



Chapter 5

Threats to Maryland's Wildlife Species and Their Habitats

APPENDICES



Chapter 5 Appendices

5a. International Union for the Conservation of Nature (IUCN) Threat Categories

Appendix 5a. International Union for the Conservation of Nature (IUCN) Threat Categories

| IUCN THREAT Categories - adapted for use in Maryland's State Wildlife Action Plan | | | | | | |
|---|--|---|--|--|--|--|
| Level 1 | Level 2 | Level 3 | | Definition / Details | Exposition | |
| 1 Residential and Commercial Development | | | | | Threats from human settlements or other non-agricultural land uses with a substantial footprint | These are threats tied to a defined and relatively compact area, which distinguishes them from those in 4. Transportation & Service Corridors which have a long narrow footprint, and 6. Human Intrusions & Disturbance which do not have an explicit footprint. |
| | 1.1 Housing and Urban Areas | | | Human cities, towns and settlements including non-housing development typically integrated with housing | This category obviously dovetails somewhat arbitrarily with 1.2 Commercial and Industrial Areas . As a general rule, however, if people live in the development, it should fall into this category. | |
| | 1.1.1 | Land conversion from natural habitat to urban and other residential areas (large and small scale) | | Habitat loss, fragmentation, and degradation; species decline and loss; remaining habitats no longer support species; remaining fragmented patches are increasingly isolated and movement corridors are restricted or eliminated | | |
| | 1.1.2 | Residential development using materials that cause collision hazards | | Increase in bird deaths from flying into windows | | |
| | 1.2 Commercial and Industrial Areas | | | Commercial and non-extractive industrial development and operations | Shipyards and airports fall into this category, whereas shipping lanes and flight paths fall under 4. Transportation & Service Corridors . Dams are NOT included here, rather they are in 7.2 Dams & Water Management/Use. Mines are NOT included here, rather they are in 3. Energy Production and Mining . Industrial discharge and settling ponds are in 9.2 Industrial and Military Effluents . | |
| | 1.2.1 | Land conversion from natural habitat to commercial or industrial areas (large and small scale) | | Habitat loss, fragmentation, and degradation; species decline and loss; remaining habitats no longer support species; remaining fragmented patches are increasingly isolated and movement corridors are restricted or eliminated | | |
| | 1.2.2 | Commercial development using materials that cause collision hazards | | Increase in bird deaths from flying into windows | | |
| | 1.3 Tourism and Recreational Areas | | | Tourism and recreation sites with a substantial footprint | There is a fine line between housing and vacation housing/resorts. Be careful not to confuse this category, which focuses on the habitat effects of recreation areas, with those in 6.1 Recreational Activities , which focuses on the disturbance effects posed by recreation. | |
| | 1.3.1 | Land conversion from natural habitat to recreation or tourism areas (large and small scale) | | Conversion of significant natural habitats into parks with ball fields, camping areas, or other inappropriate recreational areas | | |
| 2 Agriculture and Aquaculture | | | | | Threats from farming and ranching as a result of agricultural expansion and intensification, including silviculture, mariculture and aquaculture | Threats resulting from the use of agrochemicals, rather than the direct conversion of land to agricultural use, should be included under 9.3 Agricultural & Forestry Effluents . Likewise in cases where conversion to agriculture causes increased run-off and hence sedimentation of rivers and lakes, that is also best treated under 9.3 Agricultural & Forestry Effluents . |
| | 2.1 Annual and Perennial Crops (non-timber) | | | Crops planted for food, fodder, fiber, fuel or other uses | | |
| | 2.1.1 | Shifting Agriculture | | | | |
| | 2.1.2 | Small-holder Farming | | | | |
| | 2.1.3 | Agro-industry | | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | | |
| | 2.2 Wood and Pulp Plantations | | | Growing and harvesting trees and other woody vegetation for timber, fiber or fuel | If it is one or a couple timber species that are planted on a rotation cycle, it belongs here. If it is multiple species or enrichment plantings in a quasi-natural system, it belongs in 5.3 Logging & Wood Harvesting . | |
| | 2.2.1 | Small Holder | | | | |

