Dichotomous Key to General North Carolina Wetland Types, v8, 4/30/08

Before using this key, the assessor should have read and become familiar with the descriptions of the general wetland types. The assessor should use best professional judgment to verify that the wetland type determined with the use of this key matches the written description.

The following rules should be used to assist the assessor in the selection of the most appropriate general wetland type. Narrative descriptions are also available to assist in this choice (see User Manual Section 3.1).

> Wetlands with modifications (man-made or natural) should generally be classified as the original, naturally occurring type if this determination can be made. However, if the full range of stable, existing, wetland characteristics (vegetation, hydrology, and soils) better resemble another wetland type because of long-established, permanent alterations, the wetland should be classified as this current, more appropriate type.

If there is evidence suggesting the wetland is a type other than the keyed type, the wetland may be classified as the evidenced type. Also, if the wetland does not appear to conform to any of the following general types, the site should be evaluated based on what the assessor believes is the closest wetland type. If the wetland is "intensively managed" or "intensively disturbed," the assessor should note this fact on the field assessment form and then select the most appropriate general wetland type based on the guidance provided above.

I. Wetland affected by lunar or wind tide, may include woody areas adjacent to tidal marsh
   A. Wetland affected, at least occasionally, by brackish or salt water
      i. Dominated by herbaceous vegetation – **Salt/Brackish Marsh**
      ii. Dominated by woody vegetation – **Estuarine Woody Wetland**
   B. Wetland primarily affected by freshwater
      i. Dominated by herbaceous vegetation – **Tidal Freshwater Marsh**
      ii. Dominated by woody vegetation – **Riverine Swamp Forest**

II. Wetland not affected by tides
   A. Not in a geomorphic floodplain <u>and</u> not associated with a natural linear conveyance (such as a topographic crenulation), <u>nor</u> associated with a natural lake greater than or equal to 20 acres in size
      i. On a side slope – **Seep**
      ii. On interstream divides <u>or</u> on a coastal island
         1. Flats on interstream divides in Coastal Plain ecoregions
            a. Dominated by deciduous trees
               i. Intermittently to seasonally inundated (typically dominated by sweetgum and oaks) – **Hardwood Flat**
               ii. Seasonally to semi-permanently inundated (typically dominated by cypress, black gum, and oaks) – **Non-Riverine Swamp Forest**
            b. Dominated by evergreens
               i. Dominated by dense, waxy shrub species (typically include gallberries, fetterbushes, honeycup, greenbriar); canopy may include pond pine, Atlantic white cedar, and bays – **Pocosin**
               ii. Not dominated by dense, waxy shrub species
                  1. Dominated by long-leaf or pond pine and wire grass – **Pine Savanna**
                  2. Dominated by loblolly or slash pines – **Pine Flat**
         2. In depressions surrounded by uplands anywhere in the state (mafic depressions, lime sinks, Carolina bays) or on shorelines of lakes/pond

Dichotomous Key To General NC Wetland Types, Continued

2. In depressions surrounded by uplands anywhere in the state (mafic depressions, lime sinks, Carolina bays) or on shorelines of lakes/ponds (repeated from the previous page)
    a. Dominated by dense, waxy shrub species (typically include gallberries, fetterbushes, honeycup, greenbriar); canopy may include pond pine, Atlantic white cedar, and bays and not characterized by clay-based soils– **Pocosin**
    b. Not dominated by dense, waxy shrub species and not characterized by a peat-filled bay – **Small-Basin Wetland**

B. In a geomorphic floodplain or associated with a natural linear conveyance (such as a topographic crenulation) or along shorelines of natural water bodies greater than 20 acres or artificial impoundments
    i. Northern Inner Piedmont or Blue Ridge Mountains ecoregions and dense herbaceous or mixed shrub/herbaceous vegetation with characteristic bog species (see wetland type description), with or without tree canopy; typically long-duration saturation; sphagnum moss commonly present – **Mountain Bog**
    ii. Anywhere in the state and not Mountain Bog
        1. Dominated by herbaceous vegetation. At least semi-permanently inundated or saturated. Includes lacustrine and riverine fringe and beaver ponds with dense herbaceous vegetation; sphagnum moss scarce or absent – **Non-Tidal Freshwater Marsh**
        2. Dominated by woody vegetation. Trees may be present on edges or hummocks.
            a. Localized depression and semi-permanently inundated – **Floodplain Pool**
            b. Not "a"
                i. Zero- to 1st-order stream[1]. Diffuse surface flow and groundwater more important than overbank flooding.
                1. Intermittently inundated to seasonally saturated – **Headwater Forest**
                2. Seasonally to semi-permanently inundated – **Riverine Swamp Forest**
                ii. Second-order or greater stream or associated with the shoreline of waterbodies 20 acres or greater
                1. Intermittently to seasonally inundated for long duration (may be dominated by sweetgum, ash, sycamore, and oaks) – **Bottomland Hardwood Forest**
                2. Seasonally to semi-permanently inundated for very long duration (may be dominated by cypress and blackgums in Coastal Plain and ash, overcup oak, and elms in Piedmont and Mountains) – **Riverine Swamp Forest**

[1]See stream order schematic diagram in User Manual Appendix C.

1.0

2.0

3.0 WETLAND CLASSIFICATION SYSTEM

3.1 General Wetland Types

NC WAM recognizes 16 general wetland types for North Carolina. The purpose of specifying general wetland types is to 1) provide a unified list of wetland types for North Carolina, 2) account for impacts by wetland type, and 3) account for the inherent differences in function for each wetland type.

- Mountain Bog
- Headwater Forest
- Bottomland Hardwood Forest
- Floodplain Pool
- Riverine Swamp Forest
- Non-Tidal Freshwater Marsh
- Tidal Freshwater Marsh
- Estuarine Woody Wetland
- Salt/Brackish Marsh
- Seep
- Small-Basin Wetland
- Non-Riverine Swamp Forest
- Hardwood Flat
- Pine Savanna
- Pine Flat
- Pocosin

The general wetland types are a consolidation of wetland types previously defined by the NCNHP in *Classification of the Natural Communities of North Carolina: Third Approximation* (Schafale and Weakley 1990), NCDWQ in *A Field Guide to North Carolina Wetlands* (NCDEM 1996), NCDCM in *DCM Wetland Mapping in Coastal North Carolina* (Sutter 1999), and USACE in HGM (Brinson unpublished). NCNHP classified North Carolina wetlands into 59 types, NCDWQ classified North Carolina wetlands into 14 types, NCDCM classified Coastal Plain (physiographic province) wetlands into 13 types, and HGM currently recognizes five wetland classes. It should be noted that since the resulting grouping of general wetland types in NC WAM is a consolidation of types defined by these sources, definitions may overlap to some extent. A table cross-referencing NC WAM, NCNHP, NCDCM, and HGM wetland types is provided in Appendix B.

The WFAT also generated a list of four non-wetland open water types: natural waterbodies, artificial waterbodies, estuarine waters, and ocean. A method of functional assessment has not been generated for these open water types, and these open water types will not be discussed in this manual.

Some general guidance regarding the narrative descriptions of the general wetland types follows. References to inundation pertain to inundation during the growing season. Figure 1 depicts boundaries of North Carolina level III ecoregions and provides tables of the occurrence

of general wetland types by ecoregion (while Appendix F depicts boundaries of level IV and level III ecoregions). Vascular plant names follow nomenclature found in Weakley (2006) or Radford et al. (1968).

