Department of Science, Information Technology and Innovation

# Fitzroy NRM Region Soil Erodibility

## USERGUIDE

Soil and Land Resources, Science Division

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Queensland Government

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**Front Cover Photo** – taken by Dr. Andrew Brooks

The aerial photo shows a gully system in alluvial sediments in which the upper part of the gully has been filled in. Subsequently the infill material has formed a tunnel diagonally across the infill area as the subsoil dispersed reinitiating the gullying process, the infill material is eroding forming rills and the original gully headwall is active again extending the gully beyond the rehabilitation area.

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The Department of Science, Information Technology and Innovation (DSITI) has mapped the inherent erodibility of soils across the Fitzroy Natural Resource Management (NRM) Region in a project funded by the Department of Environment and Heritage Protection's (EHP), Office of the Great Barrier Reef, Reef Programs science program (RP) (formerly Reef Water Quality science(RWQ) program).

Inherent soil erodibility refers to the susceptibility of soils to detachment and transportation by erosive agents. It is a composite expression of those soil properties that affect the behavior of soil and is a function of the mechanical, chemical and physical characteristics of the soil. Soil erodibility is independent of the other factors influencing soil erosion, such as topography, land use, rainfall intensity and plant cover, but may be changed by management.

This project has developed spatial datasets similar to those produced for the Burdekin basin that describe;

- surface soil stability (A Horizon)
- subsoil dispersibility (B Horizon)
- inherent soil erodibility

The data is available as 90m GeoTIFF rasters for use in GIS and can be freely downloaded from www.data.qld.gov.au and www.qspatial.qld.gov.au

A simplified version of this dataset is used in the FORAGE Erodible Soils report available on The Long Paddock website www.longpaddock.qld.gov.au/forage/

Small scale maps of surface stability, subsoil dispersibility and inherent soil erodibility can be downloaded from www.publications.qld.gov.au

The dataset is reliable to a sub-catchment scale (1:250,000) and can be used to identify areas vulnerable to erosion.

This guide briefly outlines soil erodibility concepts, methodology used to produce the dataset and how to interpret the data; it should be read in conjunction with the dataset.

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# Background

The Reef Programs science program (RP formerly Reef Water Quality, RWQ, science program) is designed to assist with the adoption of improved land management practices that will reduce the levels of sediment, nutrients and pesticides moving offsite from agricultural land and impacting on the Great Barrier Reef (GBR).

Sediment from the grazing areas within the Burdekin and Fitzroy basins has been identified as a major threat to the GBR lagoon water quality (Kroon et al. 2013). The sediment sources have been found to be highly variable within and between these basins (Wilkinson et al. 2013).

Mapping erodible soils in grazing lands is a project funded by the *Queensland Government, Department of Environment and Heritage Protection, Reef Program science program* that supports the implementation of Reef 2050 Plan. The objective of this project was to map soil erodibility in the Fitzroy basin in a similar way to the study completed in the Burdekin basin in 2014 (Zund & Payne). This project was recognised as a priority under the RWQ Research Development and Innovation Strategy.

Further background information relating to soil erosion and the Fitzroy basin can be found in the project synthesis report (Zund & Finn 2015) which is available online from the Queensland Government Publications portal and the DEHP Library.

Soil erosion processes and erosion types vary greatly across the catchment and are influenced by the type of soil, degree of land cover, climate (seasonal and long term trends), terrain and land management practices. This project has mapped the inherent soil erodibility. Other associated Reef Programs science projects are mapping presence of gullies, producing ground cover reports and tracing sediment sources and processes in the catchment.

## Soil erodibility concepts

Soil erodibility refers to a soil's susceptibility to erosion by erosive agents (water and wind). It is a composite expression of those soil attributes (mechanical, chemical and physical) that affect the behaviour of a soil. Whether soil erosion occurs depends on soil properties, topography, land use, rainfall intensity, surface cover and land management practices.

The external factors that influence how much erosion actually occurs have not been taken into account in this dataset. Information on these additional drivers of erosion are available for the Fitzroy in the form of digital elevation models (DEM), land use mapping (QLUMP 2016), climate and land cover data.

Because these external factors have not been taken into account, products from this project are not an erosion hazard / risk map or an assessment of actual eroded areas. However mapping of soil erosion using air photo and satellite imagery has been undertaken in parts of the Burdekin and Fitzroy basins (Isaac and Dawson catchments) by the Department of Natural Resources and Mines (Pers.Comm.).

The purpose of this project was to develop a dataset that assists with the identification of soils that are vulnerable to gully and stream bank erosion. Gullies generally form when the protective surface soil is disturbed and erosive forces encounter subsoil, particularly those that are dispersive. This project uses a soil erodibility classification developed for the Burdekin dry tropics (Zund In

preparation) that defines surface soil stability and subsoil dispersiveness and combines the two into an overall inherent soil erodibility category.

Surface soil stability is affected by surface cover, which is a function of climate, soil fertility, rockiness and land management. Subsoil dispersiveness can result in channelling and is affected by subsoil attributes such as cation balance, clay type and salinity.

To initiate erosion, an external force is required such as the force of water in the form of raindrop impact and overland flow. The force of overland flow is in turn affected by slope gradient, length and surface cover. Given enough external force, every surface soil will erode to some degree.

The soil erodibility classification used in this project does not use these temporal and external forces and it is not like the K-Factor of the Universal Soil Loss Equation (USLE) (Wischmeier & Smith 1978). This classification describes a surface soil's stability (resistance to erosion) and a subsoil's erodibility. It allows the user to determine where the most unstable surface soils are and how erodible their subsoils are. This is important information if gully, tunnel and streambank erosion is to be prevented and/or eroded areas are to be remediated.

