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29. May 2024

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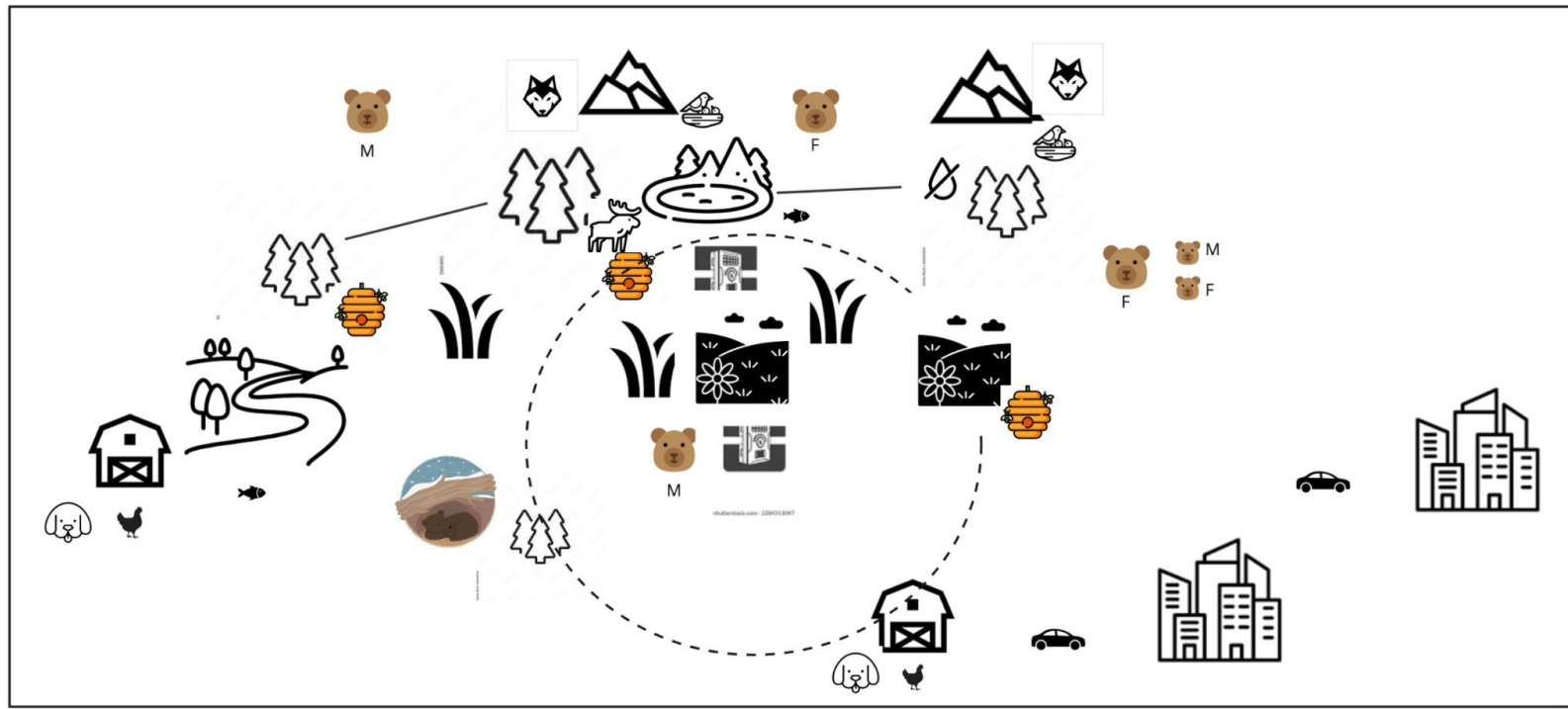
# NATUREFIRST

**A Species Conservation Recommender System based on Knowledge Graph for Brown Bear Movement Prediction**



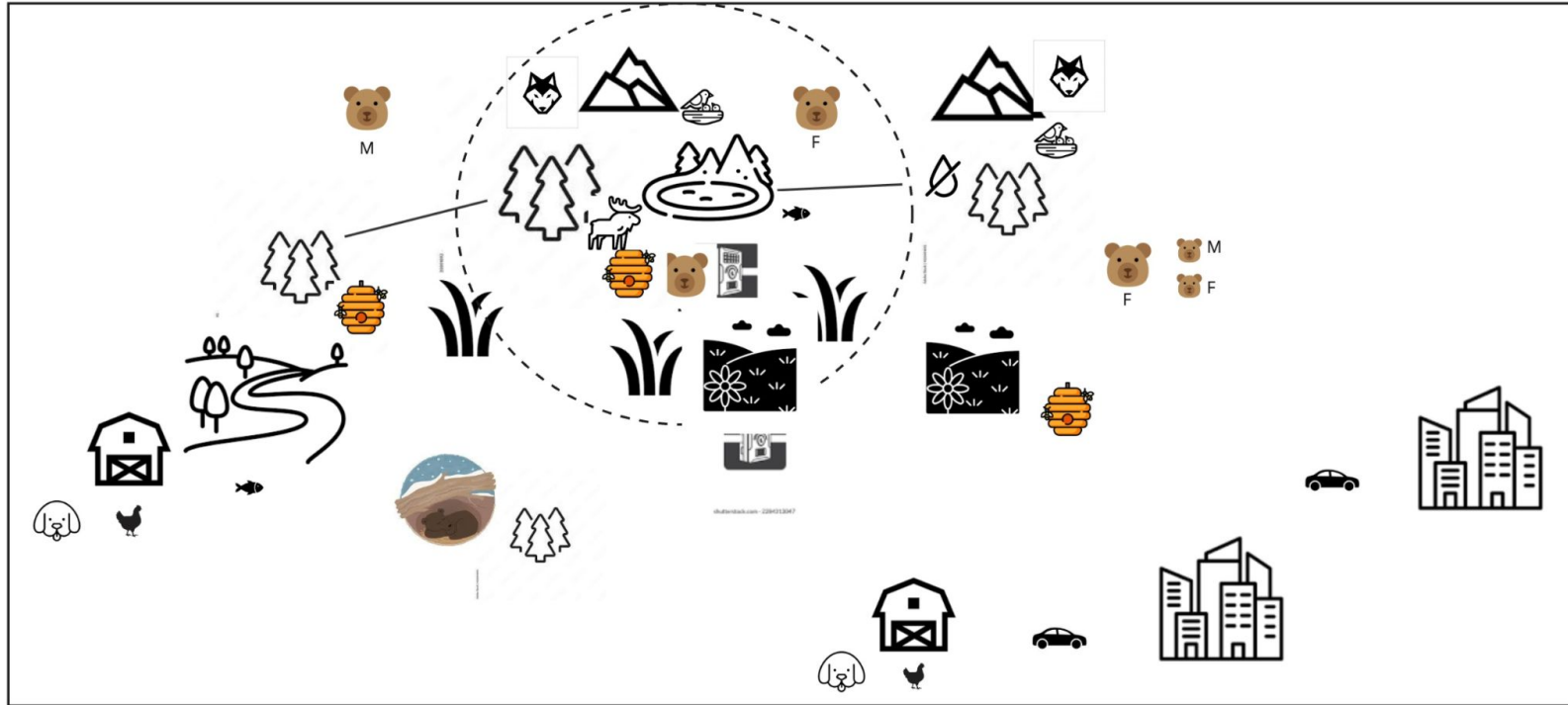
Funded by  
the European Union

# Problem space: Brown Bear Movement Prediction (1/2)



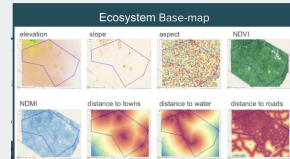
# Problem space: Brown Bear Movement Prediction

(2/2)



# Problem space: Summary

- A need to **integrate, harmonize and reason** over heterogeneous data originating from various sources:
  - **Sensor data - Digital twin:** camera traps / traptagger
  - **Brown bear habitat suitability index (HSI)**
    - Which elevations does it prefer? Slopes? Habitats?
  - Brown bear's **ecological model:** with which species and habitats does it interact? How does that change during time of the day and/or season?
  - Geographic/Spatial data on habitat structure - **ecosystem basemaps**
  - **Observations in Cluey** - points of interest, beehives etc..



