# Web-Based Demo to Show A Land Use Code Ontology

*www.ssec.wisc.edu/landuse/*

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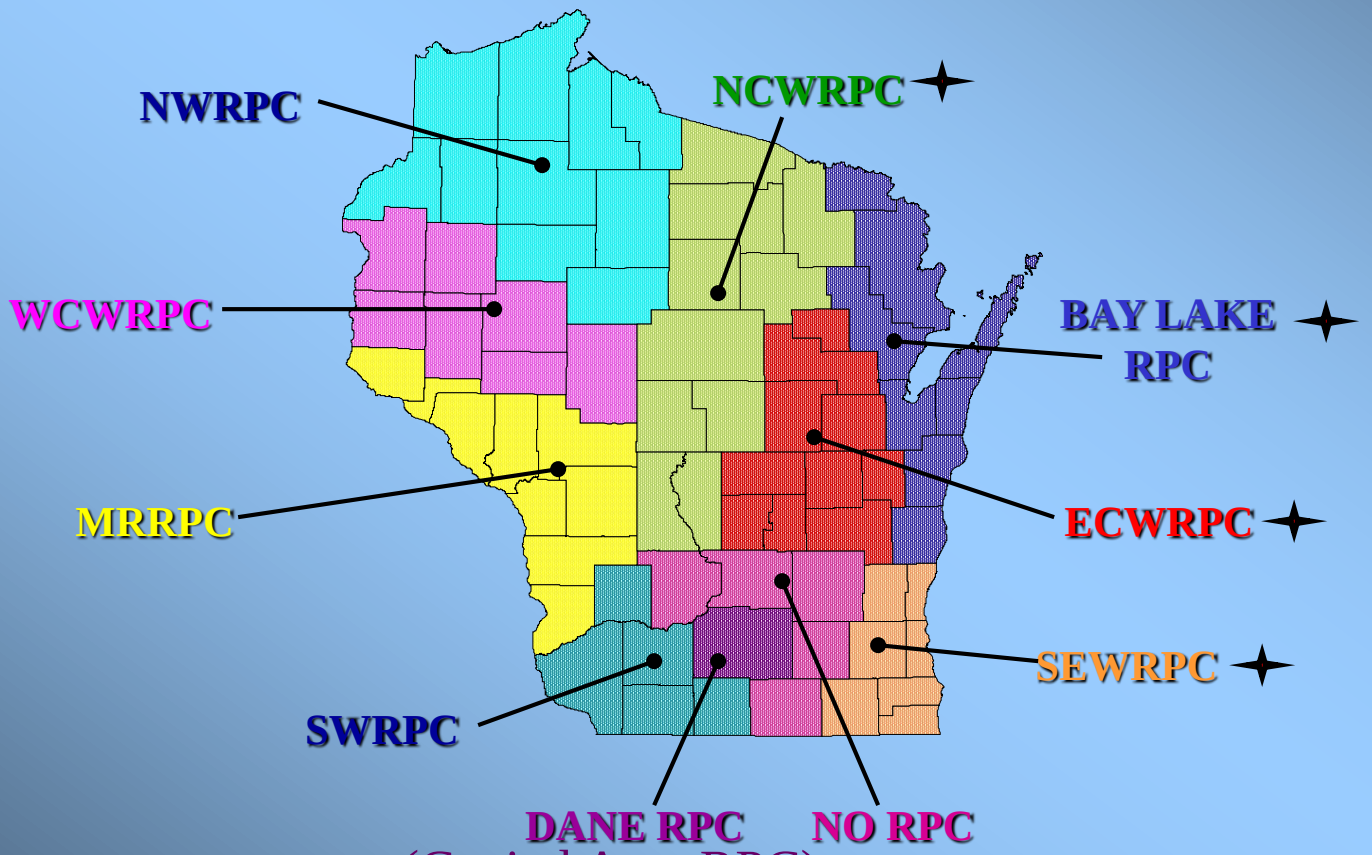
If there were local land use codes in a parcel layer, one could ask:

Where are all the Airports, Fish Hatcheries, Lumber Yards, or Single Family residences?

