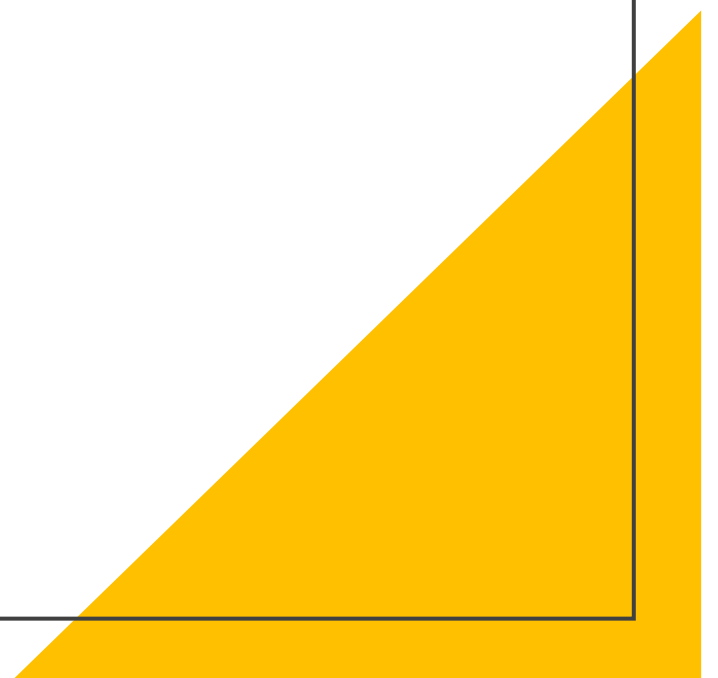


Growing Systems Thinkers: Enhancing Environmental Education with NetLogo Modeling

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Key Terms

- **Systems thinking** is an **approach** to problem-solving that involves considering the whole system, its components, and their interactions.
- **Agent-based modeling (ABM)** is a **modeling technique** used to simulate the behavior of individual agents and their interactions with one another and their environment.
- **NetLogo** is an **open-source programming environment and modeling platform** used for creating agent-based models and simulations

Advantages of NetLogo

- User friendly
- Extensive library of models
- Strong community of users
- Accessible and Inclusive

NetLogo



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NetLogo is a multi-agent programmable modeling environment. It is used by many hundreds of thousands of students, teachers, and researchers worldwide. It also powers [HubNet](#) participatory simulations. It is authored by [Uri Wilensky](#) and developed at the [CCL](#). You can download it free of charge. You can also try it online through [NetLogo Web](#).

Download NetLogo



Go to NetLogo Web



Getting Started with NetLogo

Are you new to NetLogo or programming in general? We have resources to help!

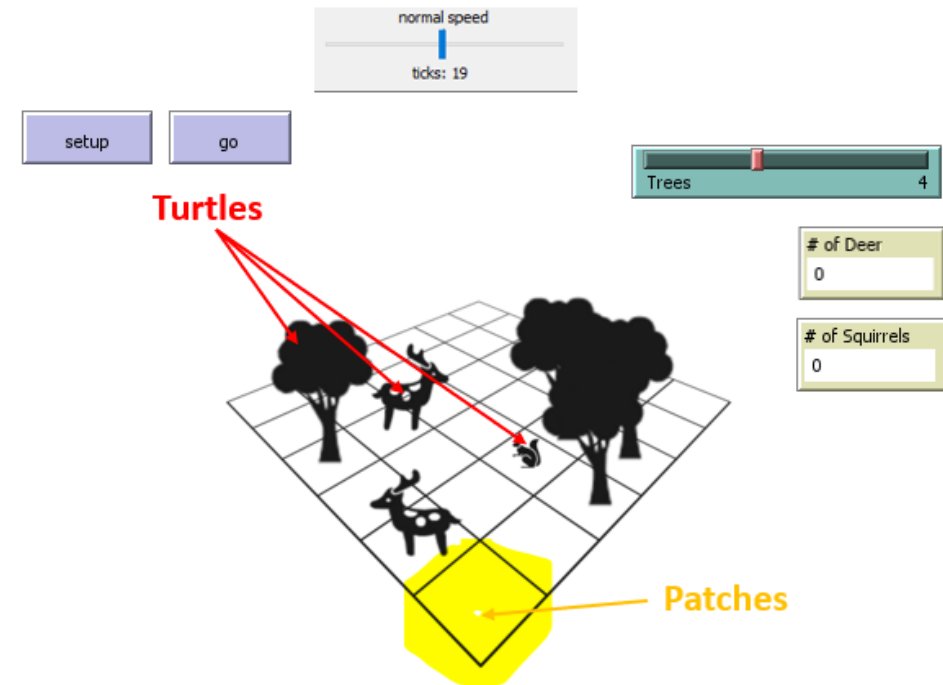
- The **NetLogo tutorials** guide you through all the basics, from [loading and using models](#), to [interacting with models with NetLogo code](#), and finally [programming a model from scratch](#).
- The **Beginner's Interactive NetLogo Dictionary** has articles and videos on introductory topics, including a [getting started page](#). The [videos](#) include multiple examples of making models from scratch. You also might want to check out "[What is a primitive?](#)" and "[The First 11 Primitives to Learn](#)" which let you interactively try out NetLogo code primitives as you learn about them.
- We also have a short (2 minute) [introduction to NetLogo video](#) that covers the basic concepts and capabilities of the software.

