# Trees

Product Description
Version 1.6

Geoscape
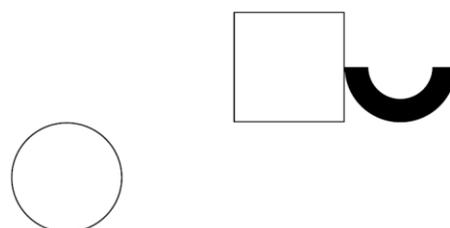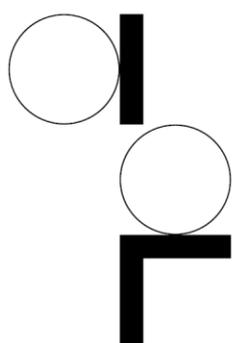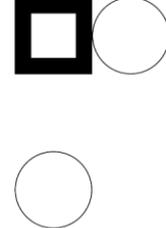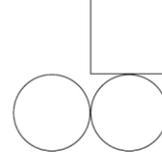
Standard

This document is based on the AS/NZS ISO 19131:2008 Geographic information – Data product specifications standard. For more information, refer to www.saiglobal.com/online/.

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Version History

Date	Version	Applicability
June 2020	1.6	Release 1.6 onwards
March 2020	1.5	Release 1.5

Contents

1. Overview

1.1 Delivery Organisation - about PSMA

Geoscape is created by PSMA Australia. It is consistently formatted spatial data that describes the buildings, addresses, land and transport networks across Australia's complex cities, regional centres and rural communities.

PSMA was formed by the governments of Australia in 1993 to collate, transform and deliver their geospatial data as national datasets. PSMA's establishment reflected the desire of Australian governments to work together to establish national, location information infrastructure to advance the emerging information economy. The organisation's first major initiative was to support the 1996 Census through the provision of Australia's first national digital basemap at street-level.

The value of Geoscape data is in its richness, which enables a broad range of innovations and applications. To support use of the data, it is available through online subscription services in business-ready formats, as well as customised enterprise plans. PSMA has a network of solution partners that integrate Geoscape data into other products and services. The partner network includes traditional geospatial specialists and data engineers, as well as software developers, marketing service providers, systems integrators and consultancies.

1.2 Data Product Specification Title

Trees Product Description

1.3 Data Scope

Trees is a digital dataset representing Trees heights and coverage across Australia
There will be a Release Report provided with each update which will detail the specific update areas and any issues contained within Trees.

1.4 Reference Date

June 2020

1.5 Responsible Party

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1.6 Language

English.

1.7 Topic Category

Boundaries for Trees and related characteristics within Australia.

1.8 Informal Description of the Data Product

Trees is a national digital dataset representing tree coverage and their associated heights for each State and Territory in Australia.

Data quality and potential capture timelines will vary across Australia.

PSMA welcomes your feedback on the Trees Dataset. We also publish regular updates on the development of our products on PSMA's website.

1.9 Distribution Format

This document is available in PDF format. For other formats and use of this document, contact PSMA Support (support@psma.com.au)

1.10 Copyright and disclaimer

Please see https://geoscape.com.au/legal/data-copyright-and-disclaimer/ .

1.11 Privacy

PSMA products and services should not contain any personal or business names or other sensitive information. PSMA undertakes reasonable data cleansing steps as part of its production processes to ensure that is the case. If you think that personal information may have inadvertently been included in PSMA products or services, please contact support@psma.com.au

