REF2021 Impact Case Study: Biodiversity Indicators to inform international policy

In response to the global biodiversity crisis, ZSL's Institute of Zoology (IOZ) and University College London (UCL) developed a suite of science-based metrics that have become globally influential tools for biodiversity assessment and leading indicators of the conservation status of the world's species. These indicators are now used by several United Nations (UN) bodies to measure conservation status around the world. Specifically, they are used to report global biodiversity change and to track progress toward international targets (e.g. Sustainable Development Goals) by intergovernmental bodies. These include the UN's Global Biodiversity Outlook 4 (2014), and 5 (2020); the UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) global and regional assessments (2019); as well as for conservation assessments and planning by national and regional governments and conservation NGOs, for example the World Wide Fund for Nature (WWF), and Environment Canada.

Underpinning research

In 2010, the UN Convention on Biological Diversity Conference of the Parties adopted a set of targets – known as the Aichi Targets – to reduce the loss of biodiversity by 2020. Research undertaken at UCL and IOZ generated global-scale biodiversity indicators that better informed progress towards these targets and are now used routinely by governments and international bodies.

The IUCN Red List, which is based on criteria developed by research at UCL and IOZ, has become a key information source for monitoring the status of global biodiversity. Over 100,000 species have now been assessed using the criteria, but it includes only a small sample of all species and is biased towards well-studied vertebrates. To address these problems, our researchers developed methods to track changes in extinction risk over time and a sampling approach for wider taxonomic coverage of the Red List Index (RLI): the Sampled Red List Index. The research addressed several key challenges, including determining which species groups should be included in the index, identifying minimum adequate sample sizes, and working out how to aggregate and weight the index. The resulting indicator assesses a representative set of species from a broader set of groups than other approaches (including invertebrates and plants) in a time- and cost-effective manner.

The research demonstrated how to accurately apply this technique to a number of new taxonomic groups, including the first global assessment of Reptiles, identifying their global threats and conservation priorities. The researchers further developed a simulation approach to demonstrate that climate change impacts, which are widely considered one of the most important threats to biodiversity, can be accounted for using Red List criteria such as occupied area and population size.

While the RLI records changes in species richness, it is a weak metric of changes in wild species abundance, which is especially important for ecosystem functioning and conservation management. Responding to this weakness, IOZ and UCL researchers developed an aggregated indicator of trends in species population abundances: the Living Planet Index. The underpinning research investigated the statistical methods that could be used to aggregate large quantities of data on trends in wildlife populations and their threats, evaluated potential biases, and examined how the data could be disaggregated (e.g. geographically, taxonomically, regionally, and by thematic area). The LPI now contains over 27,000 population trends for 4,700 species, making it one of the largest databases on wildlife abundance trends in the world, underpinning a suite of research papers investigating wildlife responses to changes in land use, climate, habitat loss and utilisation.

Many conservation assessments require information that is at more local scale and is more easily linked to ecological structure and function. Working with collaborators, UCL researchers developed a third index: The Biodiversity Intactness Index (BII). BII records changes in a local terrestrial site's biodiversity in the face of human land use and related pressures, and now includes 666 studies and 47,044 species (over 2% of all species known to science). The BII indicator is based on novel global models of the impact of land use on local biodiversity.

Details of the impact

Impacts on international policy-making

Establishing international biodiversity baselines and metrics
Our research has underpinned the frameworks for measuring biodiversity of several international treaty organisations and conservation observatories. The LPI and SRLI have both been used to track progress towards meeting the UN Convention on Biological Diversity (CBD) targets in 2014 and 2020. They are quoted by the UN Global Biodiversity Outlook report as authoritative measures of the speed of biodiversity decline, for example in the report's section on progress towards the goals of the Strategic Plan and the Aichi Biodiversity Targets (goal C, improving biodiversity status): *"Two indicators of the state of biodiversity within this goal, the Living Planet Index and the Red List Index, show current declines and an extrapolation of continuing decline to 2020 based on current drivers."* The two indices have also been highlighted as indicators for the post-2020 global target framework. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) has also used the LPI, RLI and BII to quantify trends in biodiversity in its Global Assessment report on Biodiversity and Ecosystem Services. The SRLI has, for the first time, enabled the IPBES to quantify the threat to particular species and families and to communicate these figures in ways that make clear to laypeople the urgency and scale of threat to particular types of plants and animals.

