

# RIVEAL PROJECT

## RIPARIAN FOREST VALUES AND ECOSYSTEM SERVICES – BRYOPHYTES



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### BRYOPHYTES ARE...

... small non-vascular plants that reproduce via spores and include mosses, liverworts and hornworts. The use of the term "bryophyte" is not very common in public literature, where these plants are often referred to as "mosses". But bryophytes also include liverworts and hornworts species. Bryophytes are distributed into five major taxonomic Classes:

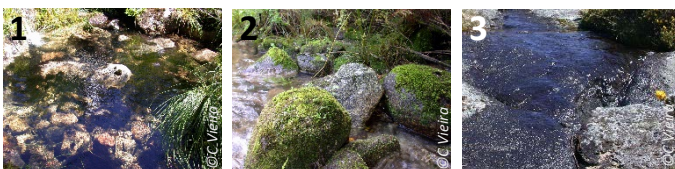
- Jungermannopsida
- Marchantiopsida
- Anthocerotopsida
- Bryopsida
- Polytrichopsida

Bryophytes cannot be classified as truly aquatic plants since they are limited in water depth by the lack of dissolved carbon dioxide. In evolutionary terms, "aquatic" bryophytes are terrestrial species adapted to live inside water and to withstand the erosion of flowing materials.

### CAN BE CLASSIFIED ...

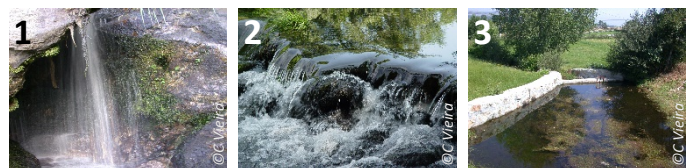
... according to the level of submersion in:

1. hydrophytic (always submerged)
2. hygrophytic (permanently humid micro-habitats)
3. drought tolerant (in riverbeds or margins completely exposed and dry seasonally)



... and according to the capacity of withstanding flow erosion they can be classified in:

1. rheophilous (able to tolerate very strong currents and water impact)
2. limnophilous/lotic (living inside free-flowing water)
3. lentic (living inside still water)



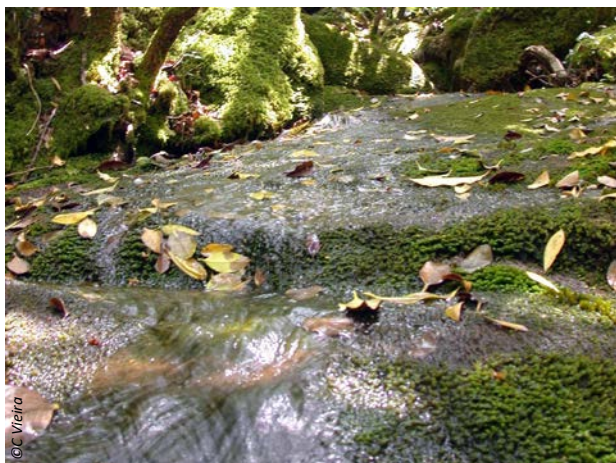
### WHAT ARE THEIR FUNCTIONS?

Bryophytes assemblages are crucial elements of freshwaters. The primary production by aquatic bryophytes can equalize or exceed that by epilithic and periphytic algae. Also, it is clear that bryophytes can profoundly influence both the abundance and community structure of stream invertebrates by structuring and creating microhabitats and by providing, directly or indirectly, food resources.

## BRYOPHYTES AS BIOINDICATORS

Bryophytes have been increasingly recognized as good bioindicators of water quality and the ecological integrity of rivers and, as such, are included in the macrophyte assessment method of determining ecological status of water bodies as required by the Water Framework Directive (WFD).

Although identification to a species level is a serious bottleneck during the surveying and quality assessment processes, broad recognition of bryophyte traits is more easily accomplished in the field. Occurrence or absence of bryophyte growth forms and taxonomic or functional groups were indicated as useful indicators to interpret hydrologic permanence, especially in non-polluted mountain locations with stable substrates.



*Bryophytes in mesotrophic waters.*

Bryophytes represent a special locus in Mediterranean-type river assessment, since vascular plant species are absent during hot, dry periods, while bryophytes remain as sessile perennial or long-living plants inhabiting the riverbed and waterside margins.

## BRYOPHYTE LIFE FORMS AND STRATEGIES

To colonize such demanding conditions, bryophytes show adaptations in their morphology, physiology and reproduction strategies, a result of convergent evolution from different terrestrial ancestors to the physical determinants of aquatic plant distribution.

Bryophyte functional classifications reflect these convergence, such as "life forms" and "life strategies" classifications.

## BRYOPHYTES IN RIVEAL

RIVEAL Project devotes to two case studies, i.e. two rivers impaired by dams with different operation rules: a run-of-river dam (Touvedo) and a reservoir dam (Fronhas). We have surveyed River Lima downstream Touvedo, River Vez and River Vade as referentials, and River Alva downstream of Fronhas dam and upstream as referentials. We found 20 bryophytes (mosses and liverworts) in the study area.



*Bryophyte sampling in low depth river stretches.*

Bryophyte communities found at RIVEAL project were composed mainly by species of:

- hydrophilous bryophytes (e.g. *Leptodictyum riparium*, *Platyhypnidium riparioides*, *Platyhypnidium lusitanicum*, *Fontinalis* spp.)
- hygrophylous bryophytes (e.g. *Brachythecium rivulare*, *Fissidens crispus*, *Kindbergia praelonga*)
- rheophilic bryophytes (*Thamnobryum alopecurum*)
- terrestrial bryophytes found at the riverbanks (e.g. *Scleropodium touretii*, *Trichostomum brachydontium*)

These bryophyte species form short and tall turfs (e.g. *Bryum* spp.), smooth mats (e.g. *Platyhypnidium* spp.) or are dendroids, i.e. bryophytes with stiff and eroded shoots (e.g. *Thamnobryum alopecurum*) or streamers, i.e. bryophytes with long and hydrodynamic shoots (e.g. *Fontinalis* spp.). They are mainly colonists of the river substrates or perennials.



*Example of the dendroid Thamnobryum alopecurum (left) and the streamer Fontinalis antipyretica (right).*

