DESIRE – DEvelopment of Sustainable adaptIve peatland management by restoration and paludiculture for nutrient REtention and other ecosystem services in the Neman river catchment

WP 3.4

Results of groundwater modeling – Gromovo Peatland (RU)

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EU STRATEGY FOR THE BALTIC SEA REGION FLAGSHIP

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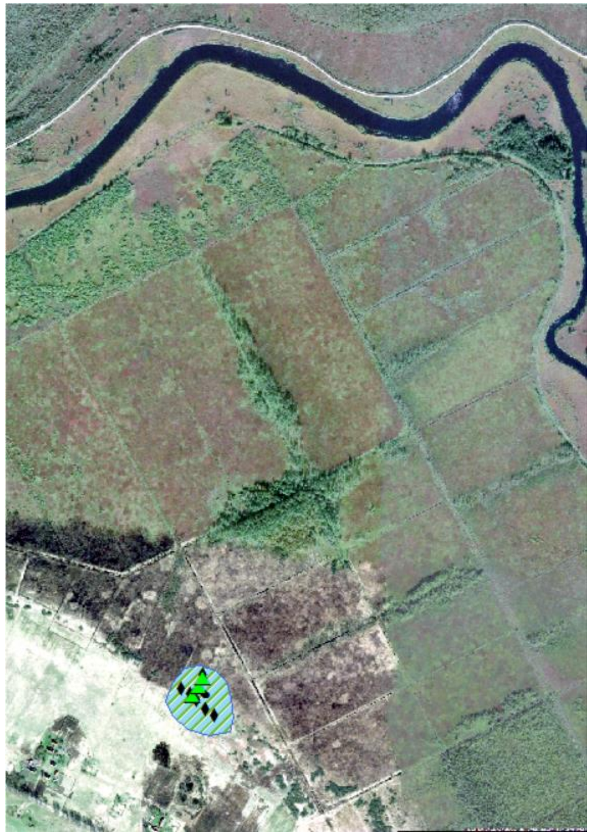
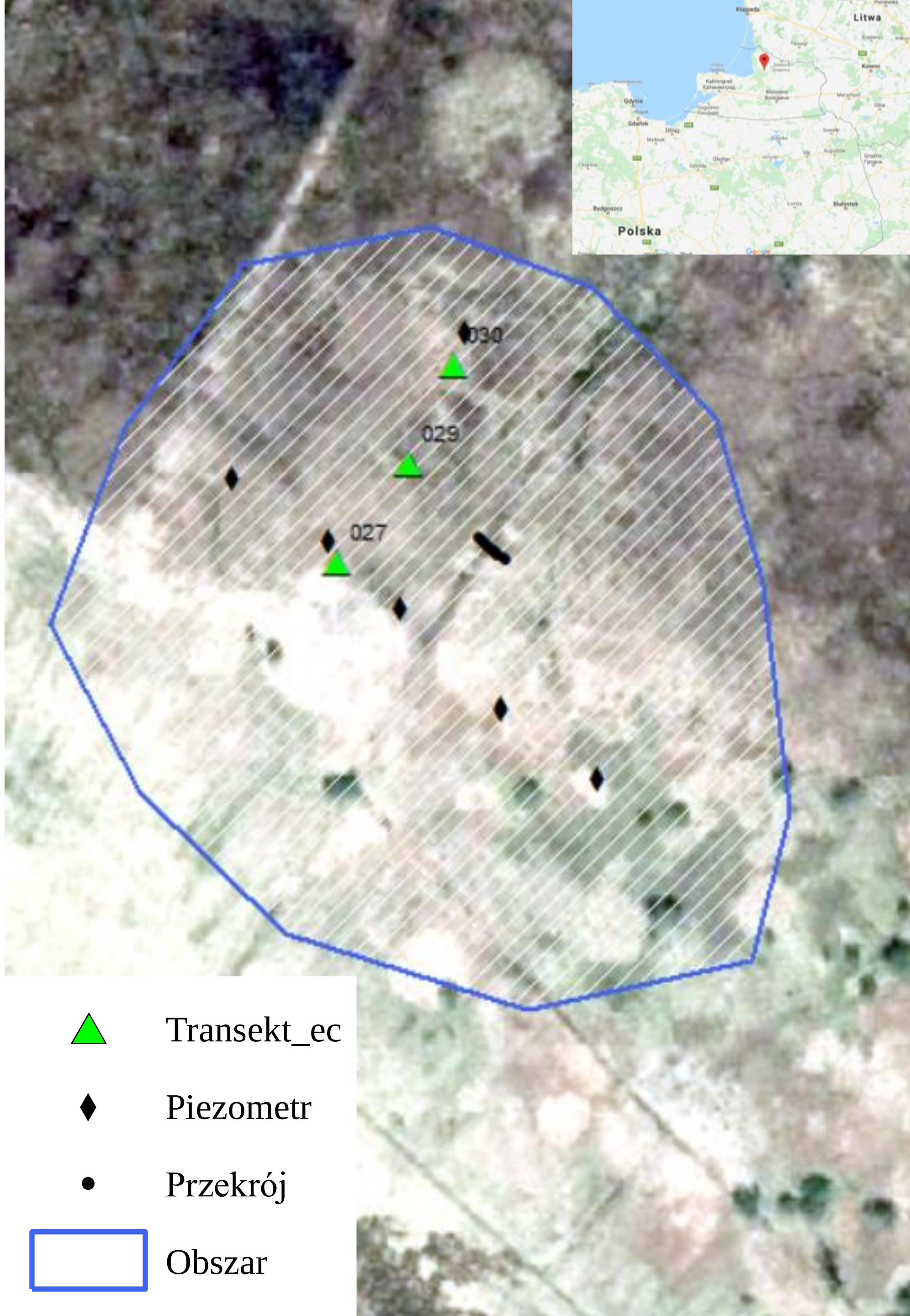
PALUDI CULTURE DESIRE

