

EcoPlots - The data Integration platform for systematic site-based surveys



Siddeswara Guru, **Javier Sánchez González**, Avinash Chandra, Arun Singh Ramesh, Junrong Yu, Gerhard Weis

j.sanchezgonzalez@uq.edu.au | www.tern.org.au

28/04/2025

We at TERN acknowledge the Traditional Owners and Custodians throughout Australia, New Zealand and all nations. We honour their profound connections to land, water, biodiversity and culture and pay our respects to their Elders past, present and emerging.



Context

In ecological site-based surveys...

- data collection happens as part of a site visit...
- to observe and measure real world features of the site
- Diverse data are collected, samples taken and archived... to measure attributes



Challenges – Data integration

- No common survey protocols/methods used across different surveys
- Multiple data formats and schemas
- Multiple terminologies and definitions
- There is no agreed standard to share field-based survey data



Challenges – Data Integration

Need for standards to exchange data

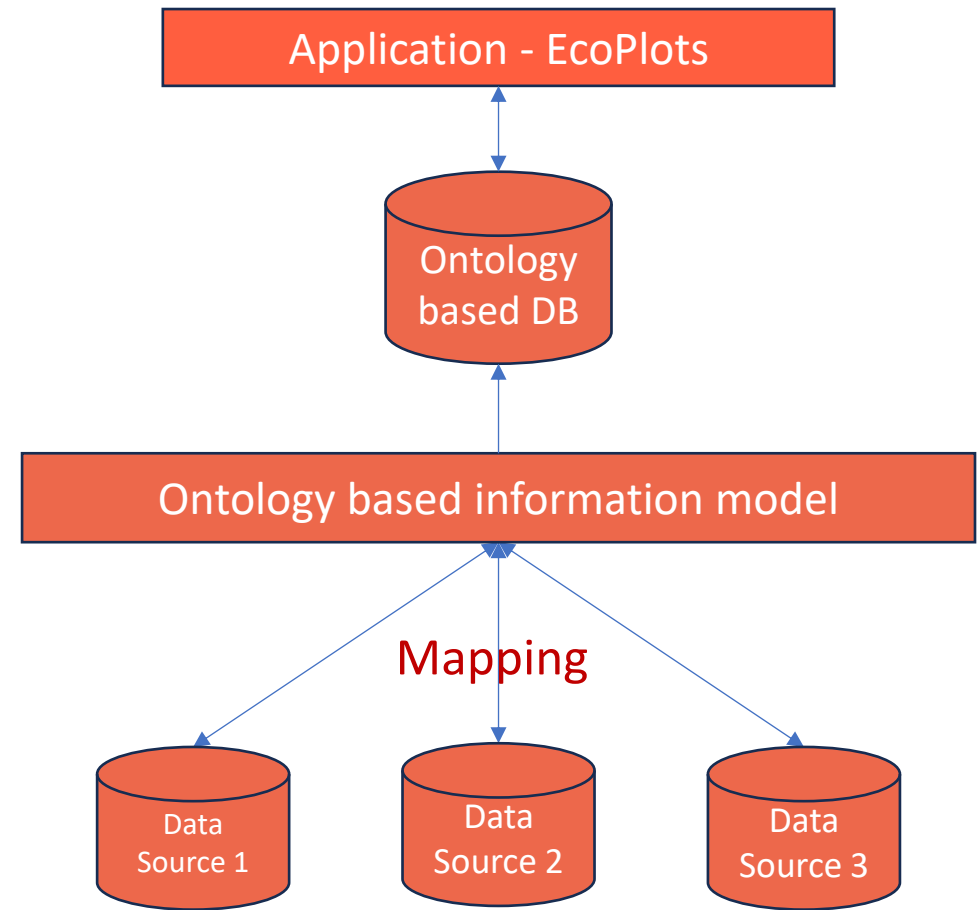
- share data across different sources
- use data from multiple sources
- enable data interoperability
- enable standard representation of data
 - develop validation tools



Ontology-based Data Integration

Ontology is a formal description of knowledge as a set of concepts within a domain

