

Ecology and Conservation 生態與保育	
Course Code	DIC 8001
Credits	Three (lectures: 3 hr per week)
Organizers	Chung-Chi Chen
Lecturers	Chung-Chi Chen, Teng-Chiu Lin, Chung-Ping Lin, Si-Min Lin, Frank Hsu, Shou-Hsien Li, Chi-Chien Kuo, Kuo-Fang Chung, Allen Chen, Sheng-Feng Shen, Benny Chan
Time	Monday 14:00-17:00
Place	C302, 3F, Colleague of Science Building, NTNU Gongguan Campus B204, 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.

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	Content	Lecturer
Week 1 2/14 NTNU	Introduction Overall briefing	Teng-Chiu Lin
Evolution, Genetics, and Conservation		
Week 2 2/21 NTNU	Diversification of Insects on Islands	Chung-Ping Lin
Week 3 2/28 NTNU	National Holiday : Peace Memorial day	
Week 4 3/7 NTNU	Disease Ecology : an application of ecological principles	Chi-Chien Kuo
Week 5 3/14 NTNU	Conservation genetics	Shou-Hsien Li
Week 6 3/21 NTNU	Niche conservatism in conservation biology – using insects as an example	Frank Hsu
Forest Ecosystems		
Week 7 3/28 THU	Ecosystem Processes & Landscapes	Chung-Te Chang
Week 8 4/11 THU	Spatial and temporal patterns in forest communities	Yiching Lin
Week 9 & 10 AS	Two days field trip Time & Location: TBA -Global warming and Sustainable development -Insects communities/ environment interactions -Biogeography and Conservation	Sheng-Feng Shen Kuo-Fang Chung
Week 11 5/2 THU	Arthropod diversity and conservation from natural forests to urban areas	I-Min Tso
Marine Ecology		
Week 12 5/9 NTNU	Physical and chemical conditions in the open ocean and anthropogenic impacts on marine ecosystem	Chung-Chi Chen
Week 13 5/16 THU	Seaweed ecology	Shao-Lun Liu
Week 14 5/23 THU	Coral reef fishes, fishery and conservation	Colin KC Wen
Week 15 5/30 AS	Field Trip: Natural and artificial rocky shores – a comparison Location: North East coast of Taiwan	Benny Chan
Week 16 6/6 AS	Coral reef ecology and conservation	Allen Chen

Detail Syllabus

Weeks taken	Content	Lecturer/ Reading Material
Week 1 2/14	Introduction Overall briefing	Teng-Chiu Lin
Evolution, Genetics, and Conservation		
Week 2 2/21	Diversification of Insects on Islands	<p>Chung-Ping Lin Reading & Homework Assignments: Before the class, students are expected to read all 3 recent papers from our laboratory and answer the assigned questions, which will be available one week before the lecture. Please print out your answers (with questions) and turn in the homework assignment in class. Also, bring with you a hard or electronic copy of the papers on the day of the lecture for discussion.</p> <p>These papers are downloadable from: http://web.ntnu.edu.tw/~treehopper/index.php?page=publications&lang=en</p> <ol style="list-style-type: none"> 1. Wang, L-Y., W-S. Huang, H-C. Tang, L-C. Huang and C-P. Lin (2018) Too hard to swallow: A secret secondary defence of an aposematic insect. <i>Journal of Experimental Biology</i> 221 (DOI: 10.1242/jeb.172486) Jan 25 2018. 2. Tseng, H-Y., W-S. Huang, M-L. Jeng, R.J.T. Villanueva, O.M. Nuñez and C-P. Lin (2018) Complex inter-island colonization and peripatric founder speciation promote diversification of flightless <i>Pachyrhynchus</i> weevils in the Taiwan-Luzon volcanic belt. <i>Journal of Biogeography</i> 45: 89–100 (DOI: 10.1111/jbi.13110). 3. Chen, Y-T., H-Y. Tseng, M-L. Jeng, Y-C. Su, W-S. Huang* and C-P. Lin* (2017) Integrated species delimitation and conservation implications of an endangered weevil <i>Pachyrhynchus sonani</i> (Coleoptera: Curculionidae) in Green and Orchid Islands of Taiwan. <i>Systematic Entomology</i> 42: 796–813 (DOI: 10.1111/syen.12242).
Week 3 2/28	National Holiday: Peace Memorial day	
Week 4 3/7	Disease Ecology: an application of ecological principles	<p>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.</p> <ol style="list-style-type: none"> 1. Life-history change in disease-ravaged Tasmanian devil populations. 2008. PNAS 105: 10023-10027. <p>Invasive honeysuckle eradication reduces tick-borne disease risk by altering host dynamics. 2010. PNAS 107: 18523-18527</p>
Week 5 3/14	Conservation genetics 1. Why conservation needs genetics? 2. Delineating conservation units 3. Importance of genetic demography 4. Conservation of adaptive traits 5. Case studies	<p>Shou-Hsien Li Reading materials: Students should read the materials below prior to the class:</p> <ol style="list-style-type: none"> 1. Allendorf et al. 2010. Nature Reviews Genetics 11, 697. 2. Funk et al. 2012. Trend in Ecology and Evolution, 27, 489. 3. Xu et al. 2015. Science 348, 242. 4. Roman & Palumbi 2003. Science 301, 508. 5. Hung et al. 2014. PNAS 111, 10636.
Week 6 3/21	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	<p>Frank 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.</p> <ol style="list-style-type: none"> 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.

