PITCH / ANNOUNCEMENT

Unlock your Conservation Data with Semantic Graphs and LLMs

Conservation data lives in silos—species inventories, camera-trap image collections, GIS layers, weather feeds and more. For many professionals answering even basic ecological questions is time-consuming and error-prone.

In this 45-minute workshop we demonstrate how a semantic knowledge graph, powered by the GraphWise-enabled Sensing Clues platform, unifies disparate data sources, links them to open data collections, and lets large-language models (LLMs) answer domain-specific questions such as ‘Which habitat, frequented by the bear, contains most red-listed species?’ while generating traceable reports automatically.

Join us to see how semantic graph technology turns fragmented files into a single, queryable knowledge fabric that accelerates science and decision-making - no graph theory deep-dive required.

SOCIALS

Unlock your Conservation Data with Semantic Graphs and LLMs

Conservation data is often scattered in silo: species lists, camera-trap images, GIS layers, weather feeds, and more. This hands-on workshop demonstrates how a semantic knowledge graph, powered by the GraphWise-enabled Sensing Clues platform, transforms fragmented conservation data into a single, AI-queryable knowledge fabric - enabling complex, real-world questions to be answered and generating transparent, traceable reports.

You'll build your own micro-graph and find answers to the conservation questions you've always wanted to explore - like "Which habitat, frequented by the bear, contains most red-listed species?"

(@rebekka)

RESOURCES CHECKLIST

- Round tables
- Projector
- Parking flipover
- Sticky notes
- Entity cards (concepts)
  - Species: bear, salmon, oak, marsh harrier, …
  - Habitats: E1 Dry grassland, S21 Willow scrub, …
  - Sites: Natura 2000 AT1101112, Local Reserve X, …
  - Data sources: field observations, camera-trap data, eDNA, satellite images, maps, …

Relational cards (links)

lives-in, feeds-on, threatened-by

overlaps, part-of, similar-as

located-in, adjacent-to

collected-by, cleaned-with

(@menno, albin, jk)

SELECTED CONCEPTS AND RELATIONS

Concepts

- Bear
- Salmon
- Berries
- Trees
- Dog
- Honey
- Forest
- Habitat
- Grassland
- Mammal
- Predator
- Oak forest
- River
- Farm
- Cheep
- Beehive
- Winter
- Autumn
- Cave
- Season
- Flora
- Fauna

Concepts

- Wolf
- Fox
- Farmer
- Children
- Waste bin
- Fruit tree
- Insects
- Rocks
- Meadow
- Village
- Snare
- Road
- Electric fence
- Tourist
- Protected area
- Ranger
- Drone
- Satellite imagery
- Animal collar
- Field observation
- Conflict report
- Camera Trap

Attributes

- Age (EKM)
- Weight (EKM)
- Name (DWC)
- Latin name (DWC)
- Common name (DWC)
- Location (lat, lon) (EKM)
- Protection status (Species Ontology)
- Code (Habitat Ontology)

Plus empty post-its to add concepts and attributes of their choice

Relations

- Lives in (OBO/EKM)
- Eats (OBO/EKM)
- Preyed by (OBO/EKM)
- Is part of (?)
- Interacts with (OBO)
- Is similar to (skos:closeMatch)
- Is attracted by (EKM)
- Is repelled by (EKM)
- Hibernates in (EKM)
- Fattens up during (EKM)
- Is available on season (EKM)

Plus empty post-its

CONTENT PREPARATION

- Choose a selection of cards to match our NF KG
- Prepare and test a few LLM / Talk to your Graph questions (#3 and #4)
- 5 flipchart sheets, each representing 1 siloed and rigid data source
- 3 slides:
  1. Rigid and siloed data → Missed insights and opportunities
  2. Knowledge graph: a web of **things** and **labelled links** (just like the web of life!) that can be combined and recombined with ease
  3. Data retrieval and reasoning: ask once, and retrieve well-informed answers from your data

FLOW

			min
1.	Welcome	Managing rigid and siloed data	5
2.	Theory	Mini-pitch: about knowledge graphs	5
3.	Practice	Build your own micro knowledge graph	15
4.	Reflect	Gallery walk + Demo	10
5.	Translate	Bridge to lived-through problems	10
6.	Convert	Commit and next steps	5
7.	Wrap up and thx		2

#1 WELCOME & DATA-ISLAND POLL

5 min

AIM

Make everyone astutely aware of data rigidity and fragmentation problems before hearing theory.

PROCESS

Show 5 siloed sheets on the wall: field observations, camera-traps, research, volunteers, tracks, …

Question:	Which sheet matches the kind of data you work with daily? Stand by it.
Quick show of hands:	Who of you combines two or more of these in a typical project? (and sweat and struggle while doing it)

OPENING

Morning all, show hands: who wrangles at least three different data formats in a single conservation project?

Those scattered spreadsheets, shapefiles and sensor logs hide answers we need every day - not seldom in plain sight.

In the next 45 minutes you'll see how a semantic knowledge graph stitches those pieces together and lets an AI answer questions you actually care about.

Ready to turn your disparate data sources into one queryable graph? Let's dive in!

#2 MINI-PITCH: ABOUT KNOWLEDGE GRAPHS

5 minutes

AIM

Make audience familiar and at ease with its key concepts

(it's *not* technical - it's simply a better way to organise your facts!)