## Solution:

Describe and align the aforementioned data with common vocabularies and taxonomies!  
Use knowledge graph as a data model to represent, connect and reason over data sources!

# What is a taxonomy?

<https://sensingclues.org/taxonomy-graphviews>

Corine Land Cover EU

Essential Biodiversity Variables

EunisSpecies

✓ Habitats EUNIS 2012

Habitats EUNIS 2017

Habitats EUNIS 2021

IUCN Habitat Classification Scheme

IUCN Red List Species

SCCSS Ontology

SCCSS Ontology v3

Interlinking sources of truth.

Making them accessible to the public.

And machine-readable for researchers and developers.

Habitats EUNIS 2012

All habitats

- A-Marine habitats
- B-Coastal habitats
- C-Inland surface waters
- D-Mires, bogs and fens
- E-Grasslands and lands dominated by forbs, mosses or lichens
- F-Heathland, scrub and tundra
- G-Woodland, forest and other wooded land
  - G1-Broadleaved deciduous woodland
    - G1.1-Riparian and gallery woodland, with dominant Alnus, Betul
    - G1.2-Mixed riparian floodplain and gallery woodland
    - G1.3-Mediterranean riparian woodland
    - G1.4-Broadleaved swamp woodland not on acid peat
    - G1.5-Broadleaved swamp woodland on acid peat
    - G1.6-Fagus woodland
    - G1.7-Thermophilous deciduous woodland
    - G1.8-Acidophilous Quercus-dominated woodland
    - G1.9-Non-riverine woodland with Betula, Populus tremula or Sor
    - G1.A-Meso- and eutrophic Quercus, Carpinus, Fraxinus, Acer, T
    - G1.B-Non-riverine Alnus woodland
    - G1.C-Highly artificial broadleaved deciduous forestry plantations
    - G1.D-Fruit and nut tree orchards
      - G1.D1-Castanea sativa plantations
      - G1.D2-Juglans groves
      - G1.D3-Prunus amygdalus groves
      - G1.D4-Fruit orchards
      - G1.D5-Other high-stem orchards
  - G2-Broadleaved evergreen woodland
  - G3-Coniferous woodland
  - G4-Mixed deciduous and coniferous woodland
  - G5-Lines of trees, small anthropogenic woodlands, recently felled wo
- I-Inland unvegetated or sparsely vegetated habitats
- J-Regularly or recently cultivated agricultural, horticultural and domestic hab
- K-Constructed, industrial and other artificial habitats

Search for a concept

Habitats EUNIS 2012

Tree View Overview Detail View

Submit Feedback

<http://eunis.eea.europa.eu/rdf/habitats.schema.rdf#name>

Fruit and nut tree orchards

**description**

Stands of trees cultivated for fruit or flower production, providing permanent tree cover once mature. Extensively cultivated and old orchards are habitats supporting rich flora and fauna.

**code**

362

<http://www.w3.org/2000/01/rdf-schema#label>

Fruit and nut tree orchards

**priority**

false

**originallyPublishedCode**

362

**habitatCode**

G1.D

**Children**

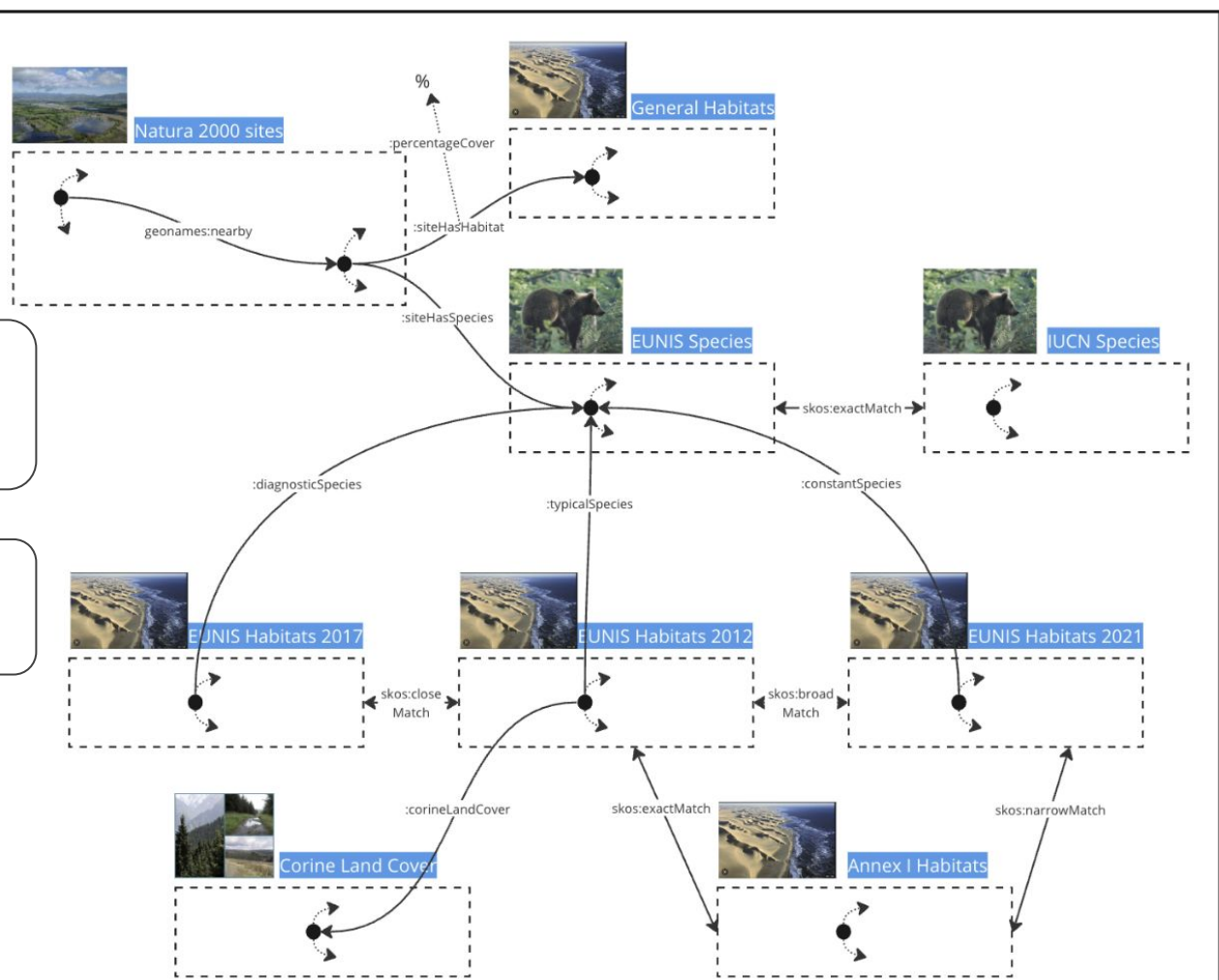
- G1.D1-Castanea sativa plantations+
- G1.D2-Juglans groves+
- G1.D3-Prunus amygdalus groves+
- G1.D4-Fruit orchards+

Authoritative source

# What is a knowledge graph?

Provide more contextual knowledge using relations: *geonames:nearby*  
Crossovers to link one dataset with another: *skos:exactMatch*

Added value: Ask more complex competency questions!



