SUMMARY OF METHOD FOR DERIVING STOCK EXCLUSION LOW-SLOPE LAND EXTENT FOR THE RESOURCE MANAGEMENT (STOCK EXCLUSION) REGULATIONS 2020

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Background

The Resource Management (Stock Exclusion) Regulations 2020 under the Resource Management Act 1991, include reference to low slope land. Low slope land has been specified in the low slope map, which is incorporated by reference in the regulations. The mapped low slope land has been defined as "land where the average slope is less than or equal to 10 degrees across the land parcel or area of land parcel used for grazing".

This methodology describes how the low slope map, and associated spatial layer that are incorporated in this regulation, have been created.

The following requirements were identified for the low slope land layer:

1. It must be nationally consistent and use nationally consistent, freely available input datasets.
2. It must use a unit of assessment that does not cross land ownership boundaries.
3. The unit of assessment must be large enough for practical land management without being so large that low-slope areas are missed in slope averaging.
4. It must reasonably capture all significant areas (whole paddocks) of low-slope land where livestock grazing is likely to occur.
5. All land uses need to be included except settlement, recognising that the layer needs to show where the stock exclusion rules would apply regardless of the current land use (for example, plantation forestry).
6. Significant areas of low-slope grassland within high-slope parcels should also be identified and these parts of parcels should be included in the low slope map.
7. The low-slope threshold is defined as an average of 10 degrees or less across all the pixels within a land parcel or part parcel where other land uses (such as settlements) have been removed from the parcel.
8. Land parcels with a parcel intent of "Road" are to be excluded from the analysis, but "Hydro" parcels are to be included because these areas are often grazed.
9. Lakes and ponds, as defined in the Land Cover Database (LCDB5) are to be removed from the layer.

Choice of unit of assessment

Land parcels, as defined in the LINZ Primary Parcel layer, have been chosen as the unit of assessment. While land parcels are typically larger than land management units (e.g. paddocks), they provide a readily

available boundary with clear ownership/management responsibility. Using a larger unit of assessment such as farm enterprise or property was problematic because:

- National datasets on this are not publically available.
- Definitions of a property are varied and can change as land is leased.
- Properties are often extensive and include land parcels that are disconnected and widely spread across a region. It would therefore not be reasonable to assess the entire property for average slope as this is likely to miss significant areas of low-slope land (Criteria 4 above).

It is recognised that, even using land parcels, it is possible that significant areas of low-slope land may be missed. This is because some rural land parcels are very large and may include an area of low-slope land and an area of very steep land, which on average exceed the low-slope threshold. For this reason, these low-slope areas within high-slope parcels were also identified and included in the final low slope land layer.

Following detailed analysis of the LINZ Primary Parcel dataset, it was noted that the layer includes multipart polygons – those for which a single land parcel was represented as a number of non-adjacent polygons, sometimes spread over some distance and into different types of terrain. For the purposes of this analysis, the mulitpart polygons have been exploded so that each unit of assessment is a single contiguous piece of land either representing an entire land parcel or a geographically discrete part of a mulitpart land parcel.

It was also noted that the LINZ Primary Parcel layer includes a small number of overlapping polygons. Following consultation with LINZ, it was confirmed that these overlaps were legitimate and therefore should be include in the analysis such that the area would be included in the final low slope land map if any of the overlapping parcels met the low-slope threshold.

Choice of elevation data set

The elevation dataset used for this analysis needed to balance providing a fair representation of the contour of the landscape without providing so much detail that the average slope measurements are unreasonably inflated. The elevation model used was the best available at the Ministry for the Environment: the Manaaki Whenua – Landcare Research 15m resolution Digital Elevation Model (DEM) derived from LINZ 20m contour data. This elevation model, which was hydrologically enforced using the River Environments Classification (REC) dataset, was developed to provide good estimates of slope and aspect for topographically correcting satellite imagery. The focus on slope accuracy, as opposed to absolute elevation accuracy, makes this DEM ideal for this application.

Source datasets

Name	Source	Date accessed
LINZ primary parcel layer	https://data.linz.govt.nz/layer/50772-nz-primary-parcels/ (version updated on 15 May, 2020)	20/5/20
MWLR 15m digital	This DEM was produced by Manaaki Whenua with a focus on getting good slope and aspect information for use in topographic	Held by MfE since 2008

elevation model (GRS80)	correction of satellite imagery. The algorithm used to build this DEM used the River Environments Classification (REC) dataset to enforce hydrology. The version used wa based on the GRS80 ellipsoid.	
LINZ Coastline	LINZ coastline and island polygons (Topo 1:50k): https://data.linz.govt.nz/layer/51153-nz-coastlines-and-islands-polygons-topo-150k/	27/6/2020
Land Cover Database 5	National land cover map available from Landcare's LRIS portal: https://lris.scinfo.org.nz/layer/104400-lcdb-v50-land-cover-database-version-50-mainland-new-zealand/	30/1/2020

Methodology

The general steps in the geo-processing methodology were as follows:

1. Starting with LCDB5, an exclusion layer of the built-up areas, open parkland, transport infrastructure, and lakes and ponds was created (LCDB5 exclusion layer).
2. The LINZ Primary Parcel layer was converted to single part and Road parcels were removed (Primary Parcel layer).
3. The LCDB5 exclusion layer was erased from the Primary Parcel layer.
4. The Slope layer was calculated in degrees from the MWLR DEM using ERDAS Imagine.
5. The average slope for each primary parcel or part parcel was calculated.
6. All land parcels with a mean slope of less than or equal to 10 degrees were selected (Initial low slope extent).
7. To identify the remaining low slope grazing areas that occur within high slope parcels, all land parcels with a mean slope greater than 10 degrees were selected and clipped to the area of high and low producing grassland, and annual cropland, in LCDB5.
8. The mean slopes for these polygons was recalculated and the polygons with a mean slope < 10 degrees selected. These polygons, that represent low-slope pockets within high-slope parcels, were added to the initial low-slope extent (All low slope areas layer).
9. This layer was dissolved without creating multiparts.
10. Polygons with an area greater or equal to 2 hectares were selected.

The result of step 10 is the final stock exclusion low slope land extent as shown in Figure 1 below and as incorporated by reference in the regulations.

Figure 1: Stock Exclusion Low slope land 2020 layer