Emerging Threats to Urban Ecosystems

Stanley MC[1], Beggs JR[1], Bassett IE[2], Burns BR[1], Dirks KN[3], Jones DN[4], Linklater WL[5], Macinnis-Ng CMO[1], Simcock R[6], Souter-Brown G[7], Trowsdale SA[8], Gaston KJ[9]

[1]School of Biological Sciences, University of Auckland, Auckland, New Zealand, [2]Auckland Council, Auckland, New Zealand, [3]School of Population Health, University of Auckland, Auckland, New Zealand, [4]Environmental Futures Centre, Griffith University, Brisbane, Australia, [5]School of Biological Sciences, Victoria University, Wellington, New Zealand, [6]Landcare Research, Auckland, New Zealand, [7]Greenstone Design Ltd, London, UK, [8]School of Environment, University of Auckland, Auckland, New Zealand, [9]Environment and Sustainability Institute, University of Exeter, Penryn, UK

Introduction

Urban ecosystems are under pressure as urbanisation intensifies. Horizon-scanning can identify emerging threats, initiating proactive research and threat mitigation. We undertook a systematic horizon scanning exercise, using a modified Delphi technique to identify emerging threats in urban ecosystems.

Identification of threats

A 'long list' (n = 137 threats) was developed by consulting with a range of experts and stakeholders (n = 67) from a range of organisations. During a 3-day workshop, we individually scored each of the 137 threats, then iterative debate and further individual ranking resulted in a list of ten emerging threats.

Health-associated demands on green space

Promotion of health and exercise in green space is emerging as a threat to urban ecosystems. While increasing numbers of people are encouraged to access nature's health benefits, biota may come under threat from green space design prioritised for human requirements, such as pathways and understorey removal.

Solar cities as ecological traps

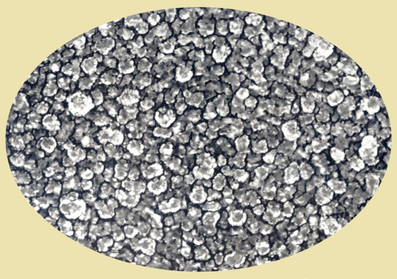
Roofscapes are increasingly being covered with solar panels in cities. However, they could create a massive source of polarized light with unknown effects on populations and food webs. For example, they could act as ecological traps by attracting aquatic insects to false sites that are not suitable for successful reproduction (cf. water bodies).

Scattered cremains

Scattering cremains (human cremation remains) directly into the environment is becoming more common, with aging populations and limited space for burials. Cremains are high in phosphate (47%) and calcium (25%), and intensive, localised input of cremains could breach the nutrient limits of what urban systems can manage.

Toxoplasma

Increasing domestic cat ownership (globally) in cities facilitates disease transmission among urban cats, and from cats to secondary hosts. Population-level impacts of *Toxoplasma gondii* on wildlife remain largely unknown, with emerging evidence of indirect food web effects and disease spill-over to remote ecosystems (e.g. the Arctic).



Nanotechnology

Nanoparticles are becoming ubiquitous in urban environments, associated with a range of human activities. However, the effects of common nanoparticles, such as nano-silver on food webs and ecosystems are unknown. Furthermore, newer nanoparticles, such as graphene oxide, are undergoing massive proliferation with little understanding of likely ecosystem impacts.

Energy efficient homes

House cavities, roof space and walls provide shelter, breeding, and feeding sites for wildlife, particularly bats and birds. To achieve greater energy efficiency, buildings are sealed off from the outside environment, reducing biodiversity via fewer resource opportunities for organisms.
Large scale retrofitting of more energy efficient dwellings is likely to impact urban biota.

Drones – unmanned aerial vehicles

The rapid uptake of drones in cities is likely to result in disturbance events for urban wildlife, particularly for nesting birds. Species which are particularly sensitive to stress and repeated aerial disturbance (e.g. noise, visual presence) may suffer interrupted foraging, disrupted sleep patterns, and nest abandonment or failure.

Switch to LED nighttime lighting

Artificial lighting is changing with the widespread switch to more energy-efficient light-emitting diodes (LEDs). The broadening of the spectrum via LEDs (particularly in the blue parts of the spectrum) means that it will overlap with the spectral sensitivities of a wider range of visual and other biological processes, having a range of ecological effects.

Self-healing concrete

Self-healing concrete is a new material on the cusp of commercialisation, which if successful, may become widespread in urban areas. It prevents cracking and increases the longevity of concrete. However, cracks in footpaths and walls form one of the most distinctive niches in urban environments. Loss of these colonisation sites and habitat opportunities with the introduction of self-healing concrete will decrease urban biodiversity.

Digital mimicry

High-quality digital nature mimicry (e.g. images, recordings) appears to be a cost-effective alternative for obtaining the health and wellbeing benefits of green space given the increasing pressure on urban green spaces. There is a risk of a loss in environmental engagement and appreciation of the value of authentic nature.

Conclusions

The ten threats identified were most commonly associated with rapid advances in technology (e.g. solar panels, LED lights, self-healing concrete) or with the demands of people on urban nature (e.g. green prescriptions). Many of the advances also have environmental benefits. We highlight the emerging risks so research and mitigation strategies can be initiated.

CENTRE FOR BIODIVERSITY AND BIOSECURITY

THE UNIVERSITY OF AUCKLAND
Te Whare Wānanga o Tāmaki Makaurau
NEW ZEALAND

Landcare Research
Manaaki Whenua

UNIVERSITY OF EXETER

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA UNIVERSITY OF WELLINGTON

Griffith UNIVERSITY
Queensland, Australia

Auckland Council
Te Kaunihera o Tāmaki Makaurau

GREENSTONE DESIGN