Australian Government

Geoscience Australia

Dynamic Land Cover Dataset Product Description

V1.0 27 May 2014

D2014-40362

Unclassified

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Document History

Revision Number	Date	Nature of Change and Reason	Author	Approval
0.1	24/02/14	Initial draft	Chris Penning	
0.2	4/3/14	Revision in line with Template v2	Jeff Kingwell	For approval
1.0	27 May 2014	Removed extraneous material (platform and sensor details; uncited references), reducing page count by 10.	Jeff Kingwell	For GL approval
1.0	28 May 2014	Document History update noting approval	Adam Lewis	Approved – D2014-109811

A Summary Description

Sheet A.1 Definition and Usage

Product Name	Dynamic Land Cover Dataset
Abbreviation	DLCD
Product Suite	Dynamic Land Cover Dataset, DLCD
Key Features of Product Suite	The Dynamic Land Cover Dataset (DLCD) is the first nationally consistent and thematically comprehensive land cover reference for Australia. It provides a basis for reporting on change and trends in vegetation cover and extent. Information about land cover dynamics is essential to understanding and addressing a range of national challenges such as drought, salinity, water availability and ecosystem health. DLCD presents a synopsis of land cover information for every 250m by 250m area of the country from April 2000 to April 2008. The classification scheme used to describe land cover categories in the Dataset conforms to the 2007 International Organization for Standardization (ISO) land cover standard (19144-2). The Dataset shows Australian land covers clustered into 34 ISO classes. These reflect the structural character of vegetation, ranging from cultivated and managed land covers (crops and pastures) to natural land covers such as closed forest and open grasslands. The source data for the Dataset is a time series of EVI data from the Moderate Resolution Imaging Spectroradiometer (MODIS) on the Terra and Aqua satellites operated by NASA. The time series includes 186 snapshots of vegetation greenness for each 250m by 250m area across the continent over an 8 year period. An example of the time series displayed by different land cover types is shown in Figure 1. The EVI time series for each 250m by 250m area was characterised using 12 time series coefficients which describe the statistical, phenological and seasonal characteristics of the land cover. A clustering approach was applied to the 12 coefficients to define homogenous regions with similar greenness dynamics over time. Regions that showed similar greenness characteristics over time were labelled using information derived from the 2009 Catchment Scale Land Use of Australia dataset and Native Vegetation Information System dataset provided by the Australian Bureau of Agriculture and Resource Economics and Sciences (ABARES).
Product Overview	The Dynamic Land Cover Dataset comprises digital files of the land cover classification showing the change in behaviour of land cover across Australia. The DLCD includes data for every 250m by 250m area for the period 2000 to 2008. DLCD provides a base-line for identifying and reporting on change and trends in vegetation cover and extent. DLCD can be used as an input for modelling: • Groundwater recharge and discharge • Climate

Sheet A.1 Definition and Usage

<table>
<tr><td></td><td colspan="4">

Wind and water erosion risk
Evapotranspiration
Carbon dynamics
Land surface processes
Inundation.

In conjunction with trends in annual Enhanced Vegetation Index (EVI) data, the DLCD can be used to identify emerging patterns of land cover change and provide a spatial and historical context within which to interpret land cover change.
</td></tr>
<tr><td rowspan="4">Planned Product Versions</td><td rowspan="2">Version</td><td colspan="3">Features</td></tr>
<tr><td>Image Data Input</td><td>Classification Schema</td><td>Number of land cover classes</td></tr>
<tr><td>V1.0 (released 2013)</td><td>MOD13Q1 from April 2000 to April 2008</td><td>ISO 19144-2</td><td>34</td></tr>
<tr><td>V2.0 (planned)</td><td>MOD13Q1 from April 2001 to December 2011</td><td>ISO 19144-2</td><td>35</td></tr>
<tr><td>Product Background</td><td colspan="4">
In 2009 the National Committee for Land Use and Management Information identified the need for land cover information to facilitate change detection and improve natural resource management.

