



Food and Agriculture
Organization of the
United Nations

GLOBAL SYMPOSIUM ON SOIL INFORMATION AND DATA

MEASURE
MONITOR
MANAGE

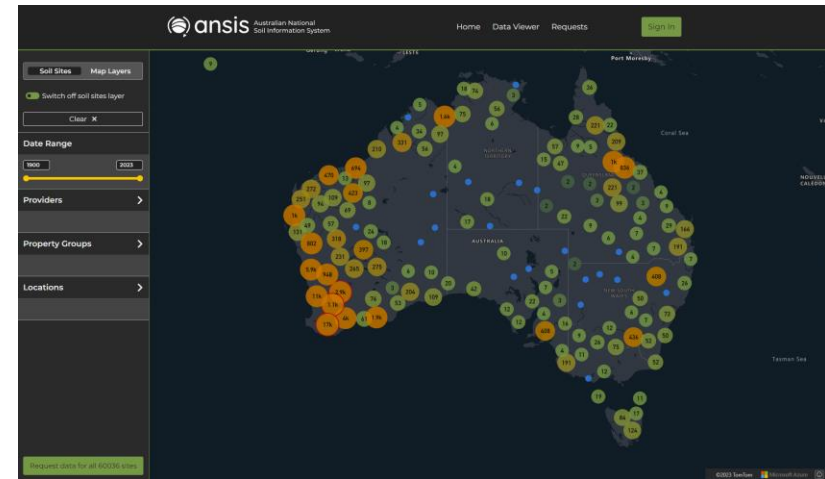
Australian National Soil Information System: Soil Information Models Alistair Ritchie

September 25-28, 2024
Nanjing, China



Australian National Soil Information System

- ANSIS delivers soil data from
 - private parties
 - research institutes
 - government agencies
- These are managed in different ways and for different purposes
- Must be harmonised for ANSIS



Sub-theme 1.2: Soil Data Standardization And Harmonization

Innovative technology, soil information modelling and distributed query allow delivery of nationally standardised soil site and analytical data through a well-governed Australian national soil information system (ANSIS)

Peter Wilson - Commonwealth Scientific And Industrial Research Organisation (CSIRO), Australia

ANSIS information models for harmonization

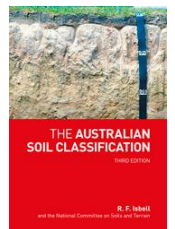
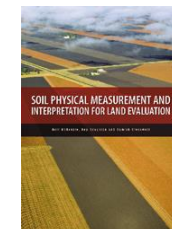
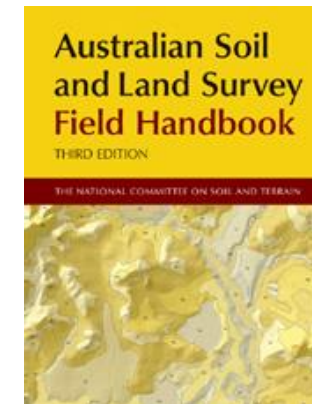
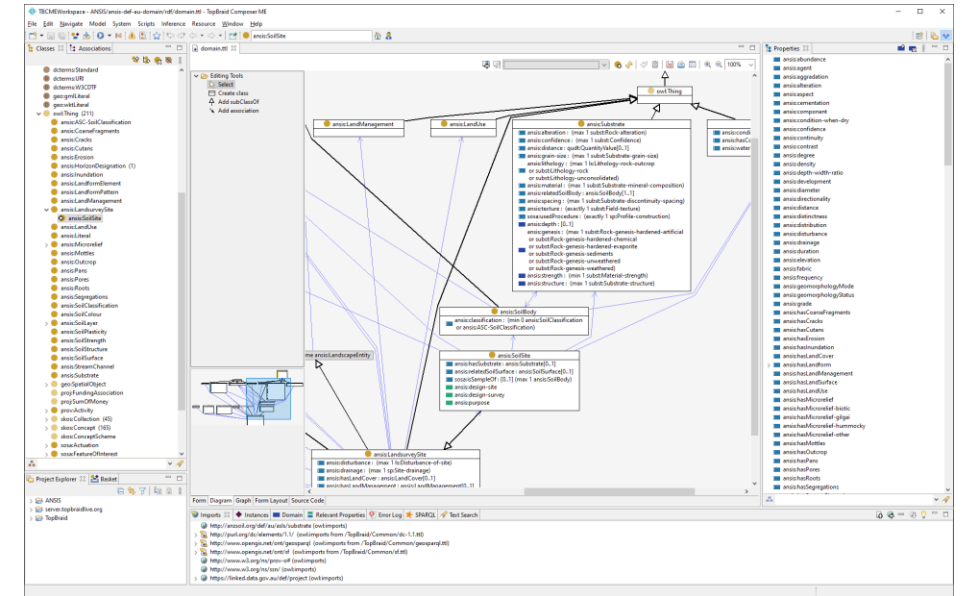
- Need a common information model to which the provider data can be mapped
 - Ontology: a conceptual view of soils
- Need schema for implementation and data delivery formats
 - JSON Schema: a physical data model for soils

