

# An Ontology-Driven Web Portal for Spatial Decision Support

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Ontolog Virtual Workshop

Semantics in Geospatial and Other Architectures: Design  
and Implementation

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# Definition of spatial decision support

Spatial decision support is the computational or informational assistance for making better informed decisions about problems with a geographic or spatial component. This support assists with the development, evaluation and selection of proper policies, plans, scenarios, projects, interventions, or solution strategies.

# Need for formalizing the knowledge in SDS

- Registration, automatic discovery and access of SDS resources (e.g. workflow templates, methods and algorithms, models and tools, data, cases studies)
- Encourage modular, reusable models and tools development
- Facilitate interoperability among models and tools
- Automatic workflow composition and orchestration
- Provide framework for science-based social decision making, integrating workflow with human and machine steps, methods, tools
- Provide a common vocabulary for the user community
- Facilitate learning in SDS

# Solution – ontology driven SDS Knowledge Portal

The screenshot displays the Spatial Decision Support Knowledge Portal. At the top, there is a navigation bar with links for HOME, CONCEPTS, RESOURCES, ABOUT, CONTACT, HELP, and LOGIN. A search bar is located on the right side. Below the navigation bar, a dark banner contains a welcome message: "Welcome to the Spatial Decision Support Knowledge Portal — your portal to knowledge, information and resources for your planning and spatial decision making needs." The main content area is divided into three sections:

- The SDS Knowledge Portal can help you:**
  - gain a systematic understanding of planning and decision making **process**
  - find relevant **methods, tools and models, data sources, literature**, and other useful resources for your specific planning/decision making **problem type** in your application domain
  - learn about **case studies** with project needs similar to yours.
- Explore the Ontology**
  - Introduction
  - Spatial Planning And Decision Problem Types
  - Planning/Decision Context
  - Planning And Spatial Decision Process
  - Methods And Techniques
  - Technology
  - Data And Domain Knowledge
  - People And Participation
  - Resources
- What's New**
  - New Portal architecture and user interface
  - The Portal content is dynamically updated via ontology web services
  - Concepts pages now have individual URLs
  - Initial version of graphical browsing of concepts
  - New interface for searching SDS resources
  - Many content updates
- SDS Consortium**

The SDS Consortium was formed in May 2008, and consists of researchers, experts and practitioners in the field of SDS. To learn more and see the complete list of members, [click here](#).
- Quick Tips for Getting Started**
  - Browse the SDS Ontology graph on the left
  - Click on a node to jump to the content of that node
  - Pan to see the rest of the graph

At the bottom left, there is a network graph representing the SDS ontology, with nodes connected by lines, showing various concepts like "Spatial Decision Support Systems", "Spatial Planning And Decision Problem Types", "Participation And Collaboration", etc.

<http://www.spatial.redlands.edu/sds/>

# Content of the SDS ontology

- Planning/decision problem types
- Planning process workflows and steps
- Strategies, methods and techniques that are commonly associated with different workflow steps
- Models and tools supporting spatial planning
- Data sources supporting spatial planning
- Spatial planning/decision support case studies
- Related concepts supporting the descriptions of the above

# Spatial planning and decision problem types

## Site Search Or Selection

Site selection involves identifying elements of biodiversity reserve or designation for timber. The two are sufficiently different to justify making assigning a set of alternative uses to all parcels in a general matrix of parcels that

### Synonyms

site search; site selection

### Related Tools

C-Plan  
MARXAN / SPEXAN  
MARXAN V  
Resnet & S  
Sites/Site S  
Vista  
Zonae Cog

### Related

Global Ser  
Sandy Rive

### Last Up

6/5/2008

## Location Allocation

Spatial allocation is primarily concerned with designating what kinds of activities can or will be done where on the lands

## Schedule

Scheduling in the context of GeoDesign problems can be thought of as a special case of selection and allocation problems in which temporal constraints also are important. A typical example of this type of problem is timber-harvest scheduling, in which there are constraints on both the types and timing of activities that can be implemented in neighboring units. These types of problems almost always are optimization problems.

## Network Design

Network design in the context of spatial decision problems is concerned with delineation of pathways through some spatial domain. Obvious examples in this realm include design of road and utility networks, which typically seek least-cost pathways that may involve both spatial and temporal considerations. The spatial computation for this class of problem is almost always global. In addition to the more conventional notion of networks in terms of roads and utilities, in conservation biology, there is also the notion of reserve networks. To the extent that an analysis for reserve design explicitly treats connectivity of patches through connecting corridors, this is an apt characterization.

### Related Planning/Decision Process Workflows

[Geodesign Process Workflow](#)

### Related Methods

Agent Based Approach  
Anticipatory Approach  
Combinatorial Approach  
Connectivity Operations  
Constraining Approach  
Mixed Approach  
Optimizing Approach  
Rule Based Approach  
Sequential Approach

### Subcategories

Reserve System  
Transportation, Vehicle Routing And Scheduling

## Suitability /

Assessments of suitability and impact assessment. status or impact assessr

### Synonyms

land suitability; water res

### Related Planning

[Conservation Process W](#)  
[Urban Planning Process](#)

### Related Methods

[Multi-Criteria Decision A](#)  
[Uncertainty Methods](#)

### Related Tools

[AHP In Arcgis](#)  
[AHP-OWA In Arcgis](#)  
[Arcgis](#)  
[Coastal Landscape Ana](#)  
[Communityviz](#)  
[Conservation Assessme](#)  
[Ecosystem Assessment & Reporting Tool](#)  
[Ecosystem Management Decision Supp](#)  
[EZ-IMPACT](#)  
[IDRISI](#)  
[Invest Toolbox](#)  
[Marine Reserve And Local Fisheries Inte](#)  
[NED](#)  
[Netweaver](#)  
[Program To Assist In Tracking Critical Ha](#)  
[Refuge GAP](#)  
[Remsoft Spatial Planning System](#)

[Land-Use Change And Analysis System \(LUCAS\)](#)

## Impact A

All management a assessment focus distinction between causality, wherea period of time, the environmental co prospective in the alternative manag

### Related Plan

[NEPA Planning P](#)  
[Scenario Planning](#)

### Related Met

[Forecasting Meth](#)  
[Spatial Analysis A](#)  
[Uncertainty Meth](#)

### Related Too

[Coastal Landscap](#)  
[Communityviz](#)  
[EZ-IMPACT](#)  
[HARVEST](#)  
[IDRISI](#)  
[IDRISI Land Char](#)  
[Invest Toolbox](#)  
[LANDFIRE](#)  
[Landscape Mana](#)  
[Landscape Successional Model \(LANDSUM\)](#)  
[Land-Use Change And Analysis System \(LUCAS\)](#)  
[LEAM](#)

# Spatial planning workflows

## Adaptive Natural Resource Plan

A prototypical process flow for adaptive natural resource management... well the process... adaptive... process.

### CMP Open Standards Framework

The CMP framework... bringing to... to help pra... guidance r...

The Open context; 2) results, an... steps or st... complex b...

**Source**  
CMP (200... content/up...

**For Dec**  
Alternative... Impact Ass... Reserve S... Status Ass... Suitability.

**For App**  
Biodiversit... Fish And V... Threatene...

**Process**  
1. Concep...  
2. Plan Ac...

### Scenario Planning

Scenario planning is a process that framework for developing a shared v... environmental, land use, etc.) that a... business conditions and better man...

The hallmark of scenario planning is that might be considered demograph... possibilities for each variable helps... future.

