

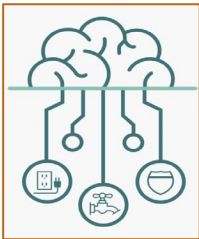
The future of information is now: visualizing PPOD networks and the Internet of Conservation

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UNIVERSITY OF CALIFORNIA



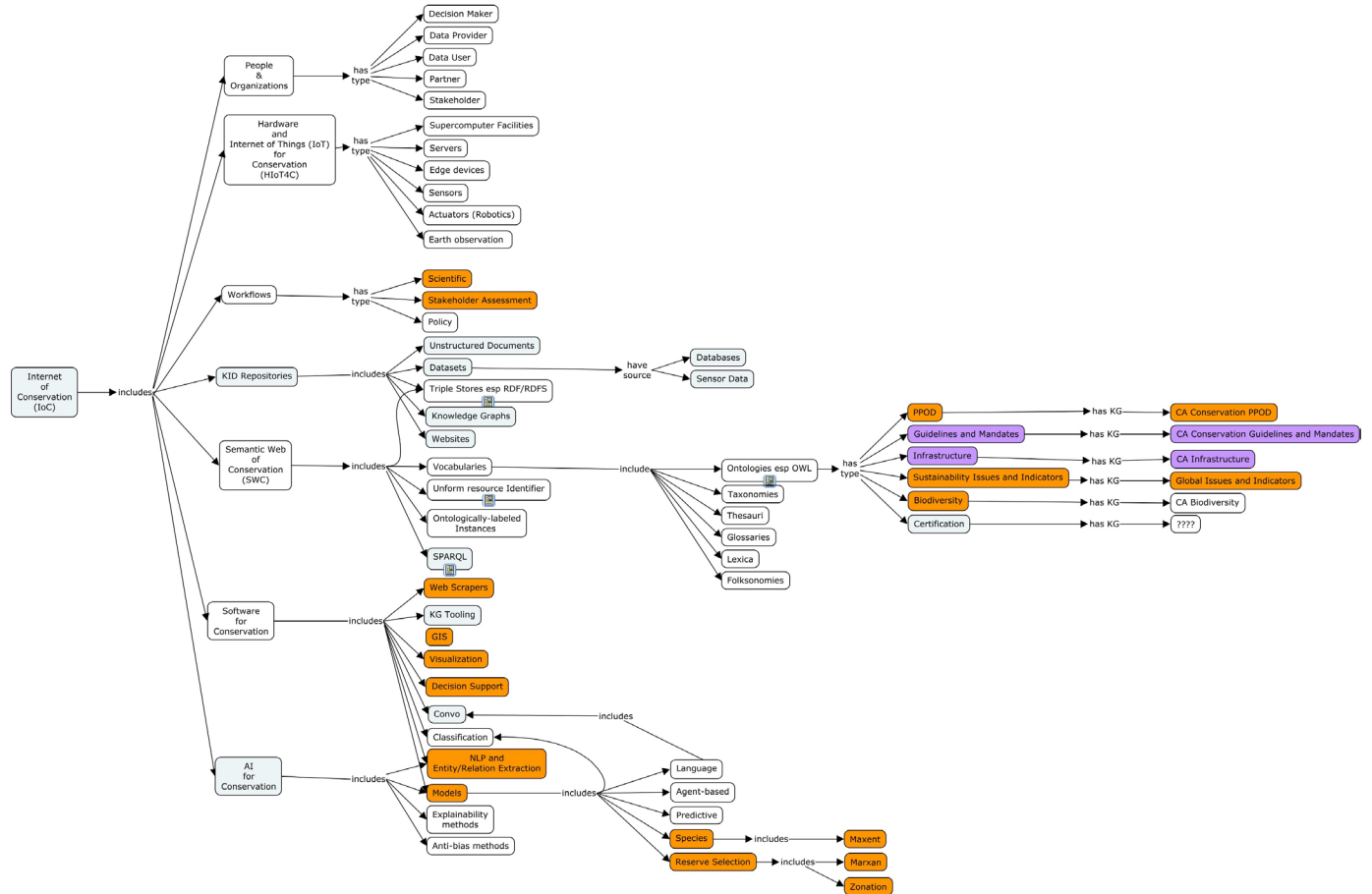
Introduction – the problem

- Successful conservation planning and implementation involves many stakeholders and data sources.
- Data/information discovery and access, workflow development, and stakeholder identification can be difficult, inefficient, and often duplicative.
- How can we integrate data and social networks for improved conservation processes and outcomes?

