

Catchments of Plešné and Čertovo Lakes (Bohemian Forest) 2007-2022. Data set 2 - Plant biomass¹

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Abstract

The above-ground biomass in the herb layer was repeatedly monitored on permanent research plots in the Plešné and Čertovo Lake catchments (Šumava Mts.) where Norway spruce (*Picea abies*) forests are natural vegetation. The biomass stock was sampled during its peak period (July / August). The sunlight in the undergrowth represents main environmental factor influencing the biomass accumulation. It is connected with tree layer damage (caused by bark beetle and wind) and wood regeneration.

Keywords: bark beetle, biomass, forest vegetation, stand regeneration, succession, Šumava, trend

The system of methods for monitoring primary production and plant biomass is very diverse, and the applicability of individual methods is also different and ranges from laboratory physiological procedures to field techniques applied in the study of natural or semi-natural ecosystems (KUBÍČEK 1977, MATĚJKA 1990). Determining of plant biomass of the herb (ground) layer (etage) in the forests is not common, as example we can found studies carried out in sites with some tree layer damage (e.g. fire, clear-cuts) as AMPOORTER ET AL. (2015), CAVARD ET AL. (2011), MACK ET AL. (2008), NYKVIST (1997). It is possible to remember some papers from the central-European forests: JURKO, KUBÍČEK ET ŠOMŠÁK (1981), KRÍŽOVÁ (1992), KUBÍČEK ET ŠOMŠÁK (1982, 1985, 2003), KUBÍČEK, ŠIMONVIČ ET ŠOMŠÁK (1994), KUBÍČEK (1999), ŠOMŠÁK ET AL. (2000), KVĚT (1966) and PENKA ET AL. (1985: pp. 171-238). First results from natural Norway spruce (*Picea abies*) forest at Boubín (Bohemian Forest) were bring by MATĚJKA (1992).

Situation in the studied plots in the catchments of the Plešné and Čertovo Lakes: The first sampling from 2005 was described by SVOBODA, MATĚJKA ET KOPÁČEK (2006). Results from sampling 2007-2010 was published in MATĚJKA (2011, 2015). This collection compares results of biomass quantitative analyse in 2014/2015 and 2019/2020.

Methods

All permanent research plots in both catchments are described in MATĚJKA (2022).

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Biomass sampling, analyses and data processing

A 0.5 × 0.5 m frame was used to sample the aboveground (AG) biomass of the herb layer (understory vegetation). The frames were randomly placed within each plot to cover variability in the set of plant microcoenoses according to dominant species. Only sites with maximal (optimally full) cover of herb layer were sampled. The number of biomass samples for each plot depended on the vegetation variability, and generally it did not decrease below 5 samples per year and plot. For each sample site, the plant material of AG biomass was cut near the soil (litter) surface using scissors, put into a plastic bag and labelled. The samplings were carried out in August. The AG biomass samples were brought to the laboratory where individual plant species were separated. The AG biomass of *Vaccinium myrtillus* was separated into green part (leaves and annual shoots; category "green") and woody stems with living shoots (category "wood") and dead woody branches (category "dead"). The samples were dried at 80°C until constant weight. These methods are the same as in MATĚJKA (2011, 2015).

Average plot biomass was estimated as product of the species cover and the maximal species biomass. The species cover is relative species representation according to the relevé, where sum of all species representations in the etage is equal to the etage cover. The maximal species biomass is given by biomass samples with highest biomass of the species in relatively homogenous stand.

Results

Four basic microphytocoenose types were identified in both catchments - they are characterized by dominant species *Vaccinium myrtillus*, *Avenella flexuosa*, *Calamagrostis villosa* and *Luzula sylvatica*. The fifth type is intermediate with mixture of two grasses, *Avenella flexuosa* and *Calamagrostis villosa*. The next type with dominant fern *Athyrium distentifolium* is not present in the selected permanent research plots, but it was recorded in specific spots of both catchments.

Plešné Lake

Variability in sites within the catchment is high as is visible for *Vaccinium myrtillus* in 2014. Two main plots (PJ3 and PJ4) are different in vegetation composition and dynamics.

The first plot PJ3 is placed in 8th forest altitudinal zone and relatively sparse tree regeneration is common in this position. There are important differences between both sampling years. *Vaccinium myrtillus* has minimal representation in the plot PJ3 at 2014. Both cover and biomass of this species increases significantly in 2019. In a similar way, ratios of biomass parts green:total are predominantly very high (95 to 100 %) indicating young spreading population. On the other hand, *Luzula sylvatica* was damaged, probably by drought and high temperature on fully sunned surface. Total aboveground biomass increases from average 436 to 650 g.m⁻² over all samples.

