Map User Notes: Wheat Suitability Map (Using Climate Futures Projections)

Summary:

The mapping aims to classify land suitable for growing Wheat according to seven 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 Wheat production using data garnered from soil cores and temperature logger records collected from hundreds of site locations across the state. The mapping assumes water for crop irrigation is available and therefore not a limiting factor to production.

Climate Futures projections were incorporated into the suitability mapping framework to assess projected changes to frost risk severity for years 2030 and 2050 (refer to metadata for more information). This compliments the current Wheat Suitability Map developed as part of the 'Water for Profit' program which was based on recent historical climate observations (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:

Soil/Climate parameter	*Threshold*	*Rating*
Soil depth:	*>40cm*	*(Well suited)*
Depth to sodic layer:	*20-30cm*	*(Suitable)*
pH:	*>6*	*(Well suited)*
Electrical conductivity:	*<3*	*(Well suited)*
Drainage:	*Very poor*	*(Unsuitable)*
Soil texture (Clay %):	*>8.5%*	*(Well suited)*
Stones:	*<10%*	*(Well suited)*
Slope:	*<5%*	*(Well suited)*
Frost risk:	*<1/5years*	*(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 Depth to sodic layer parameter '*20-30cm (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:

Soil/Climate parameter	*Threshold*	*Rating*
Soil depth:	*>40cm*	*(Well suited)*
Depth to sodic layer:	*>30cm*	*(Well suited)*
pH:	*5 – 5.5**	*(Moderately suitable)*
Electrical conductivity:	*<3*	*(Well suited)*
Drainage:	*Well drained*	*(Well suited)*
Soil texture (Clay %):	*>8.5%*	*(Well suited)*
Stones:	*<10%*	*(Well suited)*
Slope:	*<5%*	*(Well suited)*
Frost risk:	*<1/5years*	*(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 Wheat growing conditions.

- pH – Undertaking an active liming regime over several seasons can effectively reduce soil acidity over time. (refer: http://dpipwe.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://dpipwe.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 5 to identify how constraints are recognised in LISTmap).

Supplementary information for managing soils:

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

Supplementary information for growing Wheat:

- Wheat Growing Factsheet: http://dpipwe.tas.gov.au/Documents/WfW-Wheat_factsheet.pdf

Suitability Rule Matrix - Wheat

Rating	Soil depth	Depth to sodic layer	pH (top 15cm)	Electrical conductivity (ECse) dS/m	Soil texture (top 15cm - % clay)	Soil drainage	Stone abundance (>200mm diameter, top 15cm)	Slope (of land, % rise)	Frost risk *(using Climate Futures Projections)* Chance of having at least 1 day where Tmin <0°C during flowering (1 – 15 November)
1.0 Well suited	>40cm	>30cm	>=6	<3	>8.5%	Excessively well drained, Well drained, Moderately well drained	<10%	<5%	Occurs <1/5 years
1.1 Well suited (with soil management)	>40cm	>30cm	5.5 - 6*	<3	>8.5%	Imperfect*	10-20%*	<5%	Occurs <1/5 years
2.0 Suitable	>40cm	20 - 30cm	5.5 - 6	3-6	>8.5%	Imperfect	10-20%	5-25%	Occurs 1/5-3/10 years
2.1 Suitable (with soil management)	>40cm	20 - 30cm	5 - 5.5*	3-6	>8.5%	Imperfect	20-50%*	5-25%	Occurs 1/5-3/10 years
3.0 Moderately suitable	>40cm	<20cm	5 - 5.5	6-12	<8.5%	Imperfect	20-50%	5-25%	Occurs 3/10-2/5 years
3.1 Moderately suitable (with soil management)	>40cm	<20cm	4.5 - 5.0*	6-12	<8.5%	Poor*	>50%*	5-25%	Occurs 3/10-2/5 years
4.0 Unsuitable	<40cm	<20cm	<4.5	>12	<8.5%	Very poorly drained	>50%	>25%	Occurs >2/5 years

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, 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, 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.

