

Ecology and Conservation 生態與保育	
Credits	Three (lectures: 3 hr per week)
Organizers	Teng-Chiu Lin
Lecturers	Teng-Chiu Lin, Chun-Chia Chou, Yu-Feng Hsu, Chi-Chien Kuo, Chung-Chi Chen, Jyh-Min Chiang, Kuo-Fang Chung, Sheng-Feng Shen, Benny Chan, Chien-Hsiang Lin Colin KC Wen, Shao-Lun Liu, Yiching Lin, I-Min Tso
Time	Monday: 14:20-17:20 (NTNU) / 14:00-17:00 (BRCAS)
Place	C302, 3F, Colleague of Science Building, NTNU Gongguan Campus B208, BRC Building, BRCAS (Interdisciplinary Research Building)
Description	<p>This course aims to provide students with rigorous training related to ecology and conservation. The course will cover the following topics:</p> <ol style="list-style-type: none"> 1. Structure and function of community and ecosystem: <ul style="list-style-type: none"> Interactions between physical setting and biological components Driving forces of ecosystem 2. Habitat requirement of non-human keystone species in ecosystem <ul style="list-style-type: none"> Identification and characterization of habitat required by species through its life history 3. Key processes related to ecosystem structure and function <ul style="list-style-type: none"> Net primary production Biogeochemistry Ecosystem stability, resistance and resilience 4. Conservation of ecosystem <ul style="list-style-type: none"> Global warming threat and human responses and adjustments Characterizing ecosystem or habitat that needs for maintenance, wise use, or restoration practices (case studies) in conserving ecosystems 5. Ecological services and valuation of ecosystem: From structure, function, and services of ecosystem to human well-being <p>Selected readings that represent major advancement in ecology and conservation and related to the above topics will be given to students for in depth discussion. Professor(s) will give brief lectures on the topics and lead the discussion for approximately one quarter of the semester and students will lead the discussion for the rest. Through the discussion each student is expected to develop a review essay as a term paper. Questions and solutions raised in the discussions are expected to make major contributions in ecology and conservation. Novel approaches and inter-disciplinary studies are highly encouraged.</p>
Purpose	<ol style="list-style-type: none"> 1. Lectures and assigned readings are designed to provide fundamental knowledge in ecology and conservation. 2. Students will identify an area of interest and come up with a research proposal that aims to answer an outstanding question in that area.
Evaluation Criteria	<p>林登秋 Teng-Chiu Lin : 100 % Class participation and presentation 郭奇芊 Chi-Chien Kuo : 100% Class participation including paper discussion 李壽先 Shou-Hsien Li: 100% Class participation including class and paper discussion 徐堉峰 Yu-Feng Hsu: 100 % Class participation and presentation 周均珈 Chun-Chia Chou: 50 % Class participation; 50 % Class discussion 沈聖峰 Sheng-Feng Shen : 50 % Class participation; 50 % Class discussion</p>

鍾國芳-Kuo Fang Chung: 50 % Class participation; 50 % Class discussion 陳仲吉 Chung-Chi Chen : 100 % Class report/presentation 陳國勤 Benny K.K. Chan : 100 % Class report/presentation 江智民 Jyh-Min Chiang : 100% Class participation and class discussion. 溫國彰 Colin Wen: 30 % Class participation; 40 % Class report/presentation; 30 % Class discussion 劉少倫 Shao-Lun (Allen) Liu : 100% Class participation and class discussion. 林宜靜 Yi-Ching Lin : 50 % Class participation; 50 % Class discussion 卓逸民 I-Min Tso 50 % Class participation; 50 % Class discussion

Course work reminder: each student studies on assigned papers, field observations, and subsequent discussion according to each lecturer's specific requirement

