Mitigation and Adaptation Studies

Class 12: Agent-Based Models

Contents:

- Introduction
- Agents and Agent-Based Models
- Agent-Based Modeling and Simulation
- Examples
- Tools

The Need for System Simulations

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Complex Systems:

- Relevant systems are becoming more complex
- Decentralization of Decision-Making
- Systems are approaching design limits
- Increasing environmental, social, and economic Interdependencies

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New Tools and Modeling Approaches

- Most systems have always been complex, but interference was limited and analysis tools did not exist
- Economic markets are more complex and have more diverse agents
- Social systems and social networks are increasingly complex

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- More and better organized data
- Higher levels of data granularity can now support micro-simulations

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Computational Power and Approaches:
- Computational power advancing
- Communication and visualization approaches

Agent-Based Simulation

Introduction

Agent-Based Simulation

A new approach used in biological, social, and other sciences

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Based on local interaction among agents

No central authority or controller exists to determine:

- how the system operates
- how the system is modeled
- how the system/model moves from state to state

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Assumptions:

- Key aspect of agent behaviors can be defined and described.
- Mechanisms by which agents interact can be defined and described.
- Complex social processes and a system can be built “from the bottom up.”

When agent-based modeling?

- There is a natural representation as agents:
- Decision and behaviors can be defined discretely (with boundaries)
- It is important that:
    - agents adapt and change their behavior
    - agents learn and engage in dynamic strategic behavior
    - agents have a dynamic relationships with other agents
    - agent relationships form and dissolve
    - agents form organizations and adaptation and learning are important at the organization level
    - agents have a spatial component to their behaviors and interactions
- The past is no predictor of the future
- Scale-up to arbitrary levels is important
- Structural changes of processes need to be a result of the model, rather than an input to the model

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- Social insects, swarms;
- Robots, systems of collaborating robots.

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Decision rules vary by agent

- Sophistication of rules;
- Cognitive “load”;
- Internal models of the external world;
- Memory employed.

Agents and Agent-Based Models

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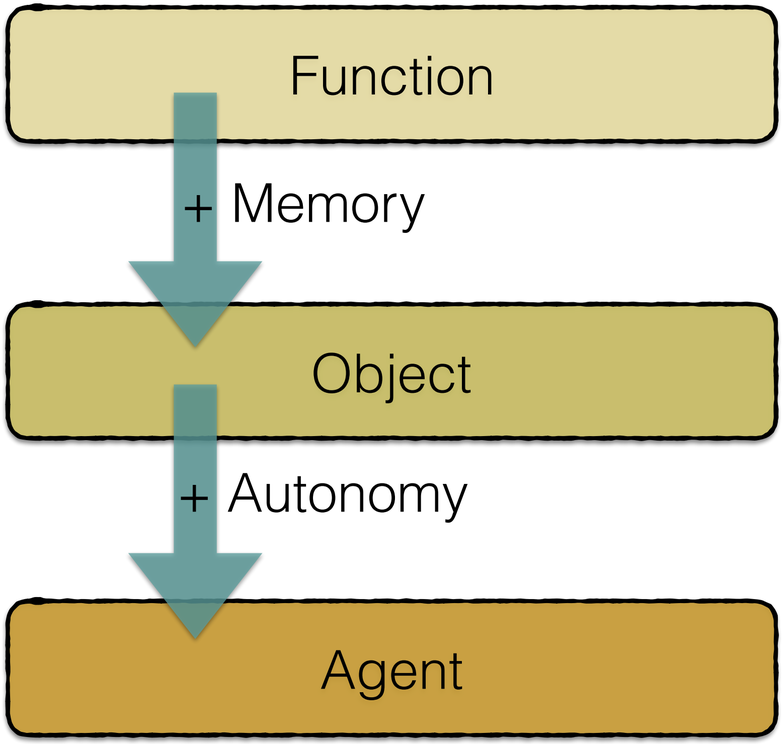
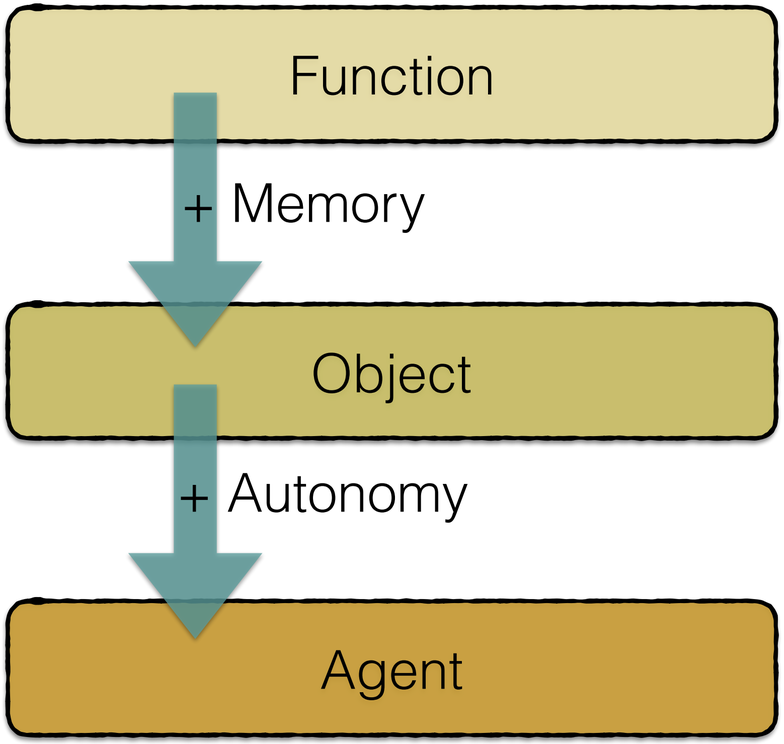
What is the effect of agent diversity on the system?

- Do certain types of agents dominate?
- Does the system evolve toward a stable mix of agent types?

What Is An Agent?



What Is An Agent?



