WP 3: AN OVERVIEW

GRANADA WORKSHOP, 29-31 JAN 2014

BILL KUNIN (UNIVERSITY OF LEEDS)

UNIVERSITY OF LEEDS

WP3: IMPROVING TOOLS AND METHODS FOR DATA ANALYSIS AND INTERFACE

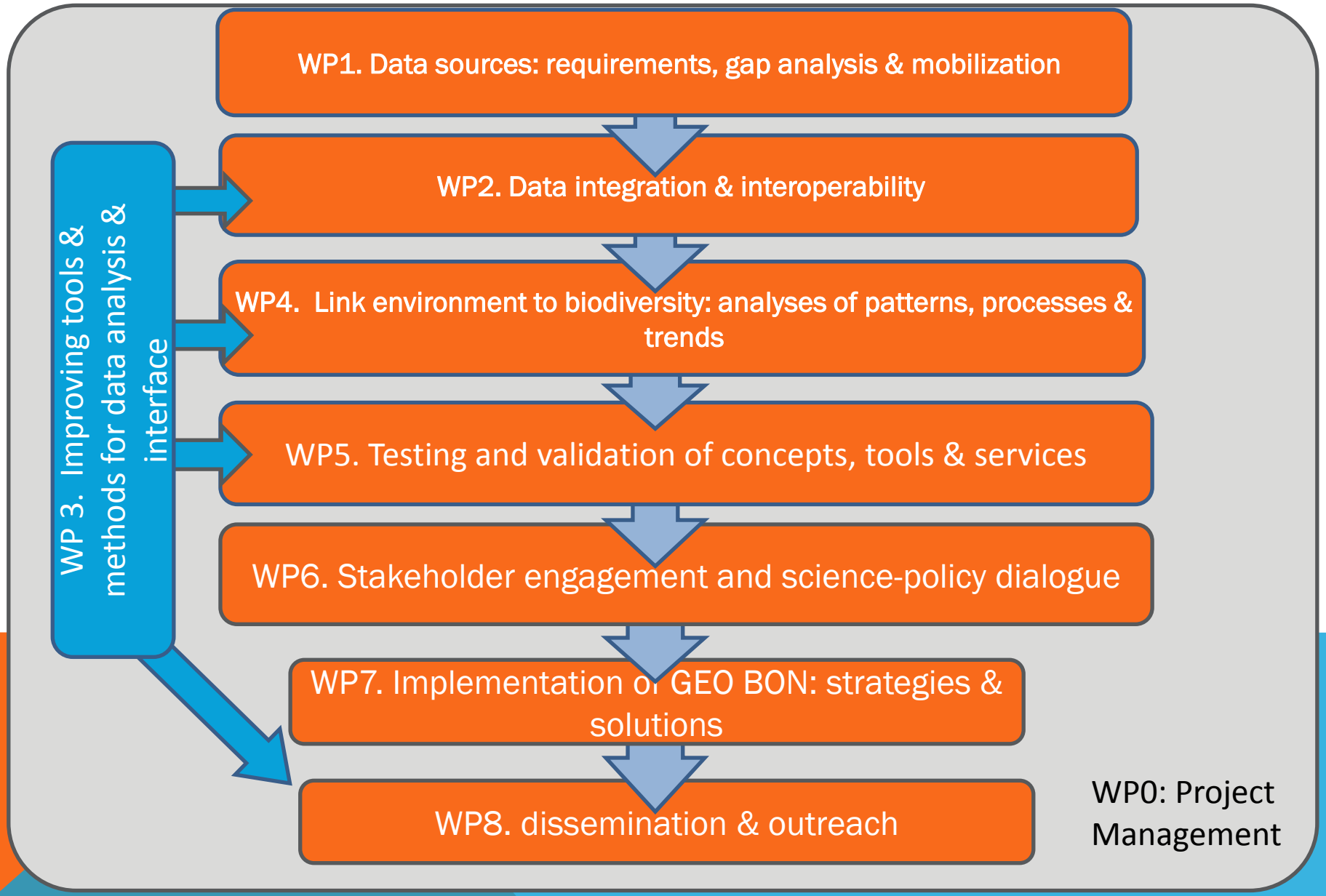
Overall WP goals:

