Technion – Israel Institute of Technology – Faculty of Architecture and Town Planning

עקרונות אקולוגיים למתכננים
Ecological Principles in Planning

Course number: 02070041
Assoc. Prof. Daniel Orenstein

Language of Instruction: English
Sundays, 10:30-13:20
404 Sego Bldg.

ABSTRACT

The goal of this course is to build a strong **scientific foundation of ecological principles** most relevant for the fields of landscape architecture and urban and regional planning and provide students with **tools and examples for applying those principles**. The course begins by considering the role of humans in nature. We then consider the extent of human impact on global and local environment, looking particularly at loss of biodiversity and ecosystem services, proliferation of invasive species, and anthropogenic climate change. The students are then presented with a range of ecological theories and paradigms that should be considered and applied in planning and design to prevent, mitigate or reverse negative ecological impacts of development. We consider how ecological impact is measured spatially and critically assess the strengths and weaknesses of such measurements. Throughout the course, students examine multiple case studies of planning and design to learn how ecological concepts and principles have been applied.

מטרת הקורס היא בניית תשתית מדעית חזקה של עקרונות אקולוגיים רלוונטיים לאדריכלות נוף ולתכנון ערים ואזורים ולהקנות לסטודנטים כלים ודוגמאות ליישום עקרונות אלה. הקורס מתחיל בדיון על מקומם של בני האדם בטבע. נבחון את מידת ההשפעה של בני האדם על הסביבה הגלובלית והמקומית תוך התייחסות לאובדן מגוון ביולוגי ושרותי המערכת האקולוגית, התפשטות של מינים פולשים, ושינוי אקלים. הסטודנטים ילמדו תאוריות ופרדיגמות שניתן יהיה להשתמש בהן בתכנון ועיצוב הנוף על מנת להקטין, לטפל או לשקם את ההשפעות השליליות של פיתוח פיזי של הנוף. הסטודנטים ילמדו מדדים מרחביים של ניטור מערכות אקולוגיות וישקלו את החוזקות והחולשות של אותם מדדים. במהלך הקורס, הסטודנטים יבחנו סיפורי מקרה רבים של תכנון ועיצוב כדי ללמוד כיצד העקרונות האקולוגיים יושמו בפועל.

LEARNING OBJECTIVES

- The student will be able to identify and characterize the major global and regional ecological challenges relevant to planners, architects, and landscape architects.
- The student will understand how biodiversity and ecosystem services play a critical role in human wellbeing.
- The student will be able to convey ecological design principles to practitioners and the theories and empirical science that underlie those principles.
- The student will be able to demonstrate their proficiency in the subject by presenting and critiquing design and planning projects that purport to advance ecological principles.

- הסטודנט יוכל לאפיין ולהסביר אתגרים אקולוגיים בהקשר לתכנון ופיתוח מרחבי
- הסטודנט יבין את התפקיד של מגוון ביולוגי ושרותי המערכת האקולוגית בקיום האדם ורווחתו
- הסטודנט יוכל לתאר את ההנחיות למתכננים ומעצבים הנגזרים מאקולוגיה ולהסביר את העקרונות האקולוגיים התומכים בהם.
- הסטודנט יישם את הידע שלו במקרי בוחן מקומיים ובינלאומיים בעיצוב נוף ותכנון

EXPECTATIONS AND GRADING

Final Oral Exam	30%
Quiz on reading material	25%
Participation	25%
Presentation of article in class (7-minutes)	20%

מבחן בעל פה	30%
בוחן על חומר קריאה	25%
השתתפות פעילה ונוכחות	25%
הצגה מאמר בכיתה (7 דקות)	20%

Course Topics

- Conceptual frameworks for understanding human-nature interactions
- Human impact on global ecological systems
- Different approaches to ecology (landscape, ecosystem, conservation) and their implications for planning
- Ecological principles: Island biogeography, evolution, species extinctions, ecosystem engineering, meta-population theory
- Spatial indices: edges, patch size, and patch distribution
- Ecological assessment frameworks
- The role of planning and design in nature conservation
- Nature-based solutions and blue-green infrastructures

נושאי הלימוד

- מסגרות רעיוניות להבנת יחסי אדם וטבע
- ההשפעה האנושי על אקולוגיה הגלובלית
- גישות של אקולוגיית הנוף, אקולוגיה של מערכות ואקולוגיה של שמורות טב והשלכות לתכנון
- עקרונות אקולוגיים: ביוגיוגרפיה של איים, אבולוציה, הכחדת מינים, הנדסת מערכות אקולוגיות, תאוריית "meta-populations"
- התפקיד של המתכנן והמעצב בשמירה על הטבע
- מדדים מרחבים: קצבות, גודל ופיזור כתמים
- מסגרות להערכת השפעה אקולוגית
- פתרונות מבוססי טבע, תשתיות כחול-ירוק

Course Schedule *(Special notice for 2024-2025 – considering national and international circumstances, the schedule may change without prior notice. The instructor will keep the students updated with the most recent information at all times)*

Note: "required readings" denote required reading for all students; "optional readings" (in italics) denotes a reading that will be assigned to one or two students for presentation in class; all students must complete one recommended reading and present the paper in class.