# How the dataset was made

The dataset has been made using a small number of soil attributes that have been predicted across the Fitzroy basin. Because different processes drive aggregate stability down the profile, different soil attributes are used between the surface and subsoil classifications. Table 1 describes the soil attributes used.

**Table 1. Summary of soil attributes used to classify a soils erodibility.**

| Soil attribute | Relevant soil layer | Description of significance |
|---|---|---|
| Clay (%) | Surface soils and subsoils | Indicates overall soil texture and is used in the surface classification to determine which surface soils are non-cohesive (< 20% clay; sands or sandy loams).<br>Used in the subsoil classification to prevent erroneously high ESP values from occurring (<10% clay; sands). |
| Clay activity | Surface soils | Indicates the possible clay mineral type. Dispersion is most pronounced in swelling clays (clay activity > 0.6) and least pronounced in kaolin dominated clays (Surface soils with a clay activity < 0.5) |
| Exchangeable Sodium Percentage (ESP) (%) | Surface soils and subsoils | Indicates soil sodicity, which is related to soil dispersibility. ESP is a measure of the dominance of sodium ions on the clay exchange of the clay colloid. Clays dominated by sodium ions are much less stable and more likely to disperse than clays dominated by calcium ions. (e.g. surface soils with an ESP ≥ 6%, Subsoils with an ESP ≥ 15%) |
| Electrical conductivity (EC) (dS/m) | Subsoils | Indicates salinity of soil. Presence of salts in the soil solution can flocculate clays that would or have dispersed due to sodium domination of the clay exchange sites, thus making soils less dispersive. (Subsoils with an EC > 0.5dS/m) |
| Calcium/Magnesium ratio (Ca/Mg) | Subsoils | Indicates the relative dominance of Mg ions on the clay colloid. Mg reinforces the dispersive nature of sodic clays and hence soils are more dispersive. (Subsoils with a Ca/Mg < 1) |

## Surface soil stability

Surface soils can provide a protective cap over more erodible subsoils. When this surface horizon is disturbed or removed, subsoil erosion may occur. Maintaining surface soil is vital. However some surface soils are more stable than others. Photo 1 demonstrates the role a stable surface soil can have in protecting the soil. In this extreme case the surface soil has prevented the dispersive subsoil below from eroding. Further information on erosion processes is available at www.qld.gov.au/soils.

This classification differentiates between less stable and more stable surface soils. Soil texture (clay %), soil sodicity (ESP) and clay type (clay activity) have been used to make this assessment. A tree based model with critical values has been used to determine each category as shown in Figure 1.

**Photo 1. Stable surface soil over a dispersive subsoil.**

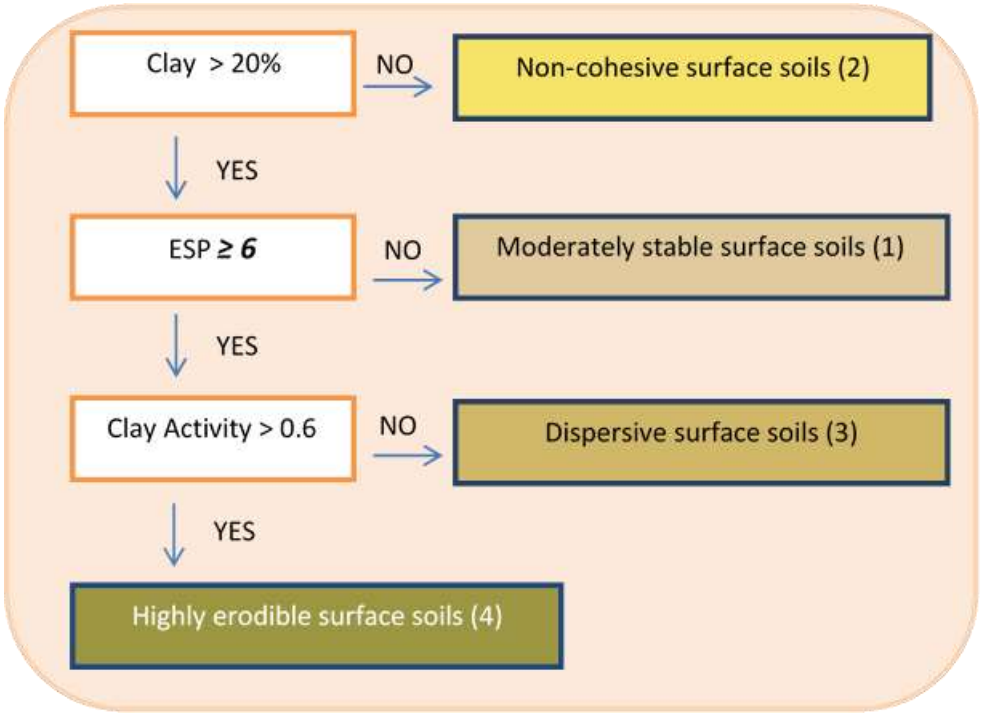


**Figure 1. Surface soil erodibility decision tree.**

The surface soil categories are

1. Moderately stable surface soils – soils that are unlikely to be dispersive. These are usually well-structured and resilient to degradation.
2. Non-cohesive surface soils – sandy soils that are non-structured or only weakly so and non-cohesive. These soils are easily eroded.
3. Dispersive surface soils – erodible loamy or clayey soils that are sodic, hardsetting and likely to disperse in water.
4. Highly erodible surface soils – highly erodible clay soils that are sodic and dominated by expanding/swelling clays that disperse readily.

## Subsoil dispersibility

Gully and bank erosion rates are influenced by how dispersible subsoils are. The more dispersible, the greater the vulnerability to gully erosion. Photo 2 shows an area where the surface soil has been removed completely and the dispersible subsoil has formed gullies where soil has completely dispersed. The pale areas are sand that has remained after the clay and silt particles have washed away. Further information on erosion processes is available at www.qld.gov.au/soils.

