Growing Systems Thinkers: Enhancing Environmental Education with NetLogo Modeling

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• **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 is a multi-agent programmable modeling environment. It is used by many hundreds of thousands of students, teachers, and researchers worldwide. It also powers MultiNet 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.

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 interactively with models with NetLogo code, and finally reprogramming 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 model?” and “The First 10 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:
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
Model Example: Biological/Ecological Systems

Biological/Ecological Systems

- Ecosystems
- Freshwater Ecosystems
- Marine Ecosystems
- Organ Systems
- Mating Systems
Model Example: **Socio-ecological Systems**

**Socio-ecological Systems**
- Social-ecological Systems
- Energy Systems
- Food Systems
- Health Systems
- Sustainability
Model Example: 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 an 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.
