

Map User Notes: Red Clover Suitability Map (Using Climate Futures Projections)

Summary:

The mapping aims to classify land suitable for growing Red Clover pasture according to nine suitability classes: “1.0 Well suited”, “1.1 Well suited (with soil management)”, “2.0 Suitable”, “2.1 Suitable (with soil management)”, “3.0 Moderately suitable”, “3.1 Moderately suitable (with soil management)”, and “4.0 Unsuitable”. These are produced from a set of pre-determined rules in accordance to a suitability matrix (refer to page 3) developed from reviewing existing literature in conjunction with industry consultation and ground-truthing. They are based on soil and climatic influences on Red Clover production using data garnered from soil cores and Bureau of Meteorology rainfall records collected from hundreds of site locations across the state.

[Climate Futures](#) projections were incorporated into the suitability mapping framework to assess projected changes to annual average rainfall for years [2030](#) and [2050](#) (refer to [metadata](#) for more information). This compliments the current [Red Clover Suitability Map](#) developed as part of the ‘[Water for Profit](#)’ program which was based on recent historical climate observations to determine historic annual rainfall averages (Refer [here](#) for more information).

How is suitability determined?

The overall suitability rating is determined using a most-limiting-factor approach, where the lowest rated parameter becomes the overall suitability rating. As an example, a location may possess the following characteristics:

<u>Soil/Climate parameter</u>	<u>Threshold</u>	<u>Rating</u>
pH:	>6	(Well suited)
Electrical conductivity:	4-5	(Suitable)
Drainage:	Very poor	(Unsuitable)
Stones:	<10%	(Well suited)
Rainfall:	>650mm	(Well suited)
Overall rating:		4.0 Unsuitable

In this case, the overall suitability is classified as “4.0 Unsuitable” due to ‘*Very poor (Unsuitable)*’ soil drainage therefore limiting suitability due to this classification. Alternatively, if for example, soil drainage were rated ‘*Well drained (Well suited)*’, the overall rating would then revert to “2.0 Suitable”, due to the Electrical conductivity parameter ‘*4-5 (Suitable)*’ now limiting the rating to this classification (refer to suitability matrix on page 3 for rule-set). A “1.0 Well suited” rating is achieved if all attributes are rated ‘Well suited’. Note that designated conservation/protection areas as well as existing urbanised/residential zones and major waterbodies were automatically classified as “4.0 Unsuitable”.

Improving suitability (with soil management)

In some circumstances, suitability ratings can be improved if measures are applied to mitigate against certain 'soft' limitations/constraints. Addressing these constraints (also known as 'Manageable constraints') using practises such as, for example, applying agricultural lime to counteract acidic soils, can result in a parcel of land becoming more suitable for a given suitability classification. As an example, a location may possess the following characteristics:

<u>Soil/Climate parameter</u>	<u>Threshold</u>	<u>Rating</u>
pH:	5-5.5*	(Moderately suitable)
Electrical conductivity:	<3	(Well suited)
Drainage:	Well drained	(Well suited)
Stones:	<10%	(Well suited)
Rainfall:	>650mm	(Well suited)
Overall rating:		2.1 Suitable (with soil management)

In normal circumstances, the above rating would be determined as "3.0 Moderately suitable" due to pH limiting suitability to this classification. However, in this case, the overall suitability is reclassified to "2.1 Suitable (with soil management)" because the low pH rating, on most occasions, can be readily mitigated (e.g. by applying agricultural lime to neutralise soil acidity) therefore rendering the land more suitable for production. In this regard, the following 'Manageable constraints' can be actively managed/mitigated to allow improved Red Clover growing conditions.

- pH – Undertaking an active liming regime over several seasons can effectively reduce soil acidity over time. (refer: <http://dpiipwe.tas.gov.au/agriculture/land-management-and-soils/soil-management/soil-ph-liming>)
- Drainage – Installation of surface and sub-surface drainage lines can carry excess water off agricultural land and prevent water logging. (refer: <http://dpiipwe.tas.gov.au/agriculture/land-management-and-soils/soil-management/land-drainage>)
- Stones– Stone removal via machine and/or manual picking prior to planting can effectively improve the soil for crop production.

Each manageable constraint (as mentioned above) is denoted by the symbol * in the suitability matrix (page 3) to indicate where management of soil impediments ought to be considered to improve growing conditions and meet the corresponding suitability rating. Note that 'Manageable constraints' can be identified in the attribute table of the map layer itself on LISTmap (refer to example on page 4 to identify how constraints are recognised in LISTmap).

