AGRICULTURE AND FISHERIES IMPACTS

HIGH CONSERVATION VALUE 4, QUESTION 16

Are there forest landscapes (or regional landscapes) that have a critical impact on agriculture or fisheries?

BACKGROUND

The HCVF Framework for Canada recognizes that forests mediate wind and microclimate at the scale of ecoregions, affecting agricultural or fisheries production. The Framework further states: "Riparian forests play a critical role in maintaining fisheries by providing bank stability, sediment control, nutrient inputs, and microhabitats."

At the watershed scale, major environmental factors determining invertebrate and fish species distributions include watershed size, stream gradients, lake depths, conductivity, and percentage of the watershed covered by forest. Within specific stream reaches and lakes the distribution of fish is influenced by temperature, oxygen, current and availability of food. Activities such as clearings and road networks created for timber harvesting and other resource extraction can directly and indirectly affect one or more of these factors and change flow rates and patterns, sediment yield, stream habitat, invertebrates, and fisheries (Furniss *et al.* 1991, McGurk and Fong 1995, Trombulack and Frissell 2000, Foster *et al.* 2005). Water quality changes, including changes to thermal regimes, water chemistry, and invertebrate communities, may occur regardless if forest buffers are intact (Herunter *et al.* 2004) therefore it is important to assess forest areas for high conservation values related to drinking water quality (Question 12) and fisheries (Question 16) regardless of regulations requiring buffer areas.

The HCVF Framework for Canada further states that "more local effects of forest areas (e.g., adjacency of forests to agriculture and fisheries production) may be more relevant in the HCV component regarding meeting basic needs of local communities." Indeed, in some regions baitfish businesses and recreational and guided sport fisheries may be important elements of local economies. For example, many of the more than 60 species of fish recorded in northern Ontario sustain commercial baitfish, subsistence, and fly-in recreational fisheries in the region. This aspect of the HCVF assessment is more closely aligned with Question 17 (needs of local communities).

In this section we address how and why to identify fish populations and fish habitat within FMAs under HCVF assessment.

DATA SOURCES

The HCVF Framework for Canada lists the following possible data sources:

- Agricultural and Fisheries scientists in university and research institutions;
- Governmental Departments (e.g., Department of Fisheries and Oceans, Agriculture and Agri-food Canada);
- Local and provincial departments.

Additional data sources might include:

- Ontario: MNR NRVIS database
- Alberta: Cooperative Fisheries Inventory Program (CFIP); Fisheries Management Information System (FMIS)
- Local and District land use plans
- Local terrain mapping and base maps showing topography
- Regional watershed plans and authorities (*e.g.*, Mattagami Region Conservation Authority)
- Provincial watershed maps**,** including Provincially Significant Wetlands (Ontario)
- Ducks Unlimited Canada – hydrological and wetlands data

INTERPRETING GLOBAL, NATIONAL AND REGIONAL SIGNIFICANCE

Most fisheries and agricultural activities within boreal forest areas in Canada are likely to be either regionally or locally significant. The significance to communities and regions of sport, subsistence and commercial fisheries is best assessed through direct communication with local experts and community leaders.

INTERPRETING THE PRECAUTIONARY PRINCIPLE

Cumulative effects

Changes in the health of boreal fish populations are driven by three often-interacting factors: habitat loss, habitat alteration, and excessive fish harvest. Multiple industrial, residential and recreational land uses, changing climate, and natural disturbances may alter water quantity and quality and impact fisheries. In addition, competition with introduced and invasive species and fishing pressure (including poaching) contribute to declines in fisheries in the boreal region. For example, as the number of land uses has increased in Alberta, managers have measured significant changes in abundance and distribution of bull trout, grayling and other boreal fish species (Stelfox 2004).

Forest roads and trails may provide access to previously remote fish populations, increasing angler pressure and negatively impacting habitats and population numbers. Popowich and Volpe (2004) estimate poaching levels approached 17% in the Elbow River watershed in Alberta during September and October 2003. In all confirmed cases, fish were taken from areas easily accessed by foot or by off-highway vehicles.

We recommend that fish population sensitivity, habitat sensitivity and potential cumulative effects be factored into an assessment of conservation value of fisheries. In cases where cumulative effects are poorly understood we further recommend that all sensitive habitats and populations be designated as HCV.