PROCESS

3 slides, 90 seconds each:

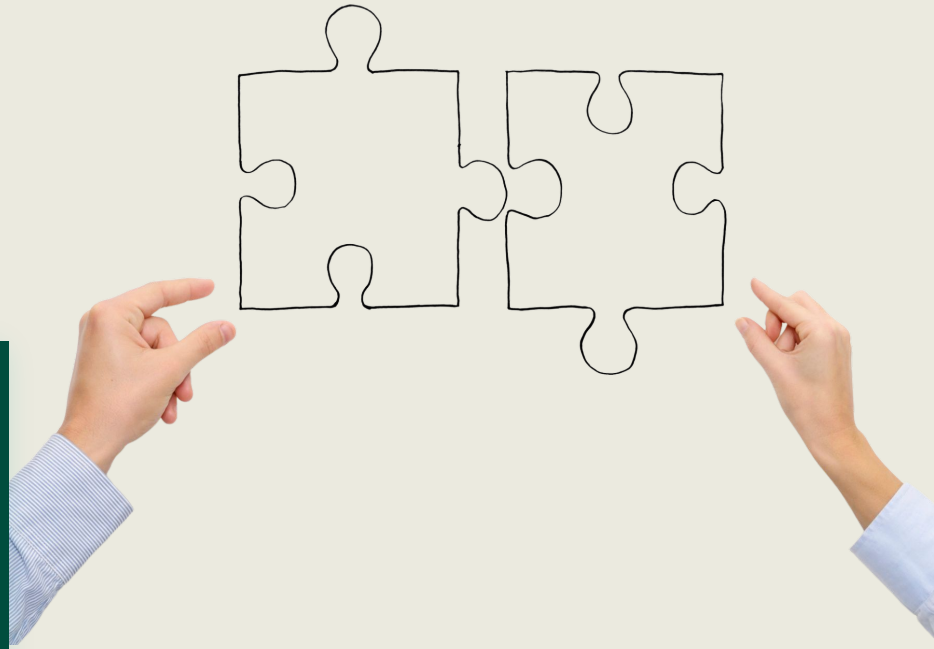
1. Rigid and siloed data → Missed insights and opportunities (visual from your existing deck)
2. Knowledge graph: a web of **things** and **labelled links** (just like the web of life!) that can be combined and recombined with ease
3. Data retrieval and reasoning: ask once, and retrieve well-informed answers from your data

GRAPHS AND AI-READINESS

Challenge
Integrating domain knowledge with AI is critical

Risk
Siloed data science leads to inaccurate models and missed insights

Goal:
Combine data science with domain expertise. Equip teams with advanced inferencing and reasoning tools