1.12 Definitions, Acronyms and Abbreviations

Term	Definition
Building	A structure generally permanent in nature which has been constructed to meet a specific objective (e.g. housing, storage, and workplace) and less permanent structures such as caravans and other portable housing may also be represented. All buildings are represented spatially both as polygons and points.
CE90	Abbreviation for circular error at 90% confidence, which is the location error in the horizontal plane. It is the radial error distance centred at zero within which 90% of the data points fall.
Contours	A line connecting points of equal elevation/height used to display a 3D surface on a 2D map or image.
Digital Elevation Model (DEM) (Bare earth model on a regular grid)	The representation of continuous elevation values over a topographic surface by a regular array of sampled z-values, referenced to a common datum and expressed on a regular grid spacing or raster dataset. The DEM is a ground only representation and excludes vegetation such as trees and shrubs and human-constructed features such as sheds, houses and bridges. Note: Some organisations refer to a bare earth model in a regular grid as a DTM. In this context, refer to the alternate DTM definition in this document.
Digital Surface Model (DSM) - Irregular Grid (Surface model irregular grid)	A topographic model of the earth's surface in digital format represented by mass points of variable density and may include break lines. The DSM represents surfaces including ground, vegetation, buildings and other constructed features.
Digital Surface Model (DSM) - Regular Grid (Surface model on a regular grid)	The representation of continuous elevation or height values over a topographic surface by a regular array of sampled z-values, referenced to a known datum and expressed on a regular grid spacing or raster dataset. The DSM represents surfaces including ground, vegetation, buildings and other constructed features.
Digital Terrain Model (DTM) (Bare earth model on the irregular grid)	A topographic model of the earth's ground surface in digital format represented by mass points of variable density and may include break lines. The DTM representation of ground includes works such as levees, banks and roads, but excludes vegetation such as trees and shrubs and human-constructed features such as sheds, houses and bridges. Note: Some organisations refer to a bare earth model in a regular grid as a DTM. In this context, refer to the specific DEM definition in this document.
Elevation	This is a measure of vertical position relative to a known vertical datum.
Height	This is a measure of the relative vertical difference between two known points on the same vertical datum.
LE90	Abbreviation for linear error at 90% confidence, which is the location error in the vertical plane. It is the absolute value error distance from zero within which 90% of the vertical data points fall.
Minimum resolution	The lowest detail/most coarse representation of a building outline acceptable to PSMA.
Raster Resolution	This is a measure of image pixel/cell dimension, providing information on the level of detail of features it represents. The smaller the value the higher the level of detail represented.
Resolution	This is a measure of the geometric fidelity of each building represented. It is a combination of the minimum area of a polygon and minimum vertex separation.
Sensor	A device/machine that measures/records 1 or more physical properties.
Visible	Observable by someone with reasonable skill and expertise.

2. Specification Scope

2.1 Scope Identification

The Trees dataset consists of one (1) theme and two (2) layers. The themes and layer have a defined extent and scope.

Identification Of Trees Dataset As Theme And Layer.

Dataset	Theme	Layer
Trees	Trees	Trees
		Tree Metadata

2.2 Extent

Spatial coverage of Trees includes Australia's land mass. The dataset has areas classified that meet certain criteria based on the occurrence of natural events (e.g. flooding), population distribution and industrial/commercial activities.

3. Data Product Identification

3.1 Title

Trees

3.2 Alternate Titles

- Formerly known as 'Geoscape'.
- Trees for Australia

3.3 Abstract

Trees is a spatial dataset which represents tree coverage and their heights derived from remotely sensed imagery.

3.4 Description

The Trees theme consists of two layers: (1) Trees and (2) Trees Metadata. The Trees layer consists of a digital pixel representation tree coverage and their associated heights derived through DEMs, while the Trees Metadata layer represents any manipulations or insight into Trees layer pixels values, or absence thereof. The Theme is comprised of pre-defined urban areas at a two-metre resolution.

Accompanying the Trees product are two 'index' shapefiles, RASTER_INDEX and CAPTURE_DATE_INDEX, that aim to assist in the use and application of the raster data. The RASTER_INDEX is a layer that represents the boundaries of the pre-defined urban areas - also known as 'Areas of Interest' (AOIs). The CAPTURE_DATE_INDEX layer provides further detail as to the capture date (dd-mm-yyyy) of pixels across these AOIs.

Data quality and potential capture timelines will vary across Australia based on two categories. Each category has been developed based on several factors defined by the population distribution, industrial/commercial activities and the probability of natural events (e.g. flooding). Population distribution is categorised based on population size.