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|---------------------------------------|--|--|---|---|
| | 2.2.2 | Agro-industry Plantations | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | |
| | 2.3 Livestock Farming and Ranching | | | In farming, animals are kept in captivity; in ranching they are allowed to roam in wild habitats. If a few animals are mixed in a subsistence cropping system, it belongs in 2.1 Annual & Perennial Non-Timber Crops . Forage of wild resources for stall-fed animals falls under 5.2 Gathering Terrestrial Plants . Domesticated livestock that has gone feral should be treated under 8.1 Invasive Non- native/Alien Species , but other wild-roaming livestock may also require closer consideration to determine if they are best placed here or also under 8.1. |
| | 2.3.1 | Small-holder Grazing | | |
| | 2.3.2 | Agro-industry Grazing | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | |
| | 2.4 Marine and Freshwater Aquaculture | | Aquatic animals raised in one location on farmed or non-local resources; also hatchery fish allowed to roam in the wild | Farmed animals are kept in captivity; hatchery fish are put into wild habitats and are the aquatic equivalent of terrestrial ranching. |
| | 2.4.1 | Subsistence/Artisanal Aquaculture | | |
| | 2.4.2 | Industrial Aquaculture | Inappropriate placement of new facilities or expansion of existing facilities, such as fish hatcheries, seeded shellfish beds | |
| 3 Energy Production and Mining | | | Threats from exploring for, developing, producing and distributing energy or geological resources | Various forms of water use (for example, dams for hydro power) could also be put in this class, but these threats seemed more related to other threats that involve alterations to hydrologic regimes. As a result, they should go in 7.2 Dams & Water Management/Use . |
| | 3.1 Oil and Gas Drilling / Pipelines | | | Oil and gas pipelines go into 4.2 Utility & Service Lines . Oil spills that occur at the drill site should be placed here; those that come from oil tankers or pipelines should go in 4. Transportation & Service Corridors or in 9.2 Industrial & Military Effluents , depending on your perspective. |
| | 3.1.1 | Drilling and distribution of petroleum and other liquid hydrocarbons | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | |
| | 3.1.2 | Hydraulic fracturing and other natural gas extraction and distribution processes | Inappropriate placement of new facilities that causes loss, degradation, and fragmentation of habitat | |
| | 3.2 Mining and Quarrying | | Exploring for, developing, and producing minerals and rocks | It is a judgement call whether deforestation caused by strip mining should be in this category or in 5.3 Logging & Wood Harvesting - it depends on whether the primary motivation for the deforestation is access to the trees or to the minerals. Sediment or toxic chemical runoff from mining should be placed in 9.2 Industrial & Military Effluents if it is the major threat from a mining operation. |
| | 3.2.1 | Surface Mining - Coal Strip Mining | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | |
| | 3.2.2 | Surface Mining - Rock Quarry | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | |
| | 3.2.3 | Deep Mining | Inappropriate placement of new facilities or expansion of existing facilities that causes loss, degradation, and fragmentation of habitat | |
| | 3.2.4 | Sand Dredging (outside shipping lanes) | Inappropriately located dredging of offshore sand for placement on Atlantic coastal beaches; alteration of natural habitats | |

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|---|---------|---|---|---|
| | | 3.3 Renewable Energy | Exploring, developing, and producing renewable energy | Hydropower should be put in 7.2 Dams & Water Management/Use . |
| | 3.3.1 | Wind Power | Inappropriate placement of new facilities or expansion of existing facilities that increases bird and bat fatalities in movement corridors and other areas; loss, degradation, and fragmentation of habitat | |
| | 3.3.2 | Solar Power | Inappropriate placement of new facilities or expansion of existing facilities that causes habitat loss, degradation, and fragmentation | |
| | 3.3.3 | Geothermal Power | Inappropriate placement of new facilities or expansion of existing facilities that causes impacts to groundwater hydrology in areas with cave systems or seepage wetlands | |
| 4 Transportation and Service Corridors | | | Threats from long narrow transport corridors and the vehicles that use them including associated wildlife mortality | This class includes transportation corridors outside of human settlements and industrial developments. These corridors create specific stresses to biodiversity including especially fragmentation of habitats and lead to other threats including farms, invasive species, and poachers. |
| | | 4.1 Roads and Railroads | Non-energy transportation corridors and the vehicles that use them | Off-road vehicles are treated in the appropriate category in 6. Human Intrusions & Disturbance . If there are small roads associated with a major utility line, they belong in 4.2. Utility & Service Lines . |
| | 4.1.1 | Land conversion from natural habitat to roads and railroads (large and small scale) | Inappropriate placement of new roads result in degradation of habitat, including pathways for invasive species; loss of interior conditions for forest interior dwelling species and subsequent reduced breeding success due to increased access by predators and parasites; increase in future development | |
| | 4.1.2 | Movement of cars and other vehicles on roads and railroads (large and small scale) | Wildlife mortality; disruption of movement corridors | |
| | | 4.2 Utility and Service Lines | Transport of energy & resources | Cell phone and other communication towers connected by small access roads belong here. If there are small utility lines using a road right of way, they belong in 4.1 Roads & Railroads. Oil spills from pipelines should go in 9.2 Industrial & Military Effluents. |
| | 4.2.1 | Land conversion from natural habitat to utility and other service lines (large and small scale) | Inappropriate placement of new service lines result in degradation of habitat, including pathways for invasive species; wildlife mortality; disruption of movement corridors; loss of interior conditions for forest interior dwelling species and subsequent reduced breeding success due to increased access by predators and parasites; increase in future development activities. | |
| | | 4.3 Shipping Lanes | Transport on and in freshwater and ocean waterways | This category includes dredging and other activities that maintain shipping lanes. Anchor damage from dive boats belongs in 6.1 Recreational Activities . Oil spills from ships should go in 9.2 Industrial & Military Effluents . |
| | 4.3.1 | Movement of large ships in shipping lanes | Known cause of mortality for species, such as North Atlantic right whale and Atlantic sturgeon; disruption of movement corridors | |
| | 4.3.2 | Dredging impacts | Inappropriate placement of dredge spoil containment facilities; alteration of natural habitats; direct mortality of mussels in fresh tidal water | |