Statewide Parcel Layer

https://maps.sco.wisc.edu/Parcels/

# Land Use Codes In Wisconsin Vary by Jurisdiction

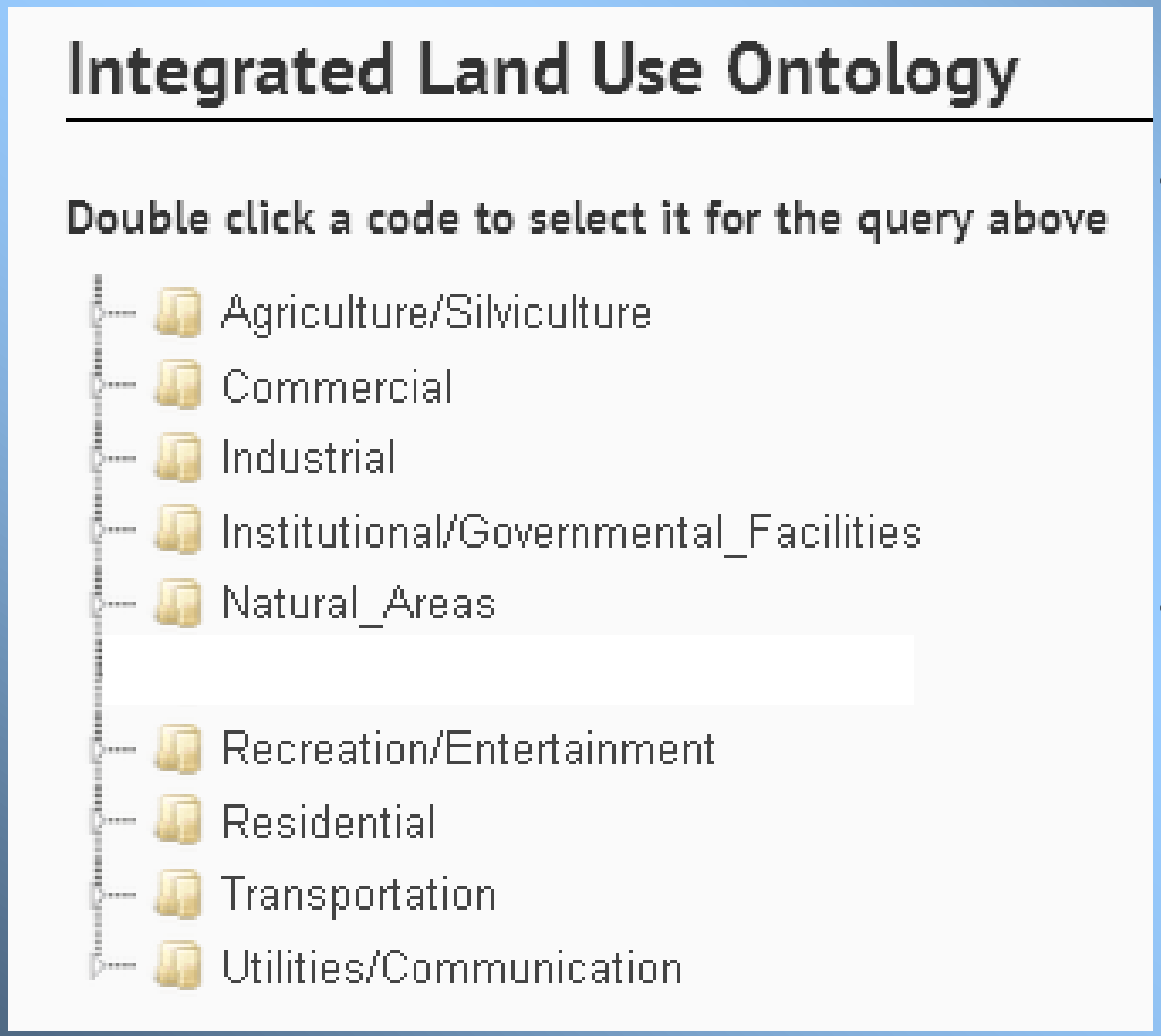



Regional Planning Commissions (old)

# Problem

- Differences in land use codes across the state because they're developed locally
- Need to determine how codes relate to each other
  - e.g., *Single Family* is a synonym to *One Family*
  - *Local Group Quarters* is a subset of *Group Quarters*

# Merged 7 code sets




(Screenshot of demo)

- Created a hierarchy with classes, subclasses, sub-subclasses, etc.
- Formalized using Semantic Web technologies

# Entered into Protégé to create an OWL file

```
<Declaration>
    <Class IRI="#Wool_Scouring,_Worsted_Combing_and_Towing_to_Top"/>
</Declaration>
<Declaration>
    <Class IRI="#Yarns_and_Threads"/>
</Declaration>
<EquivalentClasses>
    <Class IRI="#Dorms"/>
    <Class IRI="#Residence_Halls"/>
</EquivalentClasses>
<EquivalentClasses>
    <Class IRI="#Multiple_Family"/>
    <Class IRI="#Three_Or_More_Family"/>
</EquivalentClasses>
<EquivalentClasses>
    <Class IRI="#One_Family_Unit"/>
    <Class IRI="#Single_Family"/>
</EquivalentClasses>
<EquivalentClasses>
    <Class IRI="#Two_Family"/>
    <Class IRI="#Two_Family_Unit"/>
</EquivalentClasses>
<SubClassOf>
    <Class IRI="#101+_Units"/>
    <Class IRI="#Household_Units"/>
</SubClassOf>
<SubClassOf>
    <Class IRI="#101+_Units"/>
    <Class IRI="#Multiple_Family_with_5+_Dwellings"/>
</SubClassOf>
```