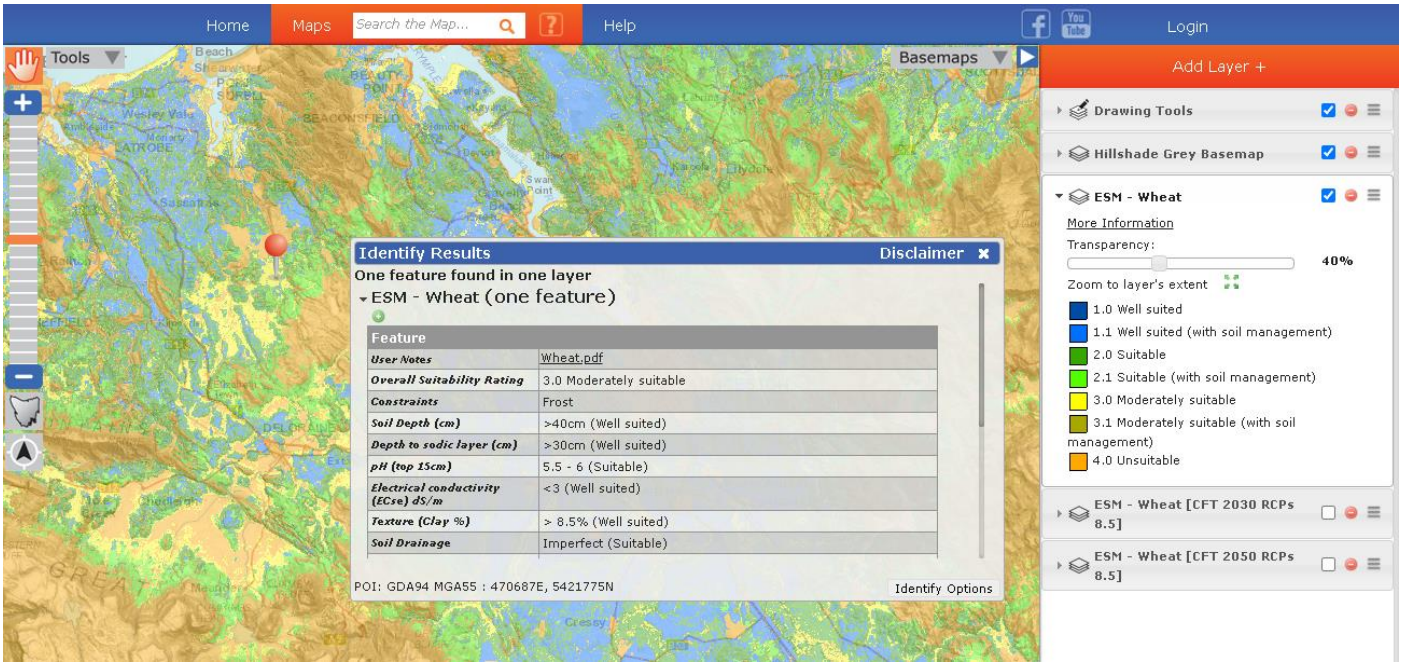
3.0 Moderately suitable: Land having soil or climatic limitations that is likely to impact on sustained productivity where risk of significant crop loss is possible in some years.

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. 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 Wheat 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 Wheat suitability. To interrogate a location, simply click on any location whilst the Wheat suitability layer is active in the table of contents panel and a window will appear listing important attributes. An example is given below:



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 Wheat 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.dpipwe.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

Contact

Natural Assets Spatial Intelligence Section
171 Westbury Road
PROSPECT TAS 7250
Phone: 03 6777 2220
Email: nasis@dpipwe.tas.gov.au

Caution and Disclaimer

The information and material in LISTmap (including the enterprise suitability map layer for Wheat and accompanying soil and climate input datasets, i.e. "material") is based on computer modelling of the potential suitability of Wheat 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.