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| | 4.4 Flight Paths | | Air and space transport | Airports fall into 1.2 Commercial & Industrial Areas . |
| | 4.4.1 | Airplane flight paths | Increased fatalities, especially during migration, within migration corridors and concentration areas | |
| 5 Biological Resource Use | | | Threats from overharvesting biological resources for commercial, recreation, subsistence, research or cultural purposes; including both deliberate and unintentional harvesting beyond sustainable levels | Consumptive use means that the resource is removed from the system or destroyed - multiple people cannot use the same resource, as they could under 6. Human Intrusions & Disturbance . Threats in the class can affect both target species (harvest of desired trees or fish species) as well as "collateral damage" to non-target species (trees damaged by felling or fisheries bycatch) and habitats (coral reefs destroyed by trawling). Persecution/control involves harming or killing species because they are considered undesirable. For some of the use threats there is an additional question on whether or not International trade is a significant driver of decline (5.1.1, 5.2.1, 5.3.1, 5.3.2, 5.4.1, 5.4.2). |
| 5.1 Hunting and Collecting Terrestrial Animals | | | Overharvesting terrestrial wild animals or animal products; includes accidental mortality/bycatch | This category focuses on animals that primarily live in a terrestrial environment. There are obviously some species that live on the terrestrial/aquatic boundary. Hunting otters, beavers, amphibians, polar bears, penguins, waterfowl, and sea birds should (somewhat arbitrarily) go here. Hunting seals, whales and other marine mammals, and freshwater and marine turtles go in 5.4 Fishing & Harvesting Aquatic Resources . Yes, most people "gather" honey, eggs, or insects or other slow moving targets, rather than "hunt" them. But for consistency it was decided to keep all animal products as being hunted. This option does not distinguish between small and large scale (unlike others below) as generally most hunting and collecting of animals is small scale, but arguably some hunting in the past was very large "industrial" scale. |
| | 5.1.1 | Intentional Use | Includes excessive or illegal collecting of butterflies and other insects; illegal collection of reptiles & amphibians; localized excessive beaver trapping | |
| | 5.1.2 | Unintentional effects | Includes bycatch of marsh birds in nutria and muskrat traps; localized loss of beaver wetlands | |
| | 5.1.3 | Persecution/Control | Includes persecution of timber rattlesnake, copperhead, and similar-looking species; localized excessive beaver trapping | |
| 5.2 Gathering Terrestrial Plants | | | Overharvesting plants, fungi, and other non-timber/non-animal products | This category focuses on plants, mushrooms, and other non-animal terrestrial species except trees which are treated in 5.3 Logging & Wood Harvesting . |
| | 5.2.1 | Intentional Use | Includes excessive collecting of orchids and other wildflowers, ginseng and other medicinal plants | |
| | 5.2.2 | Unintentional effects | Trampling or other habitat destruction | |
| | 5.2.3 | Control | | |
| 5.3 Logging and Wood Harvesting | | | Harvesting trees and other woody vegetation for timber, fibre, or fuel | Felling trees to clear agricultural land goes in the appropriate category in 2. Agriculture & Aquaculture . If it is a few timber species that are planted on a rotation cycle, it belongs in 2.2 Wood & Pulp Plantations . If it is multiple species or enrichment plantings in a quasi-natural system, it belongs here. |
| | 5.3.1 | Intentional Use (subsistence/small scale) | Management of public or private lands leading to loss, fragmentation, degradation, and isolation of forested habitats and species | |
| | 5.3.2 | Intentional Use (large scale) | Management of public or private lands leading to loss, fragmentation, degradation, and isolation of forested habitats and species | |
| | 5.3.3 | Unintentional effects (subsistence/small scale) | | |
| | 5.3.4 | Unintentional effects (large scale) | | |

