BioNet Web Service Developer guidelines

Release 4.0.2

Department of Climate Change,
Energy, the Environment and Water

NSW GOVERNMENT

Acknowledgement of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the Traditional Custodians of the lands where we work and live.

We pay our respects to Elders past, present and emerging.

This resource may contain images or names of deceased persons in photographs or historical content.

Artist and designer Nikita Ridgeway from Aboriginal design agency Boss Lady Creative Designs created the People and Community symbol.

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1. Introduction

BioNet is the trusted source of biodiversity data for New South Wales (NSW) and a resource for all. The BioNet Web Service provides an application-level open application programming interface (API). It enables developers to directly integrate biodiversity data into their software systems and unlock the innovation potential of this valuable data repository.

This guide provides advice for developers using the BioNet Web Service.

For information about the BioNet Web Map Services refer to the BioNet Web Map Service quick guide.

1.1 Available data

Release 4.0.2 of the BioNet Web Service makes the following data collections available:

Table 1 Names of BioNet Web Service entity sets within each data collection

Data collection	Description	Web service	Entity set
Species Sightings	Observations of species.	SpeciesSightings	SpeciesSightings_CoreData SpeciesSightings_AdditionalMeasurementsOrFacts SpeciesSightings_DeletedRecords
Species Names	Species names taxonomy, legislative status, and other attributes.	SpeciesNames	SpeciesNames
Threatened Biodiversity Profiles	Data on threatened species, populations, ecological communities and key threatening processes.	ThreatenedBiodiversity	ThreatenedBiodiversity_Species ThreatenedBiodiversity_Populations ThreatenedBiodiversity_EcologicalCommunities ThreatenedBiodiversity_TSGeographicData ThreatenedBiodiversity_TPGeographicData ThreatenedBiodiversity_TECGeographicData ThreatenedBiodiversity_KeyThreateningProcesses
Systematic Surveys (Flora Survey)	Data generated from systematic flora surveys.	SystematicFloraSurvey	SystematicFloraSurvey_SiteData
Vegetation Classification	Data on plant community types.	VegetationClassification	VegetationClassification_PCTDefinition VegetationClassification_PCTBenchmarks VegetationClassification_PCTStratumData VegetationClassification_PCTGrowthForm
NSW Landscapes	Data on NSW (Mitchell) Landscapes (overcleared landscapes).	NSWLandscapes	NSWLandscapes_MitchellLandscapes

The Thesaurus Web Service is an additional service to enhance search functionality. It does not relate to a data collection.

The data available via the BioNet Web Service are updated daily from the BioNet data repository (see Figure 1).

