

# Building the SISE

an environmental ontology

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# Motivation



- ❖ **SISE project: “to provide some sort of integrated environmental information space”**
- ❖ **EcoLexicon approach:**
  - enhances knowledge exchange
  - offers easy access to the conceptual structures underlying the environmental domain
  - facilitates learning and communication
  - eliminates conceptual and terminological confusion
- ❖ **eEnvironment community can benefit from Semantic Web technologies**

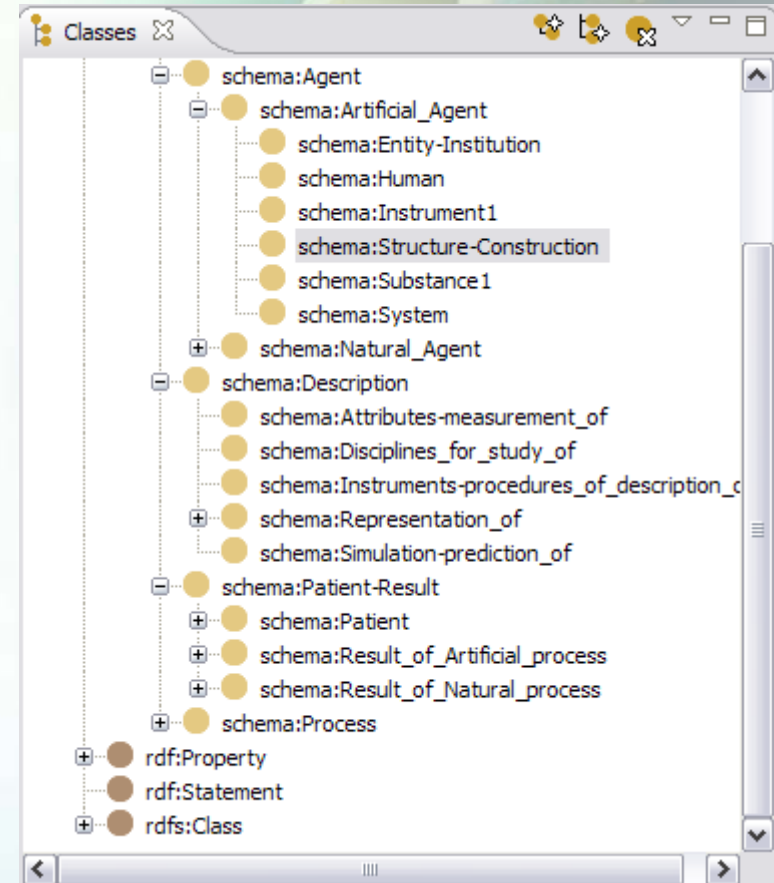
# Semantic Web

A close-up photograph of a bamboo shoot being poured with water. The bamboo is green and has a natural sheen. The water is clear and is captured mid-pour, creating a dynamic sense of movement. The background is a soft, out-of-focus light blue and green, which complements the natural colors of the bamboo.

- ❖ **Knowledge needs to be represented by ontology modelling**
- ❖ **Problem:**
  - Many projects have not been conceived as such from the beginning
  - As EcoLexicon, mostly come from relational databases
- ❖ **Proposal of integration**
  - useful for projects with similar purposes
- ❖ **Terminological resources can find in ontologies a powerful representational model**

# Terminological Knowledge Base

- ❖ **Environmental Event**
  - provides underpinnings for conceptual sub-hierarchies
- ❖ **Upper-level classes are based on frames and semantic roles**
- ❖ **Process-oriented overview of the domain**
- ❖ **Ontological classes fed from stored information in the database (D2RQ)**



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# Relationships between concepts

- ❖ **Concepts are linked through both vertical and horizontal relations**
- ❖ **Some are domain-specific and show their own internal hierarchical structure.**
- ❖ **Determination of non-taxonomic conceptual relationships is not well-researched**
- ❖ **Relations largely depend on the type of entity being described, its nature, and its own relational power**



# Relationships

|                       | examples   |
|-----------------------|--|
| <i>is_a</i>           | MAIN TRUNK SEWER -><br>SEWER PIPE -> PIPE -><br>INSTRUMENT -> AGENT<br>(semantic role) |
| <i>part_of</i>        | SCREENING <i>part_of</i><br>PRELIMINARY<br>TREATMENT                                   |
| <i>made_of</i>        | WASTEWATER <i>is made of</i><br>CONTAMINANTS   |
| <i>delimited-by</i>   | WASTEWATER<br>TREATMENT PLANT <i>is delimited by</i> THE END OF<br>THE SEWAGE SYSTEM   |
| <i>located-at</i>     | BREAKWATER <i>located at</i><br>THE COAST  |
| <i>takes-place-in</i> | THERMAL LOW <i>takes place in</i> SUMMER   |

|                     | examples  |
|---------------------|---|
| <i>attribute-of</i> | ISOTROPIC, ALLUVIAL,<br>ABYSSAL                                       |
| <i>result-of</i>    | EFFLUENT <i>is the result-of</i><br>WASTEWATER<br>TREATMENT (process) |
| <i>affects</i>      | SEWER PIPE <i>affects</i><br>WASTEWATER                               |
| <i>has-function</i> | WATER <i>has-function</i><br>IRRIGATION                               |
| <i>represents</i>   | HYDROGRAPH<br><i>represents</i> RATE OF<br>WATER FLOW                 |
| <i>effected-by</i>  | SAND TRAPPING <i>is effected by</i> A SAND<br>FILTER                  |

