

6. Conservation Issues and Actions

Some Conservation Issues impact only one or a few key habitats, some impact a broad array of habitats, and a few are independent of habitat. In addition, there are other issues that affect key habitats or SGCN indirectly by impacting resource management capacity. This section examines Conservation Issues and Actions in those four groups: individual key habitats, multiple key habitats, habitat-independent, and institutional capacity.

6.1. Key Wildlife Habitats: Descriptions and Conservation Issues and Actions

For each key habitat, the following pages contain a brief Description, Vital Statistics, Present Condition, Habitats of Conservation Concern, Associated Species of Greatest Conservation Need, and Conservation Issues and Actions that are specific to only one or a few key habitats. Additional issues and actions that pertain to many key habitats are in Section 6.2.

Attributes of Habitats of Conservation Concern and SGCN are presented in Vital Statistics tables for each key habitat. In these tables, “Protected” is defined as GAP Stewardship Status 2 or 3, which are lands that are permanently protected from habitat conversion and managed to some extent to maintain a natural state. Section 3.2 discusses the basis for the species-habitat associations that are summarized under “SGCN Species associated with HCC” in the tables and listed in detail in Appendix C; these numbers include species with known occurrences. The number of associated species may be a more accurate representation of the importance of a habitat to SGCN than is the number of known species or occurrences, since the latter may reflect insufficient inventory. Also, the typically high percentage of known SGCN species and occurrences that are protected is a function of most inventories having been conducted on conservation lands, where landowner permission is not an issue.

See Section 4.2.2 for a description of Present Condition categories.

Assignment of Conservation Issues to individual Habitats of Conservation Concern was not practical because of insufficient knowledge of impacts at that level of detail. Instead, Habitats of Conservation Concern were rolled up into the next highest level of the Wildlife Habitat Classification, typically the “blue” level (Section 4.1), for consideration of issues.

More information about many of Delaware’s wildlife habitats and SGCN can be found in *The Natural Communities of Delaware* (from which the descriptions below were largely taken), which contains detailed characterizations of Habitats of Conservation Concern. Other sources include the Whole Basin Management reports and various Natural Heritage Program reports on state wildlife areas, parks, forests and natural communities.

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6.1.1. SGCN Occurrences

Issues and actions are not listed for SGCN Occurrences since these species are included under the appropriate habitats.

6.1.2. Beach and Dune Habitats

Description

These coastal habitats are adapted to the dynamic conditions of shifting sands, strong winds and salt spray unique to the narrow zone along the Atlantic Ocean and Delaware Bay. They range from the beach – covered and exposed by the twice-daily tides – to the first grassy dunes and overwashes, to a complex of shrub-dominated back dunes.

Vital Statistics

Beach and Dune Habitats		
Attribute	Total	Protected
HCC* Acreage	3,375	1,905 (56%)
HCC Occurrences	227	169 (74%)
Known SGCN Species / Occurrences in HCC	14 / 37	12 / 34 (86% / 92%)
SGCN Species associated with HCC	26	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. These habitats have declined significantly in extent and quality during historical times primarily because of residential development and associated infrastructure, particularly artificial shoreline hardening and jetties and groins. In recent decades, this decline has greatly slowed on the Atlantic Coast, where most remaining habitats are on public land. Losses continue, albeit more slowly, along the shorelines of the Delaware Bay and Inland Bays. All of these habitats are subjected to on-going impacts from recreational activities, and Delaware Bay beaches in particular are occasionally impacted by oil spills. The long term prospect for beaches and dunes is potentially poor given predicted sea level rise, even though these disturbance-dependent habitats might be expected to accommodate sea level rise reasonably well by migrating inland. However, onshore and offshore coastal processes that would facilitate such a shift, especially sand transport, may have already been irreversibly compromised by the issues noted above. Efforts to stabilize dunes may also further disrupt these processes in the future, despite their seeming benefits at present. Beach

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replenishment is a potential solution to the loss of natural sand transport, but costs are very high and nearshore habitats that serve as a sand source may be adversely impacted.

Habitats of Conservation Concern

- Unvegetated Sandy Beach
- Beach Foredune
- Overwash Dune Grassland
- Beachgrass – Panicgrass Dune Grassland
- Wax-myrtle - Groundsel-tree Maritime Shrubland
- Bayberry - Beach Plum Maritime Shrubland
- Greenbrier - Poison Ivy Dune Shrubland
- Beach Heather Dune Shrubland

Associated Species of Greatest Conservation Need

Beach and Dune Habitats			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Cicindela dorsalis media</i>	white tiger beetle
		<i>Cicindela lepida</i>	little white tiger beetle
	Reptiles	<i>Malaclemys terrapin terrapin</i>	Northern diamondback terrapin
	Birds	<i>Charadrius melodus</i>	piping plover
		<i>Haematopus palliatus</i>	American oystercatcher
		<i>Arenaria interpres</i>	ruddy turnstone
		<i>Calidris canutus</i>	red knot
		<i>Calidris alba</i>	sanderling
		<i>Sterna hirundo</i>	common tern
		<i>Sterna antillarum</i>	least tern
		<i>Rynchops niger</i>	black skimmer
<i>Chordeiles minor</i>		common nighthawk	

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Beach and Dune Habitats			
Tier	Class	Scientific Name	Common Name
2	Insects	<i>Cicindela dorsalis</i>	Eastern beach tiger beetle
		<i>Cicindela hirticollis</i>	beach-dune tiger beetle
		<i>Melitara prodenialis</i>	a snout-moth
		<i>Drasteria graphica atlantica</i>	Atlantic graphic moth
		<i>Schinia spinosae</i>	a noctuid moth
	Birds	<i>Falco peregrinus</i>	peregrine falcon
		<i>Pluvialis squatarola</i>	black-bellied plover
		<i>Catoptrophorus semipalmatus</i>	willet
		<i>Calidris pusilla</i>	semipalmated sandpiper
		<i>Calidris maritima</i>	purple sandpiper
		<i>Calidris alpina</i>	dunlin
		<i>Larus marinus</i>	great black-backed gull
		<i>Pipilo erythrophthalmus</i>	Eastern towhee
<i>Passerculus sandwichensis</i>	savannah sparrow		

Conservation Issues and Actions

Beach and Dune Habitats		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Piers and Docks	See Section 6.2.2
Shoreline Protection Practices	Loss of Natural Beach Dynamics from Jetties and Groins	Work with the Division of Soil and Water Conservation to assess and monitor the environmental and economic costs and benefits of individual jetties and groins, and remove those that are ineffective or obsolete.

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Beach and Dune Habitats		
Issue Category	Specific Issue	Specific Action
		Work with the Division of Soil and Water Conservation to identify new materials and methods that use jetties and groins to protect, create or restore key habitats.
		Work with the Division of Soil and Water Conservation to develop a source of funding for using beach renourishment to mitigate the impacts of jetties and groins on key habitats.
	Beach Renourishment	Work with the Division of Soil and Water Conservation to develop state policies for the timing of beach renourishment, and standards for composition and placement of materials, to minimize short-term impacts to nesting sites, roosts and other critical areas.
	Dune Construction/Stabilization	Work with the Division of Soil and Water Conservation to assess needs of beach-nesting birds for overwash habitat, and work with public and private landowners to adapt stabilization projects to allow for this need.
	Artificial Shoreline Hardening	Work with the Division of Soil and Water Conservation to develop education and outreach, incentives, partnerships and/or regulations as necessary to include private landowners in beach renourishment projects, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Utility Corridors	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	White-tailed Deer	Work with hunters to increase deer harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase deer harvest as necessary to reduce impacts to key habitats.

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Beach and Dune Habitats		
Issue Category	Specific Issue	Specific Action
		Develop education and outreach encouraging landowners to increase deer harvest on private lands as necessary to reduce impacts to key habitats.
		Continue to evaluate Quality Deer Management as a long-term strategy for minimizing impacts to key habitats.
	Invasive Plants	<i>See Section 6.2.6</i>
Solid Waste Disposal	Beach Cleanup Activities (raking, events)	Schedule beach cleanup events to avoid nesting periods, peak migration and other critical times for SGCN.
		Develop education and outreach for beach cleanup participants about minimizing impacts to SGCN.
		Develop state policies for beach raking on state lands to modify or suspend activities during nesting periods, peak migration and other critical times for SGCN.
		Encourage municipalities to modify or suspend beach raking during nesting periods, peak migration and other critical times for SGCN.
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Recreational Activities	Recreational Use On Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Resource Management	Habitat/Wildlife Management	Implement the Piping Plover Recovery Plan.
		<i>See Section 0 for more actions.</i>

6.1.3. Early Successional Upland Habitats

Description

Early successional upland habitats typically result from the abandonment of agricultural fields, pastures or other cleared land. Over several decades, pioneering grasses and forbs gradually give way to shrubs and tree seedlings. If left alone, these habitats will

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eventually succeed into forests. Some areas, usually on state or NGO conservation lands, are managed to maintain this habitat by means of periodic mowing, grazing or burning. Mapping of many Early Successional Upland Habitats was accomplished through habitat modeling based on species-habitat associations, and these sites require field verification.

Vital Statistics

Early Successional Upland Habitats		
Attribute	Total	Protected
HCC* Acreage	25,198	7,755 (31%)
HCC Occurrences	1,486	714 (48%)
Known SGCN Species / Occurrences in HCC	20 / 24	14 / 15 (70% / 63%)
Associated SGCN Species	48	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Fallow agricultural fields and weedy field borders were once a fairly common site in Delaware, yet they have dwindled in recent decades with more intensive farming practices as well as from natural succession on abandoned agricultural lands. Incentive programs to reduce tillage are on the rise, but their effect so far has been modest. Also, the relentless conversion of farms to residential development threatens the long-term effectiveness of these efforts. There are numerous small occurrences of this habitat on roadsides, utility corridors and the like, although maintenance regimes on these areas may compromise their ecological value. Several public agencies and private conservation organizations are actively managing for early successional habitat, but whether or not this will ensure sufficient extent and distribution is uncertain. In addition, perpetual management is required to thwart natural succession, and costs for controlling invasive exotic plants may be especially high.

