



Manoomin (Wild Rice) Seeding Guidelines

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Preface: The following manoomin seeding guidelines are written for a general audience, and primarily from a biological perspective. In the Anishinaabe world view, an interaction of this sort with manoomin should be conducted in a respectful and culturally appropriate way. This may include things like explaining the project to the manoomin, feasting the manoomin, and offering asemaa (tobacco) to the manoomin and the nibii (water) being seeded. While these things will not be discussed further in this document, you are encouraged to consider them as part of any restoration effort.

MANOOMIN (WILD RICE) SEEDING GUIDELINES

INTRODUCTION

Manoomin has tremendous ecological, cultural, and subsistence values, yet its abundance has declined across much of its range since European contact. As a result, many natural resource agencies and private individuals are interested in seeding manoomin to restore historic beds or to establish new beds in areas of suitable habitat. This interest may be as localized as an individual who hopes to establish rice on a private wetland to enhance their opportunity to view or hunt wildlife, or as broad as an agency's interest in reestablishing some of the historic abundance of rice on a landscape level. At any scale, there are a number of social and ecological considerations that should be made to determine if a site is suitable for seeding, to maximize the likelihood of success, and (depending on the site) to minimize possible conflicts with other resources or resource users.

These guidelines are the product of nearly 3 decades of seeding efforts which have been conducted by GLIFWC and its cooperators. While not hard and fast rules, they should provide useful guidance to individuals interested in attempting seeding projects - particularly to those individuals whose familiarity with manoomin is not extensive. They are intended only to be applied within the historic range of the plant, particularly within northern Minnesota, Wisconsin and Michigan.

The general approach to seeding outlined in these guidelines is intentionally low-tech and low-cost, to have the widest application in the most efficient manner. However, despite the significant amount of experience and ecology that have been incorporated into these guidelines, manoomin establishment retains a component of art as well as science. Any particular location is likely to have some unique characteristics that are difficult to address in a set of general guidelines. We encourage any group or individual interested in pursuing a seeding project to contact GLIFWC staff, both to gain possible assistance in project evaluation and to contribute to the refinement of these guidelines as new understanding is gained through the success or failure of each seeding effort.

BACKGROUND

Wild rice (a term applied to both *Zizania palustris* or northern wild rice, and *Zizania aquatica* or southern wild rice) is an aquatic plant with significant ecological value. It is best known for its nutritious seed, which is a favored food of many species of ducks, geese and swans. Production can be substantial, with an acre of wild rice yielding well over 500 pounds of seed under good conditions.

Manoomin has other ecological values as well. It provides good cover and brood rearing habitat for waterfowl and other wetland birds, while muskrats, deer, geese, swans and other herbivores readily feed on the green portions of the plant. Wild rice beds can be important nursery areas for young fish and amphibians, and they



A dense manoomin stand can produce hundreds of pounds of nutritious seed per acre, a boon to both wildlife and human harvesters.

attract rails, red-winged blackbirds and other species of birds in the fall. Rice beds can also help maintain wetland water quality by tying up nutrients, stabilizing loose soils, and forming a natural windbreak over shallow-water areas, preventing soil nutrients from being stirred into the water column. Living and decaying straw from this annual plant supports high populations of invertebrates, the building block of the food web for many wetland-dependent species.



Manoomin's dense root masses help stabilize soft sediments, keeping nutrients out of the water column.

Wild rice also has significant historical and cultural value. Its seed has long been a staple in the diet and traditions of Native Americans living within its range, including the Ojibwe (who refer to it as manoomin), the Menominee (who take their name from this plant), and the Dakota. It also has long been an economic commodity, traded with the early fur traders and voyageurs, who also came to rely upon the nutritious seed for survival.

Although once a fairly common plant within its range, many historic wild rice beds have been lost to various human-induced alterations of the landscape. The damming of lakes and rivers and the artificial control of water levels has likely led to the greatest losses, but pollution, heavy boat traffic, the introduction of invasive species and other factors likely have contributed to the decline. Some lakeshore owners, boaters, and even anglers view rice as a nuisance plant. Beaver can negatively impact manoomin by raising water levels beyond the range of suitable depth. Climate change likely poses new and significant threats to northern wild rice, the species which is critical to human harvesters. The need for stewardship is real and substantial.



