Modeling Ecosystems with Network Exchange Objects (NEO)





Presented by Clemente Izurieta

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A collaboration among members of:

the Computational Ecology Research Group

and

the Fluvial Landscape Lab

at Montana State University, Bozeman

Fundamental Question:

"How does the structure of a system influence its function?"

- Transportation systems
 - Resources = humans; vehicles
- Economies
 - Resources = capital; commodities, services
- Social systems
 - Resources = ideas, wealth
- Ecosystems
 - Resources = water, energy, nutrients

Modeling Ecosystems with Network Exchange Objects (NEO)

Outline:

- Using NEO to represent network-based systems
- Example of a NEO ecosystem model: describing a floodplain as a flow network
- Adding complexity: introducing carbon, nitrogen, and oxygen to the flow network
- Use of parallel processing at the RMSC to satisfy computational demands



Resource: a currency that moves through the system and may be altered by the system







A NEO example: Simulating a floodplain ecosystem





Water:

a strong influence on resource movement in rivers

Surface cells:

determined by high points from elevations







Subsurface cells:

created by extending surface cells beneath the floodplain







Flow simulation:

sample model output visualized in a vector field.



Other resources? The flow network carries elements like carbon, nitrogen, and oxygen among surface and subsurface cells, influencing the ecosystem within those cells



Applications...

- How does reconfiguring a channel (e.g., stream restoration) influence water quality?
- How does channel form affect water temperature and associated fish habitat?
- How might river engineering (levees, dredging, etc.) affect patterns of flooding downstream?

RMSC: Plans for use of parallel processing



Questions?





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