

Ecology and Conservation 生態與保育	
Credits	Three (lectures: 3 hr per week)
Organizers	Teng-Chiu Lin
Lecturers	Teng-Chiu Lin, Joe Chun-Chia Huang, Frank Hsu, Chih-Min Hung, Chi-Chien Kuo, Chung-Chi Chen, Jyh-Min Chiang, Kuo-Fang Chung, Allen Chen, Sheng-Feng Shen, Benny Chan, Colin KC Wen, Shao-Lun Liu, Yiching Lin, I-Min Tso, Chung-Te Chang
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 黃俊嘉 Joe Chun-Chia Huang: 50% short essay; 50% class participation 郭奇芊 Chi-Chien Kuo : 100% Class participation including paper discussion 洪志銘 Chih-Min Hung: 100% Class participation including class and paper discussion 徐堉峰 Yu-Feng Hsu: 100 % Class participation and presentation 江智民 Jyh-Min Chiang : 100% Class participation and class discussion.</p>

沈聖峰 Sheng-Feng Shen : 50 % Class participation; 50 % Class discussion 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 陳昭倫 Allen Chen : 20 % Class participation; 20 % Class report/presentation; 30 % Class discussion; 30 % Assignments 溫國彰 : Refer to “Reading materials” 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 張仲德 Chung-Te Chang : 50% Class participation; 50% Class discussion
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Course work reminder: each student studies on assigned papers, field observations, and subsequent discussion according to each lecturer’s specific requirement

Short Schedule

Weeks taken/venue	Content	Lecturer
Week 1 2/19 NTNU	Introduction Overall briefing	Teng-Chiu Lin
Evolution, Genetics, and Conservation		
Week 2 2/26 NTNU	Breaking down barriers to fulfill the conservation shortfalls in Southeast Asia: Using bat as a model	Joe Chun-Chia Huang
Week 3 3/4 NTNU	Niche conservatism in conservation biology	Yu-Feng Hsu
Week 4 3/11 BRC	Conservation genetics 14:00-17:00pm@Room B208, BRC Building	Chih-Ming Hung
Week 5 3/18 NTNU	Biodiversity conservation and infectious diseases	Chi-Chien Kuo
Forest Ecosystems		Lecturer
Week 6 3/25 BRC	Community assembly and ecosystem functions	Jyh-Min Chiang
Week 7 4/1 BRC	Arthropod diversity and conservation from natural forests to urban areas	I-Min Tso
Week 8 4/8 BRC	The Nutrient Cycling and Landscape Pattern of Forest Ecosystem	Chung-Te Chang
Week 9 4/15 BRC	Spatial and temporal patterns in forest communities	Yiching Lin
Week 10&11 TBD	Forest Ecosystems I & II : 2 days field trip Wuling Farm& Hehuan Creek -Global warming and Sustainable development -Insects communities/ environment interactions -Biogeography and Conservation 1&2	Sheng-Feng Shen Kuo-Fang Chung
Marine Ecology		
Week 12 5/6 NTNU	Physical and chemical conditions in the open ocean and anthropogenic impacts on marine ecosystem	Chung-Chi Chen
Week 13 5/13 BRC	Introduction of blue carbon	Shao-Lun (Allen) Liu

Week 14 5/20 BRC	Natural and artificial rocky shores – a comparison	Benny K.K. Chan
Week 15 5/27 BRC	Field trip to observe coral community	Chaolun Allen Chen
Week 16 6/3 BRC	Sustainable fishery in coral reefs	Kuo-Chang Wen

