



# Update of the Erosion Susceptibility Classification (ESC) for the proposed NES for Plantation Forestry: Managing changes to the ESC and incorporating detailed mapping

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Publications Logistics Officer  
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PO Box 2526  
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# **Update of the Erosion Susceptibility Classification (ESC) for the proposed NES for Plantation Forestry**

## **Managing changes to the ESC and incorporating detailed mapping**



**Landcare Research**  
**Manaaki Whenua**



## **Update of the Erosion Susceptibility Classification (ESC) for the Proposed NES for Plantation Forestry**

### **Process for managing changes to the ESC and incorporating detailed mapping**

**Les Basher, James Barringer, Ian Lynn**

*Landcare Research*

*Prepared for:*

#### **Ministry for Primary Industries**

25 The Terrace  
PO Box 2526  
Wellington 6140  
New Zealand

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*Landcare Research, 1st Floor, 24 Nile Street, Private Bag 6, Nelson 7042, New Zealand,  
Ph +64 3 545 7700, Fax +64 3 545 7701, [www.landcareresearch.co.nz](http://www.landcareresearch.co.nz)*

*Landcare Research, Gerald St, P O Box 69040, Lincoln 7640*

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Reviewed by:



Peter Newsome  
Scientist  
Landcare Research

Approved for release by:



Chris Phillips  
Portfolio Leader  
Realising Land's Potential

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Landcare Research Contract Report:

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# Summary

## Project and Client

- The Ministry for Primary Industries (MPI) is leading a process to deliver greater national consistency in the management of plantation forestry under the Resource Management Act (RMA) by implementing a National Environmental Standard (NES) for Plantation Forestry. An Erosion Susceptibility Classification (ESC) is a critical input into the proposed NES as it underpins the level of control for different plantation forestry activities. However, the ESC has limitations related to the underlying data it was derived from, scale of mapping and misclassification of some land. MPI engaged Landcare Research to refine the ESC for misclassified land and to establish a process by which future changes to the ESC might be managed once the NES is implemented.

## Objectives

- Outline a process for managing changes in ESC class related to scale or misclassification errors.

## Results

- A proposed process is described in generic terms involving 6 roles (Initiator, Administrator, Mapper, Quality Assurance (QA), Technical Audit and Approval (TAA), Data Manager), the functions of each role are defined, information requirements to complete the process are outlined, and agencies that could fill those roles are identified.
- The process proposed includes the following steps:
  - 1) Notification by a forestry company or other party (the 'Initiator') to the Administrator of the NES of an intention to request changes to the published ESC mapping. All requests will be lodged in a centralised database maintained by the Administrator.
  - 2) The Initiator will instruct an approved Mapper either to document the basis for reclassification of a Land Use Capability (LUC) unit, or to provide detailed LUC/ESC mapping for a designated area.
  - 3) The relevant information is compiled by the Mapper, either
    - i. Detailed mapping (linework, resource inventory, LUC unit description, potential erosion assessment, ESC class) or
    - ii. Basis of a request for LUC unit ESC classification review
  - 4) QA will provide an accuracy check of the mapping and an overview to ensure national consistency and standards in the provision of mapping data, LUC classification and ESC class assessment.

- 5) The mapping/reclassification information will be submitted to TAA for independent audit and, once accepted, the changes recommended to the Administrator.
  - 6) The Administrator will update the ESC request database and instruct the Data Manager to archive the data. The Administrator will also manage access to the new ESC data.
  - 7) The Data Manager will prepare the data for archiving; be responsible for data standards, metadata and version control; load the data to a Web portal; and manage the Web portal on behalf of the Administrator.
- Detailed LUC/ESC mapping should follow the guidelines for farm scale land resource inventory mapping described in section 4 of the LUC Survey Handbook (3<sup>rd</sup> ed) since the land resource inventory is used to underpin assessment of LUC unit, potential erosion and ESC class.
  - Assessment of potential erosion, either for changes to existing ESC class or for new LUC units, should be based on:
    - maximum present mass movement (including gully and tunnel gully) erosion at the time of mapping
    - evidence of past mass movement erosion
    - frequency and magnitude of erosion events
    - interpretation of the erosional susceptibility of rock type, regolith, soils, and landforms
    - consistency with national rankings of related LUC units and definition of potential erosion (under grassland with no soil conservation measures applied)
    - historical experience with managing the terrain of that LUC unit and its current resource consent status.
  - ESC mapping that underpins the NES will require a consistent standard to be maintained as well as national correlation of LUC units and ESC. It is suggested the TAA group compile a list of Approved mappers and this list be made available via the Administrator to guide Initiators in the choice of personnel to prepare LUC/ESC maps and documentation.
  - There will be costs associated with implementation of a process to archive and manage on-going changes to the ESC and the appropriate funding model should comprise a mix of user and central government funding.

## **Conclusions**

- There will be ongoing change to the ESC after the NES for Plantation Forestry is gazetted.
- To maintain national standards and consistent application across New Zealand a robust process for approving changes and making them publically accessible is needed.
- National standards in mapping and assessment of ESC class can be achieved by using approved Mappers to provide new data, appropriate quality assurance procedures, a

transparent process for documenting and reviewing changes that are made, centralised archiving of all changes, and documentation of the basis of changes.

## **Recommendations**

- A template for a request to review ESC mapping or classification should be developed to ensure a standard set of information is supplied
- There is a need to develop a model for accreditation of approved Mappers, a list of approved Mappers, and a defined set of competencies
- A standard set of conditions for data release should be developed by the Administrator and Initiators
- Further work is needed to clarify how the legal status of changes is managed when the NES is likely to incorporate the ESC by reference.