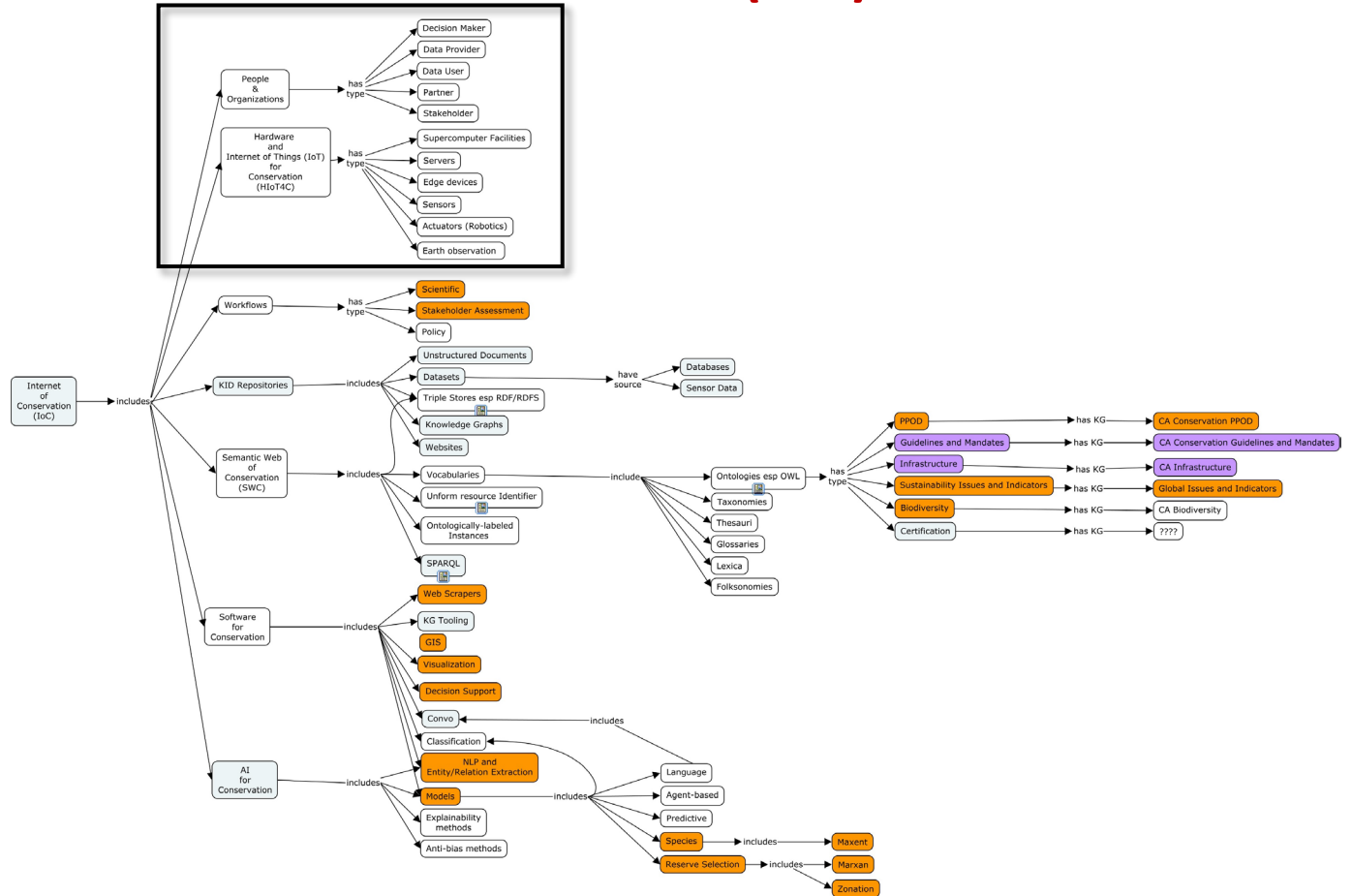
Introduction – the solution

- Linked data!
- Cyberinfrastructure: machine-readable controlled vocabularies and conceptual structures
- AI tools for assembling and accessing data

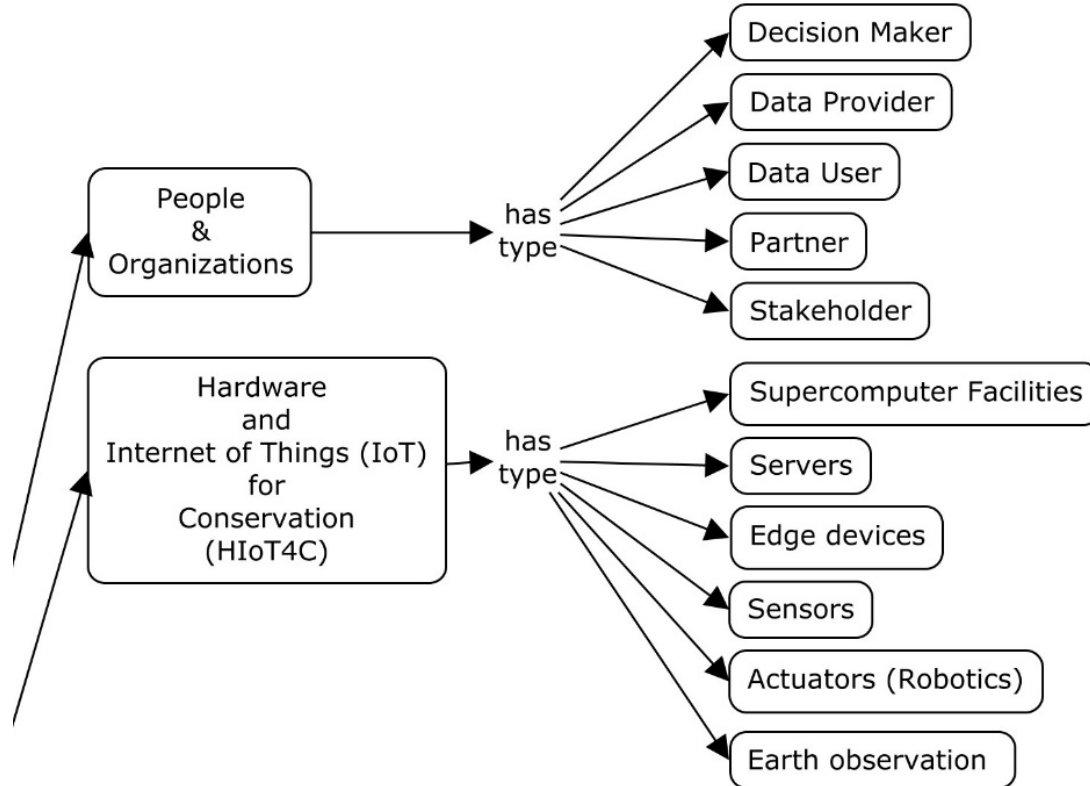
Internet of Conservation (IoC)



