❖Standard 10: Screen all target/biodiversity element occurrences for viability or ecological integrity.

Summary: **Assessing the Quality and Threats to Aquatic Targets**

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Purpose and region of analysis

The leading national threats to aquatic biota include hydrologic alteration, non-point source pollution, exotic species and resource extraction (including fishing), although there are several less widespread threats that are still significant (Richter in Recommended Reading). This example provides a brief summary of approaches to assess the viability/integrity of aquatic targets.

Criteria/Methods

Size: Abundance and distribution information on aquatic species can be used to directly attribute size. This information is not common for many targets across ecoregions. Caution should be taken when using sample point data to infer the number of populations. Often, sample points represent multiple samples of the same large population within a river system. Consultations with experts should be conducted to better understand the spatial data. Size of aquatic ecosystems is not very relevant for the ecosystem viability. Ecosystems are generally a given size. However, the length of specific stream reaches that are in good shape, or are contiguous without barriers such as dam or poor quality habitat, can be considered a measure of size which is important for wide-ranging species.

Condition: Information on species population age structure, while rarely available, is a direct indicator of condition. The proportion of historic/current species composition is a good indication of the condition of aquatic assemblages. This information is available for the conterminous United States for fishes, attributed by 8-digit HUCs through NatureServe (add web link to freshwater data). Additionally, information at the same spatial scale is available from the USGS on the freshwater exotic species (link). Ecosystem condition can be attributed using several sources of information. Direct measures are provided through the Index of Biotic Integrity (see Karr and Dudley, 1981), an index using the biotic composition of freshwater ecosystems comparing them to reference conditions. Water quality, while focused on human use, can be used, with caution, to indicate the condition of freshwater ecosystems. Caution is necessary because clear water is cherished by humans, but turbid water is often a natural condition. Dams have transformed many naturally turbid and warm water systems into cool, clear systems. Dams, levees and poorly designed and maintained road culverts are obstructions to biotic movement and alter many environmental processes. In addition, dams alter natural flows, sediment and temperature regimes, resulting in a suite of dominant impacts to the

condition of freshwater ecosystems. Gage station data can be used as a direct indicator of the extent of hydrologic alteration (Richter et al. 2003). In the absence of gage station data relative degrees of impact can be assessed through the number, height and reservoir storage capacity of dams. Dam, levee and road crossing numbers and spatial arrangements should be used when available, to evaluate the degree of fragmentation of aquatic ecosystems. Point and non-point sources of pollution, when available, are good indicators of quality. If these are not available, there are some landscape context indicators below can be used as surrogates.

Landscape context of buffers and catchments is important for species and ecosystems. Landscape patterns of connectivity of lakes, streams and wetlands are important, as well as the patterns of land use/cover. Agriculture and urban areas have great impacts on water quality and quantity. Although not as precise, the size and density of land use/cover categories which provide impacts can be quantified for catchments and buffers, as spatial scales influence the degree of impact of landscape characteristics (Lammert and Allan 1999). Landscape context of ecosystems can be directly applied to species and community targets within them. The attributes used to evaluate ecosystem catchment and buffer context generally directly affect species and communities. If precise location information on species ranges and distributions is available, then buffer and catchment locations can be made specific for those targets, as opposed to using the averages of entire ecosystem catchments (see Target Unit tools for developing catchments and buffers).

- *Example 1. Quality analysis at the watershed scale*
  In the Middle Rocky Mountain / Blue Mountain ecoregion, six equally weighted factors were evaluated for 12-digit HUCs in a GIS to create an overall index of poorest quality to highest quality. This index is being used to select high quality examples of each aquatic target. In this ecoregion, extensive spatial data sets were available across a large portion of the ecoregion, including dams, exotic species distributions, pollution point sources, degraded waterbodies (303d listed), and critical salmonid areas. Expert opinion will be used to verify the quality of and threats to selected watersheds.

Tools

Freshwater Initiative's web site at http://www.freshwaters.org

References and Suggested Reading

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