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| | | 5.4 Fishing and Harvesting of Aquatic Resources | Harvesting aquatic wild animals or plants for commercial, recreation, subsistence, research, or cultural purposes, or for control/persecution reasons; includes accidental mortality/bycatch | This category focuses on all kinds of species that are primarily found in an aquatic environment. There are obviously some species that live on the terrestrial/aquatic boundary. Hunting otters, beavers, amphibians, polar bears, penguins, waterfowl, and sea birds should (somewhat arbitrarily) go in 5.1 Hunting & Collecting Terrestrial Animals . Hunting seals, whales and other marine mammals, and freshwater and marine turtles go here. It is important to consider the distinction between intentional and an unintentional fisheries - the former specifically targets a species or adjusts its fishing tactics to catch a particular species, whereas the unintentional option covers all other fisheries including bycatch and discards. |
| | 5.4.1 | Intentional Use (subsistence/small scale) | Includes potentially excessive horseshoe crab harvest, etc. | |
| | 5.4.2 | Intentional Use (large scale) | | |
| | 5.4.3 | Unintentional effects (subsistence/small scale) | Includes loss of diamond-backed terrapins in crab traps | |
| | 5.4.4 | Unintentional effects (large scale) | Includes loss of diamond-backed terrapins in crab traps; VA winter dredging of crabs causing terrapin loss | |
| | 5.4.5 | Persecution/Control | | |
| 6 Human Intrusions and Disturbance | | | Threats from human activities that alter, destroy and disturb habitats and species associated with non-consumptive uses of biological resources | Non-consumptive use means that the resource is not removed - multiple people can use the same resource (for example, birdwatching). These threats typically do not permanently destroy habitat except perhaps in extremely severe manifestations. |
| | | 6.1 Recreational Activities | People spending time in nature or traveling in vehicles outside of established transport corridors, usually for recreational reasons | This category does not include work involving consumptive use of biodiversity - for example disturbance impacts from loggers or hunters would be in the appropriate category in 5. Biological Resource Use . Vehicles and boats in established transport corridors go in 4. Transportation & Service Corridors . The development of permanent recreational or tourist facilities (such as hotels and resorts) should be included under section 1.3 Tourism & Recreation Areas rather than here. |
| | 6.1.1 | Off-road vehicles (motorized and non-motorized) | Direct mortality; vehicles driving over dunes or through streams increase erosion and sediment threats, increase spread of invasive plants, etc. | |
| | 6.1.2 | Boating | Includes disruption of waterbird colonies, other nesting habitats, or roosting areas in the course of recreational use | |
| | 6.1.3 | Use of beaches | Includes disruption of nesting, roosting, foraging birds on beaches by pedestrians and dogs | |
| | 6.1.4 | Exploration of caves/mines | Includes disruption of roosting, hibernating bats and other organisms in the course of recreational use | |
| | 6.1.5 | Rock climbing and repelling | Includes disruption of nesting habitats, roosting areas, and sunning areas in the course of recreational use | |
| | | 6.2 Military Exercises | Actions by formal or paramilitary forces without a permanent footprint | This category focuses on military activities that have a large impact on natural habitats, but are not permanently restricted to a single area. Permanent military bases should go under 1.2 Commercial & Industrial Areas . Other military activities might best be assigned to other categories. For example, hunting of specific animals by soldiers living off the land fits under 5.1 Hunting & Collecting Terrestrial Animals . |
| | 6.2.1 | Military exercises | Includes activities at Sideling Hill Creek, Aberdeen Proving Ground, Indian Head, Andrews AFB, etc. | |
| | | 6.3 Work and Other Activities | People spending time in or traveling in natural environments for reasons other than recreation or military activities, such as law enforcement, research | |
| | 6.3.1 | Unauthorized research projects at significant habitats | Includes excessive trampling impacts in rare natural communities | |