Supplementary information for managing soils:

- Soil management website (DPIPWE):
<http://dpiipwe.tas.gov.au/agriculture/land-management-and-soils/soil-management>
- Information for soil management for Tasmanian farmers:
<http://dpiipwe.tas.gov.au/Documents/Soil-Guide.pdf>
- Information for managing Tasmania's cropping soils:
<http://dpiipwe.tas.gov.au/Documents/Managing-Tasmanias-Cropping-Soils-2000.pdf>

Suitability Rule Matrix – Red Clover

	pH (top 15cm)	Electrical conductivity (EC _{se}) dS/m	Soil drainage	Stone abundance (>200mm diameter, top 15cm)	Annual mean rainfall (using <i>Climate Futures Projections</i>)
1.0 Well suited	>6.0	<4.0	Well drained, Excessively well drained	<10%	>650mm
1.1 Well suited (with soil management)	5.5 – 6.0*	<4.0	Moderately well drained*	10-20%*	>650mm
2.0 Suitable	5.5 – 6.0	4.0-5.0	Moderately well drained	10-20%	600-650mm
2.1 Suitable (with soil management)	5.0 - 5.5*	4.0-5.0	Imperfectly drained*	20-50%*	600-650mm
3.0 Moderately suitable	5.0 - 5.5	5.0-6.0	Imperfectly drained	20-50%	500-600mm
3.1 Moderately suitable (with soil management)	<5.0*	5.0-6.0	Poorly drained*	20-50%	500-600mm
4.0 Unsuitable	NA	>6	Very poorly drained	>50%	<500mm

Manageable constraints are denoted by the symbol *

Definitions of Suitability Classes (in relation to the suitability matrix)

1.0 Well suited: Land having no significant soil or climatic limitations to sustained production where risk of significant crop loss due to adverse conditions are unlikely.

1.1 Well suited (with soil management): Land having no significant soil or climatic limitations to sustained production where risk of significant crop loss due to adverse conditions are unlikely. However, considerations of minor soil impediments with regard to pH, drainage and/or stone abundance ought to be managed if land is to be well suited for sustained production.

2.0 Suitable: Land having only minor soil or climatic limitations that will not significantly reduce productivity where any risk of crop loss is possible, but inherently low.

2.1 Suitable (with soil management): Land having only minor soil or climatic limitations that will not significantly reduce productivity where any risk of crop loss is possible, but inherently low. However, considerations of soil impediments with regard to drainage, pH, and/or stone abundance must be managed if land is to be suitable for sustained production. Failure to do so may result in an increased risk of crop loss.

3.0 Moderately suitable: Land having soil or climatic limitations that is likely to impact on sustained productivity where risk of significant crop loss is possible in some years.

3.1 Moderately suitable (with soil management): Land having soil or climatic limitations that is likely to impact on sustained productivity where risk of significant crop loss is possible in some years. Consideration of major soil impediments with regard to pH, stones and/or drainage must be managed. Failure to do so may result in significant crop loss and would be considered marginal or even unsuitable for large-scale production if constraints were left unattended.

4.0 Unsuitable: Land having soil and climatic limitations that are too severe for sustained production and will so reduce benefits, or increase required inputs, that this expenditure may not justify. Risk of crop loss is high.

LISTmap instructions

The Red Clover suitability map is a digital layer that can be manually interrogated within [LISTmap](#). Any location can be enquired within Tasmania to provide location specific parameters pertaining to Red Clover suitability. To interrogate a location, simply click on any location whilst the Red Clover suitability layer is active in the table of contents panel and a window will appear listing important attributes. An example is given below:

The screenshot shows the LISTmap web application interface. The main map area displays a suitability map of Tasmania with various colors representing different suitability levels. A red dot on the map indicates the location of the 'Identify Results' window. The window displays the following information:

Identify Results Disclaimer

One feature found in one layer
 ↳ ESM - Red Clover (one feature)

Feature	Red Clover.pdf
User Notes	Red Clover.pdf
Overall Suitability Rating	2.1 Suitable (with soil management)
Constraints	Drainage
Manageable Constraints	Drainage
pH (top 15cm)	>6 (Well suited)
Electrical conductivity (EC _e) dS/m	<4 (Well suited)
Soil Drainage	Imperfect (Moderately suitable)
Stone abundance (>200mm diameter, top 15cm)	<10% (Well suited)
Annual mean rainfall	>650mm (Well suited)

