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Automated environmental monitoring in Strandzha Nature Park – a pilot study

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Abstract. Protected ecosystems and their biodiversity are extremely sensitive to any significant environmental changes. In the context of global climate warming and droughts, it is crucial to monitor weather conditions and their dynamics, especially in such areas. Here we present some data from the region of Strandzha Nature Park and their use in predicting potential risk periods for the survival of local wild species and their communities. They could be integrated into various systems for smart environmental monitoring and/or early warning systems.

Key words: meteorology, climate change, Meteobot®, early warning system.

Introduction

Protected areas are an important line of defense in combatting the twin crises of climate change and biodiversity loss simultaneously (Mellilo et al., 2016; IUCN, 2019). On the other hand, protected ecosystems and their biodiversity are extremely sensitive to any significant environmental changes. Some studies have demonstrated that reducing the climate change impact on tree diversity is crucial because forests play a major role in carbon sequestration, thereby contributing to further climate stabilization (Mori et al., 2024).

Strandzha Mountain is well known as one of the richest regions in Bulgaria and Europe in terms of biodiversity. Situated along the Black Sea coast, at the south-eastern end of the Balkan Peninsula, it presents a natural transition between the vegetation, flora and fauna of Europe and Asia. More than 90 types of natural habitats have been identified (62 terrestrial or wetland and 28 marine), with the prevailing of forest ecosystems which cover at about 80% of the mountain. Furthermore, some of the species are remnants of the Tertiary vegetation, preserved due to its remoteness from the Quaternary glaciations, mild winters, high rainfall and air humidity. The unique ecosystems and biodiversity are of a high conservation value and since 1993, Strandzha's territory was declared as the only Bulgarian out of the five priority conservation areas of South-Eastern

Europe by the European Council of Ministers of the Environment (Petrova et al., 2024).

Strandzha Nature Park is the largest protected area in Bulgaria and is an example of successful coexistence of man and nature (Zlatkova & Parusheva, 2025). Some of our previous work was related to an assessment of the sustainable development of rural areas in this protected territory (Petrova et al., 2024) and to the development of various sensor systems for in-situ monitoring of the anthropogenic impact on the environment (Popov et al., 2024, 2025; Tokmakov et al., 2025).

In the context of global climate warming and drought, it is extremely important to monitor local weather conditions and their dynamics, as they are one of the main natural factors for the survival of protected species and ecosystems. The aim of the present study is to: 1) analyze the data obtained from the installed system for automated meteorological observations on the territory of Strandzha Nature Park; 2) discuss their use for predicting potential risk periods for the survival of native wild species and their communities.

Materials and methods

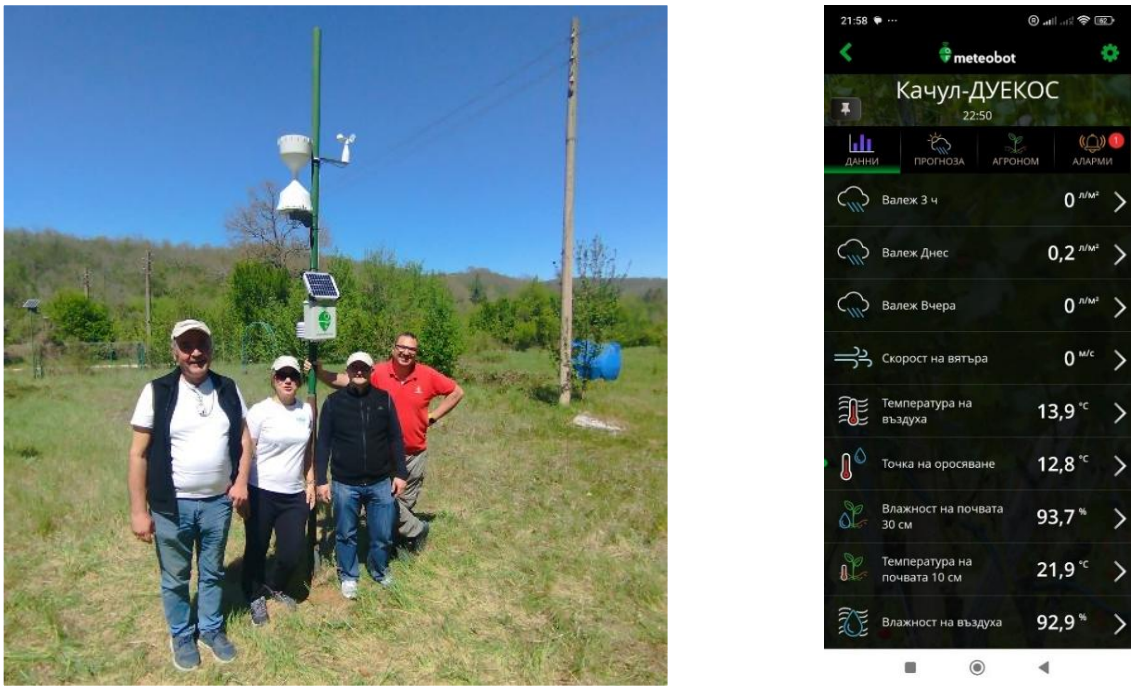
Automated meteorological monitoring was conducted thought Meteobot® system - a professional station which provides detailed meteorological information (https://meteobot.com/). It was installed on the territory of Strandzha Nature Park (Kachul area, near Gramatikovo Village) in March 2025 (Fig. 1a) and a data base has been generated since then.

