4.9 Aquatic Plants

4.9.1 Introduction

Resource Issues
▸ Coverage of non-invasive and invasive aquatic plants

Changes in the reservoir operations policy have the potential to affect invasive and non-invasive aquatic plants. Because they are rooted in shallow water (usually less than 15 feet deep), aquatic plant communities in reservoirs are affected by the amount, timing, and duration of reservoir water fill and drawdown. The volume and flow rate of water releases from TVA dams affect aquatic plants in tailwaters. The effect of reservoir operations policy alternatives on aquatic plants (both invasive and non-invasive) was evaluated by analyzing the coverage and composition of these plant communities in TVA reservoirs and tailwaters.

Aquatic plants are often referred to as aquatic macrophytes and include aquatic vascular plants, a few mosses, and macroscopic algae. Aquatic macrophytes are divided into four classes (free-floating, submersed, floating-leaved, and emergent) based on whether they are rooted in the substrate and their leaf locations in relation to the water surface. The term aquatic plants in this section of the EIS refers to submersed and floating-leaved plants; this term includes coontail (*Ceratophyllum demersum L.*) although it is typically classified as free-floating. Free-floating plants other than coontail are not major components of the aquatic plant community in the TVA system and are not included in the analysis. Emergent wetland communities are discussed in Section 4.8, Wetlands.

Algal biomass (discussed in Section 4.4, Water Quality) can alter the light available to aquatic plants. Increase or decline of aquatic plants and aquatic invasive plants can be measured in acres of substrate colonized or coverage. This value can then be compared from year to year or season-to-season to determine variations.

For this EIS, aquatic invasive plants are defined as those species of plants that spread rapidly and can crowd or out-compete native, indigenous species so thoroughly or grow so densely that the ecosystem is negatively affected. This definition includes those plants that are exotic, or non-native, to the Southeastern United States, as well as some native species that are capable of growing at sufficiently high levels to substantially alter the environment.

Since the 1960s, the most abundant submersed macrophyte in mainstem TVA reservoirs has been Eurasian watermilfoil (*Myriophyllum spicatum*). This plant can grow densely at depths below minimum winter pool water levels or in shallow embayments where soil moisture prevents freezing and drying of the rootcrowns (Webb and Bates 1989).

Spinyleaf naiad (*Najas minor*) and hydrilla (*Hydrilla verticillata*) are submersed invasive aquatic plant species that are also prevalent in several mainstem reservoirs. Several other species of aquatic plants are either presently invasive within the TVA system or have the potential to be invasive based on examination of the species' reproductive modes or habitat requirements. Table 4.9-01 lists the invasive aquatic plants that occur or potentially could become established in the TVA reservoir system. The table groups the species based on the severity of their threat to TVA and on whether they are exotic or native. In some mainstem reservoirs, 80 to 90 percent of aquatic plant coverage includes invasive species. Several of the invasive or nuisance species in Table 4.9-01 are emergent species. While most of the emergents in the table occur in small populations, others such as alligatorweed, Uruguayan water-primrose, water smartweed, giant cutgrass, and American lotus grow in large colonies in several TVA mainstem reservoirs.

Aquatic plants, both invasive and non-invasive, can be beneficial to several aspects of water quality and to wildlife, waterfowl, and fisheries that depend on plant density and coverage. Floating-leaved plants and submersed vegetation provide sediment stabilization and food, shelter, and reproductive habitat for fish, insects, and other aquatic fauna. At the same time, aquatic plants at high densities can impede boating, marina, and dock operations; shoreline access; and water contact activities, such as swimming and water skiing. The presence of aquatic plants also provides habitat for mosquitoes.

Seasonal or cyclical changes in weather, water flow, nutrient cycling, and light availability are the factors that primarily affect the coverage of aquatic plants and aquatic invasive plants. Because these natural events and conditions can fluctuate widely, TVA cannot predict or control the effects of natural environmental factors on aquatic and invasive aquatic plant resources.

On the mainstem reservoirs, the natural environmental factors that affect aquatic plant growth and decline tend to surpass the effects of reservoir operational activities, which affect aquatic plant growth and decline predominantly by manipulation of water levels. For example, TVA has observed colonies of Eurasian watermilfoil within embayments on Guntersville Reservoir and found that they increase or decrease in size independently of one another despite similarities in topographic elevation, frequency, and duration of inundation and soil/sediment composition.

