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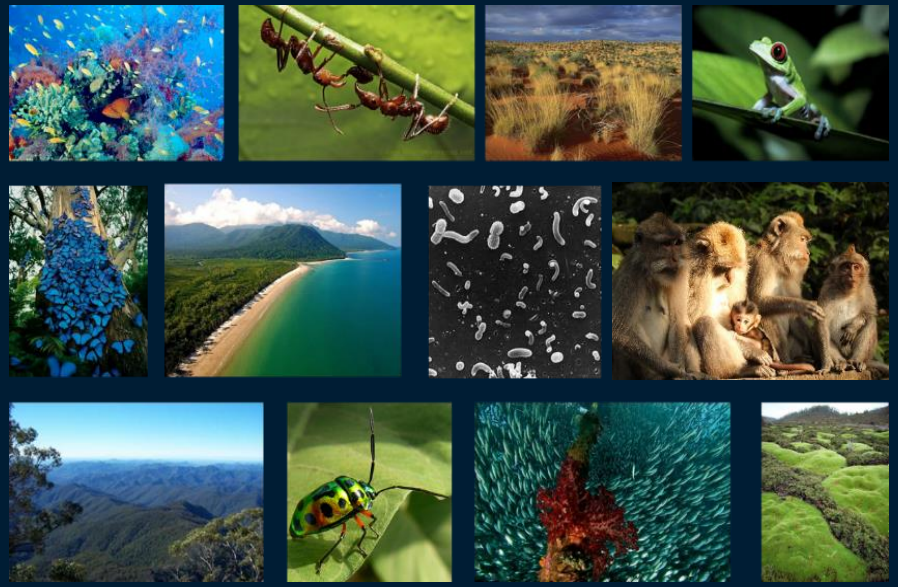
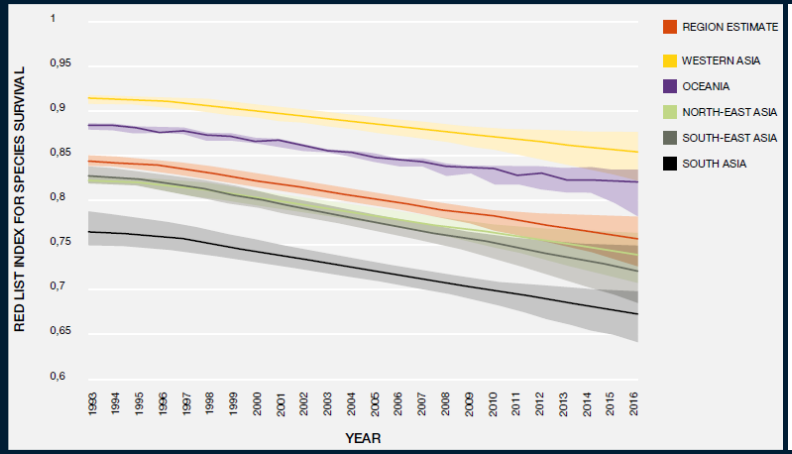
Modelling biodiversity impacts of alternative infrastructure development scenarios

Rebecca Pirzl & Karel Mokany| April 2022

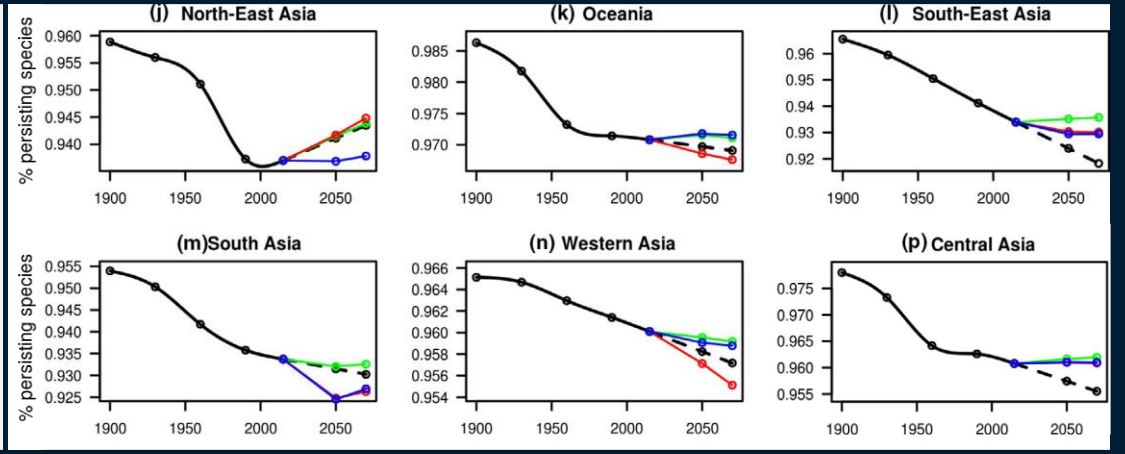
Biodiversity and nature’s benefits to people