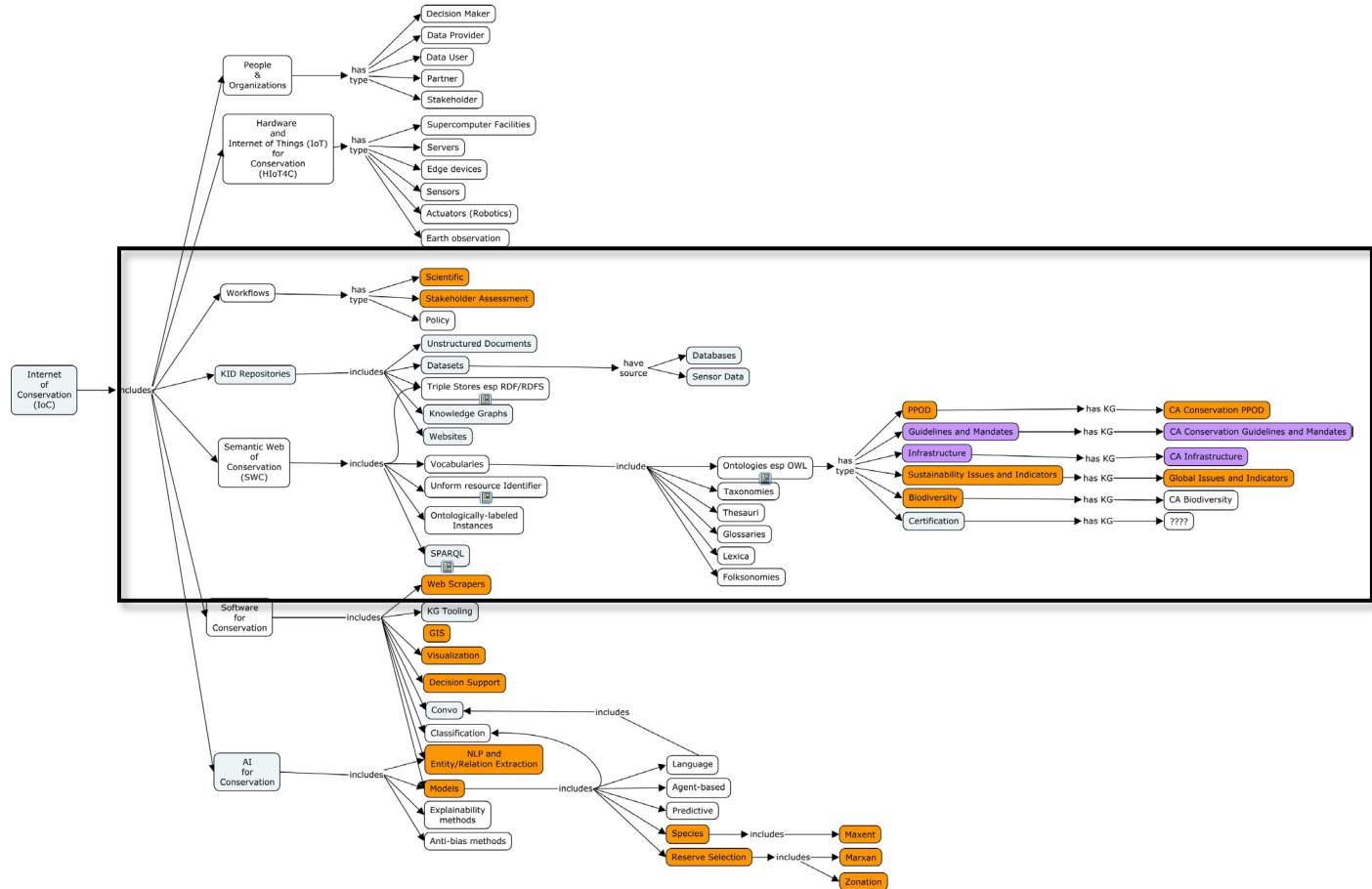
Internet of Conservation (IoC)



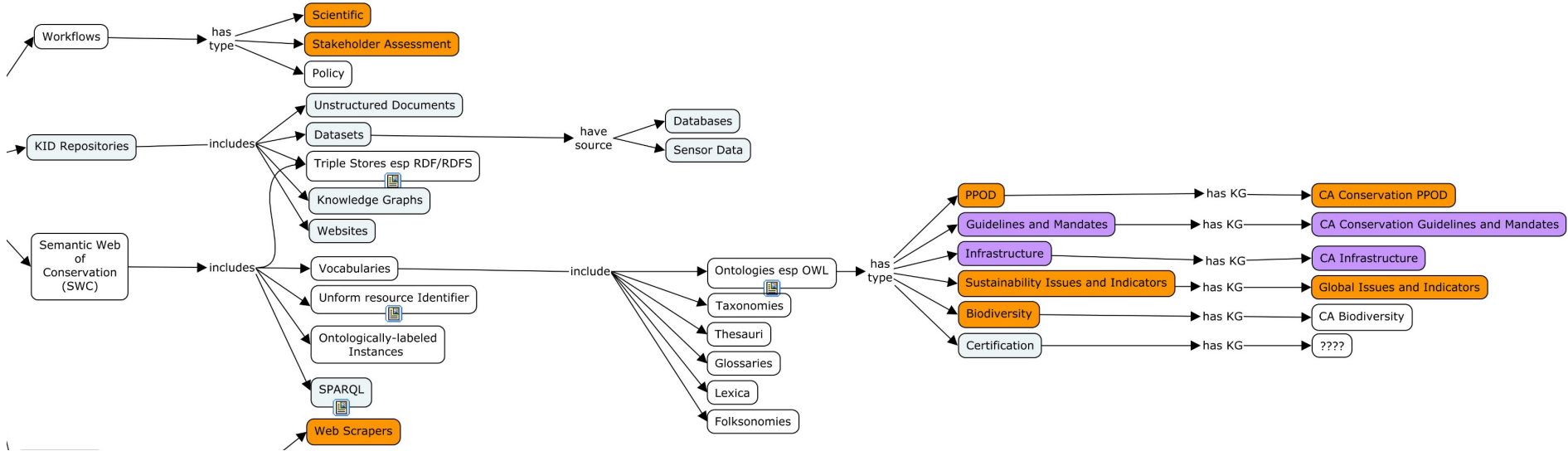
Internet of Conservation (IoC)