**Photo 2. Dispersed subsoil material.**

Subsoil dispersibility has been categorised using soil texture (Clay %), soil sodicity (ESP), soil salinity (EC) and soil cation balance (Ca/Mg). A tree-based model with critical values has been used to determine each soil category (Figure 2).

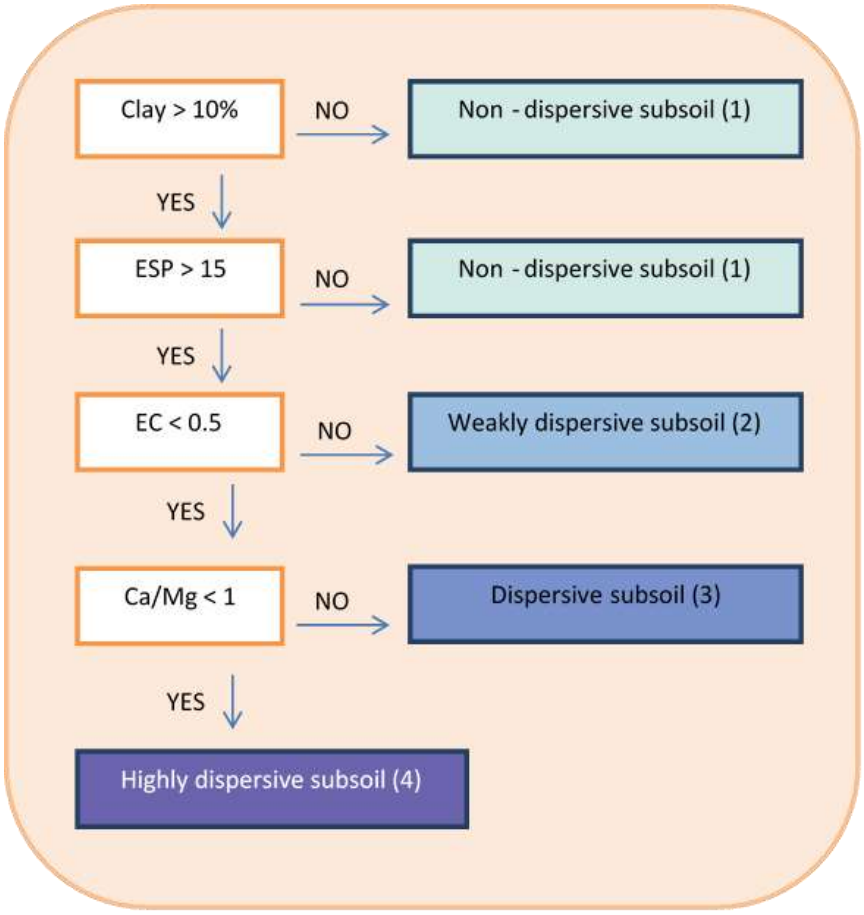


**Figure 2. Subsoil dispersibility decision tree.**

The subsoil categories are

1. Non-dispersive subsoils – non-sodic or weakly sodic subsoils that are unlikely to disperse.
2. Weakly dispersive subsoils – sodic subsoils that are saline or dominated by carbonate nodules that prevent these subsoils from dispersing readily.
3. Dispersive subsoils – sodic subsoils that disperse readily.
4. Highly dispersive subsoils – sodic soils that are also dominated by magnesium ions that enhances the dispersive affect.

## Inherent soil erodibility

A soil's overall inherent soil erodibility is a combination of the stability of the surface soil and the dispersibility of the subsoil. For example, Photo 3 shows a soil with a moderately stable surface soil over a dispersible subsoil. In areas where the surface was not stable, the soil has eroded away, exposing the subsoil to erosion. In areas where the surface soil is stable, it remains intact, providing a protective layer over the subsoil.

**Photo 3. Stable soil overlying a dispersive subsoil.**

Soil surface stability and subsoil dispersibility have been combined into 17 categories. These categories have been ranked using expert knowledge: the higher the number, the greater the overall inherent soil erodibility. Table 2 shows how these combinations were determined and their assigned rank. Table 4 describes the 17 categories.

**Table 2. Overall inherent soil erodibility based on surface soil stability and subsoil dispersibility.**

| | Surface soil stability | | | |
|---|---|---|---|---|
| **Subsoil dispersibility** | **Moderately stable surface soils** | **Non-cohesive surface soils** | **Dispersive surface soils** | **Highly erodible surface soils** |
| **No subsoil** | 1 | 5 | 11 | 8 |
| **Non-dispersive subsoils** | 2 | 4 | | 14 |
| **Weakly dispersive subsoils** | 3 | 7 | | |
| **Moderately dispersive subsoils** | 6 | 10 | 13 | 16 |
| **Highly dispersive subsoils** | 9 | 12 | 15 | 17 |

In addition to the inherent soil erodibility categories a more comprehensive dataset has been created that also takes into account the surface horizon thickness, resulting in 60 individual classes. Soils with thinner surface horizons are more vulnerable to erosion than those with thick surface horizons (Table 3).