Scenario planning creates guiding p... Stakeholders, including the public, c... future vision that provides a framew... scenarios and discussing their poss... discuss trade-offs, and make better...

Scenario planning is a flexible appro... quality of life, urban form, transporta... geographic scales (including at the... critical component in using the techn...

Scenario planning may involve aspe... to create sometime surprising future... to formalize, such as novel insights... used in conjunction with scenario pl... be demonstrated. In these cases wh... sometimes referred to as structural...

More recently in geospatial domain,

## Urban Planning Process

Urban planning is a discipline of land-use planning that explores a very wide range of aspects of the built and social environments of urbanized... created th... ideals bas...

Changes... process. I... decisions... grassroots... planning.

### Process

- Phase 1 -
- Phase 2 -
- Phase 3 -
- Phase 4 -
- Phase 5 -
- Phase 6 -
- Phase 7 -
- Phase 8 -
- Phase 9 -

### For Ge

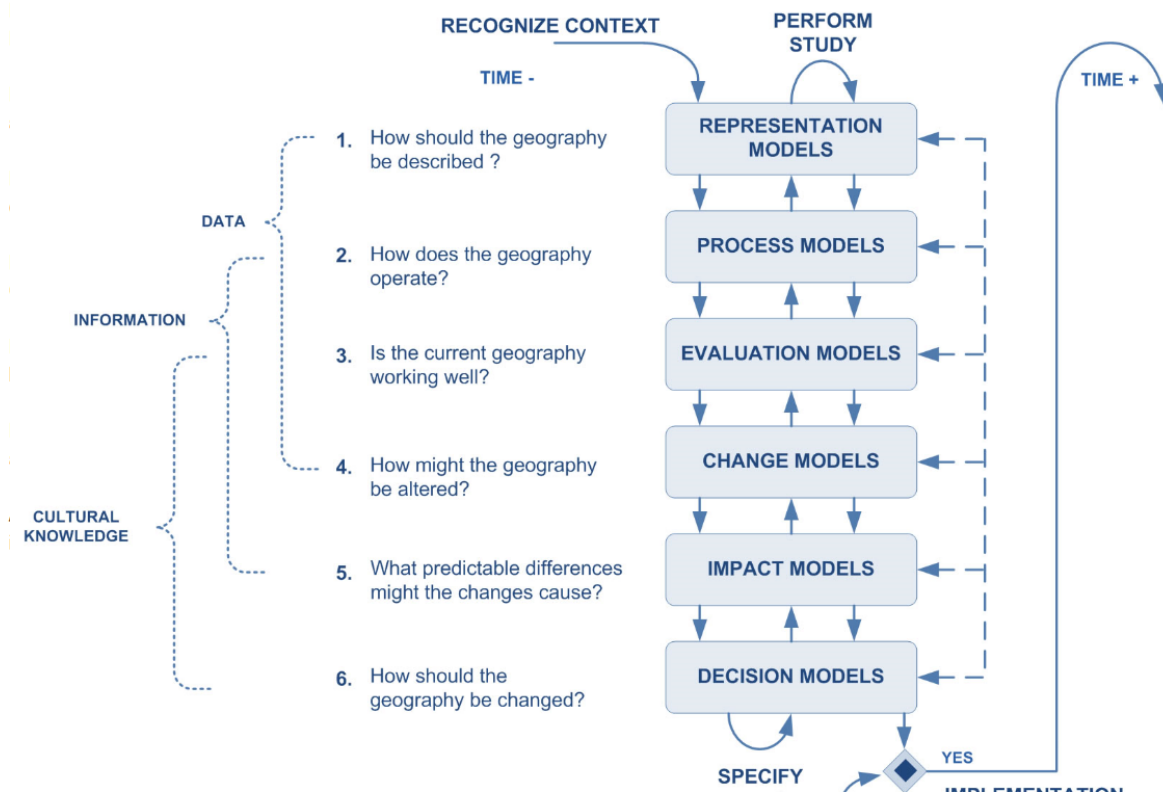
Alternative... Plan Eval... Status As... Suitability

### The Ap

Health Ca... Historic P... Land Use... Public Util... Transport... Urban Pla... Zoning

## Steinitz's Framework

Steinitz's framework is a conceptual framework proposed by Carl Steinitz (1990) to describe six levels of inquiry during a spatial decision process; each level is associated with a type (phase) of modeling with GIS to form a comprehensive expression of a decision support strategy for landscape planning and design:



# Steps in a spatial planning workflow

Spat

## Condition Assessment

Condition assessment is a ma decision maker assesses the multiattribute decision making phase. This phase is often ref

## Design

The design phase during a planning process involves creating and analyzing a set of possible solutions (alternative courses of action) to

from the

## Process

Process mapping process mapping identifying who sh

### Synonym

intelligence;

### Sub Step

Condition A

## Impact Analysis

Impact analysis is the assessment of the pros and cons of pursuing a course of action in terms of possible intended or unintended or unintended analysis is the ability to ns to be taken on

is (e.g., ng a are creating res.

## Issue A

The goal and pr clarified, and de

## Synonyms

goal identificatio

## Sub Steps

Objective Defini Problem Definit Stakeholder Eng Visualization

## Commonly

Condition Asses Process Mapping

## Participant

Recommendati Stakeholder

## Participant

Business Community Decision Maker Government Interest Group Mediator Public

## Commonly F

Condition Issue Artic

## Comm

Group Cor

## Particip

Advisor Recommen Stakehold

## Particip

Business Communit Decision M Facilitator Interest Gr Mediator Public Resource Resource

## Availab

Microsf E Microsoft / Townsqua

## Rank Alternatives

Alternative ranking is a process during which a set of alternatives (for the solution of the decision problem) is ranked based on a set of evaluation criteria, with the alternative that best meets the criteria ranked on top. When alternative ranking is done with a multicriteria decision analysis approach, the ranking is achieved by selecting and applying an appropriate multiattribute or multiobjective decision rule.

### Synonyms

alternative ranking; prioritize options; decision rules application

### Input

Alternative

### Output

Ranked Alternatives

### Commonly Followed By

Recommend Alternative


### Commonly Used Methods And Techniques

Multi-Attribute Combination Methods Multi-Objective Combination Methods Optimization Methods Uncertainty Methods

### Participant Roles Involved



# Methods, techniques, algorithms

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## Multi-Criteria Decision Analysis

Methods for making decisions (MCDM). Incommensurable. Both MADM categories required of the correct problem elements. decision alternatives assume a criteria value.

**Abbreviation**  
MCDM

**Synonyms**  
multi-criteria

**For Decision**  
Alternative Suitability

**Implementation**  
Conservation  
Criterion  
DEFINITE  
E7 IMPACT

### Analytical Hierarchy Process

The Analytical Hierarchy Process (AHP) provides a structured, hierarchical, and quantitative approach to decision making. It is used to evaluate and prioritize decision alternatives based on multiple criteria. The process involves breaking down a complex problem into a hierarchy of sub-problems, which are then evaluated and compared against each other. The final result is a ranking of the alternatives based on their overall performance.

**Abbreviation**  
AHP

**Used For**  
Condition  
Constraint  
Evaluation  
Impact A

#### Pairwise Comparison

The pairwise comparison involves comparing elements in pairs as output. Saaty (reciprocal) weights comparison.