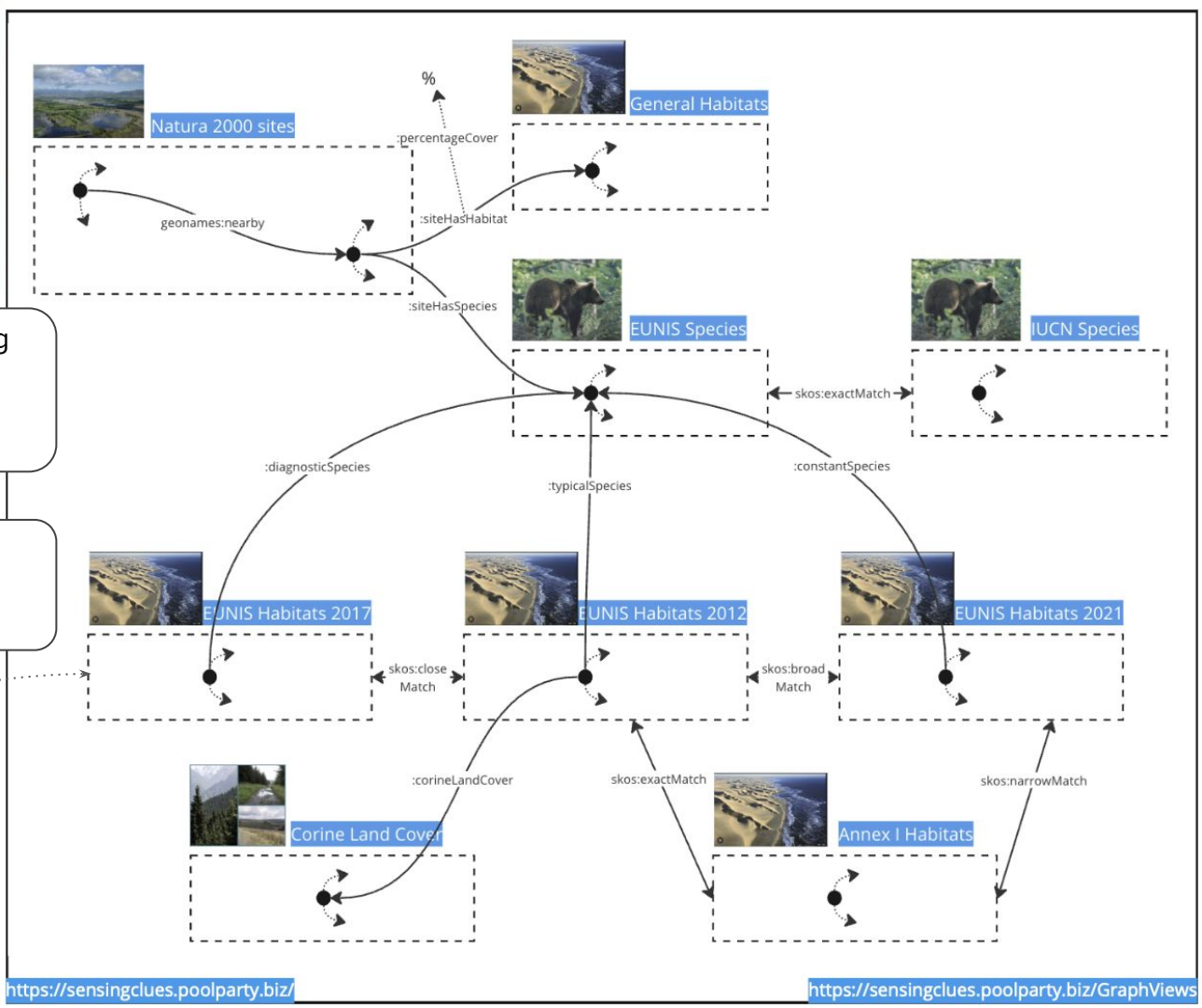
# What is a knowledge graph?

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“is equal to” (*skos:exactMatch*)

Habitat X in Ancares Courel

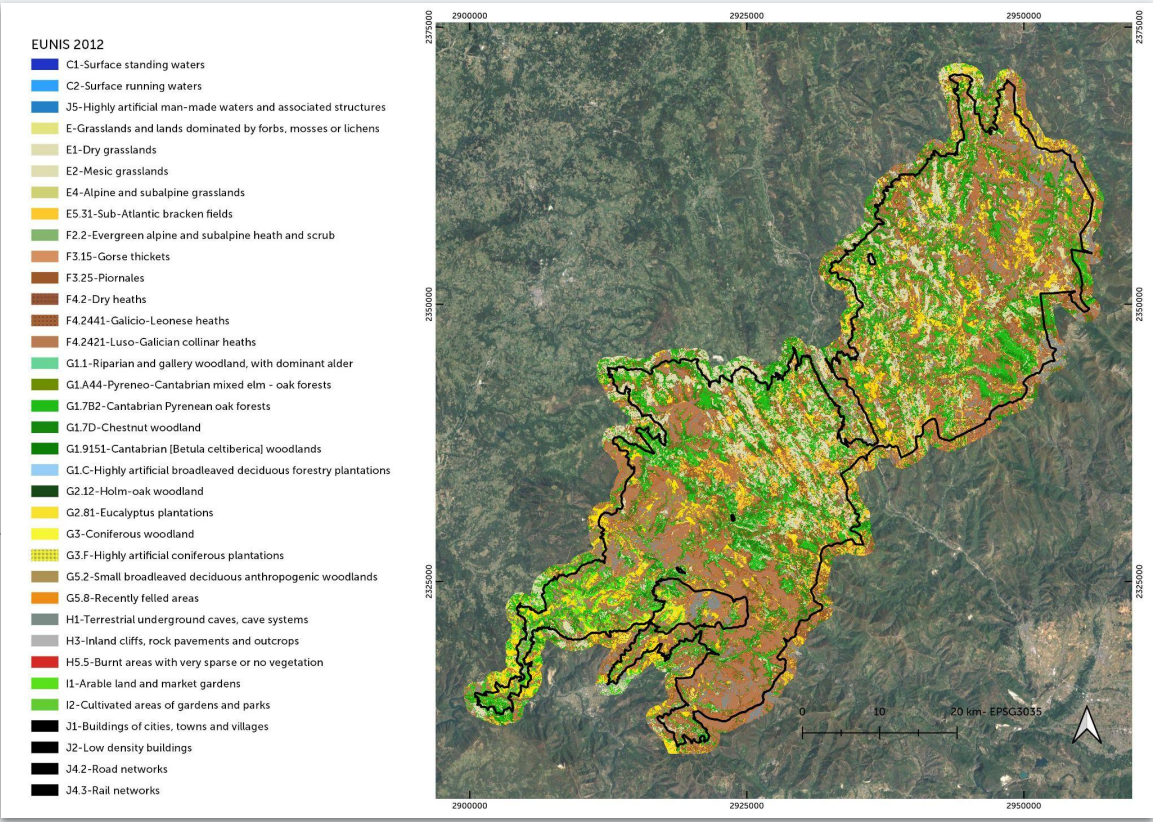




# Ancares Courel mapping using EUNIS 2012

“is equal to” (*skos:exactMatch*)

Habitat X in Ancares Courel





# Nature FIRST KG v1.0 Linked Open Data

**NATURA 2000 VIEWER** DISCLAIMER and note 2021

Search Natura 2000 sites, habitats, species, cou...

**Ancares - Courel**

Country: Spain (ES1120001)  
Type: Protected under the Habitats Directive  
Area: 182634.51 ha  
Established date: Dec. 1997  
EU protected species: 54  
EU protected habitats: 33

Open in sid... Zoo... 1 of 3

<https://natura2000.eea.europa.eu/>

Show me TOP 5 largest habitats that are close to ES1120001 (Ancares Courel)

**SPARQL Endpoint**

```

PREFIX geonames: <https://www.geonames.org/ontology#>
PREFIX sites: <https://sensingclues.poolparty.biz/natura2000site/>
PREFIX h: <https://sensingclues.poolparty.biz/Natura2000Site/>

SELECT Label (SPH/?percentage) as ?sum (group_concat(?percentage) as ?ont)
WHERE
  ?ES1120001 geonames:nearby ?sites .
  ?sites sites:label ?label sites:percentageCover ?percentage .
  BIND (xsd:double(?percentage) as ?percentage)
  BIND (xsd:double(?sum) as ?percentage)
  label order by desc(?sum) limit 5
  
```

label	sum	cnt
<a href="https://sensingclues.poolparty.biz/GeneralHabitatClasses/N08">https://sensingclues.poolparty.biz/GeneralHabitatClasses/N08</a>	138.3	39 1.3 20 54 24
<a href="https://sensingclues.poolparty.biz/GeneralHabitatClasses/N16">https://sensingclues.poolparty.biz/GeneralHabitatClasses/N16</a>	95.7	12 27.7 15 19 22
<a href="https://sensingclues.poolparty.biz/GeneralHabitatClasses/N06">https://sensingclues.poolparty.biz/GeneralHabitatClasses/N06</a>	70.89	69 89 1
<a href="https://sensingclues.poolparty.biz/GeneralHabitatClasses/N15">https://sensingclues.poolparty.biz/GeneralHabitatClasses/N15</a>	44.0	1 5 4 34
<a href="https://sensingclues.poolparty.biz/GeneralHabitatClasses/N19">https://sensingclues.poolparty.biz/GeneralHabitatClasses/N19</a>	43.0	1 25 5 12

<https://sensingclues.poolparty.biz/PoolParty/sparql/Natura2000Site>

GO TO Biodiversity | Expert viewer | More

← Back

These are the 385 sites where the species is found

Mammals

Click on a species in the list to see the location on the map.