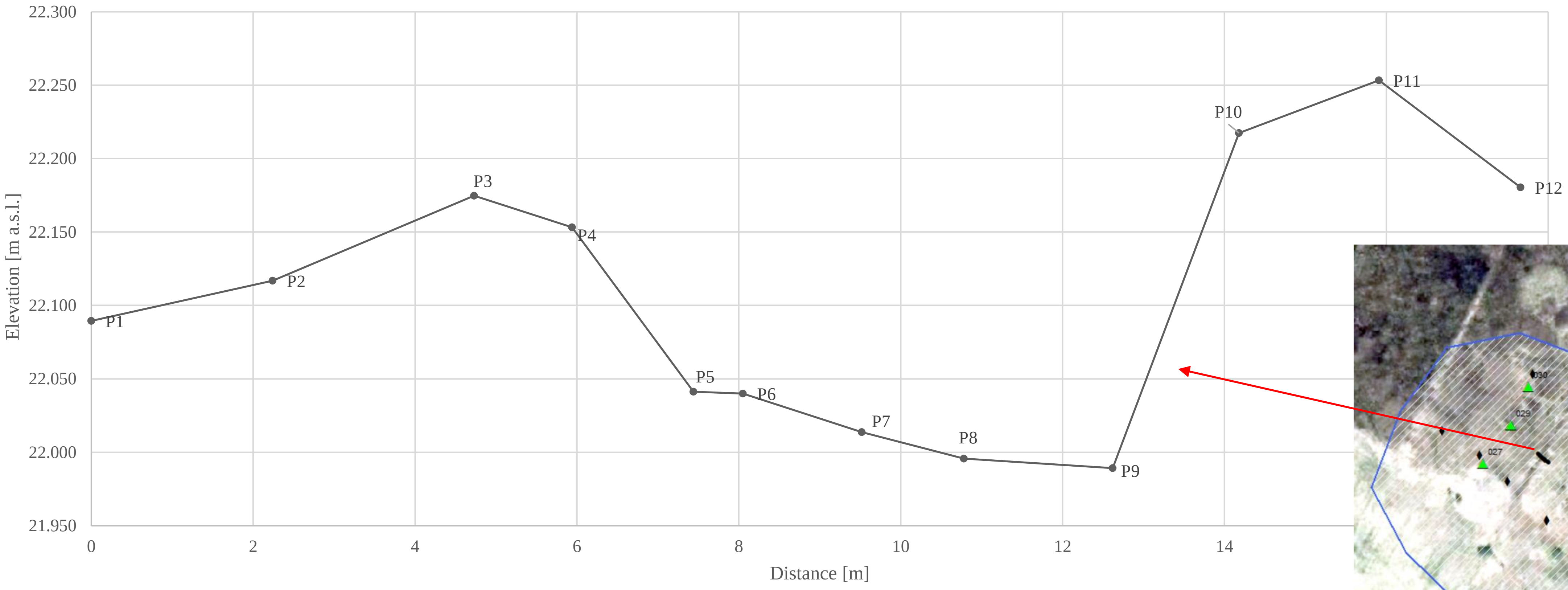
Gromovo - site

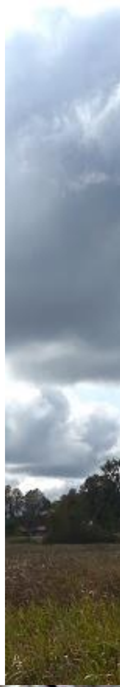
- Looks modifed and reclaimed, but in fact drainage does not work
- Installed – 10.2019
- Read-outs – 01.2020; 12.2020

