ESCI 4XXX: Landscape Evolution Modeling Final Project

Goals and Student Learning Objectives

The goal of this project is to understand the role of geomorphic processes in landscape evolution. You will do this by "playing" with the model that we built together in class, i.e., testing different scenarios, changing the processes, challenging previous assumptions made in the vanilla model. This project simulates how geomorphologists use numerical models to conduct scientific research. After completing this project, students should learn how to...

- Apply a landscape evolution model to run multiple simulations to explore and test a hypothesis

- Categorize model results into simulations that support and refute your hypothesis

- Interpret your findings and evaluate whether your hypothesis is true or false in natural landscapes

Assignment Overview

Project Plan: 20 points ($1/15$ of final grade; due 3/23
The project plan will be a 1-page document that details your group members, the project idea, and a brief explanation your group's objectives to tackle you final project. Based on the project idea that you choose, you will also develop a hypothesis to test with a landscape evolution model. For example, a project idea that focuses on the effects of climate and rainfall may have a hypothesis, such as *If rainfall rates are spatiotemporally variable due to climate cycles, then landscapes will not achieve an equilibrium state*. See rubric below (**RUBRIC 1**).

Project Presentation: 50 points ($1/6$ of final grade); due 4/25
In class, we will build a working landscape evolution model together. In the project, your group is tasked with using this model to test under which conditions your hypothesis is valid or invalid. The goal is not to have a correct hypothesis, instead, the purpose of this project is to learn how to thoroughly test a hypothesis. A negative finding is still an interesting result! During the last week of class, you will give a 15-minute oral presentation to the class on your findings. Presentations will be graded by the rubric below (**RUBRIC 2**).

Project Report: 50 points ($1/6$ of final grade); due 5/9
A written report of your results needs to be submitted by our assigned finals period (no exam). In this report, you will detail your hypothesis, methodology, results, and discussion. There is no page length requirement; you just need to make sure there is enough explanation for the reader to understand your model simulations (suggested length in rubric). This report will be graded by the rubric below (**RUBRIC 3**) You will notice this rubric is similar to the project presentation rubric; this report will give you a chance to incorporate any feedback that to received during your presentation.

Project Ideas

After forming a group, you will need to choose a project idea. Multiple groups can pursue the same project idea, as each group will likely take a different approach. Your group can also investigate project ideas that are not listed here, with my permission. Please choose from one of the following project ideas:

- What is the role of initial conditions on drainage network organization?

- What are the roles of boundary conditions on landscape evolution?

- How does unsteady and nonuniform tectonics affect landscape evolution?

- What is the effect of spatiotemporal variation in lithology on drainage network organization?

- Is landscape evolution sensitive to climate cycles?

- What is the role of lateral channel migration in landscape evolution?

- How does landsliding change landscape evolution equilibrium?

- Does the inclusion of sediment transport mechanics affect landscape evolution drastically?

- How does the choice in flow routing algorithms affect landscape evolution?

Project Logistics

- Divide yourself into groups of 2 to 3.

- As a group, you will all need to agree on a project idea.

- Each group member will be responsible for running at least one of the model scenarios.

- The number of model simulations that are needed will vary from project to project, but you should aim for at least 3 to 5 model runs to test the hypothesis.

- Each group is responsible to submitting one project plan and one presentation, and all members in the group will receive the same grade.

- After forming groups, you will need to schedule two meetings with me (20 minute meeting) during Week 9 and 12 to discuss your groups project plan and progress, respectively.

Project Schedule

Date	Event
Week 7: 2/28	Project ideas disseminated; Form groups of 2 to 3
Week 9: 3/13 - 3/17	Group meetings with Instructor to discuss project ideas (20 minutes outside class hours)
Week 10: 3/23	Project plan due
Week 12: 4/3 - 4/7	Group meetings with Instructor to discuss project progress (20 minutes outside class hours)
Week 15: 4/25 & 4/27	Project presentations

Group Meetings with Instructor

I am flexible, if the time slots do not work below for your group members schedules, please suggest some other times that works for your group, and I will make it work in my schedule.

Week 9: Project Ideas Meeting: Please choose a 20 minute slot that work for your group.

Times	Monday (3/13)	Tuesday (3/14)	Wednesday (3/15)	Thursday (3/16)	Friday (3/17)
15:00-15:20					
15:20-15:40					
15:40-16:00					
16:00-16:20					
16:20-16:40					
16:40-17:00					

Week 12: Project Progress Meeting: Please choose a 20 minute slot that work for your group.