	3. e conservatism in conservation biology Case study: Thermal niche conservatism in mammals	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.
Forest Ecosystems		
Weeks 7	3/28	<p>Ecosystem Processes & Landscapes</p> <p>Chung-Te Chang Introduction to Ecosystem Processes in Landscape. Chapter 8 in Turner and Gardner (2015) <i>Landscape Ecology in theory and practice: pattern and process</i>. 2nd edition. Springer.</p> <p><u>Each student picks up one paper and prepare a 15-20 mins briefing after reading.</u></p> <p>Reading materials:</p> <ol style="list-style-type: none"> 1. Chang et al. (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. Lin et al. (2017) Impacts of increasing typhoons on the structure and function of a subtropical forest: reflections of a changing climate. <i>Scientific Reports</i> 7: 4911. 3. Wang et al (2019) Climate-phenology-hydrology interactions in northern high latitudes: assessing the value of remote sensing data in catchment ecohydrological studies. <i>Science of the Total Environment</i> 656, 19-28 4. Chang et al. (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: 104017. 5. Wu J & Lu J (2021) Spatial scale effects of landscape metrics on stream water quality and their seasonal changes. <i>Water Research</i> 191, 116811.
Weeks 8	4/11	<p>Spatial and temporal patterns in forest communities</p> <p>Yi-Ching 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. 3. Species-area relationships explained by the joint effects of dispersal limitation and habitat heterogeneity. <i>Ecology</i> 90:3033-3041.
Week 8&9	TBA	<p>2 days field trip</p> <p>Biogeography and Conservation -Insects communities/ environment interactions -Global warming and Sustainable development Introduction of Forest ecosystem: Biodiversity of forest ecosystem Impacts of Global Change on Forest ecosystem: Impacts of climate change and habitat alternation on the forest ecosystem</p> <p>Sheng-Feng Shen Chapter 3-5, Lee Hannah (2011) <i>Climate Change Biology</i>. Academic Press. (Textbook in TIGP reservation area at Life Science Library, Academia Sinica)</p> <p>Kuo-Fang Chung Reading materials: -KF Chung, CI Peng, SR Downie, K Spalik, BA Schaal (2005) Molecular systematics of the trans-Pacific alpine genus <i>Oreomyrrhis</i> (Apiaceae): phylogenetic affinities and biogeographic implications, <i>American Journal of Botany</i> 92 (12), 2054-2071 -Chapter 2, <i>The History of Biogeography</i>. Biogeography, Lomolino, Riddle, Whittaker and Brown. Sinauer Associates -KF Chung, WC Leong, RR Rubite, R Repin, R Kiew, Y Liu, CI Peng (2014) Phylogenetic analyses of <i>Begonia</i> sect. <i>Coelocentrum</i> and allied limestone species of China shed light on the evolution of Sino-Vietnamese karst flora. <i>Botanical Studies</i> 55 (1), 1 -JC Nekola (1999) Paleoreugia and neoreugia: the influence of colonization history on community pattern and process. <i>Ecology</i>, 1999 - <i>Eco Soc America</i></p>

