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**BioBio indicator factsheet**

# Vascular Plants (Plants)

Refers to Chapter 6 'Species diversity indicators' of the Guidebook 'Biodiversity Indicators for European Farming Systems'

Agroscope

SEVENTH FRAMEWORK PROGRAMME

Bio Bio

Schweizerische Eidgenossenschaft
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Swiss Confederation

Federal Department
of Economic Affairs FDEA
**Agroscope Reckenholz-Tänikon Research Station ART**

# Vascular Plants (Plants)

## Description

Vascular plants are primary producers which dominate most terrestrial ecosystems, shaping our physical environment and forming the basis of food chains. They constitute an important part of agricultural landscape biodiversity and provide food, shelter, breeding sites, refuges, etc. for a wide range of other organisms. Most mammals, birds, invertebrates and insects are directly or indirectly dependent on one or more plant species and diversity of plants may therefore indicate diversity of other organisms. Since vascular plants are dependent on particular conditions for growth, each species can indicate the occurrence of a specific set of environmental conditions, such that changes in the environment are reflected in changes in plant abundance or distribution. Thus, plants act as a **state indicator** and over time can be used as a **change indicator**. Compared to many species groups, there is a relatively high level of knowledge about vascular plants, regarding their taxonomy, habitat requirements, present distribution and trends of change. There is a vast and accessible literature on plants in most countries, and many professionals and amateurs, who are experienced in species identification.

## Surveyor skills

Vegetation surveys require botanical expertise. The indicator is based on the habitat mapping and needs basic GIS and ecological skills. Surveyors must be familiar with the use of handheld GPS to retrieve stored co-ordinates of sampling plots.

## Data collection method

The vegetation surveys are undertaken in plots. One vegetation plot is placed in each of the habitat types identified on the farm during the habitat mapping, i.e. one vegetation plot per habitat type. The plot size is dependent upon whether the plot is placed in an areal or a linear feature. The basic recording procedure is the same for all types of plots[1]. It is important to place the vegetation plots in the centre of the element concerned to avoid edge effects. Plots in areal features are 100 $m^2$, placed in the centre of the element and set up using survey poles with strings forming the diagonals of the square. The diagonals should be orientated carefully at right angles and the plot should be orientated with the strings on the north-south and east-west axes. Four nested plots of respectively 4 $m^2$, 25 $m^2$, 50 $m^2$ and 100 $m^2$ are laid out. Firstly, all species are recorded from the inner nested plot. When the inner plot has been completed the second nested plot is examined and any additional species are recorded. Each additional nested plot is examined in this way. Cover estimates are only made for the whole plot when all sizes of nested plots have been completed. All vascular plants, but not bryophytes or lichens are recorded. In the case of linear elements, the plot is 1 x 10 m and it is laid out along the feature.

[1] Dennis P. et al. 2012. Biodiversity in organic and low-input farming systems. ALTERRA Report 2308.

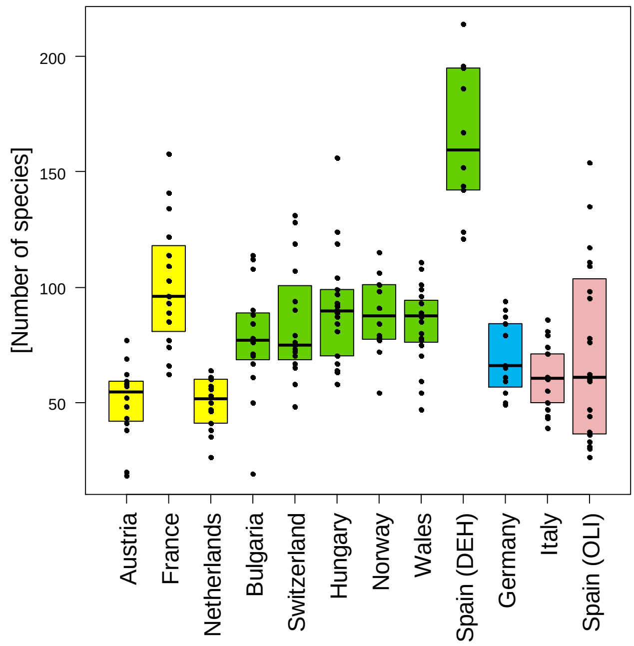
*Species rich grassland (Freising, Germany) and vegetation survey in the German case study. Photos: Sebastian Wolfrum, TUM*

## Calculation method

The basic comparator is the total number of species per habitat. This can be used to represent the number of species per farm or geographic region for general comparisons at each of these spatial scales and over time by aggregation of the number of species found in habitats. Estimates of the species richness of farms can be calculated from the species lists obtained for habitats (gamma, alpha, area weighted, rarefied and Chao estimated richness).

