

**CONSERVATION ACTION PLAN FOR THE  
AMERICAN BLACK DUCK, First Edition**  
**2011**



U.S. Fish and Wildlife Service  
Division of Migratory Bird Management

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## EXECUTIVE SUMMARY

The American black duck (*Anas rubripes*) was selected as a Focal Species due to its conservation need, representation of salt-marsh and boreal species needs, and high level of current program effort and existing partnerships. The black duck population experienced a severe decline of >50% between the 1950s and 1990s. Today, the black duck population appears stable but below desired abundance. Monitoring data including spring abundance, winter abundance and productivity paint a mixed picture of the stability and sustainability of the population. Researchers and managers have not reached consensus regarding current limiting factors.

**Major threats to the black duck include, but are not limited to:**

- Loss and degradation of boreal forest (i.e., breeding grounds) due to economic development including hydro-electric, mining, timber, and agricultural activities.
- Loss and degradation of wintering grounds, particularly coastal salt marsh due to urban expansion, pollution, recreational activities, and sea-level rise.
- Predicted changes due to climate change, including shifts in temperature and precipitation patterns and phenology that will exacerbate current limiting factors and potentially expose black ducks to novel limiting factors such as diseases.

**Priority conservation and management actions include:**

- Development of a revised breeding population goal based on the best available science.
- Development of harvest and habitat adaptive management frameworks to guide decisions and reduce key uncertainties.
- Improvement of monitoring programs designed to provide estimates of seasonal survival and productivity.
- Development of monitoring programs to estimate energetic carrying capacity on wintering grounds.

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- Research to understand and quantify functional relationships between habitat features, habitat management, vital rates, and density.
- Protection, restoration and enhancement of key land parcels on breeding grounds, migration routes and wintering grounds.



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*Front cover photo: American black duck (Photo Credit D. Bordage, CWS) ; this page: American black duck breeding habitat in the boreal forest of central Quebec (Photo Credit P. K. Devers, USFWS).*

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## INTRODUCTION

The U.S. Fish and Wildlife Service (USFWS) Division of Migratory Bird Management (DMBM) initiated the Focal Species Program (FSP) in 2004. The FSP was developed in direct response to a recommendation from the Office of Management and Budget to develop new, stronger performance measures to evaluate program success. The DMBM proposed to the Office of Management and Budget to use the FSP to systematically identify and implement management activities to improve the status of select migratory bird species and demonstrate the depth and breadth of management challenges faced by the USFWS and its partners (U.S. Fish and Wildlife Service 2007). Species that met  $\geq 1$  of the following criteria were included in the FSP: 1) high conservation need, 2) representative of a broader group of species sharing the same or similar conservation needs, 3) high level of current program effort, 4) potential to stimulate partnerships, and 5) high likelihood that factors affecting status can realistically be addressed. Based on these criteria and after broad consultation the DMBM identified 139 focal species to emphasize in the short term (U.S. Fish and Wildlife Service 2007).

The American black duck (*Anas rubripes*; hereafter black duck) was selected as a Focal Species due to its conservation need, representation of salt-marsh and boreal species needs, and high level of current program effort and existing partnerships. The black duck population experienced a severe decline of  $\geq 50\%$  resulting in a variety of management responses by Federal, Provincial and State conservation agencies in Canada and the U.S. The most concerted management response was the establishment of the Atlantic Coast Joint Venture (ACJV), Eastern Habitat Joint Venture (EHJV), and Black Duck Joint Venture (BDJV) under the North American Waterfowl Management Plan ([NAWMP](#)). The BDJV is an international partnership designed to coordinate cooperative monitoring, research, and communications programs to ensure the future sustainability of black ducks and other waterfowl species in eastern North America.

The goal of this Action Plan is to identify the research and management actions necessary to ensure the future sustainability of the black duck population. The objectives of this Action Plan are:

1. Review the natural history and population status of the black duck;
2. Identify and review potential current and future limiting factors (i.e., conservation threats);
3. Describe priority information, research, conservation, and management needs to improve the status of the black duck;
4. Describe potential methods for evaluating the success of management actions taken to improve the status of the black duck.

The target audiences of this Action Plan are the DMBM, USFWS National Wildlife Refuge System (Regions

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5, 3, 4), USFWS Regional Migratory Bird Programs (Regions 5, 3, 4), Environment Canada - Canadian Wildlife Service (CWS), State and Provincial conservation agencies of the Atlantic and Mississippi Flyways, Atlantic Coast Joint Venture (ACJV), Eastern Habitat Joint Venture (EHJV), Upper Mississippi River and Great Lakes Joint Venture (UMRGLJV), Central Hardwoods Joint Venture (CHJV), Appalachian Mountain Joint Venture (AMJV), and non-government organizations with a stake in black duck management (e.g., Ducks Unlimited). This Action Plan will be updated periodically to reflect the most current information related to black duck science, management, and conservation threats.

## POPULATION STATUS

Historically the black duck was the most abundant dabbling duck species in eastern North America (Fig. 1). The black duck population experienced a drastic (>50%) and long-term decline between the 1950s and 1990s (Fig. 2). Researchers and managers proposed several hypotheses to explain the historic decline of black ducks including over-harvest, competition and hybridization with mallards (*Anas platyrhynchos*), decrease in quality and quantity of wintering and breeding habitat, and environmental contaminants (Conroy et al. 1989, Rusch et al. 1989, Longcore et al. 2000a,b, Merendino et al. 1993, Nudds et al. 1996, Conroy et al. 2002, McAuley et al. 2004, Zimpfer and Conroy 2006). Research into each of these hypotheses has provided valuable insight into black duck ecology and management. However, the black duck community has not reached consensus regarding the cause of the population decline or current limiting factors. Further, the population remains below the North American Waterfowl Management Plan (NAWMP) continental population goal and has been identified as a *Species of Greatest Conservation Need* by 23 states in the Mississippi and Atlantic Flyways (Table 1). Finally, indices of abundance and productivity paint a mixed picture of population growth, making the future status and sustainability of the black duck population uncertain.

Based on Mid-Winter Inventory (MWI) data the average finite growth rate between 1990 and 2010 was 0.99 ( $\pm 0.142$  S.D.; Fig. 2). However, the trend differed between the Atlantic Flyway ( $= 1.0, \pm 0.1421$  S.D.) and the Mississippi Flyway ( $= 0.99, \pm 0.277$  S.D.; Fig. 2). Similarly, a recent analysis of Christmas Bird Count (CBC) data suggested regional variation in population trends of black ducks (Link et al. 2006). The CBC provides data over a larger portion of black duck winter range than the MWI and indicates that black ducks are declining in the southern and central portion of wintering range, but populations in the northeastern range are stable (Link et al. 2006).

Estimates of the breeding population from 1990–2010 suggest the black duck population is stable (Fig. 3). The mean finite growth rate between 1990 and 2010 based on the integrated breeding population estimate

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Figure 1: Distribution of the American black duck (from Longcore et al. 2000a). Breeding areas shown in blue, breeding and wintering areas in green, and wintering areas in orange.

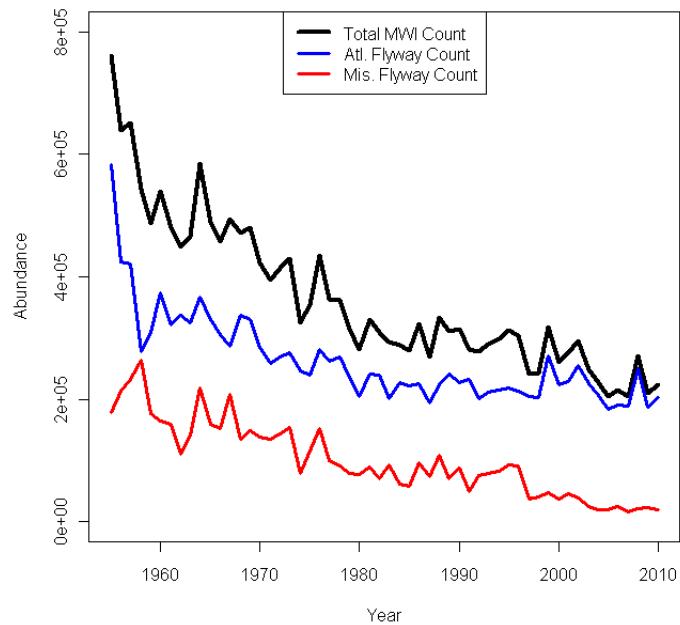


Figure 2: Estimates of black duck winter abundance based on the Mid-Winter Inventory, 1955—2010.

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Table 1: *States that have identified the black duck as a “Species of Greatest Conservation Need” as part of their State Action Plans.*

<b>State</b>	<b>Flyway</b>	<b>State</b>	<b>Flyway</b>
Connecticut	Atlantic	West Virginia	Atlantic
South Carolina	Atlantic	Vermont	Atlantic
Delaware	Atlantic	Alabama	Mississippi
Florida	Atlantic	Arkansas	Mississippi
Maine	Atlantic	Illinois	Mississippi
Maryland	Atlantic	Kentucky	Mississippi
New Hampshire	Atlantic	Michigan	Mississippi
New Jersey	Atlantic	Mississippi	Mississippi
New York	Atlantic	Ohio	Mississippi
Pennsylvania	Atlantic	Wisconsin	Mississippi
Rhode Island	Atlantic	Minnesota	Mississippi
Virginia	Atlantic		

was 1.01 ( $\pm 0.095$  S.D.). However, this estimate only applies to that portion of the black duck breeding population covered by the initial surveys and may not reflect the overall population growth rate. Estimates of black duck wintering and breeding populations in 2010 were 223,472 and 439,300, respectively. In contrast to these population indices, estimates of age ratios based on band return and hunter survey data indicate black duck productivity declined drastically between 1997 and 2007 (Fig. 4).

Though questions still remain about the cause(s) of the population decline between the 1950s and 1990s, the factors that caused the decline may not be the same as those currently limiting black duck population growth and recovery. Identifying and understanding current limiting factors is critical to black duck management and meeting the goals of the DMBM. Further, emerging issues including global climate change and increasing human activities will present important challenges to the future of black duck conservation.

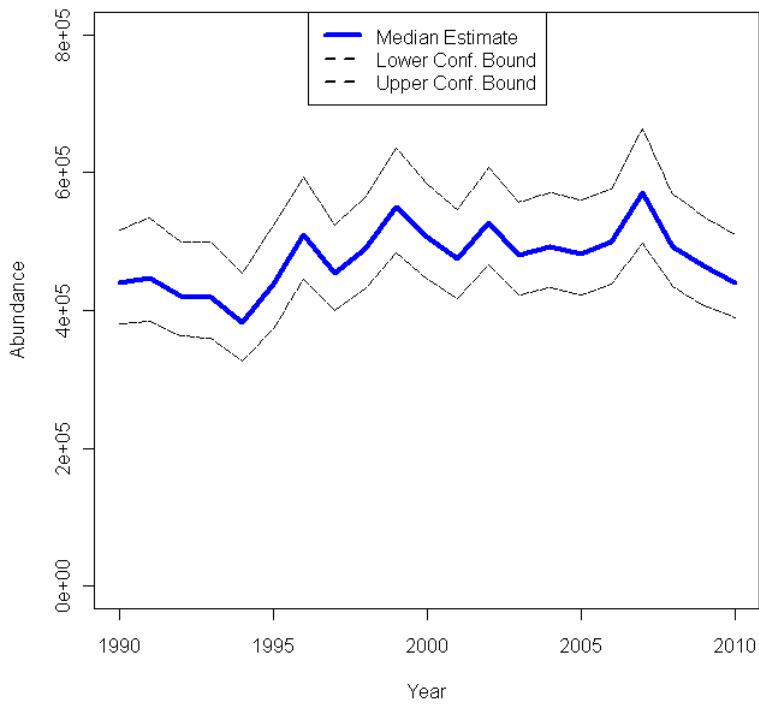


Figure 3: Estimates of total indicated breeding black ducks based on the Integrated Eastern Waterfowl Survey, 1990—2010.

## NATURAL HISTORY

### Taxonomy

The black duck is closely related to other monomorphic *Anas* species in North America and the sexually dimorphic mallard (Table 2). The black duck and mottled duck (*A. fulvigula*) were considered one species (*A. obscura*) commonly known as dusky duck until 1874 (Longcore et al. 2000b). After 1874, the black duck was known as *A. obscura* but the scientific name was changed to *A. rubripes* in 1908 (Longcore et al. 2000b). The name *A. o. rubripes* (Brewster 1902) was applied to describe a subspecies breeding in the north and west from the subspecies *A. r. tristis* (Brewster 1909) breeding in the south and east. However, the subspecies were determined not to be valid because the morphometric and color differences were related to age and sex rather than genetics (Longcore et al. 2000b).

Debate continues as to whether the black duck should be considered a subspecies of the mallard or a separate

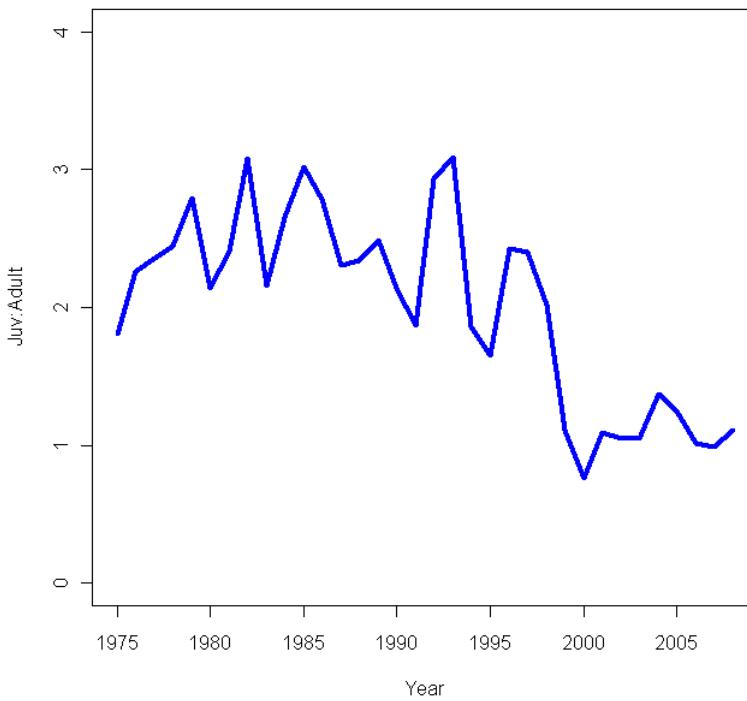


Figure 4: Trend in pre-season age ratios of black ducks harvested in the U.S., 1975—2008.

species. Some researchers consider the mallard to be closest to the ancestral form (Johnsgard 1961) and to represent a super-species. Genetic research indicates an exceptionally close evolutionary relationship between the two species and that the black duck only recently diverged from the mallard (Patton and Avise 1986, Avise et al. 1990). The low genetic variation between black duck and mallards has led some to conclude the black duck should not have species or even subspecies designation (Ankney et al. 1986).

It is difficult to theorize the ancestral form (and thus the entire mallard group) was sexually dimorphic and some populations lost this condition (Palmer 1976). Recent genetic research on the genus *Anas* suggests the mallard, black duck, mottled duck and Mexican duck evolved from a common monochromatic species with a holarctic distribution. The North American black ducks (i.e., *A. rubripes*, *A. fulvigula*, and *A. diazi*) were sexually isolated in what is now southwestern and southeastern U.S., and maritime Canada from the Eurasian stock due to glaciations (Spencer 1979). Subsequently, the Eurasian stock (i.e., mallard) evolved sexual dimorphism and re-invaded North America. Eventually the sexually dimorphic mallard hybridized with the North American black ducks (i.e., *A. rubripes*, *A. fulvigula*, *A. diazi*) creating the genetic patterns now observed across species (Spencer 1979, Johnson and Sorenson 1999). Spencer (1979) concluded the only tenable hypothesis is that the original North American black duck/mallard ancestor was

Table 2: *Taxonomic hierarchy of the black duck.*

<b>Level</b>	<b>Name</b>	<b>Related Species</b>
<b>Kingdom</b>	Animalia	
<b>Phylum</b>	Chordata	
<b>Class</b>	Aves	
<b>Order</b>	Anseriformes	
<b>Family</b>	Anatidae	
<b>Genus</b>	<i>Anas</i>	
<b>Species</b>	<i>rubripes</i>	
		<i>A. fulvigula</i>
		<i>A. diazi</i>
		<i>A. wyvilliana</i>
		<i>A. platyrhynchos</i>

sexually monomorphic because it is difficult to envision the necessary sexual isolation and selective pressure that subsequently lead to the evolutionary loss of sexual dimorphism.

## Life History

Historically, breeding black ducks occurred from North Carolina to Labrador, northern Quebec and northern Ontario (Fig. 1). However, the number of breeding black ducks in the U.S. and Ontario has declined markedly over the past 3 decades (Krementz et al. 1991). Black ducks reach sexual maturity in their first spring after hatching and form pair bonds on the wintering grounds. Nesting occurs from March in North Carolina, Virginia and Maryland to mid-May in Labrador and northern Quebec. Nests are built by the female and consist of a bowl lined with vegetative material and filled with down from the female (Allen 1893, Longcore et al. 2000b; Fig. 5). Females will re-use old nests or nests of other species (Longcore et al. 2000b). Nests can be located in a wide range of habitat types including wooded uplands, agricultural fields and margins, peat bogs, and tidal marsh (Reed 1970, Maisonneuve et al. 2000). Mean clutch size ranges from 8.9—10.4 and is typically larger in the northern compared to the southern portion of the breeding range (Stotts and Davis 1960, Coulter and Miller 1968, Reed 1970, Belanger et al. 1998, Petrie et al. 2000). Females will lay additional eggs or re-nest if eggs or clutch are lost early in the nesting cycle. Incubation period is approximately 27 days

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(Stotts and Davis 1960, Reed 1970). Ducklings are precocial and nidifugous and leave the nest within 24—27 hours (Allen 1893, Longcore et al. 2000b). Nest success varies annually and by habitat type, but averages range from 22%—77% (Stotts and Davis 1960, Reed 1970, Reed 1975, Krementz et al. 1991, Laperle 1974, Belanger et al. 1998, Maisonneuve et al. 2000, Petrie et al. 2000). Hatching success is high (>75%) but can be variable due to seasonal flooding (Mendall 1949). Mean brood size of age-class III ducklings ranges from 3.8–7.0 (Ringelman and Longcore 1982, Seymour and Jackson 1996, Longcore et al. 1998). Brood survival (i.e., fledged  $\geq 1$  duckling) ranged from 0.49 in Quebec to 0.81 in southern Maine (Reed 1970, Ringelman and Longcore 1982). Mean duckling survival in southern Maine was 0.42 (Ringelman and Longcore 1982).



Figure 5: *Black duck nest in the Chesapeake Bay, VA, 2006* (photo credit: P. K. Devers, USFWS).

Paired males leave their mates during incubation and join non-breeding males to molt across the breeding range. Molting areas include the Hudson and James Bay regions, northern Manitoba, Ungava Bay, and coastal Labrador (Palmer 1976, Bowman and Longcore 1989, Bowman and Brown 1992). Molting males make limited movements (mean 0.2 km/day) during this period and exhibit high survival rates (0.89; Bowman and Longcore 1989). Males also exhibit high site fidelity to molting grounds (Bowman and Brown 1992). Females typically molt on or near their breeding grounds (Longcore et al. 2000b).

The black duck is classified as a partial-short distance migrant (Longcore et al. 2000b). In general, black ducks migrate south through the Atlantic and Mississippi Flyways beginning in early September. Band recovery data suggest birds that breed in northern Ontario and parts of northwestern Quebec migrate through the Great Lakes region to winter in the upper (e.g., Michigan and Ohio) and middle (southern Illinois, Kentucky, Tennessee) Mississippi River and Tennessee River systems (Addy 1953, Longcore et al. 2000a). Birds that breed in southern Ontario and southeastern Quebec appear to stage on the Great Lakes

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and then move south to either the middle Mississippi River or southern Atlantic coast (e.g., western shore of Virginia, North and South Carolina) (Addy 1953, Longcore et al. 2000a). Breeding birds from central and northern Quebec, Labrador and Newfoundland migrate south and winter along the U.S. Atlantic Coast (Maine to North Carolina) (Addy 1953, Longcore et al. 2000a). Some breeding birds in Prince Edward Island, Nova Scotia, New Brunswick and Maine migrate very short distances or not at all (Addy 1953, Longcore et al. 2000a). The timing of fall migration is not well understood, but is probably influenced by weather, food abundance, and hunter disturbance (Longcore et al. 2000b). Recent research suggests the distribution of black ducks in fall and winter in the Mississippi Flyway is influenced by temperature (Brook et al. 2009). In warmer years black ducks appear to not migrate as far south and winter in the Great Lakes region.

Our understanding regarding spring migration is even more limited than fall migration. This is due, in large part, to the lack of band recoveries outside the fall hunting season. Recent work using satellite telemetry and global positioning technology suggests black ducks follow the same migratory paths during fall and spring migration. Black ducks are typically among the first species to arrive on northern staging areas and quickly occupy breeding wetlands as the ice thaws (Wright 1954, Chaulk et al. 2007). Mechanisms controlling the timing and duration of spring migration are poorly understood.

Estimates of black duck survival are typically based on band recovery models. Black ducks have been banded annually since the 1950s as part of an international harvest management program. The vast majority of bandings occur prior to the hunting season (August and September), though black ducks were commonly banded during the post-hunting season (January–March) through the 1970s. Band recoveries are obtained through hunter harvested birds and recapture of live birds during pre- and post-season banding operations. Mean annual survival typically ranges from 0.46 to 0.67 with adult males exhibiting the highest and juvenile females the lowest survival rates (Table 3). Causes of black duck mortality include hunter harvest, mammalian and avian predation, exposure, disease, and environmental contamination. Exposure is a leading cause of mortality of ducklings up to 18-days post-hatch (Longcore et al. 2000b).

Black ducks use a broad array of wetlands and associated uplands to meet their annual habitat requirements (Fig. 6). Wetland types including beaver ponds/flowages, salt and emergent marshes, freshwater and brackish ponds, streams and flooded bottomland stands are used throughout the year. Green-tree reservoirs and flooded croplands provide habitat during migration and winter particularly in the upper- and middle-Mississippi River system (Longcore et al. 2000b). Tidal flats and brackish marsh are critical components of black duck migration and winter habitat along the Atlantic coast.

Black ducks are omnivorous. Vegetative material comprises the majority of black duck diet throughout the year (Table 4), but animal material is obligatory during the nesting and wintering periods (Longcore et al.

Table 3: Summary of black duck survival rates.

Vital Rate	Cohort	Estimate	Source
Mean annual survival	Adult Male	0.63	Krementz et al. 1987
Mean annual survival	Juvenile Male	0.48	Krementz et al. 1987
Mean annual survival	Adult Female	0.47	Krementz et al. 1987
Mean annual survival	Juvenile Female	0.43	Krementz et al. 1987
Mean annual survival	Adult Male	0.64–0.67	Francis et al. 1998
Mean annual survival	Juvenile Male	0.51–0.65	Francis et al. 1998
Mean annual survival	Adult Female	0.56–0.59	Francis et al. 1988
Mean annual survival	Juvenile Female	0.46–0.57	Francis et al. 1988
Seasonal survival (molting)	Adult Males	0.89	Bowman and Longcore 1989
Seasonal (winter) survival	Female	0.65	Conroy et al. 1989
Seasonal (fall) survival	Male & Female	0.21–0.62	Longcore et al. 2000a
Mean annual survival	Adult Male	0.59	Nichols et al. 1987
Mean annual survival	Adult Female	0.49	Nichols et al. 1987
Mean annual survival	Juvenile Male	0.51	Nichols et al. 1987
Mean annual survival	Juvenile Female	0.42	Nichols et al. 1987

2000b). Ducklings feed almost exclusively on insects until 18 days post-hatch. After this time ducklings begin feeding on plants including seeds and leafy material. Black ducks will eat corn (*Zea mays*) when available (Longcore et al. 2000b). The diet of wintering black ducks in Virginia was comprised of 73% animal matter, 16% vegetation and 10% seeds (Eichholz et al. 2010). Black ducks selected for invertebrates, including scuds (*Amphipoda*), land snails (*Ellobiidae*), mud snails (*Hydrobiidae*), mussels (*Mytilidae*), and shrimp (*Palaemonidae*) (Eichholz et al. 2010). Previous work in New Jersey indicated black duck diets consisted of 91% animal matter (Costanzo and Malecki 1989). However, the composition of the animal matter differed between the two studies. The salt marsh snail (*Melampus bidentatus*) was the primary food source in New Jersey, whereas amphipods were the primary food sources in Virginia.

Intra- and inter-specific interactions vary by season. Male black ducks defend territories during the nesting period from conspecifics and mallards. Territory size varies by the habitat type in which the nest is located. Mean territory size in Nova Scotia was 0.16–3.8 ha (Seymour and Titman 1978). Results of research concerning black duck and mallard competition for nest sites and winter food resources are equivocal. Black

Table 4: *Partial list of black duck food items (from Longcore et al. 2000a, Eichholz et al. 2010).*

Food Item	Season
Mayflies (Ephemeroptera)	Breeding
Caddis flies (Trichoptera)	Breeding
Dragonflies (Odonata)	Breeding
Snails (Gastropoda)	Breeding/Migration/Winter
Bur reed ( <i>Sparganium spp.</i> )	Breeding
Aquatic buds (Himiptera)	Breeding
Beetles (Coleoptera)	Breeding
Spike rush ( <i>Eleocharis spp.</i> )	Breeding
Smartweed ( <i>Polygonum spp.</i> )	Migration/Winter
Buttonbush ( <i>Cephalanthus occidentalis</i> )	Migration/Winter
Wild rice ( <i>Zizania aquatica</i> )	Migration/Winter
Acorns ( <i>Quercus spp.</i> )	Migration/Winter
Smooth cordgrass ( <i>Spartina alterniflora</i> )	Migration/Winter
Tide-marsh water hemp ( <i>Acnida cannabina</i> )	Migration/Winter
Salt marsh bulrush ( <i>Scirpus paludosus</i> )	Migration/Winter
Marine algae (Chlorophyceae)	Migration/Winter
Gizzard shad ( <i>Dorosoma cepedianum</i> )	Migration/Winter
Blue mussel ( <i>Mytilus edulis</i> )	Migration/Winter
Bent-nosed clam ( <i>Macoma balthica</i> )	Migration/Winter
Water bulrush ( <i>Scirpus subterminalis</i> )	Migration/Winter
Periwinkle ( <i>Litorina spp.</i> )	Migration/Winter
Salt grass snail ( <i>Melampus bidentatus</i> )	Migration/Winter
Killifish ( <i>Fundulus spp.</i> )	Migration/Winter
Tupelo ( <i>Nyssa spp.</i> )	Migration/Winter
Marine gastropods	Molt
Amphipods	Molt
Blueberry ( <i>Vaccinium spp.</i> )	Molt



*Figure 6: Black duck breeding habitat in central Quebec, 2008 (photo credit: P. K. Devers, USFWS).*

ducks typically form single-species flocks during the non-breeding season, but will also form loose flocks with mallards and other species that occur on southern wintering areas.

## LIMITING FACTORS

Black duck population growth is influenced by a multitude of density-dependent and independent factors that occur at multiple spatial and temporal scales. These factors can limit the population by decreasing either productivity (i.e., reproduction and recruitment of young into the fall population) or seasonal survival. Limiting factors also are dynamic so it is useful to categorize them into immediate (i.e., on-going) and emerging (i.e., long-term) threats. For example, the loss and degradation of habitat due to human activities (e.g., housing development along coastal marshes) is an immediate threat to black duck conservation (Fig. 7).

Emerging threats such as climate change may exacerbate existing limiting factors or introduce new ones (Fig. 7; Seavy et al. 2008). Depending on the rate and magnitude of change (i.e., changes in seasonal temperature and precipitation patterns) climate change may only cause an intensification of existing limiting factors. For example, the combination of urbanization and rising sea level (due to climate change) along the Atlantic coast

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will result in an accelerated loss of winter habitat and a decline in winter carrying capacity. Alternatively, black ducks may also experience new limiting factors such as novel diseases introduced to eastern North America as a result of warmer and wetter conditions. The keys to addressing both immediate and emerging threats are to understand: 1) the functional relationships between density, habitat characteristics, and black duck vital rates, 2) how management can influence these relationships to increase the targeted vital rate, and 3) how climate change will influence habitat characteristics and the associated relationships with black duck vital rates.

The primary (hypothesized) limiting factors affecting black ducks are: 1) habitat loss, 2) habitat degradation, 3) inter-specific competition, and 4) harvest. The mechanisms of each of these limiting factors and the vital rates each influences are detailed below. Importantly, it is safe to assume all of these factors are occurring and influence black duck population growth and sustainability. The important questions are which factors are having the greatest impact and which factors are amenable to management.

## **Habitat Loss**

Habitat loss is clearly the most important limiting factor contributing to the historic decline of black ducks and limiting future growth. Black duck habitat is lost through a variety of mechanisms on the breeding grounds and migration/wintering areas. Assuming black duck population dynamics are regulated through density-dependent and independent mechanisms the loss of habitat (regardless of cause or location) should result in decreased survival and or productivity (Fig 8). For example, the loss of habitat may cause black ducks to congregate in higher densities during the winter resulting in greater exposure to avian diseases and increased mortality. Important diseases that may influence black ducks include duck virus enteritis, Newcastle disease virus and avian influenza. On the breeding grounds, habitat loss results in fewer nesting sites thus limiting reproduction. The loss of brood rearing wetlands to agriculture or urbanization may increase duckling mortality and decrease recruitment into the fall population.

Black ducks have experienced a loss of breeding habitat from the boreal forest south through historic breeding areas in North Carolina. In the boreal forest region, habitat has been lost as the result of the construction of hydro-electric dams (particularly in Quebec and Labrador), mining operations, and timber harvest (Fig. 9). The development of the electrical resources, particularly hydroelectric, is a primary component of Quebec's economy ([Quebec Ministry of Natural Resources, accessed 28 July 2010](#)). The development of hydroelectric facilities began in the mid 1900s and in 1971 the James Bay Hydro-electric Project flooded 11,500 km<sup>2</sup> in the northern part of the black duck range in Quebec. The Quebec Ministry of Natural Resources estimates the current hydroelectric generating capacity in Quebec is approximately 43,000 Megawatts (MW) and plans to develop an additional 4,500 MW between 2007 and 2010 ([Quebec Ministry of Natural Resources, accessed 28 July 2010](#)).

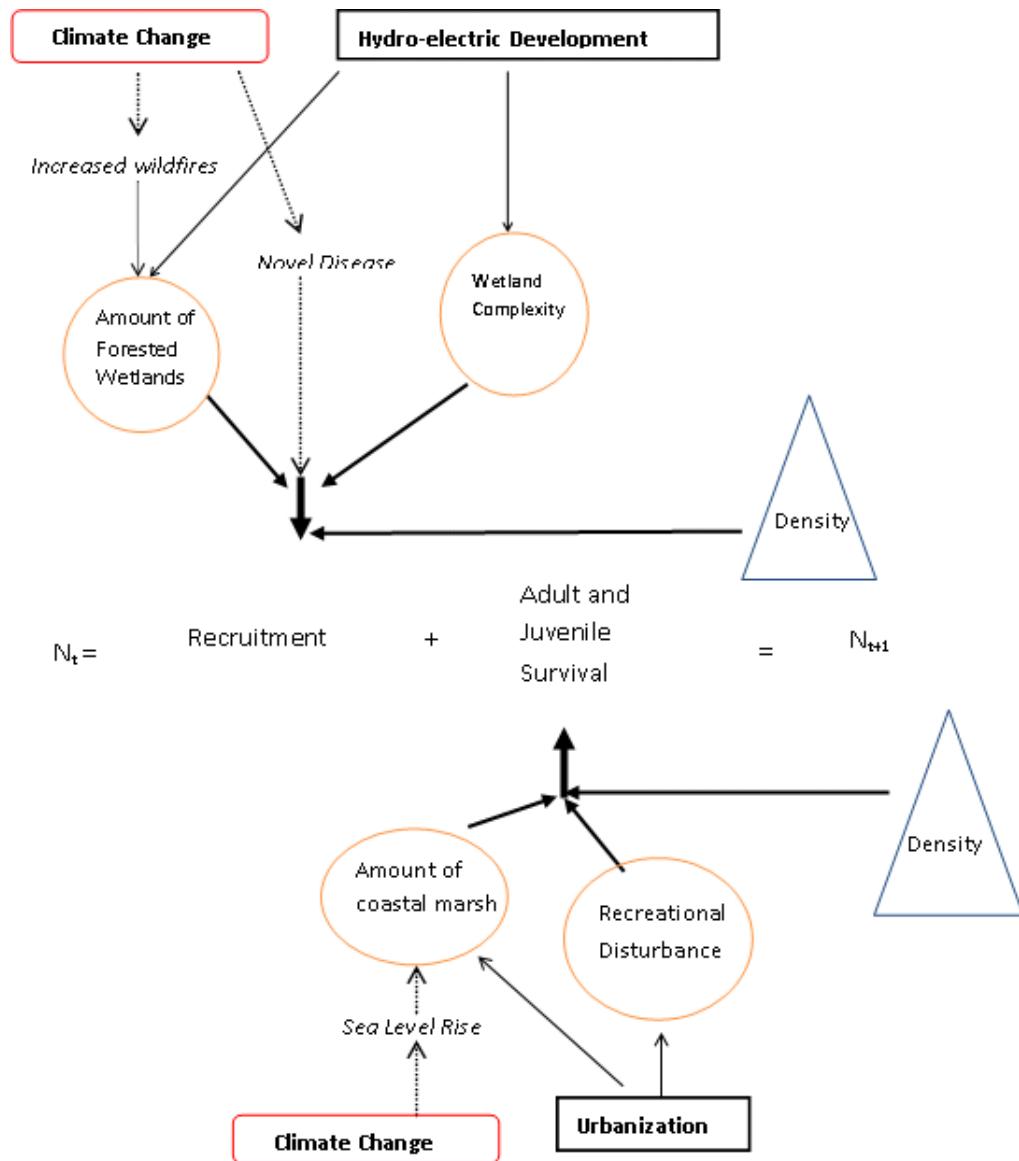


Figure 7: Conceptual diagram of black duck population dynamics and immediate (e.g., habitat loss via hydro-electric development and urbanization) and emerging limiting factors (e.g., habitat loss via climate change).