POI: GDA94 MGA55 : 472017E, 5428764N Identify Options

The right-hand panel shows the layer list with 'ESM - Red Clover' selected and a legend for the suitability ratings:

- 1.0 Well suited
- 1.1 Well suited (with soil management)
- 2.0 Suitable
- 2.1 Suitable (with soil management)
- 3.0 Moderately suitable
- 3.1 Moderately suitable (with soil management)
- 4.0 Unsuitable

The window provides information such as the “Overall Suitability Rating” as well as other useful information including:

- ‘Constraints’ - provides a list of attributes that limits a classification to a particular suitability rating;
- ‘Manageable Constraints’ - provides a lists of soft limitation attributes than should be managed in order to meet the suitability rating (refer to page 1 & 2).

In addition, information pertaining to each soil and climate attribute (according to the classifications provided in the suitability matrix on page 3) are also provided and appear below the overall suitability rating and constraint fields (as shown in the example above). This allows users to ‘drill down’ and view site-specific information regarding soil and climate requirements that relate to Red Clover production for any point of interest in Tasmania.

Vulnerable soils

Listed within the suitability layer (below the individual soil/climate fields) are ratings pertaining to soil vulnerability hazards including:

- Sodicity (ratings of high, moderate, low, nil);
- Salinity (ratings of high, moderate, low, nil);
- Water Erosion (ratings of extreme, very high, high, moderate, low, very low, nil);
- Water Logging (ratings of extreme, very high, high, moderate, low, very low, nil); and
- Wind Erosion (ratings of high, moderate, low, nil).

Information in regards to managing vulnerable soils can be obtained here:

https://nrmdatalibrary.dpiwve.tas.gov.au/FactSheets/WfW/ListMapUserNotes/Vulnerable_soils.pdf

Note that vulnerable soils categories are complementary material to the mapping and does not contribute to the “Overall Suitability Rating”.

Flood risk

Also listed within the suitability layer are categories relating to risk of flood inundation, as provided by flood plain layer within the LIST Hydrography dataset

(http://listdata.thelist.tas.gov.au/public/LIST_Hydrographic_Information.pdf).

Ratings of ‘High’, ‘Moderate’ or ‘Nil’ are listed that correspond to ‘Severe’, ‘Moderate’ or ‘Nil’ flooding potential.

Note that flood risk categories are complementary material to the mapping and does not contribute to the “Overall Suitability Rating”.

Additional Information

For information about using LISTmap, please consult the help document:

<http://listdata.thelist.tas.gov.au/public/outgoing/sif/listmaphelp.pdf>

For technical information relating to the dataset, please consult the [metadata](#).

For information relating to irrigation investment, please consult the Investing in Irrigation web-portal:

<http://dpipwe.tas.gov.au/agriculture/investing-in-irrigation>

Tasmanian graziers guide to pasture, forage and fodder crops can be accessed here:

<https://nre.tas.gov.au/Documents/Species%20for%20Profit%202021.pdf>

Contact

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Caution and Disclaimer

The information and material in LISTmap (including the enterprise suitability map layer for Red Clover and accompanying soil and climate input datasets, i.e. “material”) is based on computer modelling of the potential suitability of Red Clover to a given area and, as such, there are inherent uncertainties in the results. While every effort has been made to ensure the material is accurate, the Crown in Right of Tasmania (“Crown”) provide no warranty, guarantee or representation that the material is accurate, complete, up to date, non-infringing or fit for a particular purpose. All suitability assessments are based upon the assumption that water for crop irrigation is available and therefore is not a limiting factor. Furthermore, the Crown expressly disclaim all and any legal liability and responsibility whatsoever arising from or connected with: (a) the accuracy, reliability, validity, currency or completeness of the material; (b) the consequences of anything done or omitted to be done by any person, either in whole or in part, in reliance of the material. The material does not take into account personal circumstances. The material is made available on the understanding that the Crown are not providing professional advice and that users of this material should undertake site-specific investigations and research and obtain appropriate professional advice relevant to their particular circumstances. The relevant maps that form part of the material have been prepared at 1:50,000 scale (landscape level). These maps consider only soil and climate constraints and do not take into account other parameters or any legislative, regulatory and/or policy requirements of Federal, State or Local Governments that apply to the land in question and/or which could affect the proposed land use or agricultural enterprise.