GLOBDIVERSITY PROJECT

WITH RS-ENABLED EBVs KEY CHARACTERISTICS OF BIODIVERSITY CAN BE OBSERVED AND MONITORED WITH SATELLITES ON A GLOBAL SCALE

globdiversity
rs-enabled ebvs for terrestrial ecosystems

esa

The GlobDiversity project aims to demonstrate how satellite remote sensing can contribute to monitoring Essential Biodiversity Variables (EBVs) – a concise set of harmonized biodiversity observations to inform indicators for policy-making. It is the first fully funded project focused on engineering the EBV concepts from satellite data into usable data products. They include Land Surface Phenology (LSP), ecosystem Fragmentation (FRAG) and Canopy Chlorophyll Content (CCC).

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Remote Sensing-enabled Essential Biodiversity Variables

FRAGMENTATION

BACKGROUND AND RATIONAL

Monitoring ecosystem structure for biodiversity can be supported by remote sensing through the collection of information on the spatial distribution of habitats, their fragmentation, and hence the impact on species distributions. There is broad recognition that habitat fragmentation affects both biodiversity and ecosystem functioning; it is commonly described as the result of habitat loss in which large, continuous habitat is broken up into many smaller fragments with less overall area and separated from each other by a matrix of human-modified land use types. At a certain threshold, habitat fragmentation reduces the viability of the species which depend on those habitats. The RS-enabled EBV Fragmentation (FRAG) measures structural ecosystem discontinuity in a defined time-space, and characterises habitat core areas, edges and connectivity, calculated across a range of scales.

ALGORITHM SPECIFICATIONS

FRAG accounts for direct habitat loss, changes in the quality of patches, network density, distance between habitat patches, and changes in matrix permeability. It focuses on the effects of dispersal on the persistence of species across land cover types. Wageningen University selected an algorithm based on the LARCH-SCAN-Hanski metric which applies a formula simulating the dispersal capacity of species to all habitat types cells within the dispersal distance. FRAG is implemented generically through four steps. Firstly, it selects a land cover product. Secondly, it applies the algorithm to all land cover classes with a standard set of distances, which results in individual maps of spatial cohesion values per class. Thirdly, it selects the ecoprofile (i.e. a species with specific habitat type and fragmentation distance) and combines output cohesion maps by adding up the relevant habitat classes to represent the habitat and species of choice. Finally, it derives size and number of clusters in the study area based on the ecoprofile and selection of relevant classes.

VALIDATION AND APPLICATIONS

The FRAG algorithm was applied in a case study within the National Reserve of La Camargue in southern France. The study evaluated the dispersal of the dragonfly *Lestes macrostigma* using a habitat suitability model developed by combining flooding suitability and land cover validated using field observations of the target species (Figure 1). The analysis resulted in fragmentation maps of cohesion values for *L. macrostigma* (Figure 2). Thresholds were then used to transform the map into meaningful interpretable classes of fragmentation (Figure 3). The map shows a large core area of connected habitat and small outlying clusters that could be joined through targeted habitat management. Results are of use to the Reserve authorities to assess the impacts of management on the target species. The FRAG algorithm is available under open-source licences and ready for download and use.

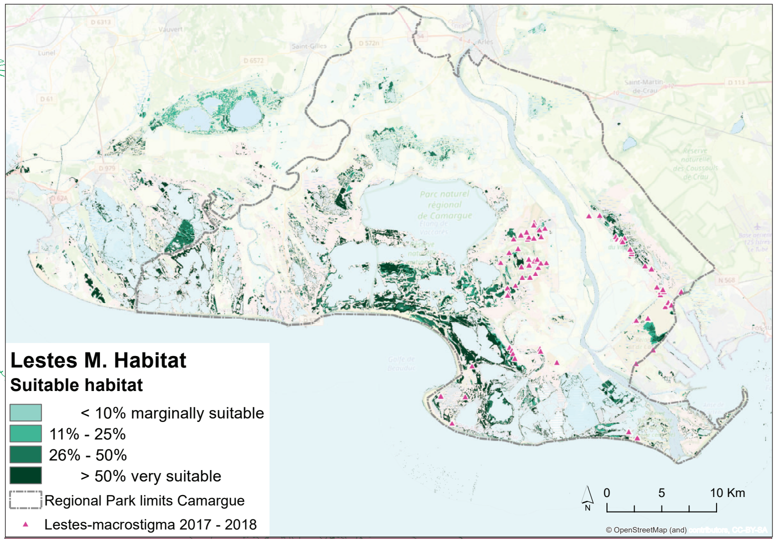

Figure 1. Habitat quality values for *Lestes macrostigma* in the Camargue.

