



ZSL SCIENCE AND CONSERVATION EVENTS

ABSTRACTS

Global land-use change: causes and consequences for biodiversity

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The Meeting Rooms, The Zoological Society of London, Regent's Park, London NW1 4RY

Global land-use impacts on local terrestrial biodiversity

Andy Purvis, Natural History Museum and Imperial College London

Human impacts such as land-use change have elevated global species extinction rates by several orders of magnitude, but their effects on local biodiversity remain unclear; this uncertainty is concerning, given the importance of local biodiversity for many key ecosystem services. Although time-series data provide an obvious window on how diversity is changing, the available data might not adequately sample land-use change and other increases in human pressure. The PREDICTS project (www.predicts.org.uk) instead takes an alternative approach based on spatial comparisons. We have collated the data from over 500 published studies that compare biodiversity at sites varying in the land-use pressures that they face. Using space-for-time substitution, we use mixed-effects modelling to show that the diversity, composition and spatial turnover of assemblages respond strongly to land use and related pressures. We then apply coefficients from our statistical models to maps of current pressures to infer and map the current state of terrestrial biodiversity. The time course of past change is inferred using spatiotemporal estimates of historical pressures. We also estimate the consequences for terrestrial biodiversity over the 21st century of each of the four Representative Concentration Pathways developed by the IPCC. Outcomes vary strongly – both globally and regionally – depending on the choice of scenario. Difficult land-use choices must be made in coming decades as demands for crops, water and infrastructure development intensify. Our analyses show how these choices affect ecological assemblages, with implications for biodiversity and ecosystem services across the world.

Tracking land-use change at multiple spatial and temporal scales

Nathalie Pettorelli, Zoological Society of London

Changes in land use leads to habitat loss and degradation for many species worldwide, being acknowledged as a primary cause of overall biodiversity loss. Understanding how different land uses per se, as well as the level of fragmentation within each land use type, impact species ecology and extinction risk is thus key to develop management solutions that can prevent further loss of wildlife. Satellite data are fundamental to track land cover and land-use change worldwide, being the only monitoring system that guarantees standardized and repeated measures being gathered at the scale of the Earth. In most cases, they represent the only source of information allowing ecologists to explore the mechanisms linking land-use change to biodiversity loss. However, these data also present challenges of their own, which are rarely discussed. In this talk, I will introduce the difference between land cover and land use; detail how these parameters are currently being monitored; and discuss limitations and potential implications for environmental planning and wildlife conservation.

Technology for Nature

Kate Jones, Zoological Society of London and University College London

Wild nature and natural ecosystems are declining rapidly as humans use more of the Earth's resources and change climate patterns. Thanks to the growth of networks of citizen scientists and new sensor technology, such as animal movement tags, camera traps and passive acoustic sensors, scientists studying the impact of anthropogenic change now have access to huge amounts of data about our changing environment and declining wildlife populations. However, analysing these 'big biodiversity data' brings its own challenges. Here I review some of latest advances in sensors used to monitor wildlife and some of the analytical tools being developed to analyse these 'big data' including using citizen scientists to classify wildlife and the development of new automatic recognition tools for wildlife images and sounds. Specifically, I discuss some of my research on automatic image recognition of butterfly images and ultrasonic bat audio recordings. I also discuss new methods that I have developed to estimate animal densities from environmental soundscapes that more fully utilise the information gathered from passive acoustic sensors. I argue that although technological advances have undoubtedly contributed to the over exploitation of natural resources and declines of wild nature, that technology can also help us to better understand the natural world and to further engage people with their environment.

A first-principles approach to understanding the effects of land-use change on biodiversity and ecosystem function

Drew Purves, Microsoft Research Cambridge

Land-use change is a pervasive pressure on biodiversity and ecosystem function worldwide, but its effects are complex, and depend on location and taxa, and the nature, magnitude, and spatial configuration of the land-use change, in ways that we do yet understand. I will briefly outline The Madingley Model, an individual-based mechanistic model of an entire ecosystem, and present some early results documenting how ecosystem structure responds to land-use change, applied alone, or in combination with hunting. As the results show, the response of this complex (albeit virtual!) ecosystem to human pressures can be highly non-intuitive, exhibiting non-linear regime shifts. Sadly, it appears that complexity is no guarantee against collapse.