

# EVALUATION OF MINING SITE RECLAMATION DEVELOPMENT USING SATELLITE DATA

Surface temperature, vegetation and wetness indices  
as a landscape function properties

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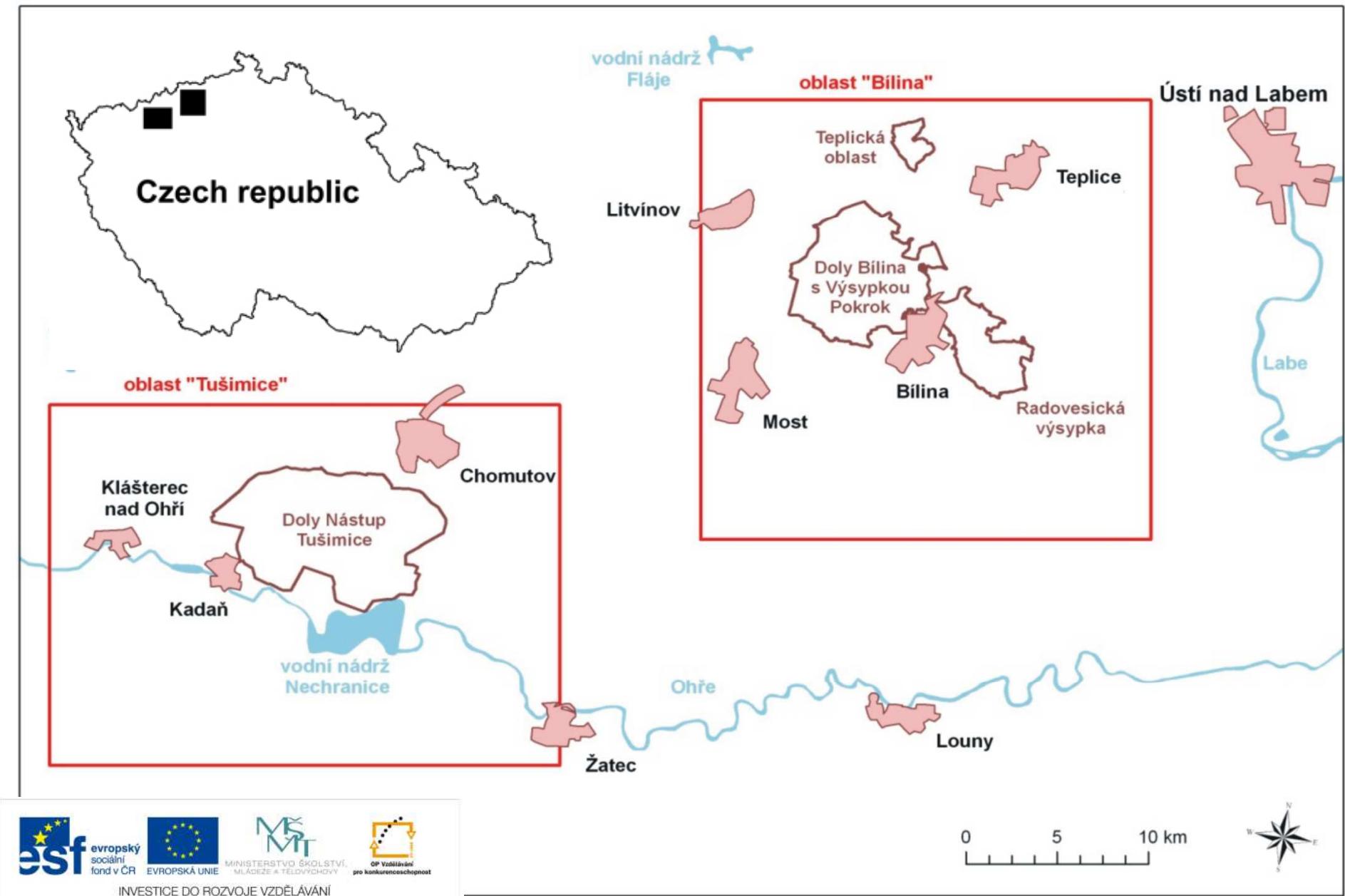
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HYDAP

The latest remote sensing technologies in the service of  
research, education and application for regional  
development



# Coal mines, dumps and reclaimed sites



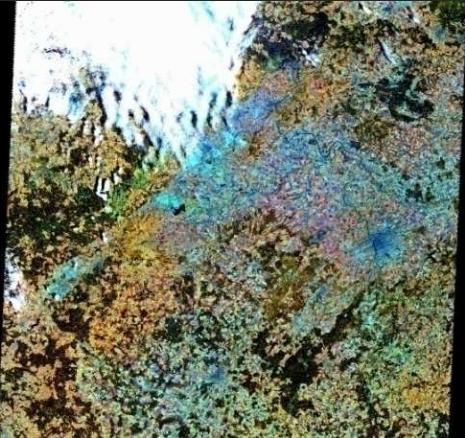
# Landsat 5 TM satellite sensor

Landsat 5 satellite	Thematic mapper sensor		
	Band	Spectral resolution ( $\mu\text{m}$ )	Spatial resolution (m)
Launched: March 1, 1984	1	0,45 – 0,52	30
Terminated: November 2011	2	0,52 – 0,60	30
Orbital cycle duration: 16 days	3	0,63 – 0,69	30
Scene dimension: 170 x 185 km	4	0,76 – 0,90	30
	5	1,55 – 1,75	30
	6	10,4 – 12,5	120
	7	2,08 – 2,35	30