Developing and refining analytical and presentational tools for application in other segments of the EU BON workplan, and for wider use by the research and policy community, specifically:

- To develop practical tools for assessing vegetation status and trends by combining remote sensing and environmental datasets
- To refine biodiversity up-scaling and population downscaling tools for non-specialist use to increase accessibility
- To develop new distributional models to improve applicability for poorly documented species and those exhibiting strong spatial patterning
- To develop new and improved tools for preparing and mining biodiversity data from the published literature

Ultimately: to contribute to the developing toolkit of biodiversity informatics in aid of EU-BON and GEOSS research and monitoring

EU-BON STRUCTURE



WP3 TASKS

3.1 Improved analytical tools to infer habitats from remote sensing data

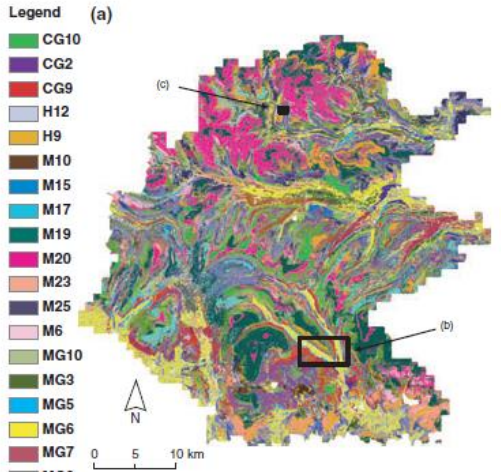
3.2 Population down-scaling & biodiversity up-scaling methods

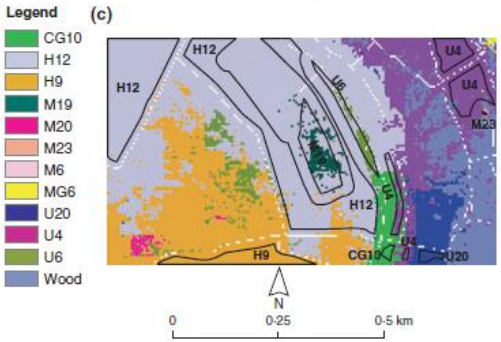
3.3 Combining spatial downscaling and bioclimatic species-distribution models

3.4 Developing data-mining methods for extracting species records

TASK 3.1. IMPLEMENTING IMPROVED REMOTE-SENSING VEGETATION MODELS

- Remote sensing data long used for habitat classification
- Including other spatial information (e.g. DEM, geology) greatly improves predictive power
- Machine learning, Random Forest algorithms; multi-scale methods
- Explore applications use of temporal change data, applications to marine & freshwater
- New code to make such methods more widely available