**Table 3. Key to surface soil thickness categories.**

| Category | Surface thickness | Cell value |
|---|---|---|
| Thick | > 0.3m | 1 |
| Medium | 0.1 – 0.3m | 2 |
| Thin | 0 – 0.1m | 3 |

**Table 4. Legend descriptions for simplified soil erodibility* and inherent soil erodibility.**

| Cell value | Legend label | Expected soil characteristics |
|---|---|---|
| 21* | Very low erosion vulnerability | |
| 1 | Moderately stable surface soils over rock or sediment | Shallow loamy or clayey soils |
| 2 | Moderately stable surface soils over non-dispersive subsoils | Loamy or clayey soils over non-dispersive subsoils |
| 3 | Moderately stable surface soils over weakly dispersive subsoils | Loamy or clayey soils over weakly dispersive subsoils |
| 22* | Low erosion vulnerability | |
| 4 | Non-cohesive surface soils over non-dispersive subsoils | Sandy massive surface soils over non-dispersive subsoils |
| 5 | Non-cohesive surface soils over rock or sediment | Shallow sandy massive soils |
| 6 | Moderately stable surface soils over moderately dispersive subsoils | Loamy or clayey soils over moderately dispersive subsoils |
| 7 | Non-cohesive surface soils over weakly dispersive subsoils | Sandy massive surface soils over weakly dispersive subsoils |
| 23* | Moderate erosion vulnerability | |
| 8 | Clayey soils that erode and/or slake readily over rock or sediment | Clay soils that are sodic and dominated by expanding/swelling clays that disperse readily |
| 9 | Moderately stable surface soils over highly dispersive subsoils | Loamy or clayey soils over highly dispersive clayey subsoils |
| 10 | Non-cohesive surface soils over moderately dispersive subsoils | Sandy massive surface soils over moderately dispersive subsoils |
| 11 | Weakly dispersive clayey soils | Loamy or clayey soils that are sodic throughout the profile, have hardsetting surfaces and are weakly dispersive |
| 24* | High erosion vulnerability | |
| 12 | Non-cohesive surface soils over highly dispersive subsoils | Sandy massive surface soils over highly dispersive subsoils |
| 13 | Dispersive clayey soils | Loamy or clayey soils that are sodic throughout the profile, have hardsetting surfaces and are moderately dispersive |
| 14 | Clayey surface soils that erode and/or slake over weakly dispersive subsoils | Clay soils that are sodic and dominated by expanding/swelling clays that have weakly dispersive sodic subsoils |
| 25* | Very high erosion vulnerability | |
| 15 | Dispersive clayey surface soils over highly dispersive subsoils | Loamy or clayey surface soils that are sodic and hardsetting over highly dispersive clay subsoils |
| 16 | Clayey surface soils that erode and/or slake over moderately dispersive subsoils | Clay soils that are sodic and dominated by expanding/swelling clays that have moderately dispersive sodic subsoils |
| 17 | Clayey surface soils that erode and/or slake over highly dispersive subsoils | Clay soils that are sodic and dominated by expanding/swelling clays that have highly dispersive sodic subsoils |

# Summary of soil erodibility predictions

An overview map at a small scale has been produced for each of the following raster datasets, surface stability, subsoil dispersibility and inherent soil erodibility. They are available online at the Queensland Government Publications portal and from the DEHP library catalogue.

## Surface soil stability

*Stable loamy to clay surface soils* dominate the Fitzroy but some of these surface soils are dispersive, particularly soils formed on older alluvium and former flood plains surrounding the MacKenzie and Lower Dawson Rivers as well as soils on the coastal plain between Gladstone and St. Lawrence. On the younger alluvium along the MacKenzie and Lower Dawson *clayey surface soils that shrink and swell* which are more vulnerable to erosion are predicted to occur. *Sandy non-cohesive surface soils* tend to be on the high ranges such as the Carnarvon, Expedition, Drummond, Denham, Connors, Broadsound, Cherwell – Harrow and Flora ranges.

## Subsoil dispersibility

Subsoils in the Fitzroy tend to be weakly dispersive in the valleys and non-dispersive on the ranges. *Moderately dispersive soils* dominate the Upper Dawson catchment along with the Zamia and Conciliation Creek areas. A complex pattern of *moderate to highly dispersive subsoils* exist around Medway, Kettle, Theresa and Sandy Creeks of the Nogoa catchment as well as the Cooroora and Oaky Creeks in the MacKenzie catchment. *Highly dispersive subsoils* dominate the Middlemount area on unconsolidated sedimentary plains as well as within the dissected Tertiary Plateau west of Middlemount and around Baffle Creek in the Upper Dawson catchment north-west of Injune on soils formed from mudstones.

## Inherent soil erodibility

Surface soil characteristics and subsoil dispersibility have been combined into 17 soil erodibility categories and consequently the most commonly predicted category is *stable loamy/clayey surface soils with weakly dispersive subsoils* on older alluvial plains (Category 3). The next most commonly predicted soil is *soils with non-dispersive subsoils* (Category 2 & 4) occurring mostly on the ranges. *Shallow soils with loamy or clayey stable surface soils* (Category 1) occur on the coastal ranges. *Stable loamy/clayey surface soils over moderately dispersive subsoils* (Category 6) dominate the Upper Dawson catchment. *Uniform clayey soils with varying subsoil dispersibility* (Category 9, 11, 14 & 15) are predicted to dominate the Mimosa and Charley Creek areas of the Lower Dawson catchment, Oaky Creek in the MacKenzie catchment and the plains west of Middlemount. These *uniform clayey soils* also dominate the Fitzroy River, Styx River and St. Lawrence Creek floodplains. *Texture-contrast soils with dispersive subsoils* (Category 10 & 12) are predicted to occur around Baffle Creek in the Upper Dawson catchment north-west of Injune on soils formed from mudstones. *Weakly dispersive clays* (Category 11) with at least a low amount of salt are predicted to occur on the flood plains of the MacKenzie River near Twelve Mile Creek.

# How to use the data

The soil erodibility dataset is intended as a tool to inform extension activities and help prioritise investment to prevent or mitigate erosion in the Fitzroy NRM Region. The dataset is most appropriately used at a scale of 1:250,000 or smaller which equates to sub-catchment scale.

The data should be combined with other available information and knowledge such as slope derived from a digital elevation model (DEM), land use, climate data and land cover data to fully assess the risk of soil erosion occurring. For example, areas with high soil erodibility are unlikely to be eroded if they have low grazing pressures and consistently high ground cover, whereas areas of low soil erodibility can still erode under sufficient grazing pressure. Hence inherent soil erodibility does not match erosion outcome necessarily.