Reading Materials

Weeks taken	Content	Lecturer/ Reading Material
Week 1 2/19	Introduction Overall briefing	Teng-Chiu Lin
Evolution, Genetics, and Conservation		
Week 2 2/26	Breaking down barriers to fulfill the conservation shortfalls in Southeast Asia: Using bat as a model	Joe Chun-Chia Huang No readings
Week 3 3/4	1. The evidence for niche conservatism The implication of niche conservatism in conservation biology -- using mammals as an example Outlines: 2. The concept of niche conservatism 3. Niche conservatism in conservation biology Case study: Thermal niche conservatism in mammals	Yu-Feng Hsu Reading materials: Student should read the materials below prior to the class. After a brief introduction by the lecturer, there will be open discussion on each of the 4 topics listed in the outlines. Students are required to actively participate in the discussion by sharing their unique insights. 1. Wiens, J. J., Ackerly, D. D., Allen, A. P., Anacker, B. L., Buckley et al. (2010). Niche conservatism as an emerging principle in ecology and conservation biology. <i>Ecology Letters</i> 13: 1310-1324. Cooper, N., Freckleton, R. P., & Jetz, W. (2011). Phylogenetic conservatism of environmental niches in mammals. <i>Proceedings of the Royal Society B: Biological Sciences</i> 278: 2384-2391.
Week 4 3/11	Conservation genetics 1. Why conservation needs genetics? 2. Importance of genetic demography 3. Case studies	Chih-Ming Hung Reading materials: Students should read the materials below prior to the class: 1. Dong, F., Kuo, H.-C., Chen, G.-L., Wu, F., Shan, P.-F., Wang, J., Chen, D., Lei, F.-M., Hung, C.-M., Liu, Y. & Yang, X.-J. (2021) Population genomic, climatic and anthropogenic evidence suggest the role of human forces in endangerment of green peafowl (<i>Pavo muticus</i>). <i>Proceedings of the Royal Society B</i> , 288, 20210073 2. Hung, C.-M., Zink, R.M. & Li, S.-H. (2018) Can genomic variation explain the extinction of the passenger pigeon? <i>Journal of Avian Biology</i> , e01858 3. Mays Jr, H.L., Hung, C.-M., Shaner, P.-J.L., Denvir, J., Justice, M., Yang, S.-F., Roth, T.L., Oehler, D.A., Fan, J., Rekulapally, D. & Primerano, D.A. (2018) Genomic analysis of demographic history and ecological niche modeling in the endangered Sumatran Rhinoceros <i>Dicerorhinus sumatrensis</i> . <i>Current Biology</i> , 28, 70-76 4. Hung, C.-M., Shaner, P.-J.L., Zink, R.M., Liu, W.-C., Chu, T.-C., Huang, W.-S. & Li, S.-H. (2014) Drastic population fluctuations explain the rapid extinction of the passenger pigeon. <i>Proc. Natl. Acad. Sci. U.S.A.</i> , 111, 10636-10641.
Week 5 3/18	Disease Ecology: 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. 1. Halliday, F.W., Rohr, J.R. and Laine, A.L., 2020. Biodiversity loss underlies the dilution effect of biodiversity. <i>Ecology Letters</i> , 23: 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> 613: 340–344.
Week 6	3/25	Community assembly and ecosystem functions Jyh-Min Chiang 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. 3. 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
Forest Ecosystems		
Weeks 7	4/1	Arthropod diversity and conservation from natural forests to urban areas I-Min Tso Readings materials: 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. 1. 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. 2. 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. Outlines 1. What are the characteristics of spider diversities in natural and plantation forests? What environmental factors might be responsible for the observed differences? 2. How does transforming the natural forests into plantation forests impact the spider diversity? 3. What strategies can we adopt to enhance the arthropod diversities in plantation forests? 4. What is the concept of ecological effectiveness? What are the commonly used ways of estimating ecological effectiveness in the cities? Are they accurate? 5. How to establish an accurate way of estimating the ecological effectiveness of urban areas? 6. What are the feasible and realistic ways we can apply to enhance biodiversity in urban areas?
Weeks 8	4/8	The Nutrient Cycling and Landscape Pattern of Forest Ecosystem Chung-Te Chang I will give a 1.5-2 hours lecture first. Please refer to: Chapters 17 from Berry DA, Oren R, and Hart SC (2008) <i>Forest Ecosystems</i> . 2 nd edition. The Johns Hopkins University Press, Baltimore. Chapter 8 from Turner MG, and Gardner RH (2015) <i>Landscape Ecology in Theory and Practice: pattern and process</i> . 2 nd edition, Springer New