Native Americans have harvested manoomin for centuries.

HABITAT REQUIREMENTS AND LIFE CYCLE

Anyone considering seeding manoomin should have a basic understanding of its habitat requirements and life cycle before proceeding.

Habitat Requirements

Water: Rice requires flowing water. Examples of optimal locations include slow-flowing river meanders, flowages and lakes that have inlets and outlets. Intermittent, seasonal flow may be adequate, but rice abundance may fluctuate more between years on these sites, or it may fail to persist altogether.

Water depth is critical. Rice grows best in about 0.5-3 feet of water, with the middle of this range being optimal. Although rice may grow in slightly deeper water, especially on the outer edges of beds and in areas of optimal habitat, these plants often do not successfully produce seed. Most beds need to have a significant portion of their area in the more optimal depths to persist. It is unwise to try to establish a bed that would be predominantly in 2.5+ feet of water, particularly where water level fluctuations are substantial.



Little Rice Creek provides the water flow needed to support rice on Gary Lake in Oneida County, WI.

Clearer water is preferred, as darkly stained water limits sunlight penetration and may hinder seed germination and early plant development. However, rice beds can be supported on moderately stained waters, particularly when water depths are limited. Water pH in most beds is in the 6.0 - 8.0 range; wetlands characterized by “boggy” species indicative of acidic conditions should be avoided.

Within a particular year water level fluctuations should generally be limited to approximately 2 feet or less, and a foot or less over the growing season. Generally, water levels that are relatively stable or decline gradually during the growing season are preferred, and sudden, prolonged increases during the floating leaf stage (see below) should be avoided whenever possible. However, it is equally important that water levels *not* be kept too stable over the long term (multiple years). Long-term stability will tend to favor perennial vegetation over an annual like wild rice, which benefits from occasional ecological disturbances, such as high or low water years.

Soils: Several inches to a foot or more of soft organic muck is considered ideal. However, rice will grow on a variety of bottom types, including moderately sandy or rocky types when other site conditions are optimal. Although extremely flocculent (unconsolidated) bottoms may be unsuitable, moderately flocculent sites are a preferred habitat type, as manoomin is able to establish itself on sediments too soft for many other aquatics. Areas high in sulfates/sulfides should be avoided, as studies in Minnesota indicate that rice growth declines in areas with more than 10 ppm sulfates, and largely ceases above 50 ppm. (In most areas, sulfate/sulfide levels will not be limiting unless they have been elevated as a result of human activity such as mining.)



Boat traffic can exclude rice from otherwise suitable areas.

Existing Vegetation: Generally, you will want to avoid sites with excessive amounts of well-established, perennial vegetation. However, it may be possible to induce a disturbance where competing vegetation is significant. For example, where water control exists, it may be possible to reduce perennial vegetation with an over-winter drawdown of 2-3 feet as needed. Occasional increases in water levels may also be effective. Private individuals considering water level manipulation should contact their state and/or tribal natural resource departments, as a permit is usually required for this activity.

Wave Action: Waves from heavy boat traffic can exclude rice from otherwise suitable areas (see picture previous page). However, if the boat traffic is restricted to channels, rice can generally establish itself on adjacent areas. Establishing defined boating channels or slow/no wake zones can minimize the negative impacts boats might otherwise cause.

Manoomin Life Cycle

Wild rice is an annual aquatic grass. It is unusual in that it goes through submerged, floating-leaf and emergent stages in the course of its yearly life cycle.

Wild rice seed normally needs to spend several months under freezing or near freezing conditions in order for germination to occur. After spending the winter in the sediment, the seed begins to germinate in early spring, and by mid-May a cluster of short, underwater leaves begins to form. Subsequent leaves eventually reach up to the water's surface and float upon it, in what is termed the "floating leaf stage," typically by early to mid-June. This is often considered a critical growth stage, for the buoyant plants can be uprooted from soft sediments by high wind or waves. Manoomin can also drown at this stage if water levels suddenly increase and re-submerge plants, which begin exchanging gasses with the air after the floating leaf stage is reached.



Manoomin in the floating leaf stage.