Raster cell values, legend labels and recommended colours (RGB) used in the dataset and maps are listed in Appendix 1.

## Data uncertainty

The surface soil stability, subsoil dispersibility and overall inherent soil erodibility datasets each have their own level of uncertainty because different soil attribute datasets were used to create each product. In addition to this, for each soil attribute dataset, the uncertainty will increase as depth increases because less soil data is available at greater depths.

## Further information

- This user guide is available from the Department of Environment and Heritage Protection Library service at http://www.qld.gov.au/environment/library and www.publications.qld.gov.au
- The raster dataset (90m pixels) is available for download from www.data.qld.gov.au and www.qspatial.qld.gov.au
- An abridged version of the data in the form of ready-made maps of soil erodibility can be requested for individual lots using the FORAGE Online Reporting Tool at The Long Paddock website www.longpaddock.qld.gov.au/forage/
- Information on soils and soil erosion can be found at http://www.qld.gov.au/soils

## Glossary

**Digital Elevation Model (DEM)** - a three dimensional representation of the earth's surface showing elevation.

**Dispersion** - the process through which clay particles are repelled by electrostatic and mechanical forces, separating from each other to form a suspension of clay particles in water.

**Electrical conductivity (EC)** – electrical conductivity of a solution due to dissolved salts, the greater the dissolved salt in the solution, the greater the electrical conductivity.

**Hardsetting** - soil which is compact and hard upon drying but softens upon wetting.

**Massive** - soil which appears to be solid or devoid of peds (or aggregates).

**Non-cohesive soil** - soil when dry is not coherent and falls apart easily. These soils are usually sandy and not structured.

**Salinity** - presence of soluble salts in soil or water.

**Sodic** - soil with a high percentage of sodium ions (in soluble or exchangeable form). Sodic soils exhibit predisposition to degradation such as by dispersion when wet and crusting when dry.

**Soil erodibility** - soils susceptibility to detachment and transportation by erosive agents. It is a composite expression of those soil properties that affect the behaviour of a soil and is a function of the mechanical, chemical and physical characteristics of the soil. It is independent of the other factors influencing soil erosion such as topography, land use, rainfall intensity and plant cover, but may be changed by management.

**Soil structure** - the way soil particles are grouped together to form aggregates (or peds). These aggregates vary in size and shape from small crumbs through to large blocks. Where there are no peds present, the soil is described as 'structure-less' and may be either non-cohesive or loose (single grain) or cohesive (massive).

**Soil texture** - the proportion of sand, silt and clay sized particles that make up the mineral fraction of a soil. For example, a light soil refers to a soil high in sand relative to clay, whereas heavy soils have a higher proportion of smaller clay particles.

**Subsoil** - the B horizon of a soil which is usually clay rich and often less fertile than the topsoil but can hold more moisture. Others have given 'sub-surface' the same meaning (Houghton and Charman 1986)

A list of common soil terms is available at http://www.qld.gov.au/soils

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# APPENDIX 1 – Raster dataset cell values, labels and colours

**Table 5. Key to surface soil stability cell values, legend labels and map colours.**

| Cell value | Legend label | Map colour (RGB) |
|---|---|---|
| 0 | Not assessed | 255, 255, 255 |
| 1 | Moderately stable surface soils | 214, 190, 133 |
| 2 | Non-cohesive surface soils | 247, 225, 57 |
| 3 | Dispersive surface soils | 191, 162, 55 |
| 4 | Highly erodible surface soils | 115, 115, 0 |
| 9 | Surface rock | 52, 52, 52 |

**Table 6. Key to subsoil dispersibility cell values, legend labels and recommended map colours.**

| Cell value | Legend label | Map colour (RGB) |
|---|---|---|
| 0 | Not assessed | 255, 255, 255 |
| 1 | Non-dispersive subsoils | 182, 237, 240 |
| 2 | Weakly dispersive subsoils | 92, 163, 230 |
| 3 | Moderately dispersive subsoils | 34, 89, 199 |
| 4 | Highly dispersive subsoils | 10, 10, 145 |

**Table 7. Key to inherent soil erodibility cell values, legend labels and recommended map colours.**

| Cell value* | Cell value** | Cell value*** | Legend label | Map colour (RGB) |
|---|---|---|---|---|
| 0 | 0 | 0 | Not assessed | 255, 255, 255 |
| 21 | 1 | 101, 102, 103 | Moderately stable surface soils over rock or sediment | 118, 219, 211 |
| | 2 | 111, 112, 113 | Moderately stable surface soils over non-dispersive subsoils | 152, 235, 159 |
| | 3 | 121, 122, 123 | Moderately stable surface soils over weakly dispersive subsoil | 237, 250, 190 |
| 22 | 4 | 211, 212, 213 | Non-cohesive surface soils over non-dispersive subsoil | 255, 255, 179 |
| | 5 | 201, 202, 203 | Non-cohesive surface soils over rock or sediment | 255, 255, 148 |
| | 6 | 131, 132, 133 | Moderately stable surface soils over moderately dispersive subsoils | 247, 243, 126 |
| | 7 | 221, 222, 223 | Non-cohesive surface soils over weakly dispersive subsoils | 232, 218, 125 |
| 23 | 8 | 401, 402, 403 | Clayey soils that erode and/or slake readily over rock or sediment | 212, 188, 116 |
| | 9 | 141, 142, 143 | Moderately stable surface soils over highly dispersive subsoils | 176, 143, 77 |
| | 10 | 231, 232, 233 | Non-cohesive surface soils over moderately dispersive subsoils | 140, 101, 42 |
| | 11 | 301, 302, 303, 311, 312, 313, 321, 322, 323 | Weakly dispersive clayey soils | 145, 115, 84 |
| 24 | 12 | 241, 242, 243 | Non-cohesive surface soils over highly dispersive subsoils | 150, 138, 149 |
| | 13 | 331, 332, 333 | Dispersive clayey soils | 158, 150, 181 |
| | 14 | 411, 412, 413, 421, 422, 423 | Clayey surface soils that erode and/or slake over weakly dispersive subsoils | 171, 150, 181 |
| 25 | 15 | 341, 342, 343 | Dispersive clayey surface soils over highly dispersive subsoils | 189, 160, 189 |
| | 16 | 431, 432, 433 | Clayey surface soils that erode and/or slake over moderately dispersive subsoils | 222, 206, 222 |
| | 17 | 441, 442, 443 | Clayey surface soils that erode and/or slake over highly dispersive subsoils | 255, 252, 255 |