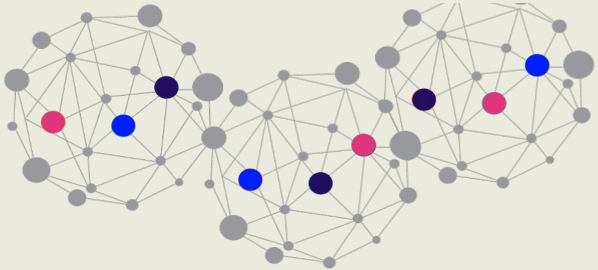
FROM TABLES TO GRAPHS

Sensing Clues Platform

GraphRAG & AI
Applications

LLM

Biodiversity Knowledge Graph



Domain Knowledge Models

Schemas
Ontologies
Taxonomies
Vocabularies

SEMANTIC DATA HARMONISATION

Graphwise Platform

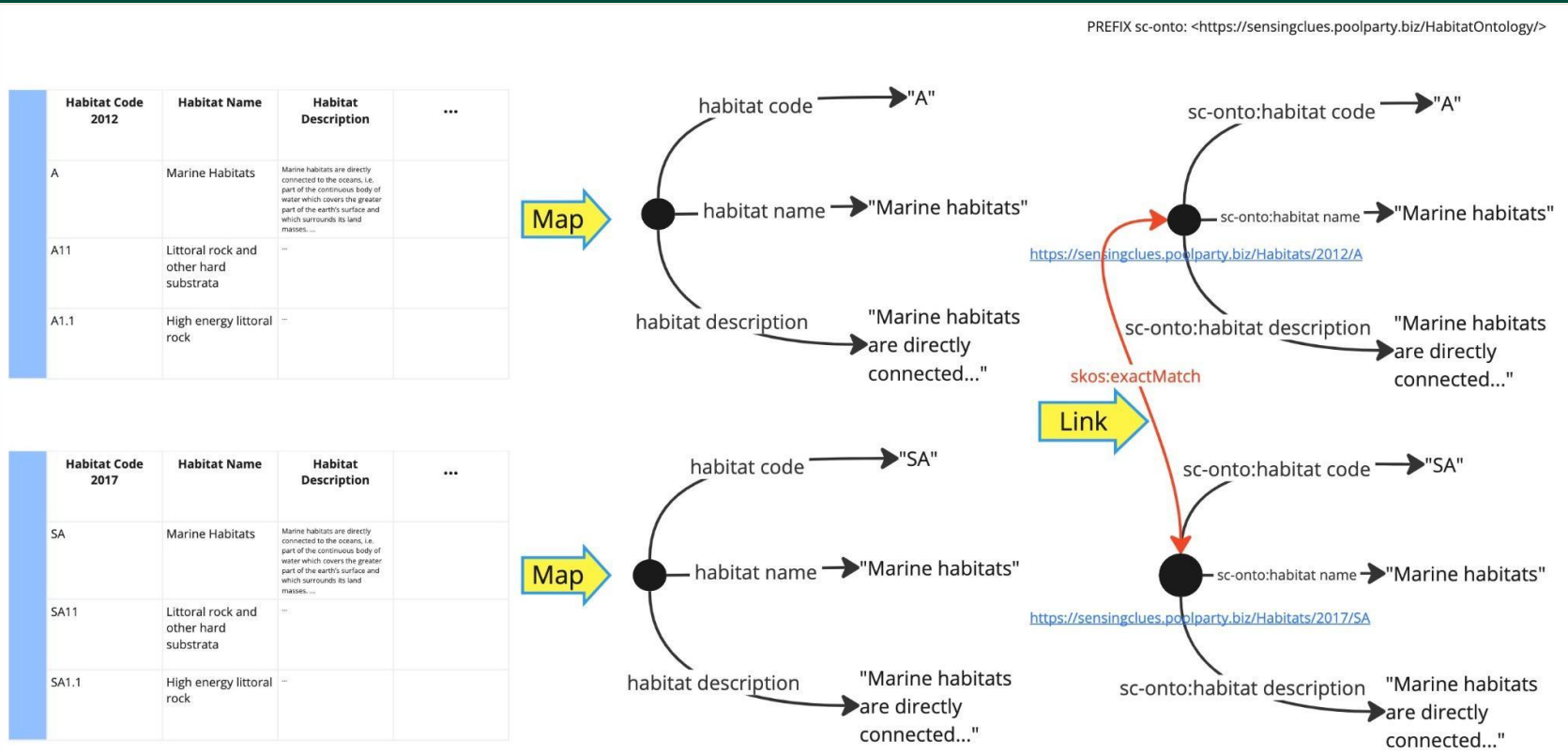
Heterogeneous Biodiversity Data

map layers
shapefiles

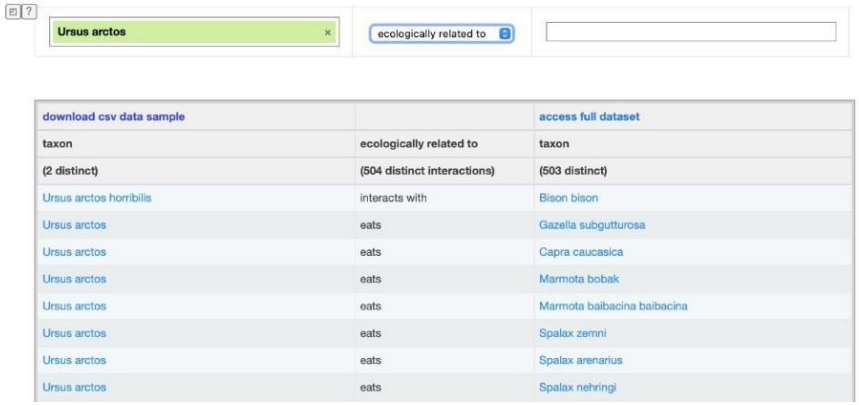
SQL
Structured Data

Any Data

MAPPING ENTITIES AND RELATIONS

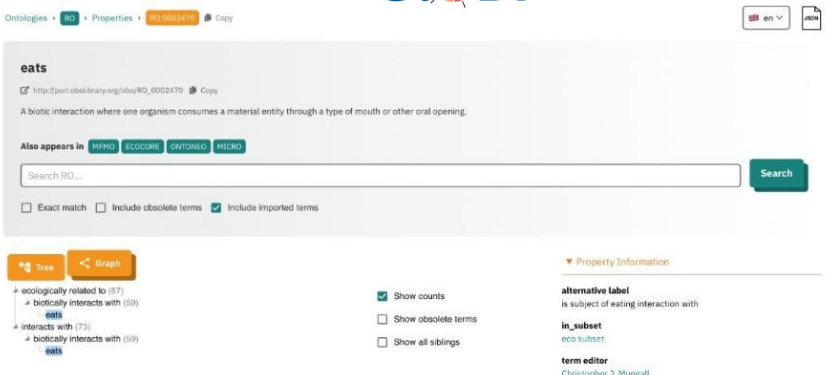


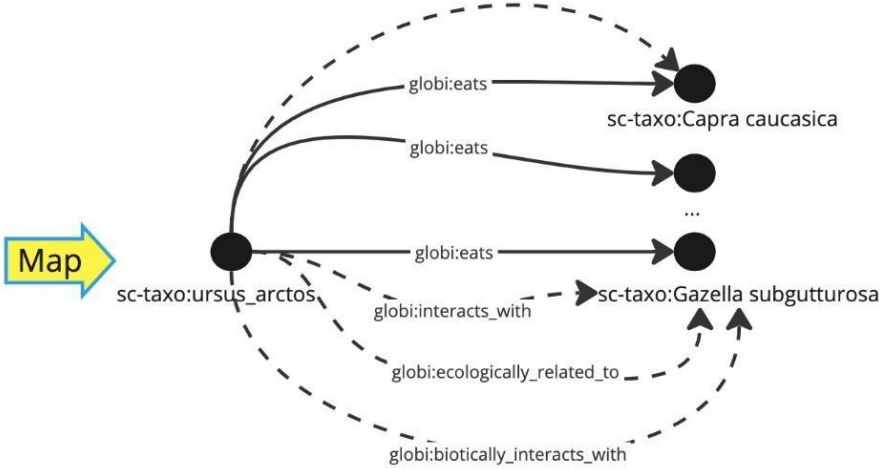
GRAPH-BASED REASONING



download csv data sample		access full dataset
taxon	ecologically related to	taxon
(2 distinct)	(504 distinct interactions)	(503 distinct)
Ursus arctos horribilis	interacts with	Bison bison
Ursus arctos	eats	Gazella subgutturosa
Ursus arctos	eats	Capra caucasica
Ursus arctos	eats	Marmota bobak
Ursus arctos	eats	Marmota baibacina baibacina
Ursus arctos	eats	Spalax zemni
Ursus arctos	eats	Spalax arenarius
Ursus arctos	eats	Spalax nehringi

