Extended Abstract
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Paper/Poster Title	Socio-economic or environmental benefits from pondscapes? Deriving stakeholder preferences using analytic hierarchy process and compositional analysis

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Abstract	***200 words max***
As part of the EU H2020 PONDERFUL project, 16 pondscapes in eight countries, the so-called demo-sites, are studied to understand comprehensively their characteristics and their capability to provide ecosystem services. In addition to the pondscapes themselves, the needs and knowledge of stakeholders who own, work, research, or benefit from the pondscapes are also important, because of their capabilities to create, maintain and develop the pondscapes. Therefore, the project established connection with stakeholders to study their preferences and visions on the pondscapes. Using analytic hierarchy process, this study shows that in general stakeholders in the European and Turkish pondscapes prefer environmental benefits to economic benefits, while stakeholders in the Uruguayan pondscapes rank higher the economic benefits. More specifically, in the European and Turkish pondscapes, the biodiversity benefits, i.e. life-cycle maintenance, habitat and gene pool protection, receive the highest ranking among all groups. On the other hand, stakeholders at the Uruguayan demo-sites rank provisioning benefits as the most important, because many ponds in Uruguay are used for agricultural purposes. Understanding those characteristics helps policy makers to address the needs of stakeholders more correctly, when considering any conservation action for the pondscapes.	

Keywords	Nature-based solutions; Ponds; Socio-economic & environmental benefits; Stakeholders' preferences; Analytic hierarchy process; Compositional analysis.
JEL Code	Q56

Introduction	***100 – 250 words***

Ponds are classified as small water bodies with sizes from 1m2 to about 2-5 hectares, might be permanent or seasonal, synthetically or naturally created. Despite the small size, small water bodies like ponds are dominating the water area worldwide, with the total of around 30-50% of standing water. And despite their abundance and importance, ponds are largely neglected by European policy makers. Therefore, currently there is not any research about pondscapes, especially as nature-based solutions, that integrates stakeholders in evaluating benefits of pondscapes to the local area. To fill in this knowledge gap, this study aims to explore the stakeholders'

perception about the relative importance of socio-economic and environmental benefits of pondscapes used as nature-based solutions. The results of this study can support policy makers in choosing nature-based solutions for the current area of the pondscapes. When a restoration action is in demand and policy makers need to choose among nature-based solutions that differ with respect to their ability to provide ecosystem services (ES), they can draw information from this research to select the action that can bring the most favorable outcomes for stakeholders. In addition, this study can further support future research, e.g. benchmarking the pondscapes in terms of providing ES.

Methodology	***100 – 250 words***

Among Multi-Criteria Decision Analysis (MCDA) methods, Analytical Hierarchy Process (AHP) is the most commonly used method to evaluate the alternatives to mitigate flood risks (de Brito and Evers, 2016), and the second most popular in nature conservation, only after the simplest form of MCDA, the Simple Additive Weighting (SAW). AHP method is a pairwise comparison approach using a pre-defined scale from 1-9 to derive the relative importance of one criterion to another. Pairwise comparison is useful when the decision weights or utility functions are not known in advance, as in SAW or in Multi-attribute Utility Theory.

To statistically analyse the data from AHP, Marre et al. (2016) used t-tests to analyze the difference in each criterion's weight between citizens and political decision makers. Due to the nature of the AHP weights data that sum to one, at least one negative correlation must exist between variables, meaning if one increases, others have to decrease. This is the so-called closure effect, which leads to various problems when applying normal analysis on a Euclidean sample space, such as spurious correlation, Simpson's paradox in splitting and merging data, and difficulties in interpreting results. Therefore, the approach for such data that sums to a constant, so-called compositional data analysis developed by Aitchison (1986), should be implemented.

Results	***100 – 250 words***

Within the demo-sites, the 1-sample Wilcoxon test of the isometric log-ratio yields significant different results for all demo-sites. The difference between economic and environmental benefits of German demo-site stakeholders is large, but due to the low number of stakeholders, the result is only significant at 10% significance level. Only Uruguayan demo-site stakeholders significantly prefer economic benefits to environmental benefits. On the other hand, all other participants in the European and

Turkish demo-sites significantly emphasize environmental benefits more than economic ones.

Both male and female stakeholders emphasize the environmental benefits significantly more than economic benefits, and so do non-doctorate stakeholders. For stakeholders with a doctorate degree, no significant result is observed, but the p-value is close to the threshold 0.1 of preferring environmental benefits to economic benefits.

Conducting a more detailed analysis within each demo-site, the ecosystem services are compared among each other to determine whether the differences between each pair of services are significant. The stakeholders' preferences closely reflect the origin and characteristics of the pondscapes and the stakeholders involved. In the case of the Uruguayan demo-site, nearly all the ponds are used for agricultural purposes and located entirely onto individual farms. Therefore, stakeholders of these ponds include farmers who own the land, thus provisioning benefits are obviously the most important benefits that the pondscapes should provide.

Discussion and Conclusion	***100 – 250 words***

The European and Turkish demo-sites have been dedicated for conservation purposes or connected to various environmental programs, so the environmental services play a more important role in the perception of stakeholders. For example, the Gete Vallei pondscapes in Belgium has been implemented as a NBS since 1970, Bois de Jussy of Switzerland since 1960, Fyn Islands of Denmark since 1980 or the Pinkhill Meadow of United Kingdom since 1990.

Other European researched pondscapes were created or implemented as a NBS even later, and are dedicated mostly to conservation management, especially to promote biodiversity. The pondscapes of this group include Pikhakendonk and Tommelen (Belgium) together with Lystrup (Denmark), which were created to translocate crested newts and provide amphibian-breeding sites. Rhône de Verbois (Switzerland) is partly involved in Ramsar to support amphibian breeding. Albera and La Pletera of Spain aim to mitigate the impact of cattle farms and roads on amphibian and fish diversity, together with Schöneiche (Germany) to create more habitat for aquatic animals. Therefore, it not surprising that the stakeholders of European researched pondscapes value the life-cycle maintenance, habitat and gene pool protection services as the most important position.

The significant differences might serve as conditions/constraints for further analyses, such as benchmarking by data envelopment analysis. For practical purposes, in cases where existing pondscapes need a conservational action, the results can also support

policy makers in choosing the most favorable decision to maximize the perceived benefits from the implementation. For instance, emphasizing the provisioning benefits in Uruguayan demo-site area.