Agent

- Attributes
- Rules of behavior
- Memory
- Sophistication
- Resources

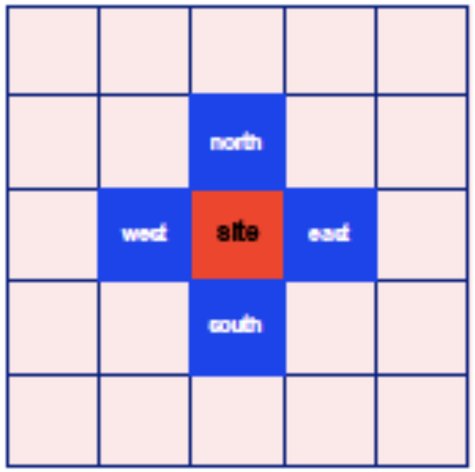
Agent Interaction

Agent Interaction

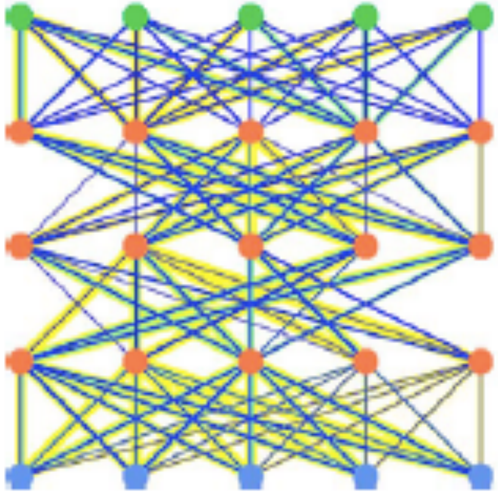
Agents have neighborhoods
Various topologies connect agents with their neighbors:

- Agents can move in free (continuous) space
- Cellular automata have agents interacting in local “neighborhoods”
- Agents can be connected by networks of various types and be static or dynamic
- Agents can move over Geographical Information Systems (GIS) tilings
- Sometimes spatial interactions are not important (“Soup” Model)

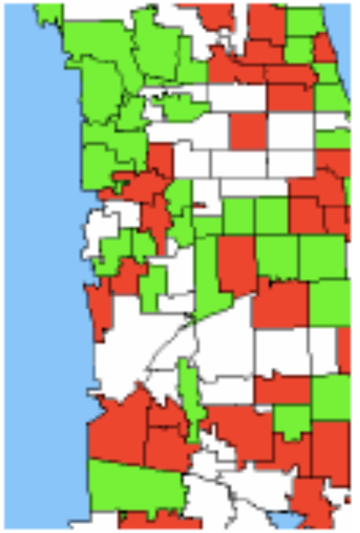
Euclidean Space: 2D, 3D



Grid



Network



GIS

Agent-Based Models

- models to simulate the actions and interactions of independent agents;
- aims at understand the behavior of social systems with many agents;
- search insight in the collective behavior of agents in complex social system.

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- individual have limited or no options for decision making and behavior is equation-based.

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Components of agent-based models:

1. numerous agents specified at various scales;
2. decision-making heuristics;
3. learning rules or adaptive processes;
4. an interaction topology;
5. an environment.

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Three ideas central to agent-based models:

- objects,
- emergence,
- complexity.

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What Is Agent-Based Modeling & Simulation (ABMS)?

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An agent-based model consists of:

- A set of agents (part of the user-defined model)
- A set of agent relationships (part of the user-defined model)

ABMS combines ABMs with a framework for simulating agent behaviors and interactions (provided by an ABMS toolkit or other implementation)

Unlike other modeling approaches, agent-based modeling begins and ends with the agent's perspective.

Agent-Based Modeling and Simulation

The agent-based model development process often makes use of several tools.

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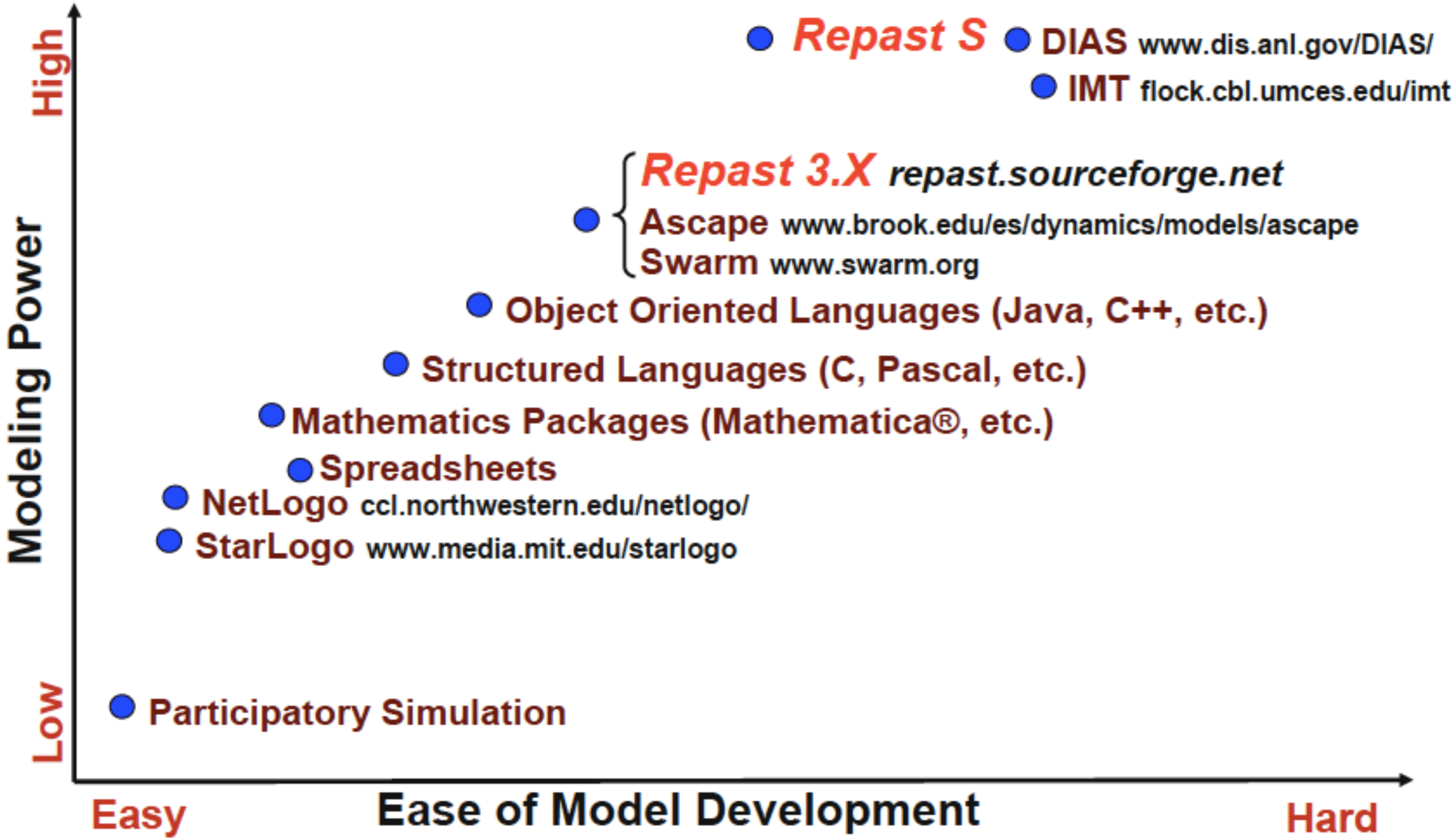
Agent-based Modeling and Simulation Toolkits
NetLogo, StarLogo
MASON
AnyLogic (commercial)
Repast (Java)
similar to Swarm (Objective C, Java)