*Simplified soil erodibility; **Soil erodibility; ***Soil erodibility with an indication of surface soil thickness

# APPENDIX 2 – FORAGE Erodible Soils Report example

## FORAGE REPORT: ERODIBLE SOILS

Queensland Government

http://www.longpaddock.qld.gov.au/forage May 3, 2017 Lot on Plan: 1SP143246 Label: BrigalowCatchmentStudySite

### Introduction

This report contains three maps of overall soil erodibility (map 1), surface soil stability (map 2) and subsoil erodibility (map 3).

This information was produced specifically for the Burdekin catchment and Fitzroy NRM region. The red cross on the map shows your location within the catchment.

Soil erodibility on these maps is the likelihood that a particular soil is susceptible to erosion.

The maps were produced for regional or sub-catchment investigations, for example comparing soils in major tributaries of rivers and not at a property scale. The maps were produced at a scale of 1:250,000 at this scale 1cm represents 2.5km.

### Location map

### About the maps

These maps were developed to characterise soils into increasing degrees of erosion vulnerability using a limited set of locally relevant soil properties. The actual extent to which a soil erodes is also influenced by non-soil factors such as land cover, landscape position, climate and land management practices. These factors are not included in these maps.

When considering the soils vulnerability to erosion, both surface soil stability and subsoil erodibility need to be considered. For example, some soils have protective stable surface soils overlying erodible subsoils while other soils have erodible surface soils over erodible subsoils. The table below describes the overall soil erodibility as shown in map 1, in terms of locations of surface soil stability (map 2) and subsoil erodibility (map 3). As you move to the right of the table the potential erodibility of the surface soil increases, correspondingly as you move down the table the potential erodibility of the subsoil increases. As such soils in the bottom right of the table have the potential to be more erodible than those soils in the top left. The colour in each cell corresponds with the legend colours of each map.

Information on soil erosion is available from www.qld.gov.au/environment/land/soil.

A userguide is available for download from https://publications.qld.gov.au/dataset/burdekin-digital-soils-mapping-bdsm. GIS data in the form of 90m raster of overall, surface and subsoil erodibility is available for free download from Queensland Government Data portal at www.data.qld.gov.au.

**Surface soil stability (Map 2)**

Increasing surface soil erodibility →

Subsoil dispersibility (Map 3) — Increasing subsoil erodibility ↓

| | Moderately stable surface soils | Non-cohesive surface soils | Dispersive surface soils | Highly erodible surface soils |
|---|---|---|---|---|
| Rock | Loamy to clayey soils over rock | Sandy massive surface soils over rock | Weakly dispersive clay soils | Clayey soils that erode and/or slake readily |
| Non-dispersive subsoils | Loamy to clayey soils over non-dispersive subsoils | Sandy massive surface soils over non-dispersive subsoils | | Clayey surface soils that erode and/or slake over weakly dispersive subsoils |
| Weakly dispersive subsoils | Loamy to clayey soils over weakly dispersive clay subsoils | Sandy massive surface soils over weakly dispersive subsoils | | |
| Moderately dispersive subsoils | Loamy to clayey soils over moderately dispersive clay subsoils | Sandy massive surface soils over moderately dispersive subsoils | Moderately dispersive clay soils | Clayey surface soils that erode and/or slake over moderately dispersive subsoils |
| Highly dispersive subsoils | Loamy to clayey soils over highly dispersive clay subsoils | Sandy massive surface soils over highly dispersive subsoils | Dispersive loamy or clayey surface soils over highly dispersive clay subsoils | Clayey surface soils that erode and/or slake over highly dispersive subsoils |

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# FORAGE REPORT: ERODIBLE SOILS