Meteobot® system consists of:

- Rain sensor;
- Soil temperature sensor;
- Soil moisture sensor;
- Wind speed sensor;
- Sensor for air temperature, air humidity and air pressure;
- Solar panel;
- Battery.

All data are stored on a served and can be accessed via Meteobot® App (Fig. 1b). This applica-tion provides the following information:

- Current and historical data from weather station;
- Local weather forecast for 10 days;
- Agronomic indicators such as rain sum, temperature sum, etc.;
- Weather history for each area;
- Weather notification for frost, intensive rain, etc.



a) b)

Fig. 1. Meteobot® system: a) installation in Strandzha Nature Park; b) app view (in Bulgarian).

Results and Discussion

The minimum air temperature (average value) in the six-month period (May-October 2025) was -0.68°C (31.10.2025), while the maximal one was 41.94°C (22.07.2025). Relative air humidity varied between 34.19% (03.05.2025) and 94.9% (28.10.2025) (Fig. 2). Soil temperature varied in the range between 9.3°C (31.10.2025) and 26.6°C (30.07.2025). Soil humidity at 30 cm depth dropped to 51% in July and August, while in the rest four months it was above 75% (Fig. 2).

Detailed daily records per each month are presented on Tables 1-6 in Annex 1.

As a whole, the air temperature values in May varied between -0.21°C (03.05.2025) and 30.38°C (05.05.2025). The minimal values were in the range from -0.21°C to 13.49°C, while the maximums were between 13.58°C and 30.38°C. When regarding the average values, they were lowest (9.1°C) on 01.05.2025 and highest (20.5°C) on 06.05.2025 (Table 1, Annex 1). The air humidity varied between 34.19% (03.05.2025) and 96.4% (31.05.2025). Minimums were between 34.19% and 84.77%, and maximums – between 91.27% and 96.4%. Average daily values for air humidity varied in the range 64.5% - 91.8% (Table 1, Annex 1). Soil temperature demonstrated a tendency to stable increase - starting from 11.6°C in the beginning of the month and reaching 18.2°C at its end. Soil moisture was the less varying parameter as it kept values in the range of 92.1% to 100% (Table 1, Annex 1). The complex analysis of all these factors showed that their values in May were favorable for the terrestrial ecosystems development and no potential risks for wild biota were detected.

In June, the air temperature was in the range from 6.72°C (01.06.2025) to 36.06°C (26.06.2025). Minimums were observed to vary between 6.72°C and 14.91°C, and maximums – between 25.19°C and 36.06°C. Average daily temperature was lowest on 01.06.2025 (16.2°C) and highest on 26-27.06.2025 (23.4°C). When regarding to the air humidity, it varied between 42.31% (24.06.2025) and 96.15% (05.06.2025) (Table 2, Annex 1). Minimums were in the range 42.31% - 65.95%, maximums – in the range 93.45% - 96.15% and the average values – in the range 74.3% - 83.0%, respectively. Soil temperature kept the tendency to increase with values between 18.2°C (01.06.2025) and 23.8°C (28.06.2025), while the soil moisture decreased from 100% in the beginning of the month to 85% at its end (Table 2, Annex 1). All measured values of both meteorological parameters in June did not pose a risk for the survival of protected ecosystems and biodiversity in the region.

In July, the air temperature varied in a wider diapason – from 9.78°C (03.07.2025) to 41.94°C (22.07.2025). Minimums were between 9.78°C and 19.38°C, maximums were found to be in the range 27.2°C up to 41.94°C, and the average daily temperature took values from 19.4°C to 26.0°C. The measured air temperature in July exceeded 30°C in a total of 26 days, 35°C in 6 days and 40°C in 1 day, respectively (Table 3, Annex 1). The air humidity values varied in the range from 29.94% (22.07.2025) to 96.12% (09.07.2025). Minimal values were between 29.14% and 61.58%, maximums – between 89.93% and 96.12%, while average humidity kept values from 61.6% to 82.9% (Table 3, Annex 1). Soil temperature slightly increased from 22.4°C (02.07.2025) up to 26.6°C (30.07.2025), and the soil moisture decreased progressively starting from 85.8% (01.07.2025) and reached up to 60.3% (31.07.2025). The analysis of all meteorological records in July showed that the registered temperature values of both air and soil were exceeded the optimum range for the development of protected ecosystems, but still stayed in their tolerance zone. Fortunately, the air and soil humidity did not drop critically, even no precipitation occurred in this month (Fig. 3).