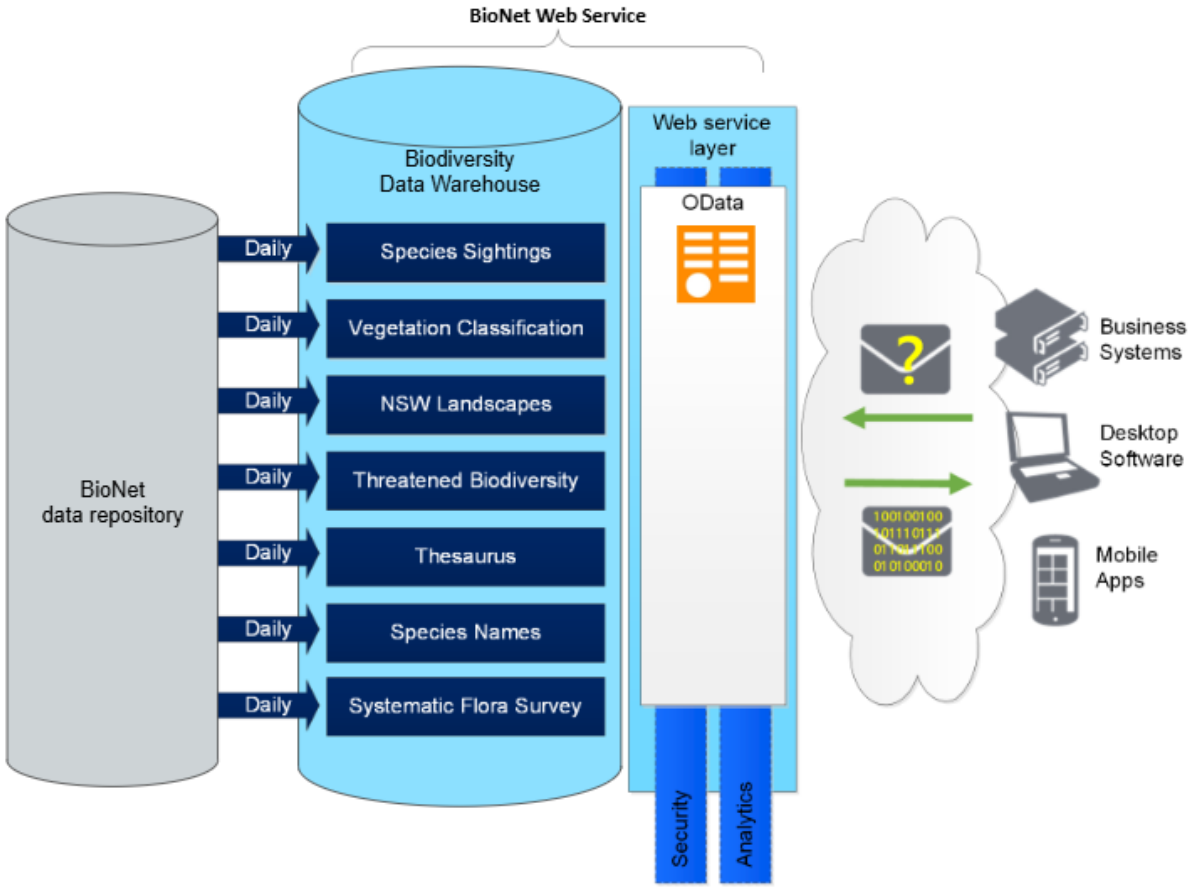

Figure 1 Overview of the BioNet Web Service implementation

The BioNet Web Service system architecture. The Biodiversity Data Warehouse is updated daily from the BioNet data repository and delivered as entity sets to your business systems and applications using OData.

2. Getting started

This section contains important information to understand and consider before starting development of your application.

2.1 Support provided by the BioNet team

The BioNet team provides advice to help guide you in your development decision making, particularly about the use and interpretation of data made available and best practice for well-formed queries.

The BioNet team will provide technical support for the server-side services – that is, for the correct functioning and availability of the API itself, and for the data that are served through that API.

For support email the BioNet team.

The BioNet team does not provide technical support for client-side applications, development toolkits or libraries. Support for these should be sourced from the vendor/supplier of the software or, in the case of open-source solutions, from the developer community.

2.2 Service level agreement

BioNet's target for the Web Service is to support 50 simultaneous connections and process a well-formed request retrieving up to 1,000 records within one second of the web service receiving the request. The service will be unavailable from 3 am to 6 am to allow us to run the daily data.

2.3 Data standards

Detailed information on the data available via the BioNet Web Service is documented in the following standards, which are available at BioNet web services:

- Species Sightings
- Vegetation Classification
- NSW Landscapes
- Threatened Biodiversity
- Species Names
- Thesaurus

2.4 Security restrictions on data

The BioNet Species Sightings data collection is provided based on user access level (see Sensitive Species Data Policy) and applies the same data security model as BioNet Atlas. Refer to Section 3 of the BioNet Atlas User Manual for user access levels.

Authentication is optional. If your application only requires public data, you can proceed with development as outlined in this guide. For higher-level access, apply for a Sensitive Species Data Licence.

Once granted the licence, authenticate to the Web Service to access data from the Species Sightings data collection at the appropriate permission level. Without credentials, only publicly available data will be returned. Sensitive species data will be omitted, as indicated in the dataGeneralizations and dataWithheld fields. Some records are not publicly shareable and will be withheld from uncredentialled queries.

2.5 Terms and conditions

There are specific terms and conditions for the data shared via the Species Sightings Web Service that application owners must read and accept before developing their application.

2.6 Restrictions on implementation of OData

2.6.1 $orderby query option

To prevent sorting on properties that are not indexed in the database, **$orderby** has been restricted to the following fields for SpeciesSightings_CoreData:

- catalogNumber
- scientificNameID
- consequence
- locationID
- PNFFilter
- occurrenceStatus
- taxonRank
- stateProvince
- coordinatePrecision
- datasetID
- occurrenceID

2.6.2 any and all functions

The **any ()** and **all ()** functions have been disabled to mitigate the risk of slow query performance and enable the service to enforce the page limits. This will not restrict the data that a user can extract; rather, it limits data served to 100,000 rows per page.