Current trends in biodiversity

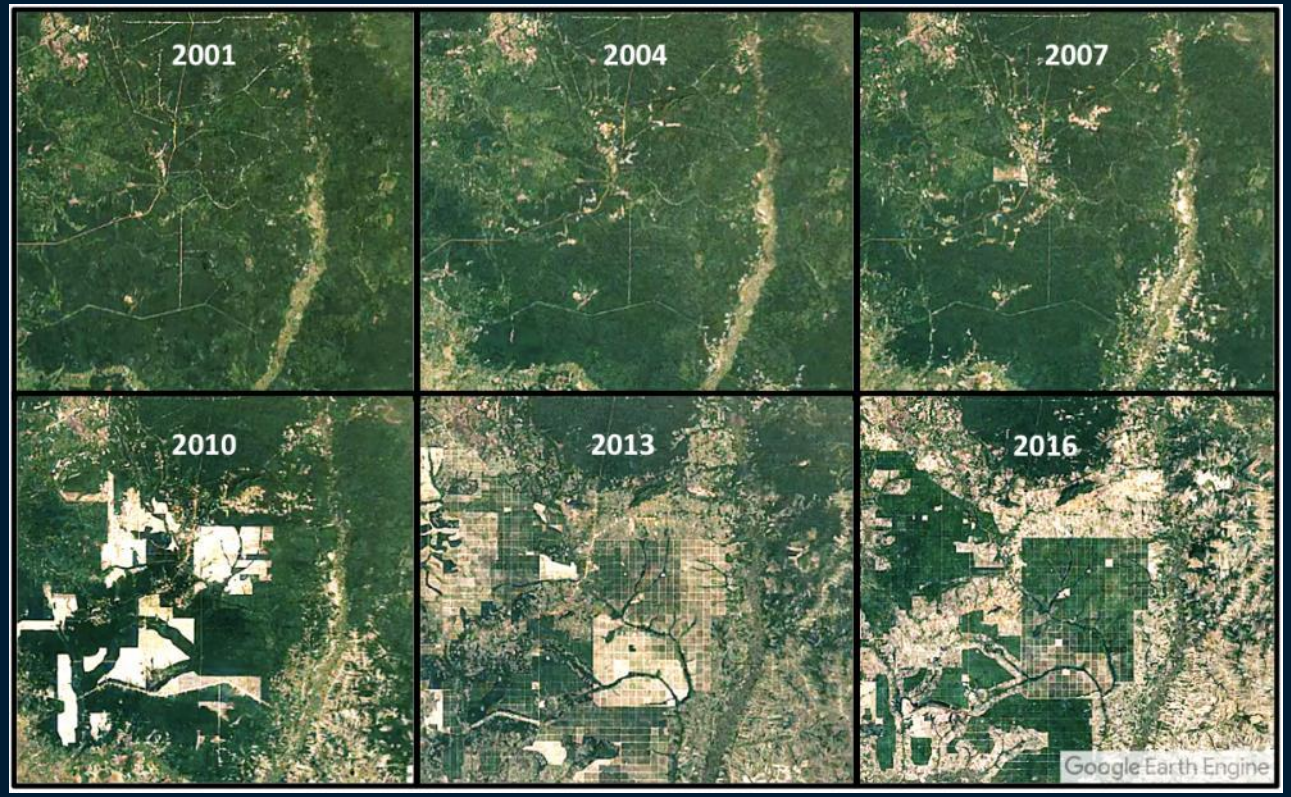


IPBES (2018) The IPBES Regional Assessment Report on Biodiversity & Ecosystem Services for Asia & the Pacific



DiMarco et al. (2019) Global Change Biology, 25: 2763-2778.

Land use change and accumulating impacts



NASA Earth Observatory images for Cambodia, by Joshua Stevens, U.S. Geological Survey and Global Forest Watch.