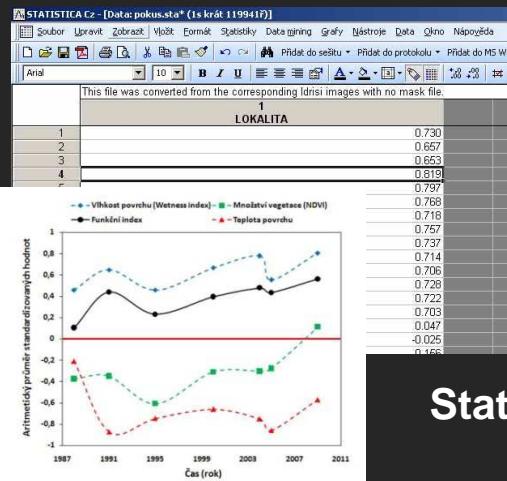


Landsat 5  
satellite

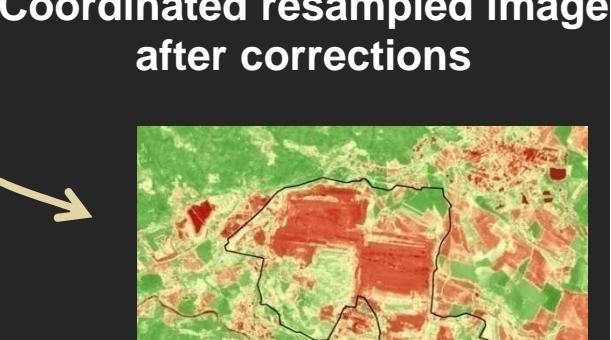
# Satellite images processing



Raw satellite image  
Landsat 5 TM

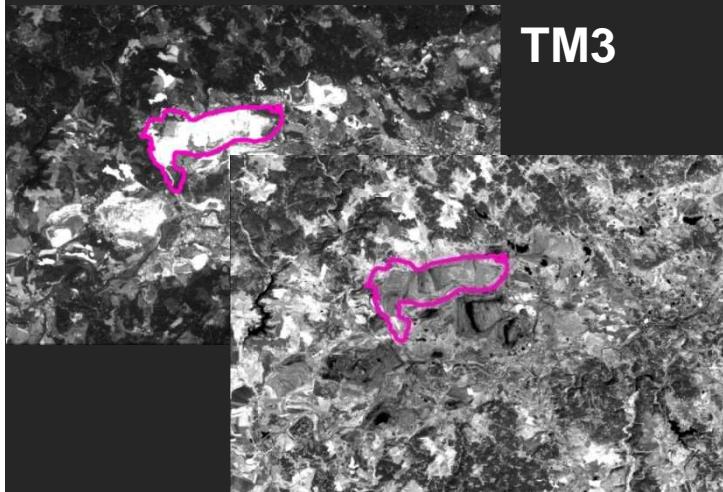


- Georeferencing (coordinate system registration)
- Cutting, resampling
- Radiometric corrections and atmospheric impact elimination