Only significantly present species are listed

Brown bear - Ursus arctos

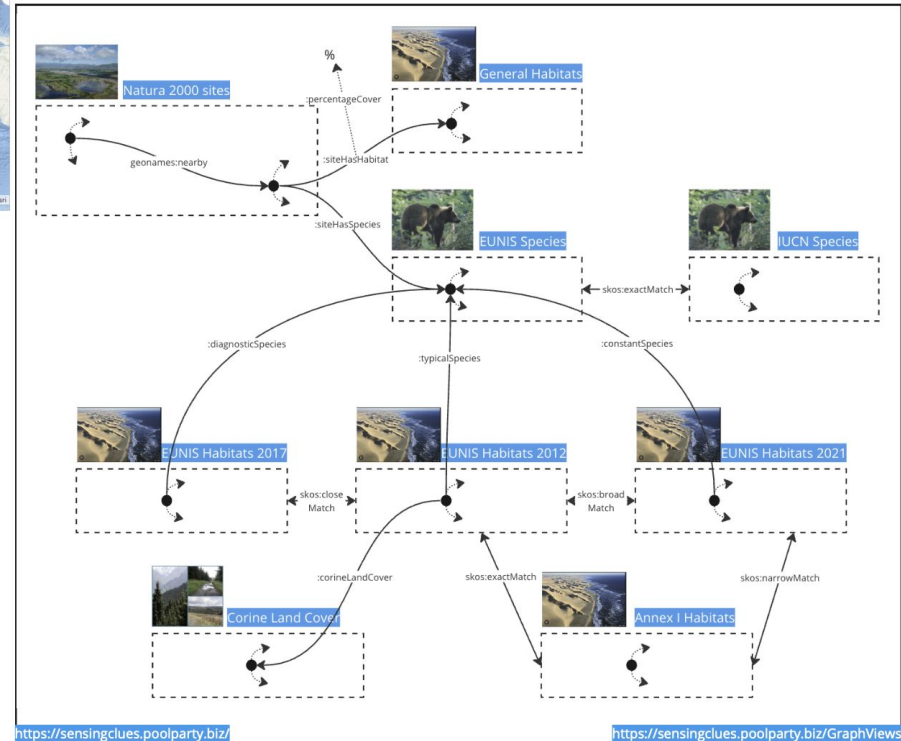
Discover more

**Brown bear - Ursus arctos**

Mammals  
Concentration Permanent Reproducing  
Wintering  
1354  
Species code

**Nature FIRST Knowledge Graph Statistics**

No #	Project (Taxonomy)	Input data	# Concepts	Crossovers	# Crossovers
1	EUNIS Species	RDF	315316	-	-
2	EUNIS Habitats 2017	RDF	7495	#1 #10	38306 ; 388
3	EUNIS Habitats 2012	XLS	2214	#1 #2	1777 ; 2231
4	EUNIS Habitats 2021	XLS	3558	#1 #2	4869 ; 3765
5	Habitats Annex I	XLS	264	#4	586
6	General habitats	XLS	54	-	-
7	IUCN Species	RDF	15139	#1	2655
8	IUCN Habitats	CSV	252	-	-
9	Natura 2000	CSV, shapefile	27054	#1 #6	240790 ; 139802
10	Corine Land Cover	RDF	65	-	-




Added value: Ask more complex competency questions!  
**Report Ancares Courel habitat in terms of EUNIS classification.**

Inherits properties and attributes from EUNIS

# Linked Open Data - Wikidata





**WIKIDATA**

- Main page
- Community portal
- Project chat
- Create a new item
- Recent changes
- Random item
- Query Service
- Neatby
- Help
- Donate
- Lexicographical data
- Create a new Lexeme
- Recent changes
- Random Lexeme
- Tools
- What links here
- Related changes
- Special pages
- Permanent link
- Page information
- Concept URI
- Cite this page
- Get shortened URL
- Download QR code

Item Discussion

## brown bear (Q36341)

species of mammal [edit](#)

Ursus arctos | grizzly bear

↳ In more languages

Language	Label	Description	Also known as
English	brown bear	species of mammal	Ursus arctos grizzly bear
German	Braunbär	Art der Gattung Ursus	Kamtschatkabär Ursus arctos Ursus arctos arctos europäischer Braunbär brauner Karpatenbär Meister Petz Meister Braun
Bavarian	No label defined	No description defined	
French	ours brun	espèce de mammifères	Ursus arctos Ursus arctos arctos Ours brun

All entered languages

### Statements

instance of [edit](#)

taxon [+ add reference](#)

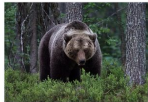
↳ 0 references [+ add value](#)

subclass of [edit](#)

bear [+ add reference](#)

↳ 0 references [+ add value](#)

image [edit](#)



Wikipedia (128 entries) [edit](#)

- af Bruinbeer
- am ቡንቡየር
- ang Brin bera
- an Ursus arctos
- ar دب بني
- arz دب بني
- ast Ursus arctos
- avk Beretraf Rupol (Ursus arctos)
- azb قوروس اوس
- az Qonur ayı
- ban Benuang soklat
- bat\_smg Meška
- ba һоро айыу
- be\_x\_old Мядзведзь бурны
- be Бурны мядзведзь
- bg Кадрена мечка
- bn অসমি বান্দুৰ
- bo ལྔ་ལོང་།
- br Arzh gell
- bs Mlki medvjed
- ca Os bru
- ceb Ursus arctos
- ce Бора ча
- chy Mo'itsenahkohe
- cr Wikipedia:Archives/ب-ا-ب-ا
- cab Bruny miedwiedz
- cs Medvěd hnědý
- cv Хăвăп ына
- cy Arth frown
- da Brun bjørn
- de Braunbär [👤](#)
- diq Heşo gewr
- dsb Bruny mjadwjeż
- el Καφέ αρκούδα
- en Brown bear [👤](#)
- eo Bruna urso
- es Ursus arctos
- et Pruunkaru
- eu Hartz arne
- fa خرس قهوه‌ای
- fiu\_vro Kahr
- fi Karhu

IUCN conservation status [edit](#)

Least Concern [+ add value](#)

↳ 1 reference

start time [edit](#)

500000 years BCE [+ add reference](#)

↳ 0 references [+ add value](#)

award received [edit](#)

Animal of the Year [+ add reference](#)

point in time 2005


↳ 1 reference

Q109758751 [edit](#)

point in time 2009 [+ add reference](#)

↳ 0 references [+ add value](#)

taxon range map image [edit](#)



Ursus arctos range map.svg  
1,000 × 500; 715 KB

media legend [+ add reference](#)

↳ 0 references

Световно разпространение на "U. arctos" (Bulgarian)


Bulgaria Distribution Ursus arctos.svg [edit](#)



Bulgaria Distribution Ursus arctos.svg  
2,483 × 1,642; 899 KB



# Linked Open Data - Wikidata



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Bavarian	No label defined	No description defined	
French	ours brun	espèce de mammifères	Ursus arctos Ursus arctos arctos Ours brun

All entered languages

### Statements

instance of [edit](#)

taxon + add reference

↳ 0 references

+ add value


subclass of [edit](#)

bear + add reference

↳ 0 references

+ add value

image [edit](#)