## 1 Introduction

The Ministry for Primary Industries (MPI) is leading a process to deliver greater national consistency in the management of plantation forestry under the Resource Management Act (RMA) by implementing a National Environmental Standard (NES) for Plantation Forestry (hereafter simply referred to as the NES). The Erosion Susceptibility Classification (ESC) developed by Bloomberg et al. (2011) from potential erosion data associated with the New Zealand Land Resource Inventory (NZLRI) is a critical input into the proposed NES as it underpins the level of control for different plantation forestry activities. The ESC has limitations related to scale of mapping and misclassification of some land (Robson 2013; Basher et al. 2014) that will result in ongoing changes to the ESC once the NES is implemented. MPI engaged Landcare Research to refine the ESC for misclassified land and to establish a process by which changes to the ESC might be managed once the NES is implemented. The work requested includes 3 components:

- 1) Design of process by which a party can apply to have ESC units/polygons refined, reassessed, or new units created, and, where appropriate, officially reclassified,
- 2) Reclassification of those ESC units/polygons that are clearly misclassified as ‘orange’ (ESC class high) or ‘red’ (ESC class very high) under the current ESC (Bloomberg et al. 2011),
- 3) A classification of ‘graded level of severity’ applied to the ‘orange’ category under the updated ESC.

This report describes work completed for the first component.

## 2 Background

Robson (2013) proposed a process for dealing with scale and misclassification issues related to the ESC; however, it did not include any means of ensuring that changes made in one area are propagated to other areas, or how to manage new detailed mapping of ESC (Basher et al. 2014). Because the ESC underpins a national environmental standard there has to be national consistency in application across the country and a ‘gatekeeper’ to archive all changes that are made. This will potentially include:

- new mapping at detailed scale provided by forestry companies and forest owners,
- requests for reclassification of some existing LUC units, and
- definition of new LUC units, and their ESC class, recognised at detailed mapping scales.

The ESC (Bloomberg et al. 2011) will determine the resource consent status of different forestry activities under the proposed NES and be used to define the erosion risk associated with each activity. The ESC was developed using ‘Potential Erosion Severity’ (PES) data for mass movement (including gully and tunnel gully erosion) published in regional Land Use Capability (LUC) bulletins and extended legends (NWASCO 1975–79, 1979; NWASCA 1986a, b) that were the basis of the NZLRI. The published PES ratings for each LUC unit

were used to classify land into four categories of erosion susceptibility: low, moderate, high and very high (Table 1).

**Table 1:** Relationship between ESC class and potential erosion severity for mass movement erosion (Bloomberg et al. 2011)

Potential erosion severity	ESC class
0 = negligible	1 = low
1 = slight	1 = low
2 = moderate	2 = moderate
3 = severe	3 = high
4 = very severe	4 = very high
5 = extreme	4 = very high

A number of concerns have been raised about the suitability of the ESC, in its current form, to set the levels of control for plantation forestry activities under an NES, namely:

- i. **Scale:** The NZLRI maps of LUC units were compiled at 1:63 360 or 1:50 000 scale, which provides broad-scale mapping suitable for establishing regional erosion risk but poorly suited for managing operational forestry activities. Commonly within the polygons (map units) of the NZLRI there will be significant variation in land characteristics and potential erosion risk. In addition, the placement of boundaries between different polygons drawn at 1:63 360 or 1:50 000 scale is often inaccurate when viewed at more detailed scale. To be directly useful for managing plantation forestry activities the ESC needs to be at a scale that is relevant to forestry operations (1:5000 to 1:10 000). Such detailed coverage of New Zealand is not currently available and therefore there are likely to be significant errors in applying the ESC derived from the NZLRI at the scale of operational forestry activities. Most NZLRI polygons would be subdivided at the detailed mapping scales used for forest harvest planning and resource consent applications, and most polygon boundaries would be realigned. This may simply require accurate placement of boundaries and subdivision of existing polygons using previously defined LUC units, but may also require new LUC units to be defined to recognise the subdivisions of landforms that can be achieved at detailed mapping scales.
- ii. **Misclassification:** This has arisen where potential erosion has been wrongly assessed for individual LUC units (i.e. they are classified conservatively), where only a single erosion severity was recorded for multiple erosion types (especially where mass movement was a sub-dominant erosion type), and where dual LUC units were recorded on a polygon and the ESC class was derived from the sub-dominant LUC unit.
- iii. **No process to update or refine ESC:** Presently the ESC lacks an agreed process both for reassessing and/or refining LUC units or creating new LUC units, and for assigning potential erosion classifications to derive ESC class. Further, there is no

identified administrator or ‘gate-keeper’ of the ESC and accompanying spatial dataset.

Many submitters to the NES for Plantation Forestry proposal commented on the need for a process to review, amend, and update both the ESC class and polygon boundaries of the published ESC map (Bloomberg et al. 2011) so that it was subject to ongoing improvement. The forest industry requested that this process be transparent, practical and timely. Establishment of a process to manage change to ESC class and mapping, and archiving of the resultant data is needed to ensure:

- national consistency of mapping and classification
- changes made in one area are propagated to other similar areas
- new information is accessible to potential users

This report describes a proposed process to deal with changes to the ESC mapping that may result from:

1. reclassification of the potential erosion status of individual LUC units, including documenting the basis for reclassification
2. changes in map unit polygons derived from detailed mapping completed for forest harvest planning or resource consent applications
3. recognition of new LUC units that result from detailed mapping

It also covers the establishment of an electronic archive of all changes to ESC and LUC unit definition, changes to map unit boundaries, and processes for making these data available to users and ensuring national consistency in application of the ESC. Additional work commissioned by MPI will address the question of correcting misclassification of the ESC class of LUC units.

### **3 Objectives**

Outline a process for managing changes in ESC class related to scale or misclassification errors.

