DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Plot to PCT Assignment Tool User Guide

Eastern NSW PCT Classification Version 1.1

environment.nsw.gov.au

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1. Background

1.1 What is the Plot to PCT Assignment Tool?

The Plot to PCT Assignment Tool ('the Tool') is a web application designed to assist with the evaluation and assignment of standard floristic survey plots to vegetation communities in the coast and tablelands bioregions of eastern New South Wales. The vegetation communities are quantitative Approved 'plant community types' (PCTs) defined in BioNet, the biodiversity data repository administered by the Department of Planning, Industry and Environment (DPIE).

The 'Flora surveys' module of the BioNet Atlas application is used to prepare standard floristic survey plot data in a format suitable for uploading into the Tool. Plot data exported from BioNet Atlas and uploaded into the Tool will undergo basic data error checks then can be analysed using a set of vegetation classification algorithms. The algorithms use the species data from each survey plot to measure its strength of match to up to 10 PCTs. Additional calculations enable the comparison of the environmental and spatial attributes of the survey plots to each of the closest matching PCTs. Users can access detailed PCT descriptions and statistical information on each matched PCT while working in the Tool, and view a map interface showing PCT reference locations. PCT matching results and PCT summary information can be downloaded from the Tool in spreadsheet form.

1.2 Where does the Tool apply?

The Tool applies to native vegetation in the coast and tablelands bioregions of eastern New South Wales. The coast and tablelands bioregions (also referred to as the 'eastern NSW PCT classification v1.1 region') are shown in Figure 1 and include:

- Australian Alps
- New England Tablelands
- NSW North Coast
- South East Corner
- South Eastern Highlands
- South Eastern Queensland
- Sydney Basin

(Interim Biogeographic Regionalisation for Australia (IBRA), version 7.0 (DAWE 2021)).

The Tool does not apply to native vegetation in western New South Wales (western slopes or western plains) as at September 2021. In NSW bioregions not listed above, native vegetation types are described by *qualitative* PCTs that have PCT identification numbers (PCT IDs) below 3000. Identification of qualitative PCTs requires separate interpretation using information in the BioNet Vegetation Classification public application itself.

1.3 PCTs in the coast and tablelands bioregions

There are 1074 Approved PCTs known to occur in the coast and tablelands bioregions (on publication of eastern NSW PCT classification v1.1 in early 2022). These are accessed in the BioNet Vegetation Classification public application. Almost all of these PCTs (1067 or 99%) are *quantitative* PCTs, which are suitable for evaluation against standard floristic survey plot data via the Tool. Quantitative PCTs are defined from a very large dataset of standard floristic survey plots using consistently applied numerical methods (DPIE 2021a). Quantitative PCTs are distinguished by having a PCT ID above 3000. Quantitative PCTs have varying levels of confidence assigned to their floristic assemblage description and

distribution summaries, based on the number of floristic survey plots from which they are defined. The PCT profile descriptions in the Tool provide guiding information to assist the user with interpretation and use of PCT data, including cautions for PCTs with lower levels of classification confidence. There are seven quantitative PCTs that are defined from quantitative but non-standard vegetation survey data (Appendix A). The Tool evaluates these PCTs, but PCT-matching metrics may be outside normal bands (see Section 7).

The Tool is unable to evaluate the seven *qualitative* Approved PCTs described in the coast and tablelands bioregions (Appendix B). Qualitative PCTs are not constructed using the same methods as quantitative PCTs and are not defined by standard floristic survey plot data. Qualitative types are distinguished by having a PCT ID below 3000. Identification of qualitative PCTs requires separate interpretation using PCT summary information in the BioNet Vegetation Classification public application itself.

1.4 Where do PCT data in the Tool come from?

All PCT data in the Tool is sourced from BioNet. The Tool is maintained regularly to ensure alignment with the current version of PCT data in BioNet. PCT member plot information is sourced from the Flora surveys module of the BioNet Atlas application. PCT profile data is sourced from the BioNet Vegetation Classification public application.

1.5 Additional reading

Detailed information on the methods used to develop the quantitative PCTs in the coast and tablelands bioregions can be accessed in DPIE 2021a and DPIE 2021b. This work is part of the integrated BioNet vegetation data for NSW (IBVD) program, which coordinates the development and management of native vegetation data and maps for New South Wales.

1.6 Where to get help

For support contact Bionet@environment.nsw.gov.au.

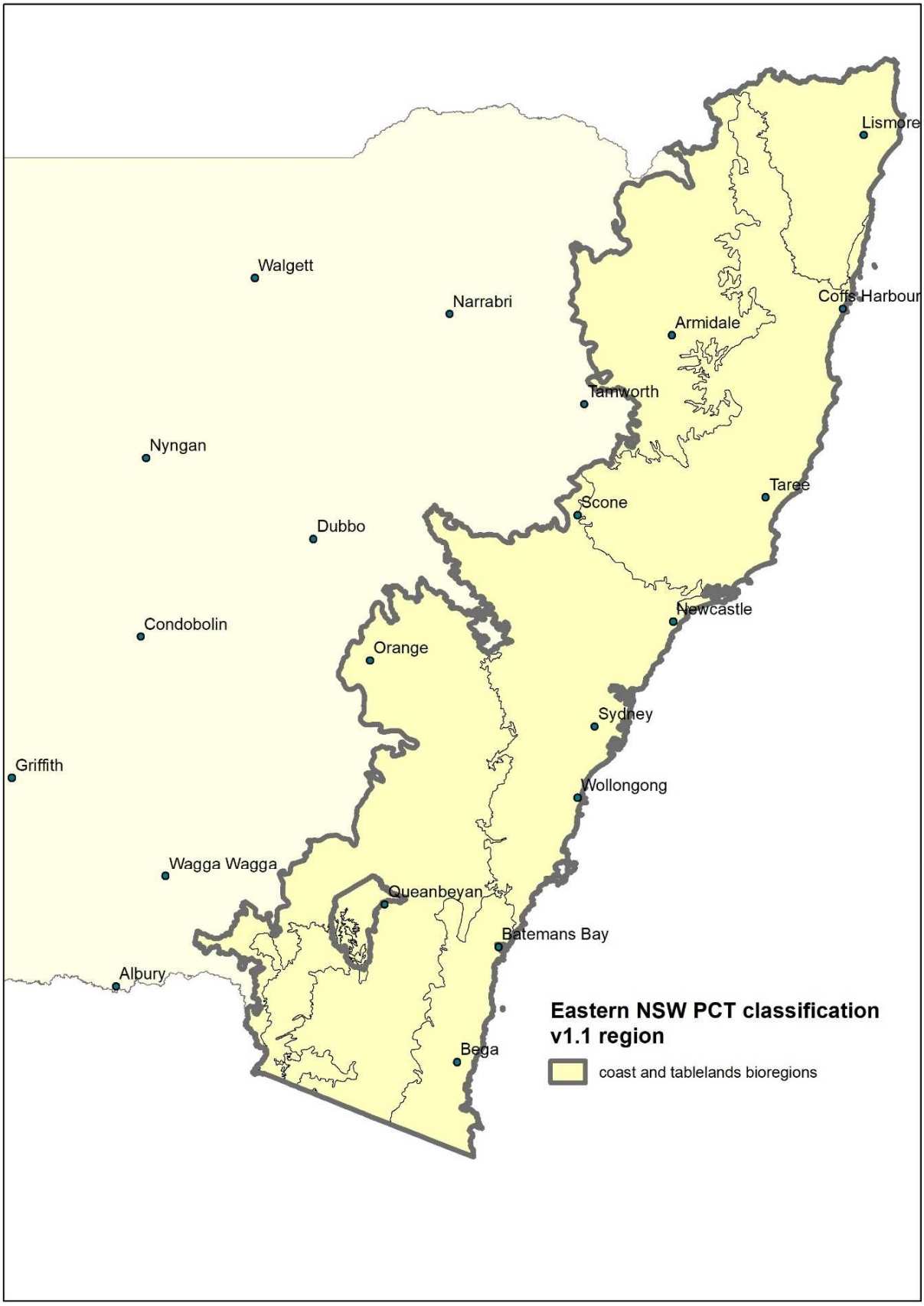


Figure 1 **Bioregions in which the Plot to PCT Assignment Tool can be used**

2. Preparing data for the Tool

2.1 Introduction

This section outlines the type of floristic survey data the Tool requires and describes the Tool's relationship to the Flora surveys module of the BioNet Atlas application.

2.2 Collecting standard floristic survey data

The Tool requires full floristic species and location data collected at survey sites using standard survey methods. Effort expended in the data collection stage significantly reduces potential for error during the analytical steps. Partial floristic data or rapid species inventories are unsuitable for use in the Tool.

In summary, data should be collected from 0.04 hectare sites (commonly 20 metre x 20 metre quadrats) where all vascular plant species are identified to the lowest possible taxonomic level and given an estimate of abundance and percent projected foliage cover. Detailed georeferenced data is also required to record the location of sites accurately. Where possible within other constraints sites should: be located in least-disturbed available vegetation, avoid obvious ecotones, use an acceptable method for choice of precise start point for the quadrat (e.g. section 4.3.4 (3) in DPIE 2020), be surveyed in suitable seasons when most plants have identifiable material.

Further information on standard vegetation survey methods is set out in:

- DPIE Native Vegetation Interim Type Standard (PDF 1.1MB) (Sivertsen 2009)
- Biodiversity Assessment Method (DPIE 2020).

Presence/absence data (species lists) can be uploaded to the Tool, where collected from a 0.04 hectare site with all species identified to the lowest taxonomic level possible. However, PCT matching analyses on presence/absence data are limited (see Section 5).

2.3 Entering floristic survey data into BioNet

The Flora surveys module of the BioNet Atlas application has purpose-built functions to standardise species taxonomy, standardise cover-abundance scores, and automatically assign environmental and spatial data to each new floristic survey site. This standardisation is required to reduce analytical errors in the PCT matching steps, while the spatial and environmental information enables operation of the environmental evaluation and map functions in the Tool.

Detailed information is available to guide data entry into the Flora surveys module of the BioNet Atlas application. Guides and manuals for BioNet are available on the NSW BioNet quick guides, manuals and datasheets webpage. If you are entering standard floristic survey plot data collected according to DPIE (2020) or Sivertsen (2009), then enter percent foliage cover into the '% cover actual' field and abundance into the 'abund actual' field for each species. Then for the survey name that your sites are within select 'species actuals' as the score method in the species score section of the scoring systems tab. This will ensure that data successfully exports for use in the Tool.

The term 'plot' in section 1 above refers to a specific combination of 'survey name', 'site number' and 'replicate number' in the Flora surveys module. As 'survey name' and 'replicate number' are not included in the data uploaded to the Tool, the term 'site' is used in the Tool and henceforth in this document.

2.4 Exporting floristic survey data from BioNet for the Tool

The Flora surveys module of the BioNet Atlas application has purpose-built functions to export floristic survey data in a format ready for upload into the Tool. The export functionality enables:

- conversion of species names to standardised taxonomy and codes for comparison with PCT data
- conversion to standardised measures of cover and abundance for each species
- exclusion of any exotic species recorded in sites
- exclusion of any genus-only records in sites
- extraction of values for elevation (metres above sea level), annual rainfall (millimetres) and annual mean temperature (degrees Celsius) for each site, from standard spatial datasets
- export of latitude and longitude for each site.

The floristic survey data matrix containing this information is exported as a .csv file, ready for upload to the Tool.

Detailed guides on extracting floristic survey data from BioNet are on the NSW BioNet quick guides, manuals and datasheets webpage. When exporting data from the Flora surveys module of the BioNet Atlas application using the Data analysis sub-module, select 'PCT classification taxonomic assignment' at step 4 and 'Plot to PCT Assignment Tool' output format at step 6.

2.5 Data matrix size

The Tool has been tested with data matrices between 1 and 150 sites. Data matrices above this size may take a long time to process or cause a drop out. If necessary, please contact Bionet@environment.nsw.gov.au for support with large datasets.

3. Uploading and analysing data

3.1 Introduction

This section steps through the process of uploading and checking data, proceeding with analysis and generating results.

To proceed you will need a .csv format data matrix exported from the Flora surveys module of the BioNet Atlas application (see Section 2). The Flora surveys module has been set up to store and export standard floristic survey data ready for upload into the Tool. If you haven't already done so, please enter your standard floristic survey data into the Flora surveys module of the BioNet Atlas application and then export it using the 'Plot to PCT assignment tool' output format.

Data uploaded into the Tool is assumed to have been exported from the Flora surveys module of the BioNet Atlas application using the 'Plot to PCT assignment tool' output format. The export from BioNet automatically applies the required standardised taxonomy, truncated species names codes, and cover and abundance score conversions. Uploading data to the Tool that has not had the standard taxonomic treatments and cover score conversions applied may give unreliable results.

3.2 Getting started

Open the online Plot to PCT Assignment Tool at this address: bionet.shinyapps.io/vegplot/.

