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SEASONAL VARIATION OF CO_2 SOIL FLUX AND VEGETATION RESPONSE AT BODOC AND BĂILE LĂZĂREȘTI

Lia STELEA[1, 2], Alexandra-Constanța DUDU[1], Corina AVRAM[1], Marius-Bogdan BĂRĂITĂREANU[1, 2], Andrei-Gabriel DRAGOȘ[1, 2], Gabriel IORDACHE[1]

[1]GeoEcoMar, 23-25 Dimitrie Onciul Street, District 2, Bucharest, Romania
[2]University of Bucharest, 4-12 Regina Elisabeta Blvd, District 1, Bucharest, Romania

Corresponding author email: lia.stelea@geoecomar.ro

Abstract

Bodoc and Lăzărești were chosen as test sites to assess an environmental monitoring methodology that combines soil CO_2 flux and vegetation surveys. Field campaigns conducted in September 2024 and April 2025 enabled a comparative assessment of spatial and seasonal variability. The two sites display very different patterns. Bodoc exhibits low CO_2 fluxes with limited seasonal change, likely driven by shallow biological processes. In contrast, Lăzărești displays high, naturally sourced CO_2 fluxes with high spatial and seasonal variability, probably also influenced by hydrological conditions and soil biological activity. Vegetation patterns also differ: at Bodoc, elevated CO_2 fluxes are associated with higher cover of healthy plants, whereas at Lăzărești, high fluxes correspond to reduced vegetation cover, changes in community composition and an increased monocot/angiosperm ratio.

Key words*: soil CO_2 flux, natural analogue, environmental monitoring, vegetation response, seasonal variability, Bodoc, Lăzărești.*

INTRODUCTION

Carbon capture and storage (CCS) is widely regarded as an important mitigation strategy for reducing greenhouse gas emissions. According to the IPCC Sixth Assessment Report (IPCC, 2023), the observed increase in global average temperatures since the industrial era is very likely driven by anthropogenic greenhouse gas emissions. The deployment of CCS has been recommended as part of the portfolio of solutions needed to achieve global climate targets outlined in recent IPCC assessments (IPCC, 2022). However, one of the key challenges associated with this technology is the potential risk of CO_2 leakage and its possible impacts on surrounding ecosystems.

Several studies describe the relationship between increased CO_2 concentration in soils and the state of vegetation. The effect of CO_2 can be direct on plants or indirect through pH changes and mobilization of nutrients and potentially toxic elements (Noble et al., 2012). These effects are typically investigated using controlled leakage at experimental field sites or by using natural analogues where there are significant CO_2 releases.

It is important to state that the changes reported are due to CO_2 leaking towards the surface from the underground sources, not due to an increase of CO_2 concentration in the air. The latter often has a fertilizing effect on above-ground organs (Norby & O'Neill, 1991; Dahlman, 1993; Huxman & Smith, 2001; Veteli et al., 2002; Hymus et al., 2003; Schäfer et al., 2003) and underground organs (Idso & Kimball, 1992; Rogers et al., 1992; Schäfer et al., 2003) in some species.

It can also have little to no effect on physiology, growth or productivity on some ecosystems (Dahlman, 1993; Kirschbaum, 1999) or even be detrimental to some species, such as *Rumex obtusifolius* and *Cardamine flexuosa*, where it introduces pronounced discolouration of the leaves and premature senescence of the foliage, as well as a decrease in yield (Diaz et al., 1993). Previous research has shown that botanical changes caused by the presence of CO_2 in soil are site and species specific. Usually, plants show no significant response at moderate concentrations of CO_2 (Bouma et al., 1997). At high concentrations, plants can have decreased height, root respiration and depth of rooting (Nobel & Palta, 1989; Vodnik et al., 2006). They can also present signs of stress such as yellowing or browning of leaves due to a rapid flux of CO_2 (West et al., 2009; Pfanz et al., 2011). There is a predominance of grasses in the proximity of

CO_2 vents (Beaubien et al., 2008; West et al., 2009). Vegetation dieback (Bergfeld et al., 2006) or absence of vegetation (Beaubien et al., 2008) can also be due to high fluxes of CO_2.

There have been sites where certain species acted as potential bioindicators of high CO_2 concentrations or fluxes. These have been genus *Polygonum* with the species *P. arenastrum* (Krüger et al., 2009) and *P. aviculare* (West et al., 2015), as well as the species *Minuartia glomerata* (Ziogou et al., 2013).

Another finding from some studies has been concentric vegetation zonation around well-defined CO_2 vents, with the more resistant taxa growing increasingly closer to the vent and often with absence of vegetation at the vent core (Beaubien et al., 2008; Krüger et al., 2009; 2011).

Romania hosts several sites suitable as natural laboratories for the study of the effects of a potential leakage from an anthropogenic CO_2 storage site (sites with natural CO_2 emissions) as well as background conditions representative of safe storage environments (natural CO_2 fields). In the framework of a nationally funded research project that aims to develop an environmental monitoring methodology, two sites have been selected as natural laboratories: Bodoc for safe storage (Covasna County) and Băile Lăzărești for leakage (Harghita county). Gas flux measurements and vegetation surveys were conducted at both sites in September 2024 and April 2025.