ANSIS Soil Ontology

- Defined according to
 - a scientific understanding of soils
 - nationally agreed practices for sampling and describing them
- Based on other environmental models
 - Terrestrial Ecosystem Research Network
 - Global Soil Information System
 - ANZSoilML
 - multi-national soil and environmental data exchange experiments
- But prioritises the work of the Australian soil community
 - e.g. the Australian Soil and Land Survey Field Handbook

ANSIS Soil Ontology

- Developed using Semantic Web modelling languages and tools
 - Web Ontology Language (OWL)
 - Resource Description Framework (RDF)
- Concepts from Australian soil community publications



... something new, something borrowed ...

Semantic Sensor Network Ontology

W3C Recommendation 19 October 2017 (Link errors corrected 08 December 2017)

OGC® **W3C**
Making location count.

This version:
<https://www.w3.org/TR/2017/REC-vocab-ssn-20171019/>

Latest published version:
<https://www.w3.org/TR/vocab-ssn/>

Latest editor's draft:
<https://w3c.github.io/sdw/ssn/>

Implementation report:
<https://w3c.github.io/sdw/ssn-usage/>

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<https://www.w3.org/TR/2017/PR-vocab-ssn-20170907/>

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[GitHub](#)
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Please check the [errata](#) for any errors or issues reported since publication.

See also [translations](#).

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Extensions to the Semantic Sensor Network Ontology

Open Geospatial Consortium Key topics ↓ About ↓ Innovation ↓ Standards ↓

Home / Standards / Observations and Measurements

Observations and Measurements

PROV-O: The PROV Ontology

W3C Recommendation 30 April 2013

This version:
<https://www.w3.org/TR/2013/REC-prov-o-20130430/>

Latest published version:
<https://www.w3.org/TR/prov-o/>

Implementation report:
<https://www.w3.org/TR/2013/NOTT-prov-implementation-20130430/>

Previous version:
<https://www.w3.org/TR/2013/PR-prov-o-20130312/>

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Please refer to the [errata](#) for this document, which may include some normative corrections.

The English version of this specification is the only normative version. Non-normative [translations](#) may also be available.

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A Project ontology

IRI:
<https://linked.data.gov.au/def/project>

Creator(s):
Simon J. Cox, *(simon.cox@csiro.au) of Commonwealth Scientific and Industrial Research Organisation*

Contributor(s):
Peter Brenton, *CSIRO*

Created:
2017-08-14

Modified:
2020-04-24

Imports:
[sdw:ssn](#)
<https://www.w3.org/2004/02/skos/core>
<https://www.w3.org/ns/time>
<https://www.w3.org/ns/org>

License:
<https://creativecommons.org/licenses/by/4.0/>

Ontology RDP:
[RDF Hurtle](#)

Code Repository:
<https://github.com/uk-ebert/linked-ssn>

GeoSPARQL – A Geographic Query Language for RDF Data

Open Geospatial Consortium Key topics ↓ About ↓ Innovation ↓ Standards ↓ Resources ↓

Home / Standards / GeoSPARQL – A Geographic Query Language for RDF Data

SKOS Simple Knowledge Organization System Reference

W3C Recommendation 18 August 2009

This version:
<http://www.w3.org/TR/2009/REC-skos-reference-20090818/>

Latest version:
<http://www.w3.org/TR/skos-reference>

Previous versions:
<http://www.w3.org/TR/2009/PR-skos-reference-20090615/>

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Please refer to the [errata](#) for this document, which may include some normative corrections.