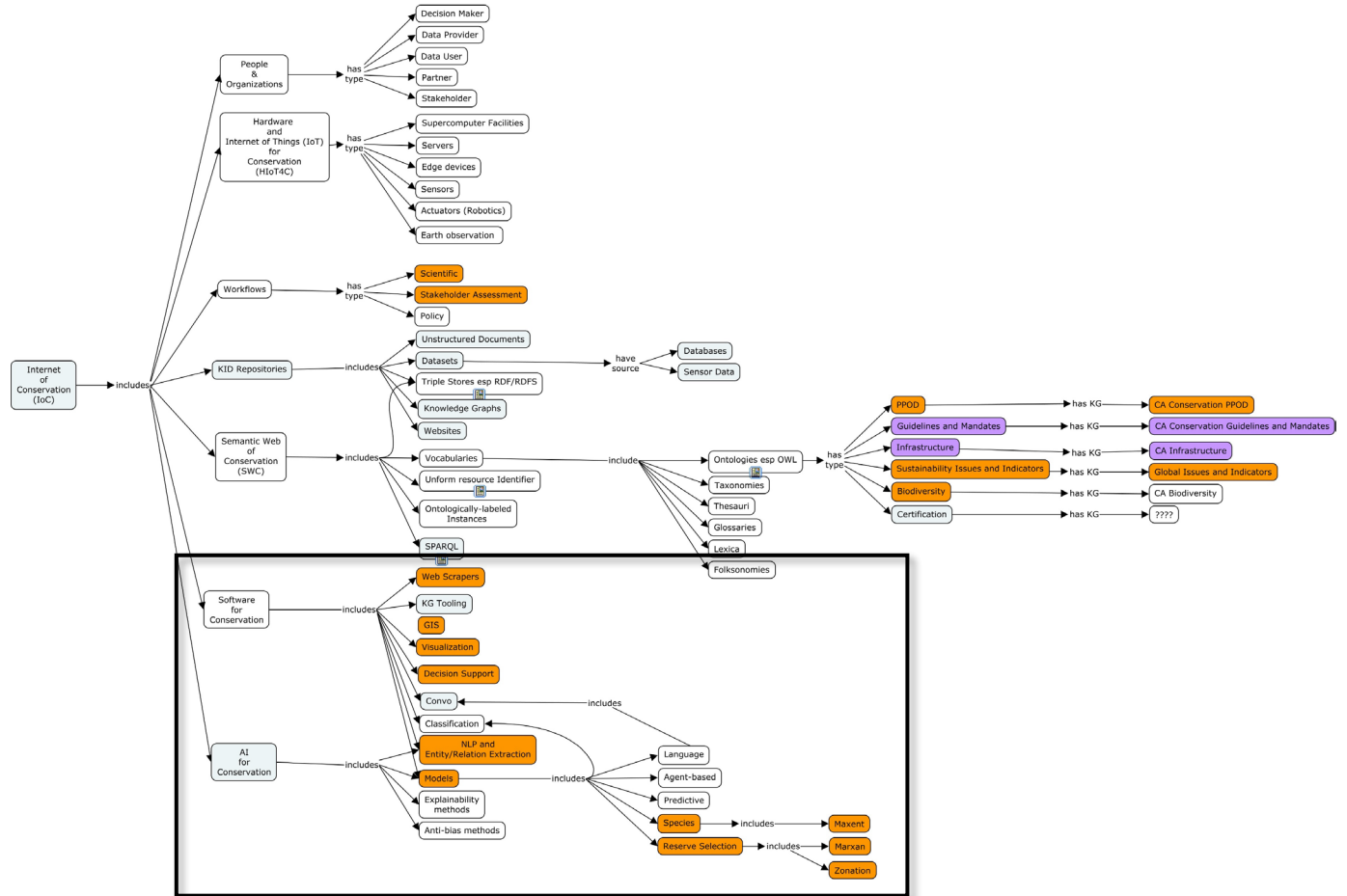
Internet of Conservation (IoC)