By late June, the aerial shoots break the water's surface and the plant becomes an emergent. The emergent stems will eventually reach a height of 2-8 feet above the surface. Plants may have a single emergent stem, or multiple tillers may develop. Tillering tends to be more pronounced in shallow water, and when the plant density is low. Each stem will produce a flower head at its tip if the stem is not browsed. The flowers begin to open in late July, with the tiny, white female flowers at the top of a stem opening before the larger, yellow/pink male flowers below them, promoting cross-pollination. Although bees often gather pollen from the male flowers, they do not visit the female flowers; pollination is accomplished by wind.



Male flowers in bloom.

The seeds generally begin to reach maturity in late August or early September, but maturation is variable. River beds tend to mature earlier than lake beds, shallow plants will ripen earlier than those in deeper water, and "main stems" will ripen before tillers. There also appears to be individual site variation with some lakes or rivers consistently being earlier or later than others. Seeds on a single stem also ripen gradually, with those at the top ripening first. Thus, the total period of seed maturation may last 2-3 weeks on a single water, and a month or more across a region. Mature seed drops from the stem and generally buries into the sediment fairly close to the mother plant; this limited natural seed dispersal is one of the reasons why manoomin benefits from reseeding efforts.

Because wild rice is an annual plant, it is important to realize that it will vary in abundance from year-to-year, sometimes dramatically. An old rule of thumb among rice harvesters is that a 4-year period is likely to have a boom year, a bust year, and a couple of middling years. Generally, the more water that flows through a site, the more consistent the production will be, likely as a result of continuous nutrient input.

HOW TO PROCEED WITH SEEDING

Site Evaluation

Site Ownership: You should determine whether the site you are interested in seeding is privately or publicly owned. The legal definition of private vs. public water varies from state to state, and from tribe to tribe, and may differ depending upon whether the site is a river, flowage or natural lake. In addition, the seeding of manoomin may be regulated in your area, so you should contact your state and/or tribal natural resources department, or any other landowners who may be involved or affected before proceeding. If you are considering planting within federal lands (US Forest Service, National Park Service, etc.), work with the appropriate federal agency to be sure that required environmental analyses have been conducted.

Site History: It is very helpful to have some knowledge of the history of the site before proceeding, especially if the site being considered is a natural body of water. In particular, a different approach may be needed to restore a historic rice water as opposed to establishing rice at a location where it hasn't previously existed. Try to determine if manoomin was ever present; if it was, it is important to determine how many years have passed since a bed existed, and what may have led to its loss.

You should not seed a site that has produced a crop within the past 8-10 years. On these sites it is possible that a viable seed bank still exists, but some other negative factor is affecting the rice. Perhaps a beaver dam has raised water levels, a downstream culvert was altered or the carp population has markedly increased. In these instances, it is best to try to determine and address the factor causing the decline, and give the remnant seed bank a chance to reestablish the bed before considering seeding. In some instances, it may be worthwhile to collect sediment samples to verify the presence or absence of a manoomin seed bank.

Site Suitability: You should make a field visit to the site to evaluate its suitability. Determine if the site has proper depths, water clarity and flow, soil sediments, and that competing perennial vegetation is not too dense. It's often best to visit the site in late July or August when any existing wild rice plants are the most obvious – but remember to look for plants which may have been browsed as well. A lake map or GPS is often useful for recording your observations. This evaluation is often best done from a canoe or kayak; marking 3-inch increments on your paddle can facilitate quick, frequent measurements of water depth. If you feel unsure of your ability to make the field evaluation yourself, seek assistance from a local natural resource agency.

Seeding

Seed Sources: There are 3 options for obtaining wild rice seed: harvest it yourself, buy it directly from a harvester, or purchase it from a wild plant nursery. There are advantages and disadvantages to each approach.

Harvesting the rice yourself is the least expensive, and it allows you to select the source of the seed and ensure its quality. Harvesting may also increase your understanding of wild rice habitat, and you may also be able to receive



Freshly harvested rice seed.

credit for your time, or the value of the seed gathered, if your seeding effort is being funded through a grant.