3.1.1 Mountain Bog

Mountain Bogs are typically found in the Blue Ridge and Northern Inner Piedmont ecoregions (Figure 1 and Appendix F). This wetland type is associated with floodplains or linear conveyances and is typically located on flat or gently sloping ground. Mountain Bogs are formed by a poorly understood combination of groundwater seepage and/or blocked overland runoff. This wetland type is semi-permanently to permanently saturated, but typically not inundated. Mountain Bogs occur on organic or mucky mineral soils, and this is a key feature in distinguishing bogs from other wetland types. This wetland type is generally transitional in nature and may therefore be found in many forms, from forested to lacking canopy trees, and with sparse ground cover to dense mats of moss and herbs. Bogs are frequently impacted by beaver, and if beaver activity causes long-term inundation, areas formerly supporting Mountain Bog may transition to Non-Tidal Freshwater Marsh.

Although sphagnum mosses (*Sphagnum* spp.) are commonly present in Mountain Bogs, they do not occur in all Mountain bogs. In general, vegetation structure may vary, but typically occurs in one of two forms: 1) dominated by dense herbaceous or mixed shrub/herbaceous vegetation with herbs consisting of small, grass-like plants and forbs with or without tree canopy and 2) tree cover over much of the wetland area and dense herb cover limited to small openings. Indicative herbaceous species include sphagnum moss, various sedges – upright sedge (*Carex stricta*), nodding sedge (*C. gynandra*), prickly bog sedge (*C. atlantica*), bristlystalked sedge (*C. leptalea*), three seeded sedge (*C. trisperma*), long sedge (*C. folliculata*), and Collins sedge (*C. collinsii*) – cinnamon fern (*Osmunda cinnamomea*), royal fern (*O. regalis*), melic mannagrass (*Glyceria melicaria*), roundleaf goldenrod (*Solidago patula*), white beaksedge (*Rhynchospora alba*), Pennsylvania rush (*Juncus gymnocarpus*), woodland rush (*J. subcaudatus*), various pitcher-plants – purple pitcher-plant (*Sarracenia purpurea*), Jones' pitcher-plant (*S. jonesii*), and green pitcher-plant (*S. oreophila*) – smooth sawgrass (*Cladium mariscoides*), and cotton grass (*Eriophorum virginicum*). Indicative shrub species include possumhaw (*Viburnum nudum*), northern wild raisin (*V. cassinoides*), tag alder (*Alnus serrulata*), swamp rose (*Rosa palustris*), winterberry (*Ilex verticillata*), long-stalked holly (*I. collina*), and Canada yew (*Taxus canadensis*).

Reference wetlands (see Section 3.2) are available for this type but, due to the variability of vegetation structure found in bogs, an assessor must recognize the proper reference type. This wetland type is typically limited in size by the availability of flat, wet sites in the Blue Ridge Mountains and western Piedmont ecoregions. Mountain Bogs can transition to Seep, Headwater Forests, Bottomland Hardwood Forest, or Non-Tidal Freshwater Marsh or may be surrounded by non-jurisdictional bottomlands or uplands. Mountain Bog can be distinguished from Seep by a lack of slope, from Headwater Forest by presence of organic soils, and from Bottomland Hardwood Forest and Non-Tidal Freshwater Marsh by lack of surface inundation.

Mountain Bog includes NCNHP types Southern Appalachian Bog (Northern and Southern Subtypes), Southern Appalachian Fen, and Swamp Forest–Bog Complex (Typic and Spruce Subtypes). This type is not separately identified with the NCDCM wetland mapping since this wetland type is not found in the Coastal Plain ecoregions. Mountain Bog corresponds to HGM

classes Riverine (sub-classes Headwater Complex and Lower Perennial) and Depression (sub-class Surface-connected).

Photo 3-1

Photo 3-2

Mountain Bog. These examples of Mountain Bog are located on a tributary to Cranberry Creek, Avery County (Photo 3-1); in the Pink Beds on a tributary to the South Fork Mills River, Transylvania County (Photo 3-2); on a tributary to Price Creek, Watauga County (Photo 3-3); and at Franklin Bog on Blyths Mill Creek, Henderson County (Photo 3-4).

Photo 3-3

Photo 3-4

Photo 3-5

Photo 3-6

Mountain Bog. These examples of Mountain Bog are located on Dry Branch, near the Transylvania/Henderson County border (Photo 3-5); at the foot of The Nooks in the Little River floodplain, Transylvania County (Photo 3-6); in the floodplain of Tom Creek, Transylvania County (Photo 3-7); and adjacent to the Pisgah Forest National Fish Hatchery in the Davidson River floodplain, Transylvania County (Photo 3-8). Dry Branch bog currently supports an early successional forest; and woody vegetation in the Fish Hatchery Bog has been removed to enhance bog turtle habitat.

Photo 3-7

Photo 3-8

3.1.2 Headwater Forest

Headwater Forests are found throughout the state along headwater streams (typically ephemeral or intermittent streams) and, in the absence of a discernable stream channel, in association with a natural linear conveyance (such as a topographic crenulation). For the purposes of NC WAM, headwater streams are typically defined as zero- (i.e., not shown) to first-order streams as shown on the most recent version of the USGS 7.5-minute quadrangle (see Appendix C for guidance on stream-order determinations). An explanation for the identification of a topographic crenulation is provided in Section 3.4 and in the Glossary of Terms (Appendix J).

Groundwater seepage and diffuse surface flow are often important sources of water, and this wetland type frequently has surface flow, especially through ephemeral channels. Overbank flooding is not a substantial source of water, and Headwater Forests are relatively dry when compared to other riverine wetland types. Headwater Forests generally occur on mineral soils that are irregularly inundated by surface water, seasonally saturated, or subject to long-term saturation. Wetlands adjacent to small streams in the Piedmont and Blue Ridge Mountains ecoregions, that are not on soils mapped as Chewacla, are likely Headwater Forests rather than Bottomland Hardwood Forests.

Hardwood tree and shrub species (examples: swamp chestnut oak [*Quercus michauxii*], hackberry [*Celtis laevigata*], sycamore [*Platanus occidentalis*], green ash [*Fraxinus pennsylvanica*], red maple [*Acer rubrum*], American hornbeam [ironwood – *Carpinus caroliniana*], tulip-tree [*Liriodendron tulipifera*], American elm [*Ulmus americana*], American holly [*Ilex opaca*], silky dogwood [*Cornus amomum*], and spicebush [*Lindera benzoin*]) are the predominant vegetation from most of the Southeastern Plains ecoregion (Figure 1) westward. Within the Sandhills level IV ecoregion, typical species include pond pine (*Pinus serotina*) and/or Atlantic white cedar (*Chamaecyparis thyoides*). Species typically present and sometimes predominant in the Middle Atlantic Coastal Plain ecoregion include bald cypress (*Taxodium distichum*), black gum (*Nyssa biflora*), and water tupelo (*N. aquatica*).