**EquivalentClasses**

*Dorms, Residence Halls*

**SubClassOf**

*101+_Units* subclass of *Household_Units*

# Viewing an existing OWL file on the Web

geosciml.org/doc/vocabularies/iso-19115-codelists.owl

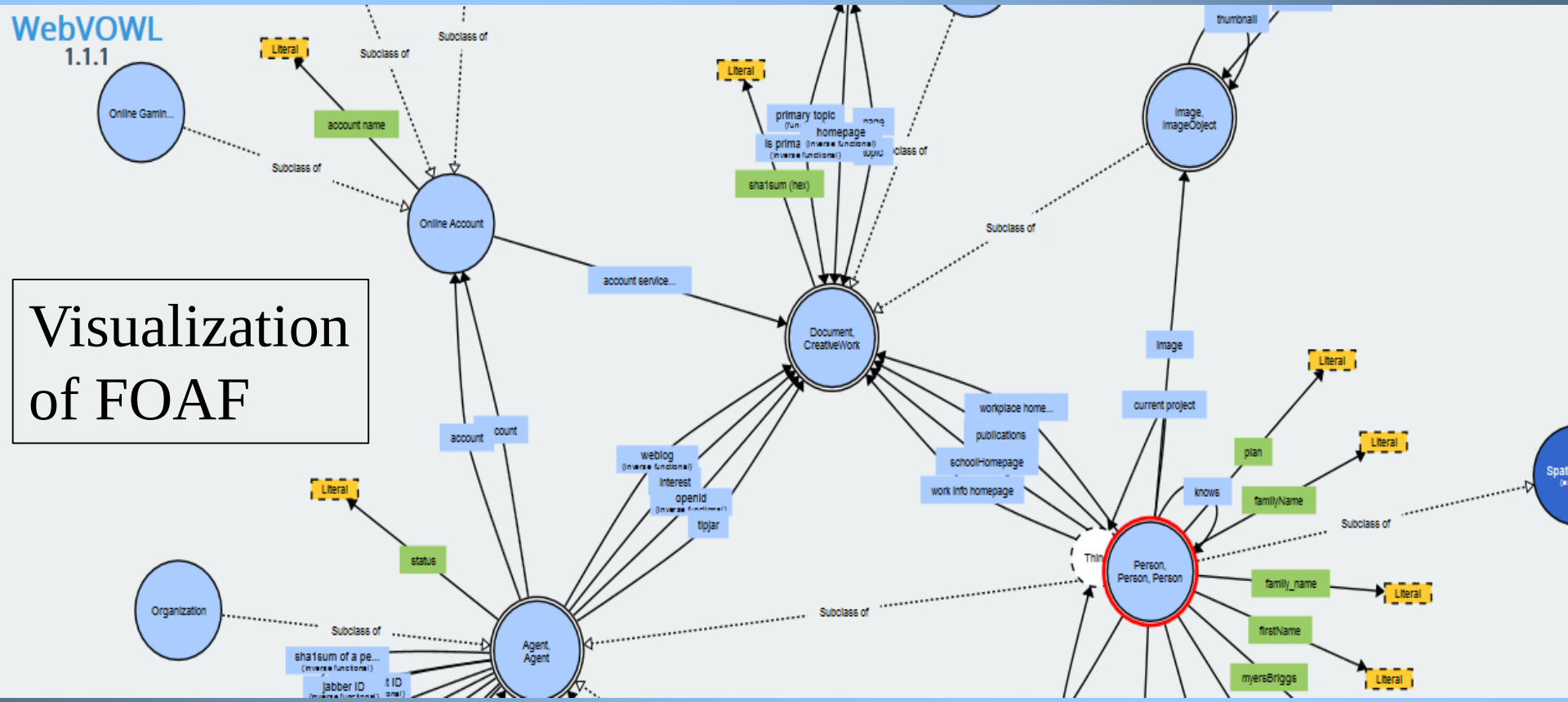
This XML file does not appear to have any style information associated with it. The document tree is shown below.

```
− <rdf:RDF xml:base="http://www.geosciml.org/vocabularies/iso-19115-codelists.owl">
    <!-- Ontology Information -->
  − <owl:Ontology rdf:about="">
    − <rdfs:comment rdf:datatype="http://www.w3.org/2001/XMLSchema#string">
        2008-03-10 version by Simon Cox, CSIRO Exploration and Mining. 1. Refactored Codelists and Enumera
        instances of terms 2. Replaced _shortname and _domainCode with Domain_code 3. use rdfs:label for offici
        prepended to overcome name clashes)
      </rdfs:comment>
    − <rdfs:comment xml:lang="en">
        title- Ontology for Geographic Information Metadata - ISO 19115:2003. creator- Akm Saiful Islam, Luis E
        ISO 19115. Vocabulary terms are declared using OWL language to support RDF applications. publisher- I
      </rdfs:comment>
      <owl:versionInfo rdf:datatype="http://www.w3.org/2001/XMLSchema#string">2.0</owl:versionInfo>
    </owl:Ontology>
    <!-- Classes -->
  − <owl:Class rdf:about="#CI_DateTypeCode">
      <iso-19115-codelists:stereotype rdf:datatype="http://www.w3.org/2001/XMLSchema#string">CodeList
      <rdfs:comment xml:lang="en">identification of when a given event occurred</rdfs:comment>
      <rdfs:label xml:lang="en">CI_DateTypeCode</rdfs:label>
      <rdfs:subClassOf rdf:resource="#CodeList"/>
    </owl:Class>
```