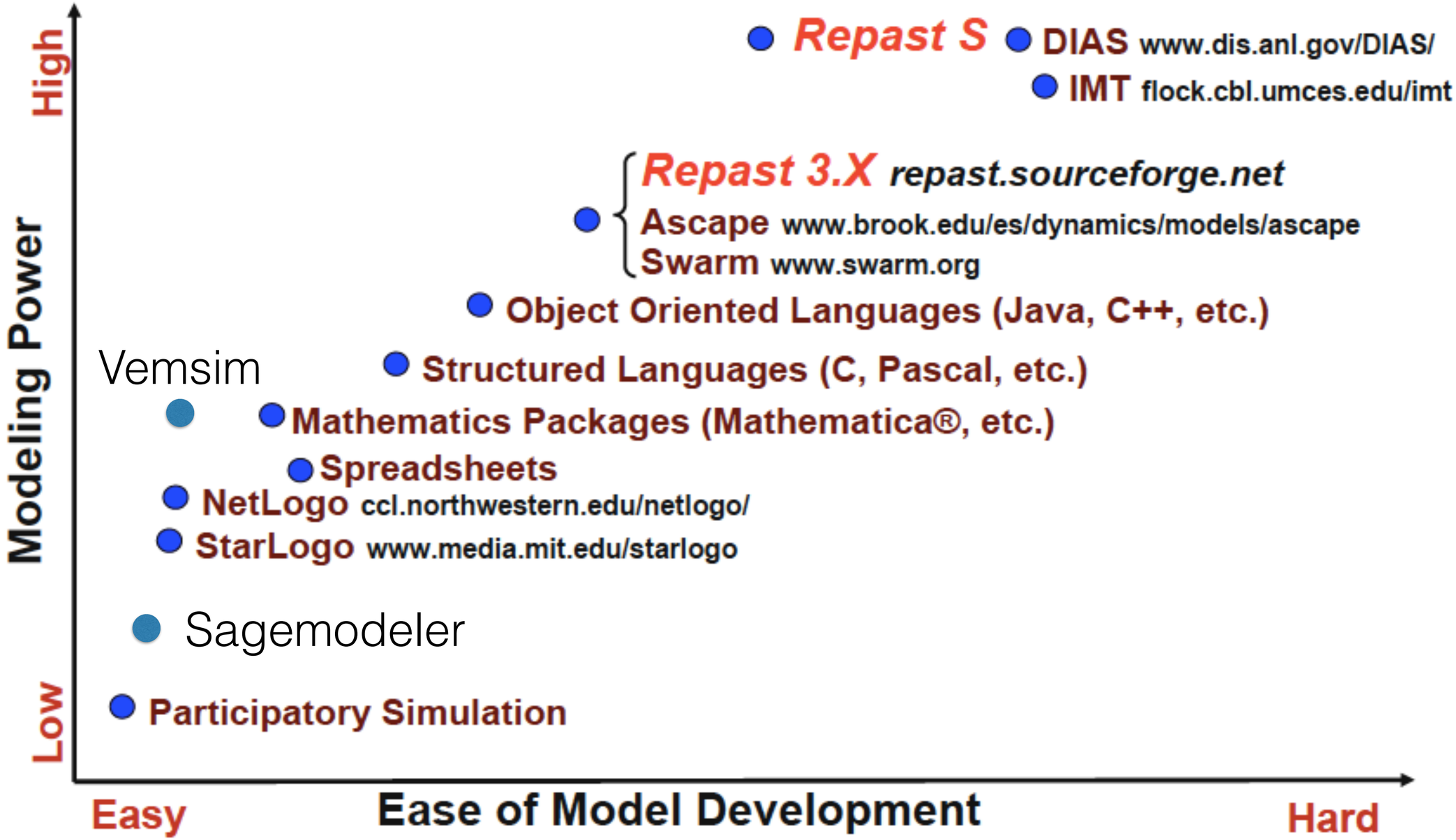
General Tools
Spreadsheets, with macro programming
Computational Mathematics Systems
- MATLAB
- Mathematica