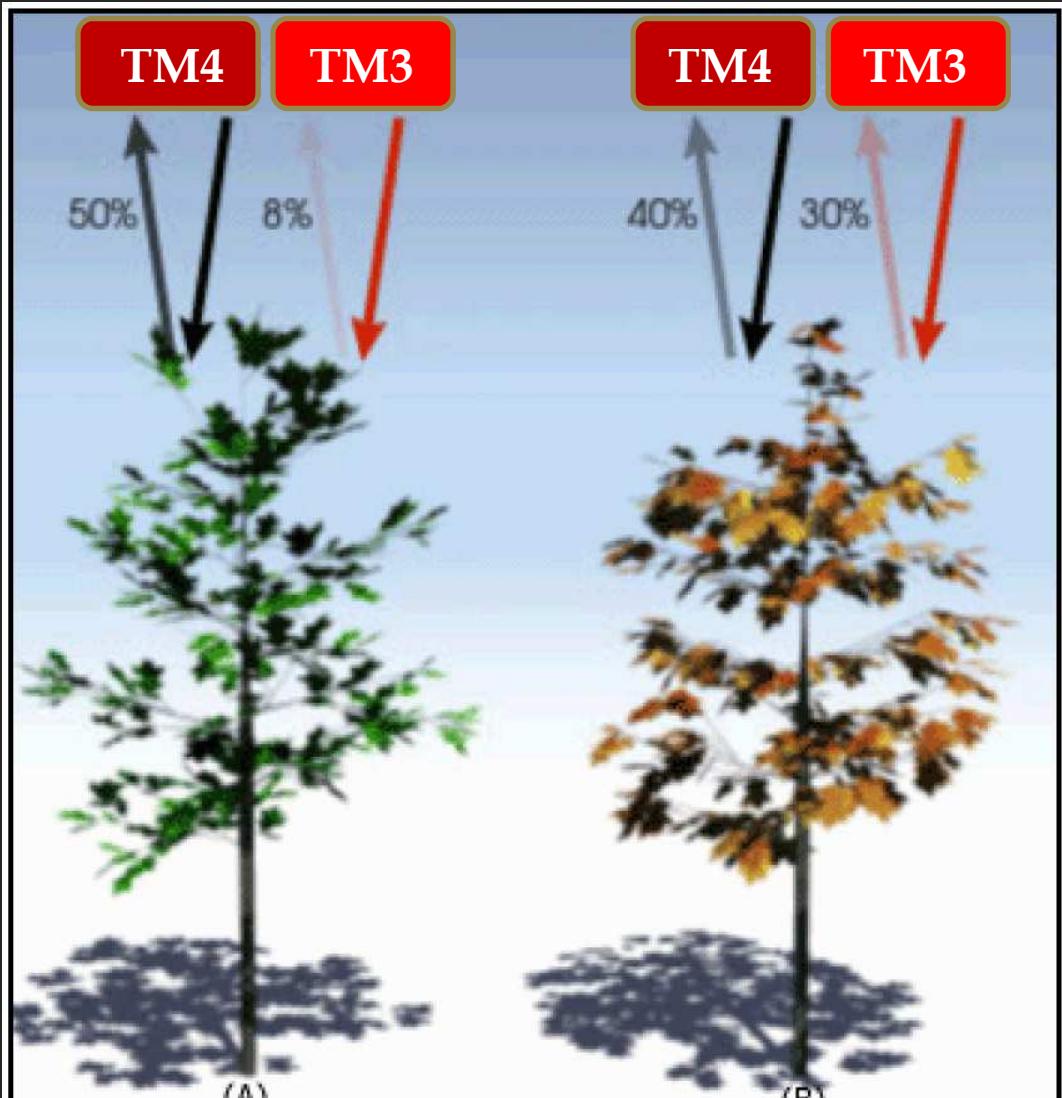
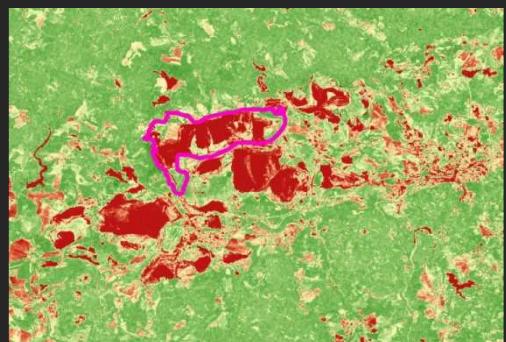


INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

# NDVI raster construction



$$\text{NDVI} = (\text{TM4} - \text{TM3}) / (\text{TM4} + \text{TM3})$$



$$\frac{(0.50 - 0.08)}{(0.50 + 0.08)} = 0.72$$

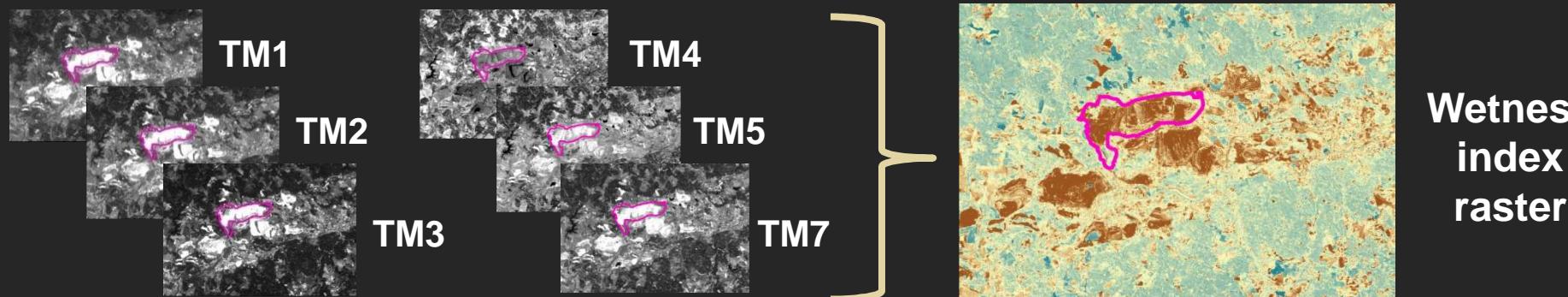
$$\frac{(0.4 - 0.30)}{(0.4 + 0.30)} = 0.14$$