### **4 Process for managing future changes to the ESC**

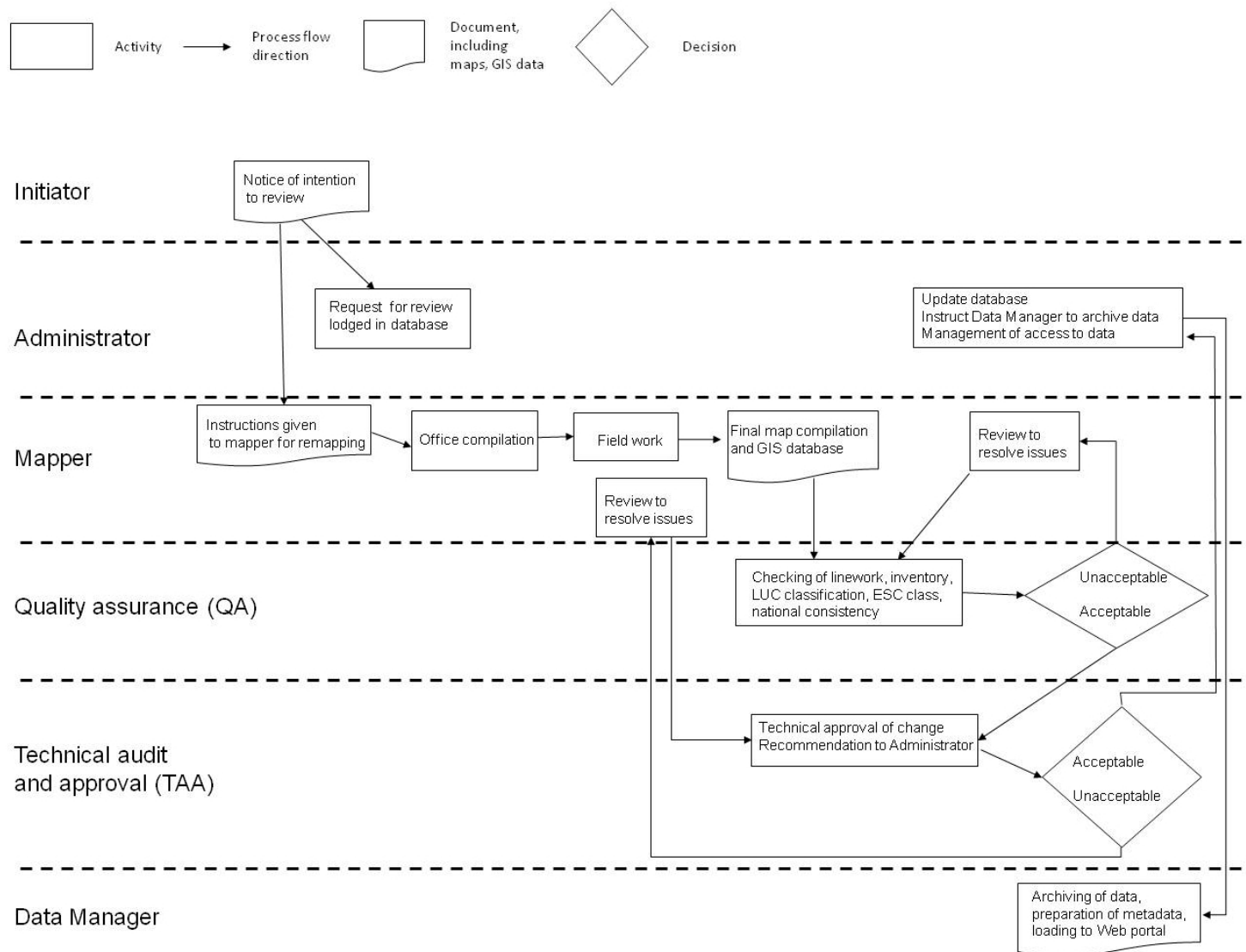
Changes to ESC class and ESC mapping will most likely be requested by forestry companies where a resource consent would be required by existing ESC mapping and the proposed NES rule set and there are clearly errors in the ESC mapping when applied at detailed scale. However, the same process could be applied if other parties (land owners with forestry blocks, regional councils, or central government agencies) request changes. The process needs to allow for review of LUC unit boundaries (to establish accurate placement of boundaries or map inclusions of LUC units within mapped polygons), and review of the ESC class of existing or newly defined LUC units. The process proposed is described in generic terms involving 6 roles (Initiator, Administrator, Mapper, Quality Assurance (QA), Technical Audit and Approval (TAA), Data Manager), the functions of each role are defined,

information requirements to complete the process are outlined, and agencies that could potentially fill those roles are identified.

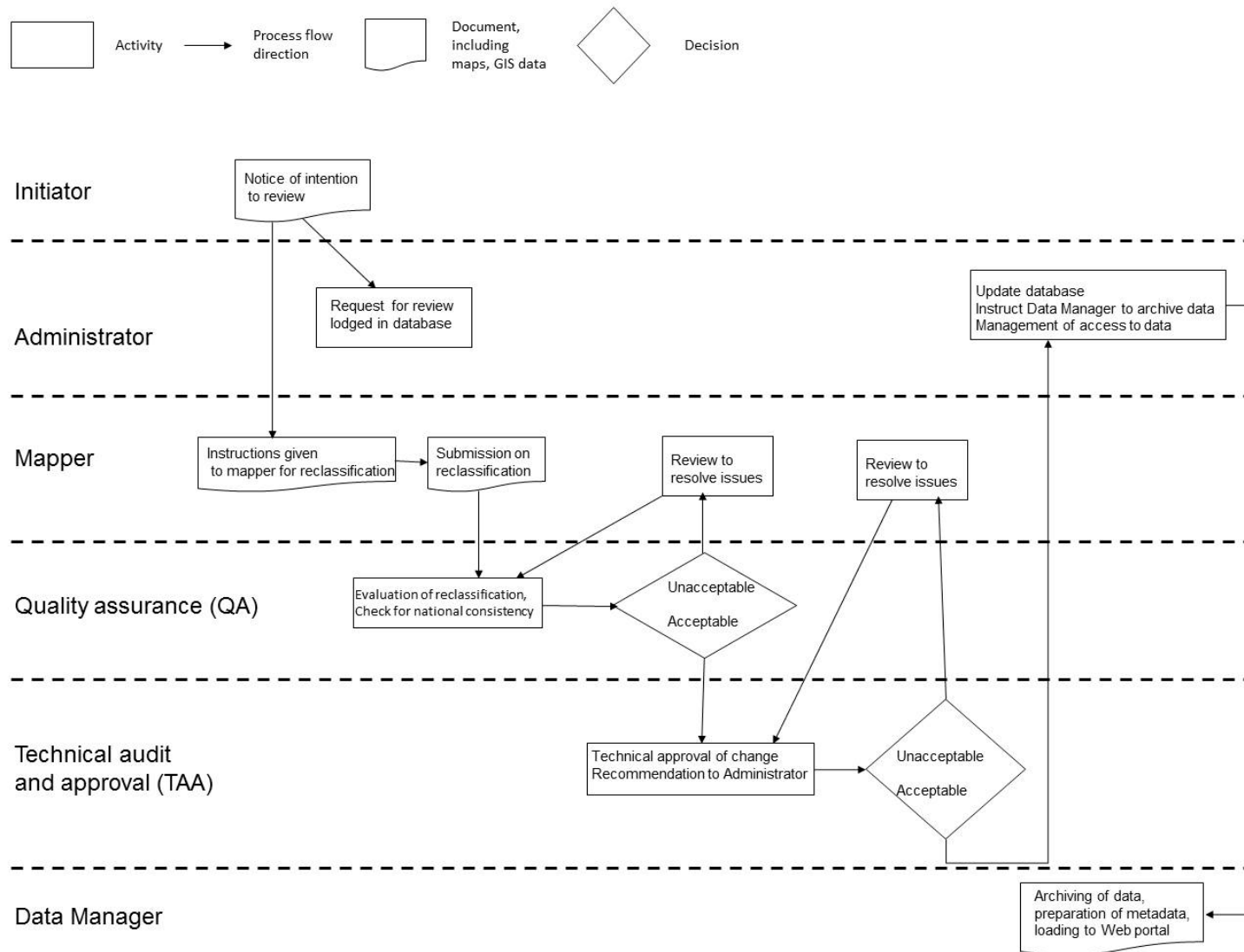
Figure 1 outlines the process proposed for detailed remapping (including definition and classification of new LUC units) and Figure 2 for reclassification since they have slightly different requirements. The process would proceed as follows:

