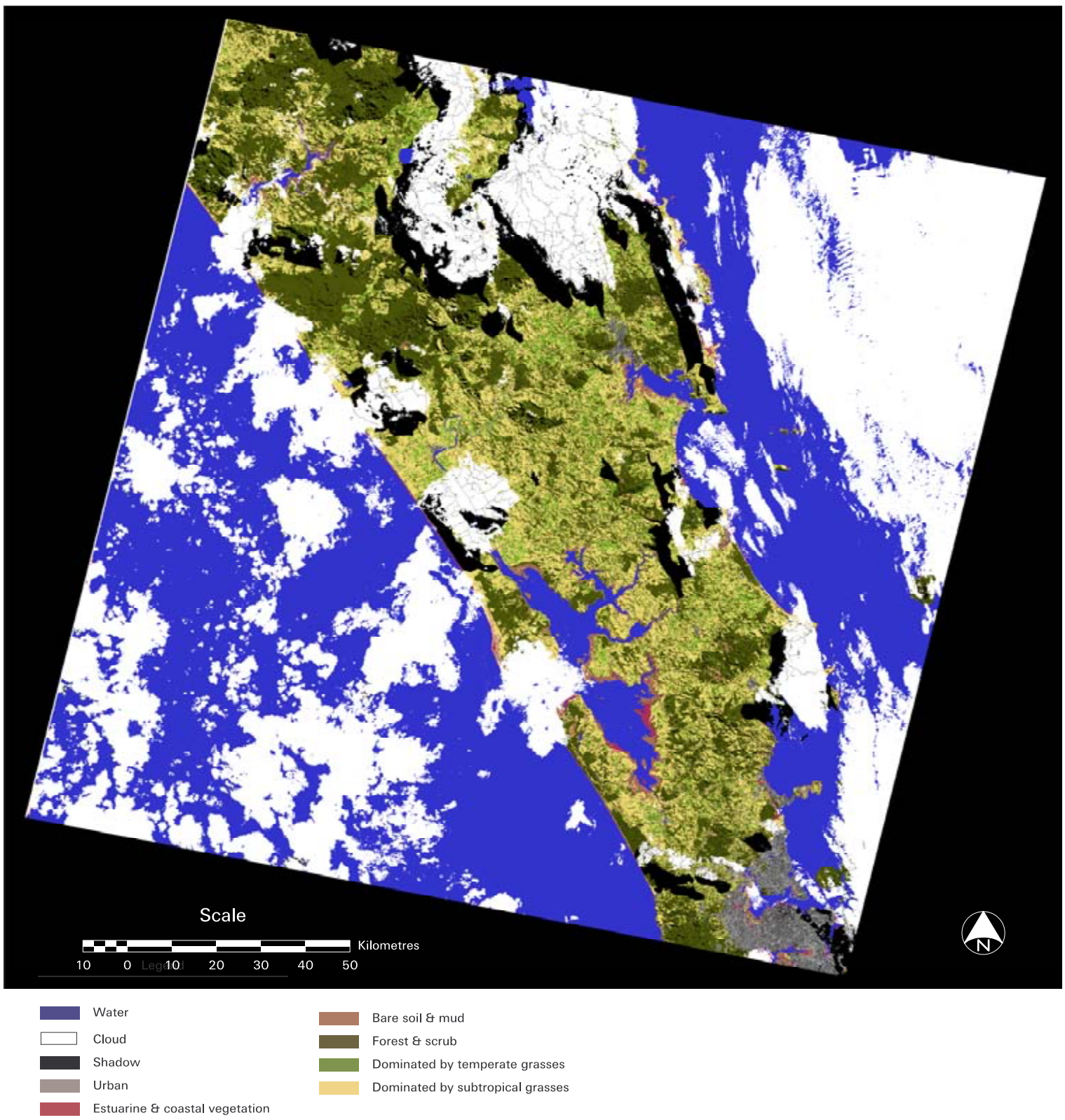
The day of the big frost
Landsat-7 ETM+ 27 June 2006
Note: A line drop-out fault is causing data losses towards the edges of the image.

Satellite imagery used for the analysis

Landsat 5 and Landsat 7 multispectral scanner data have a swath width of 185 km, 30m spatial resolution (pixel size) and spectral bands in blue, green, red, near infrared, far infrared, short-wave infrared, and thermal.

Data from both satellites are usually received over NZ by a station in Hobart every 16 days. Good satellite images of Northland are hardly ever available due to persistent cloud cover. The classification map opposite was derived from the Landsat 5 image (see below) that was taken 8 days after the frost.





Results

The resulting land cover classification map is shown above. Of the Northland/Auckland land area in pasture (and not under cloud or shadow), 81 % has been identified as dominated by kikuyu and other sub-tropical grasses and 19 % has been identified as dominated by temperate grasses. Other classes included on the map are urban/built-up areas, forest and shrublands, and bare ground.

The accuracy of these results remains to be field-checked; however, we know that inaccuracies will include:

* we do not know exactly where our classification has drawn the line between kikuyu dominance and temperate grass dominance, in terms of a percent cover.

* areas of kikuyu near to the coast or in other protective micro-environments may not have been frosted and therefore will not classify as kikuyu

* areas of temperate grasses that were heavily grazed and/or trampled between the two dates may have misclassified as kikuyu because they too will look brown or light yellow

* some bare soils look brown and may misclassify as kikuyu

* where farmers are strip-grazing in paddocks and where paddock sizes are small, the spatial resolution (pixel size) of the satellite imagery used was insufficient (too coarse) and thus spectral signatures from individual areas cannot be distinguished.

Conclusions and recommendations

Kikuyu and other sub-tropical grasses can be distinguished from temperate grasses at optimal conditions - mid-winter, after a frost - especially where the grazing practices use larger (over 2 ha) field sizes. We recommend that this classification map be rigorously field-checked to ascertain how correctly it is identifying kikuyu-dominant areas.

If a full survey was to be planned, we strongly advise the use of higher resolution satellite data sources. A pixel size of 10m or better would be suitable for paddock-scale mapping. These data, available on order, would both increase the accuracy of the mapping, and would give more opportunities for successful, cloud-free data acquisition.

Acknowledgements

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