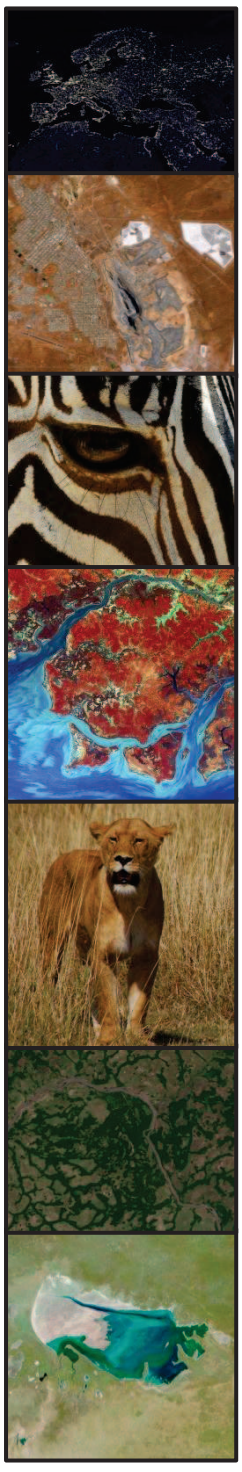
symposium

ZOOLOGICAL SOCIETY OF LONDON
REGENTS PARK, LONDON, NW1 4RY

22 and 23 May 2014

REMOTE SENSING FOR CONSERVATION: USES, PROSPECTS AND CHALLENGES

ABSTRACTS



Photos: www.earth-observation.org ; visibleearth.nasa.gov

Organised by

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Martin Wegmann, University of Wurzburg & DLR;
Woody Turner, NASA

Specifically:

1) The Global Millennium Coral Reef Map, developed with NASA support using over 1,200 Landsat images, is available through the UNEP WCMC (http://data.unep-wcmc.org/datasets/13). It provides users with a simple GIS-format basemap of geomorphological features useful to understand the spatial distribution of resources in shallow coral environments. Our next steps need to include developing the technology to map habitats using higher spatial resolution imagery, such as from DigitalGlobe's World-View 2 (2 meter resolution) and other such sensors.

2) Global assessments of coral reef stress due to high temperature events are deployed operationally by the Coral Reef Watch program (http://coralreefwatch.noaa.gov; US NOAA NESDIS); we can now use these products to evaluate changes in biodiversity of coral reef communities over the past two decades. These products are an example of the applicability of global satellite data products to understand local impacts of large-scale change.

3) Oceanic-scale ecosystem monitoring: Various complementary ocean remote sensing datasets are now available to evaluate physical and biological environmental parameters from local to global scales. These include global time series of temperature, wind, ocean currents, salinity, and ocean color observations. Experimental products help assess primary productivity and phytoplankton functional group distributions in the world's oceans based on satellite ocean color data. As hyperspectral satellite sensors are developed, we will be able to combine these into new dynamic assessments of phytoplankton size classes, functional types, and ecosystem function. We will be able to monitor 'seascapes', similar to how we evaluate terrestrial 'landscapes'. Monitoring seascapes over time will help understand how marine ecosystems are changing. An important focus needs to be the Exclusive Economic Zones of coastal nations.

These examples show that we are ready to develop and implement an operational Marine Biodiversity Observation Network. Particular emphasis on monitoring lower trophic levels seems relevant, since these organisms form the base of the marine food web, play critical roles in global biogeochemistry, and are highly sensitive to ecosystem perturbations both at the bottom and at the top of the trophic structure. Such a system will help protect the livelihoods of coastal communities in the context of the goals of the Future Earth program and of the Intergovernmental Platform on Biodiversity and Ecosystem Services.

14.30 **Benefits of hyperspectral remote sensing for tracking plant invasions**

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Biological invasions are viewed as a significant component of global change and have become a serious threat to natural ecosystems. Concerns for the implications and consequences of successful invasions have stimulated a considerable amount of research aimed at understanding the mechanisms of invasion and providing guidelines for control and management efforts. In this paper, we aim to report what remote sensing can offer for invasion ecologists and review recent progress made in plant invasion research using hyperspectral remote sensing. We review the utility of hyperspectral remote sensing for detecting, mapping, and predicting the spatial spread of invasive species. A range of topics are discussed, including the tradeoff between spatial and spectral resolutions and classification accuracy, the benefits of using time series to incorporate phenology in mapping species distribution, the potential of biochemical and physiological properties in hyperspectral spectral reflectance for tracking ecosystem changes caused by invasions, and the capacity of

hyperspectral data as a valuable input for quantitative models developed for assessing the future spread of invasive species. We found that hyperspectral remote sensing holds great promise for invasion research. Spectral information provided by hyperspectral sensors can detect invaders at the species level across a range of community and ecosystem types. Furthermore, hyperspectral data can be used to assess habitat suitability and model the future spread of invasive species, thus providing timely information for invasion risk analysis. Our review suggests that hyperspectral remote sensing can effectively provide a baseline of invasive species distributions for future monitoring and control efforts. The information collected by sensors on the spatial distribution of invasive species can help land managers to make long-term constructive conservation plans for protecting and maintaining natural ecosystems.

15.00 POSTER SESSION (TEA/COFFEE)

[illegible]

Chair: Jennifer Swenson, Duke University

15.30 **Measuring and monitoring changes in land cover**

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Land use change and habitat degradation must be monitored and measured in order to identify risks and to plan for conservation in the context of increasing population and development pressures. Historically, remotely-sensed data has been an ideal tool for this purpose, combined with expert knowledge and ground truth to train classifiers and to distinguish true patterns and trends from natural variations and errors in classification. The variety of remotely-sensed data is increasing at a spectacular rate, with new suites of sensors offering potentially huge quantities of timely data at a high resolution. Models for interpreting and classifying the data are also advancing, and in some cases are moving from the office or desktop to the Web, allowing models (for example, multispectral classifiers or topographic correction algorithms) to be shared, published and composed into flexible workflows that can be used to carry out truly reproducible science. At the same time, the explosion in citizen science and user-generated content seems very suitable for validation of land use and land cover maps against photographs, textual reports and truly scientific classifications from members of the public. The potential for combining these resources to map the state of the earth and predict environmental outcomes is huge, but there are several challenges, which include: finding useful inputs from a variety of heterogeneous information; ensuring that data and tools will work together; assessing the trustworthiness of data and results; and documenting workflow and provenance. We present some example solutions to these challenges which follow the principles of GEOSS*. Feedback mechanisms can allow users to rate and report on datasets and resources. Interoperability is illustrated with examples of Web-based landcover validation tools which are based on free and open-source software and standards, and support expert / community reporting. A variety of tools are available to gauge and handle uncertainty, and to convey its impact to decision makers, and there are important initiatives underway to standardise the way that the lineage of a dataset can be recorded. We show how these tools can be used to increase the usability of earth observation data by local stakeholders and experts, and can assist in ensuring the best possible recording of landcover change.