Times	Monday (4/4)	Tuesday (4/4)	Wednesday (4/5)	Thursday (4/6)	Friday (4/7)
15:00-15:20					
15:20-15:40					
15:40-16:00					
16:00-16:20					
16:20-16:40					
16:40-17:00					

RUBRIC 1: Project Plan

Task	Missing	Needs Work	Acceptable	Excellent	Score
Group Information	**0 points** -No info listed			**4 points** -Group members listed -Project idea listed	**/4**
Hypothesis	**0 points** -No Hypothesis	**1 - 4 points** -Hypothesis is unclear	**5 - 6 points** -Hypothesis is clear -Focus is narrow	**7 - 8 points** -Hypothesis is clear -Fully explores the project idea	**/8**
Methodology	**0 points** -No Methodology	**1 - 4 points** -Methods unclear -Parameters unlisted -Model setup not described	**5 - 6 points** -Methods are clear -Model setup described -Only 1-2 scenarios planned	**7 - 8 points** -Methods are clearr -Model setup described well -More than 2 scenarios planned and described	**/8**
				Total	**/20**

RUBRIC 2: Project Presentation

Task	Missing	Needs Work	Acceptable	Excellent	Score
Introduction	**0 points** -No Introduction	**1 point** -Project idea or hypothesis is not defined in introduction	**2 - 3 points** -Project idea and hypothesis are both stated in introduction	**4 - 5 points** -Project idea and hypothesis are both stated in introduction -Explains how the hypothesis is important to landscape evolution research	/5
Methodology	**0 points** -No Methodology	**1 - 5 points** -Methodology does not define parameters or explain model setup	**6 - 8 points** -Parameters defined -Model setup explained	**9 - 10 points** -Parameters defined -Model setup explained -States how methodology will test hypothesis	/10
Results	**0 points** -No Results	**1 - 5 points** -Results shown but not explained	**6 - 8 points** -Results clearly explained -Result of each simulation based on methodology shown	**9 - 10 points** -Results clear -Result of each simulation based on methodology shown -Results summarized in a succinct manner so the reader can understand the differences intuitively	/10
Discussion	**0 points** -No Discussion	**1 - 5 points** -Results are related to one another but no explanation for their differences is given	**6 - 8 points** -Results discussed and an attempt is made to explain the differences between scenarios -An attempt is made to validate/invalidate the hypothesis	**9 - 10 points** -Results are fully discussed -Additional analysis clearly explains the results -Discussion of results is tied back to the original hypothesis -Discussion of how model results relate to the real landscape	/10
Graphics	**0 points** -No Graphics	**1 point** -Plots of results are shown but cannot be understood	**2 - 3 points** -Clear plots and figures of results -Audience can understand figures with little explanation	**4 - 5 points** -Clear plots and figures of results -Additional figures are used to effectively to show methodology, illustrate differences in results, and explain model sensitivity	/5
Organization	**0 points** -No Organization	**1 point** -Unclear of what hypothesis is before introducing methodology -Unclear of what methodology is before showing results -Unclear of what is discussion and what are results	**2 - 3 points** -Presentation is organized logically -Connections from one section to another could be clearer	**4 - 5 points** -Presentation uses a logical order and pacing that is easily understood by audience -Connections between each section is clear	/5
Teamwork	**0 points** -No Teamwork		**2.5 points** -Each group member speaks	**5 points** -Presentation is equally divided by group members (approximately, does not have to be exact)	/5
				Total	/50

RUBRIC 3: Project Report

Task	Missing	Needs Work	Acceptable	Excellent	Score
Introduction (about 500 words)	**0 points** -No Introduction	**1 point** -Project idea or hypothesis is not defined in introduction	**2 - 3 points** -Project idea and hypothesis are both stated in introduction	**4 - 5 points** -Project idea and hypothesis are both stated in introduction -Explains how the hypothesis is important to landscape evolution research	**/5**
Methodology (about 750 words)	**0 points** -No Methodology	**1 - 5 points** -Methodology does not define parameters or explain model setup	**6 - 8 points** -Parameters defined -Model setup explained	**9 - 10 points** -Parameters defined -Model setup explained -States how methodology will test hypothesis	**/10**
Results (about 750 words)	**0 points** -No Results	**1 - 5 points** -Results shown but not explained	**6 - 8 points** -Results clearly explained -Result of each simulation based on methodology shown	**9 - 10 points** -Results clear -Result of each simulation based on methodology shown -Results summarized in a succinct manner so the reader can understand the differences intuitively	**/10**
Discussion (about 750 words)	**0 points** -No Discussion	**1 - 5 points** -Results are related to one another but no explanation for their differences is given	**6 - 8 points** -Results discussed and an attempt is made to explain the differences between scenarios -An attempt is made to validate/invalidate the hypothesis	**9 - 10 points** -Results are fully discussed -Additional analysis clearly explains the results -Discussion of results is tied back to the original hypothesis -Discussion of how model results relate to the real landscape	**/10**
Graphics	**0 points** -No Graphics	**1 point** -Plots of results are shown but cannot be understood	**2 - 3 points** -Clear plots and figures of results -Figures captions are included	**4 - 5 points** -Clear plots and figures of results -Figures captions are included -Additional figures are used to effectively to show methodology, illustrate differences in results, and explain model sensitivity	**/5**
Organization	**0 points** -No Organization	**1 point** -Unorganized and not presented in a logical order (i.e., Introduction, Methodology, Results, Discussion) -Unclear distinction between results and discussion	**2 - 3 points** -Report is organized logically -Connections from one section to another could be clearer	**4 - 5 points** -Report uses a logical order and that is easily understood -Connections between each section is clear	**/5**
Teamwork	**0 points** -No Teamwork statement			**5 points** -Teamwork statement that details how the work on the project was divided between team members.	**/5**
				Total	**/50**