The introduction page should load automatically once the address is placed in your browser. The Tool has been tested to be stable when used in Google Chrome. Unexpected delays or potentially disconnections may be experienced if it is used in other web browsers.

The Tool loads at the 'Introduction' tab. If the application remains inactive for an extended period it will automatically disconnect from the server. If this happens, either click 'Reload' or re-enter the Tool address to begin a new session.

3.3 Loading the data

Select the 'Data Input' tab on the top navigation bar. Click on the green 'Browse' button (Figure 2) then navigate to the location of your stored data matrix .csv file.

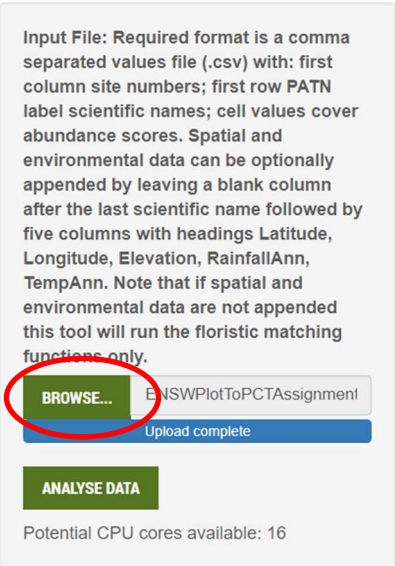


Figure 2 The 'Browse' button to upload the data matrix .csv file

On data upload, the Tool will automatically do some basic data checks and summaries. In the first instance the Tool will check that: the data matrix is in the correct format; all cover-abundance scores are in the range of 0–6 inclusive; all sites have a cover-abundance score of 1–6 for at least one species. If these conditions are not met an error message will be displayed and analysis cannot proceed until the .csv file is corrected.

When an upload is completed successfully, two tables are displayed on the screen. The first table summarises the dimensions of the data matrix uploaded by reporting the number of sites (rows), the number of species (columns), and the number of sites with spatial and environmental data detected (Figure 3). Analysis can still proceed if spatial and environmental data is not detected, but the Tool functionality will be limited.

Uploaded data information:

Number of sites (rows)	1
Number of species (columns)	47
Number of sites (rows) with spatial and environmental data detected	1

Figure 3 Uploaded data information table

3.4 Checking species taxonomy

The second table presented on the screen after data is uploaded checks the taxonomic species codes in the uploaded data matrix, and the location of uploaded sites relative to the bioregions listed in Section 1.2. The taxonomic check compares the species codes in the uploaded file to the master set of standardised taxonomic species codes used in the development of quantitative PCTs. If all species codes in the uploaded file are matched in the master set of species codes, the Tool returns a statement ‘There are no missing species: all species could be found’ (Figure 4).

Uploaded data checks:

Species names not found in PCT classification standardised taxonomy	There are no missing species: all species could be found.
Sites outside Plot to PCT Assignment Tool bioregions	0

Figure 4 Uploaded data checks table with no species names not found

If there are species codes in the uploaded file that are not present in the master set of species codes, the table displays the species codes that could not be found (Figure 5). The species codes used are known as species ‘PATN codes’, and are usually the first four letters of the genus name followed by the first four letters of the species name. Any species listed in this table will not be included in the algorithms that compare the uploaded data matrix to the quantitative PCTs.

Uploaded data checks:

Species names not found in PCT classification standardised taxonomy	There are 172 species, **and 2 could not be found: Anthscbr, Pratpurp, so were ignored in analysis.**
Sites outside Plot to PCT Assignment Tool bioregions	170904P2

Figure 5 Uploaded data checks table with species names not found

There are several reasons why species codes may not be matched:

- the uploaded data is sampling a region or locality that is poorly described by the eastern NSW PCT classification v1.1 quantitative PCT data, so that it contains species not included in the master set of species codes
- the uploaded data includes one or more rare species that have not been recorded in the standard floristic survey plots used to define quantitative PCTs and hence are not included in the master set of species codes

- the uploaded data includes taxa that have been subject to recent taxonomic revisions, and those revisions have not yet been included in the master set of species codes
- the data has not been exported through the Flora surveys module of the BioNet Atlas application and has not had the standard taxonomic treatment applied that the Tool requires.

Lists of flora species recorded in each quantitative PCT in the coast and tablelands bioregions can be found in the BioNet Vegetation Classification public application.

3.5 Checking site locations

On upload, the latitude and longitude of each site is used to check whether the site is within one of the bioregions listed in Section 1.2 (Figure 6).

Uploaded data checks:

Species names not found in PCT classification standardised taxonomy	There are 158 species, **and 3 could not be found: Anthscbr, Pratpurp, Scuthum1, so were ignored in analysis.**
Sites outside Plot to PCT Assignment Tool bioregions	BRKT0003

Figure 6 Uploaded data checks table with sites outside the study region

Sites listed as being outside the bioregions can still be analysed, but caution is needed in the evaluation of matched PCTs. In some cases, sites may be close to the bioregion boundary and the PCT matching results may remain relevant. Increasing distance from the Tool bioregions will significantly increase uncertainty in the assignment of the correct PCT.

3.6 Analysing the data

Once the upload is complete and data checks are resolved (and data reloaded if necessary) the next step is to analyse the data.

Click on the green ‘Analyse Data’ button (Figure 7). The analysis process will commence, with a progress bar appearing at the bottom right of the screen. The time the analysis takes depends on the size of the uploaded data matrix (number of sites and species). When the analysis completes, an ‘Analysis complete’ message appears under the ‘Analyse Data’ button, with an indication of the time taken for the analysis process.

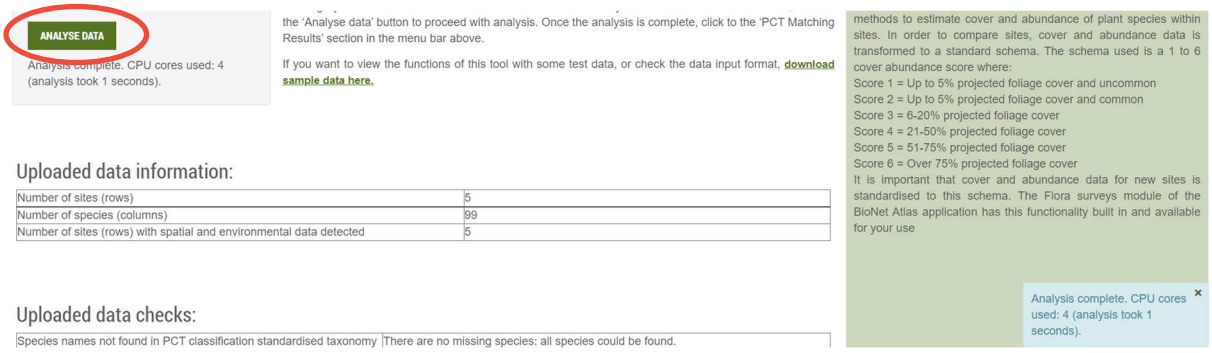


Figure 7 The ‘Analyse data’ button to commence analysis

4. Navigating the PCT matching results

4.1 Introduction

This section helps you navigate through different analysis results produced by the Tool following the data analysis step described in Section 3.6. It outlines how to access the results of analyses performed by the Tool on the compositional (floristic), environmental and spatial components of your uploaded data. This information guides you through the range of methods available for identifying the strongest matching PCT for each uploaded site.

4.2 The PCT matching results tab

Select the 'PCT Matching Results' tab on the top navigation bar (Figure 8).

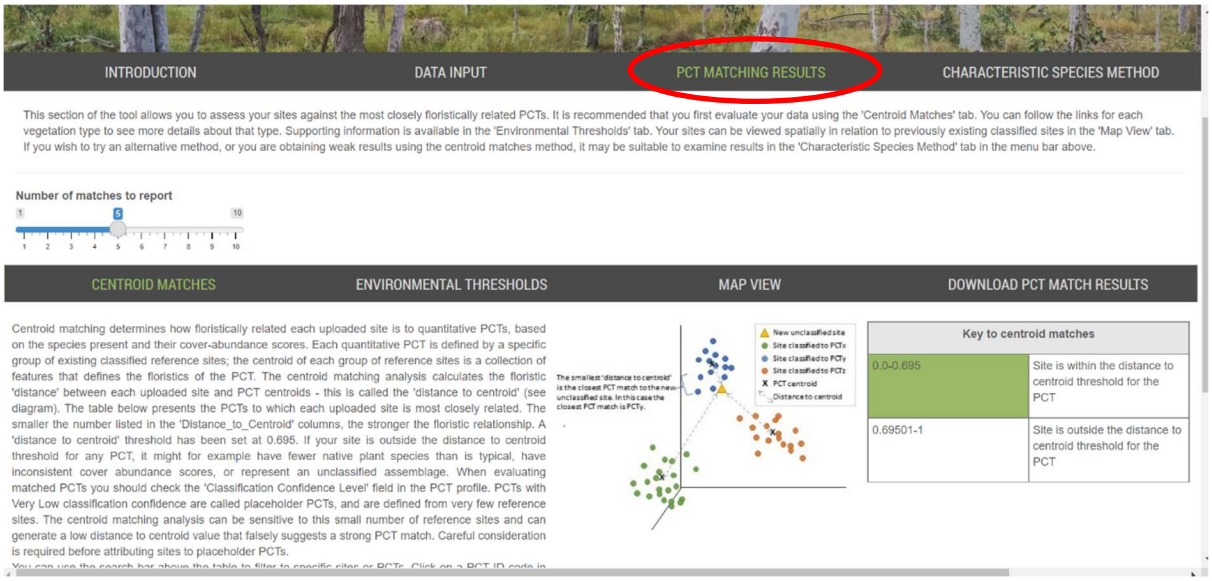


Figure 8 The 'PCT Matching Results' tab

A second-level navigation bar with four tabs appears:

- Centroid Matches
- Environmental Thresholds
- Map View
- Download PCT Match Results.

Before selecting any of these tabs, note there is a slide bar above them to choose the number of PCT matches to be returned for each uploaded site (Figure 9). The default number of PCT matches reported is five, but this can be varied between one and 10. For first time users, three matches is a useful number to reduce the initial complexity of evaluation.

Figure 9 The 'Number of matches to report' slide bar

4.3 The centroid (floristic) matches tab

The results page defaults to the 'Centroid Matches' tab. The Tool uses the species and cover-abundance score data in the uploaded data matrix to compare each site with the floristic assemblages of each of the 1067 quantitative Approved PCTs of the coast and tablelands bioregions. These quantitative PCTs are each defined by a specific group of existing classified reference sites (also known as PCT member plots). The Tool applies an algorithm that generates a measure of the floristic difference between each uploaded site and the central value or 'centroid' of the reference sites that define each PCT. This measure is called the 'distance to centroid', a value that ranges between 0 and 1 and is based on the Bray-Curtis dissimilarity index.

An uploaded site with floristic data very similar to a PCT's centroid definition will have a low distance to centroid value for that PCT, indicating a strong match. Weaker matching results have higher distance to centroid values (closer to 1), or higher dissimilarity. The Tool identifies and displays the 10 PCTs with the lowest distance values for each uploaded site, as these have the strongest match to the species assemblage of the site(s).

4.3.1 Using the centroid matches table

The centroid matches table displays the results for each uploaded site on one row, with the second column displaying the site number taken from the uploaded data matrix. The number of sites displayed per page can be modified using the drop-down list 'Show 10 entries' to the left above the table. Any column can be sorted from lowest to highest or vice versa, by clicking on the column heading. The 'Search' box to the right above the table can be used to filter the table by any values typed into the box. For example, typing all or part of a site number into the search box will result in the table showing only matching site numbers, while typing a PCT ID into the box will display only rows containing that PCT ID. If you do not wish to filter the results table, the search box should be empty.

For each site, the matched PCTs are presented as a series of columns that give the PCT ID and the distance to centroid value indicating the strength of match to that PCT. In the example in Figure 10 only the top four PCT matches are displayed. The PCT with the strongest floristic match to the uploaded site is shown in the column 'PCT_Match1'. The floristic match becomes successively weaker across the table as the 'PCT_Match' number increases.

Show 10 entries Search:

Row_No	Site_No	PCT_Match1	Distance_to_Centroid1	PCT_Match2	Distance_to_Centroid2	PCT_Match3	Distance_to_Centroid3	PCT_Match4	Distance_
1	SampleData1	3629	0.534	3448	0.612	3447	0.628	3616	0.638
2	SampleData2	4138	0.677	4023	0.69	4025	0.691	3336	0.692
3	SampleData3	3448	0.533	3433	0.606	3321	0.611	3442	0.628
4	SampleData4	3448	0.566	3320	0.569	3315	0.62	3446	0.623
5	SampleData5	3320	0.594	4025	0.614	3446	0.645	3264	0.652

Showing 1 to 5 of 5 entries Previou

Figure 10 The centroid matches table

Distance to centroid values of 0.695 or less are highlighted in green and indicate the site meets the floristic match threshold for that PCT (Figure 11). This threshold value is an important metric for deciding on the best-fitting PCT and is discussed further in Section 7 below.