GLOBI

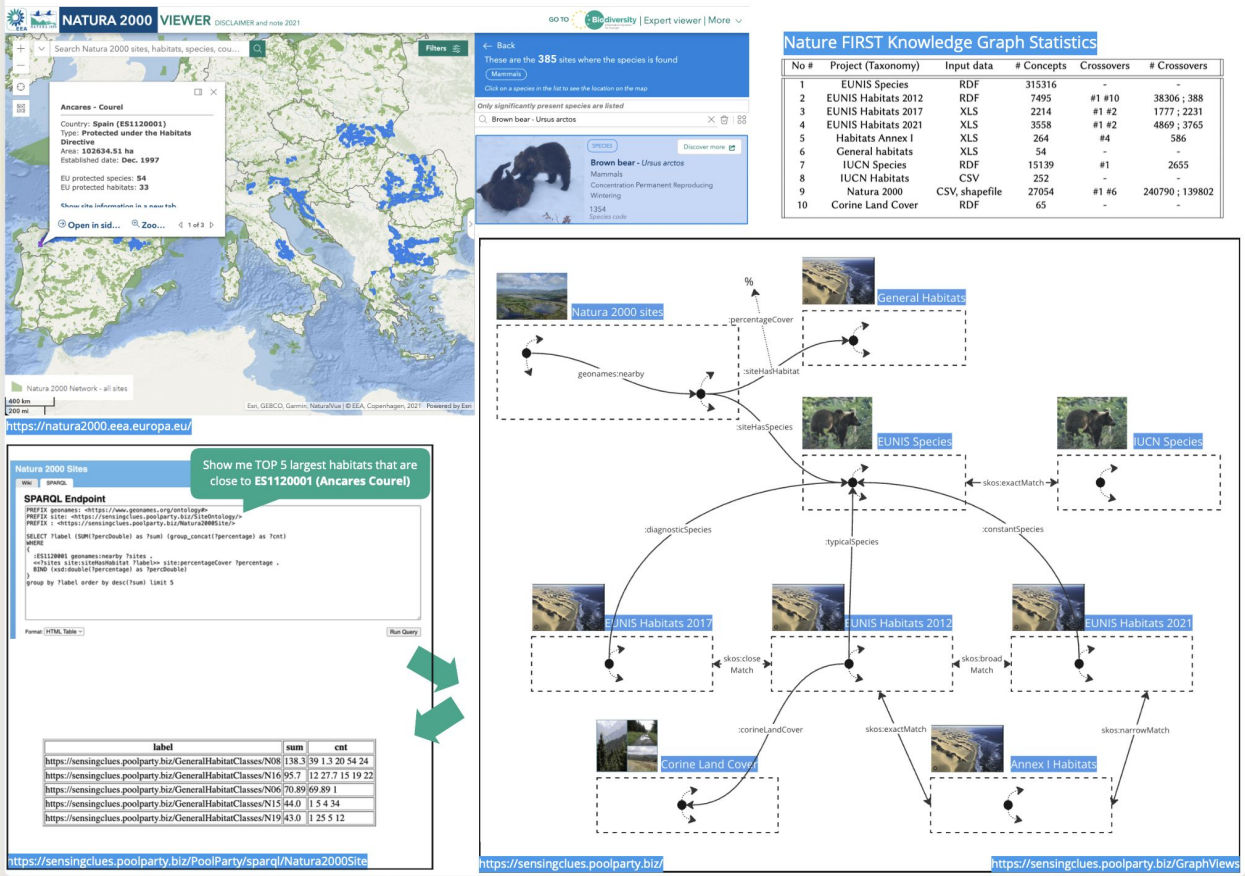




$$\forall x.y\ eats(x,y) \rightarrow biotically\_interacts\_with(x,y)$$

$$\forall x.y\ biotically\_interacts\_with(x,y) \rightarrow interacts\_with(x,y)$$

WHY?



To

harmonise data

enrich data

make taxa crossover

use data outside its original context

reason and answer complex questions

#3 BUILD YOUR OWN MICRO-GRAPH

12 min

AIM

Let people see, quite literary, that value comes from the links, not from more rows.

PROCESS

At round tables (using a white sheet, the things-cards, the relation-cards and markers):

1. Each group chooses one real conservation question they wish they could answer.
2. Pick a fitting set of entity cards and the relationships that could answer it.
3. Lay them on the table, connect with yarn/tape, and discuss how the graph can be used to answer this, and possibly other interesting questions.