- **Urban** - areas with a population greater than 200, or with significant industrial/commercial activity in a visual assessment
- **Rural** - all other areas

3.5 Purpose

The purpose of the Trees is to spatially represent tree coverage and tree heights for use by industry and government in geographic information systems and/or other information systems.

3.6 Topic Category

Raster spatial data.

3.7   Geographic Description

The spatial coverage of Trees includes Australia's land mass. The dataset has classified areas within this coverage that meet certain criteria based on the occurrence of natural events (e.g. flooding), population distribution and industrial/commercial activities. The classifications are "Urban", "Rural Balance" and 'Remote Communities" and data captured varies based these three classifications. The Bounding Box for this data is as follows:

- North bounding latitude: -9˚
- South bounding latitude: -44˚
- East bounding longitude: 160˚
- West bounding longitude: 100˚

3.8   Geographic Extent Name

The States and Territories within Australia are represented by the following:

State or Territory Name	Abbreviation	Character Code
New South Wales	NSW	1 (or 01)
Victoria	VIC	2 (or 02)
Queensland	QLD	3 (or 03)
South Australia	SA	4 (or 04)
Western Australia	WA	5 (or 05)
Tasmania	TAS	6 (or 06)
Northern Territory	NT	7 (or 07)
Australian Capital Territory	ACT	8 (or 08)
Other Territories	OT	9 (or 09)

Note: PSMA has adopted the Australian Bureau of Statistics (ABS) definition of 'Other Territories' (OT). It includes the Territory of Christmas Island, Territory of Cocos (Keeling) Islands, Jervis Bay Territory and more recently the inclusion of Norfolk Island. OT does not include any other external Territory.

4. Data Content and Structure

4.1   Data Model

The Trees Dataset Data Model Diagram is set out in Appendix A.

4.2   Data Dictionary

The Trees Dataset Data Dictionary is set out in Appendix B.

5.   Reference System

5.1   Spatial Reference System

5.1.1 Raster Data

GDA94

Datum: The Geocentric Datum of Australia 1994 (GDA94)
Projection: Transverse Mercator
Zones: 49, 50, 51, 52, 53, 54, 55, 56 and 57
Zone Width: 6 degrees
Longitude of Origin: Central Meridian of each zone
Latitude of Origin: Equator (zero degrees)
False Easting: 500 000
False Northing: 10 000 000
Central Scale Factor: 0.9996
Units: Metre
Ellipsoid: Geodetic Reference System 1980 (GRS80)

GDA2020

Datum: The Geocentric Datum of Australia 2020 (GDA2020)
Projection: Transverse Mercator
Zones: 49, 50, 51, 52, 53, 54, 55, 56 and 57
Zone Width: 6 degrees
Longitude of Origin: Central Meridian of each zone
Latitude of Origin: Equator (zero degrees)
False Easting: 500 000
False Northing: 10 000 000
Central Scale Factor: 0.9996
Units: Metre
Ellipsoid: Geodetic Reference System 1980 (GRS80)

5.2   Temporal Reference System

Gregorian calendar

5.3   Reference System Scope

The spatial objects and temporal collection periods for the Trees dataset.

6. Data Quality

6.1   Positional Accuracy

Positional accuracy is an assessment of the closeness of the location of the spatial objects in relation to their true positions on the earth's surface. Positional accuracy consists of 2 assessments:

- Horizontal accuracy assessment, and
- Vertical accuracy assessment.

The horizontal and vertical positional accuracy is the assessed accuracy after all transformations have been carried out.

6.1.1   Horizontal Accuracy

The horizontal positional accuracy of Trees data reflects the positional accuracy of source sensors utilised in data collection, and the reliability of feature classification and associated orthogonalisation processes.

The horizontal positional accuracy of source imagery varies across collected strips. The horizontal positional accuracy of imagery used for the extraction of urban buildings range from +/-0.2m to +/-2.5m Circular Error 90% (CE90).

The Tree layer was derived from the Surface Cover 2M and inherits the horizontal positional accuracy of this dataset.

