

WATER AND LITTORAL VEGETATION OF
THE GORES RESERVOIR - COOLER NAMED FOR A. V. VINTER *

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BVIBA

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The reservoir-cooler of the A.V. Vinter Gorky State Regional Power Plant was created in 1925-1930 at the site of the small, marshy Zheleznitsa river. It is a reservoir with a reversible system, its area about 200 hectares, its length about 15 km.

In 1958-69, being occupied with a study of the flora and vegetation of the reservoirs of the Gorky region, we carried out a geobotanical examination of the GoGRES reservoir-cooler. According to morphometry the reservoir is divided into two parts: an expanded, lake, part and a constricted, river, part. The lake part is more than 500 m wide and about 4 km long. Transverse dams with small conduits for water divide this part of the reservoir into three sections. The longest part, the river, is narrow, the prevailing width of which is 15-20 m. The depth of the entire reservoir does not exceed 3-3.5 m. The transparency of the water varies from 0.24 m to absolute; the pH varies from 5.5 to 7.3.

The reservoir does not freeze; in winter the temperature of the water on the surface does not sink below 4-5°C; in the period from May to September in the region of the water-gap it fluctuates from 25 to 37°. The rate of water exchange is almost once daily. As for the topography of the lake bottom - it is a flat trench; in the river part, the bottom is uneven due to the periodic excavation of the riverbed by a suction dredge. The soil on the bottom and the shores is sandy, covered with a layer of sediment or congested.

An arrangement of zones is evident in the distribution of the vegetation of the entire reservoir. In the lake part, as a result of wave action, there is a nymphide zone that is narrow and interrupted in places; in the river part, which is characterized by its steep banks, there is a sharply constricted thicket of air-water plants. The following zones are characteristic for the lake part of the reservoir:

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1. A zone of shore sedge (*Carex riparia*) and hair grass (*Deschampsia caespitosa*) on the left bank of the third section reaches a width of 200 m. The vegetation has a complex distribution: the sedge occupies the congested and excessively damp soil, and the hair grass more drained areas. Thickets of cinereous willow (*Salix cinerea*) are found, and also groups of forest rush (*Scirpus sylvaticus*) and swelled sedge (*Carex rostrata*). The herbage of all the groups attains a height of 80 cm (the projecting covering is 80%), including a large number of mesophytic meadow species and is used for cutting hay and on pasture.

2. A zone of sharp sedge (*Carex acuta*), no more than 0.5-2 m wide, often occupies a terraced edge of the bank right by the water. In places there is a woody formation of alder (a combination of *Alnus glutinosa* +

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Carex acuta). On the sloping banks among the sedge are scattered patches of thread-like rush (*Juncus filiformis*) and (unknown) (*Leerisia oryzoides*).

3. A zone of reed (*Phragmites communis*) and cattail (*Typha* sp.) is well expressed all over the left bank and also along the dams. It reaches a depth of 1-1.5 m, attaining in places a width of 80 m. The sturdy stalks of the reed and the cattails are 2.5-2.75 m high. Species of cattail form mixed thickets, but there are also combinations of the broad-leaved cattail (*Typha latifolia*) and the narrow-leaved cattail (*T. angustifolia*). Groups of reed and cattails are distinguished by an unusual saturation of species, by a multistage quality and a high projecting covering (more than 80%). Besides the great number of amphibian species, the great duckweed (*Spirodela polyrrhiza*), the small duckweed (*Lemna minor*) and watercress (*Hydrocharis morsus-ranae*) are characteristic on the surface of the water; in the depths of the water are almost all species of submerged hydrophytes that are to be found in the reservoir. In the "windows" on the surface of the water are patches of yellow pond-lilies (*Nuphar lutea*) and floating pondweed (*Potamogeton natans*).

Hydrophytes, especially eel grass (*Vallisneria spiralis*) and hornwort (*Ceratophyllum demersum*), are profusely overgrown with algae (*Oedogonium* sp. and *Melosira* sp.), on which in turn other epiphytic algae (*Gomphonema* sp.) colonize.

There are fragments of thickets of flowering rush (*Butomus umbellatus*), ordinary arrowhead (*Sagittaria sagittifolia*), erect bur reed (*Sparganium erectum*), (unknown) (*Eleocharis palustris*), water hemlock (*Oenanthe aquatica*), and lake reed (*Scirpus lacustris*).

In places that are free of thickets of helophytes, at a depth of 10 - 15 cm in sandy-muddy soil, small beds of little pondweed (*Najas minor*) are typical.

4. A zone of yellow pond-lily and floating pondweed is adapted to places that are protected from wave action and often squeezes against thickets of reed and cattails. It has a width of from 1-2 to 70 m and a depth of near 2 m. The pond-lily and the pondweed more often grow separately, forming associations with underwater formations of eel grass, hornwort, and nitella (*Nitella* sp.). The addition of the water-lily (*Nymphaea candida*) is found in the groups of yellow pond-lilies. The projecting covering of all the groups is more than 80%.

5. A zone of submerged hydrophytes forms underwater meadows over the entire open stretch of the reservoir. The vegetation is of a mosaic character: without an apparent regularity, groups of eel grass, hornwort, and sparkling pondweed (*Potamogeton lucens*) alternate. Nitella is typical in all of the combinations. There are patches of fennel-leaved pondweed (*Potamogeton pectinatus*) and waterweed (*Elodea canadensis*). All the species of plants are profusely overgrown with algae; (unknown) larvae are often found attached to the thalli of nitella.