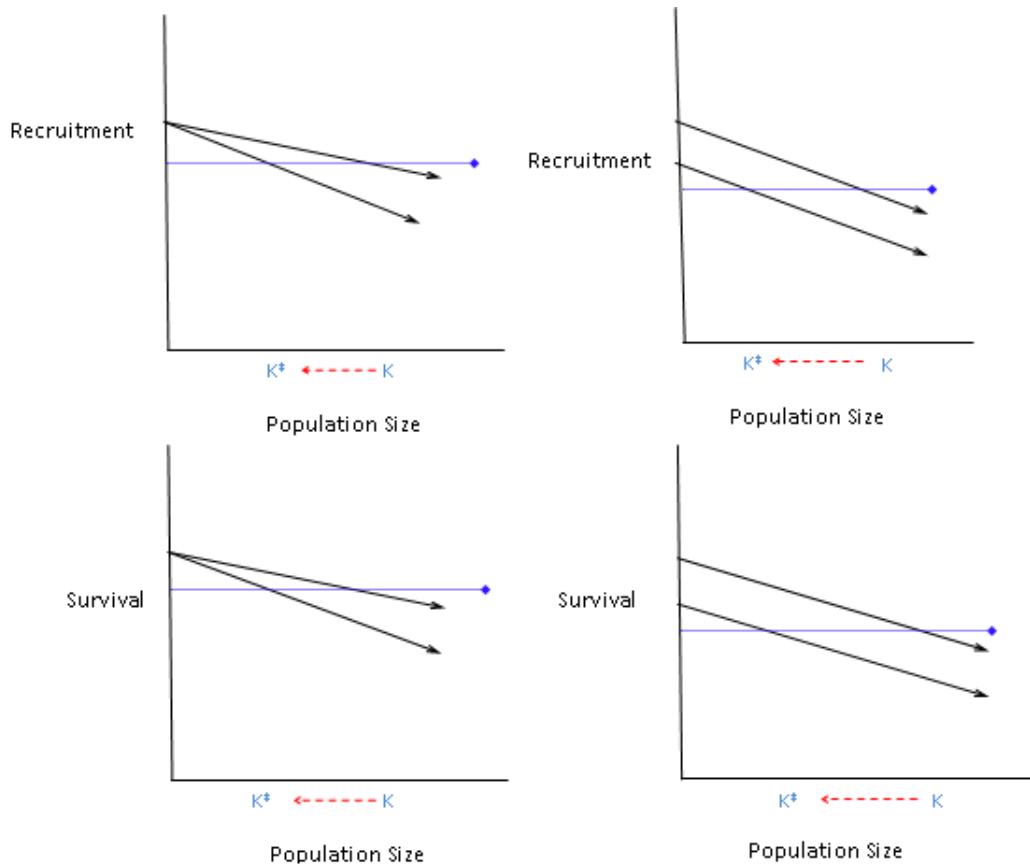


Figure 8: *Conceptual impact of decreasing carrying capacity (through habitat loss or degradation) on black duck vital rates (i.e., reproduction and survival). Top left: Habitat loss reduces carrying capacity and results in a more rapid reduction of recruitment related to density. Top right: Habitat degradation results in a lower carrying capacity and lower recruitment across all densities. Bottom left: Habitat loss results in a more rapid decrease of annual survival relative to black duck density. Bottom right: Habitat degradation results in lower survival across all ranges of density. Dashed blue line indicates density independent survival (top left and right) or recruitment (bottom left and right).* Adapted from Anderson et al. 2007.

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[28 July 2010](#)). In Newfoundland and Labrador there are approximately 35 hydroelectric facilities and a total of 87 provincial generating sites ([Newfoundland and Labrador Ministry of Natural Resources](#), accessed [28 July 2010](#)). Hydroelectric facilities have also been developed in Ontario and New Brunswick.

Mineral development is also an important part of Canada's economy. Quebec currently has 28 metallic and non-metallic mining operations and another 17 in development ([Quebec Ministry of Natural Resources](#), accessed [18 July 2010](#)). Between 2003 and 2007 mineral exploration expenditures in Quebec increased 350% from \$134 million (Canadian) to \$470 million. The Quebec government expects the mineral development sector to continue growing in the near future ([Quebec Ministry of Natural Resources](#), accessed [28 July 2010](#)). Labrador and Newfoundland have 14 active mines and 9 mines in development ([Newfoundland and Labrador Ministry of Natural Resources](#), accessed [28 July 2010](#)). Mineral exploration in Newfoundland and Labrador accounted for \$55 million (CAN) in total expenditures in 2009 and is forecasted to be \$72 million (CAN) in 2010. Future development of these operations will result in further reduction of carrying capacity for breeding black ducks. Notably, the Provinces of Ontario and Quebec independently announced strategic plans in 2009 referred to as the Far North Initiative in Ontario and Plan Nord in Quebec. These plans call for the protection of 50% of the landscape (north of the 49th and 50th parallels, respectively) for recreation and natural resources conservation, but will allow economic development of the remainder. Ultimately, the amount of black duck habitat that could be potentially lost or conserved under these programs will depend on which type of activities occur, and where.

The rate of habitat loss has been greater in southern Canada (Bird Conservation Regions 12, 13, and 14) than in northern Canada (Bird Conservation Regions 8 and 7). Importantly, southern Canada is considered the traditional core of black duck breeding range. This region historically accounted for 20% of the breeding population in Quebec and 60% in the Maritimes (Spencer 1979). In Nova Scotia >61% of the saltmarsh has been diked and drained since European settlement began in the 1600s (Eastern Habitat Joint Venture 2008). Habitat loss in this region has been the result of agricultural and industrial development and urbanization (Belanger and Lehoux 1994). The transition from forage production and dairy farming to intensive agricultural activities in southern Quebec has resulted in increased forest fragmentation, straightening of streams, and drainage of wetlands (Maisonneuve et al. 2006). The Lower Great Lakes/St. Lawrence Plain has experienced more significant impacts on habitat than in any other area of Ontario having lost 68% of its original wetland area since European settlement (Snell 1987). Over 90% of wetlands in southwestern Ontario have been converted to other land uses (Snell 1987).

The greatest rate of wetland loss in the U.S. occurred between 1950s and 1970s (coinciding with the period of greatest decline in black duck abundance) (Frayer et al. 1983). In the northeast U.S. wetland loss has averaged 25%–50% since European settlement (U.S. Environmental Protection Agency 1998). Though the rate of loss has slowed since the 1970s (corresponding with the Clean Water Act and Wetland Reserve



Figure 9: Examples of habitat loss in the boreal region of eastern Canada; (top) heavy metal mining (photo credit P. K. Devers, USFWS), (bottom) deep water reservoir created by hydro-electric dam (photo credit P. K. Devers).

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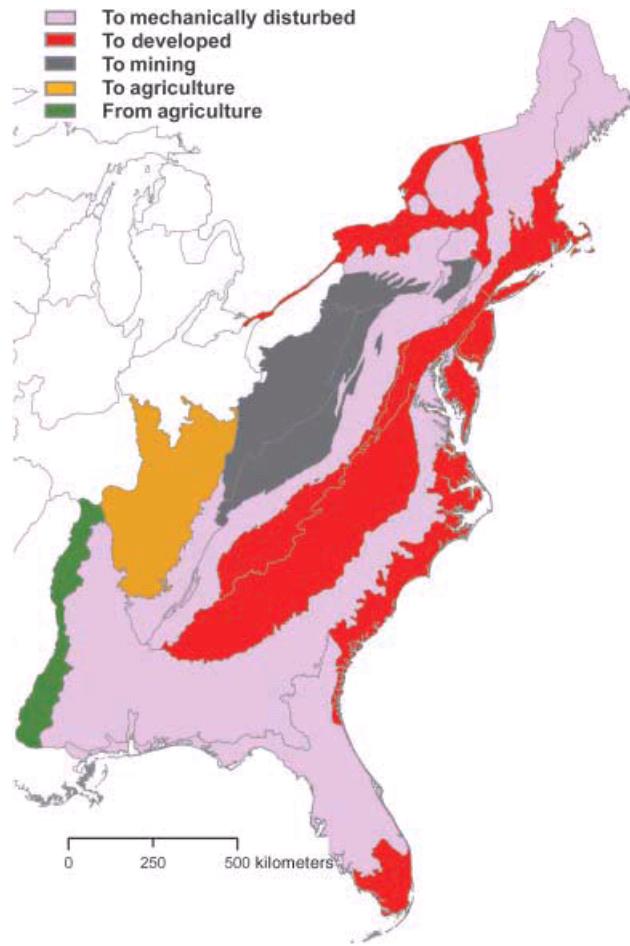


Figure 10: *Factors resulting in the loss of forest land, including forested wetlands, in the eastern U.S., 1973–2000 (reproduced from Drummond and Loveland 2010).*

Program), forested wetlands continue to decline due to agriculture, urbanization, and conversion to other types of wetlands (Hefner et al. 1994). Between 1973 and 2000 the eastern U.S. experienced a 2.3% net loss of forested land resulting in a cumulative loss of 3.7 million hectares (Drummond and Loveland 2010). Across the eastern U.S. the leading causes of forest loss were mechanical disturbance (i.e., timber harvest), development (i.e., urbanization), and mining (Drummond and Loveland 2010). Mechanical disturbances also caused the net loss of 273,000 ha of wetlands. Importantly, the leading cause of forest (and associated wetlands) loss in the primary black duck wintering areas was development (Fig. 10, Drummond and Loveland 2010). It is more difficult and expensive to restore habitat lost to development than to mechanical disturbance (i.e., timber harvest), mining, or agriculture.

## Habitat Degradation

The role of habitat degradation in the decline and current limitation of the black duck population is difficult to quantify but may be as important as habitat loss. Habitat degradation can occur in many forms and influence >1 aspect of black duck productivity (including nesting rate, nest success, hatch success) or survival (e.g., duckling, juvenile, and adult). Factors contributing to the degradation of black duck habitat include environmental pollutants, hydroelectric development, mining, timber operations, agriculture, industrialization, and urbanization.

Environmental pollutants, such as acid rain have been hypothesized to contribute to the decline of black ducks by degrading breeding habitat quality (Sparling 1990). Acid rain has been shown to decrease the amount of calcium (Ca) and phosphorus (P) and increase the amount of aluminum (Al) in lakes and wetlands across the northeast U.S. and eastern Canada. A decrease of Ca in wetlands can cause the reduction or complete loss of aquatic invertebrates preferred by black ducks and result in reduced clutch size and eggshell thinning, which in turn can reduce hatching success (Scheuhammer 1991). Black duck broods (age 1–36 days) avoided high acidic wetlands (Parker et al. 1992). Changes in Ca, P, and Al caused slower growth rates in terms of body weight, culmen, wing, and tarsi lengths and weakened bones of both black duck and mallard ducklings (Sparling 1990). The slower growth rate could increase duckling mortality due to exposure and predation. Long-term monitoring of lakes in Sudbury, Ontario suggests aquatic communities, including acid-sensitive fish, benthic invertebrates, and zooplankton recovered over a 10-year period following a 50% reduction in sulphur (Keller et al. 1992). However, monitoring by the Canadian Wildlife Service indicated that about 70% (n=600) of lakes in 3 regions (including Sudbury) showed no change in acidity status between 1988–1997 ([Environment Canada-Canadian Wildlife Service, accessed 22 March 2010](#)). These data suggest acid rain may currently limit black duck productivity.

Habitat degradation as a result of artificially high lead concentrations was historically an important mortality factor (Bellrose 1959). In Tennessee survival was negatively correlated with blood lead levels (Samual et al. 1992), but since the passage of non-toxic shot laws the importance of lead poisoning has decreased. After the ban on lead shot was implemented the prevalence of elevated blood lead in black ducks in Tennessee declined by 44% (Samual and Bowers 2000). However, lead shot is not the only source of lead in the environment. The majority of black ducks (96%) wintering at Sullivans Pond in Dartmouth, Nova Scotia had blood levels >100 parts per billion (ppb) and 76% had detrimental levels (>200 ppb; Daury et al. 1993). Researchers concluded automobile emissions were the primary source of lead causing the elevated blood lead levels in black ducks (Daury et al. 1993). Other environmental contaminants that reduce the quality of black duck habitat include agricultural runoff, coastal oil spills, municipal waste water, industrial pollutants, and atmospheric deposits, and a variety of chemical compounds (Atlantic Coast Joint Venture: waterfowl implementation plan 2005). These pollutants may result in decreased survival or reproduction.

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Timber harvest occurs throughout the black duck breeding range, but its impact on black duck productivity is equivocal. Forests cover 761,100 km<sup>2</sup> in Quebec and consists of 3 major forest types including hardwood, mixed, and boreal. Approximately 55% of the total forest area is considered commercially productive. The boreal forest, which supports the most breeding black ducks, covers 551,400 km<sup>2</sup> and approximately 35% of this area has been set aside for forest production [Quebec Ministry of Natural Resources; accessed 20 July 2010](#)). In Ontario, forested lands cover 71 million ha of which 8.5% is in protected areas. However, approximately, 48.4% of Ontario's boreal forest is currently unavailable for harvest [Ontario Ministry of Natural Resources; accessed 28 July 2010](#)) for a variety of regulatory and commercial reasons. Timber harvest in New Brunswick has been around 45 million m<sup>3</sup> between 2003 and 2007 and in 2007 lumber production in Newfoundland totaled 130 million board feet (Milley 2008). Depending on the amount, size, and number of cuts in relation to the natural matrix of the forest, timber operations may increase predation on nesting hens and eggs by creating edge and travel corridors for predators. It may also decrease duckling survival by altering water quality and food availability. Alternatively, slash created by timber harvest may increase nesting cover and nest success. Recent research in southern Quebec suggested timber harvest did not influence short-term black duck breeding distributions (Darveau et al. 2008). In the long-term, it is hypothesized that the density and success of nesting black duck are positively related to the area of forested wetlands.



Figure 11: *Example of clear cuts in Quebec. Timber harvest increases forest edge and travel corridors for mammalian predators and increases disturbance which may negatively impact black ducks (photo credit Quebec Ministry of Natural Resources).*

Agricultural activities may also reduce habitat quality resulting in depressed nesting rate, nest success, hatching success, and chick survival. Agricultural activities, such as clearing forested area and filling or draining wetlands, altering streams, and planting crops reduce wetland complexity on the landscape. Wetland complexity is a function of the number, size, and shapes of wetlands and connecting streams in an area. Black duck breeding density and potentially nesting success are hypothesized to be positively correlated

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with wetland complexity (Hanson 2001). Black duck densities were higher in forested and dairy landscapes (>39 indicated breeding pairs [IBP]/100 km<sup>2</sup>) than in croplands (8 IBP/100 km<sup>2</sup>) in southern Quebec (Maisonneuve et al. 2006). Agricultural activities may also increase hen, nest, and duckling predation by facilitating movement of predators among and between wetlands. Agriculture may contribute to increased duckling mortality via run-off resulting in decreased water quality and invertebrate abundance. In general, black duck breeding density is negatively correlated with the area of corn, plowed fields and deciduous forest (Maisonneuve et al. 2006) suggesting landscape changes from forested and coastal wetland systems to agricultural landscapes degraded black duck habitat quality and contributed to the decline of black ducks. The continued conversion of forested and coastal wetland areas to agriculture continues to operate as a limiting factor.

Human disturbance including non-consumptive activities and generic urban activities may result in decreased habitat quality. Black ducks exhibit heightened sensitivity to human disturbance (including recreation and presence of buildings) compared to other waterfowl species (Cconomy et al. 1998, Morton et al. 1989). Black ducks respond to human activities by increased alertness, flushing, and less time feeding or loafing (Morton et al. 1989, Cramer 2009). This relationship may cause increased mortality by limiting energetic intake during critical periods, such as winter (Morton et al. 1990) or by exposing black ducks to predators during flushing events. In southern New Jersey it is predicted that adult females could survive freeze events for 2.8–3.9 days based on energy reserves and juvenile females could survive for 1.4–2.1 days (Cramer 2009). Increased human disturbance in loafing or feeding areas could result in reduced energetic reserves and increased mortality during freeze events.

## **Inter-Specific Competition**

Competition occurs when 2 species use the same limited resources or harm each other when seeking those resources (Krebs 1994), resulting in depressed growth rates, abundances, and distributions of 1 of the competing species (Gotelli 1998, Case 2000). Several forms of competition have been recognized including exploitative (i.e., resource) competition, interference competition, and pre-emptive competition (Krebs 1994, Gotelli 1998, Case 2000). Exploitative competition occurs when one species suppresses another through use of a shared resource. Interference competition occurs when one species harms another in the process of obtaining a resource, even if it is not limited. Interference competition is thought to be asymmetric with one species dominating the other(s). Pre-emptive competition is a mix of exploitative and interference competition (Gotelli 1998). Pre-emptive competition occurs when species compete for space as a limiting resource. An example of pre-emptive competition is when species compete for limited nesting cover.

Simultaneous to the decline of the black duck during the latter half of the 20th century was an expansion of

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the mallard into eastern North America. The expansion of the mallard's range and increased abundance is believed to be due to human alteration of the landscape (i.e., agricultural development, forest fragmentation, and urbanization) throughout black duck range and the release of pen-reared mallards. Based on the pattern of decreasing black ducks and increasing mallards several authors hypothesized the cause of the black duck decline was inter-specific competition with the mallard (Barclay 1970, Ankney et al. 1987, Belanger and Lehoux 1994, Merendino and Ankney 1994). Ultimately, several forms of black duck-mallard competition have been proposed including competition for breeding wetlands (i.e., pre-emptive competition; Longcore et al. 1987), mates (i.e., exploitative competition; Brodsky and Weatherhead 1984), and food resources (exploitative competition; Butcher 1990, Clark 1996, Carriere and Titman 1998). The two species are very similar genetically and ecologically thus setting the stage for competition. Further, field and laboratory studies provide circumstantial evidence of competition (Conroy et al. 2002). However, it is unclear if the increase in mallards is the ultimate or proximate cause of the black duck decline or simply a concurrent event.

Mallards are not the only potential black duck competitors. During the past 2 decades the distribution and abundance of greater snow goose (*Anser caerulescens atlantica*) and Canada geese (*Branta canadensis*) have increased across black duck wintering range. Several populations of Canada geese are sympatric with black ducks on the winter range including the North Atlantic population, Southern James Bay population, Atlantic population and temperate-breeding population. The Atlantic population experienced a rapid increase in population size between 1999 and 2007 when the population grew from 77,000 pairs to > 196,000 pairs (a 260% increase). The primary winter grounds of the Atlantic population are the Delmarva Peninsula, southeastern Pennsylvania, New Jersey and New York which are also the primary black duck wintering grounds. Similarly, the temperate-breeding populations of Canada geese have increased throughout black duck winter range. The rapid growth of geese has been fueled by milder conditions on their breeding and wintering grounds and increased food availability (particularly corn) on wintering grounds. The increased abundance of geese may be contributing to the degradation of black duck feeding areas along the Atlantic coast, particularly in the Chesapeake Bay region. Geese, especially snow geese, feed in large flocks and typically feed on roots and rhizomes of important black duck food items including bulrushes and salt-marsh cordgrass. Control measures have been implemented to limit or reverse the growth of snow geese and temperate-breeding Canada goose populations.

## Harvest

Researchers and managers have posited that overharvest was a contributing, if not the primary, factor responsible for the decline of black ducks between the 1950s and 1980s (Grandy 1983, Rusch et al. 1989). In

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response to the long decline of black ducks the Humane Society of the U.S. brought a legal challenge arguing that black duck harvest was excessive (Grandy 1983). Harvest restrictions were implemented in 1983 and 1984 in the U.S. and Canada, respectively, with the goal of reducing harvest by 25%. Analysis of band recovery data suggest black duck harvest rates (across all age and sex classes) decreased after implementation of these restrictions (Francis et al. 1998). However, these data do not indicate that harvest was the only or primary cause of the black duck decline (Rusch et al. 1989). Currently, black duck harvest is managed according to a constant harvest rate strategy. This strategy was designed to provide annual harvest opportunity and maintain the population at or above the 1998–2007 breeding population average. This strategy is expected to be in place until 2012 when it will be replaced by a fully Adaptive Harvest Management strategy. The goals of the Black Duck Adaptive Harvest Management framework are: 1) maintain a black duck population that meets legal mandates and provides consumptive and non-consumptive use commensurate with habitat carrying capacity, 2) maintain societal values associated with the hunting tradition, and 3) maintain equitable access to the black duck resources between and within the U.S. and Canada.

Total harvest and harvest rates can be influenced indirectly via habitat management. Black duck harvest and harvest rates may be inversely related to the amount of habitat available. Though it is probably not a linear relationship (because hunter numbers may increase with increased habitat and access) it is assumed more habitat will decrease hunter density and pressure (in effect, providing refugia) and decrease overall harvest and harvest rate. Natural mortality factors during fall are not currently believed to limit population growth.

# **CONSERVATION STRATEGIES AND ACTIONS**

## **Population Goal**

A population goal for the black duck has been established under the auspices of the NAWMP. The initial NAWMP goal was 350,000 ducks as estimated by the mid-winter inventory (MWI). As part of the 2004 NAWMP update the black duck population goal was translated into a goal of 640,000 indicated breeding birds based on a statistical relationship between the MWI and initial results of CWS' Eastern Breeding Waterfowl Survey. This breeding population goal is incorporated into the Black Duck Adaptive Harvest Management (BDAHM) framework currently under development. This goal was also used by the ACJV to step down state-specific wintering objectives. However, the currently-employed, interim black duck harvest strategy established a population goal based on the long-term (1998–2007) breeding population estimate covering a greater portion of the breeding range than is considered in the 2004 NAWMP and BDAHM goals.

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The EHJV has established its population goal based on a different spatial extent than that used for either the 2004 NAWMP goal or the interim harvest strategy. As part of the current NAWMP revision process the BDJV, associated habitat joint ventures, and potentially the BDAHM community will re-evaluate the goal of 640,000 breeding birds and may make a recommendation for either revising the numeric population goal or converting to an estimated carrying capacity goal needed to support a desired population size. The focal species recovery plan for the black duck adopts the current NAWMP population goal and subsequent revisions.

## **Management Actions and Strategies**

The decline of the black duck population coincided with a rapid and expansive alteration of the landscape across the species' range. The changes, including the loss of forested and coastal wetlands, urbanization, and expansion of agricultural activities undoubtedly resulted in a drastic reduction of the continental carrying capacity for the black duck. The restoration of the black duck to desired levels will require a combination of habitat conservation, adaptive management, and research to reduce key uncertainties.

### **Habitat Conservation Planning and Delivery**

Habitat conservation actions that will contribute to increasing the continental carrying capacity for black ducks and the black duck population include (Atlantic Coast Joint Venture 2005):

#### Habitat Protection –

1. Fee title acquisition: Acquisition of lands to be owned by a conservation agency or organization and managed for wildlife conservation in perpetuity. Major partners include the state fish and wildlife and land conservation agencies, National Wildlife Refuges, National Forests, non-government conservation organizations.
2. Conservation easements: Conservation easements with private landowners and local governments should be used to acquire legal interests to conserve and manage important wetlands and associated upland habitats and limit development while allowing some use by the landowner consistent with the easement conditions. These easements may be particularly effective in working landscapes including working forests and farms where the use of the land is consistent with wildlife habitat conservation. Habitat management plans are important tools to guide the use of the land consistent with

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the easement conditions. Easements to be generally held by a federal, state or regional conservation agency or organization with the resources to monitor and enforce the easement conditions. Identify and review potential current and future limiting factors (i.e., conservation threats).

3. Cooperative agreements: Agreements with corporations, government agencies, private landowners, and other organizations should be used to protect wetlands and integrate compatible land use practices that benefit wetlands and associated upland habitats.
4. Leases: Long-term leases with private landowners, corporations, and other private entities can be used to implement wetland protection and management activities.
5. Financial incentives: Develop state and local legislation that would provide financial benefits, i.e., alteration in property taxes to individual landowners, to encourage protection and conservation of wetlands and associated upland habitats.

### Habitat Restoration –

1. Restore tidal wetland hydrology: Restore flow to tidal creeks and marshes that has been cutoff or reduced by placement of roads, dikes, and undersized culverts resulting in a major change in the marsh structure and often resulting in the invasion by *Phragmites*.
2. Restore drained wetlands: Restore drained and ditched wetlands by eliminating drains and ditches, restoring hydrology and planting or seeding wetland plants where needed.
3. Restore Riparian Systems: Restore the natural flow of streams and floodplain wetlands that have been straightened or altered.

### Habitat Enhancement and Management –

1. Improve water level management on managed wetlands: Upgrade existing federal, state, and other managed wetlands areas by providing adequate water control structures, dikes, etc., to maximize management opportunities and improve the quality of waterfowl breeding, wintering, and migration habitats.
2. Restore vegetation to impacted wetlands: Implement measures to restore natural vegetation and improve the health and productivity of wetland habitats that have deteriorated due to human impact and overgrazing by snow geese and other impacts resulting in loss of vegetation.
3. Restore converted wetlands: Where appropriate, restore forested wetlands that have been converted to other wetland types through planting and management.

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4. Open marsh management: Implement management measures to improve water surface and tidal exchange in saltmarsh ecosystems by plugging ditches and creating ponds and channels for the benefit of black ducks.
5. Restore and manage riparian buffers: Establish and restore riparian buffers through planting, streambank fencing and other techniques.
6. Beaver management: Where applicable, encourage, develop, and support state beaver management policies and programs that would manipulate beaver populations to improve habitat for black ducks, other waterfowl, and wildlife. Also, install devices that allow for beaver-enhanced wetlands but prevent flooding of roads.
7. Control exotic and invasive species: Eliminate or suppress the spread of invasive and exotic plants in wetlands through the use of physical, biological, or chemical agents. Eliminate or suppress population growth of invasive animal species through the use of trapping or hunting.
8. Prescribed burning: Use prescribed fire to restore natural fire-dependent ecological communities such as coastal grasslands and heathlands.
9. Implement Farm Bill: Work with NRCS to implement Farm bill conservation programs including Conservation Reserve Program, Conservation Reserve Enhancement Program, Wetland Reserve Program, Wildlife Habitat Incentive Program and others to enhance wetlands and buffers in agricultural areas.
10. Enhance habitat on federal lands: Work with federal agencies such as the U.S. Fish and Wildlife Service, U.S. Forest Service and the Department of Defense to develop and assist in the implementation of programs that would better manage and enhance waterfowl habitats on federal lands.

### Other Conservation Actions Benefiting Waterfowl Habitat –

1. Review regulatory legislation and enforcement: Evaluate existing wetland protection legislation and work with ongoing programs to strengthen or improve existing federal-state wetland protection efforts and to facilitate wetland management activities. Coordinate with the EPA, the Corps of Engineers, and appropriate state agencies to implement wetland protection provisions of the Federal Water Pollution Control Act.
2. Streamline regulation for beneficial projects: Encourage and support measures that would facilitate implementation of management actions in wetlands to benefit waterfowl and other wildlife.
3. Mitigation: Work with federal and state regulatory agencies to ensure mitigation policies and mitigation actions resulting from development projects result in enhanced wetland management opportunities.

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4. Information and education: Develop informational-educational leaflets/brochures, audio-visual programs, and other techniques to generate public interest and support for waterfowl and wetlands conservation.
5. Extension eduction on best management practices: Develop how to information for private landowners. Utilize existing network or develop and implement an extension education program to encourage private individuals to conserve and manage wetlands and associated habitats and utilize best management practices.
6. Public use management: Carry out public education efforts and provide public use opportunities in a manner compatible with reducing or eliminating disturbance to feeding or loafing waterfowl during critical winter periods.
7. Watershed protection and management: Eliminate degradation of wetland health and productivity by municipal waste, agricultural runoff, sedimentation, and industrial contaminants by developing guidelines and providing input to watershed management and estuary plans.
8. Predator management: Monitor predator populations on federal and state waterfowl management areas and implement appropriate programs to reduce depredation in problem areas.
9. Eliminate waterfowl release: Eliminate releases of captive waterfowl to the wild to reduce competition for wintering habitat between released birds and wild birds. Eliminate state and private release programs to reduce potential for pair bonding between wild and released stocks within a species, reduce the likelihood of pair bonding and hybridization between released mallards and mottled or black ducks, and reduce the potential for spread of disease between released birds and wild stocks.

Specific recommendations for habitat conservation planning and delivery by region are provided in the appendices.

## **Development of Integrated Habitat and Harvest Management Frameworks**

Black duck conservation is hampered by incomplete knowledge of system dynamics that work at multiple spatial and temporal scales. The implementation of an adaptive management framework that will allow for the simultaneous implementation of strategic management actions and increase our understanding of system dynamics is key to effective conservation of the species. There are 3 phases to developing a framework to inform both harvest and habitat management:

- Development of a Black Duck Adaptive Harvest Management process. The goal of this project is to ensure that harvest is maintained at biological and socially sustainable levels.

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- Relative priority: High
  - Estimated completion date: FY 2012/2013
  - Status: on-going
- Development of an Adaptive Management framework that links black duck seasonal vital rates (i.e., survival and productivity) to habitat characteristics. The goal of this project is to develop a framework that aids land managers with habitat conservation planning and delivery while reducing key uncertainties about the system.
  - Relative priority: High
  - Estimated completion date: FY 2014
  - Status: on-going
- Integrate adaptive harvest and habitat management frameworks into a unified framework.
  - Relative priority: Medium, elevate to High upon completion of the first 2 phases.
  - Estimated completion date: To be determined.
  - Status: not started

### **Development of novel and improvement of existing monitoring programs to inform adaptive management**

Estimating annual black duck population characteristics, including abundance, distribution, sex and age structure, and vital rates (i.e., survival and productivity) is critical to restoring the population to desired levels. Results of monitoring programs form the basis of black duck adaptive management and allow researchers and managers to assess model predictions, evaluate population responses to management, and evaluate progress toward desired goals. In addition to maintaining current monitoring programs priority monitoring needs include:

- Development and implementation of two-season banding program to provide annual estimates of seasonal survival.
  - Relative priority: High
  - Estimated completion date: FY 2015

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- Status: on-going
- Assessment of current methodologies and recommendation for improving estimates of annual productivity
  - Relative priority: High
  - Estimated completion date: FY 2012
  - Status: on-going
- Development of methodology for rapid assessment of energetic carrying capacity (including vegetative and animal food resources) at the local and regional scales.
  - Relative priority: Medium
  - Estimated completion date: To be determined
  - Status: on-going
- Improvement of the efficiency and accuracy of remote sensing programs to assess net landscape and land use change in 5-year time steps.
  - Relative priority: High
  - Estimated completion date: To be determined
  - Status: on-going
- Continue operational Breeding Waterfowl Survey in eastern Canada.
  - Relative priority: High
  - Estimated completion date: N/A
  - Status: on-going
- Continue operational pre-season black duck banding in eastern Canada.
  - Relative priority: High
  - Estimated completion date: N/A
  - Status: on-going

## Implementing research to address priority information needs

Researchers and managers have considerable interest in understanding the causes of the decline in the black duck population and potential corrective actions. Despite research efforts, there is no clear consensus among researchers and managers as to the principal cause(s) of the black duck decline or current limiting factors. Assumption driven research is critical to improving our understanding of black duck population dynamics and limiting factors and the refinement of adaptive management models. Priority research needs will change over time as our understanding of the system increases and conditions on the landscape change. [The BDJV](#) coordinates and provides financial support for research designed to address priority information needs related to black duck ecology and management. As part of the research program the BDJV maintains a current list of high priority research needs (below). Priority information and research needs for the black duck focal species plan will follow the recommendations of the BDJV research program. Interested parties are referred to the BDJV's research program for a complete list of current research needs.