See also [translations](#).

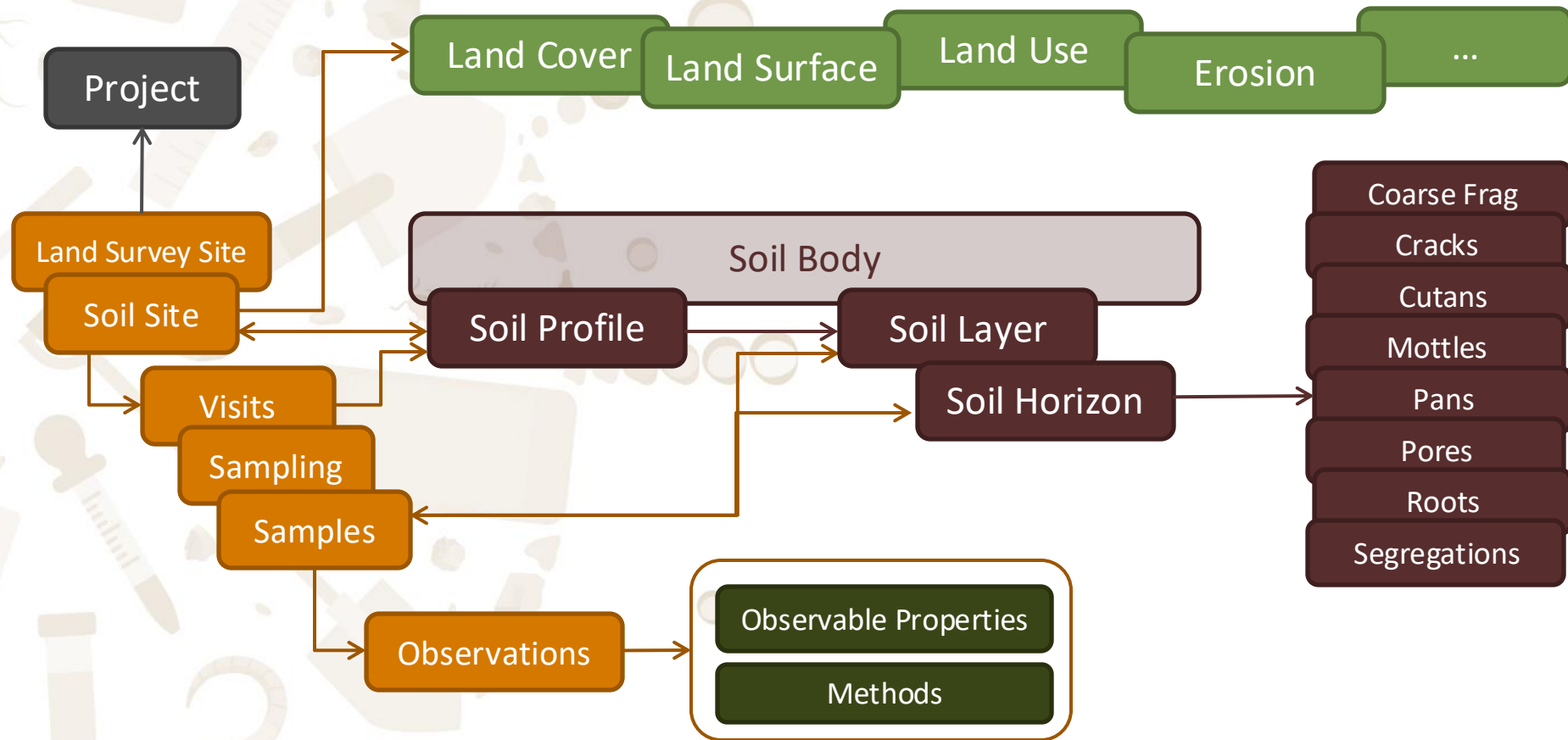
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QUDT