# Problem: How to let users view and query the ontology

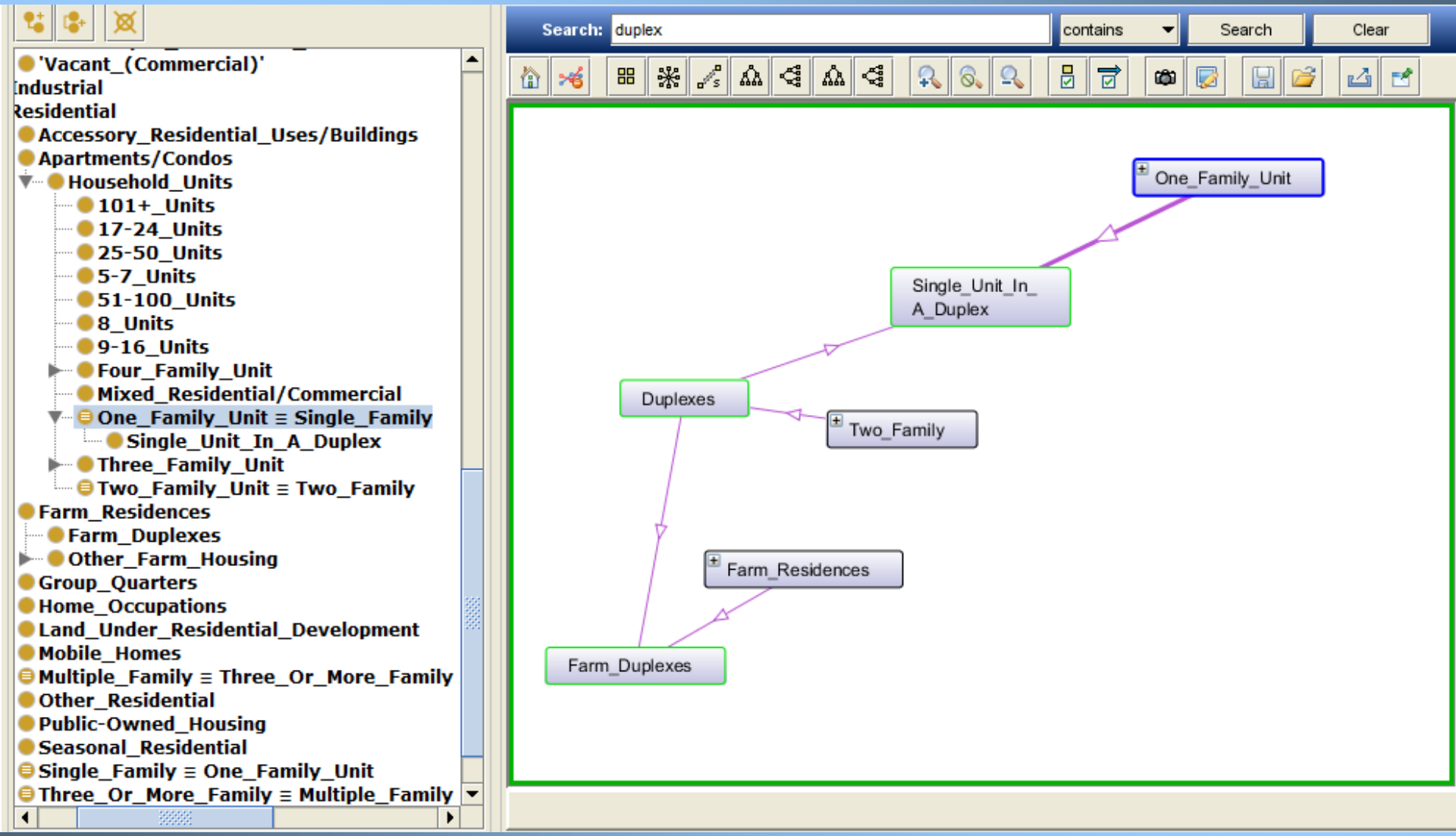
- Options:
  - Read the OWL code directly
  - Visualization software
  - Ontology editors, e.g., Protégé, download and learn including how to query
  - Ontology browsers, e.g., BioPortal or eagle-i
- All of the above are not easy