Habitats of Conservation Concern

- Herbaceous Early Successional Upland Habitats
- Shrub/Brush Early Successional Upland Habitats

Associated Species of Greatest Conservation Need

Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Nicrophorus americanus</i>	American burying beetle

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Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
		<i>Callophrys irus</i>	frosted elfin
		<i>Papaipema maritima</i>	maritime sunflower borer moth
	Reptiles	<i>Terrapene carolina</i>	Eastern box turtle
		<i>Lampropeltis triangulum</i>	milk snake
	Birds	<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Circus cyaneus</i>	Northern harrier
		<i>Bartramia longicauda</i>	upland sandpiper
		<i>Scolopax minor</i>	American woodcock
		<i>Asio flammeus</i>	short-eared owl
		<i>Chordeiles minor</i>	common nighthawk
		<i>Lanius ludovicianus</i>	loggerhead shrike
		<i>Dendroica discolor</i>	prairie warbler
		<i>Ammodramus henslowii</i>	Henslow's sparrow
2	Insects	<i>Cicindela scutellaris</i>	festive tiger beetle
		<i>Atrytonopsis hianna</i>	dusted skipper
		<i>Satyrium liparops</i>	striped hairstreak
		<i>Satyrium liparops strigosum</i>	striped hairstreak
		<i>Callophrys gryneus</i>	juniper hairstreak
		<i>Speyeria aphrodite</i>	aphrodite fritillary
		<i>Speyeria idalia</i>	regal fritillary
		<i>Boloria bellona</i>	meadow fritillary
		<i>Paratreia plebeja</i>	trumpet vine sphinx
		<i>Calyptra canadensis</i>	Canadian owlet

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Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
		<i>Acronicta rubricoma</i>	a dagger moth
		<i>Papaipema rigida</i>	rigid sunflower borer moth
		<i>Cirrhophanus triangulifer</i>	a noctuid moth
		<i>Schinia septentrionalis</i>	a noctuid moth
	Birds	<i>Plegadis falcinellus</i>	glossy ibis
		<i>Cygnus columbianus</i>	tundra swan
		<i>Coragyps atratus</i>	black vulture
		<i>Colinus virginianus</i>	Northern bobwhite
		<i>Pluvialis squatarola</i>	black-bellied plover
		<i>Coccyzus erythrophthalmus</i>	black-billed cuckoo
		<i>Chaetura pelagica</i>	chimney swift
		<i>Colaptes auratus</i>	Northern flicker
		<i>Empidonax minimus</i>	least flycatcher
		<i>Tyrannus tyrannus</i>	Eastern kingbird
		<i>Toxostoma rufum</i>	brown thrasher
		<i>Dendroica pensylvanica</i>	chestnut-sided warbler
		<i>Icteria virens</i>	yellow-breasted chat
		<i>Pipilo erythrophthalmus</i>	Eastern towhee
		<i>Spizella pusilla</i>	field sparrow
		<i>Pooecetes gramineus</i>	vesper sparrow
<i>Passerculus sandwichensis</i>	savannah sparrow		
<i>Ammodramus savannarum</i>	grasshopper sparrow		
<i>Dolichonyx oryzivorus</i>	bobolink		

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Early Successional Upland Habitats			
Tier	Class	Scientific Name	Common Name
	Mammals	<i>Cryptotis parva</i>	least shrew

Conservation Issues and Actions

Early Successional Upland Habitats		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Agricultural Harvesting Practices	Work with the Delaware Department of Agriculture and the agricultural community to provide incentives for private landowners to modify harvest methods and timing to minimize impacts to SGCN.
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Utility Corridors	See Section 6.2.1
	Dredge Spoil Disposal	See Section 6.2.1
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Solid Waste Disposal	Landfill Facilities	See Section 6.2.1
Changes in Fire Regimes	Fire Suppression	Integrate prescribed burning into management of early successional habitats as appropriate.
		Provide staff training on prescribed burning practices for early successional habitats.
		Evaluate the need for an inter-agency "burn team" to leverage resources and expertise.

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Early Successional Upland Habitats		
Issue Category	Specific Issue	Specific Action
		Develop education and outreach for landowners adjacent to areas targeted for burning.
		Provide incentives and/or technical support for private landowners to conduct prescribed burns of early successional habitats.
	Firefighting Practices	Work with the Delaware State Fire School to integrate conservation of key habitats and SGCN into practices for fighting wildfires.
Energy Production	Wind Farm Facilities	Work with energy companies to develop standards for the location of wind farms to minimize loss and fragmentation of key habitats.
Recreational Activities	Off-Road Vehicles	<i>See Section 0</i>
Airport Operations	Bird Strike Hazard Management	Work with airports to integrate early successional habitat into bird strike management.
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

6.1.4. Coastal Plain Upland Forests

Description

Found on dry or moist, but not wet, soils, Coastal Plain upland forests vary from mixed deciduous types – mostly oaks and hickories – in central Delaware, to pure stands of loblolly pine in the south. Likewise, vegetation on the forest floor may range from sparse heaths on dry sites to impenetrable thickets of sweet pepperbush in moist areas. Mapping of many Ancient Sand Ridge Forests was accomplished through habitat modeling based on topography, and these sites require field verification.

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Vital Statistics

Coastal Plain Upland Forests		
Attribute	Total	Protected
HCC* Acreage	3,462	476 (14%)
HCC Occurrences	709	105 (15%)
Known SGCN Species / Occurrences in HCC	5 / 6	4 / 5 (80% / 83%)
SGCN Species associated with HCC	48	

*HCC = Habitats of Conservation Concern.

Present Condition

Poor. Although data is not available for specific forest types, Coastal Plain Upland Forests are believed to have followed the trend of all upland forest types in Delaware, that of a long-term severe decline that continues to this day. See the discussion of Present Condition under Forest Blocks (Section 6.1.19) for more information. Compared to some other key habitats, relatively little upland forest is protected by conservation ownership, and regulatory protection is weak. Reforestation is possible but labor-intensive and time-consuming, and requires a lengthy commitment to managing impacts from deer browse, invasive exotic plants and other issues. Also, most of the state's upland forest types benefit from periodic fires that maintain oak dominance, and use of prescribed fire becomes increasingly difficult with greater residential development.

Habitats of Conservation Concern

- Chestnut Oak – Hairgrass Forest
- Tuliptree Rich Wood (Coastal Plain variant)
- Ancient Sand Ridge Forest

Associated Species of Greatest Conservation Need

Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Cicindela patruela consentanea</i>	Northern barrens tiger beetle
		<i>Callophrys irus</i>	frosted elfin
		<i>Catocala antinympha</i>	sweetfern underwing
		<i>Catocala lacrymosa</i>	tearful underwing
	Reptiles	<i>Terrapene carolina</i>	Eastern box turtle

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Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
		<i>Eumeces laticeps</i>	broadhead skink
		<i>Cemophora coccinea</i>	scarlet snake
		<i>Elaphe guttata</i>	corn snake
		<i>Lampropeltis triangulum</i>	milk snake
	Birds	<i>Haliaeetus leucocephalus</i>	bald eagle
		<i>Accipiter cooperii</i>	Cooper's hawk
		<i>Buteo platypterus</i>	broad-winged hawk
		<i>Asio otus</i>	long-eared owl
		<i>Melanerpes erythrocephalus</i>	red-headed woodpecker
		<i>Certhia americana</i>	brown creeper
		<i>Hylocichla mustelina</i>	wood thrush
	<i>Wilsonia citrina</i>	hooded warbler	
	Mammals	<i>Sciurus niger cinereus</i>	Delmarva fox squirrel
2	Gastropods	<i>Discus catskillensis</i>	angular disc
	Insects	<i>Cicindela patruela</i>	Northern barrens tiger beetle
		<i>Cicindela unipunctata</i>	one-spotted tiger beetle
		<i>Photuris frontalis</i>	a firefly
		<i>Erynnis martialis</i>	mottled duskywing
		<i>Erynnis baptisiae</i>	wild indigo duskywing
		<i>Battus philenor</i>	pipevine swallowtail
		<i>Polygonia progne</i>	gray comma
		<i>Caripeta aretaria</i>	a geometer moth
		<i>Tolype notialis</i>	a lasiocampid moth
		<i>Hemileuca maia maia</i>	the buckmoth
		<i>Cisthene kentuckiensis</i>	Kentucky lichen moth
		<i>Cisthene tenuifascia</i>	a lichen moth
		<i>Grammia phyllira</i>	phyllira tiger moth
<i>Zale metata</i>	a noctuid moth		

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Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
		<i>Catocala flebilis</i>	mournful underwing
		<i>Catocala residua</i>	residua underwing
		<i>Catocala cerogama</i>	yellow banded underwing
		<i>Acronicta exilis</i>	exiled dagger moth
		<i>Acronicta lithospila</i>	streaked dagger moth
		<i>Papaipema araliae</i>	aralia shoot borer moth
		<i>Papaipema baptisiae</i>	wild indigo borer moth
		<i>Lepipolys perscripta</i>	a noctuid moth
	Reptiles	<i>Scincella lateralis</i>	ground skink
		<i>Heterodon platirhinos</i>	Eastern hognose snake
		<i>Lampropeltis getula</i>	common kingsnake
		<i>Storeria occipitomaculata</i>	redbelly snake
		<i>Virginia valeriae</i>	smooth earth snake
		<i>Agkistrodon contortrix</i>	copperhead
	Birds	<i>Coragyps atratus</i>	black vulture
		<i>Strix varia</i>	barred owl
		<i>Caprimulgus vociferus</i>	whip-poor-will
		<i>Colaptes auratus</i>	Northern flicker
		<i>Myiarchus crinitus</i>	great crested flycatcher
		<i>Sitta pusilla</i>	brown-headed nuthatch
		<i>Vireo flavifrons</i>	yellow-throated vireo
		<i>Dendroica dominica</i>	yellow-throated warbler
		<i>Mniotilta varia</i>	black-and-white warbler
		<i>Seiurus motacilla</i>	Louisiana waterthrush
		<i>Oporornis formosus</i>	Kentucky warbler
		<i>Piranga olivacea</i>	scarlet tanager
		<i>Pipilo erythrophthalmus</i>	Eastern towhee
<i>Icterus galbula</i>	Baltimore oriole		

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Coastal Plain Upland Forests			
Tier	Class	Scientific Name	Common Name
	Mammals	<i>Lasionycteris noctivagans</i>	silver-haired bat
		<i>Lasiurus borealis</i>	Eastern red bat
		<i>Lasiurus cinereus</i>	hoary bat
		<i>Canis latrans</i>	coyote

Conservation Issues and Actions

Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	Evaluate mechanisms for protecting key upland forest habitats on private property by means of education and outreach, partnerships, voluntary guidelines, incentives and/or regulation, as necessary.
		Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
		<i>See Section 6.2.1 for additional actions</i>
Agricultural and Forestry Operations	Farmland	Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
		Work with the Delaware Forest Service and the Landowner Incentives Program to develop incentives for forest owners that prepare management plans specifically promoting conservation of key habitats and SGCN.
		<i>See Section 6.2.1 for additional actions</i>
	Livestock Grazing	Work with the Delaware Department of Agriculture and the Landowner Incentives Program to provide incentives to private landowners to exclude livestock from key habitats.
	Clearcutting and Other Forestry Practices	Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.

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Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
		Encourage the Delaware Department of Agriculture to revise the scoring system of the Agricultural Lands Preservation Act to give increased weight to conservation of key habitats and SGCN.
		<i>See Section 6.2.3 for additional actions</i>
Industrial Development and Operations	Industrial Facilities	<i>See Section 6.2.1 for additional actions</i>
	Air Pollution	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Utility Corridors	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	White-Tailed Deer	Work with hunters to increase deer harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase deer harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase deer harvest on private lands as necessary to reduce impacts to key habitats.
		Continue to evaluate Quality Deer Management as a long-term strategy for minimizing impacts to key habitats.
	Gypsy Moth	Support continued gypsy moth monitoring by the Delaware Department of Agriculture.
		Work with the Delaware Department of Agriculture to provide incentives to landowners for gypsy moth control in key habitats on private lands.
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.