Reference wetlands (see Section 3.2) are available for this type, but vary in characteristics among ecoregions. The size of Headwater Forests may vary depending on hydrology, topography, and ecoregion; and Headwater Forests can gradually grade into other wetland types making their identification problematic. In areas with steeper topography (Southeastern Plains ecoregion [Figure 1 and Appendix F] and westward), these wetlands will typically be restricted in size and associated primarily with other riverine wetland types (Bottomland Hardwood Forest, Riverine Swamp Forest); while, in areas with more gentle topography (Middle Atlantic Coastal Plain ecoregion), these wetlands may be broader and will typically grade laterally into non-riverine wetland types (Seep, Pocosin, Hardwood Flat, Pine Flat, Pine Savanna, and Non-Riverine Swamp Forest). Headwater Forest is distinguished from Bottomland Hardwood Forest by the associated stream order. See Figure 2 for an example of how to delineate the difference between a Headwater Forest and a Bottomland Hardwood Forest at the confluence of a first-order stream and a second-order stream. Headwater Forest is distinguished from Riverine Swamp Forest by duration of surface inundation (see Section 3.4 for a discussion concerning this determination); however, Headwater Forest may be

Figure 1

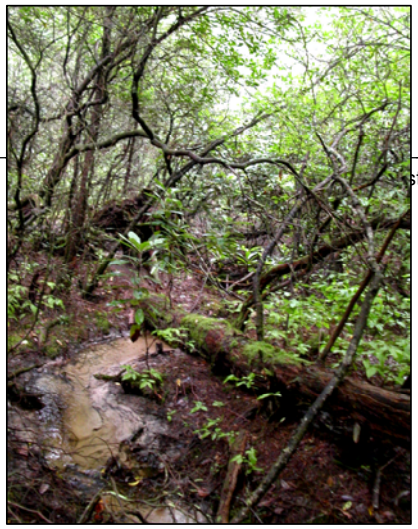
characterized by long-duration saturation (but not inundation) and therefore support plant species typical of a Riverine Swamp Forest. Headwater Forest is distinguished from Mountain Bog by soils; Headwater Forest typically occurs on mineral soils, while Mountain Bogs typically occur on organic or mucky soils. Headwater Forest is distinguished from contiguous non-riverine wetlands through association with a natural linear conveyance. Field indicators of some surface flow may aid in making this determination. However, a Seep may be characterized by flowing surface water, but this wetland type occurs on a slope above the floor of a geomorphic floodplain or not associated with a linear conveyance. Pocosin, Hardwood Flat, Pine Flat, Pine Savanna, and Non-Riverine Swamp Forest may be characterized by surface saturation or inundation for various lengths of time, but these non-riverine wetlands will typically not show signs of directional flow, while Headwater Forest will. Finally, Headwater Forests in the Sandhills ecoregion (see Appendix F) are sometimes associated with streams with no well-developed floodplain, in which overbank flooding is not common due to the high porosity of the soil. In this landscape position, Headwater Forests may have some of the vegetation components of Pocosins.

Headwater Forests correspond to NCNHP types Piedmont Alluvial Forest, Coastal Plain Small Stream Swamp (part), Streamhead Atlantic White Cedar Forest, and Streamhead Pocosin. This type is included in the NCDCM wetland type of Headwater Forest. Headwater Forest corresponds to the HGM class Riverine (sub-classes Headwater Complex and Intermittent–Upper Perennial). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-9

Photo 3-10

Headwater Forest. Both Photo 3-9 and Photo 3-10 are located in Cumberland County, the former on an unnamed tributary to Bones Creek, and the latter on an unnamed tributary to Rockfish Creek.



Headwater Forest. Photo 3-11 is located in upper Porter Creek, Beaufort County. Photo 3-12 is a first-order tributary to the South Fork of the French Broad River, Transylvania County. Photo 3-13 is a Headwater Forest located near a stormwater outlet along a first-order tributary to Hominy Creek, Buncombe County. This Headwater Forest occurs on a sediment delta at the head of a beaver impoundment on a first-order stream. Photo 3-14 is upslope of a Mountain Bog in the floodplain of Dry Branch, on the border of Transylvania and Henderson Counties.

Photo 3-13

Photo 3-14

3.1.3 Bottomland Hardwood Forest

Bottomland Hardwood Forests are found throughout the state in floodplains of second-order (Strahler 1952) and larger (typically perennial) streams and rivers (see Appendix C for guidance on stream-order determinations). These wetlands are generally intermittently to seasonally inundated for long duration. Overbank flooding can be an important source of water as can groundwater and surface runoff. Overbank flooding may be less influential for Bottomland Hardwood Forests west of the Middle Atlantic Coastal Plain ecoregion (see Figure 1 and Appendix F). Bottomland Hardwood Forests along brownwater streams receive more sediment and nutrients from overbank flooding than those found along blackwater streams. Bottomland Hardwood Forests generally occur on mineral soils. This wetland type is dominated by a variety of hardwood tree species including various oaks (*Quercus* spp.), red maple (*Acer rubrum*), ashes (*Fraxinus* spp.), sycamore (*Platanus occidentalis*), sweetgum (*Liquidambar styraciflua*), box elder (*Acer negundo*), hackberry (*Celtis laevigata*), and American elm (*Ulmus americana*).

Reference wetlands (see Section 3.2) are available for Bottomland Hardwood Forest, but vary widely in character among different floodplain sizes and the various regions of the state. The size and extent of these wetlands are dependent on floodplain size and disturbance. While smaller-order streams will typically support narrower wetlands, these wetlands may be extensive along the length of the floodplain. Bottomland Hardwood Forests may contain Floodplain Pools and may transition up slope to Headwater Forest and down slope to Riverine Swamp Forest. In the Coastal Plain ecoregions, Bottomland Hardwood Forests often occur in extensive mosaics with Riverine Swamp Forest.

Bottomland Hardwood Forest correlates to the NCNHP types Coastal Plain Bottomland Hardwoods (Blackwater and Brownwater Subtypes), Coastal Plain Levee Forest (Blackwater and Brownwater Subtypes), Piedmont/Mountain Levee Forest, Piedmont/Mountain Bottomland Forest, Montane Alluvial Forest, and part of Piedmont/Low Mountain Alluvial Forest. Bottomland Hardwood Forest is included in the NCDCM wetland type of Bottomland Hardwood Forest. Bottomland Hardwood Forest corresponds to the HGM class Riverine (sub-classes Headwater Complex, Intermittent–Upper Perennial, and Lower Perennial). Appendix B provides a cross reference of wetland types across three classification systems.

Bottomland Hardwood Forest. Photos 3-15 and 3-16 are examples of Bottomland Hardwood Forest located in association with unnamed tributaries to the Cape Fear River, Cumberland County; Photo 3-17 is located in the Swift Creek floodplain, Wake County; and Photo 3-18 depicts the Little Creek floodplain at the headwaters of Jordan Lake, Durham County. Vegetation in Photo 3-17 is early secondary growth, while shrub and herb growth in Photo 3-18 is sparse due to extended surface inundation resulting from management of the area as a waterfowl impoundment.

Photo 3-17

Photo 3-18

Photo 3-19

Photo 3-20

Bottomland Hardwood Forest. Photos 3-19 and 3-20 are more examples of Bottomland Hardwood Forest in Wake County. Photo 3-19 depicts a recently clear-cut portion of the Swift Creek floodplain, and Photo 3-20 depicts the outer edge of a floodplain on the North Fork of Little Branch. Photos 3-21 and 3-22 are both examples of disturbed Bottomland Hardwood Forests located in Cumberland and Hoke County, respectively. Photo 3-21 depicts an area maintained as a utility line corridor adjacent to Rockfish Creek, and Photo 3-22 depicts an area adjacent to Horsepen Branch that was formerly inundated as part of a beaver impoundment.