MATERIALS AND METHODS

Study areas

The Bodoc site is located on a cattle pasture situated on the outskirts of Bodoc commune, along the Borviz Brook, above a carbonated mineral water reservoir. Geographically, the Bodoc site can be found at: 45°57'57.47"N; 25°52'21.19"E and an average altitude above sea level of 586.35 m (Figure 1). Geologically, Bodoc is located at the western limit of the intensely folded and faulted Cretaceous flysch deposits.

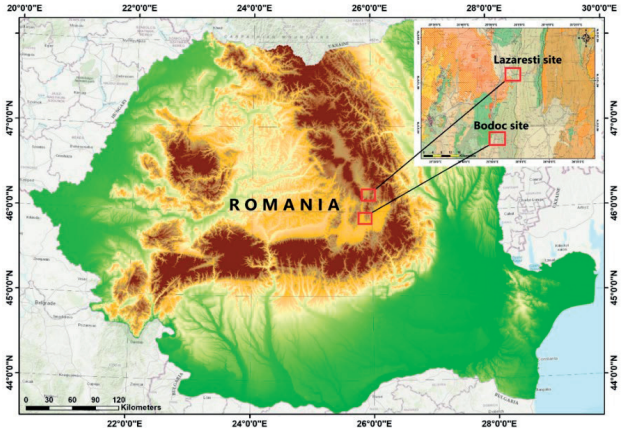


Figure 1. Location of Bodoc and Lăzărești sites in Romania and on geological map (the smaller image)

The Sânmartin-Bodoc strata are an alternation of sandstones, marls, shales and conglomerates. Aquifers are present at medium depth in the basement rock and also at shallow depth, in post tectonic deposits of the sedimentary cover. The conglomerate facies, found in a synclinal, is strongly affected by a series of transverse faults through which mineral waters migrate to the surface (Mutihac, 1990). These mineral waters are well-known, on the left bank of Borviz brook is the F1 SNAM Talomir well, with the aquifer in Upper Pliocene-Quaternary deposits and on the right bank is the oligomineral water well F2 SNAM in Quaternary deposits (SNAM, 2025).

Băile Lăzărești site, also known as Lăzărești, is situated next to the village of Lăzărești in the Cozmeni commune, being renowned by highly concentrated CO_2 emissions which can exceed 85% in volume (Dudu et al., 2024). Geographically, Băile Lăzărești is found at 46°11'00.17"N; 25°57'11.72"E and an average altitude above sea level of 743.29 m (Figure 1).

From a geological perspective, Băile Lăzărești is situated on a succession of geological deposits which starts with the Cretaceous flysch at the base (Sânmartin-Bodoc, of Barremian-Albian age) to the terrace deposits at the top. A fault system dominates the deep geological structure of the area, which facilitates the migration and distribution of post-volcanic emissions, like mofettas and mineral springs (Mutihac, 1990).

Study campaigns

The measurements were conducted at Bodoc and Lăzărești sites in September 2024 and April 2025. These included soil flux and vegetation surveys.

Soil flux measurements were performed using the West Systems portable fluxmeter equipped with CO_2, CH_4 and H_2S sensors. FluxRevision 4.11 software provided by West Systems was used to process the data.

The September 2024 campaign included 244 soil flux measurements and 107 points for vegetation assessment at Bodoc site, divided in two perimeters, one along a brook valley and one on a cattle pasture (Stelea et al., 2025). At Lăzărești site, gas measurements were done also on two perimeters, one in the area with the most important touristic features and one on a recently landscaped hill with three terraces. The sampling points were 5 m apart, with 52 sampling points for soil flux measurements and vegetation assessment.

The April 2025 campaign took place between 23-29 April 2025. The April campaign in Bodoc 2025 consisted of 131 points of variable distance and the campaign in Lăzărești 2025 consisted of 250 points, 5 m apart, all of which were assessed for gas flux and vegetation.

Vegetation surveys

The vegetation surveys for Bodoc and Băile Lăzărești for the September 2024 campaign are similar to those conducted in April 2025. The quantitative vegetation surveys were done in the same place or the immediate vicinity of the measurement points for soil gas flux and concentration, using a 50 × 50 cm quadrat placed at the locations where gas measurements were conducted.

The interior of every quadrat was digitally photographed with the camera of a mobile phone (Xiaomi Poco M3 for the 2024 campaign, Motorola Edge 50 Neo for the 2025 campaign). Using GIMP software (version 2.6 for the 2024 campaign, version 3.0.60.0 for the 2025 campaign), a grid of 25 points situated at equal distance was created inside the quadrat (Figure 2). The category corresponding to each grid intersection was recorded at the intersection or immediately above, in case it falls on multiple elements at once.

