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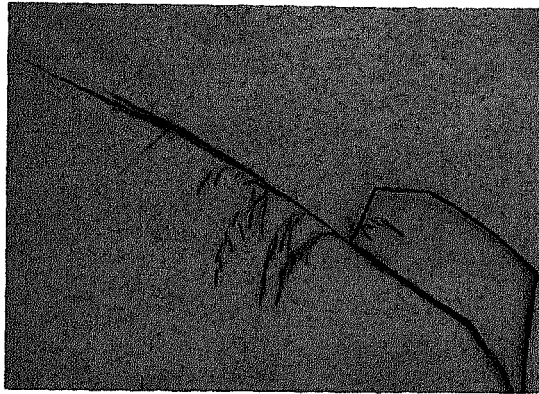
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Texas wildrice (*Zizania texana*) growing submerged in the spring-fed San Marcos River, Hays County, Texas. The blades of this rare plant ripple in clear, constant temperature waters.



Texas wildrice (*Zizania texana*) panicle or fruiting head showing both pistillate (seed) parts at the upper or extended end and the staminate (male) parts dangling below. Note, the staminate florets bloom later than the pistillate florets thus making self-pollination often difficult.



Texas wildrice (*Zizania texana*) growing submerged in the spring-fed San Marcos River, Hays County, Texas. Fruiting stems are emerging (hand pointing) above the swift current. These stems will develop a panicle with seeds well above the water.

TEXAS WILDRICE

by

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A relict population of a rare and endangered species of aquatic grass, Texas wildrice (*Zizania texana* Hitchc.), is growing in the spring-fed headwaters of the San Marcos River within the city limits of San Marcos, Hays County, Texas.

Texas wildrice is a coarse perennial forage plant that grows completely submerged in 1 to 6 feet of clear running water, excepting the panicle which emerges and rises above the current when flowering. It is found well out in the swift current and away from banks and quiet waters. It grows with other aquatic vascular plants such as *Myriophyllum* and *Potamogeton*. It has the general appearance of Johnson grass, panicum, or sedge growing under water. This plant's luxuriant growth of bright green, long, flat, narrow leaves ripple as streamers below the surface.

For ages, vast volumes of underground waters originating in the Edwards Plateau region have flowed from fissures in exposed limestone strata of the Balcones Escarpment and form the San Marcos River.

The relatively uniform annual water flow rate and constant year-round temperature of the springs create a stable aquatic environment in which *Zizania texana* is specifically adapted.

This unique plant is endemic to Texas and is habitat specific. Its natural habitat is limited to the San Marcos River's gravelly streambed which begins at Spring Lake—location of the principal springs, and extends downstream two and one-half miles where the riverbed substrate changes from a marl to a dark shale. Mean annual flow of the San Marcos springs is 157 cubic feet per second (cfs). Water temperature at the springs is approximately 71°F the year-round and varies approximately $\pm 3^\circ\text{F}$ at the habitat lower limits as influenced by air temperatures. *Zizania texana* is specifically adapted to this relatively year-round stable aquatic environment. It has not been found growing naturally elsewhere—even in Comal Springs at New Braunfels only 18 miles away in a similar locale. Attempts to culture

this plant in similar habitats at other locations or in aquaria have not been fully successful.

Zizania texana is firmly attached to its habitat gravelly streambed by relatively short spongy roots serving as a sturdy anchor system. Roots develop at the nodes of the decumbant culms (stems) and at the tips of short coarse stolons (runners). A crown of tightly entangled roots develop into a plant clone or colony which is exposed above the streambed soil. The basal area of a *Z. texana* clone ranges from a few square inches to as much as 10 square feet.

New plants other than seedlings are produced at the end of stolons. It is here where tillers (shoots) also arise. Long bright green, ribbon-like, highly pliable leaves originate at the base and nodes along the axis of the culms. Individual blades reach lengths exceeding 6 feet and have widths up to an inch.