ADDITIONAL GUIDANCE

Identify existing fisheries and naturally occurring fish habitat

Existing fisheries are best identified by communicating with local and regional experts and leaders. We also recommend that all seasonal fish habitat (*e.g.*, spawning habitats, rearing habitats, winter habitats, etc.) be identified, mapped and considered for HCVF designation. If mapped information is not available, fish habitat can be identified through habitat suitability modeling based on requirements for specific habitat parameters (*e.g.*, depth, sediment type, current, etc) for regionally occurring fish species. Developing suitability indices for both juveniles and adults allows model indices to reflect changes in habitat use with age. By combining the spatial distribution of preferred habitat in a GIS, a predictive map of the location of important fish habitat can be produced.

Assess and monitor riparian condition

Riparian health is determined by the ability of a riparian site to perform specific ecological functions including:

- Trapping and storing sediment
- Building and maintaining banks and shores
- Storing water and energy
- Recharging aquifers
- Filtering and buffering water
- Source of large woody debris
- Maintaining biodiversity

Ambrose *et al.* (2004) have developed a riparian health assessment based on vegetative and physical characteristics of a riparian site that examines which of these ecological features are intact. Parameters included in their assessments include vegetative cover, bare soil, clearing and regeneration of tree and shrub communities, structural alterations to the bank or shore, site potential, and change in hydrologic regime or plant community that may impact the ability of the area to perform these ecological functions. Sites are rated based on vegetative and physical thresholds met or exceeded.

We recommend conducting similar riparian assessments for FMAs under HCVF assessment. Such evaluations not only help identify issues but also establish baselines for monitoring riparian health and the effects of management.

Thresholds

We recommend the following thresholds –- all recommended for either Questions 12, 13 or 14 in this document – also be applied for protecting fisheries:

Forest disturbance and water quantity

A generally proportional relationship exists between total water yield (runoff) and the extent of forest disturbance (Sahin and Hall 1996). A measurable response in water flow as a result of forest disturbance was found to be at forest cover changes at or above a 20-25% (Bosch and Hewlett 1982; Hornbeck *et al.* 1993). To ensure natural water flow patterns, we suggest a threshold of 20% disturbance be set for forest practices in all watersheds, and a precautionary threshold of 0-10% be set for HCVFs identified under this criteria. We further recommend that direct measurements of hydrology (water level, trends, timing and in-stream flow) be used as indicators of water quantity.

Water quality

We suggest that a set of water quality indicators be chosen and monitored for HCVFs identified under this category. These indicators may include turbidity, concentration of dissolved organic carbon or nutrients. Suter *et al.* (1995) proposed a threshold of 20% reduction in measured physical or chemical parameters as a significance standard for ecological risk assessment. We propose this 20% threshold be applied to HCVFs under Question 16.

Stream crossings (water quality and quantity)

Watersheds with many crossings are more likely to have increased erosion, water temperature, angling pressure and temporary or permanent barriers to fish movement. Therefore stream crossing density – the number of times that roads, trails, pipelines and railroads cross streams – is another potential watershed indicator. Salmo (2004) recommends a critical threshold of $<0.5/km^2$ calculated for subwatershed, and target threshold of $<0.32/km^2$ per subwatershed for the Deh Cho Land Use Planning Area. We suggest a similar threshold is appropriate for HCVFs under Questions 13, 14 and 16 throughout the Canadian boreal region.

Cumulative effects

It should again be emphasized that thresholds should not be assessed against forestry practices alone, but should be measured against the total sum of all anthropogenic stresses. This cumulative impact is more indicative of the state of the system than a series of individual indicators.

Related questions

Question 12 – Drinking water supplies
Question 13 – Flood and/or drought mediation
Question 14 – Erosion control
Question 17 – Needs of local communities

SUMMARY OF RECOMMENDATIONS

- Account for cumulative effects in assessments of conservation value of fisheries.

- In cases where cumulative effects are poorly understood designate all sensitive habitats and populations as HCV.
- Identify fish habitat through habitat suitability modeling based
- Asses the condition of riparian areas relative to thresholds for water quality and quantity.

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