Standardized Classification of Threats to Biodiversity

Definitions for Quebec's Conservation Data Centre (CDC) v1.0

June 2021

MINISTÈRE DES FORÊTS, DE LA FAUNE ET DES PARCS

Votre gouvernement

Québec

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Introduction

The Centre de données sur le patrimoine naturel du Québec (CDPNQ), which is part of the NatureServe network as Quebec's Conservation Data Centre (CDC), is an organization that gathers, processes and distributes information on threatened or vulnerable species (EMV) in Quebec. This unifying body is coordinated by three entities: the Quebec Department of Forests, Wildlife and Parks (MFFP), the Quebec Department of Environment and the Fight Against Climate Change (MELCC) and the Canadian Wildlife Service, Quebec Region (CWS-QC), of Environment and Climate Change Canada (ECCC).

In 2017, initiatives launched by the MFFP towards developing an Integrated Approach to Recovery (AIR) highlighted the need to adopt a common classification scheme that would be used by various wildlife management organizations to harmonize the available information on plant and animal species. A standardized classification system that is shared by the institutions leading the CDPNQ would facilitate interactions between individuals, databases and organizations.

Prior to 2017, the biodiversity threat classification scheme that had been used by the CDPNQ was the one produced by the Conservation Measures Partnership (CMP) (Salafsky *et al*. 2008). This scheme was later refined jointly by the CMP and the International Union for Conservation of Nature (IUCN). These schemes use two levels of threats, with level 1 consisting of 12 broad threat categories, while level 2 defines of these categories further. In recent years, the CMP published their version 2.0 in 2016 (CMP 2016) and the IUCN released their version 3.2 in December 2019 (IUCN 2019) with a level 3 allowing a few level 2 threats to be detailed further.

This document is based on a translation of level 1 and 2 threats (Salafsky *et al*. 2008), which was produced by the CWS for the CDPNQ (Josée Tardif, unpublished data). Its purpose is to achieve the following objectives within the same standard classification:

1. Define generic threats (level 2) into precise threats (level 3).

2. Incorporate the most relevant elements (terminological and structural) that have yet to be incorporated by CDPNQ from the two recent classification schemes (CMP 2016; IUCN 2019).

3. Support the potential matching of conservation actions with the threats they address by using precise wording and concrete examples.

Following an approach similar to that used for Salafsky *et al*. (2008) in merging elements from earlier classifications, this document incorporates entries from both the CMP and IUCN into the CDPNQ classification scheme, which will harmonize exchanges of data between numerous organizations at the provincial and national levels. An equivalence table will be provided to ensure a coherent frame of reference for organizations that are referring to either one of the mother classifications.

Concept and use of the classification

This section summarizes several concepts that were proposed by Salafsky *et al.* (2008) and the CMP, which are essential to the interpretation of the threats that are proposed in this document. Nevertheless, some concepts such as the influence zone (IZ) are innovations that were developed by the MFFP to facilitate the evaluation of their scope of action (MFFP, in preparation).

Definition of a direct threat to biodiversity

This classification refers to the same definition of the direct threat than it's two mother classifications (IUCN v3.2 and CMP v2.0): the proximate human activities or processes that cause the destruction, degradation or impairment of biodiversity targets (Salafsky *et al*. 2008).

Certain natural phenomena may also be considered as direct threats when context-related indirect threats impeach species or habitats to respond to a disturbance in a manner that allows their persistence. For example, in urban areas, vegetal succession can be considered a direct threat to species of early-successional habitats when the urbanized context (indirect threat) impeaches their dispersion to suitable habitats.

Fundamental principles of the classification

The creation of the third level of the threat classification is based on seven principles that were proposed by Salafsky *et al.* (2008), and which are promoted by the CMP (2016) to produce classifications that are meaningful, consistent and logical. The classification must therefore respect the following principles (CMP 2016):

1. Simple: Uses clear language and examples / understandable by practitioners (avoids the use of technical terms).
2. Hierarchical: Creates a logical way of grouping items that are related to one another to facilitate use of the classification and meaningful analyses at different levels.
3. Comprehensive: Contains all possible items, at least at higher levels of the hierarchy.
4. Consistent: Ensures that entries at a given level of the classification are of the same type.
5. Expandable: Enables new items to be added to the classification if they are discovered
6. Exclusive: Allows any given item to only be placed in one cell within the hierarchy
7. Scalable: Permits the same terms to be used at all geographic scales

A practical hierarchy

The initial level 2 classification that was developed by Salafsky *et al*. (2008) is structured in a hierarchical manner to allow for the integration of detailed threats within categories that group them according to the similarity of their impacts. The goal of this document is therefore to integrate precise level 3 threats according to their common properties and differences. Just as a cladogram would, the arborescence of the classification groups shared characteristics of a group of threats within the description of the higher-level threat.

In order to understand the inclusions and exclusions that are related to a level 3 threat, it is of the utmost importance to **refer to the description of the higher levels**.

The stress and the influence zone (IZ)

One of the main objectives of this classification is to create hierarchical groups of threats that are based upon the similarity of their impacts on wild fauna and flora. These impacts on biodiversity, or stresses, document the method by which a threat acts upon the ecosystems or on the species, which have been described as such by the IUCN (2012):

1. **Ecosystem/community stresses**
   - 1.1. Ecosystem conversion
   - 1.2. Ecosystem degradation
   - 1.3. Indirect ecosystem effect
2. **Species stresses**
   - 2.1. Species mortality
   - 2.2. Species disturbance
   - 2.3. Indirect species effect
     - 2.3.1. Hybridization
     - 2.3.2. Competition
     - 2.3.3. Loss of mutualism
     - 2.3.4. Loss of pollinator
     - 2.3.5. Inbreeding
     - 2.3.6. Skewed sex ratios
     - 2.3.7. Reduced reproductive success
     - 2.3.8. Other

On the other hand, certain threats act simultaneously at several different spatial scales and must be targeted by entirely different conservation actions. These different spatial scales at which threats can act simultaneously are referred to as influence zones (IZ). These influence zones, therefore, justify the separation of a single threat into different phenomena despite of their direct correlation (*e.g.*, annual agriculture converts habitat at the local scale, but the related nutrient load degrades watercourses at the watershed scale). Consequently, directly correlated threats that act on different spatial scales are treated as distinct threats in order to facilitate the assessment of their impacts on biodiversity.