2.6.3 Filtering of navigation properties

Support for filtering on navigation properties will not be implemented. Filtering on navigation properties can result in a join, which will affect the performance of the service. This will not affect the usability of the service for users, as the underlying data model does not support this type of filtering.

2.6.4 Server-side queryable attributes

The BioNet team has implemented server-side queryable attributes to safeguard against large data returns and provide query optimisations. The attributes that have been implemented include:

- PageSize = 100,000
- MaxNodeCount = 50

2.7 Best practice when creating OData queries

2.7.1 Simplify queries when large data packets are expected

Construct queries with the fewest numbers of parameters to retrieve an approximation of your required data and then conduct post-processing on the client side where possible.

Queries placing excessive demand on the server will be reviewed and may be terminated.

2.7.2 Paging options

The Web Service has been optimised to use OData “server-driven paging”.

It is recommended to use the next link URL **@odata.nextLink** returned at the end of the dataset. For example:

> "samplingProtocol":null,"coordinatePrecision":"9","coordinateUncertaintyInMeters":1000.0000,"country":"Australia","countryCode":"AU","county":"BEGA VALLEY","decimalLatitude":-36.507551256,"decimalLongitude":149.770453011,"easting":748113,"geodeticDatum":"GDA94","georeferenceProtocol":null,"locality":"locality withheld","locationID":"3464-HO","locationRemarks":"locationRemarks withheld","mapSheetNumber":"8824 - BEGA","maximumElevationInMeters":null,"minimumElevationInMeters":null,"northing":5956184,"stateProvince":"NSW","zone":55,"class":"Mammalia","family":"Peramelidae","genus":"Isoodon/Perameles","infraspecificEpithet":null,"kingdom":"Animalia","nomenclaturalCode":"ICZN","order":"Peramelemorphia","scientificName":"Isoodon/Perameles sp.","scientificNameAuthorship":"NPWS Code","scientificNameID":"T081","sortOrder":3729,"specificEpithet":"sp.","taxonRank":"Genus","vernacularName":"unidentified Bandicoot**"}],"@odata.nextLink":"https://data.bionet.nsw.gov.au/biosvcapp/odata/SpeciesSightings_CoreData?$skiptoken=catalogNumber-%2725374-HO%27"**}

Paging through large datasets by specifying **$top** and **$skip** OData query operators should be avoided (e.g., .../odata/SpeciesSightings_CoreData/?$top=1000&$skip=0 .../odata/SpeciesSightings_CoreData/?$top=1000&$skip=1000).

2.7.3 Avoid using $count=true

This operator forces the database engine to scan the entire dataset (millions of rows!) to calculate this value. When paging through a large dataset a page at a time, it causes significant delay.

Tip: Count the total rows in the script after downloading the data (on the client side). Alternatively, request the total count just once and then separately request the table data.

✓ **Correct:**
https://data.bionet.nsw.gov.au/biosvcapp/odata/SpeciesSightings_CoreData/$count

This query has low overheads and has good performance because the count is computed just once:

✗ **Incorrect:**
https://data.bionet.nsw.gov.au/biosvcapp/odata/SpeciesSightings_CoreData/?$count=true

This query has bad performance, significantly affecting the download speed of the dataset because the database engine computes the total count for each block of 100,000 rows returned:

2.7.4 Use compression

For tools that support automatic HTTP decompression, several modern compression formats are now supported. For best results, use **br** (Google Brotli), or **gzip**. This can reduce the volume of data downloaded by approximately half and is especially useful when downloading the data over internet connections that are 100 Mbps or slower.

Examples:

```
curl -compressed
https://data.bionet.nsw.gov.au/biosvcapp/odata/SpeciesSightings_CoreData

Invoke-RestMethod -Headers @{"Accept-Encoding"="br"}
https://data.bionet.nsw.gov.au/biosvcapp/odata/SpeciesSightings_CoreData
```

2.7.5 $apply operator

The **$apply** operator is used for aggregations and its intended use in the BioNet Web Service is to produce lists of unique names using the `groupby` transformation. Best practice is to limit the number of fields to which you are applying the `groupby` to the minimum required to achieve your use case. For example, the query to generate a species list for a national park is limited to just the reserve name, scientific name and common (vernacular) name. The **$apply** feature can be used to dynamically generate picklists for apps to filter the data.

2.7.6 $orderby query option

The **$orderby** query option sorts results returned in either descending or ascending order. Best practice is to not use this option and instead to undertake sorting on the client side of your application.