- The goal of habitat management is to improve local conditions for black ducks and increase carrying capacity and ultimately increase  $\geq 1$  targeted vital rates (i.e., survival or productivity), thus increasing population size over time. However, researchers and managers do not currently understand how or at what scale black ducks respond to habitat management (e.g., restoring tidal wetland hydrology, predator control) or which activities are most effective at increasing carrying capacity and vital rates.
  - Assess changes in black duck seasonal vital rates (survival or productivity), density, and distribution in response to habitat management activities (at the local and landscape scale).
    - \*  $H_0$  Habitat management has no affect on black duck density or targeted vital rate(s).
    - \*  $H_1$  Habitat management increases black duck density, but not the targeted vital rate(s).
    - \*  $H_2$  Habitat management increases the targeted vital rate(s), but not density.
    - \*  $H_3$  Habitat management increases black duck density and targeted vital rate(s).
    - \*  $H_4$  Habitat management increases black duck density and decreases targeted vital rate(s).
    - \* Important covariates to consider are initial density of black ducks, abundance and distribution of mallards in the study areas, landscape composition and condition, type and scale of habitat management activity implemented, and weather conditions during the study.
- Researchers and managers have posited that waterfowl breeding success is influenced by a bird's body condition during winter and spring migration (i.e., cross-seasonal body condition). If this hypothesis is true habitat management on the wintering and spring migration routes can increase subsequent breeding success and population size.

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- Assess changes in black duck body condition during winter and spring migration in response to habitat management activities.
  - \*  $H_0$  Habitat management has no affect on black duck body condition during winter or spring migration.
  - \*  $H_1$  Habitat management increases black duck body condition during spring and or winter.
  - \*  $H_2$  Habitat management decreases black duck body condition during spring and or winter.
  - \* Important covariates to consider are initial density of black ducks, abundance and distribution of mallards in the study areas, landscape composition and condition, type and scale of habitat management activity implemented, and weather conditions during the study.
- Researchers and managers hypothesize wintering black ducks are limited by the availability and quality of food resources during the non-breeding season indicating habitat management activities should be designed to increase the amount and quality of food available to black ducks.
  - Assess the ability and effectiveness of habitat management activities to increase the amount and quality of food resources.
    - \*  $H_0$  Habitat management has no affect on the abundance or quality of food resources.
    - \*  $H_1$  Habitat management increases the amount or quality of food resources.
    - \*  $H_2$  Habitat management decreases the amount or quality of food resources.
    - \* Important covariates to consider are initial composition and abundance of food resources on the study area.

The challenge to addressing these priority information needs is being able to conduct and replicate manipulative experiments throughout the black duck range and over time, both short-term (1–2 years post-treatment) and long-term (5–10 years post-treatment). Understanding how black ducks respond to habitat management will require the synthesis of results from directed research and monitoring in an adaptive management framework.

## **PROGRESS EVALUATION**

The success of black duck management must be evaluated at multiple spatial and temporal scales. At the continental scale, the success of black duck conservation efforts will be evaluated by comparing the annual estimated breeding population to the established NAWMP population goal. At the regional scale, estimated

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seasonal abundance (obtained from breeding survey, winter surveys, or other data) will be compared to regional population goals stepped-down from the NAWMP continental goal. Based on regional population goals, habitat joint ventures will develop goals for the number of acres that must be protected, restored and managed. Progress toward acreage goals will be reported annually by the habitat joint ventures and other land management partners. Additionally, the BDJV and the habitat joint ventures are developing winter habitat goals based on energetic carrying capacity (assuming black ducks are limited in the winter by food availability). Once these objectives are developed land managers will be able to evaluate success by estimating changes in energetic carrying capacity.

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## APPENDIX A: Habitat management goals and needs for the Atlantic Coast Joint Venture planning area

(Atlantic Coast Joint Venture 2005)

The Atlantic Coast Joint Venture has targeted more than 45 million hectares (113 million acres) for conservation actions that will benefit black ducks, waterfowl and other wetland dependent wildlife (Atlantic Coast Joint Venture 2005). Target areas that will benefit black ducks are described below.

### Connecticut River, Connecticut

This wetlands and river focus area consists of over 20 individual tidal wetland units and river islands of various sizes occurring along a 40-mile (64 km) stretch of the lower Connecticut River from Old Saybrook to Cromwell. The focus area encompasses 11,426 hectares (28,234 acres). Taken as a whole, this focus area represents a gradation of tidal wetlands from a very narrow zone of relatively high salinity marshes at the mouth of the Connecticut River where it enters Long Island Sound, through an intermediate zone of brackish, lower salinity wetlands, to extensive freshwater tidal marshes and floodplain forests beginning at Deep River and extending upriver to Cromwell.

Of the 23 wetland/island units comprising this focus area, at least 14 (61%) are in need of protection and/or management, either wholly or in part. While some are entirely privately owned, many have some form of protective ownership. Several of these areas contain individual parcels owned and managed by the Connecticut Department of Environmental Protection or by conservation groups such as The Nature Conservancy, Connecticut River Gateway Commission and various Town conservation and land trusts.

Approximately 468 hectares (1,157 acres) of tidal wetlands within the focus area require acquisition and/or enhancement. Of this figure, approximately 364 hectares (900 acres) are privately owned and could be considered in jeopardy and in need of acquisition. New programs in place, such as the Landowner Incentive Plan, could allow for the restoration and enhancement of many of these privately-owned wetlands. Statewide, no estimate of wetlands in need of acquisition and/or enhancement is available.

Since 1988, approximately 193 hectares (479 acres) of wetland habitat within the focus area have been enhanced. Enhancement has been achieved through the use of open marsh water management techniques. An additional 191 hectares (474 acres) have undergone intensive vegetation control (*Phragmites* control). Statewide, in areas outside of ACJV focus areas, approximately 187 hectares (463 acres) of inland wetlands have undergone either enhancement or restoration activities. An additional 182 hectares (452 acres) have been controlled for exotic vegetation.

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**Conservation Recommendations:** A substantial portion of this nationally significant tidal marsh complex remains unprotected and/or is not being effectively managed so as to maintain its high species and habitat diversity and to optimize fish and wildlife productivity. The current complicated ownership pattern necessitates establishment of cooperative management and conservation agreements among all parties in order to protect this valuable ecosystem in its entirety rather than by any piecemeal approach. Such an arrangement could include zoning ordinances and other restrictions to maintain or enhance existing land uses. Aggressive management of invasive species such as the Mute Swan and common reed need to be pursued. Habitat degradation of protected areas is occurring due to lack of aggressive management. Acquisition of adjacent upland habitats should be actively pursued to provide buffers to existing wetlands. Restoration of tidal marshes through open marsh management techniques may be appropriate in some areas.

### Fishers Island Sound, Connecticut

This major estuary complex encompasses all of Fishers Island Sound and Little Narragansett Bay, including the coastline of southeastern Connecticut from the mouth of the Thames River to Watch Hill, Rhode Island, and the north shore of Fishers Island, New York. This large, estuary-dominated complex includes all of the waters and adjacent shorelines of Fishers Island Sound, or that body of water lying between Fishers Island (New York) and the southeastern coast of Connecticut, and enclosed within the area east of a boundary line drawn from the mouth of the Thames River at Avery Point (Groton) to the western end of Fishers Island, and north of a line drawn from the eastern end of Fishers Island to and including Napatree Point (Rhode Island) and Little Narragansett Bay. This area is approximately 13 miles (21 km) long in a southwest-northeast direction, and from 2 to 5 miles (3-8 km) in width in a north-south direction between the mainland and Fishers Island and encompasses 10,421 hectares (25,750 acres).

This complex has a mixed ownership pattern of Public Trust waters, several State-owned areas, Town parks and extensive private residential lands. State of Connecticut-owned areas include Bluff Point Coastal Preserve and State Park, Haley Farm State Park, Sixpenny Island Wildlife Area and Barn Island Wildlife Management Area. The Town of Westerly, Rhode Island, owns Napatree Point.

Approximately 103 hectares (256 acres) of tidal wetlands within the focus area need acquisition and/or enhancement. Of this figure, approximately 80 hectares (200 acres) are privately owned and could be considered in need of acquisition. New programs in place, such as the Landowner Incentive Plan, could allow for the restoration and enhancement of many of these privately-owned wetlands. Statewide, no estimate of wetlands in need of acquisition and/or enhancement is available.

Since 1988, approximately 19 hectares (47 acres) of wetland habitat within the focus area have been enhanced. Enhancement has been achieved through the use of open marsh water management techniques. An additional 3.6 hectares (9 acres) have undergone intensive vegetation control (*Phragmites* control). Statewide, in areas

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outside of ACJV focus areas, approximately 187 hectares (463 acres) of inland wetlands have undergone either enhancement or restoration activities. An additional 182 hectares (452 acres) have been controlled for exotic vegetation.

**Conservation Recommendations:** The apparent abandonment of several area nesting beaches of terns and Piping Plover as a result of human disturbances is of particular concern, and requires intensive efforts to protect both currently-occupied sites as well as recent historical localities by all available means, including beach closures, fencing, predator/pet removal, posting, beach warden patrols and public education. Habitat improvement and restoration of degraded or abandoned nesting beaches using dredging spoils should be considered. Efforts should be made to identify and implement those tasks and objectives of the Piping Plover and Roseate Tern recovery plans that may be applicable to areas within this complex. Opportunities should be sought to develop cooperative management and conservation programs between various governmental agencies, private conservation organizations and private landowners to best manage and protect for the long term the living resources of this significant estuarine complex. Protection and maintenance of water quality and wetlands throughout this complex through monitoring and regulation are necessary to ensure the continued high value of this area to fish, wildlife and plant populations dependent on them.

**Greater Hammonasset Complex, Connecticut** This complex is located along the central coast of Connecticut on the north shore of Long Island Sound, between the Towns of Madison and Westbrook and encompasses 3,182 hectares (7,863 acres). The boundary of this complex extends west to east from the nearshore area of Tuxis Island and the adjacent Connecticut mainland to Menunketesuck Island, a distance of about 12 miles (19 km), and inland to the limits of anadromous fish passage up the Hammonasset, Indian, Menunketesuck and Patchogue Rivers. In addition to those areas mentioned, the following areas are also included within this complex: Tuxis Island, Hammonasset State Park and marshes, Cedar Island, Clinton Harbor, Harbor View Beach, Hammock River wetlands, Indian River wetlands and Duck Island.

Ownership is a mixed pattern of public lands and waters and private lands, including Hammonasset State Park and Natural Area Preserve, Hammock River Marsh Wildlife Area, Black Pond Wildlife Area, Salt Meadow Unit of the Stewart B. McKinney National Wildlife Refuge and Duck Island Wildlife Area (Connecticut Department of Environmental Protection). Menunketesuck Island is privately owned; Tuxis Island is owned by the Town of Madison.

Approximately 142 ha (353 acres) of tidal wetlands within the focus area need acquisition and/or enhancement. Of this figure, approximately 121 hectares (300 acres) are privately owned and could be considered in need of acquisition. New programs in place, such as the Landowner Incentive Program, could allow for the restoration and enhancement of many of these privately owned wetlands. Statewide, no estimate of wetlands in need of acquisition and/or enhancement is available.

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Since 1988, approximately 44 hectares (109 acres) of wetland habitat within the focus area have been enhanced. Enhancement has been achieved through the use of open marsh water management techniques. An additional 19 hectares (47 acres) have undergone intensive vegetation control (*Phragmites* control). Statewide, in areas outside of Atlantic Coast Joint Venture focus areas, approximately 187 hectares (463 acres) of inland wetlands have undergone either enhancement or restoration activities. An additional 182 hectares (452 acres) have been controlled for exotic vegetation.

**Conservation Recommendations:** There are numerous opportunities and challenges throughout this complex for various governmental agencies, private conservation organizations and private landowners to work cooperatively in conserving and protecting this valuable complex of fish, wildlife and plant habitats. Certain privately-owned parcels in the Menunketesuck area should be considered for acquisition by the Federal government as additions to the National Wildlife Refuge System (Salt Meadow National Wildlife Refuge) so as to protect and manage them for their significant regional biological values, undeveloped upland areas adjacent to important marsh habitats should be considered for acquisition by federal or state agencies (e.g. Griswold Airport, properties adjacent and proximal to Salt Meadow Unit). Increased funding is necessary for habitat management of early successional habitats at Salt Meadow Unit.

**Lower Housatonic River/Great Meadows, Connecticut** This marsh/barrier beach/river focus area encompasses 2,840 hectares (7,017 acres) and is located on the southwestern Connecticut shoreline of western Long Island Sound between the mouth of the Housatonic River and Bridgeport Harbor. Portions of the lower Housatonic River are also included. The area boundary includes all of Long Beach, Pleasure Beach and Great Meadows Marsh, just east of Bridgeport Harbor, eastward to Lordship Beach, the mouth of the Housatonic River, Milford Point, Charles Island, and the Charles E. Wheeler State Wildlife Area (Nells Island marshes) and from there northward up the river to Derby Dam.

Most of the Great Meadows marsh is in public ownership. The majority of the marsh is owned by the United States Fish and Wildlife Service (Stewart B. McKinney NWR). Long Beach is owned by the Town of Stratford. There is a colony of beach cottages at the western end of Long Beach that is leased from the Town. The Town cooperates with State personnel in managing the shorebird nesting area on Long Beach. Milford Point includes Federal (Stewart B. McKinney National Wildlife Refuge) and privately-owned (CT Audubon) parcels. The Connecticut Audubon leases this piece of Milford Point from the Connecticut Department of Environmental Protection. Nells Island/Wheeler State Wildlife Management Area and several marshy islands upstream are owned and managed by the Connecticut Department of Environmental Protection.

Approximately 111 hectares (275 acres) of tidal wetlands within the focus area need acquisition and/or enhancement. Of this figure, approximately 81 hectares (200 acres) are privately owned and could be considered in need of acquisition. New programs in place, such as the Landowner Incentive Program, could

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allow for the restoration and enhancement of many of these privately-owned wetlands. Statewide, no estimate of wetlands in need of acquisition and/or enhancement is available.

Since 1988, approximately 16 hectares (41 acres) of wetland habitat within the focus area have been enhanced. Enhancement has been achieved through the use of open marsh water management techniques. An additional 10 hectares (25 acres) have undergone intensive vegetation control (*Phragmites* control). Statewide, in areas outside of ACJV focus areas, approximately 187 hectares (463 acres) of inland wetlands have undergone either enhancement or restoration activities. An additional 182 hectares (452 acres) have been controlled for exotic vegetation.

**Conservation Recommendations:** Acquisition of privately-held saltmarsh adjacent to publicly owned habitats should be aggressively pursued. Diverse partnerships between governmental and non-governmental groups need to be developed to pursue funding for acquisition and continued habitat restoration. State and Federal programs to protect and enhance water quality in Long Island Sound and adjacent waters should continue to focus on protecting tidal freshwater and brackish wetlands and coastal water quality through the regulatory process and in addressing the problems of hypoxia, oil spills, non-point source pollution, sewage and waste disposal and heavy metal contaminants in these waters to restore and maintain important fish and wildlife habitat.

**Lower Thames River System, Connecticut** This area encompasses the lower tidal reaches of the Thames River in southeastern Connecticut from New London and Groton at the mouth to Norwich. The boundary of this site includes the river channel, waters and shoreline wetlands of the lower tidal reaches of the Thames River from the confluence of the Shetucket and Quinebaug Rivers a few miles north of Norwich to the mouth of the river at New London and Groton where it enters into the eastern end of Long Island Sound, a river length of approximately 19 miles (31 kilometers). Specific areas of biological significance, in addition to the river itself, include the Mamacoke Island marshes, Horton Cove, Poquetanuck Cove marshes, Smith Cove, Greens Harbor and small rocky islands at the river mouth. The focus area is 2,121 hectares (5,242 acres) in size. This area is primarily Public Trust waters and State and private conservation and research lands. Connecticut College owns and manages Mamacoke Island Natural Area.

Approximately 20 hectares (50 acres) of tidal wetlands within the focus area need acquisition and/or enhancement. All of these wetlands are privately owned and could be considered in need of acquisition. New programs in place, such as the Landowner Incentive Plan, could allow for the restoration and enhancement of many of these privately-owned wetlands. Statewide, no estimate of wetlands in need of acquisition and/or enhancement is available. Since 1988, no wetland acreage has undergone restoration or enhancement. Statewide, in areas outside of ACJV focus areas, approximately 187 hectares (463 acres) of inland wetlands have undergone either enhancement or restoration activities. An additional 182 hectares (452 acres) have

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been

controlled for exotic vegetation.

**Conservation Recommendations:** Particular attention needs to be focused on restoring and protecting the water quality of the Thames River and its high value to fish and wildlife populations, especially anadromous fish and overwintering waterfowl. Protective measures should include stringent regulatory overview and enforcement of existing Federal, State and local environmental regulations, as well as developing and implementing environmentally sound planning and zoning policies and restoration programs. Additionally, exotic species such as Mute Swan and *Phragmites* need to be aggressively managed in this focus area.

**New Haven Harbor, Connecticut** This complex consists of 10,751 hectares (26,566 acres). The focus area is centered primarily along the central coast of Connecticut on Long Island Sound, in the New Haven Harbor area and areas to the east. The outer, shoreward boundary of this largely nearshore water and tidal flat-dominated complex extends from Merwin Point, just south of Woodmont (Milford) east to Sachem Head (Guilford), a distance of approximately 14.5 miles (23 kilometers). Enclosed within this boundary are the east and west shoreline areas around New Haven Harbor to the limit of anadromous fish passage on the West and Quinnipiac Rivers, including the Quinnipiac Meadows wetlands area and the North Haven and Wallingford sand plains north of New Haven Harbor. To the east of New Haven Harbor, the boundary incorporates the Branford River, Leetes Island and Joshua Cove marshes and tidal flats and nearshore waters of Long Island Sound for a distance averaging 1-2 miles (2-3 kilometers) south of the shoreline. A number of important wildlife islands in the Branford-Guilford vicinity are included within this nearshore water boundary, most notably The Thimbles and Kelsey Island.

A significant portion of this complex includes public coastal and river waters and wetlands, while the rest represents various mixtures of publicly and privately owned lands. Several of the islands are privately held, as is most of the sand plains area along the Quinnipiac River.

Approximately 242 hectares (598 acres) of tidal wetlands within the focus area need acquisition and/or enhancement. Of this figure, approximately 210 hectares (520 acres) are privately-owned and could be considered in need of acquisition. New programs in place, such as the Landowner Incentive Program, could allow for the restoration and enhancement of many of these privately owned wetlands. Since 1988, approximately 5.6 hectares (14 acres) of wetland habitat within the focus area have been enhanced. Enhancement has been achieved through the use of open marsh water management techniques. An additional 43 hectares (107 acres) have undergone intensive vegetation control (*Phragmites* control). Statewide, in areas outside of ACJV focus areas, approximately 187 hectares (463 acres) of inland wetlands have undergone either enhancement or restoration activities. An additional 182 hectares (452 acres) have been controlled for exotic vegetation.

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Conservation Recommendations: Protection of the nearshore waters and intertidal flats from catastrophic events such as an oil spill or hazardous chemical discharge needs to be given the highest priority among resource concerns in this area. Attention needs to be focused not only on formulating oil spill contingency plans, but developing the highest degree of readiness to respond to such an event, particularly during critical times of the year when wildlife populations are at their peak and most vulnerable, such as spring and fall migrations and winter. Measures should also be sought and instituted, whether by regulation, zoning, planning, cooperative agreements or full-scale restoration programs such as the National Estuary Program, to restore, maintain, enhance and protect aquatic and terrestrial resources in this complex. Opportunities should be identified to restore or enhance degraded wetlands, including control of common reed, and other coastal habitats in this complex to increase their value to fish and wildlife. A regional or basin-wide conservation and management plan should be developed and implemented for protecting and enhancing wintering waterfowl populations in central and western Long Island Sound, in partnership with governmental agencies, private conservation groups and landowners.

Upper Thames River Watershed, Connecticut The Upper Thames River Watershed Planning Area is located in northeast Connecticut and encompasses 376,548 hectares (941,371 acres). This entire watershed, most of which lies within the administrative boundaries of Connecticut, contains 10 individual river sub-basins and is critical to breeding and staging waterfowl in Connecticut. Wetland habitat is distributed throughout the planning area, often in the form of forested wetlands or small emergent-wetland complexes. The entire watershed lies within that portion of Connecticut that is presently least developed. The Upper Thames River Watershed is predominantly forested, with large tracts of privately owned agricultural land. Development pressure, however, is increasing, and from the period 1990-2002, the percent of the watershed classified as developed has increased 9.4% (University of Connecticut 2004). Developed land now comprises 11.9% of the entire watershed. With increased development come declines in water quality and loss of habitat. Degradation of water quality in the upper reaches of the watershed becomes magnified downstream as flow enters the Thames River and, ultimately, spills into Fishers Sound and Long Island Sound.

The 376,548 hectares (930,466 acres) of the watershed that lie within Connecticut is a patchwork of both private and public land holdings. The state of Connecticut owns significant acreage throughout the watershed in the Goodwin State Forest (SF), Natchaug SF, Nipmuck SF, and Pachaug SF. Several Department of Environmental Protection-owned wildlife management areas are also within the boundaries of the watershed. Private conservation groups such as the Windham Land Trust and Audubon Society have small, but significant, holdings within the planning area.

New programs in place, such as the Landowner Incentive Plan, could allow for the restoration and enhancement of privately owned wetlands within the planning area. Within the planning area, there are 32,732 hectares (80,884 acres) of wetlands or open water. There is no reasonable estimate of acreage to conserve

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within that figure, however, of the total watershed, approximately 20,234 hectares (50,000 acres) of forested and non-forested emergent wetlands exist in the watershed. Less than half of those acres are currently protected either through their location on state controlled or non governmental organization (NGO) controlled lands. Statewide, no estimate of wetlands in need of acquisition and/or enhancement is available.

**Conservation Recommendations:** Land-use planning that maximizes wetland conservation and open space needs to be actively pursued by municipalities within the planning area. Many towns within the planning area are developing plans that maximize biological diversity and open space. On a regional scale, this must continue. Regional planning committees comprising several adjacent municipalities have arisen in other parts of the state, and it is not unreasonable that these types of regional arrangements will proliferate into this watershed. Aggressive management of invasive species such as the Mute Swan, *Phragmites*, and purple loosestrife need to be pursued. Manpower and funding constraints have resulted in habitat degradation of protected areas in this planning area. Additionally, water level manipulation on state owned impoundments is necessary. Acquisition of adjacent upland habitats should be actively pursued to provide buffers to existing wetlands.

**Bayshore Focus Area, Delaware** The Bayshore Focus Area encompasses approximately 165,054 hectares (407,857 acres) of land of. Approximately 23,876 hectares (59,000 acres or 15%) is protected at the federal or state level or by private interests. The area stretches south from the Cedar Swamp Wildlife Management Area approximately 84 kilometers (52 miles) to Lewes and is bounded on the eastern edge by the Delaware Bay and Estuary.

Examination of the 2002 Land Use Land Cover data for Delaware indicates the predominant landuse practice in the Focus Area is agriculture, which utilizes approximately 71,705 hectares (177,187 acres or 45%) of upland habitat. The remaining land is comprised of wetlands and deep water habitat (26%), forests (11%) and residential, commercial and industrial development (18%). The Bayshore Focus Area contains some of the most natural and undeveloped wetlands remaining in the state of Delaware.

Much of this region has already been conserved or protected for wildlife by federal and state agencies and other private entities 24,123 hectares (59,611 acres). However, 85% of it still remains in private ownership. Realizing the importance of this Focus Area to migratory waterfowl and shorebirds the federal government has preserved two large tracts of land along the coast which total over 10,117 hectares (25,000 acres): Prime Hook National Wildlife Refuge and Bombay Hook National Wildlife Refuge. In addition, the state of Delaware has protected approximately 10,117 hectares (25,000 acres) of habitat at Woodland Beach Wildlife Management Area (WMA), Little Creek WMA, Ted Harvey Conservation Area, Milford Neck Wetland Management Area and Prime Hook Wetland Management Area to name just a few. The marshes and impoundments on these state lands are managed to maximize use by waterfowl and shorebirds. Finally, two non-profit organizations,

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The Nature Conservancy and Delaware Wild Lands Inc., have contributed significantly to the protection of habitat for waterfowl within the Bayshore region by purchasing approximately 3,327 hectares (8,000 acres) of land.

**Conservation Recommendations:** Efforts should focus on protecting, restoring and enhancing wetlands and associated uplands in areas adjacent to protected lands with the goal of forming large contiguous tracts of undisturbed habitat within the Bayshore Focus Area. Public and private partnerships should be developed to utilize existing funding programs and manage development in a responsible manner to maintain populations of wetland dependent migratory birds and biodiversity. Long-term protection should be favored; however, multiple ten-fifteen year agreements for restoration and enhancement will be a primary tool to maintain wildlife populations.

**Blackbird Focus Area, Delaware** The Blackbird Bay to Bay Focus Area stretches from the Maryland/Delaware border to the Delaware Bay. It encompasses the Blackbird River watershed, Appoquinimink River watershed and part of the Chester River watershed approximately 36,247 hectares (89,568 acres). Of this land, 44% is in agricultural use, 27% is wetland habitat and 12% is forest habitat. Approximately 4,856 hectares (12,000 acres) of land has been protected at the state level (Blackbird State Forest, Blackiston Wildlife Area, Cedar Swamp Wildlife Area, Augustine Wildlife Area and the C&D Canal Wildlife Area) (Earth Data International of MS, LLC., 2003). The remaining 17% is in some form of residential, commercial or industrial development. Protection and/or restoration of the remaining freshwater tidal and non-tidal wetlands, brackish marshes and associated upland habitat within this portion of the state are critical to wintering waterfowl.

Approximately 85% of the land in Delaware is privately owned and the Blackbird Bay to Bay Focus Area is no exception. Approximately 4,856 hectares (12,000 acres) of land (13%) has been protected at the state level (Blackbird State Forest, Blackiston Wildlife Area, Cedar Swamp Wildlife Area, Augustine Wildlife Area and the C&D Canal Wildlife Area). The remaining land within the Blackbird Bay to Bay Focus Area is privately owned and subject to increasing development pressure. This increasing desire to move out of the cities and into the country is the largest threat to waterfowl habitat within the state of Delaware. Protection and/or restoration of the remaining wetlands and associated upland habitat within this portion of the state are critical to wintering waterfowl.

**Conservation Recommendations:** Protect, restore and enhance wetlands and associated uplands wherever and whenever opportunities arise within this Blackbird Bay to Bay Focus Area. Work with other public and private partnerships to utilize existing funding programs and manage development in a responsible manner to minimize disturbance and maintain populations of wetland dependent migratory birds and biodiversity. Long term protection should be favored; however, multiple 10-15 year agreements for restoration and enhancement will be a primary tool to maintain wildlife populations.

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Inland Bays, Delaware The Inland Bays Focus Area is approximately 45,324 hectares (111,998 acres) in size stretching from Lewes south to Bethany Beach. It is bounded on the east by the Atlantic Ocean and encompasses the Indian River Bay, Little Assawoman Bay and Rehoboth Bay and their tributaries. The Inland Bays and adjacent upland area are comprised of 15,093 hectares (37,297 acres) of wetland that support over 8,000 ducks and geese (Waterfowl Surveys in Delaware, 2004). Ninety-two percent of the Inland Bay Focus Area is in private ownership. The remaining 8% is owned by the State of Delaware. Cape Henlopen State Park, Delaware Seashore State Park, Holts Landing, Love Creek Wildlife Management Area (WMA), Bluff Point WMA and Assawoman WMA are the only protected areas within this focus area. However, recreational use of some of these properties has rendered them less desirable to wildlife than undisturbed natural habitat. With such a high percentage of the land in this focus area in private lands it becomes increasingly important to work with these landowners to come up with cooperative solutions to habitat management.

**Conservation Recommendations:** Protect, restore and enhance wetlands and associated uplands wherever and whenever opportunities arise within the Inland Bays. Develop public and private partnerships to utilize existing funding programs and manage development in a responsible manner to maintain populations of wetland dependent migratory birds and biodiversity. Long-term protection should be favored; however, multiple 10-15 year agreements for restoration and enhancement will be a primary tool to maintain wildlife populations on private lands. Restoration and protection in the Inland Bays Focus Area will compliment other efforts within the region to address habitat destruction and overall water quality in the Bay. Such ongoing efforts include: Delaware Inland Bays Estuary Program, Livable Delaware and Green Infrastructure Program and the Agriculture Preservation Program.

Nanticoke Focus Area, Delaware The Nanticoke Focus Area is defined by the boundaries of the Nanticoke watershed and encompasses over 121,406 hectares (300,000 acres) of land within the state of Delaware. The Focus Area is 28 kilometers (17 miles) wide stretching from the Maryland state line on the west to the Redden State Forest on the east and 59 kilometers (36 miles) long from Hollandsville in the North and to the Maryland state line in the south. The watershed itself is the largest watershed within the state of Delaware covering 1/3 of the States surface. Total focus area size is 127,459 hectares (314,959 acres). An examination of the 2002 Land Use Land Cover data for Delaware indicates that the predominant land types in the Nanticoke Focus Area are agricultural lands, wetlands and mixed forests. Agricultural lands account for 54% of the land cover within the region. Wetlands account for 20% of the land within the Nanticoke Focus Area and mixed forests make up 16% (Earth Data International of MD, LLC, 2003).

Past initiatives by State agencies and private entities have been able to protect and/or enhance approximately 8,903 hectares (22,000 acres) of land preserving much of the integrity of the Nanticoke river shoreline and upland buffers. The state of Delaware has protected nearly 8,498 hectares (21,000 acres of land on

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Marshyhope Wildlife Management Area (WMA), Old Furnace WMA, Nanticoke WMA, Trap Pond State Park and Redden Forest among others. In addition The Nature Conservancy has preserved over 161 hectares (400 acres) on the Middleford North Tract in the upper tributaries of the Nanticoke Watershed. The remaining 118,553 hectares (292,951 acres or 93%) are in immediate need of attention as development pressure and agricultural/sivilcultural practices continue to grow.

**Conservation Recommendations:** Protect, restore and enhance wetlands and associated uplands wherever and whenever opportunities arise within this Nanticoke Focus Area. Develop public and private partnerships to utilize existing funding programs and manage development in a responsible manner to maintain populations of wetland-dependent migratory birds and biodiversity. Long-term protection should be favored; however, multiple 10-15 year agreements for restoration and enhancement will be a primary tool to maintain wildlife populations on private lands.

Cobscook Bay, Maine The Cobscook Bay Focus Area boundaries extend from northeast of Machias Bay along the coast of Maine to the Canadian border and encompasses 109,432 hectares (270,411 acres). The boundaries continue along the United States/Canada border across the mouth of Cobscook Bay and into the St. Croix River as far as the town of Calais, Maine. It extends inland approximately 20-30 kilometers (12-18 miles) encompassing all of Cobscook Bay and several large freshwater lakes including Pennamaquan and Boyden Lakes. Cobscook Bay is a complex of inlets, bays, tidal creeks, and rivers with approximately 156 kilometers (97 miles) of shoreline and is recognized as one of the most outstanding habitats in Maine and the northeastern United States (U.S. Fish and Wildlife Service 1990). These large tides create huge expanses of mudflats that benefit and large expanses of ice-free areas for wintering black ducks. The majority of the Cobscook Bay focus area is under private ownership. Public ownership includes the Moosehorn National Wildlife Refuge located in two divisions within the focus area. In addition, the State of Maine owns several state parks including Cobscook Bay and Quoddy Head State Parks.

**Conservation Recommendations:** The most pressing need within the focus area is to protect available habitat through fee simple or easement acquisition. The Moosehorn NWR has an active acquisition program that has resulted in a number of acres secured adjacent to both the Baring and Edmunds Units. The highest priority areas should be shoreline properties around Cobscook Bay and interior lakes and streams.

Downeast Maine The Downeast Focus Area is located in central and eastern coastal Maine and includes hundreds of miles of relatively undeveloped coastline that encompass 676,569 hectares (1,671,832 acres). Marine and estuarine habitats within this focus area are particularly significant black ducks. Large tidal amplitude combined with gentle topography and many freshwater tributaries and rivers in this region provide extensive intertidal mud flats in protected bays. Saltmarsh systems occur at the mouths of the tributaries in estuarine areas. Historically, many of these saltmarshes were ditched for mosquito control and/or salt hay

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farming. Most of the land within the focus area is privately owned. However, agencies such as the Maine Department of Inland Fisheries and Wildlife, U.S. Fish and Wildlife Service, and private organizations have been active within the focus area protecting critical habitat. The State of Maine maintains several state parks and wildlife management areas and federal land managed by the U.S. Fish and Wildlife Service (Petit Manan National Wildlife Refuge) and National Park Service (Acadia National Park) are also located in this focus area.

**Conservation Recommendations:** The relative undisturbed nature of the shoreline and islands should be protected through fee or easement acquisition to prevent any additional disturbance. Water quality is critical to the integrity and diversity of habitats within the focus area. This should be closely monitored especially with the potential for industrial pollution in the western portion of this focus area.

Inland Wetlands, Maine Maine wetlands provide breeding and migration habitats of importance to black duck and other wildlife. Certain wetland complexes, because of their geographic location and orientation, are of particular importance as migration corridors and staging areas. Breeding habitats identified in this focus area are inland freshwater systems with either historic or current importance as black duck breeding habitats. Waterfowl use of some of the historically important breeding areas has declined as some of the wetlands have been degraded as dams have fallen into disrepair. In addition to acquisition and enhancement of breeding habitat in this focus area, management of statewide beaver populations to encourage maximum wetland development acceptable to landowners will continue to provide quality black duck breeding habitat. Most of the land within the focus area is privately owned. However, agencies such as the Maine Department of Inland Fisheries and Wildlife, U.S. Fish and Wildlife Service (National Wildlife Refuges) and private organizations have been active within the focus area protecting critical habitat. The State of Maine maintains several state parks (including Baxter State Park) within this focus area.