- 1) It would begin with notification by a forestry company or other party (the 'Initiator') to the Administrator of the NES of an intention to request changes to the published ESC mapping (following Bloomberg et al. (2011) and updates completed in part 2 of the current project). There should be a right to request change and the Administrator should not be able to refuse the request at initiation so long as the mapping/reclassification is to be carried out by an approved Mapper. The Administrator will maintain a centralised database of all requests and archive the final result of each request.
- 2) The Initiator will instruct an approved Mapper to either document the basis for reclassification of an LUC unit, or to provide detailed LUC/ESC mapping for a designated area.
- 3) The Mapper will prepare the submission on reclassification or carry out the detailed mapping of the designated area.
- 4) This information will be submitted for QA to ensure all necessary data are supplied, and to maintain national consistency and standards in land inventory mapping, LUC unit assessment and ESC class.
- 5) After QA the mapping/reclassification information will be submitted to TAA for independent audit and once accepted the changes recommended to the Administrator.
- 6) The Administrator will update the ESC request database and instruct the Data Manager to archive the data. The Administrator will also manage access to the new ESC data. It is assumed that all data generated as part of this process will be made available in the public domain as an improvement in our understanding of land resources.
- 7) The Data Manager will prepare the data for archiving, be responsible for data standards and metadata, load the data to a Web portal, and manage the Web portal on behalf of the Administrator.
- 8) Feedback loops are included at steps 4 and 5 so that any disputes can be resolved, at step 4 between Mapper and QA and at step 5 between Mapper and TAA.





**Figure 1:** Outline of process proposed for managing changes to ESC mapping.



**Figure 2:** Outline of process proposed for managing changes to ESC class for LUC units.

## 4.1 Initiator

**Role:** this is any business, agency or individual who wishes to harvest or afforest a block of land and identifies possible deficiencies in existing ESC mapping or classification and seeks to have them corrected. It may also include agencies (such as regional councils) wishing to have land reclassified to ensure greater control of erosion risk.

**Function:** formally provide a notice of intention to the Administrator and identify whether the review is for reclassification or detailed remapping; instruct Mapper on the basis of the request.

**Information requirements:** location of block of land to be remapped (geographic location, cadastral description, ownership and manager of land (if they differ), size of area); list of LUC units for which reclassification is requested; identification of Mapper who will complete the work. A template for a request to review ESC mapping or classification should be developed to ensure a standard set of information is supplied.

**Possible initiators:** forestry companies, forestry block managers, landowners, regional councils, Crown land owner, or central government agencies (MPI, MfE).

## 4.2 Administrator

**Role:** the agency that will be formally responsible for the NES for Plantation Forestry once the regulation is gazetted.

**Function:** to receive notices of intention to correct ESC mapping or classification; maintain a database of requests received and the outcome of the request; maintain an overview to ensure correct process is followed for correction of ESC mapping; work with the Initiator and Data Manager to arrange archiving of new data; work with Data Manager to ensure new data are archived correctly, has appropriate metadata and manage access to new data; maintain a database of approved Mappers.

**Information requirements:** input information from Initiator to database documenting basis of requests for corrections; update database once corrections have been processed; maintain a list of recommended Mappers with a defined set of competencies from TAA.

**Possible administrators:** central government agencies (MPI or MfE), could possibly be delegated to regional councils but there will be a need for a centralised database to ensure national overview and consistency

Clarification of how the legal status of changes is managed requires more clarity about how the NES will incorporate the ESC by reference. It may be that changes cannot be released by the Administrator and Data Manager until they are legally gazetted.

### 4.3 Mapper

**Role:** provide the detailed technical input for ESC corrections. This is the key role in the entire process and will provide the data to underpin reclassification of ESC class of existing LUC units, detailed remapping of areas proposed for harvesting or afforesting, documentation of new LUC units and their ESC class, and expert interpretation of LUC and ESC data. This should be undertaken by approved Mappers determined by TAA (on the basis of a set of competencies, skills, experience and qualifications) and recommended to the Administrator.