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Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
	European Starling	Assess and monitor the effectiveness of nest boxes, snag creation and other practices to enhance the success of cavity-nesting SGCN.
	Invasive Earthworms	Assess the impacts of invasive earthworms on forests and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts as necessary.
	Invasive Plants	<i>See Section 6.2.6</i>
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Solid Waste Disposal	Landfill Facilities	<i>See Section 6.2.1</i>
Changes in Fire Regimes	Fire Suppression	Integrate prescribed burning into management of upland forests as appropriate.
		Provide staff training on prescribed burning practices for upland forests.
		Evaluate the need for an inter-agency "burn team" to leverage resources and expertise.
		Develop education and outreach for landowners adjacent to areas targeted for burning.
	Provide incentives and/or technical support for private landowners to conduct prescribed burns of upland forests.	
	Firefighting Practices	Work with the Delaware State Fire School to integrate conservation of key habitats and SGCN into practices for fighting wildfires.
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Energy Production	Wind Farm Facilities	Work with energy companies to develop standards for the location of wind farms to minimize loss and fragmentation of key habitats.
Recreational Activities	Off-Road Vehicles	<i>See Section 0</i>
Wildlife Harvesting	Inappropriate Hunting and Fishing	Develop education and outreach for hunters about the Delmarva fox squirrel to minimize impacts from accidental killing.

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Coastal Plain Upland Forests		
Issue Category	Specific Issue	Specific Action
		Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.
Resource Management	Habitat/Wildlife Management	Implement the Delmarva Fox Squirrel Recovery Plan.
		<i>See Section 0 for more actions.</i>

6.1.5. Coastal Plain Forested Floodplains and Riparian Swamps

Description

These forests are found upstream of the head of tidal influence on seasonally inundated floodplains, and in floodplain depressions having saturated soils. Red maple is found throughout in association with several other canopy species, most notably bald cypress in certain types. The herbaceous layer is often very diverse.

Vital Statistics

Coastal Plain Forested Floodplains and Riparian Swamps		
Attribute	Total	Protected
HCC* Acreage	818	522 (64%)
HCC Occurrences	37	17 (46%)
Known SGCN Species / Occurrences in HCC	8 / 8	6 / 6 (75% / 75%)
SGCN Species associated with HCC	53	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Wetland forests have generally fared better than upland forests because they typically can not be developed and are difficult to log; still, many are cut in dry years (see the discussion of forest loss under the previous habitat). Also, substantially more of these

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forests are protected – either through conservation ownership or regulation – than are their upland counterparts, although many lack adequate buffers to prevent degradation from sediment and nutrient runoff. Nonetheless, forecasted sea level rise may greatly impact these habitats over the long run. Since clearing for agriculture and development has eliminated or substantially reduced buffers around many wetland forests, there is limited opportunity for upslope migration in the face of rising water levels.

Habitats of Conservation Concern

- Black Ash Seepage Swamp
- Baldcypress – Red Maple – Swamp Black Gum Swamp

Associated Species of Greatest Conservation Need

Coastal Plain Forested Floodplains and Riparian Swamps			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Satyrium kingi</i>	King's hairstreak
	Reptiles	<i>Clemmys guttata</i>	spotted turtle
		<i>Terrapene carolina</i>	Eastern box turtle
		<i>Nerodia erythrogaster</i>	plainbelly water snake
	Birds	<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Buteo platypterus</i>	broad-winged hawk
		<i>Melanerpes erythrocephalus</i>	red-headed woodpecker
		<i>Hylocichla mustelina</i>	wood thrush
		<i>Parula americana</i>	Northern parula
		<i>Setophaga ruticilla</i>	American redstart
	<i>Limnothlypis swainsonii</i>	Swainson's warbler	
2	Insects	<i>Amblyscirtes aesculapius</i>	lace-winged roadside-skipper
		<i>Amblyscirtes carolina</i>	Carolina roadside-skipper
		<i>Libytheana carinenta</i>	American snout
		<i>Anacamptodes pergracilis</i>	cypress looper
		<i>Chloropteryx tepperaria</i>	angle winged emerald moth
		<i>Manduca jasminearum</i>	ash sphinx
		<i>Dolba hylaeus</i>	black alder or pawpaw sphinx

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Coastal Plain Forested Floodplains and Riparian Swamps			
Tier	Class	Scientific Name	Common Name
		<i>Haploa colona</i>	a tiger moth
		<i>Orgyia detrita</i>	a tussock moth
		<i>Catocala unijuga</i>	once-married underwing
		<i>Catocala praeclara</i>	praeclara underwing
		<i>Parapamea buffaloensis</i>	a borer moth
		<i>Papaipema stenocelis</i>	chain fern borer moth
		<i>Gomphaeschna antilope</i>	taper-tailed darner
		<i>Gomphaeschna furcillata</i>	harlequin darner
		<i>Sympetrum ambiguum</i>	blue-faced meadowhawk
		<i>Enallagma weewa</i>	blackwater bluet
	Amphibians	<i>Hemidactylium scutatum</i>	four-toed salamander
		<i>Pseudotriton montanus montanus</i>	mud salamander
		<i>Hyla chrysoscelis</i>	Cope's gray treefrog
		<i>Rana virgatipes</i>	carpenter frog
	Reptiles	<i>Opheodrys aestivus</i>	rough green snake
		<i>Thamnophis sauritus</i>	Eastern ribbon snake
		<i>Agkistrodon contortrix</i>	copperhead
	Birds	<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Plegadis falcinellus</i>	glossy ibis
		<i>Buteo lineatus</i>	red-shouldered hawk
		<i>Strix varia</i>	barred owl
		<i>Vireo flavifrons</i>	yellow-throated vireo
		<i>Protonotaria citrea</i>	prothonotary warbler

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Coastal Plain Forested Floodplains and Riparian Swamps			
Tier	Class	Scientific Name	Common Name
		<i>Helmitheros vermivorus</i>	worm-eating warbler
		<i>Oporornis formosus</i>	Kentucky warbler
		<i>Piranga olivacea</i>	scarlet tanager
		<i>Icterus galbula</i>	Baltimore oriole
	Mammals	<i>Lasionycteris noctivagans</i>	silver-haired bat
		<i>Nycticeius humeralis</i>	evening bat

Conservation Issues and Actions

Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
		Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
		Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
	Livestock Grazing	Work with the Delaware Department of Agriculture to provide incentives to private landowners to exclude livestock from key habitats.
	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3

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Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
	Clearcutting and Other Forestry Practices	Develop and implement the Habitat Conservation Plan for Forests in Sussex County to mitigate loss, fragmentation and degradation of Coastal Plain upland forests.
		Encourage the Delaware Department of Agriculture to revise the scoring system of the Agricultural Lands Preservation Act to give increased weight to conservation of key habitats and SGCN.
		<i>See Section 6.2.3 for additional actions</i>
Industrial Development and Operations	Industrial Facilities	<i>See Section 6.2.1</i>
	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Altered Hydrology	<i>See Section 0</i>
	Utility Corridors	<i>See Section 6.2.1</i>
	Dredge Spoil Disposal	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	White-Tailed Deer	Work with hunters to increase deer harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase deer harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase deer harvest on private lands as necessary to reduce impacts to key habitats.
		Continue to evaluate Quality Deer Management as a long-term strategy for minimizing impacts to key habitats.
	Gypsy Moth	Support continued gypsy moth monitoring by the Delaware Department of Agriculture.
		Work with the Delaware Department of Agriculture to provide incentives to landowners for gypsy moth control in key habitats on private lands.

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Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	European Starling	Assess and monitor the effectiveness of nest boxes, snag creation and other practices to enhance the success of cavity-nesting SGCN.
	Invasive Earthworms	Assess the impacts of invasive earthworms on forests and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts as necessary.
	Invasive Plants	<i>See Section 6.2.6</i>
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Water Use	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of “ecologically sustainable water management” practices to dam operations to minimize impacts to key habitats and SGCN.
Solid Waste Disposal	Landfill Facilities	<i>See Section 6.2.1</i>
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Wildlife Harvesting	Inappropriate Hunting and Fishing	Develop education and outreach for hunters about the Delmarva fox squirrel to minimize impacts from accidental killing.
		Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.

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Coastal Plain Forested Floodplains and Riparian Swamps		
Issue Category	Specific Issue	Specific Action
Resource Management	Habitat/Wildlife Management	Implement the Delmarva Fox Squirrel Recovery Plan.
		See Section 0 for more actions.

6.1.6. Atlantic White Cedar Non-tidal Wetlands

Description

Known only from southern Delaware, these wetlands are characterized by stands of Atlantic white cedar on poorly drained, mucky soils along slow-flowing streams. Numerous rare plant species, such as swamp pink, may be found in the herbaceous layer of some types.

Vital Statistics

Atlantic White Cedar Non-tidal Wetlands		
Attribute	Total	Protected
HCC* Acreage	4,272	2,246 (53%)
HCC Occurrences	121	60 (50%)
Known SGCN Species / Occurrences in HCC	17 / 26	10 / 12 (59% / 46%)
SGCN Species associated with HCC	13	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Historically, these wetlands were much more extensive in the state, covering thousands of acres in the Great Cypress Swamp alone. Beginning more than 200 years ago, timber harvest and wetland draining for agriculture eliminated most of these swamps. With the near-cessation of Atlantic white cedar logging in the last century, this habitat is in relatively stable condition at present. However, natural regeneration of white cedar is often inhibited by competition from red maple, which is presently more common than in the past, probably due to fire suppression. Also, as with other forested wetlands discussed above, loss of buffers is resulting in some short term impacts from sediment and nutrient runoff, and will exacerbate long term impacts from sea level rise.

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Habitats of Conservation Concern

- Delmarva Atlantic White Cedar Swamp
- Atlantic White Cedar – Mixed Herb Bog
- Atlantic White Cedar Millpond Headwater Hummock and Peat Mat Woodland

Associated Species of Greatest Conservation Need

Atlantic White Cedar Non-tidal Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Callophrys hesseli</i>	Hessel's hairstreak
		<i>Exyra fax</i>	pitcher plant moth
		<i>Papaipema appassionata</i>	pitcher plant borer moth
		<i>Manduca jasminearum</i>	ash sphinx
2	Insects	<i>Dolba hylaeus</i>	black alder or pawpaw sphinx
		<i>Papaipema stenocelis</i>	chain fern borer moth
		<i>Xestia youngii</i>	Young blueberry dart
		<i>Gomphaeschna furcillata</i>	harlequin darner
		<i>Argia bipunctulata</i>	seepage dancer
		<i>Enallagma weewa</i>	blackwater bluet
		<i>Nehalennia gracilis</i>	sphagnum sprite
	Amphibians	<i>Hemidactylium scutatum</i>	four-toed salamander
		<i>Pseudotriton montanus montanus</i>	mud salamander

Conservation Issues and Actions

Pending further assessment of specific impacts, Conservation Issues and Actions for Atlantic White Cedar Non-tidal Wetlands are considered to be the same as those listed for Coastal Plain Forested Floodplains and Riparian Swamps above.

