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Discussions

Interactive comment on "Monitoring of riparian vegetation response to flood disturbances using terrestrial photography" *by* K. Džubáková et al.

Anonymous Referee #1

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General comments

This paper describes the use of multispectral ground photography to monitor post-flood riparian vegetation in an Alpine braided river. The authors used several vegetation indices to measure vegetation cover, and change detection techniques to assess the short-term effects of floods on riparian vegetation. The paper is well written and generally well organized, and I believe in general the methods are sound and repeatable but could be expanded upon with more detail.

Specific comments

The main issue is that for a paper describing novel techniques/methods, the authors do not provide any solid information about which vegetation index can be used to most

accurately monitor riparian vegetation. The authors state that "The assumption is that all analyzed vegetation indices reliably represent vegetation activity and that the differences among the indices will occur mainly on the water–soil–vegetation contact zones due to their different sensitivity", and go on to analyze the results of only one index, the one that has the least disagreement from all of the others. It may be the case that all indices reliably represent vegetation activity, but because this paper is looking at fine-scale, short-term vegetation dynamics, one would expect the priority to be determining which index *most* reliably represents riparian vegetation activity when measured from broadband terrestrial photography. The decision to choose the GNDVI as the main index for analysis, based simply on the general agreement with the other indices, is problematic in my view. If you look closely at Table 3, you will see that the three "red" indices generally agree with other "red" indices, while three "green" indices agree with "green" indices, and the greatest disagreement is between "red" and "green" indices. This makes perfect sense of course, and if you look at the table the disagreement is generally about equal between the red v. red and green v. green, until you bring into play the little-known Chlorophyll Vegetation Index (CVI), which uses both red and green bands, but has much better agreement with the green vegetation ($\sim$ 17%) indices than the red ($\sim$ 32%). So the CVI is essentially the tie-breaker in this contest, but there is no reason to believe that the CVI is even a worthy index in its own right. So this is all problematic in my view, because it leads the reader/practitioner to believe that the GNDVI (or any green index) is the ideal index, when in fact the only thing we know for sure is that the GNDVI is better correlated with the CVI than the (r)NDVI is. Ultimately I would have liked to see a field validation of these RS measurements, using a handheld specroradiometer, or some basic measures of biomass or vegetation cover, which would have been a simple and effective way to validate the monitoring approaches and indices presented in this paper.

The authors also mention MSAVI in the literature review but do not use it. Why is that? The standard 0.5 L value used for the SAVI seems unnecessarily simple for this application, especially since L could have been easily modified to a study-specific value based on what is explained in the paper about the soil reflectance of the site (bright) and the general characteristics of vegetation cover (low cover). A MSAVI with site-specific L value would have likely been more sensitive to vegetation change than the SAVI and possible been the best available VI for monitoring.

The paper in its current form is also lacking detailed information on some remote sensing methods that would have helped to tell the story: band wavelengths, camera angle etc. How did you deal with low-level atmospheric effects, water mist and haze? This all needs to be clarified and specified, especially if trying to convince the audience that this may be a viable monitoring approach for their river system.

I'm also not convinced that repeat photography from small Unmanned Aerial Systems (UASs) would not be more appropriate for this type of work, and yet there is no mention of UAS in the background section, only traditional aerial photography. The authors need to better convince the reader that ground-based photography is superior to aerial & UAS for this type of research.

I would like to see a stronger explanation of how monitoring short-term vegetation change can inform science and management of riverine systems, and more general ecological information about the post-flood vegetation dynamics that are being monitored.

There is also a lot of missing literature on the subject of photo-monitoring (repeat photography, pheno-cams etc.). I would suggest reading the following:

Richardson AD, Braswell BH, Hollinger DY, Jenkins JP, Ollinger SV (2009) Near-surface remote sensing of spatial and temporal variation in canopy phenology. Ecological Applications 19(6), 1417–1428. doi:10.1890/08-2022.1.

Mizunuma T, Koyanagi T, Mencuccini M, Nasahara KN, Wingate L, Grace J (2011) The comparison of several colour indices for the photographic recording of canopy phenology of Fagus crenata Blume in eastern Japan. Plant Ecology & Diversity 4(1),

67–77. doi:10.1080/17550874.2011.563759.

Nagai S, Saitoh TM, Kobayashi H, Ishihara M, Suzuki R, Motohka T, Nasahara KN, Muraoka H (2012) In situ examination of the relationship between various vegetation indices and canopy phenology in an evergreen coniferous forest, Japan. International Journal of Remote Sensing 33(19), 6202–6214. doi:10.1080/01431161.2012.682660.