**Used For**  
Specify Criterion

**Number**  
 $n(n - 1)/2$

**Response**  
Ratio Scale

**Underlying**  
statistical/the

**Trustworthiness**  
High

**Precision**  
Quite Precise

#### Value/Utility Function

The utility function represents both the nature of the problem and the nature of the approach. The utility function (Keeney) is a convenient and inherently probabilistic, and

The value and decisions required. The individual in the decision is probabilistic, and

**For Decision**  
Balance Benefit  
Maximize Benefit

#### Criterion

Multicriteria Decision information about derivation of weight evaluation criterion the criterion in the

**Synonyms**  
weights assessment

**Used For Decision**  
Specify Criterion

**Implemented**  
Conservation Assessment  
E7 IMPACT

#### Ratio

The ratio 100 can

**Used For**  
Specify

**Number**  
n

**Response**  
Interval

**Underlying**  
none

**Trustworthiness**  
High

### Genetic

A genetic algorithm is a search algorithm that mimics the process of natural selection. It is used to solve optimization problems. The algorithm starts with a population of random solutions and iteratively improves them through selection, crossover, and mutation. The process continues until a satisfactory solution is found or a maximum number of generations is reached.

**For Decision**  
Balance Benefit  
Maximize Benefit  
Minimize Negative

**Used For Decision Process**  
Alternative Generation  
Alternative Screening  
Rank Alternatives

### Heuristic

In computer science, a heuristic is a method for finding a solution to a problem in a reasonable amount of time. It is often used when the exact solution is difficult to find or when the problem is NP-hard.

**For Decision**  
Balance Benefit  
Maximize Benefit  
Minimize Negative

**Used For**  
Alternative Generation  
Alternative Screening  
Rank Alternatives

**Subcategory**  
Metropolis Heuristic  
Simulated Annealing

**Source Of**  
<http://en.wikipedia.org>

**Used For Decision Process**  
Alternative Generation  
Alternative Screening  
Rank Alternatives

## Weighted Linear Combination

Weighted linear combination is the most often used technique for tackling spatial multicriteria decision analysis. It is a procedure based on the concept of a weighted average. The decision maker directly assigns weights to each attribute. A total score is then obtained for each alternative by multiplying the importance value given to the alternative on that attribute, and summing the products over all attributes. The alternative with the highest overall score is chosen. The GIS-based steps:

1. Define the set of evaluation criteria (map layers) and the set of feasible alternatives.
2. Standardize each criterion map layer.
3. Define the criterion weights; that is, a weight of relative importance is directly assigned to each criterion.
4. Construct the weighted standardized map layers; that is, multiply standardized map layers by their respective weights.
5. Generate the overall score for each alternative using the add overlay operation of GIS.
6. Rank the alternatives according to the overall performance scores; the alternative with the highest score is the best.

The weighted linear combination method can be operationalized using any GIS system. The technique allows the evaluation criterion map layers (input maps) to be aggregated. The method can be implemented in both raster and vector GIS environments.

**Abbreviation**  
WLC

**Synonyms**  
weighted summation; boolean overlay; simple additive weighting method; SAW; scoring

### Used For Decision Process Phases/Steps

Condition Analysis And Assessment  
Impact Analysis  
Rank Alternatives

**Input**

# Software models, tools, services

## Spatial Decision

HOME CONCEPTS

## Tools

See all the tools at a glance

- Filter By
- decision problem type targeted
- used for application domain
- domain knowledge model area
- decision process activity supported
- methods and techniques
- functional components
- technical expertise required

ArcGIS



Home Industries

GIS helps Acc

### C-Plan

#### The C-Plan Conserva

You can download

C-Plan is a decision support system for conservation planning decisions. Reserve network design is based on the principle of impedance of species, vegetation types, or other features. It is compatible with the ArcGIS Desktop GIS.

### C-Whiz



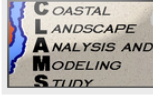
C-Whiz is a fast, reliable, accurate, efficient & easy to use general purpose linear solver for the GIS mathematical programming system.

### AutoCAD



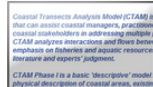
AutoCAD is a CAD (Computer Aided Design or Computer Assisted Drafting) software application for 2D and 3D design and drafting.

### Coastal Landscape Analysis and Modeling System



Simulate and analyze the aggregate ecological, economic, and social consequences of general land-use practices of urban and coastal areas. Change over a 100 year time span.

### Coastal Transacts Analysis Model



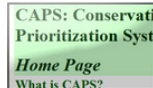
CTAM helps visualize and analyze interactions and flows between nature and human systems, with current emphasis on fisheries and aquatic resources, along with marine protected areas, land use, and coastal planning.

### Communityz



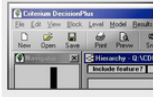
Communityz is a web-based, yet accessible, GIS software designed to help people visualize, analyze and communicate about important land-use decisions.

### Conservation Assessment and Prioritization System



CAPS is a computer software program designed to assess the biodiversity value of any location based on nature conservation, specific models, and provide advice for conservation action based on their assessed biodiversity value in comparison with other data relevant to their prioritization.

### Criterion Decision Plus



Criterion DecisionPlus (CDP) decision management system helps you evaluate and communicate complex decisions between alternatives. It is a very graphical and interactive decision support system. CDP uses a multi-criteria decision analysis (MCDA) and SMART analysis and uncertainty handling. CDP handles both qualitative and numerical inputs. CDP starts with a brainstorming component to help structure the decision. It helps and prioritizes from decision makers. The product contributions, sensitivity and threshold analysis to help visualize these preferences. The impact of uncertainties in the attributes of the alternatives on the decision outcome is calculated and shown graphically. Data from spreadsheets can be imported, and the model structure and results can be exported to spreadsheets and linking tables. CDP was created in 1992 and is supported by Informatica, Inc. of Seattle. It comes with 225 open level models and expert listing in a database.

### Decision Models created with CDP can be used in the ArcGIS desktop environment system (see the ArcGIS Desktop tool set) and can be published to the web using Informatica's Decision Services.

### DEFINITE



DEFINITE is an environmental planning analysis tool which uses judgement-based, spatial, and profile data to help users characterize the system in terms and explore trade-off interactions and emergent properties.

### EZ-IMPACT



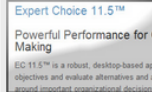
EZ-IMPACT is a planning analysis tool which uses judgement-based, spatial, and profile data to help users characterize the system in terms and explore trade-off interactions and emergent properties.

### Ecosystem Management Decision Support



The Ecosystem Management Decision Support (EMDS) system provides decision support for landscape-level analysis and planning. The system provides decision support for landscape-level analysis through user and decision engine integrated with ArcGIS 8.1a. The logic engine evaluates landscape data against a formal logic specification, designed with the user's knowledge. It can integrate multiple layers of ecosystem conditions such as biodiversity and sustainability. The decision engine evaluates how new outcomes (and data related to additional factors such as feasibility and efficacy of land management actions) against a decision model for prioritizing landscape features with decision models built in ArcGIS Desktop.

### Expert Choice



Expert Choice 11.5™ Powerful Performance for O Making

EC 11.5™ is a robust, desktop-based application for analyzing and evaluating alternatives and achieving important organizational decisions.

### Forest Vegetation Simulator



The Forest Vegetation Simulator (FVS) is the USDA Forest Service's nationally supported framework for forest growth and yield modeling.

### G2G



G2G is a PDF (over to Java) extension for ArcGIS Desktop. The extension allows you or more users to collaborate without any intermediate server. G2G (up to 2) supports:

- 1) Tool sharing;
- 2) Exchange of map content (georeferenced screenshots);
- 3) On-line and geospatial collaboration (shared editing);
- 4) Share navigation (one person can pan the map display of other users).