# Ontology

The image shows a web-based ontology editor interface. The main window is titled "Resource Form" and displays the details for a resource named "db:Concept3262". The form includes several sections:

- Name:** db:Concept3262
- Annotations:** (empty)
- Other Properties:**
  - schema:Concept\_Afecta\_a:** db:Concept729
  - schema:Concept\_Concept:** sewer
  - schema:Concept\_Definition:** conjunto de tuberías que forman parte de la red de alcantarillado y transportan el agua.
  - schema:Concept\_ID:** 3262
  - schema:Concept\_Parte\_de:** db:Concept1142
  - schema:Concept\_Tipo:** db:Concept3255
  - rdf:type:** schema:Concept, schema:Structure-0
  - owl:differentFrom:** (empty)

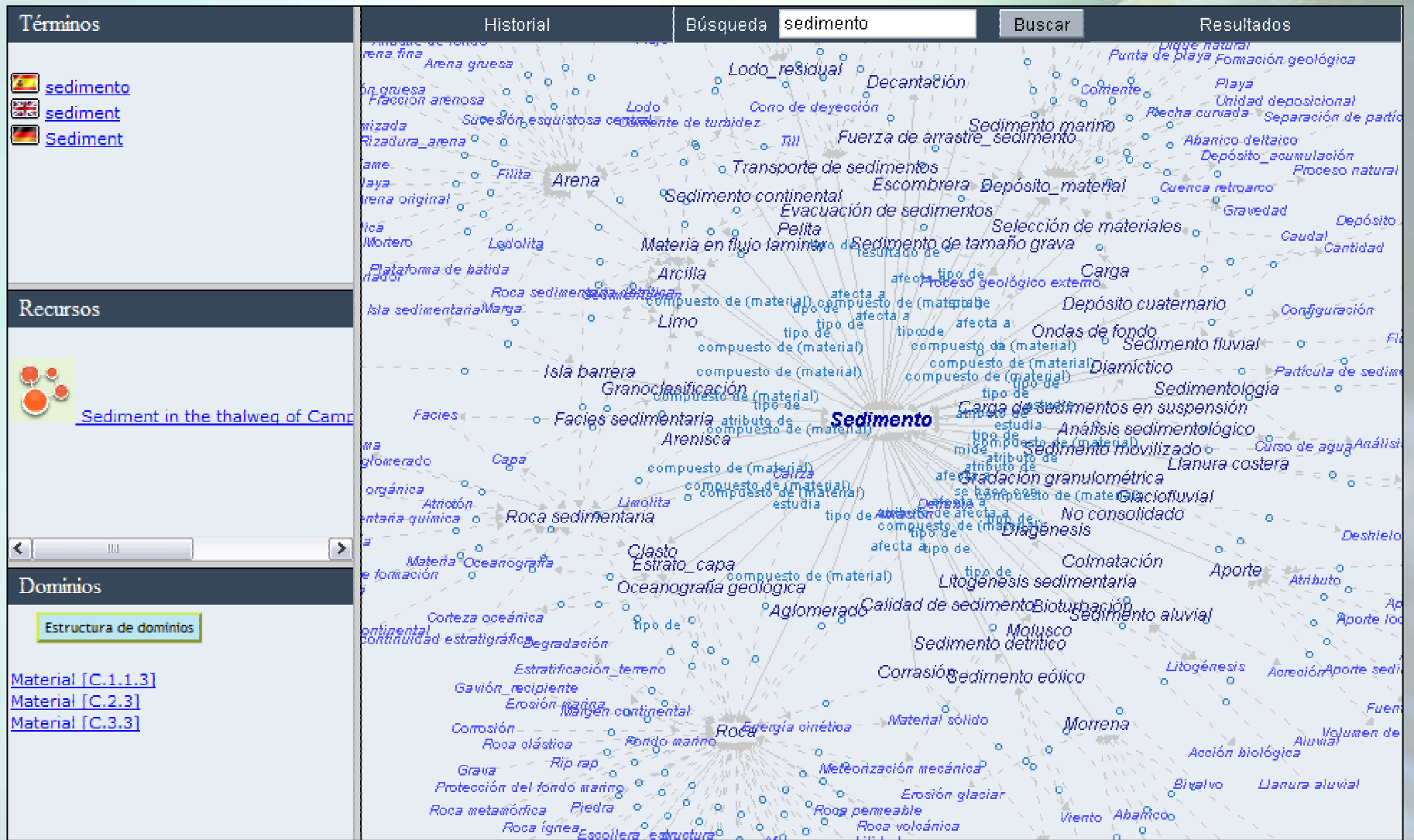
Overlaid on the bottom right is a "Query Editor" window. It has tabs for "Instances", "Rules", "Domain", "SPARQL", and "Imports". The "SPARQL" tab is active, showing a query:

```
SELECT ?y
WHERE { db:Concept3262 schema:Concept_Parte_de ?object .
?object schema:Concept_Concept ?y
}
```