**Function:** receive instruction from the Initiator and undertake work to correct ESC mapping and classification.

#### Information requirements

- For corrections involving detailed mapping the following would be required:
  - linework showing boundaries of polygons delineated;
  - inventory for each polygon including rock type, soils, slope, present erosion severity and type assessment, vegetation cover;
  - LUC unit classification, potential erosion assessment and ESC class;
  - where new LUC units are defined the new units should be documented (see p. 87 of the LUC Survey Handbook, 3<sup>rd</sup> ed, Lynn et al. 2009), relationship with existing LUC units described and potential erosion and ESC class be assessed;
  - identification of sources of data and summary of field and office mapping procedures.

Ideally all information would be supplied in digital format (GIS).

- For corrections involving detailed reclassification of existing LUC units the following would be required: assessment of potential erosion and ESC class incorporating
  - maximum present mass movement erosion at the time of mapping;
  - evidence of extent and severity of past mass movement erosion;
  - analysis of the frequency and magnitude of erosion-causing events;
  - interpretation of the erosional susceptibility of the rock type, regolith, soils and landforms;
  - comparison with related LUC units (for correlation and consistency);
  - whether potential erosion has been correctly assessed as under grassland with no soil conservation measures applied;
  - historical experience with managing the terrain of that LUC unit;
  - current resource consent status (to provide context for how reclassification will impact on resource consent status).

This information provides the basis for re-interpreting potential erosion and ESC class.

Detailed information requirements are outlined below.

**Possible mappers:** represented by a list of approved Mappers recommended by the TAA and listed by the Administrator.

#### 4.3.1 Incorporating detailed mapping

Detailed mapping should follow the guidelines for farm scale land resource inventory mapping (rock type, soil, slope, present erosion, vegetation) described in section 4 of the LUC Survey Handbook (3<sup>rd</sup> ed) with a combination of office compilation and field mapping (Lynn et al. 2009). The land resource inventory components are used to underpin assessment of LUC unit, potential erosion and ESC class.

Mappers should provide:

- Linework showing boundaries of polygons delineated. It should be supplied on an orthorectified map base preferably in digital form using New Zealand Transverse Mercator map projection to facilitate later archiving of the data. A topographic (contour) map base would be preferred as this would allow comparison of the placement of polygon boundaries and topography which would facilitate checking of the slope and soil components of the land resource inventory, which are key differentiating characteristics of adjacent polygons and LUC units. An orthorectified photo map base would also be acceptable but there would be additional cost in archiving this type of data.
- Inventory for each polygon including rock type, soils, slope, present erosion severity and type assessment, vegetation following the LUC Survey Handbook 3<sup>rd</sup> ed (Lynn et al. 2009) and LUC unit (either using existing regional LUC legends (see section 3.4 of Lynn et al. 2009), regional correlations or the new national LUC extended legend when it is complete). The inventory is needed to derive LUC unit (Lynn et al. 2009) and it is essential to ensure national consistency in the use of LUC units, particularly where new LUC units are defined. It will allow users to make use of newly defined LUC units where they occur in other areas. Sources of data could include:
  - Rock type: This information can be derived from field mapping or re-interpretation of existing geology maps since map coverage for rock type is not generally available at 1:5000 to 1:10 000 scale. The best available digital geological maps are the Qmap series (<http://www.gns.cri.nz/Home/Our-Science/Earth-Science/Regional-Geology/Geological-Maps/1-250-000-Geological-Map-of-New-Zealand-QMAP/Digital-Data-and-Downloads>), which is available nation-wide. However, the map unit boundaries are based on time stratigraphic units rather than on lithology and they are compiled at 1:250 000 scale so will require a considerable degree of interpretation, along with field checking, for use at detailed scale. The existing NZLRI rock type data will also be useful but will also need reinterpreting at detailed scale.
  - Soils: The best available digital soil data is in the new national soils database S-map (<http://smap.landcareresearch.co.nz/home>); however this does not have nation-wide coverage (most of the hill country and steep lands has not yet been mapped) nor does it utilise traditional map unit terminology. Where it is available it has been compiled at 1:50 000 scale. It will also require a considerable degree

of interpretation, along with field checking, for use at detailed scale. Similar to rock type, the existing soil maps and NZLRI soil data will also be useful but will also need reinterpreting at detailed scale.

- Slope: Should be based on field mapping (Lynn et al. 2009), a topographic map base or derived from a digital elevation model (DEM). Modern topographic map bases are typically based on DEMs and would be best derived from a LIDAR-based DEM or photogrammetric mapping. The national DEM (derived from 20-m contour data) could be used, although this will provide a poorer depiction of topography especially in low relief terrain (Basher et al. 2014). High resolution DEMs (2-m) provide high quality topographic data suitable for mapping at 1:5000 to 1:10 000 scale; however, they require additional processing to delineate map polygons required for a land resource inventory. While this could be undertaken manually from a contour map based on the DEM, Basher et al. (2014) developed an automated method in ArcGIS for converting the DEM to slope classes used in the NZLRI. The script for undertaking this processing could be made available to facilitate automated slope class mapping.
- Erosion: mapping of erosion type and severity following Lynn et al. (2009). Field-based assessment, mapping from aerial photographs or digital orthophotography could all be used to compile this data.
- Vegetation: using the vegetation classes defined in Lynn et al. (2009). Field-based assessment, mapping from aerial photographs or digital orthophotography could all be used to compile these data.
- LUC unit: this should be derived from existing regional LUC bulletins, the national extended legend when available, or if necessary new LUC units could be recognised and defined.
- Documentation would include
  - sources of data (especially for soils and rock type – reinterpretation of existing data, new field mapping),
  - summary of field mapping procedures,
  - list of LUC units and their characteristics (landforms/slope classes, rock type, soils, present erosion type and severity) and potential erosion (type and severity),
  - identification of any new LUC units with documentation including description of LUC unit, relationship to existing LUC units and why a new unit is needed, and potential erosion assigned to new LUC units.
- Map of ESC class based on potential erosion

Some regional councils have a considerable amount of detailed farm-scale LUC mapping, or erosion hazard mapping (e.g. Land Overlay 3A in Gisborne District) and this could be an acceptable source of information for detailed mapping. It would, however, need to be subject to the same quality assurance and review process in order to ensure national consistency of data before it was incorporated into a revised ESC map. Much of the farm plan mapping is old and in paper format so would be expensive to capture in digital format, while much of the new mapping is regionally based (e.g. SLUI farm plan mapping by Horizons) and would need to be nationally correlated. Land Overlay 3A was prepared for a different purpose (i.e. to target land that needs tall tree cover to reduce erosion) and using a different methodology and

therefore does not include much of the plantation forest estate. It would have to be converted to the same format as other ESC mapping to be nationally consistent.