Although changes in reservoir operations may affect aquatic plant coverage, potential changes may not override the effects of the natural cycles on plant growth or decline. This is apparent upon reviewing the historical coverage data maintained by TVA from 1976 to 2002 (Table 4.9-02, Figure 4.9-01). Several years of drought during the mid-1980s led to increasing plant coverage on mainstem reservoirs systemwide, to a maximum of slightly over 46,000 acres in 1988. Several consecutive years of low flow due to reduced rainfall led to clear waters and increases in coverage. Unfavorable growing conditions during the flood years of 1989, 1990, and 1991 (such as high stream flows, high turbidity, cold winter temperatures, and an unusual phytoplankton bloom in 1990) resulted in a decrease of coverage to about 13,500 acres in 1991. This decrease was not clearly related to TVA reservoir operational changes and was considered to be a direct result of natural events.

Table 4.9-01 Invasive or Nuisance Aquatic Plants of Concern to TVA

Group	Common Name	Scientific Name
Highly invasive, exotic species–severely problematic to reservoir use	Eurasian watermilfoil [1]	*Myriophyllum spicatum*
	Hydrilla [1]	*Hydrilla verticillata*
	Spinyleaf naiad [1]	*Najas minor*
Moderately invasive, exotic species–nuisance at a small scale or have potential to be highly invasive in the future	Alligatorweed [4]	*Alternanthera philoxeroides* (Mart.) Griseb.
	Parrotfeather [1]	*Myriophyllum aquaticum*
	Purple loosestrife [4]	*Lythrum salicaria* and *Lythrum Virgatum*
	Common reed [4]	*Phragmites australis*
	Curly-leaf pondweed [1]	*Potamogeton crispus*
	Uruguayan water-primrose [4]	*Ludwigia uruguayensis*
	Floating waterhyacinth [3]	*Eichhornia crassipes*
	Asian spiderwort [4]	*Murdannia keisak*
	Yellow flag [4]	*Iris pseudacoris*
	Torpedograss [4]	*Panicum repens*
	Giant salvinia [3]	*Salvinia molesta*
	Brazilian elodea [1]	*Egeria densa*
	Water lettuce [3]	*Pistia stratoides*
	Hyek watercress [4]	*Rorippa nasturtium-aquaticum*
	Mint [4]	*Mentha piperata*
Invasive native plant species–generally considered beneficial species but sometimes reach nuisance levels	American lotus [4]	*Nelumbo lutea*
	Southern naiad [1]	*Najas guadalupensis*
	Coontail [3]	*Ceratophyllum demersum*
	American pondweed [2]	*Potamogeton nodosus*
	Water smartweed [4]	*Polygonum amphibium* var. *emersum*/ *Polygonum coccineum*
	Small pondweed [1]	*Potamogeton pusillus*
	Giant cutgrass [4]	*Zizaniopsis miliacea*
	Reed canary grass [4]	*Phalaris arundinacea*
	Muskgrass [1]	*Chara zeylandica*
	Fragrant water lily [2]	*Nymphaea odorata*
	Duckweeds [3]	*Lemna* spp., *Spirodela* sp.
	Water paspalum [4]	*Paspalum fluitans*
	Water primrose [4]	*Ludwigia peploides* var. *glabrescens*
	Canadian elodea [1]	*Elodea canadensis*

[1] Submersed.
[2] Floating-leaved.
[3] Free-floating.
[4] Emergent.

Source: Webb pers. comm.

Table 4.9-02 Aquatic Plant Coverage on TVA Mainstem Reservoirs (1976 to 2002)

Reservoir Category	Reservoir	1976		1977		1978		1979		1980		1981	
		Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]
Mainstem storage	Kentucky	200	TR	250	TR	300	TR	350	TR	400	TR	450	TR
Mainstem storage	Pickwick	0[4]	0	0	0	0	0	0	0	0	0	0	0
Mainstem run-of-river	Wilson	150	1	175	1	20	TR	5	TR	15	TR	30	TR
Mainstem storage	Wheeler	20	TR	20	TR	20	TR	100	TR	325	TR	758	1
Mainstem storage	Guntersville	6,700	10	6,800	10	6,493	10	7,708	11	10,200	15	14,441	21
Mainstem run-of-river	Nickajack	950	9	1,000	10	1,078	10	734	7	1,025	10	1,200	12
Mainstem storage	Chickamauga	125	TR	1,042	3	1,981	6	1,570	4	3,280	9	5,407	15
Mainstem storage	Watts Bar	10	TR	10	TR	10	TR	59	TR	125	TR	903	3
Tributary run-of-river	Melton Hill	182	3	175	3	113	2	261	5	200	4	396	7
Mainstem storage	Fort Loudoun	140	1	150	1	138	1	200	1	215	2	126	TR
Tributary storage	Tellico[4]	0	0	0	0	0	0	0	0	11	TR	20	1
Total		**8,477**		**9,622**		**10,153**		**10,987**		**15,796**		**23,731**	