		<p>Kuo-Fang Chung Reading materials:</p> <ol style="list-style-type: none"> 1. KF Chung, CI Peng, SR Downie, K Spalik, BA Schaal (2005) Molecular systematics of the trans-Pacific alpine genus <i>Oreomyrhis</i> (Apiaceae): phylogenetic affinities and biogeographic implications, <i>American Journal of Botany</i> 92 (12), 2054-2071 2. Chapter 2, <i>The History of Biogeography</i>. Biogeography, Lomolino, Riddle, Whittaker and Brown. Sinauer Associates <p>Reading materials:</p> <ol style="list-style-type: none"> 3. KF Chung, WC Leong, RR Rubite, R Repin, R Kiew, Y Liu, CI Peng (2014) Phylogenetic analyses of <i>Begonia</i> sect. <i>Coelocentrum</i> and allied limestone species of China shed light on the evolution of Sino-Vietnamese karst flora. <i>Botanical Studies</i> 55 (1), 1 4. JC Nekola (1999) Paleoreugia and neoreugia: the influence of colonization history on community pattern and process. <i>Ecology</i>, 1999 - <i>Eco Soc America</i>
Week 11 5/2	<p>Arthropod diversity and conservation from natural forests to urban areas Outlines</p> <ol style="list-style-type: none"> 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? 	<p>I-Min Tso 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"> 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.
<p>Marine Ecology: Coral Reef and Rocky Shores Ecosystems -Functions of coral reefs and rocky shores -Management (e.g. Designation of marine protected area)</p>		
Week 12 5/9	<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; 3. 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 25-30 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>5. 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	5/16	<p>Seaweed ecology</p> <p>Shao-Lun Liu Please read the following three papers before attending the class:</p> <ol style="list-style-type: none"> 1. Clements CS, Burns AS, Stewart FJ, Hay ME. 2020. Seaweed-coral competition in the field: effects on coral growth, photosynthesis and microbiomes require direct contact. <i>Proc Biol Sci</i> 287: 20200366 2. Nieder C, Chen PC, Chen CA, Liu SL. 2019. New record of the encrusting alga <i>Ramicrusta textilis</i> overgrowing corals in the lagoon of Dongsha Atoll, South China Sea. <i>Bulletin of Marine Science</i> 95: 459–462. 3. Nieder C, Liao CP, Chen CA, Liu SL. 2019. Filamentous calcareous alga provides substrate for coral-competitive macroalgae in the degraded lagoon of Dongsha Atoll, Taiwan. <i>PLoS One</i> 14: e0200864. <p><u>And, please find one paper associated with the relevant topic and present it in the class (15 min).</u></p>
Week 14	5/23	<p>Coral reef fishes, fishery and conservation</p> <p>Colin KC Wen Reading materials</p> <p>Sale, P. F., Cowen, R. K., Danilowicz, B. S., Jones, G. P., Kritzer, J. P., Lindeman, K. C., ... & Steneck, R. S. (2005). Critical science gaps impede use of no-take fishery reserves. <i>Trends in ecology & evolution</i>, 20(2), 74-80.</p> <p>Huang, H., Wen, C. K. C., Li, X., Tao, Y., Lian, J., Yang, J., & Cherh, K. L. (2017). Can private management compensate the ineffective marine reserves in China?. <i>Ambio</i>, 46(1), 73-87.</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>Wen, C. K., Chen, K. S., Tung, W. C., Chao, A., Wang, C. W., Liu, S. L., & Ho, M. J. (2019). The influence of tourism-based provisioning on fish behavior and benthic composition. <i>Ambio</i>, 48(7), 779-789.</p> <p>Heard, J., Tung, W. C., Pei, Y. D., Lin, T. H., Lin, C. H., Akamatsu, T., & Wen, C. K. (2021). Coastal development threatens Datan area supporting greatest fish diversity at Taoyuan Algal Reef, northwestern Taiwan. <i>Aquatic Conservation: Marine and Freshwater Ecosystems</i>, 31(3), 590-604.</p> <p>Assignment (before class)</p> <p>Review adequate literature from one referable country (your nationality is better) to criticize the knowledge gaps and problems in marine reserves or management. Each student will share their essay with 5ish slides (powerpoint/keynote/etc).</p>
Week 15	5/30	<p>Field Trip: Natural and artificial rocky shores – a comparison Location: North East coast of Taiwan</p> <p>Benny Chan</p>

Week 16	6/6	Coral reef ecology and conservation -Natural and anthropogenic disturbances on coral reefs -Historical degradation of coral reefs -Response mechanisms of coral reefs to climate change -Marine protected areas and conservation of coral reefs	Allen Chen
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Evaluation

Lecturers	Evaluation Criteria
陳仲吉 Chung-Chi Chen	100 % Class participation and presentation
林登秋 Teng-Chiu Lin	100 % Class participation and presentation
沈聖峰 Sheng-Feng Shen	50 % Class participation; 50 % Class discussion
郭奇芊 Chi-Chien Kuo	100% Class participation, including paper discussion
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