General Programming Languages (Object-oriented)
- Java
- C++

Agent-Based Modeling and Simulation



Agent-Based Modeling and Simulation



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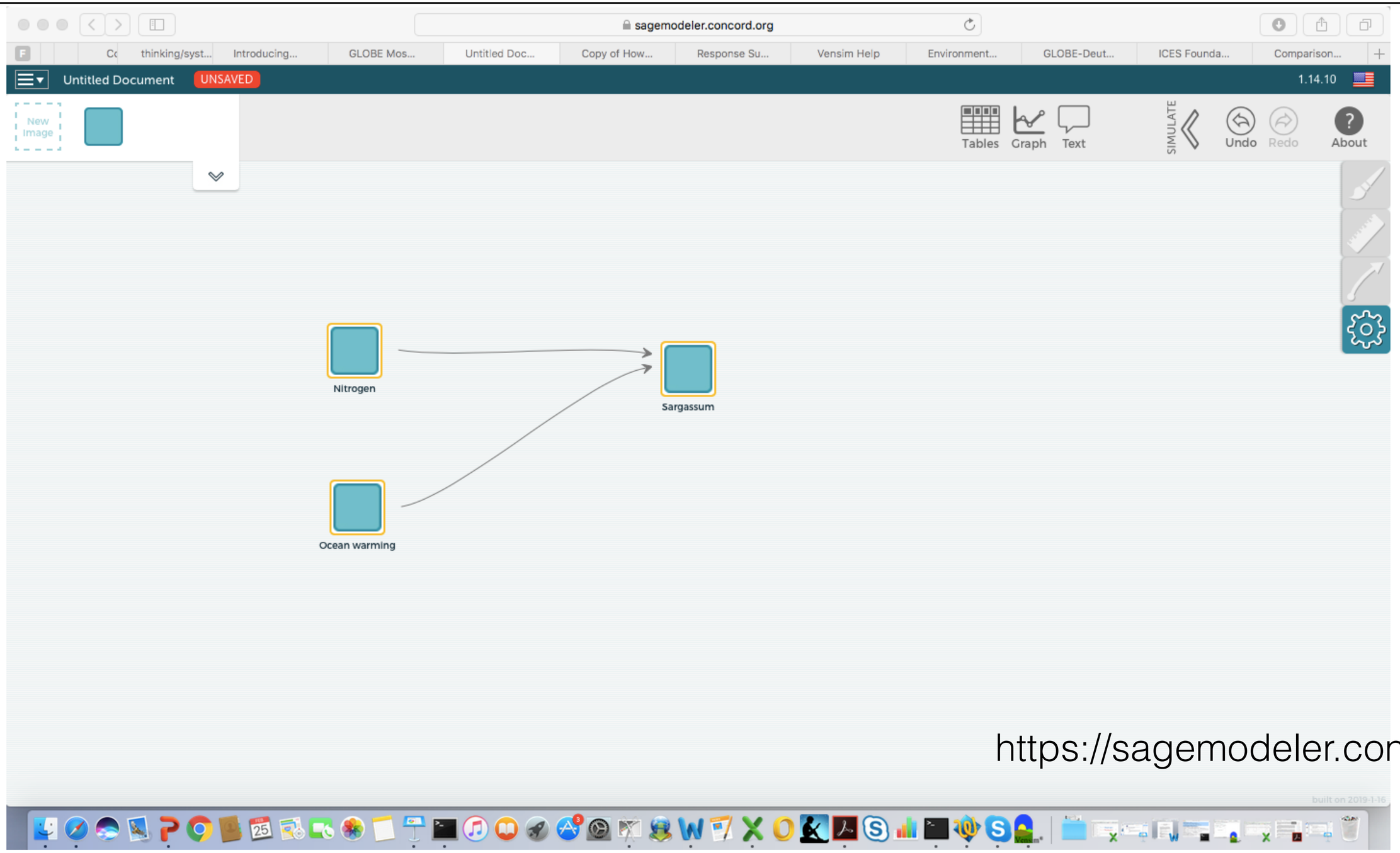
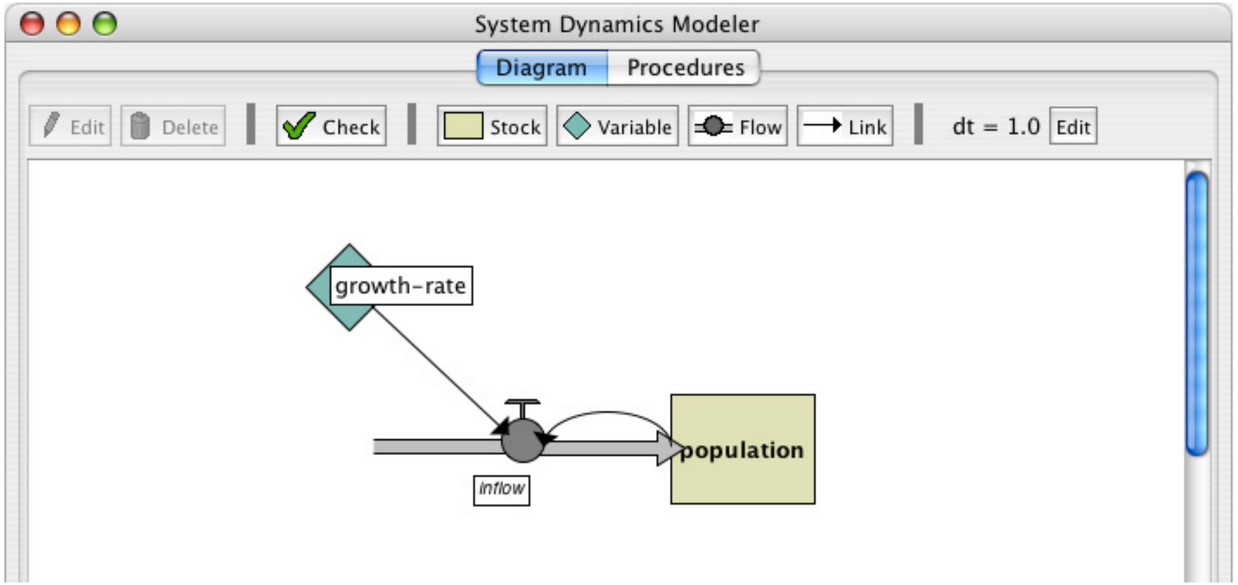
Tools