Common approaches to considering biodiversity

Avoid impacting:

- Listed threatened species

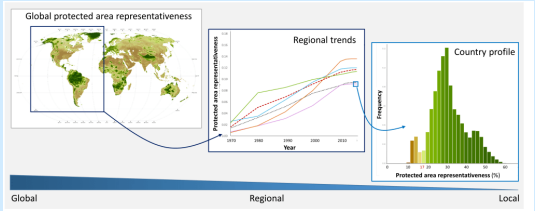
- Protected areas

- Areas of biodiversity importance

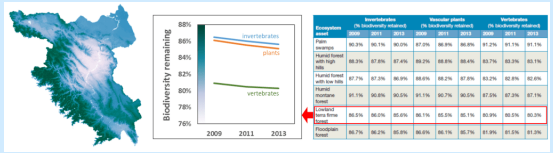
Considering biodiversity more broadly

BILBI – advanced biodiversity assessments

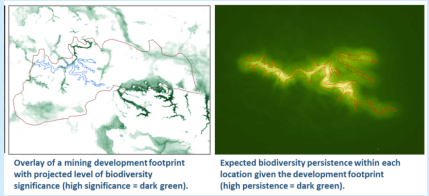
Indicators: tracking progress for biodiversity



Accounts: reporting for nations & enterprises



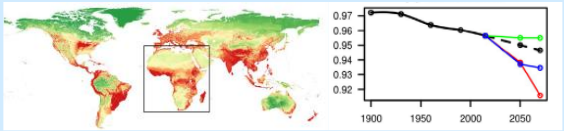
Impact assessment: development & biodiversity



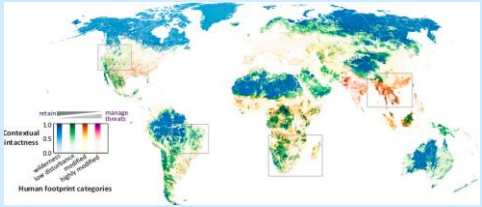
Overlay of a mining development footprint with projected level of biodiversity significance (high significance = dark green).

Expected biodiversity persistence within each location given the development footprint (high persistence = dark green).

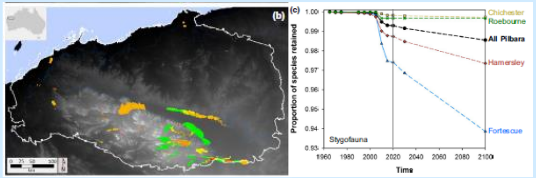
Scenarios: considering alternative futures

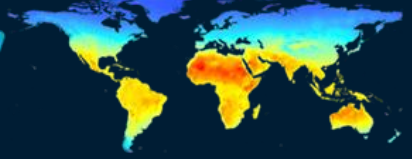


Prioritisation: which areas to retain & restore



Strategic planning and cumulative impacts





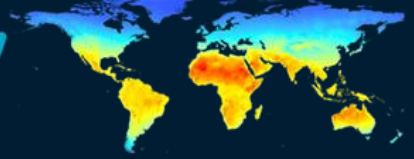
Biological data

More than 300 million records for over 400 thousand species

Modelled spatial distribution of biodiversity

Baseline environmental surfaces

1 km gridded data for terrain, soil, climate etc.



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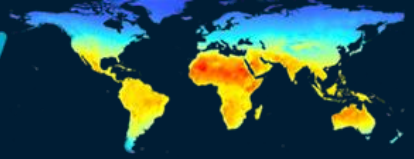
OBSERVED PAST-TO-PRESENT ENVIRONMENTAL CHANGE

Observed change in land use or habitat condition

BILBI

CSIRO



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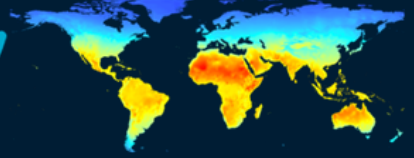
PROJECTED FUTURE ENVIRONMENTAL CHANGE

Projected change in land use or habitat condition



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Observed change in land use or habitat condition

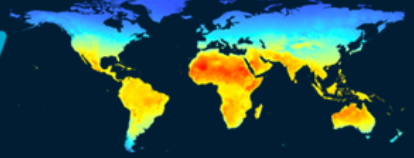
Observed change in protected area coverage