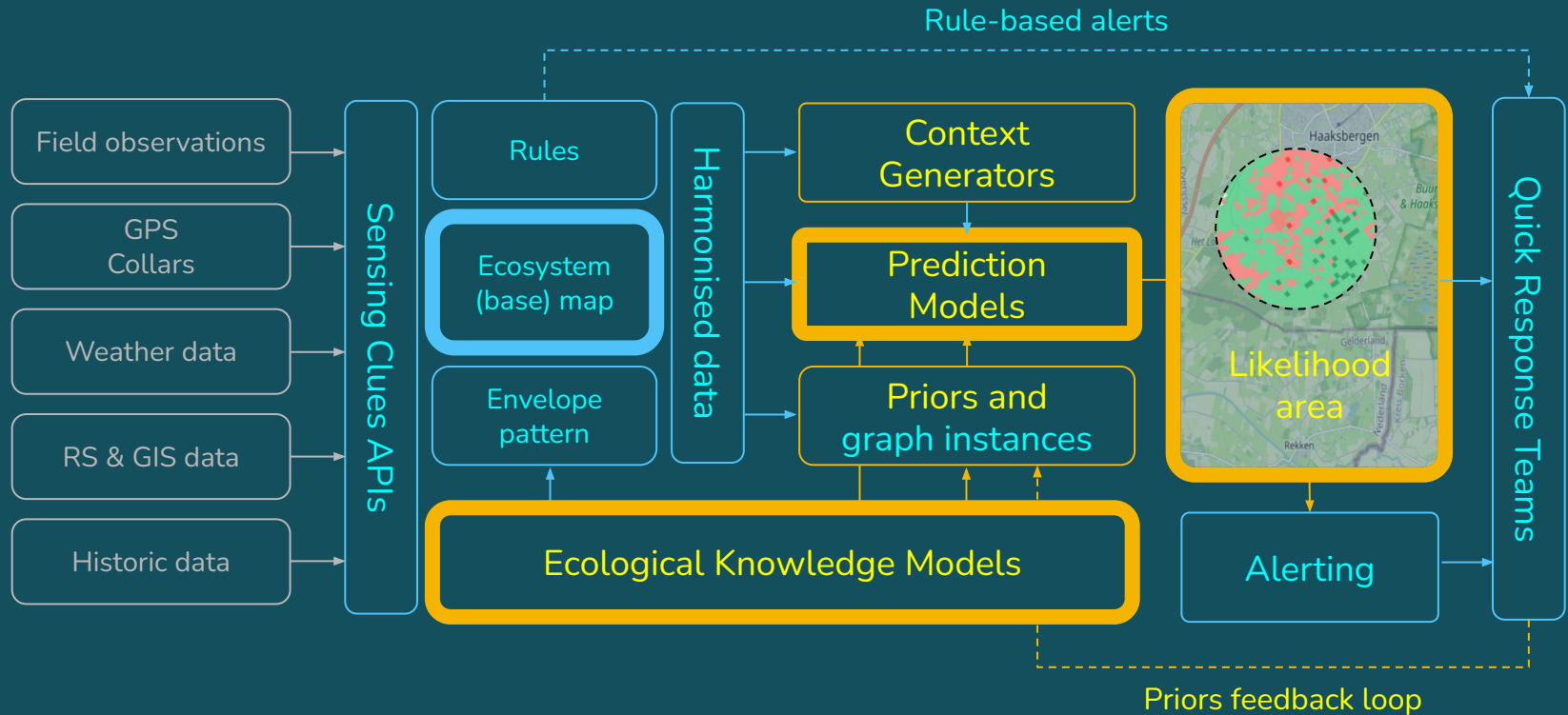


### Wikipedia (128 entries) [edit](#)

- af Bruinbeer
- am ቡንቡየር
- ang Brin bera
- an Ursus arctos
- ar دب بني
- arz دب بني
- ast Ursus arctos
- avk Beretraf Rupoł (Ursus arctos)
- azb قوروس اوس
- az Qonur ayı
- ban Benuang soklat
- bat\_smg Meška
- ba һоро айыу
- be\_x\_old Мядзведзь бурны
- be Бурны мядзведзь
- bg Кадреве мечка
- bn অসি
- bo ལྷོ་མེ་ལོང་།
- br Arzh gell
- bs Mlki medvjed
- ca Os bru
- ceb Ursus arctos
- ce Бора ча
- chy Mo'otseñahkohe
- cr Wikipedia:Archives/بني
- cab Bruny miedwiedz
- cs Medvěd hnědý
- cv Хăлăп ына
- cy Arth frown
- da Brun bjørn
- de Braunbär
- diq Heşo gewr
- dsb Bruny mjadwjež
- el Καφέ αρκούδα
- en Brown bear
- eo Bruna urso
- es Ursus arctos
- et Pruunkaru
- eu Hartz arne
- fa خرس قهوه‌ای
- fiu\_vro Kahr
- fi Karhu

Crossovers to “Catalogue of Life” and other species repositories.

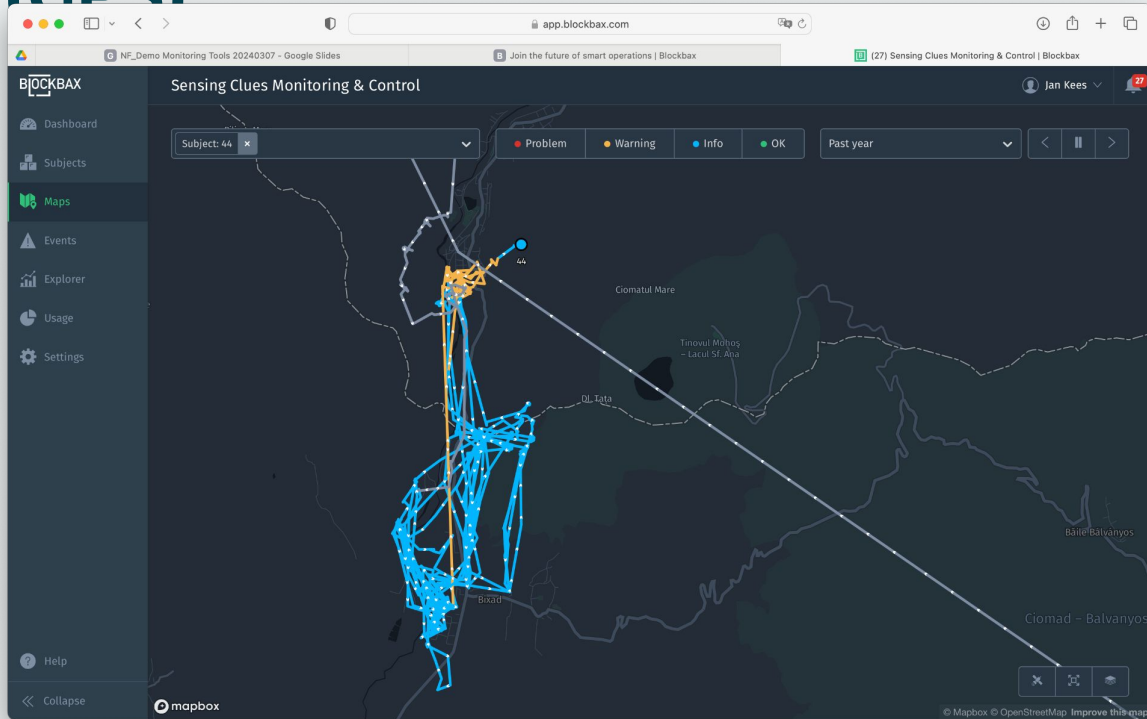
BNCF Thesaurus ID	20737	subject named as Orsi bruni alternative name Orsi europel Ursus arctos	<a href="#">edit</a> + add reference + add value
BOLD Systems taxon ID	12510	+ 1 reference	<a href="#">edit</a> + add value
Catalogue of Life ID	7F2KB	+ 1 reference	<a href="#">edit</a> + add value
CITES Species+ ID	9829	+ 1 reference	<a href="#">edit</a> + add value
CONABIO ID	184392MAMIFB501112	- 0 references	<a href="#">edit</a> + add reference + add value
Czech NDOP taxon ID	34378	+ 1 reference	<a href="#">edit</a> + add value
Den Store Danske ID	brun_bjorn	- 0 references	<a href="#">edit</a> + add reference + add value



