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BioBio indicator factsheet

Number and Amount of Different Varieties (CultDiv)

Refers to Chapter 7 ‘Indicators for genetic diversity of crops and husbandry animals’ of the Guidebook ‘Biodiversity Indicators for European Farming Systems’

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Number and Amount of Different Varieties (CultDiv)

Description

A variety or cultivar represents a plant or a plant species that has been created or selected intentionally, can be distinguished from other cultivars and can be maintained through propagation. The term “cultivar” is used to differentiate accessions of one agricultural plant species. The **unit** is the average number of cultivars across all species on the farm. **Sub-indicators** can be generated from the data such as average number of cultivars per crop category, e.g. arable, vegetable, forage or tree crops or individual crop species.

Cultivar diversity can either be used as a **state indicator** or it can be used as a **trend indicator** by performing regular assessments of on-farm cultivar diversity within selected time intervals as well as on national and international levels. The assessment of cultivars per species on a farm provides an insight into farmers’ preferences for specific crop cultivars and an estimate of the genetic diversity (i.e. within species diversity) present on a farm. Additionally, the establishment or use of data bases would allow for a more detailed evaluation of the usage and changes in use of genetic resources. However, average cultivar diversity per species represents a very simple indicator for genetic diversity on the farm. The measurement only highlights inter-varietal diversity and is based on the assumption that the number of different cultivars is correlated to genetic diversity. Insight to genetic diversity within cultivars could only be obtained through molecular genetic analyses. Cultivar diversity can only be calculated for habitats where cultivars are employed and this may vary greatly between different species. Comparisons between different case studies are therefore difficult if they do not represent the same farm type.

Surveyor skills

The development of questionnaires and the conduction of questionnaire-based interviews require no detailed agronomical or ecological education. A basic understanding of major crop categories and farm management practices reduces development and application time.

Data collection method

The data can be collected by using a questionnaire completed during interviews. The name of all crop species and the corresponding cultivars grown on farm are recorded.

Calculation method

Cultivar diversity can be calculated by dividing the total number of cultivars by the number of crop species on the farm.

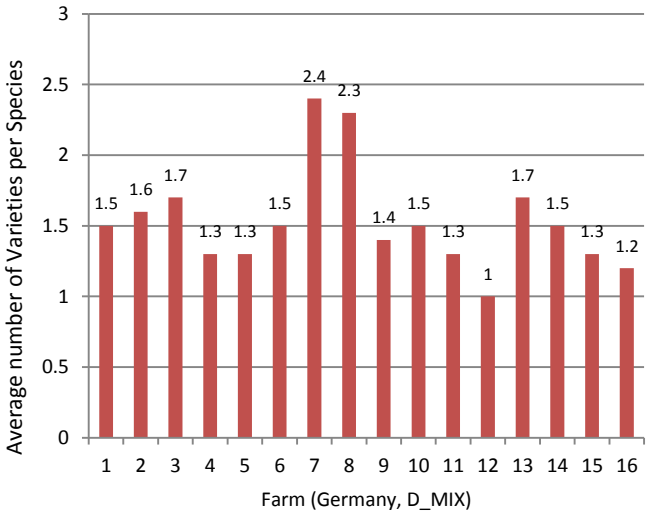
$$\text{CultDiv} = \frac{\text{Number of cultivars}}{\text{Number of crop species}}$$

The following graphic is an example of the cultivar diversity for the 16 mixed farms in the German case study. The lowest number of cultivars is one cultivar per crop species on farm 12. The highest number is 2.4 cultivars per crop species on farm 7. On average, 1.7 cultivars per crop species are cultivated within the German case study.

Potato and wheat cultivars Photos: Gabriela Brändle, ART

Synergies with other indicators

There is no relationship with other indicators which have been investigated within this project. The assessment of cultivars requires the basic information on the respective species.



Diversity of varieties/cultivars on the 16 farms of the German case study.

Estimated effort and costs (labour effort required, analysis)

Based on a general time and cost assessment within the project, the time effort in conducting the genetic diversity questionnaire was 50 min on average, depending on agricultural complexity and size of farms.

Cultivar diversity change as an indicator

A decline in indicator value (change in state) may indicate pressures on biodiversity, e.g. increased use of one variety as a monoculture due to intensification. Besides annual changes in crop rotation and changes in cultivar use, an increased cultivation of multiple cultivars of one species per farm can also be a response to farmers' preference as they may be taking into account unpredictable climatic events or higher chances of pest resistance by using various cultivars of one species. Planting multiple cultivars on farm may indicate a change from intensive and high yielding farming or more local and adaptive farming by using more or less diverse crop genetic recourses.

Interpretation

The diversity of domesticated plants and animals increases biodiversity on the farm. Particularly, agricultural systems dominated by only one cultivar may be more susceptible to any kind of disturbance. The use of various cultivars on the farm should increase resistance and also resilience after abiotic (temperature, drought) and biotic (pests, diseases) disturbances. Furthermore, an increased number of various cultivars might attract more pollinators, enhancing ecosystem functioning in agricultural landscapes. Different cultivars of one species might also have varying requirements of soil composition and properties. Thus, an increase in cultivars would lead to a more balanced use of belowground resources.[1] An increase in cultivar diversity on farm may be due to the farmers' preference for higher cultivar diversity on farm, but also due to political issues supporting the use of multiple cultivars per species either to maintain genetic resources of crops, cultural heritage or to enhance the variability and productivity of agricultural products.[2]

Strengths and weaknesses

Data is easy to collect using questionnaires. Measuring the indicator requires cooperation with farmers and preparation of a questionnaire applicable to case studies and research aims. The assesment of cultivars on farm is a simple assessment of genetic diversity and may be useful for assessments on a regional scale, addressing the issue of cultivar diversity in the actual farming situation. The indicator "Cultivar Diversity" is based on the assumption that different cultivars are genetically diverse. However, the genetic distance between two cultivars might be very small due to close relateness. This cannot be measured by cultivar diversity.

[1] Hajjar et al., 2008: The utility of crop genetic diversity in maintaining ecosystem services. *Agriculture, Ecosystems and Environment* 123, 261–270.

[2] Di Falco and Perrings, 2003: Crop genetic diversity, productivity and stability of agro-ecosystems. A theoretical and empirical investigation. *Scottish Journal of Political Economy* 50(2), 207-216.

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