Short Schedule

	Date/Venue	Content	Lecturer
Week 1	2/23 NTNU	Introduction Overall briefing	Teng-Chiu Lin
Evolution, Genetics, and Conservation			
Week 2	3/2 NTNU	Niche conservation in conservation biology-using insects as an example	Yu-Feng Hsu
Week 3	3/9 NTNU	Ghost of the past: the extinction debt and cryptic genetic extinction debt	Shou-Hsien Li
Week 4	3/16 NTNU	Integrating behavioral, sensory, and conservation ecology	Chun-Chia Chou
Week 5	3/23 NTNU	Biodiversity conservation and infectious diseases	Chi-Chien Kuo
Forest Ecosystems & Marine Ecology			Lecturer
Week 6	3/30 BRC	Spatial and temporal patterns in forest communities	Yiching Lin
Week 7	4/6 BRC	Adjusted holiday: no class	
Week 8	4/13 BRC	Arthropod diversity and conservation from natural forests to urban areas	I-Min Tso
Week 9	4/20 NTNU	Physical and chemical conditions in the open ocean and anthropogenic impacts on marine ecosystem	Chung-Chi Chen
Week 10	4/27 BRC	Community assembly and ecosystem functions → 106, 1F, Auditorium, BRC Building	Jyh-Min Chiang
Week 11	5/4 BRC	Introduction of blue carbon	Shao-Lun (Allen) Liu
Week 12	5/11 Venue to be decided	Field trip course -Global warming and Sustainable development -Insects communities/ environment interactions -Biogeography and Conservation 1&2	Sheng-Feng Shen Kuo-Fang Chung
Week 13	5/18 BRC	Field trip course: Natural and artificial rocky shores – a comparison	Benny K.K. Chan
Week 14	5/25 BRC	Marine paleontology: how do we turn the dead into work? → Classroom :B247, 2F, Green House	Chien-Hsiang Lin
Week 15	6/1	Sustainable Fishery in Coral Reefs: Bridging Ecology	Kuo-Chang Wen

	BRC	and Management	
Week 16	6/8 BRC	Final report due day	

Reading Materials

Weeks taken	Content	Lecturer/ Reading Material
2/23	Introduction Overall briefing	Teng-Chiu Lin
3/2	Niche conservation in conservation biology-using insects as an example	Yu-Feng Hsu <ol style="list-style-type: none"> 1. Ellis, S. et al. (2012) Landscape-scale conservation for butterflies and moths. 95 pp. Butterfly Conservation, UK., 2. Hsu, Y. F., L. H. Wang, C. L. Huang, M. F. Braby, W. J. Lin, R. J. Lin, Y. M. Hsu. (2021). Discovery of specialist Beech-feeding underwing moths from Taiwan (Lepidoptera: Erebidae: Catocalinae) and Its implication to biodiversity conservation of Taiwan beech forests. <i>The Annals of the Entomological Society of America</i>, 114, 338-354.
3/9	Integrating behavioral, sensory, and conservation ecology	Chun-Chia Chou Students are expected to read the assigned articles before class. Their performance will be evaluated based on their engagement in classroom discussions related to the readings and the course topic. Reading material: <ol style="list-style-type: none"> 1. Dominoni, D.M., Halfwerk, W., Baird, E. <i>et al.</i> (2020) Why conservation biology can benefit from sensory ecology. <i>Nat Ecol Evol</i> 4, 502–511. 2. Peterson, E. K., Buchwalter, D. B., Kerby, J. L., LeFauve, M. K., Varian-Ramos, C. W., & Swaddle, J. P. (2017). Integrative behavioral ecotoxicology: bringing together fields to establish new insight to behavioral ecology, toxicology, and conservation. <i>Current Zoology</i>, 63, 185-194.
3/16	Extinction vortex, Extinction debt, Effective population size, Cryptic extinction debt, and N_e/N_C ratio	Shou-Hsien Li <ol style="list-style-type: none"> 1. Hylander, K., & Ehrlén, J. (2013). The mechanisms causing extinction debts. <i>Trends in ecology & evolution</i>, <i>28</i>(6), 341-346. 2. Gargiulo, R., Budde, K. B., & Heuertz, M. (2025). Mind the lag: understanding genetic extinction debt for conservation. <i>Trends in Ecology & Evolution</i>, <i>40</i>(3), 228-237.
3/23	Biodiversity conservation and infectious diseases	Chi-Chien Kuo Reading materials: The assigned papers will be discussed in the class and students will be graded based on their participation in the discussion. <ol style="list-style-type: none"> 1. Halliday, F.W., Rohr, J.R. and Laine, A.L., 2020. Biodiversity loss underlies the dilution effect of biodiversity. <i>Ecology Letters</i>, <i>23</i>: 1611-1622. 2. Eby, P., Peel, A.J., Hoegh, A., Madden, W., Giles, J.R., Hudson, P.J. and Plowright, R.K., 2023. Pathogen spillover driven by rapid changes in bat ecology. <i>Nature</i> <i>613</i>: 340–344.
3/30	Spatial and temporal patterns in forest communities	Yiching Lin Reading material: <ol style="list-style-type: none"> 3. Ben-Said, M. 2021. Spatial point-pattern analysis as a powerful tool in identifying pattern-process relationships in plant ecology: an updated review. <i>Ecological process</i>, <i>10</i>: 56. 4. Lin, Y.-C., L.-W. Chang, K.-C. Yang, H.-H. Wang, and I.-F. Sun. 2011. Point patterns of tree distribution determined by habitat heterogeneity and dispersal limitation. <i>Oecologia</i> <i>165</i>:175-184. Species-area relationships explained by the joint effects of dispersal limitation and habitat heterogeneity. <i>Ecology</i> <i>90</i> :3033-3041.