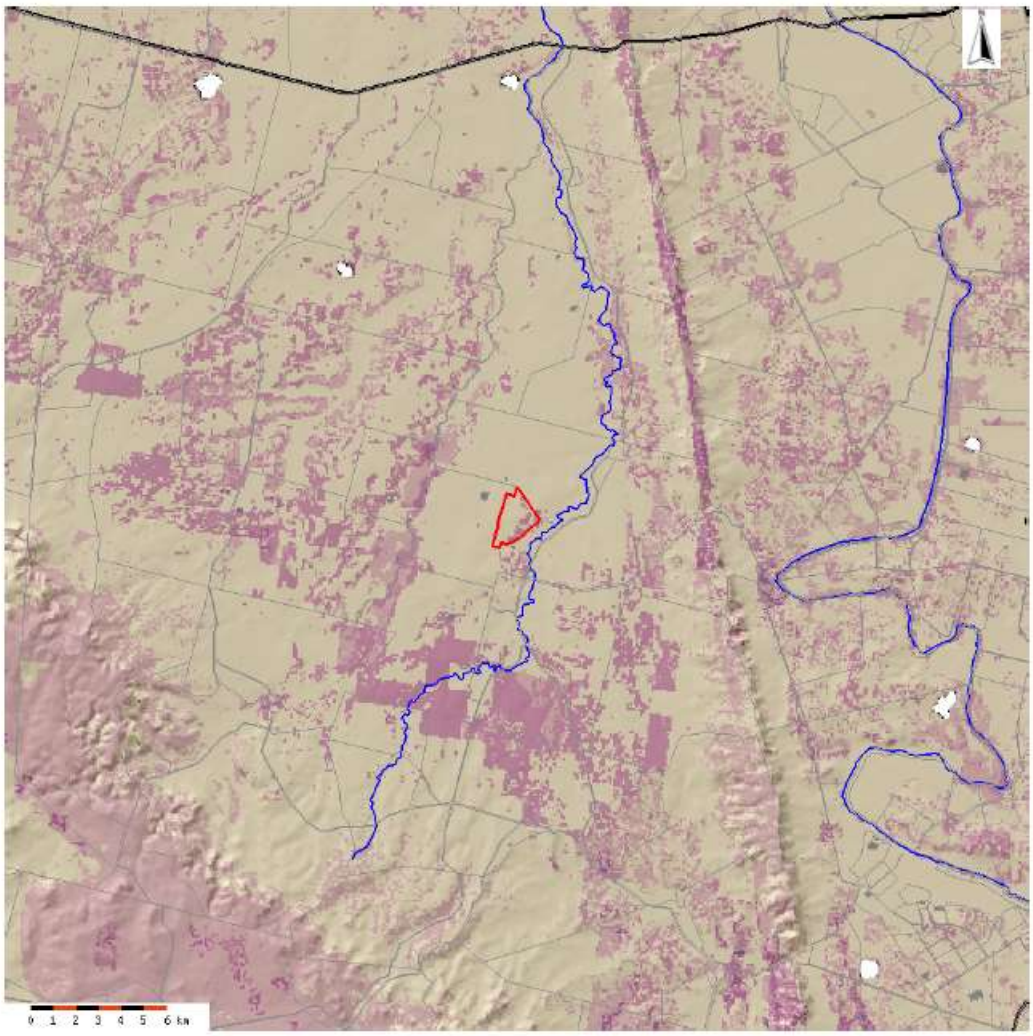
http://www.longpaddock.qld.gov.au/forage May 3, 2017 Lot on Plan: 1SP143246 Label: BrigalowCatchmentStudySite

Queensland Government

## Overall soil erodibility

Soils have been ranked into five broad categories of erodibility (very low to very high). They have been derived from a combination of surface soil stability and subsoil erodibility. The table on the first page shows the possible combinations. Using the Table in the About the Maps section and Maps 2 and 3, you can determine the soils likely to occur.

## Map 1 - Overall soil erodibility ranking




Not assessed
Very low erosion vulnerability
Low erosion vulnerability
Moderate erosion vulnerability
High erosion vulnerability
Very high erosion vulnerability

DCDB Rivers Roads Selected property/Lot on Plan

# FORAGE REPORT: ERODIBLE SOILS

http://www.longpaddock.qld.gov.au/forage May 3, 2017 Lot on Plan: 1SP143246 Label: BrigalowCatchmentStudySite

