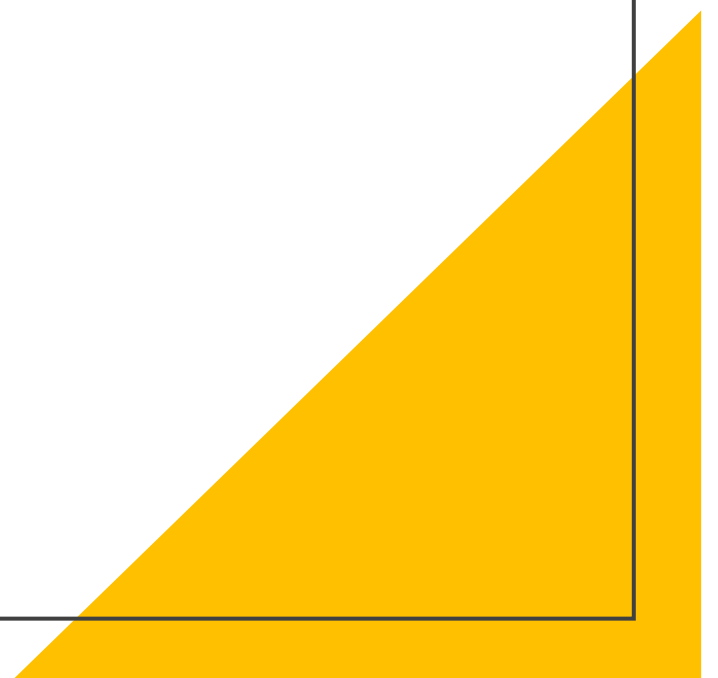# Growing Systems Thinkers: Enhancing Environmental Education with NetLogo Modeling

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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