Table 4.9-02 Aquatic Plant Coverage on TVA Mainstem Reservoirs (1976 to 2002) (continued)

Reservoir Category	Reservoir	1982		1983		1984		1985		1986		1987	
		Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]
Mainstem storage	Kentucky	1,478	1	1,633	1	1,633	1	316	TR	2,067	1	7,112	4
Mainstem storage	Pickwick	0	0	0	0	0	0	85	TR	231	1	121	TR
Mainstem run-of-river	Wilson	25	TR	25	TR	25	TR	25	TR	30	TR	30	TR
Mainstem storage	Wheeler	800	1	800	1	2,466	4	3,105	5	6,901	10	9,650	14
Mainstem storage	Guntersville	14,363	21	12,055	17	11,343	16	13,798	20	16,460	24	15,909	23
Mainstem run-of-river	Nickajack	1,150	12	1,150	12	1,166	12	1,166	11	1,485	14	1,200	11
Mainstem storage	Chickamauga	6,488	18	6,896	19	5,341	15	5,621	16	6,865	19	6,845	19
Mainstem storage	Watts Bar	712	2	1,334	3	547	1	405	1	450	1	613	2
Tributary run-of-river	Melton Hill	231	4	209	4	209	4	208	4	250	4	150	3
Mainstem storage	Fort Loudoun	135	TR	139	1	139	1	50	TR	130	1	50	1
Tributary storage	Tellico[4]	25	1	25	1	35	1	35	TR	150	TR	44	TR
Total		**25,407**		**24,266**		**22,904**		**24,814**		**35,019**		**41,724**	

Table 4.9-02 Aquatic Plant Coverage on TVA Mainstem Reservoirs (1976 to 2002) (continued)

Reservoir Category	Reservoir	1988		1989		1990		1991		1992		1993	
		Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[2]
Mainstem storage	Kentucky	6,145	4	5,718	4	2,106	1	2,813	2	2,616	2	3,467	2
Mainstem storage	Pickwick	120	TR	120	TR	25	TR	25	TR	105	TR	105	TR
Mainstem run-of-river	Wilson	30	TR	30	TR	30	TR	0	TR	5	TR	55	TR
Mainstem storage	Wheeler	9,843	14	5,991	9	1,981	3	3,462	5	4,412	6	6,597	10
Mainstem storage	Guntersville	20,242	29	14,166	21	7,891	12	5,166	7	5,993	8	7,613	11
Mainstem run-of-river	Nickajack	1,200	11	1,111	11	800	8	832	8	583	5	1,001	10
Mainstem storage	Chickamauga	7,455	21	3,492	10	2,127	6	680	2	387	1	1,186	3
Mainstem storage	Watts Bar	675	2	675	2	80	TR	10	TR	10	TR	10	TR
Tributary run-of-river	Melton Hill	150	3	150	3	100	2	240	2	240	2	240	2
Mainstem storage	Fort Loudoun	50	1	50	1	25	TR	25	TR	25	TR	25	TR
Tributary storage	Tellico[4]	103	1	941	6	368	3	340	3	228	2	246	2
Total		**46,013**		**32,444**		**15,533**		**13,593**		**14,604**		**20,545**	

Table 4.9-02 Aquatic Plant Coverage on TVA Mainstem Reservoirs (1976 to 2002) (continued)