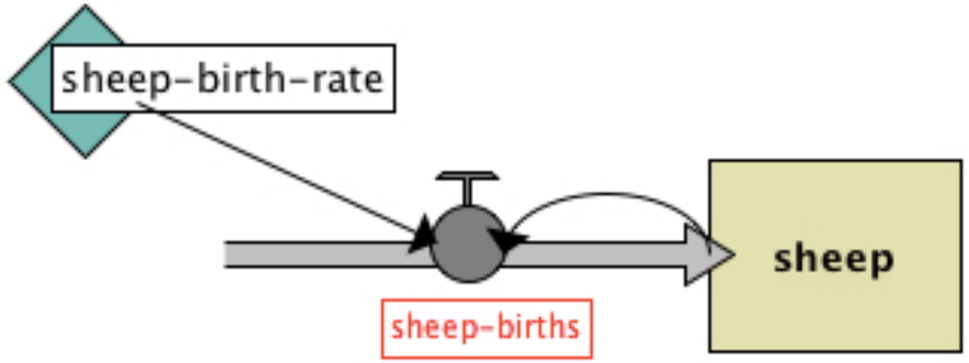


https://sagemodeler.concord.org

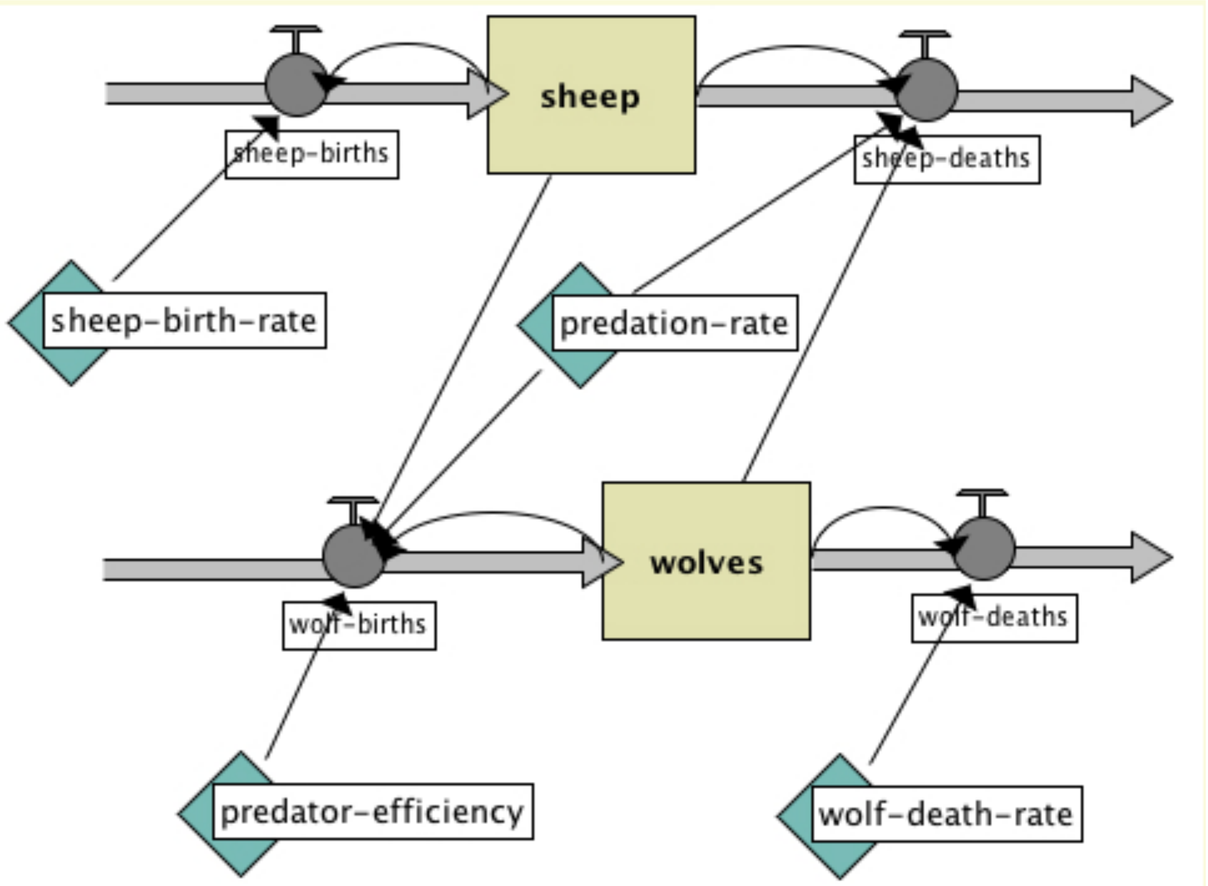
Tools



NetLogo



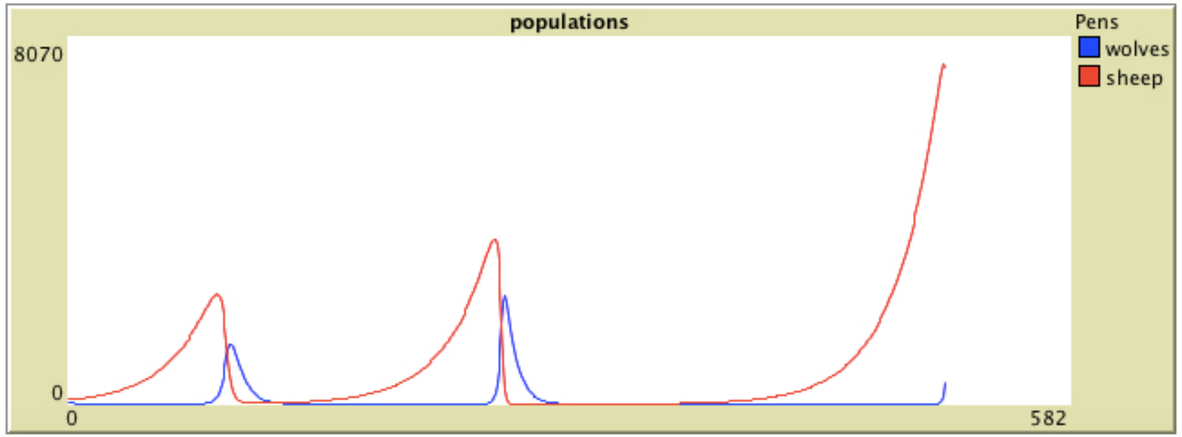
Tools


sheep
sheep-births
sheep-deaths
sheep-birth-rate
predation-rate
wolves
wolf-births
wolf-deaths
predator-efficiency
wolf-death-rate


setup
go


sheep
7379.098
wolves
467.279


More...