**Conservation Recommendations:** The relative undisturbed nature of the freshwater wetlands and associated shoreline should be protected through fee or easement acquisition to prevent any additional disturbance. Water quality is critical to the integrity and diversity of habitats within the focus area. This should be closely monitored especially with the potential for industrial pollution upriver. Also, invasive species should either be eradicated or closely monitored for spread.

Merrymeeting Bay/Lower Kennebec River, Maine The Merrymeeting Bay/Lower Kennebec River Focus Area is located in southern Maine about 50 kilometers north of Portland and is one of the most important wetland complexes along the northeast coast. The focus area encompasses 55,182 hectares (136,357 acres) and is roughly divided between the freshwater tidal habitats of Merrymeeting Bay and the brackish to saltwater habitats of the Lower Kennebec River. Merrymeeting Bay is the largest freshwater tidal marsh north of the Chesapeake Bay formed from the confluence of two large rivers, the Kennebec and Androscoggin, and four

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smaller tributaries, the Eastern River, Cathance River, Muddy River, and the Abagadasset River. Extensive emergent wetlands, including wild rice, pickerel weed, water parsnip, and several species of bulrush, as well as broad mud flats, riparian habitats, and a relatively undeveloped shoreline are ideal for breeding, migrating, and wintering birds. In conjunction with the freshwater tidal marshes is the Lower Kennebec River. The river enters Merrymeeting Bay on the north and drains the bay to the south into the Atlantic Ocean. The Kennebec River is characterized by brackish to saltwater marshes and embayments as well as mudflats along a 25 kilometer (15 miles) stretch from the bay to the mouth of the river. The uplands are composed of a mix of spruce-fir and hardwood forests interspersed with agricultural fields and meadows. The forest extends down to the high tide line. Much of the land within the focus area is privately owned. However, agencies such as the Maine Department of Inland Fisheries and Wildlife, U.S. Fish and Wildlife Service, and private organizations have been active within the focus area protecting critical habitat. The state of Maine maintains several state parks and the U.S. Fish and Wildlife Service maintain Pond Island National Wildlife Refuge located at the mouth of the Lower Kennebec River.

**Conservation Recommendations:** The relative undisturbed nature of the shoreline should be protected through fee or easement acquisition to prevent any additional disturbance. Water quality is critical to the integrity and diversity of habitats within the focus area. This should be closely monitored especially with the potential for industrial pollution upriver. Also, invasive species should either be eradicated or closely monitored for spread.

**South West Coast, Maine** The South West Coast Focus Area is located in southern Maine from the New Hampshire border to midcoast Maine, near Rockland but excludes the freshwater tidal habitats of Merrymeeting Bay and the brackish to saltwater habitats of the Lower Kennebec River, as these wetlands comprise a separate focus area. This focus area encompasses 356,340 hectares (880,532 acres). The wetlands in this area provide wintering and migration habitats for black ducks and other waterfowl where intertidal mudflat and extensive saltmarsh habitats occur. Much of the significant saltmarsh habitats in this focus area are already secured in either state or federal ownership. The remaining saltmarsh habitat in this region occurs in small acreages associated with the riparian zone of estuarine systems.

**Conservation Recommendations:** The most pressing need within the focus area is to protect available habitat through fee simple or easement acquisition. The Rachel Carson National Wildlife Refuge has an active acquisition program that has resulted in a number of acres secured. The highest priority areas should be shoreline properties around Casco Bay and interior lakes and streams to protect water quality.

**Atlantic Coastal Bays, Maryland** The Atlantic Coastal Bays Focus Area is approximately 62,145 hectares (153,563 acres) in size and extends from Bishopville at its northern end, south to the Virginia state line. It is bounded on the east by the Atlantic Ocean and encompasses the following bays and their associated

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tributaries: Assawoman Bay, Isle of Wight Bay, Sinepuxent Bay, Newport Bay, and Chincoteague Bay. The bays are uniform and shallow in depth, (*< 10 feet in depth*), with limited tidal exchange and river input. Groundwater is an important source of freshwater input. This combination of characteristics increases the susceptibility of the bays to inputs from septic systems, agriculture, wastewater treatment facilities and other non-point sources of pollution in the form of nutrients and chemicals. Wetlands in the coastal bays, especially in the northern bays, have decreased significantly, an estimated 103,105 hectares (254,778 acres) lost since settlement of the region. This loss and/or alteration is the result of numerous activities, including conversion to agriculture, development, and other human-related land uses. Large networks of ditches have drained tidal and nontidal wetlands and the construction of canals and bulkheads have further impacted wetlands through loss of spatial extent and deteriorated wetland quality or availability to waterfowl. Much of the Atlantic Coastal Bays Focus Area is in private ownership. The State of Maryland and National Park Service own and manage Assateague Island National Seashore, Assateague State Park, and E.A. Vaughn Wildlife Management Area.

**Conservation Recommendations:** Protection, restoration and enhancement of wetlands and associated uplands should occur whenever possible. Projects providing protection in perpetuity are most desirable, but shorter-term conservation agreement private landowners need to be incorporated into planning and implementation efforts. Natural ponds degraded by mosquito control actions should be restored to historic conditions. Reduce the Mute Swan population to protect critical bay living resources.

**Blackwater/Nanticoke River, Maryland** The Blackwater Nanticoke River Focus Area is approximately 162,352 hectares (401,179 acres) on the Delmarva Peninsula in southeast Maryland, and encompasses the Nanticoke River, its associated watershed, and Blackwater National Wildlife Refuge (NWR), whose most prominent feature is the Blackwater River and watershed. The Nanticoke River watershed covers approximately 50,585 hectares (125,000 acres) in Dorchester and Wicomico Counties. A large portion of the watershed is forested (approximately 38%) and supports the largest continuous pine forest left on the Delmarva Peninsula. Blackwater National Wildlife Refuge (NWR) was established in 1933 as a refuge for migratory birds and includes over 10,926 hectares (27,000 acres), composed mainly of rich tidal marsh characterized by fluctuating water levels and varying salinity. The focus area has a number of large public land holdings, including Blackwater NWR, Fishing Bay Wildlife Management Area (WMA), and Taylors Island WMA.

**Conservation Recommendations:** Protecting, restoring and enhancing wetlands should occur whenever opportunities arise. There are a number of Conservation Reserve Program and Conservation Reserve Enhancement Program projects underway and these programs should receive continuing support. Nutria eradication efforts must continue, as well as *Phragmites* control programs. Mute Swan populations should be reduced to eliminate detrimental effects on sea grasses and other critical bay living resources. Wetland reconstruction should be implemented on Blackwater NWR. Partnerships with NGOs (such as Ducks Unlimited, Inc.),

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private industry and governments should continue to be supported for work on wetland conservation and restoration.

Chester River and Kent County Bayshore, Maryland The Chester River and Kent County Bayshore Focus Area is approximately 111,430 hectares (275,348 acres) in size and stretches from the Elk and Bohemia Rivers in the north to the mouth of the Chester River at Love Point. In addition to the above named rivers, the focus area includes the Sassafras River and more than 40 named tributaries. The primary land use in the Chester River and Kent County Bayshore Focus Area is agriculture, where high quality soils grow corn and winter wheat. Approximately 1/3 of Maryland's population of Black duck (6,000) utilize the focus area. The majority of the focus area is in private ownership. Eastern Neck National Wildlife Refuge is the only protected area within the focus area.

**Conservation Recommendations:** Efforts should focus on protecting, restoring and enhancing wetlands and associated uplands in areas via public and private partnerships and existing funding programs. For example CREP and CRP programs should be used to levy resources for wetland conservation, specifically shell impoundments. Long-term protection should be favored; however, multiple ten-fifteen year agreements for restoration and enhancement will be a primary tool to maintain wildlife populations on private lands. The Mute Swan population should be reduced to protect critical bay living resources.

Choptank River, Maryland The Choptank River Focus Area is approximately 120,540 hectares (297,860 acres) in size and extends from Ridgely Maryland, downriver to the mouth of the Choptank River. The larger water bodies in the focus area include the Choptank, Little Choptank, and Tred Avon Rivers and Broad, Harris, and Tuckahoe Creeks. The Choptank River Watershed drains approximately 700 square miles of land in Maryland, including portions of Caroline, Dorchester, Queen Anne's, and Talbot Counties in the middle of the Eastern Shore. The Choptank basin is 58% agricultural, 33% forested, and 9% urban (Maryland Department of Natural Resources website). Wetlands within the focus area have been ditched and drained for agriculture for decades. Corn, soybeans, and winter wheat are the main commodities grown. The majority of the Choptank River Focus Area is in private ownership. Public lands include Tuckahoe and Martinak State Parks. The lower portion of the watershed is an important concentration area for waterfowl, including black ducks.

**Conservation Recommendations:** Continue to work through partnerships to implement Conservation Reserve Program and Conservation Reserve Enhancement Program to restore wetland habitats in the focus area. Restore SAV throughout the focus area. Reduce Mute Swan population to protect critical bay living resources.

Eastern Bay, Maryland The Eastern Bay Focus Area is approximately 57,254 hectares (141,477 acres) in size, is located on the eastern shore of Maryland and includes the Wye and Miles Rivers and Bayshore/Kent

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Island. With the eventual threat of residential development, the state of Maryland purchased a portion of the focus area, Wye Island Natural Resources Management Area (NRMA) in the mid 1970's to ensure its preservation. Most of the focus area remains in private ownership with the exception of Wye Island NRMA. The Eastern Bay Focus Area contains important wintering habitat for black ducks.

**Conservation Recommendations:** Continued support for restoring Poplar Island using dredged material from the maintenance of the Baltimore Harbor and Corps of Engineers Channels Federal Navigation Project should occur. Habitats protected and restored by this effort include 323 hectares (800 acres) of shallow water with SAV. Habitat for wintering waterfowl should continue to be created. Continue to work towards stabilizing the shorelines within the focus area through partnerships with MD DNR, NGOs and other federal agencies. The Mute Swan population should be reduced to protect critical Bay living resources.

**Patuxent River, Maryland** The Patuxent River Focus Area is approximately 67,769 hectares (167,460 acres) in size, extends from Prince Georges County in the north to the rivers mouth in St. Marys County, and includes the Western Branch and Little and Middle Patuxent Rivers. Land use in the focus area consists of high and low density development and agriculture lands. Because of the developed nature of the Patuxent River Focus Area, urban non-point and point sources both account for approximately one-third of nutrients entering the river, while agriculture contributes roughly one fifth of the nutrients (Maryland DNR). As the population in the focus area increases, nutrient loads from these sources will increase. Between 1970 and 2000, the population in the watershed increased by 136% and is projected to grow by another 22% by 2020 (Maryland DNR). The Patuxent River Focus Area is a mix of private and public lands, with the majority of acreage in private ownership.

**Conservation Recommendations** Development pressure in the Patuxent River Focus Area creates an urgent need to identify, protect, restore, and manage remaining wetlands and their associated upland habitats. Continued support for ongoing SAV transplanting efforts is a priority. Mute Swan control is underway and should continue until populations are reduced to numbers that no longer negatively impact wetland habitats, waterfowl and other migratory bird species.

**Tangier Sound and Bay Islands, Maryland** The Tangier Sound and Bay Islands Focus Area is approximately 100,350 hectares (247,969 acres) in size and extends from Bloodsworth Island in the north, south to the Virginia/Maryland state line. The focus area includes Tangier Sound, a portion of Pocomoke Sound and their islands (Bloodsworth Island, Smith Island, Cedar Island, and South Marsh Island). The focus area is rural in character; most residents make their livelihoods on the water. Timber harvest and poultry also play significant roles in supporting the local economy. Pocomoke Sound is famous for waterfowl and rail hunting. A significant portion of the focus area is in public ownership. The mainland portion of the focus area includes Deal Island Wildlife Management Area (WMA), Fairmount WMA, and Janes Island State Park. Within

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Tangier and Pocomoke Sounds are Bloodsworth Island (used as a bombing range by the U.S. Navy), South Marsh Island WMA, Cedar Island WMA, Pocomoke Sound WMA, and Martin National Wildlife Refuge. The Tangier Sound and Bay Islands Focus Area supports some of the best remaining bay grass beds in Maryland and is very important for Black duck. A portion of the focus area, Cedar Island, is legendary for its ability to attract large numbers of Black Duck due to its 1,214 hectares (3,000 acres) of tidal marsh, ponds and creeks.

**Conservation Recommendations:** Efforts are underway to restore lost wetlands on the northern end of Smith Island in the Martin National Wildlife Refuge (NWR). Tremendous loss of SAV around parts of Smith Island and be stopped and potentially reversed by protecting and restoring historic wetland communities. The recommended project includes restoration of Back Cove and Fog Point Cove using stone breakwaters and backfill, and protection of the western shoreline of the Martin NWR using breakwaters and backfill from the northern jetty near Ewell to Fog Point. Over a 50-year project life, these projects will restore or protect approximately 768 hectares (1,900 acres) of SAV and restore or protect 97 hectares (240 acres) of wetlands. The Mute Swan population should be reduced to protect critical Bay living resources. Other wetland and bay grass restoration projects should be targeted for funding and implemented. Partners should continue to work towards stabilizing the shorelines within the focus area through partnerships with MD DNR, non-governmental organizations and other federal agencies.

**Tidal Potomac River, Maryland and Virginia** The Tidal Potomac River Focus Area is shared by northeast Virginia and southwest Maryland and encompasses 474,376 hectares (1,172,203 acres) in Virginia and 295,258 hectares (729,596 acres) in Maryland. The area as a whole, especially upland habitat, is considerably developed, but the brackish and freshwater tidal wetlands have remained relatively undeveloped and provide a wide diversity of habitat for many waterfowl species. The Potomac River proper is owned by the State of Maryland and the adjacent marshes are owned by both Virginia and Maryland, on the respective sides of the river. These riverine marshes are composed of highly brackish Spartina marshes near the mouth of the Potomac to freshwater Peltandra, Lotus and wild rice marshes inland. Historically, hardwood forests dominated areas beyond the river. These forests have given way to row crop agriculture, truck farms, horse/hobby farms, loblolly pine plantations, and residential and industrial development. In recent historical times, the shallow water areas of the Potomac had a high-density of submerged aquatic vegetation (SAV) beds (Hydrilla).

**Conservation Recommendations:** Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields and farmed wetland pasture that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging black ducks. The Mute Swan population should be reduced to protect critical Bay living resources.

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Barnstable Marshes, MA The Barnstable Marshes lie on the inner coast of Cape Cod which fronts Cape Cod Bay just east of the Cape Cod Canal. Protected from the full brunt of New Englands winter weather by Sandy Neck, at more than 9 kilometers (6 miles) in length, the marshes are one of the largest barrier beaches on the New England coast. The marshes provide haven for several thousand Black ducks. The Barnstable Marshes encompass 8,300 hectares (20,511 acres). There is no federal ownership and the state owns only 88 hectares (219 acres). However, there are 2,082 hectares (5,147 acres) in municipal ownership, much of it in the Sandy Neck Reservation, and nonprofit organizations own another 204 hectares (505 acres). An additional 80 hectares (197 acres) are privately owned but protected. The rest is unprotected property.

Conservation Recommendations: Continue to acquire property and conservations restrictions within the Barnstable Marshes Focus Area as done in recent projects funded by the National Coastal Wetlands Conservation Grant Program. Buzzards Bay, Massachusetts The Buzzards Bay Focus Area encompasses the broad stretch of Massachusetts southern coastline from Woods Hole on Cape Cod to the Rhode Island line and includes some 59,893 hectares (148,000 acres). An irregular coastline is created by the many rivers, streams, harbors, and bays that occur along it. Saltmarsh habitat is limited to small sites scattered along the coast throughout the region and total 1,485 hectares (3,670 acres). Another 101 hectares (250 acres) of tidal flats are found in the region. Many small off-shore islands and rock outcroppings are found in the region including a series of larger islands known as the Elizabeth Island Chain or the Gosnold Group. The presence of the Cape Cod Canal makes inner Buzzards Bay a major shipping channel for both commercial and recreational boat traffic. Sixty three hectares (157 acres) are federally owned, primarily by the Department of Defense. The state owns 364 hectares (900 acres) and municipalities, 594 hectares (1,470 acres). Non-profit groups own another 736 hectares (1,820 acres).

Conservation Recommendations:Many pockets of saltmarsh in the Buzzards Bay Focus Area have been historically ditched for mosquito control. Restoration of these marshes to natural tidal flows would benefit wintering black duck and other migratory bird species. Acquisition of remaining undeveloped shoreline and marshes will help conserve important waterfowl wintering

habitats.

Duxbury/Plymouth Bay, Massachusetts The northern portion of Plymouth Bay contain the remaining strips of saltmarsh along this long-settled coastline, with a major piece of marsh remaining in Duxbury/Marshfield, protected by a long barrier beach. This area, particularly the tidal flats along the bay shorelines, is an important wintering site for black duck. The region encompasses 6,758 hectares (16,700 acres) including 673 hectares (1,665 acres) of saltmarsh. The town of Plymouth is the location of both the historic Plymouth Rock site and the Mayflower II is anchored in Plymouth Harbor. The Duxbury marshes are identified in the Category Plan for Preservation of Black Duck Wintering Habitat Atlantic Coast by the U.S. Fish and

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Wildlife Service (U.S. Fish and Wildlife Service 1988).

Conservation Recommendations: Approximately 607 hectares (1,500 acres) should be protected or enhanced.

Greater Boston Area, Massachusetts Located immediately north of Boston, the marshes along the Pines and Saugus Rivers are the last remaining tracts of extensive saltmarsh in the greater Boston metropolitan area. The focus area covers 967 hectares (2,390 acres) of which 509 hectares (1,260 acres) are saltmarsh. Dissected by roads and degraded by illegal dumping and the invasion of *Phragmites*, the area still provides habitat for a variety of wildlife. A smaller area 131 hectares (325 acres), including 81 hectares (200 acres) of saltmarsh located on the north end of Quincy Bay, coupled with the tidal flats of the region, provide winter habitat for several hundred Black ducks. The state owns 279 hectares (690 acres) of the Pines and Saugus Rivers area marshes while another 133 hectares (330 acres) are in municipal ownership. Only 5 hectares (13 acres) are under state ownership in the Quincy/Dorchester area with 20 hectares (50 acres) in municipal ownership. The Quincy/Dorchester area is identified in the Category Plan for Preservation of Black Duck Wintering Habitat Atlantic Coast by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 1988).

Conservation Recommendations: Fee title acquisition of remaining saltmarsh habitat. Vegetative control of *Phragmites* to restore saltmarsh habitat.

Inland Rivers, Massachusetts The river systems of Massachusetts provide valuable wildlife habitat as well as a variety of other important ecosystem functions. In Massachusetts long history, most rivers and streams were dammed in many places to provide power sources for a variety of mills. Although many of these mills are now defunct, the resulting mill ponds have succeeded into valuable wetland habitat. At the same time, there is a movement underway to remove such dams to restore streams to their natural free-flowing state. The Inland Rivers area is comprised of the Blackstone River, Nashua River, and SuAsCo system. Ownership/Protection varies greatly within the systems. The Great Meadows NWR encompasses 1,563 hectares (3,863 acres) in the Sudbury and Concord River systems and MassWildlife owns the 166 hectares (411 acre) Pantry Brook WMA which abuts and drains into the Sudbury River. Pantry Brook is a M.A.R.S.H. project site and a low dam has reclaimed about 30 hectares (75 acres) of deep marsh habitat that had previously succeeded into shrub/scrub wetland. The Assabet NWR on the Assabet portion of the SUASCO system consists of 902 hectares (2,230 acres). The Oxbow NWR in the Nashua River watershed is 674 hectares (1,667 acres).

Conservation Recommendations: There is a need to both acquire more land to protect river corridors and to institute control measures for water chestnut and purple loosestrife.

Inner Cape Cod, Massachusetts The Inner Cape Cod Focus Area extends from East Brewster to North Truro on the Cape Cod Bay side of Cape Cod and includes Wellfleet Harbor. The Cape Cod National Seashore protects some of the northern portions of the focus area including the important Great Island barrier beach.

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The Inner Cape Cod Focus Area includes 12,030 hectares (29,729 acres). There are 936 hectares (2,313 acres) federally protected as part of the Cape Cod National Seashore, 71 hectares (177 acres) in state ownership, 182 hectares (452 acres) in municipal ownership, 321 hectares (794 acres) protected by nonprofit organizations (Massachusetts Audubon), and 37 hectares (93 acres) privately protected. The southern section is this barrier beach is largely in private ownership. Massachusetts Audubon owns a 4,451 hectares (11,000 acres) sanctuary within the focus area.

**Conservation Recommendations:** Mosquito control ditching is limited in this area of Cape Cod but small pockets of saltmarsh are ditched and should be restored. Conservations restrictions on private property should be sought. Restoration of tidal flow to the Herring River will result in increases tidal marsh for waterfowl.

**North and South River Marshes, Massachusetts** The North and South Rivers are coastal estuaries located in the towns of Scituate and Marshfield, Massachusetts south of Boston and north of Plymouth Bay. The region consists of 2,717 hectares (6,714 acres). Approximately 607 hectares (1,500 acres) are saltmarsh heavily infested with *Phragmites* as one travels upriver. The region is not greatly developed by eastern Massachusetts standards. Only 4.4 hectares (11 acres) are in state ownership. The towns of Scituate and Marshfield own 283 hectares (700 acres) and 77 hectares (190 acres) are protected by nonprofit groups. The greatest bulk of the area is in private ownership.

**Conservation Recommendations:** Shoreline protection through acquisition of key tracts and *Phragmites* control.

**North Shore Marshes, Massachusetts** The North Shore Marshes are the largest contiguous saltmarsh in Massachusetts. These marshes extend 27 kilometers (17 miles) from the New Hampshire line to Cape Ann and are interlaced with tidal flats, upland islands, sounds, bays and nine rivers. The marsh, dunes, barrier beach and associated uplands spread over some 14,943 hectares (36,924 acres) and includes 6,474 hectares (16,000 acres) of saltmarsh. The area contains two Black duck wintering concentration sites, one in the mouth of the Merrimac River and a second south of Plum Island Sound. The Plum Island area and Parker River National Wildlife Refuge (NWR) are popular tourist destinations for day tripping from spring through fall. This focus area contains the 2,696 hectares (6,662 acres) Parker River NWR and 798 hectares (1,972 acres) of in state wildlife management area. An additional 619 hectares (1,530 acres) are also in state ownership. One hundred and eighty hectares (446 acres) are in municipal ownership and 2,088 hectares (5,160 acres) are owned by nonprofit organizations. The remaining acres are in private ownership. The Merrimack site and adjacent areas are identified in the Category Plan for Preservation of Black Duck Wintering Habitat Atlantic Coast by the U.S. Fish and Wildlife Service.

**Outer Cape Cod, Massachusetts** The Cape Cod National Seashore protects much of outer Cape Cod. Black

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ducks winter in Pleasant Bay outside the National Seashore boundaries. The tidal flats and saltmarsh around Sipson Meadow and Strong Island are among the most important wintering habitats in Massachusetts. The Outer Cape Cod Focus Area consists of 6,799 hectares (16,801 acres) of which 599 hectares (1,482 acres) are protected by the Cape Cod National Seashore. The state owns only 2.8 hectares (7 acres), but municipal governments own 83 hectares (206 acres) and nonprofit agencies, 181 hectares (448 acres). There are additionally 41 hectares (102 acres) privately protected.

Conservation Recommendations: Acquire conservation restrictions on buffering properties.

Westport Rivers, Massachusetts The East and West Branches of the Westport River are located in the southwestern corner of coastal Massachusetts, next to Rhode Island. Westport Point is identified in the Category Plan for Preservation of Black Duck Wintering Habitat Atlantic Coast by the U.S. Fish and Wildlife Service (U.S. Fish and Wildlife Service 1988) as an important Black Duck wintering site. The total focus area size is 6,221 hectares (15,371 acres) and contains 400 hectares (990 acres) of saltmarsh and about 101 hectares (250) acres of important tidal flats. There is no acreage under federal protection but the state owns 210 hectares (520 acres), most of which is the Horseneck Beach State Park. There is 39 hectares (97 acres) in municipal ownership and 58 hectares (145 acres) protected by nonprofit organizations.

Conservation Recommendations: Land acquisition along the shore line and buffering upland area is recommended.

Connecticut River, Vermont & New Hampshire The Connecticut River Focus Area is a shared focus area between Vermont and New Hampshire. It extends from Third Connecticut Lake on the New Hampshire/Quebec border to the Massachusetts state boundary. The focus area boundaries extend 5 kilometers (3 miles) from the centerline of the river into both Vermont and New Hampshire. Both sides of the river are punctuated by numerous oxbow wetlands, and extensive willow/alder swales, forested wetlands, and open, emergent marshes are adjacent to the river throughout much of its length. These wetlands provide important breeding and migratory stopover habitat several species of waterfowl and other priority bird species. Much of the Connecticut Valley is privately owned. However, many large tracts within and adjacent to the focus area are now either in conservation ownership or protected by conservation easements. The Vermont portion of the focus area includes 5,615 hectares (13,875 acres) of state land, 10,946 hectares (27,050 acres) of privately-owned conservation land, 2,610 hectares (6,450 acres) of municipally owned land, and 384 hectares (950 acres) of federal land. The focus area lies entirely within the approved boundaries of the Silvio O. Conte National Fish and Wildlife Refuge (SOC NFWR). Immediately to the west of the focus area in Vermont is the 8,903 hectare (22,000 acres) West Mountain Wildlife Management Area (WMA) and further west—the 10,521 hectare (26,000 acres) Nulhegan Basin Division of the SOC NFWR. These lands are part of a contiguous 53,823 hectare (133,000 acres) block of land formerly owned by Champion International Paper

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Company and now held in easement or fee by conservation entities (33,993 hectares or 84,000 acres of which are on land owned by Essex Timber Company). Other large blocks of conservation land are on the New Hampshire side of the river, including a 69,403 hectare (171,500 acres) conservation easement brokered by the Trust for Public Lands, The Nature Conservancy (TNC) and the State of New Hampshire, and another 7,689 hectare (19,000 acres) parcel in conservation easement held by TNC. Several of these projects were supported by a 2001 North American Wetland Conservation Act grant.

**Conservation Recommendations:** The purpose of the Silvio O. Conte National Fish and Wildlife Refuge is to protect the native diversity of flora and fauna throughout the Connecticut River Watershed. The actions of the refuge include working with all partners within the watershed through a variety of federal and state programs to meet the goals set forth by the refuge. These programs, not limited to the refuge, include land acquisition, managing or regulating public use, control of exotic species, dam removal, and other programs designed to enhance and conserve the rich natural resources of the Connecticut River Valley.

**Great Bay, New Hampshire** The Great Bay Focus Area encompasses approximately 110,000 hectares (271,814 acres) across twenty-four townships in southeastern New Hampshire surrounding the Great Bay Estuary. The estuary has been widely recognized as one of the most important estuarine systems and waterfowl habitat in the northeastern United States. Approximately 1,800 hectares (4,447 acres) are tidally influenced with shallow waters, mud flats, and extensive eelgrass beds. The wetlands of the focus area are characterized by several subclasses of marine intertidal, estuarine intertidal, riverine, lacustrine, and palustrine wetlands. The estuary is characterized by approximately 1,800 hectares (4,447 acres) of tidal waters with broad eelgrass beds and mudflats as well as estuarine intertidal-emergent marshes with smooth cordgrass and salt meadow hay. The uplands are a transition zone between the deciduous forest to the south and the coniferous forest to the north. Much of the Great Bay Focus Area is under private ownership in relatively small parcels. However, the U.S. Fish and Wildlife Service owns the Great Bay National Wildlife Refuge adjacent to the estuary. In addition, a number of parcels throughout the focus area are under conservation protection through the efforts of the Great Bay Resource Protection Partnership with a variety of owners including the Audubon Society of New Hampshire, The Nature Conservancy, The U.S. Fish and Wildlife Service, and local towns. The Great Bay Estuarine Research Reserve was established in 1989 and encompasses over 4,000 hectares (9,884 acres) of tidal waters. The reserve is managed by the New Hampshire Fish and Game Department under the Marine Fisheries Division. As of January, 2004, the Great Bay Resource Protection Partnership has conserved over 2,428 hectares (6,000 acres) of wildlife habitat around the bay by acquiring or securing conservation easements on important properties.

**Conservation Recommendations:** Partners with the Great Bay Resource Protection Partnership have been working successfully to protect priority parcels within the focus area. The Partnership has put together a Habitat Protection Plan outlining the priorities within the focus area and has been diligently pursuing

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plan objectives that address some of the conservation threats to the resource. Conservation of properties, especially those adjacent to other protected areas, is a priority with the Partnership to help stem development and create larger patches of habitat. Disturbance should be kept to a minimum in the higher priority areas of the estuary surrounding the eelgrass beds and mudflats. Restoration of eelgrass within the estuary should also be a priority.

**Delaware Bayshores, New Jersey** The Delaware Bayshores focus area is one of the most important migratory bird areas in the country. The marshes of the bayshores winter over 40,000 Black ducks. It is a large focus area located along the Delaware Bay coastline of New Jersey extending roughly 115 kilometers (71 miles) from the tip of Cape May to the town of Deepwater, NJ. It extends inland approximately 10-12 kilometers (6-7 miles) encompassing all the coastal wetlands as well as an upland buffer. The focus area extends up the Maurice River approximately 22 kilometers (13 miles) to Millville, NJ to include important wetland habitats associated with the river. The wetlands associated with the Delaware are a vast network of marshes and creeks ranging from high-salinity tidal saltmarshes to freshwater emergent and forested wetlands. Much of the shoreline in New Jersey is under private ownership. However, the state of New Jersey owns over 16,000 ha within the general Delaware Bayshores area. The U.S. Fish and Wildlife Service owns the 1,100 ha Supawna Meadows National Wildlife Refuge as well as Cape May NWR, which maintains several parcels along the Delaware Bayshores. Other agencies such as The Nature Conservancy, New Jersey Natural Lands Trust, and Cape May County Park Commission also maintain holdings for conservation purposes.

**Conservation Recommendations:** Oil and chemical spill contingency plans have been approved for the Delaware Bay. These plans should be kept current and periodically reviewed. Disturbance to migratory birds is a critical threat that should be eliminated. Protection through

fee acquisition and restoration of wetlands should be pursued through state and federal agencies.

**Delaware River Tidal Freshwater Tributaries, New Jersey** The Delaware River Tidal Freshwater Tributaries Focus Area is one of the most valuable focus areas in New Jersey. The focus area is located in southwestern New Jersey, within the Inner Coastal Plain physiographic province. The area encompasses portions of Salem, Gloucester, Camden, Burlington, and Mercer Counties and is located entirely within the Philadelphia, Pennsylvania metropolitan area. The focus area includes all of the major Delaware River tributaries in New Jersey between Penns Grove to the south and Trenton to the north. The dominant land use is industrial, primarily related to oil refinery, chemical production, and manufacturing. The area is also heavily residential given the proximity to Philadelphia. In the southern and northern portion of the focus area, intensive agriculture is practiced with many agricultural fields occurring within 25 meters (82 feet) of wetlands. Vegetable crops are the primary crops grown although small grains and fruit orchards are also common. Despite the high human density, the majority of the wetlands in the focus area are productive, tidal, freshwater wetlands. Tidal wet-

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lands are dominated by emergents including wild rice, arrow arum, bur marigold, spatterdock, smartweeds, rice cutgrass, and cattails. Invasive emergents, including *Phragmites* and purple loosestrife are also present. The majority of the focus area is under private ownership primarily for residential, industrial, and agricultural purposes. Although the state lays claim to ownership of all tidal wetlands through the New Jersey Wetlands Act of 1970, many individuals still pay property taxes on marshes that were previously diked for agricultural purposes. The New Jersey Division of Fish and Wildlife has three small Wildlife Management Areas within the focus area totaling 103 hectares (254 acres). Rancocas State Park, managed by the New Jersey Division of Parks and Forestry, totals 507 ha. The County Park Commissions of Gloucester, Camden, and Mercer also maintain holdings for conservation purposes. The New Jersey Audubon Society owns Monds and Chester Islands, which are situated in the Delaware River. The fertile soils and strong agricultural traditions have resulted in a considerable amount of holdings in Farmland Preservation easements.

**Conservation Recommendations:** Oil and chemical spill contingency plans are in place for the Delaware Bay and River. These plans should be periodically reviewed and updated to reduce the likelihood of future spills and improve the efficacy of oil spill response efforts. The proximity of the area to Philadelphia places tremendous commercial and residential development pressure on the few remaining open spaces. Protection through fee acquisition, land easements, and other cooperative agreements should be pursued through the various government and non-government agencies.