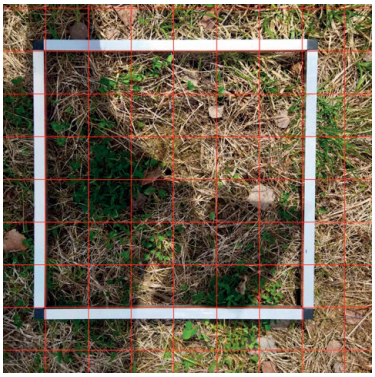


Figure 2. The grid used to calculate the relative abundance of vegetation and soil coverage categories

For the survey we performed a quantitative evaluation through the presence and dominance of categories of soil cover or plant types, also considering their state of health. Where possible, the main taxa of herbaceous plants were identified using the mobile platform iNaturalist (iNaturalist, 2024, 2025), with the observations georeferenced and published through the GBIF network (GBIF 2024; 2025).

The soil coverage categories used are similar for September 2024 and April 2025 assessments. The categories are as follows:

1. dicotyledonous angiosperms (dicots) not known as indicators - healthy organs;
2. monocotyledonous angiosperms (monocots) - healthy organs;
3. herbaceous angiosperms - withered, yellowed or browning organs;
4. herbaceous angiosperms - dried organs;
5. mosses;
6. pteridophytes;
7. external (tree leaves, twigs, litter etc.) or unidentified (shaded) elements;
8. bare ground;
9. known “indicator” taxa from other studies: *Polygonum* sp., *Minuartia glomerata*.

The criteria for selecting categories 1-2 come from scientific literature, where it was found that monocots are generally more frequent than dicots in areas with high levels of CO_2 (Krüger et al., 2009; West et al., 2009; Krüger et al., 2011; Noble et al., 2012). Categories 3 and 4 were selected because very high CO_2 emissions can lead to the yellowing or browning of leaves (West et al., 2009) or can lead to plant death (Bergfeld et al., 2006). Mosses and pteridophytes (categories 5 and 6) can be dominant in certain places although it is unknown whether their presence is related to given CO_2 concentrations. Category 7 is neutral, although external elements often mask bare ground. Categories 8 (bare ground) and 9 ("indicator" taxa) can appear at the highest CO_2 fluxes or concentrations. Using the photographs, mapping techniques and data analysis functions of Microsoft Excel relationships were analysed between the composition of soil coverage categories and the CO_2 flux, for both Bodoc and Lăzărești and both campaigns.

RESULTS AND DISCUSSIONS

Flux measurements of soil CO_2

The minimum, maximum, median and mean values for the two campaigns (2024 and 2025) at Bodoc and Lăzărești are written in Table 1 and the distribution is illustrated in Figure 3.

At Bodoc, during the September 2024 campaign the values obtained for flux measurements are relatively low. During April 2025 campaign the measured flux values are slightly higher.

The values obtained at Lăzărești in September 2024 are much higher than at Bodoc, due to known CO_2 seepage.

Table 1. CO_2 summary statistics for Bodoc and Lăzărești

Campaign	Minimum [mol/ m^2/ day]	Median [mol/ m^2/ day]	Mean [mol/ m^2/ day]	Maximum [mol/ m^2/ day]
Bodoc Sep 2024	0.042	0.272	0.291	1.382
Bodoc Apr 2025	0.233	0.604	0.693	2.736
Lăzărești Sep 2024	0.2	3.479	13.039	322.3
Lăzărești Apr 2025	0.1383	2.99	16.420	601.4

A Mann-Whitney U statistical test was performed between pairs of the four sites – campaigns: Bodoc 2024, Bodoc 2025, Lăzărești 2024, Lăzărești 2025 and the result, for all but one of six combinations, was that the rank sums are significantly different. This means that most sites, even the same site at different campaigns, has flux values that, as groups, are also significantly different from each other; Lăzărești site has values that are not statistically different in 2024 and 2025.

Vegetation survey at Bodoc

As described in Stelea et al. (2025), the herbaceous vegetation consists of a cattle pasture next to an oak forest, slightly sloped in the upper, northern area and flat in the lower, southern area, separated by a steeper slope with ungrazed vegetation. The upper sector is oriented NE–SW and shaped like a wide stripe.

Due to grazing, plants are generally no taller than 5 cm from the ground surface, except for some unpalatable taxa and plants found near shrubs. Grazing makes plants hard to identify, especially those from order Poales.

In September 2024, plants were generally affected by drought, with withered, yellowed and dried organs due to an unusually hot and dry summer and autumn. More vigorous plants were in the ungrazed parts, close to the Borviz brook or in the shade of the taller vegetation (shrubs and trees).

In April 2025 plants were green and vigorous, unaffected by drought, although some had dried organs, probably left over from last year. The trees and shrubs from the middle part of the study area were removed.

Mosses are present, without being identified by genus or species. Pteridophytes are represented by genus *Equisetum*. Dicots are dominated (as number of identified species) by families Asteraceae, Lamiaceae and Plantaginaceae. Monocots are mostly represented by order Poales, family Poaceae, with *Poa pratensis*, *Agropyrum repens* and other species which cannot be identified due to the lack of reproductive elements. Moist areas have *Luzula* sp., *Carex* sp., *Juncus* sp. One species of orchid was found, *Neotinea (Orchis) ustulata*.