### Geospatial Modeling Environment



The Geospatial Modeling Environment (GME) is a platform designed to help to facilitate rigorous spatial analysis and modeling.

### Geographic Resources Analysis Support System



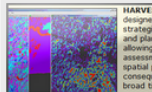
Commonly referred to as GRASS, this is a Geographic Information System (GIS) used for geographic data management and analysis, image processing, geospatial production, spatial modeling, and visualization. GRASS is currently used in academic and commercial settings around the world, as well as by many governmental agencies and environmental consulting companies. GRASS is an open project of the Open Source Geospatial Foundation.

### TPL Greenprint



The Greenprint is a customizable GIS application designed to help communities make informed decisions about conservation priorities. The Greenprint framework provides a systematic approach for identifying currently unprotected areas that offer the highest conservation benefits based on locally identified priorities. The Greenprint GIS application is coupled with a stakeholder-driven community process for identifying location-specific conservation goals and for establishing funding and equitable strategies for land protection.

### HARVEST



HARVEST is a higher level simulation model which can include common field-level related conditions (nutrient and genetic) and can compute and display biodiversity-related metrics about patches, such as interpatch habitat conditions.

### Ecosystem Functions Model



The Ecosystem Functions Model (HEC-EFM) is a planning tool that aids in analyzing ecosystem response to changes in flow regimes. The Hydrologic Engineering Center (HEC) of the U.S. Army Corps of Engineers is developing HEC-EFM to enable project teams to simulate existing ecologic conditions, highlight promising restoration sites, and assess and rank alternatives according to the relative change in ecosystem services.

### Habplan

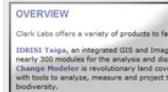
Habplan is a program for forest habitat and habitat suitability modeling.

### Hawths Tools



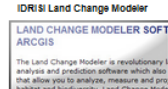
Hawths Tools is a FREE extension for ArcGIS (ArcMap) that performs a number of spatial analysis and functions that cannot be conveniently accomplished with standard ArcGIS. Most of the tools are written with ecological analyses in mind, though many will be useful to any GIS user. Hawth's Tools has been formally documented as of December 2003. The tool has software that repairs and improves upon Hawth's Tools a called Geospatial Modeling Environment (GME).

### IDRISI Taiga



IDRISI Taiga is an integrated GIS and Image Processing software solution providing nearly 200 modules for the analysis and display of digital spatial information. IDRISI offers the most extensive set of GIS and Image Processing tools in the industry in a single, affordable package. With IDRISI, all analysis features come standard—there is no need to buy costly add-ons to extend your research capabilities.

### IDRISI Land Change Modeler



An ArcGIS extension for analyzing and predicting land cover change and assessing the implications of the change for biodiversity.

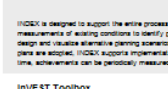
### INDEX



INDEX is an integrated suite of interactive GIS planning support tools for:

- Assessing community conditions.
- Designing future scenarios in real time.
- Measuring scenarios with performance indicators.
- Rating scenarios by goal achievement.
- Optimizing implementation of adopted plans.

### INVEST: Integrated Value and Tradeoffs



INVEST is designed to support the entire process of community planning and development. Applications often begin with benchmark measurements of existing conditions to identify problems and opportunities that merit attention in plans. INDEX can then be used to design and visualize alternative planning scenarios, analyze and score their performance, and compare and rank alternatives. Once plans are adopted, INDEX supports implementation by evaluating the consistency of development projects with plan goals. Over time, achievements can be periodically measured with progress reports.

### INVEST: Integrated Value and Tradeoffs



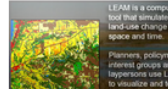
INVEST is a family of tools to map and value goods and services from nature which are essential for sustaining and fulfilling human life.

### LANDIS



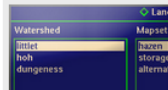
LANDIS is a spatially explicit landscape simulation model. It models natural processes, such as fire, wind, and insect disturbance, succession, and seed dispersal, as well as forest management.

### LEAM



LEAM is a comprehensive tool that simulates land-use change across space and time. It enables planners, policymakers, interest groups and decision-makers to visualize and test community decisions and their consequences. The LEAM environment enhances our understanding of the connection between urban, environmental, social, and economic systems.

### Land-Use Change and Analysis System



System designed to simulate and land change in two geographic regions.


### Landscape Management System



LMS combines the flow of information among existing growth models, computer visualization software, and analysis tools to allow the user to simulate the growth

# Case studies

Spatial Decision Support Knowledge Portal

Go to GeoDesign Portal 

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## Case Studies

<b>Filter By</b>	<a href="#">show all</a>
decision problem type	tools and models used
application domain	location
planning/decision process workflow adopted	start year
planning/decision process steps involved	end year

### Baltimore reservoirs forest conservation plan

The city of Baltimore, Maryland, used a combination of computer-based tools, primarily the ArcView geographic information system (GIS) and the NED-1 system, to analyze risks to the long-term sustainability of their reservoir lands and to develop and evaluate alternative scenarios for management of the lands. While maintaining water quality was the primary goal, the second and third goals were maintaining and enhancing the forest habitat as a contribution towards regional biodiversity. NED-1 inventories incorporated data needed to evaluate wildlife habitat composition and structure and the quality of habitat along first- and second-order streams. While providing a platform for the management and analysis of data on numerous key abiotic and biotic forest characteristics, the NED-1 decision support software did not provide a mechanism for evaluating the relationships of these landscape elements. The need to understand how landscape context and current ecological processes were shaping the forest required a synthesis of tools and often required stepping outside the decision support mechanism for critical answers to conservation problems.

### Boise-Payette-Sawtooth National Forest Plan

National forests are required to update their management plans every 10–15 years. The adjacent Boise, Payette, and Sawtooth National Forests in southern Idaho and northern Utah decided to update their plans together in order to better understand larger landscape issues and to address their many common concerns more efficiently. National forest plans do

 [Ontology Hierarchy](#)

## Site Search Or Selection

Site selection involves identifying elements of the landscape that are suitable for a biodiversity reserve or designation for timber harvest. The two are sufficiently different to justify maintaining separate lists of alternative uses to all parcels in a general matrix of parcels that are optimal for some specific purpose.

### Synonyms

site search; site selection

### Related Tools

- C-Plan
- MARXAN / SPEXAN
- MARXAN With Zones
- Resnet & Surrogacy
- Sites/Site Selection Module (SSM)
- Vista
- Zonae Cogito

### Related Case Studies

- Global Sensitivity Analysis, GIS And Multi-Criteria Evaluation For A Sustainable Planning Of A Hazardous Waste Disposal Site in Spain
- Sandy River Basin Anchor Habitats Project

