WATER RELATED ECOSYSTEM – APPLICATION COPERNICUS DATA EXAMINING CLIMATE CHANGE EFFECT ON HYDROLOGICAL REGIME OF WETLANDS

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INTRODUCTION

Biebrza wetlands - unique in Europe

Wetlands systems are at the risk to changes in hydrological regime under climatic variation. Wetland habitat is sensitive and responses quick to climate changes. Wetlands cover 6% of the world's land surface and contain about 12% of the global carbon pool, play an important role in the global carbon cycle (International Panel on Climate Change (IPCC); In a time of global climate change, wetlands conditions are not known well enough. That's why the research that we have been carried out since couple of years which are based on satellite data and in-situ data are important for depicting the changes in hydrological and vegetation parameters. Biebrza Wetlands are our main area of research, because they are:

- one of the largest area in Europe covered with marshes, swamps, and wet meadows
- 60 000 ha of flat river valley covered with hydrogenic soils such as peat in various stages of mouldering
- habitat of 271 bird species
- protected as a National Park, Natura 2000 and RAMSAR sites

Fig. 1 Biebrza Wetlands location

The results are also connected to serve as an indicator of UN Sustainable Development Goal 6.6.1 - Change in the extent of water-related ecosystems over time.

METHODS

We present optical and microwave satellite observations to quantify the temporal and spatial variability of soil moisture, evapotranspiration and vegetation indices.

- Soil moisture spatial and temporal distribution has been calculated by using Sentinel-1 polarization VV and VH
- Evapotranspiration applying temperature from MODIS, Sentinel-3 and meteorological data
- Variation of NDVI and NDII applying Sentinel-2 and MODIS
- Precipitation has recorded at the meteorological station

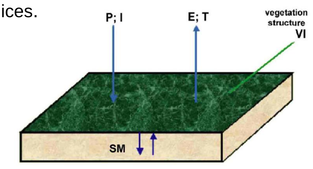


Fig. 2 Soil Moisture has been evaluated as the infiltration.

The model characterizing the input (by precipitation) and output (by evapotranspiration) has been developed. Soil Moisture in the Biebrza Wetlands has been retrieved from Sentinel-1 Imagery.

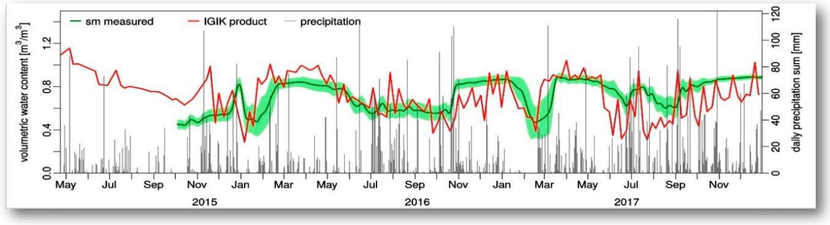


Fig. 2 Soil volumetric water content measured over marshland validation site vs IGIK product