**North Coast Complex, New Jersey** The North Coast Complex focus area is comprised of four sub-focus areas. The Hackensack Meadowlands/Hudson River sub-focus area is located in northern New Jersey in the lower Hackensack River drainage near the northern end of Newark Bay with a small extension to the lower end of the Hudson River. It is the largest remaining brackish wetland complex in the New York-New Jersey Harbor estuary. The Raritan Bay/Navesink River Sub-Focus Area is located in the southern portion of the New York-New Jersey Harbor extending up the Raritan River to Sayreville, New Jersey and east and south along the shoreline approximately 40 kilometers (24 miles) to the Navesink River/Shrewsbury River. This sub-focus area also includes Sandy Hook Bay. The Neptune sub-focus area includes the open water bay of the Shark River around Shark River Hills and Neptune City. The Manasquan River sub-focus area extends approximately 30 kilometers (18 miles) up the Manasquan River from Manasquan Inlet to west of Adelphia, New Jersey. Generally, the wetlands are large complexes of saltwater, brackish, and freshwater tidal emergent marshes with mixed areas of mudflats, sandflats, and large, open bays fed by many small tidal creeks. Most of the wetlands within the focus area have been altered primarily for mosquito and flood control through ditching, diking, and tidegates. This has altered much of the original diversity, especially with the invasion of common reed. The majority of the land within the sub-focus areas is privately owned. Publicly owned lands include those managed by the New Jersey Department of Environmental Protection, New Jersey Meadowlands Commission, and the U.S. Department of Defense.

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**Conservation Recommendations:** Large portions of these marshes already have been lost to development or alteration of hydrology. Additional losses could have increasingly serious consequences. It is recognized that a practical approach to conservation is needed in these areas of dense human settlement and intense development. Further losses of wetlands through dredging or filling or altered hydrology should be curtailed as much as possible. Development should be re-directed to areas that have been previously developed but are underused. The New Jersey Meadowlands Commission has developed a draft Master Plan for comprehensive planning in the Hackensack Meadowlands. The goals and recommendations of the plan should be implemented to help protect and restore the valuable wetlands within this area. Discharge of toxics, oil, or other chemical should be monitored and reduced or curtailed completely, if possible. Human disturbance also should be held to a minimum or eliminated on beaches with active nesting colonies.

**Northern New Jersey Limestone Valley, New Jersey** The Northern New Jersey Limestone Valleys Focus Area contains some of the most productive and valuable inland freshwater wetlands in New Jersey. The focus area is located in northwestern New Jersey to the southeast of the Kittatinny Mountains encompassing portions of Warren and Sussex Counties. Wetlands in the northeastern section of the focus area drain into the Hudson River Drainage via the Wallkill River while the remaining portion of the focus area drains into the Delaware River. The land use is a mosaic of agricultural, residential, and light manufacturing with patches of forested habitat. Small grain crops, pasture, and hay are the dominant agriculture although there are notable areas with dairy farms as well as fruit and vegetable crops. Focus area wetlands include limestone fens, floodplains, spring-fed wetlands, and a significant portion of New Jersey's glacial lakes. *Phragmites* and purple loosestrife are common in some wetlands. The majority of the focus area is privately owned. The New Jersey Division of Fish and Wildlife has seven Wildlife Management Areas within the focus area totaling 4,570 hectares (11,292 acres). The New Jersey Division of Parks and Forestry has three parks in the focus area totaling 3,995 hectares (9,871 acres). Wallkill River National Wildlife Refuge, located in the northern portion of the focus area, is comprised of 1,883 hectares (4,652 acres). The New Jersey Audubon Society and The Nature Conservancy also have land holdings. The fertile limestone valleys and strong agricultural traditions have resulted in a considerable amount of holdings in Farmland Preservation easements. Kittatinny Mountain, just west of the focus area, is predominantly public land.

**Conservation Recommendations:** Long-term planning for human population growth throughout the focus area is critical to deal with the existing development pressures. Land protection through fee acquisition, land exchanges, conservation easements, cooperative management agreements, purchase of development rights and comprehensive planning are needed to maintain the ecological integrity of focus area wild lands. Restoration of riparian habitats along some focus area tributaries could result in both improved habitat and improved water quality. Enhancement of wetlands that have been dominated by non-native, invasive plants should be a priority. Control of Mute Swan populations in the most productive wetlands should be considered.

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Passaic River Basin, New Jersey The Passaic River Basin Focus Area is one of the largest freshwater wetland complexes in the northeastern United States. However, the focus area is also located only 40 kilometers (25 miles) from downtown New York in one of the most heavily developed areas of New Jersey presenting a host of challenges. Many of the major wetland areas are preserved in public ownership although the surrounding landscape is dominated by suburban and urban development. Several major roads traverse the focus area. Focus area wetlands are predominantly palustrine, deciduous-forest wetlands followed by scrub-shrub wetlands and emergent marshes. *Phragmites* and purple loosestrife are common in many wetlands, and locally, can be dominant. Although the majority of the focus area is privately owned as very small parcels, several large tracts of publicly owned lands are also present. Great Swamp National Wildlife Refuge, located in the headwaters of Passaic River, is the largest single parcel at 3,000 hectares (7,413 acres). Several municipal and county parks, including Lord Stirling Park, Loantaka Brook Park, the Somerset County Park and Environmental Education Center, Fairmount Park, and the Morris County Outdoor Education Center, are adjacent to the refuge. The New Jersey Division of Parks and Forestry manages Troy Meadows and Great Piece Meadows Natural Areas which total 3,000 hectares (7,413 acres) along the Passaic River floodplain. Wildlife Preserves, Inc. owns additional sections of Troy Meadows. The Essex County Park Commission manages West Essex Park, which is comprised of about 9 kilometers (5.5 miles) of undeveloped floodplain forest along the east side of the Passaic River. The New Jersey American Water Company and Commonwealth Water Companies operate three drinking water reservoirs on the east side of the Passaic River. The Jersey City Water Company operates Boonton Reservoir, along the Rockaway River.

**Conservation Recommendations:** Practices for reducing the impacts of flooding including filter strips, riparian forest buffers, enhanced and maintained detention basins, and conversion of mowed turfgrass to natural vegetation should be implemented and expanded. Long-term planning for human population growth throughout the focus area basin is critical to deal with the existing development pressures. Land protection through fee acquisition, land exchanges, conservation easements, cooperative management agreements, purchase of development rights and comprehensive planning are needed to reinstate the ecological integrity of focus area wetlands. Enhancement of wetlands that are dominated by non-native, invasive plants should be a priority.

Pineland Bogs, New Jersey The Pineland Bogs focus area is located in southern New Jersey in the heart of the New Jersey Pinelands. Two sub-focus areas are recognized, Burrs Mill Bogs and Mullica River. Wetlands make up about one-third of the pinelands area and are characterized by a diverse range of wetland types including Atlantic white cedar swamps, hardwood swamps, pitch pine lowland forests, marshes, bogs, open water, and pine barren savannas. The wetlands, including bogs, of the focus area are associated with lowland areas surrounding the Mullica River and the Burrs Mill and Wading Rivers. Generally, these waters are of high quality supporting abundant communities of fauna and flora. A number of cranberry bogs, both active and abandoned, are scattered throughout the focus area. Many of the abandoned bogs are succeeding back into shrub swamps with leatherleaf associated with highbush blueberry and inkberry on

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mats of sphagnum ((U.S.F.W.S. 1996). Forested wetlands are generally dominated by Atlantic white cedar or red maple. The National Parks and Recreation Act of 1978 designated The New Jersey Pinelands as the country's first national reserve. A comprehensive management plan was written to balance protection and development interests throughout the reserve. Most of the pine barrens is privately owned, although private non-governmental conservation organizations, including The Nature Conservancy, have ownership in substantial holdings. However, roughly one-third is in public ownership (U.S.F.W.S. 1996). Public owners include the U.S. Fish and Wildlife Service with E.B. Forsythe National Wildlife Refuge, Department of Defense with Fort Dix, McGuire Air Force Base, and Lakehurst Naval Engineering Center, and the state of New Jersey with a number of state parks and wildlife management areas.

**Conservation Recommendations:** Fire maintenance of the ecosystem through prescribed burning should be a priority not only to maintain unique communities and to prevent catastrophic ecological fires and, also, to prevent catastrophic residential damage. Water quality is vital to the migrant birds that breed, migrate, and winter in the pine barrens and for those that use the important coastal habitats directly affected by the pine barrens. Activities associated with residential or commercial development, forestry, and agriculture should be closely monitored by the appropriate state and federal agencies for maintenance of water quality.

**South Atlantic Coast, New Jersey** The South Atlantic Coast focus area of New Jersey is a very large focus area extending approximately 160 kilometers (99 miles) from Point Pleasant to Cape May. It extends inland to encompass important saltwater habitats including emergent saltmarshes and shallow, back barrier lagoon systems. Also, the focus area extends up the Mullica River from the mouth of Great Bay, the Great Egg Harbor River, Toms River, and several smaller tributaries into Little Egg Harbor and Barnegat Bay to the inland extent of the tidal influence. The focus area is a diversity of wetland communities including barrier beaches, back-barrier estuaries, emergent tidal saltmarshes, sand and mudflats, islands, submerged aquatic vegetation, brackish and freshwater emergent wetlands and open water. The majority of saltmarsh as well is under public ownership. The shoreline and islands are a mix of public and private owners. Extensive saltmarshes and adjacent uplands along Barnegat and Brigantine Bays are owned and managed by the U.S. Fish and Wildlife Service. In addition, the state of New Jersey owns and manages several wildlife management areas, state parks, and natural areas within the focus area. Privately owned lands, especially along the barrier beach, are heavily developed for summer and weekend homes. **Conservation Recommendations:** Acquisition and protection of these habitats should be a priority.

**Finger Lakes, New York** The Finger Lakes Focus Area is located in central New York and encompasses two of the eleven Finger Lakes, Seneca and Cayuga. The focus area extends from approximately the northern tip of Seneca and Cayuga Lakes to the southern terminus of both lakes just south of Ithaca on Cayuga Lake and Watkins Glen on Seneca Lake. The western boundary extends as far west as Penn Yan on the northern terminus of Keuka Lake and tapers toward the northern and southern extents of the focus area. The eastern

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boundary extends east to approximately Venice Center about halfway between Cayuga and Owasco Lake. The northern tip of the focus area on Cayuga Lake abuts the southern boundary of the Montezuma Focus Area. The landscape of the focus area is dominated by agriculture, especially around the lake edges, and forests. Residential and industrial development is relatively sparse but concentrated near the edges of the lakes. The large expanse of deep, open water in Cayuga and Seneca Lakes provides habitat for migrating and wintering including black ducks. The majority of the focus area is under private ownership.

**Conservation Recommendations:** Monitoring use of the Finger Lakes Focus Area by breeding, migrating, and wintering birds should continue as well as monitoring of water quality. Disturbance to birds using the area should be held to a minimum during critical times of the year. The importance of this area for migrating and wintering waterfowl is significantly enhanced by the presence of waste grain (corn, soybeans) in adjacent upland fields. Programs that seek to protect farms and agriculture as a way of life should be encouraged and supported.

**Hudson River Valley, New York** The Hudson River Valley Focus Area stretches approximately 250 kilometers (155 miles) from the tip of Battery Park, Manhattan to the inland tidal extent at Troy Lock and Dam and encompasses 35,394 hectares (87,460 acres). The boundary generally follows the shoreline of the river. Habitats encompassed by the focus area include highly saline zones in the lower reaches of the river transitioning into brackish and then to tidal-freshwater riverine and palustrine emergent and forested habitats. The uplands and shoreline along the Hudson River is a mosaic of public and private owners.

**Conservation Recommendations:** The Hudson River Valley Focus Area is under intense threat from many different sources. A comprehensive plan that recognizes the value of the aquatic and terrestrial resources of the river should be undertaken to better understand the individual and cumulative effects of actions within the estuary. Actions undertaken to improve the quality of the estuary should consider water quality improvement, minimizing the negative effects of dredging and spoil deposition, cumulative effects of piers and platforms, control of exotics, and the maintenance and building of railroads and highways adjacent to the river to maintain the hydrologic connection or restore connection to tidal wetlands. Currently, the U.S. Army Corps of Engineers is spearheading the Hudson River Estuary Habitat Restoration Project in partnership with the New York Department of Environmental Conservation and Department of State.

**Iroquois, New York** The Iroquois Focus Area is located in western New York between the cities of Buffalo and Rochester and encompasses 53,524 hectares (132,259 acres). The boundaries of the focus area extend from the eastern end of Niagara County near Wolcottsville eastward to approximately State Highway 237. The north-south boundary extends from approximately the town of Medina on the northern end, south to the town of Oakfield, including portions of the Tonawanda Indian Reservation. This area of western New York is dominated by agriculture of medium to high productivity interspersed with many wetlands, including

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several large and diverse wetlands (T. Carroll, unpublished report). Most of the focus area is under private ownership with public lands held by Iroquois National Wildlife Refuge (NWR), owned by the U.S. Fish and Wildlife Service, and Oak Orchard and Tonawanda Wildlife Management Areas (WMA), owned by the New York Department of Environmental Conservation. Much of the Oak Orchard swamp is under state or federal ownership. The focus area also includes sections of the Tonawanda Indian Reservation in the southwest corner.

**Conservation Recommendations:** Disturbance to nesting and migrating waterfowl should be minimized or eliminated. The spring migration period is critical for hens to gain the necessary energy reserves for successful nesting. Control of purple loosestrife through beetle releases should continue to help maintain the diversity and integrity of the wetland systems. Depending on the objectives, succession of wetlands and grasslands should be controlled with proper water level management on wetlands and mowing regimes for grasslands as well as early successional management for forests.

**Lake Champlain Valley, Vermont/New York** The Lake Champlain Valley Focus Area encompasses 155,678 hectares (384,687 acres) the narrow Lake Champlain Valley between the Adirondack Mountains of New York and the Green Mountains of Vermont. Historically, the valley was dominated by northern hardwoods (Laughlin and Kibbe 1985). However, fertile soils and gently rolling topography made the valley one of the most productive agricultural areas in the northeastern United States and one of the first inland areas to be colonized by Europeans. Currently, agriculture is the dominant land use with only small fragments of forest remaining; although, increasing farm abandonment is leading to increased reforestation. The wetlands of the Lake Champlain Valley form numerous and diverse communities. Much of the Lake Champlain Valley is in private ownership.

**Conservation Recommendations:** Disturbance to breeding and migrating birds should be minimized or eliminated. Efforts should be made to control point and non-point source pollution to improve the water quality of Lake Champlain. Control of invasive species is needed to maintain or improve the biodiversity and habitat quality of the lake and the associated wetlands and uplands. Also, effort should be made to support and engage the Lake Champlain Basin Program and its mission to coordinate the development of a comprehensive plan for the Lake Champlain Basin.

**Lake Ontario Islands, New York** The Lake Ontario Islands focus area is located within the eastern basin ecosystem of Lake Ontario. The boundaries run from Bartlett Point, New York just inside the mouth of the St. Lawrence River south to Southwick Beach State Park. The boundary extends from approximately 5 kilometers (3 miles) inland west offshore to the Canada-United States border. The focus area includes the islands of Carlton, Grenadier, Fox, Galloo, Little Galloo, Stony, and Calf Islands. The focus area also encompasses the important shoals associated with the islands. Agricultural fields predominantly pasture, with

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scattered shrub and woodlands dominate the mainland habitats. Many of the farms have been abandoned with fields reverting to forests. Ownership on the mainland is predominantly private. However, several public holdings of New York Department of Environmental Conservation dot the shoreline including Ashland Flats Wildlife Management Area (WMA), Dexter Marsh WMA, Long Point State Park, and Westcott Beach State Park. The islands as well are predominantly privately owned with a few publicly owned islands such as Gull and Little Galloo Islands and parts of Galloo Island. The U.S. Coast Guard maintains ownership of the Galloo Island lighthouse.

**Conservation Recommendations:** Most conservation efforts in eastern Lake Ontario have been small scale and local. The increasing pressure on this area for recreation demands a more comprehensive approach to conservation to maintain the integrity of the diversity of habitat types within the focus area. This includes private lands needs staging areas on nearshore waters. Also, monitoring of the long-term effects of contaminants on physiology and reproduction of migratory birds should continue.

**Lake Shore Marshes, New York** The Lake Shore Marshes focus area encompasses a long narrow strip along the southern and eastern shores of Lake Ontario. The boundary runs from approximately Hamlin Beach State Park in Monroe County east through Rochester and Oswego to Southwick Beach State Park in Jefferson County along the eastern shore of Lake Ontario. The focus area extends approximately 3 km offshore. The majority of the focus area is privately owned. However, public ownership is scattered throughout the focus area with substantial public ownership in the eastern Lake Ontario section with much of the shoreline and wetlands owned and managed by the New York Department of Environmental Conservation as either state parks or wildlife management areas. The majority of the uplands in the focus area are in private ownership.

**Conservation Recommendations:** Development along the shoreline probably would prohibit acquisition of large tracts of land (NY DEC 2002). However, where tracts of important wetlands, dune systems, and tributaries exist they should be protected through fee or easement acquisition to prevent development, loss of habitat, and potential disturbance to staging and migrating birds. Also, water quality of Lake Ontario should be improved through best management practices in agricultural areas and in residential areas by curtailing use of pesticide and herbicide thus reducing runoff. Control of invasive plants is important to maintain the diversity of wetlands

**Long Island South Shore Complex, New York** This area encompasses 79,094 hectares (195,447 acres). This system extends in an east-west direction for 145 kilometers (90 miles) along the south shore of Long Island, from Coney Island in New York City east to Southampton at the eastern end of Shinnecock Bay. The shallow water wetlands and back-barrier areas are highly productive, especially the saltmarshes and mudflats that fringe the barrier islands and the estuarine habitats around the creek outlets. The deeper water habitats are composed of sandy shoals and eelgrass beds that provide cover and nursery habitat to many species. The

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ownership pattern along the south shore of Long Island is variable including federal, tribal, state, county, and town. However, most of the shoreline is privately owned and developed for residences, marinas, and marine-related industries.

**Conservation Recommendations:** Disturbances to wintering black ducks needs to be minimized or eliminated entirely. The single most important factor to preserve the aquatic habitats is controlling waste and nonpoint source pollution entering the estuary to protect the bay fishery and maintain habitat quality. Efforts should be made to designate the bay as a "no discharge zone" for sewage from recreational boating. Dredging new boat channels should be avoided and alterations to the inlet should be minimal to preserve the present tidal pattern.

**Montezuma, New York** The Montezuma Focus Area is one of the largest and most important wetland complexes in the northeastern United States encompassing 65,229 hectares (161,183 acres). The focus area is located in central New York in Wayne, Seneca, and Cayuga Counties about halfway between Syracuse and Rochester. The boundary of the focus area generally follows the 118 meter (390 foot) contour encompassing a diversity of habitat types around the wetland complex. The dominant land use is agriculture with corn, potatoes, onions, beans, and wheat or hay as the major crops. Purple loosestrife, *Phragmites*, pale swallow-wort and white water lily are prevalent in the wetlands. Globally significant inland saltmarshes are found within the focus area as well as non-vegetated mudflats (Ducks Unlimited 2000). Rural homesteads and small communities make up most of the developed land, which is a minor component of the land use. The majority of the focus area is under private ownership dominated by dairy farms and muck farms. Public ownership is within the Montezuma National Wildlife Refuge, U.S. Fish and Wildlife Service and the Northern Montezuma Wildlife Management Area, New York Department of Environmental Conservation. In addition, the New York Department of Transportation owns significant acreage along the Seneca River/Barge Canal (U.S. Fish and Wildlife Service 1991) with much of these lands under Management Agreement with the U.S. Fish and Wildlife Service and the New York Department of Environmental Conservation.

**Conservation Recommendations:** Restoration of marginal or abandoned farmlands, both wetland and upland, should be pursued where possible and followed with long-term management (S. Hess, personal communication). Agricultural runoff and potential leaching of harmful pollution from the landfill should be monitored. Water quality within the impoundments (i.e. Seneca River/Barge Canal) should be monitored for pollution from agricultural practices as well as the quality and integrity of restored mucklands. Public education is an important component of long-term management for the Montezuma wetlands complex and should be fostered to increase public awareness about the critical role this area plays in the annual cycle of migratory birds. Controlled access on the federal and state lands should continue to limit the number of people using the area at any one time to minimize disturbance to migrating black ducks and maintain the value of the complex. Purple loosestrife control should continue with control of other invasive species.

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Niagara River/Buffalo Harbor, New York The Niagara River/Buffalo Harbor Focus Area extends the length of the Niagara River corridor connecting Lakes Erie and Ontario on the United States side only. It includes Grand Island and extends approximately 3 kilometers (1.8 miles) offshore from Buffalo Harbor in the southern reaches of the focus area. It is a significant migration and wintering area for waterfowl including black ducks. The natural communities of the Niagara River corridor have been severely degraded through a variety of human disturbances. Most of the wetlands have been lost due to filling, contamination, dewatering through river diversion, and invasion of exotic plants such as purple loosestrife. Some of these degraded wetlands are within or adjacent to publicly held parkland while others are adjacent to developed commercial lands. The majority of the land along the river corridor is privately owned by municipal, corporate, or private interests. However, a number of state parks and national historic sites are scattered along the corridor. The area has significant cultural resources related to the history of the United States with the National Park Service maintaining three National Historic Landmarks along the river. Also, portions of the corridor are owned by the New York State Department of Parks, Recreation, and Historic Preservation and the New York State Department of Environmental Conservation.

**Conservation Recommendations:** Although toxic contamination from PCBs and dioxins have been reduced and continue to be addressed, these contaminants represent a long-term threat to the integrity of the health of all wildlife using the focus area. Contaminants in the Niagara River should continue to be monitored with increased efforts to reduce the influx of long-term and injurious chemicals. The remaining wetlands and shallow-water habitats should be protected and restored for use by black ducks and other migratory birds. Tourist-related disturbance should be eliminated or reduced to a minimum.

Oneida Lake, New York The Oneida Lake Focus Area encompasses Oneida Lake and portions of the Mohawk River/Erie Canal to Ilion, New York and includes 121,150 hectares (299,366 acres). The southern boundary extends to Syracuse, New York and runs east approximately along the New York State Thruway (I-90) where the eastern boundary tapers to its terminus in Ilion, New York. The southern portion of the focus area includes the large Cicero Swamp area. Because of the productive wetland soils, agriculture is a dominant land use and has resulted in the substantial loss of wetlands. Most of the agriculture is dairy farms with vegetable, sheep, beef, and equine farming comprising the remaining non-dairy farming operations. Loss of some farming operations has resulted in many restoration opportunities within the focus area. The eastern portion of the focus area follows the Mohawk River/Erie Canal for approximately 60 kilometers from the eastern shoreline of Oneida Lake. The majority of the ownership within the focus area is private either in residential or agriculture. Many seasonal homes are located along the shoreline of the lake, especially along the southern shore, which is the most heavily developed area of Madison County. The New York Department of Environmental Conservation, and the Department of Parks, Recreation, and Historic Preservation own and maintain several Wildlife Management Areas, State Parks, and State Forests within the focus area. Commercial and industrial ownership is based around the cities and villages and makes up a very small

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percentage of the ownership pattern.

**Conservation Recommendations:** Monitoring the spread and potential direct and indirect effects of exotic species, especially zebra mussels, should be a priority for this focus area. Disturbance from shoreline development and recreational boating should be held to a minimum. Wetlands should be protected and restored, where opportunities exist, to provide habitat for black ducks and other wildlife species.

**Peconic Bay Marshes, New York** The Peconic Estuary is composed of diverse communities distributed among a series of interconnected bays between the north and south forks of eastern Long Island and encompasses 43,873 hectares (108,412 acres). The wetland habitats within the Peconic Estuary are diverse including emergent and rocky intertidal, freshwater, and brackish wetlands, mudflats, beaches and dunes, and beds of submerged aquatic vegetation such as eelgrass and wigeongrass. Much of the land surrounding the estuary is held in private ownership. Approximately 60% is either in open space/recreational, agriculture, or is vacant; however, most of these lands are vulnerable to development (Suffolk County 1991, Suffolk County 1999). The remaining 40% is under residential, industrial, or commercial development. The Peconic Estuary Program has developed a Comprehensive Conservation and Management Plan that details strategies to protect the valuable resources of eastern Long Island and the estuary (Suffolk County 1999). The state of New York owns several state parks on the extreme eastern end of both the north and south forks. The U.S. Fish and Wildlife Service own several small refuges located within the Peconic Estuary.

**Conservation Recommendations:** Protecting the integrity of the Peconic Estuary is critical to many species of migratory birds and other wildlife. The Suffolk County Department of Health Services prepared a Comprehensive Conservation Management Plan (Suffolk County 1999) for the Peconic Estuary to address the conservation needs and outline the necessary strategies to protect the estuary in the face of the rapidly changing surrounding landscape. The Peconic Estuary Plan makes a number recommendations to conserve the integrity of the estuary. Some of these include reduce and restrict shoreline hardening, reduce non-point source pollution, and pursue acquisition of undeveloped parcels. Refer to the Peconic Estuary Program: Comprehensive Conservation Management Plan (1999) for a complete list of recommendations.

**St. Lawrence Plain, New York** The St. Lawrence Plain is a mosaic of diverse habitat types supporting a broad array of waterfowl and non-waterfowl species. The landscape of the focus area is dominated by agriculture with croplands, hay fields, and pasture (Wells 2000). The area encompasses 713,871 hectares (1,764,006 acres). This agricultural landscape is interspersed with numerous forested, scrub-shrub, and emergent wetlands. A unique feature of the focus area is the presence of sheetwater wetlands (Northern Ecological Associates 1994). Most of the St. Lawrence Plain is held in relatively small private holdings. However, numerous Wildlife Management Areas, State Parks, and other state-owned lands are located throughout the focus area. The New York State Power Authority operates the St. Lawrence/Franklin D.

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Roosevelt Hydroelectric Facility in conjunction with the Province of Ontario. The Power Authority has created a number of parks primarily on the St. Lawrence River within the towns of Waddington, Massena, Lisbon, and Louisville (Woodlot Alternatives, Inc. 1999, New York Power Authority 2002). The largest federal landowner is the U.S. Army at Fort Drum. The U.S. Fish and Wildlife Service own the St. Lawrence Wetlands and Grasslands Management District, a small parcel of less than 202 hectares (500 acres) of grassland habitat. In addition, the U.S. Fish and Wildlife Service owns over 404 hectares (1,000 acres) of Farmers Home Administration transfer properties and numerous easements, primarily wetlands.

**Conservation Recommendations:** The primary conservation concern is keeping agricultural grasslands from succeeding into shrublands and eventually to forests. The Farm Bill sponsors many programs that could assist farmers keep their land agricultural, thus maintaining habitat for grassland species, and restore and maintain important wetlands. Some of these programs include the Conservation Reserve Enhancement Program, Wildlife Habitat Incentives Program, and Wetlands Reserve Program. The U.S. Fish and Wildlife Service have developed the Landowner Incentives Program that could be used to help manage private grasslands, shrublands, and forest patches for priority species. Pollution from agricultural and industrial runoff needs to be monitored and reduced or eliminated where it poses a threat to the health of priority habitats.

**Carolina Bays, North Carolina** The Carolina Bays Focus Area encompasses approximately 170,842 hectares (422,159 acres) in southeastern North Carolina and includes portions of Bladen, Cumberland, and Sampson Counties. This area of the coastal plain is characterized by numerous depressional wetlands called Carolina Bays. Hundreds of these depressions occur in the focus area, and many have been drained or altered. Some of the bays are filled by lakes while others support densely shrubby pocosin communities. A few, like Bushy Lake in southeastern Cumberland County, have both open water and pocosin communities. The bay rims support longleaf pine communities, and intervening flats support a mix of upland longleaf pine and wetland pocosin communities. Extensive floodplain swamp habitat is also present in this focus area, with brownwater communities along Cape Fear River, which originates in the Piedmont, and blackwater communities along the streams and rivers originating in the Coastal Plain. Many of the Carolina Bays are intact and do provide habitat for waterfowl and other wetland-associated species. Additionally, many can be restored to provide similar habitat. Much of the surrounding upland landscape is dominated by southern pine forests. These areas were historically important wintering and migration habitat black duck. Land in this region is primarily privately owned, followed by various properties under stewardship of the State of North Carolina. Uplands are dominated by industrial forest interests and agriculture, interspersed with ridges of longleaf pine. The relatively low number of landowners in the region has helped retain the natural qualities of the region and limit development. Opportunities exist to restore drained and altered Carolina Bays, and to restore large areas to longleaf pine.

**Conservation Recommendations:** Major conservation actions here are restoration of the natural hydrology

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of Carolina Bays, and protection of extensive bays and remaining wetlands. Major recommendations for this focus area are to limit development through conservation easements, and to provide incentives to landowners to protect and restore the longleaf pine/wiregrass ecosystem.

**Currituck Sound/North River, North Carolina** The dominant feature of the Currituck Sound/North River Focus area is the fresh and brackish water wetlands of the Currituck Sound. The Northwest River, which drains into the upper portion of Currituck Sound, and the North River along the western edge of the focus area, are the other major waterbodies included. The focus area is located in Camden and Currituck counties and encompasses 94,914 hectares (234,538 acres). The western edge of the area is composed of forested wetlands adjacent to the North River while the eastern edge is bordered by the Atlantic Ocean. Land use is a mixture of agricultural interests, corporate and private woodlots, and residential development. Notwithstanding the Currituck Sound and other waterbodies which are considered public waters, the majority of the focus area is under private ownership with a mixture of small woodlots, farming, and residential development. Public ownership occurs primarily with the U.S. Fish and Wildlife Service (USFWS) at the Mackay Island and Currituck National Wildlife Refuges and with the North Carolina Wildlife Resources Commission (NCWRC) at the North River Game Land and the Northwest River Marsh Game Land. Number of hectares under ownership by these entities exceeds 10,000 hectares (24,711 acres). Number of hectares under private ownership and with conservation easements approaches 1,000 hectares

(2,471 acres) and includes 600 hectares (1,482 acres) of the Pine Island Audubon Sanctuary.

**Conservation Recommendations:** Due to the tremendous increase in land value in the last decade, acquisition of habitat in Currituck County (especially adjacent to Currituck Sound) will be difficult and costly. However, conservation organizations should continue to look for and pursue key parcels of land for acquisition and/or for conservation easement. Annual or periodic monitoring of SAVs in Currituck Sound has not been conducted in the past, but efforts are now underway to acquire consistent funding sources and to develop a strategy for long-term SAV monitoring. This should continue to be a high priority for all natural resource agencies and organizations. To offset long-term losses of SAV, restoration of prior-converted wetlands into high quality managed areas should receive high priority. The most likely locations for land acquisition where habitat development and restoration can be accomplished will be in the intensively farmed areas of northern Currituck County and Camden County. The North Carolina Partners and/or similar programs (CRP, CREP and WHIP) that are a cooperative effort between natural resources agencies and private landowner should be encouraged and promoted in the area.

**Falls/Jordan Lakes, North Carolina** The Falls/Jordan Lakes Focus Area encompasses portions of Chatham, Durham, Granville, Lee, Orange, and Wake Counties in the Piedmont of North Carolina. The focus area is 302,120 hectares (746,556 acres) in size. The notable wetland feature is the presence of Falls and Jordan

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Lakes, and Harris Reservoir. Both Falls and Jordan Lakes are managed by the U.S. Army Corps of Engineers for flood control, water supply, and recreation. Harris Reservoir was constructed to serve the Shearon Harris nuclear power plant. As mitigation for the loss of wetland/waterfowl habitat when both Falls and Jordan Lakes were created, a series of green-tree reservoirs were created at Jordan Lake while a combination of green-tree reservoirs and moist-soil type impoundments were constructed near Falls Lake. In addition to the lakes and managed areas, the relatively narrow hardwood floodplain fringing the numerous tributaries to each of the lakes is the other primary wetland feature. The majority of the focus area is in private ownership; however, several large public landholdings include both Butner-Falls of Neuse 16,700 hectares (41,266 acres) and Jordan 17,300 hectares (42,749 acres) Game Lands. A large portion of these game lands are owned by the U.S. Army Corps of Engineers and managed by the North Carolina Wildlife Resources Commission. Two state parks, Eno River and William B. Umstead account for an additional 3,200 hectares (7,907 acres) in the focus area.

**Conservation Recommendations:** Conservation organizations should continue to look for opportunities to protect the remaining fringe of bottomlands along the lakes and tributaries. Admittedly, acquisition will be difficult as land prices are very high in this area. One purpose for the creation of this focus area is to recognize the important contribution the existing green-tree reservoirs and managed moist soil impoundments provide to waterfowl in the area. Opportunities do exist for the creation of additional managed wetland habitat on areas already owned by public entities and for enhancement of existing areas. These options should be pursued.

**Lower Cape Fear River, North Carolina** The Lower Cape Fear River Focus Area encompasses 117,840 hectares (291,189 acres) in Bladen, Pender, Brunswick, and New Hanover Counties, with smaller portions occupying Columbus and Sampson Counties. This focus area extends southeastward along the Cape Fear River from the Carolina Bays Focus Area eventually reaching the ocean. This portion of the Cape Fear River is navigable, and as the river nears the ocean, it becomes a slow moving coastal river, and eventually becomes a coastal estuary below Wilmington, North Carolina. This portion of the Cape Fear River is a brownwater river that is tidally influenced well inland upstream of New Hanover County.