6.1.7. Coastal Plain Seasonal Ponds

Description

More than 1,000 of these small depressional wetlands, usually flooded by groundwater and precipitation in the winter and spring but dry in the summer and fall, are scattered throughout the state. They often occur in groups or complexes that may share a common

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groundwater source and among which pond-dwelling organisms freely travel. Although the ponds naturally occur imbedded in a forest matrix, they contain only herbaceous and shrub vegetation within their boundaries. They are important breeding locations – sometimes the only locations – for a number of frogs and salamanders that inhabit the surrounding forest. Also, over 30 rare plant species are found in these ponds, including five that are globally rare. Mapping of many Coastal Plain Seasonal Ponds was accomplished through habitat modeling based on aerial photograph interpretation, and these sites require field verification. Recent surveys of some sites have shown that the modeling incorrectly classified some depressional wetlands as Coastal Plain ponds, and failed to correctly identify other wetlands as ponds.

Vital Statistics

Coastal Plain Seasonal Ponds		
Attribute	Total	Protected
HCC* Acreage	1,014	185 (18%)
HCC Occurrences	1,591	303 (19%)
Known SGCN Species / Occurrences in HCC	7 / 9	3 / 3 (43% / 33%)
SGCN Species associated with HCC	28	

**HCC = Habitats of Conservation Concern.*

Present Condition

Fair. A recent status assessment of this habitat in the Blackbird-Millington corridor determined that many pond complexes in this area – which has the largest concentration of ponds in the state – are in relatively good condition, based on pond density and forest buffer. This is due, at least in part, to the protection of some ponds on state forest lands. However, hundreds of other ponds elsewhere are not in conservation ownership and have been significantly impacted by draining, tilling, loss of forest buffers and invasive plant species. A statewide analysis of Coastal Plain ponds found that about 25% of pond habitat is surrounded half or less by a forested buffer adequate for the conservation of typical pond-breeding salamanders; less than 20% is completely surrounded by such a buffer. Also, the effect on pond hydrology of groundwater withdrawals for drinking water and crop irrigation is uncertain, although there is substantial pumping for irrigation in the vicinity of many ponds. Even in locations where hydrology is intact, the need to conserve ponds in large complexes interconnected by extensive forests complicates protection efforts on both public and private property.

Habitats of Conservation Concern

- Buttonbush - Mannagrass - Smartweed Coastal Plain Seasonal Pond Vegetation
- Buttonbush - Warty Panicgrass - Eaton's Witchgrass Coastal Plain Pond Vegetation
- Walter's Sedge - Eaton's Witchgrass Coastal Plain Seasonal Pond Vegetation

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- Cape May - Delmarva Depression Meadow
- Three-way Sedge - Canada Rush Coastal Plain Seasonal Pond Vegetation
- Creeping Rush - Boltonia Coastal Plain Seasonal Pond Vegetation
- Maidencane Coastal Plain Seasonal Pond Vegetation
- Mixed Grass Depression Meadow
- Waterlily Deepwater Coastal Plain Seasonal Pond Vegetation

Associated Species of Greatest Conservation Need

Coastal Plain Seasonal Ponds			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Poanes massasoit</i>	mulberry wing
	Amphibians	<i>Ambystoma tigrinum tigrinum</i>	tiger salamander
		<i>Hyla gratiosa</i>	barking treefrog
	Reptiles	<i>Clemmys guttata</i>	spotted turtle
2	Insects	<i>Euphyes dion</i>	dion skipper
		<i>Aeshna tuberculifera</i>	black-tipped darner
		<i>Aeshna verticalis</i>	green-striped darner
		<i>Anax longipes</i>	comet darner
		<i>Gomphaeschna antilope</i>	taper-tailed darner
		<i>Tetragoneuria costalis</i>	stripe-winged baskettail
		<i>Celithemis verna</i>	double-ringed pennant
		<i>Leucorrhinia intacta</i>	dot-tailed whiteface
		<i>Libellula axilena</i>	bar-winged skimmer
		<i>Libellula deplanata</i>	blue corporal
		<i>Sympetrum ambiguum</i>	blue-faced meadowhawk
		<i>Sympetrum semicinctum</i>	band-winged meadowhawk
		<i>Lestes eurinus</i>	amber-winged spreadwing
		<i>Enallagma dubium</i>	burgundy bluet
		<i>Enallagma durum</i>	big bluet
<i>Enallagma pallidum</i>	pale bluet		

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Coastal Plain Seasonal Ponds			
Tier	Class	Scientific Name	Common Name
		<i>Enallagma vesperum</i>	vesper bluet
		<i>Nehalennia irene</i>	sedge sprite
		<i>Gomphus villosipes</i>	unicorn clubtail
	Amphibians	<i>Ambystoma maculatum</i>	spotted salamander
		<i>Hemidactylium scutatum</i>	four-toed salamander
		<i>Hyla chrysoscelis</i>	Cope's gray treefrog
		<i>Scaphiopus holbrookii</i>	Eastern spadefoot
	Reptiles	<i>Thamnophis sauritus</i>	Eastern ribbon snake

Conservation Issues and Actions

Coastal Plain Seasonal Ponds		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Farmland	See Section 6.2.1
	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
	Clearcutting and Other Forestry Practices	See Section 6.2.3
Industrial Development and Operations	Industrial Facilities	See Section 6.2.1
	Air Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1

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Coastal Plain Seasonal Ponds		
Issue Category	Specific Issue	Specific Action
Invasive Species, Nuisance Animals and Wildlife Diseases	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	Invasive Plants	<i>See Section 6.2.6</i>
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of “excellent groundwater recharge areas.”
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

6.1.8. Interdunal Wetlands

Description

These small wetlands are found only among maritime dunes along the Atlantic Coast. Despite their proximity to the ocean, their seasonal flooding is driven by groundwater and precipitation. As dynamic as many other beach and dune habitats, these swales are periodically created or destroyed by major storms. Some types have purely herbaceous vegetation, while others are dominated by shrubs. More than 20 types of rare plants are found in these wetlands.

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Vital Statistics

Interdunal Wetlands		
Attribute	Total	Protected
HCC* Acreage	72	61 (85%)
HCC Occurrences	81	73 (90%)
Known SGCN Species / Occurrences in HCC	1 / 2	1 / 1 (100% / 50%)
SGCN Species associated with HCC	2	

*HCC = Habitats of Conservation Concern.

Present Condition

Good. At present most of these habitats are relatively stable, and the great majority are protected on state parkland. Most of those not on state land have been degraded by loss of upland buffers, changes in hydrology and invasive plants, all of which result from encroaching residential development. Impacts from predicted sea level rise, made worse by disturbance of normal coastal processes, could be substantial. See the discussion of Condition under Beach and Dune Habitats for more information on these processes. Note that although interdunal wetlands are part of a very dynamic coastal ecosystem, their recovery from disturbance – including sea level rise – is believed to be fairly slow, given the need for a thin layer of peat to develop on the substrate.

Habitats of Conservation Concern

- Cranberry Interdunal Swale
- Twig Rush Interdunal Swale
- Round-head Rush - Common Threesquare Interdunal Swale

Associated Species of Greatest Conservation Need

Interdunal Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Photuris bethaniensis</i>	Bethany Beach firefly
2	Insects	<i>Cicindela hirticollis</i>	beach-dune tiger beetle

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Conservation Issues and Actions

Interdunal Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	<i>See Section 6.2.1</i>
	Altered Hydrology	<i>See Section 6.2.2</i>
	Nutrients and Sediments	<i>See Section 6.2.2</i>
	Pesticides	<i>See Section 6.2.2</i>
Industrial Development and Operations	Air Pollution	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	<i>See Section 6.2.6</i>
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

6.1.9. Piedmont Stream Valley Wetlands

Description

This is a somewhat artificial grouping of wetlands that is in need of further definition. Some types result from the emergence of groundwater on, or at the base of, forested slopes above streams, while others are in or adjacent to the stream channel where they are subject to occasional flooding. Vegetation is dominated by sedges and rushes in most types, although some support a variety of forbs.

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Vital Statistics

Piedmont Stream Valley Wetlands		
Attribute	Total	Protected
HCC* Acreage	104	56 (54%)
HCC Occurrences	85	39 (46%)
Known SGCN Species / Occurrences in HCC	8 / 8	8 / 8 (100% / 100%)
SGCN Species associated with HCC	18	

*HCC = Habitats of Conservation Concern.

Present Condition

Good. Most of these habitats occur on either steep slopes (seepage wetlands) or river floodplains (streamside wetlands) where they are generally immune from direct loss as a result of residential development or other habitat conversion. Impacts to seepage wetlands from groundwater withdrawal, to streamside wetlands from changes in flow regimes, and to both types from nutrient enrichment are of concern over the long term. A number of streamside wetlands are presently affected by invasive plants, which in some cases could accelerate eutrophication.

Habitats of Conservation Concern

- Piedmont Streamside Seepage Wetland
- Forested Seepage Slope Wetland
- Streamside Backwater Marsh
- Streamside Tussock Meadow
- Twisted Sedge Sand Bar

Associated Species of Greatest Conservation Need

Piedmont Stream Valley Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Poanes massasoit</i>	mulberry wing
		<i>Euphyes conspicua</i>	black dash
		<i>Papaipema eupatorii</i>	eupatorium borer moth
	Reptiles	<i>Glyptemys muhlenbergii</i>	bog turtle
2	Insects	<i>Euphyes dion</i>	dion skipper

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Piedmont Stream Valley Wetlands			
Tier	Class	Scientific Name	Common Name
		<i>Boloria selene</i>	silver-bordered fritillary
		<i>Boloria selene myrina</i>	myrina fritillary
		<i>Euphydryas phaeton</i>	Baltimore checkerspot
		<i>Satyroides eurydice</i>	eyed brown
		<i>Acronicta connecta</i>	a noctuid moth
		<i>Parapamea buffaloensis</i>	a borer moth
		<i>Cordulegaster erronea</i>	tiger spiketail
		<i>Cordulegaster bilineata</i>	brown spiketail
		<i>Libellula flavida</i>	yellow-sided skimmer
		<i>Sympetrum semicinctum</i>	band-winged meadowhawk
	Amphibians	<i>Eurycea longicauda</i>	longtail salamander
	Reptiles	<i>Regina septemvittata</i>	queen snake
		<i>Thamnophis sauritus</i>	Eastern ribbon snake

Conservation Issues and Actions

Piedmont Stream Valley Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0

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Piedmont Stream Valley Wetlands		
Issue Category	Specific Issue	Specific Action
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Water Use	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of “ecologically sustainable water management” practices to dam operations to minimize impacts to key habitats and SGCN.
	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of “excellent groundwater recharge areas.”
Resource Management	Habitat/Wildlife Management	Implement the Bog Turtle Recovery Plan.
		See Section 0 for more actions.

6.1.10. Peat Wetlands

Description

These herbaceous wetlands occur on deep, mucky peat that forms in open-water depressions, impoundments, and seeps within a shrub-dominated swamp matrix. They are found along only a few creeks in southern Delaware. Several rare plants occur here, including sundews and purple pitcher plant.

Vital Statistics

Peat Wetlands		
Attribute	Total	Protected
HCC* Acreage	41	10 (24%)
HCC Occurrences	8	5 (63%)
Known SGCN Species / Occurrences in HCC	1 / 1	0 / 0
SGCN Species associated with HCC	7	

*HCC = Habitats of Conservation Concern.