populations
Pens
wolves
sheep
8070
0
0
582

Tools

https://vensim.com/vensim-personal-learning-edition/

Vensim VENTANA systems, inc

Home Contact Us Software Support FAQ News

Vensim® Personal Learning Edition

Contents

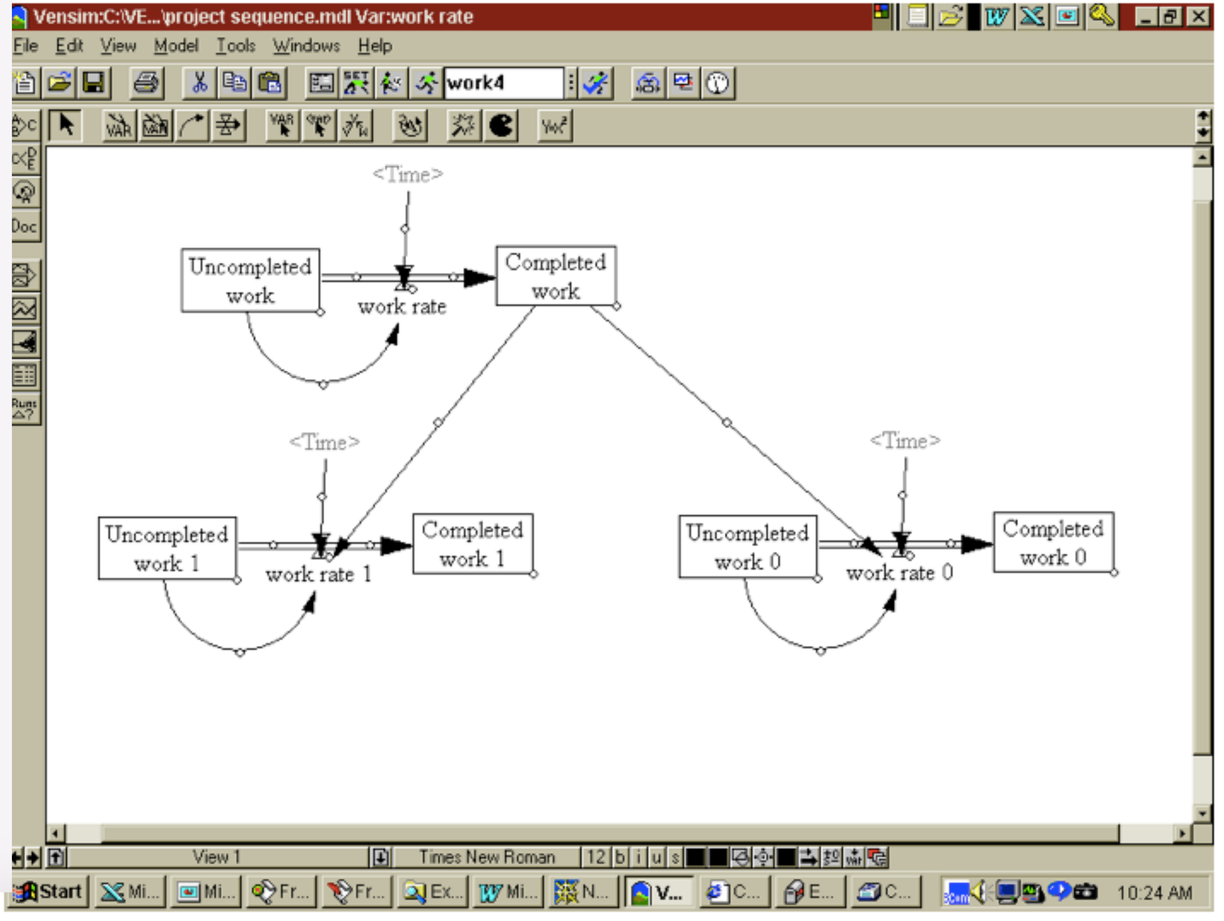
1. Vensim PLE:
2. Vensim PLE Survey
3. Commercial Use
4. Download Vensim PLE at the Download page.
5. Vensim PLE Documentation (User's Guide)
6. Return to Software

Vensim PLE is a version of Vensim that has been designed to lower the barriers to the beginning system dynamics modeler.