**Conservation Recommendations:** Protection of the aquatic habitat in Cape Fear River and its tributaries is difficult because it is affected by activities throughout the watershed. These include industrial effluents, agricultural runoff, and municipal treatment facility outfall. Some sources of pollution can be reduced by careful control of sedimentation and storm water runoff. A buffer zone of vegetated, undisturbed soil along river banks is also beneficial. Cape Fear River should be regularly monitored to gauge impacts to water quality over time. The following conservation actions have been identified in this region: acquire land and conservation easements, promote private lands management compatible with conservation goals for the targeted communities, restore groundwater hydrology, reduce and mitigate impacts associated with livestock

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wastes, and reduce and mitigate impacts from incompatible forestry practices.

**Lower Pee Dee River, North Carolina** The Lower Pee Dee River Focus Area is located in Anson, Montgomery, Richmond and Anson Stanly counties, encompassing 81,389 hectares (201,115 acres) along the Pee Dee River, including Blewett Falls Lake. The Pee Dee River begins in North Carolina on the eastern escarpment of the Southern Appalachians near the Tennessee and Virginia boundaries. Several significant wetland habitats such as oxbow lakes, beaver ponds and vernal ponds occur in the floodplain forests of the Great Pee Dee River. These wetlands provide key habitat for many wetland-dependant species, including black ducks, other waterfowl and many other wetland- associated birds. Ownership in this focus area is primarily in private holdings, although the Pee Dee National Wildlife Refuge and Uwharrie National Forest are both located in this focus area. Property owned by Progress Energy Carolinas and managed by the North Carolina Wildlife Resources Commission as the Pee Dee River Game Lands (North Carolina Wildlife Resources Commission) is also located in this focus area.

**Conservation Recommendations:** Conservation organizations should continue to look for opportunities to protect, through acquisition or easement, property which will complement and enhance both the aesthetic and natural qualities of the river. The North Carolina Partner's and/or similar programs (CRP, CREP and WHIP) that are a cooperative effort between natural resources agencies and private landowner should be encouraged and promoted in the area.

**Lumber River, North Carolina** The Lumber River is a winding blackwater river that originates in the Sandhills region of North Carolina then flows freely through the southern coastal plain and into the Pee Dee River in South Carolina. The Lumber River Focus Area encompasses 81,386 hectares (201,112 acres) primarily in Robeson County with smaller portions in Bladen, Columbus, and Cumberland Counties. Ownership in this focus area is primarily in private holdings, the exception being the Lumber

River State Park encompassing 3,212 hectares (7,937 acres).

**Conservation Recommendations:** The Lumber River is the only blackwater type stream with the wild and scenic designation in North Carolina. Conservation organizations should continue to look for opportunities to protect, through acquisition or easement, property which will complement and enhance both the ascetic and natural qualities of the river. The North Carolina Partner's and/or similar programs (CRP, CREP and WHIP) that are a cooperative effort between natural resources agencies and private landowner should be encouraged and promoted in the area.

**Neuse/Pamlico Rivers, North Carolina** The Neuse Pamlico Rivers Focus area is the largest in North Carolina, encompassing 498,000 hectares (1,230,607 acres) and representing a variety of wetland habitats. Along the Pamlico/Tar River, the focus area reaches upstream from near Greenville downstream to the Pamlico

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Rivers confluence with the Pamlico Sound. Likewise, the Neuse River reaches upstream from Fort Barnwell downstream to its confluence with the Pamlico Sound. Also included in the focus area are the Pungo River and the complex of naturally formed lakes found in the Croatan National Forest. The focus area is located in portions of Beaufort, Carteret, Craven, Hyde, Jones, and Pamlico Counties. The majority of the focus area is under private ownership with a mixture of agricultural land, large holdings of corporate timberland and smaller, individually-owned woodlots. Ownership of those lands with either conservation protection or natural resource management emphasis is quite varied. Area under protection from the U.S. Fish and Wildlife Service and the North Carolina Wildlife Resources Commission approaches 10,000 hectares (24,711 acres) and includes the Cedar Island National Wildlife Refuge and the Goose Creek Game Lands. Approximately half of the 65,000 hectares (160,621 acres) Croatan National Forest is in the focus area.

**Conservation Recommendations:** Conservation efforts should focus on providing additional protection along portions of both rivers where development potential is greatest. Best Management Practices relating to land use/water quality issues should be strengthened and promoted within the area. The presence of brackish water marsh impoundments is a feature unique to this area and provides critical habitat for a variety of wetland dependent species. Continued availability and management of these areas is a high priority. Annual or periodic monitoring of SAVs in both rivers and Pamlico Sound has not been conducted in the past, but efforts are now underway to acquire consistent funding sources and to develop a strategy for long-term SAV monitoring. This should continue to be a high priority for all natural resource agencies and organizations. The North Carolina Partner's and/or similar programs (CRP, CREP and WHIP) that are a cooperative effort between natural resources agencies and private landowner should be encouraged and promoted in the area.

New River, North Carolina The New River Focus area is located entirely within Onslow County and encompasses 85,420 hectares (211,078 acres). It includes the New River and its tributaries from Jacksonville downstream where it empties into the Atlantic Ocean. Much of the Camp Lejeune Marine Corps Base is located within the focus area. The New River found within this focus area should not be confused with the New River located in the northwestern portion of North Carolina. A variety of wetland habitats exist and include estuarine open water, estuarine emergent marsh, pocosin, and isolated forested wetlands. A number of green-tree reservoirs as well as a 31 hectares (76 acres) brackish water impoundments is located within Camp Lejeune and managed specifically for waterfowl. Land use in the focus area is varied. Part of the area may be considered urban/suburban as it includes the city of Jacksonville (population 66,000) and the Camp Lejeune infrastructure while much of the area is generally rural with land use being associated with Marine Corps activities. The majority of the focus area is under public ownership with the Camp Lejeune Marine Corps Base the primary landholder. The Stones Creek Game Land, 1,015 hectares (2,508 acres) is located within the focus area and is managed by the North Carolina Wildlife Resources Commission.

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**Conservation Recommendations:** To ensure continued availability of preferred waterfowl foods, Best Management Practices relating to land use/water quality issues should be strengthened and promoted within the area. Conservation efforts should focus on providing additional protection along the New River and its tributaries where development potential is greatest. Distribution and quantity of SAV in the New River is unknown. At a minimum, an initial investigation of SAV with future periodic monitoring should be considered.

**Northern Albermarle, North Carolina** The Northern Albemarle Focus Area is characterized by three freshwater river systems (Perquimans, Little, and Pasquotank) whose drainage originates from the expansive Great Dismal Swamp. The area includes nearly all of the Albemarle Sound (except the extreme western portion). The focus area is located in northeastern North Carolina and includes all or portions of the following counties: Camden, Chowan, Currituck, Gates, Pasquotank, and Perquimans. Over the last 200 years, much of the area has been ditched, drained and converted to agricultural cropland. The primary land use is agricultural. Forested wetlands adjacent to the river systems are the dominant wetland type. Submerged aquatic vegetation (SAV) can be found in the lower reaches of each of the river systems and also along the Albemarle Sound shoreline. Trends in SAV coverage are unknown, but anecdotal information suggests that coverage has increased in recent years. This development is encouraging in that overall SAV coverage in coastal habitats has declined over the long-term. The majority of the focus area is under private ownership dominated by farms and private woodlots. Public ownership occurs primarily with the U.S. Fish and Wildlife Service (USFWS), North Carolina Wildlife Resources Commission (NCWRC) and North Carolina State Parks. Number of acres under ownership by these three entities exceeds 20,600 hectares (50,904 acres) with over 14,000 hectares (34,595 acres) occurring at the Great Dismal Swamp National Wildlife Refuge and adjacent Dismal Swamp State Natural Area in the extreme northern portion of the area. Additional property under conservation easement accounts for an additional 375 hectares (926 acres) while Department of Transportation mitigation sites exceeds 364 hectares (900 acres).

**Conservation Recommendations:** With the exception of the Dismal Swamp complex, habitat conservation (acquisition, restoration, and enhancement) activities by public entities have been minimal. Protection of the remaining swamp (through acquisition or easement) adjacent to the lower portions of each of the river systems should be a high priority. However, protection will be difficult as much of the land is very expensive; prices having increased dramatically in recent years due to the explosion in housing development. In recent years, conservation organizations have acquired thousand of acres of wetland habitats in eastern North Carolina. The areas primarily consist of marsh habitat and/or large contiguous blocks of semi-permanently flooded swamp. Because of the undevelopable nature of these areas, cost/acre is relatively small. As an alternative, public and private conservation entities should consider acquisition or easement of land that is under a higher threat of residential or industrial development. Because these areas are generally characterized by a relatively small wetland fringe bordered by uplands, cost/acre will be much greater than those areas which

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cannot be developed due to existing environmental regulations. The conservation of these areas will not only protect wetlands but will also have greater water quality benefits than the acquisition of those areas already having de facto protection. Restoration of prior-converted wetlands in the area has great potential especially at those sites where agricultural production is marginal due to poor drainage conditions. The North Carolina Partner's and/or similar programs (CRP, CREP and WHIP) that are a cooperative effort between natural resources agencies and private landowner should be encouraged and promoted in the area.

Pamlico/Albermarle Peninsula, North Carolina The Pamlico-Albemarle Focus Area can be characterized as a large peninsula with Albemarle Sound to the north, Pamlico Sound to the south and Croatan Sound to the east. This region is also been designated by the U.S. Environmental Protection Agency as the second largest estuarine system in the United States with nationally significant aquatic and wetland resources. Alligator River is the major river drainage system in the area with the Scuppernong River, Little Alligator River and the Pungo River representing secondary natural drainage systems. Inland four large lakes dot the landscape. Mattamuskeet Lake, the largest natural lake in North Carolina, covers 15,600 hectares (38,548 acres). It is a freshwater lake averaging only 0.6 meters (1.9 feet) in depth. More than half of the lake bottom is covered by submerged aquatic vegetation (SAV). The dominant SAVs are wild celery, redhead grass, southern naiad, and muskgrass. The focus area is located in northeastern North Carolina and includes all or portions of the following counties: Washington, Beaufort, Tyrrell, Hyde and Dare. Over the last 100 years, much of the area has been ditched, drained and converted to agricultural cropland. The primary land use is agricultural. Forested wetlands adjacent to the river systems are the dominant wetland type. A large percent of the area is under federal and state ownership (approximately 186,000 hectares or 459,614 acres) comprised of Alligator River National Wildlife Refuge (NWR), Mattamuskeet NWR, Swanquarter NWR, Pocosin Lakes NWR, the Departments of the Navy and the Air Force, and State Gamelands (Alligtor River, J. Morgan Futch, Buckridge, Gull Rock, Pungo River, Long Shoal, New Lake and Lantern Acres). The remainder of the focus area is under private ownership dominated by farms, nonriverine swamps and pocosin habitat.

Conservation Recommendations: In recent years, conservation organizations have acquired thousand of acres of wetland habitats in eastern North Carolina, especially within the Albemarle-Pamlico Peninsula Focus Area. These areas primarily consisted of marsh habitat, pocosin habitat and/or large contiguous blocks of semi-permanently flooded swamp. Because of the undevelopable nature of these areas, cost/acre is relatively small. As an alternative, public and private conservation entities should consider acquisition or easement of land that is under a higher threat of residential or industrial development. With the increase in the wood products industry for hardwood species and improved logging practice (i.e. shovel-logging), the protection of the remaining nonriverine swamp (through acquisition or easement) should be a high priority. In addition, the restoration of prior-converted wetlands in the area has great potential especially at those sites where agricultural production is marginal due to poor drainage conditions. The North Carolina Partner's and/or similar programs (CRP and WRP) that are a cooperative effort between the Natural Resources Conservation

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Service and private landowner should be encouraged and promoted in this focus area.

**Roanoke/Chowan Rivers, North Carolina** The Roanoke-Chowan Rivers Focus Area includes the Roanoke River basin which is recognized as one of the largest intact bottomland hardwood systems remaining in the Mid-Atlantic region. The focus area is located in northeastern North Carolina and includes all or portions of the following counties: Bertie, Chowan, Gates, Halifax, Hertford, Martin, Northampton, and Washington. The boundary roughly follows the drainage of the Roanoke and Chowan Rivers in North Carolina. Forested wetlands adjacent to the Roanoke and Chowan Rivers as well as their major tributaries (Cashie, Meherrin and Wiccacon) are the dominant wetland type. The range expansion of beaver into this area has greatly increased this habitat type in the last 20 years. The river systems are generally characterized by natural river levees transitioning into bottomland flats that either grade into large interior back swamps or into a ridge and swale system found adjacent to the river levee. Increases in submerged aquatic vegetation (SAV) have been noted in recent years in the western portion of the Albemarle Sound (at the confluence of the Chowan and Roanoke Rivers). This development is encouraging in that overall SAV coverage in coastal habitats has declined over the long-term. The focus area encompasses 590,098 hectares (1,458,159 acres) and includes only four towns of approximately 5,000 and one town of approximately 17,000. The majority of the focus area is under private ownership dominated by farms, private woodlots and corporate timberlands. Public ownership occurs primarily with the U.S. Fish and Wildlife Service (USFWS)/Roanoke River National Wildlife Refuge and the North Carolina Wildlife Resources Commission (NCWRC). Number of hectares under ownership by the USFWS and NCWRC exceeds 15,000 hectares (37,066 acres). Management agreements of various time lengths exist with other public (N.C. Division of Parks and Recreation) and private landowners (The Nature Conservancy) and account for approximately 12,950 hectares (32,000 acres) under current protection. Other significant public ownership is by the North Carolina Department of Corrections which operates two farms encompassing approximately 3,600 hectares (8,895 acres) and Merchants Millpond State Park 485 hectares (1,200 acres).

**Conservation Recommendations:** Conservation activities in the past have largely centered on the acquisition of intact tracts of back swamp and hardwood ridges adjacent to the river systems. This should continue where opportunities exist with the goal of establishing a large wildlife corridor stretching from the Albemarle-Pamlico peninsula through the upper portion of the Roanoke and Chowan River basins in Virginia. The decline in the quality and the unpredictable nature of wetland habitat due to the asynchronous and untimely flooding regime along the Roanoke River calls for more intensive wetland creation, restoration, and enhancement activities than what has typically occurred in the past. The goal of this activity is to provide a stable habitat base available each year for migratory waterfowl. The ability to intensively manage the large tracts of back swamp will be difficult, but opportunities do exist. This effort will require a close working relationship with those entities managing water flows and with other state and federal organizations including the North Carolina Division of Water Quality, North Carolina Division of Marine Fisheries and the Army Corp

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of Engineers. Restoration of marginal or abandoned farmlands, both prior-converted wetland and upland, should be actively pursued where possible and followed with long-term management. Recent efforts through the cooperative North Carolina Partners program have restored over 34 hectares (85 acres) of wetlands on private lands and should continue.

Southern Outer Banks, North Carolina The Southern Outer Banks Focus Area can be characterized as a barrier island complex with the Croatan, Pamlico and Core Sounds to the west and the Atlantic Ocean to the east. This region can be divided into four distinct habitat zones: beach, shrub-scrub, maritime forest and marsh. Of these zones, the marsh and adjacent Sound waters are most important to waterfowl, particularly black ducks.. This focus area contains the most extensive area of submerged aquatic vegetation (SAV) in the state. Eighty percent (80%) of the SAV is in southern and eastern Pamlico Sound. Lesser areas occur west of Bogue Inlet, in western Pamlico Sound, Croatan Sound, and Roanoke Sound. The focus area is located in eastern-most North Carolina (i.e. Outer Banks) and includes all or portions of the following counties: Dare, Hyde and Carteret. A large percentage of the area is in private ownership. The remaining portion is under federal and state ownership approximately 26,400 hectares (65,235 acres) and is comprised of Pea Island National Wildlife Refuge, Cape Hatteras National Seashore, Cape Lookout National Seashore, and Roanoke Marshes Gameland.

Conservation Recommendations: Environmental planning will be essential to conserve and protect the region's water quality and natural communities. The need is to balance economic growth on the Southern Outer Banks with the need to secure the environmental future is the greatest conservation challenge for this focus area.

Upper Neuse River, North Carolina The Upper Neuse River Focus Area encompasses Johnston County in its entirety and a portion of Wayne County in east central North Carolina and comprises approximately 222,218 hectares (549,111 acres). This focus area is largely comprised of a complex of lakes, rivers, and tributaries, with extensive riparian areas between Goldsboro and Raleigh. Much of the upland area is forested or in agriculture. Ownership in this focus area is largely privately-owned.

Conservation Recommendations: Some recommendations for this focus area are to acquire land and conservation easements, reduce and mitigate impacts associated with livestock and other agricultural wastes, and reduce and mitigate impacts from incompatible forestry practices.

Waccamaw River, North Carolina The Waccamaw River Focus Area encompasses 183,979 hectares (454,622 acres) in Brunswick, Bladen, and Columbus counties. This area includes the upper Waccamaw River, a portion of Green Swamp, and Lake Waccamaw. The Waccamaw River is classified as a blackwater river system. The Waccamaw River is unique in that it is the only river originating from a Carolina Bay, beginning at Lake Waccamaw in Columbus County, North Carolina. The Waccamaw River has a large, relatively

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unbroken riverine bottomland hardwood ecosystem Land in this region is primarily privately owned, followed by various properties under stewardship of the State of North Carolina, including Lake Waccamaw State Park, and The Nature Conservancy. Uplands are dominated by some of the best examples of longleaf pine forests and savanna communities remaining in the southeastern United States. The relatively low number of landowners in the region has helped retain the natural qualities of the region and limit development.

**Conservation Recommendations:** Major conservation actions here are restoration of the natural hydrology of Carolina Bays, and protection of extensive swamps and remaining bottomland hardwood forests. Major recommendations for this focus area are to limit development through conservation easements, and to provide incentives to landowners to protect and restore the longleaf pine/wiregrass ecosystem. .

Cussewago Bottoms, Pennsylvania Cussewago Bottoms lies within the glaciated Pittsburgh plateau section of the Appalachian Plateau physiographic province and is within the Lower Great Lakes/St. Lawrence Plain Bird Conservation Region (BCR 13). Cussewago Creek is within the French Creek watershed and its associated bottomlands and uplands comprise about 5,260 hectares (13,000 acres) in north central Crawford County. Cussewago Creek is a low gradient stream subject to frequent flooding. This creates numerous seasonally flooded wetlands and pasturelands within the floodplain. Much of the site is composed of bottomland-hardwood forest and scrub/shrub wetlands, with smaller acreages of emergent wetlands. Meanders within the creek, oxbows and beaver dams have created many high quality wetlands for waterfowl and other wetland dependent wildlife. Most of the area is in private ownership with land use being composed primarily of agriculture, forest uses and rural housing. State Game Lands 269 is a 267-hectare (660 acre) tract owned and managed by the Pennsylvania Game Commission. It is composed of a large wetland complex with a small impoundment and adjacent uplands.

**Conservation Recommendations:** Efforts to protect existing lands within the Bottoms from development should be undertaken through acquisition and conservation easement or through local land use zoning laws. Conservation practices should be implemented on farmland through the Conservation Reserve Enhancement Program (CREP) and other USDA, NRCS and State programs. Monitoring and control of invasive plant species such as purple loosestrife, common reed and reed canary grass should be undertaken.

Delaware River Basin, Pennsylvania The Delaware River is the longest free-flowing river in the eastern United States. The Delaware River Basin Planning Area encompasses 749,943 hectares (1,853,142 acres) and includes the entire non-tidal Pennsylvania portion of the Delaware (Morrisville and north), as well as the eastern half of the Pennsylvania portion of the rivers drainage basin. The western half of the basin is not included in the Planning Area because of its lower value to waterfowl due to the presence of more intensive urban and agricultural land use as well as some more mountainous areas. Approximately 15-20% of the northern portion of the planning area is in public ownership (Pennsylvania Game Commission, Pennsylvania Department of

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Conservation and Natural Resources, and National Park Service), including a substantial portion of the large intact wetland complexes in the Pike County Focus Area. In addition, much of Long Pond Swamp is secure under the ownership of The Nature Conservancy. Several water authorities, timber companies, and hunting clubs control large unfragmented parcels, while remaining private lands include residential developments, lower-density residential areas, and some farmland. South of the Kittatinny Ridge, public landholdings are limited to a few small, isolated state game lands (Quakertown Swamp is included in SGL 139) and state / county parks surrounded by privately owned farmland and residential developments.

**Conservation Recommendations:** There is an urgent need throughout the planning area for coordinated municipal and regional planning to ensure that ongoing development is conducted in an environmentally sensitive manner. Waterfowl habitat partners should work with local authorities and developers to ensure the protection of existing wetlands (including preventing the conversion of emergent wetlands to open-water habitats), the maintenance of adequate connectivity and upland buffers to minimize the effects of disturbance and non-point pollution, and the preservation of agricultural lands as feeding areas for migrating and wintering waterfowl. Carefully targeted acquisitions and easements will be important tools in securing the most vulnerable high-quality wetland systems.

Wetland restoration and enhancement on both public and private lands should also be a high priority in this planning area. In agricultural areas, these efforts should be linked to the Pennsylvania Conservation Reserve Enhancement Program and other Farm Bill programs that promote expansion of perennial nesting cover. Technical assistance should be provided to lake associations and other private landowners who wish to restore or enhance waterfowl habitat on recreational lakes and other wetlands. Where possible, especially on public lands, recreational use should be managed through use of restricted-entry propagation areas and other means to minimize disturbance to breeding waterfowl. Increased control efforts for invasive species would result in marked habitat improvements in many areas.

**Lower Susquehanna River, Pennsylvania** The Lower Susquehanna River Planning Area (LSRPA) is contained within the Ridge and Valley and Piedmont physiographic provinces and extends from Sunbury down the Susquehanna River to the Maryland state line and includes many tributary creeks and reservoirs. The planning area encompasses 2,100,206 hectares (5,189,701 acres). The Susquehanna River corridor is an important migratory pathway for migratory birds bound for the Chesapeake Bay. The LSRPA and its productive shallow waters, lakes, islands, wetlands, gravel bars and mudflats provide important feeding and resting habitat for waterfowl. Less than 5% of the total acreage of the LSRPA is in public ownership. Many of the river islands within the LSRSPA are owned and managed by Pennsylvania Game Commission (PGC), Pennsylvania Department of Conservation and Natural Resources (DCNR) or public utilities. Many islands in the LSRPA are managed specifically for waterfowl and are designated refuges by the PGC.

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**Conservation Recommendations:** Efforts should continue and be expanded to prevent the loss and degradation of wetland habitat in support of the goals of the Chesapeake Bay 2000 agreement (Environmental Protection Agency, 2000) and Chesapeake Bay Executive Order (Department of the Interior 2010). Nutrient reduction and wetland restoration efforts should be expanded to improve water quality and wetland habitat for waterfowl. Enrollment of private farmlands in the Conservation Reserve and Enhancement Program (CREP) should be encouraged to provide benefits to water quality and upland nesting habitat. Refuge areas should be acquired to provide disturbance free habitat to breeding, migrating and wintering waterfowl. Acquisition, restoration and enhancement of wetland habitats within the LSRPA should be actively pursued and funding sources secured for these programs.

**Middle Creek, Pennsylvania** The Middle Creek Focus Area is located within piedmont physiographic province and is also within Bird Conservation Region 29. Middle Creek provides important wintering and migration habitat for migratory birds, especially waterfowl. The Middle Creek Wildlife Management Area (WMA) contains a 161-hectare (400-acre) impoundment along with smaller shallow water wetlands and moist soil areas managed for waterfowl and other wetland birds. The surrounding privately owned lands are primarily agricultural, and provide waste grain and forage for ducks, geese and swans during spring and fall migration. The 2,509-hectare (6,200-acre) Middle Creek WMA is managed for wildlife by the Pennsylvania Game Commission. The remaining lands in the focus area are in private ownership with land use composed primarily of agriculture, rural residential and small residential communities.

**Conservation Recommendations:** There is an urgent need to develop land use planning efforts to protect the remaining open space and farmland surrounding the Middle Creek WMA. Conservation easements should be acquired and where possible acquisition of key areas should be a priority. Enrollment of private farmland in the Conservation Reserve and Enhancement Program (CREP) should be encouraged to provide benefits to water quality and upland nesting habitat. Acquisition, restoration and enhancement of wetland habitats within the focus area should be actively pursued and funding sources secured for these programs. Monitoring and control of invasive plant and animal species should be expanded.

**Northwest Planning Area, Pennsylvania** The Northwest Planning Area lies within the Glaciated Pittsburgh Plateau Section of the Appalachian Plateau Physiographic province and encompasses 120,041 hectares (296,628 acres). The river valley from Jamestown to Greenville is privately owned. Below Greenville, most of the river floodplain, including Shenango Lake is largely in public ownership through the U.S. Army Corps of Engineers and has a forested buffer along most of the length. The Moraine portion of the Planning Area is under public ownership through the Pennsylvania Department of Conservation and Natural Resources.

**Conservation Recommendations:** Water levels in the Shenango River are now regulated by releases from Pymatuning Reservoir, which help feed municipal water supplies downstream and maintain water levels in

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the Beaver River (Coxe 2003). Along with the imperatives given these uses, the maintenance of natural communities and ecological systems need to be taken into consideration with the release of water from the reservoir. The requirements of these natural systems will need to be better researched and evaluated.

Activities upstream in the watershed need to be evaluated for their impact in increasing nutrients and runoff flowing into the Shenango River Focus Area (Coxe 2003). Efforts to decrease the non-point pollution through streambank fencing programs and upgrades to sewage treatment plants would be key to reducing nutrient loads in the river. Substantial and contiguous riparian buffers (forest and shrubland) would not only assist in reducing non-point source pollution but also add to natural habitat within stream valleys. Invasive species need to be monitored along the length of the river and efforts taken to prevent their spread to other parts of the river. Landowner(s) should be made aware of the significance of what they own and be given information on how to manage for the plants, animals and habitats present here. It may be possible for groups like the Shenango Conservancy or the Shenango River Watchers to help in educating landowners and users of the corridor as to the significance of the habitats and requirements of the animals and plants of special concern. Increasing the amount of forested riparian areas along the Shenango River would encourage the development of more viable natural communities, both instream and out. Intact woodlands are also better able to resist invasive species, which are prevalent along the river. Monitoring of invasive species would help in tracking their spread and ultimately in control efforts.

Wetland restoration and enhancement activities should be implemented on private lands within the Planning Area, to provide quality habitat for waterfowl and other wetland dependent wildlife. Landowners should also be encouraged to participate in the Conservation Reserve Enhancement Program (CREP) for the Ohio River basin, which will improve water quality and provide upland nesting cover for breeding waterfowl.

Careful planning within the Planning Area and the Shenango River Focus Area would benefit both the ecological resources and people living on the land. Recognizing the river and surrounding landscape, as a prime ecological and recreational resource may be an initial step in this planning (Coxe 2003). The U.S. Army Corps of Engineers, the many private landowners and the municipalities included in the focus area should come together to consider comprehensive planning. Resources available through the county, state, and federal governments such as agency management plans, Rivers Conservation Plans, and other initiatives may help in defining issues and providing some guidance in developing community-based conservation plans.

Ohio River Valley, West Virginia This planning area consists of the islands of the Ohio River, the back channels and riverine habitats associated with these islands, and adjacent wetland, embayment and bottomland habitat within the Ohio River floodplain in West Virginia (WV), and the Ohio River Focus Area in Pennsylvania. In WV, the planning and focus area spans 450 kilometers (280 miles) of the Ohio River corridor and includes 401,714 hectares (992,653 acres). In Pennsylvania, the focus area incorporates 58,462

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hectares (144,462 acres). Most of the habitats within this area have been classified as Resource Category I under the United States Fish and Wildlife Mitigation Policy. These areas, particularly the islands, back channels, and embayments, have long been recognized by state, federal, and private organizations as having high quality fish and wildlife, recreational, scientific and natural heritage value. The majority of the Ohio River floodplain area is privately owned. The Ohio River Islands National Wildlife Refuge (NWR), established in 1990, protects 22 islands and 3 mainland tracts totaling approximately 1,416 hectares (3,500 acres) of floodplain habitats. A total of 30 islands are targeted for acquisition or protection, and over 809 hectares (2,000 acres) of embayments and wetlands in West Virginia are identified for protection. The West Virginia Division of Natural Resource owns over 404 hectares (1,000 acres) of lands and open water along the Ohio River at Green Bottom Wetland Management Area.

**Conservation Recommendations:** Restoration of floodplain wetlands previously altered by agriculture; conservation easements or acquisition of embayments and other important riparian habitats; continued acquisition of islands; reduction of non-point source pollution loading which affects aquatic bed habitat; minimization of dredging and spoil disposal in productive wetland habitats.

**Pike County, Pennsylvania** The Pike County Waterfowl Focus Area lies within the Glaciated Low Plateau Section of the Appalachian Plateau physiographic province and is within the Appalachian Mountains Bird Conservation Region (BCR 28) and the Delaware River Basin Waterfowl Planning Area. Pike County has been identified as a waterfowl focus area within the Delaware River Basin Planning Area because of its especially high concentration of exceptional quality wetlands; Pike County is the most heavily forested portion of the wetland-rich glaciated region of Pennsylvania, and therefore the premier area in the state for those avian species that thrive in this combination of habitats. The focus area includes all but the extreme northern and western portions of Pike County (which contain fewer wetlands and less public land); it is bordered on the northeast and southeast by the Delaware River, on the northwest by the Lackawaxen River, and on the southwest by the higher elevations of the Pocono Plateau. The focus area consists of about 12,140 hectares (30,000 acres) of freshwater wetlands within a forested (primarily deciduous) habitat matrix of approximately 121,400 hectares (300,000 acres). Wetland types present are diverse and often interspersed. They include bogs, slow-moving streams, beaver ponds, emergent marshes, shallow lakes, and scrub-shrub and forested swamps. The forested matrix is a vital accompaniment to these wetlands because it provides a buffer zone that helps maintain wetland water quality, reduce human disturbance, and provide breeding habitat for cavity nesting species.

Approximately 35% of the land within the focus area is in public ownership (Pennsylvania Game Commission, Pennsylvania Department of Conservation and Natural Resources, and National Park Service). Several additional large, unfragmented parcels are controlled by private hunting clubs. Other private lands include large second home developments in primarily forested settings, lower density residential areas, and numerous

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small tracts of privately owned forestland.

**Conservation Recommendations:** The most urgent conservation need in the focus area is coordinated planning to ensure that ongoing development is conducted in an environmentally sensitive manner. Waterfowl habitat partners should work with local authorities and developers to ensure the protection of existing wetlands (including preventing the conversion of emergent wetlands to open-water habitats) and the maintenance of adequate connectivity and upland buffers to minimize the effects of nest predation, human disturbance, and non-point pollution. Carefully targeted acquisitions and easements will be important tools in securing the most vulnerable high-quality wetland systems. Technical assistance should be provided to hunting clubs, lake associations, and other landowners who wish to enhance waterfowl habitat on their properties. Recreational use should be managed to minimize disturbance to waterfowl, especially during critical nesting and brood-rearing periods in spring and early summer, through use of restricted-entry propagation areas, educational materials, and other means. For invasive species, monitoring efforts should be increased and aggressive prevention and control measures implemented to address incipient threats while they remain at manageable levels.

**Presque Isle, Pennsylvania** Presque Isle is a narrow sand spit of land extending into Lake Erie. It lies within the Eastern Lake Section of the Central Lowland physiographic province and is within the Lower Great Lakes/St. Lawrence Plain Bird Conservation Region (BCR). Presque Isle contains about 1,294 hectares (3,200 acres) of deciduous woodlands, freshwater wetlands and lakeshore habitat. There are approximately 185 hectares (458 acres) of freshwater wetlands. All 1,294 hectares (3,200) acres of Presque Isle are owned by the Commonwealth of Pennsylvania as Presque Isle State Park (PISP) and managed by the Pennsylvania Department of Conservation and Natural Resources. Gull point, the eastern tip of the peninsula was designated a migratory bird sanctuary in 1927.

**Conservation Recommendations:** Efforts should continue to manage and reduce human disturbance to migrating and nesting birds. Aggressive control of invasive plant and animal species on PISP should be implemented. Research into understanding the relationship of botulism to zebra mussels, and round goby and the effects of selenium and other contaminants on waterfowl and waterbird population is needed.

**Pymatuning, Pennsylvania** The Pymatuning Focus Area lies within the glaciated Pittsburgh plateau section of the Appalachian Plateau physiographic province and is within the Lower Great Lakes/St. Lawrence Plain Bird Conservation Region (BCR 13). The Pymatuning-Hartstown wetland complex (Pymatuning-Hartstown) and Conneaut Outlet wetlands (Conneaut Outlet) are located within the Shenango River and French Creek Watersheds, respectively. Pymatuning-Hartstown comprises 12,132 hectares (29,978 acres) in a diverse, horseshoe-shaped wetland complex (Tautin 2004a). Pymatuning State Park encompasses most of the lower 8,304 hectares (20,442 acres) and is mainly open water with upland buffer for public recreation

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(boating, fishing, swimming, camping, etc.) although 356 hectares (886 acre) of Blackjack Swamp and Clark Island have been designated a natural area. The upper portion of Pymatuning-Hartstown is separated from the lower portion by a causeway dam. Much of Pymatuning and immediate buffer areas are under State jurisdiction and thus afforded a significant measure of protection. The Pennsylvania Department of Conservation and Natural Resources manages Pymatuning State Park. The Pennsylvania Game Commission (PGC) owns and manages 2,164 hectares (5,391 acres) of State Game Lands (SGL) 214 and 1,664 hectares (4,145 acres) of Pymatuning State Park land through lease agreement. Conneaut Outlet is managed as SGL 213 by the PGC, while adjoining buffer lands remain in private ownership.