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|--|---------|---|---|---|
| 7 Natural Systems Modifications | | | Threats from actions that convert or degrade habitat in service of “managing” natural or semi-natural systems, often to improve human welfare | This category deals primarily with changes to natural processes such as fire, hydrology, and sedimentation, rather than land use. Thus it does not include threats relating to agriculture (which should be under 2. Agriculture & Aquaculture), or infrastructure (1. Residential & Commercial Development and 4. Transportation & Service Corridors). |
| 7.1 Fire and Fire Suppression | | | Suppression or increase in fire frequency and/or intensity outside of its natural range of variation | This category focuses on the human activities that lead to either not enough fire or too much fire in the ecosystem in question. If fire escapes from established agricultural lands, it belongs here, if fire is used to clear new agricultural lands, it belongs in the appropriate category in 2. Agriculture & Aquaculture . It also includes damaging "natural" fires in systems that have lost their natural resilience. |
| | 7.1.1 | Increase in Fire Frequency/Intensity | Including illegal fires set in lower Eastern Shore marshes in late winter | |
| | 7.1.2 | Suppression of Fire Frequency/Intensity | Including lack of fire in fire-dependent habitats | |
| 7.2 Dams and Water Management/Use | | | Changing water flow patterns from their natural range of variation either deliberately or as a result of other activities | This category focuses on the human activities that lead to either not enough water or too much water in the ecosystem in question. Note that homogenizing flows to a constant level may be outside the "natural range of variation." Dredging belongs in 4.3 Shipping Lanes. |
| | 7.2.1 | Abstraction of Surface Water (domestic use) | Includes water diversion from streams and rivers; ditching, impounding, and other marsh management techniques for mosquito control; stream channelization | |
| | 7.2.2 | Abstraction of Surface Water (commercial use) | | |
| | 7.2.3 | Abstraction of Surface Water (agricultural use) | Includes stream ditching and channelization | |
| | 7.2.5 | Abstraction of Ground Water (domestic use) | Includes the disruption of groundwater hydrology during construction of residential or commercial developments | |
| | 7.2.6 | Abstraction of Ground Water (commercial use) | Includes the disruption of groundwater hydrology during mining operations and hydraulic fracturing | |
| | 7.2.7 | Abstraction of Ground Water (agricultural use) | Includes groundwater pumping for irrigation | |
| | 7.2.9 | Small Dams | | |
| | 7.2.10 | Large Dams | | |
| | 7.2.11 | Dams (size unknown) | | |
| | 7.2.12 | Culverts | | |
| | 7.2.13 | Stream Burial | Loss of headwater/ intermittent streams | |
| | 7.2.14 | Impervious Surfaces | Hydrological alterations resulting in "flash" pulses of rainwater, loss of groundwater recharge areas, increased stream bank destabilization, etc. | |
| 7.3 Other Ecosystem Modifications | | | Other actions that convert or degrade habitat in service of “managing” natural systems to improve human welfare | This option includes both too much management (over-management) or too little (abandonment). The latter is particularly relevant when former agricultural lands are abandoned. |
| | 7.3.1 | Shoreline Stabilization | Includes rip-rap, jetties, bulkheads, groins, etc. | |
| | 7.3.2 | Inappropriate timing of mowing | Includes roadside mowing, haying of fields | |
| | 7.3.3 | Removal of coarse woody debris (streams, forests) | | |
| | 7.3.4 | Lack of natural disturbance patterns or ecosystem functions due to species loss | | |
| | 7.3.5 | Imbalanced predator-prey dynamics | Includes increased levels of predation by mesocarnivores due to loss of apex carnivores | |

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|---|---|---|---|--|
| 8 Invasive and Other Problematic Species, Genes and Diseases | | | Threats from non-native and native plants, animals, pathogens/microbes, or genetic materials that have or are predicted to have harmful effects on biodiversity following their introduction, spread and/or increase in abundance | After much deliberation it was decided to restrict the use of "invasive species" to refer to non-native species to keep things simple for policy makers. The term "problematic native species" is used instead to refer to native species that have become superabundant or otherwise cause problems. If possible, also record the source of the invasive species and/or conditions that exacerbate their effect. This is the class of threats that covers diseases. Where the Kingdom for a fungal disease is unknown, it should be coded under 8.1.1, 8.2.1 or 8.3.1 and the disease name should be noted in the text field. |
| | 8.1 Invasive Non-native/ Alien Species/ Diseases | | Harmful plants, animals, pathogens not originally found within the ecosystem(s) in question and directly or indirectly introduced and spread into it by human activities | We are defining non-native/alien/exotic species and diseases as those brought in either intentionally or accidentally by humans in the last 10,000 years. Note that for diseases, it is the infective agent which is considered to be the threat, with the disease being its manifestation in individuals. Domesticated livestock that has gone feral should be coded here, but there is a grey area concerning 'farmed' livestock which are allowed to roam wild; if these are rounded up periodically they could be considered "farmed" and coded under 2.3 Livestock Farming & Ranching . |
| | 8.1.1 | Unspecified Species | | |
| | 8.1.2 | Invasive non-native aquatic animals | Includes zebra mussel, blue catfish | |
| | 8.1.3 | Invasive non-native aquatic plants | Includes hydrilla, water chestnut | |
| | 8.1.4 | Invasive non-native terrestrial/wetland animals | Includes feral cats, hemlock woolly adelgid, feral horses | |
| | 8.1.5 | Invasive non-native terrestrial/wetland plants | Includes phragmites, garlic mustard | |
| | 8.1.6 | Invasive non-native fungal/bacterial diseases | Includes chytrid fungus, white-nose syndrome fungus | |
| | 8.2 Problematic Native Species/Diseases | | Harmful plants, animals, or pathogens that are originally found within the ecosystem(s) in question, but have become out-of-balance or released directly or indirectly due to human activities | It is a judgment call as to when a species becomes "problematic" or "outside its natural range of variation." |
| | 8.2.1 | Unspecified Species | | |
| | 8.2.2 | Named Species | Includes white-tailed deer, raccoon roundworm | |
| | 8.3 Introduced Genetic Material | | Human altered or transported organisms or genes | Hatchery fish are not necessarily invasive species, but they can upset the gene pool of native fish. |
| | 8.3.1 | Herbicide resistant crops | Includes loss of common milkweed from excessive agricultural herbicide applications resulting in loss and degradation of monarch habitat | |
| | 8.4 Problematic Species/Diseases of Unknown Origin | | | |
| | 8.4.1 | Unspecified Species | | |
| | 8.4.2 | Named Species | | |
| | 8.5 Viral/Prion-induced Diseases | | | |
| | 8.5.1 | Unspecified Species (Disease) | | |
| | 8.5.2 | Named Species (Disease) | Includes West Nile Virus, ranavirus, sudden oak death | |
| | 8.6 Diseases of Unknown Cause | | | |
| | | <i>List the specific disease</i> | | |
| 9 Pollution | | | Threats from introduction of exotic and/or excess materials or energy from point and nonpoint sources | This class deals with exotic or excess materials introduced to the environment. There is obviously a fine distinction when the pollution comes from another threat - for example, should an oil spill from a pipeline be classified as 4.2 Utility & Service Lines or 9.2 Industrial & Military Effluents ? You will have to exercise some judgment here as to which represents the direct threat in your situation. In some cases, the source of the pollution may be either unknown or from a historical source (e.g., heavy metals buried in sediments). In these cases, you may have to make an educated guess as to which category to assign the pollutant. |