Key to centroid matches	
0.0-0.695	Site is within the distance to centroid threshold for the PCT
0.69501-1	Site is outside the distance to centroid threshold for the PCT

Figure 11 **Thresholds for colour coding of the distance to centroid values**

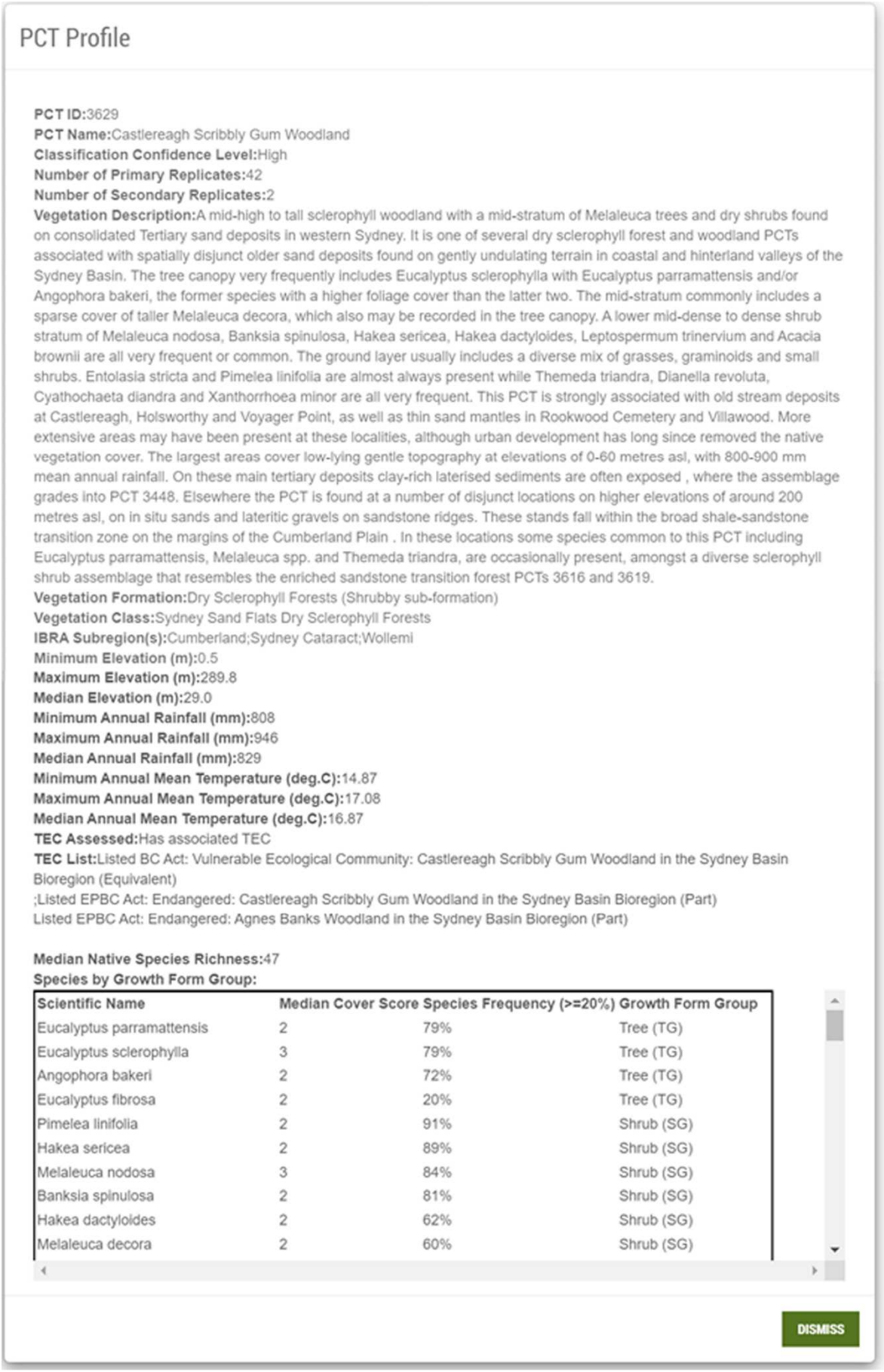
4.3.2 Accessing the PCT name and PCT description

Detailed information about each of the matched PCTs can be obtained by clicking on the four-digit PCT ID in any of the 'PCT_Match' columns.

In the example in Figure 12, clicking on the PCT ID (3629) in the 'PCT_Match1' column for site SampleData1, results in the PCT name 'Castlereagh Scribbly Gum Woodland' appearing above the centroid matches table.

Figure 12 **The PCT name and the 'View PCT profile' and 'View PCT sites' buttons**

To view more information about the PCT, click on the 'View PCT profile' button and detailed information will appear in a pop-up page (Figure 13). The information is presented in a long profile of text and data. The PCT profile information and data are explained in Section 7.4. To close the PCT profile, click 'Dismiss' at the bottom right of the pop-up, or simply click anywhere outside the pop-up area.



PCT Profile

PCT ID:3629
PCT Name: Castlereagh Scribbly Gum Woodland
Classification Confidence Level: High
Number of Primary Replicates:42
Number of Secondary Replicates:2
Vegetation Description:A mid-high to tall sclerophyll woodland with a mid-stratum of Melaleuca trees and dry shrubs found on consolidated Tertiary sand deposits in western Sydney. It is one of several dry sclerophyll forest and woodland PCTs associated with spatially disjunct older sand deposits found on gently undulating terrain in coastal and hinterland valleys of the Sydney Basin. The tree canopy very frequently includes Eucalyptus sclerophylla with Eucalyptus parramattensis and/or Angophora bakeri, the former species with a higher foliage cover than the latter two. The mid-stratum commonly includes a sparse cover of taller Melaleuca decora, which also may be recorded in the tree canopy. A lower mid-dense to dense shrub stratum of Melaleuca nodosa, Banksia spinulosa, Hakea sericea, Hakea dactyloides, Leptospermum trinervium and Acacia brownii are all very frequent or common. The ground layer usually includes a diverse mix of grasses, graminoids and small shrubs. Entolasia stricta and Pimelea linifolia are almost always present while Themeda triandra, Dianella revoluta, Cyathochaeta diandra and Xanthorrhoea minor are all very frequent. This PCT is strongly associated with old stream deposits at Castlereagh, Holsworthy and Voyager Point, as well as thin sand mantles in Rookwood Cemetery and Villawood. More extensive areas may have been present at these localities, although urban development has long since removed the native vegetation cover. The largest areas cover low-lying gentle topography at elevations of 0-60 metres asl, with 800-900 mm mean annual rainfall. On these main tertiary deposits clay-rich laterised sediments are often exposed , where the assemblage grades into PCT 3448. Elsewhere the PCT is found at a number of disjunct locations on higher elevations of around 200 metres asl, on in situ sands and lateritic gravels on sandstone ridges. These stands fall within the broad shale-sandstone transition zone on the margins of the Cumberland Plain . In these locations some species common to this PCT including Eucalyptus parramattensis, Melaleuca spp. and Themeda triandra, are occasionally present, amongst a diverse sclerophyll shrub assemblage that resembles the enriched sandstone transition forest PCTs 3616 and 3619.
Vegetation Formation: Dry Sclerophyll Forests (Shrubby sub-formation)
Vegetation Class: Sydney Sand Flats Dry Sclerophyll Forests
IBRA Subregion(s): Cumberland;Sydney Cataract;Wollemi
Minimum Elevation (m):0.5
Maximum Elevation (m):289.8
Median Elevation (m):29.0
Minimum Annual Rainfall (mm):808
Maximum Annual Rainfall (mm):946
Median Annual Rainfall (mm):829
Minimum Annual Mean Temperature (deg.C):14.87
Maximum Annual Mean Temperature (deg.C):17.08
Median Annual Mean Temperature (deg.C):16.87
TEC Assessed: Has associated TEC
TEC List: Listed BC Act: Vulnerable Ecological Community: Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion (Equivalent)
;Listed EPBC Act: Endangered: Castlereagh Scribbly Gum Woodland in the Sydney Basin Bioregion (Part)
Listed EPBC Act: Endangered: Agnes Banks Woodland in the Sydney Basin Bioregion (Part)

Median Native Species Richness:47
Species by Growth Form Group:

Scientific Name	Median Cover Score	Species Frequency (>=20%)	Growth Form Group
Eucalyptus parramattensis	2	79%	Tree (TG)
Eucalyptus sclerophylla	3	79%	Tree (TG)
Angophora bakeri	2	72%	Tree (TG)
Eucalyptus fibrosa	2	20%	Tree (TG)
Pimelea linifolia	2	91%	Shrub (SG)
Hakea sericea	2	89%	Shrub (SG)
Melaleuca nodosa	3	84%	Shrub (SG)
Banksia spinulosa	2	81%	Shrub (SG)
Hakea dactyloides	2	62%	Shrub (SG)
Melaleuca decora	2	60%	Shrub (SG)

DISMISS

Figure 13 The PCT profile pop-up

4.3.3 Accessing the map of reference sites for matched PCTs

A display of the known distribution of a matched PCT can be obtained by first clicking on the four-digit PCT ID in any of the 'PCT_Match' columns, then when the PCT name appears above the centroid matches table, clicking on 'View PCT sites'. A pop-up map appears, showing classified reference sites for the selected PCT as orange dots, and the uploaded site's location indicated by a blue pointer box with a cross and the site number (Figure 14). The base map can be changed from 'Terrain' to 'Satellite' using the radio buttons in the top right corner of the map. The + and – symbols at top left can be used to zoom in or out, and the map can be panned. To close the PCT site map, click 'Dismiss' at the bottom right, or simply click anywhere outside the pop-up.

If spatial data is not detected in the uploaded data matrix, the map of PCT reference sites can be viewed, but the location of the uploaded site(s) will not be displayed.

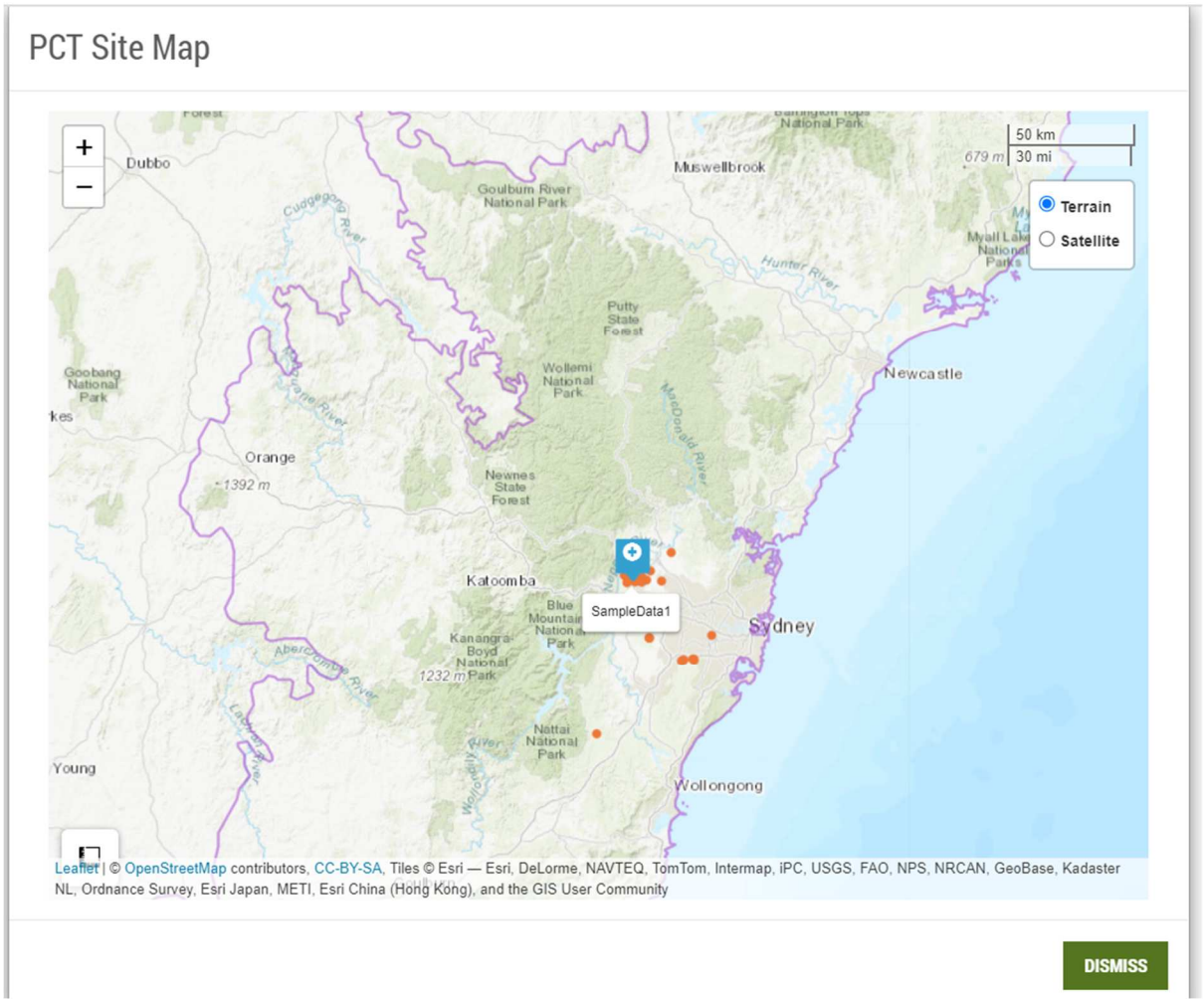


Figure 14 The PCT sites pop-up map

4.4 The environmental thresholds tab

The environmental thresholds analysis compares the environmental attributes for each uploaded site to the calculated typical environmental range for each matched PCT. The environmental attributes used are elevation (metres above sea level), mean annual rainfall (millimetres) and annual mean temperature (degrees Celsius). The environmental data source used to calculate the typical range for each PCT is the same data source used to populate the environmental variables for sites entered into BioNet. The typical range for

each PCT is determined by calculating upper and lower threshold values of each environmental attribute from PCT reference sites. The lower threshold is the first quartile minus three times the difference between the median and the first quartile. The upper threshold is the third quartile plus three times the difference between the median and the third quartile. This is a slight variation of the widely applied method of identifying outliers using one and a half times inter-quartile range.

