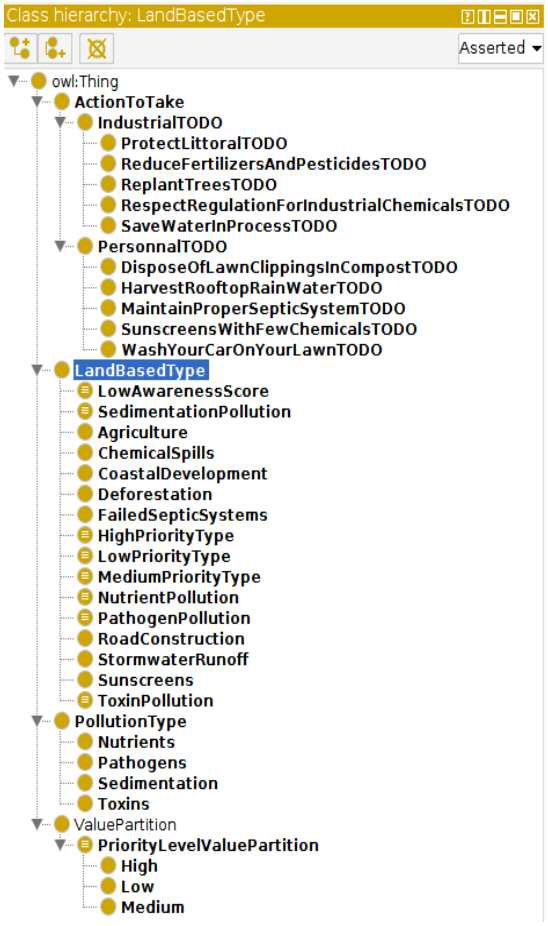
TP Protege OWL: Protect the coral reef from land-based activities

1-/ Introduction:

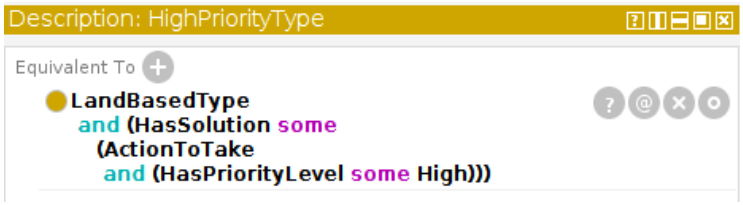
The purpose of this ontology is to model the problem of the land-based coral reef pollution and its consequences. For this purpose we will introduce several land-based activities (such as Agriculture, deforestation…) and their consequences in terms pollution (such as Nutrients, Sedimentation…). In addition to this, we will add various possible solutions (such as Saving water, replanting trees...) for each activities in order to address the problem. We also introduce a priority order for each land-based problem to address (High, Low and Medium).

2-/ Classes explanation:

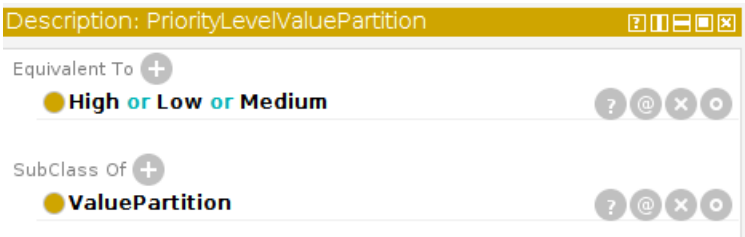
First we create each class with specific hierarchy and property. As explained in the introduction, we are dealing with disjoints classes:



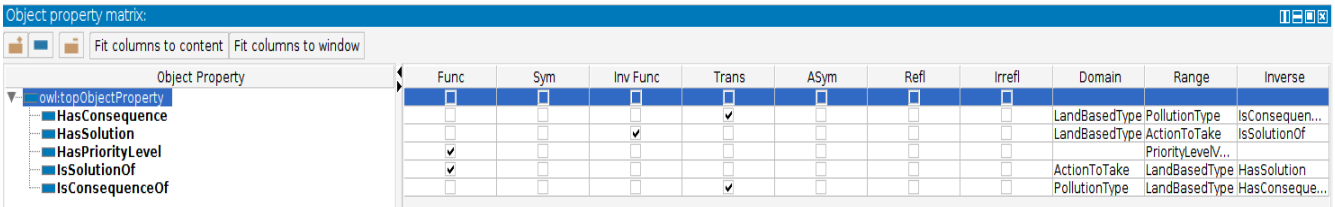
- **LandBasedType**: land-based human activities creating pollution. There are several defined classes in this one in order to have a quick access to interesting insights such as high priority activities or which ones are contributing to nutrients.