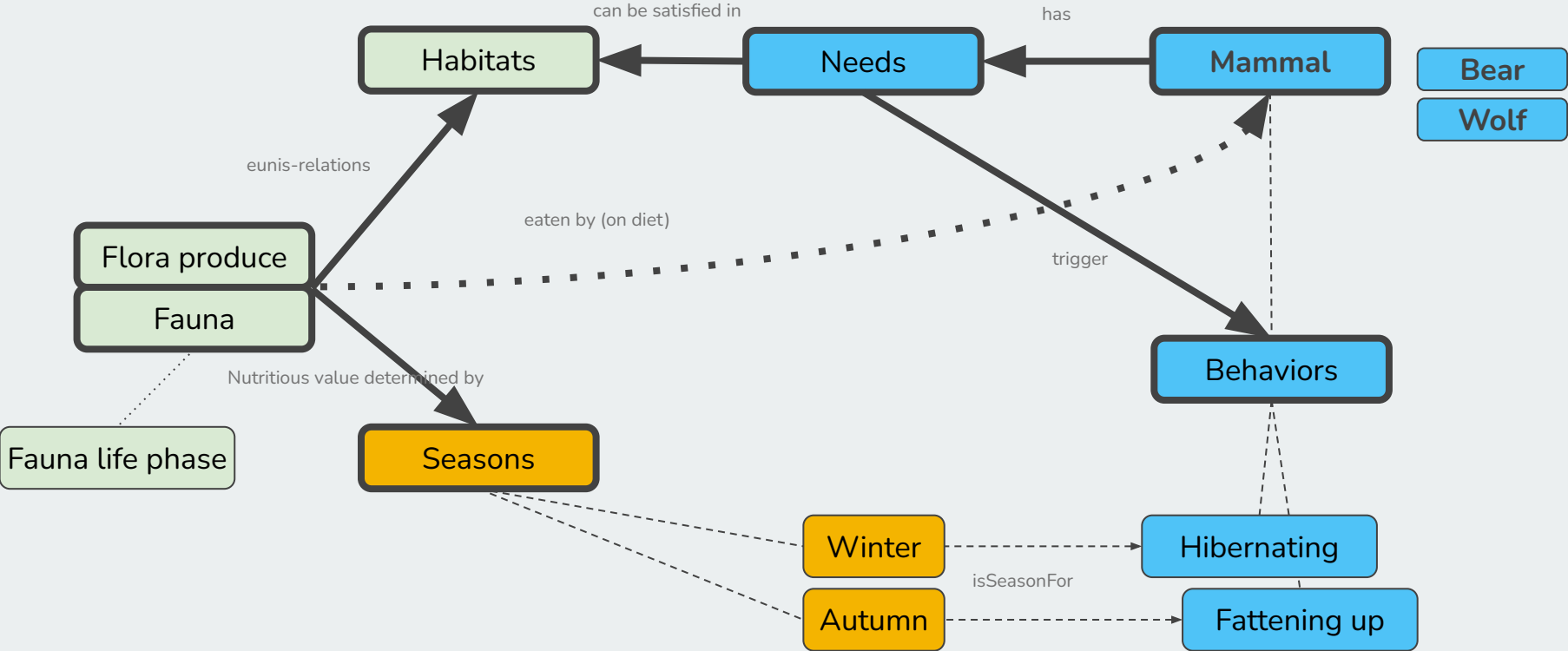
Conceptual architecture: knowledge-driven approach



# Learning brown bear behaviors from collared data (GPS)



# Ecological Knowledge Model (EKM)



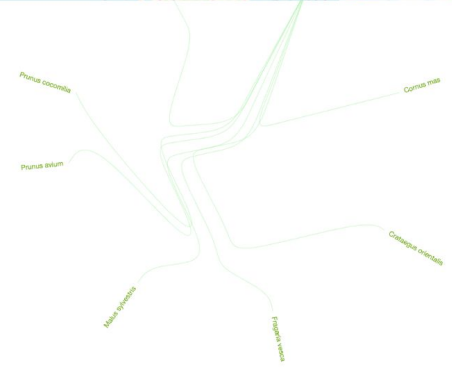
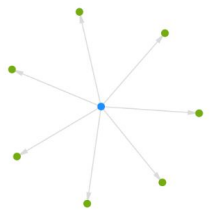
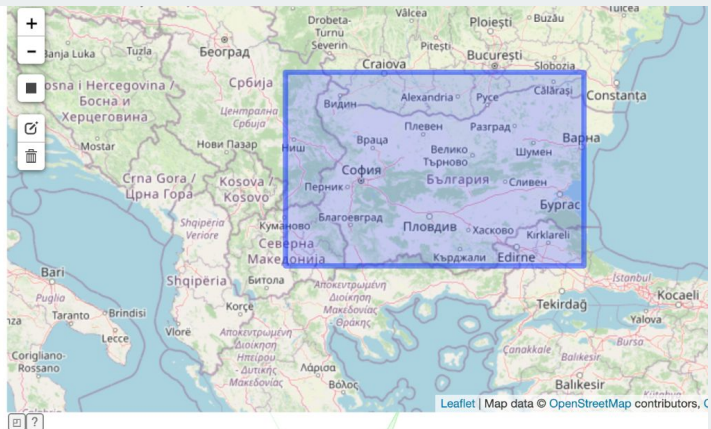


# EKM completed with GLoBI



Ursus arctos x ecologically related to

download csv data sample		access full dataset
taxon	ecologically related to	taxon
(1 distinct)	(7 distinct interactions)	(7 distinct)
Ursus arctos	eats	Fragaria vesca
Ursus arctos	eats	Malus sylvestris
Ursus arctos	eats	Cornus mas
Ursus arctos	eats	Prunus cocomilia
Ursus arctos	eats	Prunus avium



# EKM completed with GLoBI



PROJECT CORPORA TOOLS ADVANCED English ursus.arc

Global Biotic Interactions - No hierarchy

Biotic Interactions (1)

Interactions (724)

- Abies lasiocarpa (0)
- Acanthomyops (0)
- Achillea millefolium (0)
- Acinetobacter sp. (0)
- Acomys nesiotus (0)
- Actaea rubra (0)
- Actinopterygii (0)
- Actitis hypoleucos (0)
- Aeromonas sp. (0)
- Agoseris aurantiaca (0)
- Agrostis (0)
- Alces alces (0)
- Alectoris barbara (0)
- Alectoris chukar (0)
- Alectoris graeca (0)
- Alectoris rufa (0)
- Allium schoenoprasum (0)
- Alloccicetulus eversmanni (0)
- Alphacoronavirus (0)
- Alphacoronavirus 1 (0)
- Alphavirus (0)
- alpine vegetation (0)
- Amelanchier alnifolia (0)
- Amelanchier ovalis (0)
- Ammoperdix griseogularis (0)
- Anabrus simplex (0)
- Anaplasma phagocytophilum (0)
- Anas (0)
- Anas acuta (0)
- Anas clypeata (0)
- Anas crecca (0)
- Anas platyrhynchos (0)

## Ursus arctos

<https://sensingclues.poolparty.biz/GloBI/Ursus%20arctos>

+ Add to Exclude-list + Add to ExactMatch

Details Notes Documents Linked Data Triples Visualization Quality Manager

SKOS **Globi\_Schema**

eatenBy (1)

- Canis lupus
- Homo sapiens
- Panthera tigris
- Ursus arctos
- Ursus arctos arctos

eats (1)

- Abies lasiocarpa
- Acanthomyops
- Achillea millefolium
- Acomys nesiotus
- Actaea rubra
- Actinopterygii
- Actitis hypoleucos
- Agoseris aurantiaca
- Agrostis
- Alces alces
- Alectoris barbara
- Alectoris chukar
- Alectoris graeca
- Alectoris rufa
- Allium schoenoprasum
- Alloccicetulus eversmanni
- alpine vegetation