Existing land cover datasets are composites of State and Territory datasets which have been developed to meet specific legislative needs. This leads to thematic mismatches between different datasets and limits the capacity for meaningful change detection.

Nationally consistent and thematically comprehensive land cover information is essential to addressing a range of natural resource challenges. These include sustainable farming practices, management of water resources, air quality, soil erosion and forests, as well as emergency management and urban planning.

The DLCD is based on an analysis of a 16-day EVI composite collected at 250 metre resolution using the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite for the period 2000 to 2008.

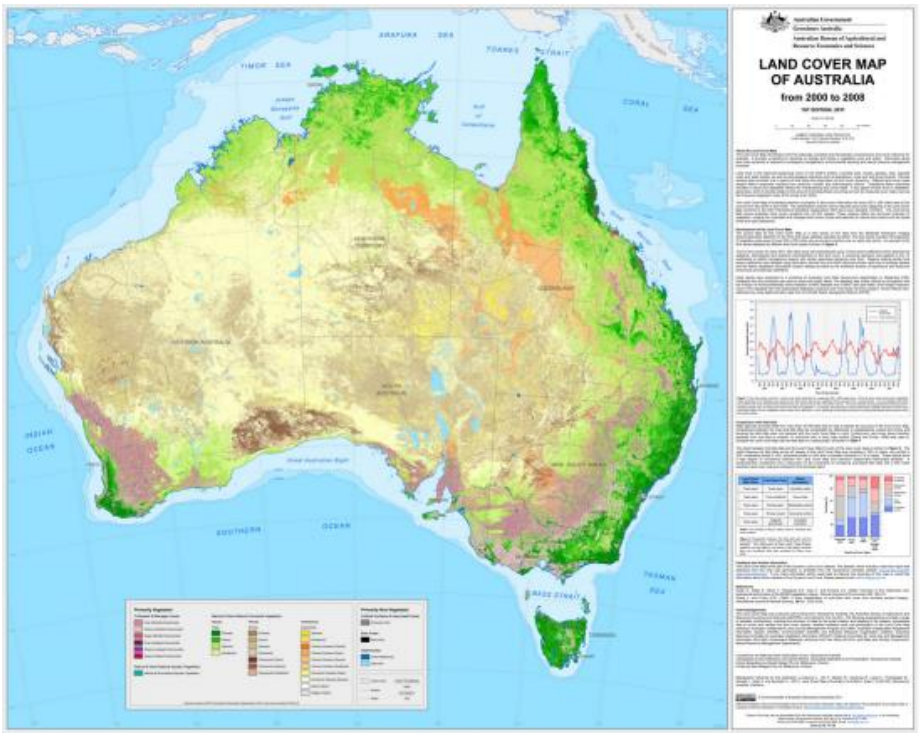
The MODIS time series for each pixel was analysed using an innovative technique which reduced each time series into 12 coefficients based on the statistical, phenological and seasonal characteristics of each pixel. These coefficients were then clustered using a support vector clustering algorithm and the resultant classes were labelled using agreed National data supplied from catchment scale land use mapping and the National Vegetation Information System (NVIS).

The DLCD classification methodology and process along with major algorithms used are described in detail in the National Dynamic Land Cover Dataset - Technical Report (Lymburner et al, 2011).
</td></tr>
<tr><td>Potential Applications</td><td colspan="4">
DLCD can be used as an input for modelling:

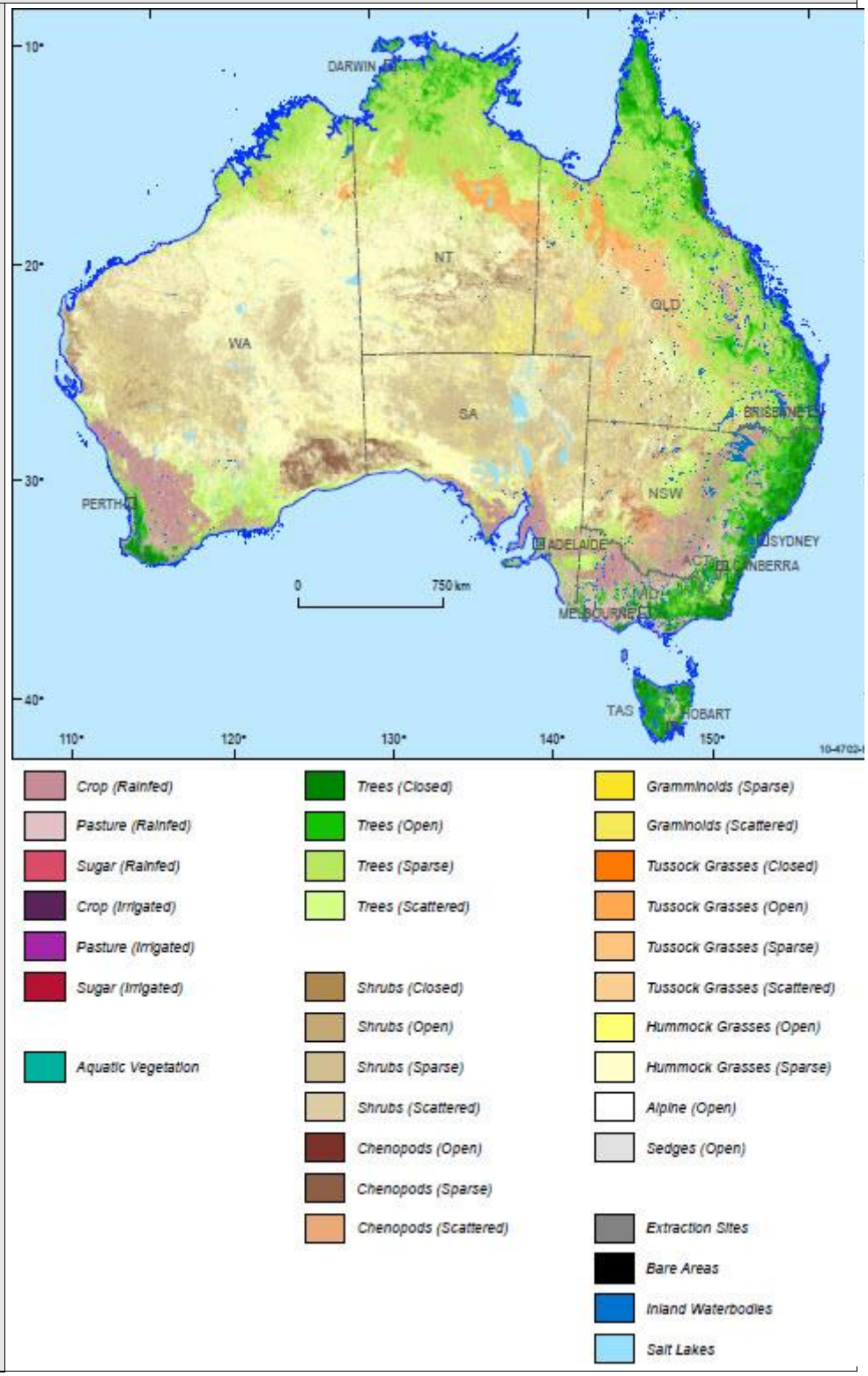
Groundwater recharge and discharge
Climate
Wind and water erosion risk
Evapotranspiration