SELECTED CONCEPTS AND RELATIONS

Concepts

- Bear
- Salmon
- Berries
- Trees
- Dog
- Honey
- Forest
- Habitat
- Grassland
- Mammal
- Predator
- Oak forest
- River
- Farm
- Cheep
- Beehive
- Winter
- Autumn
- Cave
- Season
- Flora
- Fauna

Concepts

- Wolf
- Fox
- Farmer
- Children
- Waste bin
- Fruit tree
- Insects
- Rocks
- Meadow
- Village
- Snare
- Road
- Electric fence
- Tourist
- Protected area
- Ranger
- Drone
- Satellite imagery
- Animal collar
- Field observation
- Conflict report
- Camera Trap

Attributes

- Age (EKM)
- Weight (EKM)
- Name (DWC)
- Latin name (DWC)
- Common name (DWC)
- Location (lat, lon) (EKM)
- Protection status (Species Ontology)
- Code (Habitat Ontology)

Plus empty post-its to add concepts and attributes of their choice

Relations

- Lives in (OBO/EKM)
- Eats (OBO/EKM)
- Preyed by (OBO/EKM)
- Is part of (?)
- Interacts with (OBO)
- Is similar to (skos:closeMatch)
- Is attracted by (EKM)
- Is repelled by (EKM)
- Hibernates in (EKM)
- Fattens up during (EKM)
- Is available on season (EKM)

Plus empty post-its

#4 GALLERY WALK + DEMO

8 minutes

AIM

Close the loop by showing proof: KG → machine-readable + LOD → tough questions answered.

PROCESS

- Groups leave their mini-graph on the table
- Everyone walks around to look at each other's mini-graph

- Run an LLM-assisted SPARQL or natural-language query

  Which competitors for food does the bear have in autumn?
- Result pops up.

#5 BRIDGE TO LIVED-THROUGH PROBLEMS

8 minutes

AIM

Personalise benefits for people in the audience; uncovers follow-up leads.

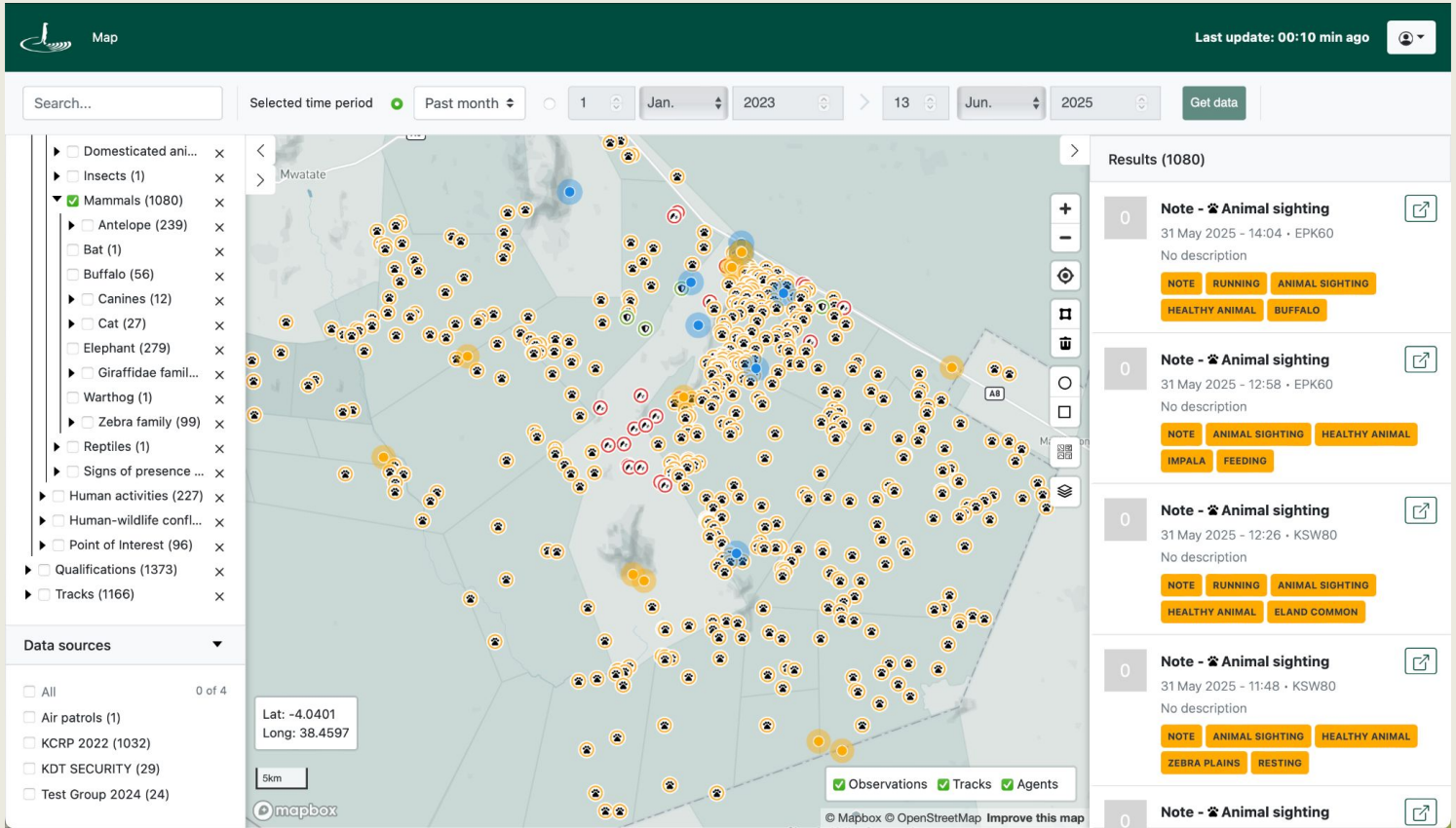
PROCESS

Brief interview-style prompts (raise hands):