Photo 3-21

Photo 3-22

3.1.4 Floodplain Pool

Floodplain Pools are found throughout the state in geomorphic floodplains of streams and rivers. These wetlands often occur in abandoned stream or river channels (oxbows) or in localized depressions near the toe of slopes. They are generally small in size, typically occur on mineral soils, and are semi-permanently to permanently inundated. Sources of water are primarily ground water, precipitation, and sometimes overbank flooding. A distinctive feature of Floodplain Pools is that they usually dry out at some point of the year and thereby provide important habitat for amphibians due to the lack of fish communities. Trees characteristic of wetland and upland floodplains and levees are commonly found around the edge of the pool rather than growing within the pool. Vegetation within the pool can be sparse or variable with a variety of ferns, sedges, and other herbaceous plants present.

Reference wetlands (see Section 3.2) are available for this type. Floodplain Pools can transition to Bottomland Hardwood Forest, Riverine Swamp Forest, and Mountain Bog or may be surrounded by uplands. Relative to Riverine Swamp Forest, Floodplain Pools typically support vegetation only on the periphery and exist as local depressions. Floodplain Pools can be distinguished from Mountain Bogs by hydrology and soils. Floodplain Pools are characterized by semi-permanent inundation, while Mountain Bogs are characterized by long-duration saturation and little or no inundation. Floodplain Pools typically occur on mineral soils, while Mountain Bogs typically occur on organic or mucky mineral soils. Floodplain Pools near the outer boundary of floodplains may transition to Seeps along the outer floodplain slope. As stated above, Floodplain Pools are generally small in size.

Floodplain Pool corresponds to the NCNHP type of Floodplain Pool. This wetland type is not separately identified within the NCDCM wetland classification system. Floodplain Pool corresponds to the HGM classes Riverine (sub-classes Headwater Complex, Intermittent-Upper Perennial, and Lower Perennial) and Depression (sub-class Surface-connected). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-23

Photo 3-24

Floodplain Pool. These examples of Floodplain Pool are located in the floodplain of Ready Branch of Sweetwater Creek, Martin County (Photo 3-23), the floodplain of Swift Creek at Hemlock Bluffs Nature Preserve, Wake County (Photo 3-24), the floodplain of Speight Branch, Wake County (Photo 3-25), and at the foot of The Nooks in the floodplain of Little River, Transylvania County (Photo 3-26).

Photo 3-25

Photo 3-26

3.1.5 Riverine Swamp Forest

Riverine Swamp Forests are found throughout the state, but are most extensive and abundant in Coastal Plain ecoregions (see Figure 1 and Appendix F). This wetland type may occur in a variety of landscape positions and on mineral or organic soils, but all undisturbed Riverine Swamp Forests are characterized by seasonal to semi-permanent (very long duration) inundation. This wetland type occurs in (but is not limited to) the following settings (listed from highest to lowest in the landscape):

- headwaters of streams in depressions subject to surface flow and/or groundwater expression;
- wettest portions of large river floodplains and other permanent water bodies, including linear depressions that lead to stream systems;
- tidally-influenced lower river reaches (primarily freshwater, but also brackish water in the upper reaches of estuaries);
- linear depressions (both with and without surface water channels [natural or man-made]) draining to rivers and sounds in the Middle Atlantic Coastal Plain; and
- along the shorelines of large lakes (20 acres or larger in size).

Overbank or tidal flooding is usually an important source of water, but groundwater and overland runoff are also important. Seasonal fluctuations in water levels of large lakes (larger than 20 acres in size) may mimic the seasonal flooding of rivers. These large lakes may provide enough fetch for effective wind tides, approximating overbank flooding as experienced in floodplains. The size threshold used to determine small versus large water bodies was taken from Cowardin et al. (1979).

Vegetation is most often dominated by mesic and hydrophytic tree species such as overcup oak (*Quercus lyrata*), ashes, and American elm in the Piedmont and Blue Ridge Mountains ecoregions and bald cypress (*Taxodium distichum*), black gum (*Nyssa biflora*), and water tupelo (*N. aquatica*) in the Coastal Plain ecoregions. Herbaceous cover is typically more open than in bottomland hardwood forest. In estuaries, lower reaches of rivers, and along the shorelines of large lakes, Riverine Swamp Forest can be distinguished from marshes by having a predominance of woody vegetation.

Reference wetlands (see Section 3.2) are available for this type. The size of this community varies widely from narrow strips of backwater at the toe of floodplain slopes to broad expanses extending for hundreds of acres. In the Southeastern Plains, Piedmont, and Blue Ridge ecoregions, Riverine Swamp Forests may transition upslope to Bottomland Hardwood Forest, Headwater Forest, Mountain Bog, and Seep and down slope to Non-Tidal Freshwater Marsh. In the Middle Atlantic Coastal Plain, Riverine Swamp Forests may transition upslope to Headwater Forest and Seep; laterally (perpendicular to a linear depression) to Non-Riverine Swamp Forest, Pocosin, and Hardwood Flat; and down slope to Tidal Freshwater Marsh, Salt/Brackish Marsh, and Estuarine Woody Wetland. In the Coastal Plain ecoregions, Bottomland Hardwood Forests often occur in extensive mosaics with Riverine Swamp Forest.

Riverine Swamp Forest corresponds to NCNHP types Cypress–Gum Swamp (Blackwater and Brownwater Subtypes), Coastal Plain Small Stream Swamp (part), Piedmont/Mountain Swamp Forest, Tidal Cypress–Gum Swamp, and Natural Lake Shoreline (part). Riverine Swamp Forest is included in the NCDCM wetland type of Swamp Forest. Riverine Swamp Forest corresponds to the HGM classes Riverine (sub-classes Headwater Complex, Lower Perennial, Beaver Impounded, and Human Impounded), Lacustrine Fringe (sub-classes Semi-permanently Flooded, Intermittently Flooded, and Reservoir), and Estuarine Tidal Fringe (subclass Estuarine Wind Intertidal). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-27

Photo 3-28

Riverine Swamp Forest. These examples of Riverine Swamp Forest depict the Broomfield Swamp floodplain, Beaufort County (Photo 3-27); an unnamed tributary in the Green Swamp, Brunswick County (Photo 3-28); the Little River floodplain, Transylvania County (Photo 3-29); and the headwaters of Huddle's Cut, Beaufort County (Photo 3-30).

Photo 3-29

Photo 3-30

Photo 3-31

Photo 3-32

Riverine Swamp Forest. These examples of Riverine Swamp Forest are located along the Pungo Lake shoreline (the lake is greater than 20 acres in size, and this wetland is subject to wave action, seasonal water-table variations, and wind tides), Washington County (Photo 3-31); along the eastern shore of the Alligator River (subject to wind tides and wave action), Dare County (Photo 3-32); in Deep Creek, a broad, linear feature with no readily identifiable channel, Washington County (Photo 3-33); and in the floodplain of Doe Creek (subject to lunar tides), Brunswick County (Photo 3-34).

Photo 3-33

Photo 3-34

Photo 3-35

Photo 3-36

Riverine Swamp Forest. These examples of Riverine Swamp Forest are a beaver-impacted portion of the Mingo Creek floodplain, Wake County (Photo 3-35); the headwaters of Robertson's Millpond on Buffalo Creek, Wake County (Photo 3-36); Town Creek (subject to lunar tides), Brunswick County (Photo 3-37); and in a beaver-impacted, first-order tributary to Milburnie Lake, Wake County (Photo 3-38).