Reservoir Category	Reservoir	1994		1995		1996		1997		1998		1999	
		Coverage (acres)[1]	% Area[2]	Coverage (acres)[1]	% Area[3]	Coverage (acres)[1]	% Area[3]	Coverage (acres)[1]	% Area[3]	Coverage (acres)[1]	% Area[3]	Coverage (acres)[1]	% Area[3]
Mainstem storage	Kentucky	415	TR	1,150	1	200	TR	150	TR	100	TR	100	TR
Mainstem storage	Pickwick	15	TR	15	TR	15	TR	15	TR	15	TR	60	TR
Mainstem run-of-river	Wilson	10	TR	10	TR	10	TR	10	TR	10	TR	10	TR
Mainstem storage	Wheeler	6,597	10	6,500	10	6,500	10	5,500	8	6,000	9	5,000	7
Mainstem storage	Guntersville	9,584	14	8,843	13	10,485	15	13,000	18	15,203	22	15,337	22
Mainstem run-of-river	Nickajack	1,001	10	600	6	900	9	800	8	850	8	1,377	13
Mainstem storage	Chickamauga	1,186	3	700	2	1,000	3	900	2	900	2	2,500	7
Mainstem storage	Watts Bar	10	TR	10	TR	10	TR	10	TR	10	TR	25	TR
Tributary run-of-river	Melton Hill	240	2	240	2	240	2	50	TR	5	TR	10	TR
Mainstem storage	Fort Loudoun	25	TR	25	TR	25	TR	25	TR	25	TR	25	TR
Tributary storage	Tellico[4]	246	2	240	2	240	2	240	2	100	1	125	1
Total		**19,329**		**18,333**		**19,625**		**20,700**		**23,218**		**24,569**	**50**

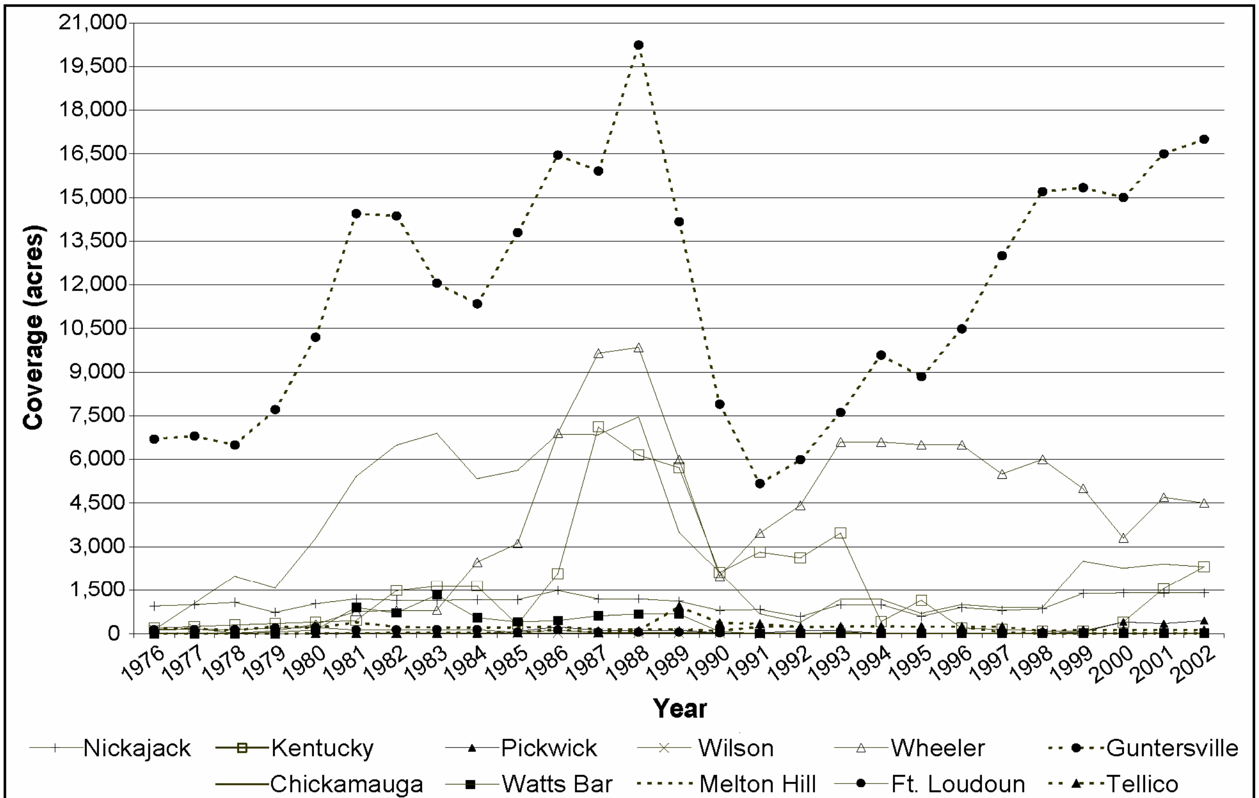
Table 4.9-02 Aquatic Plant Coverage on TVA Mainstem Reservoirs (1976 to 2002) (continued)