Mapping data should be provided digitally by preference rather than as hard copy, but there may also be a need to be able to accept paper copy. Where hard copy is provided there would be an additional cost in archiving this electronically.

#### **4.3.2 Changes to ESC classification of LUC units**

The current work commissioned by MPI will address the question of misclassification of the ESC class of LUC units that has arisen where potential erosion has been wrongly assessed for individual LUC units, where only a single erosion severity was recorded for multiple erosion types (especially where mass movement was a sub-dominant erosion type), and where multiple LUC units were recorded on a polygon and the ESC class was derived from the sub-dominant LUC unit. This should resolve many of the current misclassified LUC units. However, because of the poor definition of potential erosion and lack of an objective method of assessing it (Basher et al. 2014) there may still be LUC units whose ESC class is disputed and a process for resolving these disputes is required. Similarly detailed mapping may result in new LUC units being defined and there needs to be an agreed process for defining and reviewing their ESC class.

Requests for changes to ESC class for individual LUC units will need to provide an assessment of potential erosion and a justification for the change to ESC class. Similarly, new LUC units will require an assessment of potential erosion and classification of ESC class that is consistent with national ratings of ESC class of related LUC units. The assessment of potential erosion should incorporate:

- maximum present mass movement erosion at the time of mapping
- evidence of extent and severity of past mass movement erosion (landslide scars, storm damage reports, changes in gully dimensions/numbers, etc)
- analysis of the frequency and magnitude of erosion events
- interpretation of the erosional characteristics of the rock type, regolith, soils and landforms

Justification for changes to ESC class would be based on the revised assessment of potential erosion, whether potential erosion has been correctly assessed as under grassland with no soil conservation measures applied, historical experience with managing the terrain of that LUC unit, comparison of the rating of ESC class with other similar LUC units (i.e. correlation and consistency at national scale), and whether the ESC class as mapped by Bloomberg et al. (2011) has resulted in a change to resource consent status under the NES compared to the resource consent status prior to the NES being implemented.

#### **4.3.3 Accreditation of Mappers**

Mappers will need to be identified on the basis of a core set of competencies that will include skills, experience in LUC mapping, understanding of erosion processes, and qualifications. It is suggested that initially the TAA provide a list of approved Mappers to the Administrator.

However, it may be appropriate that they would also be members of a professional body (such as the New Zealand Association of Resource Management or New Zealand Institute of Forestry) that could endorse their competencies, and also provide a Code of Ethics and disciplinary procedures. There is a need to develop a model for accreditation of approved Mappers

#### **4.4 Quality Assurance (QA)**

**Role:** review the information provided by the Mapper before recommending approval to TAA

**Function:** ensure all required information is supplied; review polygon boundaries, inventory for each polygon, LUC classification, potential erosion and ESC class; provide expert interpretation of LUC and ESC data; maintain national standards in mapping and national consistency in use and description of LUC units; recommend approval of mapping for TAA.

**Information requirements:** all information compiled by the Mapper (linework showing boundaries of polygons delineated, polygon inventory, LUC unit classification, potential erosion assessment and ESC class; documentation for new LUC units, identification of sources of data and summary of field and office mapping procedures; for reclassification assessment of potential erosion and ESC class)

**Possible quality assurer:** Landcare Research has the greatest capability and capacity to fill this role; regional councils could possibly also fill it but are unlikely to have a national overview; no central government agencies currently have the capacity or capability to fill this role.

The mapping will be subject to review of the polygon boundaries, checking of completeness and consistency in the inventory for each polygon, LUC classification and potential erosion. In the past data auditing for the NZLRI involved field checking but this is probably unrealistic for all applications. However, it may be required where the terrain is particularly complex or the level of field work carried out by the Mapper is considered potentially inadequate. In the past this would have also involved comparison of field compilation sheets against the GIS database for data input errors. The only practical checking would be an office check of appropriateness of boundaries, completeness of inventory, and LUC/ESC classification errors. The role of QA is to provide an accuracy check of the mapping, (primarily based on the topographic base map and interpretation of rock type and soil data) and an overview to ensure national consistency in the provision of mapping data, LUC classification, new LUC unit definition and ESC class assessment.

If any discrepancies are identified in the LUC mapping, the polygon inventories, or ESC assessment these should be resolved by discussion between the mappers and QA. If any unresolvable disputes arise these will be resolved by the TAA process (section 4.5).



#### **4.5 Technical Audit and Approval (TAA)**

**Role:** provide independent oversight of changes to LUC mapping and ESC class.

**Function:** audit and approve detailed mapping and ESC class changes and recommend approval to Administrator; resolve disputes between Mapper and QA; provide register of approved Mappers to the Administrator.

**Information requirements:** information as supplied to, and approved by, QA from the Mapper; to recommend approved Mappers will require individuals to submit a request to the TAA group outlining their skills, experience in LUC mapping, and qualifications to the TAA group.

**Possible composition of the Technical Audit and Approval Group:** the Technical Advisory Group (TAG) of the recently established Land Use Capability Classification System (LUCCS) Governance Group is the most likely group that could fill this role, although it could perhaps be delivered by one of the Special Interest Groups of the regional councils (e.g. Compliance and Monitoring or Land Managers). The role requires specialist knowledge and capability that no central government agencies (e.g. MPI, MfE) currently have.

It is suggested that the Technical Advisory Group (TAG) of the recently established Land Use Capability Classification System (LUCCS) Governance Group be used to provide independent audit and approval of detailed mapping and ESC class changes. The TAG and the LUCCS Governance Group have distinctly different roles and membership (see Appendix 1 and 2), with the TAG providing detailed technical expertise and the LUCCS Governance Group providing more of a strategic oversight of developments to the LUCCS.