For the lower-situated plot PJ4 was typical increase of cover of *V. myrtillus* without changes of maximal biomass (1119 and 1053 g.m⁻² in both years) and minimalization of the representation (both cover and biomass) of another species in the herb layer. *V. myrtillus* grows in different-age patches which are indicated by interval of ratios of biomass parts green:total from 60 to 84 % and from 51 to 84 % in 2014 and 2019 respectively.

The herb layer above-ground biomass was increasing during observed period in both plots (tables 6 and 7). The last (2022) estimated increase in the plot PJ3 is caused by increase of *Vaccinium myrtillus* cover.

Čertovo Lake

Increase in above-ground plant biomass was observed in both plots between two years under comparison (tables 4-5). The population of *Vaccinium myrtillus* in the CL plot is in the same development stage in both years because share of green biomass in total biomass is near the same (62.6 % and 64.8 % respectively), but biomass stock increase from 380 to 485 g m⁻². Increase of the grass biomass in the CU plot was more rapid: from 154 to 442 g m⁻². It was caused by lighting of understory as consequence of a complete tree layer damage.

The herb layer above-ground biomass was only oscillating at the CL plot (table 8), but increasing at the CU plot (table 9) during whole period 2007-2022.

Conclusion

Data on above-ground plant biomass complete info on the plant community development / succession, mainly after disturbance of tree layer. Direct damage in the herb layer can be observed by population of *Vaccinium myrtillus* as result of either direct mechanical damage or late spring frost (compare data of phytocoenological relevés in MATĚJKA 2022). Increase of the biomass stock is connected with higher sum of the sun radiation in the understory. None of the selected four plots covers a situation with a massive regeneration of the woody layer, when the amount of sunlight reaching the undergrowth is strongly limited, as is common in other places, especially in the Plešné Lake basin (example of plots PJ1 and PJ2, MATĚJKA 2022), where the herb layer biomass is strongly limited, often to zero.

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Table 1. Analysed samples of aboveground biomass of the Plešné Lake catchment in 2014 (part 1), *Vaccinium myrtillus* type of microphytocenose (MFC). All values in g per 0.25 m².

Plot		P19	P19	P19	P19	P20	P20	P20	PJ4	PJ4	PJ4	X2	X2	X3	X3	X3	X4	X4	X4	AVG
Sample		1	2	3	4	1	2	3	1	2	3	1	2	1	2	3	1	2	3	V
Type of MFC		V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V	V
<i>Avenella flexuosa</i>						0.15	2.82	0.09	0.03											0.17
<i>Dryopteris dilatata</i>									0.39	5.32		2.23								0.44
<i>Epilobium angustifolium</i>									1.15	1.68	0.12	2.63								0.31
<i>Oxalis acetosella</i>						0.01	0.05	0.76				0.23								0.06
<i>Picea abies</i>													0.29							0.02
<i>Vaccinium myrtillus</i>	wood	10.42	18.36	107.24	47.00	77.47	114.98	56.94	72.66	92.33	30.40	125.22	133.35	130.54	116.49	103.76	67.10	177.76	41.01	84.61
	dead	25.17	26.75	27.49	9.69	32.15	25.33	44.06	20.74	26.29	14.99	34.36	36.26	0.00	36.57	13.40	13.04	26.91	5.09	23.24
	green	70.54	119.51	213.84	147.67	289.71	320.82	158.26	161.60	174.30	233.56	302.37	210.58	76.83	134.32	90.66	242.80	237.81	146.31	185.08
	Total	106.13	164.62	348.57	204.36	399.33	461.13	259.26	255.00	292.92	278.95	461.95	380.19	207.37	287.38	207.82	322.94	442.48	192.41	292.93
<i>Vaccinium vitis-idaea</i>	dead	1.86	2.72																	0.25
	green	63.75	83.41						0.61					27.92	42.91	0.40				12.17
	Total	65.61	86.13						0.61					27.92	42.91	0.40				12.42
Total		171.74	250.75	348.57	204.36	399.49	464.00	261.65	262.64	293.04	283.81	462.18	380.48	235.29	330.29	208.22	322.94	442.48	192.41	306.35

Table 2. Analysed samples of aboveground biomass of the Plešné Lake catchment in 2014 (part 2), type of microphytocenose (MFC): *Avenella flexuosa-Vaccinium myrtillus* (A-V), *Avenella flexuosa* (A), *Avenella flexuosa-Calamagrostis villosa* (A-C), *Calamagrostis villosa* (C) and *Luzula sylvatica* (L). All values in g per 0.25 m².

