



THE UNIVERSITY OF ALABAMA IN HUNTSVILLE

Information Technology and Systems Center

DRAFT

User's Manual for Noesis

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INFORMATION TECHNOLOGY AND SYSTEMS CENTER

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Noesis

Noesis is a meta-search engine and resource aggregator that uses ontologies to help users produce intelligent searches of internet-based resources. It suggests search terms by drawing information from its underlying domain ontologies. These ontologies encode domain specific knowledge of concepts, constraints and the relationships among them. Noesis helps users refine their search query and thereby achieve better precision and completeness in their results. The search results are aggregated according to filters selectable by the user. This section will illustrate how Noesis is used to search for information and how the user can organize the results.

Searching for Information

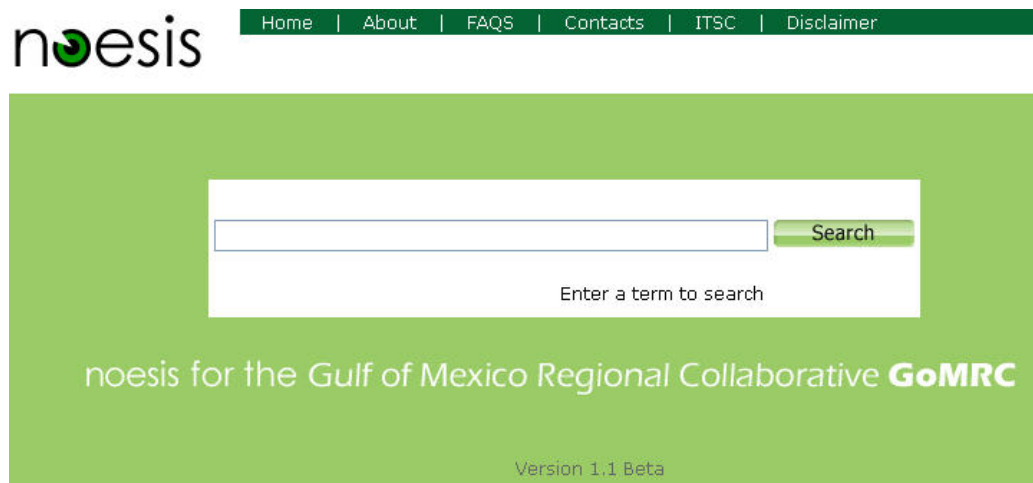


Figure 1 Main Noesis search screen

Noesis presents a very simple search interface. As shown by Figure 1, the user simply enters a search term in a text box. As the user types in their term, Noesis will automatically show a list of terms that begin with the typed letters. For example, typing “Sed” as a start toward typing the word “sediment” will result in Noesis suggesting a list of terms beginning with “Sed.” The user can continue typing or double click on one of the suggested terms.

Once the search term is entered, a new page will appear containing four sections. At the top of the page is information about the search term including its definition. In the middle of the page below the definition are the search results. On the left side is a list of terms with check boxes for each term. On the right is a list of filters with check boxes next to each (Figure 2).

The screenshot shows the Noesis search results page. At the top, there is a navigation bar with links for Home, About, FAQs, Contacts, ITSC, and Disclaimer. Below this is a search bar with the term "Sediment" entered. To the right of the search bar is a "Stop" button. Below the search bar, the number of results is shown as 76. The main content area is divided into three columns: "Refine Search", "Search Results", and "Filter by Engine".

Refine Search:

- + Sediment
- Related Terms
 - + Structure
 - Sea Grass
 - Ecological Structur...
 - + ControllingFactor
 - Bathymetry
 - Substrate Quality
 - Light
 - Sediment Dynamics
 - Substrate Type
 - Inundation
 - Water Quality
 - Controlling Factor
 - + Others
 - Natural
 - High
 - Medium
 - Regional
 - Type
 - Spatial Scale
 - Weight
- Add Additional Terms
 - Mobile
 - Add
- Current Additional Terms

Search Results:

- ERDC/RSM-TN-13, Lessons Learned in Regional Sediment Management ...
 Google
 relative to sediment transport over the region. The Mobile District then developed a program stated, bathymetric data are limited over the RSM region. ...
<http://www.wes.army.mil/rsm/pubs/pdfs/rsm-tn-13.pdf>
- SMF Europe - Multibeam bathymetry : Specialists in shallow water ...
 Google
 SURVEX is a multibeam bathymetry mobile vessel. ... A sediment sampling tool is used on board SURVEX vessel to collect sediment for analysis when required.
<http://www.smf-europe.fr/?lang=en>
- MOBILE UNIT FOR SHALLOW WATER MULTIBEAM BATHYMETRY and SONAR IMAGERY
 Google
 profiles and sediment studies Waterways network mapping Periodic ... MULTIBEAM BATHYMETRY MOBILE UNIT the best powerfull tool for your surveys ...
<http://www.dansurvey.com/Downloads/Survex1.pdf>
- Overthrusting and sediment accretion along Kilauea's mobile south ...
 Google
 Locations of line 2 (black, with annotated shot points) and nearby seismic lines (gray) are indicated. Illumination is from north. Bathymetry is from Smith ...
<http://geology.geoscienceworld.org/cgi/content/full/28/7/667...>
- Overthrusting and sediment accretion along K - lauea's mobile ...
 Google
 Overthrusting and sediment accretion along K. I. -. lauea's mobile ... Shaded-relief bathymetric and topographic map of K ...
<http://geology.geoscienceworld.org/cgi/reprint/28/7/667.pdf>

