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State of art in soil degradation status, pressures and trends with the example of good practices in Bosnia and Herzegovina and in Federation of Bosnia and Herzegovina

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The main soil degradation processes



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- Various forms of soil degradation:
 - ✓ erosion,
 - ✓ loss of organic matter,
 - ✓ compaction,
 - ✓ salinization,
 - ✓ landslides,
 - ✓ contamination,
 - ✓ sealing,
 - ✓ desertification, etc.,
- BiH and FBiH have not been spared from similar degradation processes of land and soil and their harmful impact on the entire ecosystem.

Soil erosion



- Main risk factors for water-type soil erosion:
 - ✓ Steep terrain (more than 70% of the land in FBiH is located on sloping terrains)
 - ✓ Relatively large amount of precipitation,
 - ✓ Unplanned deforestation,
- There are no official data on areas exposed to erosion, nor is there an organized system for monitoring erosion.
- Designing an erosion map of SR BiH was completed in 1985. Two copies of the erosion map were then made. During the war (1992 - 1995), both copies were destroyed. The total average amount of sediment created on the territory of SR BiH per year is 16.518.031 m³ or 323 m³/km².
- The example of good practices:
 - ✓ timely tillage, avoiding deep and frequent cultivation
 - ✓ sowing plants with dense plant cover and deeper root system (grasses, cereals, legumes...)
 - ✓ conservation treatment-leaving harvest residues etc...

Excessive use of agrochemicals



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- According to FAO data, the consumption of mineral fertilizers in BiH from 1995 to 2019 looked as follows:
 - ✓ Nitrogen consumption was from a minimum of 2.9 kg /ha (1996) to a maximum of 99.5 kg/ha (2015).
 - ✓ Phosphorus consumption was from a minimum of 2.9 kg P₂O₅/ha (1996) to a maximum of 11.7 kg P₂O₅ (2004).
 - ✓ Potassium consumption was from a minimum of 2.9 kg K₂O/ha (1996) to a maximum of 11.7 kg K₂O (2004).
- This consumption is significantly lower compared to economically developed countries, such as Germany. For example average consumption NPK in 2019 was:
 - ✓ Nitrogen 115.18 kgN/ha in Germany and in BiH 61.96 kg N/ha.
 - ✓ Phosphorus 20.8 kg P₂O₅/ha in Germany, and in BiH 8.3 kg P₂O₅/ha
 - ✓ Potassium 35.2 kg K₂O/ha in Germany, and in BiH 8.95 kg K₂O / ha .
- The reason for lower fertilizer consumption in BiH is a less intensive form of crop production and weaker purchasing power of Bosnian farmers.
- These data indicate that the consumption of fertilizers in BiH is significantly lower than the average consumption of economically developed countries and significantly lower nitrogen consumption than the maximum allowed 170 kg/ha (Nitrates Directive).
- Unfortunately, there are no official data on the use of pesticides
- Measures of good practice: planned application of mineral and organic fertilizers (doses, time and method of application)

Soil organic carbon

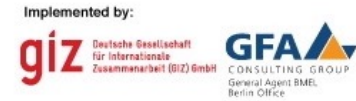


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- A functional system of organic carbon analysis and a monitoring network in the FBiH has not yet been established.
- There are indications that the Federal Institute of Pedology in Sarajevo will start monitoring it.
- However, according to the map of organic carbon content in top soils in Europe, which have been prepared for use by JRC of the European Commission, it can be stated that the majority of soil in FBiH fall into two classes: class 2 - 6% organic carbon content in top soils, and; class 1 - 2% organic carbon content in top soils.
- Certain studies and research show that the content of organic carbon in the soils of FBiH is mostly at the middle level.
- According to ISRIC data on the content of organic carbon (SOC) ranged between 0 to 174 t/ha, while the average is 111,7 t/ha. Carbon stocks in forest areas amount to 119,3 t/ha, and in agricultural 107,9 t/ha. t/ha.
- Measures of good practice: introduction of organic matter into the soil (organic fertilizers, crop residues, etc.), crop rotation, reduction of intensive tillage

Soil compaction



- Soil compaction is related to the degradation of soil structure due to imposed stresses by machinery and livestock trampling.
- Soil compaction causes a number of poor soil properties:
 - ✓ reduces soil aeration
 - ✓ reduces water drainage and infiltration,
 - ✓ limits root growth and seed germination,
 - ✓ decreases soil biodiversity etc.
- Unfortunately, monitoring of soil compaction in FBiH is not performed.
- General assessment is that this type of degradation is not of great importance on most agricultural lands in FBiH due to the lower use of agricultural machinery.
- Measures of good practice: rational and optimal use of agricultural machinery, adequate grazing (time, method, etc.)