Photo 3-37

Photo 3-38

3.1.6 Non-Tidal Freshwater Marsh

Non-Tidal Freshwater Marshes are found throughout the state in floodplains, along linear conveyances, in headwaters, and along shorelines of large water bodies (greater than 20 acres in size, Cowardin et al. 1979). These wetlands are subject to inundation or saturation for extended periods during the growing season, but are typically not subject to regular or occasional flooding by tides, including wind tides (regardless of whether or not the tidal waters reach wetlands through natural or artificial watercourses). Non-Tidal Freshwater Marshes occur on mineral or organic soils. Vegetation within this wetland type is predominantly herbaceous (less than 50 percent coverage by living woody species). Appendix E provides a list of vegetation species typically found in saturated (non-emergent) versus inundated (emergent and submergent [aquatic]) representatives of Non-Tidal Freshwater Marsh.

Due to the transitional nature of this wetland type, reference wetlands are not available for this type (see Section 3.2). Since this general wetland type has no reference, the condition of Non-Tidal Freshwater Marshes may be difficult for an assessor to discern. Indicators of condition degradation within this wetland type may include dead vegetation, ditching, spoil piles, reduced size, lack of vegetation diversity, and presence of invasive species. The size of these marshes varies depending on landscape position from very small to rarely 50 acres or more. Non-Tidal Freshwater Marshes can transition to other riverine wetlands such as Bottomland Hardwood Forest, Riverine Swamp Forest, and Headwater Forest.

Non-Tidal Freshwater Marshes may occur naturally along the fringes of streams, rivers, and large lakes. These wetlands also commonly occur in association with impoundments, whether man-made or natural (example: beaver impoundments), and in association with regularly disturbed areas (maintained utility line corridors). Other wetland types with similar hydroperiods (Riverine Swamp Forest, Non-Riverine Swamp Forest, Seeps) may acquire marsh-like vegetation due to disturbance (examples: fire or clear-cuts). However, when identifying the wetland type, an assessor will need to determine whether the full range of stable, existing wetland characteristics better resemble Non-Tidal Freshwater Marsh or another wetland type that existed prior to disturbance. Freshwater marshes found outside of floodplains or linear conveyances or in association with small (less than 20 acres) waterbodies are considered Small-Basin Wetlands. Localized depressions dominated by woody vegetation located within floodplains or adjacent to linear conveyances are considered Floodplain Pools.

Non-Tidal Freshwater Marsh includes NCNHP types Piedmont/Mountain Semi-permanent Impoundment (part), Coastal Plain Semi-permanent Impoundment (part), Natural Lake Shoreline (part). This type is included in the NCDCM wetland type of Freshwater Marsh. Non-Tidal Freshwater Marsh corresponds to HGM classes Riverine (sub-classes Headwater Complex, Beaver Impounded, and Human Impounded), Lacustrine Fringe (sub-classes Semipermanently Flooded and Reservoir), and Depression (sub-class Surface-connected). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-39

Photo 3-40

Non-Tidal Freshwater Marsh. These examples of Non-Tidal Freshwater Marsh are located on a beaver impounded oxbow of the North Fork Mills River, Henderson County (Photo 3-39); on a beaver-impounded reach of a tributary to the Rocky River, Cabarrus County (Photo 3-40); within the Haw River floodplain, Guilford County (Photo 3-41); and along an intensively managed power line corridor over an unnamed tributary to the Cape Fear River, New Hanover County (Photo 3-42).

Photo 3-41

Photo 3-42

Photo 3-43

Photo 3-44

Non-Tidal Freshwater Marsh. These examples of Non-Tidal Freshwater Marsh are located on a man-impounded reach of an unnamed tributary to McPherson Creek, Cumberland County (Photo 3-43); in association with a beaver dam spillway on an unnamed tributary to Little River, Transylvania County (Photo 3-44); at the upper end of a man-made impoundment on Stewarts Creek, Hoke County (Photo 3-45); and in an intensively managed portion of the floodplain of Ragsdale Creek, Buncombe County (Photo 3-46). This last wetland is the result of ground surface compaction and vegetation maintenance.

Photo 3-45

Photo 3-46

3.1.7 Tidal Freshwater Marsh

Tidal Freshwater Marshes are found in the tidewater region of the Middle Atlantic Coastal Plain ecoregion on the margins of estuaries and in lower reaches of streams and rivers where they are saturated most of the time and are also subject to regular or occasional flooding by tides, including wind tides (regardless of whether or not the tidal waters reach wetlands through natural or artificial watercourses). Tidal Freshwater Marshes typically have salinities below the threshold of 0.5 parts per thousand (ppt), but may be subject to salinities above this threshold as a result of storm events. Tidal Freshwater Marshes occur on mineral or organic soils. This wetland type is characterized by predominantly herbaceous vegetation (less than 50 percent coverage by living woody species). Tidal Freshwater Marshes typically support a larger diversity of plant species than either Non-Tidal Freshwater Marshes or Salt/Brackish Marshes. Indicators of degradation within this wetland type may include dead vegetation, ditching, spoil piles, reduced size, lack of vegetation diversity, presence of invasive species and saltwater intrusion. Presence of snags is only considered to be an indicator of degradation if there is evidence of a recent die-off.

Reference wetlands (see Section 3.2) are available for this type. These wetlands vary in size from small, narrow, fringing bands to broad patches extending hundreds of acres. Tidal Freshwater Marshes can transition upstream to Riverine Swamp Forest, upslope to Estuarine Woody Wetland, Non-Riverine Swamp Forest, and Pocosin, and downstream to Salt/Brackish Marsh.

Tidal Freshwater Marsh includes the NCNHP type Tidal Freshwater Marsh. This type is included in the NCDCM wetland type of Freshwater Marsh. Tidal Freshwater Marsh corresponds to the HGM class Estuarine Tidal Fringe (sub-classes Estuarine Lunar and Estuarine Wind). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-47

Photo 3-48

Tidal Freshwater Marsh. These examples of Tidal Freshwater Marsh are adjacent to Lockwood Folly River, Brunswick County (Photo 3-47); Sturgeon Creek, Brunswick County (Photo 3-48); an unnamed tributary to Hidden Lake in Palmetto-Peartree Preserve, Tyrrell County (Photo 3-49); and the Broad Creek Arm of South Lake in Alligator River National Wildlife Refuge, Dare County (Photo 3-50). The unnamed tributary to Hidden Lake is a naturalized excavated canal, which has provided a conduit for periodic brackish water intrusion into the adjacent wetland, resulting in a change in wetland type from a likely Riverine Swamp Forest to the present Tidal Freshwater Marsh. Lockwood Folly River and Sturgeon Creek are subject to lunar tides, while the unnamed tributary to Hidden Lake and South Lake are subject to wind tides.

Photo 3-49

Photo 3-50

3.1.8 Estuarine Woody Wetland

Estuarine Woody Wetlands occur in the tidewater region of the Middle Atlantic Coastal Plain ecoregion. These wetlands are transitional in nature. They occur on the margins of estuaries, are associated with tidal marshes, and have the following attributes: 1) they are subject to occasional flooding from salt or brackish water; 2) they are subject to occasional flooding by tides, including wind tides (regardless of whether or not the tidal waters reach wetlands through natural or artificial watercourses); and 3) they are dominated (greater than 50 percent coverage) by woody vegetation including shrubs and trees. Estuarine Woody Wetlands occur on mineral or organic soils. Due to typically unstable hydrological and chemical influences, the plant community is one adapted to disturbance, resulting in variable vegetation composition and physical structure. The vegetation assemblage is typically dominated by loblolly pine, cedars (*Juniperus* spp.) and hardwoods adapted to disturbance such as red maple and sweetgum, or by shrubs. Shrubs include bays, silverling (*Baccharis halimifolia*), marsh elder (*Iva frutescens*), and common wax myrtle (*Morella cerifera*). Herbs may include grasses and sedges from adjacent marshes.