Filter by Engine:

- + All
- + Data
 - GoMRC - 17
 - NCDC - 0
 - NASA GCMD - 0
- + Web
 - Google - 10
 - Yahoo - 10
- + Publications
 - Ecol. & Systematics - 1
 - J. Ecol. Apps - 3
 - Ecol. Mono. - 1
 - Ecology - 2
 - J. Animal Ecol. - 0
 - J. Ecol. - 2
 - Rem. Sens. Env. - 0
 - AMS - 0
- + Education
 - DLESE - 47

Figure 2 Noesis search results page

Modifying the Search

As the search results are returned and listed in the center of the page, Noesis will present a list of terms on the left side of the page (Figure 3). These terms are generated from the ontology and fall into three categories: Specializations, Synonyms and Related Terms. Users may add these terms to the current search

query simply by clicking the text box next to the desired term. Noesis will immediately begin a refined search based on the combination of terms selected.

Specializations can be used to provide a more detailed search. For example a search for “Cyclone” would show specializations, “Hurricane” and “Typhoon”.

Synonyms are different terms that have the same meaning. In ontological terms these are the equivalent concepts. For example a search for “Reflectance” shows synonym, “Albedo”. Appending this term to the query expands the search, thus providing better search coverage.

The image shows a web interface for searching related terms. At the top, a green header reads "Related Terms". Below it, there are three expandable sections: "+Structure", "+ControllingFactor", and "+Others". Each section contains a list of terms with a checkbox to its left. In the "+ControllingFactor" section, the checkbox for "Bathymetry" is checked. Below the list, there is a green header "Add Additional Terms", followed by a text input field containing the word "Mobile", a green "Add" button, and another green header "Current Additional Terms". Under this header, the checkbox for "Mobile" is checked.

- Sea Grass
- Ecological Structur...
- Bathymetry
- Substrate Quality
- Light
- Sediment Dynamics
- Substrate Type
- Inundation
- Water Quality
- Controlling Factor
- Natural
- High
- Medium
- Regional
- Type
- Spatial Scale
- Weight

Mobile

Mobile

Figure 3 Terms related to sediment as suggested by Noesis

Every concept has a set of related properties that are neither in the same inheritance hierarchy nor equivalent. These are called Related Terms. They are captured in the ontology through the property relationships. The user can search for resources on a concept with respect to a particular property. For example, a

search for “Cyclone” shows “Rain” as a Related Term. Appending this term to the search narrows the search to resources that contain information about “Cyclone” within the context of “Rain.”

In addition to the terms suggested by Noesis, there is a text box at the bottom left where the user can type in a free text term. In Figure 3 the user has typed in the term “Mobile”. User-added terms can be removed from the search just as easily by unchecking the associated checkbox.

Filtering the Results

On the right side is a list of filters (Figure 4). The search results can be managed by selecting returns from a number of resources by checking the check boxes next to their name. For example if the user only wants to see search results from Google they can check that check box only.

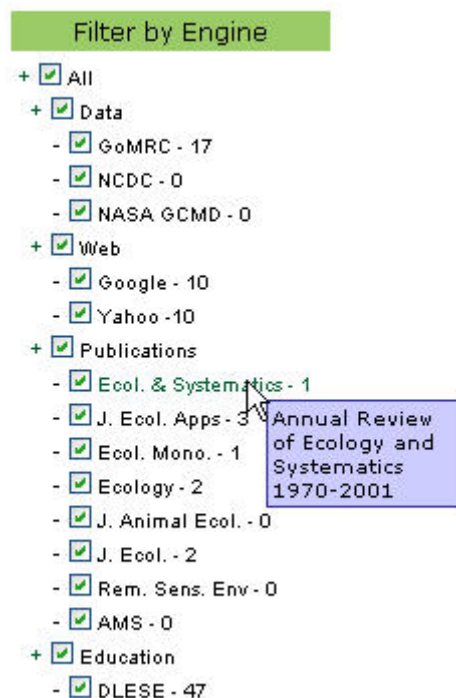


Figure 4 List of filters provided by Noesis.