6.1.2   Vertical Accuracy

Source elevation data used for the derivation of Trees height attributes is a digital surface model (DSM). Absolute spatial accuracy of the DSM ranges from +/-0.34m to +/-2m Linear Error 90% (LE90), +/-0.2m to +/-2m CE90 with relative accuracies of +/-1m LE90, +/-1m CE90.

Multiple factors can impact the quality of the assigned elevation or height, these include but are not limited to:

- Age of source imagery
- Correct classification of the feature
- The off-nadir angle of source imagery
- The omission of the feature: Where surface cover is not captured it cannot be assigned a height.

6.2   Thematic Quality

Thematic accuracy is defined as the accuracy of quantitative attributes, the correctness of non-quantitative attributes, and of the classification of features and their relationships.

6.2.1   Classification Correctness

Classification correctness is an assessment of the reliability of values assigned to features in the dataset in relation to their true 'real world' values.

Tree Theme

The rate of classification correctness of the Trees dataset has been measured at above 90%.

6.3   Logical Consistency

Logical consistency is a measure of the degree to which data complies to a technical specification. The test procedures are a mixture of software scripts and manual visual analysis. The data structure of Trees has been tested for conformance to the data model. The following have been tested and confirmed to conform:

• File names

• Attribute names

• Attribute types

• Attribute domains

• Object type

6.4   Topological Consistency

Topological consistency is the measure of how features spatially relate to other features within and across Trees theme. Topological inconsistencies are identified using a combination of automated rules, and visual analysis. Where topological inconsistencies are identified, they are notified back to the supplier for remediation. Some minor topological inconsistencies are corrected during product processing. The level of topological consistency is dependent on the data supplied to PSMA.

6.5   Temporal Accuracy

Temporal accuracy is an assessment of both temporal consistency (how well-ordered lifecycle events are) and temporal validity (validity of data with respect to time).

6.6   Completeness

Completeness is an assessment of the extent and range of the dataset with regard to completeness of coverage, completeness of classification and completeness of verification. Components that makeup Trees includes Dataset, Theme, and Layer Coverage and coverage will be 100% complete across the areas captured to date. The Trees product contains a complete population of Trees layer.

Attribute Completeness

The layer within the Trees have a full population of attributes in accordance with the data model.

Feature Completeness

The omission rate of Trees is directly related to the classification correctness of the Trees 2M and the vertical accuracies of the DSM and DTM.

6.7   Data Quality Scope

All spatial features including their attributes in the current time period for the Trees Dataset.

7. Data Capture

Trees are a pixel representation of areas identified as having a tree coverage in remotely sensed source imagery.

Trees are also represented as raster cells within the Surface Cover dataset. Areas classified as Trees have been integrated with Digital Surface Model (DSM) and Digital Elevation Model (DEM) Information to extract a height value for every cell.

Efforts to provide an accurate height for all tree pixels have been undertaken. Due to proximity to other features, resolution and anomalies within the Digital Surface Model (DSM) and/or the Digital Elevation Model (DEM), heights for a small portion of pixels are higher than the real world feature they represent. To reduce the impact of these, all trees that are higher than plausible tree heights (100 metres) in the area are assigned a height of 25m. The tree metadata dataset identifies pixels that have been modified, the Tree Metadata AUT table describes the reason a tree pixel has been modified and any treatment that has occurred.

The likely maximum tree heights for each zone (region) across Australia has been determined. This has resulted in four codes listed I the below table

Maximum Tree Height Codes

CODE	NAME	DESCRIPTION
50	Trees above 50m	Trees pixel exceeded the expected max tree height of 50m for this region. Tree height remains unaltered.
60	Trees above 60m	Trees pixel exceeded the expected max tree height of 60m for this region. Tree height remains unaltered.
75	Trees above 75m	Trees pixel exceeded the expected max tree height of 75m for this region. Tree height remains unaltered.
80	Trees above 80m	Trees pixel exceeded the expected max tree height of 80m for this region. Tree height remains unaltered.