</td></tr>
</table>

Sheet A.1 Definition and Usage

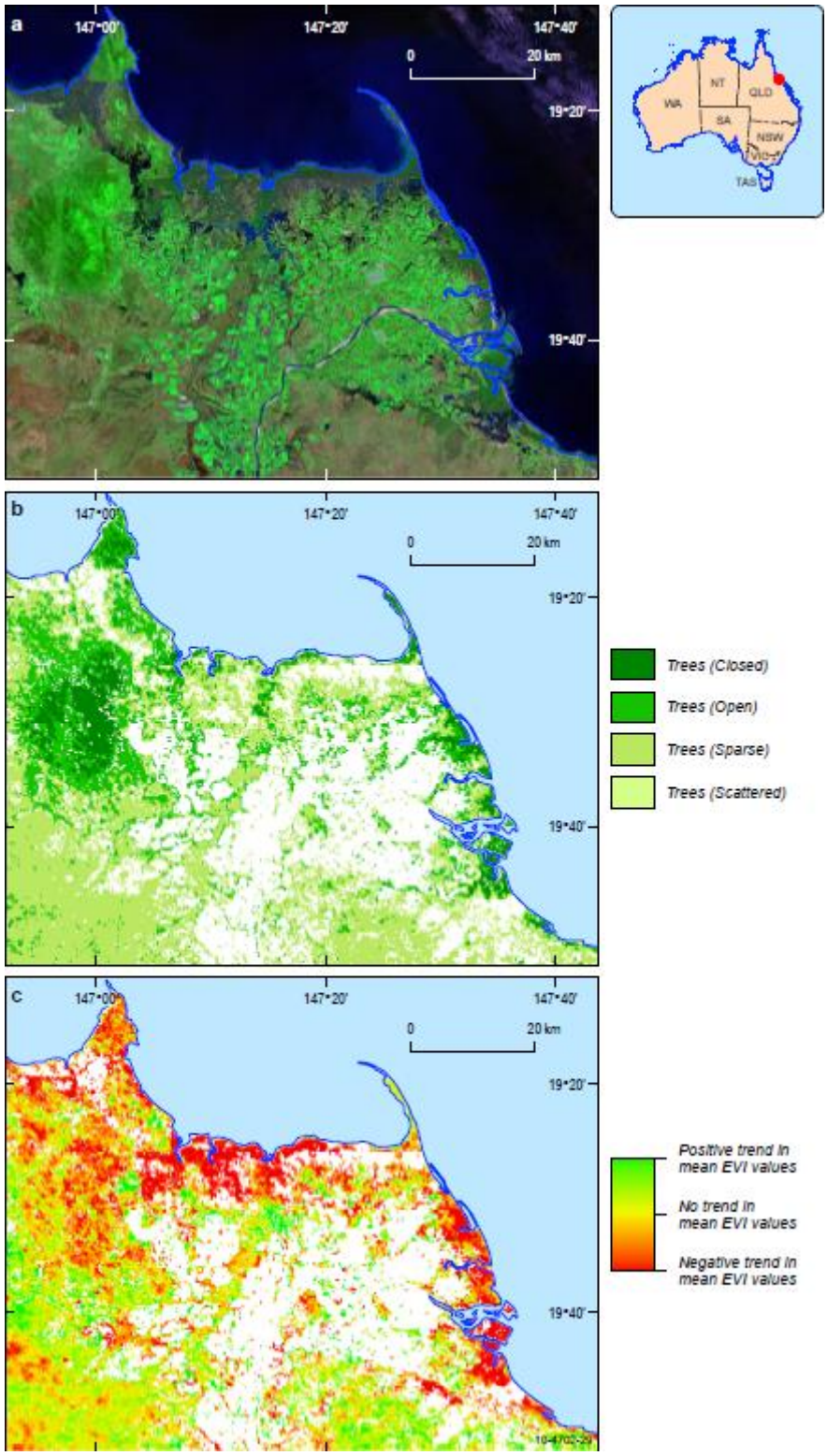
	• Carbon dynamics • Land surface processes • Inundation. In conjunction with trends in annual Enhanced Vegetation Index (EVI) data, the DLCD can be used to identify emerging patterns of land cover change and provide a spatial and historical context within which to interpret land cover change.
Expected Lifespan	Ongoing – while coarse resolution optical Earth observation data is available for Australia.
Illustrations	

