SYLLABUS

Special Topics in Ecology & Evolution (11:216:600:02)
- Subtitle: "*Monitoring and Modeling Processes in Terrestrial Ecosystems*"

Spring 2025

Instructor: Prof. Chi Chen
Office: ENR Room 127
Office Hours: Mon, Thur, 9:50 – 10:50 am, or by appointment
E-mail: chi.chen@rutgers.edu

- **Please include "MAPTerra: 11:216:600" in the subject line of all emails with the instructor.** I'll try to answer all appropriate emails within 24 hours.

Lectures:
- Monday, Thursday, 8:30 – 9:50 am
- Room 123, Environmental & Natural Resource Sciences Building (ENR)

Computer Lab Access:
- Room 237, ENR Building
- Anytime when Room 237 is not occupied by other classes

Course description:
Welcome to the MapTerra (Monitoring And Modeling Processes in Terrestrial Ecosystems) course. The primary aim of this class is to systematically present modern theories and techniques for monitoring and modeling processes within terrestrial ecosystems. These processes play a crucial role in governing the mass and energy exchanges among soils, vegetation, and the atmosphere, thereby exerting significant control over global ecological processes and Earth's climate.

Throughout the course, we will delve into key topics such as the interactions between vegetation processes and the physical climate, the carbon cycle, land surface energy balance, and other global environmental changes. Our exploration will span a wide range of spatial and temporal scales. Additional emphasis will be placed on understanding the capabilities, limitations, and future prospects of satellite remote sensing in monitoring and modeling these ecosystem processes.

Students will learn through a combination of lecturing, literature reviews, discussions, and quantitative analysis and modeling with observational data. Additionally, students will have the opportunity to learn scientific programming skills. The course will also cover instructions on utilizing High-Performance Computing (Amarel).

References:
Francis Stuart Chapin et al. "Principles of terrestrial ecosystem ecology." (2011). Springer. https://link.springer.com/book/10.1007/978-1-4419-9504-9

Bonan, G. "Ecological climatology: concepts and applications." (2015). 3rd edition. Cambridge University Press

Tentative Course Schedule

WEEK	DATE	LECTURE #	TOPIC
Week 1	1/20/25	Martin Luther King, Jr. Day	No Class - Holiday
	1/23/25	Lecture 1	Introduction & Carbon Pools
Week 2	1/27/25	Lecture 2	Global carbon cycle
	1/30/25	Lecture 3	Atmospheric CO_2 & simple radiation basics
Week 3	2/3/25	Lecture 4	Terrestrial Carbon Cycle
	2/6/25	Lecture 5	Remote sensing of terrestrial Vegetation - 01
Week 4	2/10/25	Lecture 6	Discussion: tropical green/browning
	2/13/25		No Class - SMAP ST Meeting
Week 5	2/17/25	Lecture 7	Remote sensing of terrestrial Vegetation - 02
	2/20/25	Lecture 8	Satellite GPP/NPP algorithm
Week 6	2/24/25	Lecture 9	Satellite GPP/NPP algorithm (continued)
	2/27/25	Lecture 10	MODIS labs / download, QA, plot maps
Week 7	2/3/25	Lecture 11	Earth greening
	2/6/25	Lecture 12	Photosynthesis-inside a leaf
Week 8	3/10/25	Lecture 13	Discussion: NPP increase/decrease
	3/13/25	Lecture 14	Photosynthesis-leaf level
Week 9	3/17/25	Spring Recession	No Class - Spring Recession
	3/20/25	Spring Recession	No Class - Spring Recession
Week 10	3/24/25	Lecture 15	Amarel tutorial
	3/27/25	Lecture 16	Eddy covariance - NEE and respiration
Week 11	3/31/25	Lecture 17	Optimization models - Katul model
	4/3/25		No Class - GEDI ST Meeting
Week 12	4/7/25	Lecture 18	Optimization models - Prentice model &Coordination theory
	4/10/25	Lecture 19	Radiation principle & canopy radiation & multi-layer GPP-01
Week 13	4/14/25	Lecture 20	Radiation principle & canopy radiation & multi-layer GPP-02
	4/17/25	Lecture 21	Energy Balance Principles - 01

Week 14	4/21/25	Lecture 22	Energy Balance Principles - 02 and Leaf energy balance
	4/24/25	Lecture 23	Discussion: whether greening induced cooling or warming
Week 15	4/28/25	Lecture 24	Penman-Monteith & Thermal Dynamics Principles & Solving LST
	5/1/25	Lecture 25	LST attribution
Week 16	5/5/25	Lecture 26	Final presentation

Grading

Grading	
Attendance	5%
Assignments / Labs	45%
Participation & Discussion	20%
Final Project & Presentation	20+10=30%

Assignments: The assignments will be a combination of problem sets and programming. For assignments with programming, example scripts will be provided. Students are highly encouraged to write their own scripts to implement the algorithms.

Final Project: Students will use the concepts learned in this course to download and analyze data. Throughout the semester, there will be multiple meetings with the instructor to guide the development of students' projects, including a project proposal, a mid-term assessment of their progress, a final write-up, and a final presentation.

Late Policy:

- Assignments will be due at **6 pm** on the due date. Late assignments will be accepted but will receive a **50% penalty**.
- In special cases where the due date has been changed (i.e., to accommodate holidays or other special circumstances), the change will be announced in class or by email and it is the responsibility of the student to be aware of these changes.

Attendance:

Attendance is required in this course. It is the students' responsibility to attend the class, exams, and quizzes. If you have the extenuating circumstances, please email me in advance:

- **Absence due to religious holidays.** Notify the instructor PRIOR to the holiday. That week's Labs & Assignments is still due at the normal time, and it is the student's responsibility to arrange to have the Lab & Assignment turned in on time.

- **Absence due to sickness.** A medical note must accompany your assignment to avoid a late penalty. Lab & Assignment can be delayed.
- **Absence due to other extenuating circumstances.** (e.g., jury duty, family emergency) will only be accepted with written documentation AND a note from the Dean's office. Every effort must be made by the student to inform the instructor before the absence. Lab & Assignment can be delayed.

Academic conduct: All polices in the University Code of Conduct & Academic Integrity will be followed. Please find the detailed information using the University Code of Conduct & Academic Integrity: https://studentaffairs.newark.rutgers.edu/support-services/community-standards/code-conduct-academic-integrity#:~:text=Treat%20all%20other%20students%20ethically,nor%20obstruct%20their%20academic%20progress.

Diversity, Equity, and Inclusion

Following the University Equity and Inclusion guidelines (https://diversity.rutgers.edu/), our course is committed to fostering a learning environment that values and respects the diversity of backgrounds, experiences, and perspectives of all students. I believe that an inclusive educational experience enriches the learning process and prepares students to engage effectively in a global society.

In this course, I strive to create a safe and inclusive space where all voices are heard and valued. Discrimination, harassment, and any form of exclusionary behavior will not be tolerated. I encourage open dialogue, mutual respect, and the exploration of diverse viewpoints. I am dedicated to ensuring that all students, regardless of their background, feel empowered to participate, ask questions, and share their insights.

I welcome feedback from students on how we can continuously improve our efforts to make this course more inclusive and equitable. If you have any concerns or suggestions related to diversity, equity, and inclusion, please feel free to reach out to the instructor. Together, I hope to create a positive and enriching learning journey for everyone.