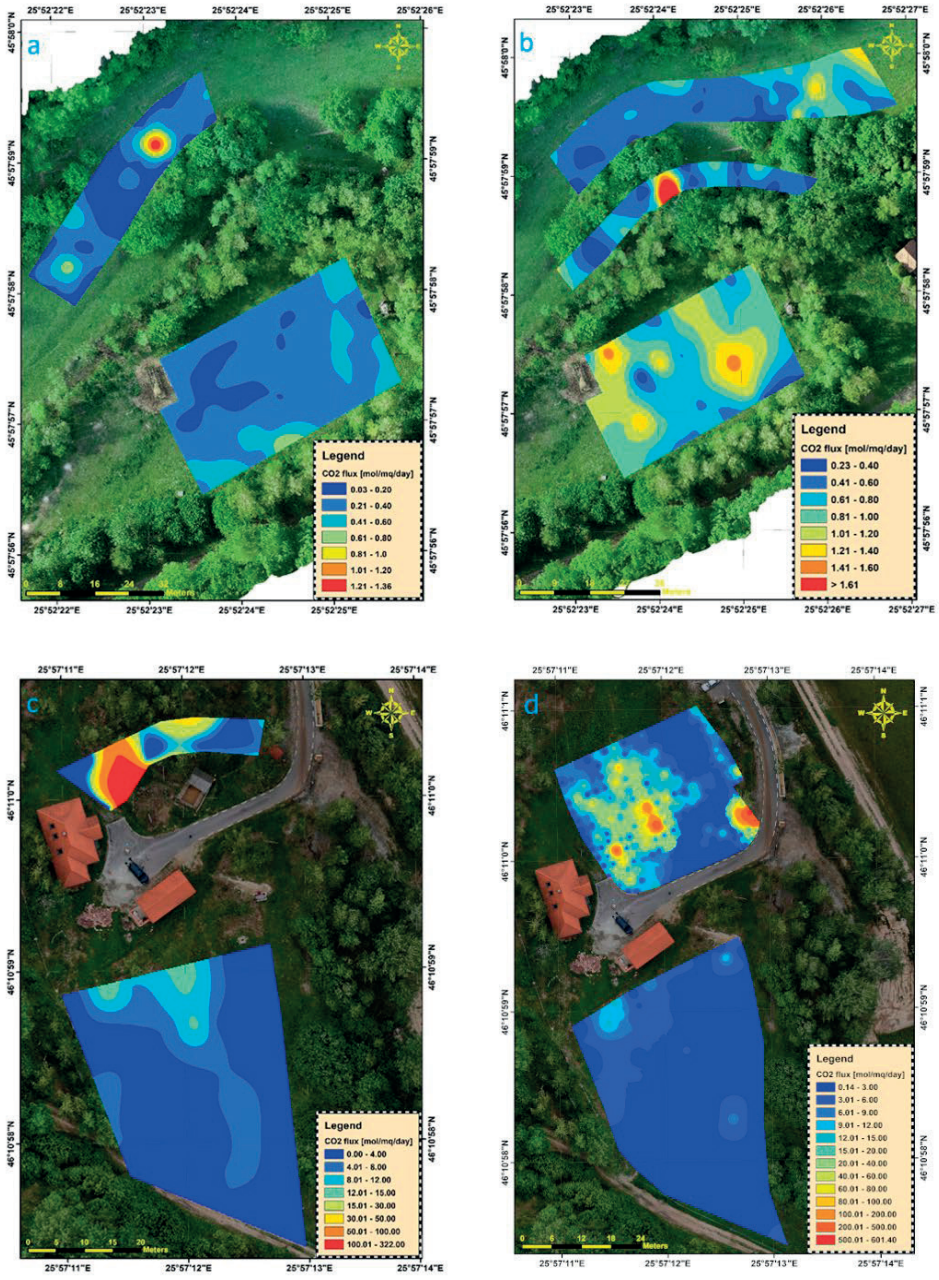


Figure 3. Flux maps at Bodoc 2024 (a), Bodoc 2025 (b), Lăzărești 2024 (c) and Lăzărești 2025 (d)

Vegetation survey at Lăzărești

The study area was also described in Stelea et al. (2025). It is a vegetated enclosure with built structures for balneotherapy and some terracing works. The area has a marked, but not steep slope, with Northern exposure. Vegetation is represented by trees (dominated by birches – *Betula pendula*, with hornbeams – *Carpenus betulus* and spruces – *Picea abies*), shrubs (*Salix capraea*, *Juniperus communis*) and herbaceous vegetation. Unlike for Bodoc, Lăzărești vegetation reaches its typical growth height, but

may be prevented to grow by anthropic intervention such as treading, mulching and by the presence of balneotherapy constructions. Herbaceous plants are generally vigorous although some are yellowed in appearance.
Mosses are present but they were not identified. Among pteridophytes are present *Lycopodium clavatum*, *Equisetum* sp., *Pteridium aquilinum* and *Athyrium filix-femina*. Dicotyledonous angiosperms are dominated as a number of species by the families Asteraceae, Caryophyllaceae, Fabaceae, especially genus *Trifolium*. Monocotyledonous angiosperms are dominated by order Poales, with families Poaceae, Cyperaceae and Juncaceae. Other monocots found were autumn crocuses (*Colchicum autumnale*), as well as unidentified orchids (missing reproductive elements at the time of the survey).

