Nuisance Aquatic Macrophyte Growth[1]

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ABSTRACT

Aquatic macrophytes of the Columbia and Snake River watersheds were observed at 723 sites in Washington, Oregon, and Idaho and classified according to adjacent land use, water body type, altitude, water temperature, and nuisance growth. The prevalence of eight weed species was subjected to matrix analysis. Nuisance weed growths were most extensive in water bodies where the surrounding land area was near a population center, was heavily grazed by livestock, or received irrigated agricultural runoff.

INTRODUCTION

This paper is a summary of a survey of the aquatic vascular flora of the Columbia and Snake River watersheds (United States) and the coastal drainage areas (Figure 1). It describes the distribution of aquatic vascular vegetation and relates this distribution to characteristics of the habitat of each collection site (2).

The lands owned by the United States and their associated water areas at Corps of Enginers water resources projects provide significant outdoor recreation and fish and wildlife resources. They are deemed necessary for the water resources projects and are managed for outdoor recreation use to the maximum extent consistent with accomplishment of the specifically authorized purposes.[2]

METHODS AND MATERIALS

The survey was conducted by visiting 723 sites distributed throughout the 20 sub-basins in the study area. Most collections were made in April through September 1973, and sites were selected so that varied habitats were represented within each sub-basin. Sites were also selected with high diversity of plant species and high standing crops of aquatic vegetation. Particular attention was given to sites with macrophyte development of nuisance proportions, e.g., where plant populations were aesthetically offensive, impeded water flow in channels, clogged water intakes, and hindered boating, swimming, or navigation.

At each collection site, the collectors sampled or identified aquatic macrophytes in a brief overview. A subjective estimate was made of the abundance of each taxa found; rare, sparse, common, heavy, or nuisance density. Depending on the water depth, plants were collected by a combination of grab samples, rakes, and scuba diving. Choice of sampling area was dictated by ease of access; however, in smaller water bodies, the entire water surface or shoreline was often sampled. Observations were made on water velocity, water temperature, and surrounding land use. Selection of sample sites was biased toward sites of heavy plant growths so this study is not a truly representative cross-section of all aquatic habitates in the study area (4, 6). The "Flora of the Pacific Northwest" (5) was accepted as the taxonomic authority. Identifications were supported by Correll and Correll (1), Fassett (3), Steward, Dennis, and Gilkey (7), and the herbaria at the University of Idaho and Washington State University.

Observations on adjacent land use, water body type, al-

[1]Field data were assembled under contract NO. DACW 68-72-C-0269, Walla Walla, Washington, District of the U. S. Army Corps of Engineers, to the University of Idaho, Moscow, Idaho.

[2]Coastal Zone Resources Corporation Study of Land Use for Recreation and Fish and Wildlife Enhancement (Main Report). Coastal Zone Resources Corporation, Wilmington, North Carolina, 1975.