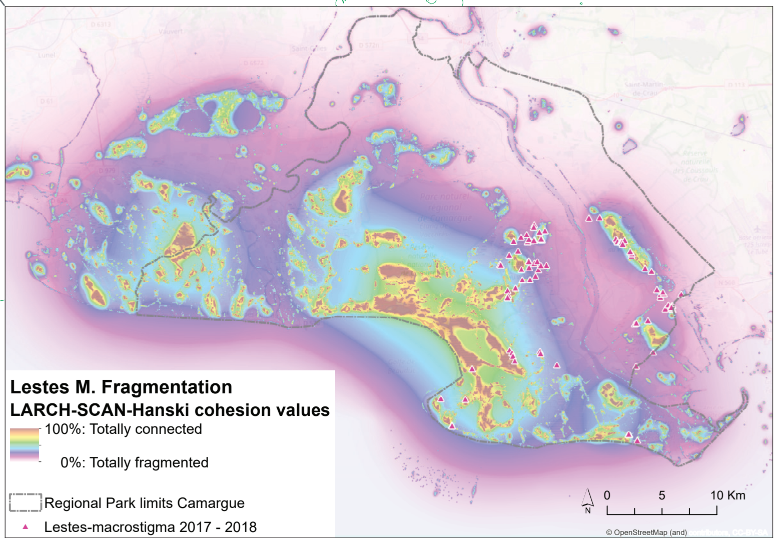

Figure 2. Cohesion values which comprise a measure for ecosystem connectivity for *Lestes macrostigma* in La Camargue.

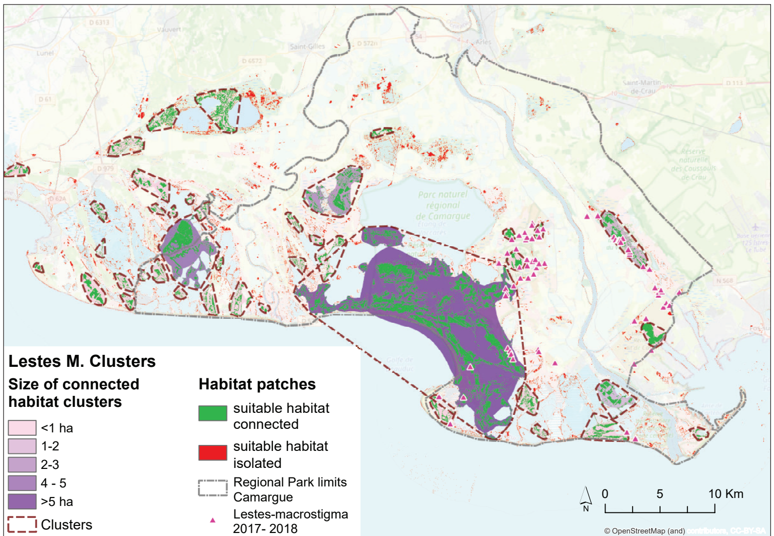

Figure 3. Habitat clusters for *Lestes macrostigma* in La Camargue and their size in hectares of habitat using a threshold 10% of habitat in the defined neighbourhood.

PILOT SITES

01
Toolik Lake
Tundra, Alaska, USA

02
La Camargue
Mediterranean, France

03
Lägern
Temperate, Switzerland

04
Bavarian Forest NP
Temperate, Germany

05
Kruger NP
Tropical, South Africa

06
Udzungwa Mountains NP
Tropical, Tanzania

07
Aldabra
Deserts, Seychelles

08
Lambir
Tropical, Borneo

09
Danum Valley
Tropical, Borneo

10
Kytalyk
Tundra, Siberia, Russia

COMPLETED TASKS WITHIN THE GLOBDIVERSITY PROJECT

01 REQUIREMENT ANALYSIS

RS-enabled EBVs were defined and their satellite observation requirements to track changes in terrestrial biodiversity at global scales were characterized; results are detailed in the Satellite Observation Requirements document available on the GEO BON website.

02 PRODUCT BENCHMARKING

A trade-off analysis of published algorithms and a proof of concept of selected algorithms for engineering RS-enabled EBV products was successfully carried out.

03 ALGORITHMS PROTOTYPING

Selected RS-enabled EBVs algorithms were successfully prototyped and are now available in GitHub repositories. Results are detailed in the Algorithm Technical Baseline Document available on the GEO BON website.

04 CONSERVATION APPLICATIONS

The core RS-enabled EBVs were applied in conservation-oriented use cases which focused on ecosystem modelling, invasive species monitoring, habitat health assessment and fragmentation analyses. The outcomes are exhaustively described in the User Hand Book.

The European Space Agency (ESA) is Europe's gateway to space. Its mission is to shape the development of Europe's space capability.

GlobDiversity focuses on the development
and engineering of RS-enabled EBVs.

If you would like to know more get in touch at info@globdiversity.net;
or if you would like to know more about the GlobDiversity project then visit www.globdiversity.net