### Last Updated

6/5/2008

### Contributor

Keith Reynolds

### Graphical Ontology Browser

Expand All Collapse All

filter hierarchy

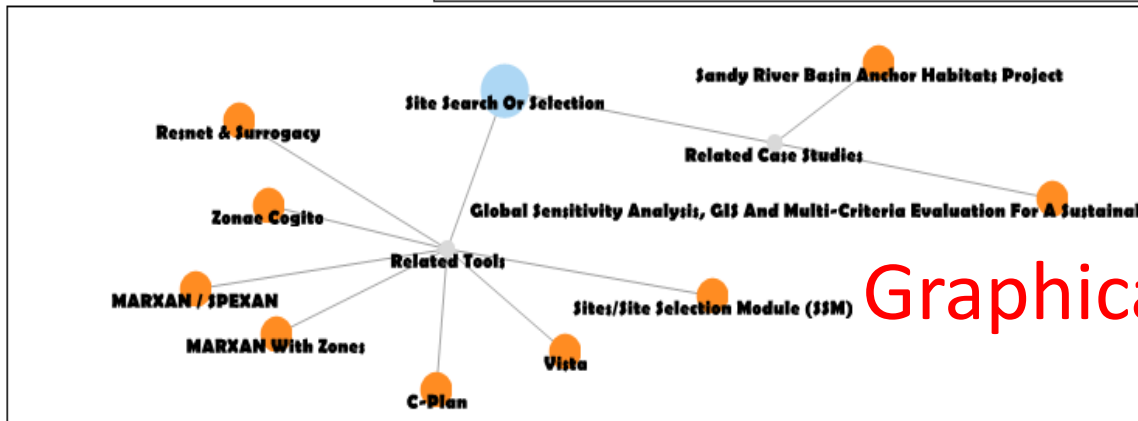
Ontology Hierarchy

- Introduction
- Spatial Planning And Decision Problem Types
  - Envisioning
- Assessment
- Planning
  - Alternative Evaluation
  - Network Design
  - Plan Evaluation
  - Schedule
  - Select Or Allocate
    - Location Allocation
    - Resources Allocation
    - Site Search Or Selection
  - Plan Performance Evaluation
- Planning/Decision Context
- Planning And Spatial Decision Process
- Methods And Techniques
- Technology
- Data And Domain Knowledge
- People And Participation
- Resources

There are currently no assigned tags  
add a tag

Follow the ontology hierarchy

Follow the relation links from concept to concept



Graphical browsing

# Searching on SDS Knowledge Portal

Search by filtering



## Tools

See all the tools at a glance

Filter By		show all
decision problem type targeted	analysis extent	x Alternative Evaluation
used for application domains	analysis unit	x Condition Analysis And Assessment
domain knowledge modeling area	supports multi-spatial scale analysis	x Multi-Attribute Combination Methods
decision process activity supported	platform	x Scenario Management And Comparison

## Analytical Hierarchy Process

Expand All Collapse All

analy

## Ontology Hierarchy

There are currently no assigned tags  
add a tag

Search the ontology hierarchy

## Spatial Decision Support Knowledge Portal

HOME CONCEPTS RESOURCES ABOUT CONTACT HELP LOGIN

## Search Results for "AHP"

### Tools

#### AHP in ArcGIS

Implementation of the analytical hierarchy process with VBA in ArcGIS

#### AHP-OWA in ArcGIS

The AHP-OWA module brings the capabilities of two major procedures of Analytical Hierarchy Process and Linguistic Quantifier Ordered Weighted Averaging into ArcGIS environment for spatial decision making problem solving.

#### Criterion Decision Plus

Criterion DecisionPlus (CDP) decision management system helps you structure and communicate complex decisions between alternatives. It is a very graphical Windows Desktop application that embodies multi-criteria decision (AHP and SMART) analysis and uncertainty handling. CDP handles both qualitative and numerical inputs. CDP starts with a brainstorming component to help structure the decision. It helps elicit preferences from decision makers, then provides contributions, sensitivity and tradeoffs analysis to help validate those preferences. The impact of uncertainties in the attributes of the alternatives on the decision outcome is calculated and shown graphically. Data from spreadsheets can be imported, and the model structure and results can be exported as graphs and underlying tables. CDP was created in 1993 and is supported by InfoHarvest Inc. of Seattle, it comes with a 350 page user's manual and onsite training is available. Decision models created with CDP can be used in the EMDS e-management system (see the EMDS EBM tool entry) and can be published to the web using InfoHarvest's Decision Hosting services.

