European Evaluation Helpdesk for Rural Development

ASSESSING RDP IMPACTS ON SOIL IN THE CZECH REPUBLIC 2014-2020

FACTSHEET OF THE EUROPEAN EVALUATION HELPDESK FOR RURAL DEVELOPMENT - SEPTEMBER 2019

PRESERVING THE EU'S MOST VITAL RESOURCE

Soil is one of the most vital natural resources and an essential ingredient in providing nutrients, water, oxygen and support to plants as well as providing other indispensable facilities in terrestrial ecosystems. Soil serves as the platform for human activities, landscape, and heritage and is the base component for providing the food and resources for sustaining much of life on this planet. Soil absorbs all the consequences of human activities both directly (intensive and extensive farming, irrigation, compaction, contamination, etc.) and indirectly (reducing the soils ability to react to natural forces, such as, water erosion) and is therefore of utmost importance to preserve and manage effectively. A wide array of processes threaten soil including soil erosion, biodiversity loss, a decline in organic matter, drought, compaction, contamination, salinization, sealed oils, and desertification.

In the Czech Republic conditions according researchers for individual types of soil degradation differ with the area, however, the most notable being water erosion which threatens more than 51% of agricultural areas or 5.4 million acres and wind erosion 14%. Heavily farmed and damaged soils do not have the proper structure to prevent their top layers from being washed or blown away. Research shows both forms of erosion are the result of poor management and climate change.[1]

Therefore, it is crucial that the contribution of policies to address soil protection and effective management be assessed to ensure the sustainability of Europe's soil.

OVERVIEW: EVALUATION ELEMENTS FOR ASSESSING RDP IMPACTS ON SOIL

The assessment of soil falls under RDP Priority 4 'restoring, preserving and enhancing ecosystems related to agriculture and forestry' and Focus Area 4C 'preventing soil erosion and improving soil management'.[2]

In the Enhanced Annual Implementation Report (AIR) 2019 and ex post evaluation in 2024, Member States are required to assess RDP impacts. This is achieved through assessing impact indicators, which provide the means to assess the extent to which the programme has achieved its strategic objectives (EU and national/regional) established at the programme level. These impact indicators form the basis for answering the evaluation related questions related to EU level objectives.

FURTHER INFORMATION

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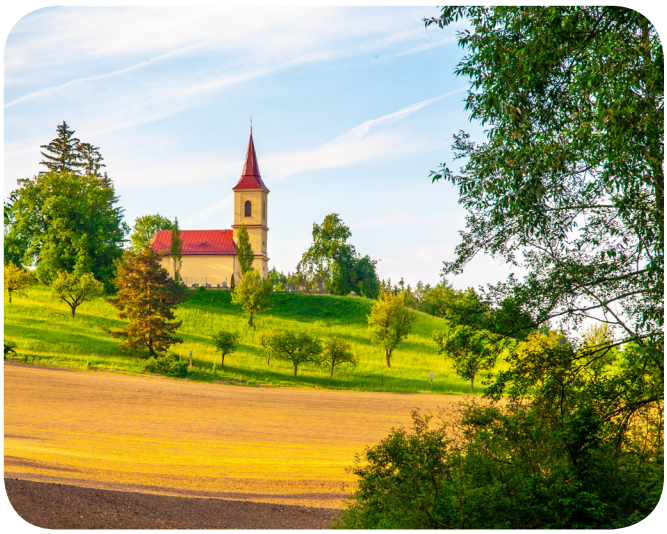
For additional information on the Evaluation:
https://evaluace.eu/



Environmental impact indicators are related to the CAP objective of 'sustainable management of natural resources and climate action' and more specifically for Impact Indicators 8–13 help to answer the horizontal evaluation question, 'to what extent has the RDP contributed to the CAP objective of ensuring sustainable management of natural resources and climate action?'.[3]

This factsheet focuses on the assessment of RDP impacts on soil organic carbon content and erosion in the Czech Republic.

Using Geographic Information Systems (GIS) and modelling to assess RDP impacts on soil

In the case of the Czech Republic for the assessment of RDP impacts on soil through the use of Common Impact Indicators I.12 (soil organic

carbon (SOC) matter on arable land) and I.13 (soil erosion) a counterfactual approach was applied using geographic information systems (GIS) data for I.12 and a modelling approach taken for I.13.

Evaluation Question	Common Impact Indicators
Common Evaluation Question Number 28: 'To what extent has the RDP contributed to the CAP objective of ensuring sustainable management of natural resources and climate action?'	• I.12 (soil organic carbon (SOC) matter on arable land) • I.13 (soil erosion caused by water)

I.12 Soil Organic Matters (SOM) content in arable land (GIS based counterfactual)

The Czech Republic has a historically robust system for collecting data on soil through its programme for agrochemical soil testing. This system collects data from both supported and non-supported farms in long term time periods, which facilitates the construction of a counterfactual comparison. To determine the soil organic matter in soils, the ground-based infrared spectral (NIR) spectroscopy measurement was chosen for the purpose of evaluating the impact of the RDP measures. Soil samples were collected from the 0–20 cm soil layer to measure the % of COx in the soil. Afterwards, using constant values (%) the humus content in the soil was calculated.

Due to the favourable availability of data, the evaluation was performed using statistical methods. The assessment was based on pre-prepared data sets using spatial analyses and conducted in the following steps:

- Step 1: for each measure groupings were created within soil blocks (DPB) based on where the measure was implemented. Then a COx measurement was performed on each of these DPBs. This step was carried out by using overlay analyses of polygons and points from the GIS. In cases where there were multiple measurements within one group, the average value was assigned to each DPB.
- Step 2: each grouping within the soil blocks where the measure was implemented was then compared with groupings of DPBs on which RDP measures were not implemented. Again, overlay analyses of polygons and points from the GIS were used to make this comparison. Similarly, in cases where there were multiple measurements within one group, the average value was assigned to each DPB.
- Step 3: statistical analysis was then conducted on comparisons of measurement results between the two groups of blocks (supported and non-supported). The double sample t-test of independent measurements was used for this purpose. The hypothesis H0, 'the values do not differ significantly from each other', and H1, 'the values differ significantly from each other', were then tested.