As a whole, in August the air temperature varied in the range from 10.43°C (28.08.2025) to 36.26°C (22.08.2025). Minimums were found to be between 10.43°C and 16.81°C, maximums – between 24.39°C and 36.26°C, while the average daily temperature changed from 16.2°C to 22.8°C (Table 4, Annex 1). A significant decrease in air temperature was observed in comparison with the previous month – at about of 3°C per daily average, but also in the number of days exceeding 30°C (16 days in August, 26 days in July) and 35°C (1 day in August, 6 days in July). Another important occurrence was the precipitation on 19.08.2025 with 50.8 l/m^2, as well as the quite smaller ones on 06-07.08., 20.08. and 24.08.2025 (Fig. 3). As a result, the air humidity changed between 31.16% (18.08.2025) and 96.73% (07.08.2025). Minimal values were registered in the range 31.16% - 68.11%, maximums – in the range 93.13% - 96.73%, and the average humidity was between 71.0% and

88.0% (Table 4, Annex 1). Soil moisture was also influenced by the rain – the values in the beginning of the on the month were in the range 52.1% - 59.4%, but after the intense precipitation they reached 95%-100%. When regarding the soil temperature, a tendency to continuous decreased was found, starting from 24.8°C (01.08.2025) and dropped to 19.9 – 20.1°C at the and of August. As commented above, the analysis of the main ecological factors in this month revealed that their values were not so threating in terms of ecosystems and biodiversity survival when compared to data from July. In the previous year – 2024, the situation was quite different as no precipitation occurred in both summer months, so the trees in the protected forests and all other species were subjected to a continuous heat and drought stress.

The air temperature in September was in the range from 5.16°C (19.09.2025) to 15.85°C (05.09.2025). Minimums varied between 5.16°C and 15.85°C, maximums – between 15.99°C and 32.78°C, and the average daily temperature was between 12.1°C and 21.2°C (Table 5, Annex 1). Air humidity took values in the range from 40.0% (10.09.2025) to 96.56% (05.09.2025). Minimums varied between 40.0% and 66.85%, maximums – between 92.64% and 96.56%, and average air humidity was between 78.6% and 92.0%. Soil moisture was significant, having values in the range 86.6% - 95.0% (Table 5, Annex 1). Soil temperature kept decreasing – from 20.3-20.4°C at the beginning of September up to 14.5°C at its end. A total of 5 days with weak precipitation were registered (Fig. 3). No potential risk for the ecosystems and biodiversity in the Strandzha region was detected after the analyses of data performed.

The air temperature in October, the last month of the studied period in 2025, varied significantly in the range from -0.68°C (31.10.2025) to 23.52°C (23.10.2025). Minimums were found to between -0.68°C and 11.96°C, maximums – between 13.21°C and 23.52°C, and average daily values – between 6.6°C and 15.9°C (Table 6, Annex 1). Air humidity took values in the range 47.73% (01.10.2025) – 96.98% (24.10.2025), with minimums between 47.73% and 93.88%, maximums between 93.34% and 96.98%, and average values between 81.3% and 94.8%. A total of 18 days with rain were registered, some of them with higher quantities – 21.2 l/m² (02.10.2025), 14.8 l/m² (03.10.2025), 40.4 l/m² (07.10.2025), 22.8 l/m² (27.10.2025) (Fig. 3). Soil moisture was also affected and the values were in the range 86.1% - 99.0%. Soil temperature continued to decrease and took values from 13.6°C-15.1°C in the first days of October to 9.5°C-9.3°C in the last days (Table 6, Annex 1). Similarly to the previous month, all data registered from the meteorological observations in the Strandzha Nature Park, did not pose a potential threat to the protected ecosystems and biodiversity.