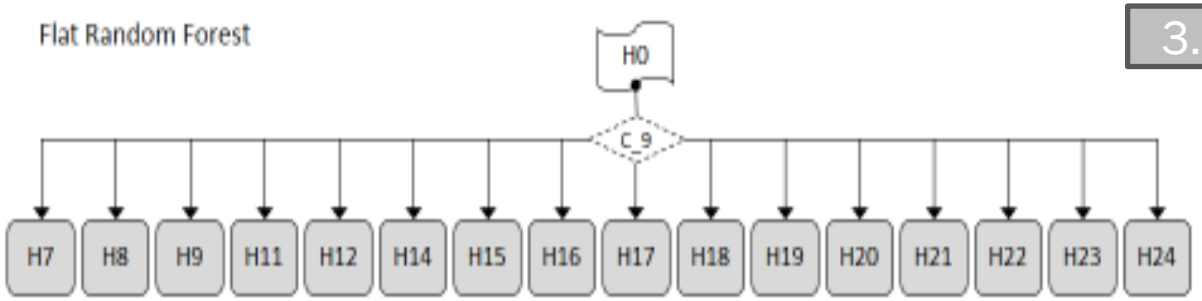




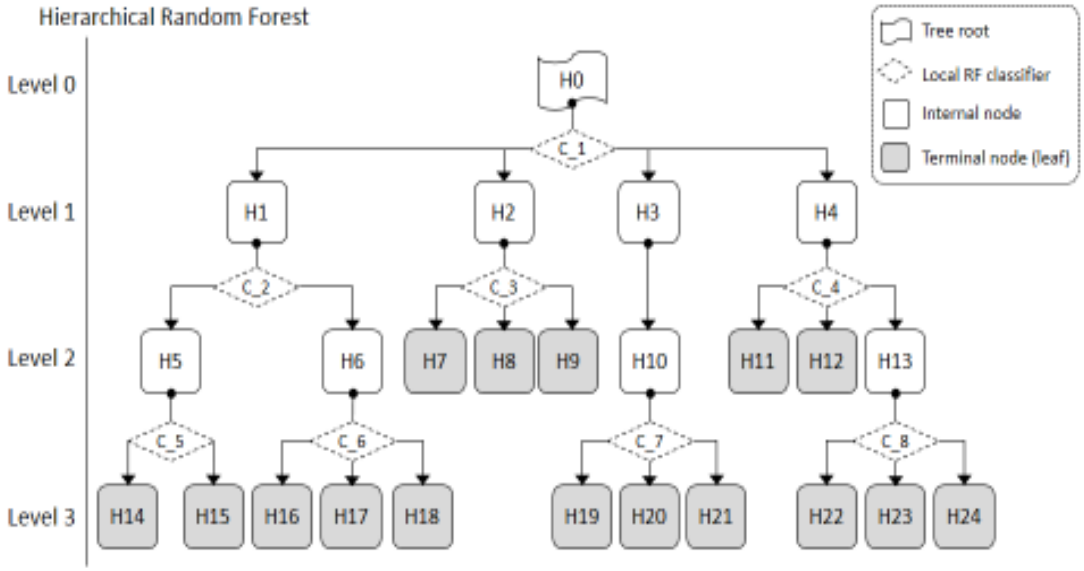
Sources: Bradter *et al* (2011) *J Appl Ecol* 48: 1057; (2012) *MEE*

TASK 3.1 HIERARCHICAL CLASSIFICATION

Progress so far: classical ("flat") Random forest approaches coded into GRASS GIS (by FEM)



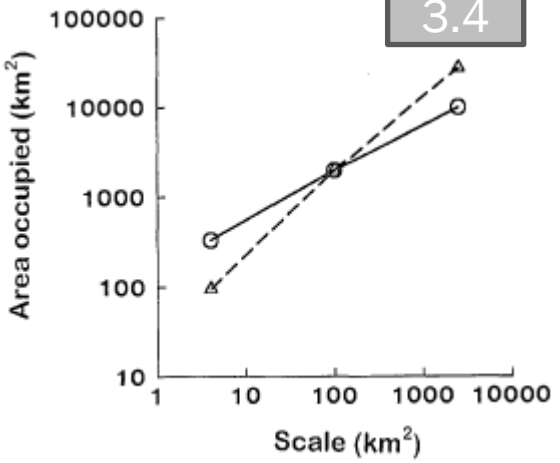
Work in progress: Coding hierarchical random forest approaches – helps ensure low-impact errors (Leeds)



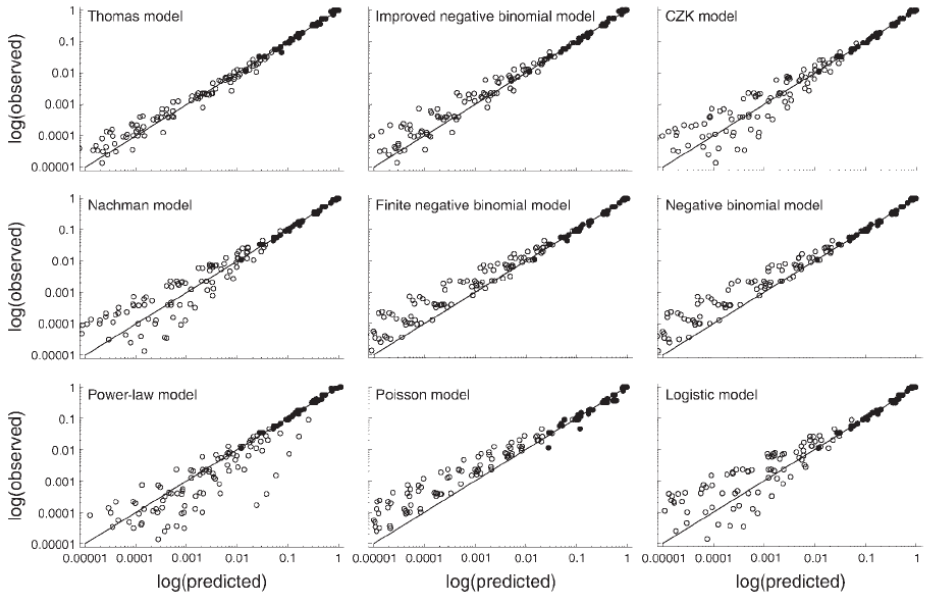
Longer term goal: to have tested approaches ready for application when Sentinel 2 data becomes available – allowing high-resolution, multispectral repeated images across Europe.