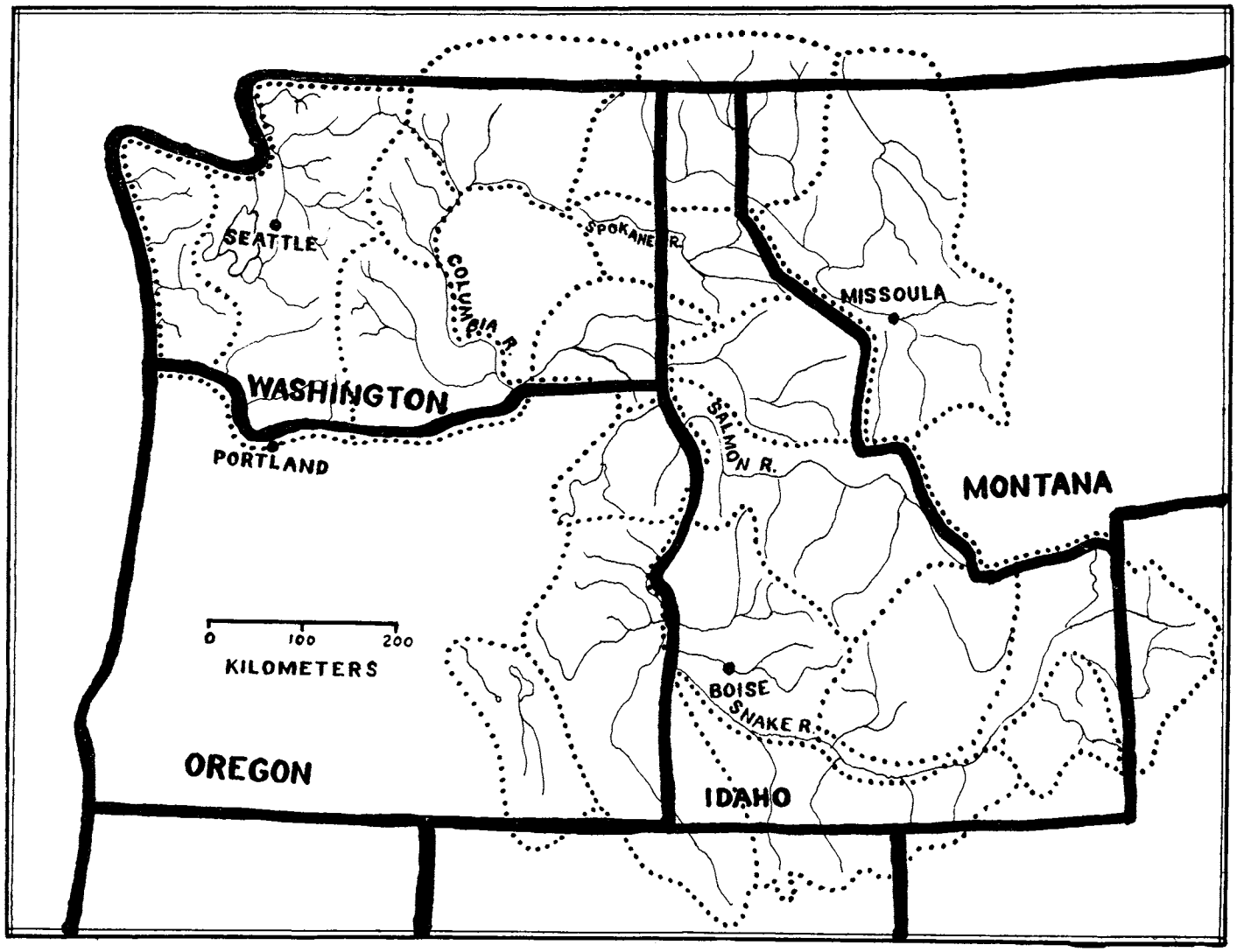

Figure 1. Pacific Northwest Study Area.

titude, and water temperature as related to nuisance growth were studied by matrix analysis to determine conditions and indicator plants, as listed in Table 1. The multiple regression equation of this data set is:

$$y = 5.4095 + 0.4333 X_1 \text{ (land use)} - 0.5322 X_2 \text{ (water body type)} - 0.2248 X_3 \text{ (altitude of growth site)} - 0.0215 X_4 \text{ (temperature of growth site)}$$

RESULTS AND DISCUSSION

Location of macrophytes which most often occurred in heavy densities show little apparent geographical or river basin zonation with most taxa. The taxa seem to be freely distributed over basin boundaries, with all "problem" taxa being very widespread. Within the Pacific Northwest, it appears that the presence or absence of a taxon in a specific river drainage is not a question of prior introduction but whether the habitat is suitable for growth. Certain habitat characteristics showed definite relationships to heavy macrophyte growth. Of all small ponds and lakes sampled, 60.0% and 53.7%, respectively, had heavy growths while only 30.1, 28.7, and 11.4% of large lakes, rivers, and drawdown reservoirs had heavy growths. Drawdown pools and rivers generally were poor plant habitat.

Of the five land-use categories, irrigated agricultural, sagebrush-grazed, and near-population centers had the highest percentages of heavy growth sites 53.3, 42.7, and 47.9%,

TABLE 1. SUMMARY OF ADJACENT LAND USE, WATER BODY TYPE, AND PLANT GENERA IN DECREASING ORDER OF NUISANCE GROWTH EFFECT.

Land Use	Water-Body Type	Nuisance Genera
Population center	Slough	*Elodea*
Grazing land	Lake	*Potamogeton*
Irrigated land	Pond	*Chara*
Forest land	Canal	*Ranuculus*
Dryland farming	Creek	*Ceratophyllum*
	Reservoir	*Myriophyllum*
	River	*Nitella*
		Nuphar

respectively. Dryland agricultural and forested were both 33.3% heavy growth sites. On-site observations further showed that the plant density within heavy or nuisance sites was greater where surrounding land use was greater. These data suggest a strong relationship between macrophyte abundance and land disturbance of the soil. High temperature sites had a greater percentage of the heavy growths (75%), with the growth decreasing steadily with decreasing temperatures of the higher water sites (down to 25.7%).

Approximately 70% of the specific problem areas are caused by 8 genera:

Elodea, Potamogeton, Chara, Ranuculus, Ceratophyllum, Myriophyllum, Nitella, and *Nuphar,* ranked in order of the decreasing percentage of nuisance sites.

Of significance is that despite these taxa causing most of the heavy growths in the study area, all were also found in "sparse" or "rare" densities. Furthermore, more than 95% of all taxa found were observed in "nuisance densities" at least once. In "heavy" sites, dense growths were just as likely to consist of 6-8 dominant taxa as of one dominant taxon. Likewise, sparse growths might have consisted of one, or of many different taxa.

TABLE 2. NUISANCE GENERA AS RELATED TO ADJACENT LAND USE AND WATER BODY TYPE AT 300 METERS ALTITUDE AND 27 DEGREES C.

Land Use	Water-Body Type	Nuisance Genera
Population center	Slough	*Ceratophyllum*
	Lake	*Ranucullus*
	Pond	*Chara*
	River	*Chara*
	Creek	*Potomageton*
	Reservoir	*Elodea*
	Canal	*Elodea*
Grazing Land	Slough	*Ceratophyllum*
	Lake	*Ceratophyllum*
	Pond	*Ranucullus*
	River	*Chara*
	Creek	*Potomageton*
	Reservoir	*Potomageton*
	Canal	*Elodea*
Irrigated agriculture	Slough	*Myriophyllum*
	Lake	*Ceratophyllum*
	Pond	*Ranucullus*
	River	*Chara*
	Creek	*Chara*
	Reservoir	*Potomageton*
	Canal	*Elodea*

Many of the water bodies were in developed areas, such as farms, residential sites, and road fill surrounding the shoreline. Extensive development of lake banks may encourage littoral vegetation through the formation of shallow areas since eroded soil of the banks supply necessary nutrients for growth and substrate for anchoring plant roots.

Percolation through soil removes solids from pasture runoff, irrigation wastes, and septic tank wastes; however, nutrient-laden water may reach water where they may stimulate prolific macrophyte growth in near-shore water.

Aquatic weed problems were most common at lower altitudes and higher temperatures. The predicted nuisance species using the multivariant regression equation is given in Table 2 for categories of land use and water-body type. Table 2 can be of value as a "rule of thumb" in predicting the aquatic plant growth for different recreation sites and associated land use. *Elodea, Nitella* and *Nuphar* were widely distributed among forest land and dryland sites with little or no correlation to land use or water body type.

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