The expected maximum tree heights for the zones across Australia are shown in Figure 58. The trees in red (100m) and hatched black regions where the tree heights are above 100m or below 25m will not have any trees identified in the TREES_METADATA table.
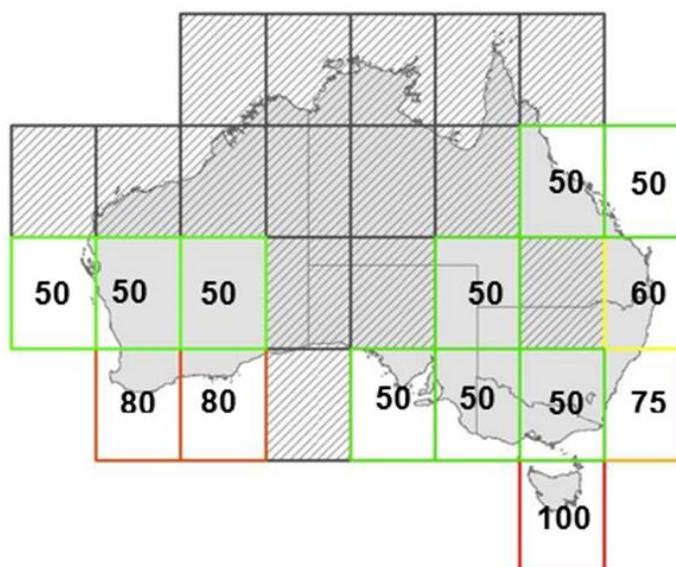
Zones used as regions with the expected maximum tree heights

8. Data Updates and Maintenance

PSMA completed delivery of the national Trees product in October 2018 and has since commenced the update, maintenance and improvement program. More information on the proposed update schedule is available from the Geoscape website.

8.1   Update Frequency

Updates to Trees are applied and released on a quarterly schedule.

8.2   Update Scope

Trees updates occurs for all existing objects with changed geometry, attributes and/or metadata, as well as data for new objects supplied prior to the release time period. Updates to the product include:

1. The inclusion of any new capture of Trees data received from third-party partners.
2. Corrections and/or improvements to production processes in generating Trees.

9. Delivery Format

9.1 Components

The Trees product will include raster components. The data is separated into each State and Territory, with the exception that ACT and NSW are combined. Also, ACT/NSW includes Jervis Bay Territory raster data.

Raster data will be made available using only the Tagged Image File Format described below with the AUT tables made available in DBF.

Accompanying the Trees product are two shapefiles, RASTER_INDEX and CAPTURE_DATE_INDEX, that assist in using and navigating the raster data. The RASTER_INDEX is comprised of simple polygons that represent the boundaries of Areas of Interest (AOIs). The CAPTURE_DATE_INDEX is comprised of complex polygons grouped by id, state, zone and capture_date attributes.

9.2 Supplied Formats

9.2.1 TIFF

Format name:

Tagged Image File Format

Specification:

This format includes files with the following extensions: *.tif

A popular image format for storing and manipulating raster graphics images. The latest specification 6.0 was published in 1992 and maintained by Adobe Systems.

Language:

English

9.2.2 Shape

Format name

Shape – ESRI™

Specification

This format includes files with the following extensions: *.shp, *.shx, *.dbf, *.prj

ESRI Shapefile Technical Description, an ESRI White Paper, July 1998. Follow this link: www.esri.com/library/whitepapers/pdfs/shapefile.pdf

Language

English

10. PSMA Partner Network

The value of PSMA's products is in the richness of the partner networks who have specialist skills and knowledge to provide business-ready solutions. Our network includes traditional geospatial specialists, data engineers, software developers, marketing service providers, system integrator, independent software vendors, research organisations and consultancies.