TASK 3.2 DOWN-SCALING POPULATION DISTRIBUTIONS

- Coarse-resolution spp distribution maps are widely available for many European taxa
- Conservation decisions require finer resolution population estimates
- Geometry of distributions can allow fine-scale abundance to be inferred



Source: Kunin (1998) *Science* 281: 1513-1515



Source: Azaele et al. (2012)
Ecological Applications 22: 1004-1014

Progress to date:

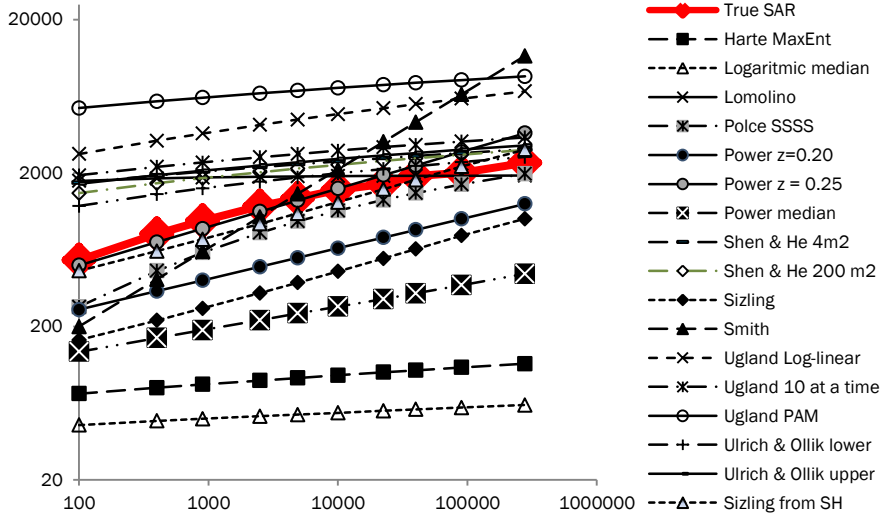
- Most existing down-scaling methods have been coded into R: increase access (Leeds)

Plans in progress:

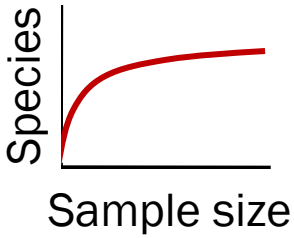
- Application to improved RDB classification for rare plants (NHM + Leeds)

TASK 3.2 UP-SCALING BIODIVERSITY

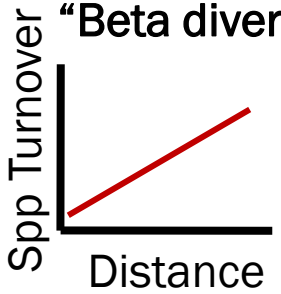
- Relatively easy to assess local ("point") species richness, but hard to survey at coarser (regional, national, global) scales
- Coarse-scale richness depends in part on turnover across space
- Methods developing to assess coarse-scale richness from spatially structured set of local samples
- Published methods of rather mixed success

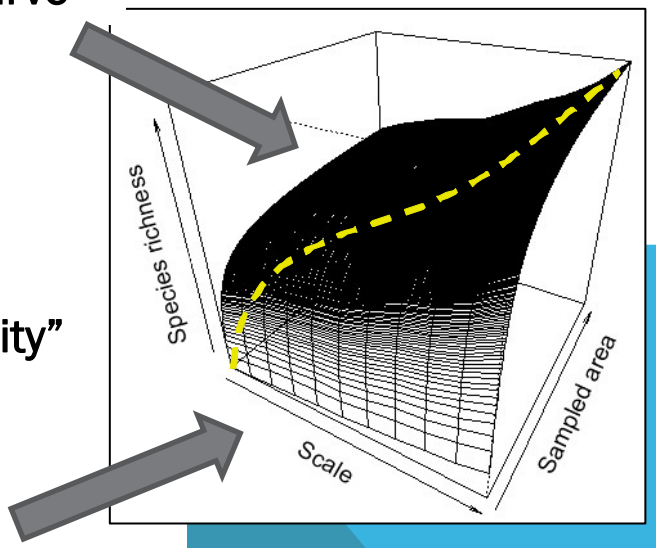


"Collectors' curve"