Monitoring and conservation impact
IOZ-UCL research has led to new species-level IUCN monitoring and conservation efforts. As the global authority on the status of the natural world and conservation with over 1,400 member organisations and signatory governments, the IUCN maintains the Red List, the world's most comprehensive index on the extinction risk of animal, fungus and plant species. Revisions and refinements to the Sampled Red List by our researchers has been used to determine the extinction risk of groups such as reptiles, which were not previously represented. This led to the assessment of 1,500 species and their subsequent listing on the IUCN Red List. New IUCN guidelines drawing on this research have also been established for assessing species vulnerability to climate change and this led to the creation of the IUCN climate change impacts modelling group.

All three metrics (LPI, BII, RLI) underpinned the WWF's flagship biennial report, the 'Living Planet Report' in 2016 and 2018. This report has a global reach: it is published in 110 countries and in more than 20 languages, and it is estimated that the press coverage reach was over 100 million people. In the UK, biodiversity loss figures from our indicators found in this report were cited as the impetus for an Early Day Motion on Global Biodiversity in the House of Commons on 31 October 2016. As a result of this debate, 41 MPs signed a motion urging the UK government to tackle the effects of climate change, habitat loss and degradation, species over-exploitation, pollution and animal diseases.

The indicators developed at both UCL and IOZ informed the UN Environment Programme's assessment of the state of the environment, 'Global Environment Outlook 6' (2019) which explained the indices' ability to create a more nuanced and accurate picture of biodiversity and species loss than previous measures.

Influencing regional and national policy-making

Our researchers have undertaken commissioned assessments of biodiversity for a range of thematic groups across the world, including in:
The Arctic: The Arctic Species Trend Index [S7] was commissioned by the Arctic Council and the Conservation of Arctic Flora and Fauna (CAFF), based upon the methodology and dataset developed for the LPI.
European wetlands: The LPI methodology and open-source tools were also used to produce the Wetland Extent Index.
**Rewilding Europe:** Further adaptation of these tools underpinned a Rewilding Europe project on extinction risk and abundance, and was presented in the 'Wildlife Comeback in Europe' report in 2013. This report celebrated successful conservation efforts in 18 mammal and 19 bird species across Europe, and our indicators were used to

assess the impact of these interventions and the lessons that could be learned from them for future projects and policy makers.

Canada: IOZ researchers also developed a series of regional assessments of biodiversity, building upon the methodology and data developed for the global LPI. The Sustainability Directorate, Environment and Climate Change Canada and IOZ researchers collaborated to adapt the LPI methodology to establish the Canadian Species Index. This filled a gap in intelligence on vertebrate population changes across Canada and enabling the measurement of progress towards the Canadian Environmental Sustainability Indicators and the 2020 Biodiversity Goals and Targets for Canada, now used by the Canadian Government to monitor national biodiversity trends.

Australia: In Australia, IOZ researchers collaborated with the nation's Threatened Species Recovery Hub and the University of Queensland to help develop the Australian Threatened Species Index to track wildlife abundance of threatened species there.

UK: The Biodiversity Intactness Index of the UK, developed by UCL researchers, was featured in the UK's 'State of Nature Report' (2016), an annual snapshot of the state of the UK's biodiversity assembled from data from over 50 organisations.
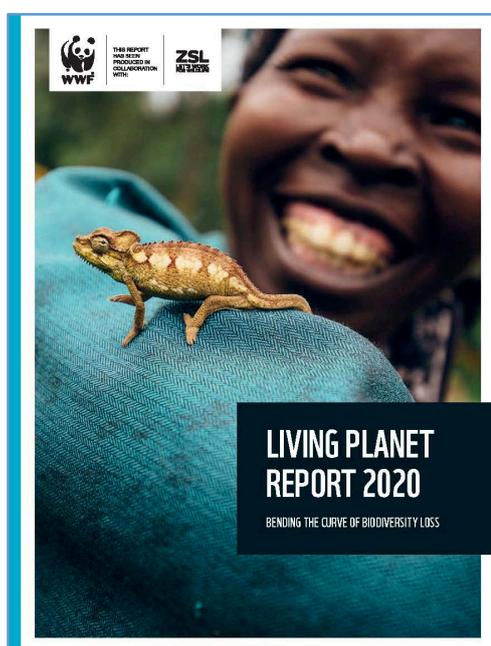
The Living Planet Report 2020

The Living Planet Index was most recently communicated in the Living Planet Report (WWF, 2020).

The report had a press reach of over 100 million people, was released in 110 countries and in more than 20 languages; had 290 million social media mentions including 3560 mentions from monitored global news outlets. The report showed a 68% decline in average relative abundance in almost 21,000 wildlife populations between 1970 and 2016, with particular declines in the neotropics and freshwater habitats.