Classification

This section presents a standardized classification of phenomena that are considered as threats to biodiversity. While it was developed by partners who are located across North America, the scope of this classification goes beyond this continent and might prove useful in other parts of the world. Threats are hereby organized according to their hierarchical ranks, starting from generic wording (level 1), which is progressively articulated into precise descriptions (level 3). When necessary, the classification entries are accompanied by a description, specifications allowing the description of inclusions and exclusions and may also be accompanied with examples.

1 Residential & commercial development

This threat refers to all human settlements (cities, towns, etc.) or non-agricultural land uses with a substantial ecological footprint. It includes habitat conversion that is associated with early phases of development (deforestation, filling/excavation, drainage, etc.), as well as infrastructure use, maintenance and subsequent impacts that are related to the presence of infrastructure (e.g., birds flying into windows). Excludes transportation- (threat 4) and pollution-related issues (threat 9).

1.1 Housing & urban areas

Anything that is related to or integrated with urban or housing structures. Urban areas (cities), suburbs, villages, cottages, shopping areas, offices, schools, hospitals, and urban parks, among others.

1.1.1. *Dense housing & urban areas*

Medium- to high-density urban development for residential use and buildings for related services. Allows very little to no maintenance of ecological functions.
E.g., urban areas, suburbs, villages, schools, libraries, seniors' housing, hospitals.

1.1.2. *Low-density housing areas*

Extensive development that is residential (including resorts), where the spacing allows ecological functions to continue to some extent. This type of development is seen particularly in rural and agroforestry areas.
E.g., residential buildings in agricultural areas, cottages, vacation homes near water bodies, ecotourism lodges, fishing resorts, backcountry ski lodges.

1.2 Commercial & industrial areas

Anything that is related to or integrated with commercial or industrial structures, as well as designated areas for storing waste material. Includes animal deterrence activities, which are needed near certain infrastructures.

1.2.1 *Commercial & industrial areas*

E.g., industrial parks, manufacturing plants, offices, shopping centres, all military base facilities, power plants, seaports, shipyards, airports.

1.2.2 *Open dump sites*

Open-air facilities that are used to dispose of materials or to store them prior to recycling.
E.g., automobile junkyards, metal recycling centres.

1.2.3 *Landfills*

1.2.4 *Nuclear waste disposal facilities*

1.3 Tourism & recreation areas

Tourist sites or recreational facilities with a significant ecological footprint. Excludes residential infrastructures (threat 1.1).

1.3.1 *Parks and sports fields*

Areas that are intensively managed (*e.g.*, grass-cutting, thinning of woodlands) and are primarily designed for recreation activities, such as walking in urban parks and sports. Also includes outdoor sites that are managed for prayer or mourning (cemeteries).

E.g., large spaces that are mown/maintained for walking, picnics, children's activities, mourning (cemeteries), golf courses, driving ranges, shooting ranges, mini-golf, soccer, American football, baseball fields, basketball and tennis courts.

1.3.2 *Campgrounds*

Sites that are maintained for camping activities, for which the facilities may have some ecological impact. To be distinguished from wilderness camping without amenities (threat 6.1.5).

E.g., car or RV camping areas, with or without services, camping with site management and/or facilities.

1.3.3 *Ski resorts*

Rights-of-way of ski trails (managed areas of the hills) and service facilities (ski lifts, visitor centres, etc.).

1.3.4 *Recreational trails*

Creation of trails in parks (see Parks and sports fields, threat 1.3.1) or areas outside the urban environment for walking and recreation. Includes the creation and maintenance of trails in recreational parks as well as private properties. Excludes activities that are related to the use of the trail *(e.g.*, hiking, threat 6.1.2).

1.3.5 *Docks & marinas*

High-impact infrastructures that are associated with recreational boating. To be distinguished from the activity of recreational boating itself (threat 6.1.4) and includes local dredging.

E.g., docks, marinas, boat launches.

2 Agriculture & aquaculture

Threats from agricultural activities, such as the expansion and intensification of agriculture and livestock farming, including silviculture, mariculture and aquaculture and related infrastructures. This includes the initial conversion of habitat (deforestation, filling/excavation, draining of wetlands, etc.) that is associated with cultivation or infrastructure development, as well as uses and practices (intensification of agricultural practices, use of machinery, etc.), but not the transport of the resources that are produced (threat 4), crop irrigation (threat 7.2.4) or pollution (threat 9.3).

2.1 Annual & perennial non-timber crops

Non-timber crops that are planted for food, fodder, fuel or other uses; farms, crop fields, vineyards, mixed agroforestry systems, etc. Crops are classified according to the methodology used to describe land use in the St. Lawrence Lowlands (ECCC and MELCC 2018). For rotational crops, it is necessary to refer to the most intensive practice that is used. Considering the diversity of agricultural practices and related impacts, some speciality cultures will be pooled into a generic threat category (2.1.3).

2.1.1 *Annual cropping systems (field crops)*

Wide-row crops that require the most intensive agricultural practices and which have the most significant impacts.

E.g., maize (corn), soybean, barley, vegetable crops, oats, wheat, canola, hemp.

2.1.2 *Perennial cropping systems*

Crops that are associated with less intensive agricultural practices that have less of an ecological impact than do annual crops.