"Beta diversity"





- Promising new method developed in SCALES– additional steps in progress
- Additional "3-D manifold" approach to be explored based on combining collector's curve and beta-diversity
- Create application libraries (e.g. in R) to improve access to these approaches

TASK 3.3: ENHANCED METHODS FOR SPECIES DISTRIBUTION MODELLING

Classic "niche" species-distribution models (e.g. Bioclim, GARP, MaxEnt) ignore spatial patterning: affects predictive power

Spatial "down-scaling" methods focus on spatial pattern, but ignore environment: can't predict WHERE occupancy should occur

Develop a "Hybrid" between the two: the best of both?

TASK 3.3: ENHANCED METHODS FOR SPECIES DISTRIBUTION MODELLING

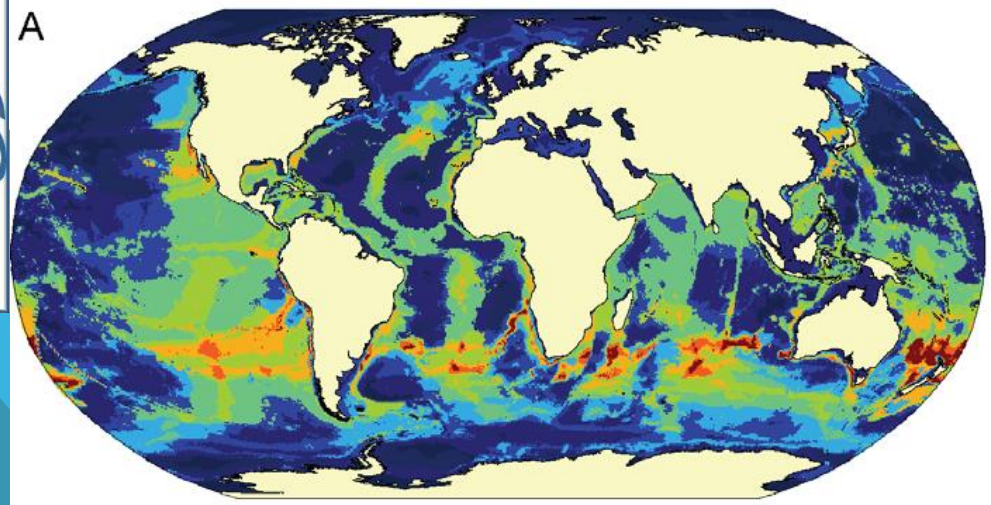
Approaches for taxa with poor distributional information (e.g. marine)

Incorporating expert knowledge

Plans:

Develop WIKI-style interface for Aquamaps

Explore alternative Bayesian & spatial mapping methods



Source: Kaschner et al (2011) PLoS One 6(5):e19653

Task 3.4 Developing tools to prepare, extract and mine published legacy and prospective biodiversity literature

Australutica africana n. sp.
urn:lsid:zoobank.org:act:40BD6CA4-1A94-445F-9CDA-BE42EFF39DB6
Figures 1-7

Nomenclature

Literature

ZooBank
The Official Online Registry for Zoological Nomenclature

Description Male: total length 5.00 mm; carapace 2.68 mm long, 1.88 mm wide, TI + PI: 1.92.

Colour: carapace yellow, darkened along margin and with two black longitudinal bands and a black spot behind the fovea (Figs 1, 7); fovea orange. Sternum pale yellow, slightly suffused with black along lateral margins. Chelicerae brownish yellow. Legs yellow except femora with broad dark distal rings on all pairs and smaller dark patches at the base of posterior pairs; tibiae with faint darker suffusion on sides. Abdomen pale; dorsum with faint darker pattern delimiting pale chevrons on posterior part. Spinnerets pale yellow.