Quantitative survey - comparison

For the quantitative survey there were processed for Bodoc 107 points in 2024 and 131 in 2025. For Lăzărești 52 points in 2024 and 250 in 2025 were processed. By analysing the data from spring 2025, a new category of vegetation coverage has been identified in the form of dried plant organs, which can be an indicator of extreme stress or just a remnant from previous year. This identification leads to the reinterpretation of the autumn 2024 data, previously presented in Stelea et al. (2025).
Comparing the two surveys (Table 2, Figure 4) from the two separate campaigns, we can see that at Bodoc there is a similar proportion of healthy dicots and monocots in autumn 2024 but not in spring 2025, when there are more healthy dicots. At Lăzărești there are more healthy monocots than dicots in both campaigns.
Bodoc in the autumn of 2024 has plants with more dried organs than either Lăzărești or Bodoc in the spring 2025 campaign. The explanation for this phenomenon is the 2025 drought.
At Lăzărești in the spring of 2025 there are more dried plant organs than in the autumn of 2024, because they probably died during the cold season and had not yet decomposed or covered by new growth.
External elements, such as leaves, twigs, roots or unidentified and shaded elements are poorly represented at Bodoc in 2024. There are more external elements at Lăzărești in the spring of 2025 (mostly birch leaves) than in autumn 2024 or at Bodoc in both campaigns.
As minor elements there are mosses and pteridophytes. The percentages of bare ground are similar in 2025 in both Bodoc and Lăzărești, slightly higher in Lăzărești 2024 campaign and lower in Bodoc 2024 campaign.
"Indicator" plants were lacking from all studied points.
Based on soil coverage we calculated two indicators – "Healthy plants coverage" and "Monocots/Total angiosperms ratio".
"Healthy plants coverage" (Figures 5 and 6) represents the proportion of plants with healthy organs from the sample – monocots, dicots and pteridophytes. We excluded mosses from the calculation, because they were mostly dehydrated.
Typical values for Bodoc in spring 2025 are around the average of 65.5% with a standard deviation of 18.3%. Typical values for Lăzărești in the same campaign are around the average of 42.3% with a standard deviation of 23.7%. These values and the distribution show us that at Bodoc healthy vegetation generally covers a much higher proportion that at Lăzărești, but considering the results from the autumn of 2024, we consider that things can change with the influence of climatic factors and vegetation succession.

Table 2. Comparison between soil coverage categories at Bodoc and Lăzărești

	Campaign	Dicots (%)	Monocots (%)	Stressed organs (%)	Dried organs (%)	Moss (%)	Pteridophytes (%)	Other (%)	Bare ground (%)
Bodoc	2024	17.27	17.38	6.5	46.43	2.58	0	7.07	2.77
	2025	36.61	28.67	0.82	3.48	1.44	0	22.66	6.32
Lăzărești	2024	22.62	44	3.08	7.77	0.08	0.38	12.92	9.15
	2025	9.42	30.4	1.49	15.54	2.37	0.11	34.56	6.11

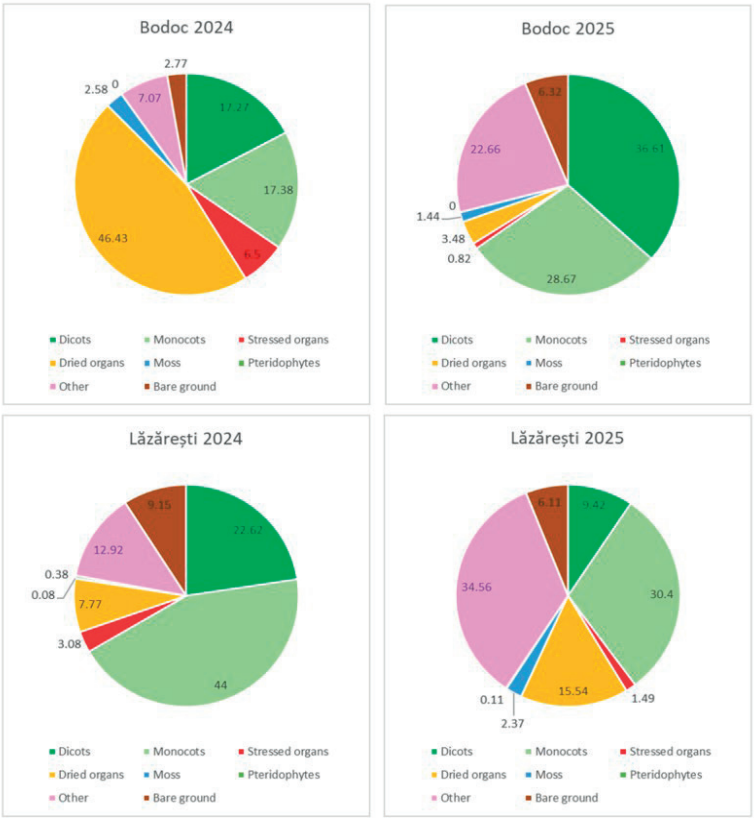


Figure 4 Comparison between soil coverage categories for Bodoc and Lăzărești in 2024 and 2025

