Urbanization, Biodiversity, and Ecosystem Services in Norway: Challenges and Strategies for Sustainable Land Use

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Abstract
Urban areas are complex systems where urbanization affects vegetation and land use, leading to biodiversity loss and fragmented green-blue spaces. Understanding urban biodiversity is essential for maintaining ecosystem services (ES), but assessing land-use changes remains difficult. There's growing interest in restoring and integrating nature into cities to support climate regulation, food production, recreation, health, and more. In Norway, "Area neutrality" (Arealnøytralitet) promotes a municipal land-use management system that prioritizes nature protection in urban development and extends the net-zero philosophy to nature loss. This article explores how urbanization in Norway impacts biodiversity and ES, and which planning tools can help bridge science and policy to address land-use and climate challenges. It emphasizes the need for local knowledge, citizen science, and policies to better integrate ES into urban planning.

Introduction

Nature is essential for human existence and good quality of life but is not often distributed equally across space and time and among different segments of society. There are often trade-offs in the production and use of nature's contributions (IPBES, 2019). The negative trends in biodiversity and ecosystem functions are projected to continue or worsen in many future scenarios in response to indirect drivers such as rapid human population growth, unsustainable production and consumption. According to Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) societal goals, including those related to food, water, energy, health and human well-being for all, mitigating and adapting to climate change and conserving and sustainably using nature, can be achieved in sustainable pathways through the rapid and improved deployment of existing policy instruments and new initiatives that more effectively enlist individual and collective action for transformative change.

Biodiversity creates the unique variety of life on our planet that provides multiple benefits derived from ES, such as clean air and water, food, health and recreation. Nature is as important for our mental and physical wellbeing as it is for our society's ability to cope with global change, health threats and disasters (EC, 2020). Nature is in crisis. Anthropogenic land use, resource overuse, climate change, pollution, and invasive species have eroded biodiversity, pushing many species toward extinction. Wildlife populations have dropped 60% in the last four decades, with nature in steep decline globally. *Global Assessment Report on Biodiversity and Ecosystem Services* (IPBES, 2023) identified land-use change as the first direct driver of biodiversity loss for terrestrial and freshwater ecosystems, and sea-use change as the second direct driver for marine ecosystems.

Urban areas are dynamic and complex landscapes, where urbanization effects on vegetation are influenced by socio-ecological processes across multiple scales (Ernstson et al., 2008). Urban areas have become increasingly important for ecosystem services (ES) and biodiversity management as more than 50% of the world's population now lives in cities; a share that is estimated to reach 70% by 2050 (UN DESA, 2009). Under current processes of densification of urban areas, the alteration in land use is likely to be a major driver of changes in the distribution of ES (Eigenbrod et al., 2011). Sustainable urban development strives for an optimal relationship between built (grey) and green infrastructure. Increase of buildings, roads, and industrial areas often corresponds to the increase of impervious surfaces and decrease of green areas. The combined effect of increasing population and loss of permeable surfaces is likely to result in greater and more frequent floods and also loss of habitat for biodiversity due to fragmentation of natural habitats and drastic and persistent alteration of habitats (Ahrne et al., 2009). Further, the delivery of urban ecosystem services (ES) depends on the spatial structure of ecosystems (Alberti, 2005). The TEEB-Report for Cities (TEEB, 2010) suggests that ES could be used as a tool; thus, cities can make positive changes, saving municipal costs, strengthening local (green) economies, enhancing quality of life and securing livelihoods. There is renewed interest in reconnecting, restoring, and designing nature into the built environment to provide a wide suite of benefits for urban residents, infrastructure, and economies, which

include climate-change regulation, local food production, recreation, human health, and many other benefits. Many recent reports, (e.g.IPBES, 2023, the World Economic Forum,2022), have emphasized the importance of such an approach and encourage the implementation of nature-based solutions around the world. There is a need to develop place-based empirical knowledge, citizens' science and to define appropriate measures/policies for better integrating generation of ES into spatial planning (Kaczorowska et al., 2015).

Area neutrality

In Norway, "Area neutrality" (Arealnøytralitet) is promoted as a municipal land use management system that prioritizes the protection of nature in urban development (McCormack et al., 2022). This framework calls for first avoiding nature destruction, then reducing nature loss, and finally "replacing" natural lands that are developed for human use by restoring other areas. In effect, it extends the net-zero philosophy to the loss of nature.

Current research on nature and land use management emphasizes the need for holistic strategies that integrate ecological, social, and spatial planning considerations. This approach recognizes that biodiversity loss and ecosystem degradation are complex issues requiring collaboration across multiple fields, such as ecology, urban planning, environmental policy, and sociology as well as involving and mainstreaming to stakeholders at various levels. Institutional innovation can ensure more involving urban transformations (Nilssen & Hanssen, 2022). The complexity of today's societal challenges, such as political and economic instability, threat of war, climate change, loss of nature and alienation to nature, requires a greater ability for coherent thinking, reflection and a unified political direction. There is the importance of coordinating natural, technological, and socio-economic systems when designing, planning, and managing urban nature-based solutions to enable optimal social-ecological outcomes (McPaerson et al., 2022). Overall, interdisciplinary research underscores the need for comprehensive strategies where ecological preservation, policy design, and community development intersect to achieve sustainable land use and biodiversity conservation.