# Web-based Visualization of Ontologies
## WebVOWL

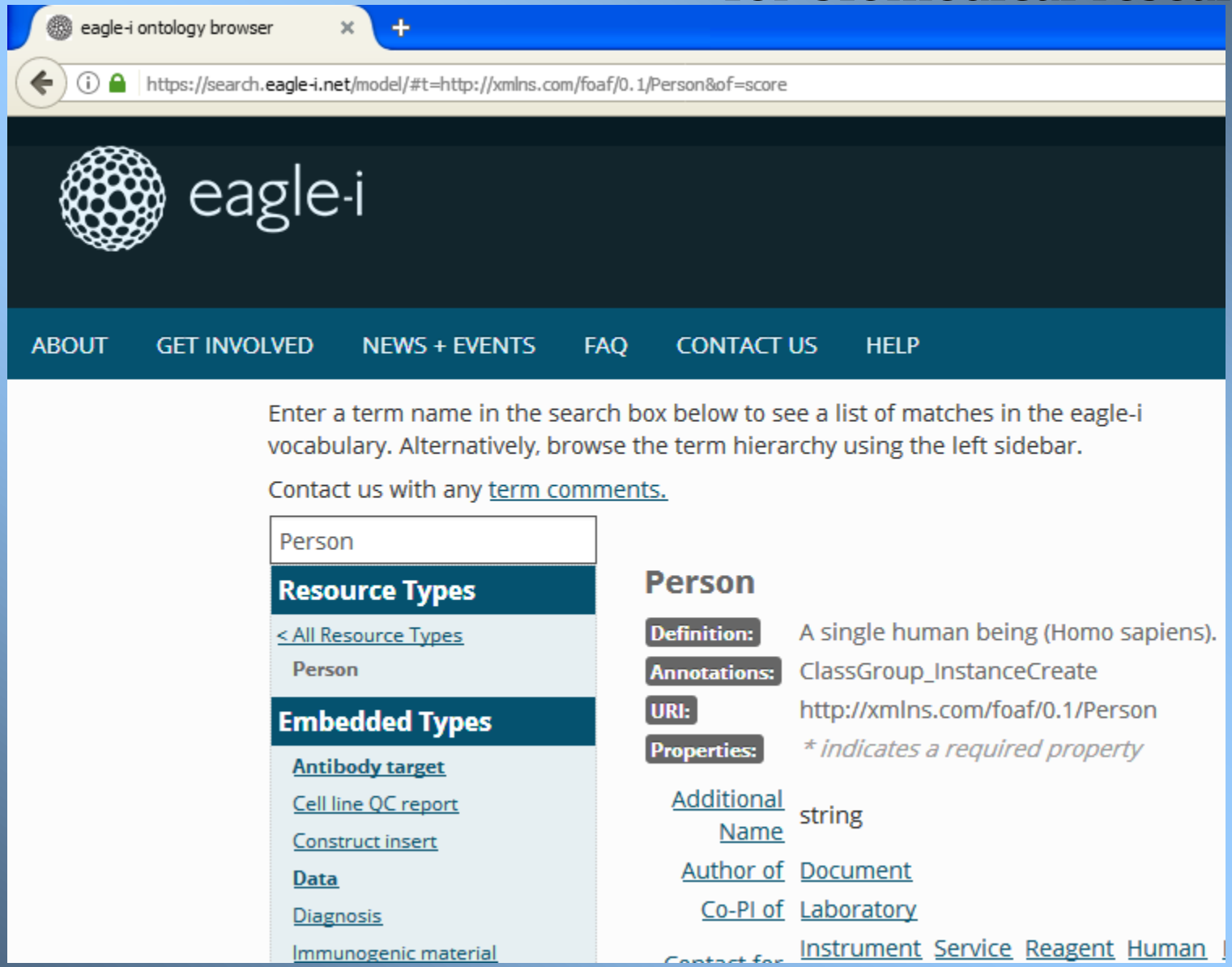



Scroll to see classes and subclasses

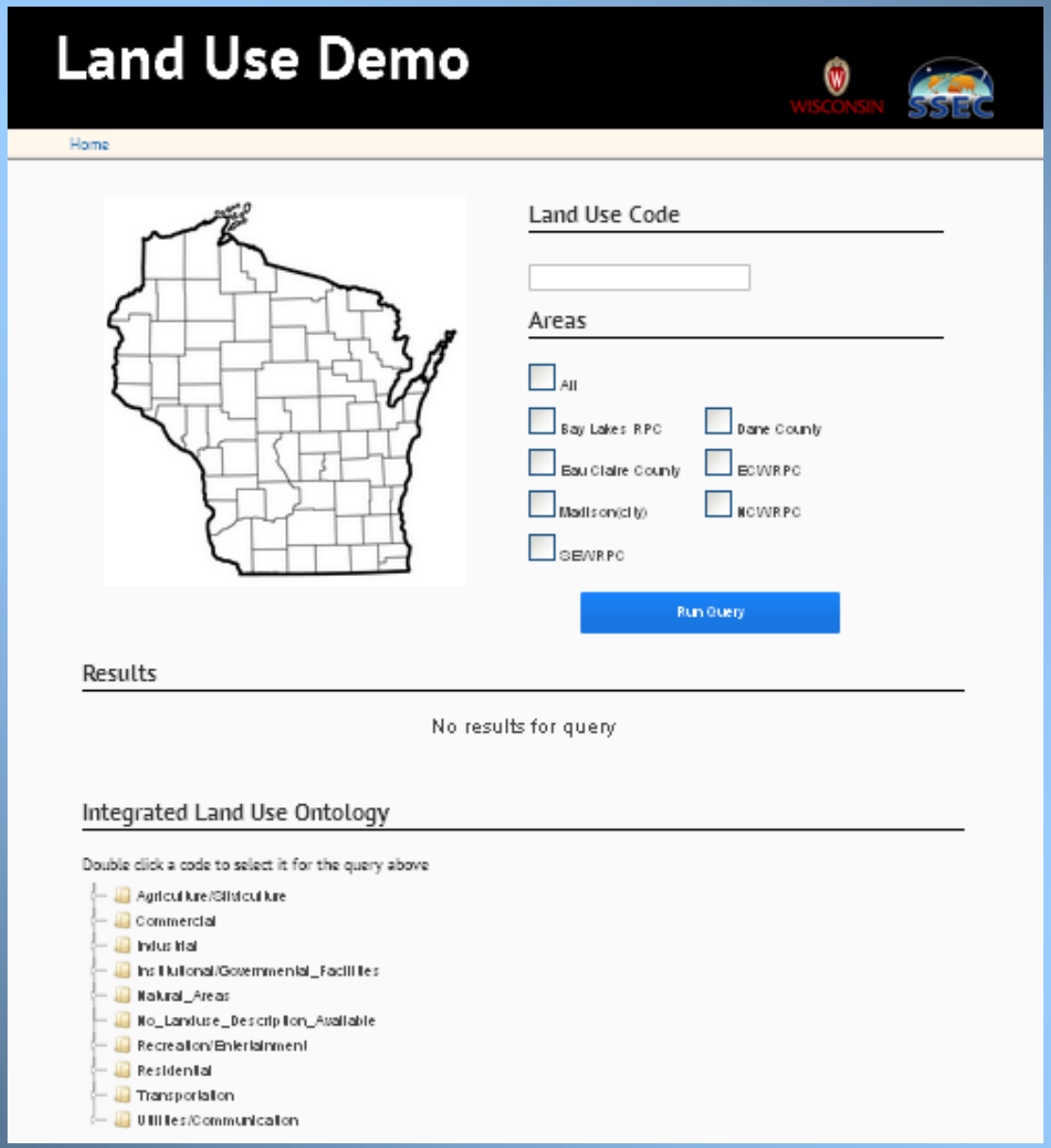
# Protégé's OntoGraph, Search for 'Duplex'



# Ontology Browser of eagle-i (resource discovery tool for biomedical research)



# http://www.ssec.wisc.edu/landuse/



http://www.ssec.wisc.edu/landuse/

# Land Use Demo

Home

## Land Use Code

## Areas

- All
- Bay Lakes RPC
- Dane County
- Eau Claire County
- ECWRPC
- Madison(city)
- NCWRPC
- SEWRPC