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

normal speed

ticks: 19

setup   go

Trees   4

# of Deer
0

# of Squirrels
0
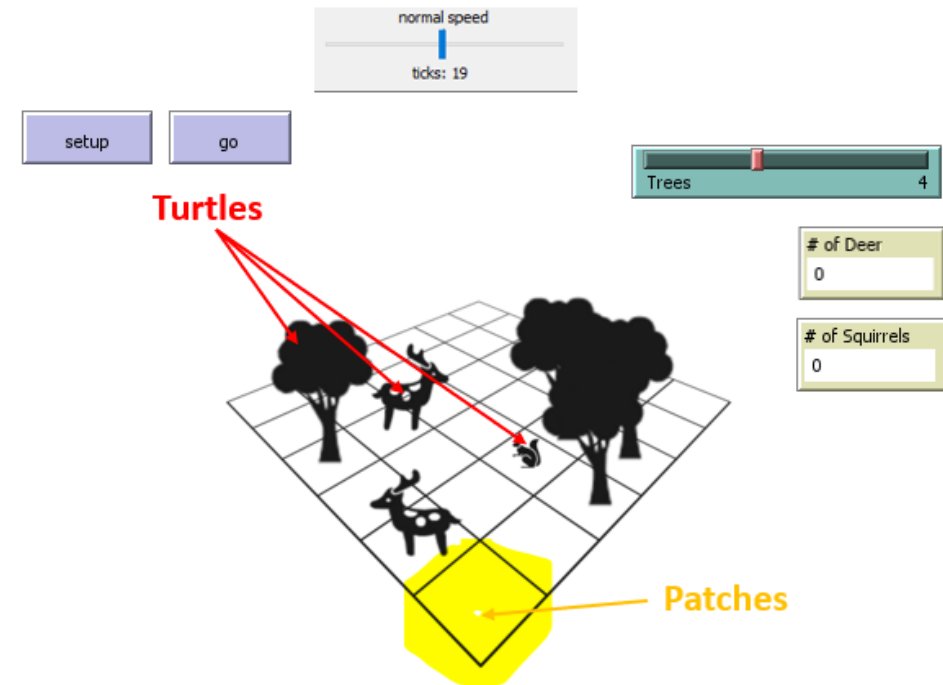
Turtles

Patches

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

Model Example: Biological/Ecological Systems

Biological/ Ecological Systems

Ecosystems
Freshwater Ecosystems
Marine Ecosystems
Organ Systems
Mating Systems

Model Example: Socio-ecological Systems
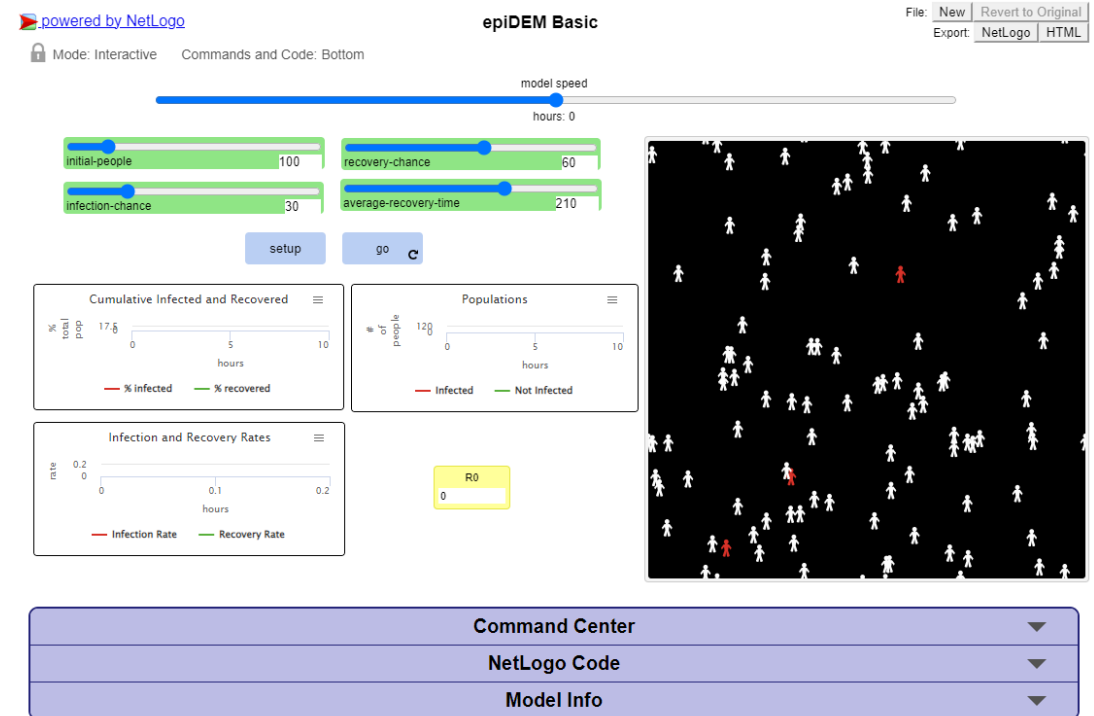
Model Example: Social Systems
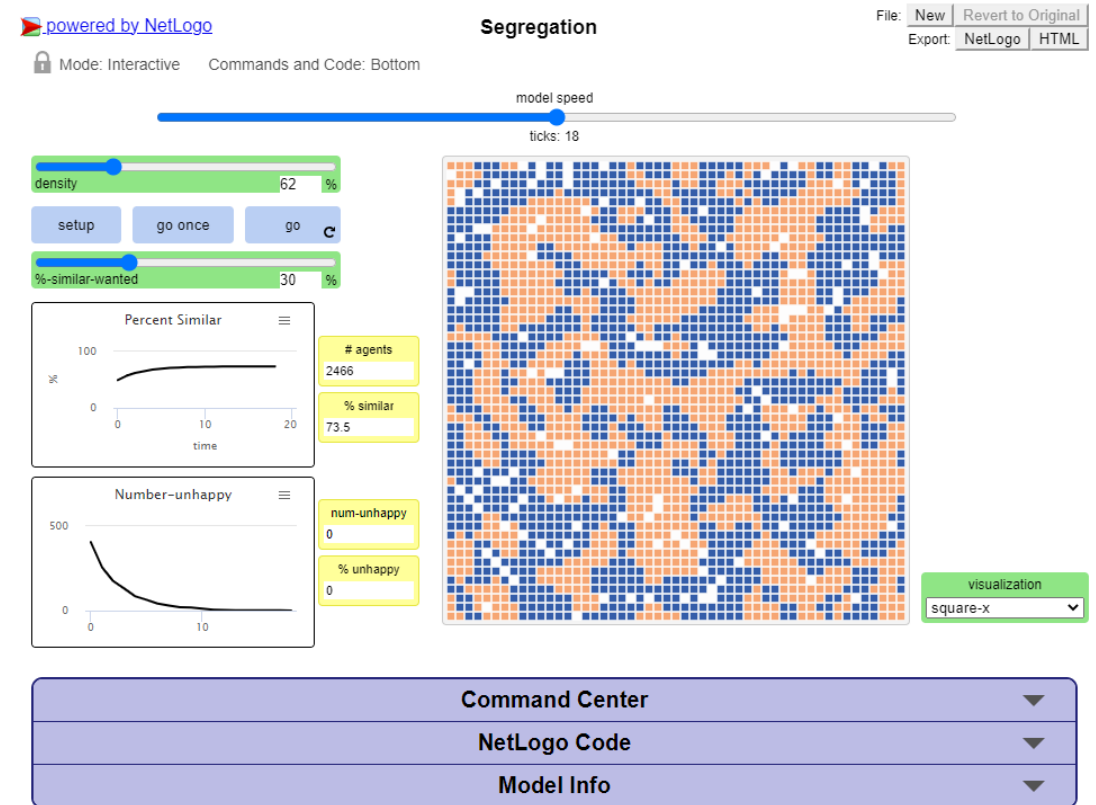
Conclusion

- 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.