Plot	X5	P20	P20	PJ3	PJ4	PJ4	PJ4	X1		P20	PJ3	PJ3	PJ3		P20	PJ3	X1	X5	X6	X6	X6		PJ3	X1		
Sample	1	5	6	4	4	5	6	3	AVG	7	1	2	5	AVG	4	3	2	2	1	2	3	AVG	6	1	AVG	
Type of MFC	A-V	A	A	A	A	A	A	A	A	A-C	A-C	A-C	A-C	A-C	C	C	C	C	C	C	C	C	L	L	L	
<i>Avenella flexuosa</i>	55.47	89.83	84.45	79.06	72.55	78.99	82.37	37.44	74.96	19.27	73.83	13.72	29.31	34.03	2.35	6.69										
<i>Calamagrostis villosa</i>	0.22			0.27					0.04	97.52	53.26	114.86	68.85	83.62	153.40	76.11	120.42	53.79	51.12	80.34	120.21	93.63	24.67	0.00	12.34	
<i>Dryopteris dilatata</i>	0.39	8.26							1.18	3.99				1.00	0.08			3.96			8.60	1.81	1.09		0.55	
<i>Epilobium angustifolium</i>		0.09	1.64			0.07			0.26									6.01							0.86	
<i>Homogyne alpina</i>			1.30						0.19						0.55									0.56	0.28	
<i>Luzula sylvatica</i>	1.09								0.00			4.88		1.22		0.27				8.33	8.91	2.50	84.76	54.53	69.65	
<i>Oxalis acetosella</i>		0.04							0.01	0.19	0.07	0.02		0.07	0.06	0.01	0.29	0.17			0.17	0.10				
<i>Picea abies</i>	0.35								0.00																	
<i>Rubus idaeus</i>																		0.38	0.32						0.10	
<i>Sorbus aucuparia</i>				0.17					0.02																	
<i>Trientalis europaea</i>											0.51	0.76		0.32									0.51	0.06	0.29	
<i>Vaccinium myrtillus</i>	wood	3.93																								
	dead				1.37				0.20																	
	green	64.58	0.03		20.67				2.96	22.67				5.67	0.23									0.03	0.02	
	total	68.51	0.03		22.04				3.15	22.67				5.67	0.23									0.03	0.02	
Total		126.03	98.25	87.39	79.50	94.59	79.06	82.37	37.44	79.80	143.64	127.67	134.24	98.16	125.93	156.67	83.08	120.71	64.31	51.44	88.67	137.89	100.40	131.05	70.86	100.96

Table 3. Analysed samples of aboveground biomass of the Plešné Lake catchment in 2019, type of microphytocenose (MFC): *Vaccinium myrtillus* (V), *Avenella flexuosa* (A), and *Calamagrostis villosa* (C). All values in g per 0.25 m².

Plot		PJ3	PJ3	PJ3	PJ3	PJ3	PJ3	PJ3	PJ4	PJ4	PJ4	PJ4
Sample		1	2	3	4	5	6	AVG	1	2	3	AVG
Type of MFC		V	V	A	C	C	C	all	V	V	V	all
<i>Avenella flexuosa</i>			22.68	58.98	0.16	0.05	0.53	13.73	0.01	0.92		0.31
<i>Calamagrostis villosa</i>				2.32	103.27	70.80	109.93	47.72				
<i>Carex canescens</i>						0.11		0.02				
<i>Dryopteris dilatata</i>			5.06			1.62		1.11				
<i>Oxalis acetosella</i>			0.07		0.08		0.05	0.03				
<i>Picea abies</i>												
<i>Trientalis europaea</i>			0.05				0.74	0.13				
<i>Vaccinium vitis-idaea</i>										16.28		5.43
<i>Vaccinium myrtillus</i>	dead	71.36	3.29					12.44	27.08	15.18	94.31	45.52
	green	196.38	142.76	0.66	0.28	0.97	6.83	57.98	99.71	143.67	235.46	159.61
	wood	171.83	4.65					29.41	8.19	12.38	136.50	52.36
	total	439.57	150.70	0.66	0.28	0.97	6.83	99.84	134.98	171.23	466.27	257.49
Total		439.57	178.56	61.96	103.79	73.55	118.08	162.59	134.99	188.43	466.27	263.23

Table 4. Analysed samples of aboveground biomass of the Čertovo Lake catchment in 2015, type of microphytocenose (MFC): *Vaccinium myrtillus* (V), *Avenella flexuosa* (A), *Avenella flexuosa-Calamagrostis villosa* (A-C) and *Calamagrostis villosa* (C). All values in g per 0.25 m².