E.g., pastures, forage crops, hay, alfalfa, clover.

2.1.3 *Other types of agriculture*

Specialty crops for which the ecological impacts may vary depending on the practices that are used.

E.g., cranberry bogs, vineyards, berry fields, sod production, greenhouse farming.

2.2 Plantations

Wood plantations that produce timber, fibre or other non-timber products that are made from trees and which maintain a certain amount of forest cover year-round. This type of plantation is generally located outside of natural forests and often consists of non-native tree species.

2.2.1 *Plantation of pulpwood*

Cultivation of hybrid poplars and other species that are used for pulp production.

2.2.2 *Ornamental tree plantations*

E.g., cultivation of ornamental cedars, Christmas tree farms.

2.2.3 *Non-timber products from plantations*

Cultivation of trees outside of natural forests for the production of fruits, nuts, bark or sap.

E.g., orchards, walnut production, rubber production.

2.3 Livestock and poultry farming

Farming of various domestic (cows, pigs, chickens, sheep, goats, turkeys, ducks, etc.) or semi-domesticated animals (llamas, alpacas, etc.); livestock rearing in outdoor pens (farms) or extensive rearing in natural habitat (pastures, ranching). Productivity is measured in terms of animal units.

2.3.1 *Outdoor extensive livestock operation (on pasture)*

2.3.2 *Outdoor intensive livestock operation (high-density)*

2.3.3 *Indoor livestock operation*

2.4 Marine & freshwater aquaculture

Aquaculture that is conducted in different types of facilities (finfish aquaculture in the ocean, in tanks, in pens, along the shoreline, etc.). Farming fish for the purpose of stocking natural lakes falls under this category. It also includes the construction, maintenance and use of facilities, but not the transport of resources (threat 4) and contaminants (threat 9).

2.4.1 *Marine finfish aquaculture*

2.4.2 *Finfish aquaculture in outdoor tanks*

2.4.3 *Finfish aquaculture in indoor tanks*

2.4.4 *Algae cultivation*

2.4.5 *Marine shellfish cultivation*

E.g., oyster farming and cultivation of other shellfish (scallops, mussels, softshell clams, etc.).

3 Energy production & mining

Threats from the production/development of non-biological resources, including the conversion of the original habitat, development of necessary infrastructure, as well as uses and practices (use of machinery, exploration, excavation, drilling and storage of ore or drill cuttings, tailings ponds, settling ponds, site reclamation after development, etc.). Excludes the transport of resources (threat 4) and contaminants (threat 9). Also includes the impacts of wildlife collisions with the related infrastructures.

3.1 Oil & gas drilling

Exploring for (prospecting), developing and producing petroleum or other hydrocarbons.

3.1.1 Onshore oil development

3.1.2 Offshore oil development

3.1.3 Oil development in freshwater

3.1.4 Onshore natural gas development

3.1.5 Offshore natural gas development

3.1.6 Natural gas development in freshwater

3.2 Mining & quarrying

Exploring for, developing and producing minerals, rocks and various other substrates (sand, gravel, etc.). Includes tailings treatment (settling and tailings ponds), site expansion and site reclamation after development. This threat does not include the transportation of resources (threat 4) and acid mine drainage (threat 9.2.2). Although not a mineral resource, peat harvesting induces impacts on the ecosystems that are similar to quarries and sandpits due to the use of similar excavation machinery.

E.g., coal mines, mining of various sources of metals (gold, copper, nickel, magnesium, etc.), quarries, sand pits.

3.2.1 Underground mines

3.2.2 Open-pit mines

3.2.3 Quarries & sand pits

3.2.4 Peat harvesting

3.3 Renewable energy

Exploring and developing infrastructure for and producing renewable energy; excludes its transport (threat 4).

3.3.1 Hydroelectric dams

3.3.2 Wind farms

3.3.3 Hydrokinetic turbines

3.3.4 Solar farms

4 Transportation & service corridors

Threats from developing, using and maintaining transportation corridors (roads, pipelines, power lines, etc.) and their rights-of-way. These types of facilities may create obstacles or hinder the natural movement of species in addition to causing disturbances during maintenance (*e.g.*, disturbance of falcon nests during bridge maintenance; widespread avoidance of roads by caribou, etc.). This threat also includes vegetation control during rights-of-way maintenance and collisions with wildlife.

4.1 Roads & railroads

Development, maintenance and presence of the surface transportation network. The impact of rights-of-way may vary according to their size.

4.1.1 Roads

4.1.2 Railroads

4.1.3 Bridges

Includes road and rail network bridges.

4.1.4 Logging roads

4.2 Utility & service lines

Linear networks for transporting energy and various resources, including their rights-of-way. Possible impacts: electrocution, barrier to dispersal, habitat modification/loss, fatal collisions.

4.2.1 Power and service lines

Networks of buildings, towers, pylons and poles that are associated with electricity distribution and telecommunications, excluding hydroelectric dams or power plants (threat 3.3.1). The scope of rights-of-way may vary according to their size.

4.2.2 Oil & gas pipelines

Infrastructure network for transporting oil and natural gas products aboveground or underground, including seismic lines, but excluding extraction sites (threat 3.1).

4.3 Shipping lanes

Threats associated with transporting people and goods on water (oceans, estuaries, rivers, etc.), as well as waterway development. This category does not include activities that are related to recreational boating (threat 6.1.4).

4.3.1 Shipping

Ships striking wildlife, damage associated with wake waves, disturbance caused by the presence of vessels transporting people and goods.

4.3.2 Dredging of shipping lanes

Dredging in order to facilitate the transit of boats. Excludes dredging within marinas and docks (threat 1.3.5) and dredging for locks and canals (threat 4.3.3).

4.3.3 Locks & canals

Creation, maintenance, and use of locks and canals. Includes the associated dredging.

