

Ecosystem Ecology 生態系生態學

2022 Fall

Lecturer 教師： Chung-Te Chang 張仲德

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Office Hours (討論時間及地點)：

Tuesday 14:00 -15:00 at LS135 (Tunghai University)

Friday 10:00 – 11:00 at LS135 (Tunghai University)

Course objectives (教學目的)：

Ecosystem ecology examines the integrations between organisms and their environment as an integrated system. The primary focus of this course is to understand the movement and transformation of energy and materials into, within, and out of the system. The key processes that shape the structure and function of an ecosystem, including hydrologic and nutrient cycling, ecosystem productivity, disturbances, and invasive species, will be covered in this course. Discussion of how human induced global change affects the ecosystem stability and function will also be covered. The advancement of geospatial technology help to explore the associations between environmental and ecological changes and the potential driving forces at broad scale. Students are expected to understand the basic principles and concepts of ecosystem ecology and explain why it is relevant to the society.

Course schedule (主要內容與教學大綱)：

Week 01 [[Sept.5](#)]: Course introduction (Ecosystem Concept) and arrangements (chapter 1)

Week 02 [[Sept.12](#)]: Climate, geology and soils (chapters 2-3, assigned reading & report)

Week 03 [[Sept.19](#)]: Terrestrial water and energy balance (chapter 4, assigned reading & report)

Week 04 [[Sept.26](#)]: Carbon inputs and budgets of ecosystem (chapters 5-6, assigned reading & report)

Week 05 [[Oct.3](#)]: Decomposition and budgets of ecosystem (chapter 7, assigned reading & report)

Week 06 [[Oct.10](#)]: National Holiday

Week 07 [[Oct.17](#)]: Terrestrial plant nutrient use and cycling (chapters 8-9, assigned reading & report)

Week 08 [[Oct.24](#)]: **Mid-term Exam**

Week 09 [[Oct.31](#)]: Terrestrial plant nutrient use and cycling (chapters 8-9, assigned reading & report)

Week 10 [[Nov.7](#)]: Trophic dynamics & Ecosystem Processes (chapters 10-11, assigned reading & report)

Week 11 [[Nov.14](#)]: Temporal dynamics & Disturbance (chapter 12, assigned reading & report)

Week 12 [[Nov.21](#)]: Landscape heterogeneity and ecosystem dynamics (chapter 13, assigned reading & report)

Week 13 [[Nov.28](#)]: Changes, Management and Sustainability of Ecosystems (chapters 14-15, assigned reading & report)

Week 14 [[Dec 5](#)]: Large-scale Ecology (& global climate change, assigned reading & report)

Week 15 [[Dec 12](#)]: **Term Oral Reports (student presentation)**

Week 16 [[Dec 19](#)]: **Term Oral Reports (student presentation)**

Major Textbooks:

Chapin, F.S., H.A. Mooney, and M.C. Chapin (2011) *Principles of Terrestrial Ecosystem Ecology*, Springer, New York, NY.

***All students are required to read the designated chapter and assigned reading materials for each week prior to attending the class.**

Presentation of assigned reading (see the reading materials)

Two students will lead a 20-minute presentation and discussion of assigned literatures that is pertinent to that week's lecture topic during weeks 2 and 14.

Final term report

Each student will give an oral presentation near the end of the semester.

General research, review, or synthesis are all acceptable forms.

The presentation will be limited within 25 minutes (including 5 minutes for discussion), and each student should write his/her paper (report) following the format of journal *Ecosystems*.

Finally, each student should hand the final term report (paperwork) to me by the end of week 16, at the following email (chungtechang@thu.edu.tw).

Grading policy (成績考核)

Class participation (20%)

Presentation of assigned reading (20%)

Midterm (25%)

Final oral report (35%)

*penalty of 5% loss of paper grade will be applied for each day past due

Bonus: will depend on students who raise questions and discuss in the class.

Reading materials (two students arranged/assigned at least)

Week 02 (chapters 2-3)

1. Puma MJ, Cook BI (2010) Effects of irrigation on global climate during the 20th century. *Journal of Geophysical Research* 115: D16120.
2. Chadwick OA, Derry LA, Vitousek PM, Huebert BJ, Hedin LO (1999) Changing sources of nutrients during four million years of ecosystem development. *Nature* 397: 491-497.

Week 03 (chapter 4)

1. Ryan M, Yoder BJ (1997) Hydraulic Limits to Tree Height and Tree Growth. *BioScience* 47: 235-242.
2. Knapp AK, Smith MD (2001) Variation Among Biomes in Temporal Dynamics of Aboveground Primary Production. *Science* 291: 481-484.
3. Vega-Medina JA, Wright SJ, Bongers F, Schnitzer SA, Sterck FJ (2022) Vegetation phenologies of lianas and trees in two neotropical forests with contrasting rainfall regimes. *New Phytologist* 235: 457-471.