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|---------|---------|--|--|--|
| | | 9.1 Domestic and Urban Waste Water | Water-borne sewage and non-point runoff from housing and urban areas that include nutrients, toxic chemicals and/or sediments | This category does not include major industrial discharge, which falls under 9.2 Industrial & Military Effluents . It does include chemicals and next generation pollutants (caffeine or pharmaceuticals) in household waste streams. Technically, sewage from a pipe is "point-source" whereas a leaking septic system is "nonpoint- source." This category does not include agricultural runoff, which falls under 9.3 Agricultural & Forestry Effluents . |
| | 9.1.1 | Sewage | Includes leaking septic systems, discharge from municipal wastewater treatment plants, untreated sewage | |
| | 9.1.2 | Run-off | Includes oil and sediment from roads, chemicals from roads and lawns, road salt, golf course chemicals, etc | |
| | 9.1.3 | Other | | |
| | | 9.2 Industrial and Military Effluents | Water-borne pollutants from industrial and military sources including mining, energy production, and other resource extraction industries that include nutrients, toxic chemicals and/or sediments | The source of the pollution is often far from the system – an extreme example are the heavy metals that migrating eels bring to the Sargasso Sea. Often, the pollutants only become a problem when they bioconcentrate through the food chain. Oil spills from pipelines should generally go here. |
| | 9.2.1 | Oil Spills | Includes leakage from fuel tanks, spills from pipelines, PCBs in river sediments | |
| | 9.2.2 | Seepage from Mining | Includes acid mine drainage, mine tailings | |
| | 9.2.3 | Other | | There are other known examples of industrial pollution, which are not specifically captured under the classification scheme. These should be coded here for now, and the type/cause of the pollution noted in the text box. Examples include: toxic chemicals from factories, illegal dumping of chemicals, other industrial effluent, ship waste discharge, etc. |
| | 9.2.3 | Other: Hydraulic fracturing | Includes toxic spills from failure of wastewater ponds, failure of pipe casements, etc | |
| | 9.2.4 | Other: Industrial toxic settling ponds | Increase in wildlife deaths from landing in or drinking from ponds | |
| | | 9.3 Agricultural and Forestry Effluents | Water-borne pollutants from agricultural, silvicultural, and aquaculture systems that include nutrients, toxic chemicals and/or sediments including the effects of these pollutants on the site where they are applied | Wind erosion of agricultural sediments or smoke from forest fires goes in 9.5 Air- Borne Pollutants . |
| | 9.3.1 | Nutrient Loads | Includes nutrient loading from fertilizer run-off, manure from feedlots, nutrients from aquaculture, etc. | |
| | 9.3.2 | Soil Erosion and Sedimentation | Includes soil erosion from overgrazing, increased run-off and hence sedimentation due to conversion of forests to agricultural lands, etc. | |
| | 9.3.3 | Herbicides and Pesticides | Includes herbicide run-off from agricultural fields, etc. | |
| | 9.3.3 | Control of insect pests leading to mortality of non-target species | Includes mosquito control using larvacides and adulticides, etc. | |
| | 9.3.4 | Other | | |
| | | 9.4 Garbage and Solid Waste | Rubbish and other solid materials including those that entangle wildlife | This category generally is for solid waste outside of designated landfills - landfills themselves should go in 1.2 Commercial & Industrial Areas . Likewise, toxins leaching from solid waste - for example, mercury leaking out of a landfill into groundwater - should go in 9.2 Industrial & Military Effluents . |
| | 9.4.1 | List the type, source, and if possible, the specific pollutants of concern | Includes municipal waste, litter from cars and boats, waste that entangles or strangles wildlife, construction debris, etc. | |
| | | 9.5 Airborne Pollutants | Atmospheric pollutants from point and nonpoint sources | It may be difficult to determine the sources of many atmospheric pollutants – and thus hard to take action to counter them. |