4.4 Flight paths

Using air space to transport people and goods, excluding recreational activities such as hang-gliding (threat 6.1.3) and drones (threat 6.1.6).

4.4.1 *Flight paths*

Flying airplanes, paragliders, helicopters or ultralight aircraft at low altitudes, which could lead to collisions with birds or disturbance of other wildlife.

E.g., disturbance of caribou herds by low-altitude training flights.

5 Biological resource use

Threats that are due to the use/consumption of wild biological resources, including the impacts of legal, illegal and unintentional harvesting. The disturbance and control of certain species falls under this threat category, which includes habitat conversion and degradation, the development of related infrastructure as well as the uses and practices that are associated with the latter (*e.g.*, use of machinery, wood storage, soil management). Excludes the transport of resources (*e.g.*, logging roads, threat 4.1.4) and peat harvesting (threat 3.2.4).

5.1 Hunting & collecting terrestrial animals

Hunting animal species or collecting animal products for commercial, recreational, subsistence, cultural, research study or control purposes. Includes hunting terrestrial species and trapping semi-aquatic species. This category also covers incidental captures, control and persecution, but excludes harvesting for research purposes (threat 6.3.1).

5.1.1 *Hunting*

Harvesting of wild animal species by hunting for recreation or subsistence that is governed by management measures. Includes incidental killing, but illegal harvesting or killing should be classified under “Poaching/Persecution of terrestrial animals” (threat 5.1.4). Excludes contamination of habitats due to solid lead from hunting ammunition (threat 9.4.2).

E.g., hunting with firearms, bows or crossbows, or blunt objects for sport or subsistence, taxidermy, trophies.

5.1.2 *Trapping*

Harvesting of wild terrestrial or semi-aquatic animal species (*e.g.*, beavers) by trapping that is governed by management measures. Includes incidental killing, but animal control by trapping should be classified under “Management/control of terrestrial animals” (threat 5.1.5).

E.g., trapping of wild terrestrial or semi-aquatic animals for fur, meat, taxidermy, trophies, non-target birds of prey caught in traps.

5.1.3 *Non-lethal harvesting of terrestrial animal products*

Harvesting of terrestrial animal products that does not require the killing of individuals and that is governed by management measures.

E.g., down collection, guano collection.

5.1.4 *Poaching/persecution of terrestrial animals*

Illegal harvesting of terrestrial animals or animal products (*e.g.*, feathers) for personal, commercial or persecution purposes, or actions that would interpreted as abuse or harassment of wildlife.

E.g., hunters killing coyotes or birds of prey, people deliberately harming snakes out of fear, illegal collection of seabirds or shorebird egg collection, illegal wildlife trade for skins, meat or the pet trade.

5.1.5 *Management/control of terrestrial animals*

Deliberately killing individuals of a terrestrial species for human gain that is governed by management measures.

E.g., cormorant culling.

5.2 Gathering terrestrial plants or fungi

Harvesting and gathering wild plants, mushrooms or other non-animal/non-timber species for commercial, recreational, subsistence, cultural, research or control purposes, but excludes research (threat 6.3.1).

5.2.1 *Recreational or subsistence harvesting*

Harvesting of plant or fungi species that has a lethal effect on the individual and is governed by management measures. Illegal harvesting should be classified as “Poaching/eradication of terrestrial plants or fungi” (threat 5.2.4).

E.g., recreational or subsistence harvesting of wild leeks.

5.2.2 *Commercial harvesting*

Commercial harvesting of plants or fungi species that has a lethal effect on the individual and is governed by management measures. Excludes peat harvesting (threat 3.2.4) and products from plantations (threat 2.2).

E.g., commercial harvesting of fiddleheads.

5.2.3 *Non-lethal harvesting of terrestrial plant products*

Sub-lethal harvesting of plants or fungi related products, which is governed by management measures.

E.g., collecting of cedar bark, tree tapping for sugar maple production.

5.2.4 *Poaching/eradication of terrestrial plants or fungi*

Deliberate and illegal harvesting of plants or fungi for personal or commercial purposes or eradication due to prejudices against the species.

E.g., illegal gathering of American ginseng, eradication of cow parsnip because of its similar appearance to giant hogweed, an invasive alien species.

5.2.5 *Management/control of terrestrial plants or fungi*

Deliberately destroying a plant species or fungi for human gain. Includes indirect or unintended impacts on other species, but excludes cutting or vegetation management due to maintenance activities or early phases of development.

E.g., eradication of dandelions from lawns.

5.3 Logging & wood harvesting

Harvesting trees/other forest species in natural environments for timber or fibre outside of plantations (threat 2.2). Includes cutting and the use of machinery, as well as wood storage and debris management, excluding their transport (threat 4.1.4) and associated erosion (threat 9.3.2.).

5.3.1 *Complete removal of the forest cover*

Cuttings removing the majority of the forest cover.

E.g., clear-cutting and related cuts (CT, CRS, CPRS, CPHRS, CPPTM).

5.3.2 *Partial removal of the forest cover*

Partial cutting of the forest leaving a certain amount of cover.

E.g., shelterwood cutting, selection cutting.

5.3.3 *Improvement cutting in natural forests*

Silvicultural treatments that alter the composition of the forest to increase the growth of certain plant species. These interventions alter wildlife habitat by affecting the availability of food and shelter.

E.g., pre-commercial thinning, tending felling.

5.3.4 *Artificial regeneration of forest stands*

Planting of trees in natural forests (opposed to planting taking place outside of natural forests, threat 2.2) to promote the regeneration of stands that are composed of species of commercial interest where natural regeneration is absent or insufficient.

5.3.5 *Management of cutting areas*

Management of the area and debris during a cutting or afterwards.

E.g., scarification, formation of windrows from woody debris.