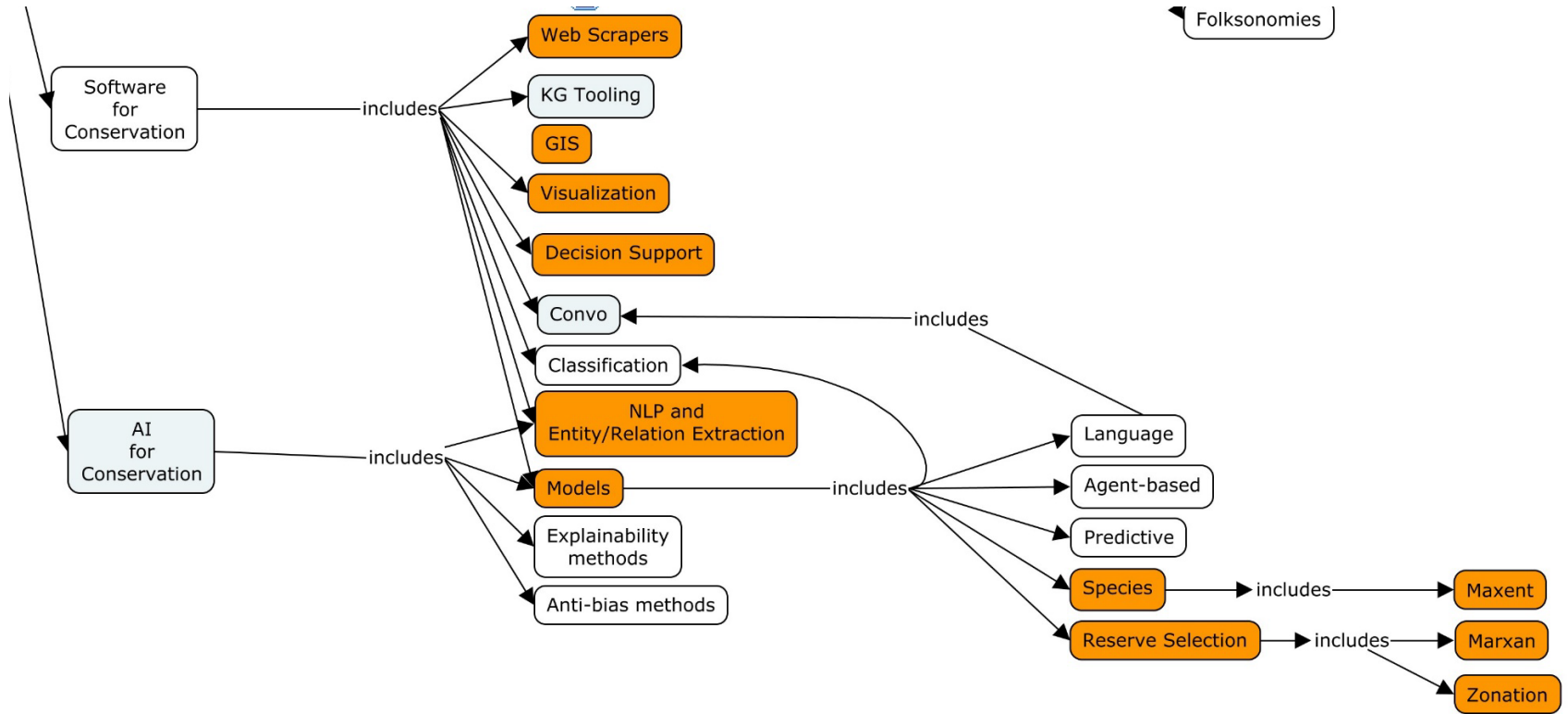
Internet of Conservation (IoC)



Internet of Conservation (IoC)



Internet of Conservation (IoC)



ICICLE

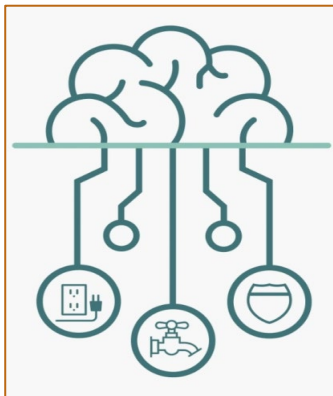


Intelligent CI with Computational
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NSF-Funded AI Institute

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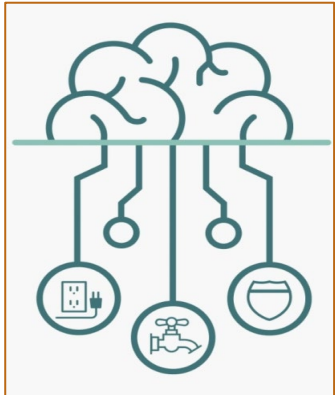


Computer Science

- Software
- AI tools
- Cyberinfrastructure

Domain Science

- Animal ecology
- Digital agriculture
- Smart foodsheds



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Ontologies and knowledge graphs

- Ontologies - formal, machine-readable descriptions of knowledge
- Examples: Gene Ontology, Environment Ontology (ENVO), Sustainable Development Goals Interface Ontology
- Knowledge graphs – real world information structured by ontologies

PPOD+

- People, Projects, Organizations, Datasets (PPOD; “Peapod”): who is working on what where and when?
- An ontology describing organizations, their characteristics, and their relationships to other organizations and entities.
- We assembled a knowledge graph of information on organizations that potentially participate in conservation planning and implementation in California.