Plot		CL	CL	CL	CL	CL	CL	CU	CU	CU	CU	CU	CU	
Sample		1	2	3	4	5	AVG	4	5	6	1	2	3	AVG
Type of MFC		V	V	V	V	V	V	A	A-C	A-C	C	C	C	
<i>Avenella flexuosa</i>								33.37	29.31	27.12	10.93	17.93	3.18	20.30
<i>Calamagrostis villosa</i>								0.00	9.98	1.48	42.06	30.53	25.38	18.24
<i>Vaccinium myrtillus</i>	green	82.28	46.60	91.66	48.75	35.50	60.96							
	wood	41.86	18.34	66.96	17.95	8.29	30.68							
	dead	3.90	3.03	14.46	5.85	1.71	5.79							
Total		128.04	67.97	173.08	72.55	45.50	97.43	33.37	39.29	28.60	52.99	48.46	28.56	38.55

Table 5. Analysed samples of aboveground biomass of the Čertovo Lake catchment in 2019 (plot CL) and 2020 (plot CU), type of microphytocenose (MFC): *Vaccinium myrtillus* (A-V), *Avenella flexuosa* (A), *Avenella flexuosa-Calamagrostis villosa* (A-C) and *Calamagrostis villosa* (C). All values in g per 0.25 m².

Year		2019					2020							
Plot		CL	CL	CL	CL	CL	CL	CU	CU	CU	CU	CU	CU	CU
Sample		1	2	3	4	5	AVG	1	3	6	4	2	5	AVG
Type of MFC		V	V	V	V	V	V	A	A	A	A-C	C	C	
<i>Avenella flexuosa</i>								87.60	77.75	104.41	54.04	26.18	0.00	58.33
<i>Calamagrostis villosa</i>								5.16	0.00	0.00	40.38	147.77	119.24	52.09
<i>Picea abies</i>		0.79			0.11		0.18							
<i>Vaccinium myrtillus</i>	dead	6.51	3.32	12.17	7.20	3.89	6.62							
	green	67.40	81.74	93.47	92.95	57.29	78.57							
	wood	36.48	24.25	39.10	42.63	38.16	36.12							
	total	110.39	109.31	144.74	142.78	99.34	121.31							
Total		111.18	109.31	144.74	142.89	99.34	121.49	92.76	77.75	104.41	94.42	173.95	119.24	110.42