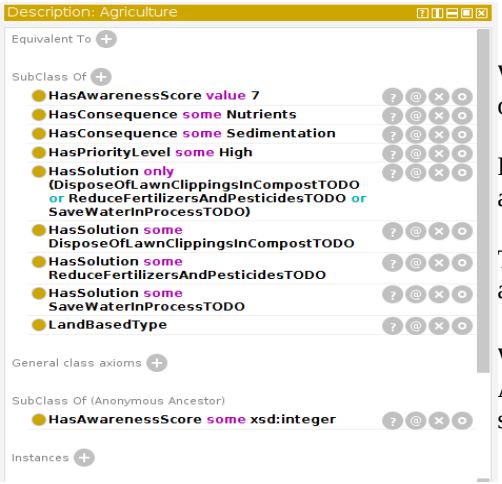
- **PollutionType:** the type of pollution from the corresponding land-based activity.
- **ActionToTake:** here we can find various solutions to address each land-based pollution problem, some actions are personal and others are industrial.
- **PriorityLevelValuePartition:** It is a value partition that will help us to prioritize each problem.



3-/ Object properties explanations:



As shown on this image, we create object properties in order to connect our classes. First we create the transitive property **HasConsequence** to connect the range: PollutionType to the domain: LandBasedType and its inverse function **IsConsequenceOf**. On the same principle we create the inverse functional property **HasSolution** to connect LandBasedType and ActionToTake and its inverse function **IsSolutionOf**. To justify the fact that HasSolution is inverse functional, we can say that if to different land-based activities have exactly the same solutions, they should be the same land-based type. We also create the functional property **HasPriorityLevel** to add a priority level to each land-based type.



4-/ Define and describe classes:

We now use what we defined to describe our classes, let's take the example of the LandBasedType **Agriculture**.

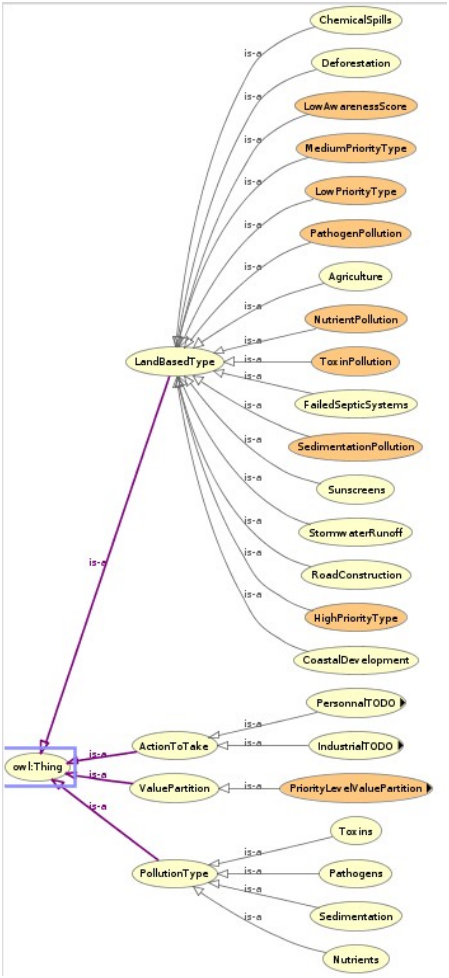
First, we add the consequences of Agriculture thanks to HasConsequence and some PollutionType elements.