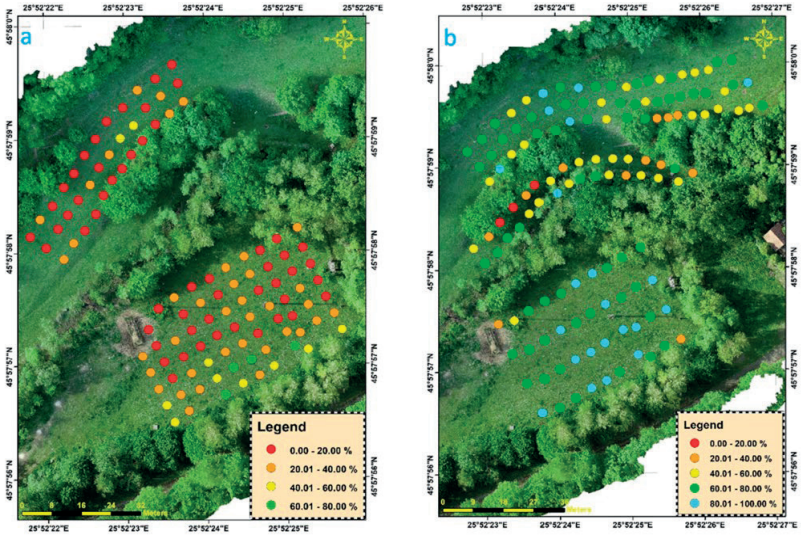


Figure 5. Healthy plant coverage at Bodoc in the 2024 campaign (left - a) and 2025 campaign (right - b)

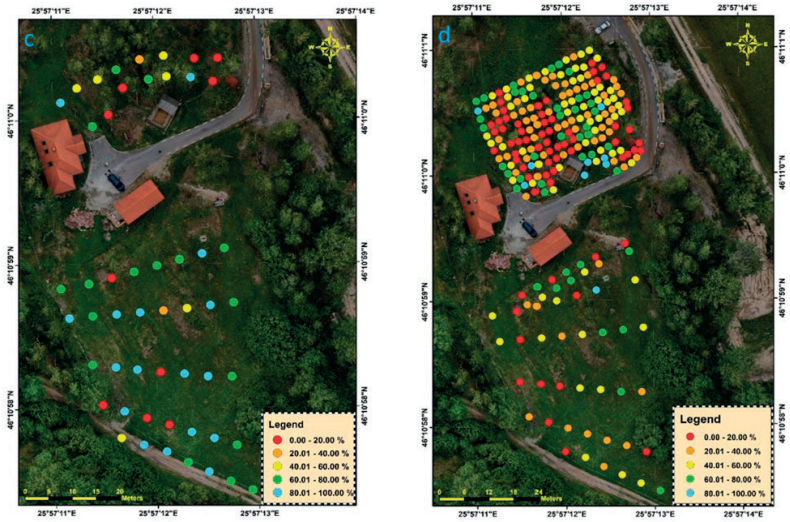


Figure 6. Healthy plant coverage at Lăzărești in the 2024 campaign (left - c) and 2025 campaign (right - d)

The monocots/Total angiosperms ratio represents the proportion of apparently healthy organs (leaves, stems, flowers, fruits) of monocots divided to the total of healthy angiosperms. The higher the value, the higher the chances of species substitution due to high fluxes of CO_2.

Typical values for Bodoc in 2025 are around the average of 43.3% with a standard deviation of 22.1%. Typical values for Băile Lăzărești are much higher, with an average of 72.6% but the distribution shows a strong increase of the values up to the maximum. These values and their distribution show us that at Lăzărești is a higher proportion of monocots, which is to be expected, but it is possible that with vegetation succession over the year these values and proportions can change.

The relationship between the vegetation survey and the flux measurements at Bodoc and Băile Lăzărești in 2025

We attempted to highlight quantitative relationships between the composition of soil coverage categories and the flux of CO_2. We have done this by identifying three categories of flux (high, intermediate and low) for both Bodoc and Băile Lăzărești. At first, we have tried a correlation analysis of individual samples with CO_2 flux but it did not give any significant results due to samples being too small and too variable. However, if summed up together we can observe some trends.

For Bodoc we established three categories – under 0.5 mol/m^2/day (relatively low flux), between 0.5 and 1 mol/m^2/day (relatively average flux), over 1 mol/m^2/day, up to 2.7 mol/m^2/day (relatively high flux) of CO_2 (Figure 7).