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Present Condition

Good. The lengthy process required to form the deep peat substrate of this habitat indicates a long absence of disturbance, a trend which will continue in the near future – given their location towards the interior of larger wetland complexes along streams, these habitats are well protected from direct loss due to habitat conversion. Common reed invasion has impacted some peat wetlands, and natural succession may ultimately replace these habitats with another type of community, although succession appears to proceed extremely slowly. The effect of sea level rise may be substantial, since the slow development of these wetlands may be overwhelmed by rising water levels.

Habitats of Conservation Concern

- Mixed Herb Deep Peat Wetland

Associated Species of Greatest Conservation Need

Peat Wetlands			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Exyra fax</i>	pitcher plant moth
		<i>Papaipema appassionata</i>	pitcher plant borer moth
2	Insects	<i>Papaipema stenocelis</i>	chain fern borer moth
		<i>Xestia youngii</i>	Young blueberry dart
		<i>Gomphaeschna antilope</i>	taper-tailed darner
		<i>Argia bipunctulata</i>	seepage dancer
		<i>Nehalennia gracilis</i>	sphagnum sprite

Conservation Issues and Actions

Peat Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives to tax ditch associations to implement BMPs that minimize impacts to key habitats.

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Peat Wetlands		
Issue Category	Specific Issue	Specific Action
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	See Section 6.2.6
	Control of Invasive Plants	See Section 6.2.6
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.11. Riverine Aquatic and Submerged Vegetation

Description

These habitats are characterized by plants that are either entirely submerged or that float on the water surface in stream channels and backwaters. They are found throughout the Coastal Plain, most extensively in the Nanticoke watershed.

Vital Statistics

Riverine Aquatic and Submerged Vegetation		
Attribute	Total	Protected
HCC* Acreage	75	10 (13%)
HCC Occurrences	8	4 (50%)
Known SGCN Species / Occurrences in HCC	0 / 0	--
SGCN Species associated with HCC	1	

*HCC = Habitats of Conservation Concern.

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Present Condition

Poor. Even though substantial beds of aquatic vegetation remain in two river systems, this is thought to represent a significant loss within historic times from channelization, sedimentation, nutrient enrichment and stream flow changes. The current situation is no better, with gains in recent decades from point source water pollution controls probably offset by more intensive row crop farming and increased application of poultry wastes to agricultural fields in Coastal Plain sites. Non-point source pollution and changes in stream flows from expanding residential development are expected to further degrade and/or diminish these habitats in the future. See Section 6.1.16 for more information about the condition of non-tidal Coastal Plain streams.

Habitats of Conservation Concern

- Mixed Species Submergent Vegetation
- Submerged Tapegrass Community

Associated Species of Greatest Conservation Need

Riverine Aquatic and Submerged Vegetation			
Tier	Class	Scientific Name	Common Name
2	Insects	<i>Ischnura kellicotti</i>	lilypad forktail

Conservation Issues and Actions

Riverine Aquatic and Submerged Vegetation		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives for tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4

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Riverine Aquatic and Submerged Vegetation		
Issue Category	Specific Issue	Specific Action
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Altered Hydrology	<i>See Section 0</i>
	Channel Dredging	Work with the Division of Water Resources and the US Army Corps of Engineers to integrate key habitat and SGCN conservation into dredging plans.
Invasive Species, Nuisance Animals and Wildlife Diseases	Mute Swan	Continue implementation of the DFW mute swan management plan.
	Invasive Plants	<i>See Section 6.2.6</i>
Water Use	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of “ecologically sustainable water management” practices to dam operations to minimize impacts to key habitats and SGCN.
	Surface Water Withdrawals	Work with the Division of Water Resources to integrate key habitat and SGCN conservation into state water quality standards for low flows.
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

6.1.12. Freshwater Tidal Forested and Scrub-Shrub Wetlands

Description

This group of wetlands ranges from thinly forested types to those dominated by small trees and shrubs. They are typically found at the head of tide or along the fringes of tidal creeks, where tidal flooding is irregular.

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Vital Statistics

Freshwater Tidal Forested and Scrub-Shrub Wetlands		
Attribute	Total	Protected
HCC* Acreage	3,095	1,187 (38%)
HCC Occurrences	501	117 (23%)
Known SGCN Species / Occurrences in HCC	13 / 16	5 / 6 (38% / 38%)
SGCN Species associated with HCC	4	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Although seldom destroyed outright, these habitats have been somewhat impacted by ditching, dredging and channelization. They also have long been subject to incremental degradation arising from incompatible land use practices upslope, often magnified by the frequent loss of adjacent buffers. Where these buffers no longer exist, opportunities for migration inland in the face of sea level rise will be limited.

Habitats of Conservation Concern

- Atlantic White Cedar - Red Maple - Pumpkin Ash Freshwater Tidal Swamp
- Red Maple - Ash Tidal Swamp
- Smooth Alder - Silky Dogwood Shrub Swamp

Associated Species of Greatest Conservation Need

Freshwater Tidal Forested and Scrub-Shrub Wetlands			
Tier	Class	Scientific Name	Common Name
2	Insects	<i>Atlides halesus</i>	great purple hairstreak
		<i>Manduca jasminearum</i>	ash sphinx
		<i>Acronicta connecta</i>	a noctuid moth
		<i>Papaipema stenocelis</i>	chain fern borer moth

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Conservation Issues and Actions

Freshwater Tidal Forested and Scrub-Shrub Wetlands		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	<i>See Section 6.2.1</i>
	Nutrients and Sediments	<i>See Section 6.2.2</i>
	Pesticides	<i>See Section 6.2.2</i>
	Piers and Docks	<i>See Section 6.2.2</i>
Agricultural and Forestry Operations	Farmland	<i>See Section 6.2.1</i>
	Altered Hydrology	<i>See Section 6.2.3</i>
	Nutrients and Sediments	<i>See Section 6.2.3</i>
	Pesticides	<i>See Section 6.2.3</i>
	Clearcutting and Other Forestry Practices	<i>See Section 6.2.3</i>
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore wetlands, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Industrial Facilities	<i>See Section 6.2.1</i>
	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
	Chronic Water Pollution	<i>See Section 6.2.4</i>
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Utility Corridors	<i>See Section 6.2.1</i>
	Dredge Spoil Disposal	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	<i>See Section 6.2.6</i>
Solid Waste Disposal	Landfill Facilities	<i>See Section 6.2.1</i>
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

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6.1.13. Freshwater Tidal Marshes

Description

These are wetlands of the intertidal zone above the reach of saline waters, characterized by the complete absence of woody plants. Vegetation is sparse in some types (e.g. quillwort flat) but extremely dense in others (e.g. mixed broadleaf marsh). The mixed broadleaf marsh is found throughout the Coastal Plain, from the Christina to the Nanticoke, while the others have more restricted distributions.

Vital Statistics

Freshwater Tidal Marshes		
Attribute	Total	Protected
HCC* Acreage	5,976	2,933 (49%)
HCC Occurrences	325	89 (27%)
Known SGCN Species / Occurrences in HCC	24 / 25	12 / 12 (50% / 48%)
SGCN Species associated with HCC	24	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. As with the forested wetlands above, these marshes have suffered relatively little outright destruction from habitat conversion, but have been subjected to the same impacts from offsite sources. However, there has been substantial contraction of these marshes from saltwater intrusion, especially along streams draining into Delaware Bay. Some have also experienced invasion by common reed. Even though non-forested wetlands such as these might be expected to migrate landward with little trouble in response to rising sea levels, they may in fact be significantly reduced by the accompanying saltwater intrusion. In some areas, migration may also be impeded by dams or steep stream valley slopes.

Habitats of Conservation Concern

- Mixed Broadleaf Freshwater Tidal Marsh
- Sea Level Fen
- Freshwater Intertidal Quillwort Flat

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Associated Species of Greatest Conservation Need

Freshwater Tidal Marshes			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Poanes massasoit chermocki</i>	Chermock's mulberry wing
		<i>Nannothemis bella</i>	elfin skimmer
	Reptiles	<i>Clemmys guttata</i>	spotted turtle
	Birds	<i>Podilymbus podiceps</i>	pied-billed grebe
		<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Pandion haliaetus</i>	osprey
2	Insects	<i>Lycaena hyllus</i>	bronze copper
		<i>Papaipema birdi</i>	umbellifer borer moth
		<i>Libellula axilena</i>	bar-winged skimmer
		<i>Argia bipunctulata</i>	seepage dancer
		<i>Nehalennia gracilis</i>	sphagnum sprite
	Birds	<i>Botaurus lentiginosus</i>	American bittern
		<i>Ixobrychus exilis</i>	least bittern
		<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Anas platyrhynchos</i>	mallard
		<i>Rallus elegans</i>	king rail
		<i>Porzana carolina</i>	sora
		<i>Dolichonyx oryzivorus</i>	bobolink

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Conservation Issues and Actions

Freshwater Tidal Marshes		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	<i>See Section 6.2.1</i>
	Nutrients and Sediments	<i>See Section 6.2.2</i>
	Pesticides	<i>See Section 6.2.2</i>
	Piers and Docks	<i>See Section 6.2.2</i>
Agricultural and Forestry Operations	Farmland	<i>See Section 6.2.1</i>
	Nutrients and Sediments	<i>See Section 6.2.3</i>
	Pesticides	<i>See Section 6.2.3</i>
	Clearcutting and Other Forestry Practices	<i>See Section 6.2.3</i>
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore wetlands, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Industrial Facilities	<i>See Section 6.2.1</i>
	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
	Chronic Water Pollution	<i>See Section 6.2.4</i>
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Dredge Spoil Disposal	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	Invasive Plants	<i>See Section 6.2.6</i>
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Solid Waste Disposal	Landfill Facilities	<i>See Section 6.2.1</i>
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

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6.1.14. Tidal High Marshes

Description

These are usually the more landward of the coastal salt marshes, occurring at a slightly higher elevation where they are subjected to a shorter period of tidal inundation. Most types consist almost entirely of grasses, sedges and rushes, but a few (e.g. bishop-weed marsh) are composed primarily of broadleaf plants. Mapping of many *Spartina* High Salt Marshes was accomplished through habitat modeling based on aerial photograph interpretation, and these sites require field verification.

Vital Statistics

Tidal High Marshes		
Attribute	Total	Protected
HCC* Acreage	8,087	5,740 (71%)
HCC Occurrences	277	140 (51%)
Known SGCN Species / Occurrences in HCC	5 / 5	5 / 5 (100% / 100%)
SGCN Species associated with HCC	26	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Even though the majority of these habitats are protected on state land, they have been subjected to a number of significant impacts in historic times, especially harvesting of “salt marsh hay,” conversion to impoundments and management for mosquito control. The first two have largely ceased, but mosquito control efforts continue today by use of Open Marsh Water Management (OMWM). Published reports indicate few effects from this management on an array of species and habitat measures. However, there was sufficient concern about OMWM impacts on black rail – a possible indicator species for Tidal High Marsh – to lead to a cessation of this practice in Maryland in the early 1990s. Circumstantial evidence from at least one site in Delaware supports this concern, and the issue warrants further study. The particular topographic setting of these marshes, adjacent to uplands, makes landward migration in the face of sea level rise highly problematic.

