An analysis of ecological indicators applied to agricultural ecosystems: what to retain to shape a future indicator for pollinators

Sergio Albertazzi[1] , Elisa Monterastelli[2], Manuela Giovanetti[1] *, Simone Flaminio[1], Emanuele L. Zenga[1], Laura Bortolotti[1] and Marino Quaranta[1]

[1] CREA Research Centre for Agriculture and Environment, Via di Corticella 133, 40128 Bologna, Italy
[2] Independent Researcher, Via di Corticella 85, 40128 Bologna, Italy

* Corresponding author: manuela.giovanetti@crea.gov.it

crea
Consiglio per la ricerca in agricoltura e l'analisi dell'economia agraria

Abstract:

Biodiversity loss has been demonstrated to have direct impacts on human welfare. However, policymakers need to refer to commonly accepted standards to monitor biodiversity, especially to direct fund granting. Intending to collate information for the creation of a reliable pollinators' one, we screened available indicators. Our first criterion was selecting indicators applied in agricultural contexts and legitimated by a regulatory agency. Further, we included indicators referring to any arthropod taxa and officially recognized at least by national bodies. We compared survey scale, monitoring scheme, type of environment, sampling effort, expected arthropod population, taxonomic level of data. As a common approach, we identified the combination of a territorial analysis by remote tools (e.g. GIS) and animal taxa surveys. The strength of indicators including arthropods emerges in the simultaneous inclusion of biotic and abiotic components. However, most of them just refer to confined environments (e.g. grasslands, riversides). Pollinators' sensitivity to changes at the micro-habitat level is widely recognized, even helping to distinguish different methods of agricultural management. To develop a biodiversity indicator based on pollinators, we suggest improving knowledge on local pollinator species and their environmental requirements, coupled with wide (in time and space) national monitoring programs.

Keywords: biodiversity; agroecosystems; arthropods; environment; pollinators; indicators; RDPs measures