Date and topic	Required readings	Optional readings
Meeting 1 – 10 November **Human impact on the planet and the role of planners and architects**		
Meeting 2 – 17 November **Ecological objectives I: Biodiversity other global sustainability challenges**	*גרוסברד ש, רנן א. (עורכים). 2024. דו"ח מצב הטבע – 2023. כרך המגוון הביולוגי. המארג – התכנית הלאומית להערכת מצב הטבע. מוזיאון הטבע ע"ש שטיינהרדט, אוניברסיטת תל אביב. עמ' 64-18 (תקציר ופרק "המגוון הביולוגי בישראל).* *Richardson et al. 2023. Earth beyond six of nine planetary boundaries. Sci. Adv. **9**, eadh2458.*	*Folke et al. 2021. Our future in the Anthropocene biosphere. Ambio. 50:834-869* *Ceballos et al. 2017. Biological annihilation via the ongoing sixth mass extinction signaled by vertebrate population losses and declines. PNAS. 114 (30) E6089-E6096* *Bennett, E.M., et al. 2016. Bright spots: seeds of a good Anthropocene. Frontiers in Ecology and the Environment. 14(8): 441–448,* *Tilman et al. 2017. Future threats to biodiversity and pathways to their prevention. Nature. 546:73-81.*
Meeting 3 – 24 November **Ecological objectives II: Regulating services and ecosystem integrity**	*DeGroot et al. 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. Ecological Complexity. 7 (2010) 260–272.* *McPhearson et al. 2015. Resilience of and through urban ecosystem services. Ecosystem Services. 12:152-156.*	*Sutherland et al. 2018. Undervalued and under pressure: A plea for greater attention toward regulating ecosystem services. Ecological Indicators* *Wu. 2013. Landscape sustainability science: ecosystem services and human well-being in changing landscapes. Landscape Ecology. 28:999-1023* *Windhager et al. 2010. Toward Ecosystem Services as a Basis for Design. Landscape Journal. 29(2):107-123.* *Corinovis and Geneletti. 2019. A framework to explore the effects of urban planning decisions on regulating ecosystem services in cities. Ecosystem services. 38:100946* *Babi Almenar et al. 2018. Integration of ecosystem services into a conceptual spatial planning framework based on a landscape ecology perspective. Landscape Ecology. 33:2047-2059.* *Müller. 2005. Indicating ecosystem and landscape organization. Ecological Indicators. 5:280-294.*
Meeting 4 – 1 December **Ecological objectives III: Provisioning and cultural services**	*Nassauer, 1995. Messy Ecosystems, Orderly Frames. Landscape Journal 14(2):161-169*	*Zimroni et al. 2017. בין תרבויות של טבע לקהילות של ידע: ידע מקצועי וידע מקומי בתפיסת נופי יערות הכרמל. Israeli Sociology. 2017.* *Misgav and Amir. 2001. Integration of Visual Quality Considerations in Development of Israeli Vegetation Management Policy. Environmental Management. 27(6):845-857.* *Depietri and Orenstein. 2020. Managing fire risk at the wildland-urban interface requires reconciliation of tradeoffs*