The environmental thresholds analysis is intended to provide an alternative line of evidence, indicating whether an uploaded site has environmental conditions likely to support any of the PCTs matched using floristic data in the centroid matches analysis.

If environmental data is not detected in the uploaded data matrix, the environmental thresholds functions are disabled.

4.4.1 Using the environmental thresholds table

From within the ‘PCT Matching Results’ tab, select the ‘Environmental Thresholds’ tab on the second-level navigation bar (Figure 15).

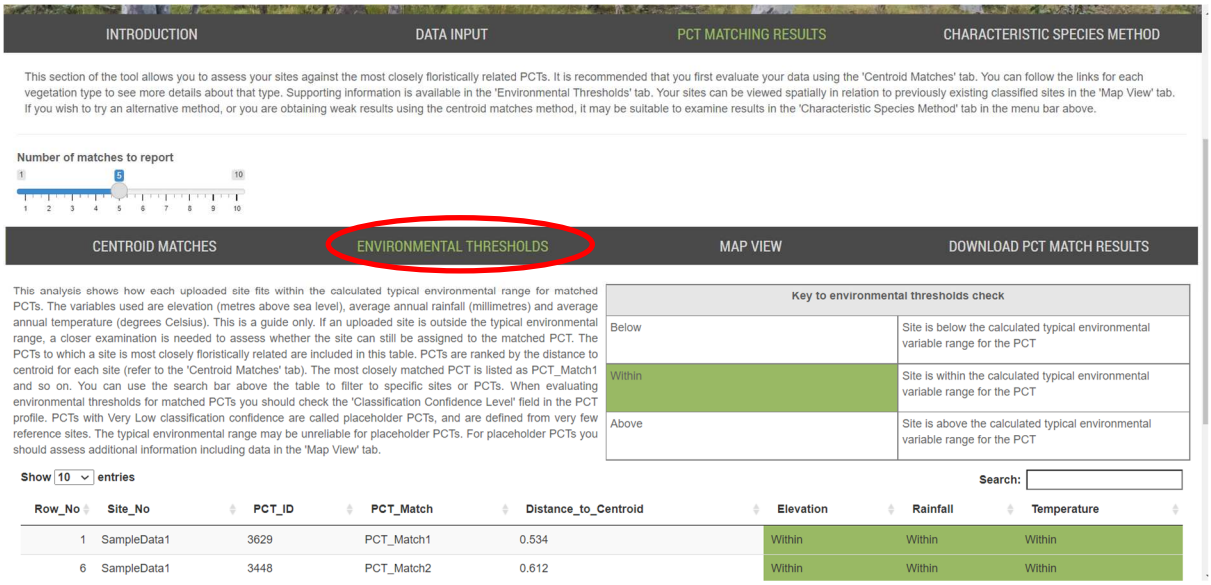


Figure 15 The ‘Environmental Thresholds’ tab

An environmental thresholds table displays (Figure 16).

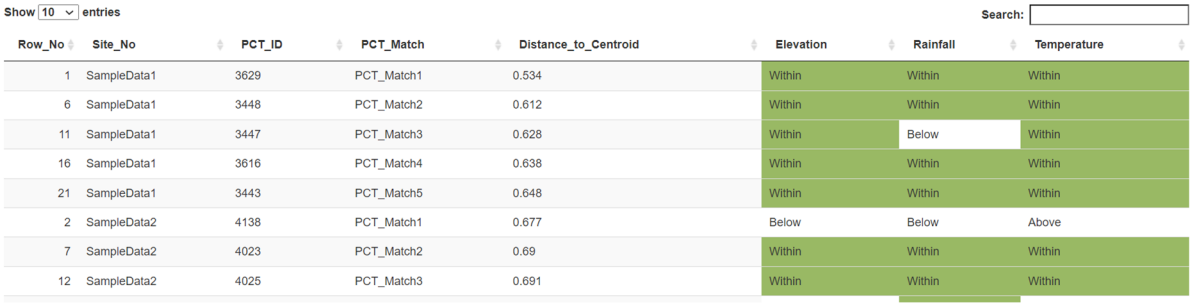


Figure 16 The environmental thresholds table

The environmental thresholds table is ordered differently from the centroid matches table. It extracts the set of PCT match results obtained from the centroid matching algorithm for each of the uploaded sites and lists them in separate rows. The number of matches (rows)

displayed for each uploaded site is determined by the ‘Number of matches to report’ selection applied in Section 4.2. The ‘Distance to Centroid’ value is shown for each site to PCT match. In the example below there are three PCT matches reported for each uploaded site and they are sorted from strongest to weakest floristic match. Each row then indicates whether the uploaded site is within the typical range of elevation, rainfall and temperate for the corresponding PCT in that row, or is above or below the typical range. In the example below, site AVNA018M is within the typical range of elevation and annual mean temperature for PCT 3264, but above the typical range of annual rainfall for this PCT.

As for the centroid matches table, the number of rows displayed per page can be varied, data can be sorted by any column, and filtering can be done using the ‘Search’ box (see Section 4.3.1). However, it is not possible to open PCT profile or PCT site map pop-ups from the environmental thresholds table; this must instead be done from the centroid matches table.

4.5 The map view tab

The ‘Map View’ tab provides the functionality to understand spatial and geographic relationships between uploaded sites and matched PCT reference sites. Users can interact with the map data to query the individual uploaded sites or the PCT reference sites to obtain PCT matching results data.

If spatial data is not detected in the uploaded data matrix, the map view functions are disabled.

4.5.1 Using the map view

From within the ‘PCT Matching Results’ tab, select the ‘Map View’ tab on the second-level navigation bar (Figure 17). The map may take a few moments to load, depending on your internet connection and browser. The map view is most stable in Google Chrome.

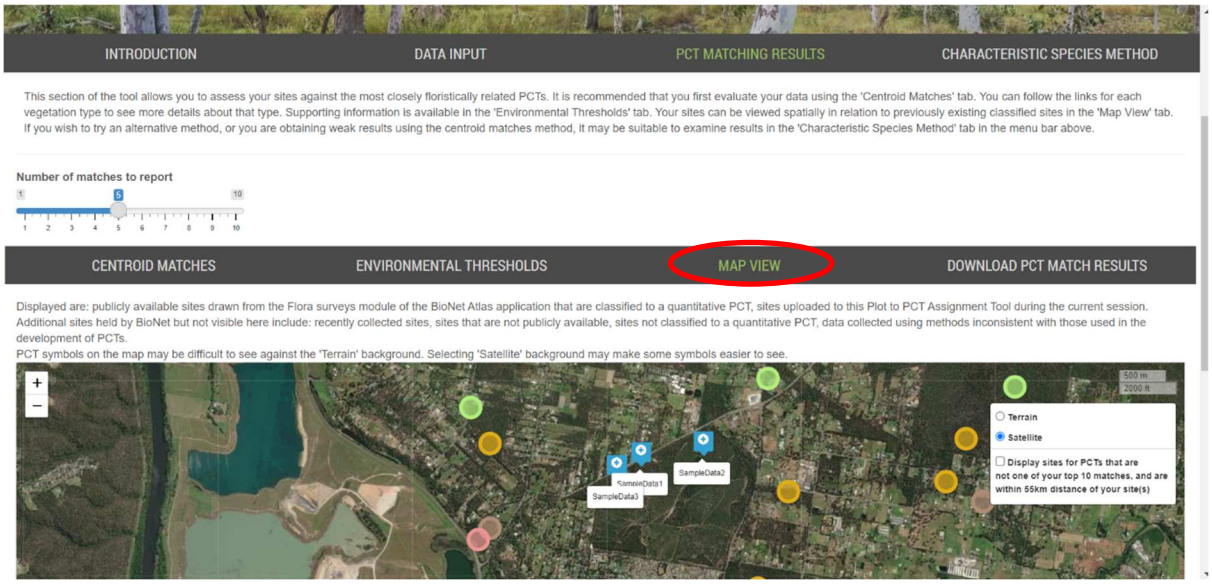


Figure 17 The ‘Map View’ tab

The map displays:

- the locations of uploaded sites, shown by blue pointer boxes with a cross above and site number labels
- PCT reference sites, shown as dots with each PCT represented by a different colour.

The + and – symbols can be used to zoom in or out, and the map can be panned. The base map can be changed from ‘Terrain’ to ‘Satellite’ using the radio buttons in the top right corner of the map. PCT reference sites may be difficult to see against the ‘Terrain’ background; selecting ‘Satellite’ may make some symbols easier to see.

PCT reference sites are drawn from the Flora surveys module of the BioNet Atlas application. Sites from BioNet Atlas are only shown on the map if they have been classified to a quantitative PCT in the coast and tablelands bioregions. Sites held in BioNet Atlas that are not visible on the map include: recently collected sites, sites that are not publicly available, sites collected using methods inconsistent with those used in the development of PCTs, and sites not classified to an eastern NSW PCT classification v1.1 quantitative PCT.

By default, the map shows only the location of reference sites for PCTs matched to the uploaded sites via the centroid matches algorithms (Figure 18). The number of matched PCTs displayed on the map varies according to the ‘Number of matches to report’ slide bar.

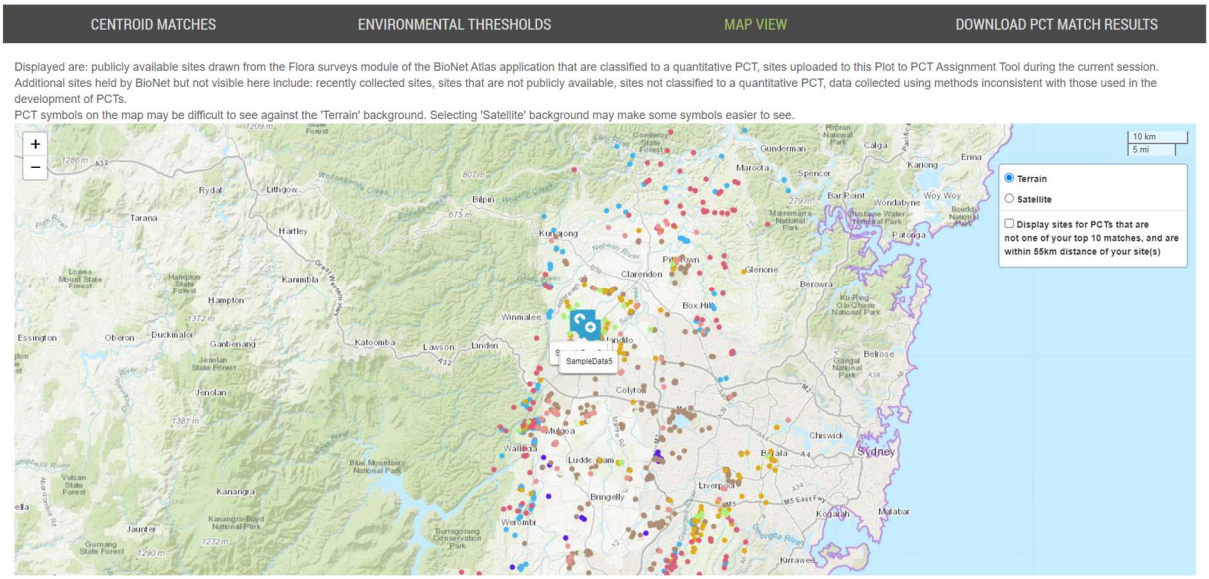


Figure 18 Display of uploaded sites and classified sites in the map view

To display the location of ALL reference sites for quantitative PCTs in the coast and tablelands within the vicinity of your uploaded sites, tick ‘Display sites for PCTs that are not one of your top 10 matches, and are within 55km distance of your site(s)’ near the top right of the map. PCT reference sites that do not belong to one of the matched PCTs in the centroid matches table are displayed.