Habitats of Conservation Concern

- *Spartina* High Salt Marsh
- Bishop-weed – Mixed Species Brackish Marsh

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Associated Species of Greatest Conservation Need

Tidal High Marshes			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Problema bulenta</i>	rare skipper
	Birds	<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Anas rubripes</i>	American black duck
		<i>Circus cyaneus</i>	Northern harrier
		<i>Laterallus jamaicensis</i>	black rail
		<i>Asio flammeus</i>	short-eared owl
		<i>Cistothorus platensis</i>	sedge wren
		<i>Ammodramus caudacutus</i>	saltmarsh sharp-tailed sparrow
		<i>Ammodramus maritimus</i>	seaside sparrow
		<i>Melospiza georgiana nigrescens</i>	Coastal Plain swamp sparrow
2	Insects	<i>Pero zalissaria</i>	a geometer moth
		<i>Acontia delecta</i>	a noctuid moth
		<i>Papaipema birdi</i>	umbellifer borer moth
		<i>Brachymesia gravida</i>	four-spotted pennant
	Birds	<i>Botaurus lentiginosus</i>	American bittern
		<i>Ixobrychus exilis</i>	least bittern
		<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Porzana carolina</i>	sora
		<i>Fulica americana</i>	American coot
		<i>Tyto alba</i>	barn owl
<i>Cistothorus palustris</i>	marsh wren		

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Conservation Issues and Actions

Tidal High Marshes		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	<i>See Section 6.2.1</i>
	Nutrients and Sediments	<i>See Section 6.2.2</i>
	Pesticides	<i>See Section 6.2.2</i>
	Piers and Docks	<i>See Section 6.2.2</i>
Agricultural and Forestry Operations	Farmland	<i>See Section 6.2.1</i>
	Nutrients and Sediments	<i>See Section 6.2.3</i>
	Pesticides	<i>See Section 6.2.3</i>
	Clearcutting and Other Forestry Practices	<i>See Section 6.2.3</i>
Industrial Development and Operations	Industrial Facilities	<i>See Section 6.2.1</i>
	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
	Chronic Water Pollution	<i>See Section 6.2.4</i>
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Utility Corridors	<i>See Section 6.2.1</i>
	Dredge Spoil Disposal	<i>See Section 6.2.1</i>
Invasive Species, Nuisance Animals and Wildlife Diseases	Nutria	Assess the potential for impacts to key habitats, monitor populations, and develop adaptive management strategies if necessary.
	Snow Goose and Resident Canada Goose	Increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.

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Tidal High Marshes		
Issue Category	Specific Issue	Specific Action
	Mute Swan	Continue implementation of the DFW mute swan management plan.
	Control of Mosquitoes and Forest Pests By Aerial Application	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	Control of Mosquitoes with Open Marsh Water Management and Impoundment Management	Work with the Mosquito Control Section to assess and monitor the impacts of Open Marsh Water Management on key habitats and SGCN.
		Work with the Mosquito Control Section to adapt Open Marsh Water Management practices for conservation of key habitats and SGCN, as necessary.
	Invasive Plants	<i>See Section 6.2.6</i>
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Solid Waste Disposal	Landfill Facilities	<i>See Section 6.2.1</i>
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.

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Tidal High Marshes		
Issue Category	Specific Issue	Specific Action
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.15. Tidal Low Marshes

Description

The more seaward of the coastal salt marshes, these habitats are flooded for longer periods of time during daily tidal cycles. Again, most types are dominated by grasses and grass-like plants, although mudflats may be largely devoid of vascular plants.

Vital Statistics

Tidal Low Marshes		
Attribute	Total	Protected
HCC* Acreage	48,533	28,956 (60%)
HCC Occurrences	904	386 (43%)
Known SGCN Species / Occurrences in HCC	31 / 55	24 / 31 (77% / 56%)
SGCN Species associated with HCC	42	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair. Much of the vast acreage of spartina low marshes is in conservation ownership, and that which is not enjoys substantial protection from state regulation of tidal wetlands. Nonetheless, this habitat was significantly altered through ditching, draining, dredging and filling until just a few decades ago. Extensive portions of spartina low marsh have been invaded by monotypic stands of common reed, and control efforts have been limited both in scope and duration. Also, “eat outs” from burgeoning snow goose populations have substantially degraded some low marshes in the last 20 years. Intertidal flats face threats from sea level rise, rip-rapping, bulk heading and associated development issues. Low marsh should be capable of migrating landward in response to sea level rise – in part at the expense of Tidal High Marshes – although many marshes lack sufficient buffers to accommodate this shift.

Habitats of Conservation Concern

- Spartina Low Salt Marsh
- Unvegetated Intertidal Mudflat

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Associated Species of Greatest Conservation Need

Tidal Low Marshes			
Tier	Class	Scientific Name	Common Name
1	Insects	<i>Problema bulenta</i>	rare skipper
	Reptiles	<i>Malaclemys terrapin terrapin</i>	Northern diamondback terrapin
	Birds	<i>Podilymbus podiceps</i>	pied-billed grebe
		<i>Nycticorax nycticorax</i>	black-crowned night-heron
		<i>Nyctanassa violacea</i>	yellow-crowned night-heron
		<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Anas rubripes</i>	American black duck
		<i>Circus cyaneus</i>	Northern harrier
		<i>Arenaria interpres</i>	ruddy turnstone
		<i>Calidris canutus</i>	red knot
		<i>Sterna hirundo</i>	common tern
		<i>Sterna forsteri</i>	Forster's tern
		<i>Rynchops niger</i>	black skimmer
		<i>Asio flammeus</i>	short-eared owl
		<i>Ammodramus caudacutus</i>	saltmarsh sharp-tailed sparrow
<i>Ammodramus maritimus</i>	seaside sparrow		
2	Insects	<i>Cicindela marginata</i>	marginated tiger beetle
		<i>Pero zalissaria</i>	a geometer moth
		<i>Acontia delecta</i>	a noctuid moth
		<i>Brachymesia gravida</i>	four-spotted pennant
	Birds	<i>Pelecanus occidentalis</i>	brown pelican
		<i>Phalacrocorax carbo</i>	great cormorant
		<i>Phalacrocorax auritus</i>	double-crested cormorant
		<i>Ardea herodias</i>	great blue heron
		<i>Casmerodius albus</i>	great egret
		<i>Egretta thula</i>	snowy egret
		<i>Egretta caerulea</i>	little blue heron

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Tidal Low Marshes			
Tier	Class	Scientific Name	Common Name
		<i>Egretta tricolor</i>	tricolored heron
		<i>Bubulcus ibis</i>	cattle egret
		<i>Plegadis falcinellus</i>	glossy ibis
		<i>Anas platyrhynchos</i>	mallard
		<i>Falco peregrinus</i>	peregrine falcon
		<i>Rallus elegans</i>	king rail
		<i>Fulica americana</i>	American coot
		<i>Pluvialis squatarola</i>	black-bellied plover
		<i>Himantopus mexicanus</i>	black-necked stilt
		<i>Catoptrophorus semipalmatus</i>	willet
		<i>Calidris pusilla</i>	semipalmated sandpiper
		<i>Calidris alpina</i>	dunlin
		<i>Sterna nilotica</i>	gull-billed tern
		<i>Tyto alba</i>	barn owl
		<i>Cistothorus palustris</i>	marsh wren

Conservation Issues and Actions

Tidal Low Marshes		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Residential and Commercial Structures	See Section 6.2.1
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
	Piers and Docks	See Section 6.2.2
Agricultural and Forestry Operations	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore wetlands, in place of installing bulkheads and revetments, to minimize impacts to key habitats.

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Tidal Low Marshes		
Issue Category	Specific Issue	Specific Action
Industrial Development and Operations	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
	Chronic Water Pollution	<i>See Section 6.2.4</i>
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	<i>See Section 6.2.1</i>
	Utility Corridors	<i>See Section 6.2.1</i>
	Commercial Ships and Boats	Develop education and outreach for ship and boat operators about the impacts of wakes on shorelines.
		Post and enforce “no wake” zones to protect key habitats.
Dredge Spoil Disposal	<i>See Section 6.2.1</i>	
Invasive Species, Nuisance Animals and Wildlife Diseases	Nutria	Assess the potential for impacts to key habitats, monitor populations, and develop adaptive management strategies if necessary.
	Snow Goose and Resident Canada Goose	Work with hunters to increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.
	Mute Swan	Continue implementation of the DFW mute swan management plan.
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
Invasive Plants	<i>See Section 6.2.6</i>	

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Tidal Low Marshes		
Issue Category	Specific Issue	Specific Action
	Control of Invasive Plants	<i>See Section 6.2.6</i>
Climate Change	Sea Level Rise	<i>See Section 6.2.7</i>
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing hunting and trapping regulations.
		Integrate SGCN conservation into hunting and trapping regulations.
		Incorporate information about SGCN conservation into the Hunting and Trapping Guide.
		Maintain compliance with federal regulations.
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

6.1.16. Non-tidal Coastal Plain Streams

Description

These are the upper reaches of streams that originate in the Coastal Plain. Most drain to the Delaware River or Bay, but some head west towards the Chesapeake Bay. Generally, stream gradients are low, current velocity is slow and substrate consists of sand and silt. Many of these streams have been ditched in order to lower water tables in adjacent areas for agriculture.

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Vital Statistics

Non-tidal Coastal Plain Streams		
Attribute	Total	Protected
HCC* Acreage	8,915	778 (9%)
HCC Occurrences	362	90 (25%)
Known SGCN Species / Occurrences in HCC	12 / 12	4 / 4 (100% / 100%)
SGCN Species associated with habitat***	54	

*HCC = Habitats of Conservation Concern.

Present Condition

Poor. The condition of non-tidal Coastal Plain streams is believed to mirror the overall condition of streams in the state as described in DNREC's bi-annual water quality assessment reports to EPA. These reports show significant improvements in water quality from the late-1970s to the mid-1990s as a result of control of point source pollution discharges. However, in the last decade water quality has decreased slightly, and as of 2004, 65% of state streams still did not fully meet criteria for fish and wildlife habitat. Most current problems stem from non-point source pollution such as nutrients from agricultural fields and septic systems; hydrocarbon pollutants from streets and parking lots; and sediment from land that has been cleared for development. The hydrology of many streams has also been impacted by the increase in impervious surfaces that accompanies residential and commercial development, such that base flows have decreased and storm flows have increased. Recent surveys of fish and mussel communities in non-tidal streams provide further indication of the condition of these habitats – species abundance was skewed toward types that are more tolerant of degraded habitat. Although water quality issues are being actively addressed, the tremendous rate of land development in Delaware will make long term improvements in stream habitat condition difficult to obtain.

Habitats of Conservation Concern

- None described at this time.