During periods of inflorescence, the long rigid decumbant culm, which reaches lengths of 12 feet or more, will bend upward at its nodes,

emerge above the strong current, and produce a graceful 8 to 12 inch panicle at the distal 2 to 3 feet above water.

Flowering panicles of the *Zizania texana* are normally produced during the autumn and spring—usually early spring. However, inflorescences are produced sporadically throughout the year. Since the habitat waters remain relatively constant as to warm temperature the year-round, the panicles are rarely affected by frost.

Flowers of the Texas wildrice are borne in a branching panicle. The individual flowers (florets) are rather large and are unisexual. The pistillate (female) florets are at the top of ascending or appressed branches and are the first to bloom. Staminate (male) florets, which bloom later, are suspended pendulously on lower spreading branches of the panicle. Separation of the flowers promotes cross-fertilization, which is further assured by early blooming of the pistillate flowers before the staminate ones on the same panicle release their pollen. Self-pollination is also possible.

Zizania texana has the capability of reproduction by seeds. Unfortunately it has little opportunity to produce viable seeds due to two situations: first, scattered and thinning clones; and second, floating debris covering and weighing down culms and panicles. The first reduces the opportunities for cross-fertilization, and the second precludes either cross or self-pollination. Floating debris from frequent cutting of aquatic vegetation in Spring Lake and city park areas is the most detrimental factor affecting the natural seeding capabilities of this plant. Therefore, it is highly unlikely that this rare plant is reproducing itself significantly by seeds.

Under present circumstances, Texas wildrice's principal means of reproduction is vegetatively by stolons. However, this method is not sufficient to assure a viable population.

Texas wildrice population size is declining to the point of extinction, not primarily due to natural fac-

tors but chiefly to man's modifications of the habitat, wanton destruction and collection of individual clones or clumps of the plant, floating freshly cut aquatic vegetation debris, and local pollution of the stream. Presently, *Zizania texana's* thinning population is found only in the lower one and one-half miles of the natural habitat area. This section is downstream from the San Marcos city park dam and is 60 percent of the entire habitat and is not the most favored. From recent surveys, it is estimated that approximately 2580 square feet or 0.6 acres of basal area is all that remains of the *Z. texana* population.

Zizania texana has been completely eradicated from the upper reaches of the San Marcos River, which includes Spring Lake and the city park area. This has been accomplished by selective grubbing, cutting, and streambed plowing or harrowing by city park and Spring Lake maintenance personnel. Texas wildrice is not permitted to reestablish and grow in this portion of its natural habitat. Locally it is considered as a weed and an obnoxious aquatic grass and is treated as such.

Intense activities of plant collectors have a marked effect upon the Texas wildrice population. Those involved in commercial aquatic plant activities regularly pull out economically unimportant aquatic plants not suited for aquaria and replace them in a gardening operation by saleable species. Such activities disturb the stream and lake bottoms and physically dislodge the economically unimportant perennials which include *Z. texana*. Collections made by students, plant collectors, and aquaria enthusiasts also contribute to the population decline.

Since the headwaters area of the San Marcos River is situated in a densely populated and high-use area, *Zizania texana* habitat waters are subjected frequently to pollution by inflows of the city storm drainage system, occasional raw sewage leakages, and normal watershed runoff from streets, highways, railroads, and recreational areas. The pollution activities degrade the

habitat and have a detrimental effect upon the plant population.

For reasons as yet not understood, this relict *Zizania texana* population continues to exist—remain relatively vigorous in stable environment of the Marcos River.

Historically and scientific little is known about Texas wildrice. Since it is habitat specific and economic importance is unknown, only limited interest is expressed in this rare species. Studies and investigations so far have been by a few concerned individuals.