The TAG is the appropriate group to provide independent oversight of changes to LUC mapping and ESC class. It currently has 3 members representing the regional councils, independent consultants, and Landcare Research, but also has access to a wider body of LUC practitioners with extensive local knowledge of the LUC mapping system, management requirements of different types of land (LUC units), as well as strong connections to both regional councils and the forestry industry. The forestry industry is not currently represented on the TAG but can influence it through its membership on the LUCCS Governance Group. There is also provision for the industry to be represented on the TAG in the future if this was considered appropriate. The TAG can as required co-opt specialist members who may have detailed regional knowledge. The TAA process would recommend approval of changes of the ESC to the Administrator and would resolve any disputes relating to ESC assessment.

It is envisaged that the role of TAA will be to ensure correct process has been followed rather than a polygon-by-polygon analysis of the mapping. They will also be the arbitrators of any unresolved disputes between Mapper and QA.

## 4.6 Data Manager

**Role:** ensure archiving of all new mapping and classification data and delivery of data via a Web portal

**Function:** archiving of the original and any new mapping and classification data; preparation of data standards and metadata, management of version control; loading of data to Web portal; management of Web portal on behalf of Administrator.

**Information requirements:** provision of approved mapping and classification data from the Administrator; preparation of metadata to support the available data

**Possible Data Manager:** requires specialist skills in GIS, database management and delivery of information and supporting metadata via the Internet. Landcare Research currently has the greatest capability and capacity to fill this role and is very familiar with managing land resource data and delivery over the Internet; central government agencies such as MPI and MfE may also have capability to fill this role.

Once approved by the Administrator, the mapping data and LUC unit descriptions for new units will be added to a national LUC Extended Legend, currently being developed by Landcare Research, and displayed on a Web portal. It is not possible to incorporate new detailed mapping in the NZLRI spatial database because of the existing structure of this dataset. The new data will either be archived as an independent dataset that will be progressively added to, or the structure of the NZLRI dataset will have to be modified to incorporate multi-scale, multi-temporal data. The former is more likely but there needs to be a link with the NZLRI, and the new data needs to have version control to track changes through time.

The Web portal would include:

- The LUC unit descriptions (for both the existing original regional units and any newly defined units) including potential erosion and ESC class. It will also include the single National Extended Legend when complete, with version control to relate mapping data to the appropriate version of the legend.
- Detailed mapping data available in a map viewer. This will allow users to see where detailed map data are available and might be relevant to ongoing usage and change
- An up-to-date summary of changes to the ESC class of LUC units, definition of new LUC units and their ESC class, and the relationship between newly defined LUC units and previous LUC units.
- Metadata that describe purpose of the data, how the data were compiled, date of creation, author of the data, and standards used in the preparation of data.

These data will be read-only so that any changes can be made only by the Data Manager with approval from the Administrator. Where data are required by 3rd parties (e.g. where detailed mapping is going to be undertaken in an area adjacent to existing detailed mapping and there is a need to maintain boundary and inventory consistency) it would be made available for download on request. A standard set of conditions for data release should be developed by the Administrator and Initiators.

Similar Web portals are currently available, including:

- Our Environment (<http://ourenvironment.scinfo.org.nz/home>). This Web portal is hosted by Landcare Research and displays certain types of land resource data for New Zealand but does not allow data to be downloaded.
- The Land Resource Information System (LRIS) portal (<https://lris.scinfo.org.nz/>) portal is hosted by Landcare Research and contains extensive datasets of land resource data for New Zealand and allows the data to be both displayed in a map viewer and downloaded in a variety of formats (including GIS, Google Earth and csv). Metadata and data dictionaries describing the data content and format are also available.
- The Kooordinates Web portal (<https://kooordinates.com/>) contains extensive land resource datasets for New Zealand from a wide variety of providers (including CRIs, regional and district councils, LINZ, DOC, etc). This site allows the data to be both displayed in a map viewer and downloaded in a variety of formats (including GIS, Google Earth and csv). Metadata and data dictionaries describing the data content and format are also available. The existing ESC mapping (Bloomberg et al. 2011) is currently made publically available via this portal.

None of the existing Web portals are entirely suitable for managing the data that are likely to result from the detailed mapping and changes to ESC class, and we recommend a dedicated ESC/LUC Web portal. Policy would need to be developed to address issues of privacy and restrictions on access of the data.

#### **4.7 Approved mappers**

When the NZLRI was being prepared there was an extensive programme to train central government LUC mappers and maintain nationally consistent standards. Subsequently most of the LUC mapping has been completed by regional council staff (who were trained in-house or attended training courses run by independent consultants) and independent consultants (many of whom were initially employed by regional councils). Much of the recently completed farm plan LUC mapping has had a regional emphasis with no national correlation or quality assurance. There is no recognised programme of LUC training for LUC mappers, similar to the OVERSEER university courses now offered.

ESC mapping that underpins the NES will require a consistent standard to be maintained as well as national correlation of LUC units. There is a limited pool of experienced LUC mappers available in New Zealand and it would be appropriate for the TAA Group to compile a list of approved Mappers, and for that list be made available via the Administrator to guide Initiators in the choice of personnel to prepare LUC/ESC maps and documentation. In the future it may be possible to work towards an accredited standard that Mappers must meet.

#### **4.8 Funding**

There will be costs associated with implementation of a process to review, archive, and manage on-going changes to the ESC. While the costs need to be constrained as much as possible, it is important to accept the proposed process does involve costs to implement.

However, the costs of providing detailed data mapping and ESC will be one-off costs. Once completed for any forest they should not have to be repeated during future harvest cycles. It is extremely difficult to estimate the time and cost to process a proposed ESC change and/or new mapping. It will depend on many factors including the quality of the data supplied, the size and complexity of the area, etc.

Initiators can be expected to cover the costs associated with preparing new detailed ESC mapping or applications for review of the ESC class for an LUC unit as a normal part of resource consent application and forest harvest planning. Most other agencies could only participate in the proposed process on a 'fee-for-service' basis, although there are elements of the process that provide benefit to central and local government, and the proposed process will add valuable data to our understanding of land resources, and extensions to the National LUC Extended Legend. Central and local government funding may be available for central and local government agencies as part of their policy and regulatory role.