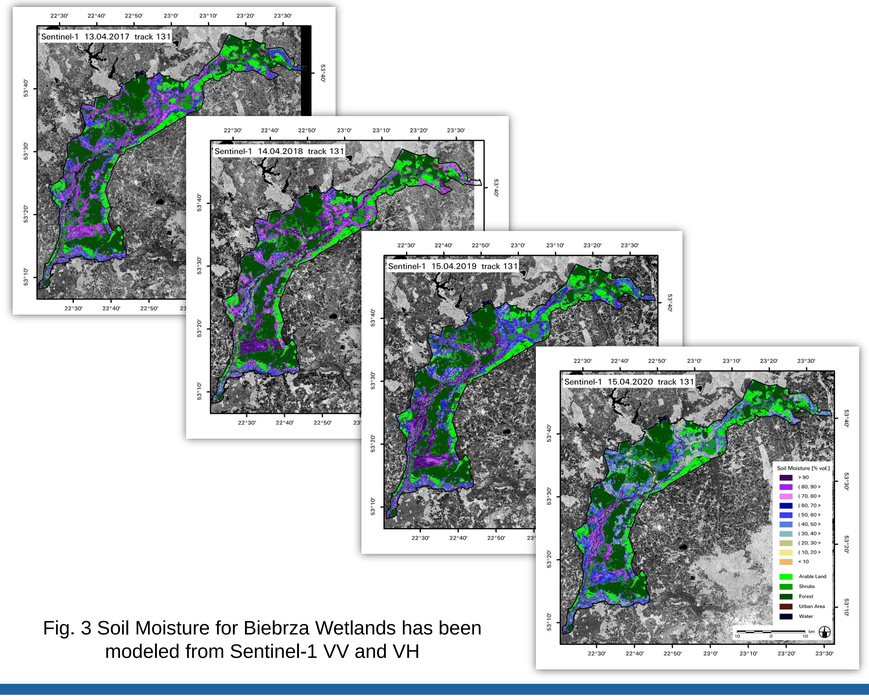


Fig. 3 Soil Moisture for Biebrza Wetlands has been modeled from Sentinel-1 VV and VH

RESULTS

Simultaneously with satellite acquisitions, ground campaigns were carried out from April to October in the chosen sites that cover various types of vegetation habitats. The increasing availability of multi-scale remotely sensed data and global weather datasets is allowing the estimation of evapotranspiration (ET) at multiple scales. One of the simple but robust methods is the method based on the Simplified Surface Energy Balance (SSEB) approach developed by Senay et al., (2007). This method uses remotely sensed data (Ts from MODIS)and global weather datasets to produce evapotranspiration (ET) for the contiguous areas at various time scales.

