Remote sensing for conservation science

Satellite remote sensing is changing the way we look at Earth’s biodiversity, as well as how we monitor, assess and protect wildlife and habitats – and IoZ is at the forefront of these developments.

**Societal, economic and scientific interests**

In knowing where biodiversity is, how biodiversity is faring and what can be done to efficiently mitigate further biodiversity loss are at an all-time high. Among the variety of methodologies likely to deliver global monitoring options for capturing and understanding change in biological diversity, satellite remote sensing has been highlighted as displaying considerable potential (Skidmore et al. 2015). Reasons for this include the fact that remote sensing can (1) provide global coverage that spans multiple decades; (2) inform on the loss of biological diversity at a wide range of scales in a consistent, borderless, repeatable and rapid manner; and (3) support a dynamic approach to environmental and wildlife management (Pettorelli et al. 2015).

**Integrating research to map biodiversity**

Researchers at IoZ have been at the forefront of developments in using satellite remote sensing technology for ecological analysis and biodiversity monitoring across spatial scales, and have made major inroads at integrating approaches to provide new insights into the status of biodiversity and the causes and consequences of future change. High-resolution images have been used to map problems associated with oil exploration and exploitation; the response of animals to shifts in resource availability have been analysed and predicted from satellite-based information; and land degradation and fragmentation of ecosystems have been successfully monitored using the unique viewpoint of satellites. Examples of research conducted by our staff and students in this arena include developing a new, highly accurate framework to remotely map artificial water points from space using freely available data and open-source software (Owen et al. 2015), and demonstrating how satellite-derived information on resource dynamics can improve our macroecological understanding of habitat use by species (Duncan et al. 2015). Recently, we also demonstrated the potential for satellite remote sensing-based methodologies to support conservation in data-deficient areas, such as the Sahara (Pettorelli et al. 2016), and shape the next generation of species distribution models (He et al. 2015).

**The global impact of IoZ’s remote monitoring**

The research carried out at the IoZ on the use of Earth observations to inform biodiversity monitoring has clear global impact. Over the past 12 months this work has been featured in *Scientific American*, Mongabay and *Wired*, and our work has played a key role in the development of the Remotely Sensed Essential Biodiversity Variable Framework for the Group on Earth Observations Biodiversity Observation Network. A recent IoZ-led publication (Pettorelli et al. 2016a) has become the reference paper for the 2016 European Space Agency (ESA) funding call on Essential Biodiversity Variables. In 2015 ZSL launched a new open-access journal, *Remote Sensing*...
in Ecology and Conservation, in order to provide a platform for innovative research at the interface of ecology, conservation and remote sensing science.

As satellite data become more accessible, there’s little doubt that space technology will play an increasing role in helping track biodiversity change across the planet. Essential Biodiversity Variable, Natural Capital, Biodiversity Indicator and Ecosystem Service are four concepts that underpin the most popular frameworks currently considered for helping coordinate and structure biodiversity monitoring efforts worldwide, and IoZ is leading the way in terms of understanding how satellite remote sensing can inform these initiatives (Pettorelli et al. 2016b).

The next steps
Priorities for future research include (1) capitalising on the new data made available by NASA and ESA to develop tools and processes that better track anthropogenic pressures to biodiversity, particularly in desert ecosystems; (2) demonstrating how satellite data can be used to inform the Red List of ecosystems; and (3) exploring how satellite data can help interpret and predict changes in the Living Planet Index.

References