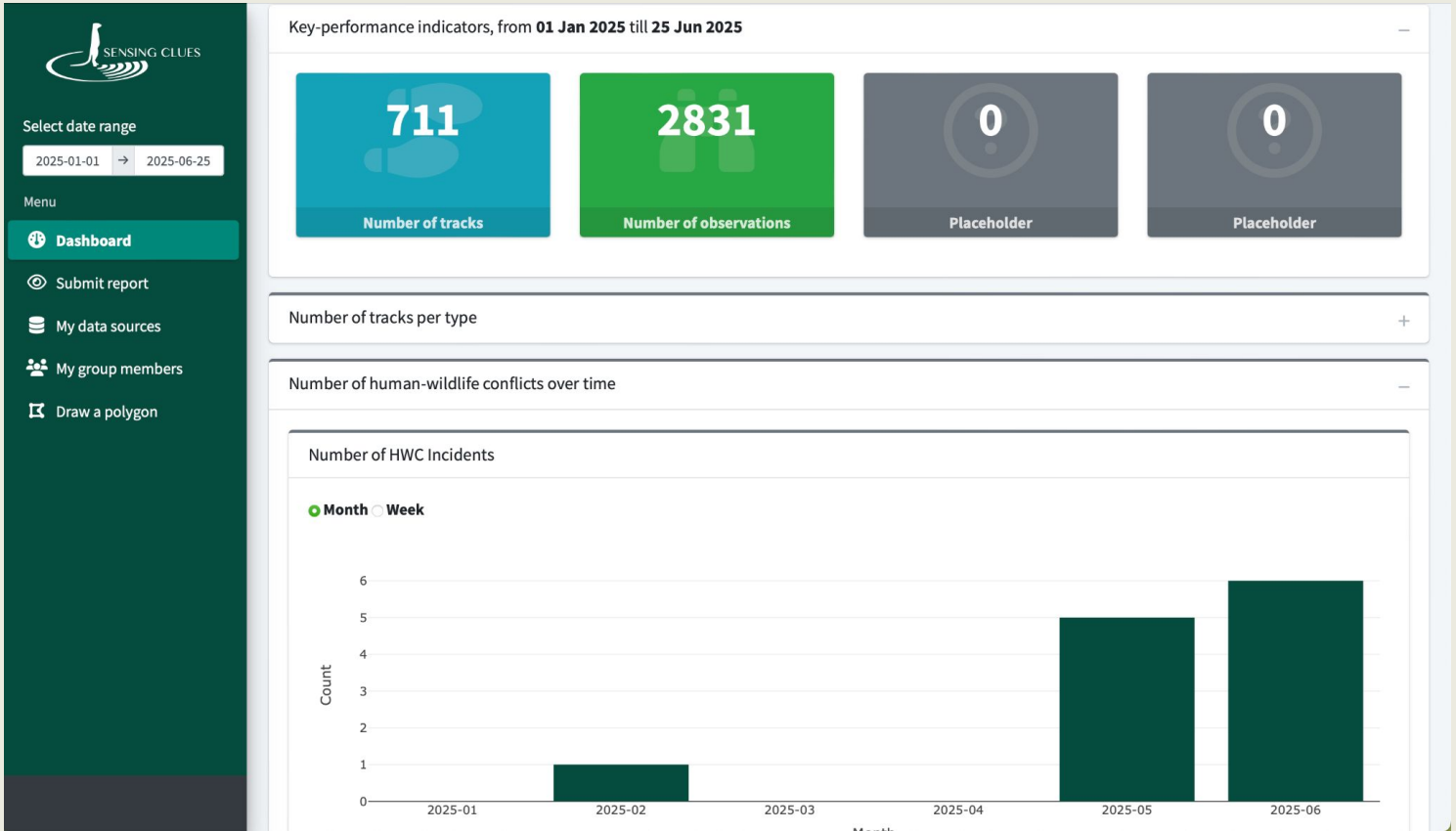
- Who merges datasets?” → show harmonised data in Focus 360
- Who conducts ecological research? → show LOD example
- Who creates KPI-reports for donors → show enterprise-wide KPI dashboard