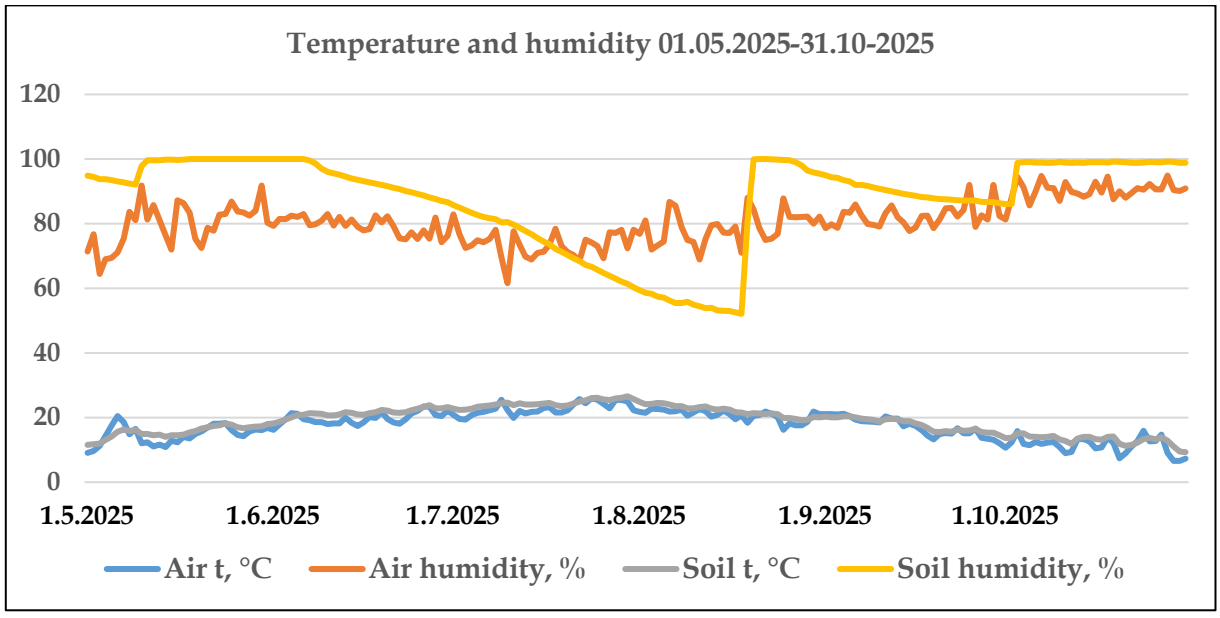


Fig. 2. Temperature and humidity during the studied 6-month period.

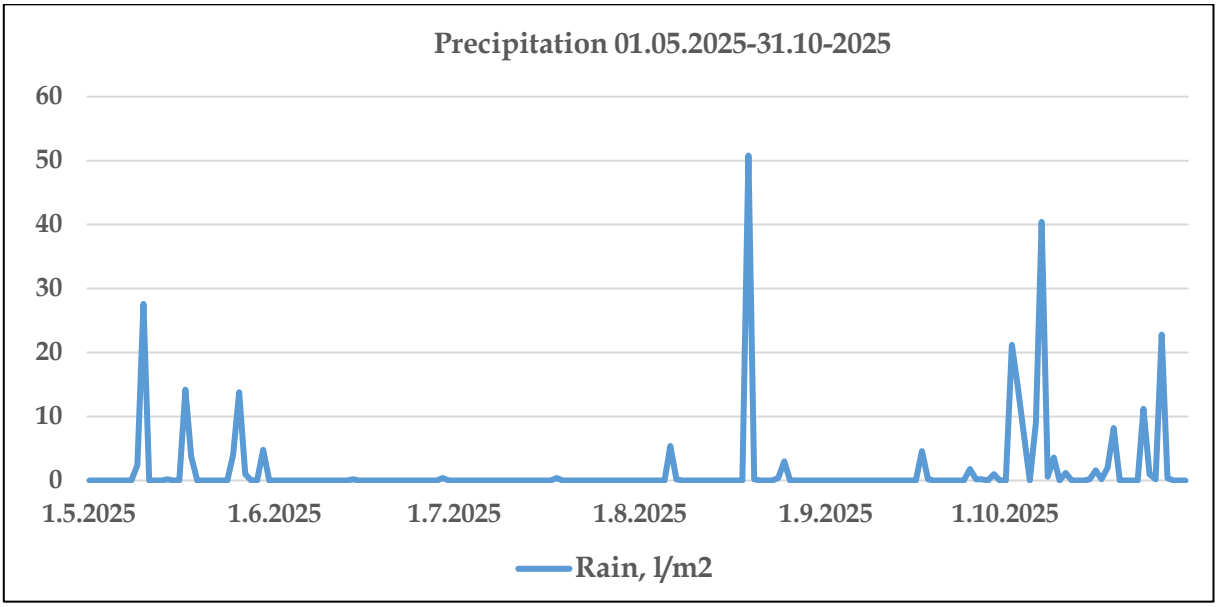


Fig. 3. Precipitation data for 6-month period.