The results table shows the following data:

| [y]                                     |  |
|---|--|
| S drainage system                       |  |
| S sewage collection and disposal system |  |
| S sewage disposal system                |  |
|   |  |
|   |  |
|   |  |
|   |  |
|   |  |
|   |  |

# Overinformation



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
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# Constraints


- ❖ **Relational constraints according to concept types, multidimensionality and contextual factors**
  - At a broad level
    - concepts are described in a prototypical way and relational constraints only depend upon the main properties of each concept type (*entity*, *process*, etc) and the semantic role they possess (although, due to multidimensionality, one concept may have several roles).
  - At a more specific level
    - concepts appear in more fine-grained representations, where context-dependent dimensions are added, restricted or highlighted

# Contextual network

**Términos**

-  [sedimento](#)
-  [sediment](#)
-  [Sediment](#)

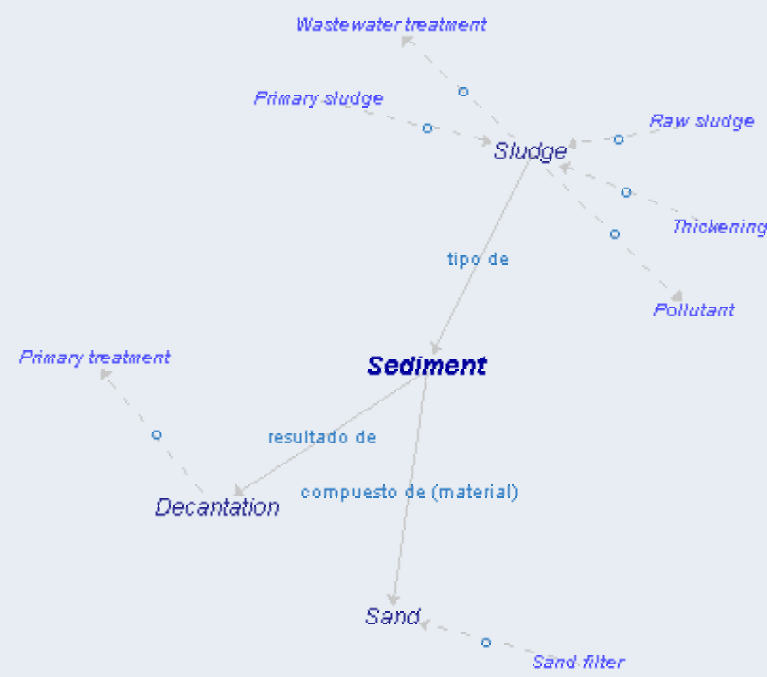
**Recursos**

-  [Sediment in the thalweg of Camp](#)

**Dominios**

- [Estructura de dominios](#)
- [Material \[C.1.1.3\]](#)
- [Material \[C.2.3\]](#)
- [Material \[C.3.3\]](#)

Historial | Búsqueda  |  | Resultados



```
graph TD; Sediment -- tipo de --> Sludge; Sediment -- resultado de --> Decantation; Sediment -- compuesto de material --> Sand; Sludge -- tipo de --> WastewaterTreatment[Wastewater treatment]; Sludge -- tipo de --> PrimarySludge[Primary sludge]; Sludge -- tipo de --> RawSludge[Raw sludge]; Sludge -- tipo de --> Thickening; Sludge -- tipo de --> Pollutant; Decantation -- resultado de --> PrimaryTreatment[Primary treatment]; Sand -- resultado de --> SandFilter[Sand filter];
```

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# Conclusions

- ❖ **Legacy systems and ontologies can be integrated in a common framework by following a set of appropriate criteria**
  - Linguistic semantics stored in the database can be enriched with OWL expressiveness
- ❖ **Contextual restrictions have been proven to be a viable solution for managing overinformation**



# Future work



- ❖ **Extending the procedure followed in the WASTEWATER TREATMENT context to other domains in the relational database**
  - Efficiency is an issue that deserves special attention at this stage
- ❖ **Interconnection with outside sources of information**
  - methodologies of ontology mapping and matching can be applied

# Thank You !



## Questions?



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