## Synergies with other indicators

There is a relationship with the indicator farm gamma species richness of 'Wild Bees and Bumblebees' (8 of 12 case studies), of 'Spiders' (in 7 of 12 case studies) and of 'Earthworms' (in 3 of 12 case studies). In most of the farms, plant species richness was not significantly correlated to indirect management indicators recorded at farm level. However, 'Total Nitrogen Input' as well as 'Pesticide Use' had a negative correlation with the plant species richness in the German case study. In three case studies (Germany, Wales and Switzerland) 'Mowing Timing' was positively correlated with plant species richness. Among the habitat diversity indicators, 'Habitat Richness' was significantly positively correlated to the plant species richness in 9 case studies. Species richness was noticeably related to 'Tree Cover' and sub-indicators in Austria. The 'Percentage of Farmland with Shrubs' was positively correlated to the plant species richness in 3 of 12 case studies.




***Distribution of indicator 'Vascular Plants'.***
*Each point displays the indicator value of a farm. Farms are grouped in the respective case studies. yellow: field crops & horticulture in Austria, France and the Netherlands, green: specialist grazing livestock in Bulgaria, Switzerland, Hungary, Norway, Wales and Dehesa in Spain,blue: mixed crops & livestock in Germany, pink: permanent crops in Italy and olives in Spain. The colored box contains the values of 50 % of the farms of a case study. The line marks the median.*

## Estimated effort and costs (labour effort required, analysis)

For the vegetation survey field work is required. Additional lab work may be required for species determination. The time effort for the vegetation surveys ranges between 0.4 and 5.1 hours of fieldwork per plot (3.2 hours on average), depending on the complexity of the farm in terms of habitat types and on the travel time between the dispersed fields.

## Plant species richness change as an indicator

A change in indicator value (change in state) may indicate pressures on biodiversity, e.g. increased nitrogen input or pesticide use. A decrease in plant species per farm can also be a response to land use changes, such as on the one hand the change from extensive farming to intensive production systems or on the other hand the abandonment of farming. Positive changes in state may be a response to the application of agri-environmental policies, e.g. increased proportion of semi-natural habitats, nature friendly management practices or reduced input of fertilizers and pesticides.

## Interpretation

Interpretation of plant species richness is straightforward. A higher indicator value is normally connected to higher biodiversity. However, there is no information on population structure and species composition. This means that there is no information as to whether an increase in indicator values maybe due to valuable or endemic plants or habitat generalists or neophytes. To derive information on the quality of composition or conservation values etc. sub-indicators or other analyses need to be used. Plant species richness is dependent on landscape context therefore the indicator can only be interpreted in the context of the farm landscape under study.

*Sown flower strip in Switzerland, increasing plant species richness on farm. Photo: Gabriela Brändle, Agroscope*

## Strengths and weaknesses

Vegetation surveys need fieldwork and prior assessment of habitats. Therefore, GIS and GPS skills are useful. Indicator values depend on timing and number of sampling replications. BioBio sampled plants once during the height of the growing season. Especially in arable crops a second assessment in early spring or in late summer (e.g. for maize) may be necessary to obtain more complete species lists and to find some of the annual plants typical for these habitats. Especially in grassland habitats management activities (e.g. mowing) prior to sampling have to be considered to avoid distorted results. However, vegetation data is independent of weather conditions and easy to collect by botanically skilled persons. There is a high relationship with other biodiversity indicators like bees or spiders and management pressures. Especially flowering plants are broadly noticed and are highly valued by both, farmers and non-farmers for aesthetic reasons. Sub-indicators can be used to assess valuable habitats or habitat quality (e.g. by number of rare species).

This factsheet is part of the Guidelines **Biodiversity Indicators for European Farming Systems**.
More detailed information on the set of indicators developed in the EU FP7 research project BIOBIO (Biodiversity indicators for organic and low input farming systems, KBBE-227161) is given in a printed report, published as ART Publication Series Nr. 17. The report can be downloaded from the BIOBIO website.
Printed versions can be ordered at www.agroscope.admin.ch or at Agroscope, Reckenholzstrasse 191, 8046 Zurich, Switzerland

## BIOBIO Indicator Factsheets

**Genetic diversity**

| | |
|---|---|
| Breeds: | Number and amount of different breeds |
| CultDiv: | Number and amount of different varieties |
| CropOrig: | Origin of crops |

**Species diversity**

| | |
|---|---|
| Plants: | Vascular plants |
| Bees: | Wild bees and bumblebees |
| Spiders: | Spiders |
| Earthworms: | Earthworms |

**Habitat diversity**

| | |
|---|---|
| HabRich: | Habitat richness |
| HabDiv: | Habitat diversity |
| PatchS: | Average size of habitat patches |
| LinHab: | Length of linear habitats |
| CropR: | Crop richness |
| ShrubHab: | Percentage of farmland with shrubs |
| TreeHab: | Tree habitats |
| SemiNat: | Percentage of semi-natural habitats |

**Indirect management indicators / parameters**

| | |
|---|---|
| EnerIn: | Total direct and indirect energy input |
| IntExt: | Intensification/Extensification - Expenditure on inputs |
| MinFert: | Area with use of mineral nitrogen fertiliser |
| NitroIn: | Total nitrogen input |
| FieldOp: | Field operations |
| PestUse: | Pesticide use |
| AvStock: | Average stocking rate |
| Graze: | Grazing intensity |