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| **112(1)/2023 Fall Semester TIGP-ESS課程資訊表**  **112(1)/2023 Fall Semester TIGP-ESS course information form** | | |
| 科目名稱(中文) | | 人類活動與地表變遷 |
| Course Title (English) | | Human Activities and Land Use/Land Cover Changes |
| 授課時間  Time | | Tue 09.00 am -13.00 am (2 hours lecture + 2 hours exercise) |
| 授課地點  Location | | RCEC 2034 |
| 學分數  Course Credits | | 3 |
| 主要授課老師 Main Instructors | | 陳奕穎 Yi-Ying Chen |
| 聯絡郵件  E-mail | | [yiyingchen@gate.sinica.edu.tw](mailto:yiyingchen@gate.sinica.edu.tw) |
| 辦公時間 Office Hours | | e.g. Thru 3-5p.m. in IES R323 or by appointment |
| 課程目標 Course Objectives | | The course was designed for students interested in understanding the relationship between human history and environmental changes (e.g., land-use and land-cover changes). Two distinctive time scales, millennia and the latest 300-years, were selected to have a different look at the impact of land-use and land-cover changes on human life. The following topics: human history and scales, vegetation growth and climate, and reconstruction of historical land-cover/land-use and geological dating, and impact of land-use and land-cover changes on the global environment, were included in this lecture. I will discuss ideas and findings from selected journal papers, textbooks: “Land-Use and Land-Cover Change: Local Processes and Global Impacts” by Lambin, E.F. 2004 and “ Understanding Human History” by Hart, M. H. 2007 with students in this lecture. In addition, methods and coding skills for building a toy model to reconstruct/project LULCC will also introduce.  期望以人類文明發展的角度觀察人類活動對於地球環境所產生的影響，其中包含: 人類文明與不同時、空尺度的介紹、植被與氣候之關聯、地質年代與地表覆蓋之重建、局地土地利用改變對全球環境之衝擊以及科學進展對於重建歷史地表覆蓋的貢獻。課程規劃期中考之前探討萬年以前的時間尺度、期中考以後探討近代約300年的時間尺度。最終將引導學生了解如何建構一個試驗性的土地覆蓋變化模式。 |
| 授課內容 Course Description | | An overall picture of human history on exploring the land of Earth  The impact of local land-use change on the global environment  Advance in science development for reconstructing the past land-use and land-cover  Understanding how to build a toy model to reconstruct the historical land-use and land-cover map and to project future land-use/land-cover map  概括性的了解人類歷史與探索地球的歷程  局地土地利用對全球環境改變的衝擊  科學進展對於重建歷史地表覆蓋的與土地使用的貢獻  建構一個試驗性的土地覆蓋變化模式 |
| 教科書/參考書 Textbooks/References | | 1. Lambin, E. F. and Geist, H. 2004. Land-Use and Land-Cover Change: Local Processes and Global Impacts. Springer  2. Hart, M. H. 2007. Understanding Human History. Washington Summit Publisher |
| 自編教材比例  Self-compiled Textbook/References Proportion(if any) | | 80% Self-compiled Slides / 15% Reference papers/ 5% Open online resource  **Reference:**   1. Allen, T. F. H., &Hoekstra, T. W.,1992. *Toward a Unified Ecology*.<https://doi.org/10.2307/4002476> 2. Canadell, J., Jackson, R., Ehleringer, J., Mooney, H. A., Sala, O. E.,andSchulze, E.