

The Victorian Land Use Information System (VLUIS)

Metadata description

The Victorian Land Use Information System (VLUIS) dataset has been created by the Spatial Sciences Group of the Agriculture Research Division in the Department of Environment and Primary Industries. The method used to create VLUIS is significantly different to traditional methods used to create land use information and has been designed to create regular and consistent data over time. It covers the entire landmass of Victoria and separately describes the land tenure, land use and land cover for each cadastral parcel across the state, biennially for land tenure and use and annually for land cover; for each year from 2006 to 2013. The data is in the form of a shapefile. The table contains a Parcel_PFI column which links to the same code within the state-wide cadastral data layer so that data on land use, land tenure and land cover is attached to each land parcel.

To use the VLUIS data correctly it is important to understand the difference between the three components of VLUIS. The "Guidelines for land use mapping in Australia: principles, procedures and definitions, Edition 3" published in 2006 by the Commonwealth of Australia, defines them as follows:

Land tenure is the form of an interest in land. Some forms of tenure (such as pastoral leases or nature conservation reserves) relate directly to land use and land management practice.

Land use means the purpose to which the land cover is committed. Some land uses, such as agriculture, have a characteristic land cover pattern. These usually appear in land cover classifications. Other land uses, such as nature conservation, are not readily discriminated by a characteristic land cover pattern. For example, where the land cover is woodland, land use may be timber production or nature conservation.

Land cover refers to the physical surface of the earth, including various combinations of vegetation types, soils, exposed rocks and water bodies as well as anthropogenic elements, such as agriculture and built environments. Land cover classes can usually be discriminated by characteristic patterns using remote sensing.

The land cover data is sourced (created) annually whilst the land tenure and land use data is available bi-annually. This means that the VLUIS 2010 dataset is comprised of 2010 land tenure, use and cover information, while there is only land cover information updated in 2011.

Land Tenure

The "Public" land tenure data has been sourced from the Department of Sustainability and Environment PLM25 dataset

(<http://services.land.vic.gov.au/catalogue/metadata?anzlicid=ANZVI0803003978&publicid=guest&extractionProvided=1>) and is also derived from the V_Parcel_mp_crown_approved dataset in the corporate spatial data library.

Land Use

The land use data has been sourced from the Valuer General Victoria. The Landuse Codes and Descriptions for "Public" Land are sourced from the PLM25 database on request from DSE and have been modified to match the AVPCC (Australian property classification codes). The AVPCC has nine primary categories; 1. Residential, 2.

Commercial, 3. Industrial, 4. Extractive Industries, 5. Primary Production, 6. Infrastructure and utilities, 7. Community services, 8. Sport Heritage and Culture and 9. National parks, conservation areas, forest reserves and natural water reserves. Each of the primary categories are divided into numerous secondary and tertiary codes, all of which are reported in the VLUIS dataset. Some tertiary codes include a decimal to represent a sub category however these are

not reported in the VLUIS dataset. The full code list can be found at <http://www.dtpli.vic.gov.au/property-and-land-titles/valuation/council-valuations/revaluation-2014>

Land Cover

The land cover information has been created specifically for the VLUIS using time series analysis of satellite imagery. The land cover information has been created using time series analysis of the MOD13Q1 product produced by NASA using data collected by the MODIS sensor and freely available on the Reverb | ECHO website at http://reverb.echo.nasa.gov/reverb/#utf8=%E2%9C%93&spatial_map=satellite&spatial_type=rectangle.

Ground data is collected annually across Victoria using a stratified random sampling approach for calibration of the annual seasonal curves and validation of the classification output. The ground data is split into three groups with 50% used to develop classification rules, 25% used to produce interim validation results that feed back into the rule development process with the remaining 25% used to independently validate the final classification.

The TIMESAT GUI is used to create smoothed annual time series for the Normalised Differenced Vegetation Index (NDVI) and the Red and Near Infrared (NIR) MOD13Q1 bands using the Savitsky-Golay algorithm. A suite of 11 seasonal parameters are created that each numerically describe features of the annual seasonal curves for each band. In addition the standard deviation of the annual seasonal curve is calculated for each band and used in conjunction with the seasonal parameters.

Prior to classification, the ground data and the MOD13 data is stratified into regions with similar climate, soils and farming systems using the Primary Production landscapes developed by DEPI. For each stratified region a three-tiered hierarchical classification was developed to assign a dominant land cover class to each pixel. Initially, rules developed using expert knowledge were applied to the seasonal parameters and the annual standard deviation in conjunction with a GIS data-set of water bodies greater than 12.5ha in area to classify each pixel as either Tree, Non-tree or Water based on two data sets from the corporate spatial data library, HY_WATER_AREA_POLY.shp and VM_LITE_HY_WATER_AREA.shp; and are combined to form the water bodies layer. In addition, the primary classes are cross checked using data from preceding and following years to reduce misclassification prior to the secondary classification.