Capture extra use-cases on second colour sticky; park on wall

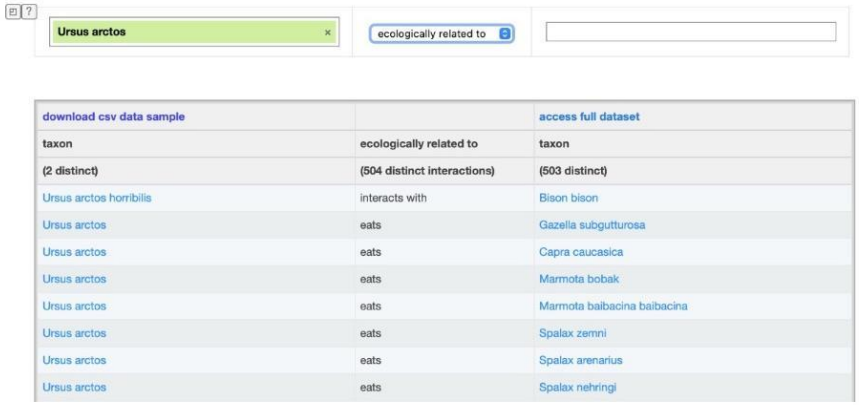
FOCUS 360


Map
Last update: 00:10 min ago
Search...
Selected time period
Past month
1
Jan.
2023
13
Jun.
2025
Get data
Domesticated ani...
Insects (1)
Mammals (1080)
Antelope (239)
Bat (1)
Buffalo (56)
Canines (12)
Cat (27)
Elephant (279)
Giraffidae famil...
Warthog (1)
Zebra family (99)
Reptiles (1)
Signs of presence ...
Human activities (227)
Human-wildlife confl...
Point of Interest (96)
Qualifications (1373)
Tracks (1166)
Data sources
All
0 of 4
Air patrols (1)
KCRP 2022 (1032)
KDT SECURITY (29)
Test Group 2024 (24)
Mwatate
Lat: -4.0401
Long: 38.4597
5km
Observations
Tracks
Agents
mapbox
© Mapbox © OpenStreetMap Improve this map
Results (1080)
Note - Animal sighting
31 May 2025 - 14:04 • EPK60
No description
NOTE
RUNNING
ANIMAL SIGHTING
HEALTHY ANIMAL
BUFFALO
Note - Animal sighting
31 May 2025 - 12:58 • EPK60
No description
NOTE
ANIMAL SIGHTING
HEALTHY ANIMAL
IMPALA
FEEDING
Note - Animal sighting
31 May 2025 - 12:26 • KSW80
No description
NOTE
RUNNING
ANIMAL SIGHTING
HEALTHY ANIMAL
ELAND COMMON
Note - Animal sighting
31 May 2025 - 11:48 • KSW80
No description
NOTE
ANIMAL SIGHTING
HEALTHY ANIMAL
ZEBRA PLAINS
RESTING
Note - Animal sighting

DASHBOARD

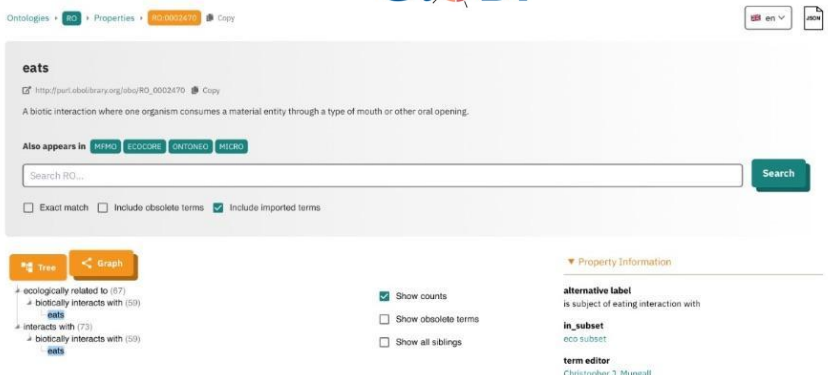

SENSING CLUES
Select date range
2025-01-01
2025-06-25
Menu
Dashboard
Submit report
My data sources
My group members
Draw a polygon
Key-performance indicators, from 01 Jan 2025 till 25 Jun 2025
711
Number of tracks
2831
Number of observations
0
Placeholder
0
Placeholder
Number of tracks per type
Number of human-wildlife conflicts over time
Number of HWC Incidents
Month
Week
Count
0
1
2
3
4
5
6
2025-01
2025-02
2025-03
2025-04
2025-05
2025-06

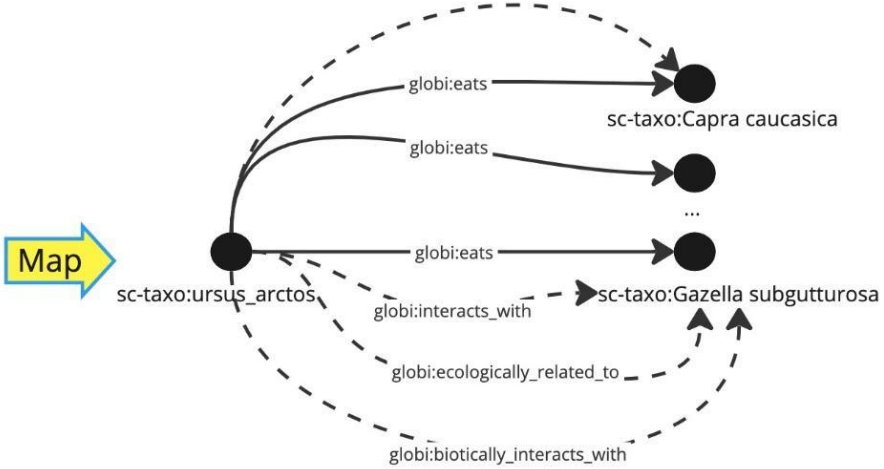
Linked Open Data



download csv data sample		access full dataset
taxon	ecologically related to	taxon
(2 distinct)	(504 distinct interactions)	(503 distinct)
Ursus arctos horribilis	interacts with	Bison bison
Ursus arctos	eats	Gazella subgutturosa
Ursus arctos	eats	Capra caucasica
Ursus arctos	eats	Marmota bobak
Ursus arctos	eats	Marmota baibacina baibacina
Ursus arctos	eats	Spalax zemni
Ursus arctos	eats	Spalax arenarius
Ursus arctos	eats	Spalax nehringi