4.5.2 Querying uploaded sites in map view

Information on an uploaded site can be accessed via the map view screen by clicking on its blue box and cross icon. A box appears, giving the site number, spatial and environmental data, and the list of PCTs matched to that site in the centroid matches table (Figure 19). The distance to centroid values for each PCT match are displayed. The number of PCTs included in the list is determined by the ‘Number of matches to report’ slide bar (between one and 10 matches).

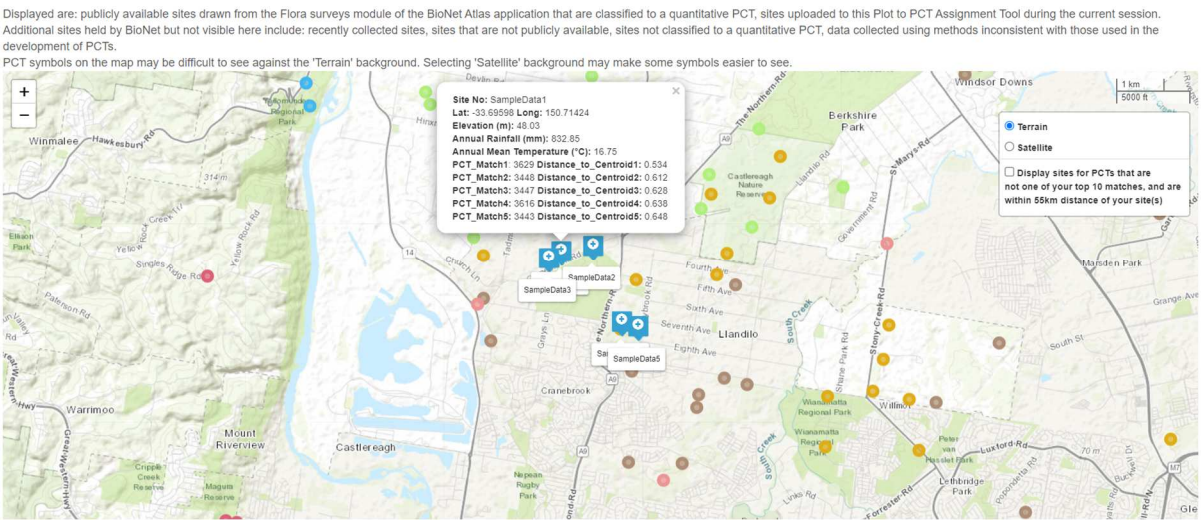


Figure 19 Uploaded site information in the map view

4.5.3 Querying PCT reference sites in map view

Information on a PCT reference site can also be accessed via the map view screen by clicking on the dot of the site of interest (Figure 20). A box appears, giving:

- PCT ID and PCT name to which the site is classified in BioNet
- site number and survey name, as held in the Flora surveys module of the BioNet Atlas application
- environmental attributes at the site location (elevation, annual rainfall and annual mean temperature), as held in BioNet.

If 'Display sites for PCTs that are not one of your top 10 matches…' is ticked (top right on the map), site attribute information can be obtained for any PCT reference sites in the vicinity of uploaded sites, whether or not they are classified to a PCT matched in the centroid matches table.

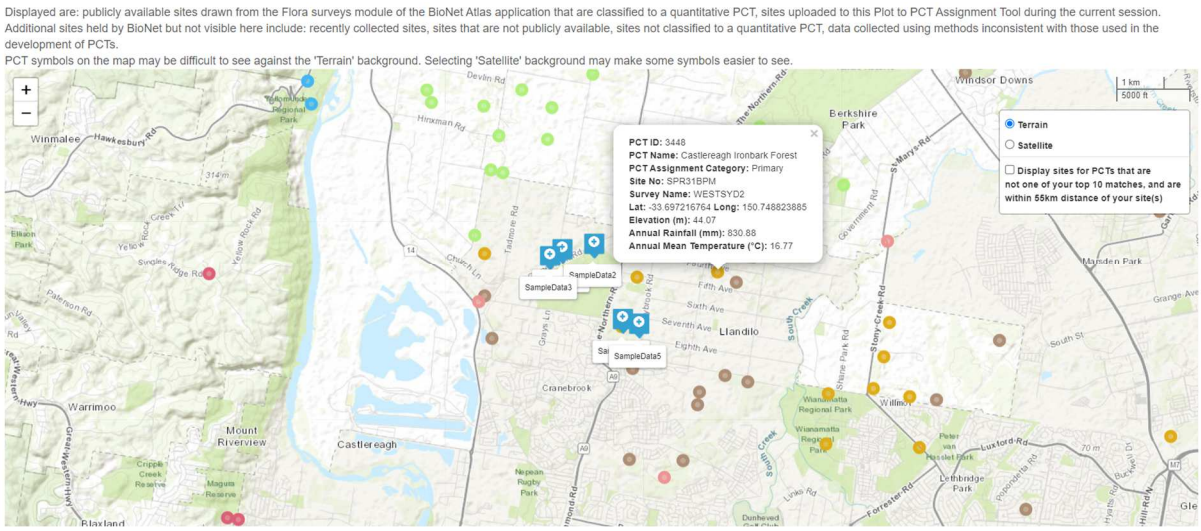


Figure 20 PCT reference site information in the map view

5. Matching PCTs using the characteristic species method

5.1 Introduction

The characteristic species method is an alternative method for matching uploaded site data against quantitative PCTs. This method is experimental and is included in the Tool to promote further research and development. We strongly recommend first applying and evaluating the centroid matches method described in Section 4.3 before turning to the characteristic species matching method, as the centroid matches will provide important comparative data for your evaluation.

One potential application of the characteristic species method is for sites that have a reduced native species inventory and/or unusual cover and abundance, either because of human disturbance or seasonal conditions. Sites with low species richness may yield plausible PCT matches via this method if the species present are characteristic of one or more quantitative PCTs.

The ‘characteristic species’ are a subset of the species inventory of each PCT, derived from the flora species recorded in PCT reference sites. They are identified based on presence-only data, disregarding cover-abundance scores. Characteristic species have been identified for quantitative PCTs by modelling the distribution of each flora species across all PCTs in the same vegetation formation. Species strongly ‘explained by’ a PCT, typically those more frequent in the particular PCT as opposed to other PCTs in the same vegetation formation, are treated as ‘characteristic species’. The number of characteristic species for any PCT varies between five and 15.

When an uploaded site is analysed in the Tool, a simple algorithm calculates the percentage of characteristic species for each of the 1067 quantitative PCTs present in that uploaded site. The PCTs that have the highest percentage match (i.e. the PCTs with the highest number of characteristic species present in the uploaded site) are presented in the characteristic species method matches table. A higher percentage value indicates a stronger match.

5.2 Using the characteristic species matches table

The ‘Characteristic Species Method’ tab is separated from the ‘PCT Matching Results’ tab because it is still experimental; however, the ‘Number of matches to report’ slide bar within the ‘PCT Matching Results’ page drives the number of matches returned by the characteristic species method. Use the slide bar to select the number of PCT matches you wish to return before proceeding.

Select the ‘Characteristic Species Method’ tab on the top navigation bar (Figure 21).

The characteristic species matches table appears, as shown in Figure 22. The table displays the results for each uploaded site on one row, with the second column displaying the site number taken from the uploaded data matrix. The number of sites displayed per page can be modified using the drop-down list ‘Show 10 entries’ to the left above the table. Any column can be sorted from lowest to highest or vice versa, by clicking on the column heading. The ‘Search’ box to the right above the table can be used to filter the table by any values typed into the box. For example, typing all or part of a site number into the search box will result in the table showing only matching site numbers, while typing a PCT ID into the box will display only rows containing that PCT ID. If you do not wish to filter the results table, the search box should be empty.

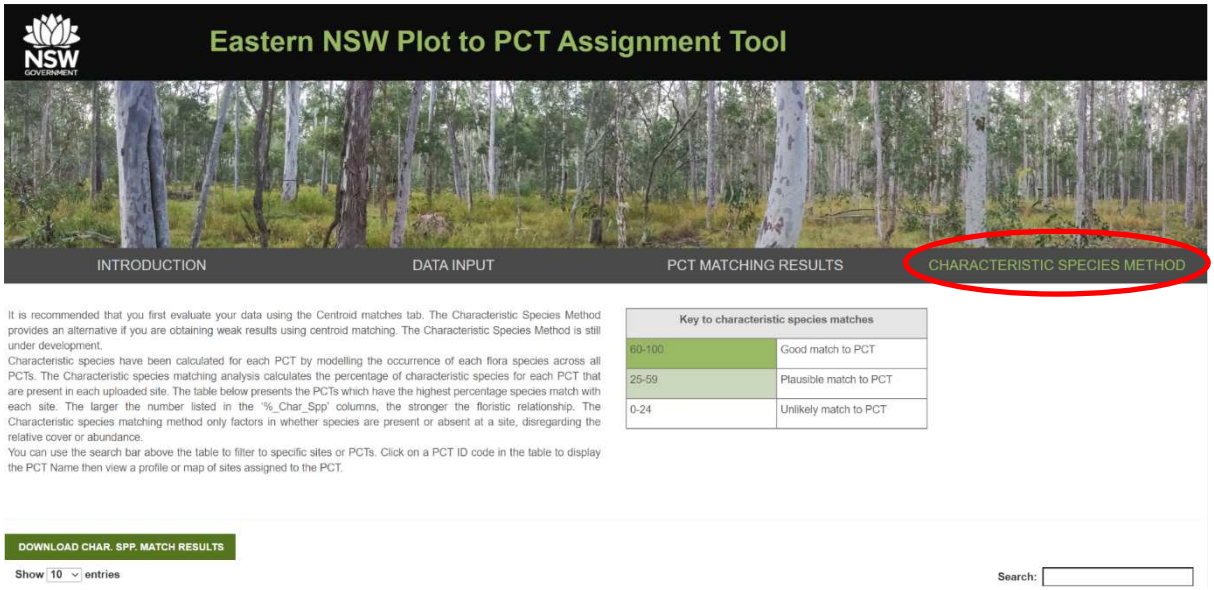
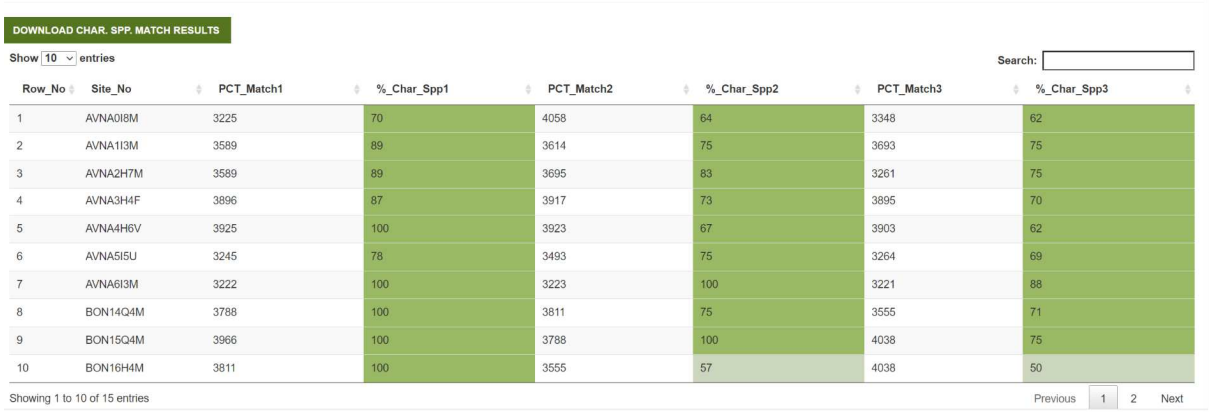


Figure 21 The 'Characteristic Species Method' tab



Row_No	Site_No	PCT_Match1	%_Char_Spp1	PCT_Match2	%_Char_Spp2	PCT_Match3	%_Char_Spp3
1	AVNA0I8M	3225	70	4058	64	3348	62
2	AVNA1I3M	3589	89	3614	75	3693	75
3	AVNA2H7M	3589	89	3695	83	3261	75
4	AVNA3H4F	3896	87	3917	73	3895	70
5	AVNA4H6V	3925	100	3923	67	3903	62
6	AVNA5I5U	3245	78	3493	75	3264	69
7	AVNA6I3M	3222	100	3223	100	3221	88
8	BON14Q4M	3788	100	3811	75	3555	71
9	BON15Q4M	3966	100	3788	100	4038	75
10	BON16H4M	3811	100	3555	57	4038	50

Figure 22 The characteristic species matches table

For each site, the matched PCTs are presented as a series of columns that give the PCT ID and the percent characteristic species value measuring the strength of match to that PCT. The larger the number listed in the '%_Char_Spp' column, the stronger the match between the site's floristics and the PCT's characteristic species list. The PCT with the strongest floristic match to the uploaded site is shown in the column '%_Char_Spp1'. The floristic match becomes successively weaker across the table as the '%_Char_Spp' number decreases. Percent characteristic species values are colour coded as a guide to the likelihood of the uploaded site matching the PCT (Figure 23).