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|-----------|--|----------------------------------|--|--|
| | 9.5.1 | Acid Rain | Includes acid rain, excess nitrogen deposition, wind dispersion of pollutants or sediments, radioactive fallout, smoke from forest fires, etc. | |
| | 9.5.2 | Smog | Includes smog from vehicle emissions, coal burning, smoke from forest fires, wind dispersion of pollutants or sediments, hydraulic fracturing pollutants, etc. | Smog is a type of air pollution derived from vehicular emission from internal combustion engines and industrial fumes that react in the atmosphere with sunlight to form secondary pollutants that also combine with the primary emissions to form photochemical smog. Smog is also caused by large amounts of coal burning in an area caused by a mixture of smoke, sulphur dioxide and other components. |
| | 9.5.3 | Ozone | Includes ozone from vehicle emissions, factory smoke emissions, smoke from forest fires, wind dispersion of pollutants or sediments, etc. | Ozone is not emitted directly by car engines or by industrial operations, but formed by the reaction of sunlight on air containing hydrocarbons and nitrogen oxides that react to form ozone directly at the source of the pollution or many kilometers down wind. |
| | 9.5.4 | Methane | Includes methane from hydraulic fracturing emissions | |
| | 9.5.5 | Herbicides and Pesticides | Includes impacts to non-target organisms and habitats from aerial application of chemicals to control pests, such as gypsy moths, mosquitos, etc. | |
| | 9.6 Excess Energy | | Inputs of heat, sound, or light that disturb wildlife or ecosystems | These inputs of energy can have strong effects on some species or ecosystems. |
| | 9.6.1 | Light Pollution | Includes lamps attracting insects, beach lights disorienting turtles, tower lights disorienting migrating birds, etc. | |
| | 9.6.2 | Thermal Pollution | Includes heated water from power plants and impervious surfaces, damaging atmospheric radiation resulting from ozone holes, etc. | |
| | 9.6.3 | Noise Pollution | Includes noise from highways or airplanes, sonar from submarines that disturb whales, offshore wind development construction, etc. | |
| | 9.6.4 | <i>Other</i> | | |
| 10 | Geological Events | | Threats from geological events that may eliminate a vulnerable species or habitat | Strictly speaking, geological events may be part of natural disturbance regimes in many ecosystems. But they need to be considered a threat if a species or habitat is damaged from other threats and has lost its resilience and is thus vulnerable to the disturbance. |
| | 10.1 Volcanoes | | | |
| | | <i>List the specific problem</i> | | |
| | 10.2 Earthquake/Tsunamis | | | |
| | | <i>List the specific problem</i> | Increase in seismic activity | |
| | 10.3 Avalanches/Landslides | | | |
| | | <i>List the specific problem</i> | Includes mudslides, landslides, etc. | |
| 11 | Climate Change and Severe Weather | | Threats from long-term climatic changes or other severe weather that may eliminate a vulnerable species or habitat | Strictly speaking climatic events may be part of natural disturbance regimes in many ecosystems. But they are a threat if a species or habitat is damaged from other threats and has lost its resilience and is thus vulnerable to the disturbance. Many climatic events may also be increasing in frequency or intensity outside their natural range of variation due to human causes. |
| | 11.1 Habitat Shifting or Alteration | | Major changes in habitat composition and location | This category focuses primarily on the habitat effects of climate change. |
| | 11.1.1 | Sea Level Rise | Includes coastal habitat alterations, such as existing tidal marshes converting to open water and adjacent uplands converting to tidal marshes | |
| | 11.2 Droughts | | Periods in which rainfall falls below the normal range of variation | |
| | 11.2.1 | Droughts | Timing of droughts may eliminate small wetlands and streams; freshwater mussel loss | |