		<p>York.</p> <p>We then have a discussion based on reading materials related to the topic of lecture, from which the evaluation of class preparation/participation include. Therefore, all students need to read three assigned papers below.</p> <p>Reading materials & Discussion:</p> <ol style="list-style-type: none"> 1. Chang CT, Wang LJ, Huang JC, Liu CP, Wang CP, Lin NH, Wang L, Lin TC (2017) Precipitation control on nutrient budgets in subtropical and tropical forests and the implications under changing climate. <i>Advances in Water Resources</i> 103: 44-50. 2. Chang CT, Yang CJ, Huang KH, Huang CJ and Lin TC (2022) Changes of precipitation acidity related to sulfur and nitrogen deposition in forests across three continents in north hemisphere over last two decades. <i>Science of the Total Environment</i> 806: 150552. 3. Chang CT, Song CE, Lee LC, (2021) Influence of landscape mosaic structure on nitrate and phosphate discharges: An island-wide assessment in subtropical mountainous Taiwan. <i>Landscape and Urban Planning</i> 207: 14017.
Week 9	4/15	<p>Spatial and temporal patterns in forest communities</p> <p>Yiching Lin Reading material:</p> <ol style="list-style-type: none"> 1. 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>, 10: 56. 2. 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> 165:175-184. <p>Species-area relationships explained by the joint effects of dispersal limitation and habitat heterogeneity. <i>Ecology</i> 90:3033-3041.</p>
Week 10	4/22	<p>2 days field trip: Wuling Farm Mountain Area</p> <p>-Global warming and Sustainable development</p> <p>Sheng-Feng Shen Kuo-Fang Chung No readings</p>
Week 11	4/29	<p>-Insects communities/ environment interactions</p> <p>-Biogeography and Conservation</p>
<p>Marine Ecology: Coral Reef and Rocky Shores Ecosystems</p> <p>-Functions of coral reefs and rocky shores</p> <p>-Management (e.g. Designation of marine protected area)</p>		
Week 12	5/6	<p>Physical and chemical conditions in the open ocean and anthropogenic impacts on marine ecosystem</p> <ol style="list-style-type: none"> 1. Overview of marine environment; 2. 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 pick up an article based on his (her) own interesting and do 10-12 mins presentation on how human interference on marine ecosystems</p> <p>Reading materials:</p> <ol style="list-style-type: none"> 1. 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) 2. Chen*, C.-C., F.-K. Shiah, G.-W. Gong, and T.-Y. Chen (2021). Impact of upwelling on phytoplankton blooms and hypoxia along the Chinese coast in the East China Sea. <i>Marine Pollution Bulletin</i>. doi: 10.1016/j.marpolbul.2021.112288 3. Chen, C.-C., G.-C. Gong, W.-C. Chou, and F.-K. Shiah (2020). Hypoxia in autumn of the East China Sea. <i>Marine Pollution</i>

		<p><i>Bulletin</i> 152, Art. no. 110875. doi: 10.1016/j.marpolbul.2019.110875.</p> <p>4. 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.</p> <p>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.</p>
Week 13	5/13	<p>Introduction of blue carbon</p> <p>Shao-Lun Liu</p> <p>Lecture, no readings</p>
Week 14	5/20	<p>Field trip: North East coast of Taiwan</p> <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>
Week 15	5/27	<p>Grading Criteria:</p> <p>1. Selection of Study (10 points): Relevance (5 points): Chooses a study that aligns with the provided papers and focuses on the ecology or biology of reef fishes. Justification (5 points): Clearly justifies the selection, explaining the significance of the chosen study.</p> <p>2. Implications for Sustainable Fishery (30 points): Comprehension (12 points): Demonstrates a comprehensive understanding of the chosen study's findings. Application (10 points): Effectively applies the findings to propose implications for sustainable fishery in coral reefs. Insight (8 points): Provides insightful and well-reasoned implications that showcase critical thinking.</p> <p>3. Infographic Creation (35 points): Content Relevance (12 points): Ensures the infographic reflects key information from the chosen study. Design and Creativity (15 points): Creates a visually appealing and creative infographic,</p> <p>Colin KC Wen</p> <p>Task:</p> <ol style="list-style-type: none"> Skim Reading and Search: <ul style="list-style-type: none"> Skim read the provided papers. Conduct a search for a study similar to those provided, focusing on the ecology or biology of reef fishes. Preferably select a study conducted in your country. Implications for Sustainable Fishery: <ul style="list-style-type: none"> Provide your own implications for sustainable fishery in coral reefs based on the findings of the chosen paper. Infographic Creation: <ul style="list-style-type: none"> Create an infographic using figures/tables from the chosen paper or design your own. Report Form: <ul style="list-style-type: none"> Complete the report form available at this link: Report Form Link. Presentation: <ul style="list-style-type: none"> Present your findings to the class using a single slide/infographic. <p>Submission Details:</p> <ul style="list-style-type: none"> Submit your infographic and report form by 2024/May/20. Ensure that your chosen paper and infographic align with the provided guidelines. Be ready to present your findings in class on May/27. <p>Provided paper</p> <ol style="list-style-type: none"> 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. 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>utilizing figures/tables effectively.</p> <p>Clarity (8 points): Ensures the infographic is clear, concise, and easy to understand.</p> <p>4. Class Presentation (25 points):</p> <p>Organization (13 points): Presents findings in a well-organized manner.</p> <p>Engagement (10 points): Engages the class effectively during the presentation.</p> <p>Clarity (2 points): Ensures clarity in conveying key points on the single slide/infographic.</p> <p>Note: Make sure to adhere to the guidelines and requirements outlined in the assignment. If you have any questions, feel free to seek clarification from the instructor."</p>	
<p>Week 16 6/3</p>	<p>Field trip to observe coral community</p>	<p>Allen Chen</p>