Contact us to provide feedback on the Trees product or for further information on accessing PSMA Data:

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W: www.psma.com.au

11. PSMA Data Products

DATASET	ACCESS	THEME	LAYER
Administrative Boundaries	Open Data (www.data.gov.au) PSMA Partner Network	ABS Boundaries 2011	2011 ABS Mesh Blocks
			Indigenous Location (ILOC)
			Indigenous Areas (IARE)
			Indigenous Region (IREG)
			Remoteness Areas (RA)
			Socio-Economic Indexes for Areas (SEIFA)
			Urban Centre Localities /Section of State
			Significant Urban Areas (SUA)
		ABS Boundaries 2016	2016 ABS Mesh Blocks and Statistical Areas
			2016 ABS Indigenous Regions, Areas and Locations
			2016 Urban Centre and Locality - Section of State - Significant Urban Area
			2016 Remoteness Areas (RA)
			2016 Socio-Economic Indexes for Areas (SEIFA)
		Electoral Boundaries	Commonwealth Electoral Boundaries
			State Electoral Boundaries
		Local Government Areas (LGAs)	
		Suburbs/Localities	
		State Boundaries	
		Town Points	
		Wards	
CadLite	PSMA Partner Network	Cadastre	
		Property	
Surface Cover	PSMA Partner Network	Surface Cover	2 Metres
			30 Metres
Buildings	PSMA Partner Network	Buildings	
Trees	PSMA Partner Network	Trees	
G-NAF	Open Data (www.data.gov.au) PSMA Partner Network	Geocoded physical addresses	
Land Tenure	PSMA Partner Network	Land Tenure	
Features of Interest	PSMA Partner Network	Features of Interest	
Postcodes	PSMA Partner Network	Postcode Boundaries	
Transport & Topography	PSMA Partner Network	Transport	Roads
			Rail
			Rail Stations
			Airports
		Hydrology	
		Greenspace	

Appendix A –Trees Data Model
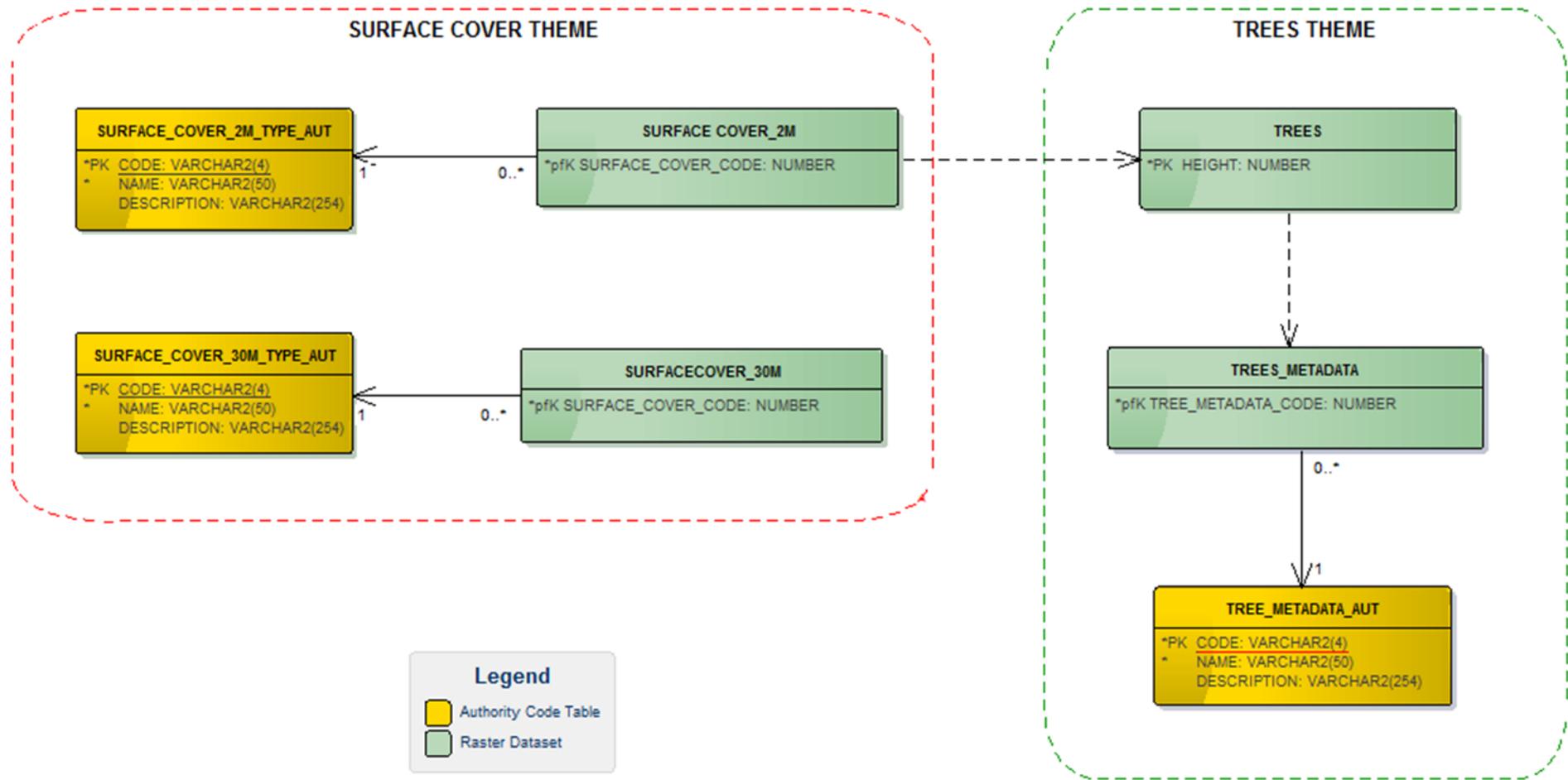
Trees Data Model