# Wetness index raster construction

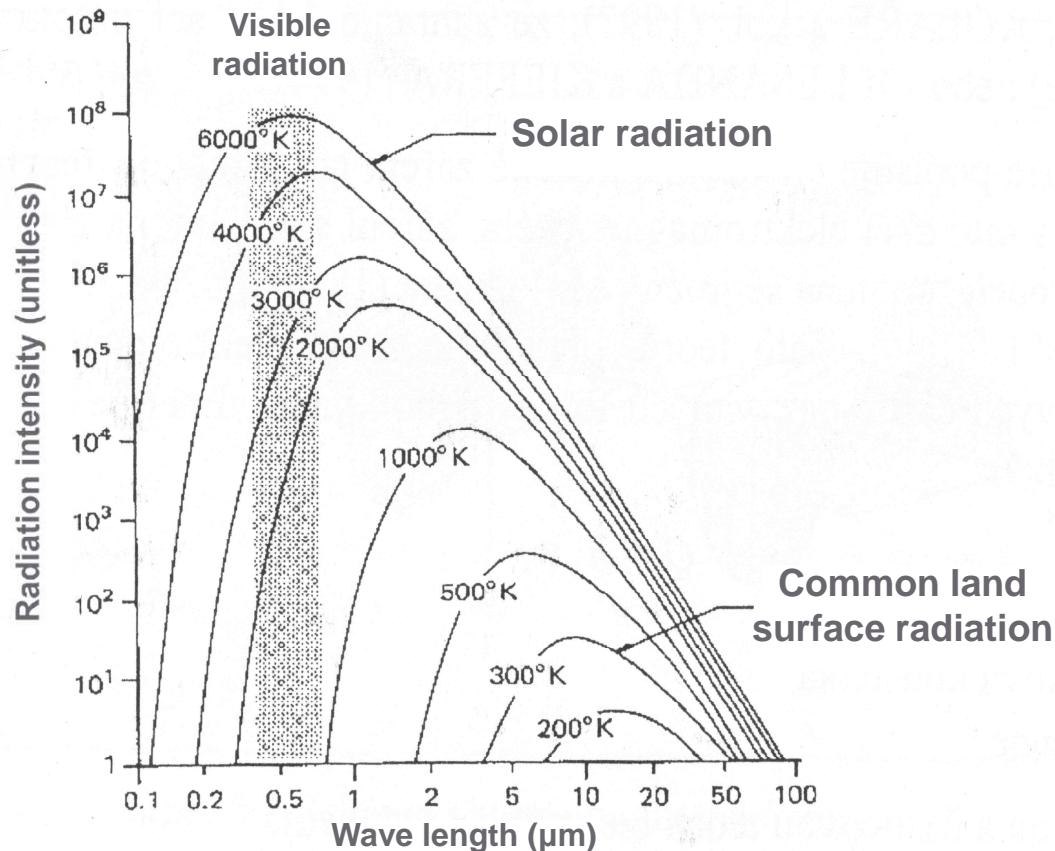
-The 3rd axis of Tasseled cap transformation

-Moistness of surface

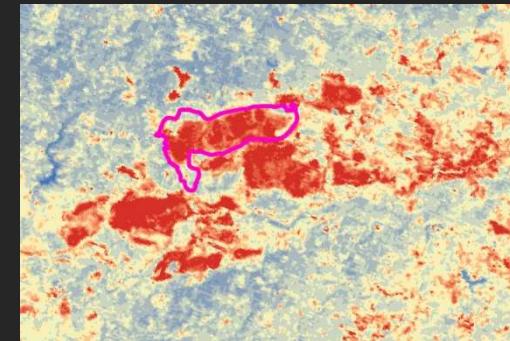
$$TC3 = 0,315 \cdot TM1 + 0,2021 \cdot TM2 + 0,3102 \cdot TM3 + 0,1594 \cdot TM4 - 0,6806 \cdot TM5 - 0,6109 \cdot TM7$$



# Surface temperature raster construction



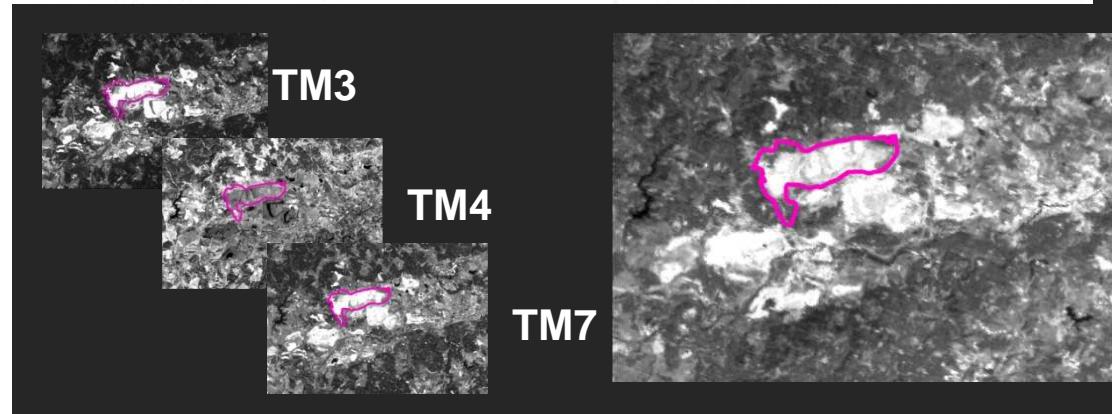
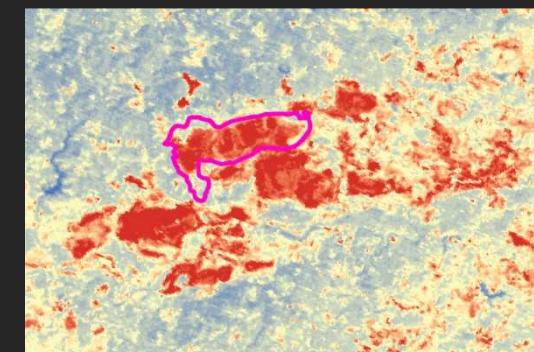
TM6 band (10.4 – 12.5  $\mu\text{m}$ )



