

# Combining social and ecological indicators in the case study of Monfurado



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The Millennium Ecosystem Assessment pointed streams as the most threatened ecosystem in continental Portugal, particularly stressing the problem of water pollution.

The impacts resulting from agriculture intensification might be multiplied or mitigated by **land owner's choices**. Many times, **alternative options** in management of streams and water bodies can be more or less damaging (e.g. leaving riparian vegetation bands bordering streams or not). The factors determining those choices might relate to the **values, place attachment and environmental awareness** of land owners

The intensifying use of rural areas for farming and extensive cattle production systems adds pressure in streams: i) Resulting organic pollution and eutrophication; ii) Diversion of water for irrigation and animals; iii) Manipulation of water bodies structures

Fig. 1 – Main Components in local superficial water mgmt in Agriculture



The objective of this work is to develop an approach to understand better the relation between **land owner's values and attitudes and environmental status of streams**, and explore its contribution to local water management, concentrating in the economic and sociologic components of analysis.

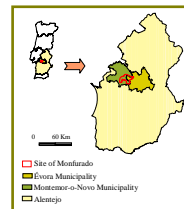


Fig 2 – Localization of Monfurado



The Case Study is one of the richest hydrographic networks in the south of Portugal, the Site of Monfurado.

Besides being 2000 Natura Network, the territory is mainly privately owned, with farming and cattle systems being the dominant activity, illustrating the introduced conflict and tendency.



Fig 3 – Sampling points and hydrographic net in Monfurado

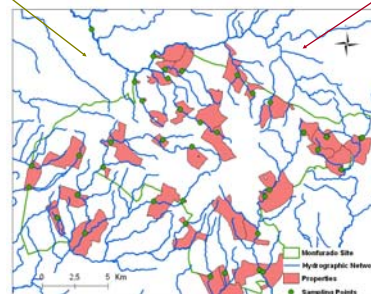


## Monitoring Environmental Status

In the same sampling points, an Integrity Biotic Index, the QBR, was applied, characterizing level of vegetation cover, structure, quality and connectivity and the level of artificialization of the stream, features shown in the pictures below.

Transplants of *Fontinalis antipyretica* were placed for 3 months in the sampling points and after surveyed for Nitrogen levels.

## Identifying Landholders values and attitudes



Values of Streams
Place Attachment and Identity
Level and Type of knowledge about streams
Risk and Environmental Perception
Perception of Control
Institutional and Stakeholder Survey
Stream and water management

A survey was applied to landholders from 34 of a total of 36 properties that include the sampling points. There are in total, 750 properties in Monfurado Site. The survey was performed through an open interview with questions regarding the above variables.

## Values of Streams Survey Results

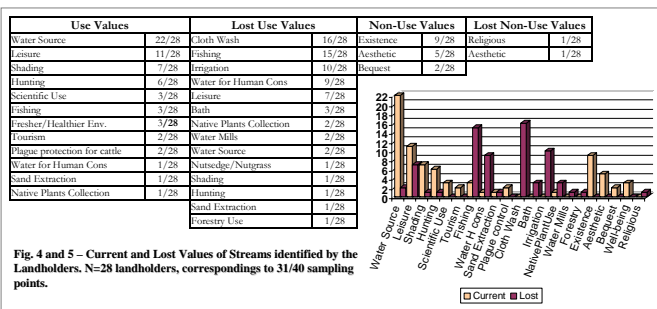


Fig. 4 and 5 – Current and Lost Values of Streams identified by the Landholders. N=28 landholders, correspondings to 31/40 sampling points.

## Preliminary results of Discourse Analysis

Regarding the practices of landholders on the streams, they generally "clean" it, removing sediments in river bed and most shrubs in the margins, and unsatisfied with not being allowed to do it, nor having moose doing it periodically. With respect to awareness, climate change and resulting different surface water availability, was highlighted by landholders (please refer to citations below). High civic worries with neighbour properties and with water pollution were also main worries. Finally, place attachment and perception of farm-life were filled with a mix of happiness and nostalgia; in general place attachment was high (please refer to statements below, to the right), but rural demographic abandonment and the slow death of agricultural sector were permanent factors of worry. Low proactivity for alternatives, self-placement as weak influence socio-political systems and regional resource management, were also present.

**Practices on streams**

"I clean the bushes that dirt the stream"

"We cannot touch it, so we don't destroy it."