Texas wildrice is closely related to Annual wildrice (*Zizania aquatica* L.), an economically important annual plant which grows abundantly wild in cool, marshy areas in northern, central, and eastern portions of North America but west of the southern Mississippi River into Texas. Grains of this annual species are edible and used as table food. However, *Zizania texana* is not closely related to Common white rice (*Oryza sativa* L.), an annual cultivated cereal of high economic value. Nor is *Z. texana* closely related to Southern wildrice (*Zizaniopsis miliacea* Doell. Asch.), a coarse perennial forb plant resembling *Zizania* and found along banks of ponds and streams throughout most of Texas in favorable habitats. Texas wildrice does not appear to be closely related to *Zizania latifolia* Turcz. (Manchurian water-rice), a coarse perennial grass introduced from the Orient.

About 200 years ago Franciscan monks, while making explorations and working with the American Indians, discovered San Marcos springs on Saint Mark's Day and named them for the saint. In 1833 the area of the springs became Spanish landgrant. Fourteen years later two ranches were located nearby to be followed by 200 wagon loads of settlers and pioneers. This was the beginning of modern man's impact upon the natural habitat of the Texas wildrice. Prior to the influx of people, the prime dangers to the *Zizania texana* population were those of habitat alteration by natural phenomena which

could alter significantly the spring flows, local geography, and water chemistry.

Scientifically, first attention given to Texas wildrice was in August 1892 by G. C. Nealley, a botanical collector commissioned by the U. S. Department of Agriculture to explore southwest Texas for grass and forage plants. He reported his find of an aquatic grass growing in the springfed headwaters of the San Marcos River as a variety of *Zizania aquatica* (Annual wildrice). In the late 1920s, W. A. Silveus, an agrostologist of San Antonio, collected specimens of the aquatic grass at San Marcos from the running water. The plant material was so scant that its distinguishing characters were overlooked. Once again it was called *Zizania aquatica*. Later Silveus noted some taxonomic differences and felt that this plant may be a new species. He asked A. S. Hitchcock, an eminent agrostologist and widely travelled plant explorer, to verify his latest observations. Hitchcock confirmed the grass to be a new species. The plant was officially named *Zizania texana* Hitchcock in 1932.

In his writing in 1932, Silveus commented that cattle had been

sticking their heads deep into the running water to graze on *Zizania texana*. He noted further that he did not see any of the grass growing out on the banks. In 1933, he noted that panicles of Texas wildrice were seen throughout the year and that the plant's growth in the water was so luxuriant that the irrigation company had difficulty in keeping the artificial lake (Spring Lake) and ditches clear. From these reports, *Z. texana* was very vigorous and grew abundantly for approximately 1000 feet behind the dam which impounds Spring Lake, in the two and one-quarter miles of river below the dam, and in irrigation waterways from the lake and along the river.

In 1967, Dr. W. H. P. Emery, Professor of Biology, Southwest Texas State University, reported in *The Southwestern Naturalist* some drastic *Zizania texana* population and natural habitat changes. He noted that there was only one plant of Texas wildrice growing in Spring Lake, none in the first half mile of the San Marcos River immediately below Spring Lake dam and through the city park, and only scattered clones below this point for the next one and one-half miles. From his observations, Dr. Emery

felt that the rapid decline of *Z. texana* population was probably due to the factors of floating cut aquatic vegetation debris from Spring Lake, streambed plowing in the city park area, plant collecting, and pollution of the stream.

Factors bearing upon the population decline of *Zizania texana* as suggested by Dr. Emery are supported in studies and surveys made during the period 1972-74.

Texas wildrice's existence is threatened with extinction as a direct result of man's stresses upon the rapidly dwindling population. Very little is known about this rare Texas aquatic grass, and its beneficial properties need to be determined. For continuance of this endangered species, the following actions are essential: 1) preservation and protection of the entire population and its habitat, 2) restrict or ban all collection and eradication activities. 3) re-establish the plant in the upper reaches of the habitat (Spring Lake and city park areas), 4) restrict release of cut vegetation debris into the stream, 5) effect stream pollution control measures, and 6) promote active research projects on the species and the habitat.

This bibliography is supplied by Mr. Harold E. Beaty for those who would like to read more about Texas Wildrice and its related species.

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