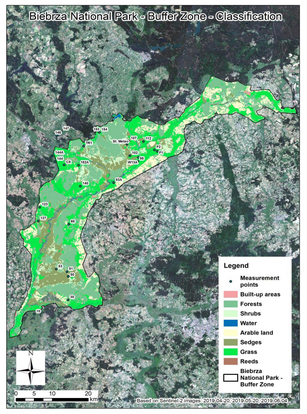


Fig. 4 Biebrza Wetlands Vegetation Classification

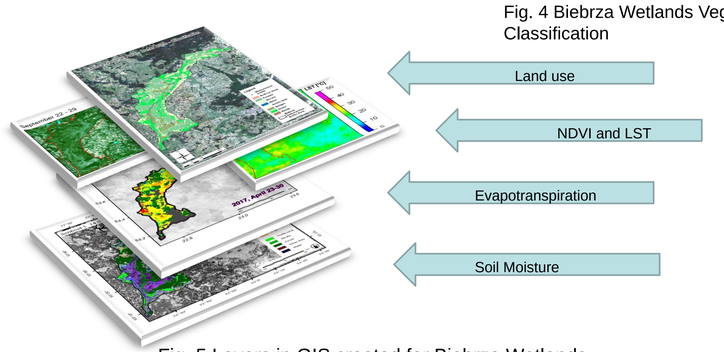


Fig. 5 Layers in GIS created for Biebrza Wetlands

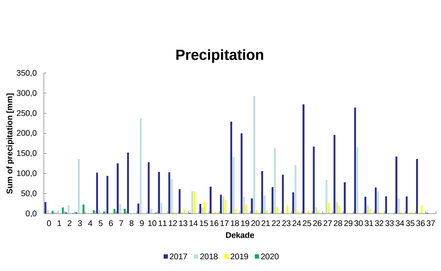


Fig. 6 Precipitation from meteorological station

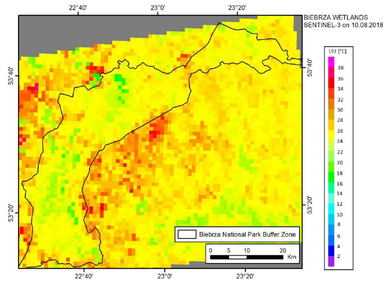
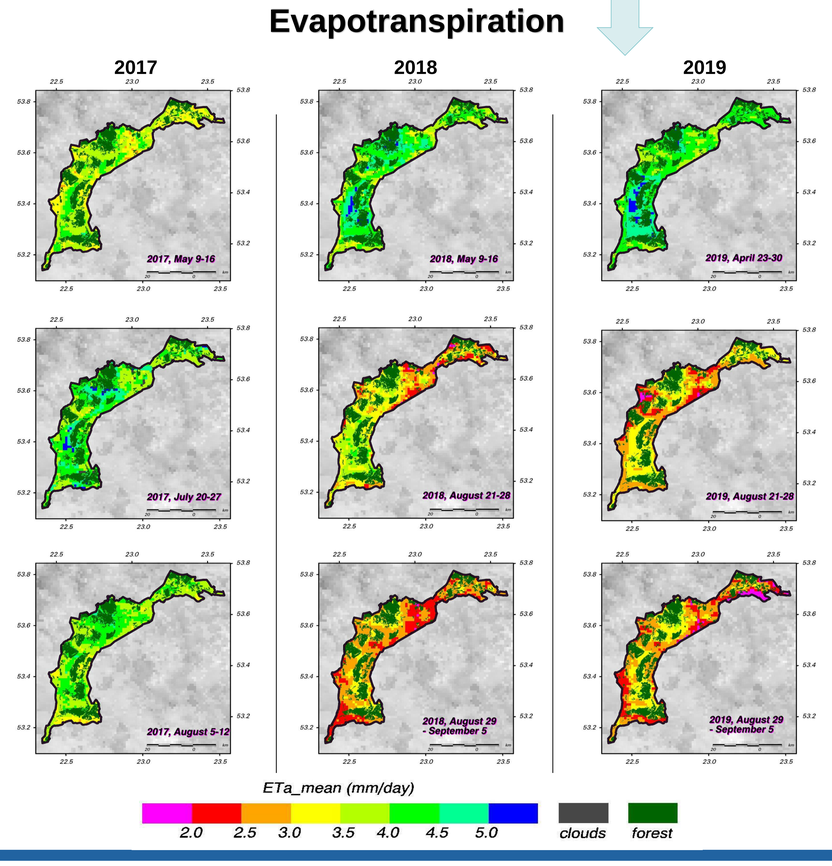


Fig. 7 LST from Sentinel 3 data



CONCLUSIONS

Due to extremely dry conditions in spring 2020, the area of wetlands had been effected by the fire. The recovery of vegetation after the fire has been monitored by **satellites.**

