

Global Applications of CSIRO's Biodiversity Modelling Infrastructure

BILBI, CSIRO's biodiversity modelling infrastructure, is used for multi-scale applications: from measuring the local condition of natural habitats in protected areas, to predicting the impact of climate and land use change on ecological communities globally

In an era of rapid global change, we need advanced tools to monitor the state of biodiversity at a spatial resolution that is both capable of capturing essential ecological processes and suited to inform management. BILBI is CSIRO's [Biodiversity modelling Infrastructure for Large scale Biogeographic Indicators](#) developed for this purpose. It is a multi-scale analytical infrastructure that combines biological, environmental, and socio-economic data at a 1km resolution, and can be applied at local through to global spatial extents. The applications of BILBI are numerous (Fig. 1), from monitoring of habitat loss within individual protected areas through to the scenario-based assessments of global biodiversity.

Biodiversity Indicators

Biodiversity indicators are needed to monitor progress towards meeting targets for the global conservation of biodiversity. BILBI has enabled the development of two indicators endorsed by the Convention on Biological Diversity for reporting against Aichi Targets.

The Protected Area Representativeness & Connectedness Indices (PARC) represent the diversity of biological communities within a protected area system (Fig. 2), as well as the level of connectedness of protected areas within the broader landscape. It is used to report on [Aichi Target 11](#). The Biodiversity Habitat Index (BHI) represents the proportion of biodiversity retained within a given area (such as a country or an ecoregion) in relation to the degree of habitat loss, degradation and fragmentation experienced. It is used to report on [Aichi Target 5](#).

Environmental Accounting

Assessing the current status of biodiversity, and how this changes over time, is critical to focus investment towards protection of our natural capital. BILBI is being used to inform environmental accounting by producing maps of the observed impact of human activities on local biodiversity. BILBI has been used for local-scale biodiversity accounting in the [San Martin Province of Peru](#).

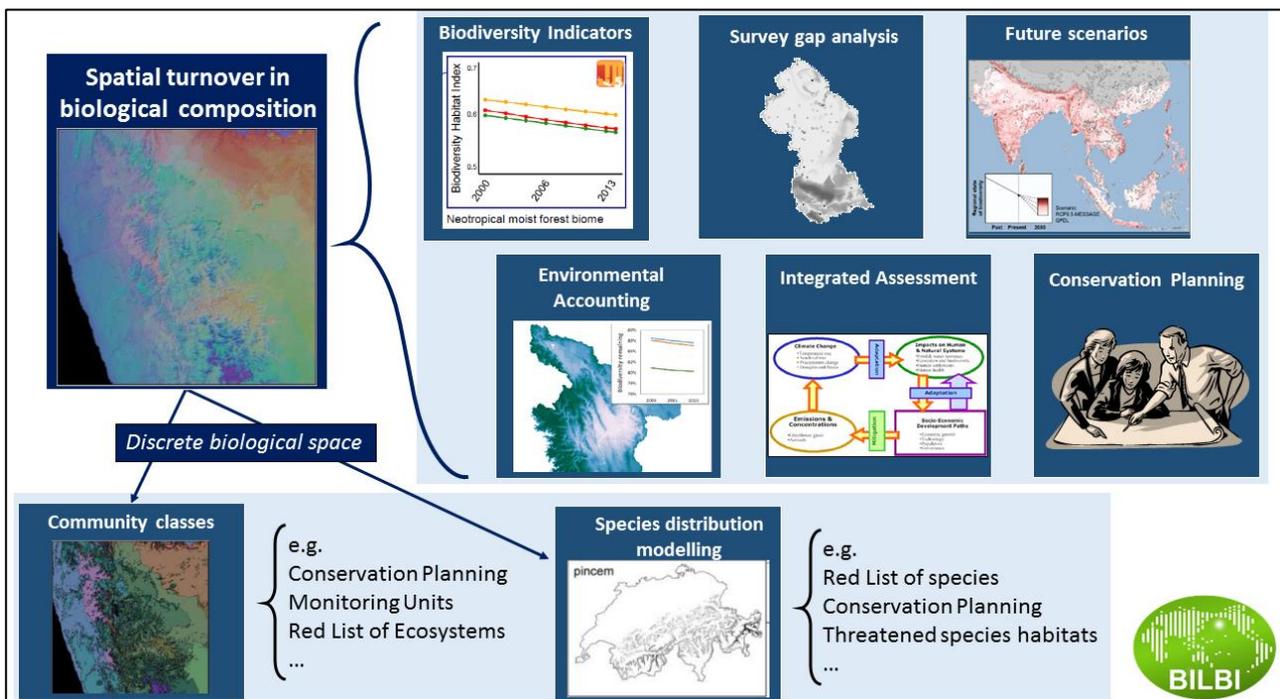


Figure 1 The applications of BILBI across the continuous and discrete biological space.