PPOD+ - ontology

PPOD Core -> PPOD Conservation ->
PPOD California Conservation

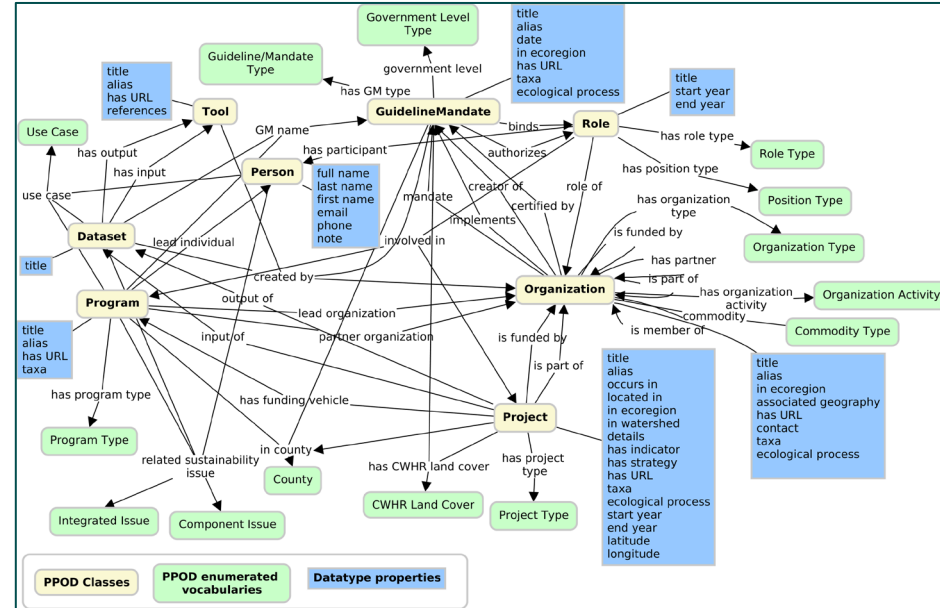


The screenshot shows the GitHub repository page for 'PPOD Schema'. The repository name is 'PPOD Schema' and it has 4 repositories, 5 people, and 5 teams. The main content is the README file, which describes the project as 'PPOD - Developing data schemas and infrastructure around the Persons-Projects-Organizations-Datasets data pattern'. The README text includes:

In our work in environmental data management, we have repeatedly observed a pattern where groups collect information on persons, projects, organizations, and datasets. Seeing this, we have developed a number of data schemas, vocabularies, and ontologies to help express the interrelationships between these core data classes. This organization has been set up to host repositories, discussions, and general development of the PPOD pattern.

At present there are three main repositories in this organization. These are:

- **PPODtotl** which holds a Python script to convert a PPOD database in a Google Sheets document into RDF Turtle format. This database describes resources of interest to the [UC Davis Food Systems Lab](#).
- **PPOD_FSL** which is a [LinkML](#) schema characterizing the UC Davis FSL PPOD database.
- **PPOD_CA** which contains an RDF database describing linkages between environmental conservation and the food system in California.



<https://github.com/PPODschema>

PPOD+ - knowledge graph

As of June 7, 2023

Organizations: 2,514

Programs: 278

Projects: 491

People: 705

Guidelines/Mandates: 145

Datasets: N/A

1	Organization	Alias	isPartOf	isMemberOf	County	Ecoregion
2392	Yolo County Parks Department		Yolo County		Yolo	Northern Cali
2393	Yolo County Resource Conservation District	Yolo RCD		California Association of Re	Yolo	Great Valley,
2394	Yolo Habitat Conservancy				Yolo	Great Valley
2395	Yolo Land & Cattle Co.				Yolo	Northern Cali
2396	Yolo Land Trust				Yolo	Great Valley,
2397	Yolo Subbasin Groundwater Agency	YSGA			Yolo	Great Valley
2398	Yolo-Solano Air Quality Management District			Capital Region Climate Re	Yolo, Solano	Northern Cali
2399	Yorba Linda Water District	YLWD		Association of California Wi	Orange	Southern Cal
2400	Yosemite National Park		U.S. National Par		Madera, Marip	Sierra Nevad
2401	Youth Outside			TOGETHER Bay Area		
2402	Yreka Fish and Wildlife Office		USFWS Pacific S		Siskiyou, Shas	Southern Ca:
2403	Yuba County			Sacramento Area Council c	Yuba	Sierra Nevad
2404	Yuba County Resource Conservation District	Yuba County RCD		California Association of Re	Yuba	Sierra Nevad
2405	Yuba County Water Agency	YCWA		Capital Region Climate Re	Yuba	Sierra Nevad
2406	Yuba Salmon Partnership Initiative				Yuba	
2407	Yuba Watershed Institute	YWI		Cosumnes American Bear	Nevada	Sierra Nevad
2408	Yuba Watershed Protection and Fire Safe Council			California Fire Safe Council	Yuba	Sierra Nevad
2409	Yucaipa Valley Water District	YVWD		San Timoteo Sustainable G	San Bernardino	Southern Cal
2410	Yuima Municipal Water District			Association of California Wi	San Diego	Southern Cal
2411	Yurok Tribe	Yurok Indian Reserv		Trinity Management Council	Humboldt, Del	Northern Cali
2412	Zone 7 Water Agency			Association of California Wi	Alameda	Central Valle

Sustainability Issues and Indicators Ontology

Social & Political Capital

1. Markets
2. Productivity
3. Public Health
4. Governance
5. Human Rights
6. Poverty
7. Food Production
8. Trade Policies
9. Property Rights
10. Technology
11. Institutions
12. Educational Resources
13. Population Growth
14. Women's Participation
15. Sociocultural Systems
16. Geographical Distribution
17. Women & Wages
18. Social Structure
19. Participation
20. Population Structure
21. Disasters

Human Capital

1. Nutritional Status
2. Public Health
3. Safety
4. Labor
5. Diseases
6. Mortality
7. Literacy
8. Reproductive Health

Physical & Financial Capital

1. Income
2. Inputs
3. Infrastructure
4. Finance
5. Energy
6. Agricultural Sector

Natural Capital

1. Air & Climate
2. Land & Soil
3. Biodiversity
4. Water
5. Ecosystem Services
6. Common Pool Resources
7. Oceans & Coasts
8. Protected Areas
9. Deforestation
10. Wastes & Pollution