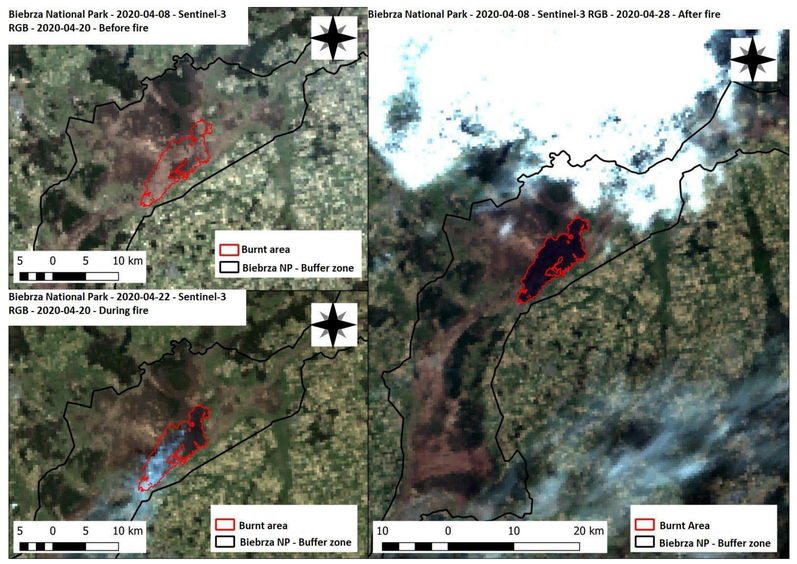


Fig. 8 Biebrza National Park on fire

Vegetation recovery after the fire in Biebrza Nataional Park

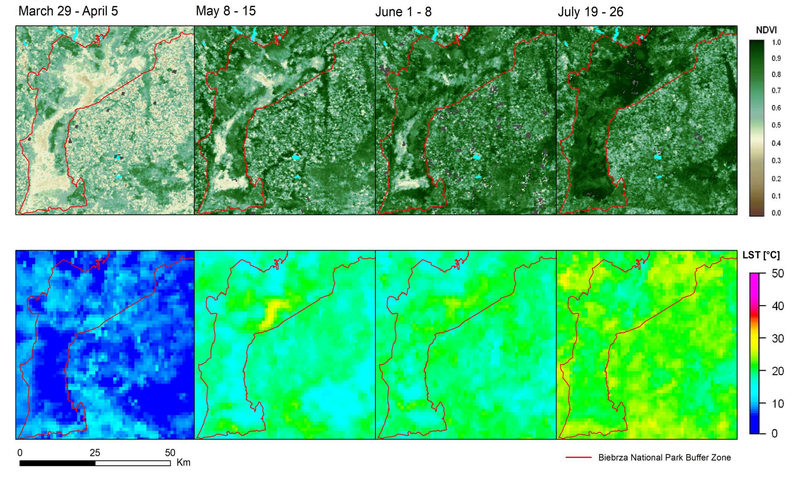


Fig. 9 NDVI and LST from MODIS of Biebrza National Park before, during and after fire

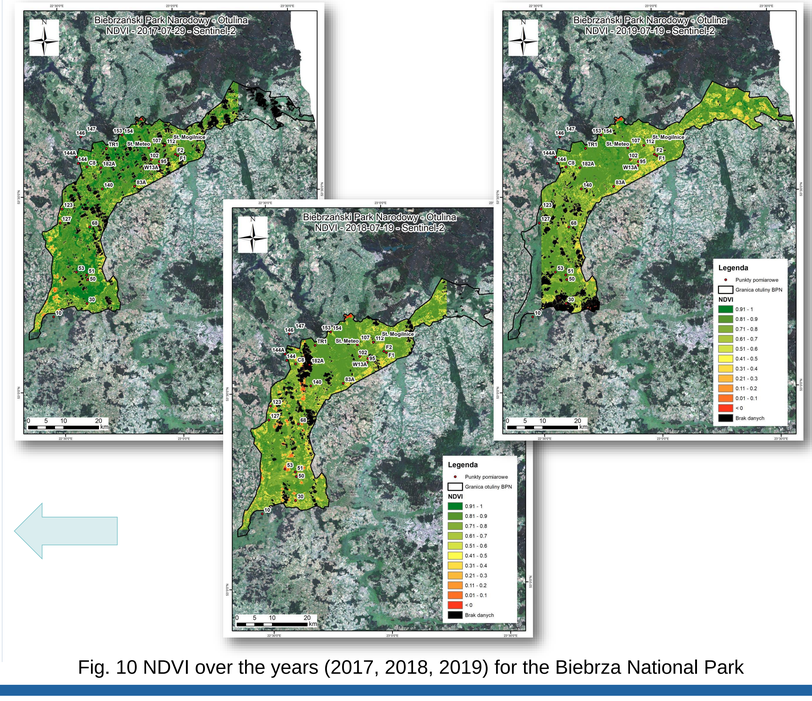


Fig. 10 NDVI over the years (2017, 2018, 2019) for the Biebrza National Park