## Stats:

p	cnt
<a href="https://sensingclues.poolparty.biz/GloBI/eats">https://sensingclues.poolparty.biz/GloBI/eats</a>	"535" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/hasParasite">https://sensingclues.poolparty.biz/GloBI/hasParasite</a>	"76" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/hostOf">https://sensingclues.poolparty.biz/GloBI/hostOf</a>	"71" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/interactsWith">https://sensingclues.poolparty.biz/GloBI/interactsWith</a>	"39" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/hasPathogen">https://sensingclues.poolparty.biz/GloBI/hasPathogen</a>	"21" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/preysOn">https://sensingclues.poolparty.biz/GloBI/preysOn</a>	"10" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/eatenBy">https://sensingclues.poolparty.biz/GloBI/eatenBy</a>	"5" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://www.w3.org/2004/02/skos/core#altLabel">http://www.w3.org/2004/02/skos/core#altLabel</a>	"3" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/hasEndoparasite">https://sensingclues.poolparty.biz/GloBI/hasEndoparasite</a>	"3" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/hasEctoparasite">https://sensingclues.poolparty.biz/GloBI/hasEctoparasite</a>	"2" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="https://sensingclues.poolparty.biz/GloBI/killedBy">https://sensingclues.poolparty.biz/GloBI/killedBy</a>	"2" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://purl.org/dc/terms/contributor">http://purl.org/dc/terms/contributor</a>	"1" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://purl.org/dc/terms/modified">http://purl.org/dc/terms/modified</a>	"1" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://www.w3.org/1999/02/22-rdf-syntax-ns#type">http://www.w3.org/1999/02/22-rdf-syntax-ns#type</a>	"1" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://www.w3.org/2004/02/skos/core#broader">http://www.w3.org/2004/02/skos/core#broader</a>	"1" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://www.w3.org/2004/02/skos/core#exactMatch">http://www.w3.org/2004/02/skos/core#exactMatch</a>	"1" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer
<a href="http://www.w3.org/2004/02/skos/core#prefLabel">http://www.w3.org/2004/02/skos/core#prefLabel</a>	"1" <input checked="" type="checkbox"/> http://www.w3.org/2001/XMLSchema#integer

# EKM completed with Wikidata



Synonyms fetched from Wikidata



Crossovers

# Brown Bear Habitat Suitability Index (Koen et al.)

The screenshot shows a web interface for configuring a concept. The main panel is titled "Elevation 0.0-200.0" and contains a list of properties to be defined:

- count (Any Type)
- habitatType (Any Type)
- max (200.0)
- min (0.0)
- weight (20.0)

The interface also includes a left sidebar with a tree view of concepts and a top navigation bar.

$$|scheme| \sum_{i=1} w_i * dim_{w_i}$$

A dotted arrow points from the  $w_i$  term in the equation to the weight property in the screenshot above.

The screenshot shows a web interface for configuring a concept. The main panel is titled "Elevation" and contains a list of properties to be defined:

- count (Any Type)
- habitatType (Any Type)
- max (20)
- min (0.0)
- weight (10)

The interface also includes a left sidebar with a tree view of concepts and a top navigation bar.

# Brown Bear Habitat Suitability Index (Koen et al.)

PROJECT CORPORA TOOLS ADVANCED | Search: Theoretical Concepts

Elevation 0.0-200.0

Details Notes Documents Linked Data Triples Visualization Quality Management History

SKOS **Habitat Suitability**

No relations defined yet.

- count ⓘ Any Time
- habitatType ⓘ Any Time
- max ⓘ 200.0 ⓘ
- min ⓘ 0.0 ⓘ
- weight ⓘ

$$|scheme| \sum_{i=1} w_i * dim_{w_i}$$

$\sum = 1$

$$|scheme| \sum_{i=1} dim_{w_i} = 1; 0 \leq |scheme| \sum_{i=1} w_i * dim_{w_i} \leq 1$$

Elevation 0.0-200.0

Metadata **Habitat Suitability** Triples Visualization History

No relations defined yet.

- count ⓘ Any Time
- habitatType ⓘ Any Time
- max ⓘ 20 ⓘ
- min ⓘ 0.0 ⓘ
- weight ⓘ 10 ⓘ

# HSI alignment with EUNIS 2012 via crossovers

The screenshot displays a web-based interface for managing habitat suitability index (HSI) concepts. On the left, a sidebar titled 'Ursus Arctos Habitat Suitability Index' contains a tree view of habitat classes. The class 'B3 - Rock cliffs, ledges and shores, including the supralittoral' is highlighted in orange. The main panel shows the details for this concept, including its SKOS label, broader and narrower concepts, and related concepts. The right-hand panel provides additional information such as the preferred label, alternative labels, hidden labels, notation, scope notes, and an example. A 'Crossovers' label is positioned below the interface, with a vertical dotted line pointing to the 'Exact Matching Concepts' section.

**Ursus Arctos Habitat Suitability Index**

- Distance from roads (6)
- Distance from settlements (5)
- Distance to water (6)
- Elevation (5)
- Habitat classes (45)
  - B1 - Coastal dunes and sandy shores (0)
  - B2 - Coastal shingle (0)
  - B3 - Rock cliffs, ledges and shores, including the supralittoral (0)**
  - C1 - Surface standing waters (0)
  - C2 - Surface running waters (0)
  - C3 - Littoral zone of inland surface waters (0)
  - D1 - Raised and blanket bogs (0)
  - D2 - Valley mires, poor fens and transitional fens (0)
  - D3 - Aapa, palsa and polygon mires (0)
  - D4 - Base-rich fens and calcareous spruce fens (0)
  - D5 - Sedge and reedbeds, normally with sedge (0)
  - D6 - Inland saline and brackish marshes (0)
  - E1 - Dry grasslands (0)
  - E2 - Mesic grasslands (0)
  - E3 - Seasonally wet and wet grasslands (0)
  - E4 - Alpine and subalpine grasslands (0)
  - E6 - Inland salt steppes (0)
  - E7 - Sparsely wooded grasslands (0)
  - F1 - Tundra (0)
  - F2 - Arctic, alpine and subalpine scrub (0)

**B3 - Rock cliffs, ledges and shores, including the supralittoral** [+ Create Narrower Concept...](#)

<https://sensingclues.poolparty.biz/EunisClasses/4> [+ Add to Exclude-list](#) [+ Add to ExactMatch](#)

**Details** Notes Documents Linked Data Triples Visualization Quality Management History

**SKOS** [Habitat Suitability](#) [+](#)

**Broader Concepts** [⊗](#)

**Narrower Concepts** [⊗](#) [+](#)

**Related Concepts** [⊗](#)

**Top Concept of Concept Schemes**  
[Habitat classes](#)

**Exact Matching Concepts**  
<http://eunis.eea.europa.eu/habitats/44> [Unknown Source: Unknown Source](#)

**Preferred Label**  
[⊗](#) B3 - Rock cliffs, ledges and shores, including the supralittoral

**Alternative Labels**  
[⊗](#) Rock cliffs, ledges and shores, including the supralittoral  
[+](#)

**Hidden Labels**  
[+](#)

**Notation**  
[+](#)

**Scope Notes**  
[+](#)

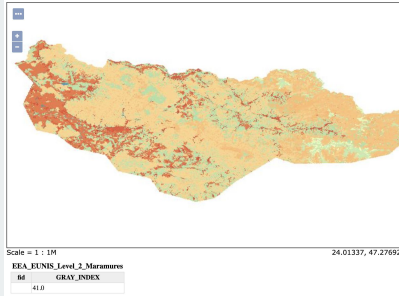
**Example**  
[+](#)

[Link to PoolParty](#)