Conclusions

Automated monitoring systems are very useful and reliable tool to monitor environmental conditions and their dynamics. Being easy to install, autonomous working and not so expensive nowadays, they could be integrated in various protected areas. The results obtained during this 6-months pilot study clearly demonstrated the potential of such monitoring systems for detection of stress periods for biodiversity survival, based on continuous meteorological observations. They are crucial to address the extent of climate change in regions with protected ecosystems which are particularly sensitive to any environmental disturbances. Data obtained through long-term measurement will provide a possibility to mathematical modelling of the natural hazards risk and will help to proactive prevention of these areas with of conservation importance. They could be integrated into various systems for smart environ-mental monitoring and/or early warning systems.

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Annex 1. Daily values of some meteorological parameters, registered in Strandzha Nature Park, Bulgaria

Table 1. Daily values of air and soil parameters in May 2025.

Date	Air temp min (°C)	Air temp max (°C)	Air temp average (°C)	Air humidity min (%)	Air humidity max (%)	Air humidity average (%)	Soil humidity (%)	Soil temp (°C)
01.05.	1.19	19.46	9.1	42.08	93.92	71.4	94.9	11.6
02.05.	1.33	18.77	9.7	50.89	92.45	76.7	94.5	11.8
03.05.	-0.21	24.73	11.3	34.19	93.02	64.5	93.8	12
04.05.	2.14	28.94	14.2	36.45	92.25	69	93.8	13
05.05.	4.97	30.38	17.5	36.16	94.32	69.4	93.5	14.1
06.05.	13.1	29.61	20.5	47.06	91.27	71.1	93.1	15.6
07.05.	10.51	28.97	18.6	45.29	93.85	75.4	92.8	16.3
08.05.	8.52	23.18	14.8	63.55	93.86	83.7	92.4	15.8
09.05.	10.57	24.43	16.5	56.5	94.73	81.1	92.1	16.2
10.05.	10.33	13.58	12.1	84.77	94.62	91.8	97.8	14.9
11.05.	5.69	20	12.4	56.42	95	81.3	99.6	14.9
12.05.	4.8	18.97	11.1	65.26	94.71	85.8	99.6	14.5
13.05.	4.65	17.38	11.7	56.92	95.08	81.1	99.6	14.7
14.05.	3.13	20.22	10.9	48.33	94.36	76.3	99.8	14
15.05.	0.98	25.34	12.8	39.23	95.38	72	99.8	14.5
16.05.	6.98	21.62	12.4	56.66	94.49	87.2	99.7	14.5
17.05.	10.1	20.66	14	62.83	95.22	86.3	99.8	14.7
18.05.	7.72	22.51	13.5	50.76	95.44	83.4	100	15.4
19.05.	4.23	26.05	14.9	39.77	96.12	75.3	100	15.8
20.05.	7.1	24.89	15.7	39.83	95.2	72.5	100	16.6
21.05.	6.31	27.72	16.9	43.05	95.27	78.7	100	17
22.05.	8.9	29.88	18.1	41.67	94.94	77.8	100	17.4
23.05.	8.06	29.09	18.1	57.31	95.5	82.8	100	17.6
24.05.	10.6	27.36	18.3	61.53	96	83	100	18.2
25.05.	13.39	19.9	16.1	73.56	94.38	86.8	100	17.8
26.05.	8.88	20.93	14.6	57.37	94.72	83.8	100	17
27.05.	7	22.4	14.2	56.11	94.96	83.5	100	16.7
28.05.	8.59	23.24	15.7	53.26	95.66	82.5	100	17
29.05.	8.56	24.25	16.3	54.53	95.44	84	100	17.2
30.05.	13.49	21.28	16.1	74.61	95.7	91.8	100	17.3
31.05.	10.17	24.25	16.8	55.32	96.4	80.3	100	18

Table 2. Daily values of air and soil parameters in June 2025.