Key to characteristic species matches	
60-100	Good match to PCT
25-59	Plausible match to PCT
0-24	Unlikely match to PCT

Figure 23 Thresholds for colour coding of the characteristic species match values

The functionality of the characteristic species matches table is the same as the centroid matches table (see Sections 4.3.2 and 4.3.3). Click on a PCT ID code in the table to display the PCT name, then view a PCT profile or PCT site map for the selected PCT.

There is no environmental threshold functionality enabled on PCT matches derived from the characteristic species method, unless a PCT presented in the characteristic species matches table is also returned in the PCT matching results section.

6. Downloading results

6.1 Introduction

This section helps you navigate the files that can be downloaded from the Tool following completion of the data analysis step described in Section 3.6, and the on-screen assessments described in Section 4 and Section 5 (if used).

The following data can be downloaded from the Tool in .csv spreadsheet format:

- **Centroid matches** – a copy of the centroid matches table
- **Environmental threshold assessment** – a copy of the environmental thresholds table, with the addition of PCT names
- **PCT profile information** – a tabular version of the data in the PCT profile pop-ups, with the exception of the PCT floristic summary data
- **PCT floristic summary data** – a tabular copy of the floristic summary data presented in the ‘Species by Growth Form Group’ section of the PCT profile pop-ups
- **Characteristic species matches** – a copy of the characteristic species matches table.

The number of PCTs included in the download files is determined by the selection on the ‘Number of matches to report’ slide bar on the PCT matching results page.

6.2 PCT data version date

When downloading and saving data from the Tool it is important to note the dates in the top row of the downloaded spreadsheet file. These dates indicate when the Tool’s PCT data was last updated from BioNet, and when the .csv file was downloaded from the Tool. If a downloaded file is saved for later use it must be remembered that the PCT data therein is only guaranteed to be up to date at the time it was downloaded from the Tool. PCT data in saved download files may over time become out of date relative to BioNet, as downloaded .csv files will not automatically update to reflect any PCT data changes in BioNet.

6.3 Downloading centroid matches results

From within the ‘PCT Matching Results’ tab, select the ‘Download PCT Match Results’ tab on the second-level navigation bar (Figure 24). The four download options related to centroid matches will appear in a list below the navigation bar.

Clicking on any one of these green buttons will initiate a download of the relevant file. A progress bar will display at the bottom right of the screen. Once the download is complete a .csv file name will appear (Figure 25). In most instances the default program for opening a .csv file is Microsoft Excel. Click on the file name to open, view and save the file.

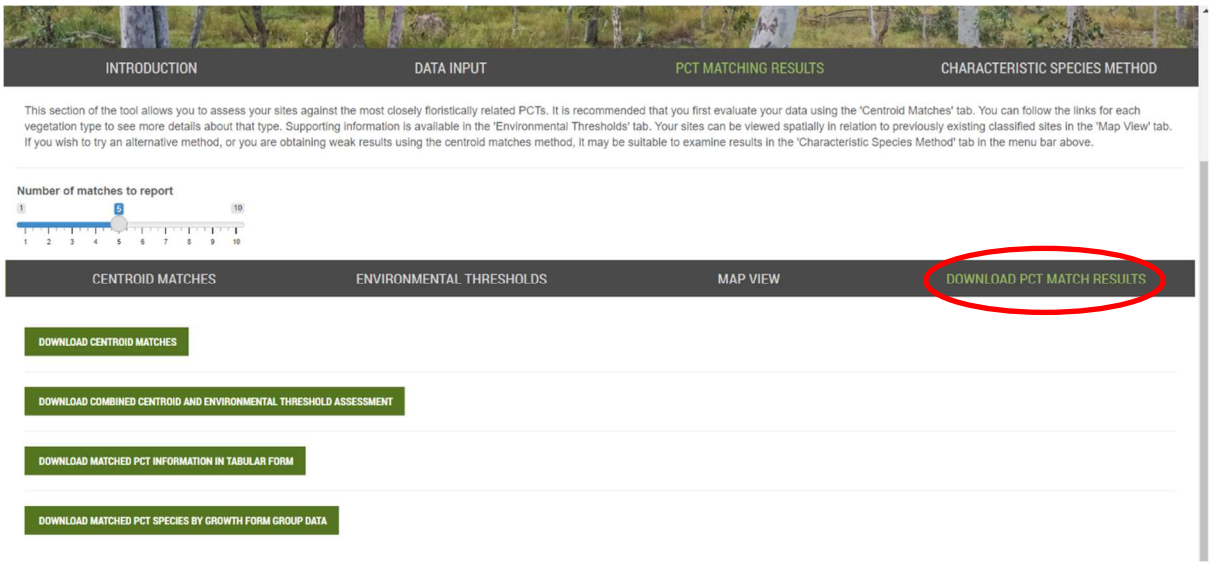


Figure 24 The 'Download PCT Match Results' tab

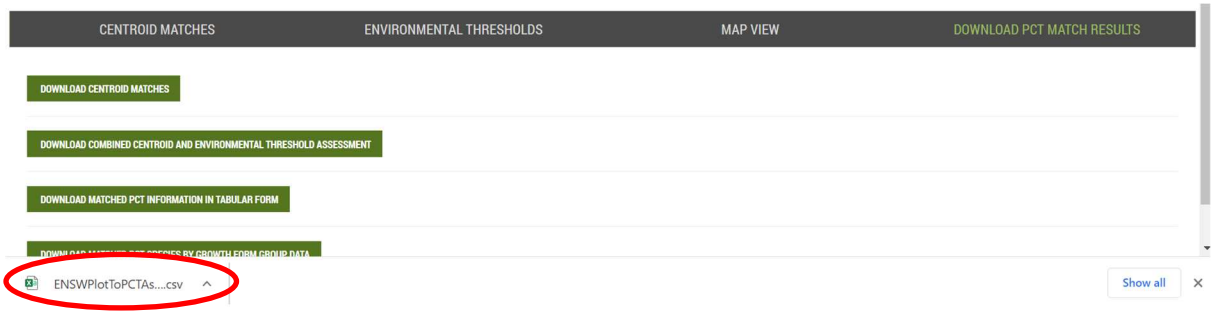


Figure 25 Downloading file to .csv format

6.4 Downloading characteristic species method results

Select the 'Characteristic Species Method' tab on the top navigation bar. Click on the green 'Download Char. Spp. Match Results' button above the characteristic species matches table (Figure 26). This will initiate a download of a spreadsheet copy of the characteristic species matches table. A progress bar will display at the bottom right of the screen. Once the download is complete a .csv file name will appear. In most instances the default program for opening a .csv file is Microsoft Excel. Click on the file name to open, view and save the file.

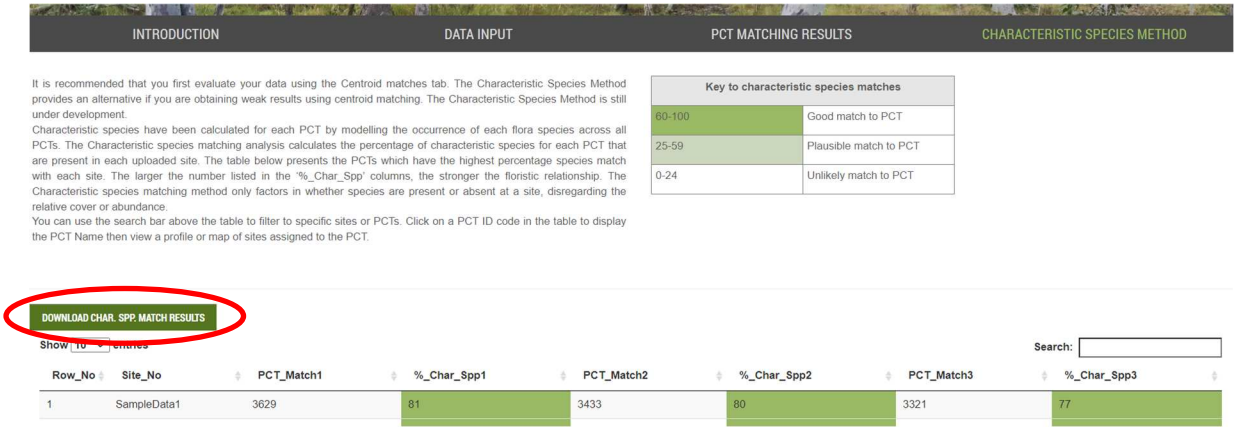


Figure 26 The 'Download char. spp. match results' button

7. Evaluating the PCT match results

7.1 Introduction

This section discusses components of the Tool's results and outputs in more detail. It provides a working example from the NSW Southern Highlands using actual field data, and illustrates the steps to take in assigning candidate PCTs under various scenarios.

7.2 Understanding centroid match results

In the eastern NSW PCT classification v1.1 framework, PCT reference sites (also known as PCT member plots) have a 'PCT assignment category' label stored in BioNet. Sites with a Primary assignment are used in the circumscription of both the floristic assemblage and habitat characteristics of the PCT to which they are assigned. Sites with a Secondary assignment are not used in the circumscription of the floristic assemblage but contribute to characterising the habitat attributes of the PCT to which they are assigned.

In the Tool, the distance to centroid values provide a measure of similarity between the set of species in the uploaded site and the species assemblages of individual quantitative PCTs in the coast and tablelands bioregions, using 1–6 cover-abundance scores. The distance to centroid values commonly lie between 0.5 and 0.85, where 0.5 is a closer match and 0.85 weaker.

We apply thresholds to the distance to centroid value to interpret the strength of match based on floristic data alone. To be suitable for a Primary assignment the distance to centroid value is usually below 0.695. In the Tool, all distance to centroid values at or below the threshold of 0.695 are highlighted in green. Often sites will return multiple PCT matches that fall below the threshold. This is to be expected, as many PCTs share species along a continuum. PCTs are constructs operating across shades of grey and are rarely, if ever, abrupt black and white choices. Distance to centroid values above 0.695 may be suitable for a Secondary assignment if the interpreter is satisfied the site meets the characteristics of the matched PCT.

One common driver of high distance to centroid values is sites that have lower native species richness than is typical for the PCT. Common examples are disturbed sites where some elements of the expected floristic assemblage are no longer present. Other examples are sites affected by seasonal issues that limit the availability of sufficient material for confident species identification. Sites where only a partial floristic inventory has been completed can also result in weaker PCT matches.

Importantly, a high distance to centroid value may also signify a new assemblage that is not well sampled and captured by the eastern NSW PCT classification v1.1 set of quantitative PCTs. This is important as it can potentially signify a new plant community type, particularly if the species present in the site do not easily relate to the PCT description or species assemblage of any of the strongest matched quantitative PCTs suggested by the Tool. If this is demonstrated by repeated sampling in similar environments, it signals a strong likelihood that you might have something new.

7.3 Understanding environmental thresholds results

The confidence of the match between an uploaded site and a PCT can be improved by considering the spatial proximity to PCT reference sites. PCT reference sites have also been used to calculate a typical environmental range for each PCT, using three simple measures describing elevation and climate (annual rainfall and mean annual temperature). If an uploaded site falls within the typical environmental range of a floristically-matched PCT this provides additional supporting evidence of the PCT match.

When the uploaded site is outside the typical range for one or more of the environmental variables for a matched PCT, this is a cue to check the environmental variable values of the site and the PCT. At present the Tool's categorisation of 'below' and 'above' the typical environmental variable range is rudimentary, as it does not indicate how far outside the typical range your uploaded site falls. The degree to which the site falls outside the range may not be significant; for example, if a site is only 20 metres above the typical elevation range, this may not be significant. Environmental thresholds provide information to assist in your PCT evaluation, but not definitive answers.

