Light detecting and ranging (LIDAR) is a remote sensing (RS) technology that provides unprecedented information on vegetation height and structure. This ecosystem structure information can be valuable in guiding conservation decisions and to derive Essential Biodiversity Variables (EBVs) that can be used to monitor progress towards Sustainable Development Goal 15: sustainable use of terrestrial ecosystems. LIDAR has also become a key tool for evaluating carbon stocks in procedures aiming at reduction of emissions from deforestation and forest degradation (REDD+).

THE ROLE OF EARTH OBSERVATION FOR ASSESSING AND MONITORING EBVs

Essential Biodiversity Variables (EBVs) were conceived as a means to harmonise disparate biodiversity observations. Thus, a concise set of indicators for monitoring biodiversity change could be obtained from EBVs. RS is becoming key to the assessment of many EBVs because it enables global ecosystem assessments over large inaccessible areas. LIDAR is one type of remote sensor which provides valuable information about ecosystem structure. Its ability to vertically map vegetation canopies sets it apart from other RS technologies. Therefore EBV datasets informed by LIDAR can be helpful for monitoring progress towards Aichi Biodiversity Targets, such as those on reducing habitat loss and enhancing carbon stocks (5 and 15).

LIDAR AND REDD+

LIDAR data can be used for carbon stock baseline assessments and monitoring in the context of REDD+. It can also help to target REDD+ policies and measures to the most carbon-rich forests, whilst LIDAR information from underneath forest canopies can also be used to combat illegal logging.
LIDAR RESOURCES AVAILABLE

- FUSION software (USDA Forest Service).
- R packages: lidR and rLiDAR.
- WWF conservation technology (Melin et al, 2017).
- Natural Resources Canada Best Practices Report (White et al. 2013)
- Further information:
  - Rubén Valbuena (rv314@cam.ac.uk)
  - Will Simonson (will.simonson@unep-wcmc.org)
  - Brian O’Connor (brian.o’connor@unep-wcmc.org)

PATHWAYS TO BIODIVERSITY INDICATORS FROM LIDAR

LIDAR technology can inform EBVs in two ways:
- Direct derivation of morphological traits of ecosystems – vegetation height, density and vertical structure
- Prediction of variables (using LIDAR in conjunction with additional data to calibrate)

Airborne LIDAR provides spatially continuous coverage. This presents opportunities to assess habitat extent, connectivity and fragmentation. Spaceborne LIDAR provides discretely sampled information which is gathered consistently around the world. LIDAR information can also be combined with other remote sensors, such as Landsat imagery or synthetic aperture radar (SAR).

ECOSYSTEM STRUCTURE INDICATORS

LIDAR information can be summarised into components of forest structure:

1. Vegetation height;
2. Vegetation density;

These concise indicators can be produced for large areas and used by stakeholders to incorporate ecosystem structure information in their conservation projects.

SATELLITE MISSIONS & NATIONAL AIRBORNE PROGRAMMES

Many LIDAR datasets are openly available. Upcoming NASA satellite missions (GEDI and IceSAT-2) will acquire global data. Many countries, such as Canada, Finland and Spain, are being scanned through national airborne programmes. These provide a unique opportunity to generate indicators that are globally consistent and develop methods that can be replicated by any stakeholder.