-D. 1996. Maximum rooting depth of vegetation types at the global scale. *Oecologia* 108 583–595. <https://doi.org/10.1007/BF00329030> 3. Chang-Martínez, L. A., Mas, J. F., Valle, N. T., Torres, P. S. U.,andFolan, W. J. 2015. Modeling historical land cover and land use: A review from contemporary modeling. *ISPRS International Journal of Geo-Information* 4(4): 1791–1812. <https://doi.org/10.3390/ijgi4041791> 4. Chen, X.,andNiu, J. 2020. Relationships between tree height and tree species richness at small scales. *Acta Oecologica* 109(October): 103668. <https://doi.org/10.1016/j.actao.2020.103668> 5. Chen, Y.Y., Huang, W., Wang, W.H., Juang, J.Y., Hong, J.S., Kato, T., Luyssaert, S., 2019. Reconstructing Taiwan’s land cover changes between 1904 and 2015 from historical maps and satellite images, *Scientific Reports*, 9, 3643. <https://doi.org/10.1038/s41598-019-40063-1> 6. Deng, X.,andLi, Z. 2016. A review on historical trajectories and spatially explicit scenarios of land-use and land-cover changes in China. *Journal of Land Use Science* 11(6): 709–724. <https://doi.org/10.1080/1747423X.2016.1241312> 7. 劉翠溶. 2005. 中國環境史研究芻議. <https://idv.sinica.edu.tw/ectjliu/> 8. Ellis, E. C. 2021. Land Use and Ecological Change: A 12,000-Year History. *Annual Review of Environment and Resources* 46 1–33. <https://doi.org/10.1146/annurev-environ-012220-010822> 9. Ellis, E. C., Kaplan, J. O., Fuller, D. Q., Vavrus, S., Goldewijk, K. K.,andVerburg, P. H. 2013. Used planet: A global history. *Proceedings of the National Academy of Sciences of the United States of America* 110(20): 7978–7985. <https://doi.org/10.1073/pnas.1217241110> 10. Fayet, C. M. J., Reilly, K. H., VanHam, C.,andVerburg, P. H. 2022. What is the future of abandoned agricultural lands? A systematic review of alternative trajectories in Europe. *Land Use Policy* 112(February 2021): 105833. <https://doi.org/10.1016/j.landusepol.2021.105833> 11. Gingrich, S., Niedertscheider, M., Kastner, T., Haberl, H., Cosor, G., Krausmann, F., Kuemmerle, T., Müller, D., Reith-Musel, A., Jepsen, M. R., Vadineanu, A.,andErb, K. H. 2015. Exploring long-term trends in land use change and aboveground human appropriation of net primary production in nine European countries. *Land Use Policy* 47 426–438. <https://doi.org/10.1016/j.landusepol.2015.04.027> 12. Goldewijk, K. K. 2001. Estimating global land use change over the past 300 years: The HYDE database. *Global Biogeochemical Cycles* 15(2): 417–433. <https://doi.org/10.1029/1999GB001232> 13. Goldewijk, K. K. and Navin Ramankutty 2004. Land cover change over the last three centuries due to human activities: The availability of new global data sets <https://doi.org/10.1007/s10708-004-5050-z> 14. Harrison, S. P., Bartlein, P. J.,andPrentice, I. C. 2016. What have we learnt from paleoclimate simulations? *Journal of Quaternary Science* 31(4): 363–385. <https://doi.org/10.1002/jqs.2842> 15. Haywood, A. M., Valdes, P. J., Aze, T., Barlow, N., Burke, A., Dolan, A. M., von derHeydt, A. S., Hill, D. J., Jamieson, S. S. R., Otto-Bliesner, B. L., Salzmann, U., Saupe, E.,andVoss, J. 2019. What can Palaeoclimate Modelling do for you? *Earth Systems and Environment* 3(1): 1–18. <https://doi.org/10.1007/s41748-019-00093-1> 16. ArchaeoGLOBE Project. 2019. *A**rchaeological assessment reveals Earth ’ s early transformation through land use*. 