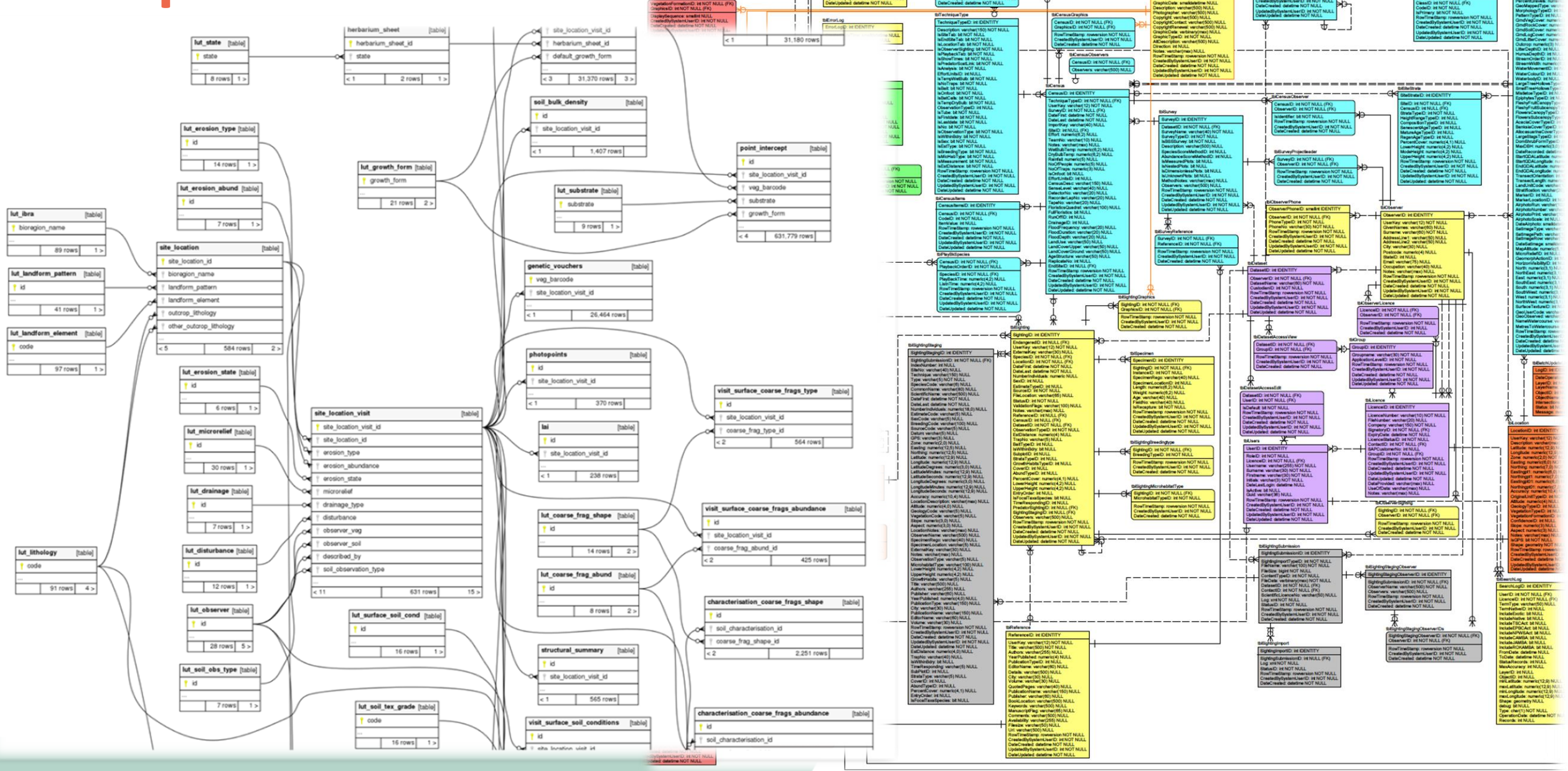
Enables sharable and reusable knowledge representation