### Data Sources

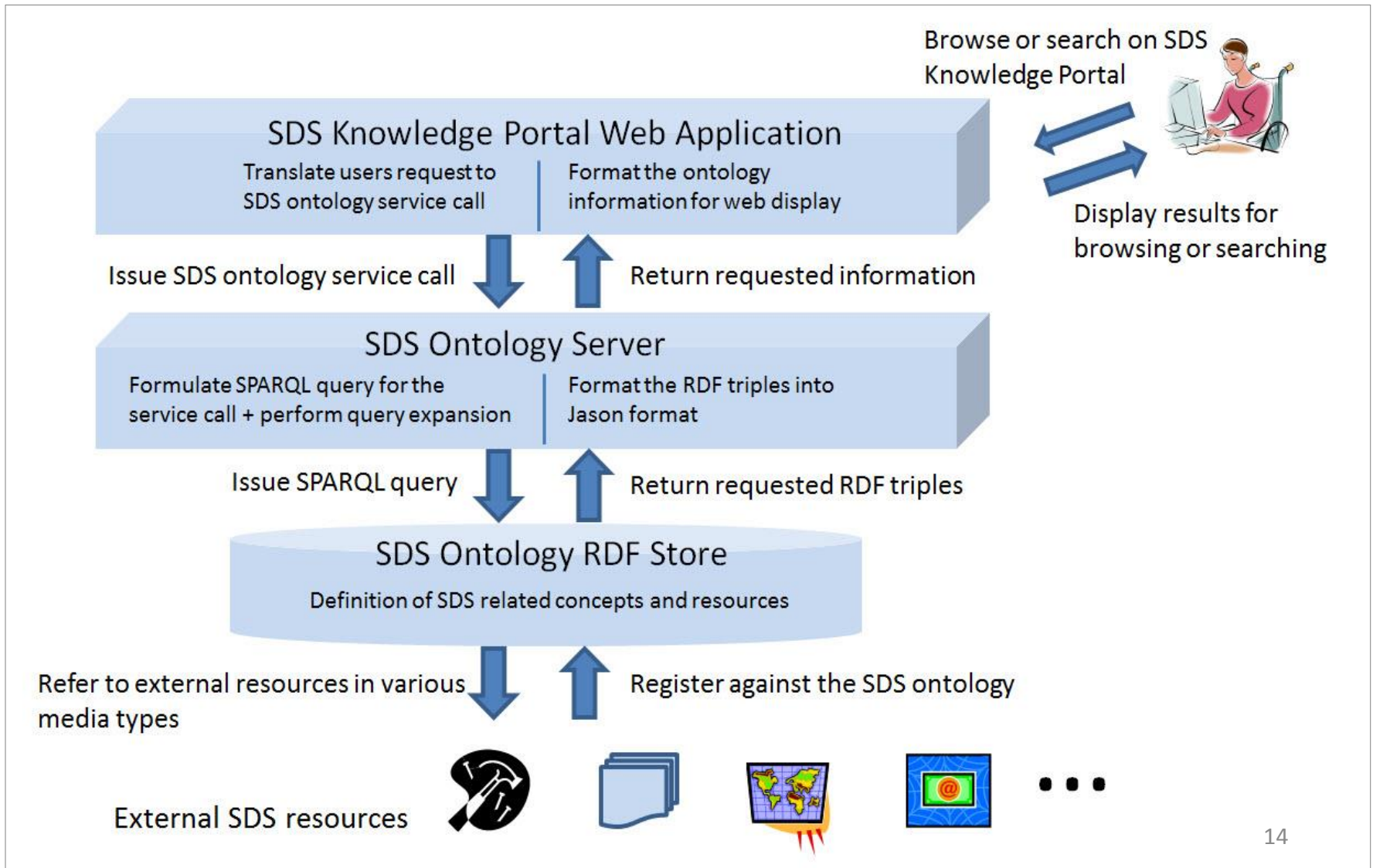
### Case Studies

#### Toronto quality of life

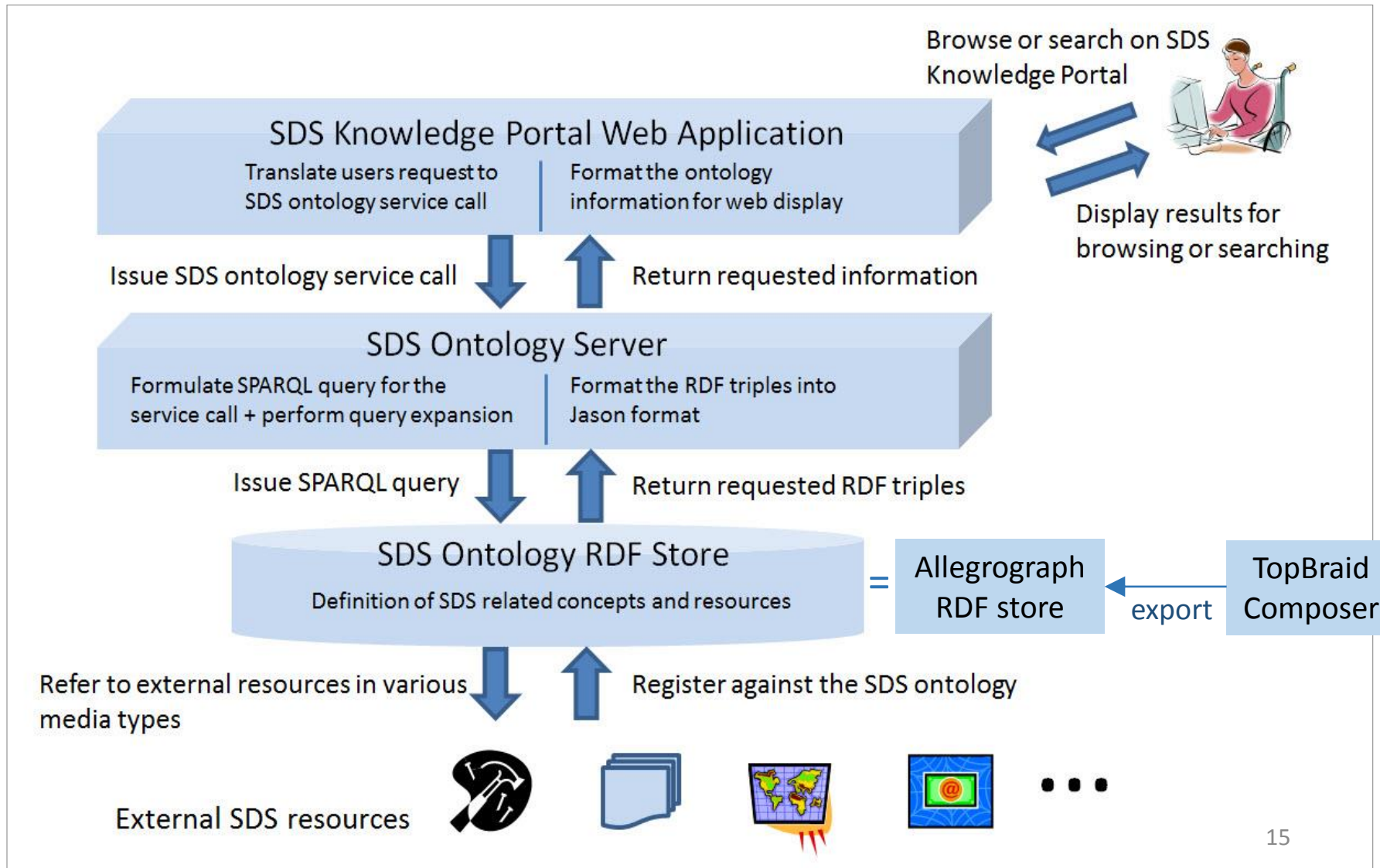
This paper proposes to use principles of geographic visualization in conjunction with multi-criteria evaluation methods to support expert-level spatial decision-making. Interactive maps can be combined with analytical tools to explore various settings of multi-criteria evaluation parameters that define different decision-making strategies. In a case study, the analytic hierarchy process

Advanced semantic search

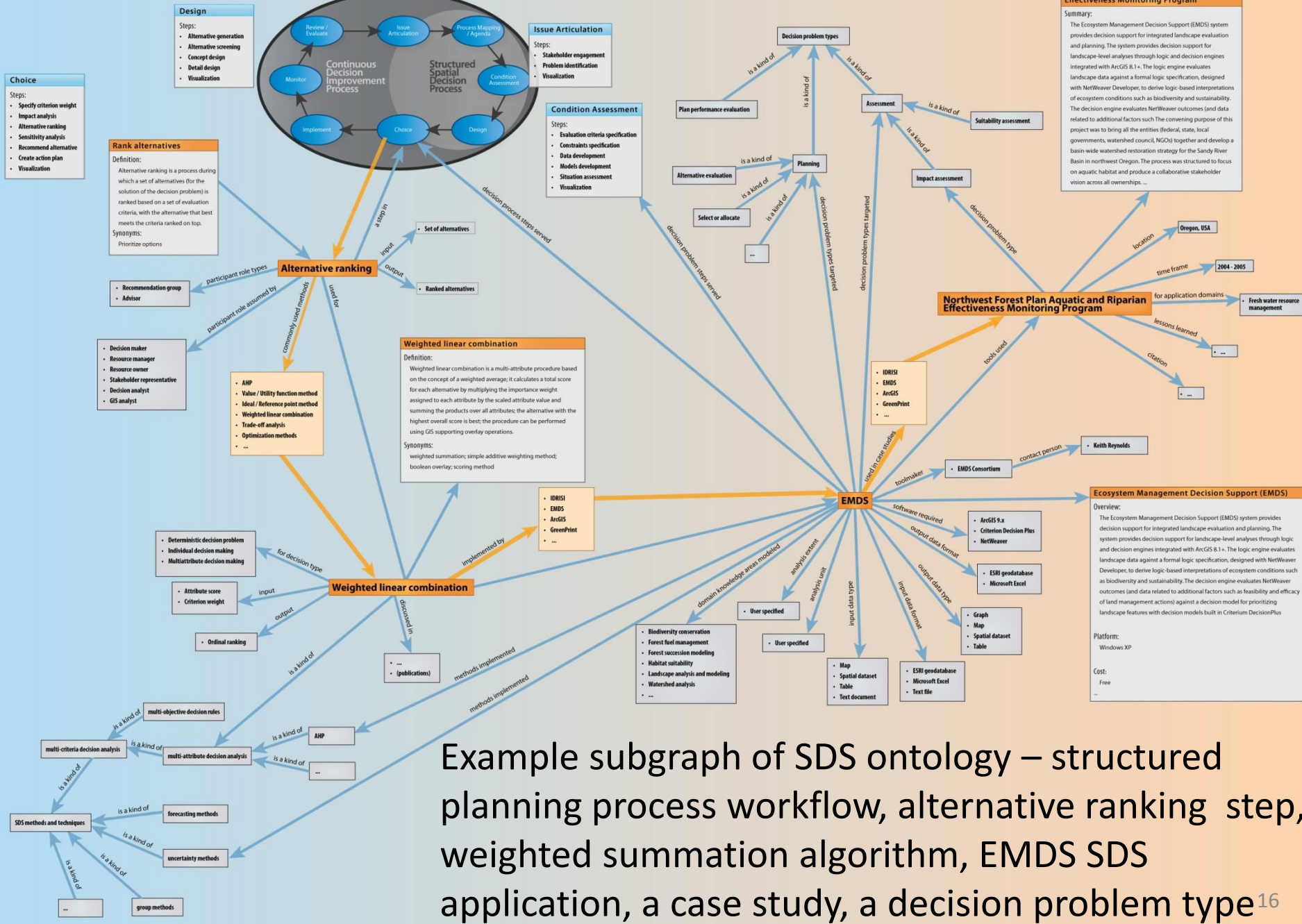
# Architecture of the SDS Knowledge Portal