7.4 Working with the PCT profile data

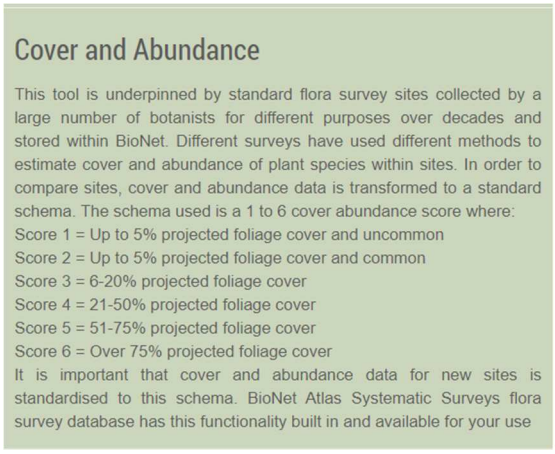
The Tool provides users with immediate access to descriptive and statistical floristic and environmental summary data for matched PCTs. Using the functions described in Section 4.3.2 the PCT profile pop-up provides the best starting point to diagnose the PCT. You can evaluate the PCT profile data one PCT at a time while working in the Tool, or download the profile data for all matched PCTs to a .csv file to look at multiple PCTs at once.

Below is a description of the information fields in the PCT profiles. All data is sourced from, and can also be accessed in, the BioNet Vegetation Classification public application. A more thorough description of each of these profile data fields is provided in DPIE (2021b).

- **PCT name** – a colloquial plant community description that can be understood by non-botanists. It may include common names of dominant plant species, or names of a geographical region, a substrate, a soil type or a climatic zone.
- **Classification confidence level** – an indication of how robust the PCT classification is.
- **Number of primary and number of secondary replicates** – the number of PCT reference sites (also known as PCT member plots). This is a useful indicator of how well the PCT is sampled, and the number of sites that have been used to define the species and environmental attributes of the PCT. A higher number indicates greater confidence that the assemblage and environmental patterns are recurring in the landscape and are diagnoseable. Other information such as the spread or distribution of PCT reference sites (visible via the PCT site maps (Section 4.3.3)) also brings additional understanding. The number of PCT reference sites need not always be high for high confidence; for example highly distinctive plant assemblages occurring in restricted environments such as rock outcrops or sand deposits.
- **Vegetation description** – a summary of the main structural, compositional and environmental attributes of the PCT. Terms describing the vegetation structure follow protocols in the DPIE standard (Sivertsen 2009). Consistent terms are used to describe the frequency of occurrence of plant species. In some cases descriptions also provide an indication of how the PCT relates to other floristically or spatially proximate PCTs.
- **Vegetation formation and vegetation class** – the vegetation formation and vegetation class to which the PCT is assigned.
- **IBRA subregions** – a list of subregions in which the PCT is known to occur based on the location of PCT reference sites.
- **Minimum, maximum and median values of environmental variables** – summary statistics for the PCT for elevation, mean annual rainfall and annual mean temperature. These values are useful to help understand the environmental thresholds analysis (Section 4.4), but are not the same as the 'typical environmental range' that is used in that analysis. Instead, these values indicate the full known range of these environmental variables for the PCT, based on the location of PCT reference sites.
- **TEC association** – see Section 7.5
- **Median native species richness** – the median number of native species recorded in the PCT Primary reference sites. Comparing this value to the species richness of the uploaded site may provide insight into the strength of match in the centroid matches table.

- **Species by growth form group** – species summary data that provides the key floristic compositional attributes of the PCT. All native species that occur in more than 20% of PCT reference sites for the type are included in the table. Species are sorted by the 'growth form group' used in the Biodiversity Assessment Method (DPIE 2020), and then in descending order of frequency in that PCT's reference sites. The median cover-abundance score for each species in PCT reference sites is also presented. The Tool's 'Data Input' page summarises the meaning of the cover-abundance scores (Figure 27). In the example in Figure 28, *Eucalyptus fibrosa* occurs in 90% of PCT reference sites (sites classified to the PCT in the Flora surveys module of the BioNet Atlas application) with a median cover-abundance score of 3 (6–20% projected foliage cover).

  There is no expectation that any uploaded site would include all the species listed in the species by growth form group table of any PCT. Rather, the matching process looks for commonality with the most frequently recorded species in each of the growth form groups. The dominant tree species are not always a useful diagnostic of the PCT; while they may be among the species with highest cover-abundance values, they still represent a relatively small proportion of the total species richness present at a site.



Cover and Abundance

This tool is underpinned by standard flora survey sites collected by a large number of botanists for different purposes over decades and stored within BioNet. Different surveys have used different methods to estimate cover and abundance of plant species within sites. In order to compare sites, cover and abundance data is transformed to a standard schema. The schema used is a 1 to 6 cover abundance score where:

Score 1 = Up to 5% projected foliage cover and uncommon
Score 2 = Up to 5% projected foliage cover and common
Score 3 = 6-20% projected foliage cover
Score 4 = 21-50% projected foliage cover
Score 5 = 51-75% projected foliage cover
Score 6 = Over 75% projected foliage cover

It is important that cover and abundance data for new sites is standardised to this schema. BioNet Atlas Systematic Surveys flora survey database has this functionality built in and available for your use

Figure 27 The standardised cover and abundance scores

Species by Growth Form Group:

Scientific Name	Median Cover Score	Species Frequency (>=20%)	Growth Form Group
Eucalyptus fibrosa	3	90%	Tree (TG)
Allocasuarina littoralis	2	29%	Tree (TG)
Acacia parramattensis	2	23%	Tree (TG)
Acacia decurrens	2	21%	Tree (TG)
Eucalyptus crebra	2	20%	Tree (TG)
Bursaria spinosa	2	67%	Shrub (SG)
Lissanthe strigosa	2	62%	Shrub (SG)
Melaleuca decora	3	62%	Shrub (SG)

Figure 28 The PCT species summary data

7.5 Is the PCT a threatened ecological community (TEC)?

Threatened ecological communities (TECs) are a focus for many biodiversity assessment and land management activities. TECs are legally defined entities that use independent classifications applied by Scientific Committees under NSW and Commonwealth biodiversity legislation. As at June 2021 there are no current NSW TEC determinations that cite quantitative PCTs in the coast and tablelands bioregions.

Users look to PCTs to provide guidance on the relationships between the two classifications. PCT–TEC relationships require interpretation using the defining attributes of a TEC Final Determination (NSW) or Listing Advice (Commonwealth). Different PCT associations can be generated when applying these interpretations to similarly-named and characterised vegetation assemblages listed under NSW versus Commonwealth legislation.

7.5.1 No TEC relationships for a matched PCT

In the 'TEC Assessed' field the PCT profile pop-up indicates whether the PCT is associated with any NSW or Commonwealth TEC. A value of 'No associated TEC' indicates the PCT is not associated with any TEC.

7.5.2 TEC relationships exist for a matched PCT

A value of 'Has associated TEC' in the 'TEC Assessed' field indicates the PCT is associated with a TEC. A PCT may have a relationship with one or more TECs under NSW and/or Commonwealth legislation.

NSW TECs

The relevant NSW TECs are listed in the 'TEC List' field of the PCT profile, with the prefix 'Listed BC Act' (*Biodiversity Conservation Act 2016*).

Equivalent PCT–TEC matches

Where there is a one-to-one relationship between the PCT and the TEC (that is, all of the known extent of the TEC is the PCT and no other PCTs, and all of the known extent of the PCT is the TEC and no other TECs, based on available data), the term 'Equivalent' is added as a suffix after the TEC name.

Part PCT–TEC matches

In other cases the term 'Part' is added as a suffix after the TEC name. This can mean either that only part of the PCT relates to the TEC, or that only part of the TEC relates to the PCT (for example, more than one PCT may relate to the TEC).

There are many conditions in a TEC Final Determination that may produce a partial PCT–TEC relationship. One of the more common ones is the definition of the TEC area. An IBRA bioregion(s) is frequently used to define the area in a TEC Final Determination; a PCT that straddles bioregional boundaries can only relate to a TEC within the bioregion(s) stated in that TEC's Final Determination. Where the suffix 'Part' appears after a TEC name in the PCT profile data, users need to access the BioNet Vegetation Classification public application to obtain information on which part of the PCT applies and the qualifying condition(s). For eastern NSW PCT classification v1.1 quantitative PCTs, this information is stored in the 'TEC comments' field in the Vegetation Classification public application.

Commonwealth TECs

The expression of Commonwealth TEC relationships in BioNet, and hence in the Tool, is complex. As at September 2021, Commonwealth TECs are represented in BioNet using the BC Act name of the related NSW TEC, if there is one. For example, the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) TEC 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest' is represented in BioNet by two BC Act names: 'Cumberland Plain Woodland in the Sydney Basin Bioregion' and 'Shale Gravel Transition Forest in the Sydney Basin Bioregion'. This situation has many limitations, as Commonwealth and state TECs are often different despite sharing similar names. Where a PCT is associated with an EPBC Act TEC, users are encouraged to access the Vegetation Classification public application, where the field 'TEC comments' contains information on the relevant EPBC Act TEC name and qualifying conditions that apply to the PCT–TEC relationship.

7.6 Assigning PCTs to uploaded sites – examples

7.6.1 Strong floristic and environmental match to one PCT

In the example shown in Figure 29, the uploaded site easily falls within the distance to centroid threshold for PCT 3746, with a distance to centroid value of 0.629. This is a strong result, and the second PCT match distance to centroid value is much weaker at 0.702. The first PCT match also meets the typical range for the PCT across the three environmental attributes.

PCT_ID	PCT_Name	PCT_Match	Distanc	Elevati	Rainfal	Tempe
3746	Southern Tableland Snow Gum-Candlebark Shrub Forest	PCT_Match1	0.629	Within	Within	Within
3738	Goulburn-Lithgow Tableland Hills Grassy Forest	PCT_Match2	0.702	Within	Within	Within
3367	Central Tableland Granites Grassy Box Woodland	PCT_Match3	0.706	Within	Within	Within

Figure 29 Example of strong floristic and environmental match

This example also presents the top three PCT matches as falling within the typical environmental ranges for each of the PCTs. This suggests the uploaded site has an assemblage with broad similarities to a common environmental domain, in this case the Southern Tablelands.

The uploaded site is a very strong candidate to be added to the library of reference sites that are used to define the environmental and compositional attributes for PCT 3746.

7.6.2 Floristic and environmental match to multiple PCTs

In the example shown in Figure 30, the uploaded site falls within the distance to centroid threshold for three PCTs, with values between 0.66 and 0.675. The site is also within the typical environmental range for all but one of these PCTs. In this example, interpretation will play a stronger role in understanding the best PCT to allocate the site to. The species found in the uploaded site are likely to be common to all of the top PCT choices, and the site might be sampling a transition between each of them.

PCT_ID	PCT_Name	PCT_Match	Distanc	Elevati	Rainfal	Tempe
3338	Goulburn Tableland Frost Hollow Grassy Woodland	PCT_Match1	0.66	Within	Within	Within
3341	Monaro-Gourock Frost Hollow Grassy Woodland	PCT_Match2	0.667	Within	Within	Above
3413	Monaro Kangaroo Grass Woodland-Grassland Complex	PCT_Match3	0.675	Within	Within	Within

Figure 30 Example of floristic and environmental match to multiple PCTs

The site shows very similar floristic relationships to first match PCT 3338 (distance to centroid value 0.66) and second match PCT 3341 (distance to centroid value 0.667) on the distance to centroid metric. Any of the top three matching PCTs may be plausible and each should be evaluated. One way to help evaluate the best fit is to check the number of species recorded in the uploaded site against the median native species richness for the PCT, as sometimes the strength of match to a PCT may be elevated for PCTs that have low median native species richness.

The analysis for the second match PCT 3341 indicates the site location is above the typical mean annual temperature threshold for the PCT. We can also compare the environmental data of the site to the environmental summary data in the PCT profile pop-up to get an indication of whether the site is outside the full known range of mean annual temperature values for the PCT, and if so by what magnitude. We can also use the PCT sites map to check the spatial proximity of PCT reference sites, which might suggest the site is only slightly above the typical range of this environmental variable.

The site may be suitable as a Primary assignment to one of these three PCTs after further interpretation based on all available information.

7.6.3 False PCT match – the trick of placeholders

Occasionally you may get a PCT match that looks erroneous; for example, the uploaded site is not in the geographic area of a matched PCT, but the centroid matches analysis suggests it is a close floristic match. In the example shown in Figure 31, the uploaded site has a distance to centroid value within threshold to PCT 3508 (distance to centroid value 0.617). The PCT name suggests something is odd however, as this site is in the Southern Tablelands while the PCT occurs on the New England Tablelands. The results of the environmental thresholds analysis are another immediate signal: the uploaded site falls outside the typical range of all of the environmental variables for PCT 3508. How can this situation come about?

PCT_ID	PCT_Name	PCT_Match	Distanc	Elevati	Rainfal	Tempe
3508	Western Guy Fawkes Plateau White Gum Flats Forest	PCT_Match1	0.617	Below	Below	Below
3341	Monaro-Gourock Frost Hollow Grassy Woodland	PCT_Match2	0.625	Within	Within	Within
3325	South Coast Valley Flats Ribbon Gum Forest	PCT_Match3	0.644	Above	Within	Below

Figure 31 Example of match to a placeholder PCT

If we examine the 'Vegetation Description' for PCT 3508 in the PCT profile pop-up we see '*This placeholder PCT is defined from a single plot located on moderately steep terrain to the east of Guyra, where the New England Tableland begins to drop off into the eastern escarpment. Caution is required in the evaluation and assignment of new plots to this PCT*.' 'Placeholder' PCTs are also identified with the value 'Very Low' in the 'Classification Confidence Level' field in the PCT profile.