**“Integrated” Issues
45 total**

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Physical & Financial Capital

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7. Oceans & Coasts
8. Protected Areas
9. Deforestation
10. Wastes & Pollution

Sustainability Issues and Indicators Ontology

Biodiversity

1. Agrobiodiversity
2. Ecosystem Health
3. Forest Canopy Cover
4. Forest Ecology
5. Forests
6. Genetic Diversity within Species
7. Grasslands
8. Habitats
9. Invasive Species
10. Land Cover
11. Land Fragmentation
12. Protection of Threatened & Rare Ecosystems
13. Species Diversity
14. Species Introduction
15. Species Migration
16. Species Threatened with Extinction
17. Wild Animal Trade

**“Component” Issues
325 total**

Interactive Knowledge and Learning Environment (IKLE)

ICICLE Visual Analytics V1 ppod
Select A Dataset

PROGRAM PERSON **ORGANIZATION** COUNTY BEST

label	taxa	ecological_process
California Grazing Land Coalition		
California Health and Human Services Agency		
California High-Speed Rail Authority		
California Independent System Operator		
California Institute of Environmental Studies	birds	
California Institute of Food and Agricultural Research		
California Invasive Plant Council		
California Labor and Workforce Development Agency		
California Landscape Conservation Partnership		
California Landscape Stewardship Network		
California Native American Heritage Commission		
California Native Grasslands Association	PGS	
California Native Plant Society	plants	
California Natural Resources Agency		
California Oak Mortality Task Force	oaks	
California Oaks	oaks	

Graph Control Panel


Organization <id>: 1260 taxa: "" use_case_ecuador: "" use_case_meat: "" ecological_process: ""

label: "California Natural Resources Agency" contact_info: "" title: "California Natural Resources Agency"

uri: "https://raw.githubusercontent.com/adhollander/FSLschemas/main/CA_PPODterms.ttl#org_b186fd" use_case_SCAG: ""

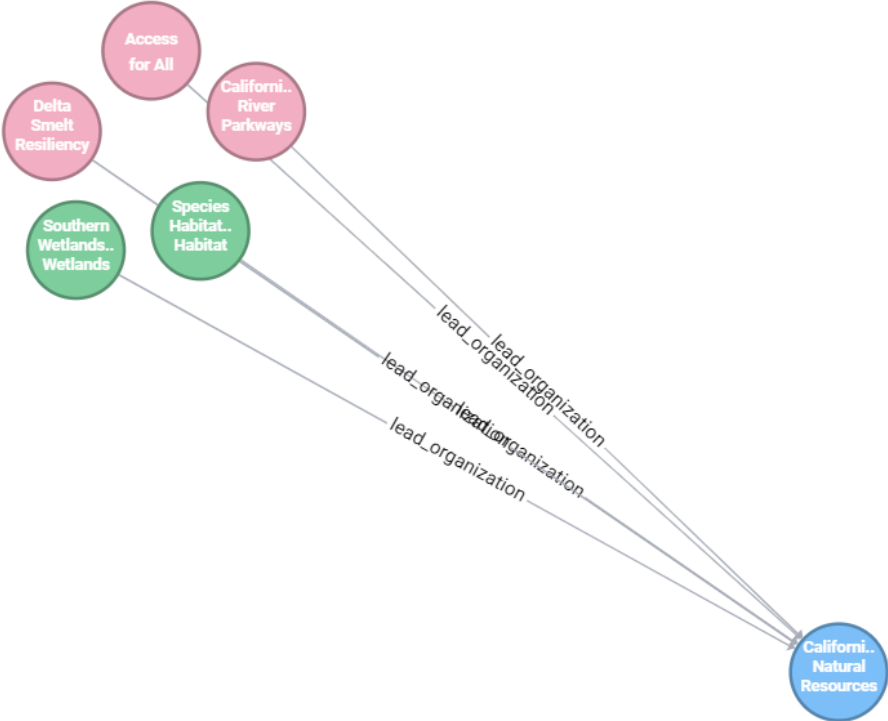
use_case_conservation: "" alias: "" use_case_sacramento: "x" id: "n1259" mapping: "label"

entity_type: "Organization"