**Conservation Recommendations:** Monitoring and control of invasive plant species such as purple loosestrife, common reed, multiflora rose and reed canary grass should be maintained and/or intensified. Continued management of wetlands through periodic wetland draw-downs and use of aquatic vegetation cutter to maintain habitat diversity and productivity. Maintain and enhance existing grasslands and early succession habitats. Replace old or non-functioning water control structures to improve wetland management opportunities. Acquire a high volume water pump to improve water management capabilities. Acquire important adjoining buffer habitats as opportunities arise. Wetland restoration and enhancement activities should be implemented on private lands within the Focus Area, to provide quality habitat for waterfowl and other wetland dependent wildlife. Landowners should also be encouraged to participate in the Conservation Reserve Enhancement Program (CREP) for the Ohio River basin, which will improve water quality and provide upland nesting cover for breeding waterfowl. Continue wildlife nest structure programs.

**Shenango River Valley, Pennsylvania** The Shenango River Valley Focus Area lies within the Glaciated Pittsburgh Plateau Section of the Appalachian Plateau Physiographic province and Bird Conservation Region (BCR) Lower Great Lakes/St. Lawrence Plain #13. The Shenango River represents the main watershed and the Focus Area encompasses approximately 4,775 hectares (11,800 acres). The Shenango River Focus Area includes the Shenango River and Shenango Reservoir from Jamestown Borough to the city of Sharon. The Shenango River Valley Focus Area supports a variety of land uses, including crop fields, pastures, quarries and recently timbered forest and contributes to habitat discontinuities along this riparian corridor (Coxe 2003). The river valley from Jamestown to Greenville is privately owned. Below Greenville, most of the river floodplain, including Shenango Lake is largely in public ownership through the U.S. Army Corps of Engineers and has a forested buffer along most of the length. The Pennsylvania Game Commission leases and manages 1,255 hectares (3,100 acres) of Shenango Lake and buffer lands for wildlife, principally migratory birds.

**Conservation Recommendations:** Water levels in the Shenango River are now regulated by releases from Pymatuning Reservoir, which help feed municipal water supplies downstream and maintain water levels in the Beaver River (Coxe 2003). Along with the imperatives given these uses, the maintenance of natural communities and ecological systems need to be taken into consideration with the release of water from the

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reservoir. The requirements of these natural systems will need to be better researched and evaluated.

Activities upstream in the watershed need to be evaluated for their impact in increasing nutrients and runoff flowing into the Shenango River Focus Area (Coxe 2003). Efforts to decrease the non-point pollution through streambank fencing programs and upgrades to sewage treatment plants, is key to reducing nutrient loads in the river. Substantial and contiguous riparian buffers (forest and shrubland) would not only assist in reducing non-point source pollution but also add to natural habitat within stream valleys. Invasive species need to be monitored along the length of the river and efforts taken to prevent their spread to other parts of the river. Landowner(s) should be made aware of the significance of what they own and be given information on how to manage for the plants, animals and habitats present here. It may be possible for groups like the Shenango Conservancy or the Shenango River Watchers to help in educating landowners and users of the corridor as to the significance of the habitats and requirements of the animals and plants of special concern. Increasing the amount of forested riparian areas along the Shenango River would encourage the development of more viable natural communities, both instream and out. Intact woodlands are also better able to resist invasive species, which are prevalent along the river. Monitoring of invasive species would help in tracking their spread and ultimately in control efforts.

Wetland restoration and enhancement activities should be implemented on private lands within the Focus Area, to provide quality habitat for waterfowl and other wetland dependent wildlife. Landowners should also be encouraged to participate in the Conservation Reserve Enhancement Program (CREP) for the Ohio River basin, which will improve water quality and provide upland nesting cover for breeding waterfowl.

Careful planning within the Shenango River Focus Area would benefit both the ecological resources and people living on the land. Recognizing the river and surrounding landscape, as a prime ecological and recreational resource may be an initial step in this planning (Coxe 2003). The U.S. Army Corps of Engineers, the many private landowners and the municipalities included in the focus area should come together to consider comprehensive planning. Resources available through the county, state, and federal governments such as agency management plans, Rivers Conservation Plans, and other initiatives may help in defining issues and providing some guidance in developing community-based conservation plans.

Susquehanna River, Pennsylvania The Susquehanna River drains 27,500 square miles in New York, Pennsylvania, and Maryland. It provides half of the freshwater input to the Chesapeake Bay and is an important migration corridor for many avian species, particularly black ducks that winter on the Chesapeake and along the mid-Atlantic Coast. The Pennsylvania portion of the Susquehanna River Waterfowl Focus Area includes approximately 300 river miles of the North Branch and main stem Susquehanna River, from Sayre to the Maryland line, along with all adjacent uplands. A small portion of the West Branch, just above its confluence with the North Branch at Sunbury, is also included. Throughout its length, the river is wide, shallow,

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and slow-moving, with numerous islands, gravel bars, and mudflats. Over 95% of the uplands adjacent to the Susquehanna River are in private ownership. However, many islands within the river are owned by the Pennsylvania Game Commission (PGC), Pennsylvania Department of Conservation and Natural Resources (DCNR), or public utilities, with several of the PGC-owned islands managed specifically for waterfowl and designated as refuge areas.

**Conservation Recommendations:** Necessary improvements in water quality cannot be achieved within the focus area alone, but will require coordinated efforts throughout the Susquehanna River watershed (e.g., Upper and Lower Susquehanna River Waterfowl Planning Areas) to both increase filtering capacity through protection and restoration of wetlands, bottomland forest, and other vegetated riparian buffers adjacent to the Susquehanna and its tributaries and reduce pollutant sources through improved wastewater treatment, stabilization of erodible land, and education of resource users. Many of these actions are doubly beneficial to waterfowl because they improve local feeding and nesting habitat as well as downstream / Chesapeake Bay water quality. For example, the Conservation Reserve Enhancement Program (CREP) retires highly erodible cropland from production, both reducing sediment loads and providing nesting habitat. Funding and technical assistance to implement this and other Farm Bill conservation programs should be expanded.

On existing public lands within the focus area, human disturbance should continue to be carefully regulated, and further reduced where necessary. Acquisition of additional key concentration points for breeding, migrating, and wintering waterfowl, and areas with high potential for waterfowl habitat restoration, should be pursued. Monitoring and control efforts for invasive species should be increased on both public and private lands.

**Upper Susquehanna River, Pennsylvania** Most of this planning area is part of the Glaciated Low Plateau Section of the Appalachian Physiographic Province and is characterized by a rolling landscape that historically contained an abundance of small natural swamps, bogs, beaver ponds, and marshes. Many of these wetlands remain, but many others have been drained for agricultural production or converted to lower-quality open water habitats (farm ponds, recreational lakes, etc.). The area encompasses 727,624 hectares (1,797,991 acres). Overall, approximately two-thirds of the planning area is forested, but with the exception of some more mountainous sections in the western portion, agricultural lands are extensively interspersed throughout. The only large lakes in the focus area are the three flood control reservoirs comprising the Tioga-Cowanesque region. The Susquehanna River Focus Area includes the entire Pennsylvania portion of the North Branch of the Susquehanna River focus area below Sayre, the lower portion of the West Branch, and adjacent uplands. Both branches are generally wide, shallow, and slow-moving. The upper reaches of the North Branch flow through the Glaciated Low Plateau, while the West Branch and lower reaches of the North Branch flow through the Ridge and Valley Physiographic Province, where there is a greater preponderance of agricultural, industrial, and urban land use. Overall, only about 5% of the planning area

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is in public ownership (predominantly state forest, state game lands, and state parks), and many of these parcels are concentrated in the more heavily forested mountainous areas with lower wetland densities. Two areas are notable exceptions: a 56 hectares (140 acres) portion of Marsh Creek is owned and managed by the Pennsylvania Game Commission as State Game Lands 313, and Tioga, Hammond, and Cowanesque Lakes in the Tioga-Cowanesque region are owned and managed by the U. S. Army Corps of Engineers. The majority of the planning and focus areas are in private ownership as small family farms, woodlots, and low-density residential areas, with some urbanized / industrial areas along the Susquehanna River.

**Conservation Recommendations:** Wetland restoration and enhancement on private lands should be a high priority in this focus area. The benefits of these efforts can be compounded by linking them to the enrollment of marginal farmland into the Pennsylvania Conservation Reserve Enhancement Program, which has recently been expanded into this area and can be expected to benefit breeding waterfowl through improved water quality and expanded upland nesting cover. Acquisition of high-quality wetland complexes, especially those known to support breeding black duck, should also be pursued to secure such areas while lands in the focus and planning areas remain relatively affordable. In the Susquehanna River Focus Area , bottomland forest and other vegetated riparian buffers adjacent to the Susquehanna River should be maintained and / or restored to enhance water quality and provide feeding and nesting habitat. It should be recognized that wetland conservation actions in this focus area provide not only local benefits, but have a positive effect on important waterfowl / wetland habitats downstream, including the Chesapeake Bay.

**100 Acre Cover/Warren-Palmer Rivers, Rhode Island** The Hundred-Acre Cove and Warren-Palmer Rivers Focus Area is a large area located in the northeastern portion of Narragansett Bay, Rhode Island (latitude 41° 43', longitude 71° 17') and encompasses 1,058 hectares (2,614 acres). This area includes the wetlands generally associated with cove and the Palmer River including Belcher Cove and extending into Bristol County, Massachusetts. This estuarine wetland system flows in a southerly direction into Narragansett Bay. Extending from Narragansett Bay towards Bristol County, a transition occurs from salt to freshwater marsh habitats located adjacent to the river channels. A major feature of the marshes found here is the presence of four large permanent non-tidal ponds. Three of the ponds are on the Tongue, the fourth is on the mainland and is unique due to the presence of a wide band of saltmarsh which surrounds the pond. The Palmer River marshes are high quality and are largely unditched. The majority of the focus area is under private ownership. However, several small ( $\leq 2$  hectares/5 acres) tracts of land in Barrington, and located directly adjacent to the Palmer River, are protected by organizations such as the Audubon Society of Rhode Island and local land trusts. In addition, Rhode Island Department of Environmental Management owns a small portion of mainly saltmarsh habitat located within Hundred-Acre Cove. The total area protected by all of these tracts is comparatively small ( 40 hectares/100 acres) relative to the overall size of the focus area. In addition, the locations of the protected land is largely scattered along the river corridor.

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Conservation Recommendations: Recommendations include the purchase of surrounding upland habitat and wetlands associated with the Hundred-Acre Cove and the Warren-Palmer River. Upland acquisition should be extensive enough to serve as an adequate buffer from visual and aural disturbance as well as physical disturbance. Controlled access may be necessary depending on the accessibility of protected lands. Land acquisition should be considered in pursued along

the entire extent of the Palmer River, including the headwaters located in Massachusetts. This will insure that the integrity of this wetland system is not compromised by upstream pollution. Finally, invasive species, particularly *Phragmites* have encroached along the fringe saltmarsh and degraded the habitat quality in these areas. A management plan should be developed and implemented to restore and enhance the habitat quality provide in these areas.

Arnold Neck and Hamilton Cove, Rhode Island Located on the west side of Narragansett Bay are Arnold Neck Cove and Hamilton Cove. These coves are similar in habitat type and waterfowl use; therefore, are discussed together in this description. Arnold Neck Saltmarshis located along the east side of Amtrak Rail Line and draining eastward to Greenwich Bay. This Cove encompasses 287 hectares (709 acres) and is located in a heavily developed area within Warwick. In addition, a railway has physically divided the wetland. The portion of the cove on the west side of the tracks is fresh water and is adjacent to US Route 1. Hamilton Cove, North Kingstown is located east of US Route 1, north of the Jamestown Bridge and south of Wickford Harbor. The cove encompasses 204 hectares (504 acres) and has fringe saltmarsh protected by a peninsula with some upland hardwoods. The bay side of the peninsula is a cobble beach. There are indications that wave action may cause the peninsulas to become isolated, hence forming an island. The majority of the focus area is under private ownership. However, several small ( $\approx$  2 hectares/5 acres) tracts of land are undeveloped and have acquisition potential. A large contiguous parcel of open space in the southeastern portion of the Hamilton Cove focus area was recently donated to Rhode Island Department of Environmental Management (DEM) by Narragansett Electric Company. This area of open space is managed by Rhode Island Division of Parks and Recreation and allows for a variety of public use activities (biking and hiking trails, picnicking etc.).

Conservation Recommendations: Recommendations include the purchase of surrounding upland habitat and wetlands associated with the Arnold Neck and Hamilton Cove Focus Areas. Upland acquisition should be extensive enough to serve as an adequate buffer from visual and aural disturbance as well as physical disturbance. The undeveloped portions of the upland habitat surrounding the salt and fresh water pond draining into Arnold Neck are in need of protection

from any future development. In addition, enhancement actions should be taken to improve the water quality and therefore habitat quality of these wetlands. Finally, the spread of non-native invasive species such as,

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*Phragmites* has negatively impacted the habitat quality off these wetlands. A management plan should be developed and implemented to restore and enhance the habitat quality provide in these areas.

Boyd Marsh and Fogland Point, Rhode Island Boyd Marsh is located at the north end of Portsmouth along Mt. Hope Bay and encompasses 129 hectares (319 acres). The marsh is isolated to the east, south, and west by roads and development. An abandon railway is located to the north of the marsh; yet, a connection exists to the Mount Hope Bay allowing tidal intrusion into the marsh creating brackish conditions. The marsh was partially filled by the Army Corps of Engineers (circa 1945). In addition, the town of Portsmouth and the Rhode Island Department of Environmental Management permitted the construction of a golf course on the fill site. Fogland Point and associated wetlands are located in the towns of Little Compton and Tiverton. Fogland Point marsh consists of 14 hectares (37 acres) saltmarsh, 39 hectares (97 acres) of upland hardwoods and brush adjacent to the Sakonnet River. Associated wetlands include a forested swamp on the west side of Puncatest Neck Road and unnamed pond on the east side of the road. In addition, Nonquit Pond, a public drinking water supply area, is located within the Fogland Point Focus Area. Adjacent uplands include pasture and row crop agriculture and residential areas. Total area size is 982 hectares (2,427 acres). The Rhode Island Department of Environmental Managements (RI DEM) Division of Fish and Wildlife owns a 22-hectare (56 acres) parcel in the center of Boyds Marsh. In addition, RI DEM Division of Parks and Recreation owns a 2 hectare (5 acres) parcel located at the northern end of the marsh and including part of the coastline. However, the majority of the Boyds Marsh Focus Area is under private ownership. Several moderate to large (4 - >40 hectare/10 - >100 acres) tracts of land are located directly adjacent to the marsh, including a golf course and contain conservation action potential. Surrounding uplands associated with the Fogland Point Focus Area are privately owned in large landholdings. However, over 202 hectares (500 acres) within this area are currently preserved in some fashion (e.g., outright sale, development rights).

**Conservation Recommendations:** Recommendations include the purchase of surrounding upland habitat and wetlands associated with Boyd Marsh. Upland acquisition should be extensive enough to serve as an adequate buffer from visual and aural disturbance as well as physical disturbance. Finally, restoration efforts are necessary to control and eliminate the spread of invasive species, particularly *Phragmites australis*. Many large parcels remain within the Fogland Point focus area including farms. Acquisition of these parcels or development rights would be integral in preserving the integrity of the wetlands within this focus area.

Briggs Marsh, Rhode Island Briggs Marsh, an 84.6-ha (209 acres) shallow coastal pond, is located in Little Compton, Rhode Island and encompasses 1,001 hectares (2,474 acres). The wetland (historically recorded as Awaskonk Marsh) is unique in that prior to 1920 it was a saltmarsh open to the Atlantic Ocean via a navigable outlet. At some point in time after 1920, a barrier beach formed across the outlets opening. Water levels in the marsh now vary depending on freshwater inflow of three seasonal streams and periodic breaching. Annual breaching of Briggs Marsh occurs in the southwest section of the barrier beach during

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spring and after storms. Salinity levels in the marsh range between 7 to 12 parts per thousand (ppt). Water levels in the marsh range to 1.5 meters (5 feet). Shoreline vegetation on the marsh consists primarily of Phragmites intermixed with narrow leaf cattail and traces of bulrush. Three islands are located in the west end of the marsh and contain native trees and ground cover of trout lilies. Uplands surrounding the area contain stands of mixed hardwoods, pastures, cornfields, and lawns. The majority of the focus area is under private ownership. However, several areas are protected including the eastern portions of Briggs Marsh and the southern section of Quicksand Pond. In addition, several smaller parcels are under ownership by The Nature Conservancy and the local land trust.

**Conservation Recommendations:** There is a considerable amount of land in rather large parcels within the focus area and are prime areas for conservation acquisition either through outright sale, conservation easement, development rights or other avenues. Conservation actions could include assisting the local land-trust to acquire development rights of those properties not currently in holding. Finally, restoration efforts are necessary to control and eliminate the spread

of invasive species, particularly *Phragmites* and purple loosestrife.

Coastal Ponds, Rhode Island Rhode Islands southern coastline hosts a string of barrier beaches and back-barrier coastal lagoons known locally as salt ponds. These ponds are similar in their general size and habitat types but vary in terms of level of development and tidal connection. Quonochontaug Pond, Winnapaug Pond, Ninigret Pond, Potter Pond, and the Galilee Bird Sanctuary maintain a permanent connection to the ocean through breachways and thus have plants and animals associated with marine and estuarine ecosystems including extensive backbarrier salt-marshes and floodtidal deltas and sand flats. Trustom Pond is breached annually or as needed for water quality and wildlife management and the wetlands retain brackish conditions. Several smaller freshwater ponds are located within the Point Judith Ponds Sub-Focus Area. Total area size is 5,684 hectares (14,045 acres). The majority of the focus area is under private ownership. However, several large tracts of land are under state and federal protection. Included in these is the South Shore Management Area (SSMA) owned by the Rhode Island Department of Environmental Management (RI DEM). This includes a network of coastal agricultural fields managed for Canada Goose hunting. RI DEM also owns portions of the Galilee Bird Sanctuary, which is a recently restored saltmarsh and operates several state beaches. In addition, the United States Fish and Wildlife Service (USFWS) owns two relatively large refuges within the Ninigret Pond and Trustom Pond Sub-Focus Area.

**Conservation Recommendations:** Recommendations include the purchase of surrounding upland habitat and wetlands associated with the Coastal Ponds focus area. Upgrading septic systems for houses around the ponds may be needed to limit the nutrient input and eutrophication of the ponds. Upland acquisition should be extensive enough to serve as an adequate buffer from visual and aural disturbance as well as physical

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disturbance and to protect the water quality of the ponds. Controlled access may be necessary depending on the accessibility of protected lands. Many of the wetlands associated with this focus area have been subjected to the spread of non-native invasive species such as *Phragmites* purple loosestrife, and coontail. A management plan should be developed and implemented to restore and enhance the habitat quality provide in these areas.

**Narragansett Bay Islands, Rhode Island** The islands located within Narragansett Bay are similar in their geological formation and bedrock composition. However, three of these islands are unique in that they contain predator-free habitat. That is to say, that these islands contain no known mammalian predator populations (e.g., fox, coyote, raccoon). Rose Island is approximately 16 acres, located south of the Claiborne Pell Bridge between Jamestown and Newport. Gould Island (West Passage) is located in Narragansett Bay north of the Claiborne Pell Bridge between Jamestown and Middletown. Gould Island is dominated by exotic deciduous species including autumn olive, asiatic bittersweet, Japanese black pine, and Sycamore maple. Dyer Island is a 32-acre island located west of Melville, Portsmouth and southeast of Prudence Island. Habitat consists of a 2 acre saltmarsh, with upland comprised of, but not limited to, blackberries, staghorn sumac, asiatic bittersweet, northern bayberry, black chokeberry, eastern red cedar, Japanese black pine, and tree-of-heaven. The Rose Island Lighthouse Foundation (RILF) currently owns Rose Island. The RILF has restored the Rose Island Lighthouse and uses it as a museum and guest house. The surrounding portions of the island are overgrown with multiflora rose and contain dilapidated brick structures. The Rhode Island Department of Environmental Management (RI DEM) currently owns approximately 66% of the 23-hectare (57-acres) island known as Gould Island. The remaining portion of the island is owned by the Federal Government Department of Defense. The Navy expropriated the island in 1919 and it became a major seaplane base and torpedo testing station during WWII. Abandoned in the 1970s, a segment of the island was turned over to RI DEM during the mid-1970s. Unfortunately the island remains listed as a biohazard dumpsite waiting to be cleaned up by the Navy. In addition, a coal dump remains on the southern portion of the island. The state of Rhode Island purchased Dyer Island as part of its Estuarine Sanctuary in 2001. The island has an elevation of 4 meters (13 feet) above sea level, making it vulnerable to storm surges.

**Conservation Recommendations:** Recommendations include the purchase of the islands as well as habitat restoration. Restoration in the form of clean up of waste, potential demolition and removal of some, non-historic structures, invasive species control and revegetation with native species.

**Pettaquamscutt Cove, Rhode Island** Pettaquamscutt Cove is located in southern Rhode Island at the southern end of the Narrow River estuary where it feeds into Rhode Island Sound at the mouth of Narragansett Bay. The cove encompasses 971 hectares (2,399 acres) and is bordered by South Kingstown to the west and Narragansett to the east. This shallow estuarine system receives freshwater influence from an extensive wetland system including Carr Pond to the north. This tidal cove is bordered on all sides by fringing salt-marsh habitat. The majority of the focus area is under private ownership. However, several tracts of land are under state and federal protection. The U.S. Fish and Wildlife Service (USFWS) owns a refuge located

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along Pettaquamscutt Cove known as the John Chafee National Wildlife Refuge. In addition, the Rhode Island Department of Environmental Management and the Audubon Society of Rhode Island own several scattered parcels within the focus area.

**Conservation Recommendations:** Recommendations include the purchase of surrounding upland habitat and wetlands associated with the Pettaquamscutt Cove Focus Area. Upland acquisition should be extensive enough to serve as an adequate buffer from visual and aural disturbance as well as physical disturbance. Finally, invasive species, particularly *Phragmites* have encroached along the fringe salt- marsh and degraded the quality of habitat in these areas. A management plan should be developed and implemented to restore and enhance the habitat quality provided in these areas.

**ACE Basin, South Carolina** The ACE Basin Focus area is located in the southern coastal region of South Carolina and includes 675,221 hectares (1,668,501 acres) of the drainage basins of the Ashepoo, Combahee and Edisto Rivers. The focus area includes all of Colleton County and portions of Charleston, Beaufort, Hampton, Dorchester, Orangeburg and Bamberg Counties. Extending inland from the Atlantic Ocean, the area consists primarily of managed wetland impoundments, fresh and saltwater tidal marsh, and forested wetlands. Managed wetlands provide migration and wintering habitat for large numbers of dabbling ducks. Ownership patterns of the area include state, federal and local government owned lands, with a large component of privately-owned lands, including forest industry lands. In the lower portion of the focus area, nearly 64,753 hectares (160,007 acres) have been protected from development by various conservation mechanisms including over 25,000 hectares (61,776 acres) in conservation easements. Over 20,235 hectares (50,001 acres) of public land have been protected through state parks, state wildlife management areas, a national wildlife refuge (ACE Basin National Wildlife Refuge) and a national estuarine research reserve (ACE Basin Reserve).

**Conservation Recommendations:** Strategic tracts should be protected through acquisition by state, federal and non-governmental conservation organizations. Conservation easements will continue to be a major protection method in the region. Protection of wetlands along river corridors will be a major focus in the future.

**CAWS Basin, South Carolina** The CAWS Basin (Cooper, Ashley, Wando, and Stono) Focus Area is located in the central coastal region of South Carolina and includes the Charleston Metropolitan Area. Approximately 329,887 hectares (815,165 acres) in size, it includes major portions of Berkeley and Charleston Counties and a small portion of Dorchester County. The CAWS Basin Focus Area encompasses the drainages of the Ashley, Cooper, Stono, and Wando Rivers which form the Charleston Harbor Estuarine Drainage Area. These rivers originate as short blackwater streams in the lower coastal plain. The Santee-Cooper Hydroelectric Project, upstream on the Cooper River, diverts some water flow from the Santee River watershed to the Cooper River Watershed for hydroelectric and flood control purposes. Because of its large size, the CAWS Basin

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Focus Area was subdivided into three sections (sub-focus areas) in 1997: Stono/Sea Islands, Cooper/Wando Rivers, and Ashley River. Ownership patterns within the focus area include federal, state, county, and city, as well as numerous private properties. Large private plantations exist along all of the river systems and on the barrier islands. This area consists of former rice plantations which are largely undeveloped and harbor important natural habitats including tidal, managed, and forested wetlands, as well as upland forests and agricultural areas.

**Conservation Recommendations:** Important wintering, nesting, and foraging habitats need to be protected from destruction and disturbance. As many of these areas need to be protected via conservation easement or purchase and they need to be done on a large landscape scale. Disturbance from the increasing number of residents, industries, and development along with the pollution that accompanies them need to be kept in check. A major effort should be to protect the large tracts on both the riverine systems and adjacent uplands that are being sold off by the large timber companies.

Santee River, South Carolina The focus areas includes the floodplain of the Santee River from the Santee Dam to the Atlantic Ocean at Cedar Island, involving portions of Berkeley, Charleston, Clarendon, Georgetown, and Williamsburg Counties. The coastal marshes of this focus area occupies 221,692 hectares (547,813 acres), including significant areas of managed wetlands. This marsh area represents 32% of the states total marsh area. A significant portion of this focus area also encompasses the Francis Marion National Forest, one of the largest remaining remnants of the fire dependent longleaf pine ecosystem. The USDA Forest Service is moving towards restoration of this ecosystem on public lands in the focus area. Much of this focus area is protected in public ownerships: the Francis Marion National Forest (established in 1936), and the Cape Romain National Wildlife Refuge (established in 1932). There are numerous state wildlife management areas in the focus area, as well as a large number of private properties protected through conservation easements.

**Conservation Recommendations:** It is recommended that wetland habitat in this focus area continue to be protected by the active pursuit of conservation easements, deed restrictions, Memoranda of Understanding, management agreements, gifts, and purchase.

South Lowcountry, South Carolina South Carolinas South Lowcountry Focus Area contains approximately 860,993 hectares (2,127,552 acres) located along the lower Savannah River, encompassing the western portion of Aiken County, all of Barnwell, Allendale, and Jasper Counties, and the majority of Hampton and Beaufort Counties. The goal of the South Lowcountry Focus Area task force is to protect all properties along the Savannah River from the Savannah National Wildlife Refuge, including the Savannah River Site, northward along the river until it meets with the Upper Savannah River Focus Area at the Fall Line. The task force is also focusing on protection of other drainages flowing into and parallel to the Savannah River. The landownership patterns of the South Lowcountry Focus Area are still relatively unfragmented and rather

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large with most landowners along the Savannah River owning anywhere from several hundred to several thousand acres. Protected areas on the Savannah River include the Savannah National Wildlife Refuge, Webb Wildlife Management Area, Palachucola Wildlife Management Area (United States Army Core of Engineers), and the Savannah River Site. Land ownership patterns are unique to this area, with 60 private plantations contributing significantly to the natural landscape of the area. Wildlife and forest management are emphasized on most of these plantations. These large landownerships are a tremendous benefit to the habitat protection strategy of the South Lowcountry Focus Area.

**Conservation Recommendations:** Efforts should be made to increase private landowner participation in the South Lowcountry Focus Area and to increase the number of properties protected by conservation easements. State and Federal officials should also work to leverage funding for habitat protection projects along the Savannah River Corridor. One of the major conservation actions in this focus area is the protection of remaining bottomland hardwood forests. From the Savannah River Site to the Atlantic Ocean, significant tracts of undeveloped forested wetlands remain. These lands should be acquired or protected through conservation easements by federal, state, or private conservation organizations. The pine uplands have great potential for restoration to longleaf pine. Significant issues are associated with the three major reservoirs and the Savannah River Site, and actions should be taken to reduce and minimize all activities that impact water quality. In the upper portion of the focus area, measures should be taken to reduce impacts to water quality from timber production and excessive recreational use. Riparian areas and associated watersheds should be protected.

**Upper Waccamaw River, South Carolina** The Waccamaw River is classified as a blackwater river system. Blackwater rivers typically originate in the coastal plain and have a dark tint because of tannic acid leached from organic matter. The Waccamaw River is also unique in that it is the only river originating from a Carolina Bay, beginning at Lake Waccamaw in Columbus County, North Carolina. The Waccamaw River has a large, relatively unbroken riverine bottomland hardwood ecosystem. This focus area encompasses 43,433 hectares (107,320 acres) in Horry County. Many key tracts within the focus area currently owned by forest industry or non-industrial forest landowners. However, significant holdings by state government do exist. The South Carolina Department of Natural Resources owns the Waccamaw River Heritage Preserve and Lewis Ocean Bay Heritage Preserve. At least one conservation easement has been placed on a private tract.

**Conservation Recommendations:** Strategic tracts should be protected through acquisition by state and non-governmental conservation organizations. The pursuit of conservation easements will be a major protection method in the region. Protection of wetlands along river corridors will be a major focus in the future.

**Little Pee Dee-Lumber Rivers, South Carolina** This focus area encompasses 65,256 hectares (161,251 acres) in portions of Marion, Dillon, and Florence Counties. Many key tracts within the focus area currently owned

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by forest industry or non-industrial forest landowners. However, significant holdings by state government do exist. The South Carolina Department of Natural Resources owns the Little Pee Dee River Heritage Preserve in Marion and Horry counties adjacent to the Little Pee Dee and Lumber Rivers, and Cartwheel Bay Heritage Preserve.

**Conservation Recommendations:** Strategic tracts should be protected through acquisition by state and non-governmental conservation organizations. The pursuit of conservation easements will be a major protection method in the region. Protection of wetlands along river corridors will be a major focus in the future.

**Great Pee Dee-Lynches Rivers, South Carolina** The Great Pee Dee-Lynches Focus Area is 254,044 hectares (627,756 acres) and includes portions of Chesterfield, Darlington, Dillon, Florence, Lee, Marion, Marlboro and Sumter Counties. All of the upper portions of the Great Pee Dee River floodplain and the entire lower portion of the Lynches Rivers floodplain are included, as well as significant portions of Jefferies Creek. Several significant wetland habitats such as oxbow lakes, beaver ponds and vernal ponds occur in the floodplain forests of the Great Pee Dee. These wetlands provide key habitat for many wetland dependent species. Most key areas within the focus area currently owned by forest industry or non-industrial forest landowners. However, significant holdings by state and local governments do exist. South Carolina Department of Natural Resources owns one property in Darlington County adjacent to the Great Pee Dee River. Other government entities include Lee State Natural Area on the Lynches River in Lee County, and the Lynches River County Park and Pee Dee Station Wildlife Management Areas, both in Florence. Several State Natural Heritage Preserves are located within this focus area. The Carolina Sandhills National Wildlife Refuge is located adjacent to this focus area.

**Conservation Recommendations:** Strategic tracts should be protected through acquisition by state and non-governmental conservation organizations. The pursuit of conservation easements will be a major protection method in the region. Protection of wetlands along river corridors will be a major focus in the future.

**Catawba River Basin, South Carolina** The Catawba Focus Area consists of 386,524 hectares (955,119 acres) bordering both sides of the Catawba River from the North Carolina line to the Wateree Dam. The east boundary of the property extends from the North Carolina line south on Hwy 521 to Dekalb. The boundary then shoots across country to the Wateree Dam and again across country to Hwy 34. The boundary then follows Hwy 321 North and then Hwy 161 to the North Carolina line. The northern boundary of this focus area is the North Carolina / South Carolina line. This focus area includes parts of York, Chester, Lancaster, Fairfield, and Kershaw Counties. While the Piedmont area does not consist of the typical wetlands as found in the Coastal Plain, the forested wetlands provide extensive breeding, migration, and wintering habitat waterfowl. Ownership patterns of the area include state and local government-owned lands, with a large component of privately-owned lands, including forest industry and energy subsidiary lands. Examples of

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protected lands include Landsford Canal State Park, Landsford Forest Legacy Area, Historic Brattonsville, Lake Wateree State Recreational Area, and Draper Wildlife Management Area.

**Conservation Recommendations:** Strategic tracts should be protected through acquisition by state, federal and non-governmental conservation organizations. Conservation easements will continue to be a protection method in the region. Protection of wetlands along river corridors will be a major focus in the future.