Reference wetlands (Section 3.2) exist for this type; however, an assessor must recognize that this community occurs with variable vegetation composition and structure components. The size and shape of this wetland type is dependent on topography and disturbance (fire, clear-cutting, storm damage), and may range from narrow, sometimes intermittent bands along the outer fringe of Salt/Brackish Marshes to broad expanses of hundreds of acres. Estuarine Woody Wetland may transition up slope to Pocosin, Pine Flat, Hardwood Flat, and Non-Riverine Swamp Forest and down slope to Tidal Freshwater Marsh or Salt/Brackish Marsh.

Estuarine Woody Wetland includes NCNHP types Salt Shrub, Estuarine Fringe Loblolly Pine Forest, and Tidal Red Cedar Forest. This type is included in the NCDCM wetland type of Estuarine Shrub-Scrub and Estuarine Forested Wetlands. Estuarine Woody Wetland corresponds to HGM class Estuarine Tidal Fringe (sub-classes Estuarine Lunar and Estuarine Wind). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-51

Photo 3-52

Estuarine Woody Wetland. These examples of Estuarine Woody Wetland are on Bell Island east of Rose Bay, Swanquarter National Wildlife Refuge, Hyde County (Photo 3-51); at the east end of East Lake near Mashoes, Alligator River National Wildlife Refuge, Dare County (Photo 3-52); islands in a sea of brackish marsh along Croatan Sound, Dare County (Photo 3-53); and a wooded border along the upslope edge of salt marsh fringing Bogue Sound on Emerald Isle, Carteret County (Photo 3-54).

Photo 3-53

Photo 3-54

3.1.9 Salt/Brackish Marsh

Salt/Brackish Marshes are found in the tidewater region of the Middle Atlantic Coastal Plain ecoregion in areas subject to regular or occasional flooding by tides, including wind tides (whether or not the tidal waters reach wetlands through natural or artificial watercourses), provided that 1) water salinities equal or exceed 0.5 ppt during the period of average, annual low flow; 2) flooding by saline waters is not limited to storm events; and 3) woody vegetation constitutes less than 50 percent coverage of the community. The salt marsh component is associated more closely with ocean and inlet waters, while the brackish marsh component is somewhat removed from a direct connection with ocean and inlet saline waters. Salt/Brackish Marshes typically occur on both organic and mineral soils. This wetland type is characterized by predominantly herbaceous vegetation (less than 50 percent coverage by woody species). Salt Marsh vegetation is dominated by saltmarsh cordgrass (*Spartina alterniflora*) and contains black needle rush (*Juncus roemerianus*), large saltmeadow cordgrass (*Spartina patens*), and sawgrass (*Cladium jamaicense*). Brackish marshes are typically more diverse in the vegetation assemblage and may include black needle rush, large saltmeadow cordgrass, giant cordgrass (*Spartina cynosuroides*), and sawgrass (Schafale and Weakley 1990).

Most examples of Salt/Brackish Marsh are considered by regulatory agencies as high-quality wetlands. Indicators of degradation within this wetland type may include stands of dead vegetation, altered hydrology, ditching, spoil piles, reduced size, and extensive presence of invasive species.

Reference wetlands (Section 3.2) are available for this type. This wetland type may vary in size from small, narrow, fringing bands to hundreds of acres. Salt/Brackish Marsh can transition upstream to Tidal Freshwater Marsh, upslope to Estuarine Woody Wetland, Non-Riverine Swamp Forest, and Pocosin, and downstream to Salt/Brackish Marsh.

Salt/Brackish Marsh includes NCNHP types Salt Marsh, Brackish Marsh, and Salt Flat when these sites are wetlands. This type is included in the NCDCM wetland type of Salt/Brackish Marsh. Salt/Brackish Marsh corresponds with HGM class Estuarine Tidal Fringe (sub-classes Estuarine Lunar and Estuarine Wind). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-55

Photo 3-56

Salt/Brackish Marsh. These examples of Salt Marsh are located along the lower Cape Fear River, New Hanover County (Photo 3-55); along an armored shoreline of Calico Creek, Carteret County (Photo 3-56); near Mad Inlet, Brunswick County (Photo 3-57); and just east of the Bodie Island lighthouse, Dare County (Photo 3-58).

Photo 3-57

Photo 3-58

Photo 3-59

Photo 3-60

Salt/Brackish Marsh. These examples of Brackish Marsh are in association with Estuarine Woody Wetland in Huddy Gut, Beaufort County (Photo 3-59); along Rose Bay at Bell Island, Swanquarter National Wildlife Refuge, Hyde County (Photo 3-60); adjacent to the battleship U.S.S. North Carolina, New Hanover County (supporting a stand of the exotic species *Phragmites australis*) (Photo 3-61); and adjacent to a roadside canal near the US 64/US 264 junction, Dare County (Photo 3-62).

Photo 3-61

Photo 3-62

3.1.10 Seep

Seeps are located throughout the state where groundwater is discharged to the surface on a slope outside of a geomorphic floodplain and not in association with a linear conveyance. Wetlands of this type usually occupy small areas on sloping hillsides in interstream divides or on the outer rim of floodplains and are semi-permanently to permanently saturated by ground water on mineral or organic soils. This wetland type typically does not have sufficient surface flow to form channels, but is usually saturated to the surface. Topographic mapping is useful in determining the extent of Seeps, especially when a Seep abuts another wetland type. For instance, a Seep may occur on the outer slope of a geomorphic floodplain and extend down slope into another wetland type on the floor of the floodplain (such as Headwater Forest, Bottomland Hardwood Forest, Riverine Swamp Forest, Floodplain Pool, Non-Tidal Freshwater Marsh, or Mountain Bog). In this case, the lower boundary of this wetland type may be defined using topographic mapping at the point where the toe of the slope meets the floodplain floor. When making this determination, an assessor may use the most detailed topographic mapping available. Assessors will need to use best professional judgment to determine the boundary between a Seep and the upper limit of a Headwater Forest.

Vegetation in Seeps is quite variable. Depending on size, vegetation of Seeps in the Piedmont and Blue Ridge Mountain ecoregions may be zoned, with open interiors characterized by sparse to dense wetland herbs and a forested outer edge. This wetland type may be small enough to be shaded by adjacent trees. Vegetation structure in the Coastal Plain ecoregions is dependent on fire regime and may vary from dense to sparse growth of shrubs.

Reference wetlands (see Section 3.2) are available for this type. Because this type is very heterogeneous, care will be needed to select the appropriate reference, which will vary by ecoregion and site conditions. Seeps are typically small relative to other general wetland types, but may be larger in the Sandhills ecoregion and in the higher mountains. Seeps can transition to Headwater Forest, Bottomland Hardwood Forest, Riverine Swamp Forest, Non-Tidal Freshwater Marsh, Pine Flat, and Mountain Bog. Seeps can be distinguished from all these wetland types by location on a slope.