Reservoir Category	Reservoir	2000		2001		2002	
		Coverage (acres)[1]	% Area[3]	Coverage (acres)[1]	% Area[3]	Coverage (acres)[1]	% Area[3]
Mainstem storage	Kentucky	400	TR	1,550	1	2,300	2
Mainstem storage	Pickwick	400	2	350	2	450	2
Mainstem run-of-river	Wilson	10	TR	10	TR	10	TR
Mainstem storage	Wheeler	3,300	5	4,700	7	4,500	7
Mainstem storage	Guntersville	15,000	21	16,500	23	17,000	24
Mainstem run-of-river	Nickajack	1,400	13	1,400	13	1,400	13
Mainstem storage	Chickamauga	2,261	6	2,400	7	2,300	6
Mainstem storage	Watts Bar	25	TR	25	TR	25	TR
Tributary run-of-river	Melton Hill	10	TR	15	TR	15	TR
Mainstem storage	Fort Loudoun	25	TR	25	TR	25	TR
Tributary storage	Tellico[4]	125	1	125	1	125	1
Total		**22,956**		**27,100**		**28,150**	

Notes:

TR = Trace or less than 1 percent area.
0 = No or negligible plant coverage.

1 "Coverage" values are in acres and are based on data from the TVA Aquatic Plant Management Program (Webb pers. comm.).
2 Percent area for 1976 to 1995 was based on data from the TVA Aquatic Plant Management Program (TVA 1995, TVA 1994, Burns et al. 1983–1993).
3 Percent area for 1995 to 2001 was calculated by Normandeau based on data provided by TVA from the Aquatic Plant Management Program.
4 In the analysis, Tellico was treated as a mainstem storage reservoir because of its connection and similar operation with Fort Loudoun Reservoir.



Source: TVA data.

Figure 4.9-01 Aquatic Plant Coverage on TVA Mainstem Reservoirs (1976 to 2002)

Three representative mainstem and five tributary reservoirs and two tailwaters were selected for analysis to characterize the aquatic and invasive aquatic plant resources throughout the Tennessee River watershed. These representative reservoirs and tailwaters were chosen based on several factors, including data availability and similarity of operation to other mainstem and tributary reservoirs. The reservoirs selected were Kentucky (mainstem storage), Guntersville (mainstem storage), Chickamauga (mainstem storage), Douglas (tributary storage), Fort Patrick Henry (tributary run-of-river), Tims Ford (tributary storage), Chatuge (tributary storage), and South Holston (tributary storage). Available information for reservoirs other than those listed above was included in the data analyses where it assisted in creating a more complete assessment of the present status of aquatic plants in the region. Selected tailwaters included the Holston River downstream of Cherokee Reservoir and the French Broad River downstream of Douglas Reservoir. These river stretches were chosen because the best documented data on riverine aquatic plant communities were available for them.

4.9.2 Regulatory Programs and TVA Management Activities

Regulatory Programs

Executive Order 13112—Invasive Species (National Invasive Species Council 1999) requires federal agencies to: (1) prevent the introduction of invasive species, (2) detect and respond rapidly to and control populations of such species in a cost-effective and environmentally sound manner, (3) monitor invasive species populations accurately and reliably, and (4) provide for restoration of native species and habitat conditions in ecosystems that have been invaded. TVA's Aquatic Plant Management Program supports compliance with Executive Order 13112.

TVA Management Activities

Aquatic plant populations have become large enough on several TVA mainstem reservoirs to interfere with multiple uses of the reservoirs. TVA initially tried to eradicate aquatic plants such as Eurasian watermilfoil with large-scale herbicide applications. Since the 1970s, however, TVA's Aquatic Plant Management Program has limited management efforts to control only excessive infestations of aquatic plants in areas subject to the greatest public and private use. This approach allows for a balance between meeting the desires of stakeholder groups for aquatic plant control in developed shoreline areas and preserving the ecological benefits of aquatic plants with a minimum of conflict. On Guntersville Reservoir, for example, TVA manages only between 5 and 10 percent of total vegetation cover by herbicide application and mechanical harvesting.