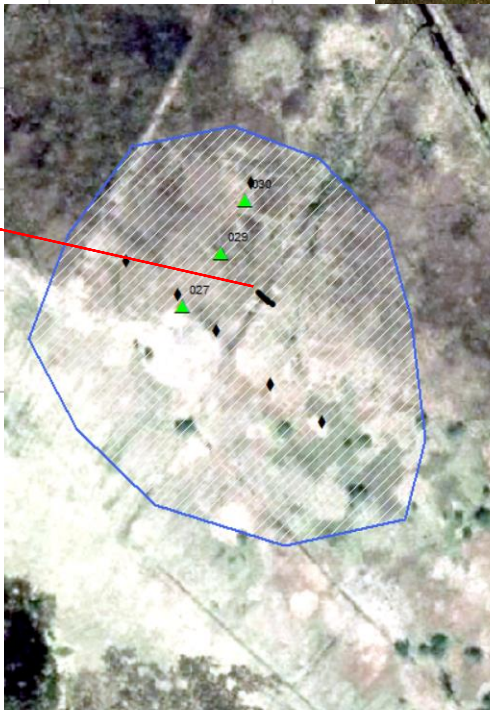




Cross section of the drainage ditch

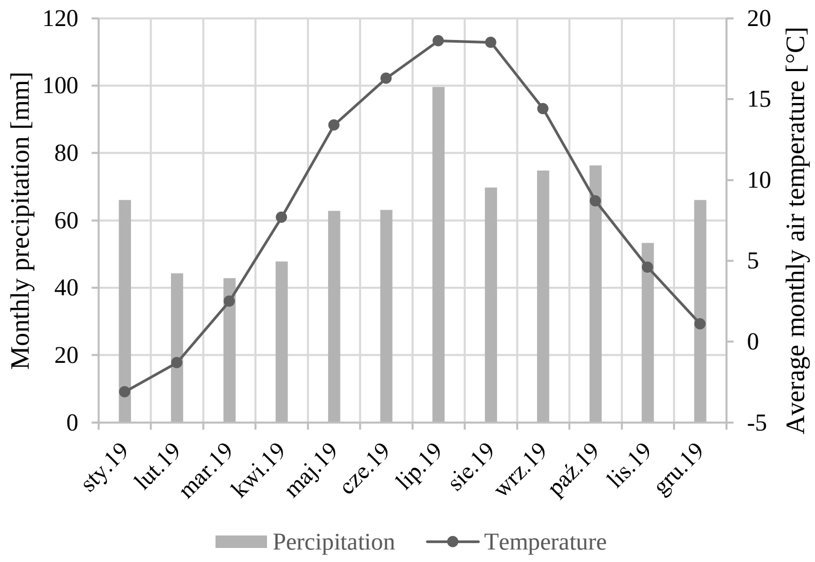




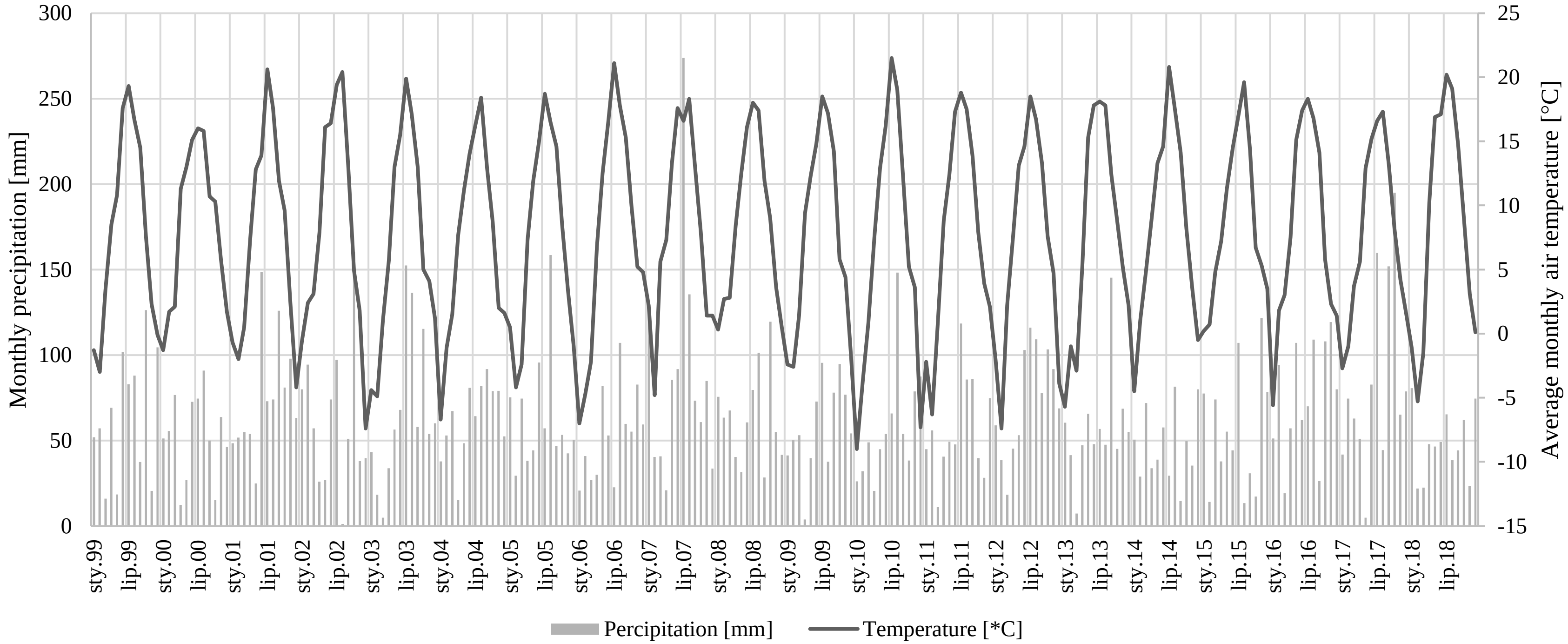


Meteorology

- Average annual P (1999-2018) – 761 mm
- Average annual T (1999-2018) – 7.9^{o}C

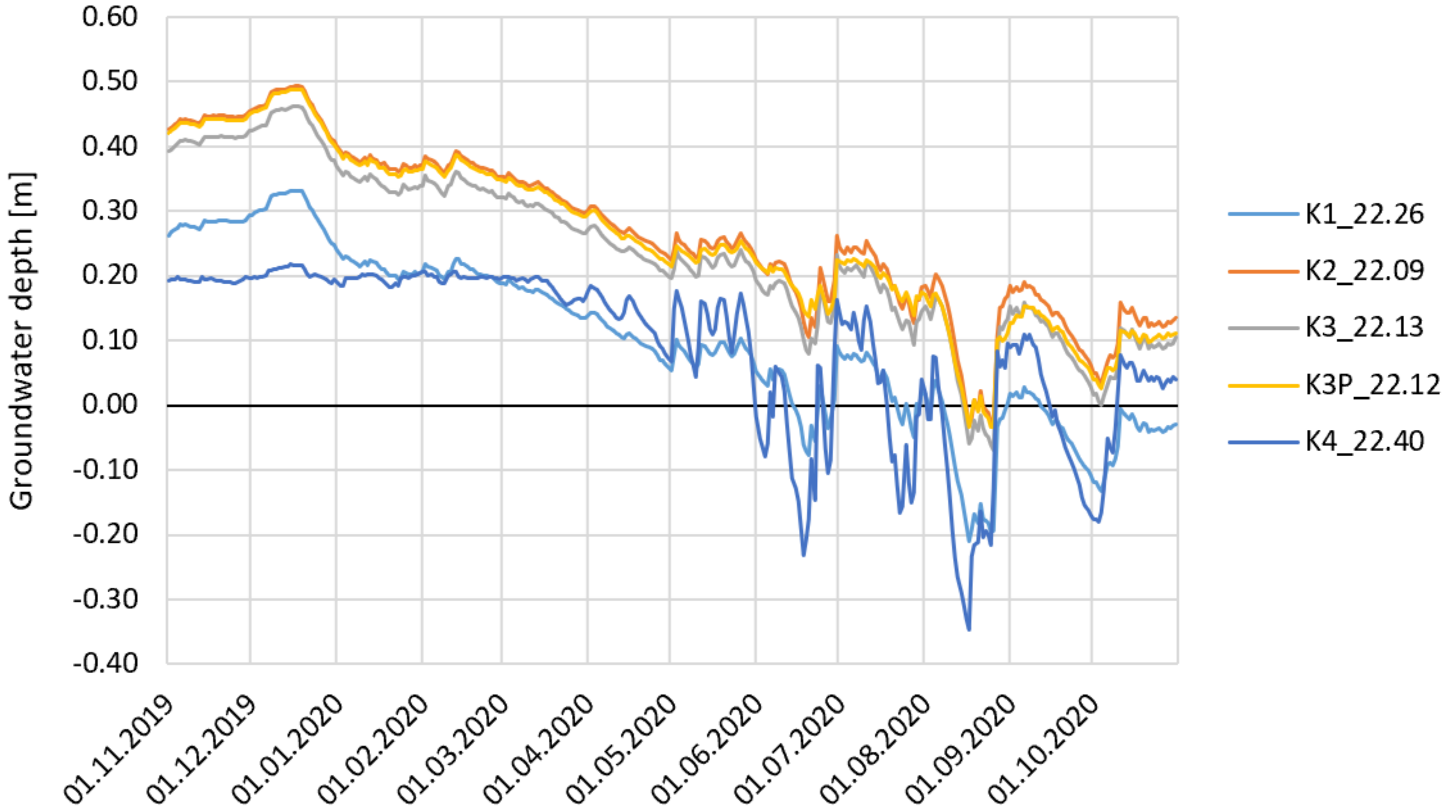


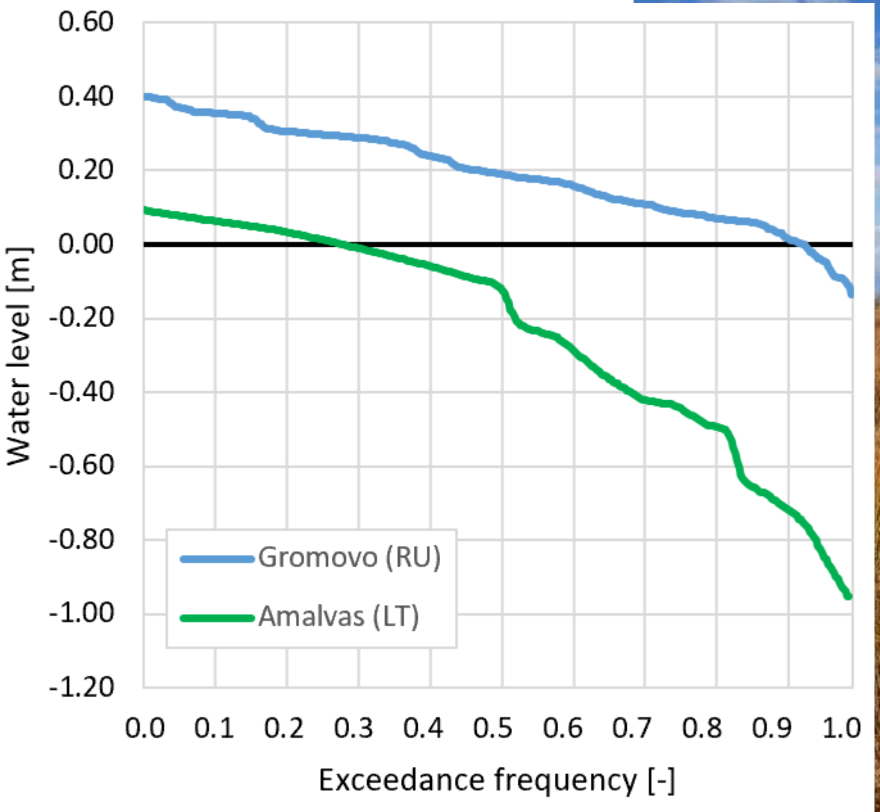
Source: http://russia.pogoda360.ru/807234/