5.4 Fishing & harvesting aquatic resources

Harvesting aquatic species (wild plants and animals) for commercial, recreational, subsistence, cultural, research or control/scaring purposes. This category also covers incidental capture (bycatch), but excludes research activities (threat 6.3.1).

5.4.1 *Recreational or subsistence fishing*

Harvesting of aquatic species for recreation or subsistence that is governed by management measures. Illegal harvesting by fishing should be classified under "Poaching/persecution of aquatic species" (threat 5.4.4). Includes bycatch and damage to released individuals, but excludes contamination of habitats due to solid lead from fishing gear (threat 9.4.2).

E.g., recreational fishing of sturgeon, accidental catching of mudpuppies during ice fishing, turtles ingesting hooks, personal collection for fishkeeping with authorized species.

5.4.2 *Commercial fishing*

Harvesting of aquatic species for commercial purposes that is governed by management measures for which the environmental impact is primarily on the species (as opposed to habitat damage from sea bottom trawling, threat 7.3.6). Includes bycatch, but excludes ghost fishing gear entangling wildlife (threat 9.4.4).

E.g., commercial fisheries, use of nets and fishing gear for eels, factory ships, marine mammals caught in industrial fishing nets.

5.4.3 *Poaching/persecution of aquatic species*

Deliberate and illegal harvesting of aquatic animals for personal or commercial purposes or persecution, harassment, abuse or to cause deliberate harm due to prejudices against the species.

E.g., poaching of glass eels

5.4.4 *Management/control of aquatic species*

Deliberately killing individuals of an aquatic species for human gain that is governed by management measures.

E.g., control of lampreys using lampricides, control of mosquitoes in their aquatic larval stage (*BTi*), water weed cutting.

6 Human intrusions & disturbance

Threats from human activities (unrelated to the use of biological resources) that disturb, alter or destroy habitats and their species.

6.1 Recreational activities

Activities with generally low ecological impact that are conducted in natural areas for recreational purposes away from road networks (threat 4). To be distinguished from threat 1.3 (tourism and recreation areas with a significant footprint), which is a source of pressure primarily on habitats, whereas recreational activities (6.1) have a more direct impact on individuals of species (disturbance, mortality) and, to a lesser extent, habitats.

6.1.1 *Motor vehicles*

Using recreational motor vehicles.

E.g., ATVs, motocross motorcycles, snowmobiles.

6.1.2 *Hiking*

Walking, cycling or horseback riding on or off trails in natural environments. Includes opportunistic observation of nature, but excludes disturbance by intensive observation/photography that is oriented towards one of several target species (threat 6.1.8).

E.g., walking, jogging, running, dirt biking, geocaching, orienteering, disturbance from users or their domestic animals.

6.1.3 *Recreational use of cliffs and rock faces*

E.g., rock climbing, hang-gliding.

6.1.4 *Recreational boating*

Use of recreational boats and watercraft that disturb wildlife, incur collisions with animals, and induce wake damage. Excludes the spread of invasive species (threat 8.1).

E.g., yacht, zodiac boats, watercraft.

6.1.5 *Wilderness camping without amenities*

Temporary camping without amenities, away from dedicated networks. Distinguished from threat 1.3.2 (campgrounds) by the lack of amenities.

6.1.6 *Drones*

6.1.7 *Caving*

6.1.8 *Wildlife observation/photography*

Wildlife observation activities without any gathering that disturb the target species due to harassment or through the use of attractants and lures.

E.g., photographers attracting birds of prey with domestic rodents.

6.1.9 *Special events in natural environments*

Outdoor performances in natural settings, gatherings that cause trampling and disturbance of habitat. Does not include noise pollution (threat 9.6.3).

E.g., outdoor concerts, gatherings on beaches that incur some trampling, outdoor sports competitions in natural habitats (XTrails).

6.2 War, civil unrest & military exercises

Military and paramilitary activities that do not have a permanent ecological footprint. To be distinguished from the construction and use of permanent military bases (threat 1.2.1).

6.2.1 *War*

E.g., military intervention in conflicts, transportation using military vehicles, minefields.

6.2.2 *Riots*

6.2.3 *Military exercises*

Off-base military training activities with a local footprint.

E.g., unexploded ordnance, trampling from military training activities, firing ranges, military equipment testing.

6.3 Work & other activities

Activities carried out in natural areas (undeveloped areas) for purposes other than recreational or military activities.

6.3.1 *Research activities*

Research activities that are governed by management measures that can affect species by causing a disturbance, by collecting individuals, or by degrading the environment.

E.g. Research fisheries requiring mortality, trampling by research teams.

6.3.2 *Illegal activities*

Illegal activities that are unrelated to the harvesting of wild animal or plant species. Also includes habitat or species disturbance during related law enforcement interventions.

E.g., illegal activities or law enforcement intervention, drug trafficking, illegal immigration.

6.3.3 *Vandalism*

Deliberate and illegal destruction of structures that are of benefit to animal and plant species.

E.g., destruction of gates limiting access to bat caves.

7 Natural system modifications

Threats from activities that are generally carried out to improve human welfare, but may result in habitat degradation or destruction. This threat category includes the development or redevelopment (management) of natural and semi-natural habitats, as well as certain natural processes that can act as threats. Stopping a conservation action or a practice that is conducive to conservation (threat 7.4 in CMP v2.0) is not interpreted as a threat, but as a return to the source threat (*e.g.*, vegetation succession affecting pioneer species). Excludes meteorological or climate change-related threats that may modify natural systems (threat 11).

7.1 Fire & fire suppression

Suppression or increase in fire frequency, severity or scope, changes in the natural fire regime that are directly related to human activity.

7.1.1 *Increase in the fire regime*

Increase in fire frequency/scope/severity due to human activities.

E.g., out of control agricultural burning, campfires.

7.1.2 *Suppression in the fire regime*

Interventions aimed at preventing and putting out forest fires (fire management).