Impact Assessment

Impact Assessment is an essential tool to estimate the potential impact of industrial activities on the environment and support sustainable development. BILBI enables business and governments around the world to assess the potential impact of planned development on biodiversity. The high-resolution information produced by BILBI allows the assessment of biodiversity risk at a scale directly relevant to decision making.

Future scenarios of biodiversity

Measuring trends in the status of biodiversity is core to our understanding of biodiversity change, and to inform conservation actions to enhance the retention of biodiversity. By combining current distributions of biological communities with future scenarios of land use and climate change, BILBI predicts where environmental change will have the highest impact on biodiversity under future scenarios of socio-economic development and climate mitigation strategies. BILBI is being used to develop scenarios for the [IPBES global assessment](#), which will be of broader relevance within the context of the [UN 2030 Agenda for Sustainable Development](#).

Survey gap analysis

The BILBI infrastructure is being used to derive spatially continuous predictions of plant and animal communities at fine resolutions and over vast regions, including those with large unsurveyed areas. By measuring the difference in species composition between locations that have been surveyed and locations that have not, it is possible to identify which localities are more likely to host unrecorded species. BILBI can be used to design biodiversity surveys in data-poor regions, in a way that maximises records of new species.

Conservation Planning

BILBI supports conservation decision-making at national and international scales, by providing detailed spatial information on areas with higher or lower conservation status with respect to their pristine baseline. BILBI can also help identify areas that host biological communities with low representativeness within the protected areas of a given region. In conservation planning terms, BILBI can be used to estimate the 'vulnerability' and 'irreplaceability' of any defined planning unit (e.g. a 1km grid cell, a water catchment, etc.).

Classifying biological communities

BILBI outputs can be used to predict the difference in species composition between any two locations in a region (i.e. the spatial turnover). Predicted spatial turnover can then be used as a basis for aggregating locations based on their predicted species content, and identifying discrete biological communities. One of the potential applications of this approach is the spatial definition of ecosystems within a region, which can serve to identify units for assessment in the IUCN Red List of Ecosystems. The map of discrete biological communities can also be used to define features of interest (similar to habitat types) for use in conservation planning.

Species distribution modelling

BILBI outputs can be used as a predictor for modelling the distribution of individual species. Species occurrence points are overlaid on the biologically-scaled environments produced by BILBI, and regression used to identify areas of high and low suitability for the species.

[This approach performs better than many standard techniques for modelling species distributions.](#)

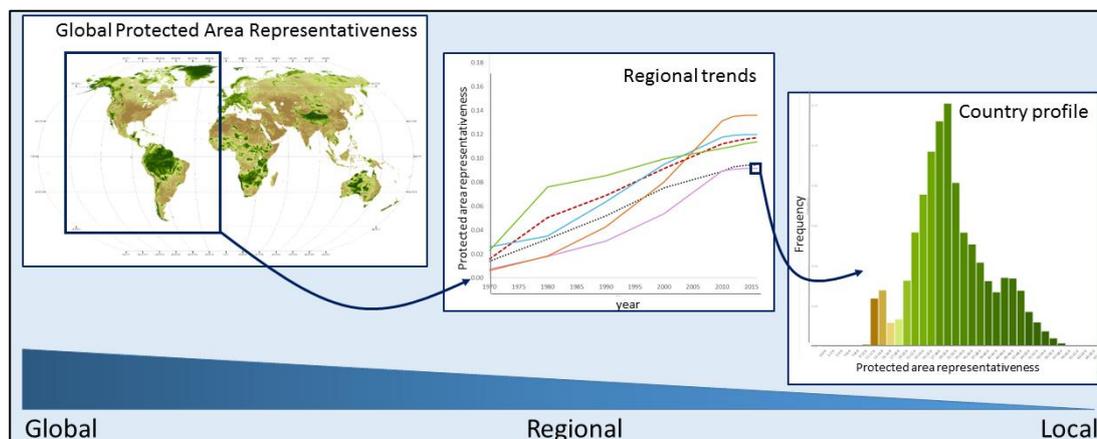


Figure 2 Multi-scale applications of BILBI, from left to right: global representativeness of the protected area system, trends in protected areas representativeness in the Americas, current protection levels in Belize.

CONTACT US

t 1300 363 400
+61 3 9545 2176
e csiroenquiries@csiro.au
w www.csiro.au

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CSIRO Land & Water

Simon Ferrier
t +61 2 6246 4191
e simon.ferrier@csiro.au
w research.csiro.au/macroecologicalmodelling