Source: http://aisori-m.meteo.ru/waisori/

Gromovo - observations

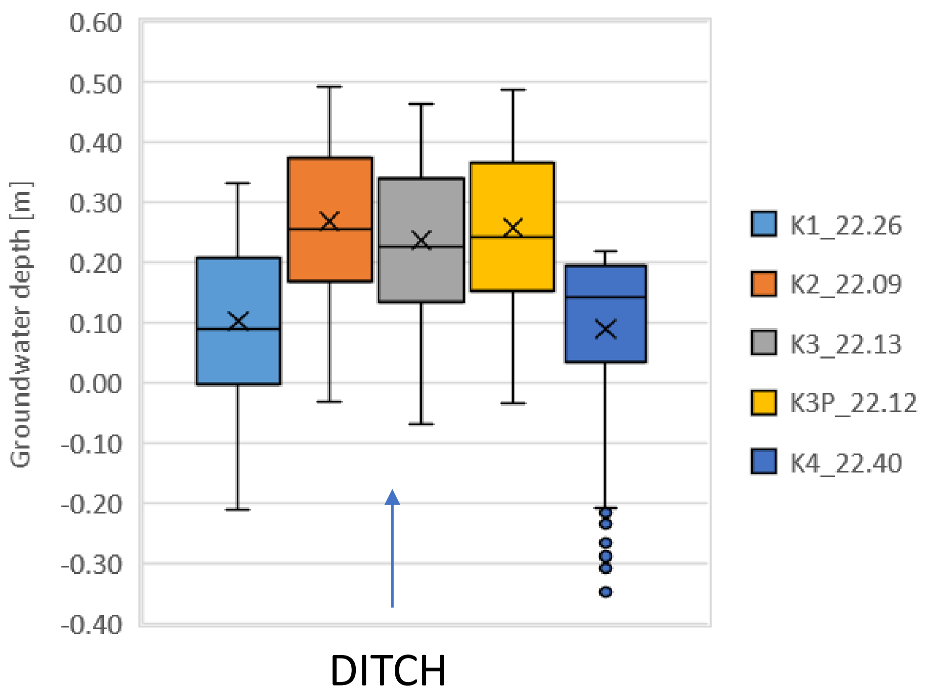




Gromovo - observations

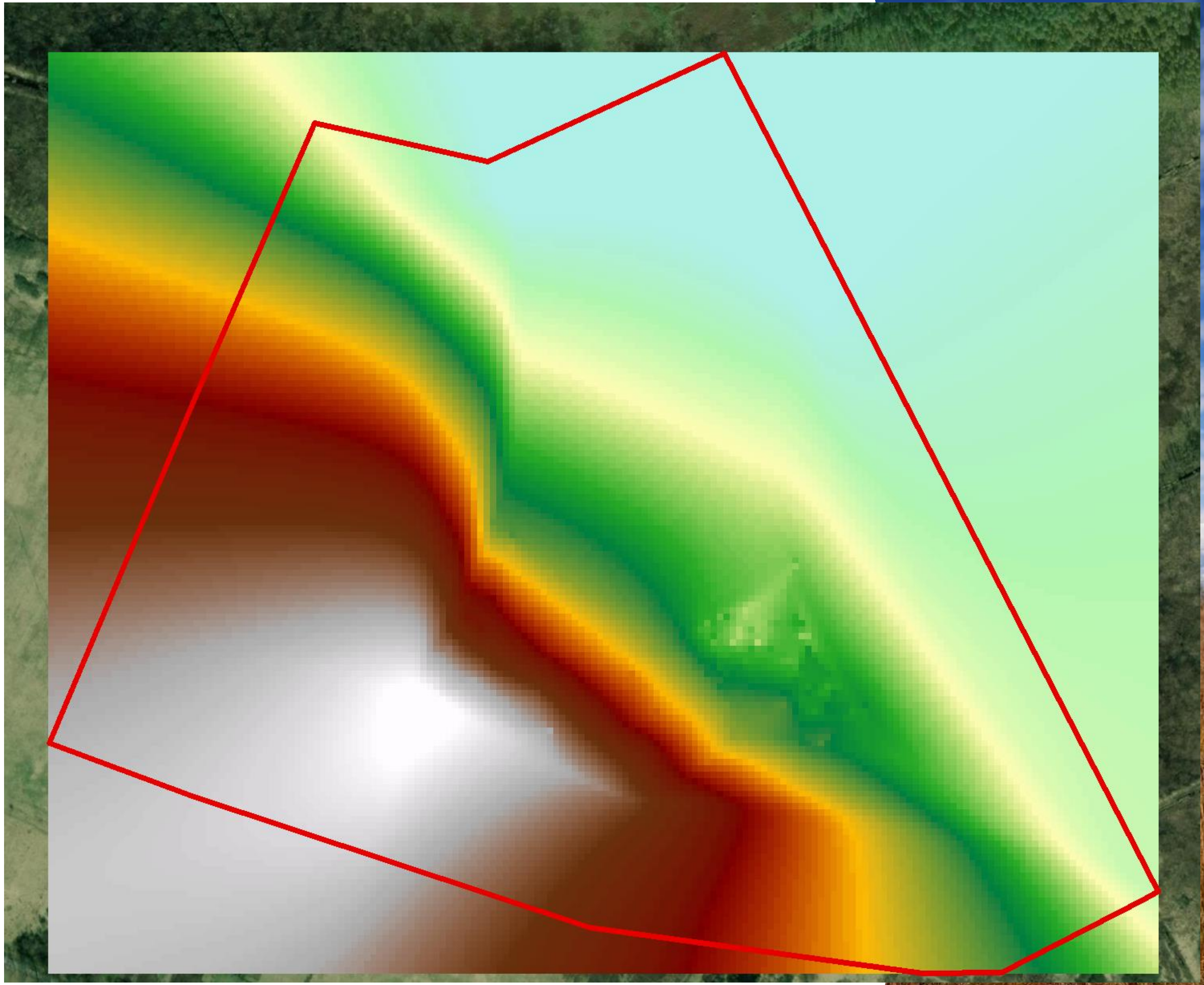
- Favourable conditions for the peat
- Low eutrophication potential (high inundation frequencies – FIT; natural peat)
- Good example of spontaneous peatland restoration