A secondary classification developed using rules based on expert knowledge is applied to split the primary class Tree into the secondary classes Native Woody Cover and Treed Production and the primary class Non-tree into the secondary classes Pasture/ Grassland and Crops.

Finally, a tertiary classification further divides the secondary class Treed Production into the tertiary classes Hardwood Plantation, Softwood Plantation and Woody Horticulture and the secondary class Crops into the tertiary classes Brassicas, Legumes, Cereals and Non-Woody Horticulture based on rules developed using the data mining tool C5 and modified where appropriate by expert knowledge (Figure 1).

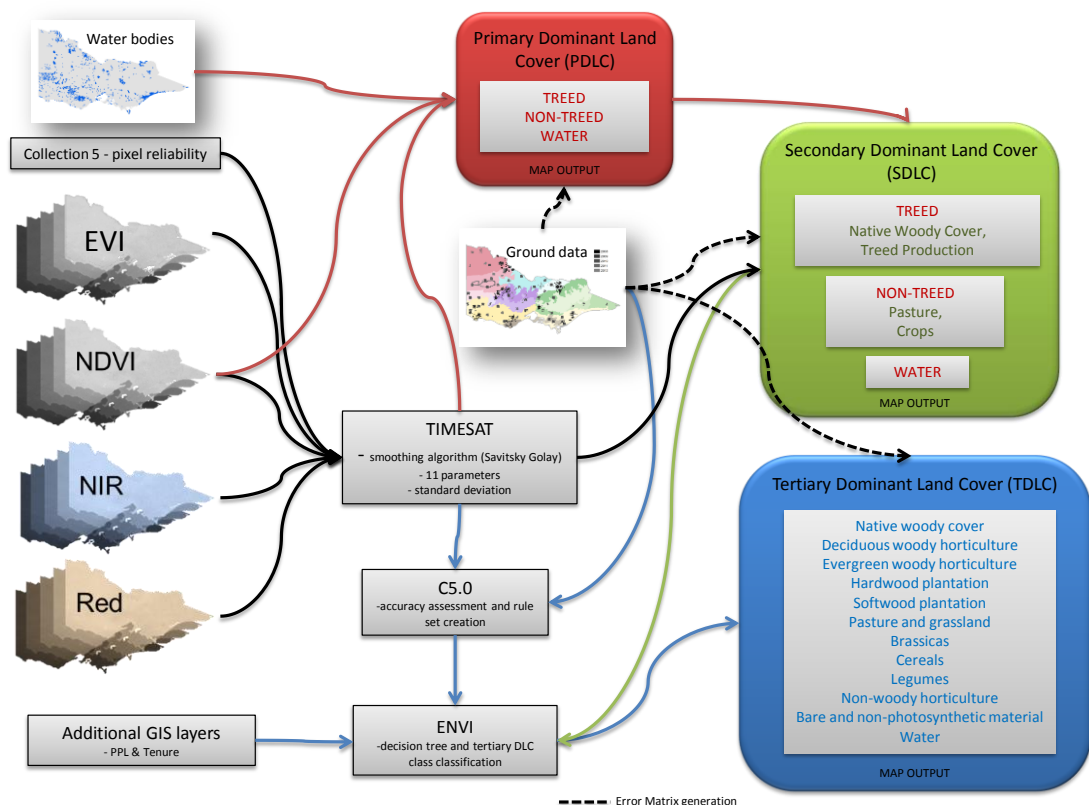


Figure 1: Main processes and outcomes involved in creating VLUIS Dominant Land Cover data.

Land cover classes

The following tables summarise the land cover classes used at the primary, secondary and tertiary levels, their names, abbreviated names and class numbers. The relationships between the different class levels are shown in the final table.

These are the Primary Dominant Land Cover (PDLC) classes used.

PDLC class name	PDLC abbreviated name	PDLC class number
Unknown	UNK	0
Water	WAT	1
Woody vegetation	WVT	10
Non-woody vegetation	NWV	20

These are the Secondary Dominant Land Cover (SDLC) classes used. The PDLC class Woody vegetation is split into: Woody vegetation – production (which incorporates horticulture, plantations and forestry) and Native woody cover. The PDLC class Non-woody vegetation is split into Pasture and grassland (which includes agricultural land and native grasslands) and Non-woody vegetation – production (which incorporates crop production and horticulture).