-Radiometric corrections and atmospheric impact elimination

-Absolute surface temperature calculation ( $^{\circ}\text{C}$ ) using empirical algorithm (comprising TM3, TM4 and TM7 spectral bands)

Surface temperature raster ( $^{\circ}\text{C}$ )

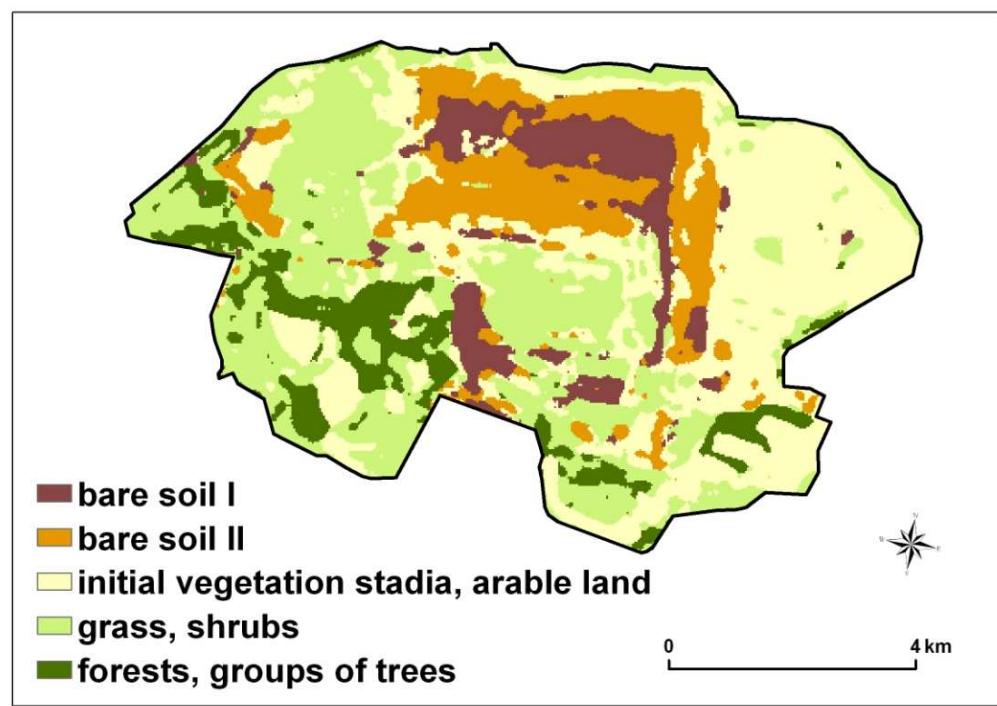


TM6

# Doly Nástup Tušimice, 1988 - 2059



Ortofoto: CENIA 2011



14.8.1988



20.6.2000



24.8.2009



## NDVI - Doly Nástup Tušimice

7.8.1991



10.8.2004



1.7.1995



28.7.2005



High vegetation  
amount



Low vegetation  
amount



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

14.8.1988



20.6.2000



24.8.2009



# Wetness - Doly Nástup Tušimice

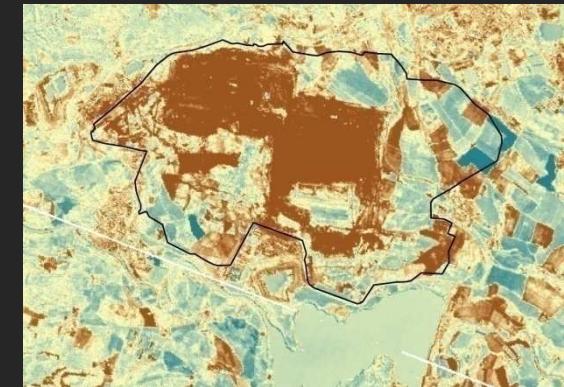
7.8.1991



10.8.2004



1.7.1995



28.7.2005



High wetness



Low wetness



evropský  
sociální  
fond v ČR



EVROPSKÁ UNIE



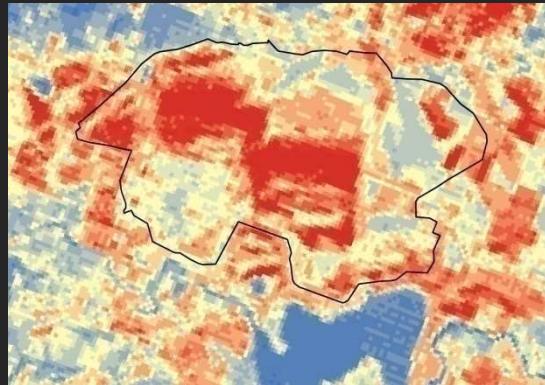
MINISTERSTVO ŠKOLSTVÍ,  
MLÁDEŽE A TĚLOVÝCHOVY



OP Vzdělávání  
pro konkurenčnost

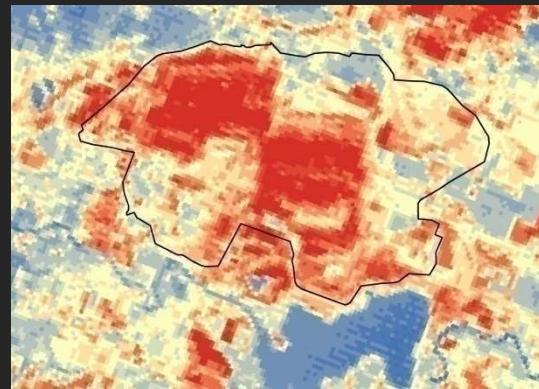
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