When you're ready to dive deeper into NetLogo programming, check out the [full NetLogo manual](#). Of particular note are:

Using NetLogo

Basic Introduction to NetLogo Environment

- **Agent-based modeling (ABM)** is used to simulate the behavior of individual agents and their interactions with one another and their environment.
- **NetLogo elements:**
 - **Turtles**
 - **Patches**
 - Rules
 - Users



Rules: Turtle (Trees) remain stationary but Turtle (Deer) and Turtle (Squirrels) move randomly to different Patches (Environment).

Users: Determine number of Turtle (Trees) using the Trees slider

Model Example: Earth Systems

Earth Systems

Atmospheric Systems
Climate Systems
Weather Systems
Hydrologic Systems
Physical Systems

powered by NetLogo

Climate Change

File: [New](#) [Revert to Original](#)
Export: [NetLogo](#) [HTML](#)

Mode: Interactive Commands and Code: Bottom

model speed
ticks: 327

setup go

sun-brightness 1
albedo 0.6

watch a ray

temperature 13.5
CO2 amount 25

add cloud remove cloud
add CO2 remove CO2

Global Temperature

Command Center
NetLogo Code
Model Info

Model Example: Biological/Ecological Systems

Biological/ Ecological Systems

Ecosystems
Freshwater
Ecosystems
Marine
Ecosystems
Organ Systems
Mating Systems

powered by NetLogo

Wolf Sheep Predation

File: [New](#) [Revert to Original](#)
Export: [NetLogo](#) [HTML](#)

Mode: Interactive Commands and Code: Bottom

model speed
ticks: 0

model-version
sheep-wolves

initial-number-sheep 100 initial-number-wolves 50

grass-regrowth-time 30

setup go

Sheep settings Wolf settings

sheep-gain-from-food 4 wolf-gain-from-food 20
sheep-reproduce 4 % wolf-reproduce 5 %

show-energy?