Home QUDT Overview QUDT Catalog

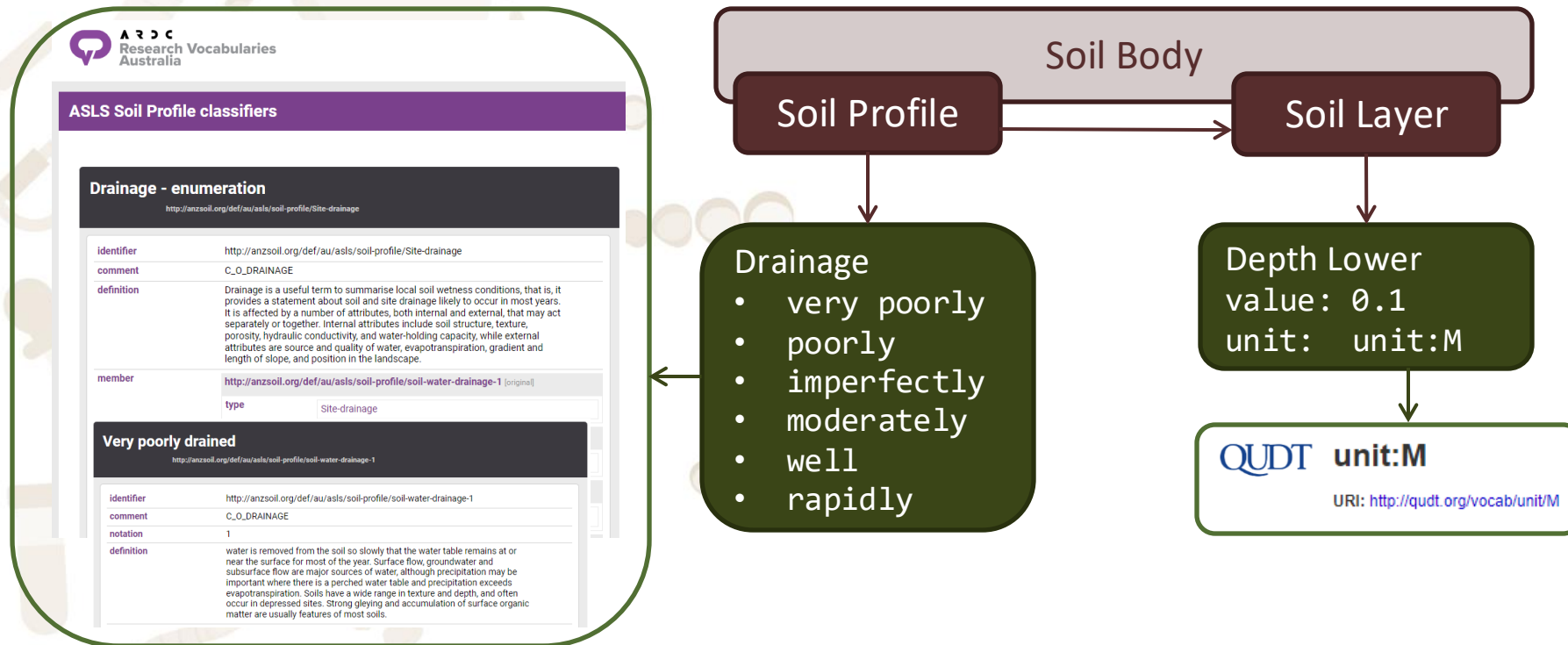
```
graph TD
    Quantity --> QuantityValue[Quantity Value]
    Quantity --> QuantityKind[Quantity Kind]
    Quantity --> QuantityKindDimensionalIndicator[Quantity Kind Dimensional Indicator]
    QuantityValue --> Unit
    QuantityKind --> Unit
    QuantityKindDimensionalIndicator --> Unit
    Unit --> SystemOfUnits[System of Units]
```

ANSIS Soil Ontology Primer



ANSIS Soil Ontology Primer

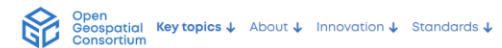
- Extensive use of controlled vocabularies and structured values



Observable Properties

- Asserted Properties
 - names; identifiers; projects
- Observed Properties ... AKA Soil Properties
 - value estimated by a particular sensor (includes people) according to a method
 - matrix colour; drainage; total Carbon; ...
- ISO/OGC Observations and Measurements
 - Observation event/activity metadata

Extensions to the Semantic Sensor
Network Ontology



[Home](#) / [Standards](#) / [Observations and Measurements](#)