Week 04 (chapters 5-6)

1. Running SW, Nemani RR, Heinsch FA, Zhao M, Reeves M, Hashimoto H (2004) A Continuous Satellite-Derived Measure of Global Terrestrial Primary Production. *BioScience* 54: 547-560.
2. Granier A, et al. (2007) Evidence for soil water control on carbon and water dynamics in European forests during the extremely dry year: 2003. *Agricultural and Forest Meteorology* 143; 123-145.

Week 05 (chapter 7)

1. Schuur EAG, et al. (2008) Vulnerability of permafrost carbon to climate change: Implications for the global carbon cycle. *BioScience* 58: 701-714.
2. Janssens IA, et al. (2010) Reduction of forest soil respiration in response to nitrogen deposition. *Nature Geoscience* 3: 315-322.
3. Sun H, Xu Z, Jia B (2022) A compiled soil respiration dataset at different time scales for forested ecosystems across China from 2000 and 2018. *Earth System Science Data* 14: 2951-2961.

Week 06: National Holiday

Week 07 (chapters 8-9)

1. Vitousek P (1982) Nutrient Cycling and Nutrient Use Efficiency. *The American Naturalist* 119: 553-572.
2. Theodose TA, Bowman WD (1997) Nutrient availability, plant abundance, and species diversity in two alpine tundra communities. *Ecology* 78: 1861-1872.
3. Vitousek P, et al. (1997) Human alteration of the global nitrogen cycle: sources and consequences. *Ecological Applications* 7: 737-750.

Week 08: Mid-term Exam

Week 09 (chapters 8-9)

1. Kane ES, et al. (2008) Precipitation control over inorganic nitrogen import–export budgets across watersheds: a synthesis of long-term ecological research. *EcoHydrology* 1; 105-117.
2. Chang CT, Wang LJ, Huang CJ, Liu CP, Wang CP, Lin NH, Wang L, Lin TC (2017) Precipitation controls on nutrient budget in subtropical and tropical forests and the implications under changing climate. *Advances in Water Resources* 103: 44-50.

Week 10 (chapters 10-11)

1. Chapin III FS, et al. (2000) Consequences of changing biodiversity. *Nature* 405: 234-242.
2. Hooper DU, et al. (2005) Effects of biodiversity on ecosystem functioning: a consensus of current knowledge. *Ecological Monographs* 75: 3-35.

Week 11 (chapter 12)

1. Bump JK, Peterson RO, Vucetich JA (2009) Wolves modulate soil nutrient heterogeneity and foliar nitrogen by configuring the distribution of ungulate carcasses. *Ecology* 90: 3159-3167.
2. Turner MG (2010) Disturbance and landscape dynamics in a changing world. *Ecology* 91: 2833-2849.
3. Lin KC, Hamburg SP, Wang L, Duh CT, Huang CM, Chang CT, Lin TC (2017) Impacts of increasing typhoons on the structure and function of a subtropical forest: reflections of a changing climate. *Scientific Reports* 7: 4911.

Week 12 (chapter 13)

1. Fausch KD, Torgersen CE, Baxter CV, Li HW (2002) Landscapes to riverscapes: bridging the gap between research and conservation of stream fishes. *BioScience* 52: 483-498.
2. Thies C, Steffan-Dewenter I, Tschardt T (2003) Effects of landscape context on herbivory and parasitism at different spatial scales. *Oikos* 101: 18-25.
3. Bonnin N, Stewart FA, Wich SA, Pintea L, Jantz SM, Dickson R, Bellis J, Chitayat A, Ingram R, Moore RJ, Piel AK (2020) Modelling landscape connectivity change for chimpanzee conservation in Tanzania. *Biological Conservation* 252: 108816.

Week 13 (chapters 14-15)

1. Foley JA, et al. (2005) Global consequences of land use. *Science* 309: 570-574.
2. Oki T, Kanae S (2006) Global hydrological cycles and world water resources. *Science* 313: 1068-1072.
3. Bonan GB (2008) Forests and climate change: forcings, feedbacks, and the climate benefits of forests. *Science* 320: 1444-1449.

Week 14 (large-scale ecology)

1. Morisette JT, et al. (2009) Tracking the rhythm of the seasons in the face of global change: phenological research in the 21st century. *Frontiers in Ecology and Environment* 7: 253-260.
2. Marvin DC, Pin Koh L, Lynam AJ, Wich S, Davies AB, Krishnamurthy R, Stokes E, Starkey R, Asner GP (2016) Integrating technologies for scalable ecology and conservation. *Global Ecology and Conservation* 7: 262-275.