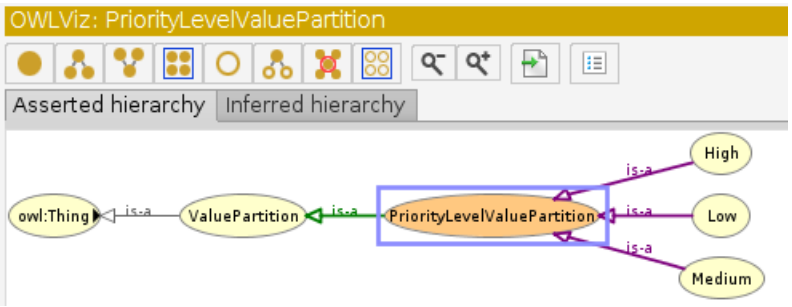
Then we add the priority of this land-based type thanks to HasPriorityLevel and a priority level, here High.

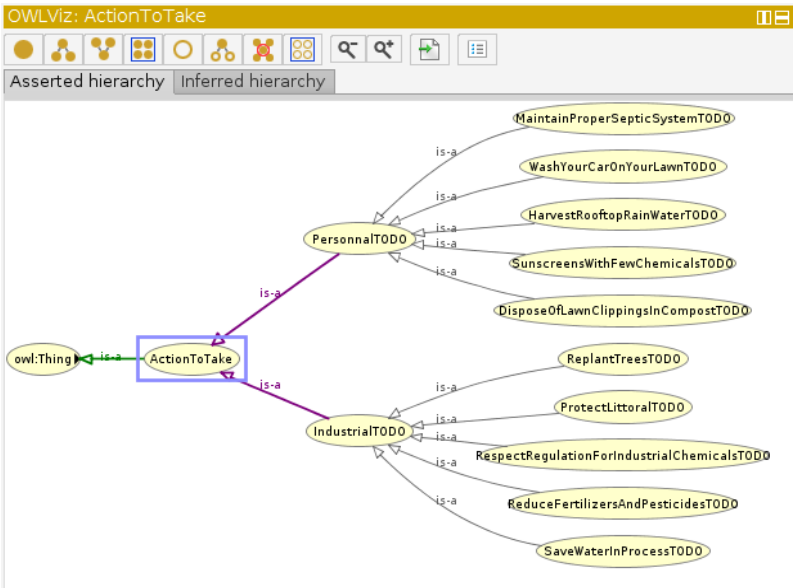
We then add solutions thanks to HasSolution and some elements from ActionToTake. In addition we use **closure axioms** to illustrate the fact that solutions must only be kinds of the one we chose.

5-/ OwlViz Insights:

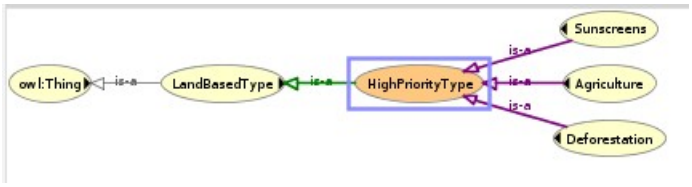
Asserted hierarchy

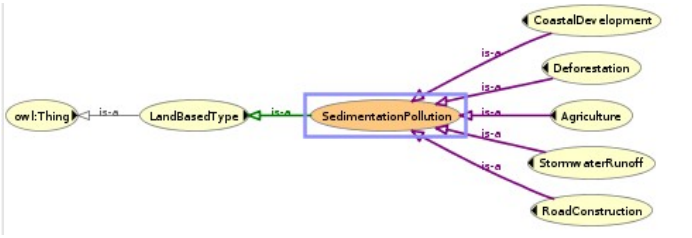






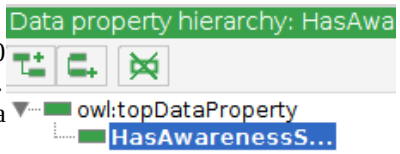
Inferred hierarchy





6-/ Data Properties

We create a data property named **HasAwarenessScore** in order to give a score between 0 and 10 for how well people are inform of this issue according to what we read in articles. We will use it to create a **LowAwarenessScore** defined class in order to see in which area it could be useful to give more information.