**Observations and
Measurements**



Observations

ansis:drainage

hasResult: sp:soil-water-drainage-3

<http://anzsoil.org/def/au/asls/soil-profile/soil-water-drainage-3>

sp:soil-water-drainage-3

prefLabel: *imperfectly drained*

ansis:slope

hasResult:

value: 42

unit: unit:DEG

usedProcedure: Lf:slope-evaluation-A

<http://anzsoil.org/def/au/asls/landform/slope-evaluation-A>

Lf:slope-evaluation-A

prefLabel: *Abney Level or clinometer
and tape*

ansis:cationExchangeCapacity

hasResult:

value: 42

unit: unit:CentiMOL-PER-KiloGM

usedProcedure: scm:15I4

resultTime: 2023-01-26T07:50:00Z

<http://anzsoil.org/def/au/scm/15I4>

scm:15I4

prefLabel: *CEC measurement - titration
of NH₄ and Cl⁻*

Observable Properties and Methods

observable properties chemical and physical						
File Edit View Insert Format Data Tools Extensions Help						
100% 123 Default... 10 B I A						
H1	A	B	C	D	E	F
1	Collection	(constituent or soil fraction)	ObservableProperty	Notation	Procedure identifier	result type
2	Chemical	bedrock fragment	Presence or absence of carbonates	-	http://anzsoil.org/default/scm/19C1	code - presence/absence
3		Carbonate concretions > nodules, three	Presence or absence of carbonates	-	http://anzsoil.org/default/scm/19C1	code - presence/absence
4		fine soil fraction (<2mm)	Acid neutralising capacity (CaCO3 equivalent)	- ANC BT	http://anzsoil.org/default/scm/20H1	number PERCENT
5			Aluminium saturation	-	http://anzsoil.org/default/scm/15O1	number PERCENT
6			Anion exchange capacity	- AEC	http://anzsoil.org/default/scm/15E1	number CentiMOL-PER-KiloGM
7					http://anzsoil.org/default/scm/15E2	number CentiMOL-PER-KiloGM
8					http://anzsoil.org/default/scm/15E3	number CentiMOL-PER-KiloGM
9			Anion storage capacity (previously P retention)	-	http://anzsoil.org/default/scm/9H1	number PERCENT
10			Base saturation percentage	- BSP	http://anzsoil.org/default/scm/15L1	number CentiMOL-PER-KiloGM
11			Cation exchange capacity	- CEC	http://anzsoil.org/default/scm/15C2	number CentiMOL-PER-KiloGM
12				- CEC	http://anzsoil.org/default/scm/15B1	number CentiMOL-PER-KiloGM
13					http://anzsoil.org/default/scm/15B2	number CentiMOL-PER-KiloGM
14					http://anzsoil.org/default/scm/15B3	number CentiMOL-PER-KiloGM
15					http://anzsoil.org/default/scm/15C1	number CentiMOL-PER-KiloGM
16					http://anzsoil.org/default/scm/15D1	number CentiMOL-PER-KiloGM
17					http://anzsoil.org/default/scm/15D2	number CentiMOL-PER-KiloGM
18					http://anzsoil.org/default/scm/15D3	number CentiMOL-PER-KiloGM
19					http://anzsoil.org/default/scm/15E1	number CentiMOL-PER-KiloGM
20					http://anzsoil.org/default/scm/15E2	number CentiMOL-PER-KiloGM
21					http://anzsoil.org/default/scm/15E3	number CentiMOL-PER-KiloGM
22					http://anzsoil.org/default/scm/15F1	number CentiMOL-PER-KiloGM
23					http://anzsoil.org/default/scm/15F3	number CentiMOL-PER-KiloGM
24					http://anzsoil.org/default/scm/15I1	number CentiMOL-PER-KiloGM
25					http://anzsoil.org/default/scm/15I2	number CentiMOL-PER-KiloGM
26					http://anzsoil.org/default/scm/15I3	number CentiMOL-PER-KiloGM
27					http://anzsoil.org/default/scm/15I4	number CentiMOL-PER-KiloGM
28					http://anzsoil.org/default/scm/15K1	number CentiMOL-PER-KiloGM
29			Colwell-P/PBI (ColP) ratio	-	http://anzsoil.org/default/scm/9K2	number
30			Effective cation exchange capacity	- ECEC	http://anzsoil.org/default/scm/15J1	number CentiMOL-PER-KiloGM
31			Electrical conductivity	- EC	http://anzsoil.org/default/scm/14B1	number DeciS-PER-M
32					http://anzsoil.org/default/scm/3A1	number DeciS-PER-M
33			Equilibrium phosphorus concentration	- EPC	http://anzsoil.org/default/scm/9J1	number MicroGM-PER-L
34					http://anzsoil.org/default/scm/9J2	number MicroGM-PER-L
35			Estimated soluble salts	-	http://anzsoil.org/default/scm/3B1	number DeciS-PER-M
36			Exchangable sodium percentage (ESP)	-	http://anzsoil.org/default/scm/15N1	number PERCENT
37			Exchange acidity	-	http://anzsoil.org/default/scm/15G1	number CentiMOL-PER-KiloGM
38					http://anzsoil.org/default/scm/15H1	number CentiMOL-PER-KiloGM

```
"electricalConductivity": {
  "$anchor": "electricalConductivity",
  "$id": "nil:template",
  "title": "electrical conductivity",
  "description": "Electrical conductivity (EC).",
  "type": "object",
  "range@type": [
    "sosa:ObservableProperty",
    "qudt:QuantityValue"
  ],
  "required": [
    "hasResult",
    "usedProcedure"
  ],
  "properties": {
    "hasResult": {
      "type": "object",
      "required": [
        "value",
        "unit"
      ],
      "properties": {
        "value": {
          "$ref": "../qudt.json#value"
        },
        "unit": {
          "$ref": "../qudt.json#unit",
          "enum": [
            "unit:DeciS-PER-M"
          ]
        }
      }
    },
    "usedProcedure": {
      "enum": [
        "scm:14B1",
        "scm:3A1"
      ]
    },
    "resultTime": {
      "$ref": "../sosa.json#resultTime"
    },
    "qualityOfObservation": {
      "$ref": "../sosa.json#qualityOfObservation"
    }
  }
}
```