Indicator	Unit	K1	K2	K3	K3P	K4
> 0.0	*days*	273	357	354	357	287
FIT	*%*	0.75	0.98	0.97	0.98	0.78
< -0.4	*days*	0	0	0	0	0
AVG		0.10	0.27	0.24	0.26	0.09
MIN	*m bgl*	-0.21	-0.03	-0.07	-0.03	-0.35
MAX		0.33	0.49	0.46	0.49	0.22
MAGN	*m*	0.54	0.53	0.53	0.52	0.57



Gromovo - DEM

- Quite accurate within the zone of monitoring,
- Coarse outside of this zone
- Lidar would be optiomal

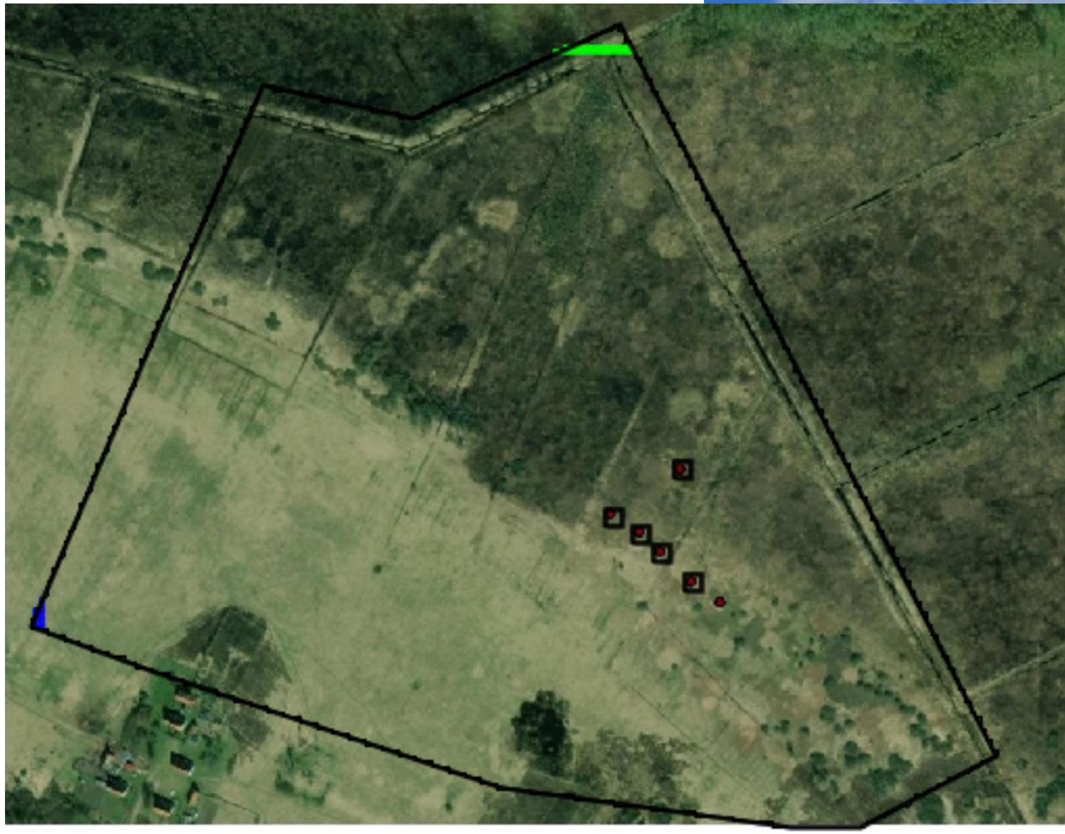


Gromovo – groundwater flow modeling - MODFLOW

- Groundwater recharge – P-ET (0.000351 m/d)
- Kx peat (calibrated – 0.073 m/d)
- Kx sand (calibrated – 15.1 m/d)
- Conductance of ditches – 0.1 m/d
- Depth of dithes – 0.2 m
- Simulation period: 01.11.2019-31.10.2020

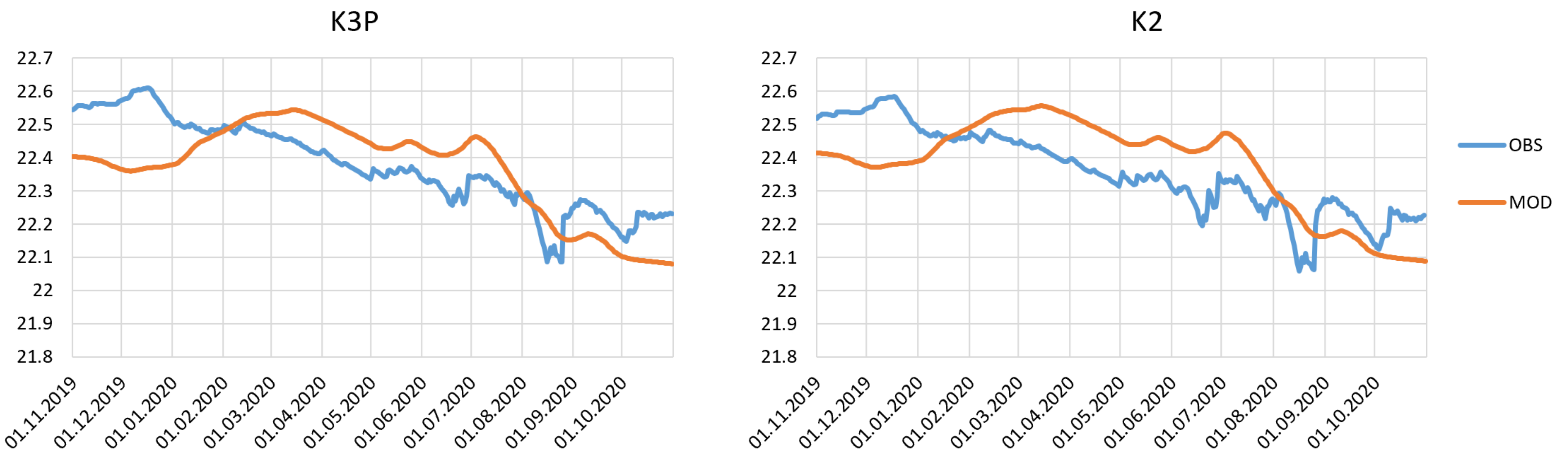
Tab. 1. Comparison of average observed and modelled groundwater levels (values in m asl)

Piezometer	OBS	MOD
P4	22.34	22.37
P3	22.38	22.36
P2	22.37	22.36
P1	22.36	22.36
P3P	22.38	22.35



Gromovo – modeling - MODFLOW

- RMSE = 0.11 m,
- Data can be improved – boundary conditions barely known, DEM can be improved, P and ET should be collected in the field (Here – data from Elbląg, PL)