Webb RH, Leake SA, Turner RM (2007) 'The Ribbon of Green: Change in Riparian Vegetation in the Southwestern United States.' (University of Arizona Press)

P2L2: I would delete "a new setup with", is repeat photography really new or novel?

P2L25: Please include citations and examples of these important ecosystem services.

P3L16-23: This is a key point, but it is not clear how the study of near-term vegetation change relates to these key processes. A flood can have immediate negative impacts on vegetation, but recovery can also be quick and the long-term effects may be negligible. More specifically, you need to clarify exactly how monitoring short-term vegetation change can inform science and management of riverine systems.

P4L5: Please discuss the use of unmanned aerial photography, the temporal sampling rate can be user defined, and therefore is an advantage over traditional aerial photography.

Berni J, Zarco-Tejada PJ, Suarez L, Fereres E (2009) Thermal and Narrowband Multispectral Remote Sensing for Vegetation Monitoring From an Unmanned Aerial Vehicle. IEEE Transactions on Geoscience and Remote Sensing 47(3), 722–738. doi:10.1109/TGRS.2008.2010457.

Dunford R, Michel K, Gagnage M, Piégay H, Trémelo M-L (2009) Potential and constraints of Unmanned Aerial Vehicle technology for the characterization of Mediterranean riparian forest. International Journal of Remote Sensing 30(19), 4915–4935. doi:10.1080/01431160903023025.

Also: https://www.mdpi.com/journal/remotesensing/special_issues/uav#info

P4L14: Above you describe strengths and weaknesses of approaches, so you need to also describe some of the weaknesses of repeat ground photography in this paragraph. There are many criticisms of oblique photography.

P4L16: Please include the specific wavelengths.

P4L19: This is incorrect. There are VIs that do not use the NIR, please re-write this sentence. This also makes me wonder why the EVI was not used as one of the test Vis?

P5L4-5: Need citations for this sentence (and entire paragraph). Also, the choice of VI is also often determined by the spectral bands available.

P5L10: Delete the last sentence.

P5L11-15: I still do not feel at this point that the hypothesis/research aim is sufficiently supported by ecological literature. I am no expert on vegetation dynamics of gravel bars, so I would like to see a little more background to explain why short-term dynamics are important for understanding/managing this ecosystem.

P7L1: I am confused a bit about the vegetation you are monitoring here. There is a lot of talk about tree species, but looking at figure 4 it seems that most of the change is happening in the herbaceous strata right in the floodplain. Either way it is difficult to tell based on the scale of the figures so I would suggest at least one close up figure to help with this issue. Also, the results section refers to vegetation changes as “riparian vegetation” and does not specifically reference any of these species or lifeforms mentioned here, this intro section made me think we were talking about big trees, but by the results/discussion I didn’t believe that to be the case. So please be more specific about what type of changes we are seeing after the floods.

P7L6: I would introduce the image collection methods first, followed by the meteorological data section.

P8L11: change to: positioned on a hill 530 m. . .

P8L13: again, spectral band info would be nice. P8L20: I would like to see more info on the details in this paper rather than a reference to a yet unpublished work.

P9L1: It is unclear why you needed to orthorectify the images. Why not just do the change detection on the raw photos? That would have been much easier. Orthorectifying makes sense if you are linking these to other RS images or field data, but otherwise seems like it just increases the chance of introducing error into the data set. Besides eliminating high-haze/humidity, did you consider using any simple normalization/correction procedures for atmospheric haze? I think a simple invariant-target image normalization procedure would have been appropriate to reduce low-level effects of haze and moisture.

P9L21: There is a big literature on digital change detection methods using multispectral imagery. Please put your change detection methods into this context. Lu D, Mausel P, Brondizio E, Moran E (2004) Change detection techniques. International Journal of Remote Sensing 25, 2365–2407.

Kennedy RE, Townsend PA, Gross JE, Cohen WB, Bolstad P, Wang YQ, Adams P (2009) Remote sensing change detection tools for natural resource managers: Understanding concepts and tradeoffs in the design of landscape monitoring projects. Remote Sensing of Environment 113(7), 1382–1396. doi:10.1016/j.rse.2008.07.018.

P15L10: Please expand upon this, specifically by which mechanism floods can enhance vegetation vigor at such a short time scale. It is possible that light availability might increase after a flood clears some overstory, which leads to enhanced photosynthesis and growth, but probably not during this time frame. Possibly access to nutrients? So what is causing the enhancement in your opinion? Explain.

Also in general this discussion section should be brought back to a species-level to discuss differences that may have been detected due to vegetation lifeform/growthform, perennial vs. annual, etc. This would help clarify the dynamics of this mosaic system.

Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 11, 3359, 2014.