Date	Air t min (°C)	Air t max (°C)	Air t average (°C)	Air humidity min (%)	Air humidity max (%)	Air humidity average (%)	Soil humidity (%)	Soil t (°C)
01.06.	6.72	26	16.2	51.11	95.8	79.3	100	18.2
02.06.	8.71	27.58	17.9	56.26	94.18	81.5	100	18.7
03.06.	10.29	30.07	19.5	57.31	95.76	81.4	100	19.4
04.06.	11.96	31.81	21.4	56.97	95.66	82.5	100	20.1
05.06.	14.12	29.97	21.2	59.51	96.15	82.1	100	20.8
06.06.	10.63	28.13	19.5	62.6	95.45	83	100	20.9
07.06.	11.96	26.73	19.2	55.42	94.13	79.5	99.5	21.4
08.06.	10.68	27.33	18.6	49.71	95.19	79.8	98.6	21.3
09.06.	8.43	29.5	18.6	52.4	95.18	80.9	97	21.2
10.06.	11.12	25.15	18	63.07	95.79	83	96.1	20.7
11.06.	9.69	27.48	18.2	52.54	94.85	79.4	95.6	20.7
12.06.	9.53	26.67	18.2	64.91	93.84	82.1	95.2	21
13.06.	13.83	27.3	20	56.34	95.3	79.3	94.6	21.7
14.06.	12.32	25.68	18.4	57.59	94.66	81.3	94	21.5
15.06.	9.58	26.62	17.4	52.09	95.23	79	93.6	21
16.06.	8.49	29.74	18.5	44.28	94.46	77.9	93.2	20.9
17.06.	10.46	31.2	20.2	47.51	94.96	78.3	92.8	21.4
18.06.	11.01	28.25	19.9	63.53	94.67	82.6	92.4	21.7
19.06.	13.59	31.48	21.8	54.25	95.46	80.4	92	22.4
20.06.	14.27	25.84	19.6	63.3	95.28	82.3	91.6	22.2
21.06.	12.46	25.49	18.5	54.17	95.31	79.2	91.1	21.6
22.06.	9.89	27.57	18.1	44.83	94.36	75.5	90.7	21.5
23.06.	8.1	31.6	19.5	43.61	94.84	75.2	90.1	21.7
24.06.	10.49	34.31	21.3	42.31	95.14	77.3	89.7	22.3
25.06.	12.54	32.85	22.1	42.53	95.05	75.3	89.2	22.8
26.06.	12.19	36.06	23.4	43.67	95.25	77.9	88.7	23.2
27.06.	14.5	33.64	23.4	47.4	95.55	75.4	88.1	23.8
28.06.	14.91	26.72	20.8	65.95	93.63	81.9	87.6	22.9
29.06.	13.89	27.36	20.5	47.77	95.03	74.3	87	22.9
30.06.	12.7	32.07	22.2	50.79	93.45	76.2	86.6	23.2

Table 3. Daily values of air and soil parameters in July 2025.

Date	Air t min (°C)	Air t max (°C)	Air t average (°C)	Air humidity min (%)	Air humidity max (%)	Air humidity average (%)	Soil humidity (%)	Soil t (°C)
01.07.	14.43	27.2	20.9	59.22	95.35	82.9	85.8	22.8
02.07.	11.58	29.04	19.6	48.34	95.26	76.7	85	22.4
03.07.	9.78	29.5	19.4	41.01	93.66	72.5	84.2	22.5
04.07.	10.83	32.07	20.8	43.42	93.42	73.3	83.4	22.8
05.07.	11.41	33.26	21.5	42.79	95.19	74.9	82.7	23.3
06.07.	12.27	33.24	21.8	43.37	94.63	74.3	82.1	23.5
07.07.	11.55	34.77	22.3	41.04	94.75	75.3	81.7	23.7
08.07.	12.61	34.44	22.8	51.59	95.39	78.1	81.4	24
09.07.	13.68	39.78	25.5	34.41	96.12	69.6	80.4	24.4
10.07.	15.21	32.24	22.4	39.74	89.93	61.6	80.5	24.6
11.07.	10.93	28.19	19.9	54.41	94.82	77.6	79.7	23.8
12.07.	13.65	30.82	22.1	43.54	95.22	73.5	78.7	24.4
13.07.	11.29	33.5	21.3	37.69	93.04	69.8	77.7	24
14.07.	11.28	33.87	21.8	37.1	93.21	68.9	76.7	24
15.07.	12.29	32.9	21.9	40.46	93.12	71	75.6	24.1
16.07.	12.47	34.58	23	41.69	92.45	71.3	74.5	24.3
17.07.	13.95	33.26	23.2	48.41	93.5	73.6	73.7	24.5
18.07.	16.39	27.52	21.6	61.58	93.6	78.4	72.2	23.8
19.07.	13.14	32.65	21.6	43.8	95.22	73.1	71.3	23.5
20.07.	11.49	34.77	22.3	37.56	93.84	71.2	70.3	23.7
21.07.	13.58	36.81	24	38.88	94.8	70.3	69.3	24.3
22.07.	13.99	41.94	25.7	29.94	94.4	68.6	68.4	24.9
23.07.	15.12	33.97	24.4	50.35	94.25	75.1	67.2	25.3
24.07.	19.38	34.75	26	43.99	92.92	74.2	66.6	26
25.07.	17.69	35.56	25.5	39.26	95.39	73.1	65.7	26.1
26.07.	14.59	36.37	24.2	37.38	94.41	69.3	64.8	25.6
27.07.	13	33.2	22.9	53.63	93.88	77.3	63.9	25.4
28.07.	17.13	36.64	25.5	48.07	95.49	77.1	63	25.9
29.07.	17.43	33.6	25.4	57.52	95.25	78.1	62.1	26.1
30.07.	18.23	32.98	25	48.76	91.36	72.4	61.4	26.6
31.07.	16.06	29.61	22.3	56.65	95.1	78.1	60.3	25.7

Table 4. Daily values of air and soil parameters in August 2025.