Results of RDP measures on organic matter content in arable land

In the case of organic farming, the results show a statistically significant impact of the measure on the organic matter content in the soil. Exceptions are vineyards and orchards, where the effect has not been proven (in the case of orchards, however, the statistical significance is close). A higher effect (approx. 0.3 pp) would be measured in the case of permanent grassland. For arable land liabilities the impact of the aid is estimated at approximately 0.16 pp.

The net impact of the RDP on soil oxidizable carbon content can be estimated to be more than 4 g per kilogram of soil. This result suggests that the oxidizable carbon content on the analysed areas increased as a direct result of the implementation of the relevant RDP measures. With a total size of 523,178 hectares which can be attributed to FA 4C, the absolute value of the net RDP contribution can be estimated at 363.4 tonnes of oxidizable carbon per year.

I.13 Soil erosion by water (counterfactual model)

A long-term model providing data for supported and control plots has been used to assess the impact of the RDP at the macro level. A model approach was made possible due to the availability of data on characteristics of the supported and non-supported agricultural parcels through GIS analysis (using LPIS data) which facilitated the construction of a counterfactual.

The data from the monitoring system on Agri-environment-climate and organic farming was used to identify and quantify these measures. The geographical data was further used to calculate erosion risk. The basic input data for the erosion risk calculations were:

- Hydrologically correct digital terrain model (DMT) derived from the 4th generation of the digital relief model of the Czech Republic (DMR 4G) (© Czech institute for Geodesy and cadastre - ČÚZK)
- Soil ecological units according to their quality (BPEJ) (© - State land office - SPÚ) valid as of 1 October 2018
- Rain erosion factor (© Czech hydro-meteorological institute - CHMU)

The erosion risk assessment was assessed with the USLE model[4]. The USLE model is based on the principle of 'allowable soil loss', which considers the maintenance of economically long-term soil fertility. By substituting corresponding values of factors of the investigated land into the model equation, the long-term average loss of soil by water erosion in tons per hectare per year are thus determined by the soil use.[5]

The evaluation of the impact of the measures was carried out on the basis of the determination of long-term land loss for areas of individual measures in individual years (2015 - 2018). The impact of measures on long-term soil loss by water erosion is based on the conditions for implementing agri-environment-climate measures and organic farming. From the point of view of erosion risk, these conditions affect exclusively the vegetation protection factor (C factor). Based on the expert knowledge of the authors and published C factor values for various crops and management (Mistr, 2016 and Mistr, 2018), the individual measures determined the C factor values for which the value of long-term soil loss by water erosion was subsequently calculated. In view of the possible different approaches in the application of measures, the values were determined in two variants:

- Variant 1, where the impact of the measure is assessed strictly.
- Variant 2, where the impact of the measure is assessed moderately.

Results of RDP measures on soil erosion caused by water

The results of the model provide a range of values showing the varying effects of the measure. The results show a decrease in tons per hectare per year long-term soil loss due to water erosion through the application of the measures.

A summary of the assessment of the Agri-environment-climate and organic farming measures throughout the Czech Republic can be seen in the table.

Model Scenario	Decrease value of long-term loss of land (tons per hectare per year)
Variant 1: impact of the measure is assessed strictly	4,639
Variant 2: impact of the measure is assessed moderately	4,757

The application of the Agri-environment-climate and organic farming measures in the Czech Republic has resulted in a reduction in the long-term average loss of soil on land with the applied measure by at least 4,698 tons per hectare per year. This reduction has a positive effect on all aspects of water erosion such as soil degradation, clogging of water reservoirs and watercourses.

However, the overall assessment does not distinguish between management practices. Therefore, a detailed evaluation of sub-titles was carried out. The results of the model evaluation show that the applied measures within Agri-environment-climate have the greatest influence in permanent crops. Measures on arable land (bio-corridors) do not have any significant impact in terms of long-term erosion risk. This is mainly because these measures do not affect soil blocks as a whole, but only some of its parts.

Organic farming has the greatest positive impact in terms of water erosion in permanent crops. The arable land measures, compared to the Agri-environment-climate measures are more broadly focused on the whole soil block, therefore, their impact is significantly higher and more positive in terms of long-term erosion risk assessment.

LESSONS LEARNT AND RECOMMENDATIONS

MAJOR CHALLENGES:

- Accessibility of micro-data regarding COx values of soil samples.
- Low statistical significance of analysis in the case of less represented managements/titles.

SOLUTIONS TAKEN:

- Close cooperation with authorities who collect and own the data and analysis by means of GIS tools.
- Macro-level analysis and extrapolations.

Send your questions to:
info@ruralevaluation.eu

[1] https://www.soils.org/discover-soils/story/czech-researchers-create-comprehensive-model-evaluate-soil-degradation.

[2] Article 5(4)(c) of the Regulation (EU) Nº 1305/2013 of the European Parliament and of the Council on support for rural development by the European Agricultural Fund for Rural Development (EAFRD)

[3] Implementing Regulation (EU) No 834/2014 and Implementing Regulation (EU) No 808/2014

[4] Universal equation for calculating the average long-term soil loss by erosion (Wishmeier, Smith 1978)

[5] For more information on this model and factors please see the Guidelines Assessing RDP Achievements and Impacts in 2019.

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