Soil Contamination



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- Areas in FBiH with a potentially high risk of contamination with pollutants consist of extremely acidic soils with a pH below 4.5, with light texture, noncarbonated and with a relatively small share of humus in the soil profile. Such soils account for 9.7% (252.129,74 ha).
- Potentially medium risk of contamination with pollutants consists of soils whose pH ranges from 4.5 to 5.5. These soils are of relatively lighter, loamy structure, medium humus, non-carbonate and medium deep. They are represented on 13.1% of the territory of the Federation of Bosnia and Herzegovina or 338,753.18 hectares.
- The remaining largest part of 1,985,736.72 hectares, or 76.3% of the territory FBiH, consists of a soil group whose pH is above 5.5 and poses the least risk of contamination with pollutants.
- However, potentially the largest and most vulnerable areas in the FBiH exposed to the contamination process are lands near industrial areas (Tuzla and Zenica cantons, etc.). Thus, for example, only coal exploitation in BiH takes place on an area of 18,000 ha, while the area for waste disposal covers almost 6,000 ha.
- The positive fact is that the Federal Institute for Agropedology in the FBiH has established a system for monitoring the level of soil pollution with heavy metals and organic pollutants.
- According to research by this institute from 2013, out of 260 tested locations, 26 or 10% of them have the highest percentage of pollution both in terms of the number of elements and the level of pollution for all tested heavy metals. At 54 sites or 21% of the total investigated, it was contaminated with three elements (Cd, Ni and Mn). As for other locations, 53 or 20% of them are not polluted with any element, i.e., they are completely clean areas. Based on the conducted analyses, it was determined that there was no soil contamination with organic pollutants (PAHs) at the investigated locations.
- Measures of good practice: prevent the introduction of various types of contaminants into the soil, implementation of decontamination measures, calcification of acid soils, use of physiologically neutral and alkaline fertilizers, etc.

Soil sealing



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- Agricultural land in FBiH is significantly exposed to this type of degradation.
- ✓ Demographic displacement of the population after the war significantly contributed to this
- ✓ Renovation and construction of new facilities and infrastructure after the war
- ✓ Lack of legislation, such as the FBiH spatial plan,
- ✓ Non-compliance with existing legislation, such as the conversion of non-agricultural land into agricultural land on the basis of collected fees taken in the conversion of agricultural land into construction land.
- Estimates of the condition of these areas that are under soil sealing in the FBiH are obtained based on the CORINE database.
- Measures of good practice: stimulation and planned reconstruction and development of rural areas, adoption of appropriate strategic, planning and legal solutions

Soil acidification



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- Human-induced acidification of agricultural and forest soils is primarily associated with removal of base cations and loss of soil buffering capacity or increases in nitrogen and sulphur inputs (e.g., atmospheric deposition).
- In FBiH, there is no systematic monitoring of the state of soil acidification, but it is regularly monitored and measured through the analysis of soil fertility and accordingly provide an appropriate measure to reduce it if it is necessary.
- About 25% of the land in FBiH has a pH reaction below 5.5
- Measures of good practice: calcification of acid soils, use of physiologically neutral and alkaline fertilizers

Biodiversity

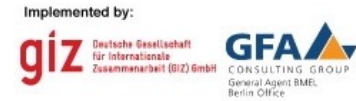


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- Bosnia and Herzegovina, due to its specific position in three different climatic and geological regions (the Mediterranean, Continental and Mountainous), has a particularly rich biological diversity.
- It is one of the richest countries in Europe in terms of biological diversity, with over 5,000 different plant species and about 1.800 (30%) of the total endemic flora in the Balkans located in BiH.
- This rich biodiversity is increasingly threatened by different forms of degradation and climate change.
- Good practice measures: implementation of all biodiversity protection measures (crop rotation, conservation and protection of rare plant and animal species, etc.)

Soil drought



- As a result of climate change, periods of soil drought are becoming more frequent.
- Drought reduces the mass of plant cover on the soil, especially if the plant cover is exposed to grazing livestock
- Reducing soil cover increases the risk of soil erosion, especially if more abundant precipitation falls after a dry period.
- An adequate measure to combat drought is irrigation
- Due to underdeveloped irrigation infrastructure in FBiH, only 0.65% of agricultural land is irrigated
- On the other hand, in Bosnia and Herzegovina there is great potential for irrigation because the abundance of water is one of the main characteristics of BiH.
- Good practice measures: establishment of irrigation systems, sowing of more drought-resistant plant species, improvement of soil retention properties, etc.

Floods



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- Bosnia and Herzegovina is the richest country in the region in terms of water potential and the fourth in Europe.
- However, most of Bosnia and Herzegovina's rivers and streams have a regime of torrents with high waters during rain and melting snow, which causes floods.
- Floods are natural phenomena, but lately they have become more frequent as a result of man's irresponsible attitude towards nature.
- Good practice measures: measures against floods (arrangement of watercourses, drainage, afforestation and maintenance of plant cover, etc.)



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