Information Model

- Based on Semantic Sensor Network Ontology (SSN)
- Dependent on RDF, RDFS, Dublin core, GeoSPARQL
- Expressed in OWL - Web Ontology Language
- Shapes Constraint Language (SHACL) for validation
- Simple Knowledge Organization System (SKOS) to represent controlled vocabularies

Complex schemas

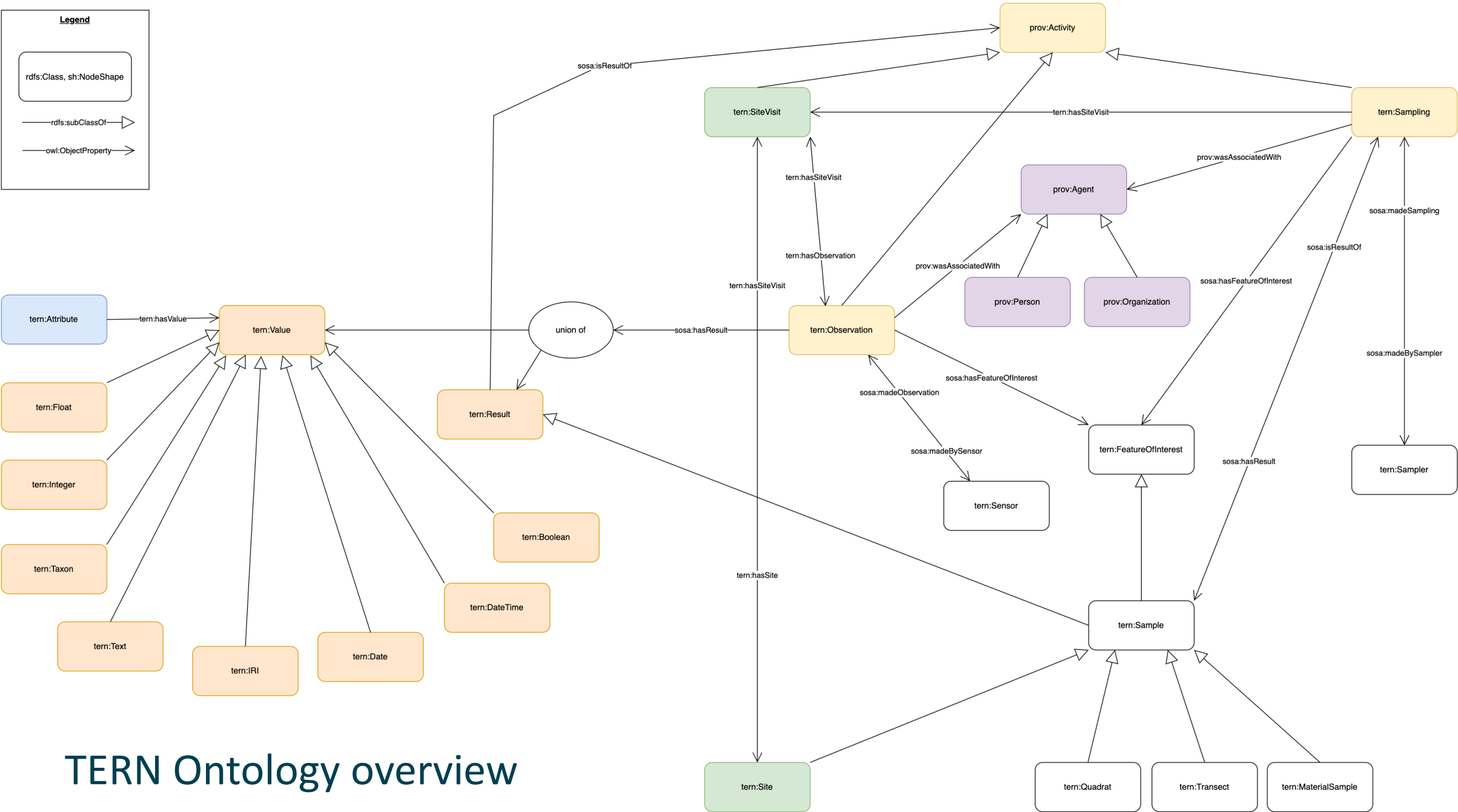


Legend

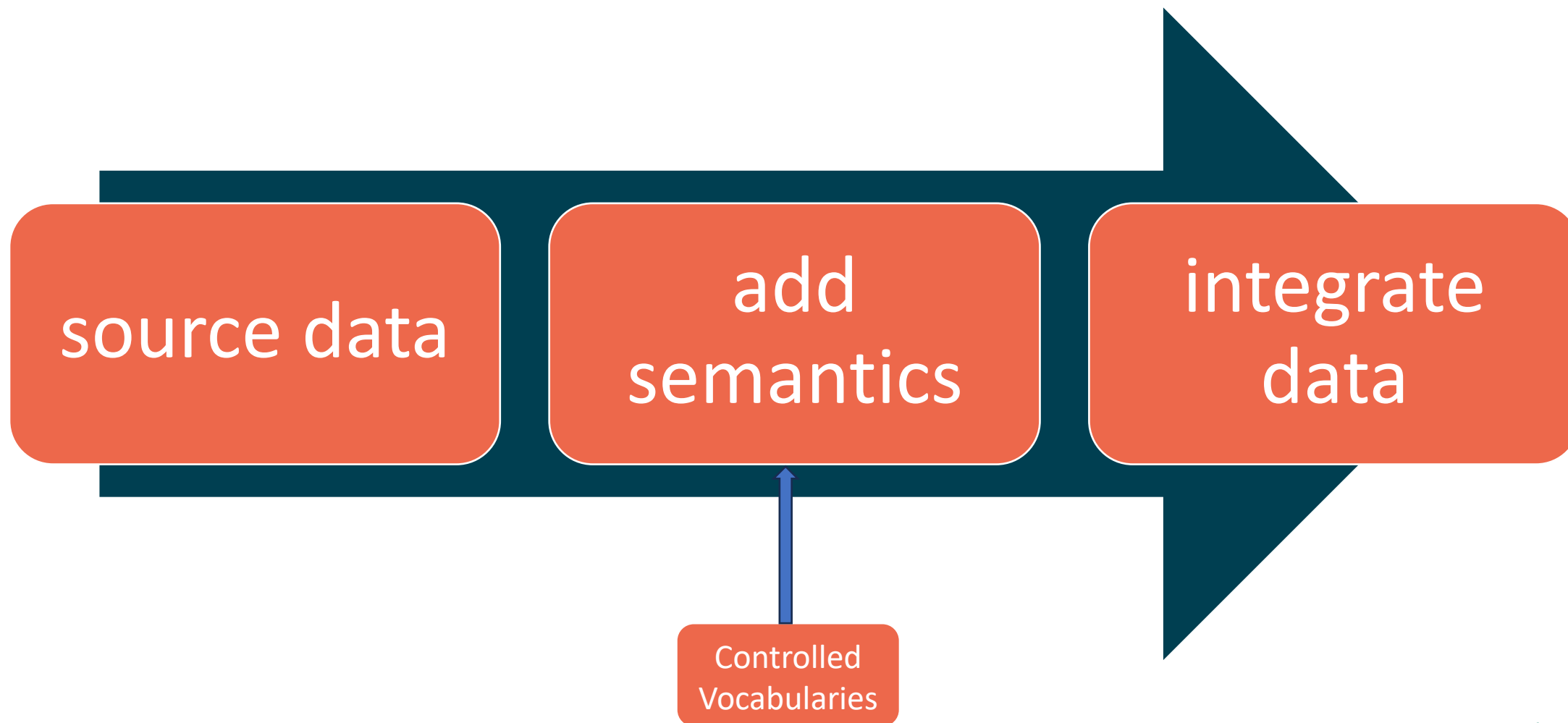
rdfs:Class, sh:NodeShape

rdfs:subClassOf

owl:ObjectProperty



TERN Ontology overview





<https://ecoplots.tern.org.au>

Map View Get Data </> API

Filter by: Clear All Filters

Region Types and Regions (1)

