**Q1: What system would you like to build a model of?**

This model simulates a hillslope or mountainous terrain that undergoes rainfall-induced landslides. It captures how rainfall saturates soil, destabilizes terrain, and causes sediment movement and tree loss through landslides

**Q2:What are the principal components or actors involved in this system?**

Patches (terrain units): Represent parts of the landscape with properties like elevation, soil saturation, sediment load, and whether they have failed due to a landslide

Turtles (trees): Represent vegetation rooted in terrain patches. Trees may die if landslides occur nearby

Global variables: Track total rainfall, number of landslides, sediment movement, and tree count

**Q3: What actions (or behaviors) can the agents/actors take?**

Patches:

* Absorb rainfall (increase saturation)
* Check slope and saturation to determine failure (landslide)
* Transfer sediment to lower neighboring patches

Turtles (trees):

* Remain stationary unless a landslide occurs nearby, in which case they may be removed (die)

**Q4: How will you model the system (ABM?**

The system is modeled as an Agent-Based Model (ABM) where:

* Patches act as agents with local environmental states
* Turtles (trees) act as individual agents affected by patch conditions
* The environment evolves based on local interactions (e.g., slope comparison, neighbor selection) and external forcing (rainfall input)

**Q5: In what kind of environment do these agents operate? Describe the basic environment type (e.g., spatial, network, featurespace, etc.) and fully describe the environment.**

* Environment Type: Spatial grid (2D patch-based environment)
* Each patch has an elevation forming a pseudo-slope (elevation decreases along the x-axis)
* Trees are placed only on higher elevation patches
* Patches interact with their 8 surrounding neighbors for sediment flow and landslide checks
* The environment simulates natural terrain dynamics under rainfall

**Q6: If you had to “discretize” the phenomenon into time steps, what events and in what order would occur during any one time step? Fully describe everything that happens during a time step.**

Each tick the following happens;

* Rain: All patches receive rainfall, increasing saturation
* Saturate: Caps saturation to 100% to avoid overflow
* Flow sediment: Sediment from failed patches flows to lower neighbors
* Check for landslides: A vulnerable patch is selected and triggered if stability (slope - saturation/2) falls below threshold
* Trigger landslide (if applicable): Changes patch color, removes trees, increases sediment, and lowers elevation
* Update monitors and plots: Recalculate totals and plot rainfall, landslides, and sediment
* Stop condition: Simulation stops when all patches have failed (pcolor = brown)

**Q7:What are the inputs to the model? Identify all relevant inputs.**

* rainfall-rate: mm of rainfall per tick
* landslide-threshold: critical stability value; lower = more frequent landslides
* sediment-flow-rate: how easily sediment moves downhill
* number-of-trees: how many trees (turtles) are initially placed

**Q8: What do you hope to observe and assess from this model? Identify all relevant outputs.**

Test different environmental resilience scenarios by adjusting the landslide-threshold

* Evaluate how sensitive the system is to small changes in stability thresholds
* We can observe it through the following:
  + Time and frequency of landslide events
  + Tree survival rate over time
  + Terrain condition (visually and via failure count)

Feel free to add here…