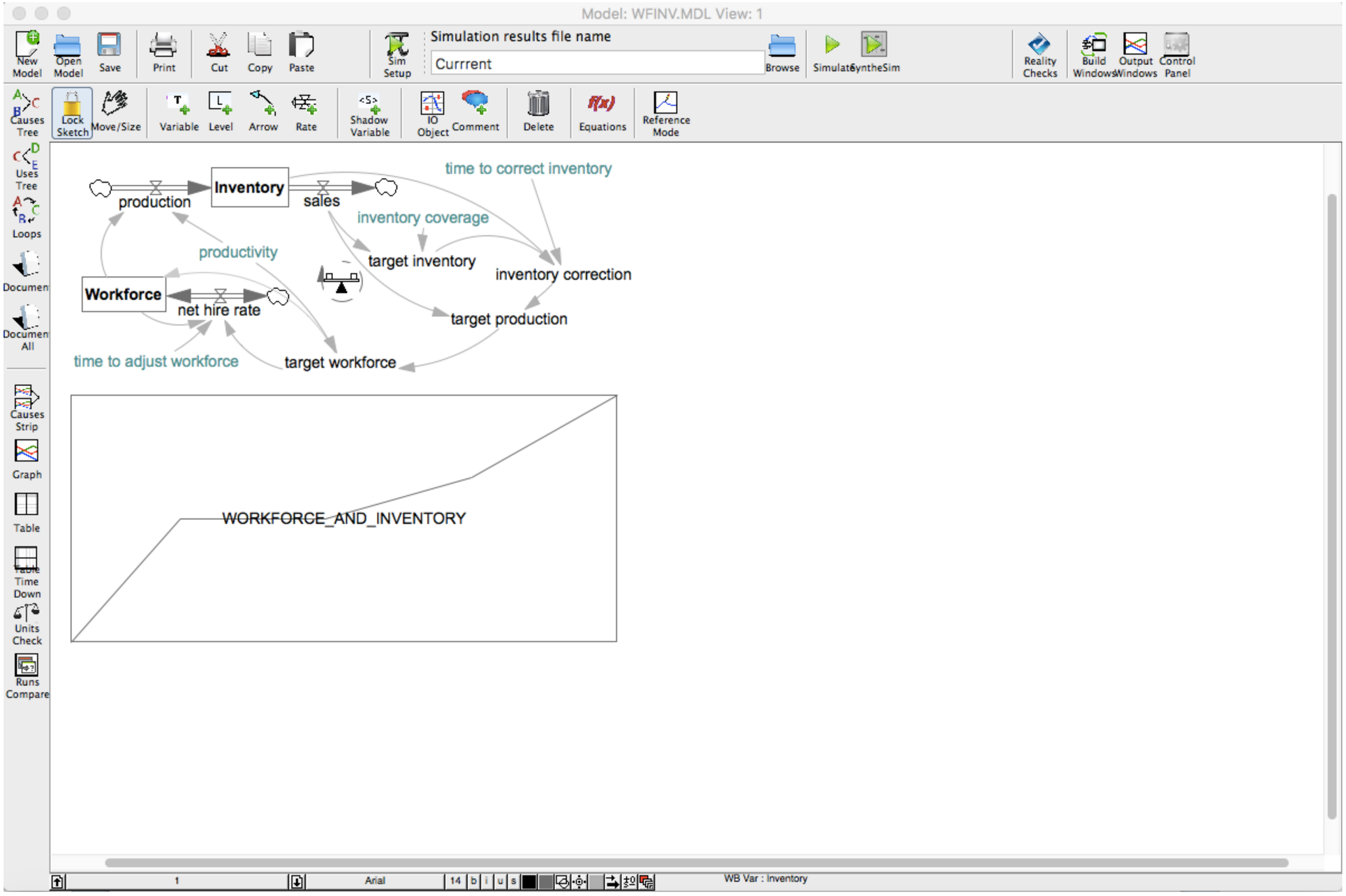
Vensim PLE is fully functional system dynamics software that is **free** for personal and educational use, and comes complete with sample models, help engine, and Adobe Acrobat format PLE User's Guide. You can download Vensim PLE here.

Vensim PLE:

- Is free for academic and personal use.
- Has simplified menus and dialogs.
- Contains fewer option settings.
- Has a fixed tool set.
- Contains fewer model-building tools.
- Contains fewer of functions.



Tools


Model: WFINV.MDL View: 1
New Model
Open Model
Save
Print
Cut
Copy
Paste
Sim Setup
Simulation results file name
Currrent
Browse
Simulate
SyntheSim
Reality Checks
Build Windows
Output Windows
Control Panel
Causes Tree
Lock Sketch
Move/Size
Variable
Level
Arrow
Rate
Shadow Variable
IO Object
Comment
Delete
Equations
Reference Mode
Uses Tree
Loops
Documen
Documen All
Causes Strip
Graph
Table
Table Time Down
Units Check
Runs Compare
Inventory
production
sales
time to correct inventory
inventory coverage
target inventory
inventory correction
productivity
Workforce
net hire rate
target production
time to adjust workforce
target workforce
WORKFORCE_AND_INVENTORY
WB Var : Inventory

Vensim Help

Contents | Index | Search

- Vensim Help
- Release Notes
- Models that Come with Vensim
- User Guide - Vensim Introduction & Tutorials
- Modeling Guide -- Concepts with Examples
- Reference Manual
- Appendix
- Molecules
- Vensim Model Reader
- Vensim Demo

Models that Come with Vensim

Top Previous Next

Vensim installs many different models with the Help documentation. Many of the models are described and used within the Help system. There are also a number of models that are not described in detail in the documentation. Here we outline the location and naming conventions for the documented models and describe a number of other models that come with Vensim.

Models install to the Models directory, in the same path as this help system, so that models can be linked for quick access. The Models directory contains the following subdirectories:

- UserGuide - models used in the User Guide.
- ModelGuide - models from the Modeling Guide, organized by topic
- FunctionExamples - examples of usage for every function in Vensim, as described in the Reference Guide
- Sample - other sample models.
- OptSensi - examples of extended payoffs, stochastic optimization, Markov Chain Monte Carlo and Simulated Annealing, and sensitivity simulations.
- Molecules - Molecules are useful pieces of structure

It is fine to run the models in place. However, if you plan to modify the models, we strongly recommend that you copy these directories to a working location in your control, outside the help path. This will prevent system permission problems and loss of work when Vensim updates the help files.

The location of the Models directory varies by platform. Normally the full path for this directory is

- c:\Documents and Settings\All Users\Vensim\Models (Windows XP),
- c:\Users\Public\Vensim\Models (Windows Vista/7), or
- /Users/Shared/Vensim/Models (Macintosh)

https://www.smithsonianmag.com/science-nature/invasion-of-the-lionfish-131647135/

INVASIVE LION FISH

BY: ZIA BOHANAN

WHERE ARE THEY FOUND?