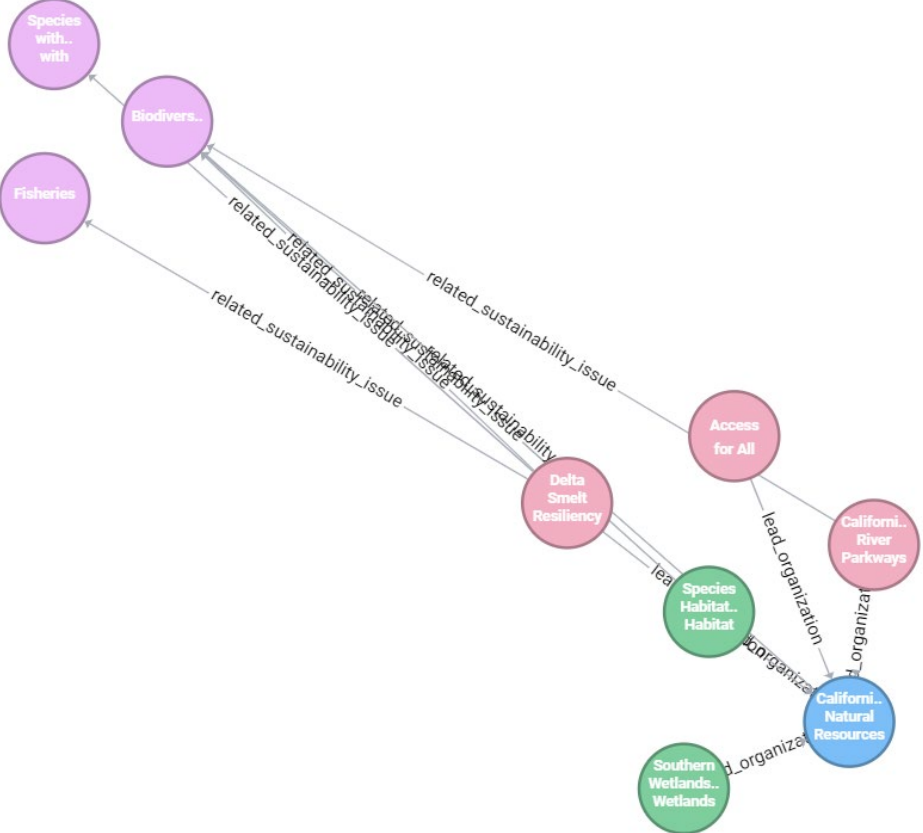


Interactive Knowledge and Learning Environment (IKLE)

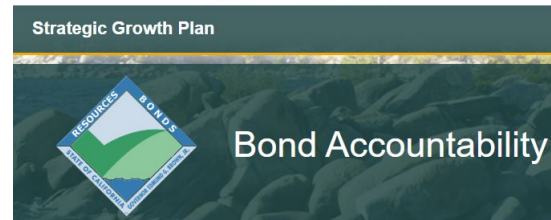
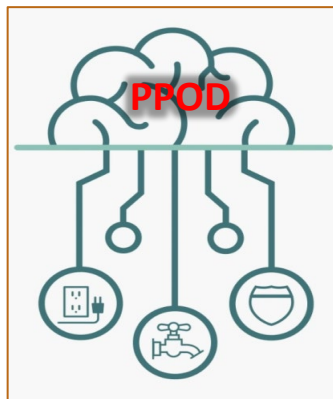
```
undefined <id>: 28009 mapping: "relationship_type" relationship_type: "lead_organization"
```



Interactive Knowledge and Learning Environment (IKLE)



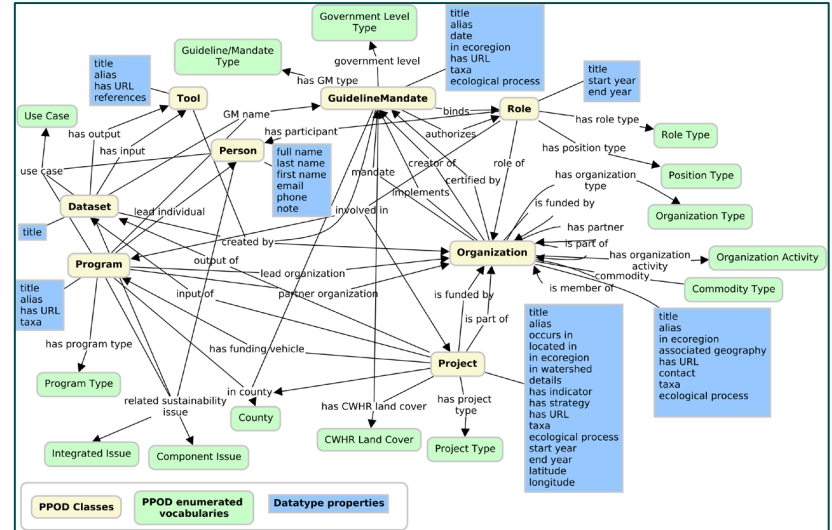
Data federation



Conversation agent



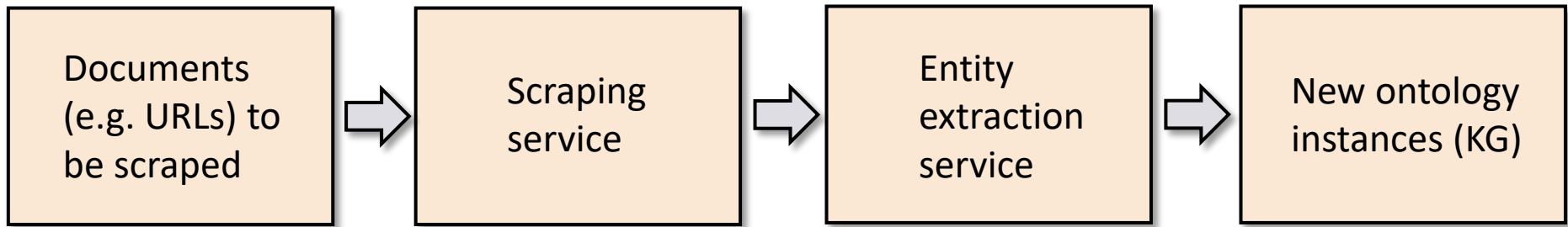
Large Language Model (LLM)



Ontology/KG

Knowledge Harvest

- Moving from manual construction of knowledge graphs to automated
- Scraping websites to add instances to PPOD
- Currently working on adding Issues to PPOD organizations as a test case



Next steps

- Finalize data federation with four example databases, identify new databases for federation
- Finalize LLM/ontology-based conversation agent
- Continue work on Knowledge Harvest pipeline
- Identify partners for development of new use cases

Acknowledgements

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- National Science Foundation for ICICLE funding
- University of Ottawa for partnership in Knowledge Harvest