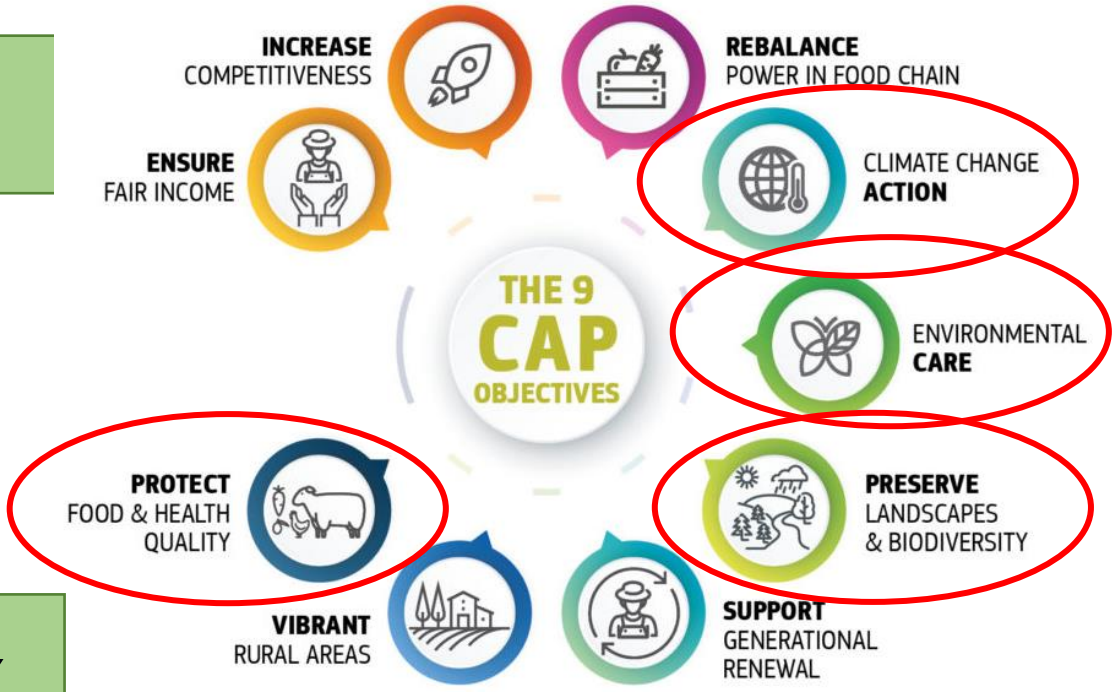
BDEE 2021

Context

BIODIVERSITY of the AGROECOSYSTEMS

crucial to tackle

- food security
- human and environmental health
- climate change



sustaining BIODIVERSITY

through

- greening measures
- country/continental survey
- fund granting to local farms

evaluation based on bioindicators

implementing indicators with POLLINATORS?

BDEE 2021

Pollinators: desirable candidates

BUTTERFLIES

BEES

HOVERFLIES

in Italy:
a pilot indicator
(in progress)

why IDEAL subjects?

- perform services in support of food production
- indirectly inform on pollutants and environment

- identifying and analyzing the structure of other bioindicators
- data collection

+

- reverse the decline of pollinators (EU Biodiversity Strategy for 2030)
- monitoring: group of experts at work (EU Pollinator Monitoring Scheme)

BDEE 2021

How to proceed: methods

first-level filtering by

indicators that apply

1 evaluation of biodiversity in agroecosystems

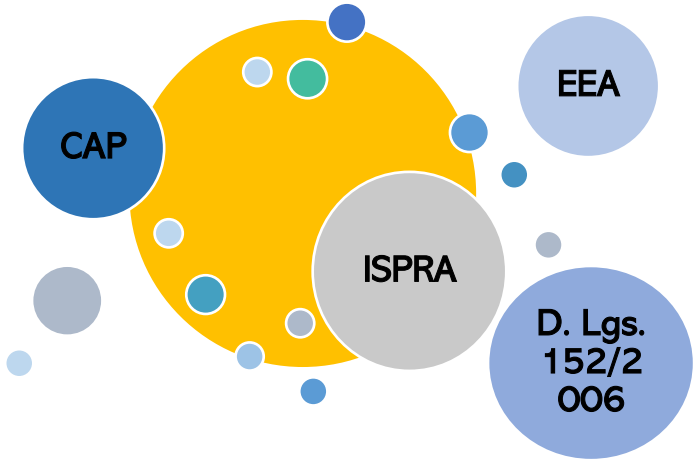
2 arthropods as bio-indicator organisms

second-level filtering by

indicators that are

legitimated (through a protocol approved by a scientific regulatory agency)

officially recognized (through their inclusion in regulation; being the official method in the given context)



bibliographic search through official websites of the regulatory agencies

BDEE 2021

Methods

Taxonomic groups

the taxa of the subject species and their ecological/biological resemblance with pollinator lifestyles.

Spatial context

definition of the spatial scale and of parameters applied to define it, arbitrary or ecological.