As shown by Figure 4, search returns are available from several resources. The major web search engines Google and Yahoo are available as are a number of publications databases and data catalogs such as the Global Change Master Directory (GCMD). Figure 5 shows selected search results from Google, Yahoo and a publications database.

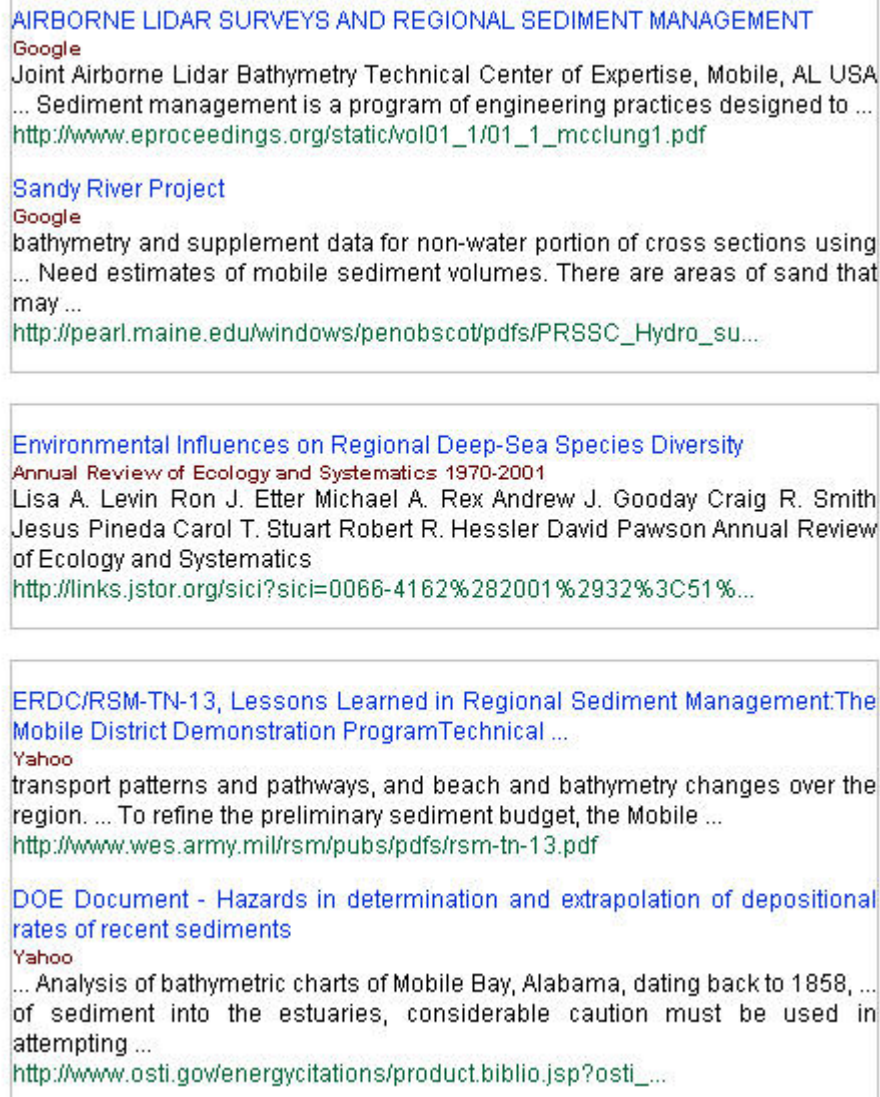


Figure 5 Noesis search results organized by filter

Launching the RTIV and Map Maker

In many cases it is desirable to allow Noesis to search localized catalogs. Research projects may develop a specialized database of information that relates to a special topic, geographic region or research area. In cases such as these, domain experts

may have developed conceptual models, ontologies or databases that are very specific. If there exists sufficient information about a data product and there are well defined methods for importing that product into an application, then Noesis can produce specialized search returns that allow the user to launch the application directly. This is the case with imagery and map products that are viewable with the RTIV and Map Maker. In the previous sections it was shown that both the RTIV and Map Maker can be launched through a URL with product information appended. When Noesis encounters a search result for such a product, it drops in special icons that will launch the respective tool when clicked. Figure 6 shows search results from a query on SST with icons that will launch the RTIV and Map Maker.