Region types and regions

Region Types Show results

Type of region where the site is located Clear

Bioregions

Region

The region where the site is located Clear

Cape York Peninsula X

Data Sources, Datasets, Projects,

Sites and Visits (1)

Data sources, datasets, projects, sites and site visits

Data Sources Show results

The data source name Clear

TERN Surveillance Monitoring X

Sites

The site name

Select site

site visit

plant occurrence

Rows: 175,718 Page Size: 50

« < 1 > »

Data source	Site id	Site visit id	Site visit date	Latitude	Longitude	Feature of interest	Parameter	Result value	Result time	Unit of measure	Method
TERN Surveillance Monitoring	QDACYP0010	20180614	14/06/2018	-13.09186	142.7728	plant occurrence	plant height	0.21	14/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0002	20180607	07/06/2018	-15.28454	145.1915	plant occurrence	plant height	0.05	07/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0020	20180710	10/07/2018	-10.93617	142.467	plant occurrence	plant height	2	10/07/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0002	20180607	07/06/2018	-15.28454	145.1915	plant occurrence	plant height	0.05	07/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0023	20180712	12/07/2018	-12.33224	142.2311	plant occurrence	plant height	0.01	12/07/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0013	20180704	04/07/2018	-12.20213	142.5687	plant occurrence	plant height	0.3	04/07/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0001	20180607	07/06/2018	-15.27823	145.2528	plant occurrence	plant height	0.66	07/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0011	20180614	14/06/2018	-13.20697	142.7398	plant occurrence	plant height	0.2	14/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0003	20180608	08/06/2018	-15.27674	145.2863	plant occurrence	plant height	0.21	08/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0003	20180608	08/06/2018	-15.27674	145.2863	plant occurrence	plant height	0.07	08/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0005	20180610	10/06/2018	-14.14262	142.9763	plant occurrence	plant height	0.05	10/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0006	20180611	11/06/2018	-14.22668	142.9325	plant occurrence	plant height	9	11/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0012	20180615	15/06/2018	-13.32028	142.5913	plant occurrence	plant height	3	15/06/2018	metre	Point intercept
TERN Surveillance Monitoring	QDACYP0002	20180607	07/06/2018	-15.28454	145.1915	plant occurrence	plant height	0.6	07/06/2018	metre	Point intercept



- Ability to search and access at individual observation
- Provide facets to search based on...

Region Types Q Show results

Type of region where the site is located Clear

Bioregions

Region

The region where the site is located Clear

Cape York Peninsula

Arnhem Plateau (40,166)

Australian Alps (126,214)

Avon Wheatbelt (22,589)

Ben Lomond (17,243)

Brigalow Belt North (12,263)

Brigalow Belt South (92,820)

Broken Hill Complex (76,671)

Burt Plain (50,282)

Parameters

The parameters name

plant

non-woody vascular plant cover (33,678)

non-woody vascular plant cover mean (873)

plant carbon mass (716)

plant count (210,363)

plant cover (58)

plant fuel dry biomass (234)

plant fuel water content (234)

plant functional type (2,222)

Data Sources

The data source name

Select data source

NSW FMIP (8,618)

QBEIS (1,713,700)

TERN AusPlots Forest (242,631)

TERN Ecosystem Processes (302,448)

TERN Surveillance Monitoring (4,345,714)

Three Parks Savanna (1,345,077)

Williams Wet Tropics Vertebrate database (599,793)

Feature Type

The feature name

Select feature type

landform (63,453)

plant community (242,058)

plant individual (708,372)

plant litter (1,432)

plant occurrence (3,522,647)

plant population (1,505,826)

plant specimen (99,412)

soil (38,575)

soil profile (35,760)

Species Name

Species name, taxonomic rank, etc.

One or more values, comma separated

Plantae, Eucalyptus...