# Architecture of the SDS Knowledge Portal



# Spatial Decision Process



Example subgraph of SDS ontology – structured planning process workflow, alternative ranking step, weighted summation algorithm, EMDS SDS application, a case study, a decision problem type <sup>16</sup>



# Design considerations of the SDS ontology

- Modularity -- more than 40 sub ontologies (in OWL)

Decision problem types

Data models

Data topics

Data attributes

Decision contexts

Models and tools

Decision related

Decision process steps

Data sources

Application domains

Decision process workflows

Case studies

Knowledge domains

Decision methods and techniques

Literature

Software system functionality

Participation and collaboration

People

General

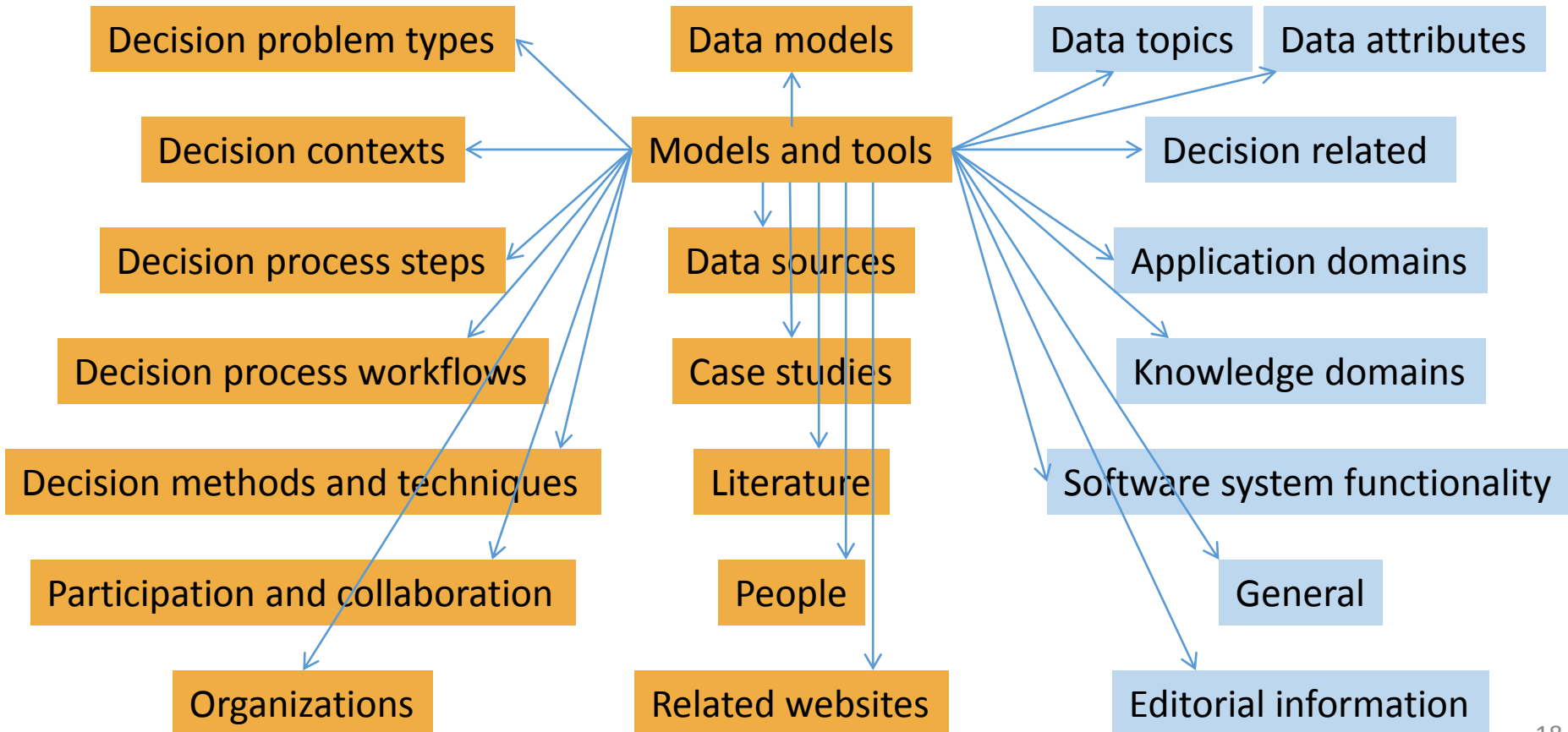
Organizations

Related websites

Editorial information

# Design considerations of the SDS ontology

- Modularity – allowing concepts in more specific ontologies refer to concepts in more general ontologies



# Design considerations of the SDS ontology

- Modularity – Allowing easy import of well-established 3<sup>rd</sup> party ontologies

Decision problem types

Data models

Data topics

Data attributes

Decision contexts

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Decision related

Decision process steps

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# Design considerations of the SDS ontology

- Modularity – Allowing easy import of well-established 3<sup>rd</sup> party ontologies

Decision problem types

Data models

ISO 19115

Data attributes

Decision contexts

Models and tools

Decision related

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# Design considerations of the SDS ontology

- Degree of formalization -- Determined by user's need of search and navigation

E.g. for “models and tools”:

- name
- acronym
- summary
- overview
- toolmaker
- decision problem types targeted
- decision process steps supported
- methods and techniques implemented
- used in case studies
- analysis extent
- analysis unit
- data models used
- application areas
- knowledge domains
- indicators used
- supports analysis of interdisciplinary interactions
- supports multi spatial scale analysis
- supports social negotiation
- input, output data type
- Input, output data format
- description of system components
- software required
- platform
- scientific expertise level required
- technical expertise level required
- developer support needed
- development status
- online download available
- cost
- information source

# Design considerations of the SDS ontology

- Choice of relation types – based on best practice and the purpose
  - Identify a minimal set of subclasses and superclasses
  - Express other facts using non- taxonomic relations or attributes
  - Dynamically generate extra taxonomic relations out of non-taxonomic relations based on the user's browsing need

# Design considerations of the SDS ontology

- Automatic generation of multiple taxonomic relations

E.g. for “models and tools”:

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# Design considerations of the SDS ontology

- Automatic generation

E.g. for “models and tools”:

