

Automatic detection of vegetation dynamics by remote sensing in riparian zone of braided-wandering river system Miloš Rusnák, Anna Kidová, Lukáš Michaleje, Tomáš Goga

River channels are key elements for maintaining landscape



::: braided and wandering Belá River







GEOGRAFICKÝ ČASOPIS / GEOGRAPHICAL JOURNAL 64 (2012) 4, 311-333

25



::: braided and wandering Belá River

A. Kidová et al. / Geomorphology 272 (2016) 137-149



139

How do identify and monitor vegetation changes?

- homogenous spatio-temporal pattern of riparian zone identification
- monitoring based on the satellite multispectral images

data

Spatial pattern

- channel pattern (water, gravel bar, islands)
- floodplain morphology (height above channel, floodplain age)
- distance from channel
- vegetation (automatic detection)

Temporal patern

- temporal changes from 1949 – 2018

vegetation

indices

- 11 aerial images
- ALS 2018

pattern

- SkySat 2018
- Sentinel 2 (2015 2019)









:::Vegetation



3 bands; RGB aerial images



4 bands; RGBi aerial images







RGB image



Red-Green-Blue Vegetation Index (RGBVI)





:::Vegetation

OBIA (RF) classification:

- grass, shrubs and riparian forest (exclusively Salix spp. combined with adult forest, mainly Picea abies)
- + water, gravel, agriculture surfaces, buildings, roads and shadows

classification:

73% overall accuracy was reached for vegetation (water 98 %, gravel bars 94 %)

validation matrix:

 generated from 100m +
 30m in braidplain fishnet (942 points).



Pixel-based (RF) classification:

grass, shrubs and riparian forest (exclusively Salix spp. combined with adult forest, mainly Picea abies)

classification:

- 85% overall accuracy was reached for vegetation
- Iower for (BW images): 80 - 86 %
- Higher for NDVI images: 87 – 92 %







:::: VI and MI calculation

Sentinel-2:

- data range (1st March 31st October), (2015 2019);
- Cloud cover (less than 50%);
- granule (T34UDV).
- lownloaded using USGS's Bulk Download Application.
- Sentinel-2 data were pre-processed using the Sen2Cor algorithm (ESA v.2.5.5 and v.2.8).
- The clouds, cloud shadows and water bodies were removed using L2A_SceneClasses (1:3, 6, 8:11).

SkySat data:

- SkySat Collect and SkySat Scene
- 4 bands
- TOA corrections



VI and MI calculation:

- Normalised difference vegetation index (NDVI)
- Green-Red Vegetation Index (GRVI)
- Green Chlorophyll Index (ClG)
- Structure Insensitive Pigment Index (SIPI)
- Modified Normalized Difference Water Index (MNDWI) only S2
- Normalised Difference Water Index (NDWI)
- Moisture index (MSI) only S2

:::Drought identification



:::Spatio-temporal pattern

vegetation indices

Sentinel-2:

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- different riverine landscape spatial zones:
 - 1) planform type (single, avulsion, wandering, channelized)
 - 2) distance from the channel (buffer zone 50 m, 100 m, 150 m and more than 150)
 - 3) height above channel
 4) in-channel processes (
 - 4) in-channel processes (bank erosion, gravel accumulation)
 - 5) vegetation type

Datasets were simplified by removing all polygons with an area lower than 300 m² and minimum bounding geometry 30x30m for mitigating errors arising by a combination of high-resolution (1m and 20 cm) and medium-resolution datasets (10 m).

::: Spatio-temporal pattern





::: Spatio-temporal pattern

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Belá River system:

- global climatic changes (droughts, floods)
- direct human impact (gravel mining; channelization (positive feedback), channel regulation; dike construction; afforestation, deforestation)
- Spatial distribution of vegetation and moisture indices are not affected by distance from the channel
- Differences are visible in different channel pattern
- Spatial distribution of VI/MI values reached for wandering and avulsion channel patterns equally.
- The seasonal variance of VI and MI follows the phonology curve during the year and local hydrologic conditions.
- The effect of droughts on vegetation health is disputable.
- However, significant drought impact analyses are necessary to investigate more extended periods with the robust and statistical relevant database to avoid local variation of vegetation or changes that cannot be interpreted due to drought impact.



THANKS!

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