E.g., putting out forest fires, controlled burning, creating firebreaks and trenches, and other measures.

7.2 Dams & water management/use

Facilities or activities that alter the natural water regime (flow or water levels).

7.2.1 *Water level management using dams*

Construction, operation and water management using non-power dams. Includes the dismantling of man-made dams and excludes dams used for power generation (threat 3.3.1), but excludes lock systems (threat 4.3.3)

E.g., dams and weirs for containing water.

7.2.2 *Beaver dam management*

Structures (dams) built by beavers create habitats for a number of species; however, these dams may be dismantled by humans. Dismantling of dams results in habitat loss by drying-out the beaver-created basin and flooding lands downstream. It could also potentially cause loss of accumulated sediments due to increased flow in streams farther downstream.

E.g., dismantling of dams, development of infrastructure that promotes the free flow of water (installation of drains), decision to maintain dams.

7.2.3 *Water management using culverts*

The design, installation and management of culverts that are used to permit water flow under roads or railroads can cause discontinuities in streams and promote erosion.

7.2.4 *Drainage in agricultural environments*

Construction and maintenance of channels that drain surface waters in agricultural environments. Excludes the use/management of culverts (threat 7.2.3). Excludes erosion/sedimentation that are associated with this drainage system (threat 9.3.2).

7.2.5 *Drainage in forest environments*

Construction and maintenance of channels that drain surface waters in forest environments. Excludes the use/management of culverts (threat 7.2.3). Excludes erosion/sedimentation that is associated with this drainage system (threat 9.3.2).

E.g., draining private wood lots to increase maple or timber production in forested environments.

7.2.6 *Withdrawal of surface water*

Withdrawal of fresh surface water for human consumption, crop production or other purposes.

E.g., withdrawal by municipalities, spring water bottling companies and farmers; reservoirs for firefighting, creation of man-made lakes.

7.2.7 *Withdrawal of groundwater*

Withdrawal of groundwater for human consumption, crop production or other purposes.

E.g., pumping water from the water table.

7.3 Other ecosystem modifications

Other activities that contribute to habitat alteration or loss by redeveloping natural systems to improve human welfare. To be distinguished from the development and maintenance of urban parks (threat 1.3.1).

7.3.1 *Shoreline alteration*

E.g., shoreline hardening, riprap along shorelines, breakwaters, concrete walls, shoreline filling.

7.3.2 *Vegetation succession*

Natural vegetation succession causing habitat loss for species of early successional habitats.

7.3.3 *Natural erosion and sedimentation*

Removal, transport and deposition of sediments that is caused by natural erosional processes. To be distinguished from the transport of sediments that is associated with tides (threat 4.3.1), or by drainage systems in agriculture (threat 7.2.5) and forestry (threat 7.2.6).

7.3.4 *Beach development*

Creation of beaches, their nourishment (substrate replenishment) and maintenance.

7.3.5 *Removal of snags in watercourses*

Removal of snags and other structures that are used by wildlife within watercourses to promote water flow, embellish the landscape, or facilitate boating. Excludes the maintenance of road ditches (4.1.1) and agricultural ditches (7.2.4), as well as shoreline clean-ups that are performed as a conservation action.

E.g., removal of rock or snags that are used by river turtles for basking (thermoregulation).

7.3.6 *Sea bottom trawling*

Trawling of the sea bottom that alters marine habitats. Excludes the impact of harvesting on target species (threat 5.4.2).

8 Invasive & other problematic species, genes & diseases

Threats posed by non-native and native species (plants, animals, pathogens or genetic materials) that have or are expected to have harmful effects on biodiversity following their introduction, spread or increase in population (abundance).

8.1 Invasive non-native/alien plants & animals

Harmful plants and animals that were not originally present within an ecosystem, but were directly or indirectly introduced into or spread in the ecosystem as a result of human activities. The concept of exotic species includes species that are not native to a specific habitat; it can therefore include the introduction of species that are considered native to a different region of Quebec (*e.g.,* American mink invasion of the Magdalen Islands). Domestic species are also considered non-native, whether they are feral or semi-domesticated (e.g., domestic cats going outside). Also includes introduction of wildlife due to “mercy releases”.

NB: Given that conservation actions that are related to invasive alien species (IAS) generally only target one species at a time, these threats have exceptionally been listed separately for each species rather than grouped by category in a 4th level. This 4th level is based on the species codes (Species_code) that are used by the Global Invasive Species Database (GISD) (GISD, 2020). This approach makes it possible to track these species individually, based upon their differing impacts on biodiversity. Some examples are provided below but the 4th level of this section should be personalized by each organization, depending on their local invasive species.

8.1.1 *Terrestrial animals*

8.1.1.24 *Felis catus* – Domestic cat
8.1.1.722 *Agrilus planipennis* – Emerald ash borer
8.1.1.969 *Neovison vison* – American mink

8.1.2 *Terrestrial plants*

8.1.2.91 *Polygonum cuspidatum* – Japanese knotweed
8.1.2.809 *Rhamnus cathartica* – European buckthorn

8.1.3 *Aquatic animals*

8.1.3.50 *Dresseina polymorpha* – Zebra mussel
8.1.3.217 *Orconectes rusticus* – Rusty crayfish

8.1.4 *Aquatic plants*

8.1.4.278 *Myriophyllum spicatum* – European water milfoil
8.1.4.567 *Trapa natans* – Water chestnut

8.2 Problematic native plants & animals

Plants and animals that were originally present in ecosystem(s), but whose populations have increased to a level where they are now “out of control” or overabundant as a direct or indirect result of certain human activities.

8.2.1 *Habitat alteration by beavers*

Flooding/drainage of habitats caused by beavers.

8.2.2 *Increased grazing by vertebrates*

E.g., increased grazing by white-tailed deer and snow geese.