The Aquatic Plant Management Program coupled fall and winter drawdowns with carefully applied herbicides for a majority of their vegetation management efforts (TVA 1993). Because of growth from seed and recolonization of the drawdown zone by vegetative fragments of Eurasian watermilfoil, hydrilla, and other species, herbicides were required to suppress aquatic plants in near-shore areas during summer. TVA has also used biological control methods, such as the single stocking of Guntersville Reservoir with sterile grass carp (*Ctenopharyngodon idella*) in 1990. In selected reservoirs, TVA manages plants on a smaller scale according to reservoir-specific aquatic plant management plans developed by local stakeholder groups. Management methods include application of herbicides in near-shore areas along developed shoreline and the use of mechanical harvesters to cut and maintain access lanes.

4.9.3 Coverage of Aquatic Plants

Mainstem Reservoirs

<u>Existing Conditions</u>

In both storage and run-of-river mainstem reservoirs, common groups of vegetation are found due to similarities among the reservoirs relative to configuration (their width and area), depth, water level fluctuation, and substrate. Much of the vegetation of these reservoirs occurs in embayments, overbanks, and shallow cove areas.

In a majority of the storage mainstem reservoirs, submersed/ floating-leaved plant communities that are dominated by annual species colonize the drawdown zone; this zone is exposed and dewatered during late fall and winter (Figure 4.9-02). Eurasian watermilfoil, hydrilla, and coontail are invasive species that can invade the drawdown zone when water levels come up in late spring and early summer or colonize areas that remain wet or inundated during fall and winter.