- NATIVE TO INDO-PACIFIC
- FOUND IN THE ATLANTIC OFF THE EAST COAST

ISSUES WITH LIONFISH

- NOT MANY PREDATORS IN THE ATLANTIC
- FEEDS ON A VARIETY OF NATIVE ATLANTIC REEF FISH
- REDUCE SPECIES RICHNESS OF NATIVE FISH RAPIDLY
- QUICK REPRODUCTION RATE

STAKEHOLDERS

NOAA

↓

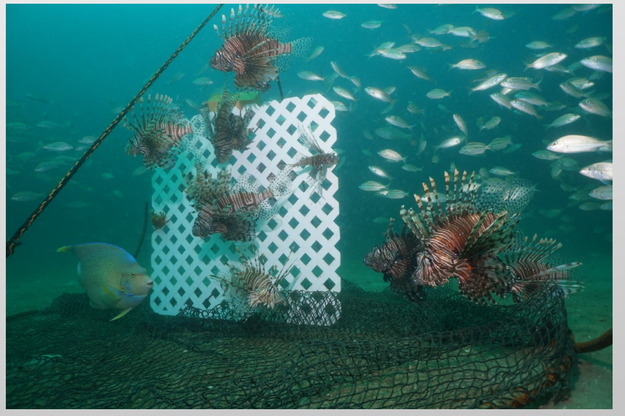
LOCAL COMMUNITIES AND FISHERIES , NON PROFIT ORGANIZATIONS SUCH AS SAILORS FOR THE SEA

↓

INTERNATIONAL CORAL REEF INITIATIVE (REGIONAL LIONFISH COMMITTEE), GULF AND CARIBBEAN FISHERIES INSTITUTE, LION FISH RESEARCH PROGRAM, UNIVERSITY OF FLORIDA

↓

LOCAL OFFICIALS FROM AFFECTED AREAS, ENVIRONMENTAL PROTECTION AGENCY



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- HTTP://WWW.SAILORSFORTHESEA.ORG
- HTTPS://SNORKELAROUNDTHEWORLD.COM/2016/04/LIONFISH-INVASION/

Lionfish

Implementing & Monitoring the Sustainable Development Goals in the Caribbean: The Role of the Ocean
Saint Vincent and the Grenadines
January 17-19, 2018

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THE WORKSHOP · LOGISTICS · PARTICIPATE · SCHEDULE · PROGRAM · USER ACCESS

Implementing and Monitoring the Sustainable Development Goals in the Caribbean: The Role of the Ocean

Workshop Information

- Participants
- Recommendations
- Story (pdf)
- Executive Summary (pdf)
- Report (Long Version, pdf)
- Flyer (low resolution)
- Full Print Version
- Table Round Questions
- 2+2 Forms
- Data inventory, Matching Framework
- Organizers
- Questionnaires

Identifying and Articulating Knowledge Needs for the Implementation and Monitoring of the Sustainable Development Goals in Caribbean Small Island States and Matching Those Needs to Knowledge, Tools, and Data.

SERENITY DIVE
St. Vincent & The Grenadines

Vaughn Martin

SERENITY DIVE

St. Vincent & The Grenadines

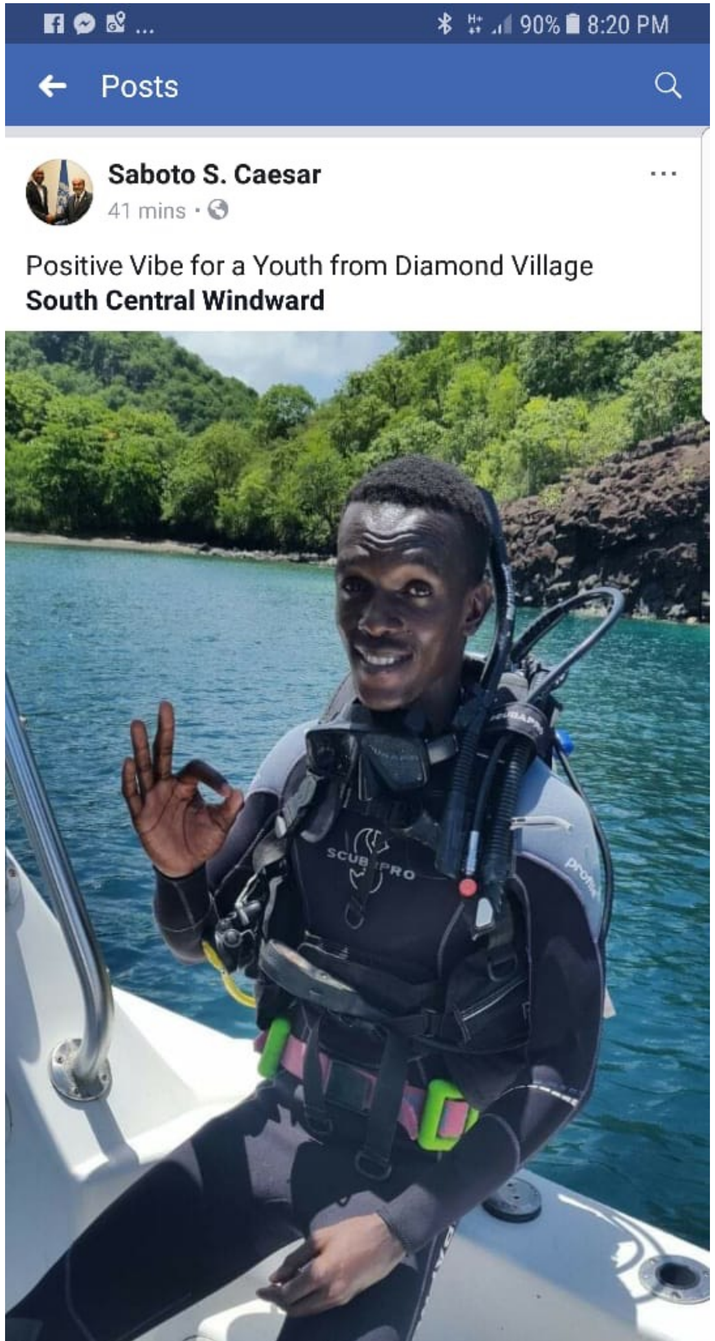
We have to eat them

To defeat them

Lionfish

Lionfish

Lionfish



Training people in St. Vincent and the Grenadines to hunt lion fish …