ANSIS JSON Schema

- Converted the ontology into a JSON Schema
 - Rules for the structure and content of JSON documents
- Complimentary schema, not a replacement
- Constrains options in the ontology
 - Manageable 'graph'
- Why?
 - Consistent patterns for structure of data from an API/web service
 - Uses more widely available technology
 - (Slightly) less intimidating than an ontology

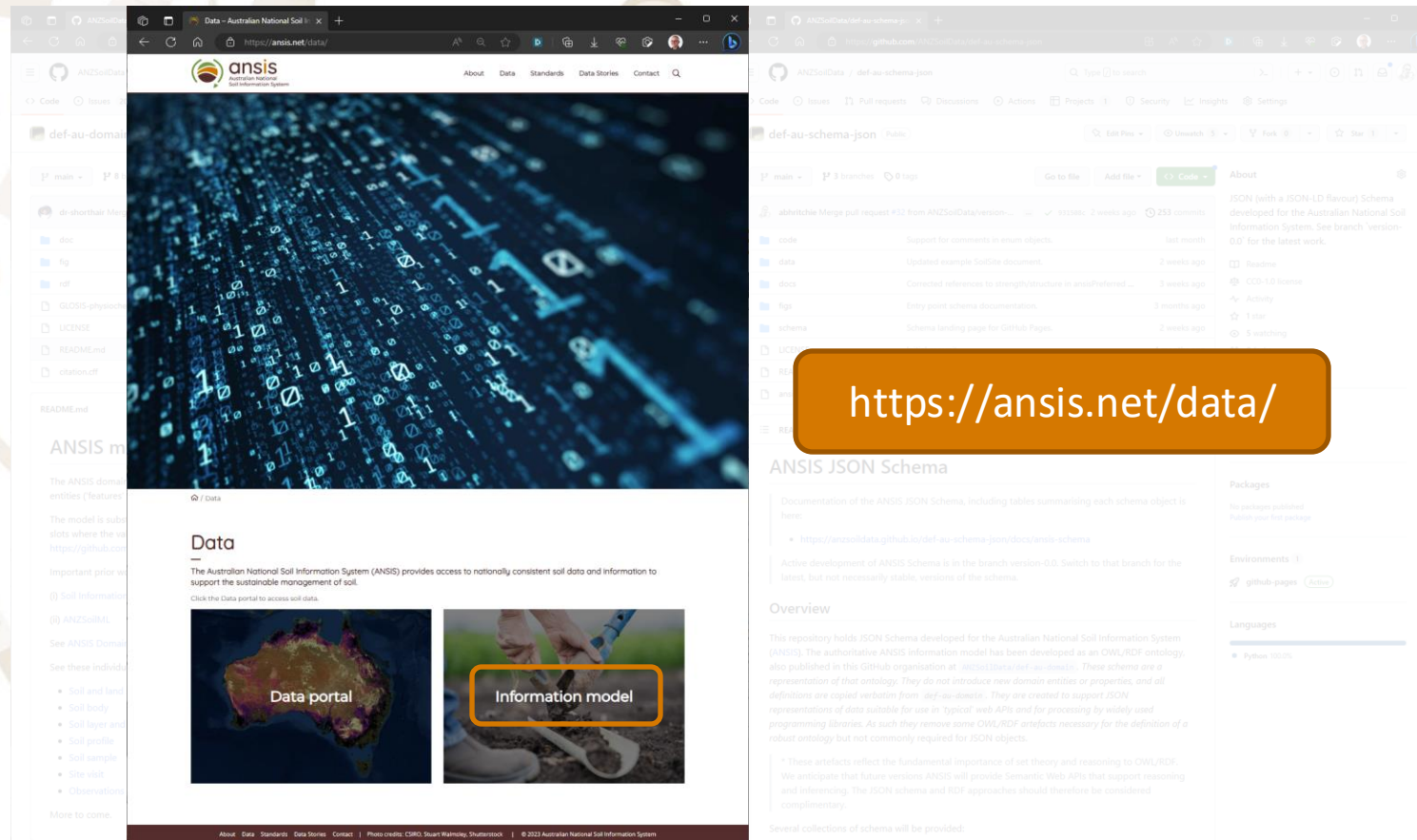

```

"relatedLayer": {
  depthInSeawater : {