Further work is needed on defining the appropriate and acceptable funding model. Once a process is agreed with all interested parties it would be useful to work through a case study or two and try to assess how much time and cost is likely to be involved.

## **5 Conclusions**

- There will be ongoing change to the ESC after the NES for Plantation Forestry is gazetted.
- To maintain national standards and consistent application across New Zealand a robust process for approving changes and making them publically accessible is needed.
- National standards in mapping and assessment of ESC class can be achieved by using approved Mappers to provide new data, appropriate quality assurance procedures, a transparent process for documenting and reviewing changes that are made, centralised archiving of all changes, and documentation of the basis of changes.

## **6 Recommendations**

- A template for a request to review ESC mapping or classification should be developed to ensure a standard set of information is supplied
- There is a need to develop a model for accreditation of approved Mappers, a list of approved Mappers and a defined set of competencies
- A standard set of conditions for data release should be developed by the Administrator and Initiators
- Further work is needed to clarify how the legal status of changes is managed when the NES is likely to incorporate the ESC by reference
- Further work is needed on defining the appropriate and acceptable funding model for the process and it would be useful to work through a case study or two and try to assess how much time and cost is likely to be involved.

## **7 Acknowledgements**

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## **8 References**

- Basher L, Lynn I, Barringer J 2014. Peer review of the process proposed to update the Erosion Susceptibility Classification for the National Environmental Standard for Plantation Forestry. Landcare Research Contract Report LC1877 for Ministry for Primary Industries.
- Bloomberg M, Davies T, Visser R, Morgenroth J 2011. Erosion Susceptibility Classification and analysis of erosion risks for plantation forestry. Report prepared by the University of Canterbury for the Ministry for the Environment, Wellington.
- Lynn IH, Manderson AK, Page MJ, Harmsworth GR, Eyles GO, Douglas GB, Mackay AD, Newsome PJF 2009. Land Use Capability Survey Handbook – a New Zealand handbook for the classification of land, 3<sup>rd</sup> ed. Hamilton, AgResearch; Lincoln, Landcare Research; Lower Hutt, GNS Science.
- NWASCA (National Water and Soil Conservation Authority) 1986a. NZLRI worksheets (2nd ed) 1: 63 360. Wellington, National Water and Soil Conservation Authority.
- NWASCA (National Water and Soil Conservation Authority) 1986b. NZLRI (2nd ed) 1: 50 000. Wellington, National Water and Soil Conservation Authority.
- NWASCO (National Water and Soil Conservation Organisation) 1975–79. NZLRI worksheets 1: 63 360. Wellington, National Water and Soil Conservation Organisation.
- NWASCO (National Water and Soil Conservation Organisation) 1979. ‘Our Land Resources’ – a bulletin to accompany NZLRI worksheets. Wellington, National Water and Soil Conservation Organisation. 79 p.
- Robson B 2013. Updating the Erosion Susceptibility Classification – process for finer scale mapping and assessment. Report for Ministry for Primary Industries, Wellington.



## **Appendix 1 – Purpose and membership of the LUCCS Governance Group**

The purpose of the Land Use Capability Classification System (LUCCS) Governance Group is to guide the maintenance and future development of the LUCCS by:

- taking the lead in setting the overall direction for the maintenance and future development of the LUCCS so that it remains fit-for purpose and develops in response to new needs and technologies;
- providing a forum where stakeholders can express their individual and collective community needs;
- ensuring that key agencies are engaged and supportive of the maintenance and development of the LUCCS;
- identifying and seeking the support of key stakeholders to arrange funding for the on-going development of the LUCCS; and
- facilitating improvements to the LUCCS including, but not limited to, technical improvements and adaptation to changing end user requirements.

The Governance group is made up of up to 10 representatives of key stakeholder groups, and includes representatives from:

- Regional councils and unitary authorities: at least three representatives (at least one representative from each of the current Land Monitoring Forum, Land Managers Group and Regional Policy Managers Group).
- Territorial authorities: at least one representative.
- Science providers: At least two representatives (e.g. Landcare Research, AgResearch).
- Central government stakeholders: up to two representatives (e.g. from MPI, MfE, MBIE)
- Up to two members representing the land-based primary sector.
- The Chair, or a nominated representative, of the Technical Advisory Group.

Current membership consists of Alison Collins (Landcare Research, chair), Alec Mackay (AgResearch), Liz McGruddy (Federated Farmers), Martin Workman (MPI), Deborah Burgess (MfE), Peter Weir (NZ Forest Owners Association), Trevor Freeman (Gisborne District Council, Regional Council Land Managers Special Interest Group), Reece Hill (Waikato Regional Council, Regional Council Land Monitoring Special Interest Group), Jonathon Streat (Greater Wellington Waikato Regional Council, Regional Council Regional Policy Managers Special Interest Group), and James Barringer (Landcare Research, LUCCS TAG).

## **Appendix 2 – Purpose and membership of the LUCCS TAG**

The purpose of the LUCCS Technical Advisory Group (TAG) is to provide technical advice to the LUCCS Governance Group and its role includes:

- providing recommendations for the resolution of technical issues as directed by the LUCCS Governance Group; and
- identifying technical implications for users of decisions made by the Governance Group.

Its functions include advising/reviewing/moderating the specifications for existing and new LUC units in the national extended legend.

The Technical Advisory group is made up of a core of 3–5 technical experts, with the ability to co-opt additional specific expertise as required or as directed by the Governance Group. TAG membership provides diversity and level of technical knowledge and consists of individuals who are active developers or users of the LUCCS. Membership of the TAG may include representatives from:

- Science providers (e.g. Landcare Research, AgResearch, GNS).
- Land resource mapping consultants.
- Regional councils and unitary authorities.
- Territorial authorities.
- Central government (e.g. from MPI, MfE, MBIE)
- Land-based primary sector

Its current membership is Malcolm Todd (Horizons Regional Council), Norm Ngapo (independent consultant, Waiora Soil Conservation Limited), and James Barringer (Landcare Research).