Appendix B – Data Dictionary

The following table refers to the columns used in all tables that form part of the data dictionary, with the exception of tables for the authority code tables.

TREES

The Trees are raster data and are not joined with any tables. The TREE_METADATA_AUT table is a lookup table used for referring to the values in the TREES_METADATA raster data. The trees identified by this process are for information purposes only and the height or classification of these trees will remain unaltered.

Table 1: TREE_METADATA_AUT

Name	Data Type	Description	Prim Key	Man	F K TABLE	F K Col	10 Char Alias
CODE	CharacterString (4)	Code identifying unique tree metadata code.	Y	Y	-	-	CODE
NAME	CharacterString (50)	Name of the tree metadata type.	N	Y	-	-	NAME
DESCRIPTION	CharacterString (254)	Description of the tree metadata type.	N	N	-	-	DESCRIPTN

Table 2: TREE_METADATA_AUT Codes

CODE	NAME	DESCRIPTION
1	Low Trees	Tree pixel did not meet the minimum height requirement. Set to unspecified vegetation or building in SURFACE COVER 2M dataset.
2	High Trees	Tree pixel did not meet maximum height restriction. Tree height set to 25m.
50	Trees above 50m	Trees pixel exceeded the expected max tree height of 50m for this region. Tree height remains unaltered.
60	Trees above 60m	Trees pixel exceeded the expected max tree height of 60m for this region. Tree height remains unaltered.
75	Trees above 75m	Trees pixel exceeded the expected max tree height of 75m for this region. Tree height remains unaltered.
80	Trees above 80m	Trees pixel exceeded the expected max tree height of 80m for this region. Tree height remains unaltered.

Table 3: RASTER INDEX table

Attribute name	Data Type	Description	Example
id	CharacterString (10)	The persistent identifier unique to an Area of Interest (AOI).	16702

Attribute name	Data Type	Description	Example
state	CharacterString (10)	The state and/or territory the LAOI is positioned within.	WA
zone	CharacterString (5)	The UTM Zone the AOI is associated with.	50

Table 4: CAPTURE DATE INDEX table

Attribute name	Data Type	Description	Example
id	CharacterString (10)	The persistent identifier unique to an Area of Interest (AOI).	16702
capt_date	date (dd-mm-yyyy)	The date the source data was taken.	08-07-2017
state	CharacterString (10)	The state and/or territory the LAOI is positioned within.	WA
zone	CharacterString (5)	The UTM Zone the AOI is associated with.	50