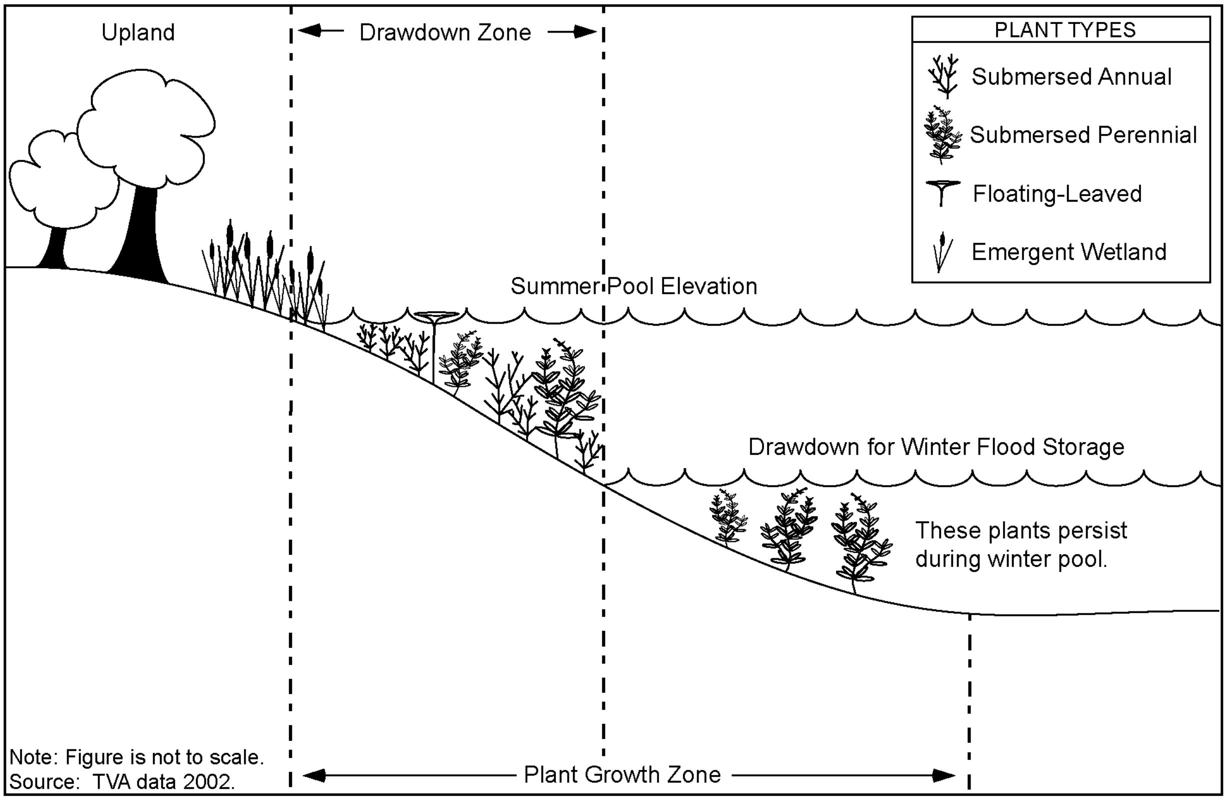


Figure 4.9-02 Generalized Diagram of Aquatic Plant Zones in a TVA Mainstem Storage Reservoir

Run-of-river mainstem reservoirs do not have a winter drawdown zone. Water levels generally fluctuate daily for hydrogeneration and slightly from season to season based on natural factors, primarily rainfall, that affect the water level in the Tennessee River. This allows for a mix of submersed/floating-leaved annual (naiads, some pondweeds, and muskgrass) and perennial species (Eurasian watermilfoil, hydrilla, and some pondweeds). Total aquatic plant coverage on run-of-river reservoirs is generally less than on most storage reservoirs because of their smaller size and lack of numerous large, shallow embayments. Like the storage mainstem reservoirs, aquatic plant coverage on run-of-river mainstem reservoirs fluctuates with climatic conditions, but the decline in the early 1990s was not as large as on most of the storage mainstem reservoirs.

Table 4.9-03 containes a list of typical aquatic plant species found in mainstem reservoirs.

Table 4.9-03 Submersed, Floating-Leaved, and Free-Floating Aquatic Plant Species on TVA Mainstem Reservoirs

Common Name	Scientific Name
Eurasian watermilfoil[1, 3]	*Myriophyllum spicatum*
Hydrilla[1, 3]	*Hydrilla verticillata*
Southern naiad[1, 3]	*Najas guadalupensis*
Spinyleaf naiad[1, 3]	*Najas minor*
Small pondweed[1, 3]	*Potamogeton pusillus*
Coontail [1, 5]	*Ceratophyllum demersum*
Muskgrass[1, 3]	*Chara zeylandica*
American pondweed[1, 4]	*Potamogeton nodosus*
Waterthread pondweed[2, 4]	*Potamogeton diversifolius*
Horned pondweed[2, 3]	*Zannichellia palustris*
Water stargrass[2, 3]	*Heteranthera dubia*
Canadian elodea[2, 3]	*Elodea canadensis*
Curly-leaf pondweed[1, 3]	*Potamogeton crispus*
Brazilian elodea[2, 3]	*Egeria densa*
Sago pondweed[2, 3]	*Potamogeton pectinatus*
Eelgrass[2, 3]	*Vallisneria americana*
Parrotfeather[2, 3]	*Myriophyllum aquaticum*
Ribbonleaf pondweed[2, 4]	*Potamogeton epihydrus*
Tennessee pondweed[2, 4]	*Potamogeton tennesseensis*
Fanwort[2, 4]	*Cabomba caroliniana*
Duckweeds[1, 5]	*Lemna* spp., *Spirodela* sp.
Mosquito fern[2, 5]	*Azolla caroliniana*

[1] Common in several reservoirs.
[2] Uncommon or only in a few reservoirs.
[3] Submersed.
[4] Floating-leaved.
[5] Free-floating.

Sources: Webb and Bates 1989, TVA data.

Future Trends

A review of total coverage of plants for each year from 1976 to 2002 (Table 4.9-02) reveals that, overall, plant acreage increased gradually from approximately 8,500 acres in 1976 to a maximum coverage of slightly over 46,000 acres in 1988 (Burns et al. 1991), then declined to about 13,500 acres in the early 1990s. Acres of plant coverage have been slowly increasing since then, but in 2002 were 60 percent of the maximum levels of the late 1980s, which can be attributed to natural variability as previously discussed. Aquatic plant coverage is expected to continue to fluctuate based on natural conditions, predominately rainfall.