Seep includes the NCNHP types Low Elevation Seep, High Elevation Seep, Sandhill Seep, and Hillside Seepage Bog. This wetland type is not separately identified with the NCDCM wetland classification system. Seep corresponds to the HGM class Slope (sub-classes Organic Soil and Mineral Soil). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-63

Photo 3-64

Photo 3-65

Seep. These examples of Seep are located on a slope outside of the floodplain of an unnamed tributary to Little River, Wake County (Photo 3-63); on a mountain slope near Deep Gap, Watauga County (Photo 3-64); and on the upper floodplain slope of an unnamed tributary to McPherson Creek in Cumberland County (Photo 3-65). The source of wetland hydrology in all examples is groundwater expressing to the surface over impermeable surfaces, bedrock in the first two examples and a clay lens in the third example.

3.1.11 Small-Basin Wetland

Small-Basin Wetlands occur throughout the state in depressions surrounded by uplands (usually on interstream flats or in localized depressions). This wetland type may also occur on the fringes of small water bodies (less than 20 acres in size). Wetlands fringing larger water bodies are subject to hydrology more closely matching riverine conditions and are therefore considered Riverine Swamp Forest or Non-Tidal Freshwater Marsh. The size threshold used to determine small versus large water bodies was taken from Cowardin et al. (1979). Small-Basin Wetlands are seasonally to semi-permanently inundated but may lose surface hydrology during later portions of the growing season. Sources of water are perched groundwater, groundwater discharge, overland runoff, and precipitation. Seasonal waterlines are often apparent on the vegetation. Small-Basin Wetlands generally occur on mineral soils. Small-Basin Wetlands may be characterized by a variety of mineral soil types ranging in particle size and type from sandy soils associated with Coastal Plain lime sinks and inter-dune swales to clay-based soils underlying mafic depressions. Vegetation structure within this wetland type may vary widely from forest in mafic depressions and ephemeral pools, to primarily herbaceous or emergent in lime sinks, man-excavated depressions, and along the shorelines of small bodies of water.

Reference wetlands (see Section 3.2) are available for some forms of this wetland type, but since this wetland type is so heterogeneous, an assessor must recognize that an appropriate reference must be considered on a case-by-case basis. Non-reference Small-Basin Wetlands are rare and most frequently include the wetland edges of excavated farm ponds. Small-Basin Wetlands vary in size based on the variable landscape positions that they may occupy. This wetland type is generally surrounded by uplands, but may occasionally transition to Pine Savanna, Pocosin, or Pine Flats.

Small-Basin Wetland comprises NCNHP types Vernal Pool, Cypress Savanna, Upland Depression Swamp Forest, Upland Depressional Pond, Inner Dune Pond, and Upland Pool. This wetland type is not separately identified in the NCDCM methodology, but would likely be included in the Swamp Forest (non-riverine) and Freshwater Marsh in some cases. Small-Basin Wetland corresponds to the HGM classes Depression (sub-classes Isolated Groundwater, Isolated Precipitation, and Human Impounded or Excavated) and Estuarine (sub-class Impounded). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-66

Photo 3-67

Photo 3-68

Photo 3-69

Small-Basin Wetlands. These examples of Small-Basin Wetland are a mafic depression on an interstream divide, Mecklenburg County (Photo 3-66), a post hurricane scour pool on Ocracoke Island, Hyde County (Photo 3-67); within an inter-dune swale on Bogue Banks, Carteret County (Photo 3-68); and a grass and sedge-dominated limesink depression within Carolina Beach State Park, New Hanover County (Photo 3-69).

3.1.12 Non-Riverine Swamp Forest

Non-Riverine Swamp Forest occurs primarily in the embayed region (the northeastern Middle Atlantic Coastal Plain ecoregion) on poorly drained, interstream flats not associated with streams, rivers, or estuaries. This wetland type is seasonally to semi-permanently saturated or inundated with hydrology driven by groundwater discharge, overland runoff, and/or precipitation rather than overbank or tidal flooding. This wetland type occurs on mucky mineral or organic soils. Non-Riverine Swamp Forests are typically characterized by forest vegetation, often dominated by bald cypress (*Taxodium distichum*), black gum (*Nyssa biflora*), Atlantic white cedar (*Chamaecyperis thyoides*) and oaks (swamp chestnut oak [*Quercus michauxii*], water oak [*Q. nigra*], and overcup oak [*Q. lyrata*]) as well as other tree species, especially in successional stages.

Reference wetlands (see Section 3.2) are available for this type. This wetland type varies in size, but may be quite extensive in the northeastern Middle Atlantic Coastal Plain ecoregion. Non-Riverine Swamp Forest transitions to Pocosin, Hardwood Flat, or Pine Flat with decreasing wetness and to Riverine Swamp Forest in proximity to riverine or tidal systems and large water bodies (greater than 20 acres in size, Cowardin et al. 1979).

Non-Riverine Swamp Forest includes NCNHP types Nonriverine Swamp Forest, Peatland Atlantic White Cedar Forest, Maritime Swamp Forest, and Maritime Shrub Swamp. This wetland type is included in the NCDCM wetland type of Swamp Forest and Maritime Forest on coastal islands. Non-Riverine Swamp Forest corresponds to HGM classes Depression (sub-classes Isolated Groundwater and Isolated Precipitation) and Flat (sub-classes Organic Soil and Mineral Soil). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-70

Photo 3-71

Photo 3-72

Non-Riverine Swamp Forest. These examples of Non-Riverine Swamp Forest are in Buckridge Estuarine Reserve in southeastern Tyrrell County (Photo 3-70); between US 64 and the Albemarle Sound in northeastern Tyrrell County (Photo 3-71); and in a hurricane-damaged area west of Phelps Lake, Washington County (Photo 3-72).

3.1.13 Hardwood Flat

Hardwood Flats are found primarily in the Coastal Plain ecoregions on poorly drained, interstream flats. These areas are usually seasonally saturated or intermittently to seasonally inundated by a high water table or poor drainage, but have a shorter hydroperiod than Non-Riverine Swamp Forests. The primary source of water is a high water table resulting from precipitation and overland runoff. Hardwood Flats generally occur on mineral soils. These systems are dominated by hardwood tree species including various oaks (examples: swamp chestnut oak [*Quercus michauxii*], laurel oak [*Q. laurifolia*], and cherrybark oak [*Q. pagoda*] and sweetgum [*Liquidambar styraciflua]*).

Reference wetlands (see Section 3.2) are available for this type. This wetland type may vary widely in size, but can be quite large, dependent on landscape position and disturbance. Hardwood Flat can transition to Pocosin, Pine Savanna, Pine Flat, and Non-Riverine Swamp Forests on interstream flats and can transition to Headwater Forest at the upper extent of drainage slopes. Hardwood Flat is distinguished from Pocosin, Pine Savanna, and Pine Flat through canopy species composition and from Non-Riverine Swamp Forest by hydrology indicators. Headwater Forest is distinguished from a Hardwood Flat through association with a natural linear conveyance, likely in combination with indicators of some surface flow.