sheep 100 wolves 50 grass N/A

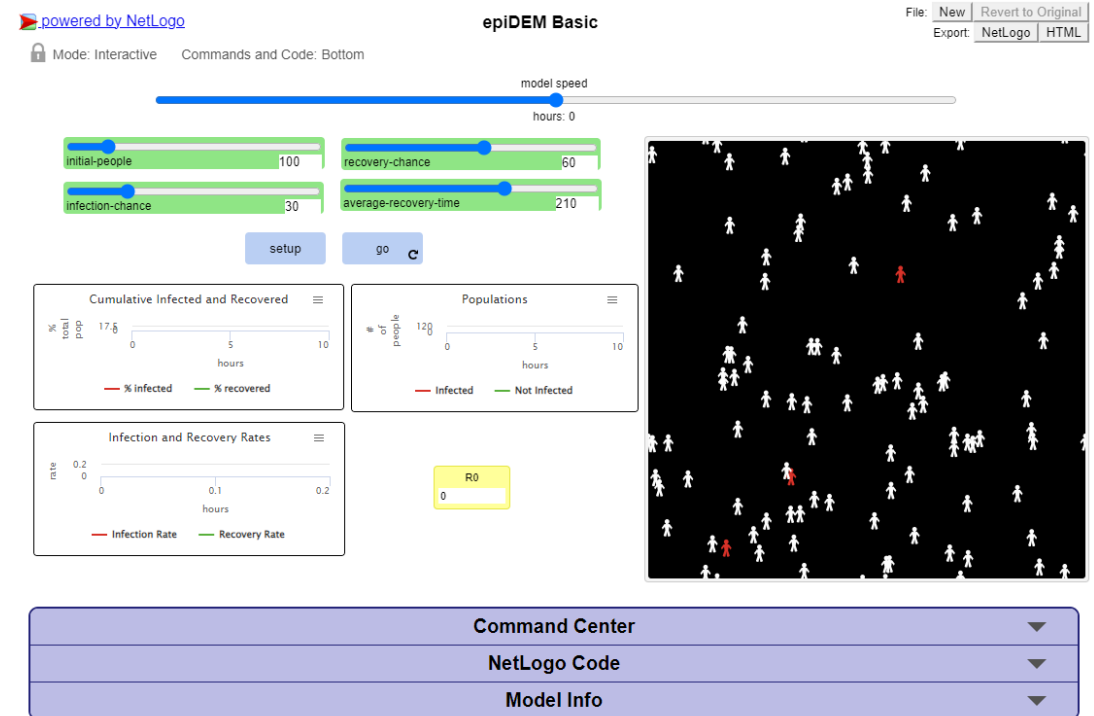
populations

Command Center
NetLogo Code
Model Info

Model Example: Socio-ecological Systems

Socio-ecological Systems

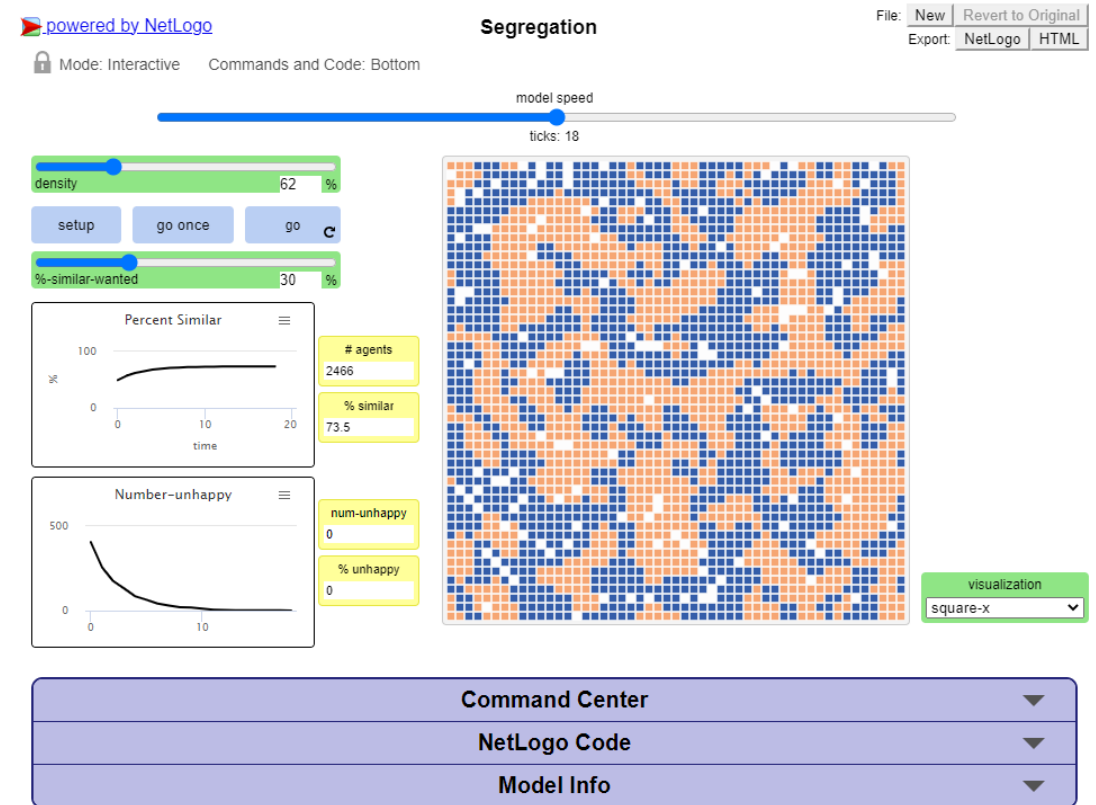
Social-ecological Systems
Energy Systems
Food Systems
Health Systems
Sustainability



Model Example: Social Systems

Social Systems

Social Systems
Political Systems
Economic Systems
Educational Systems
Cultural Systems
Systems of Oppression





Conclusion

-
- NetLogo modeling in environmental education is an effective and accessible way to engage learners in critical thinking and problem-solving related to complex systems.
 - Use of the NetLogo model library provides a easy starter tool to explore the interactions between different components of a system and how changes in one part can affect the whole. This helps to promote a systems thinking approach to problem-solving and decision-making, which is crucial in addressing complex environmental issues.
 - NetLogo's user-friendly interface and ability to visually represent data make it an ideal tool for introducing students to programming concepts and data analysis. By incorporating NetLogo modeling into environmental education, we can help grow the next generation of systems thinkers and environmental problem-solvers.

Wilensky, U. (1999). NetLogo. <http://ccl.northwestern.edu/netlogo/>. Center for Connected Learning and Computer-Based Modeling, Northwestern University, Evanston, IL.

Murphy KJ, Ciuti S, Kane A. An introduction to agent-based models as an accessible surrogate to field-based research and teaching. *Ecol Evol.* 2020 Oct 2;10(22):12482-12498. doi: 10.1002/ece3.6848. PMID: 33250988; PMCID: PMC7679541.