Life Cycle Initiative

A joint organisation
of UNEP & SETAC

Building consensus for assessing land use impacts on biodiversity
- Contribution of UNEP/SETAC's Life Cycle Initiative

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October 21–23, 2015

LCIA Global Consensus Project: Biodiversity Land Use taskforce

GOAL

To provide **global guidance and consensus building** regarding indicators and methods for the assessment of **biodiversity impacts from Land Use** in LCA

Specific Tasks

- **Critical review of the existing framework for LU impact assessment**
- **Expert workshops**
- **Review and evaluation of existing indicators**
- **Guidance on how to best establish a particular regional impact category indicator, in case global consensus cannot be achieved**

What is biodiversity?

TABLE 1. Biodiversity Indicators Across Hierarchical Components (Gene, Species, Community, and Ecosystem) and Biological Attributes (Compositional, Structural, and Functional)[a]

hierarchical components	biological attributes: composition	structure	function	assessment tools and methods
genes (biotic)	heterozygosity, allelic diversity, % polymorphic loci, genetic variance, phylogenetic diversity	chromosomal or phenotypic polymorphisms, physical genetic distance, effective population size, generation overlap, heritability	mutational diversity, mutation rate, duplication rate, selection intensity, rate of genetic drift, gene flow	visible polymorphisms, molecular markers (protein electrophoresis), DNA markers (microsatellites, DNA sequencing), parent-offspring regression, sibling analysis
species (biotic)	(meta)population size and number, absolute or relative abundance, frequency, biomass, cover, intactness, density	size, morphological variability, physiognomy, population structure, home range size and distribution in space, dispersal patterns, habitat requirements	metapopulation dynamics (drift, bottle necks, inbreeding, outbreeding trends) demographic processes (growth, reproductive, feeding, nesting, dispersal rate)	population censuses, time series analysis, remote sensing and GIS, habitat suitability index, species-habitat modeling, population viability analysis, species distribution modeling
communities (biotic, abiotic)	species richness, relative abundance, higher taxon diversity, phylogenetic diversity, number of endemics, invasive, threatened or focal species, similarity and turnover of species assemblages	habitat structural complexity, foliage physiognomy and layering, habitat density, gap density, volume, surface area, slope, aspect, rugosity index, nearest neighbor distance	nutrient turnover and cascades, functional group or guild diversity, number and strength of interspecific interactions (predator–prey, parasite-host), biomass production, extinction, colonization rates	remote sensing and GIS, aerial photographs, time series analysis, physical habitat measures, observation habitat descriptions, multispecies, local sampling techniques, multivariate integrative indices (Shannon–Wiener index, dispersion, layering, biotic integrity)
ecosystems and landscapes (abiotic)	patch diversity, richness, composition, number of ecosystems, relative or absolute area, area of seminatural vegetation in agriculture, emergent patterns in species distribution (richness, endemism)	patch shape and configuration (fragmentation, isolation, connectivity, spatial linkage), patch size frequency distribution, topography, river and shoreline profile	disturbance patterns and regimes (frequency, extent, intensity, seasonality), pattern metrics (patch turnover), erosion potential, geomorphic and hydrologic processes, land use patterns and trends	remote sensing and GIS, aerial photographs, time series analysis, spatial statistics, mathematical indices (pattern, connectivity, heterogeneity, layering, edge extent, diversity, fractal measures and autocorrelation)

[a] The final column on the right illustrates possible assessment methods (adapted from refs *21* and *22*).

Curran et al. (2011), based on Noss (1990)

Why care about biodiversity?

1. humankind has a moral and ethical responsibility to care for life on earth
2. many organisms bring pleasure to countless people and enrich our lives
3. species can be useful as drugs, food, etc.,
4. organisms provide essential ‘ecosystem services’ and maintain life support systems of the planet
5. species are the touchstones of whether we are using the planet sustainable

Kunin and Lawton (1996)

