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Studying hydrology

Scientific Computing Meetup

Background:

Research takes place in Castle Rock and Mt St Helens

* Research sites

Sedimentation generation by and transport from forest roads to nearby streams

* Sedimentation = dirt

Heavy trucks, heavy rain = sedimentation.

* Detrimental effects on nearby rivers

Salmon like to spawn in gravel bedded rivers.

Tackling the problem:

* Thru modeling
* Model the sediment generation.
* Effects of different sediment treatment

Landlab:

Python-based earth surface process modelling toolkit

3 main parts: grid, components and utilities.

landland.github.io

Road erosion in Landlab: Truck pass erosion model

Generate a map-view of road segment

Crown at the center of the world.

Ideal world = trucks passes on truck path (wheel rut)

Crown = highest height of the road.

In Landlab:

Start with a grid. = 3 dimensional road surface, gradient = height.

Process:

Grid = whole bunch of cells = cell -> sedimentation to either the back, or sides cell

The road recovers a little bit. Back to an equilibrium state.

Not included compaction.

No lower limit.

Road erosion in drones:

To get data to validate.

You can use drones with change detection.

Pictures and changes = structure for motion.

Digital elevation models.

Survey on both disturbed and undisturbed roads.

Get digital elevation of each, and subtract from one another

Going forward:

Rainfall detachment component

Sediment transport component

Effects of different treatments

Carry out full-scale survey

#CatsWhoCode

Q&A:

*Drone accuracy?*

*Create a baseline survey*

*If the entire road sunk an inch?*

*Ground control points from GPS.*

*Survey of drones?*

*60 pictures*

*two different heights plus around.*

*Analysis is dependent on lighting?*

*Yes.*

*Trucks? Torque? Weight?*

*Most of loaded log trucks, would have the same.*

*And unloaded log trucks.*

*Trying to capture imagery?*

*Motion sensor and traffic counter.*

*Sediment?*

*Yes, collection of sediment data.*

*Particle size? Density?*

*Depends. They’ll be similar in grain size. Smaller than glacial?*

*Relation to Salmon?*

*Salmon mom will kick the gravel to create a salmon nest.*

*Sediments might get embedded in the nest.*

*Might decrease oxygen supply and baby salmon harder to come out after hatching.*

*Chemical testing on sediments?*

*Nope. Only sediment volume.*

*Ensemble?*

*Sediment only from erosion? How about from the side of the hill?*

*Not that much from the hill because of the vegetation.*

*Had crude analysis on water volume. Not much because of filtration.*

*Is there sediment being produce aside from traffic?  
yes, rainfall, etc.*

*Conclusion? Recommendation? After the study.*

*Check quality of road. Harder road surface.*

*Grassing the ditch line to hold sediments.*

*Sediments trap on the ditch line.*

*Question of what’s the most cost effective.*

*Road gets covered with stuff during summer, white stuff.*

*Main line logging road gets maintained a lot.*

*How does the model will help in the real world, in regards to the sediment?*

*Validate and calibrate. Instead of extensive field research, make a small field research.*

*How large is the model? One segment?*

*Right now, just a road segment, 250ft.*

*Hope to capture in simulations.*