Projected change in land use or habitat condition

Projected change in climate

Modelled outputs showing the estimated consequences of observed or projected environmental change for biodiversity

CSIRO



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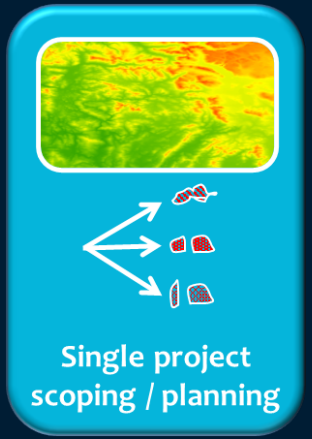
Projected change in climate

Modelled outputs showing the estimated consequences of observed or projected environmental change for biodiversity

CSIRO

BILBI – assessments for developments



Single project scoping / planning

Single project assessment

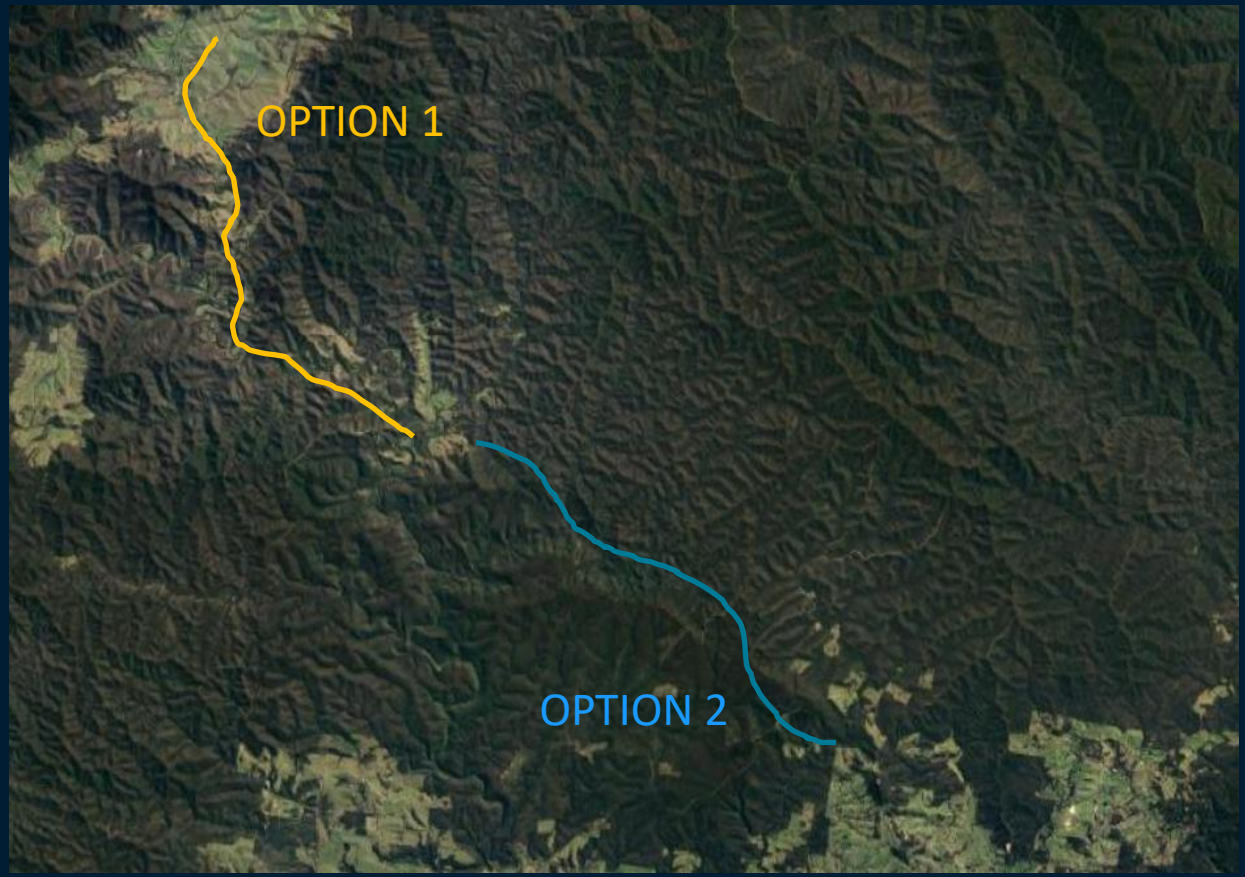
Identify & assess offsetting actions

Portfolio of projects screening

Portfolio impact assessment

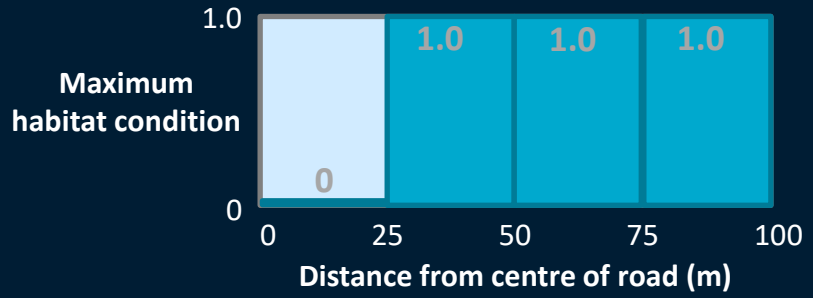
Enterprise-wide accounting (SEEA)