Sheet A.1 Definition and Usage



Sheet A.1 Definition and Usage

Example Images



Sheet A.2 Product Revisions

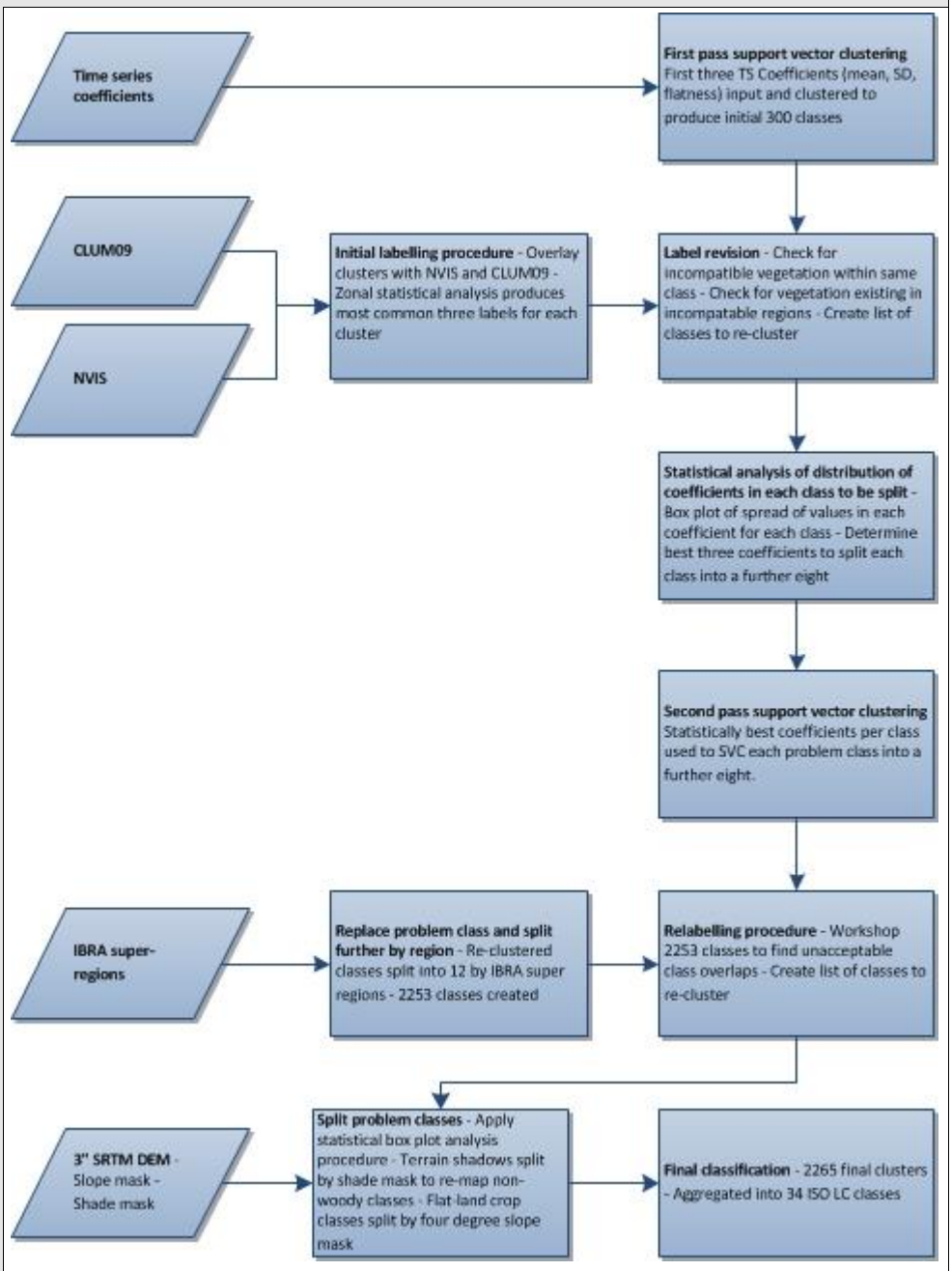
Revision Number	Date	Nature of Change and Reason	Author/Approval
V1.0	**2013**	Initial public release. See http://www.ga.gov.au/earth-observation/landcover.html	**Leo Lymburner/Adam Lewis**