Run Query

## Results

# Type in 3 letters; it autofills.

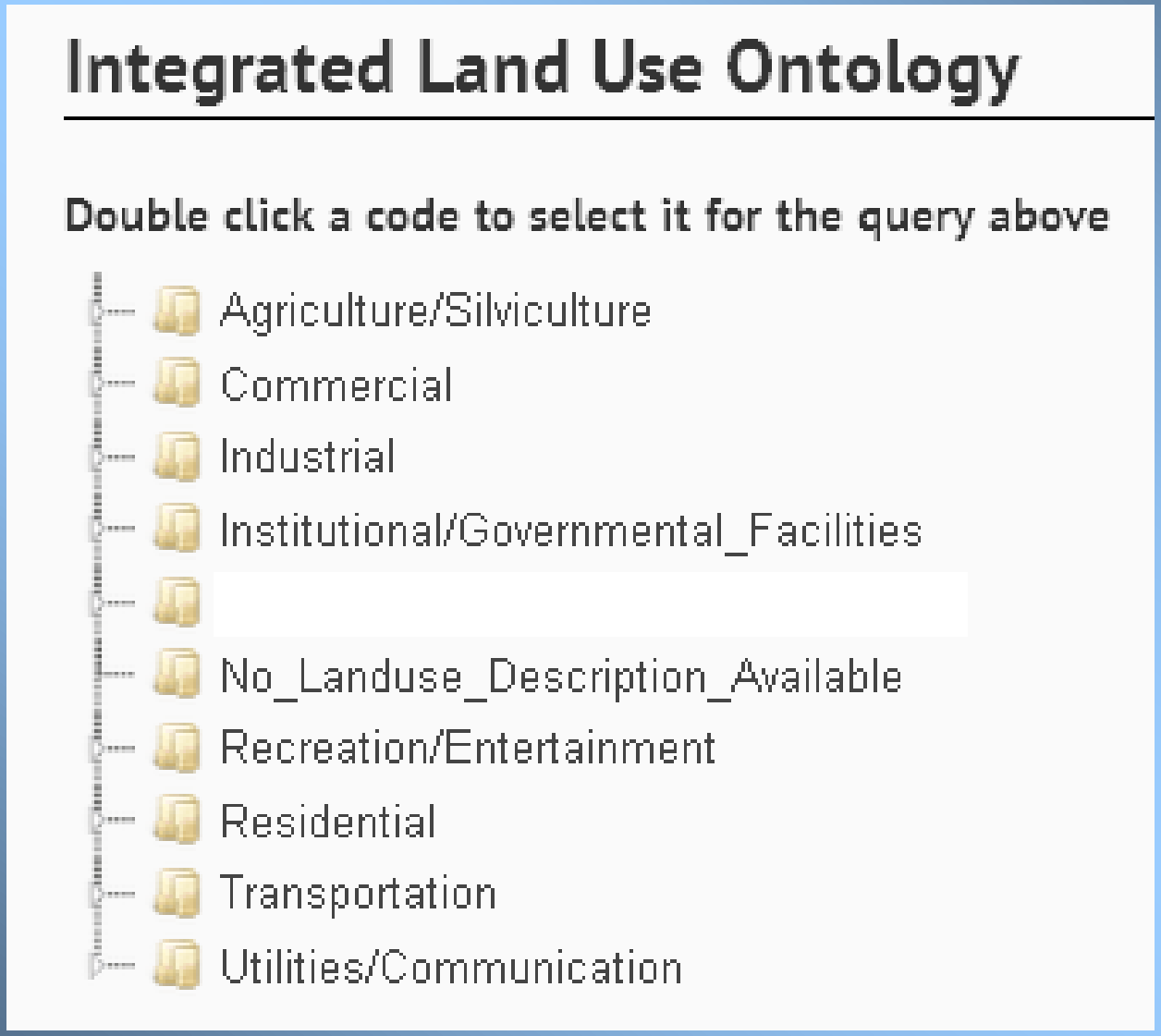
**Land Use Code**

Resi

Accessory_Residential_Uses/Buildings
Farm_Residences
Fly_Ash_and_Other_Fire_Residue_Disposal
Garages/Residential_Storage
Home_Occupations_In_Farm_Residences
Land_Under_Residential_Development
Mixed_Residential/Commercial
Mixed_Residential/Commercial_(Commercial)
Other_Residence_Halls/Dorms
Other_Residential
Parking_Lots_in_Residential_Area

http://www.ssec.wisc.edu/landuse

# Or, choose a code from the ontology below.



Return: local term, internal code, and relation to the query term

**Land Use Code**

Single_Family

**Areas**

- ✓ All
- Bay Lakes RPC
- Dane County
- Eau Claire County
- ECWRPC
- Madison(city)
- NCWRPC
- SEWRPC