GLOBI





$$\forall x.y\ eats(x,y) \rightarrow biotically\_interacts\_with(x,y)$$

$$\forall x.y\ biotically\_interacts\_with(x,y) \rightarrow interacts\_with(x,y)$$

#6 COMMIT AND NEXT STEP

5 min

AIM

Identify interest and hottest prospects

PROCESS

- Bring out 2 votes (dot-stickers) on the sticky-note wall for problems you'd like help with.
- Browse: Sandbox GraphDB to start your experiments
- Make appointment with one of the Sensing Clues

MORE INFORMATION

applied sciences

MDPI

Article

Enabling Biodiversity-Informed Architecture Through Ontology-Driven Data Integration

Albin Ahmeti [1,*], Defne Sunguroglu Hensel [2], Cédric Pruski [3], Jakub Tyc [1] and Michael Hensel [1]

1 Department of Digital Architecture and Planning, Faculty of Architecture and Planning, Technical University of Vienna, Karlsplatz 13, 1040 Wien, Austria; jakub.tyc@tuwien.ac.at (J.T.); michael.hensel@tuwien.ac.at (M.H.)
2 Internationalisation Demonstration School, Southeast University, Si-Pai-Lou 2, Nanjing 211102, China; defnesunguroglu@gmail.com
3 Luxembourg Institute of Science and Technology, 5, Avenue des Hauts-Fourneaux, L-4362 Esch-sur-Alzette, Luxembourg; cedric.pruski@list.lu
* Correspondence: aljbin.ahmeti@tuwien.ac.at

A Neuro-Symbolic Data Architecture to Modeling and Preserving Nature: Predicting Brown Bear Movement based on Knowledge Graphs*

Albin Ahmeti[a,c,*], Robert David[a], Artem Revenko[a] and Jan-Kees Schakel[b]

[a]Semantic Web Company / Graphwise, Austria
[b]Sensing Clues, Netherlands
[c]Vienna University of Technology, Austria

ARTICLE INFO

Keywords:
biodiversity
knowledge graphs
taxonomies
ontologies
data architecture

ABSTRACT

Protecting endangered species and preventing human-wildlife conflicts are vital pillars of effective nature conservation. As human activities increasingly encroach on natural habitats, interactions between people and wildlife – specifically brown bears (Ursus arctos) – can intensify, often leading to harm for both parties. Likewise, many designated nature reserves are now too small to sustain healthy wildlife populations, therefore animals are venturing in human-populated areas. In this paper we propose a novel, conceptual neuro-symbolic data architecture that combines symbolic AI with prediction models leveraging machine learning and statistical methods. Our approach builds on the Nature FIRST Knowledge Graph, while addressing the specific ecological needs of the brown bear, extending it to incorporate species taxonomic rank, biotic interactions, and food availability based on seasons. We also integrate geospatial data, including map layers, habitat suitability indices, and observational data into the knowledge graph. This integration enhances predictive accuracy by providing a holistic view of spatial, environmental and ecological factors. The proposed data architecture offers new insights into understanding and predicting the movement patterns of brown bears across various habitats.

Towards Preserving Biodiversity using Nature FIRST Knowledge Graph with Crossovers

Albin Ahmeti[1,2,*], Jan-Kees Schakel[3], Robert David[1] and Artem Revenko[1]

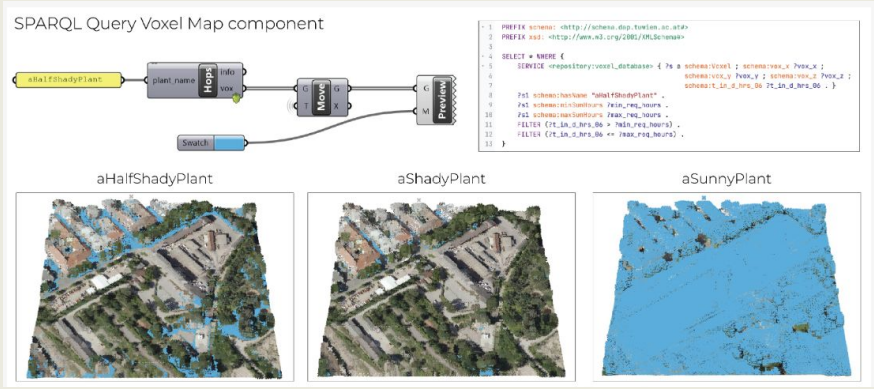
[1]Semantic Web Company, Austria
[2]Vienna University of Technology (TU Wien), Austria
[3]Sensing Clues Foundation, Netherlands.

Abstract

Preserving biodiversity, encompassing species and their habitats, is gaining significant attention and becoming a central concern, alongside the focus on climate change. Climate change directly impacts biodiversity and is a prominent aspect of Environmental, Social, and Governance (ESG) criteria. At the EU level, designated areas called Natura 2000 sites have been established for protection and conservation, aimed at safeguarding habitats and species. However, the data regarding these sites, habitats, and species is currently dispersed and isolated, resulting in limited usefulness. To address this issue, we introduce our work on a *Knowledge Graph* (KG) for biodiversity, known as *Nature First KG*. This KG aims to connect various data silos, including information about sites, species, and habitats, through cross-references called *crossovers*. Combining it with a digital twin, we empower recommender use cases such as: preventing human-wildlife conflicts, facilitating species reproduction, and combating illegal poaching to name a few.

Keywords

knowledge graphs, biodiversity, data integration, linked open data, FAIR



Talk to your graph example

- “Competes” is not a relation in the ontology