```

The image is a vertical collage of promotional content for the Open Geospatial Consortium (OGC) and GeoPackage. At the top, the OGC logo (a stylized 'G' made of three cubes) is displayed next to the text 'Open Geospatial Consortium'. Below this is a map showing a geographical area with labels for 'Horseshoe Reservoir', 'Dixon Reservoir', and 'Vancouver-Spur Trail'. The middle section is titled 'Features' and contains the text 'Approved Standard' with a checkmark icon, followed by 'OGC API - Features - Part 1: Core and Part 2: Coordinate Reference Systems by Reference are both publicly available.' Below this text are two blue buttons: 'More Info' and 'GitHub repo'. The bottom section features the text '{ json:api }' in a large, stylized font, followed by 'A SPECIFICATION FOR BUILDING APIS IN JSON'. Below this are two more blue buttons: 'View the specification' and 'Contribute on GitHub'. The very bottom of the collage shows a 3D rendering of a cardboard box labeled 'GeoPackage' with the OGC logo, containing a globe of the Earth. A URL 'https://geo-package.org' is visible on the side of the box. The background of the collage is a light gray with faint, repeating text patterns like 'ons', 'at', 'aterial.', 'ss)', and 'ss)'.

ANSIS Information Model Documentation



The image displays two side-by-side screenshots. The left screenshot shows the ANSIS website (https://ansis.net/data/) with a header navigation bar and a main content area featuring a 'Data' section and a 'Data portal' image. The right screenshot shows the GitHub repository for 'def-au-schema-json' (https://github.com/ansisnet/def-au-schema-json) with a header navigation bar and a main content area featuring an 'ANSIS JSON Schema' section and an 'Overview' section. An orange box with the URL 'https://ansis.net/data/' is overlaid on the right screenshot.

<https://ansis.net/data/>

Conclusion

- Information models ensure scientifically robust harmonisation and delivery of consistent data.
- They support versatile data products that anticipate multiple ways of using the data, including
 - profile reports,
 - GIS layers, or
 - DSM-ready tables of data.
- ANSIS users will have unprecedented access to an Australia-wide soil dataset supporting robust modelling, research, and policy and decision making



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Megan Wong (Federation University of Australia)

THANK YOU



ansis

Australian National
Soil Information System



Federation
University



Manaaki Whenua
Landcare Research