It can be observed at the three flux categories that with the increase of the CO_2 flux also increases the prevalence of healthy plants, especially monocots, and the bare ground percentage decreases. The neutral elements percentage is higher at a flux of CO_2 under 0.5 mol/m^2/day and approximately equal at higher fluxes (~21%). The dicot percentage is almost 31% at the relatively low flux and approximately equal at the relatively intermediate and high fluxes.

Higher CO_2 fluxes are associated with more plant coverage, especially of monocots. It is necessary, though, to repeat the measurements to see if these results were not due to chance.

Also, for Băile Lăzărești we established three categories – 0-10 mol/square meter/day (low flux), 10-49.(9) mol/square meter/day (intermediate flux), 50+ mol/square meter/day (high flux) (Figure 8). These categories are not the same as the ones used at Bodoc, because we have different orders of magnitude for the CO_2 flux.

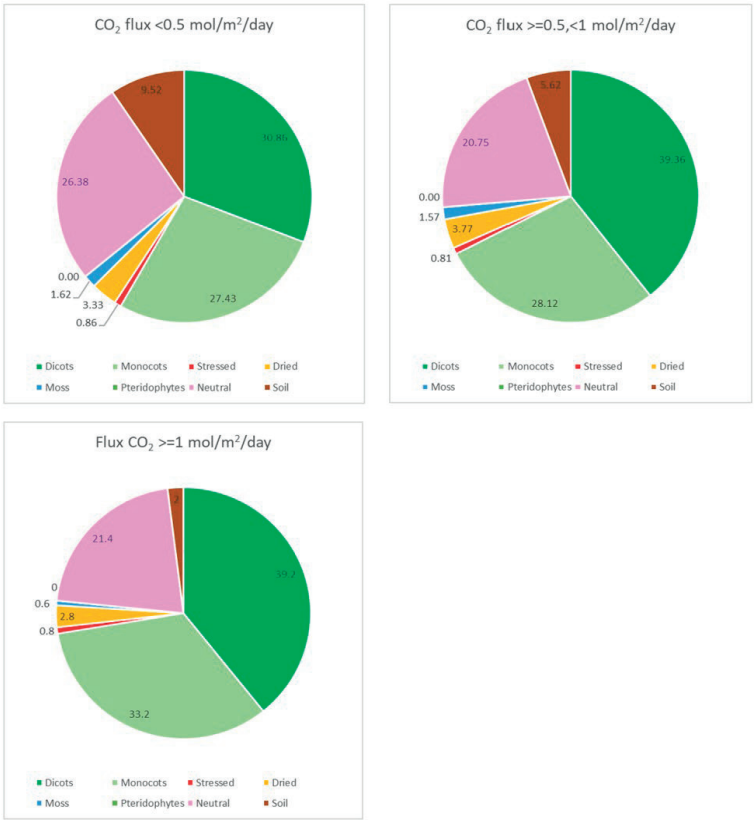


Figure 7. Soil coverage categories function of CO2 flux at Bodoc, 2025

We have analysed three subcategories of the low flux – under 0.499 mol/m^2/day, 0.5-0.999 mol/m^2/day and 1-3 mol/m^2/day to compare with results from Bodoc, but it was inconclusive, probably due to the small number of samples with such values.

Analysing the data and graphs with the soil covering categories coupled with CO_2 flux categories for Lăzărești we can see the following trends:

- A decrease of the ratio of healthy plants – monocots, dicots and pteridophytes. The indicator "Healthy plant coverage" decreases from the average of 43.7% for low flux, to 35.2% for intermediate flux and 12% for high flux.
- No change for the ratio of monocots/total angiosperms; even though the average values slightly decrease, a Mann-Whitney test performed on pairs reveals that the samples are statistically similar.
- A decrease of pteridophyte ratio.
- A decrease of dried plant organs ratio.
- A slight increase of moss coverage.
- A high increase of the surface covered by external elements and bare ground.
- Absence of "indicator" taxa.

As interpretation, it is considered that the decrease of surface covered by healthy plants is due primarily to soil and water acidification produced by CO_2 and associated gases. Differently from what we observed at Bodoc, higher values of CO_2 are not associated with richer vegetation, but poorer.

The decrease of the ratio of dried plant organs is related to the decrease of the ratio of healthy-looking plant organs. In the present case, we consider that dried organs are not primarily due to the toxic effect of CO_2 and other gases but represent a normal plant response to the cold season.