Baseline background

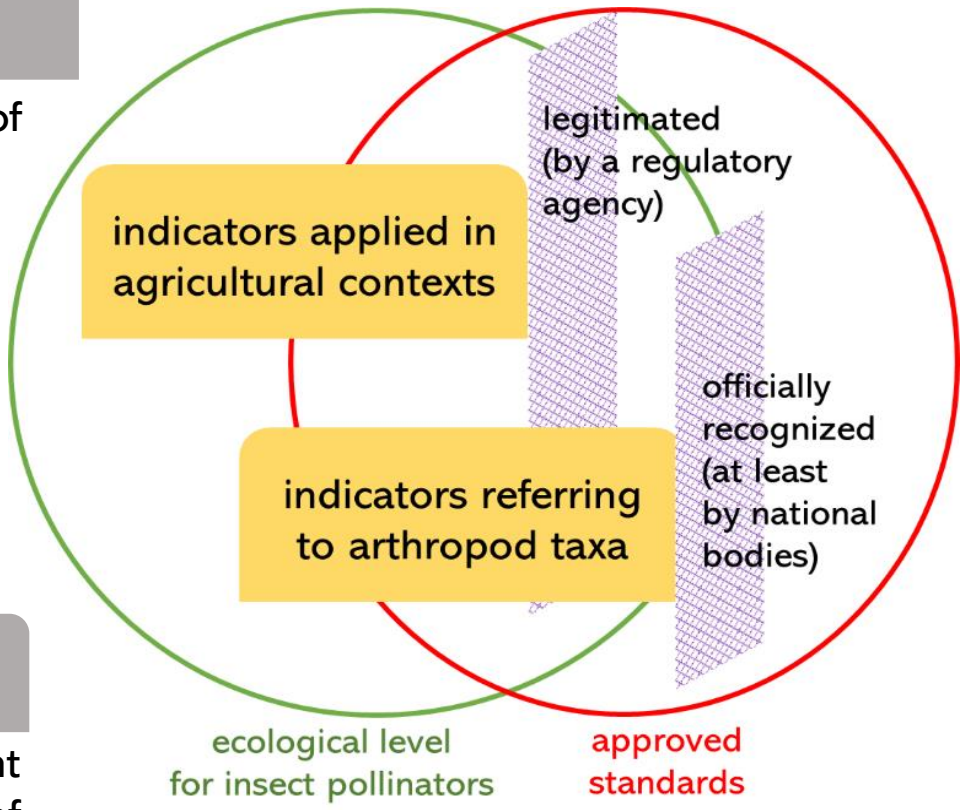
level of ecological/biological knowledge on the subject species.

Sampling effort and level of taxonomic identification

type of sampling protocol and subsequent taxonomic effort; the taxonomic level of identification; skills required for these activities.

Final output

quantity and type of outputs (i.e.: descriptive, or class/category).



parameters

BDEE 2021

Results

From the selection: 8 indexes/indicators

	indicator/index	acronym	legitimated	officially reckon
biodiversity	Farmland Bird Index	FBI	EEA/2005	CAP (from 2000 to post-2020)
	High Natural Value Farming	HNVF	EEA/2004	CAP (from 2007 to 2020)
	Proxy	PrY	EEA/2019	CAP post-2020
arthropods	Fresh water macrobenthos index	STAR ICMI	ISPRA/2014	Directive 2000/60/EC
	Grassland Butterfly Index	GBI	EEA/2013	none
	Soil macrobenthos Index	QBS-ar	(CREA, ISPRA)	Emilia-Romagna Region (from 2015)
	Sirph_the_Net	STN	ISPRA/2015	none
	Ground beetle index	GrB	ISPRA/2005	none

BDEE 2021

Results

From the selection: 8 indexes/indicators

Taxonomic groups	all taxa of pollinators; but not at the same level of detail
Spatial context	from largely adopted European monitoring plans to individual case studies.
Baseline background	rate of extinction risk, morphometric adaptations to individual microhabitats
Sampling effort and level of taxonomic identification	monitoring plans include a different pool of species; trained professional and volunteers; identification in the laboratory; type of collected data
Final output	compare a resulting value with a reference (year, farm, a given population); or set of user-friendly values so that also non-experts can compare

what to focus on?

BDEE 2021

Conclusion

for an indicator on pollinators

cartographic analysis of the territory

sharpened to greater detail

complex indicator based on several indexes

including environmental parameters and the target taxa

integrate abundancy and occupancy

widening monitoring and the range of legitimated methodologies

\+ ABUNDANT FIELD TESTING AND PUBLIC AWARENESS \+ REFINEMENT PHASE AND PILOT STUDIES

BDEE 2021

Acknowledgments

LIFE 4 POLLINATORS LIFE18 GIE/IT/000755 2019 - 2023 Coordinating Beneficiary: Alma Mater Studiorum – University of Bologna; Associated Beneficiaries: Coldiretti – CREA-AA – CSIC – EZVD - UVIGO – UAEGEAN

BeeNet 2019 -2023 (Italian National Fund under FEASR 2014-2020 by the Mipaaf «Ministry for Environment, Land and Sea Protection» to the CREA «Research Centre for Agriculture and Environment»)

Dr. Antonella Trisorio
CREA - Agricultural Policies and Bioeconomy

BDEE 2021