Table 6. The above-ground plant biomass estimation in the plot PJ3 during 2007-2022. Calculated maximal biomass in blue.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total E ₁ cover (%)	80	80	80	80	90	90	90	90	95	95	95	95	85	80	85	85
Species cover (%):																
<i>Athyrium distentifolium</i>						0.50	0.49	4.70	4.60	0.49	0.44	0.46	2.20	4.80	5.10	3.90
<i>Avenella flexuosa</i>	19.00	21.00	21.00	27.00	35.00	37.00	37.00	35.00	46.00	49.00	44.00	35.00	33.00	17.00	18.00	14.00
<i>Betula pubescens</i>	0.08	0.08			0.09	0.10					0.09				0.10	
<i>Blechnum spicant</i>												0.09			0.10	0.08
<i>Calamagrostis villosa</i>	13.00	14.00	21.00	18.00	16.00	9.90	9.80	16.00	16.00	17.00	15.00	16.00	15.00	17.00	18.00	14.00
<i>Carex canescens</i>					0.09	0.10							0.09			
<i>Dryopteris dilatata</i>	7.50	8.20	8.50	7.20	4.60	5.00	4.90	4.70	2.30	2.50	0.44	2.30	0.44	0.48	0.51	0.39
<i>Epilobium angustifolium</i>	0.38	0.41	0.43	0.07	0.09	0.50	0.10	0.09	0.46	0.10	0.09	0.46		0.10	0.10	0.39
<i>Fagus sylvatica</i>										0.10						
<i>Galium saxatile</i>															0.10	
<i>Homogyne alpina</i>	1.90	2.10	2.10	3.60	0.46	0.50	0.49	0.47	0.09	0.49	0.44	0.46	0.44	0.10	0.10	0.39
<i>Luzula sylvatica</i>	13.00	8.20	4.30	3.60	2.30	2.50	2.50	4.70	4.60	4.90	4.40	0.46	0.44	0.48	0.10	0.08
<i>Oxalis acetosella</i>	0.38	0.41	0.43	0.07	0.46	0.50	0.10	0.09	0.09	0.10	0.09	0.09	0.44			
<i>Picea abies</i>	1.90	0.41	2.10	7.20	9.20	9.90	9.80	9.40	9.20	9.80	8.80	9.30	4.40	9.50	10.00	1.90
<i>Populus tremula</i>									0.09	0.10			0.09	0.10	0.10	0.08
<i>Rubus idaeus</i>		0.41	0.43	0.36	0.46	0.50	2.50	2.30	2.30	2.50	0.44	2.30	0.09	0.10	0.10	0.08
<i>Sorbus aucuparia</i>	7.50	8.20	8.50	3.60	4.60	5.00	4.90	2.30	4.60	2.50	4.40	4.60	4.40	4.80	5.10	1.90
<i>Trientalis europaea</i>	1.90	2.10	2.10	1.80	0.46	0.50	0.49	0.47	0.46	0.49	0.44	0.46	2.20	2.40	2.50	0.39
<i>Vaccinium myrtillus</i>	13.00	14.00	8.50	7.20	16.00	17.00	17.00	9.40	4.60	4.90	15.00	23.00	22.00	24.00	25.00	48.00
<i>Vaccinium vitis-idaea</i>											0.09					0.08
Maximal biomass (g/0.25m ²):																
<i>Avenella flexuosa</i>	34.94	34.94	61.68	61.68	65.52	69.36	73.20	77.04	67.89	58.74	49.60	40.45	31.30	31.30	31.30	31.30
<i>Calamagrostis villosa</i>	65.92	65.92	78.40	78.40	80.10	81.79	83.49	85.18	88.84	92.51	96.17	99.84	103.50	103.50	103.50	103.50
<i>Luzula sylvatica</i>	128.86	128.86	109.68	109.68	105.74	101.79	97.85	93.90	93.90	93.90	93.90	93.90	93.90	93.90	93.90	93.90
<i>Vaccinium myrtillus</i>	172.93	172.93	296.00	296.00	316.77	337.53	358.30	379.07	399.83	420.60	441.37	462.13	482.90	482.90	482.90	482.90
Average total biomass (g/m ²):																
<i>Avenella flexuosa</i>	26.6	29.3	51.8	66.6	91.7	102.7	108.3	107.9	124.9	115.1	87.3	56.6	41.3	21.3	22.5	17.5
<i>Calamagrostis villosa</i>	34.3	36.9	65.9	56.4	51.3	32.4	32.7	54.5	56.9	62.9	57.7	63.9	62.1	70.4	74.5	58.0
<i>Luzula sylvatica</i>	67.0	42.3	18.9	15.8	9.7	10.2	9.8	17.7	17.3	18.4	16.5	1.7	1.7	1.8	0.4	0.3
<i>Vaccinium myrtillus</i>	89.9	96.8	100.6	85.2	202.7	229.5	243.6	142.5	73.6	82.4	264.8	425.2	425.0	463.6	482.9	927.2
Total	217.8	205.4	237.2	224.1	355.4	374.7	394.5	322.6	272.6	278.9	426.3	547.4	530.0	557.1	580.3	1002.9