However, if sorting on the server side is required it should be noted that ordering is very resource-intensive and can result in query time-outs. In this instance, best practice is to combine the **$orderby** with a **$filter** operator to limit the result set that is being sorted.

In testing, it was found that sorting result sets of ±500,000 records performed acceptably.

For example, **?$filter=vernacularName eq 'Square-tailed Kite'&$orderby=locationID desc**.

2.7.7 Which fields should my query target?

The **eq** operator can be used on any field.

2.7.8 Recommended fields?

The BioNet team recommends that you return the dcterms_bibliographicCitation and a unique identifier for the records (e.g. catalogNumber for Species Sightings, PCTID for Vegetation Classification, profileID for Threatened Biodiversity). These fields enable the record to be identifiable in case a data audit is required.

2.8 Acknowledging BioNet Web Service in applications

Please contact us for how you can best attribute BioNet Web Service in your application.

2.9 BioNet Web Service URL

View the BioNet Web Service URL.

2.10 Architecture

All requests are made using HTTPS to the relevant service URL.

HTTPS request with App Token or Basic Auth in header and conforming to the OData protocol.

Web service processes request and send responses in JSON format. No other formats are supported at this time.

OData response contains results. Results are paged at 100,000 rows per page with a 'NEXTLINK' link embedded in the data. Note that this only occurs if the resultant record count is greater than 100,000. For example, **'@odata.nextLink":"https://data.bionet.nsw.gov.au/biosvcapp/odata/SpeciesSightings_CoreData?$skiptoken=catalogNumber-%2725374-HO%27'.**

2.11 Authentication

2.11.1 Authenticate using App Token:

To authenticate using an App Token, include the token you have been supplied within the ‘access_token’ header of the HTTP request. Below is an example:

GET /biosvcapp/odata/SpeciesSightings_CoreData?$top=1 HTTP/1.1

Host: data.bionet.nsw.gov.au

access_token:
9waEWNa1J6k=:KvDKDEs2QymAHMo9JbBhDzZX8W/Ppd4+g753kSdherAtHzgQ
+x4a12v8HJPdYqSSCYI3uByibc8mY+7voHflPFqp/e+7i6M9CpNqBFwcAzw=

Accept-Encoding: gzip, deflate, br

Connection: keep-alive

2.11.2 Authenticate using Basic Auth:

Alternatively, you can authenticate using Basic Auth by supplying the encoded username and password (following the standard Base64 encoding process) in the ‘Authorization’ header. The username and password are combined into a single string in the format username:password, which is then Base64 encoded. Below is an example:

GET /biosvcapp/odata/SpeciesSightings_CoreData?$top=1 HTTP/1.1

Host: data.bionet.nsw.gov.au

Authorization: Basic TYAcSk2cW2tkUOaNJKLmqeZvdR1p

Accept-Encoding: gzip, deflate, br

Connection: keep-alive

3. Samples

3.1 Sample OData queries

Calling the Species Sightings Web Service returns the first 100,000 rows of the dataset. All queries return data paged at 100,000 rows at a time; the NEXT link is at the bottom of the output.

Server-side queryable attributes. Note this list is not exhaustive. For a full list of attributes use the metadata url [https://data.bionet.nsw.gov.au/biosvcapp/odata/$metadata].

- ?$filter=catalogNumber eq '065000001'
- ?$select=catalogNumber,scientificName,vernacularName
- ?$filter=contains(vernacularName,'River Red')
- ?$filter=startswith(vernacularName,'Red')
- ?$filter=startswith(toupper(vernacularName),'RED')
- ?$filter=endswith(scientificName,'camaldulensis')
- ?$filter=indexof(vernacularName,'blue') gt -1
- ?$filter=(PNFFilter eq 'Y')&$select=catalogNumber,recordNumber,scientificNameID,scientificName,vernacularName,PNFFilter&$orderby=scientificNameID
- ?$select=catalogNumber,scientificNameID,scientificName,vernacularName,PNFFilter,decimalLatitude,decimalLongitude,geodeticDatum&$filter=((decimalLongitude ge 142.0) and (decimalLongitude le 142.5)) and ((decimalLatitude lt -32.000000001) and (decimalLatitude gt -32.499999999))&$orderby=scientificNameID

4. Data BioNet collects

The service logs request details for internal analytics usage. The following information is captured:

- Web Service name
- Request parameters (excluding password or token)
- Date and Time of request
- Data Size of response
- Geographic Location of requestor
- User name
- Application ID
- User type
- IP address