14.8.1988

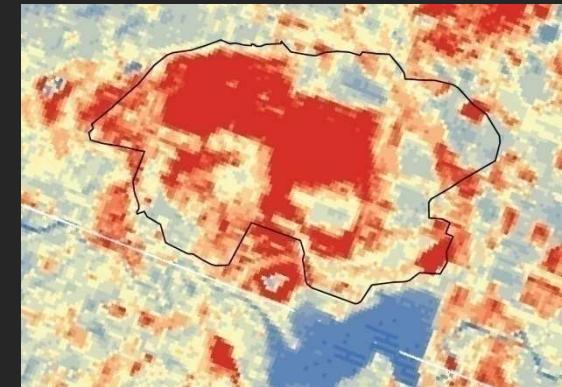


## Surface temperature - Doly Nástup Tušimice

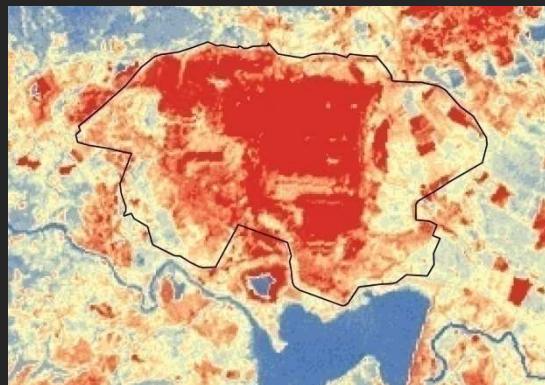
7.8.1991



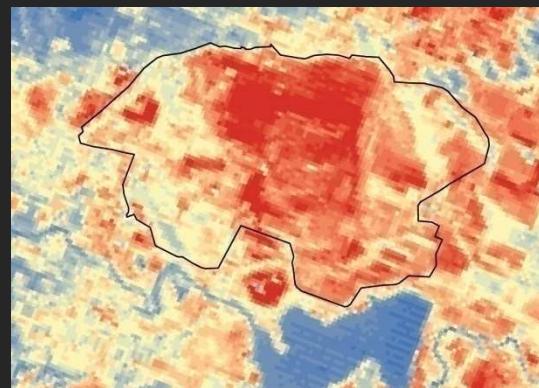
1.7.1995



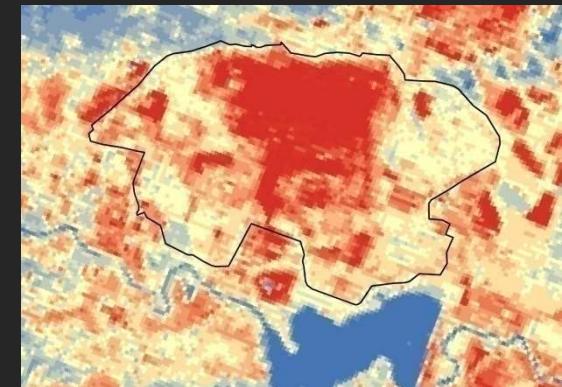
20.6.2000



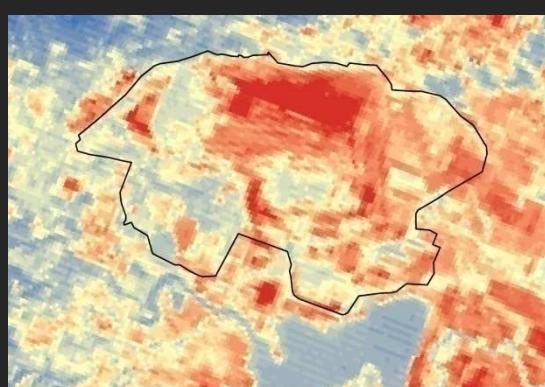