Run Query

**Results**

Bay Lakes RPC [110]: Single Family

Dane County [111]: Single Family

ECWRPC [9411]: Single Family

Eau Claire County [RS]: Single Family

Madison(city) [1110]: One Family Unit synonym of Single Family

Madison(city) [111]: Single Family

NCWRPC [5]: Residential superclass of Single Family

SEWRPC [111]: Single Family

Bay Lakes RPC [110]: Single Family

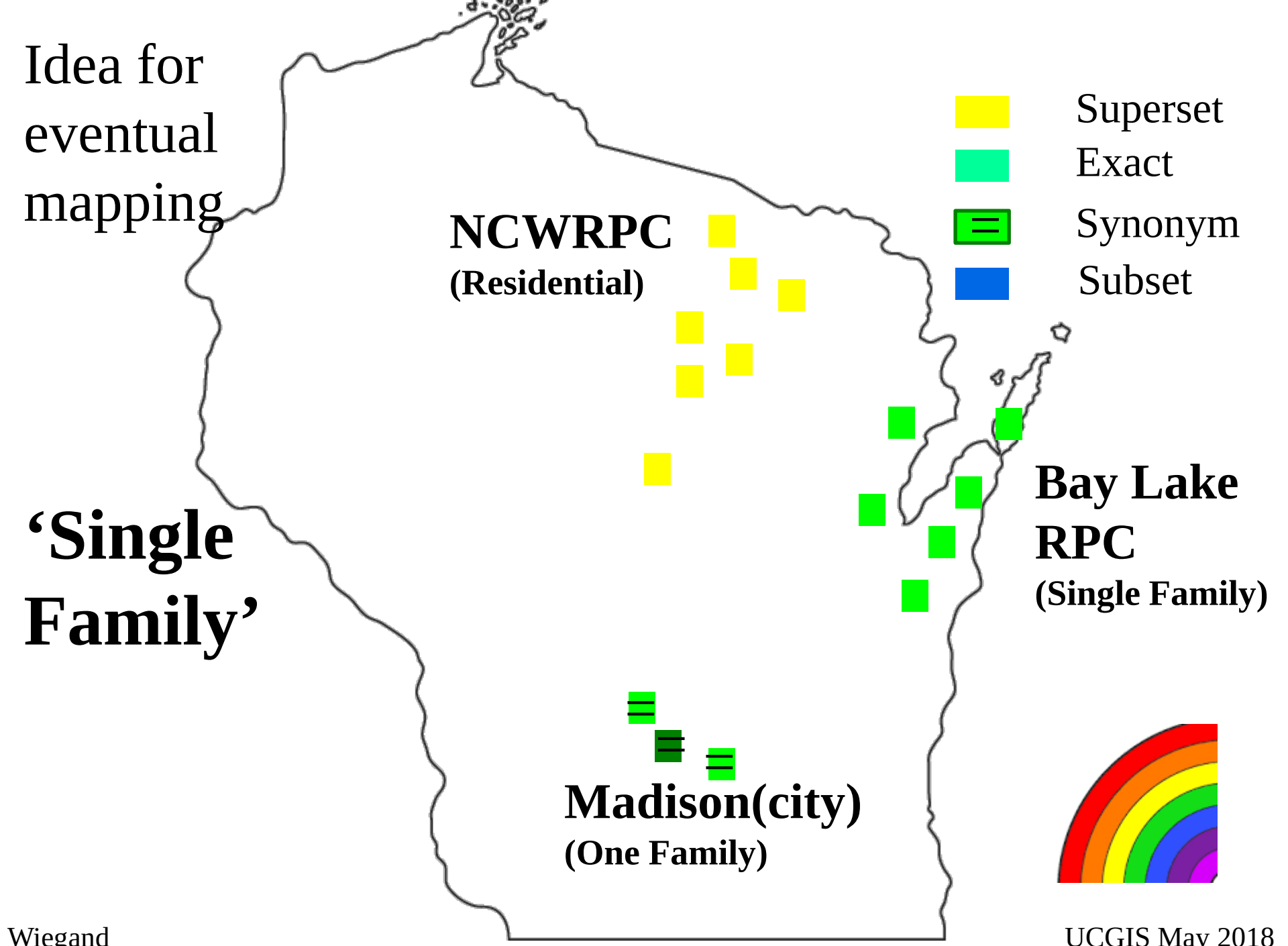
Madison(city) [1110]: *One Family Unit* synonym of Single Family

NCWRPC [5]: *Residential* superclass of Single Family

# Output from the Demo

- Could be incorporated into a statewide parcel system that contained local codes
- User query would result in a list of parcels by jurisdiction along with the relation
- Or, a mapped result

Idea for eventual mapping




**‘Single Family’**

# We set the Jurisdiction and Internal Value using Annotations in Protege

```
<AnnotationAssertion>
    <AnnotationProperty abbreviatedIRI="rdfs:comment"/>
    <IRI>#Air_Related</IRI>
    <Literal datatypeIRI="&rdf;PlainLiteral">Bay Lakes [460]
        ECWRPC [481]  Dane County [43]  Madison [43]
</Literal>
</AnnotationAssertion>
```

# Internal OWL Demo Format

- For each land use code in the ontology, we listed all the jurisdictions having that code (and the actual representation)
  - Air Related (Bay Lakes, 460), (ECWRPC, 481), (Dane County, 43), (Madison, 43)
    - Airports/Flying Fields (Madison, 431), (Madison, 4310), (ECWRPC, 481), (Dane County, 43), (Eau Claire, IA)
      - Private Landing Strips (Eau Claire, IA)
      - Air Fields (SEWRPC, 463)
      - Associated Operations (Eau Claire, IA)

# Demo Summary

- Wanted an easy ontology viewer, reminiscent of e.g., ShapeViewer for ESRI shape files
  - Web-based, available to anyone
  - No login, no software to be installed
  - See relations between terms
- We needed a special kind of ontology viewer because of the merged ontology
- Nevertheless, idea could be adapted to other applications or re-written to be general purpose

# Thank you!


- Acknowledgements
  - Tommy Jasmine at Space Science and Engineering, UW-Madison, for setting up and hosting the demo on the Web
  - Coda Philips for writing the demo, funded by an NSF Research Experience for Undergraduates (REU) grant
  - http://www.ssec.wisc.edu/landuse/



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