



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	

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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		