10.8.2004



28.7.2005



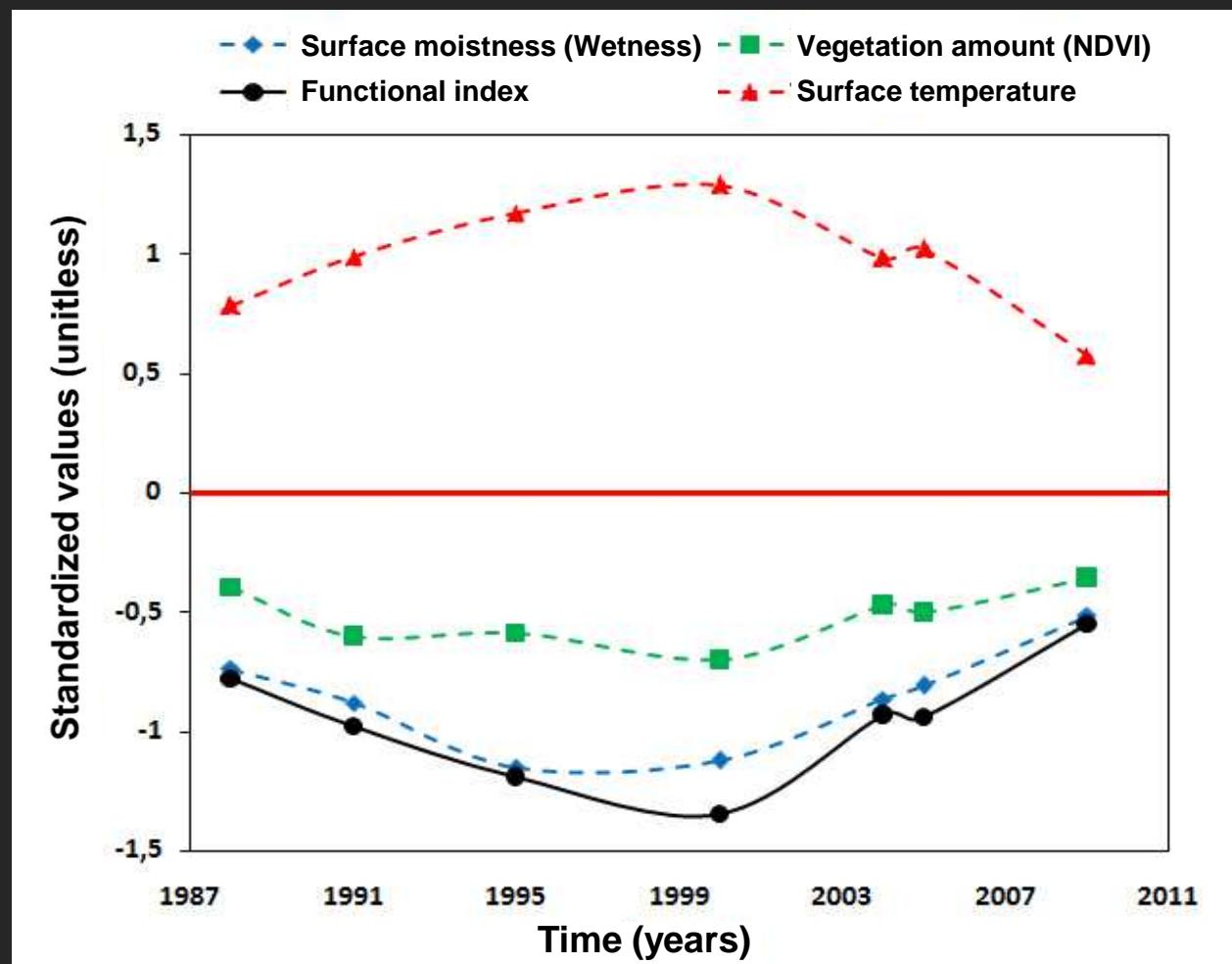
24.8.2009



High temperature

Low temperature

# Surface properties development



After year 2000:

- Increasing amount of functional vegetation (NDVI)
- Increasing surface moisture (Wetness index)
- Decreasing surface temperature