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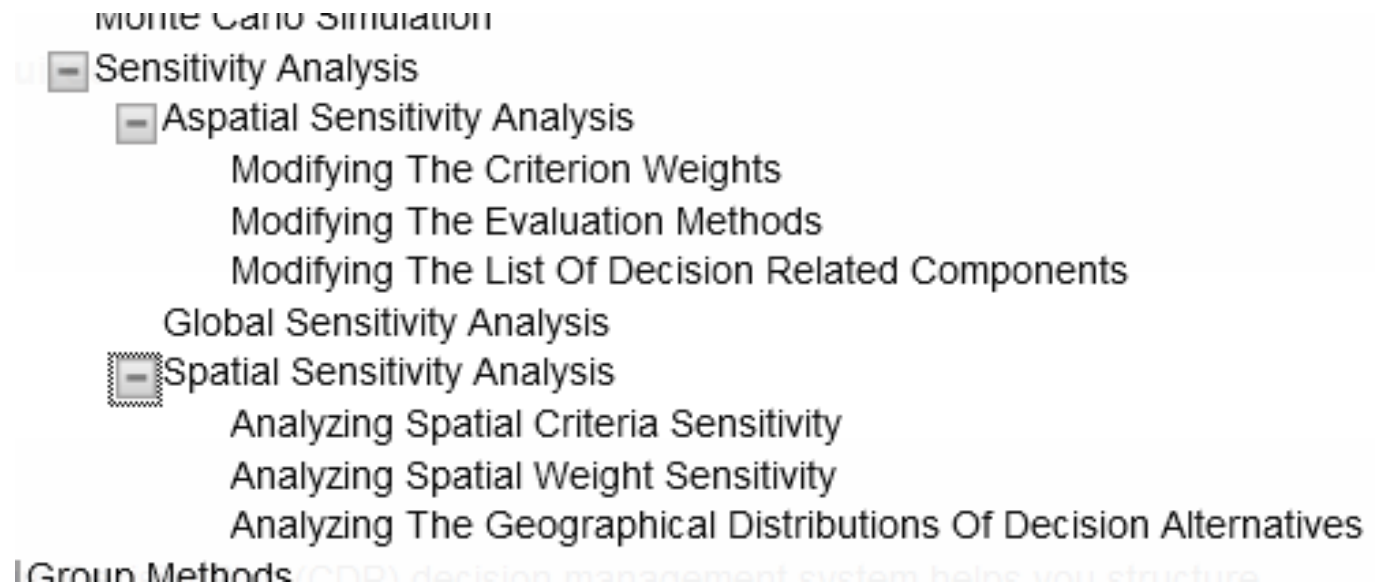
The screenshot displays a hierarchical ontology interface with an orange header bar. The header contains two buttons: "Expand All" (with a star icon) and "Collapse All" (with a star icon inside a circle). To the right of the header is a search box labeled "filter hierarchy". The main content area is a tree view with three main categories, each indicated by a red arrow:

- Tools Sorted By Decision Problem Types**
  - Assessment
    - Impact Assessment
    - Status Assessment
    - Suitability Assessment
  - Planning
    - Alternative Evaluation
    - Network Design
    - Plan Evaluation
    - Schedule
  - Select Or Allocate
  - Plan Performance Evaluation
- Tools Sorted By Decision Process Steps/Activities**
  - Project Management
  - Data Development, Management And Analysis
  - Domain Knowledge Modeling
  - Condition Analysis And Assessment
  - Decision Alternatives Generation, Scenario Simulation
  - Alternative Ranking, Decision Making
  - Collaboration And Participation
  - Plan Implementation, Monitoring, Performance Evaluation
  - Visualization
- Models Sorted By Knowledge Domains**
  - All (User Specified Domain Knowledge Modeling Area)
  - Climate Change Modeling
  - Conservation Of Biodiversity
  - Decision Modeling
  - Estuarine And Marine Ecosystem Modeling
  - Forest Fuel Management
  - Forest Succession Modeling



# Design considerations of the SDS ontology

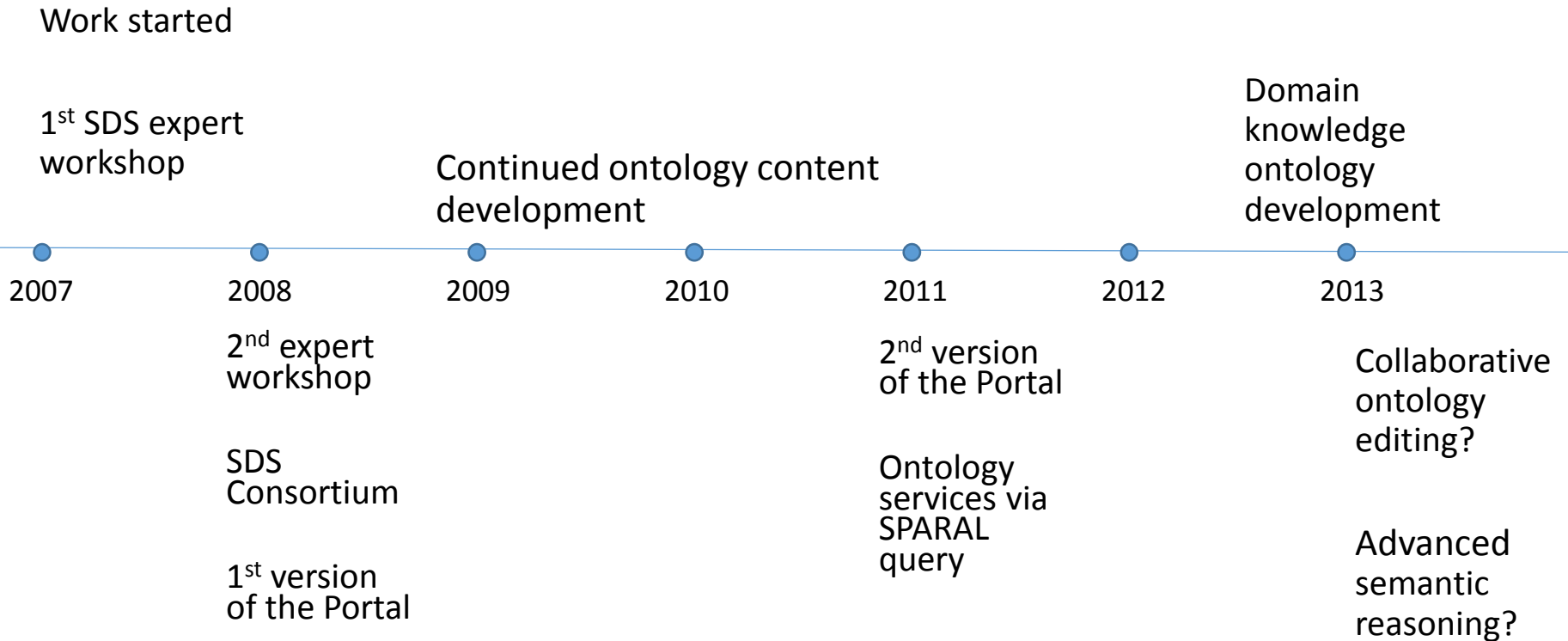
- Leveraging logical relations in search and navigation
  - Subsumption relation, e.g.  
Find a tool that implements sensitivity analysis:  
→ return all the subclasses of sensitivity analysis



# Design considerations of the SDS ontology

- Leveraging logical relations in search and navigation
  - Subsumption relation, e.g.  
Find a tool that implements sensitivity analysis:  
→ return all the subclasses of sensitivity analysis
  - Inverse relation, e.g.  
“Tool X implements Method A”  
→ “Method A is-implemented-by Tool X”
  - Transitive relation

# Timeline and future work



# Contact

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- Philip Murphy, [philip\\_murphy@spatial.redlans.edu](mailto:philip_murphy@spatial.redlans.edu)

See also:

- [www.spatial.redlands.edu/sds](http://www.spatial.redlands.edu/sds)
- Li, N., Raskin, R., Goodchild, M. and Janowicz K. (2012) An Ontology-Driven Framework and Web Portal for Spatial Decision Support. *Transactions in GIS* 16(3): 313-329.