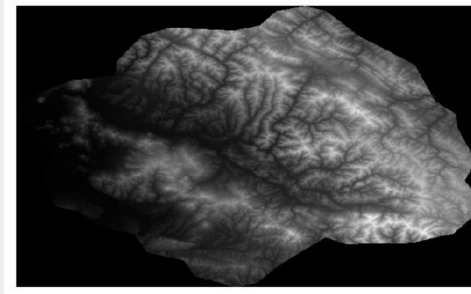
Crossovers



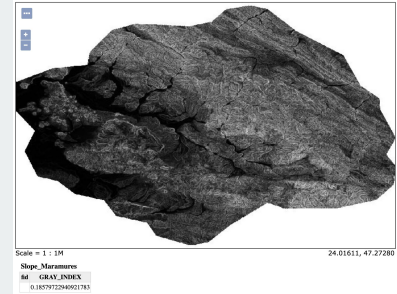
# Geoserver ecobasemaps for Maramoures



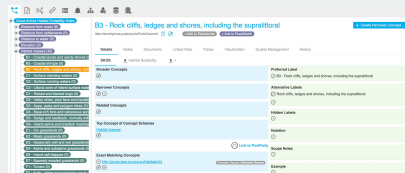
EUNIS 2012- Level 2



Aspect



Slope



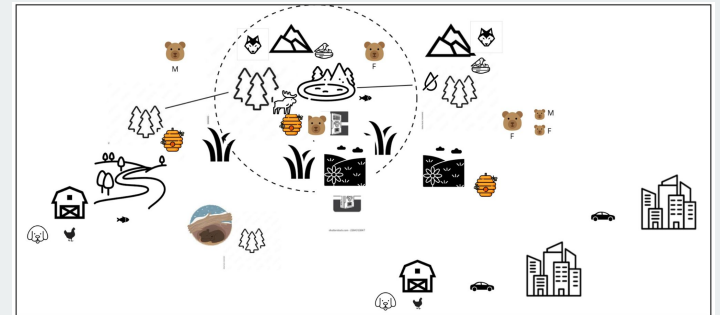
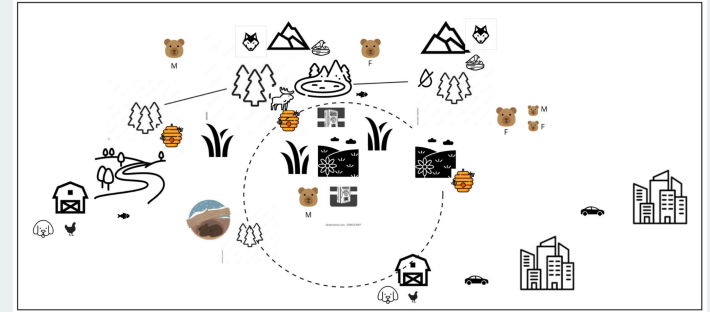
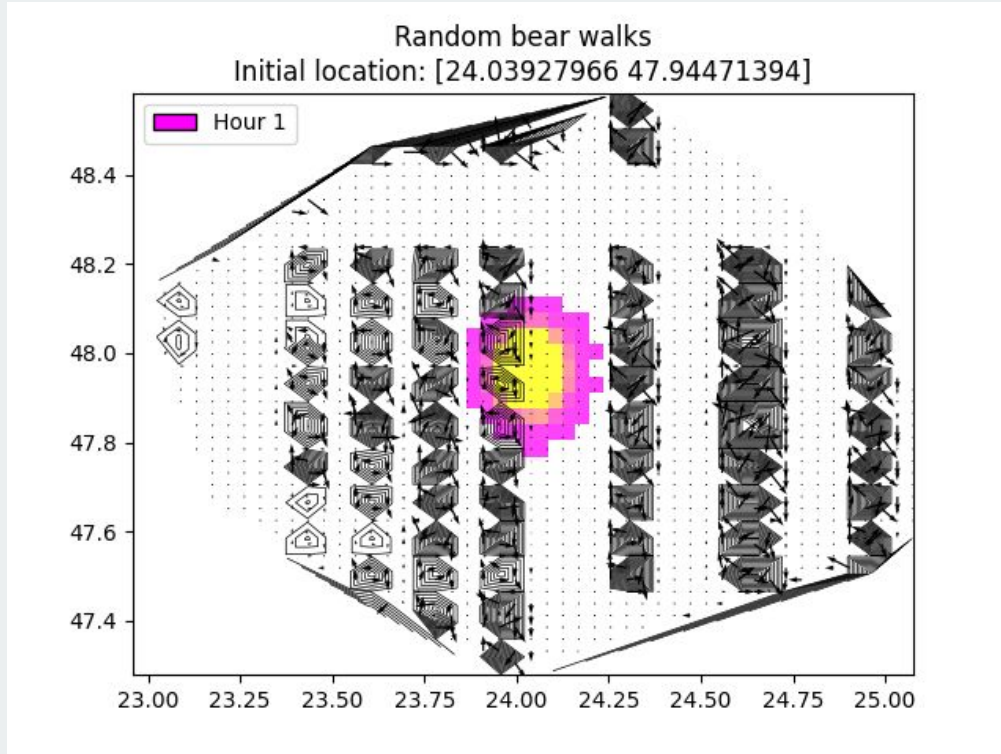
HSI

$$|scheme| \sum_{i=1} w_i * dim_{w_i}$$

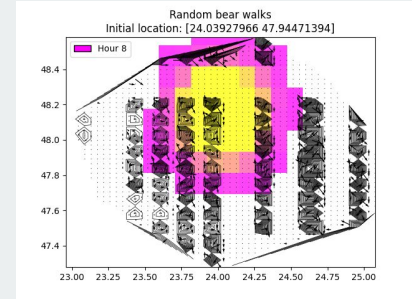
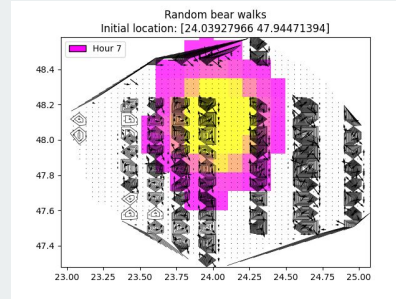
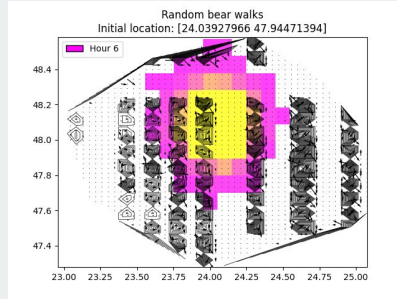
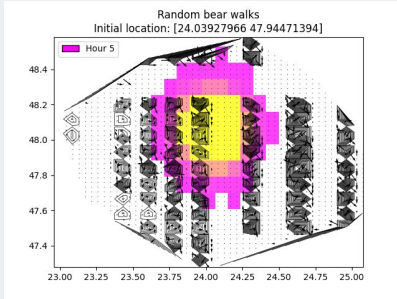
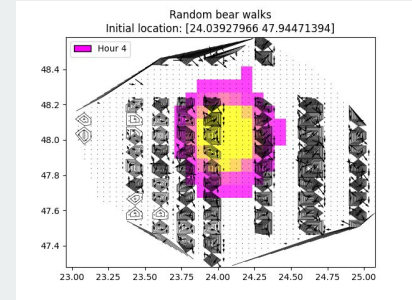
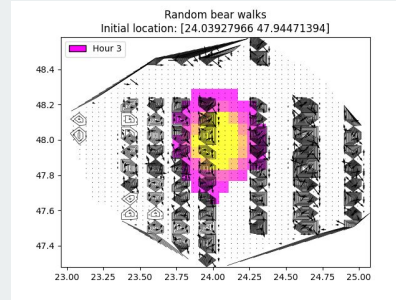
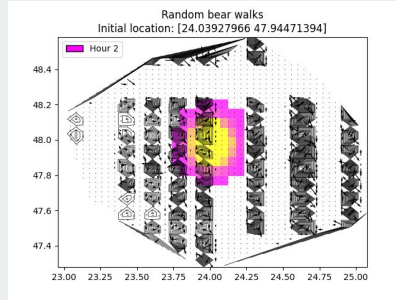
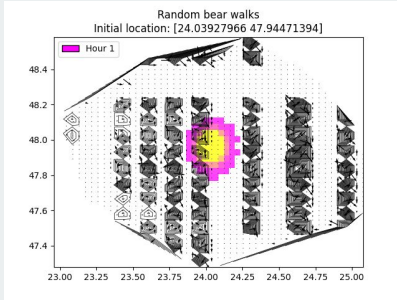


Priors

# Agent based simulation - Preliminary results



# Agent based simulation - Preliminary results



# Future work

- Integration of ecosystem basemaps
  - Distance to town
  - Distance to river
  - L3 EUNIS 2012
  - ..
- Applying path-based queries (e.g. for computing short-path distance) and integration with Ecological Knowledge Model
- Application of Machine Learning algorithms to learn habits from brown bear logs



# Questions & Answers