Placeholder PCTs are vulnerable to becoming 'false' PCT matches, because unlike other PCTs they are characterised by very few reference sites. In this case the PCT is defined from just a single reference site, and there are species shared between the uploaded site and the PCT 3508 reference site. The centroid matching algorithm generates a notionally strong match, but the result is biased by the low sample size. The typical environmental range may also be unreliable for placeholder PCTs.

In this example, PCT 3508 is easily disregarded so we move on to examine the second PCT match. The uploaded site is within the distance to centroid threshold for the second PCT match and also within the typical environmental range; the second PCT match (PCT 3341) looks like a good choice.

Some PCTs in the Coastal Freshwater Lagoons vegetation class require specific consideration of environmental domain before they are selected as the most appropriate PCT match. These non-woody wetland PCTs are generally characterised by low native species richness, a high degree of temporal and spatial heterogeneity, high levels of anthropogenic disturbance and often poor coverage by standard floristic survey plots. Approximately half the PCTs in this vegetation class are placeholder PCTs. The remainder have higher levels of classification confidence, yet may still require consideration of environmental domain such as whether they are estuarine wetlands, floodplain wetlands, or freshwater coastal swamps and lagoons fed by rainfall/runoff (including depressions and swales of dunal areas).

7.6.4 Weak floristic match but strong environmental match

In the example shown in Figure 32, the distance to centroid values for the uploaded site indicate the first match PCT 3338 (value 0.722) exceeds the threshold of 0.695; however, the site location falls within the typical environmental range of PCT 3338. There may be many reasons why the floristic centroid match is weak. The first check to make is whether the number of native species recorded in the uploaded site is much lower than the median native species richness of the PCT. Secondly, there may be species that are atypical of the

PCT, or have been recorded with an unusually high cover-abundance score. The second match PCT (PCT 3746) has a similar distance to centroid value to PCT 3338, and the site is also within the typical environmental range of the second match PCT. A site like this will require further investigation to understand what may be driving the weak centroid matches. One thing to check is the combination of species for the site in the uploaded data matrix. Sometimes there could be a simple data entry error or species misidentification that can be corrected and reanalysed. Commonly, however, a centroid matches result such as this indicates site disturbance. Less frequently it indicates a new floristic assemblage and a candidate new PCT.

PCT_ID	PCT_Name	PCT_Match	Distanc	Elevati	Rainfal	Tempe
3338	Goulburn Tableland Frost Hollow Grassy Woodland	PCT_Match1	0.722	Within	Within	Within
3746	Southern Tableland Snow Gum-Candlebark Shrub Forest	PCT_Match2	0.726	Within	Within	Within
3373	Goulburn Tableland Box-Gum Grassy Forest	PCT_Match3	0.745	Within	Within	Within

Figure 32 Example of weak floristic match but strong environmental match

If it is determined the site was disturbed and has low native species richness, but that otherwise the floristic and environmental attributes are consistent with PCT 3338, the site would be assigned to PCT 3338 as a Secondary assignment.

7.6.5 Very weak floristic match and mixed environmental match

Very high distance to centroid values indicate the list of plants recorded in the uploaded site is an unusual combination not recorded in other standard floristic survey sites in the coast and tablelands bioregions to date. In the example shown in Figure 33 the closest distance to centroid score is greater than 0.8 for PCT 4088 and higher for PCT 3415.

Site_No	PCT_ID	PCT_Name	PCT_Match	Distanc	Elevati	Rainfal	Tempe
BAM201201_154930	4088	Southwest Riverflat Red Gum Forest	PCT_Match1	0.819	Within	Within	Within
BAM201201_154930	3415	Southern Tableland Red Grass-Spear Grass Grassland	PCT_Match2	0.841	Above	Above	Within
BAM201201_154930	3376	Southern Tableland Grassy Box Woodland	PCT_Match3	0.85	Within	Within	Within

Figure 33 Example of weak floristic match and mixed environmental match

In most cases, very high distance to centroid values such as this will be due to a very low number of species in the uploaded site compared to the median species richness of the matched PCTs. For example, in very disturbed sites the native species present may be only a small subset of the original species assemblage. Alternatively, the placement of a site that traverses very abrupt changes in vegetation assemblages may introduce an unusual combination of species. Very narrow riparian habitats are examples, where mesophyll species may be replaced by sclerophyll dominated vegetation over a short distance.

In rarer cases, very high distance to centroid values signal that the uploaded site is a previously unsampled assemblage of species that presents a candidate new PCT. Interrogation of the floristic, environmental and spatial data of the uploaded site and the matched PCTs is required. At the end of the interpretation process it may be that you are comfortable assigning the uploaded site to an existing PCT as a Secondary assignment. Alternatively, you may feel you cannot match the uploaded site to any of the candidate PCTs and genuinely have a new assemblage. In this case, contact Bionet@environment.nsw.gov.au to discuss your data and interpretation process.

8. Glossary

Term	Definition
PCT master list	The cumulative set of PCTs in the BioNet Vegetation Classification applications, including PCT Definition Status of 'Approved', 'Draft-Working', 'Decommissioned'
Approved PCT	An Approved PCT in the BioNet Vegetation Classification public application (on publication of eastern NSW PCT classification v 1.1 in early 2022).
quantitative Approved PCT	A quantitative Approved PCT in the BioNet Vegetation Classification public application (on publication of eastern NSW PCT classification v1.1 in early 2022). A quantitative PCT has its plot membership defined in the Flora surveys module of the BioNet Atlas application. PCT profile data is a based on the data of member plots. Quantitative PCTs are distinguished by having a PCT ID above 3000
qualitative Approved PCT	A qualitative Approved PCT in the BioNet Vegetation Classification public application (on publication of eastern NSW PCT classification v1.1 in early 2022). Qualitative PCTs are distinguished by having a PCT ID below 3000
BioNet Vegetation Classification public application	The application (user interface) where public users can access the PCT master list and PCT summary data
BioNet Vegetation Classification edit application	The application (user interface) where DPIE staff undertake edits to the PCT master list and PCT data. PCT data is published from the edit application to the public application
BioNet	The biodiversity data repository administered by DPIE
Flora surveys module of the BioNet Atlas application	The application (user interface) where users can access and edit flora survey data in the Systematic Surveys data collection
member plot	A plot that is part of the defined membership of a quantitative PCT; also called 'PCT reference sites'
standard floristic survey plot	A plot that meets the survey standards defined in Sivertsen (2009). Usually a 400 square metre area within which all vascular plants are identified to the lowest taxonomic level possible, together with standardised estimate of frequency and projected foliage cover
eastern NSW (ENSW)	Parts of New South Wales that fall within one of the following 10 IBRA v7 bioregions (DAWE 2021): the Australian Alps, New England Tableland, NSW North Coast, South East Corner, South Eastern Highlands, South-East Queensland, Sydney Basin, Brigalow Belt South, Nandewar and NSW South Western Slopes. 'Eastern NSW' is comprised of the 'east coast and tablelands bioregions' and the 'western slopes bioregions'
coast and tablelands bioregions	Parts of New South Wales that fall within one of the following seven IBRA v7 bioregions (DAWE 2021): the Australian Alps, New England Tableland, NSW North Coast, South East Corner, South Eastern Highlands, South-East Queensland, Sydney Basin
western slopes bioregions	Parts of New South Wales that fall within one of the following seven IBRA v7 bioregions (DAWE 2021): Brigalow Belt South, Nandewar and NSW South Western Slopes

Term	Definition
eastern NSW PCT classification v1.1	The PCT classification for the coast and tablelands bioregions, published in BioNet (on publication of eastern NSW PCT classification v1.1 in early 2022).
eastern NSW PCT classification v1.1 region	The area over which the eastern NSW PCT classification v1.1 applies, being the coast and tablelands bioregions
distance to centroid	A measure of the floristic difference between a site and the central value or 'centroid' of the member plots (reference sites) that define a quantitative PCT
Primary assignment	A plot that has a distance to centroid value of 0.695 or less and has been classified to a PCT with a Primary 'PCT assignment category'. An exception is non-woody freshwater wetlands which have some Primary assignments greater than 0.695 distance to centroid.
Secondary assignment	A plot that has a distance to centroid value of greater than 0.695 and has been classified to a PCT with a Secondary 'PCT assignment category'

9. References

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DPIE (Department of Planning, Industry and Environment) 2021a, *A Revised Classification of Plant Communities of Eastern NSW*, NSW Department of Planning, Industry and Environment, Sydney.

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Sivertsen D 2009, *Native Vegetation Interim Type Standard*, NSW Department of Environment, Climate Change and Water, Sydney, www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Research/Maps-and-data/native-vegetation-interim-type-standard-100060.pdf (PDF 1.1MB).

Appendix A: Quantitative PCTs in the coast and tablelands bioregions that are defined from non-standard presence-only survey data

These PCTs can be identified using the Plot to PCT Assignment Tool, but PCT-matching metrics may be outside normal bands. Data in this table was sourced from BioNet Vegetation Classification edit application on 26 April 2021.

PCT ID	PCT name	Vegetation formation	Vegetation class	IBRA region(s)	IBRA subregion(s)
3105	South Coast Escarpment Dry Rainforest	Rainforests	Dry Rainforests	South East Corner	South East Coastal Ranges
3411	Tollgate Island Littoral Scrub	Grasslands	Maritime Grasslands	South East Corner	Bateman
3720	Torrington Riparian Forest-Scrub	Dry Sclerophyll Forests (Shrubby sub-formation)	Northern Tableland Dry Sclerophyll Forests	New England Tablelands	Binghi Plateau
3846	Tenterfield Plateau Kunzea Scrub	Heathlands	Northern Montane Heaths	New England Tablelands	Stanthorpe Plateau; Tenterfield Plateau
4124	Torrington Granite Shrub Forest	Dry Sclerophyll Forests (Shrubby sub-formation)	Northern Tableland Dry Sclerophyll Forests	Nandewar; New England Tablelands	Nandewar Northern Complex; Binghi Plateau; Tenterfield Plateau
4128	Northern New England Rock Outcrop Shrubland	Heathlands	Northern Montane Heaths	New England Tablelands	Binghi Plateau; Severn River Volcanics
4130	Warra Rockplate Shrubland	Heathlands	Northern Montane Heaths	New England Tablelands	Northeast Forest Lands; Round Mountain

Appendix B: Qualitative PCTs in the coast and tablelands bioregions

These qualitative PCTs cannot be identified or accessed using the Plot to PCT Assignment Tool.

Data in this table was sourced from BioNet Vegetation Classification edit application on 26 April 2021.

PCT ID	PCT name	Vegetation formation	Vegetation class	IBRA region(s)	IBRA subregion(s)
611	Grass Tree tall shrubland on shallow basalt soil and talus on the Liverpool Range, Brigalow Belt South Bioregion	Dry Sclerophyll Forests (Shrub/grass sub-formation)	New England Dry Sclerophyll Forests	Brigalow Belt South; Nandewar; NSW North Coast	Liverpool Range; Peel; Tomalla
774	Coast Banksia scrub on sand in the Elderslie area, Sydney Basin Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	Sydney Sand Flats Dry Sclerophyll Forests	Sydney Basin	Cumberland
2068	Moreton Bay Fig – Myrtle Ebony dry vine rainforest on sandstone at Pillar Rock, east of Grafton, South Eastern Queensland Bioregion	Rainforests	Dry Rainforests	South Eastern Queensland	Clarence Sandstones; Clarence Lowlands
2079	Blakes Wattle – Wilga – Wild Quince – Kurrajong thickets, NSW North Coast Bioregion and New England Tablelands Bioregion	Rainforests	Dry Rainforests	New England Tablelands; NSW North Coast	Walcha Plateau; Armidale Plateau; Coffs Coast and Escarpment; Carrai Plateau; Macleay Gorges; Upper Manning
2101	Black Wattle – Hill Kanuka – Coachwood – Mountain Banksia – Soft Corkwood low closed forest on shallow soils of the Dorrigo Escarpment, NSW North Coast Bioregion	Rainforests	Northern Warm Temperate Rainforests	NSW North Coast	Chaelundi; Coffs Coast and Escarpment
2247	Large-fruited Blackbutt shrubby open forest on conglomerates of the Broken Bago Range near Wauchope on the Mid North Coast, NSW North Coast Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	North Coast Dry Sclerophyll Forests	NSW North Coast	Macleay Hastings
2250	Blue-leaved Stringybark open forest on exposed sites in the Macleay-Hastings region, NSW North Coast Bioregion	Dry Sclerophyll Forests (Shrubby sub-formation)	North Coast Dry Sclerophyll Forests	NSW North Coast	Macleay Hastings