Monitoring of riparian vegetation growth on fluvial sandbars

Michael Nones\textsuperscript{1}, Massimo Guerrero\textsuperscript{2}, Renata Archetti\textsuperscript{2}

\textsuperscript{1} Institute of Geophysics, Polish Academy of Sciences, Poland
\textsuperscript{2} DICAM, University of Bologna, Italy
Problem definition

**Case study**

**Bankline extraction**

**Vegetation patterns**

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Di Silvio & Nones, ISRS 2013

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$Q_{\text{max}}$  
$Q(t)$  
$Q_{\text{min}}$  

$B(t)$  
Water flow  

$B$  
$B_{\text{veg}}$  
Nude surface (active width for transport)  
Vegetated surface (grass, shrubs and trees)  
Total surface, $B_{\text{tot}}$  

$K(t) = dB_{\text{veg}}/dB_{\text{tot}}$  
Vegetation density  

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- video camera Mobotix MX-M15D-SEC
- router Sierra Wireless RV50
- images acquired every 12 hours (day/night sensors)
- monitored period: July 2017-November 2018

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water levels monitored every 30’
hourly averaged and adjusted considering the water slope

the reference level is used for water management and flood/drought warning
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USV with GPS

linear homography

50 target points

(25 training + 25 validation)
studied period: July-December 2017
maximum vegetated areas follow a dry period
floods tend to destroy the vegetation
being seasonal, during the winter the vegetation dies

what are the main drivers of the vegetation growth?
monitoring edge-of-water lines displacements and vegetation patterns with a fixed camera is an economic and reliable method for pointing out fluvial dynamics at the reach scale
flooding waves remove sediments (and seeds) accumulated on the central bar during low flow conditions, redistributing them across a wider cross section
floods destroy vegetation patterns created during low flow conditions, but contribute in redistributing the seeds along and across the channel
vegetation patterns are related to seasonality, therefore a longer monitoring period is necessary

combining field survey (camera) with remote sensing (satellite) can provide insights on the medium- to long-term vegetation dynamics over fluvial sandbars
intrinsic uncertainties related to camera (image rectification) and satellite (image resolution) data affect the final results
Thank you for your attention

Michael Nones¹, Massimo Guerrero², Renata Archetti²

¹ Institute of Geophysics, Polish Academy of Sciences, Poland – mnones@igf.edu.pl
² DICAM, University of Bologna, Italy

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mnones@igf.edu.pl
- errors computed by subtracting the actual position of the target points from the assessed one
- errors <20 m till a distance of 250 m from the camera, then reach a max of around 70 m
- the error is a function of the lateral distance (azimuth): for points having the same longitudinal distance, the higher the distance from the optical axis, the higher the error
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\[
NDVI = \frac{NIR - Red}{NIR + Red} = \frac{\text{band5} - \text{band4}}{\text{band5} + \text{band4}}
\]

Class I  NDVI < 0.0  water
Class II  NDVI 0.0–0.1  bare soil
Class III NDVI 0.1–0.2  seasonal vegetation
Class IV  NDVI 0.2–0.4  semi-permanent vegetation
Class V  NDVI > 0.4  permanent vegetation

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