IUCN THREAT Categories - adapted for use in Maryland's State Wildlife Action Plan

| Level 1 | Level 2 | Level 3 | Definition / Details | Exposition |
|-------------------------------------|-------------|--|---|------------|
| | | 11.3 Temperature Extremes | Periods in which temperatures exceed or go below the normal range of variation; Includes heat waves, extreme cold spells, oceanic temperature changes, etc. | |
| | 11.3.1 | Temperature extremes | Includes surface temperature increase and general temperature increases that lead to loss of habitats and species adapted to cooler temperatures, such as "frost pocket" wetlands in Garrett County | |
| | | 11.4 Storms and Flooding | Extreme precipitation and/or wind events, including hurricanes, tornados, ice storms, excessive beach erosion | |
| | 11.4.1 | Storms and flooding | Extreme flooding breaches existing natural sand berms along shores that normally limit tidal flooding events and cause conversion of "baymouth barrier wetlands" to open water or other natural communities | |
| | | 11.5 Phenology Shifting or Alteration | | |
| | 11.5.1 | Phenology shifts related to pollination ecology | Includes timing of host plant life history is mismatched with timing of wildlife life history, i.e., plants may bloom before required pollinators are present | |
| | 11.5.2 | Phenology shifts related to predator-prey ecology | Includes mismatched timing of animal movements with their prey item life cycle, e.g., migratory songbirds may not return in spring at time of maximum caterpillar emergence | |
| | 11.6 | Increased Rainfall | Includes long-term increases in soil moisture | |
| 12 Resource Management Needs | | | | |
| | | 12.1 Resource information collection needs | | |
| | 12.1.1 | Lack of initial baseline inventory | Includes need for new surveys for new SGCN and new surveys in undersurveyed or new locations | |
| | 12.1.2 | Lack of up-to-date existing information | Includes resurveying previous locations; monitoring | |
| | 12.1.3 | Need to answer research question | May include monitoring | |
| | 12.1.4 | Need to develop new technique | | |
| | | 12.2 Management decision needs | | |
| | 12.2.1 | Need to provide technical assistance | Includes assistance to landowners, public and private land managers, government agencies | |
| | 12.2.2 | Need to conduct environmental reviews | Includes review and providing recommendations to avoid, minimize, and mitigate impacts to various types of private or public development projects | |
| | 12.2.3 | Need for fish, wildlife and/or habitat planning | Includes creating, regularly reviewing, and updating species management plans, public land management plans, private land management plans, prioritization or targeting plans | |
| 13 Recreation Needs | | | | |
| | | 13.1 Training Needs | | |
| | 13.1.1 | Need for more and/or improved training in outdoor recreational methods | | |
| | 13.1.2 | Need to improve safety/ethics in outdoor recreation | | |

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| Level 1 | Level 2 | Level 3 | Definition / Details | Exposition |
|-------------------------------------|---------------------------------|--|---|------------|
| | 13.2 Public access needs | | | |
| | 13.2.1 | Need for more public access to areas or facilities for outdoor recreation | | |
| | 13.2.2 | Need to maintain or improve quality of areas or facilities for outdoor recreation | | |
| | 13.3 Utilization needs | | | |
| | 13.3.1 | Lack of information on how fish and wildlife resources are utilized | | |
| | 13.3.2 | Lack of information on how outdoor recreation areas and facilities are utilized | | |
| | 13.3.3 | Lack of information on locations of fish and wildlife resources and public access areas and facilities | | |
| | 13.3.4 | Need to maintain or increase recruitment and/or retention of outdoor recreationalists | | |
| 14 Education/ Outreach Needs | | | | |
| | 14.1 Utilization needs | | | |
| | 14.1.1 | Need to maintain or increase supply of fish to support fishing | | |
| | 14.2 Education needs | | | |
| | 14.2.1 | Need for improved knowledge of fish and wildlife and their habitats | Includes training for contractors to recognize vernal pools and other wetland types | |
| | 14.2.2 | Lack of aquatic resources and wildlife education facilities | | |
| | 14.2.3 | Need for improved knowledge of WSFR grant programs and their accomplishments | | |
| | 14.3 Outreach needs | | | |
| | 14.3.1 | Need to develop and/or maintain a broad base of support for agency goals and objectives | | |
| | 14.3.2 | Need to maintain and/or increase constituent base | | |

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| Level 1 | Level 2 | Level 3 | Definition / Details | Exposition |
|--------------------------------|---|--|---|------------|
| 15 Administrative Needs | | | | |
| | 15.1 Infrastructure needs | | | |
| | 15.1.1 | Need to maintain or improve fish and wildlife agency administrative facilities | | |
| | 15.1.2 | Need to maintain or improve information management systems | Includes Biotics central GIS | |
| | 15.2 Organizational/program planning needs | | | |
| | 15.2.1 | Need for agency organizational planning to meet goals and objectives | | |
| | 15.2.2 | Need for WSFR program/subprogram planning to meet goals and objectives | | |
| | 15.3 Coordination/administration needs | | | |
| | 15.3.1 | Need for agency administrative support for effective operations | | |
| | 15.3.2 | Need for coordination for effective program/project management | | |
| | 15.3.3 | Need for increased legal protection | Includes updating existing laws/regulations and enacting new laws/regulations | |
| | 15.3.4 | Need for increased enforcement of laws | | |
| | 15.3.5 | Need for changes in government policies | | |