4/13	Arthropod diversity and conservation from natural forests to urban areas	<p>I-Min Tso Readings materials:</p> <p>Student should read the following articles before the class. The lecturer will give an overview about these two articles and relevant researches. Then discussions will be conducted on the questions listed in the outline. Students are expected to actively participate in the discussion to realize the impacts of human activities on arthropod diversities in natural as well as urban habitats and to reflect on feasible and realistic ways of conserving biodiversity in these areas.</p> <ol style="list-style-type: none"> Huang, P. S., Lin, H. C., Lin, C. P. & Tso, I. M. 2014. The effect of thinning on ground spider diversity and micro-environmental factors of a subtropical spruce plantation forest in East Asia. <i>European Journal of Forest Research</i>, 133:919-930. Huang, P. S., Tsai, S. M., Lin, H. C. & Tso, I. M. 2015. Do biotope area factor values reflect ecological effectiveness of urban landscapes? A case study on university campuses in central Taiwan. <i>Landscape and Urban Planning</i>. 143: 143-149. <p>Outlines</p> <ol style="list-style-type: none"> What are the characteristics of spider diversities in natural and plantation forests? What environmental factors might be responsible for the observed differences? How does transforming the natural forests into plantation forests impact the spider diversity? What strategies can we adopt to enhance the arthropod diversities in plantation forests? What is the concept of ecological effectiveness? What are the commonly used ways of estimating ecological effectiveness in the cities? Are they accurate? How to establish an accurate way of estimating the ecological effectiveness of urban areas? What are the feasible and realistic ways we can apply to enhance biodiversity in urban areas?
4/20	<p>Physical and chemical conditions in the open ocean and anthropogenic impacts on marine ecosystem</p> <ol style="list-style-type: none"> Overview of marine environment; Effects of climate change on marine ecosystems: example from the East China Sea; Hypoxia in the East China Sea 	<p>Chung-Chi Chen Each student should select article(s) based on their own interests about human impacts on marine ecosystems and deliver a 15-minute presentation during class</p> <p><u>Reading materials:</u></p> <ol style="list-style-type: none"> Speight, M. R. and R. A. Henderson. 2010. <i>Marine Ecology: Concepts and Applications</i>. Wiley-Blackwell. ISBN-10: 1444335456. (Ch. 1, 2, 7, 11, 12). (Textbook in TIGP reservation area at Life Science Library, Academia Sinica) Chen*, C.-C., C.-h. Hsieh, Y.-H. Cheng, W.-J. Huang, W.-C. Chou, F.-K. Shiah, G.-C. Gong, C.-C. Chung, and T.-Y. Chen (2024). Effect of a tropical cyclone on the pelagic ecosystem of a continental shelf. <i>Limnology and Oceanography</i> : . doi: 10.1002/lno.12730 Chen*, C.-C., W.-C. Chou, C.-C. Hung, and G.-W. Gong (2024). Nutrient sources, phytoplankton blooms, and hypoxia along the Chinese coast in the East China Sea: Insight from summer 2014. <i>Marine Pollution Bulletin</i>. 205, Art. no. 116692. doi: 10.1016/j.marpolbul.2024.116692 Chen*, C.-C., G.-C. Gong, W.-C. Chou, C.-C. Chung, C.-H. Hsieh, F.-K. Shiah, and K.-P. Chiang (2017). The influence of episodic flooding on pelagic ecosystem in the East China Sea. <i>Biogeosciences</i> 14: 2597-2609. Chen*, C.-C., G.-C. Gong, and F.-K. Shiah (2007). Hypoxia in the East China Sea: one of the largest coastal low-oxygen areas in the world. <i>Mar. Environ. Res.</i> 64: 399-408.