8.2.3 *Localized increase in invertebrate grazing*

E.g., increased grazing of American ginseng by native slugs.

8.2.4 *Insect pest epidemics*

Increases in insect pest density, resulting in large-scale impacts on the ecosystem. To be distinguished from localized increases in invertebrate grazing (threat 8.2.3).

E.g., eastern spruce budworm outbreaks.

8.2.5 *Increased predation by mesopredators*

E.g., racoons, striped skunks, foxes, coyotes.

8.2.6 *Increased predation by large predators*

E.g., increased predation on large ungulates due to an increase in wolf density; increased predation by seals, intentional reinforcement of predator populations.

8.2.7 *Ectoparasites*

E.g., fleas, ticks, mites.

8.2.8 *Interspecific competition with a favoured species*

Direct competition with a favoured species.

E.g., exclusion of Horned Grebe by Pied-billed Grebe through competition for the same niche.

8.3 Introduced genetic material

Human modified or altered organisms/genes that pose a threat to biodiversity in natural environments by competing with wild populations or hybridizing with them and altering their gene pool.

8.3.1 *Genetic material from agriculture*

E.g., pesticide-resistant cereals/forages, use of genetically modified insects for biocontrol.

8.3.2 *Genetic material from silviculture*

E.g., genetically modified trees.

8.3.3 *Genetic material from aquaculture*

E.g., genetically modified salmon.

8.4 Pathogens

Diseases caused by various taxa of pathogenic micro-organisms living within hosts.

8.4.1 *Bacterial pathogens*

8.4.2 *Viral pathogens*

E.g., ranavirus in amphibians, rabies in raccoons.

8.4.3 *Fungal pathogens*

E.g., white-nose syndrome in bats (WNS), snake fungal disease (SFD), salamander chytrid disease (*Bsal*), fungal pathogens affecting the roots of American ginseng.

8.4.4 *Worm-induced disease*

Any diseases directly induced by a worm (helminthiases).

E.g., flatworms, nematodes, nemertean worms.

8.4.5 *Protozoan-induced diseases*

8.4.6 *Prion diseases*

E.g., chronic wasting disease of cervids (CWD).

9 Pollution

Threats that are associated with the introduction of foreign or excess material/energy from point and non-point sources. Threats that are posed by pollution are typically correlated with other human activities listed in the other sections (*e.g.*, air pollution from cars, water pollution from sewage, agricultural effluents). Although there is a direct correlation between pollution and these other threats, their impact (scope and severity) is often evaluated separately from the source activity.

9.1 Domestic & urban waste water

Point or non-point source wastewater from residential and urban areas; these discharges (may) contain nutrients, sediments, toxic substances, chemicals, etc.

9.1.1 *Domestic wastewater*

Liquid domestic waste that is produced by urban centres and discharged primarily by the sewage system.

E.g., discharges from municipal waste treatment plants, leaks from sewers/septic tanks, untreated discharges, pit toilets, medical components in water (birth control hormones, antidepressants, antibiotics), toxoplasmosis, etc.

9.1.2 *Runoff*

Effluents resulting from urban activities that are separate from the water supply system. For oils and other hydrocarbons, refer to threat 9.2.1.

E.g., salt/sand used to de-ice roads, fertilizers and pesticides used for lawns, parks, golf courses.

9.2 Industrial & military effluents

Wastewater (pollutants) from industrial and military sectors, including mines, energy production sectors and other resource extraction industries. These effluents may result from deliberate or accidental spills that are legal or illegal and (may) contain various nutrients, sediments, toxic substances and chemicals, among others. Considering the difficulty in identifying contaminants or contaminant “cocktails” that are responsible for environmental damage, other unknown contaminants from industries will be listed within 9.2.7. This section excludes natural sources of contaminants that are found in the environment (*e.g.*, mercury found in soils or in river substrates). Intoxication due to natural sources of these contaminants are likely to result from an indirect threat increasing exposure and to which conservation actions can be matched.

9.2.1 *Oil spills*

Spills from vehicle fuel tanks or from facilities that are associated with hydrocarbon extraction and transportation.

E.g., oil spills from grounded vessels, military vehicles, pipeline failures.

9.2.2 *Acid mine drainage (AMD)*

9.2.3 *Flame retardant*

9.2.4 *PCB*

9.2.5 *Mercury*

9.2.6 *Industrial lead*

Lead released into the environment by industrial effluents. Excludes lead contamination due to hunting ammunition or fishing gear (9.4.2).

9.2.7 *Other industrial discharges*

Unidentified or mixed toxic liquid chemicals that are released from industrial plants.

9.3 Agricultural & forestry effluents

Wastewater (pollutants) that is generated by agricultural, silvicultural and aquacultural activities. These discharges are transported primarily in drainage systems, runoff and eroded soil; they (may) contain various nutrients, toxic substances, chemicals, etc. Excludes erosion and sedimentation that is associated with drainage systems in agriculture (threat 7.2.4) and forestry (threat 7.2.5), or oil spills from machinery (9.2.1).

9.3.1 *Nutrient loads*

E.g., manure, compost, chemical fertilizers.

9.3.2 *Soil erosion, sedimentation*

Erosion and sedimentation that are due to agricultural or silvicultural activities, regardless of the presence of local drainage systems (threat 7.2.4 and 7.2.5).

9.3.3 *Herbicides & pesticides*

Includes the use of inputs for controlling crop pests.

E.g., herbicides, insecticides, fungicides.

9.4 Garbage & solid waste

Garbage and solid waste, including materials that can intoxicate or entangle plants and animals (strangulation/asphyxiation from plastic bags, elastic materials, ropes, etc.).

9.4.1 *Garbage*

Garbage and solid waste in the environment. Excludes waste in open dump-sites (threat 1.2.2), landfills (threat 1.2.3), and ashore or adrift in the ocean (threat 9.4.4).