SDLC class name	SDLC abbreviated name	SDLC class number
Unknown	UNK	0
Water	WAT	1
Native woody cover	NWC	11
Woody vegetation - production	WVP	12
Pasture and grassland	PGR	21
Non-woody vegetation - production	NWP	22

These are the Tertiary Dominant Land Cover (TDLC) classes used. Woody vegetation – production is split into: Deciduous and Evergreen horticulture, and Hardwood and Softwood plantations. Non-woody production is split into Brassicas, Cereals, Legumes and Non-woody horticulture.

TDLC class name	TDLC abbreviated name	TDLC class number
Unknown	UNK	0
Water	WAT	1
Native woody cover	NWC	11
Deciduous woody horticulture	DWH	121
Evergreen woody horticulture	EWL	122
Hardwood plantation	HPL	123
Softwood plantation	SPL	124
Pasture and grassland	PGR	21
Brassicas	BRA	221
Cereals	CER	222
Legumes	LEG	223
Non-woody horticulture	NWH	224
Bare and non-photosynthetic material	BNP	3

This table shows the relationship between PDLC, SDLC and TDLC levels.

PDLC	SDLC	TDLC
Unknown (0)	Unknown (0)	Unknown (0)
Water (1)	Water (1)	Water (1)
Woody vegetation (10)	Native woody cover (11)	Native woody cover (11)
	Woody vegetation – production (12)	Deciduous woody horticulture (121)
		Evergreen woody horticulture (122)
		Hardwood plantation (123)
		Softwood plantation (124)
Non-woody vegetation (20)	Pasture and grassland (21)	Pasture and grassland (21)
	Non-woody vegetation – production (22)	Brassicas (221)
		Cereals (222)
		Legumes (223)
		Non-woody horticulture (224)
		Bare and non-photosynthetic material (3)

Class definitions

Primary classes

Water (1)

Areas larger than 12.5Ha that are covered by water for more than 6 months every year such as lakes, large dams and reservoirs.

Woody Vegetation (10)

Dominated by woody perennial vegetation and may be either trees or shrubs but may include some fraction of non-woody ground cover or bare ground.

Non-woody Vegetation (20)

Dominated by non-woody annual or perennial vegetation.

Secondary classes

Water (1)

See the Primary class definition

Native woody Cover (11)

Naturally established woody perennial vegetation (trees and shrubs) dominated by native species but may include some fraction of non-woody ground cover or bare ground. Woody vegetation density can vary from crowns touching or overlapping, through to crowns separated by some distance. The Australian Soil and Land Survey Field Handbook Third Edition, Table 17 on page 81 describes the woody vegetation density classes. As the woody vegetation fraction decreases, the annual growth curves will begin to show characteristics that are not typical of trees.

Woody vegetation production (12)

Dominated by woody perennial vegetation (trees and large shrubs) that is managed to produce a crop for harvest, but may also include some fraction of non-woody ground cover or bare ground depending on the time of year and management or seasonal conditions.

Pasture and grasslands (21)

Any non-woody ground cover that is present for most of the year. Management can vary from grazing, cutting many times in one year to spraying with herbicide. The plants may be native or introduced, annual or perennial and may be grasses, legumes (eg. lucerne, clover or medic) or herbs. This class also includes the fallow phase of a cropping regime which may be managed by grazing or spraying to remove photosynthetic vegetation in the growing season to conserve soil moisture or act as a disease break for the following crop. In the Mallee and parts of the Wimmera, there is little traditional pasture and much of the land in these areas classified as pasture will actually be a fallow phase in a cropping regime that may or may not be grazed. Cutting or grazing the pasture may be reflected by a dip in the annual growth curve.

Non-woody vegetation production (22)

A landcover that may be either cereals, legumes or brassica species that will be harvested for seed. In dryland areas the annual growth curve will typically be shaped like a sine wave increasing from a baseline after the Autumn break, reaching a peak in spring and decreasing back to the baseline by early summer. The the start and finish of the seasonal growth curve and its height and width will vary for different climatic regions with the higher rainfall areas in southern Victoria usually having higher, broader peaks with a later finish than crops in northern Victoria. Irrigated broadacre crops such as corn and maize are not common and typically start to grow in late spring and finish in Autumn. The growth curve characteristics are similar to dryland crops. Unlike Pasture /Grasslands land cover, crops usually do not show any dip in the annual growth curve.

Tertiary classes

Brassicas (221)

Annual, dryland, broadacre crops of canola, which is a member of the Cruciferae family.

Cereals (222)

Annual, broadacre crops in the Gramineae family such as wheat, barley, oats, rye, triticale, millet, maize and sorghum. Generally cereal crops are non-irrigated with growth commencing after the autumn break and harvest in early summer, but there are small areas of irrigated cereals (usually millet, maize or sorghum) that commence growing in spring and are harvested in autumn.