7-/ Metrics

Ontology metrics:

Metrics

Axiom	165
Logical axiom count	119
Declaration axioms count	46
Class count	40
Object property count	5
Data property count	1
Individual count	0
Annotation Property count	1

Class axioms

SubClassOf	87
EquivalentClasses	9
DisjointClasses	7
GCI count	0
Hidden GCI Count	1

Object property axioms

SubObjectPropertyOf	0
EquivalentObjectPropert...	0
InverseObjectProperties	2
DisjointObjectProperties	0
FunctionalObjectProperty	1
InverseFunctionalObject...	1
TransitiveObjectProperty	2
SymmetricObjectProperty	0
AsymmetricObjectProperty	0
ReflexiveObjectProperty	0
IrrefexiveObjectProperty	0
ObjectPropertyDomain	4
ObjectPropertyRange	5
SubPropertyChainOf	0

Data property axioms

SubDataPropertyOf	0
EquivalentDataProperties	0
DisjointDataProperties	0
FunctionalDataProperty	0
DataPropertyDomain	0
DataPropertyRange	1

MIRO – Minimum Information for Reporting of an Ontology

A-Basics

A-1 Ontology Name: coralreefs: Coral_Reef_Jean_Jules_Bigeard_Tine_Rey.
A-2 Ontology owner: Bigeard Jean-Jules and Tina rey.
A-3 Ontology License: MIT.
A-4 Ontology URL: https://github.com/JeanJulesBigeard/Practical-Works/blob/master/Logic/Coral_Reef_Jean_Jules_Bigeard_Tine_Rey.owl.
A-5 Ontology repository: https://github.com/JeanJulesBigeard/Practical-Works/tree/master/Logic
A-6 Methodological framework:The methodology is available in the report.

B-Motivation

B-1 Need: We all know about the coral reef issue but we do not have a a detailed knowledge about the causes of it, especially land-based causes and what we could do to improve the situation.
B-2 Competition: For what we know, it is the first ontology on the subject.
B-3 Target audience: It concerns everyone who wants to know more about coral reef destruction and to act against it.

C-Scope, requirements, development community

C-1 Scope and coverage: from the site https://oceanservice.noaa.gov/facts/coral-pollution.html.
C-2 Development community: National Ocean Service.
C-3 Communication: jeanjules.bigeard@gmail.com.

D-Knowledge acquisition

D-1 Knowledge acquisition methodology: from the graph.
https://aamboceanservice.blob.core.windows.net/oceanservice-prod/facts/coral-pollution.pdf.
D-2 Source knowledge location: from the site https://oceanservice.noaa.gov/facts/coral-pollution.html.
D-3 Content selection: The content is detailed in the transcript of the document we used.

E-Ontology content

E-1 Knowledge representation language: We used OWL version 2.
E-2 Development environment: Protege 5.5.0.
E-3 Ontology metrics: This info is available in the part 7-/ of the ontology report.
E-4 Incorporation of other ontology: None.
E-5 Entity naming convention: Naming convention is available in the ontology report.
E-6 Identifier generation policy: Using suffix TODO for action to take.
E-7 Entity metadata policy: Each class have a textual definition as comment.
E-8 Upper ontology: None, there is no ontology related to this subject.
E-9 Ontology relationships: Relationships are represented on part 3-/ and 4-/ of the report.
E-10 Axiom patterns: Patterns are explained through an example in part 3-/ and 4-/.

F-Managing change

F-1 Sustainability plan: No particular sustainability plan.
F-2 Entity deprecation strategy: Deprecated classes should be labeled as obsolete with an annotion.
F-3 Versioning policy: https://github.com/JeanJulesBigeard/Practical-Works/blob/master/Logic/Coral_Reef_Jean_Jules_Bigeard_Tine_Rey.owl.

G-Quality assurance

G-1 Testing: Thanks to the ontology, we had a better view on the problem and how each land-based activity is acting on the coral reef and precisely how it is acting on it.
G-2 Evaluation: Visualization on the OwlViz plugin offer a way to check if our ontology is coherent with our support information.
G-3 Example of use: An example of use is to check which activities are the most harmful for the coral reef or which ones are the less well known to produce focus awareness campaign.
G-4 Institutional endorsement: None
G-5 evidence of use: None but an awareness campaign using the less well known activities and the most harmful is a good idea.