Intervention on stream corridors is not allowed by landholders without license given by the regional environment administration. In spite of this, the answers regarding the practices on streams ranged from high debastation of river vegetation to a stated absence of any action on the river, as predicted by law. However the big majority stated the need to manage the stream or showed strong beliefs they should do it, because of: i) Flooding; ii) Erosion ("When de river level gets higher we loose soil, that excess is caused by people that don't care about the streams"); iii) Dirt (meaning from vegetation to garbage) that cannot be left in the stream bank.

**Awareness**

"The floodings are now stronger, not because its raining more: what rains accumulates in the stream and the water doesn't fall the soil, the soil gets dryer. Now you have storms in May, April, at any time, now it rains torrencial, it runs torrencial to the stream immediaty and disappears."

"Before, streams didn't dry so much in the summer, it's raining less."

"everything (all river) is contaminated, and population doesn't have special care about it."

"There's no fish because of pollution."

"it's all spoiled, no one can drink in the field..."

"people come with garbage, specially to put there"

"(...) do not pollute so neighbours don't get it"

**Place Attachment**

"I like to live here; (but) socially, a lot of things, tradition, knowledge and rural culture is disappearing."

"I'm sad to see that abandoned (the stream and spring)"

"It has everything I want"; "I feel comfortable"

"I like it, but there were things here that we miss..."

"I like... I like the work here; (...) is from here that we all eat, this should be more accompanied; (...) positive would be agriculture continuing; (...) I like much more to live in the country than in a city"

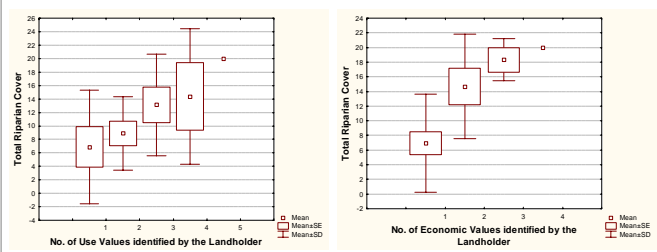


Fig. 6 and 7 – Relation between Total Riparian Cover (the proportion of established vegetation that exists in the margins: shrubs and trees, one of the four components measured through QBR, ranging to 0-25% of the index) and the number of Use Values identified by the Landholder of the corresponding stream (left) and the number of economic values identified by them (right, considered: water for cattle, shading for cattle, irrigation, rural tourism and hunting renting contracts). N=28 landholders, correspondings to 31/40 sampling points. Landholders dealing with streams having higher Riparian Cover levels, recognize in them more utilitarian and economic value and inputs for their activities, which is opposite to the nature of the conflict regarding land use in the Case Study: conservation Vs economic development.

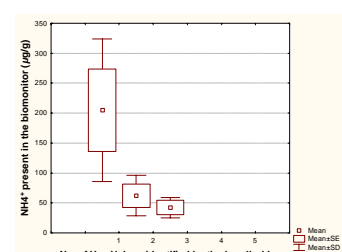


Fig. 8 – Relation between ammonium (µg/g) present in *Fontinalis antipyretica*, the aquatic moss used as biomonitor in the sampling points and the number of Use Values identified by the Landholder of the corresponding stream. N=28 landholders, correspondings to 31/40 sampling points. The higher the level of contamination by ammonium in a stream, the lower are the uses recognized for it.

## Concluding Remarks

- Landholder's utilitarian valuation of streams (use values and, even more accentuated, economic use values) related accordingly to the ecologic valuation of streams (Fig. 6 and 7), which is very interesting as it shows a possible point of conciliation for local water and stream management, evidencing the inputs of analysing Human-Nature relation scale to management plans at local;
- Identifying types of use helped explain and showed related to nutrient status of water quality (Fig. 8);
- Preliminary results of discourse analysis about the general attitudes of Landholders through discourse revealed important to achieve a clearer view of problems and needs, the beliefs and practices regarding streams and the receptiveness of population for adjustments on these issues, potentially improving management planning and management success.

Cenci, R.M. (2000). The use of aquatic moss (*Fontinalis antipyretica*) as monitor of contamination in standing and running waters: limits and advantages. Journal of Limnology, 60 (suppl.1), 53-61

Munné, A; Prat, N; Solà, C; Bonada, N and Rieradevall, M. (2003). A simple field method for assessing the ecological quality of riparian habitat in rivers and streams: QBR index. Aquatic Conservation: marine and freshwater ecosystems, 13: 147-163