Hardwood Flat comprises the NCNHP types Non-Riverine Wet Hardwood Forest, Wet Marl Forest, and successional forests in similar landscape positions. Hardwood Flats are included in the NCDCM wetland type of Hardwood Flats. Hardwood Flat corresponds to the HGM class Flat (sub-class Mineral Soil). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-73 **Photo 3-74**

Hardwood Flat. These examples of Hardwood Flat are located south of the Pamlico River, Beaufort County (Photo 3-73), near the community of East Lake, Dare County (Photo 3-74), north of Phelps Lake, Washington County (this wetland had recently suffered storm damage from Hurricane Isabel) (Photo 3-75), and on an interstream flat east of I-95 in northern Robeson County (Photo 3-76).

Photo 3-75

Photo 3-76

3.1.14 Pine Savanna

Pine Savannas are found in the Coastal Plain ecoregions on poorly drained, interstream flats. These areas are usually seasonally saturated by a high water table or poor drainage, but have a shorter hydroperiod than Non-Riverine Swamp Forest. The primary sources of water are a high water table resulting from precipitation and overland runoff. Pine Savannas are maintained by frequent, low-intensity fires and occur on mineral soils. This wetland type is dominated by long-leaf (*Pinus palustris*) and pond pine (*P. serotina*), with scattered, low shrubs such as little gallberry (*Ilex glabra*), creeping blueberry (*Vaccinium crassifolium*), common wax-myrtle (Morella cerifera), and dangleberry (*Gaylussacia frondosa*) (Schafale and Weakley 1990) and grassy ground cover (dominated by grasses, sedges, composites, orchids, and lilies (Schafale and Weakley 1990) in reference condition. Regular burns provide conditions for very high herb species diversity.

Reference wetlands (see Section 3.2) are available for this type; the few examples remaining in North Carolina are located primarily in the southeastern portion of the state. Size of this wetland type is dependent on long-term fire frequency. Pine Savannas can transition to Pocosin and Pine Flat.

Pine Savanna corresponds to NCNHP types Wet Pine Flatwoods and Pine Savannas. Pine Savannas are included in the NCDCM wetland type of Pine Flats. Pine Savanna corresponds to the HGM class Flat (sub-class Mineral Soil). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-77

Photo 3-78

Pine Savanna. These examples of Pine Savanna are both from Brunswick County and are located within the Military Ocean Terminal, Sunny Point (Photo 3-77) and along NC 211 in the Green Swamp (Photo 3-78).

3.1.15 Pine Flat

Pine Flats are found primarily in the Coastal Plain ecoregions on poorly drained interstream flats. These areas are usually seasonally saturated or intermittently to seasonally inundated by a high water table or poor drainage. The primary source of hydrology is a high water table resulting from precipitation and overland runoff. Pine Flats generally occur on mineral soils. This wetland type may be dominated by forest, early successional forest/shrub, or managed pine plantation. Common canopy trees are pines including loblolly (*Pinus taeda*) and slash pine (*P. elliottii*), and may include a large component of red maple (*Acer rubrum*) and sweetgum (*Liquidambar styraciflua*). The shrub component is typically not dense and may include horsesugar (*Symplocos tinctoria*), American holly (*Ilex opaca*), swamp bay (*Persea palustris*), coastal white alder (sweet pepperbush – *Clethra alnifolia*), and common wax-myrtle (*Morella cerifera*).

Almost all Pine Flats are successional in nature and represent altered variants of the Pine Savanna, Hardwood Flat, or Non-Riverine Swamp Forest; therefore, there are no reference wetlands for this type (see Section 3.2). This wetland type is typically managed and is often characterized by low species diversity and structural complexity, which decreases the Habitat function of this wetland. Pine Flats may vary widely in size, but can be quite large, dependent on landscape position and disturbance. Pine Flats can transition to Pocosin, Pine Savanna, Hardwood Flat, and Non-Riverine Swamp Forests on interstream flats; to Headwater Forest at the upper extent of drainage slopes; and to Estuarine Woody Wetland and Salt/Brackish Marsh in the embayed portion of the Middle Atlantic Coastal Plain ecoregion.

This wetland type has no NCNHP counterpart, but includes disturbed variants of several types of non-alluvial forests such as Nonriverine Wet Hardwood Forest, Nonriverine Swamp Forest, Wet Pine Flatwoods, and Pine Savanna. Pine Flat is included in the NCDCM wetland type of Pine Flat and Managed Pineland. Pine Flat corresponds to the HGM class Flat (sub-class Mineral Soil). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-79

Photo 3-80

Photo 3-81

Photo 3-82

Pine Flat. These examples of Pine Flat are south of the Pamlico River, Beaufort County (Photo 3-79); east of I-95 in northern Robeson County (Photo 3-80); south of US 64, Tyrrell County (Photo 3-81); and east of Havelock, Craven County (Photo 3-82).

3.1.16 Pocosin

Pocosins are found in the Coastal Plain ecoregions on poorly drained, interstream flats and in basins of various sizes such as peat-filled Carolina bays. Pocosins can be seasonally saturated or inundated by a high or perched water table. The primary source of water is a high water table resulting from precipitation and slow drainage, but, rarely, Pocosins are found adjacent to surface waters. Pocosins occur on mineral or organic soils. Vegetation is dominated by dense, waxy evergreen shrubs that typically include gallberries (*Ilex* spp.), fetterbushes (*Leucothoe* spp.), honey-cup (*Zenobia pulverulenta*), and bamboo-vine (greenbrier – *Smilax laurifolia*) often mixed with pond pine (*Pinus serotina*) and evergreen hardwoods such as loblolly bay (*Gordonia lasianthus*), swamp bay (*Persea palustris*), and sweet bay (*Magnolia virginiana*).

Pocosin vegetation structure may take a variety of forms, resulting in the need for the assessor to be familiar with multiple sub-type reference wetlands (see Section 3.2) (see corresponding NCNHP wetland types below). Pocosins may transition to a variety of wetland types depending on topography, hydrologic regime, and disturbance including Non-Riverine Swamp Forest, Pine Savanna, Pine Flat, Hardwood Flat, Riverine Swamp Forest, Salt/Brackish Marsh, Non-Tidal Freshwater Marsh, and Estuarine Woody Wetland. Areas of this wetland type vary greatly in size dependent on landscape position. The extent of the wetland type may not be apparent in the field or with the use of aerial photography due to past disturbance; however, soils mapping may prove useful in determining the potential extent of Pocosin prior to disturbance. Appendix D contains a list, compiled by NCDCM, of soils that are known to typically support Pocosin. This list is not considered to be all-inclusive, but rather a guide for use when estimating the original aerial extent of a Pocosin.

Pocosin comprises NCNHP types Low Pocosin, High Pocosin, Pond Pine Woodland, Small Depression Pocosin, and Bay Forest. Pocosins are included in the NCDCM wetland type of Pocosin along with some of the Pine Flat wetland type if it is dominated by pond pine. Pocosin corresponds to the HGM classes Flat (sub-classes Mineral Soil and Organic Soil) and Depression (sub-classes Isolated Groundwater and Isolated Depression). Appendix B provides a cross reference of wetland types across three classification systems.

Photo 3-83

Photo 3-84

Photo 3-85

Photo 3-86

Photo 3-87

Pocosin. These examples of Pocosin are the low pocosin sub-type, Brunswick County (Photo 3-83); the high pocosin subtype, Brunswick County (Photo 3-84); intensively managed Pocosin within a power line corridor, Brunswick County (Photo 3-85); a pond pine woodland dominated by pond pine and loblolly bay in Alligator River National Wildlife Refuge, Dare County (Photo 3-86); and a double Carolina bay, Bladen County (Photo 3-87).