Date	Air t min (°C)	Air t max (°C)	Air t average (°C)	Air humidity min (%)	Air humidity max (%)	Air humidity average (%)	Soil humidity (%)	Soil t (°C)
01.08.	14.12	30.02	21.8	50.39	95.4	76.8	59.4	24.8
02.08.	14.94	29.88	21.5	61.05	95.06	81	58.6	24.1
03.08.	15.15	32.98	22.8	39.24	94.95	72	58.3	24.2
04.08.	14.48	32.63	22.7	38.64	93.95	73.3	57.4	24.5
05.08.	14.34	32.19	22.5	45.16	95.31	74.5	57.1	24.4
06.08.	15.43	29.99	21.9	66.41	95.18	86.7	56.2	24
07.08.	16.81	28.97	22	62.46	96.73	85.6	55.4	23.5
08.08.	16.15	30.16	22.5	51.91	96.35	78.9	55.4	23.5
09.08.	12.46	30.66	20.6	43.77	96.14	75	55.8	22.9
10.08.	12.6	32.76	21.6	39.23	95.12	74.4	54.9	22.9
11.08.	13.17	34.57	22.7	39.49	93.13	68.9	54.5	23.2
12.08.	14.34	31.33	22	47.87	94.35	75.4	53.9	23.4
13.08.	12.35	28.99	20.3	56.39	95.59	79.5	54	22.8
14.08.	12.91	29.47	20.9	56.73	95.37	79.9	53.2	22.5
15.08.	14.81	30.83	22.2	42.78	95.54	77.2	53.1	22.8
16.08.	13.24	29.47	21.1	51.78	96.24	77.1	53	22.5
17.08.	11.88	29.02	19.5	50.96	94.9	79.1	52.6	21.7
18.08.	11.08	32.14	20.7	31.16	95.37	71	52.1	21.6
19.08.	13.42	26.35	18.4	68.11	95.23	88	80.5	21.1
20.08.	14.98	29.02	20.6	55.45	96.12	84.4	99.9	21.4
21.08.	13.66	32.82	20.8	46.46	95.86	78.6	100	21.3
22.08.	11.07	36.26	21.9	37.61	95.56	75	100	21.1
23.08.	14.13	30.55	21.2	42.39	95.58	75.4	99.9	21.3
24.08.	13.12	29.45	20.2	37.39	95.39	76.8	99.8	21.1
25.08.	10.67	24.39	16.2	65.26	94.46	87.8	99.7	19.9
26.08.	12.73	26.89	18.2	51.88	95.77	82.1	99.6	19.9
27.08.	11.51	26.79	17.6	54.89	95.68	82	99	19.6
28.08.	10.43	27.85	17.6	55.86	95.91	82.1	98	19.2
29.08.	11.05	29.23	18.7	52.61	95.71	82.2	96.5	19.3
30.08.	14.97	32.99	21.9	49.47	93.98	80	95.9	20.2
31.08.	13.28	31.78	21.1	52.05	96	82.2	95.5	20.1

Table 5. Daily values of air and soil parameters in September 2025.