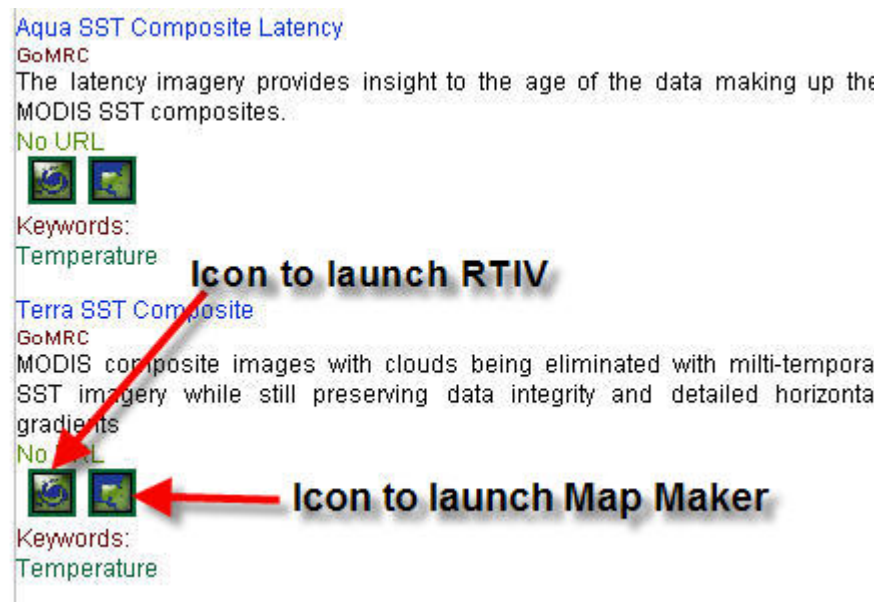


Figure 6 Noesis search return with icons for RTIV and Map Maker

Noesis Search Architecture

Noesis uses a three step algorithm to search resources. The three steps are Query Analysis, Semantics Presentation and Resource Search. The algorithm architecture is depicted in Figure 7.

A. Query Analysis

In this step, the user-provided search query is broken down to identify concepts that are defined in the domain ontology. Once they are identified, they are annotated with the associated concepts from the ontology.

B. Semantics Presentation

The annotated concepts from the query string are used to search the Ontology Inference Service (OIS) for associated concepts (Specializations, Generalizations, Synonyms and Related Terms). The Specializations and Generalizations are shown in a tree structure to allow users to navigate through the hierarchy. Synonyms and Related Terms are shown in separate categories and a check box is provided to let the user select the term to append to the search. The user employs these terms to refine the search query.

C. Resource Search

The selected terms are then used for searching the resources. For open web resource searches the refined query is directly used to provide results since no semantic information is encoded (annotated) in these resources. For hidden web resources like data archives, an Application Ontology is added for every new vocabulary used. The concepts in the refined query are used to search the Ontology

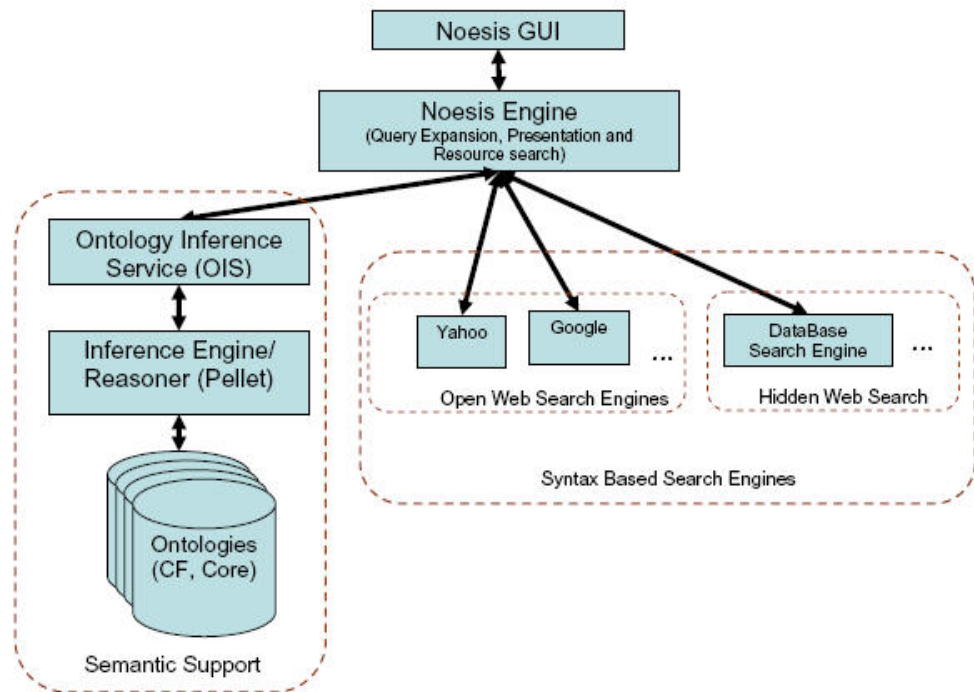


Figure 7 Noesis search architecture