4/27	Community assembly and ecosystem functions	<p>Jyh-Min Chiang</p> <ol style="list-style-type: none"> 1. Tilman D., Isbell F., Cowles J.M. (2014) Biodiversity and ecosystem functioning. <i>Annu. Rev. Ecol. Evol. Syst.</i> 45:471–93 2. Chiang J.M., Spasojevic M.J., Muller-Landau H.C., Sun I.-F., Lin Y., Su S.-H., Chen Z.-S., Chen C.-T. Swenson N.G., and McEwan R.W. (2016) Functional composition drives ecosystem function through multiple mechanisms in a broadleaved subtropical forest. <p>Castillioni K. and Isbell F. (2023) Early positive spatial selection effects of beta-diversity on ecosystem functioning. <i>Landscape Ecology</i> https://link.springer.com/article/10.1007/s10980-023-01786-9</p>
5/4	Introduction of blue carbon	<p>Shao-Lun Liu</p> <p>Lecture, no readings</p>
5/11	Field trip course Venue to be decided	<p>Sheng-Feng Shen & Kuo-Fang Chung</p> <p>No reading materials</p>
5/18	Field trip course: East coast of Taiwan	<p>Benny Chan</p> <p>I will introduce natural and artificial rocky shores. Then I will bring students to visits a natural and an artificial wave breaker shore in NE coast in the second lecture. Students will carry samplings in these two types of shores and compare their diversity. My objective is to describe when shores become urbanized, their diversity is drastically reduced. I will send student a review paper on these two types of shores before my lecture.</p>
5/25	Marine paleontology: how do we turn the dead into work?	<p>Chien-Hsiang Lin</p> <p>No reading materials</p>
6/1	Sustainable Fishery in Coral Reefs: Bridging Ecology and Management	<p>Colin KC Wen</p> <p>Assignment: From Biology to Policy Goal: Find one ecological research paper from your preferred region and use AI tools to generate an infographic that visualizes its management implications.</p> <ol style="list-style-type: none"> 1. Reading & Search <ul style="list-style-type: none"> • Reference Models: Skim the provided papers (Wen et al. & Price et al.) to understand the link between <i>biology</i> and <i>management</i>. • Your Task: Search for one peer-reviewed paper that: <ul style="list-style-type: none"> ○ Focuses on reef fish ecology/biology in your region. ○ Contains specific data (e.g., growth curves, catch rates, spillover effects) that implies a management rule. 2. AI-Generated Infographic (The Core Task) <ul style="list-style-type: none"> • Task: Use an AI tool to generate an infographic summarizing your paper. • Requirements: <ul style="list-style-type: none"> ○ Visuals: The infographic must visually represent the biological mechanism (e.g., a diagram of fish migration). ○ Data: It must include real scientific data from your paper (do not let the AI invent numbers). • Tools: You may use tools like Canva (Magic Design), Piktochart AI, Napkin.ai, or ChatGPT (DALL-E 3). • Submission: Upload the final image + Report Form by May 31 Link.

		<p>3. The Presentation (June 1st)</p> <ul style="list-style-type: none"> • Time: 5 minutes (Flash Talk). • Visual: Your AI-generated infographic will be your only slide. • Focus: Present the <i>biology</i> behind the <i>management rule</i>. Be prepared to explain which parts were AI-generated and how you verified the accuracy. <p>Provided paper</p> <p>Wen, C. K., Almany, G. R., Williamson, D. H., Pratchett, M. S., Mannering, T. D., Evans, R. D., ... & Jones, G. P. (2013). Recruitment hotspots boost the effectiveness of no-take marine reserves. <i>Biological Conservation</i>, 166, 124-131.</p> <p>Price, N. W., Chen, K. S., Chen, C. A., & Wen, C. K. C. (2021). Scraping and grazing herbivorous/detritivorous fish display opposite feeding behaviours under different protection regulations. <i>Marine Biology Research</i>, 17(9-10), 876-891.</p>
6/8	Final report due day	