Associated Species of Greatest Conservation Need

Non-tidal Coastal Plain Streams			
Tier	Class	Scientific Name	Common Name
1	Bivalves	<i>Alasmidonta heterodon</i>	dwarf wedgemussel
		<i>Alasmidonta undulata</i>	triangle floater
		<i>Lampsilis cariosa</i>	yellow lampmussel

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Non-tidal Coastal Plain Streams			
Tier	Class	Scientific Name	Common Name
		<i>Lampsilis radiata</i>	Eastern lampmussel
		<i>Leptodea ochracea</i>	tidewater mucket
		<i>Ligumia nasuta</i>	Eastern pondmussel
	Insects	<i>Gomphus fraternus</i>	midland clubtail
	Fishes	<i>Cottus caeruleomentum</i>	Blueridge sculpin
		<i>Acipenser brevirostrum</i>	shortnose sturgeon
		<i>Acipenser oxyrinchus</i>	Atlantic sturgeon
		<i>Notropis bifrenatus</i>	bridle shiner
		<i>Notropis chalybaeus</i>	ironcolor shiner
		<i>Moxostoma macrolepidotum</i>	shorthead redhorse
		<i>Ictalurus natalis</i>	yellow bullhead
		<i>Acantharchus pomotis</i>	mud sunfish
		<i>Percina peltata</i>	shield darter
	Birds	<i>Actitis macularia</i>	spotted sandpiper
2	Bivalves	<i>Anodonta implicata</i>	alewife floater
		<i>Elliptio fisheriana</i>	Northern lance
		<i>Strophitus undulatus</i>	creeper
	Insects	<i>Photuris pensylvanica</i>	a firefly
		<i>Photuris hebes</i>	a firefly
		<i>Cordulegaster bilineata</i>	brown spiketail
		<i>Dromogomphus spinosus</i>	black-shouldered spinyleg
		<i>Gomphus rogersi</i>	sable clubtail
		<i>Gomphus apomyius</i>	banner clubtail
		<i>Macromia taeniolata</i>	royal river cruiser
		<i>Tetragoneuria costalis</i>	stripe-winged baskettail
		<i>Helocordulia selysii</i>	Selys' sundragon
		<i>Somatochlora filosa</i>	fine-lined emerald

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Non-tidal Coastal Plain Streams			
Tier	Class	Scientific Name	Common Name
		<i>Somatochlora provocans</i>	treetop emerald
		<i>Celithemis ornata</i>	faded pennant
		<i>Enallagma dubium</i>	burgundy bluet
		<i>Enallagma durum</i>	big bluet
		<i>Enallagma pallidum</i>	pale bluet
		<i>Enallagma weewa</i>	blackwater bluet
		<i>Nehalennia integricollis</i>	Southern sprite
		<i>Archilestes grandis</i>	great spreadwing
		<i>Gomphus plagiatus</i>	russet-tipped clubtail
		<i>Gomphus villosipes</i>	unicorn clubtail
		Fishes	<i>Lampetra aepyptera</i>
	<i>Lampetra appendix</i>		American brook lamprey
	<i>Anguilla rostrata</i>		American eel
	<i>Alosa mediocris</i>		hickory shad
	<i>Notropis amoenus</i>		comely shiner
	<i>Noturus insignis</i>		margined madtom
	<i>Apeltes quadracus</i>		fourspine stickleback
	<i>Enneacanthus chaetodon</i>		blackbanded sunfish
	<i>Enneacanthus obesus</i>		banded sunfish
	<i>Etheostoma vitreum</i>	glassy darter	
	Reptiles	<i>Pseudemys rubriventris</i>	redbelly turtle
		<i>Regina septemvittata</i>	queen snake
	Birds	<i>Anas platyrhynchos</i>	mallard
		<i>Lophodytes cucullatus</i>	hooded merganser

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Conservation Issues and Actions

Non-tidal Coastal Plain Streams		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Ditching and Draining	Work with the Division of Soil and Water Conservation to provide incentives for tax ditch associations to implement BMPs that minimize impacts to key habitats.
	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Shoreline Protection Practices	Artificial Shoreline Hardening	Provide incentives for private landowners to restore stream banks, in place of installing bulkheads and revetments, to minimize impacts to key habitats.
Industrial Development and Operations	Air Pollution	See Section 6.2.4
	Accidental Spills of Toxins and Sewage	See Section 6.2.4
	Chronic Water Pollution	See Section 6.2.4
	Impingement / Entrapment / Entrainment at Water Intakes	Work with utilities and industry to assess impacts to SGCN from impingement / entrapment / entrainment, and adapt the design and operation of water intakes as necessary for SGCN conservation.
	Sediments from Sand and Gravel Quarrying	See Section 6.2.4
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
	Road Salt	Work with the Delaware Department of Transportation to assess and monitor impacts to SGCN from road salt, adapt salt application practices as practicable for SGCN conservation, and evaluate alternatives to salt use as necessary.

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Non-tidal Coastal Plain Streams		
Issue Category	Specific Issue	Specific Action
	Commercial Ships and Boats	Assess impacts to SGCN from collisions and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts as necessary.
		Work with the shipping and commercial fishing industries to develop education and outreach for boat operators about minimizing impacts to key habitats and SGCN.
		Post and enforce “no wake” zones to protect key habitats and SGCN.
	Channel Dredging	Work with the Division of Water Resources and US Army Corps of Engineers to integrate key habitat and SGCN conservation into dredging plans.
Invasive Species, Nuisance Animals and Wildlife Diseases	Snow Goose and Resident Canada Goose	Increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.
	Asiatic Clam	Assess the impacts of clams on SGCN and use this assessment and long-term monitoring to guide adaptive management, education and outreach efforts as necessary.
		Develop education and outreach for boaters, like the “Stop Aquatic Hitchhikers” campaign of the Aquatic Nuisance Species Task Force, to minimize the spread of clams.
	Invasive Plants	<i>See Section 6.2.6</i>
Water Use	Dams	Work with utilities to assess the impacts of dams and other barriers on fragmentation of key habitats, and use this assessment and long-term monitoring to guide adaptive management, including barrier removal and installation of passage structures as necessary.

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Non-tidal Coastal Plain Streams		
Issue Category	Specific Issue	Specific Action
	Dam Operations	Work with the Division of Water Resources and water utilities to evaluate the application of “ecologically sustainable water management” practices to dam operations to minimize impacts to key habitats and SGCN.
	Dam Removal	Assess the impacts of dam removal on key habitats and SGCN, and use this assessment and long-term monitoring to guide adaptive management, including control of sediments and associated toxins as necessary.
	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat and SGCN conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of “excellent groundwater recharge areas.”
	Surface Water Withdrawals	Work with the Division of Water Resources to integrate key habitat and SGCN conservation into state water quality standards for low flows.
		Work with the Division of Water Resources to integrate key habitat and SGCN conservation into long-range water supply planning.
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing recreational and commercial fishing regulations.
		Integrate SGCN conservation into fishing regulations.
		Incorporate information about SGCN conservation into the Fishing Guide.
		Maintain compliance with interstate management agreements.
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

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6.1.17. Nearshore Habitats

Description

Nearshore habitats consist of open water and benthic features in the Delaware Bay, the Inland Bays, and the Atlantic Ocean out to a distance of three miles from the coast. Though the typical nearshore habitat is a rather featureless area of sand and mud, there are also many smaller areas of diverse nearshore marine habitats such as oyster beds, *Sabellaria* (tubeworm) reefs, sulfur sponge reefs, mussel beds, shoal and flat areas, and artificial reefs. The shell habitat that oyster beds provide is being augmented and expanded through the placement of surf clam shell. As one of the estuary's most common invertebrates, the tubes created by *Sabellaria* provide important reef habitat in the bay. *Sabellaria* beds are currently being identified and delineated in the Delaware Estuary. Large areas of sulfur sponge in the lower bay provide an important habitat for numerous species. Blue mussel beds also provide valuable nearshore habitat, though they tend to be ephemeral in the estuary and are probably limited by high summer water temperatures. Sand/mud shoal areas are common in the estuary. Artificial reefs, primarily in the form of concrete structures, have become a prominent nearshore habitat in recent years. Currently, eight sites in the estuary have been approved for the placement of artificial reef materials which are closely monitored. Because nearshore habitat classification is poorly defined, these habitats have not been mapped.

Vital Statistics

Nearshore Habitats		
Attribute	Total	Protected
HCC* Acreage	not mapped	not mapped
HCC Occurrences	not mapped	not mapped
Known SGCN Species / Occurrences in HCC	not mapped	not mapped
SGCN Species associated with HCC	35	

*HCC = Habitats of Conservation Concern.

Present Condition

Fair – Good. Generally, nearshore habitat in the Delaware Estuary has experienced an improvement since the 1930's and 40's when pollution blocks degraded habitat, particularly in the upper estuary. Oyster beds serve as an important habitat type which suffered a drastic decline in the 1950's due to overfishing and disease (MSX). The current status of the oyster population is low but relatively stable and is sufficient to support a limited commercial fishery. Though several areas in the estuary were previously identified as important for *Sabellaria* and associated wildlife, only minimal protection has been offered (e.g. limiting suction dredging for beach nourishment projects) and little information is available on their long-term abundance/distribution. Whereas areas of heavy *Sabellaria* concentrations tend to be avoided by the commercial dredge fisheries, sulfur sponge beds are sometimes targeted by the commercial

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blue crab dredge fishery, which may pose a threat to this habitat. Sand/mud shoals are disturbed by scallop and toothbar dredge activity associated with the commercial fisheries. The extent of the impact is not well known, but it has been suggested that disturbance is spatially patchy. Threatening all of these habitats is the fact that the estuary is one of the nation's largest petrochemical centers, and spills are an ever-present danger. In addition, invasive species are a continued concern.

Habitats of Conservation Concern

- Open Water
- Oyster Reef
- Tubeworm Reef
- Clam Bed
- Mussel Bed
- Sand Bar/Sand Flat

Associated Species of Greatest Conservation Need

Nearshore Habitats			
Tier	Class	Scientific Name	Common Name
1	Crustaceans	<i>Callinectes sapidus</i>	blue crab
	Arachnids	<i>Limulus polyphemus</i>	horseshoe crab
	Fishes	<i>Pristis pectinata</i>	smalltooth sawfish
		<i>Acipenser brevirostrum</i>	shortnose sturgeon
		<i>Acipenser oxyrinchus</i>	Atlantic sturgeon
	Reptiles	<i>Caretta caretta</i>	loggerhead sea turtle
		<i>Chelonia mydas</i>	Atlantic green turtle
		<i>Lepidochelys kempii</i>	Kemp's Ridley sea turtle
	Birds	<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Pandion haliaetus</i>	osprey
	Mammals	<i>Phocoena phocoena</i>	harbor porpoise
		<i>Balaenoptera physalus</i>	fin whale
<i>Megaptera novaeangliae</i>		humpback whale	
<i>Balaena glacialis</i>		Northern right whale	
2	Fishes	<i>Cetorhinus maximus</i>	basking shark