		between regulating and cultural ecosystem services. Ecosystem Services. 44:101108. *Ahern et al. 2014. The concept of ecosystem services in adaptive urban planning and design: A framework for supporting innovation. Landscape and Urban Planning 125(2014):254-259*
Meeting 5 – 8 December **Ecological Campus Planning (campus tour)**	*Orenstein et al. 2019. Utilizing spatial and landscape planning to promote ecological conservation on a university campus. International Journal of Sustainability in Higher Education* *Or* *עקרונות וכלים, טרופין וחב', 2016. לתכנון וממשק אקולוגי אוניברסיטאיים בקמפוסים והמלצות לטכניון, הטכניון*	
Meeting 6 – 15 December **Ecological concepts for designers and planners I: Changing discourse**	*Buizer, Elands, and Vierikko. 2016. Governing cities reflexively—The biocultural diversity concept as an alternative to ecosystem services, Environmental Science & Policy, 62:7-13,*	*Artmann. 2023. Human-nature resonance in times of social-ecological crisis – a relational account for sustainability transformation. Ecosystems and People, 19(1).* *Beery, et al. 2023. Disconnection from nature: Expanding our understanding of human–nature relations. People and Nature, 5, 470–488.* *Roman, et al. 2021. Beyond 'trees are good': Disservices, management costs, and tradeoffs in urban forestry. Ambio, 50(3), 615–630.*
Meeting 7 – 22 December **Ecological concepts for designers and planners II: Ecosystem theory, island biogeography, metapopulation theory, ecosystem flows and states**	*Pulliam and Johnson. 2002. Ecology's New Paradigm: What Does It Offer Designers and Planners? Chpt 3 in Johnson, B.R. and K. Hill (eds.) Ecology and Design: Frameworks for Learning. Island Press, Washington.* ***51-84****.*	*Chetkiewicz et al. 2006. Corridors for Conservation: Integrating Pattern and Process. Annual Review of Ecology, Evolution and Systematics. 37:317-342* *Corry and Nassauer. 2005. Limitations of using landscape pattern indices to evaluate the ecological consequences of alternative plans and designs. Landscape and Urban Planning 72:265-280.* *Fahrig. 2003. Effects of Habitat Fragmentation on Biodiversity. Annual Review of Ecology and Evolution and Systematics. 34:487-515.* *Collinge. 1996. Ecological consequences of habitat fragmentation: implications for landscape architecture and planning. Landscape and Urban Planning. 36:59-77* *Ahern. 2005. Integration of landscape ecology and landscape architecture: an evolutionary and reciprocal process. Pp. 311-319 in Wiens, J.A. and M.R. Moss (eds), Issues and Perspectives in Landscape Ecology, Cambridge University Press*
Meeting 8 – 5 January **Ecological concepts for designers and planners IV: Nature-Based**	*Milovanovic et al. 2020. Eighty-year review of the evolution of landscape ecology: from a spatial planning perspective. Landscape Ecology. 35:2141-2161.*	*Kolokotsa et al. 2020. On the impact of nature-based solutions on citizens' health and wellbeing. Energy and Buildings. 229:110527*

Solutions and Green Infrastructures	*Frantzeskaki et al. 2019. Nature-Based Solutions for Urban Climate Change Adaptation: Linking Science, Policy, and Practice Communities for Evidence-Based Decision-Making. BioScience. 69(6):455-466.*	*Soga et al. 2021. Impacts of the COVID-19 pandemic on human-nature interactions: Pathways, evidence and implications. People and Nature. 3:10201.* *Pamukca-Albers et al. 2021. Building green infrastructure to enhance urban resilience to climate change and pandemics. Landscape Ecology. 36:665-673.*
Meeting 9 – 12 January **Ecological concepts for designers and planners V: Spatial indicators and impact assessment**	*האיגוד הישראלי של אדריכלי הנוף. 2019. כלי מדידה לאדריכלות נוף מקיימת, עקרונות למדידה. www.land-arch.org.il*	*Leitão and Ahern. 2002. Applying landscape ecological concepts and metrics in sustainable landscape planning. Landscape and Urban Planning. 59:65-93.* *Ries et al. 2004. Ecological Responses to Habitat Edges: Mechanisms, Models, and Variability Explained. Annual Review of Ecology, Evolution and Systematics. 35:491-522* *Hunter and Hunter. 2008. Designing for Conservation of insects in the built environment. Insect Conservation and Diversity. 1:189-196.* *Yoffe et al. 2022. Towards sustainability evaluation of urban landscapes using big data: a case study of Israel's architecture, engineering and construction industry. Landscape Research. 47(1):49-67.*
Meeting 10 – 19 January **Applying Ecological Principles in Planning and Design in Real Life**	*No mandatory readings*	
Meeting 11 – 26 January **21st Century Ecology; Movie and Discussion + Quiz**	*Quiz on readings*	*Vijayaraghavan. 2016. Green Roofs: A critical review on the role of components, benefits, limitations and trends. Renewable and Sustainable Energy Reviews. 57:740-752* *Goddard et al. 2009. Scaling up from gardens: biodiversity conservation in urban environments. Trends in Ecology and Evolution. 25(2):90-98.* *Forman and Collinge. 1997. Nature conserved in changing landscapes with and without spatial planning. Landscape and Urban Planning. 37:129-135.* *Blanchart et al. 2018. Towards an operational methodology to optimize ecosystem services provided by urban soils. Landscape and Urban Planning. 176:1-9* *Kowarik et al. 2016. Biodiversity functions of urban cemeteries: Evidence from one of the largest Jewish cemeteries in Europe. Urban Forestry and Urban Greening. 19:68-78.* *Paker et al. 2014. The effect of plant richness and urban garden structure on bird species richness, diversity and community structure. Landscape and Urban Planning. 122:186-195.*
Meeting 12 – 4 February **Final meeting – TBA**	*No mandatory readings*	
Meeting – Finals - TBA		