- multiple geographic regions
- datasets, projects, sites
- feature type and attributes
- procedure used to collect data
- parameters / observable properties
- taxonomic information
- time range
- ...

```

{
  "type": "FeatureCollection",
  "features": [
    {
      "type": "Feature",
      "id": "http://linked.data.gov.au/dataset/tern-ecosystem-processes/dataset-vegetation_species/sv-alice_mulga",
      "properties": {
        "dataset": {
          "dataset.title": "TERN Ecosystem Processes",
          "dataset.attributes": {}
        },
        "site": {
          "siteName": "Alice Mulga, corelha",
          "parentSite": "Alice Mulga",
          "site.attributes": {
            "plotwidth_Metre": {
              "attribute": "plot width_ metre",
              "value": 100.0,
              "unit": "Metre"
            },
            "plotlength_Metre": {
              "attribute": "plot length_ metre",
              "value": 100.0,
              "unit": "Metre"
            }
          }
        },
        "siteVisit": {
          "siteVisitName": "20120123",
          "siteVisitDate": "2012-01-23T00:00:00"
        },
        "observations": [
          {
            "featureId": "http://linked.data.gov.au/dataset/tern-ecosystem-processes/dataset-vegetation_species/sv-alice_mulga/obs-20120123-001",
            "feature.type": "plant individual",
            "featureId.attributes": {},
            "feature.observations": {
              "scientificName": {
                "observableProperty": "scientific name",
                "attributes": {},
                "value": "Acacia aneura",
                "unit": null,
                "resultTime": "2012-01-23T00:00:00",
                "usedProcedure": "http://linked.data.gov.au/def/tern-cv/0f7b2bf3-2012-01-23T00:00:00"
              }
            }
          }
        ]
      }
    }
  ]
}

```

- Data download based on BagIT specification
 - as CSV
 - as GeoJSON
- Data accessible through API and SPARQL endpoint
- Mint DOI to improve the reusability of data

tern Ecosystem Research Infrastructure

TERN SPARQL Query Editor

Query X +

```

1 PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
2 PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
3 SELECT * WHERE {
4   ?sub ?pred ?obj .
5 } LIMIT 10

```

	A	B	C	E	F
1	datasetTitle	projectTitle	siteName	latitude_Degree	longitude_Degree
2	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.2
3	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.2
4	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.2
5	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251
6	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251
7	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251
8	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251
9	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251
10	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251
11	TERN Ecosystem Processes	Vegetation species	NTABRT0002	-22.2837	133.251

Swagger
powered by SMARTBEAR

openapi.yaml

TERN EcoPlots REST API 1.0 OAS 3.0

openapi.yaml

Providing machine readable search and download endpoints to support the discovery of ecological plot data.

All API endpoints need system generated API Key to access and retrieve data. Login to [Term Account](#) to generate API Key. Click on how to use [API Key usage](#) to learn more. The user manual

[Terms of service](#)
[TERN esupport - Website](#)
[Send email to TERN esupport](#)
[Creative Commons 4.0](#)

Servers

Dataqueries Discovers and/or returns all data based on species.

POST /data Get the data as GeoJSON or CSV.

Conclusions

- Built common information Model as an extension to Observation and Measurement (O&M) standards and SOSA ontology for data integration
 - The information model is the domain model in the Biodiversity Data Repository (BDR) built by the Australian Government
- Built semantic web platform to integrate systematic-survey data collections
- Ability to query data at single observation from a particular site visit

Further Information

- TERN Information Model: <https://linkeddata.tern.org.au/tern-ontology/>
- TERN Vocabularies: <https://linkeddata.tern.org.au/prez/tern-cv/v/>
- EcoPlots: <https://ecoplots.tern.org.au>
- TERN: [TERN - Australia's Terrestrial Ecosystem Research Network](#)
- BDR: [Biodiversity Data Repository - DCCEEW](#)



We at TERN acknowledge the traditional owners and their custodianship of the lands on which TERN operates. We pay our respects to their ancestors and their descendants, who continue cultural and spiritual connections to country.

TERN is enabled by NCRIS.

Our work is a result of collaborative partnerships with many universities and institutions.

To find out more please go to **tern.org.au**.

Acknowledgement: TERN Data Services and Analytics Team, ARDC Infrastructure

Contact: Javier Sánchez González, j.sanchezgonzalez@uq.edu.au