2014

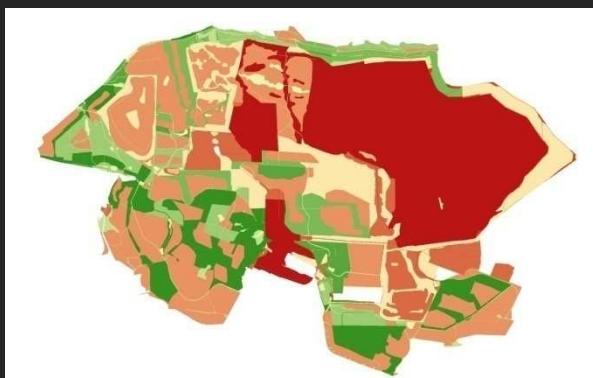


## NDVI - Doly Nástup Tušimice

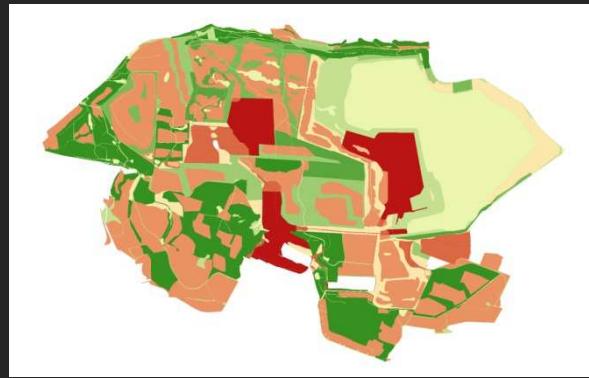
2019



2029



2041



2059



High vegetation  
amount



Low vegetation  
amount

2014

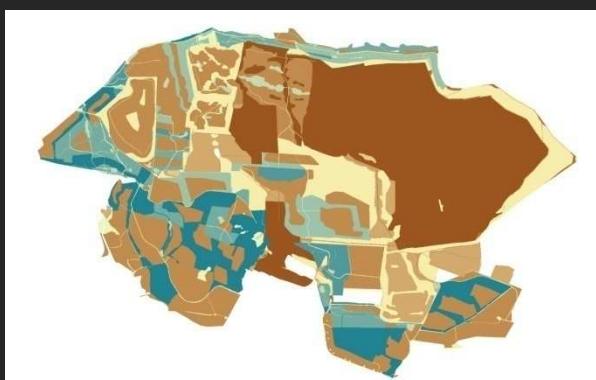


## Wetness - Doly Nástup Tušimice

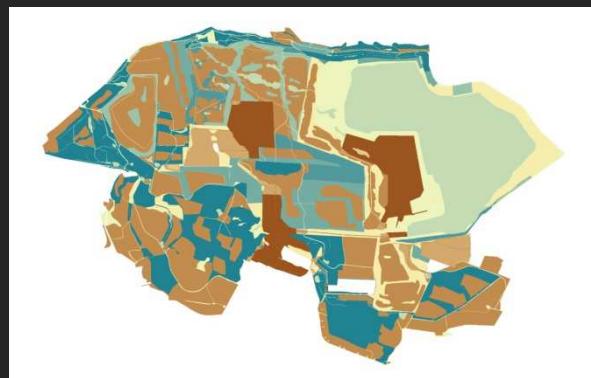
2019



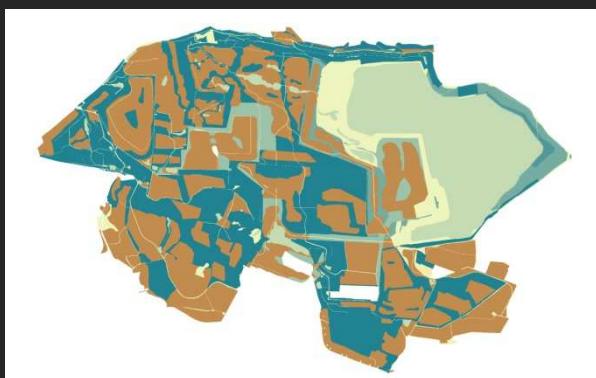
2029



2041



2059



High wetness

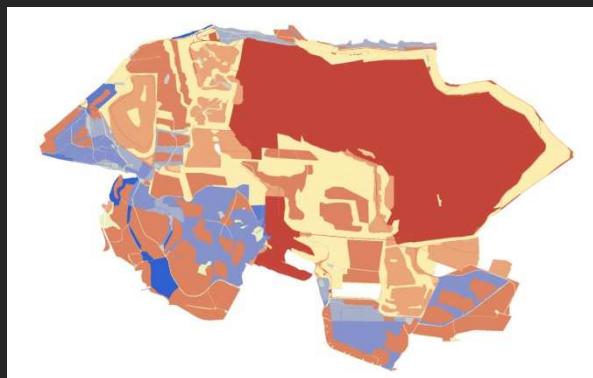
Low wetness

2014

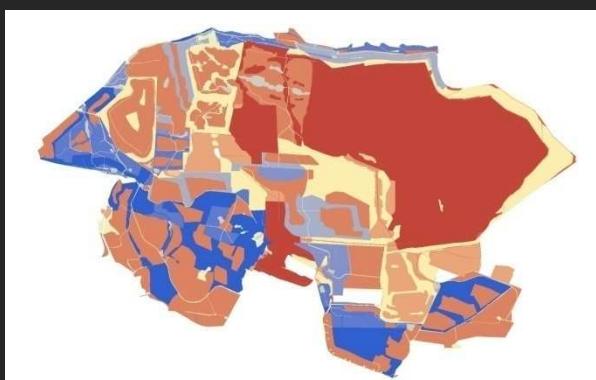


## Surface temperature Doly Nástup Tušimice

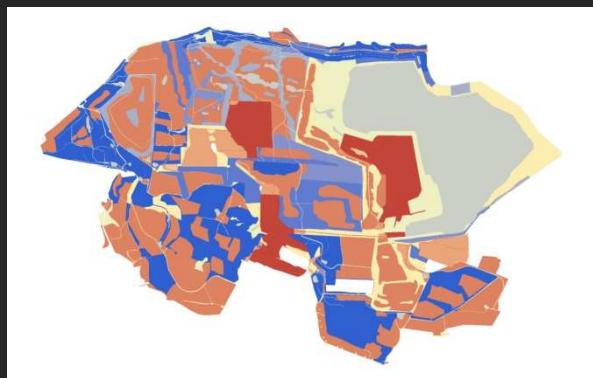
2019



2029



2041



2059



High temperature

Low temperature

# Prediction of surface properties development

- ■ - Vegetation amount (NDVI)      - ◆ - Surface moistness (Wetness)      - ▲ - Surface temperature      - ● - Functional index