902 897–902. <https://www.science.org/doi/10.1126/science.aax1192> 17. Hoffmann, P., Reinhart, V., Rechid, D., Noblet-ducoudré, N.De, Davin, L., Asmus, C., Bechtel, B., Böhner, J., Katragkou, E.,andLuyssaert, S. 2021. *Future Changes*. *August* 1–43. 18. Jin, X. 2018. *Historical Farmland in China During 1661-1980*. <http://www.springer.com> 19. Kattge, J., Díaz, S., Lavorel, S., Prentice, I. C., Leadley, P., Bönisch, G., Garnier, E., Westoby, M., Reich, P. B., Wright, I. J., Cornelissen, J. H. C., Violle, C., Harrison, S. P., VanBodegom, P. M., Reichstein, M., Enquist, B. J., Soudzilovskaia, N. A., Ackerly, D. D., Anand, M.,…Wirth, C. 2011. TRY - a global database of plant traits. *Global Change Biology* 17(9): 2905–2935. <https://doi.org/10.1111/j.1365-2486.2011.02451.x> 20. Klein Goldewijk, K.,andRamankutty, N. 2004. Land cover change over the last three centuries due to human activities: The availability of new global data sets. *Geo Journal* 61(4): 335–344. <https://doi.org/10.1007/s10708-004-5050-z> 21. Kottek, M., Grieser, J., Beck, C., Rudolf, B.,andRubel, F. 2006. World map of the Köppen-Geiger climate classification updated. *Meteorologische Zeitschrift* 15(3): 259–263. <https://doi.org/10.1127/0941-2948/2006/0130> 22. Liu, J., Kuang, W., Zhang, Z., Xu, X., Qin, Y., Ning, J., Zhou, W., Zhang, S., Li, R., Yan, C., Wu, S., Shi, X., Jiang, N., Yu, D., Pan, X.,andChi, W. 2014. Spatiotemporal characteristics, patterns and causes of land use changes in China since the late 1980s. *Dili Xuebao/Acta Geographica Sinica* 69(1): 3–14. <https://doi.org/10.11821/dlxb201401001> 23. Liu, J., Zhang, Z., Xu, X., Kuang, W., Zhou, W., Zhang, S., Li, R., Yan, C., Yu, D., Wu, S.,andJiang, N. 2010. Spatial patterns and driving forces of land use change in China during the early 21st century. *Journal of Geographical Sciences* 20(4): 483–494. <https://doi.org/10.1007/s11442-010-0483-4> 24. Liu, M.,andTian, H. 2010. China’s land cover and land use change from 1700 to 2005: Estimations from high-resolution satellite data and historical archives. *Global Biogeochemical Cycles* 24(3):. <https://doi.org/10.1029/2009GB003687> 25. Miao, L., Zhu, F., He, B., Ferrat, M., Liu, Q., Cao, X.,andCui, X. 2013. Synthesis of China’s land use in the past 300years. *Global and Planetary Change* 100 224–233. [https://doi.org/10.1016/j.gloplacha.2012.10.021\](https://doi.org/10.1016/j.gloplacha.2012.10.021/) 26. Morrison, KD, Hammer, E, Boles, O, Madella, M, Whitehouse, N, Gaillard, M-J, et al. 2021. Mapping past human land use using archaeological data: A new classification for global land use synthesis and data harmonization. *PLoS ONE* 16(4): e0246662. <https://doi.org/10.1371/journal.pone.0246662> 27. Moulds, S., Buytaert, W., and Mijic, A. 2015, An open and extensible framework for spatially explicit land use change modelling: the lulcc R package, Geosci. Model Dev., 8, 3215–3229, <https://doi.org/10.5194/gmd-8-3215-2015> 28. Park, J.R. *Environmental Management in Agriculture: European Perspectives*. 29. Reinhart, V., Hoffmann, P., Rechid, D.,andBechtel, B. 2021. *High-resolution land-use land-cover change data for regional climate simulations over Europe - Part I: The plant functional type basemap for 2015*. *August* 1–54. 