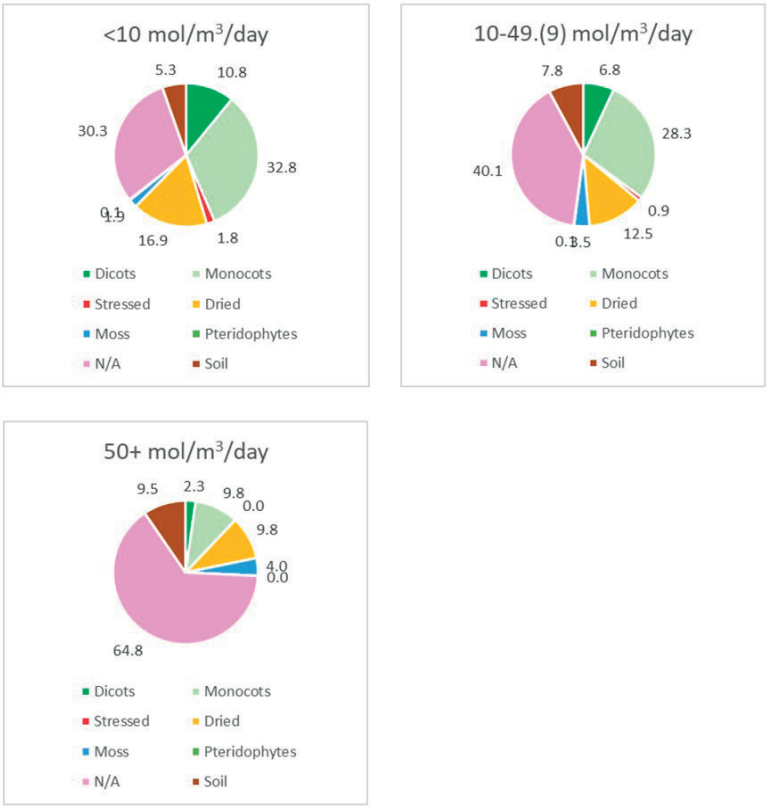


Figure 8. Soil coverage categories function of CO_2 flux at Lăzărești, 2025

Because the CO_2 flux did not start suddenly, like for the case of experimental grounds, but represented more or less a constant presence, we consider that the vegetation at Lăzărești is adapted to the high CO_2 fluxes, having relatively few organs with signs of stress (apart from the dried ones).

The lowering of the ratio of pteridophytes and the increase of mosses must be considered with caution, due to the small values of their presence and dominance. The increase of the surface occupied by external elements and bare ground is a good indication for the CO_2 flux, both directly, due to the toxic effects of the mofetta gases, as well as indirectly (the closeness to the mofettas with high concentrations of CO_2 can lead to a higher anthropic impact in those areas, which would affect the vegetation).

Lastly, the study areas did not contain known "indicator taxa" like the genus *Polygonum* or the species *Minuartia glomerata*. This does not mean that there aren't areas with abundant CO_2, but that the presence of "indicator" plants which are tolerant to high fluxes of CO_2 is not necessary. Other plant taxa strongly associated with high fluxes of CO_2 were not identified.

CONCLUSIONS

The study evaluated the potential of vegetation surveys as an environmental monitoring tool for CO_2 geological storage and the presence of bioindicators that could be used as early signs of CO_2 leakage. In order to meet these objectives, vegetation surveys were conducted in two natural analogues relevant for geological CO_2 storage monitoring and representing different storage scenarios (one for safe storage and one for a leaking site) aiming to compare vegetation characteristics and to correlate where possible with different categories of CO_2 fluxes. Another aim of the study was to assess whether vegetation responses to increase CO_2 fluxes

described in the international literature are observable in the Romanian sites.

From the start, one conclusion is that the study areas are floristically too different to be readily compared. Bodoc area is a cattle pasture surrounded by an oak forest. Băile Lăzărești represents an ecosystem lacking large herbivores, but anthropically modified. There are biotope differences which are reflected in the species composition, with taxa which prefer higher humidity and colder climate present at Lăzărești.

The higher fluxes of CO_2 in the area of Bodoc, still close to the normal values, are associated with a higher prevalence of healthy plants, particularly monocots. In the area of Băile Lăzărești the higher fluxes of CO_2, significantly above normal, are associated with a decrease of the coverage by healthy and dried plants, and in the areas with the highest fluxes, vegetation is almost absent and bare ground is often found, which can also be due to anthropic factors.

The observed relationships between vegetation cover, plant functional groups, and soil CO_2 flux suggest that herbaceous vegetation may provide a useful complementary indicator for identifying areas affected by elevated CO_2 emissions at CO_2 geological storage sites. However, vegetation responses are strongly influenced by local ecological conditions and anthropogenic disturbance, limiting the use of vegetation alone as a qualitative monitoring tool.

As a limitation of the study, the observed trends appear at the sums of categories but not at the individual samples, which are too varied in composition and cannot be used for a correlation analysis. Vegetation monitoring should therefore be considered as a complementary component of integrated CCS monitoring strategies, to be used together with geophysical and geochemical methods rather than as a standalone indicator of CO_2 leakage.

An important limitation of the methodology is that soil flux measurements required the removal of inventoried vegetation at the sampling points, in order to achieve the airtightness required for the measuring chamber of the fluxmeter. This disturbance modifies the local plant assemblages over time by favouring opportunistic colonizing species, making long-term monitoring of identical points unreliable. For this reason, future studies should either establish adjacent non-destructive monitoring plots or periodically relocate sampling points.

Comparing this study to others performed on natural analogues in other countries has revealed the lack of potential "indicator species" for higher CO_2 values. Because of the random placement of the high, mid and low flux CO_2 points and their possibly inconsistent emission patterns as revealed by the flux maps, the concentric vegetation zonation present in places with well-individualized CO_2 vents is absent at Lăzărești.

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