Date	Air t min (°C)	Air t max (°C)	Air t average (°C)	Air humidity min (%)	Air humidity max (%)	Air humidity average (%)	Soil humidity (%)	Soil t (°C)
01.09.	14.4	30.89	21.1	41.15	95.14	78.6	95	20.3
02.09.	13.49	32.07	21.1	49.4	94.93	79.8	94.4	20.1
03.09.	12.76	32.78	21	45.89	95.21	78.7	94.2	20.1
04.09.	13.96	29.21	21.2	62.59	95.37	83.7	93.5	20.4
05.09.	15.85	27.8	20.5	58.32	96.56	83.4	93.1	20.4
06.09.	14.88	25.35	19.4	66.85	95.43	86	92	20.1
07.09.	13.29	26.44	18.9	52.19	95.79	82.6	92	19.7
08.09.	13.02	27.44	18.8	47.92	95.61	79.9	91.7	19.5
09.09.	11.62	29.57	18.7	47.97	95.31	79.6	91.2	19.3
10.09.	8.98	31.16	18.5	40	95	79.1	90.8	18.7
11.09.	14.4	29.43	20.4	55.18	95.6	83.3	90.4	19.5
12.09.	14.76	27.62	19.7	62.62	95.66	85.7	90	19.6
13.09.	14.51	26.35	19.7	56.81	96.15	82	89.6	19.5
14.09.	10.88	24.76	17.3	56.05	95.92	80.4	89.2	18.9
15.09.	12.02	26.52	18.1	52.55	92.73	77.7	88.9	18.9
16.09.	9.73	30.52	17.4	43	94.46	78.8	88.6	18.2
17.09.	8.35	25.95	16.1	54.92	95.37	82.4	88.2	17.7
18.09.	8.56	24.13	14.4	48.61	95.88	82.5	88.1	16.8
19.09.	5.16	24.43	13.2	44.03	95.12	78.6	87.8	15.6
20.09.	6.7	25.96	14.9	54.02	94.28	81.3	87.6	15.5
21.09.	8.4	24.69	15.2	61.03	96.1	84.8	87.5	15.8
22.09.	6.96	25.54	15	61.46	96.07	84.9	87.4	15.6
23.09.	10.06	26.79	16.7	56.64	95.19	82.2	87.2	16.3
24.09.	9.06	26.13	15.1	58.24	95.2	84.3	87.1	15.9
25.09.	9.78	20.9	15.1	83.3	95.42	92	87.1	16
26.09.	10.91	18.93	16.6	63.19	95.49	79	87.1	16.5
27.09.	9.88	20.02	13.7	57.42	93.78	82.6	86.7	15.5
28.09.	9.06	18.78	13.4	63.32	92.64	81.3	86.7	15.3
29.09.	9.19	15.99	13.1	84.12	94.89	92	86.6	15.3
30.09.	6.36	21.3	12.1	48.14	95.94	82.4	86.3	14.5

Table 6. Daily values of air and soil parameters in October 2025.

Date	Air t min (°C)	Air t max (°C)	Air t average (°C)	Air humidity min (%)	Air humidity max (%)	Air humidity average (%)	Soil humidity (%)	Soil t (°C)
01.10.	4.62	21.76	10.7	47.73	93.34	81.3	86.1	13.6
02.10.	5.81	17.19	12.4	72.68	94.84	88	86.1	13.7
03.10.	11.88	20.32	15.8	86.89	96.24	94.5	98.8	15.1
04.10.	7.18	18.46	11.9	70.12	95.82	91.3	99	15.1
05.10.	6.01	21.93	11.5	48	96.18	85.7	99.1	14.1
06.10.	5.92	20.47	12.5	76.55	95.6	90	98.9	14
07.10.	11.03	13.21	11.9	93.88	95.39	94.8	98.9	13.9
08.10.	9.75	17.28	12.3	71.91	95.75	91.1	98.8	14
09.10.	9.17	17.11	12.5	67.36	95.22	91	98.8	14.3
10.10.	4.81	20.97	10.9	53.28	96.36	87	99.1	13.2
11.10.	4.97	15.32	9	71.18	95.9	92.9	98.9	12.7
12.10.	1.49	18.19	9.4	63.55	95.75	89.8	98.8	11.9
13.10.	10.35	19.26	13.3	63.97	95.8	89.3	98.9	13.5
14.10.	10.78	18.16	13.3	67.04	95.81	88.3	98.8	14
15.10.	7.93	19.04	12.6	66.23	95.77	89.1	99	14
16.10.	6.84	16.95	10.5	75.86	95.79	93	99	13.3
17.10.	5.16	17.89	10.8	67.13	96.17	89.6	99	13.1
18.10.	11.96	16.66	13.8	90.65	95.93	94.6	98.9	14
19.10.	5.03	18.39	12.2	50.06	96.29	87.5	99.2	14.1
20.10.	1.51	17.81	7.4	65.84	95.57	90	99.1	11.9
21.10.	2.41	18.83	9	54.82	96.1	88	99	11.3
22.10.	4.76	22.06	11.1	60.77	95.86	89.5	98.8	11.6
23.10.	7.15	23.52	12.7	64.58	96.42	91	98.8	12.3
24.10.	10.05	22.95	15.9	72.34	96.98	90.5	98.9	13.3
25.10.	8.87	17.71	12.6	65.97	96.21	92.3	99.1	13.7
26.10.	6.52	19.25	12.7	74.24	95.77	90.6	99	13.2
27.10.	8.87	19.65	14.7	82.94	95.51	90.6	99	13.9
28.10.	5.03	14.77	9.1	88.14	96.23	94.9	99.2	12.8
29.10.	0.52	18.83	6.6	59.12	96.57	90.4	99.1	11.1
30.10.	-0.4	20.58	6.6	62.26	96.36	90.1	98.8	9.5
31.10.	-0.68	21.28	7.3	63.54	96.14	90.9	98.8	9.3