**Congaree-Wateree/Upper Santee Rivers, South Carolina** The focus area encompasses 127,264 hectares (314,475 acres) in the floodplain and adjoining uplands associated with the Congaree River, the Wateree River, and the upper portion of the Santee River. The area supports a great abundance and diversity of wetland-associated wildlife species. Despite habitat alterations throughout much of the focus area, significant amount of old growth forest still occurs here. The Congaree River is influenced upstream by Lake Murray and Parr Reservoir. The Wateree River is influenced upstream by Wateree Lake. Other influences include urban storm water run-off, mining, agriculture, and forestry practices. The ownership of properties within the focus area is mostly private. There are, however, several notable parcels of publicly owned property. The Congaree Swamp National Park located on the eastern side of the Congaree River, was established to preserve old growth bottomland forest. On the eastern side of the Wateree River is the Manchester State Forest. The upper reaches of the Santee River are actually the swampy head of Lake Marion. This area, referred to as the upper Santee Swamp, is publicly owned by the S.C. Public Service Authority. State Heritage Preserves protect significant ecological areas at Congaree Creek and Congaree Bluff. Most of the privately owned land in the focus area is managed as timberland or agricultural land. Management for waterfowl and other wildlife species and wildlife-associated recreation are primary objectives of many landowners within the focus area. Because of the proximity of these bottomlands to the Columbia Metropolitan Area, many of the properties are owned by land consortiums as recreational properties. A limited number of the private lands in the focus area are under legal conservation easements. A portion of the Santee National Wildlife Refuge is within this focus area.

**Conservation Recommendations:** Conservation needs for the Congaree/Wateree/Upper Santee Focus Area should be centered on preserving the integrity of this large undeveloped forested wetland. Incentives for private landowners to manage for longer rotations of timber should be sought. Portions of the area must be preserved for older growth forest management through acquisition or easements. A strategy to protect against fragmentation of this unique bottomland is vital. Measures should be taken to reduce impacts to water quality from non-point source pollution, leveeing, agriculture, and logging activity.

**Connecticut River, Vermont & New Hampshire** The Connecticut River Focus Area is a shared focus area between Vermont and New Hampshire. It extends from Third Connecticut Lake on the New Hampshire/Quebec border to the Massachusetts state boundary. The focus area boundaries extend 5 kilometers (3 miles) from

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the centerline of the river into both Vermont and New Hampshire. Both sides of the river are punctuated by numerous oxbow wetlands, and extensive willow/alder swales, forested wetlands, and open, emergent marshes are adjacent to the river throughout much of its length. These wetlands provide important breeding and migratory stopover habitat several species of waterfowl. Although only 11% of the watershed is under agriculture, most of this lies adjacent to the river and within the focus area (U.S. Fish & Wildlife Service 1995). Agricultural crops often increase the value of sheet water habitats that commonly occur here, especially in the spring, and provide an important resource for migratory birds during their annual cycle. Much of the Connecticut Valley is privately owned. However, many large tracts within and adjacent to the focus area are now either in conservation ownership or protected by conservation easements. The Vermont portion of the focus area includes 5,615 hectares (13,875 acres) of state land, 10,946 hectares (27,050 acres) of privately-owned conservation land, 2,610 hectares (6,450 acres) of municipally owned land, and 384 hectares (950 acres) of federal land. The focus area lies entirely within the approved boundaries of the Silvio O. Conte National Fish and Wildlife Refuge (SOC NFWR). Immediately to the west of the focus area in Vermont is the 8,903 hectare (22,000 acres) West Mountain Wildlife Management Area (WMA) and—further west—the 10,521 hectare (26,000 acres) Nulhegan Basin Division of the SOC NFWR. These lands are part of a contiguous 53,823 hectare (133,000 acres) block of land formerly owned by Champion International Paper Company and now held in easement or fee by conservation entities (33,993 hectares or 84,000 acres of which are on land owned by Essex Timber Company). Other large blocks of conservation land are on the New Hampshire side of the river, including a 69,403 hectare (171,500 acres) conservation easement brokered by the Trust for Public Lands, The Nature Conservancy (TNC) and the State of New Hampshire, and another 7,689 hectare (19,000 acres) parcel in conservation easement held by TNC. Several of these projects were supported by a 2001 North American Wetland Conservation Act grant. Vermont state lands along the river include Roaring Brook, Fairlee Marsh and Skitchewaug WMA; Ascutney and Fort Dummer State Park; and Thetford Hill State Forest. In New Hampshire, public lands include the Lime Pond and Huntington Hill Conservation Easements; Fort Hill, Reeds, Hubbard Farms, Great Island, Cornish, and Wilder WMA; Hidden Valley Wildlife Conservation Area; Hubbard Hill, Cape Horn, and Connecticut River State Forest, and Wantastiquet Mountain Natural Area.

**Conservation Recommendations:** The purpose of the Silvio O. Conte National Fish and Wildlife Refuge is to protect the native diversity of flora and fauna throughout the Connecticut River Watershed. The actions of the refuge include working with all partners within the watershed through a variety of federal and state programs to meet the goals set forth by the refuge. These programs, not limited to the refuge, include land acquisition, managing or regulating public use, control of exotic species, dam removal, and other programs designed to enhance and conserve the rich natural resources of the Connecticut River Valley.

Lake Champlain Valley, Vermont/New York The Lake Champlain Valley Focus Area encompasses 398,851 hectares (985,577 acres) and includes the narrow Lake Champlain Valley between the Adirondack Mountains

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of New York and the Green Mountains of Vermont. The valley is very different from the surrounding areas with a strong alliance to the St. Lawrence Valley and the Great Lakes lowlands (Thompson and Sorenson 2000). Historically, the valley was dominated by northern hardwoods (Laughlin and Kibbe 1985). However, fertile soils and gently rolling topography made the valley one of the most productive agricultural areas in the northeastern United States. The wetlands of the Lake Champlain Valley form numerous and diverse communities. Much of the lakeshore wetlands are comprised of floodplain forests that are flooded every spring with the rise of water levels. In addition, highly productive forested, emergent, and scrub-shrub wetlands are associated with the deltas formed by several large rivers draining into the lake. Submerged aquatic vegetation is prevalent in the shallow bays especially in the Missisquoi Bay on the northern end of the lake and South Bay in the extreme southern end. Also, several unique lakeside bogs are located in the northern one-third of the lake. Palustrine forested and emergent wetlands created through beaver activity make up most of the wetlands found throughout the valley and associated with the many tributaries that feed into Lake Champlain. Sub-focus areas encompass 45,248 hectares (111,809 acres). Much of the Lake Champlain Valley is in private ownership. However, the states of Vermont and New York own a number of Wildlife Management Areas and State Parks along the shore of Lake Champlain. Much of the New York side of Lake Champlain forms the eastern boundary of the Adirondack Park extending from approximately Port Kent, New York to the southern tip of the lake, South Bay. Federally-owned properties include the Missisquoi National Wildlife Refuge, which encompasses the Missisquoi Delta, the largest wetland delta on Lake Champlain.

**Conservation Recommendations:** Disturbance to breeding and migrating birds should be minimized or eliminated. Efforts should be made to control point and non-point source pollution to improve the water quality of Lake Champlain. Control of invasive species is needed to maintain or improve the biodiversity and habitat quality of the lake and the associated wetlands and uplands. Also, effort should be made to support and engage the Lake Champlain Basin Program and its mission to coordinate the development of a comprehensive plan for the Lake Champlain Basin.

**Lake Memphremagog, Vermont** The Lake Memphremagog Focus Area encompasses 313,816 hectares (775,452 acres) and includes the entire county of Orleans and parts of Essex. The eastern border is adjacent to the Connecticut River Focus Area, which extends 5 kilometers (3 miles) from the center of the river. The focus area is laced with rivers and creeks. Remote wooded swamps, bogs, and beaver flowages are prevalent over the Lake Memphremagog area. The area is poorly drained over large expanses and generally less productive with more acidic water than Lake Champlain. However, the value of the area lies in the aggregate of the many remote wetlands that have high value for black duck and other waterfowl and waterbirds. A few relatively large wetlands occur around the Black and Barton Rivers at South Bay in Lake Memphremagog and along the Clyde River, also near the southern end of the lake. Several large lakes, including Memphremagog, occur in the focus area and include Seymour, Averill, and Caspian Lakes and Lake Willoughby. These areas

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provide important deep-water habitat for species such as Common Loon. The majority of the focus area is privately owned. However, over 40,480 hectares (100,027 acres) of private forest lands are publicly accessible. The State of Vermont manages six Wildlife Management Areas including the 4,170 hectare (10,374 acres) Bill Sladyk and the 9,190 hectare (22,708 acres) West Mountain Areas. In addition several state parks and state forests are within the boundaries of the focus area including Groton State Forest, Vermont's second largest parcel of state-owned land at 10,580 hectares (26,143 acres). The U.S. Fish and Wildlife Service's Silvio O. Conte National Fish and Wildlife Refuge manages the Nulhegan Basin, a 10,520 hectare (25,995 acres) National Wildlife Refuge adjacent to West Mountain Wildlife Management Area.

**Conservation Recommendations:** Although timber harvesting can be detrimental to wetland quality, it is extremely valuable to the local and regional economy. Loss of the economic sustainability of the industry could result in permanent loss of wetlands through development. Disturbance to remote wetlands and water bodies important for waterfowl and waterbird nesting should be minimized, through buffer zones that limit harvest intensity. Further development (shoreline or adjacent) of remote lakes and ponds should be minimized through fee or easement acquisitions of property that provides high quality habitat.

**Delmarva Peninsula, Virginia** The Eastern Shore of Virginia contains a wide diversity of waterfowl habitats. An extensive set of coastal saltmarshes and series of undeveloped barrier islands run the length of the Eastern Shore from Maryland to Fishermans' Island National Wildlife Refuge (NWR). On the Bayside of the Shore, brackish tidal marshes abound from Saxis Island to Hacks Neck encompass 102,225 hectare (252,601 acres). A series of islands occurs in the Chesapeake Bay along these brackish marshes. The Eastern Shore is primarily a rural agricultural, aquacultural community and includes 149,661 hectare (369,819 acres). Many individuals earn their living from the wetland community, including oystermen, crabbers, clammers, and commercial fishermen. In recent times, an agricultural shift has occurred from row crops to commercial vegetable production, resulting in a loss of foraging habitat for many waterfowl species. Additionally, many individuals have taken to purchasing tracts of former wetlands and restoring these sites to emergent marsh systems, resulting in the concentration of waterfowl on managed wetland habitats. The total area of this focus area is 251,886 hectares (622,420 acres). Several groups are working to protect the valuable natural communities on the Eastern Shore. Three National Wildlife Refuges (NWRs) are located in this focus area. Chincoteague National Wildlife Refuge NWR is located on the Maryland border, and the Eastern Shore NWR and Fishermans' Island NWR are located on the extreme southern end of the Shore. The Nature Conservancy owns several of the seaside barrier islands, and owns or holds conservation easements on a number of seaside farms. The Virginia Department of Game and Inland Fisheries owns four wildlife management areas, two on the bayside and two on the seaside (The GATR tract, Mockhorn Island Wildlife Management Area (WMA), Saxis WMA and Guards Shore WMA) The Virginia Department of Conservation and Recreation owns one state park and two natural areas and a barrier island (Wreck Island) on the bayside of the eastern shore. Additionally, many individuals have taken to purchasing tracts of former wetlands and

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restoring these sites to emergent marsh systems, resulting in the concentration of waterfowl on managed wetland habitats.

**Conservation Recommendations:** Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations. Exotic invasives, such as *Phragmites* are continuing to gain a foothold in the area, and treatment of these sites needs to be continued. Future zoning of lands to reduce development will ensure the continued rural setting of this community.

**Lower Potomac River, Virginia** The Potomac River focus area is located in Northeast Virginia encompassing 168,573 hectares (416,551 acres). The area as a whole is considerably developed, as would be expected in Northern Virginia. The brackish and freshwater tidal wetlands are relatively undeveloped, and provide a wide diversity of habitat for black ducks and other waterfowl species. The Potomac River proper is owned by the State of Maryland, and is not included in the focus area. The adjacent marshes are located in Virginia and are included. These marshes are composed of highly brackish Spartina marshes near the mouth of the Potomac to freshwater Peltandra, Lotus and wild rice marshes inland. Historically, hardwood forests dominated areas beyond the river. These forests have given way to row crop agriculture, truck farms, horse/hobby farms, loblolly pine plantations, and residential and industrial development. In recent historical times, the shallow water areas of the Potomac have a history of high-density submerged aquatic vegetation (SAV) beds (*Hydrilla*). The majority of land in this focus area is in private ownership. The U.S. Fish and Wildlife Service owns Masons Neck National Wildlife Refuge (NWR) and Marumsco NWR, The Virginia Department of Conservation and Recreation owns several state parks, Mason Neck State Park, Leesylvania State Park, Caledon Natural Area, and Westmoreland State Park, as well as several small natural area preserves. Additional federal ownership in the area includes Quantico Marine Corps Base, Dahlgren Laboratory, George Washington Birthplace National Monument, and Fort Belvoir Military Reservation.

**Conservation Recommendations:** Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields and farmed wetland pasture that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations.

**Lower James River, Virginia** The Lower James River Focus Area encompasses 445,277 hectares (1,100,299 acres) and includes the James River and its tributaries from its mouth in the Chesapeake Bay to the non-tidal fall line near Richmond Virginia. It includes the Nanesmond River, the Chickahominy River, the Appomattox River and other tributaries. The area is known for its extensive brackish and freshwater tidal marshes along the expanse of the river. Extensive freshwater wetlands are found adjacent to tributary streams, and beaver ponds abound in the vicinity. The area is highly developed, intermixed with low-density

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rural sites. Agricultural row-crops are giving way to development and planting of loblolly pine plantations. The vast majority of land in this watershed is in private ownership. The U.S. Fish and Wildlife Service own the James River/Presquile National Wildlife Refuge. The federal government also owns other lands including Fort Eustis Military Reservation and Jamestown Island National Historic Site. The Virginia Department of Game and Inland Fisheries owns three sites, The Chickahominy Wildlife Management Area (WMA), Hog Island WMA, and Ragged Island WMA, each which have a large component of wetland habitat. Dutch Gap Conservation Area is owned and managed by Chesterfield County. The Virginia Department of Conservation and Recreation owns Chippokes Plantation State Park. A few large historic farms in private or corporate ownership provide the most area on private land managed for waterfowl. Conservation Recommendations: Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior converted crop fields that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations. Restoration of streamside riparian buffers will improve water quality in the James River and the Chesapeake Bay. Exotic invasives, such as *Phragmites* are continuing to gain a foothold in the area, and treatment of these sites needs to be continued.

Rappahannock River, Virginia The Rappahannock River Focus Area is located in east-central Virginia covering portions of the Counties of Richmond, Lancaster, King George, Spotsylvania, Essex, and Middlesex. Encompassing 299,296 hectares (739,575 acres), the Lower Rappahannock Valley is within the Coastal Plain Province. Much of the land surrounding the Rappahannock River is in agricultural use. Major components of this land use type include cropland and to a much lesser degree, pastureland. The U.S. Fish and Wildlife Service (USFWS) have an active acquisition effort to purchase property for the Eastern Virginia Rivers National Wildlife Refuge (NWR) Complex in this focus area. The USFWS is currently purchasing fee title and easements on a series of properties within their acquisition boundary. These tracts are not contiguous, but are acquired based on their value to wildlife. The Virginia Department of Game and Inland Fisheries own two properties, Lands End Wildlife Management Area, which is managed as a waterfowl refuge, and Pettigrew Wildlife Management Area. Fort A.P. Hill Military installation is also located in this focus area.

Conservation Recommendations: Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields and farmed wetland pasture that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations. The use of Department of Agriculture conservation programs will help install needed buffers.

Roanoke River, Virginia The Roanoke River Focus Area includes 656,490 hectare (1,622,215 acres) and is located in south-central Virginia covering portions of the Counties of Campbell, Charlotte, Halifax, Mecklenburg, and Pittsylvania. The area contains the Kerr Reservoir, which is a United States Army Corps

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of Engineers flood protection project. This area remains relatively undeveloped, and current development is slow. Two major river systems, The Roanoke and the Dan, feed into John H. Kerr Reservoir. These rivers are characterized by wide floodplains currently utilized for agricultural or forest product production. Historically, these floodplains were dominated by large expanses of bottomland hardwood forest. The majority of land in this focal area is in private ownership. The United States Army Corps of Engineers owns several tracts of land adjacent to Kerr Reservoir. The Virginia Department of Game and Inland Fisheries have one wildlife management area (Dick Cross Wildlife Management Area) and The Virginia Department of Conservation and Recreation owns two State parks in the focus area.

**Conservation Recommendations:** Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields and farmed wetland pasture that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations.  
United States Department of

Agriculture programs such as Conservation Reserve Program and Conservation Reserve Enhancement Program will help install riparian buffers and fences on streams and rivers, enhancing water quality.

**Shenandoah River, Virginia** The Shenandoah River Planning Area is located in northwest Virginia covering 848,291 hectares (2,096,164 acres) of the Shenandoah River Valley. The Shenandoah Valley is extremely important to Virginia Waterfowl populations due to its impact on water quality concerns in the Chesapeake Bay. The Valley is an area of intense row crop agriculture and beef cattle pastureland, flowing directly into the Potomac River and the Chesapeake Bay. The area is also known for mass poultry production. Chicken and turkey houses abound in the vicinity, close to sources of cheap feed. Headwater wetlands are very important to water quality. The nutrients and chemicals, which flow into these sites, if not treated, can make their way over long distances, and have impacts far from the originating source. Habitat improvements conducted in this area can have large, beneficial impacts on Virginia's waterfowl populations. Much of the non-agricultural land surrounding the Valley is in public ownership. The George Washington National Forest borders the Focus Area on the west and the Shenandoah National Park, including the Appalachian National Scenic Trail, borders the area on the East. The Virginia Department of Game and Inland Fisheries own, Goshen-Little North Mountain Wildlife Management area in the southern portion of the Focus Area. Of the agricultural lowlands, essentially all are in private ownership.

**Conservation Recommendations:** Agricultural conservation groups are very active in the region. Continued utilization of programs such as Conservation Reserve Enhancement Program (CREP), The Conservation Reserve Program (CRP), Environmental Quality Incentives Program (EQIP) and others will help relieve pressure to intensively farm sites. Private non-profit groups such as Ducks Unlimited and The Chesapeake

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Bay Foundation and state groups such as the Virginia Department of Game and Inland Fisheries and the Virginia Department of Conservation and Recreation work with landowners in the region to develop environmentally-friendly land management plans to alleviate some of these problems.

Southeast Virginia, Virginia The Southeast Virginia Focus Area is located in portions of the Counties/Cities of Virginia Beach, Chesapeake, and Suffolk, excluding highly-developed areas. The area contains The Great Dismal Swamp, Back Bay, The North Landing River and Northwest River systems and encompasses 138,879 hectares (343,176 acres). This area is developing at a rapid pace, in spite of zoning protections put in place by the localities. The large open water wetlands of Back Bay were renowned in the 1960s for their abundance of submerged aquatic vegetation (SAV). Currently, the amounts of SAV are greatly reduced. The reduction is believed linked to water quality degradation linked to agricultural and residential runoff to Back Bay. patchwork of land is held for conservation purposes. The U.S. Fish and Wildlife Service has Great Dismal Swamp, Back Bay, and Mackay Island National Wildlife Refuges. The State of Virginia owns Princess Anne Wildlife Management Area, False Cape State Park, and several dedicated Natural Area Preserves. The City of Virginia Beach currently has an agricultural reserve program, which purchases development rights on property, and The Nature Conservancy has an active easement and land acquisition program on the North Landing River. Although these holdings seem impressive, a large majority of the land in this focus area is in private ownership. This land is highly sought for development in one of the fastest growing regions on the east coast.

Conservation Recommendations: Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior converted crop fields that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations. Exotic and invasive species, such as *Phragmites* are continuing to gain a foothold in the area, and treatment of these sites needs to be continued.

Western Bayshore, Virginia The Western Bayshore Marshes are abundant tidal brackish-water systems similar in character to the bayside marshes of the Eastern Shore. They include Mobjack Bay, the Guinea Marshes, The Piankatank River, Fleets Bay, Dividing Creek and the Great Wicomico River. The marshes open directly to the Chesapeake Bay and take their character from the Bay. The marshes consist mainly of Spartina, Juncus, and other salt tolerant species. Total waterfowl numbers are modest in this area; however, these are important habitats for black ducks and other species. Development in this area is moderate, but increasing as the demand for waterfront property becomes more pronounced. Local watermen depend upon these marshes for a variety of species utilized for commercial gain. Adjacent lands are typically forested, intermixed with agricultural row-crops. The focus area encompasses 161,150 hectares (398,209 acres). Public lands in this area are very limited. The Virginia Department of Conservation and Recreation owns a few

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small natural area preserves in the focus area, including Dameron Marsh Natural Area Preserve. The Virginia Institute of Marine Science owns a small tract of research land on the Dragon Run. The Virginia Department of Forestry also owns a small parcel on Dragon Run.

**Conservation Recommendations:** Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields and farmed wetland pasture that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations.

**York/Poquoson, Virginia** The York/Poquoson Focus Area is located in east-central Virginia following the York River up to and containing the Mattaponi and Pamunkey River systems. The area encompasses 473,472 hectares (1,169,970 acres). These systems contain significant acres of tidal freshwater and brackish marsh, emergent, shrub-scrub, and forested wetlands. The Mattaponi and Pamunkey River systems are key dabbling duck areas. Both river systems have abundant tidal gum swamps. The majority of land in this focus area is in private ownership. The U.S. Fish and Wildlife Service owns Plum Tree Island National Wildlife Refuge (NWR). The Colonial National Historic Park is located adjacent to the lower York River. The U.S. Naval Weapons Station, Cheatham Annex and Camp Peary Naval Reservation are also all located on the lower York. The Virginia Department of Conservation and Recreation owns York River State Park, as well as several natural areas within the watershed. Both the Mattaponi and Pamunkey Indian Tribes have reservations within the focus area. The Virginia Department of Forestry owns two properties in the focus area.

**Conservation Recommendations:** Continued acquisition and protection of land in a series of conservation corridors will help this area retain its usefulness for migratory birds. Prior-converted crop fields and farmed wetland pasture that are restored to wetland habitat provide excellent waterfowl habitat and receive high use in these areas. Continued restoration of these sites will help wintering and staging waterfowl populations.

**Allegheny Highlands, West Virginia Canaan Valley,** the major component of the Allegheny Highlands Planning Area, contains the largest wetland area in West Virginia, making up 39% of the state's wetlands. The total planning area encompasses 24,974 hectares (61,713 acres). It contains the one of the largest shrub swamp and bog complexes in the eastern United States. With an average elevation of 975 meters (3,200 feet) above sea level and a 14,164 hectares (35,000 acres) watershed, Canaan Valley is the highest valley of its size east of the Rocky Mountains. There are 9,712 hectares (24,000 acres) identified for protection in the Canaan Valley alone for this planning area. Currently 6,169 hectares (15, 245 acres) are protected on the Canaan Valley National Wildlife Refuge (NWR). This includes 2,245 hectares (5,549 acres) of wetland habitat. The wetlands include those in the valley proper and numerous perched wetlands, springs and beaver ponds in the uplands surrounding the valley. There are currently 3,543 hectares (8,755 acres) within the

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refuge acquisition boundary owned by either large power companies or private individuals. Almost all of the wetlands and riparian habitat in Preston and Randolph Counties is privately owned.

**Conservation Recommendations:** Opportunities for habitat restoration and preservation are numerous in the Allegheny Highlands Planning Area. Partnerships with private landowners and businesses could address wetland protection and water quality issues. Other actions could include eliminating ditches for agriculture in wet meadows to restore the natural hydrology of the area and enhance wetland values. Reforestation could occur in logged upland areas of the surrounding watershed to prevent erosion and reestablish red spruce and northern hardwood forest communities. Extensive work is required to reestablish historic water flows throughout the Canaan Valley where they have been interrupted and diverted through road construction and ATV damage. The remaining privately-owned land with the Canaan Valley NWR acquisition boundary should be purchased. Specific wetlands along with sufficient upland buffer should be acquired in Randolph and Preston counties. Riparian habitat along the Tygart Valley River in Randolph County should be protected through acquisition or easement.

**Eastern Panhandle, West Virginia** The planning area, approximately 197,567 hectares (488,197 acres) is made up of the three easternmost counties in West Virginia, Berkeley, Jefferson and Morgan bordering the Potomac River to the north and the Shenandoah River to the east. These large rivers in addition to numerous spring fed streams and wetlands interspersed in an area dominated by agriculture provide abundant productive habitat for many species including waterfowl. The ownership pattern in the region is federal, state, county and town. The majority of property in the region is privately owned. The region is dominated by agriculture and possesses some of the best farmland in West Virginia. Orchards, grain crops, cattle and horses are all raised in the region. **Conservation Recommendations:** Disturbances to wintering populations need to be minimized or eliminated entirely, especially in riparian areas and around wetlands. This can be accomplished by acquiring conservation easements and/or excluding livestock from sensitive habitats.

**Meadow River, Virginia** This planning area encompasses 360,558 hectares (890,955 acres) of Greenbrier and Summers Counties in southeastern West Virginia. The planning area includes the Meadow River wetlands which is West Virginia's second largest contiguous wetland complex making up 8% of the state's total nonchannel wetland acres. The area seasonally floods providing excellent waterfowl nesting and migratory habitat and is a wintering area for black duck when not frozen. Additionally, the area's unique hydrological situation provides varied palustrine-emergent systems to numerous game and nongame species both resident and migratory. Also included in this planning area are portions of the New and Greenbrier River corridors and Bluestone Lake. These rivers and their riparian zones are very important to wintering waterfowl because they often have the only open water in the area during freezing weather. Bluestone Lake is part of the mid-winter waterfowl survey in West Virginia. Total waterfowl counts in this segment range from the 150 when much of the lake is frozen to over 1,000 in milder weather. Land ownership within the planning area is

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predominately private including both individual and corporate holdings. There is also a significant amount of land in public ownership including portions of the focus areas. The West Virginia Division of Natural Resources owns 1,009 hectares (2,495 acres) in the Meadow River wetlands complex. The U.S. Army Corps of Engineers owns Bluestone Lake and the National Park Service owns 24 hectares (60 acres) of riparian habitat and islands on the New River below Bluestone Lake.

**Conservation Recommendations:** The remaining private lands within the Meadow River wetlands purchase area boundary, both wetlands and upland buffer, should be purchased. Prior converted wetlands in the Meadow River area should be restored once acquired. Riparian habitat along the Greenbrier and New rivers should be protected and/or restored by a combination of easements, purchase, and fencing.

**Ohio River Valley, West Virginia** This planning area consists of the islands of the Ohio River, the back channels and riverine habitats associated with these islands, and adjacent wetland, embayment and bottomland habitat within the Ohio River floodplain in West Virginia. The planning and focus area spans 450 kilometers (280 miles) of the Ohio River corridor and includes 401,714 hectares (992,653 acres). Most of the habitats within this area have been classified as Resource Category I under the United States Fish and Wildlife Mitigation Policy. This area, particularly the islands, back channels, and embayments, have long been recognized by state, federal, and private organizations as having high quality fish and wildlife, recreational, scientific and natural heritage value. The majority of the Ohio River floodplain area is privately owned. The Ohio River Islands National Wildlife Refuge (NWR), established in 1990, protects 22 islands and 3 mainland tracts totaling approximately 1,416 hectares (3,500 acres) of floodplain habitats. A total of 30 islands are targeted for acquisition or protection, and over 809 hectares (2,000 acres) of embayments and wetlands in West Virginia are identified for protection. The West Virginia Division of Natural Resource owns over 404 hectares (1,000 acres) of lands and open water along the Ohio River at Green Bottom Wetland Management Area.

**Conservation Recommendations:** Restoration of floodplain wetlands previously altered by agriculture; conservation easements or acquisition of embayments and other important riparian habitats; continued acquisition of islands; reduction of non-point source pollution loading which affects aquatic bed habitat; minimization of dredging and spoil disposal in productive wetland habitats.

## **APPENDIX B: Habitat management goals and needs for the Eastern Habitat Joint Venture planning area.**

Black ducks are a cornerstone species for the Eastern Habitat Joint Venture (EHJV) with 95% of the continental population breeding within the EHJV. The EHJV has established a goal of growing the black duck breeding population from 272,524 indicated breeding pairs (IBP) to 363,000 IBP (33% increase). Due to the vast geographic area (Ontario, Quebec, New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland, and Labrador) covered by the EHJV targeted conservation activities will be focused in those areas where the black duck response is expected to be the greatest and where there is the greatest risk of future loss of wetlands, namely the agricultural and coastal areas of eastern Canada. Given ongoing wetland degradation and loss it is essential that conservation actions, including policy development at the regional and provincial scale and local scale stewardship/extension programs, focus on both habitat retention and restoration. Local stewardship/extension programs are the most costly and will be targeted to the highest priority areas with the most appropriate conservation actions. The EHJV estimates black duck restoration will require the securement of 40,582 acres of wetland and 39,591 acres of associated upland habitat and the restoration of 14,520 wetland and 13,601 upland acres. In addition, stewardship and extension activities will influence 739,430 wetland and 283,470 acres of associated uplands. Finally, additional management activities will be directed towards the 263,001 wetland acres currently under agreement.

A prioritization exercise ensures that activities are strategically focused toward those habitats that have the greatest impact on waterfowl limiting factors. Habitat retention activities will require the investment of \$57.5M and will secure 1,103,073 acres that will support 919,713 IBP or 60% of population objectives. Over the course of this Implementation Plan the habitat restoration program is expected to enhance 28,121 acres at a cost of \$23.2M. The restoration of 14,520 wetland acres is estimated to result in habitat for an additional 17,943 IBP.

Key policy actions for the EHJV to achieve habitat goals:

1. Maintain strong wetland legislation in the Maritime Provinces; provide enhanced legislative protection to 81,296 wetland acres in Prince Edward Island, 940,000 in New Brunswick, and 948,370 acres in Nova Scotia.
2. Wetland policies are developed or enhanced in Newfoundland and Labrador, Ontario, and Quebec. The goal is to help develop wetland policies for Quebec's entire wetland base estimated at 74.8M acres, develop wetland policy for Newfoundland and Labrador, and to enhance protection of 500,000 acres of key wetland habitat in southern Ontario.

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3. Promote policies that enhance habitat conservation in the industrial sectors (agriculture, forestry and mining). The agriculture sector will be influenced through the promotion of biodiversity Best Management Practices (BMPs) in current and future Federal/Provincial agricultural strategies while policy in the forest sector will involve a focus on BMPs that benefit wetlands and waterfowl.
4. Promote valuation of natural capital through the development of an Ecological Goods and Services (EG&S) framework beyond the initial pilot projects that EHJV partners participated in.

## **APPENDIX C: Habitat management goals and needs in the Upper Mississippi River and Great Lakes Joint Venture planning area.**

The Upper Mississippi River and Great Lakes Joint Venture ([UMRGLJV](#)) has established a black duck breeding population goal of 8,400 birds and estimates the current population at 7,000 birds (Soulliere et al. 2007). The objective of UMRGLJV is to maintain regional breeding carrying capacity and eliminate the current population deficit through effective and efficient habitat conservation that is considerate of other species of concern. The UMRGLJV plans to obtain their breeding population goal for black ducks by maintaining (i.e., protecting) existing breeding habitat area and quality at sites within the current or historic range (see Soulliere et al. 2007 for detailed locations). The UMRGLJV intends to improve habitat for migrating and staging black ducks. A primary information need for the UMRGLJV is to estimate spring migration carrying capacity.

## **APPENDIX D: Habitat management goals and needs in the Central Hardwoods Joint Venture planning area**

The Central Hardwoods Joint Venture (CHJV) is a relatively new JV and has not established goals for the black duck. Appropriate goals and implementation plans need to be developed in consultation with the U.S. Fish and Wildlife Service Division of Migratory Bird Management, the Black Duck Joint Venture, and the Mississippi Flyway Council.

## **APPENDIX E: Habitat management goals and needs in the Appalachian Mountains Joint Venture planning area.**

The Appalachian Mountains Joint Venture (AMJV) is a relatively new JV and has not established goals for the black duck. Appropriate goals and implementation plans need to be developed in consultation with the U.S. Fish and Wildlife Service Division of Migratory Bird Management, the Black Duck Joint Venture, and the Atlantic and Mississippi Flyway Councils. The AMJV region was originally included in the Atlantic Coast Joint Venture region and important conservation areas for black ducks are currently identified in the ACJV section (see APPENDIX A).

## **APPENDIX F: Habitat management goals and needs identified in the Chesapeake Bay Executive Order Strategy (Department of Interior 2010).**

Goal: Restore a three-year running average wintering black duck population in the Chesapeake Bay Watershed of 100,000 birds by 2025.

**Conservation Recommendations:** Target wetlands and adjacent uplands for protection, restoration, and enhancement to increase the energetic carrying capacity of the Chesapeake Bay to support a wintering population of 100,000 black ducks. Partners will develop an adaptive framework to guide habitat management decisions related to restoration and enhancement at the local scale by 2013. By 2017, National Wildlife Refuges will increase the availability of food resources on refuge lands by 10%. This will be accomplished through active wetland restoration and management, habitat protection, invasive species control, and potential expansion of refuges. The Atlantic Coast Joint Venture, Black Duck Joint Venture and other partners are examining the total acreage of forage habitat needed to support a wintering population of 100,000 black ducks.