Descriptions

Biodiversity Heritage Library

Images

Encyclopedia of Life

species

Plazi

Morphbank

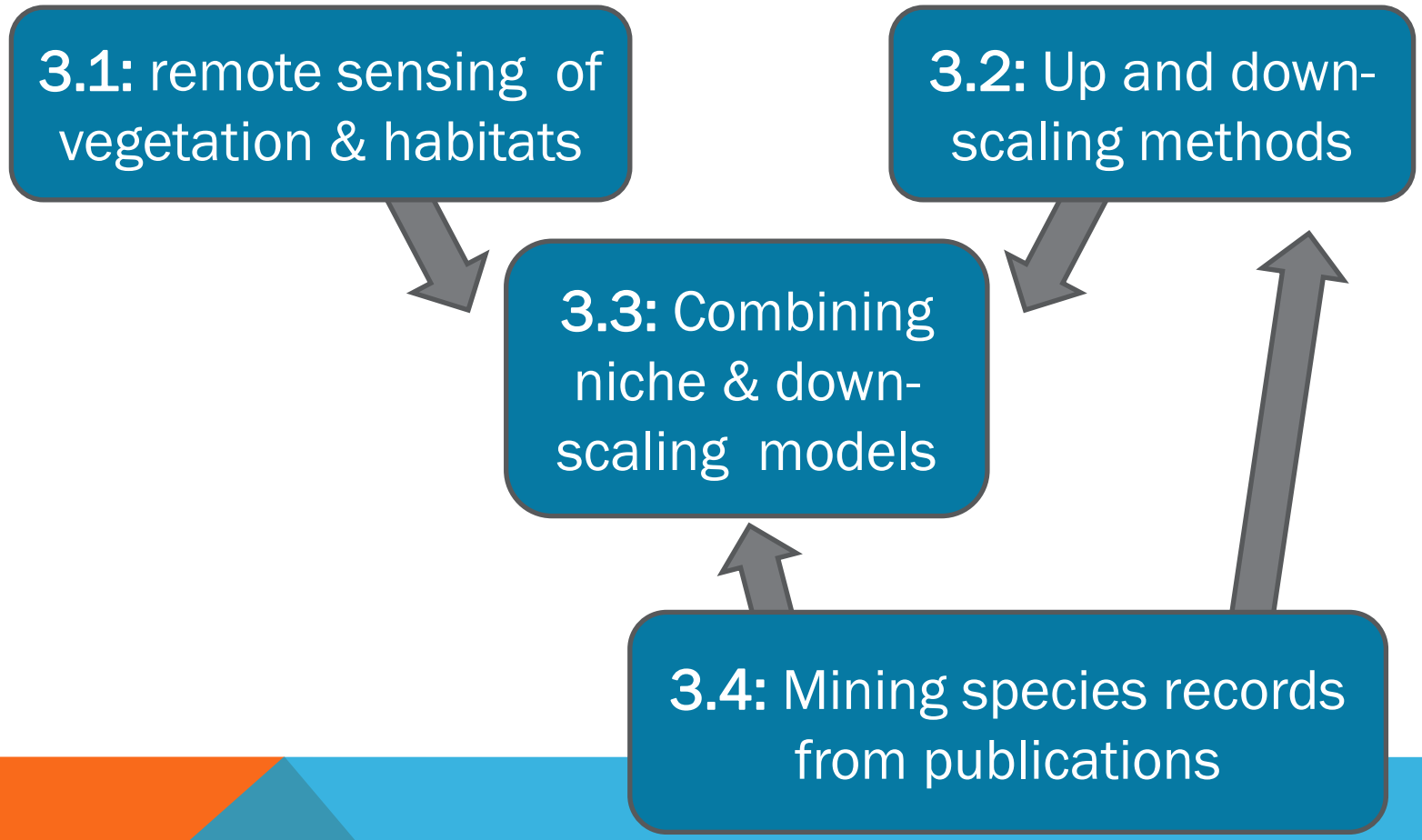
Type material Holotype: male: South Africa, Limpopo Province, Soutpansberg, Lajuma, 23°02'29"S 029°26'45"E, 17.XI.2004, pitfalls in woodland, M. Mafadza (NCA 2006/1002).