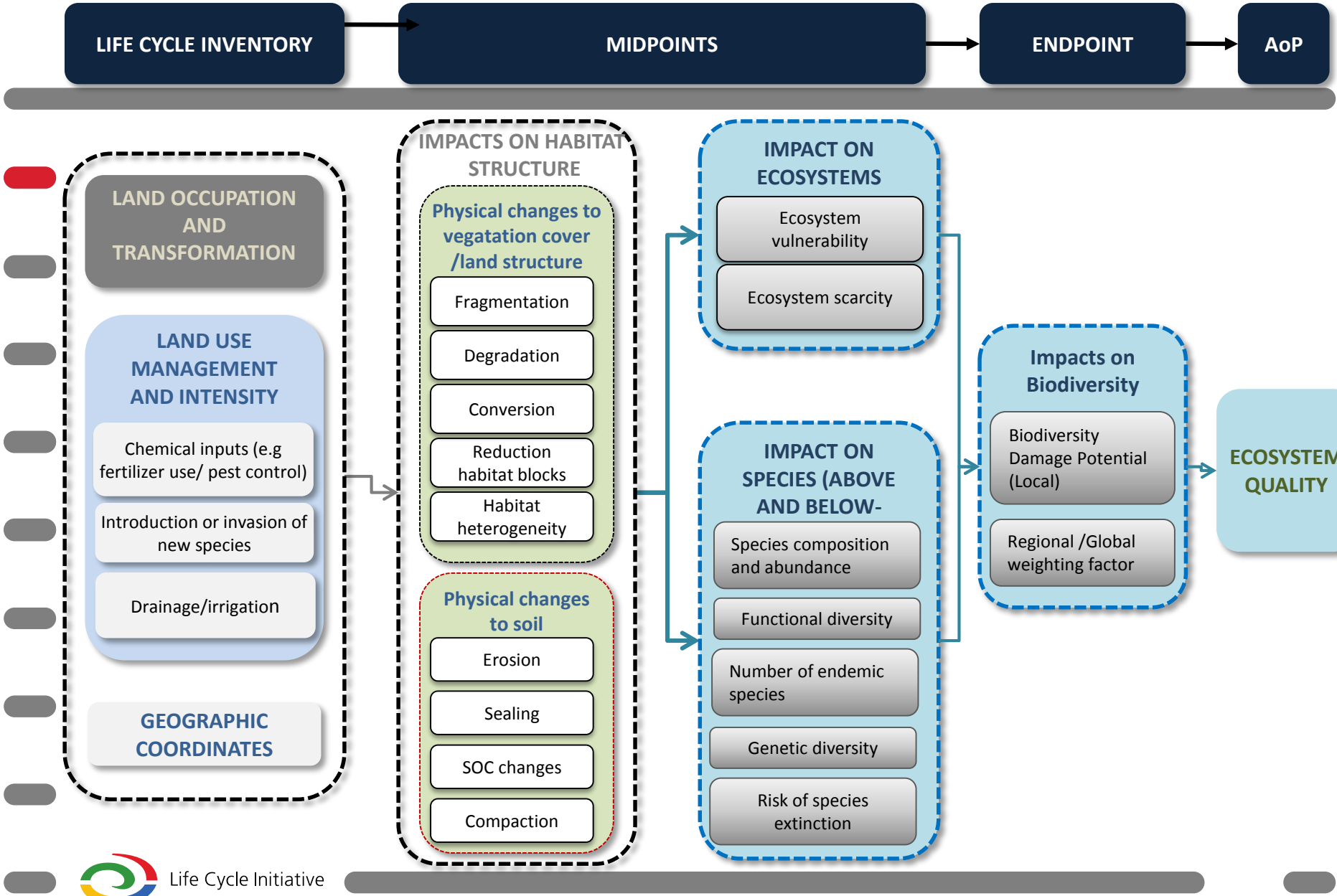
What is the main goal?

1. Protect as many species as possible?
   - Species rich ecosystem more valuable than species poor ecosystem
2. Protect ecosystem functions?
   - Protect 'enough' and 'the right' species
   - Species rich ecosystem not necessarily more valuable than species poor ecosystem per se
3. Protect endangered species?
   - Focus on species in risk of extinction
   - Red listed species essential

VALUE CHOICES

Michelsen, O.; Lindner, J.P. 2015 Why Include Impacts on Biodiversity from Land Use in LCIA and How to Select Useful Indicators. Sustainability 7: 6278-6302

Impact Pathway



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Expert workshops

San Francisco on October 7th, 2014 hosted by the US EPA

14 invited top experts in biodiversity metrics, LCA and ecology, as well as institutional and business partners.

Brussels on November 18 - 19, 2014 hosted by the Confed. European Paper Industries

24 invited top experts in biodiversity metrics, LCA and ecology, as well as institutional and business partners.

Topics discussed were:

(a) Concept of biodiversity and modelling strategies,

(b) Data availability and feasibility,

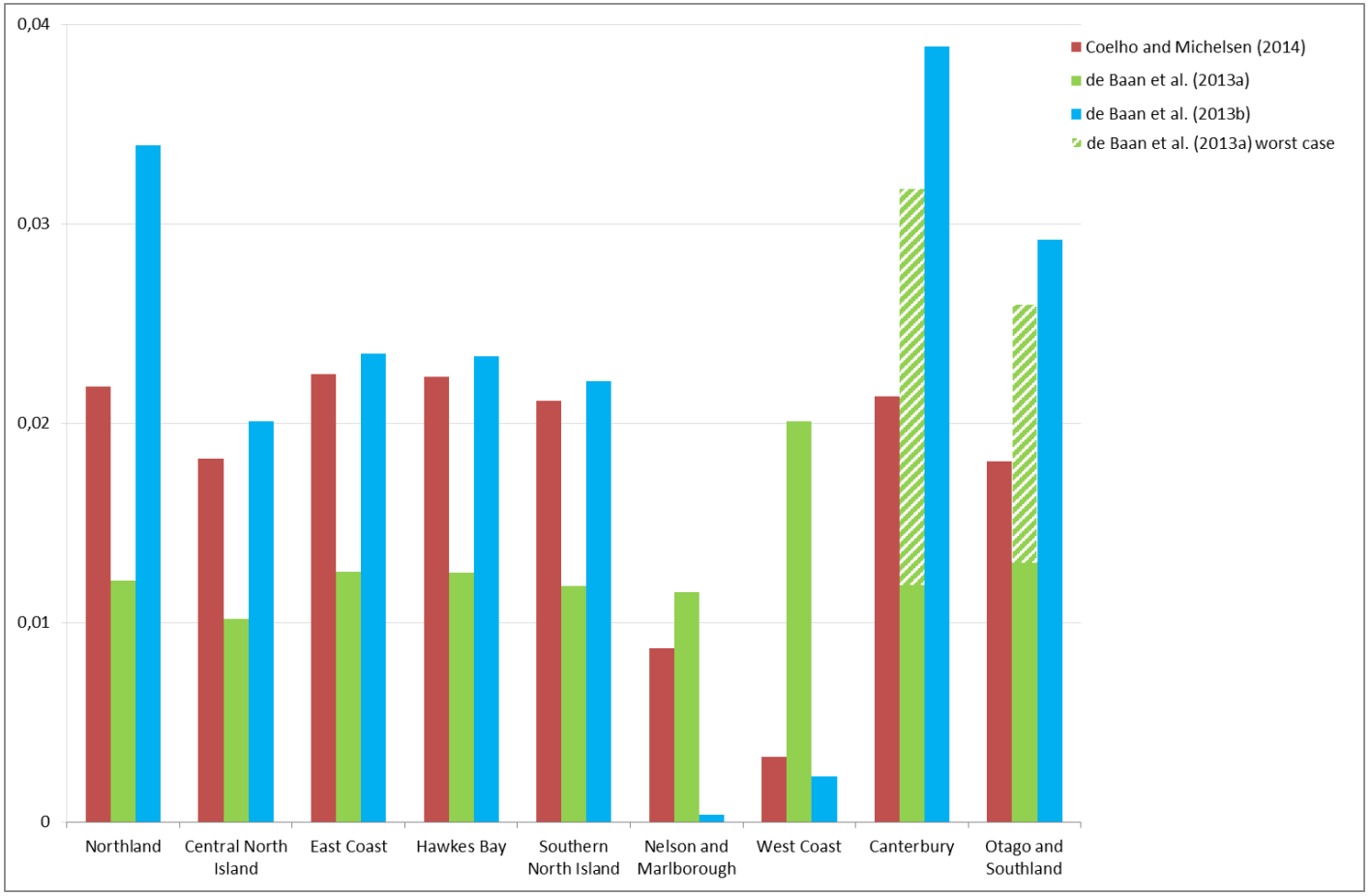
(c) Desired characteristics of indicators, usability and consensus

(d) Concerns and limitations about using biodiversity indicators in LCA.

Conclusions: guidance

- There is already a good basis of methods and indicators for biodiversity impacts from land use, but **improvement is still needed**
- An acceptable model must include a **local** indicator for land use intensity and **regional** weighting factor
- Species loss / richness seems to offer broadest **data availability** but are not sufficient explicit as indicator
- Potential to consider species **loss functions and habitat loss inclusion**: hemeroby, functional diversity, HANPP, ecosystem fragmentation
- Land use covers and **intensities**
- To conduct quantitative comparison of promising models in shared **case studies**

Example - Plantation forestry on NZ



Michelsen, O.; McDevitt, J.E.; Coelho, C.R.V. 2015. A comparison of three methods to assess land use impacts on biodiversity in a case study of forestry plantations in New Zealand. Int. J. LCA 19:1214-1225

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Thanks for your attention

Building consensus for assessing land use impacts on biodiversity

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Teixeira, R.; Souza, D.; Curran, M.P.; Antón, A.; Michelsen, O.; Milà i Canals, Ll. 2015 Towards consensus on land use impacts on biodiversity in LCA: UNEP/SETAC Life Cycle Initiative preliminary recommendations based on expert contributions. Journal of Cleaner Production (doi:10.1016/j.jclepro.2015.07.118)

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