Spatial location of road development

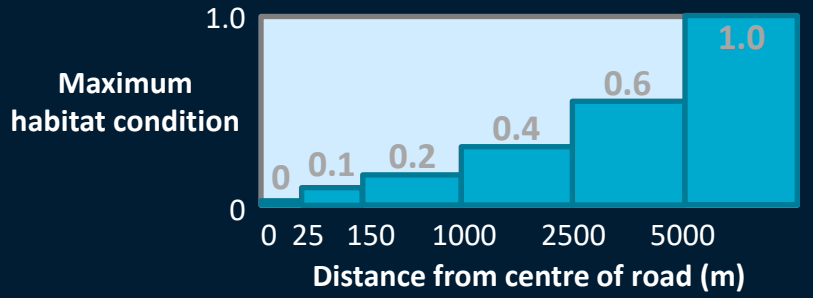


Effect on habitat condition

Direct impacts



Indirect impacts



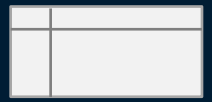
BILBI - assessment

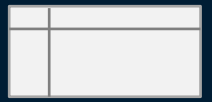
Habitat condition layer
OPTION 1

Habitat condition layer
OPTION 2

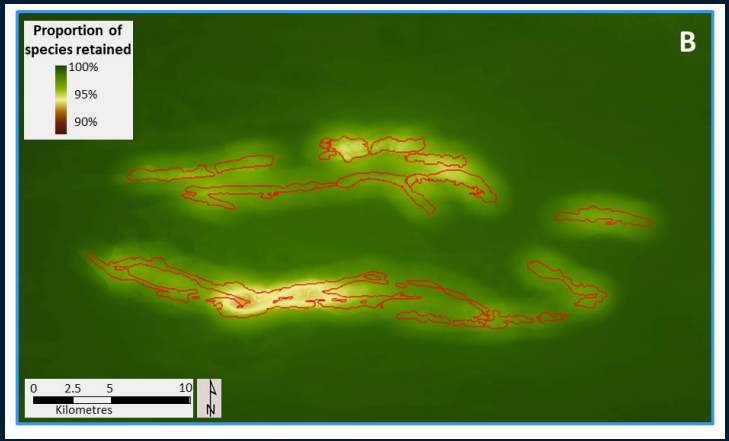
Expected biodiversity patterns

Biodiversity assessment

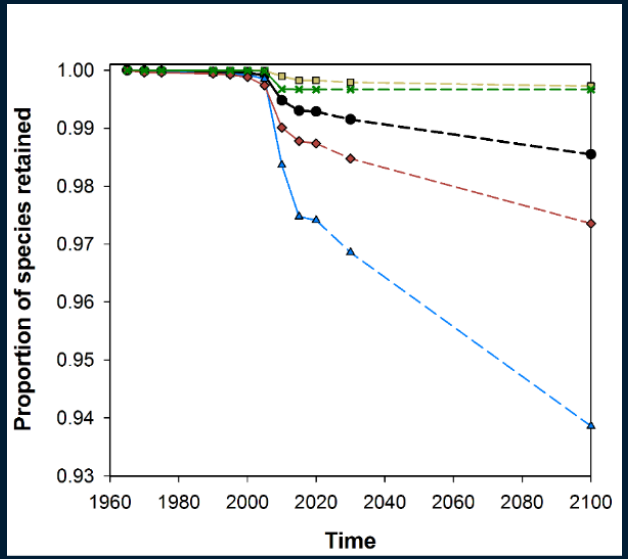




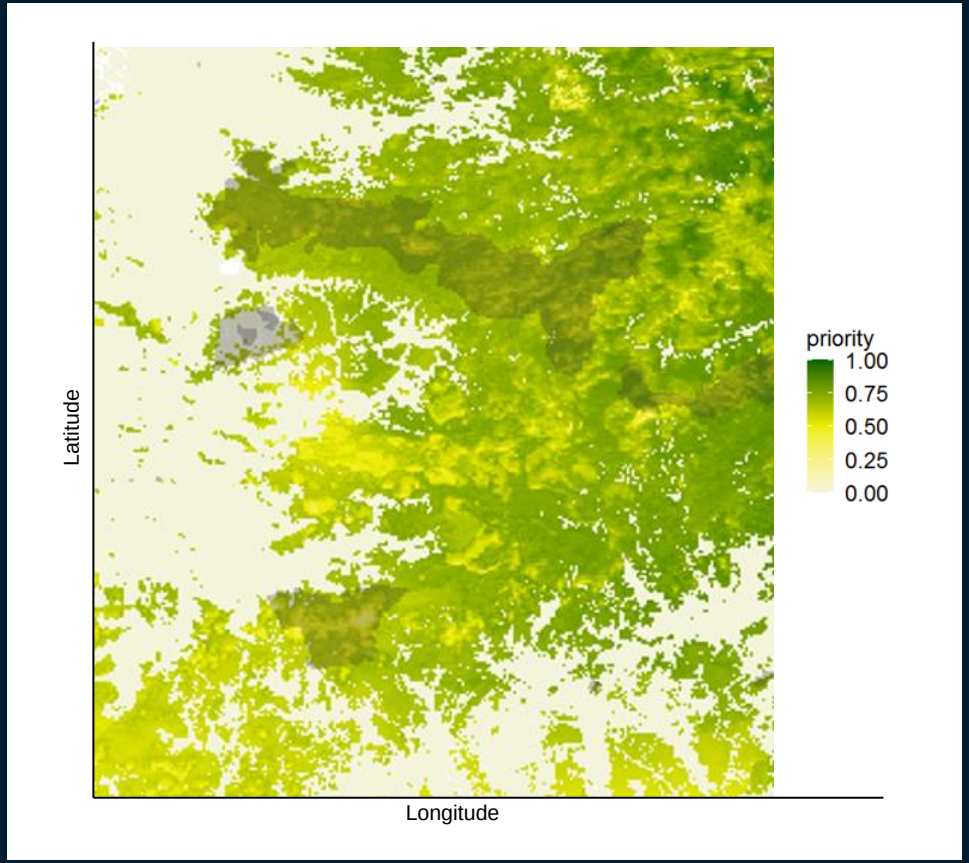
BILBI – visualising impacts



Biological group	Baseline species persistence (%)	Post development species persistence (%)	Change in species persistence	Change in number of species persisting
Invertebrates	71.5385	71.5032	-0.0353	-64.82
Plants	71.9374	71.9003	-0.0371	-3.79
Vertebrates	71.9274	71.8925	-0.0349	-0.51
All	71.7493	71.7145	-0.0348	-67.45



Identifying priority habitat for protection



Benefits for transport infrastructure development

Rapid single project assessment

Easily compare alternatives for a project (e.g. location, configuration)

Ongoing outcome monitoring (for single projects, or multiple projects in combination)

Account for the cumulative impacts of all development actions within a region (e.g. transport + agriculture)

Analyse a proposed portfolio of transport developments (e.g. for a country or region)

A sustainable & biodiverse future

Smart decisions - harnessing best available information and tools

Ecosystem services and nature's benefits to people are dependent on a wide-range of biodiversity.

Assessment approaches that account for a wide range of biodiversity can complement species-based approaches to provide a more complete picture of impacts.

Modelling tools that predict how biodiversity might change in response to development activities can assess alternatives and help decision-makers identify options that create better outcomes for biodiversity.

Thank you.

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https://research.csiro.au/macroecologicalmodelling/bilbi/