Tributary Reservoirs

Existing Conditions

Most tributary reservoirs are located in mountainous areas and are characterized by steep shorelines and compacted substrate. Storage tributary reservoirs have larger winter drawdowns than mainstem reservoirs. Natural changes in the hydrologic cycle result in annual fluctuations in water elevations and durations of inundation on these reservoirs. Summer pool levels are not always met in some dry years, and water elevations decline earlier in a dry year than in normal and wet years. This wide fluctuation leads to a drawdown zone that is less habitable for plants than on the mainstem reservoirs and, in combination with the steep shorelines and compacted substrate, creates an environment in which little or no submersed or floating-leaved aquatic vegetation exists.

Run-of-river tributary reservoirs have fairly stable water levels that fluctuate a few feet on a daily basis for hydropower generation and slightly from season to season based on natural factors, primarily rainfall, that affect the water level in the corresponding tributary. These reservoirs also often contain an inhospitable environment for aquatic plants due to sloping and substrate challenges.

In locations where rivers or tributary streams enter the reservoirs—or along the upstream portions of backwater embayments, coves, and sloughs—substrate types and soil moisture are adequate to support aquatic plants. When present, typical aquatic species include American pondweed, spinyleaf naiad, and the emergent water smartweed.

Future Trends

Unlike the mainstem reservoirs, data are not collected annually for the tributary reservoirs, largely due to the lack of submersed and floating-leaved plants on tributary reservoirs. Overall trends of drought and flood that have affected the mainstem reservoirs probably have similarly affected the tributary reservoirs but on a much smaller scale due to the limited coverage of vegetation. Variation of natural factors will continue to influence the future trends related to coverage of aquatic plants and aquatic invasive plants in tributary reservoirs. Drought years can result in decreasing coverage due to dewatering of suitable habitat, while high rainfall years can result in increasing or decreasing coverage, depending on the species colonizing the reservoirs and the extent of the rainfall (which influences water elevation and duration).

Tailwaters

Existing Conditions

Aquatic riverine plants in the Tennessee River watershed are mostly rooted species that occur in cobble/gravel shoals. With a few exceptions (for example, the Holston River below Cherokee Dam), plant communities are dominated by native species. Aquatic plants are most abundant in quiet stretches where the slowing current has allowed fine sediments to deposit (Haslam and Wolseley 1978). The exceptions are species that can attach to rocks, such as riverweed; or species that efficiently utilize niches of fine sediments in bedrock, cobble, and gravel to gain a root hold in moderate current (for example, several of the pondweeds and eelgrass). The deeper pools with a sand and silt bottom are mostly unvegetated. See Table 4.9-04 for examples of aquatic plants observed in various rivers of the Tennessee Valley.

Future Trends

Data are not available concerning trends in coverage of riverine plants of the Tennessee Valley. Aquatic plant coverage in tailwaters is expected to continue to fluctuate based on natural conditions, predominately rainfall.

Table 4.9-04 Submersed and Floating-Leaved Aquatic Macrophytes Occurring along Rivers of the Tennessee River System

Scientific Name	Common Name	Duck	Elk	Clinch	French Broad	Holston[1]	Hiwassee	Little Tennessee[2]
Callitriche heterophylla	Water starwort		■			■		■
Elodea canadensis	Canadian elodea	■		■		■		
Heteranthera dubia	Water stargrass	■		■	■	■		
Isoetes macrospora	Large quillwort						■	■
Myriophyllum spicatum	Eurasian watermilfoil		■			■		
Podostemum ceratophyllum	Riverweed	■	■		■		■	■
Potamogeton amplifolius	Large-leaved pondweed							■
Potamogeton crispus	Curly-leaf pondweed			■	■	■		
Potamogeton diversifolius	Waterthread pondweed				■			■
Potamogeton epihydrus	Ribbonleaf pondweed						■	■
Potamogeton foliosus	Leafy pondweed	■	■		■	■		■
Potamogeton nodosus	American pondweed	■		■	■	■		■
Potamogeton pectinatus	Sago pondweed			■		■		
Potamogeton pulcher	Spotted pondweed						■	
Potamogeton pusillus	Small pondweed							■
Potamogeton tennesseensis	Tennessee pondweed						■	■
Vallisneria americana	Eelgrass			■		■		
Zannichellia palustris	Horned pondweed		■	■		■		

[1] Includes the North and South Forks of the Holston River.
[2] Most of downstream portion is now impounded (Tellico Reservoir).

Source: Webb and Bates 1989.

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