In the river part the zone arrangement of the vegetation has a somewhat

different character:

1. The sharp sedge, forming a zone 0.5-1 m wide. Scattered in places among the sharp sedge are patches of grayish sedge (*Carex canescens*) and swollen sedge, forest rush, (unknown), peppery knotweed (*Polygonum hydropiper*), and trifid bur-marigolds (*Bidens tripartita*). Along the river bed are found the adhesive alder and osier beds (Combination of *Salix cinerea* + *S. triandra*).

2. Spotty thickets of air-water plants, where groups of rooted rush (*Scirpus radicans*), reed and broad-leaved cattail dominate. Less widespread are groups of narrow-leaved cattail, flowering rush, water-plantains (*Alisma plantago-aquatica*), riparian horse-tail (*Equisetum fluviatile*), (unknown), ordinary arrowhead, floating manna grass (*Glyceria fluitans*), and lake rush.

3. Floating pondweed, which occupies the entire surface of the canal in the vicinity of the warm water gap, with projecting covering of about 90%. Patches of yellow pond-lilies are found in places.

4. There are mosaic groups of hornwort and eel grass in the central part of the river bed. Eel grass gives the group a projecting covering of more than 90%. Among the eel grass and hornwort are scattered fragments of thickets of fennel-leaved pondweed and waterweed.

Production of the water and littoral-water vegetation of the
GoGRES reservoir-cooler and the Gorkovsk reservoir
(air-dried weight in g/m²)

Plant group	GoGRES Reservoir			Gorkovsk reser- voir, 1964
	1939	lake 1939	river 1934	
<i>Leersia oryzoides</i>	—	—	313	—
<i>Phragmites communis</i>	—	1733	1167	720
<i>P. communis</i> + <i>Typha latifolia</i>	—	2400	—	—
<i>Carex acuta</i>	—	893	—	627
<i>C. canescens</i>	—	—	187	220
<i>C. rostrata</i>	—	800	—	365
<i>Alisma plantago-aquatica</i>	—	—	259	327
<i>Butomus umbellatus</i>	—	—	834	108
<i>Ceratophyllum demersum</i> (на глубине 1 м)	1700	366	407	—
<i>C. demersum</i> (на глубине 1.5 м)	240	—	—	—
<i>Elodea canadensis</i>	1860	653	—	405
<i>Nuphar lutea</i>	—	973	—	—
<i>N. lutea</i> + <i>Potamogeton natans</i>	—	1202	—	—
<i>N. lutea</i> + <i>Vallisneria spiralis</i>	—	913	—	—
<i>Potamogeton natans</i>	—	866	449	—
<i>P. natans</i> + <i>Ceratophyllum demersum</i>	—	—	607	—
<i>P. natans</i> + <i>Vallisneria spiralis</i>	—	483	699	—
<i>Sagittaria sagittifolia</i>	—	300	266	304
<i>Scirpus lacustris</i>	—	933	—	133
<i>S. radicans</i>	—	—	836	332
<i>Typha angustifolia</i>	—	2006	1770	—
<i>T. angustifolia</i> + <i>Phragmites communis</i>	—	2534	—	—
<i>T. latifolia</i>	11500	3033	1490	1456
<i>Vallisneria spiralis</i>	—	600	330	—
<i>V. spiralis</i> + <i>Ceratophyllum demersum</i>	—	1127	—	—

33 basic formations of vegetation have been distinguished in the reservoir. The air-water and moisture-loving vegetation are more diverse (13 formations and 12 formations, respectively), but the water vegetation stands in first place in terms of the area occupied. In the period of their maximum development, water and littoral vegetation cover about 70% of the area of the reservoir.

In the first and second sections of the lake part, formations of eel grass, hornwort and cattails predominate; in the third section - formations of eel grass, sparkling pondweed, reed and cattails. In the river part, formations of floating pondweed, eel grass, rooted rush, reed and broad-leaved cattail predominate.

The heightened thermal level of the reservoir, increasing the period of vegetation to 9-12 months, its shallowness, the weak current and other factors are conducive to high productive levels by groups of water and littoral plants (see table). The productivity of several analogous groups, for example those in the Gorky reservoir (our data), is lower than that of the groups in the reservoir-cooler. The groups of air-water high grasses create the largest phytomass per unit area of all. The biomass of the predominant groups of genuine water plants is fairly significant.

P.M. Pavlinova (1939) studied the overgrowth in the reservoir from 1934 to 1937; here data on the phytomass for some groups are higher than our measurements. This is possibly connected with the frequent disturbance of the thickets of macrophytes by excavations of the river bed.

During a period of more than 30 years changes occurred in the arrangement and characteristics of the predominant vegetation. At the present time the most typical of all the formations in the entire reservoir is the eel grass. This thermophilic plant appeared later and probably got into the reservoir from an aquarium. The natural habitat of eel grass in our country is in the southern regions (Flora USSR, 1934). The Balakhninskii reservoir is the only place of habitation of this plant in the Gorky region and, apparently, in the central region of the European part of the USSR.

Thick overgrowth in the reservoir hinders its operation; therefore the work of GoGREG on acclimatization of the reservoir on the White Amur river is expedient.

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