

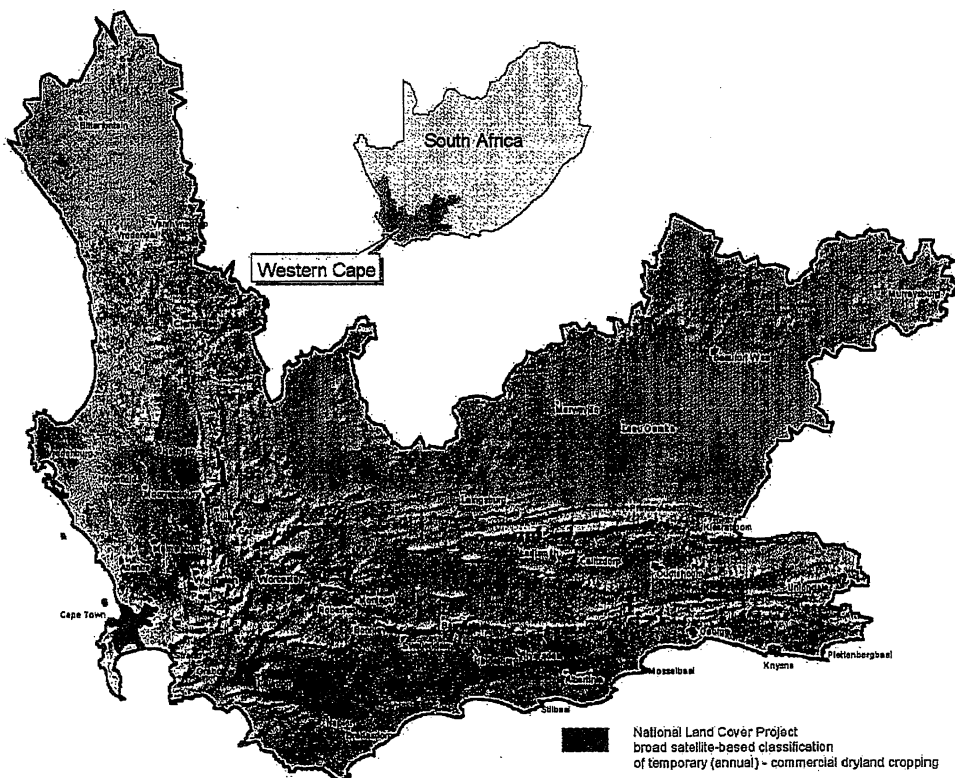
Report to the Protein Research Trust

Modelling the Potential for Lupin and Canola Production in the Western Cape

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EXECUTIVE SUMMARY

Information regarding the production potential of canola and lupin species in the Western Cape can make a considerable contribution to strategic industry planning and development. Apart from the oil and protein value of these crops, they also play an important role in small grain crop rotations.

The objective of the project was therefore to produce a spatial Geographic Information System (GIS) model to determine the potential of the environment, in terms of climate, topography and soils, to support the production of lupin and canola species. The model will enable the output of production potential maps on a regional basis.

The methodology used was as follows:

- Development of a soil-water balance model framework and literature review of similar work.
- Conversion and “cleaning” existing Land Type data into a form usable in GIS.
- Synthesis of a digital terrain model (DTM) from elevation point data.
- Derivation of rainfall grids using the Schäfer interpolation method.
- Interpolation of evaporation grid data.
- Development of a GIS-model for the delineation of terrain units from the DTM.
- Refinement of the land type database to terrain unit level.
- Development of the soil water-balance crop model. The model process, briefly is as follows:
 - Calculate distributed soil water balance based on soil properties (texture, water holding capacity, wetness), monthly mean/median climatic data and terrain unit position.
 - Apply crop specific weighting factors to determine potential.
 - Exclude or penalise known unsuitable areas e.g. salinity, waterlogging-susceptibility, slope, stony soils.
 - Exclude unavailable regions such as metropolitan areas, conservation areas and mountain reserves.
- Establish model to determine lupin and canola potential.

- Produce report.
- Run model to produce maps.

The model is written in the AVENUE[®] GIS programming language and allows the user to change parameters such as antecedent soil moisture, crop factors, maximum theoretical yield and optimal water use. The model has a subroutine for waterlogging susceptibility – particularly important in some lupin species. The ability of the available resources to support such requirements is then evaluated, and a yield potential map produced. As expected it is predominantly the areas which traditionally produced high wheat yields which show the greatest promise for canola and lupin species. The various drought and waterlogging stress tolerances of the plants are catered for in the model.

The model will provide decision support to regional workers and planners, particularly in the light of the recent deregulation of the single channel marketing system for wheat, creating a need for alternative cropping strategies.

Crop models are seldom regarded as complete and final works and are updated and improved as new data, knowledge and technology become available. The model will be improved, maintained and operated by workers in the section Resource Utilization at Elsenburg, on an ongoing basis as part of their proposed crop decision support system (DSS) for the Western Cape. A particular need in this study is for accurate crop factors appropriate to dryland conditions in the Western Cape as this information appears to be unavailable. It is also expected that far more accurate topography data may become available through a NASA project aimed at producing 30 metre resolution elevation data for most of the land masses on Earth. Such data will improve the determination of terrain position and vastly improve predictions of waterlogging susceptibility. Given that most of the extensive cropping areas in the Western Cape have an inherently high coefficient of variation of annual rainfall (i.e. inter-year rainfall variation), it is planned that future development of this model will include a user-defined risk profile to assist regional planners and advisors.