30. Rosina, K., Batista e Silva, F., Vizcaino, P., Marín Herrera, M., Freire, S.,andSchiavina, M. 2020. 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Global patterns and determinants of forest canopy height. *Ecology* 97(12): 3265–3270. <https://doi.org/10.1002/ecy.1580> 35. Weigelt, P., König, C.,andKreft, H. 2020. GIFT – A Global Inventory of Floras and Traits for macroecology and biogeography. *Journal of Biogeography* 47(1): 16–43. <https://doi.org/10.1111/jbi.13623> 36. Yang, X., Jin, X., Xue, Q.,andZhou, Y. 2022. *Land Use Policy Reconstruction of the spatial distribution of historical farmland in the Taiwan Province of China for 1659 – 1945*. 114(October 2020): 37. Yang, X., Xue, Q.,and Zhou, Y. 2021. Reconstruction of farmland dataset of Taiwan province in recent 300 years. *Journal of Natural Resources* 36(8): 2163. <https://doi.org/10.31497/zrzyxb.20210819> 38. Yang, Y., Zhang, S., Liu, Y., Xing, X.,andDeSherbinin, A. 2017. 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Hurtt, G., Chini, L., Sahajpal, R., Frolking, S., Bodirsky, B., Calvin, K., et al. 2020. *Harmonization of Global Land-Use Change and Management for the Period 850–2100 (LUH2) for CMIP6*. *Geoscientific Model Development Discussions*. <https://doi.org/10.5194/gmd-2019-360> 43. IPCC, 2019. Special report on climate change and land 44. 陳媛. 2020. 土地利用變化對區域域碳會的影響綜述. *地礦測繪*3(3): 35-36. 45. 劉多森. 2004. 黃土高原近兩千年來土地利用和環境變遷. *第四紀研究* 24(2): 184-190 46. 李相僖/尹信榮. 2018.人類的起源. 譯者/陳建安/三采文化 47. UN, 2022, Global Land Outlook |
| 授課方式 Course Requirements | | ▓講授(Lecture)；  □研討(Seminar)；  ▓實習/實驗(Internship/Experiment)；  □個別指導(Individual Discussion)；  □其他(Other) |
| 評量配分比重 Course Grade | | Course participation: 30%  Assignments: 20%  Mid-term + Final: 50% |
| 課程領域Areas | | □基礎學科(共同)(Basic subjects (common))  □固態地球科學(Solid earth sciences)  □水圈科學(Aquatic sciences)  ▓應用語言(Applied Languages)  □大氣科學(Atmospheric sciences)  ▓人類圈與永續科學(Anthro & Sustain sciences) |
| 產業領域Areas | | □地探科技(Geological monitoring technology)  □氣象科技(meteorological science and technology)  □太空科技(Space Technology)  □環保科技(environmental protection science and technology)  ▓資訊科技(Informational Technology)  ▓教學研究(Teaching & research)  □地質科技(Geosciences and technology) |
| 課程進度與內容  Lecture outline and content | | |
| 週次  week | 周次/ 學習主題/學習時數(課前+課程+課後)小時/參考書(Textbook[T])與閱讀文章(Reference[R]) | |
| **1** | Introduction of Scale and Human History (I)/4(0+2+2)/T[2], R[1][7][32][46] | |
| **2** | Introduction of Scale and Human History (II)/ 4(1+2+1)/T[2], R[1][7][32][46] | |
| **3** | Vegetation growth and Climate, and Chronology/5(2+2+1)/T[1,CH2][2], R[4][19][21][31][34][35] | |
| **4** | Civilization and land-use/land-cover change (LULCC) over the Past 12,000 years (Indo-Europe)/4(1+2+1)/T[1,CH2][2], R[8][9][26] | |
| **5** | Civilization and LULCC over the Past 12,000 years (Pan-Asia)/6(1+2+2)/T[1,CH2][2], R[8][9][26] | |
| **6** | Global LULCC Reconstruction Projects/6(3+2+1)/T[1,CH1][2], R[3][12][13][19][26][33][47] | |
| **7** | Modeling local LULCC: Build up a Toy Model (Formulation)/4(1+2+1)/T[1,CH5], R[38][39][40] | |
| **8** | Modeling local LULCC: Build up a Toy Model (using R/GIS)/6(2+2+2)/T[1,CH5], R[27] | |