Deciduous woody horticulture (121)

Deciduous woody plants that are grown for fruit for many years. The inter-row space may be significant and may be bare or covered with non-woody vegetation. Typical examples are stone and pome fruit, nut trees, vines and berries. In many instances the area covered by plantings of deciduous woody horticulture is difficult to identify however some plantings of crops like olives and almonds may cover large continuous areas.

Evergreen woody horticulture (122)

Evergreen woody plants that are grown for fruit for many years. The inter-row space may be significant and may be bare or covered with non-woody vegetation. Typical examples are olives, citrus and avocados.

Hardwood plantation (123)

Hardwood trees planted to large continuous areas in rows. Prior to 2 years old the woody vegetation will usually be dominated by the inter row cover (either bare ground or non-woody vegetation) and may not show characteristics typical of trees. Between 2 and 5 years old the inter row area may still be a significant fraction of the total land cover, but over 5 years old there will generally be a closed canopy with little ground cover/ bare ground visible, lower branches may be starting to die and the annual time series will be typical of trees.

Legumes (223)

Annual, dryland, broadacre crops in the Fabaceae family such as field peas, faba beans, lentils, chick peas, vetch and lupins. The growth form of these crops is quite varied

Native woody cover (11)

See the Secondary class definition

Non-woody horticulture (224)

Herbaceous, mostly annual paddock grown fruit and vegetables such as potatoes, tomatoes, carrots and lettuce. Some of these crops may be growing at any time in the year and usually rely on irrigation water. These crops usually cover relatively small areas and are difficult to identify using data with the spatial resolution of MOD13 imagery.

Pasture /Grasslands (21)

See the Secondary class definition

Softwood plantation (124)

Softwood trees planted to large continuous areas in rows. Prior to 2 years old the woody vegetation will usually be dominated by the inter row cover (either bare ground or non-woody vegetation) and may not show characteristics typical of trees. Between 2 and 5 years old the inter row area may still be a significant fraction of the total land cover, but over 5 years old there will generally be a closed canopy with little ground cover/ bare ground visible, lower branches may be starting to die and the annual time series will be typical of trees.

Water (1)

See the Primary class definition

Categories not covered by the Tertiary classes

Asteraceae crops

Annual crops in the family Asteraceae are sunflower and safflower. Only small areas are grown and they may be irrigated or dryland.

Burnt areas.

Typically grassland pasture would recover fairly quickly while fire scars in woody vegetation may be evident for several years.

Data field descriptions:

Field	Description
PARCEL_PFI	Parcel_MP Persistent Feature Identifier. (unique)
PARCEL_SPI	Parcel_MP Standard Parcel Identifier (unique)
PARCEL_LGA_CODE	Parcel_MP Local government area code
PROP_PROPNUM	Property_MP Property Number. Links to Valuer General Data (not unique)
LGA	LGA100 LGA Names
TENURE	Calculated "Public" if there is a relationship of Parcel_PFI to PFI in the V_Parcel_mp_crown_approved dataset
CMA	Catchment Management Authority Name that the parcel intersects
PROPERTY_PFI	Property_MP Property Feature Identifier. (unique)
LU_DESC	AVPCC Landuse description from VGV, VEAC25 & LIMS
LU_CODE	AVPCC Landuse code from VGV, VEAC25 & LIMS
LU_1, LU_2, LU_3	LU_CODE field for querying and symbology purposes on Primary Code, Secondary Code, Tertiary Code
IRR_STATUS	Populated with "active/inactive" water use, from the DSE water register in 2010
LC_CODE	Numbers from 0 to 12 relating to the dominant land cover
LC_DESC	Dominant land cover description
HECTARES	Hectare area value of the parcel of land.

NOTE:

The methodology is still being refined and as such the dataset is subject to improvements and the release of later versions. It is important you speak to the custodian to be advised of the technical details of the dataset and its utility for your desired use.

The dataset does not replace LandUse100 which is still valid for the time in which it was created (1996 - 2005).

ESRI™ Symbology layer files are available for the primary and secondary AVPC codes and the land cover codes.

Format:

Data is stored as ESRI File Geodatabase format.

SRID: 3111 (Vicgrid 94)

Projection: Lambert's conformal conic projection

Datum: Geocentric Datum of Australia 1994 (GDA94) using the

Geodetic Reference System 1980 ellipsoid (GRS80)

Semi major axis (a) 6,378,137 metres exactly

Inverse flattening (1/f) 298.257222101 metres

<https://www.data.vic.gov.au/data/dataset/victorian-land-use-information-system-2010>