E.g., municipal waste, litter discarded on roads from vehicles, floating waste from recreational boats, construction debris/waste, etc.

9.4.2 *Solid lead*

Lead released into the environment in a solid form (*e.g.*, pellets) from a source other than industrial effluents (threat 9.2.6).

E.g., lead from ammunition or fishing gear contaminating the environment, ammunitions from shooting ranges.

9.4.3 *Asbestos*

9.4.4 *Drifting plastic and entanglement rubbish*

Plastic garbage adrift or ashore of oceans or large water bodies that intoxicate or entangle wildlife.

E.g., floating rubbish, nets, robes, buoys, ghost or derelict fishing gear, plastic bags.

9.5 Airborne pollutants

Air contaminant emissions from a point or non-point source.

9.5.1 *Acid rain*

9.5.2 *Smog*

Smog caused by air pollutant emissions from cars (vehicles in general).

9.5.3 *Ozone*

Atmospheric nitrogen deposition.

9.5.4 *Dust & ashes*

Fine particles carried by the wind that pollute the environment when deposited or taken in by organisms. Excludes ash from volcanic eruptions (threat 10.1.1).

E.g., radioactive fallout, wind dispersion of pollutants/sediments, smoke from forest fires or wood burning.

9.6 Excess energy

Inputs of heat, sound or light that disturb wildlife or ecosystems.

9.6.1 *Light pollution*

E.g., lamps (light) that attract insects or birds, lights on beaches that disorient turtles.

9.6.2 *Thermal pollution*

E.g., heated water discharges from power plants (coal, gas, nuclear, etc.), atmospheric radiation resulting from ozone layer thinning.

9.6.3 *Noise pollution*

E.g., noise from highways, air traffic (airplanes), submarine sonar that disturbs whales and other marine mammals, loud music from outdoor events and engine noise from marine traffic.

10 Geological events

Threats from catastrophic geological events.

10.1 Volcanoes

Volcanic activities, eruptions, emissions of volcanic gases.

10.1.1 *Eruptions*

10.1.2 *Emissions of volcanic gases*

10.2 Earthquakes / tsunamis

Earthquakes and associated events (tsunamis, etc.).

10.2.1 *Earthquakes*

10.2.2 *Tsunamis*

10.3 Avalanches / landslides

Avalanches, landslides, mudslides.

10.3.1 *Avalanches*

10.3.2 *Landslides and mudslides*

11 Climate change & severe weather

Threats from major changes in ecosystems and severe climate/weather events outside of the natural range of variation that could harm species or habitats. May or may not be related to climate change.

11.1 Habitat shifting & alteration

Major changes in habitat composition or location.

11.1.1 *Changes in vegetation communities*

Major changes in an ecosystem resulting in changes to vegetation communities. To be distinguished from natural vegetation succession, which may threaten open-country species (threat 7.3.2).

E.g., migration of deciduous trees towards the boreal forest, rising sea levels, desertification, thawing permafrost (in tundra), coral bleaching.

11.1.2 *Phenological mismatch*

Behaviours that have evolved to adapt to seasonal changes become unsynchronized due to irregularities or delays in the cycle of the seasons.

E.g., torpor in hibernating animals that is initiated before the season gets cold.

11.2 Changes in geochemical regime

Large-scale changes in an ecosystem's physico-chemical makeup.

11.2.1 *Changes in pH of habitats*

E.g., ocean acidification.

11.2.2 *Changes in salinity*

11.3 Changes in temperature regimes

Periods in which temperatures of the air, water or soil either exceed or fall below the normal range of variation. Events that may or may not be related to climate change.

11.3.1 *Heat waves*

11.3.2 *Extreme cold spells*

11.3.3 *Gradual temperature change*

E.g., altered sex-ratio in species relying upon a temperature dependent sex determination, reduction of dissolved oxygen that is available to fish species, earlier ice-free dates, thawing of permafrost affecting bird breeding sites.

11.3.4 *Increase in temperature fluctuations*

Increase in temperature fluctuations, which disturb the phenological responses of wildlife.

E.g., raise in the frequency of freeze-thaw events, rain-on-snow events, etc.

11.4 Changes in precipitation & hydrological regimes

Periods in which the amount and frequency of precipitation either exceeds or falls below the normal range of variation. Events that may or may not be related to climate change, and exclude periods that are associated with storms and heavy weather (threat 11.5).

11.4.1 *Overabundant rains*

11.4.2 *Droughts*

11.4.3 *Gradual change in the precipitation regime*

11.4.4 *Increase of fluctuations in the precipitation regime*

Increase in the fluctuations that are related to the precipitation regime, which have impacts on the hydrology of natural habitats.

11.5 Storms & severe weather

Strong winds and extreme weather events or a major change/shift in the storm season.

11.5.1 *Storms & severe weather*

E.g., thunderstorms, tropical storms, hurricanes, cyclones, tornadoes, hailstorms, ice storms, blizzards, dust storms.

11.5.2 *Storm surges*

E.g., erosion of shorelines/beaches during storms

Conclusion

A classification is a conceptual representation that is designed to achieve specific goals. The present document was developed to group similar phenomena affecting biodiversity and to distinguish them by their impacts to facilitate the identification of the most efficient conservation action. Nevertheless, no single document can target every single classification need and no conceptual representation can reflect perfectly the complexity of the real world. Therefore, this document that was developed by the MFFP and its collaborators is the first version of a level 3 standard classification of threats to biodiversity, which will be refined as it is implemented.

Thus, the users of this classification are welcome to share their comments and classification challenges with the authors (at the following email address: philippe.lamarre@mffp.gouv.qc.ca), so that their issues can be addressed in later versions. This collaboration on improving the terminology used for the threats affecting our biodiversity will facilitate their management and prioritization of conservation efforts.

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