B Specification

Sheet B.1 Provenance and Algorithms

Data Sources	**Primary**	MOD13Q1 Enhanced Vegetation Index data from April 2000 to April 2008.	
	Metadata	https://lpdaac.usgs.gov/products/modis_products_table/mod13q1	
	Ancillary	Source	Derived Data
		Catchment Land Use Maps 2009 (CLUM09) dataset	The Catchment Land Use Maps 2009 were used to constrain the areas mapped as irrigated land cover types and cropping.
		National Vegetation Information System (NVIS) dataset	Height at image scene centre, plus slope and aspect per pixel for topographic correction
		Interim Biogeographic Regionalisation of Australia (IBRA) dataset	The IBRA is used to reduce confusion between open savannah in northern Australia with pasture in the temperate and sub-tropical regions.
		3" SRTM DEM	A DEM generated slope product is used to identify shaded terrain.
Major Algorithms	The DLCD classification methodology and process along with major algorithms used are described in detail in the National Dynamic Land Cover Dataset - Technical Report (Lymburner et al, 2011).		
Processing Sequence	The DLCD is based on an analysis of a 16-day EVI composite collected at 250 metre resolution using the Moderate Resolution Imaging Spectroradiometer (MODIS) satellite for the period 2000 to 2008. The MODIS time series for each pixel was analysed using an innovative technique which reduced each time series into 12 coefficients based on the statistical, phenological and seasonal characteristics of each pixel. These coefficients were then clustered using a support vector clustering algorithm and the resultant classes were labelled using agreed National data supplied from catchment scale land use mapping and the National Vegetation Information System (NVIS).		

Sheet B.1 Provenance and Algorithms



Validation of Underlying Algorithms

The results of the initial labelling procedure were assessed by:

- Review by a panel of peers;
- Comparison with other remotely sensed datasets, including CSIRO Land and Water's Fraction of absorbed
- Photosynthetically Active Radiation (FPAR) data and the Queensland Statewide Landcover and Trees Study (SLATS) teams FPC data;
- Comparison with the 2007 Landsat 7 mosaic based on visual interpretation;
- Comparison with Google Earth™ based on visual interpretation.

All the clusters which were identified as being wrongly labelled were visually assessed and compared to high resolution imagery. Five different types of mismatch were identified. After each of the five error types had been addressed, the dataset was further evaluated by comparing it with 25,817 field survey data points captured between 1999 and 2009.
The classification process identified 34 final International Standard Organisation land cover classes

Sheet B.1 Provenance and Algorithms	
	for Australia.
Accuracy and Limitations	Limitation statement to cover (where relevant): • data accuracy (as defined in Section 4.5); • data source mentioning resolution, frequency and reliability (without duplicating other information in Section B); • obstructions to observations.

C Availability

Sheet C.1 Licencing and Access

Support	Supported
Licencing	Creative Commons 3.0 Attribution Australia (CC BY 3.0 AU).
Search Tool	NaviGAtor (GA Discovery & Delivery Tool) and GeoCat Product Search.
Preview Facility	N/A
Ordering and Distribution	Free download from GA website – www.ga.gov.au

Sheet C.2 Delivery Information

File Name

DLCDv1_Class contains the final 34 DLC classes. The dataset includes a layer file and an attribute table for use in ArcGIS. The files are as follows:

DLCDv1_Class.tif	main DLC 34 class data file
DLCDv1_Class.tif.vat.dbf	attribute table for 34 class data
DLCDv1_Class.lyr	ArcGIS layer file for 34 class data
DLCDv1_Class.tif.aux	ArcGIS auxiliary file

trend_evi_max shows the trend in the annual maximum of the Enhanced Vegetation Index (EVI) from 2000 to 2008. The dataset includes a layer file and an attribute table for use in ArcGIS. The files are as follows:

trend_evi_max.tif	main evi max data file
trend_evi_max.tif.lyr	ArcGIS layer file for max evi trend
trend_evi_max.rrd	ArcGIS pyramid file
trend_evi_max.aux	ArcGIS auxiliary file
trend_evi_max.tif.xml	ArcGIS metadata file

trend_evi_mean shows the trend in the annual mean of the Enhanced Vegetation Index (EVI) from 2000 to 2010. The dataset includes a layer file and an attribute table for use in ArcGIS. The files are as follows:

trend_evi_mean.tif	main evi mean data file
trend_evi_mean.tif.lyr	ArcGIS layer file for mean evi trend
trend_evi_mean.rrd	ArcGIS pyramid file
trend_evi_mean.aux	ArcGIS auxiliary file
trend_evi_mean.tif.xml	ArcGIS metadata file

trend_evi_min shows the trend in the annual minimum of the Enhanced Vegetation Index (EVI) from 2000 to 2010. The dataset includes a layer file and an attribute table for use in ArcGIS. The files are as follows:

trend_evi_min.tif	main evi min data file
trend_evi_min.tif.lyr	ArcGIS layer file for min evi trend
trend_evi_min.rrd	ArcGIS pyramid file
trend_evi_min.aux	ArcGIS auxiliary file
trend_evi_min.tif.xml	ArcGIS metadata file

The DLCD Technical Report (Lymburner et. al., 2011) describes the DLCD, how the dataset was generated, presents a comparison of the DLCD with independent datasets

Sheet C.2 Delivery Information

File Format Split into columns for different product versions if required.	and examples of how the DLCD classification can be used to analyse trends in the Enhanced Vegetation Index (EVI) and other data sources. The files are as follows: DLCD-Technical-Report.pdf	
	Data	Adobe PDF, Reference documents, 34.23MB Tagged Image File Format (TIFF), Shows the trend in the annual minimum of the Enhanced Vegetation Index (EVI) from 2000 to 2008, 467.33MB Tagged Image File Format (TIFF), Shows the trend in the annual mean of the Enhanced Vegetation Index (EVI) from 2000 to 2008, 466.87MB Tagged Image File Format (TIFF), Contains the final 34 DLC classes, 25.77MB Tagged Image File Format (TIFF), Shows the trend in the annual maximum of the Enhanced Vegetation Index (EVI) from 2000 to 2008, 468.31MB
	Metadata	.dbf file
	Quicklook	Adobe PDF 7.5MB Adobe PDF (High resolution) 35.94MB JPEG image 10.01MB
Data Volume (see Section 3.4) Split into columns for different product versions if required.	**Per product**	Reference documents, 34.23MB Trend in the annual minimum of the Enhanced Vegetation Index (EVI) from 2000 to 2008, 467.33MB Trend in the annual mean of the Enhanced Vegetation Index (EVI) from 2000 to 2008, 466.87MB Final 34 DLC classes, 25.77MB Trend in the annual maximum of the Enhanced Vegetation Index (EVI) from 2000 to 2008, 468.31MB
	Total Product	1462.51MB

Note

This document describes the relevant GA Product as delivered directly by GA. Some details may vary in versions of the product delivered by third parties.

References

Lymburner, L., Tan, P., Mueller, N., Thackway, R., Lewis, A., Thankappan. M., Randall, L., Islam, A., and Senarath, U. (2011). The Dynamic Land Cover Datset. 95pp. GA Record 2011/31, ISBN 978-1-921954-30-6, Geoscience Australia, Canberra.