

RIPARIAN VEGETATION OF THE NORTHERN RANGE, YELLOWSTONE
NATIONAL PARK; CLASSIFICATION, SUCCESSION, AND
ENVIRONMENTAL RELATIONSHIPS

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Introduction and Objectives

For many years interest in and research concerning wetlands has lagged behind the more extensive efforts put forth in upland and aquatic ecosystems. Recent years have seen wetlands featured in several symposia (Johnson and Jones 1977; Johnson and others 1985; Ratliff 1985; Brosz and Rodgers 1986). Within the Greater Yellowstone Ecosystem and contiguous areas several studies both intensive (Norton, et al 1981; Tuhy 1981; Mattson 1982; Mutz and Queiroz 1983) and extensive (Tuhy and Jensen 1982; Youngblood, et al 1985; Pierce and Johnson 1986) have been completed.

The climate of northern Yellowstone is a hybrid between continental and inland maritime. There is a gradient in precipitation and temperature between the lowest recording station Gardiner (1616 m) and the Northeast Entrance station (2244 m). Gardiner, by virtue of its low elevation, is the warmest and driest location with only 277 mm mean annual precipitation, of which most occurs in the late spring-early summer. The Northeast Entrance, the highest reporting station in this northern portion of the park, is the wettest (670 mm) and coldest. However, precipitation at the Northeast Entrance is more evenly distributed throughout the year with distinct peaks in early summer and mid winter.

Of potentially greater importance than climate to understanding wetland composition is water chemistry. Streams originating to the east of the study area in the Absaroka Range drain predominately extrusive igneous (andesitic) rock and glacial till. Streams originating to the south of the study area drain oligotrophic tephra and rhyolitic substrates. To the west and north a mix of sedimentary and glacial till substrates are represented. Groundwater from these distinct geologic substrates, in addition to water from unique thermal features producing a complexity of groundwater environments in this "northern range".

The specific objectives of the study are the following:

1. Sample, classify, and describe current riparian plant community types in the northern range of Yellowstone National Park.

2. Map pilot or demonstration areas to test the classification, ascertain whether the juxtaposition of represented types conforms to expectations, and illustrate the scale of pattern development.
3. To hypothesize the causal factors (environmental and perturbations) leading toward development of each vegetation type.
4. To illustrate the relationships among vegetation types along environmental gradients and the most probable successional pathways between related successional stages.
5. To develop a Yellowstone riparian data base, parallel and cooperative to that underway as an interagency cooperative effort in Montana by the Montana Riparian Association.

Methods and Results

Initial emphasis has been on sampling the range of diversity of wetland communities and environments in the northern range. Sampling sites were chosen on the basis of ease of access and community diversity. Plots were located in areas judged to be homogeneous, based on vascular species composition and dominance in all layers. This approach has been described as "subjective sampling without bias" (Mueller-Dombois and Ellenberg 1974). During the summer of 1985 a total of 200 plots were sampled.

Canopy coverage (Daubenmire 1959) and height was ocularly estimated for all vascular plant species and for the bryophyte layer as a whole. The cover classes employed were T = <1%, 1 = 1 to <5%, 2 = 5 to <25%, 3 = 25 to <50%, 4 = 50 to <75%, 5 = 75 to <95%, 6 = 95 to 100%. Voucher specimens were collected for all taxa and deposited in the appropriate herbaria. Difficult taxa (Salix spp., Carex spp., and Aster spp.) were sent to recognized authorities for determination. To facilitate accurate Salix spp. identification, catkin collections were made early in the growing season and parent plants tagged. Subsequent visits to tagged plants permitted us to compare the identified sexual plants with their vegetative condition and extrapolate observed correlations. The plots also received a general description with reference to landmarks and other plots. The following site variables were recorded: 1) elevation (meters, from topographic map), 2) aspect (degrees), 3) slope (percent), 4) topographic position, 5) landform, 6) configuration (slope shape in both plane and vertical profile), 7) distance from water (meters), and 8) depth to water (cm) by excavation, soil probe, or measurement of depth to the nearest freewater surface. In addition to the site variables, observations on animal disturbance were recorded. During the spring of 1986, a preliminary wetland community type classification of the northern range was completed.

During the second field season, the following activities were completed: 1) an additional 158 plots were sampled along with the appropriate environmental parameters, 2) 1 m plastic pipes were installed in representative plots to monitor water pH, conductivity, dissolved oxygen, soil moisture content and water levels throughout the growing season, 3) field tested and revised the preliminary

classification, 4) installed 24 permanent plots (m^2) adjacent to two established exclosures (Mammoth and Junction Butte exclosures) to monitor responses of various species of Salix, Betula occidentalis, and Populus tremuloides, 5) mapped the Junction Butte exclosure area to test and demonstrate the classification system, and 6) mapped one transect along a moisture gradient in the Swan Lake region.

During the winter of 1987 we will be analyzing the 358 plot data base to produce a revised community type classification by June 1987. The data will be analyzed with FUZPHY, an interactive computer program for constructing association tables, Sorensen's similarity coefficients, Bray-Curtis ordination, DECORANA, and TWINSpan.

During the summer of 1987 we will be field testing the revised key to the community types and will be collecting additional data in order to elucidate environmental and successional relationships of each community type. The third year of the study will allow us to test the hypotheses and finalize the classification and interpretation.

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