In the context of Norwegian urbanization, this paper presents how systems-based, interdisciplinary planning approaches—leveraging area neutrality, ecosystem services, and participatory methods—can bridge the science–policy gap to address land use, biodiversity loss, and climate adaptation.

References

Alberti, M. (2005). The effects of urban patterns on ecosystem functions International Regional Science Review 28(2) 168–192

Convention on Biodiversity (2022). United Nations Environmental Programme. https://www.cbd.int/doc/decisions/cop-15/cop-15-dec-04-en.pdf

EC - European Commission (2020). Biodiversity strategy for 2030. Retrieved from https://op.europa.eu/en/publication-detail/-/publication/31e4609f-b91e-11eb-8aca-01aa75ed71a1

IPBES (2019). Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio E.S., H. T. Ngo, M. Guèze, J.Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany.

IPBES (2023) *Spatial planning and connectivity assessment.* The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services´Report. URL: https://www.ipbes.net/spatial-planning-assessment

Kaczorowska A, Kain J-H, Kronenberg J, Haase D (2015). *Ecosystem services in urban land use planning: integration challenges in complex urban settings – case of Stockholm*. Ecosystem Services URL: http://dx.doi.org/10.1016/j.ecoser.2015.04.006

Klima- og Miljødepartementet (2015): Natur for livet - Norsk handlingsplan for naturmangfold. Melding til Stortinget 14 (2015-2016). 156 s.

McCormack, A.A., Foldnes Lunde, L.M., McDowell, J. L., 1 Iqbal, A., Ojee, S., Nowokreschenow, A. (2022). *Area Neutrality: safeguarding urban biodiversity with a new land management framework in Trondheim.* IOP Conf. Ser.: Earth Environ. Sci. 1122 012017

McPhearson TPS, Grimm N, Niemelä J, Elmqvist T, Weber C, Breuste J, Haase D, Qureshi S (2016) Ecology for an urban planet: advancing research and practice towards a science of cities. Bioscience. https://doi.org/10.1093/biosci/biw002

McPhearson, T., E. M. Cook, M. Berbes-Blazquez, C. Cheng, N. B. Grimm, E. Andersson, O. Barbosa, D. G. Chandler, H. Chang, M. V. Chester, and D. L. Childers. 2022. A social-ecological-technological systems framework for urban ecosystem services. One Earth 5(5):505-518. https://doi.org/10.1016/j.oneear.2022.04.007

Miljødirektoratet (2023c): Utrede konsekvenser for naturmangfold - Miljødirektoratet (miljodirektoratet.no) [22.11.2023] https://www.miljodirektoratet.no/ansvarsomrader/overvaking-arealplanlegging/arealplanlegging/konsekvensutredninger/metode-for-utredning/naturmangfold/

Nilssen, M., Hanssen, G. (2022). *Institutional innovation for more involving urban transformations: Comparing Danish and Dutch experiences.* Elsevier Cities, Volume 131. DOI: 10.1016/j.cities.2022.103845

Norges første naturmangfoldregnskap for et kommunalt byggeprosjekt (Asplan Viak Rapport, 2024)

Restaurerbar natur i Nordre Follo (NINA Rapport, 2023)

TEEB (2010). *The Economics of Ecosystems and Biodiversity Ecological and Economic Foundations.* Edited by Pushpam Kumar. Earthscan, London and Washington URL: http://www.teebweb.org/

Trøndelag fylkeskommune (2025). *Faktafredag - befolkningsvekst 2020-2050.* Trøndelag Fylkeskommune [Online] available at: https://www.trondelagfylke.no/vare-tjenester/plan-og-areal/kart-statistikk-og-analyse/nyhetsarkiv-kart-og-statistikk/faktafredag---befolkningsvekst-2020-2050/#:~:text=Vi%20vil%20være%20516%20600,000%20personer%20frem%20mot%202050.) 2025-01-17

United Nations General Assembly (2015). Transforming our world: the 2030 agenda for sustainable development. https://sustainabledevelopment.un.org/post2015/transformingourworld/publication

UN DESA. (2009). *Revision of World Urbanization Prospects*. Retrieved from: http://esa.un.org/unpd/wup/index.htm

Kommunedelplan: energi og klima 2017-2030. [Online] available at: https://www.trondheim.kommune.no/globalassets/10-bilder-og-filer/10-byutvikling/miljoenheten/klima-og-energi/kommunedelplan-energi-og-klima130618.pdf

Mind the gap. [Online] available at: https://oda.oslomet.no/oda-xmlui/bitstream/handle/11250/2831905/2021-107%20EcoGaps%20prosjektark.pdf?sequence=1&isAllowed=y

Area Neutrality: safeguarding urban biodiversity with a new land management framework in Trondheim. [Online] available at: https://iopscience.iop.org/article/10.1088/1755-1315/1122/1/012017/pdf

World Economic Forum; Alexander Von Humboldt Biological Resources Research Institute (2022). Biodivercities by 2030: transforming cities' relationship with nature. [Online] available at: https://www.weforum.org/reports/biodivercities-by-2030-transforming-cities-relationship-with-natu