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Nearshore Habitats			
Tier	Class	Scientific Name	Common Name
		<i>Carcharodon carcharias</i>	white shark
		<i>Carcharhinus obscurus</i>	dusky shark
		<i>Squatina dumeril</i>	Atlantic angel shark
		<i>Alosa mediocris</i>	hickory shad
		<i>Apeltes quadracus</i>	fourspine stickleback
	Reptiles	<i>Eretmochelys imbricata imbricata</i>	hawksbill
	Birds	<i>Pelecanus occidentalis</i>	brown pelican
		<i>Phalacrocorax carbo</i>	great cormorant
		<i>Phalacrocorax auritus</i>	double-crested cormorant
		<i>Cygnus columbianus</i>	tundra swan
		<i>Branta bernicla</i>	brant
		<i>Aythya valisineria</i>	canvasback
		<i>Aythya americana</i>	redhead
		<i>Aythya marila</i>	greater scaup
		<i>Aythya affinis</i>	lesser scaup
		<i>Clangula hyemalis</i>	oldsquaw
<i>Melanitta nigra</i>		black scoter	
<i>Melanitta perspicillata</i>	surf scoter		
<i>Melanitta fusca</i>	white-winged scoter		
<i>Bucephala albeola</i>	bufflehead		

Conservation Issues and Actions

Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3

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Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Shoreline Protection Practices	Beach Renourishment	Work with the Division of Soil and Water Conservation to integrate key habitat and SGCN conservation into selection of nearshore borrow areas.
Industrial Development and Operations	Air Pollution	<i>See Section 6.2.4</i>
	Accidental Spills of Toxins and Sewage	<i>See Section 6.2.4</i>
	Chronic Water Pollution	<i>See Section 6.2.4</i>
	Impingement/Entrapment/Entrainment at Water Intakes	Work with utilities and industry to assess impacts to SGCN from impingement / entrapment / entrainment, and adapt the design and operation of water intakes for SGCN conservation, as necessary.
	Sediments from Sand and Gravel Quarrying	<i>See Section 6.2.4</i>
Transportation and Utility Operations and Maintenance	Channel Dredging	Work with the Division of Water Resources and the US Army Corps of Engineers to integrate key habitat and SGCN conservation into dredging plans.
	Commercial Ships and Boats	Assess impacts from collisions on SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.
		Work with the shipping and commercial fishing industries to develop education and outreach for boat operators about minimizing the impacts to key habitats and SGCN.
		Post “no wake” zones to protect key habitats and SGCN, and enforce them.
Invasive Species, Nuisance Animals and Wildlife Diseases	Green Crab and Japanese Shore Crab	Assess impacts of crabs on key habitats and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.
Solid Waste Disposal	Trash Ingestion	Assess impacts to SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.

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Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
Energy Production	Wind Farm Facilities	Work with energy companies to develop standards for the location of wind farms to minimize loss and fragmentation of key habitats.
	Tidal Turbines	Work with energy companies to develop standards for the location of tidal turbines to minimize impacts to SGCN.
		Support research on improving the design of turbines to minimize impacts to SGCN.
	Thermal Pollution from Power Plants	Support research on minimizing impacts to SGCN.
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	<i>See Section 0</i>
Wildlife Harvesting	Inappropriate Hunting and Fishing	Strengthen enforcement of existing recreational and commercial fishing regulations.
		Integrate SGCN conservation into fishing regulations.
		Incorporate information about SGCN conservation into the Fishing Guide.
		Maintain compliance with interstate management agreements.
	Fishing Gear Entanglement	Incorporate information about reducing the impacts of entanglement on SGCN into the Fishing Guide.
		Develop education and outreach about reducing the impacts of entanglement on SGCN for distribution with commercial fishing licenses.
		Expand efforts to recover and recycle fishing line and gill nets using Florida's "Monofilament Recovery & Recycling Program" or a similar strategy.
		Evaluate expanding International Coastal Cleanup Day to include recovery of submerged lost or abandoned fishing gear.
	Fisheries Bycatch	Assess impacts to SGCN and use this assessment and long-term monitoring to guide adaptive management, education, outreach and enforcement efforts, as necessary.

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Nearshore Habitats		
Issue Category	Specific Issue	Specific Action
		Support research on designing fishing gear and techniques that minimize impacts to SGCN.
	Commercial Fisheries Dredging	Assess impacts to key habitats and SGCN and use this assessment and long-term monitoring to guide adaptive management, including restrictions on frequency and timing, and the designation of “no dredge zones” if necessary.
		Support research on designing fisheries dredging gear and techniques that minimize impacts to key habitats and SGCN.
Resource Management	Habitat/Wildlife Management	<i>See Section 0</i>

6.1.18. Impoundments

Description

Impoundments are man-made coastal habitats where water levels can be manipulated by some sort of control structure. Some are freshwater environments that may be groundwater-dependent. Many are brackish and are connected to tidal streams.

Vital Statistics

Impoundments		
Attribute	Total	Protected
HCC* Acreage	6,385	3,551 (56%)
HCC Occurrences	61	31 (51%)
Known SGCN Species / Occurrences in HCC	14 / 18	9 / 10 (64% / 56%)
SGCN Species associated with habitat***	19	

*HCC = Habitats of Conservation Concern.

Present Condition

Good. Very few new impoundments are currently being created, but existing ones are maintained in a relatively stable condition by active management. Some are impacted by eutrophication and overbrowsing by geese and others suffer from common reed invasion.

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Presumably, sea level rise will not be an issue for this habitat, since dikes can be elevated and water control structures modified to accommodate higher water levels.

Habitats of Conservation Concern

None described at this time.

Associated Species of Greatest Conservation Need

Impoundments			
Tier	Class	Scientific Name	Common Name
1	Birds	<i>Podilymbus podiceps</i>	pied-billed grebe
		<i>Branta canadensis</i>	Canada goose (migratory)
		<i>Anas rubripes</i>	American black duck
		<i>Pandion haliaetus</i>	osprey
		<i>Actitis macularia</i>	spotted sandpiper
2	Birds	<i>Cygnus columbianus</i>	tundra swan
		<i>Anas platyrhynchos</i>	mallard
		<i>Anas clypeata</i>	Northern shoveler
		<i>Aythya valisineria</i>	canvasback
		<i>Aythya marila</i>	greater scaup
		<i>Aythya affinis</i>	lesser scaup
		<i>Bucephala albeola</i>	bufflehead
		<i>Lophodytes cucullatus</i>	hooded merganser
		<i>Fulica americana</i>	American coot
		<i>Pluvialis squatarola</i>	black-bellied plover
		<i>Himantopus mexicanus</i>	black-necked stilt
		<i>Catoptrophorus semipalmatus</i>	willet
		<i>Calidris pusilla</i>	semipalmated sandpiper
<i>Calidris alpina</i>	dunlin		

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Conservation Issues and Actions

Impoundments		
Issue Category	Specific Issue	Specific Action
Residential and Commercial Development Practices	Altered Hydrology	See Section 6.2.2
	Nutrients and Sediments	See Section 6.2.2
	Pesticides	See Section 6.2.2
Agricultural and Forestry Operations	Altered Hydrology	See Section 6.2.3
	Nutrients and Sediments	See Section 6.2.3
	Pesticides	See Section 6.2.3
Transportation and Utility Operations and Maintenance	Transportation Infrastructure	See Section 6.2.1
	Altered Hydrology	See Section 0
Invasive Species, Nuisance Animals and Wildlife Diseases	Snow Goose and Resident Canada Goose	Increase goose harvest on state lands as necessary to reduce impacts to key habitats.
		Encourage federal and NGO conservation land managers to increase goose harvest as necessary to reduce impacts to key habitats.
		Develop education and outreach encouraging landowners to increase goose harvest on private lands as necessary to reduce impacts to key habitats.
	Control of Mosquitoes and Forest Pests By Aerial Application of Pesticides	Work with the Mosquito Control Section to assess and monitor the impacts of aerial application on SGCN insects, and on the prey base of SGCN insectivorous birds, small mammals and bats.
		Work with the Mosquito Control Section to adapt aerial application practices for conservation of SGCN, as necessary.
	Control of Mosquitoes with Open Marsh Water Management and Impoundment Management	Work with the Mosquito Control Section to evaluate the impacts of impoundment management on key habitats.
		Work with the Mosquito Control Section to adapt impoundment management for conservation of key habitats, as necessary.
	Invasive Plants	See Section 6.2.6
Control of Invasive Plants	See Section 6.2.6	

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Impoundments		
Issue Category	Specific Issue	Specific Action
Water Use	Groundwater Withdrawals	Work with the Division of Water Resources to integrate key habitat conservation into long-range water supply planning.
		Work with the Division of Water Resources to integrate key habitat conservation into protection of "excellent groundwater recharge areas."
Climate Change	Sea Level Rise	See Section 6.2.7
Recreational Activities	Recreational Use on Foot and with Boats, Personal Watercraft and Off-Road Vehicles	See Section 0
Airport Operations	Overflights	Continue/expand studies of disturbance of SGCN from overflights, and work with Dover Air Force Base to mitigate disturbance.
Resource Management	Habitat/Wildlife Management	See Section 0

6.1.19. Forest Blocks

Description

Forest Blocks may include upland forests and/or wetland forests. These constituent habitats are described above, as are the relevant Associated Species of Greatest Conservation Need and Conservation Issues and Actions. Additional issues and actions that pertain to Forest Blocks are in Section 6.2.

Vital Statistics

Forest Blocks		
Attribute	Total	Protected
Acreage	119,268	35,058 (29%)
Occurrences	263	96 (37%)
Known SGCN Species / Occurrences	96 / 259	71 / 158 (74% / 61%)

Delaware Wildlife Action Plan

Present Condition

Poor. Most of Delaware was forested at the time of European settlement. The amount of forest loss since then is difficult to determine with much accuracy, but it has been estimated at 50-75% (since some existing forest represents second growth that has occurred on abandoned farmland, especially in the northern part of the state, the loss was probably greater than this at its peak in the 19th century). More recently, calculations of forest loss in the state range from 35,000 acres from 1984-1992 and 20,000 acres from 1986-1999; in 2005 alone, loss was estimated to be as high as 4,500 acres. Historically, this loss stemmed from conversion to agriculture, but is now mostly the result of residential and commercial development and associated infrastructure.

As striking as the overall loss of forest is the fragmentation of that which remains. Mapping of tree cover in the state completed in 2004 delineated about 4,150 separate wooded patches larger than 10 acres. The median size among those patches is only 34 acres, and just 6% are larger than 250 acres. An examination of patch “thickness,” which accounts for size and shape, reveals only a few (<0.1%) that have sufficient interior habitat to sustain area-sensitive species like cerulean warbler, Northern parula and black-and-white warbler for the long term. Additional analysis indicates that the patches are highly isolated from each other, with less than 10% meeting the isolation thresholds for hooded warbler, American redstart, red-shouldered hawk and brown creeper. Finally, calculation of perimeter/area ratio for the forest blocks highlights their very irregular shapes. Almost 90% have a ratio greater than that of a 10:1 rectangle, a configuration that produces major edge effects.

Recent field surveys of nearly 100 Coastal Plain forest blocks found about half of them to be in “Good” or “Very Good” condition, but this rating was based on vegetative characteristics, not on spatial attributes or wildlife habitat.

See the discussion of Present Condition under Coastal Plain Upland Forests (Section 6.1.4) for more information about forest condition.

6.1.20. Wetland Blocks

Description

Wetland Blocks may contain non-tidal wetlands, freshwater tidal wetlands, and/or saltwater and brackish tidal wetlands. These constituent habitats are described above, as are the relevant Associated Species of Greatest Conservation Need and Conservation Issues and Actions. Additional issues and actions that pertain to Wetland Blocks are in Section 6.2.