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Criteria for reference site selection

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Introduction

An ideal reference stream should fulfill all requirements necessary to allow a completely undisturbed fauna and flora to develop and establish itself. Therefore, "reference sites" should not only be characterised by clean water but also by undisturbed stream morphology and near-natural catchment characteristics. Though it is impossible to find sites in such a pristine condition for many stream types, certain criteria should be met by "realistic" reference sites wherever possible.

In the following section primary criteria, i.e. those that should always be met by reference sites are underlined. The other criteria are seen as highly desirable but not essential if no other "perfect" reference sites can be found.

Basic statements

- The reference condition must be politically palatable and reasonable.
- A reference site, or process for determining it, must hold or consider important aspects of "natural" conditions.
- The reference conditions must reflect only minimal anthropogenic disturbance.

Land use practices in the catchment area

- In most countries there is anthropogenic influence within the catchment area. Therefore, the degree of urbanisation, agriculture and silviculture should be as low as possible for a site to serve as a reference site. No absolute minimum or maximum values have been set for the defining reference conditions (e.g. % arable land use, % native forest); instead the least-influenced sites with the most natural vegetation are to be chosen.

River channel and habitats

- The reference site floodplain should not be cultivated. If possible, it should be covered with natural climax vegetation and/or unmanaged forest.
- Coarse woody debris should not be removed (minimum demand: presence of coarse woody debris).
- Stream bottoms and stream margins must not be fixed.
- Spawning habitats for the natural fish population (e.g. gravel bars, floodplain ponds connected to the stream) should be present.
- Preferably, there should be no migration barriers (effecting the bed load transport and/or the biota of the sampling site).
- In streams types, in which naturally anadromous fish species would occur, the accessibility of the reference site from downstream is an important aspect for the site selection.
- Only moderate influence due to flood protection measures can be accepted.

Riparian vegetation and floodplain

Natural riparian vegetation and floodplain conditions must still exist making lateral connectivity between the stream and its floodplain possible; depending on the stream type, the riparian buffer zone should be greater or equal to 3 x channel width.

Hydrologic conditions and regulation

- No alterations of the natural hydrograph and discharge regime should occur.
- There should be no or only minor upstream impoundments, reservoirs, weirs and reservoirs retaining sediment; no effect on the biota of the sampling site should be recognisable.
- There should be no effective hydrological alterations such as water diversion, abstraction or pulse releases.

Physical and chemical conditions

There should be:

- no point sources of pollution or nutrient input affecting the site
- no point sources of eutrophication affecting the site
- no sign of diffuse inputs or factors which suggest that diffuse inputs are to be expected
- "normal" background levels of nutrient and chemical base load, which reflect a specific catchment area
- no sign of acidification
- no liming activities
- no impairments due to physical conditions; especially thermal conditions must be close to natural
- no local impairments due to chemical conditions; especially no known point-sources of significant pollution, all the while considering near-natural pollution capacity of the water body
- no sign of salinity

Biological conditions

There should not be any

- significant impairment of the indigenous biota by introduction of fish, crustaceans, mussels or any other kind of plants and animals
- significant impairment of the indigenous biota by fish farming
- intensive management, e.g. of the fish population

In many cases, e.g. some lowland stream types or larger streams, no reference sites meeting all of the criteria above are available. For these stream types the "best available" existing sites, which meet most of the criteria should only be a starting point; the description of reference communities should be supplemented by evaluation of historical data and possibly the biotic composition of comparable stream types, e.g. streams of a similar size but located in different ecoregions.