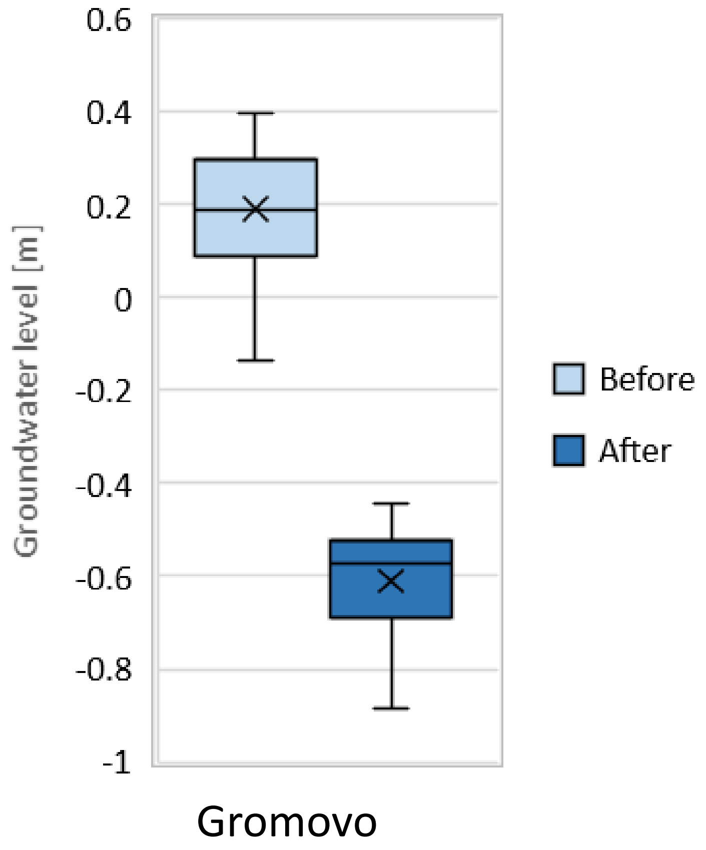
Gromovo – modeling - MODFLOW

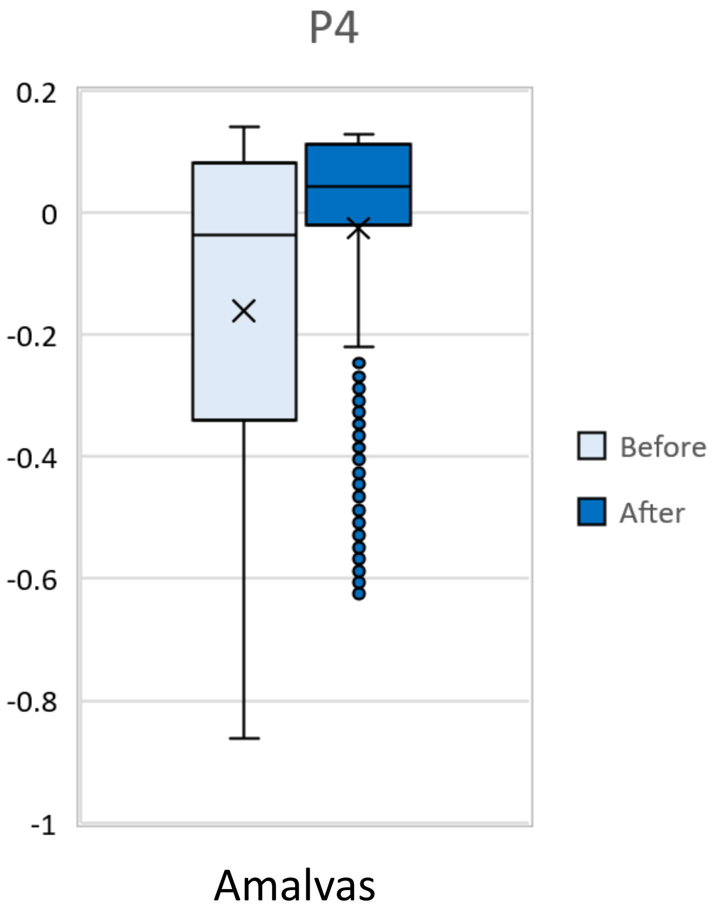
- Scenario 1 – Renewal of drainage ditches (1 m deep, clean), no modification of river regime

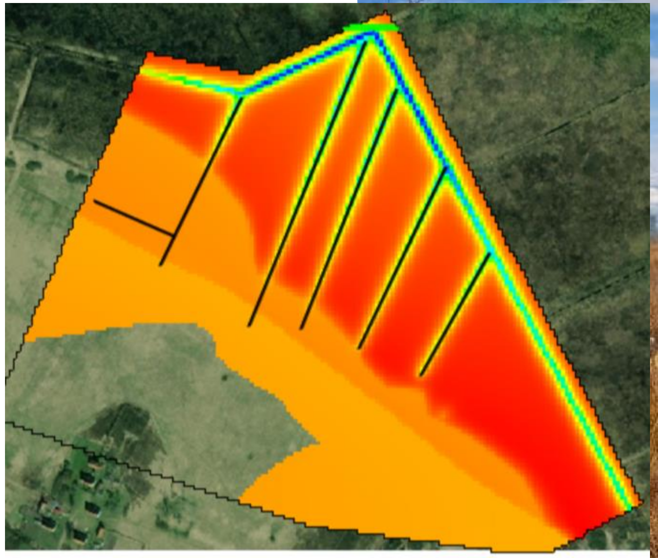
Indicator	Unit	NOW					DRAINAGE				
		K1	K2	K3	K3P	K4	K1	K2	K3	K3P	K4
> 0.0	*days*	272	356	353	356	286	0	0	0	0	0
FIT	*%*	0.74	0.97	0.96	0.97	0.78	0.00	0.00	0.00	0.00	0.00
< -0.4	*days*	0	0	0	0	0	366	285	315	320	366
AVG	*m bgl*	0.10	0.27	0.24	0.26	0.09	-0.67	-0.50	-0.54	-0.54	-0.80
MIN		-0.21	-0.03	-0.07	-0.03	-0.35	-0.95	-0.78	-0.81	-0.81	-1.08
MAX	*m*	0.33	0.49	0.46	0.49	0.22	-0.50	-0.33	-0.37	-0.38	-0.63
MAGN		0.54	0.53	0.53	0.52	0.57	0.44	0.44	0.44	0.44	0.45

Gromovo – modeling - MODFLOW

- Scenario 1 – Renewal of drainage ditches (1 m deep, clean), no modification of river regime