Paratypes: 4 ♂: together with holotype (1 ♂ in MRAC 223765).

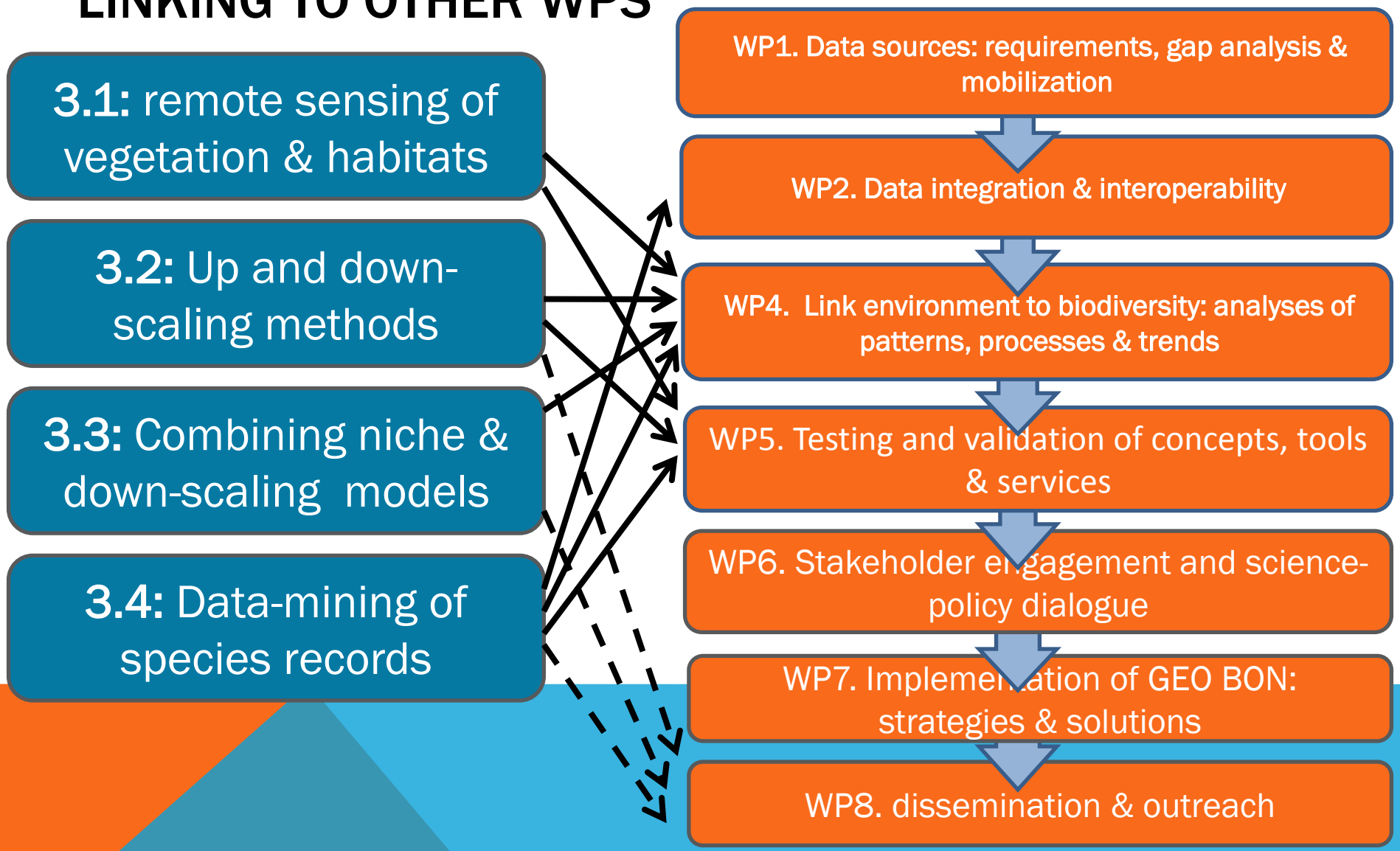
Other material examined None.

Occurrences

LINKING TASKS



LINKING TO OTHER WPS



IN SUMMARY

Four potentially important contributions to the tool-kit of global biodiversity informatics

Our challenge: map out the way forward, define roles, work out timetable…

…and get to work!

ANY QUESTIONS?