| **9** | **Mid-term/5(3+1+1)** | |
| **10** | Impact of LULCC on Climate Change/4(1+2+1)/T[1,CH4][2], R[14][15][44] | |
| **11** | IPCC Special report on Climate Change and Land/4(1+2+1)/R[43] | |
| **12** | Global LULCC over the past 300 years (Asia/China) /6(3+2+1)/T[1,CH2][2], R[6][18][20][22][23][24][25][45] | |
| **13** | Global LULCC over the past 300 years (Europe) /6(3+2+1)/T[1,CH2][2], R[10][11][20][28][29][30] | |
| **14** | Global LULCC Harmonization/6(3+2+1)/T[1,CH1][2], R[1][12][13][17][33][42][47] | |
| **15** | Taiwan LULCC Reconstruction (II: 2020 to 1900)/4(1+2+1)/R[5][37] | |
| **16** | Taiwan LULCC Reconstruction (I: 1900 to 1650)/4(1+2+1)/R[36][37] | |
| **17** | Sustainable Land Management and Climate Objectivity/4(1+2+1)/T[1,CH6], R[41] | |
| **18** | **Final exam/5(3+1+1)** | |
| 課程所屬學制(Educational System): 博士班(Doctoral Program) | | |
| 核心能力I: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select core abilities and its corresponding assessments of this course | | |
| 請勾選學程所訂之核心能力(可複選)  ▓獨立思考與研究能力Independent thinking and research capacity  ▓進階數理及專業知識能力Advanced mathematical and professional knowledge and ability  ▓觀測模擬及分析推理能力Observation simulation and analysis of reasoning ability  ▓電腦及程式語言運用能力Computer and programming language proficiency  □國際視野與語文溝通能力International perspective and language communication skills  □專業倫理及服務學習能力Professional ethics and service-learning ability | | |
| 核心能力II: 請點選本課程培養學生具備核心能力之強度指數，並填寫對應之評量方式  Please select the core abilities and its corresponding assessments of this course | | |
| |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | 強度指數 Overall rating of Core Abilities | 1 非常低 Very Low | 2 低 Low | 3 普通 Medium | 4 高 High | 5 非常高 Very High | 評量方式 Corresponding Assessments | | 獨立思考與研究能力 Independent thinking and research capacity | □ | □ | □ | □ | ▓ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  ▓出席/課堂表現(Attendance/Performance)  ▓學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演  (Products/Creative Performance)  □其他(Others) | | 進階數理及專業知識能力 Advanced mathematical and professional knowledge and ability | □ | □ | ▓ | □ | □ | ▓紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 觀測模擬及分析推理能力 Observation simulation and analysis of reasoning ability | □ | □ | □ | □ | ▓ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  ▓實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  ▓學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 電腦及程式語言運用能力Computer and programming language proficiency | □ | □ | □ | ▓ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  ▓實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 國際視野與語文溝通能力 International perspective and language communication skills | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | 專業倫理及服務學習之能力 Professional ethics and service-learning ability | □ | □ | □ | □ | □ | □紙筆測驗/會考(Test/Exam)  □作業練習(Assignments)  □口頭報告/口試(Presentation/Oral Exam)  □專題研究報告(書面)  (Research Report(printed on paper))  □實作/實驗(Practices/Experiments)  □出席/課堂表現(Attendance/Performance)  □學習檔案評量(Portfolios Assessment)  □自我評量/同儕互評  (Self-Assessment/ Peer Assessment)  □作品/創作展演(Products/Creative Performance)  □其他(Others) | | | |