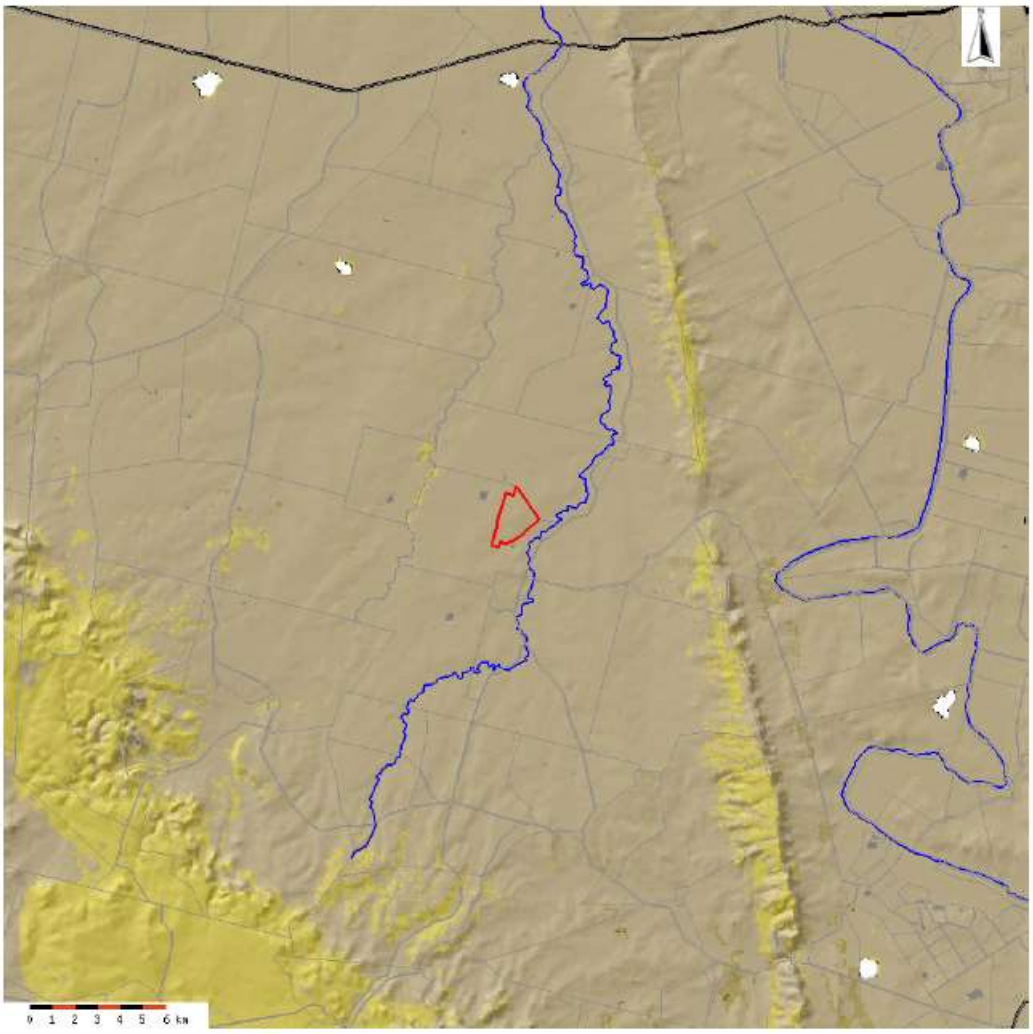
Queensland Government

## Surface soil

The surface soils have been classified into the following four categories. These categories generally relate to increasing surface soil erodibility:

1. Moderately stable surface soils are usually structured and resilient to degradation .
2. Non-cohesive surface soils are sandy soils that are not structured or only weakly so and non-cohesive. These soils are easily eroded.
3. Dispersive surface soils are loamy or clayey soils that are sodic, hardsetting and are likely to disperse in water.
4. Highly erodible surface soils are clayey soils that are sodic and dominated by shrink/swell clays that readily disperse.

## Map 2 - Surface soil stability



# FORAGE REPORT: ERODIBLE SOILS

http://www.longpaddock.qld.gov.au/forage May 3, 2017 Lot on Plan: 1SP143246 Label: BrigalowCatchmentStudySite

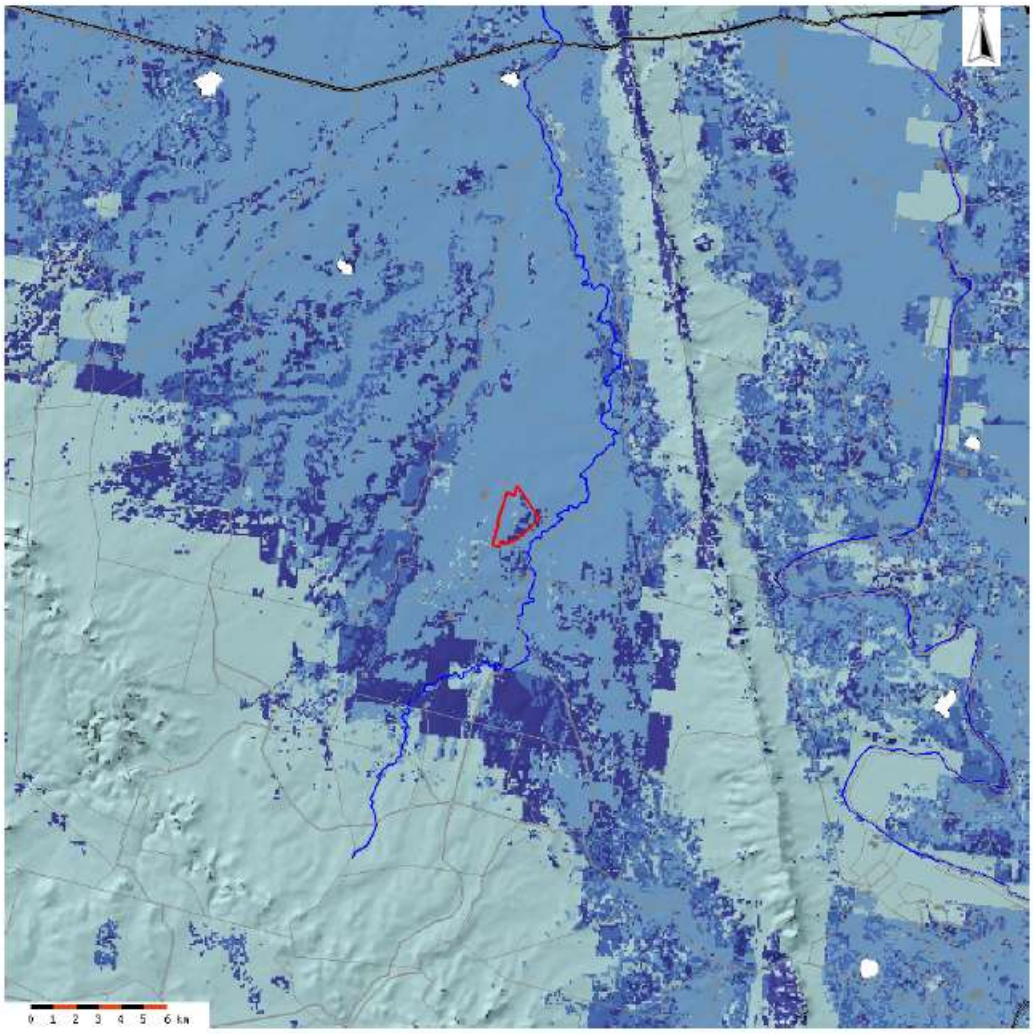
Queensland Government

## Subsoil

The subsoils have been classified into the following four categories:

1. Non-dispersive subsoils that are non-sodic or only weakly sodic and are unlikely to disperse.
2. Weakly dispersive subsoils are sodic subsoils that are saline or dominated by carbonate nodules that prevent these subsoils from dispersing readily.
3. Dispersive subsoils are sodic subsoils that disperse readily.
4. Highly dispersive subsoils are sodic subsoils that are also dominated by magnesium ions that enhance the dispersive affect.

## Map 3 - Subsoil dispersibility




Not assessed
Non-dispersive subsoils
Weakly dispersive subsoils
Moderately dispersive subsoils
Highly dispersive subsoils
Rock
DCDB
Rivers
Roads
Selected property/Lot on Plan