Table 7. The above-ground plant biomass estimation in the plot PJ4 during 2007-2022. Calculated maximal biomass in blue.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total E ₁ cover (%)	25	30	35	40	45	50	60	70	65	70	60	70	75	75	80	85
Species cover (%):																
<i>Avenella flexuosa</i>	5.20	1.60	0.37	0.26	0.29	0.29	0.38	0.42	1.80	2.00	0.08	0.28	0.45	0.45	0.41	0.39
<i>Betula pubescens</i>		0.06	0.07	0.26	1.50	2.90	3.80	4.20	3.60	3.90	2.00	0.46	0.45	0.45	0.41	0.39
<i>Calamagrostis villosa</i>									0.07	0.08	0.08	0.09	0.09	0.09	0.08	0.08
<i>Carex canescens</i>								0.08	0.07							
<i>Dryopteris dilatata</i>	0.52	0.32	0.37	1.30	0.29	0.29	0.38	2.10	1.80	3.90	0.39	0.46	0.45	0.45	0.41	0.39
<i>Epilobium angustifolium</i>		0.32	0.37	5.20	5.80	10.00	13.00	4.20	7.30	3.90	0.39	4.60	0.18	0.18	0.08	0.08
<i>Fagus sylvatica</i>		0.06														
<i>Larix decidua</i>									0.07	0.08	0.08	0.09				
<i>Picea abies</i>	0.52	3.20	3.70	5.20	5.80	5.90	13.00	15.00	13.00	14.00	14.00	16.00	16.00	16.00	14.00	14.00
<i>Populus tremula</i>								0.08								
<i>Rubus idaeus</i>			0.07	0.26	0.29	0.29	0.38	0.42	0.36	2.00	2.00	0.46	0.18	0.18	0.16	0.08
<i>Senecio ovatus</i>				0.05	0.06											
<i>Sorbus aucuparia</i>		0.32	0.37	0.26	0.29	0.29	0.38	0.42	0.36	0.39	2.00	0.46	0.45	0.45	0.41	0.39
<i>Vaccinium myrtillus</i>	18.00	24.00	28.00	26.00	29.00	29.00	28.00	42.00	36.00	39.00	39.00	46.00	56.00	56.00	62.00	69.00
<i>Vaccinium vitis-idaea</i>	0.52	0.32	1.90	1.30	1.50	0.29	0.38	2.10	0.36	0.39	0.39	0.46	0.45	0.45	2.10	0.39
Maximal biomass (g/0.25m ²):																
<i>Avenella flexuosa</i>	28.16	28.16	31.87	31.87	43.94	56.02	68.09	80.16	80.16	80.16	80.16	80.16	80.16	80.16	80.16	80.16
<i>Vaccinium myrtillus</i>	82.66	82.66	166.40	166.40	193.91	221.42	248.92	276.43	314.40	352.38	390.35	428.33	466.30	466.30	466.30	466.30
Average total biomass (g/m ²):																
<i>Avenella flexuosa</i>	5.9	1.8	0.5	0.3	0.5	0.6	1.0	1.3	5.8	6.4	0.3	0.9	1.4	1.4	1.3	1.3
<i>Vaccinium myrtillus</i>	59.5	79.4	186.4	173.1	224.9	256.8	278.8	464.4	452.7	549.7	608.9	788.1	1044.5	1044.5	1156.4	1287.0
Total	65.4	81.2	186.8	173.4	225.4	257.5	279.8	465.7	458.5	556.1	609.2	789.0	1046.0	1046.0	1157.7	1288.2

Table 8. The above-ground plant biomass estimation in the plot CL during 2007-2022. Calculated maximal biomass in blue.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total E ₁ cover (%)	50	55	55	55	55	50	50	50	50	55	65	70	70	70	70	70
Species cover (%):																
<i>Abies alba</i>	0.32	0.38	0.38	0.41	0.42	0.22	0.37	0.37	0.36	0.40	0.41	0.44	0.44	0.44	0.09	0.41
<i>Avenella flexuosa</i>	6.50	3.80	3.80	0.41	0.42	0.37	0.37	0.37	0.36	0.40	0.25	0.09	0.09	0.44	0.46	
<i>Calamagrostis villosa</i>						0.08										
<i>Dryopteris dilatata</i>	1.60	1.90	1.90	0.41	0.42	0.37	0.37	0.37	0.36	0.40	0.41	0.44			0.09	
<i>Epilobium angustifolium</i>			0.08													
<i>Fagus sylvatica</i>	0.32		0.08							0.08	0.08		0.09			
<i>Lycopodium annotinum</i>			0.15	0.16	0.17	0.15	0.15				0.08	0.09	0.09			
<i>Picea abies</i>	0.32	0.38	0.38	0.41	0.42	1.90	1.90	1.90	1.80	2.00	2.00	2.20	2.20	2.20	0.46	8.10
<i>Rubus idaeus</i>	0.07			0.08	0.08											
<i>Sorbus aucuparia</i>	0.32	0.38	0.38	2.00	0.42	0.37	0.37	0.37	1.80	2.00	0.41	0.44	0.44	0.44	0.46	0.41
<i>Vaccinium myrtillus</i>	41.00	48.00	48.00	51.00	53.00	47.00	47.00	47.00	45.00	50.00	61.00	66.00	67.00	66.00	68.00	61.00
<i>Vaccinium vitis-idaea</i>		0.08														
Maximal biomass (g/0.25m ²):																
<i>Avenella flexuosa</i>	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00	20.00
<i>Vaccinium myrtillus</i>	173.20	60.43	66.36	101.84	100.00	100.00	100.00	100.00	97.43	103.40	109.37	115.33	121.30	121.30	121.30	121.30
Average total biomass (g/m ²):																
<i>Avenella flexuosa</i>	5.2	3.0	3.0	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.1	0.1	0.4	0.4	0.0
<i>Vaccinium myrtillus</i>	284.0	116.0	127.4	207.8	212.0	188.0	188.0	188.0	175.4	206.8	266.9	304.5	325.1	320.2	329.9	296.0
Total	289.2	119.1	130.5	208.1	212.3	188.3	188.3	188.3	175.7	207.1	267.1	304.5	325.2	320.6	330.3	296.0