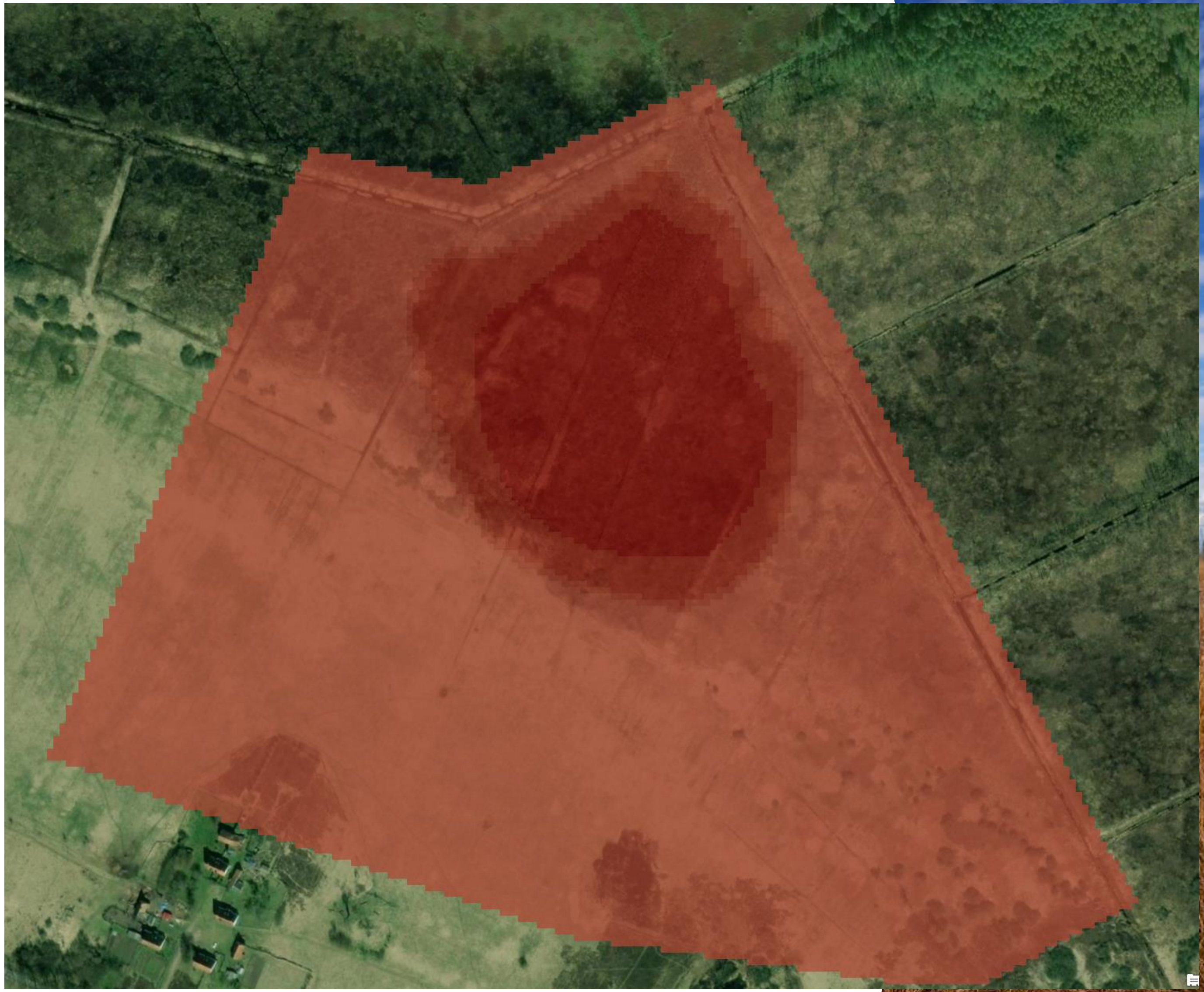




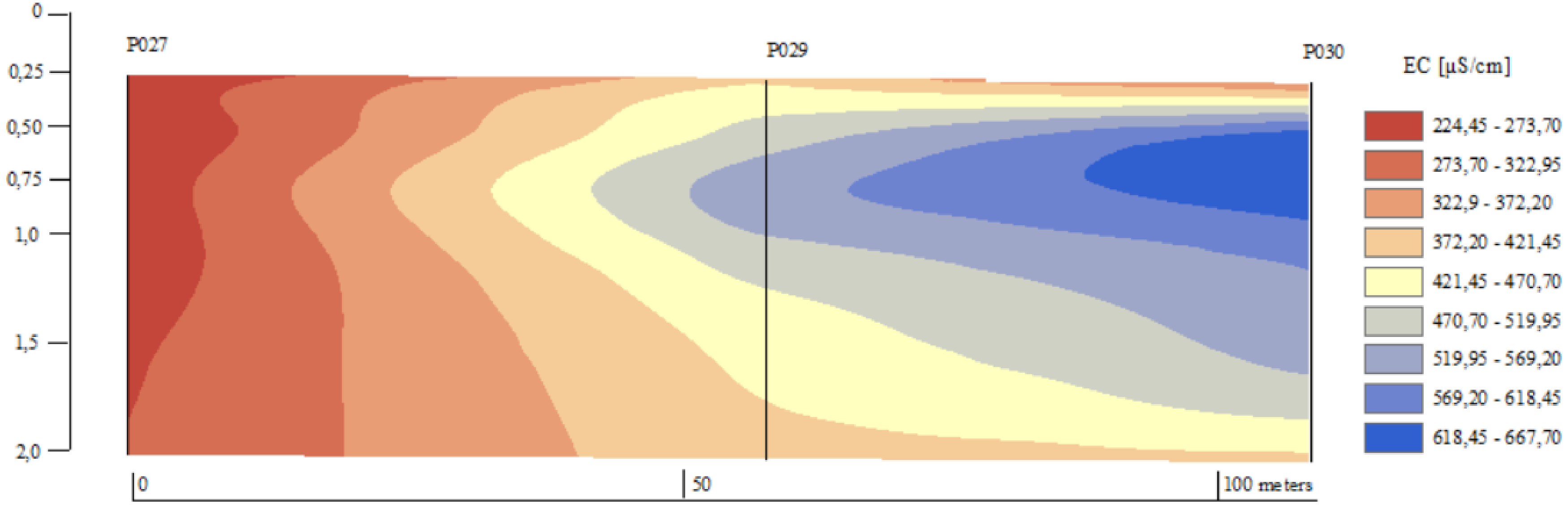


Gromovo – modeling - MODFLOW

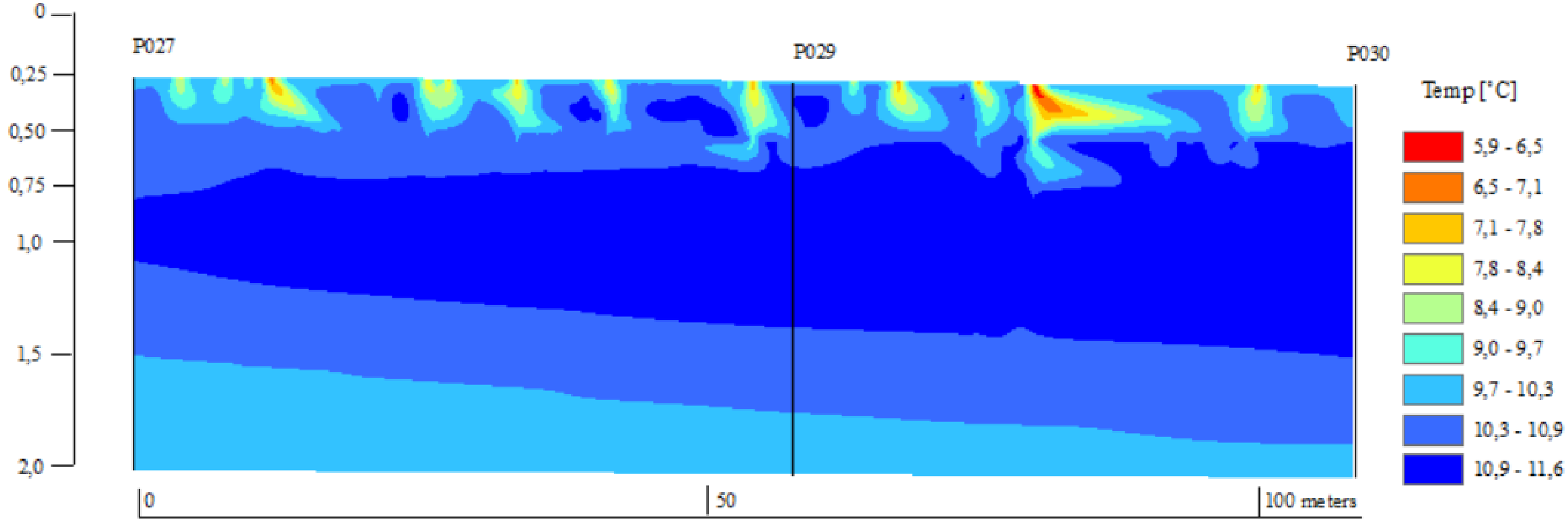
- Areal decline of goroundwater level;
- The highest – within the core zone of ditches



Groundwater EC vs. drainage

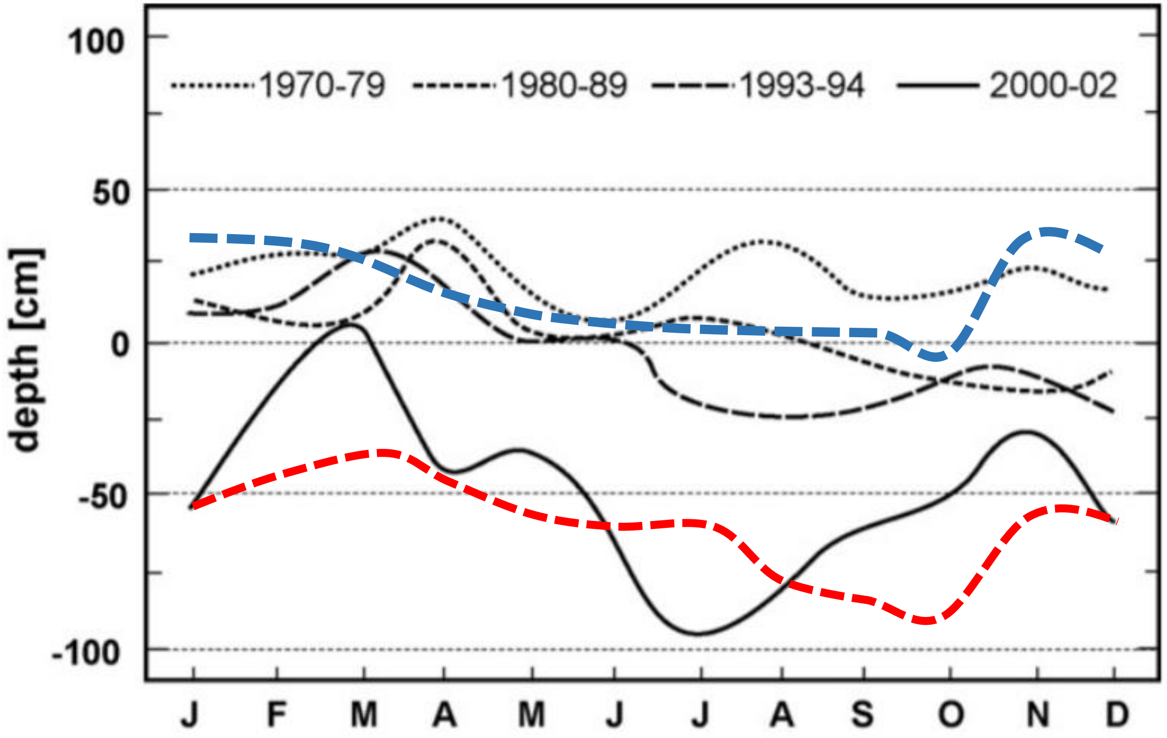


Graphic analysis of the groundwater electroductivity in the transect.



Graphic analysis of the groundwater temperature in the transect.

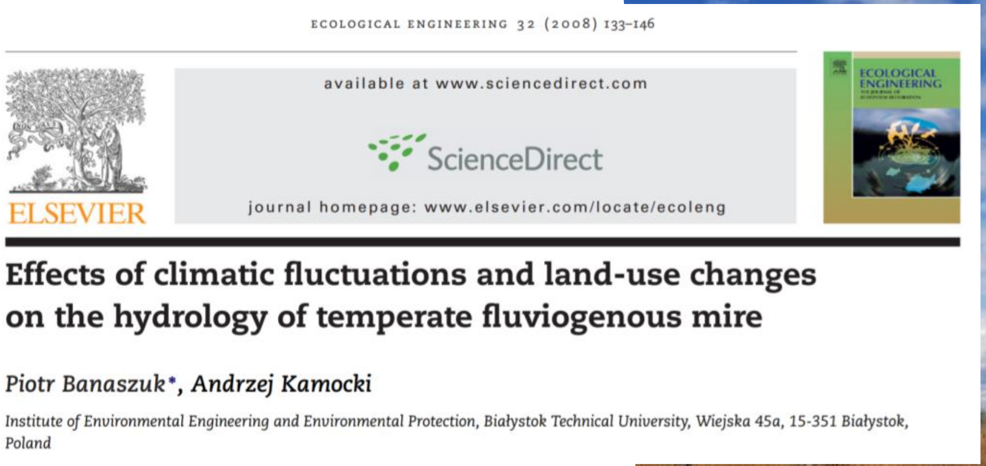
Comparison with the other fluviogenous mire (Narew Valley) – 2020 – the warmest year recorded



Gromovo – year 2020

Gromovo – Scenario 1

Fig. 8 – Annual march of the water table during various periods of observation for dipwell 4 at transect Bokiny. Note the temporal shift of spring flood timing toward earlier dates.



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Effects of climatic fluctuations and land-use changes on the hydrology of temperate fluviogenous mire

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Conclusions

- Gromovo peatland provides unique habitat conditions as a fluviogeneous mire,
- Contemporary conditions indicate that ~100 years of the lack of human influence may result in spontaneous restoration of such mires given the appropriate flow regime of adjacent water bodies,
- Drainage is likely to result in deep degradation of this peatland and the scale of negative response is likely much higher than the response of peatlands to rewetting
- Drainage is likely to result in changing trophic regime of the mire by facilitating surface runoff and removing ions supplied to the system from the side of Neman

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Thank you

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