Table 9. The above-ground plant biomass estimation in the plot CU during 2007-2022. Calculated maximal biomass in blue.

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total E ₁ cover (%)	85	85	85	85	85	90	90	90	85	80	85	65	75	80	80	90
Species cover (%):																
<i>Avenella flexuosa</i>	46.00	49.00	52.00	63.00	63.00	63.00	58.00	63.00	57.00	54.00	61.00	17.00	53.00	61.00	52.00	49.00
<i>Betula pubescens</i>							0.09	0.10			0.10	0.09	0.08			0.08
<i>Calamagrostis villosa</i>	31.00	25.00	26.00	18.00	18.00	18.00	23.00	18.00	23.00	19.00	17.00	35.00	15.00	17.00	15.00	30.00
<i>Dryopteris dilatata</i>	6.20	9.90	5.20	2.50	2.50	5.10	4.70	5.10	4.50	5.40	4.90	4.70	4.20	0.49	4.20	3.90
<i>Epilobium angustifolium</i>										0.11	0.49	0.47	0.08	0.10	4.20	3.90
<i>Luzula sylvatica</i>	0.62	0.49	0.52	0.51	0.51	2.50	2.30	2.50	0.45	0.33	0.10	2.40	0.42	0.49	0.42	2.00
<i>Lycopodium annotinum</i>	0.62	0.49	0.52	0.30	0.30	0.51	0.47	0.10	0.27	0.33	0.10	0.09				0.08
<i>Oxalis acetosella</i>			0.10													
<i>Picea abies</i>			0.10	0.10	0.10	0.51	0.47	0.51	0.27	0.33	0.49	4.70	2.10	0.49	4.20	0.39
<i>Pinus sylvestris</i>																0.08
<i>Rubus idaeus</i>				0.10	0.10	0.10	0.09	0.10	0.09	0.11	0.49		0.08	0.10	0.42	0.39
<i>Sorbus aucuparia</i>	0.12	0.10	0.10	0.10	0.10	0.10	0.09	0.10	0.09	0.11	0.10	0.09	0.08	0.10	0.08	0.08
<i>Vaccinium myrtillus</i>				0.10	0.10	0.10	0.09	0.51	0.09	0.11	0.49	0.47	0.42	0.49	0.08	0.08
Maximal biomass (g/0.25m ²):																
<i>Avenella flexuosa</i>	18.03	18.03	29.55	29.55	30.19	30.82	31.46	32.09	32.73	43.42	54.12	64.81	75.51	86.20	86.20	86.20
<i>Calamagrostis villosa</i>	31.26	31.26	35.03	35.03	36.92	38.80	40.69	42.57	44.46	60.63	76.80	92.96	109.13	125.30	125.30	125.30
Average total biomass (g/m ²):																
<i>Avenella flexuosa</i>	33.2	35.3	61.5	74.5	76.1	77.7	73.0	80.9	74.6	93.8	132.0	44.1	160.1	210.3	179.3	169.0
<i>Calamagrostis villosa</i>	38.8	31.3	36.4	25.2	26.6	27.9	37.4	30.7	40.9	46.1	52.2	130.1	65.5	85.2	75.2	150.4
Total	71.9	66.6	97.9	99.7	102.6	105.6	110.4	111.5	115.5	139.9	184.3	174.2	225.6	295.5	254.5	319.3