Gathering wild rice is not particularly difficult, and even relative novices can be successful. However, there are a few basic regulations which must be followed, and a state or tribal permit is often required. Novices should gain some understanding of appropriate and respectful harvesting techniques before gathering. One good way is to find an experienced ricer to mentor you; another resource is the Great Lakes Indian Fish & Wildlife Commission's brochure "*Harvesting Wild Rice in a Good Way.*"

You can also purchase rice directly from a harvester. One way to do this is to visit good ricing waters in your area during the harvest season. This approach will be moderate in cost (seed purchased this way in Wisconsin in 2017 was selling for around \$3 per pound; generally less in Minnesota) but still allows you to select a local seed source and assures the seed you obtain will be fresh. In some instances, it is also possible to buy seed from tribal natural resource agencies, who typically have bought it directly from harvesters themselves.

The most expensive, but easiest approach is to buy seed from a wild plant nursery. This seed should be of good quality, but you likely will not know where the rice was originally harvested. Do not use any commercial variety of wild rice that is sold for use in the "paddy" or cultivated wild rice industry; this rice has been bred to grow best in cultivated conditions and is not appropriate for establishing natural stands. Use only wild-origin seed.

Should I plant Zizania palustris or Zizania aquatica: Both northern wild rice (*Zizania palustris*) and southern wild rice (*Zizania aquatica*) are native to the region. The northern species grows across the region (but is more common in the north), while the southern one is more limited to southern parts of the region, where it is generally associated with river systems. Both have great value to wildlife, but the northern species tends to be shorter in height and has larger seeds – traits that are greatly favored for human harvesting. Typically, only northern wild rice is available from wild plant nurseries, although it may be sold as either *Z. palustris* or *Z. aquatica*.

In northern areas, northern wild rice should be planted. In the southern parts of the region, either variety can be tried. In all cases, it is preferable to obtain seed from a relatively local source when possible. If your site is southern and riverine and appears more suitable for the southern species, you will likely need to harvest the seed for planting yourself.

When to Plant: Fall planting is recommended, to allow the seed to overwinter in the sediments and naturally break its dormancy. The easiest option is to plant the seed within a couple of days of getting it. Immediate seeding is often the least amount of work, but it may have the drawback that some seed may be consumed by ducks or other animals during the remainder of the fall. For this reason, some people store the rice as described below, and plant it later in the fall when most of the duck migration has passed.

Spring seeding is sometimes done, but it must be done immediately after ice-out to be successful – and even then the seed may not break dormancy until another year has passed. Although rarely done, it is also possible to seed on the ice in late winter. The biggest benefit to this approach is that it is easy to tell which areas have been seeded and how heavily. Its drawbacks are that it is fairly labor intensive, and requires storing the seed for a long period of time. It can also be more difficult to determine that the appropriate areas are being planted, and shifting ice can move seed to unsuitable areas.

Seed Care: The viability of manoomin seed will decline if it dries excessively, heats up, or molds between harvesting and planting. (Wild rice that has been “finished” for human consumption cannot be used for planting.) As a result, it is generally best to plant rice as quickly as possible, and/or take steps to preserve its viability.

Rice seed is usually purchased in large plastic-weave grain sacks. (These sacks may be quite heavy, weighing 50 pounds or more.) For short-term storage (about 1-3 days) it is generally adequate to simply keep the seed cool and damp. However, if you are planning on doing this, you should make sure that the picker has not already stored the rice this way.

If seed must be stored for longer periods, it is best stored in cool, fresh, flowing water. A great option is to place the sacks in a cool, flowing stream (weighing them down to keep them from moving). They can also be stored in the shallows of a lake, or even in large water-filled tanks, if the water is changed regularly. These latter methods, however, will tend to not keep the rice as cool, and so should be used only for shorter periods of time. Alternatively, if you have the facilities, seed can be stored in a near frozen condition for long periods of time, if steps are taken to prevent drying.

Soaking bags of seed may attract muskrats or even bears. And any seed that is soaked for very long is likely to take on a rather rank smell. The smell itself doesn’t seem to reduce viability, but seed that has been allowed to mold will be hard to hand-broadcast, and likely has reduced viability. In all cases, try to keep seed out of the sun. Warm, wet rice may begin to ferment, generating heat and reducing viability.

Seeding Method and Rates: Seeding is best done from a canoe or small boat travelling slowly enough to ensure proper distribution. Scatter the seed by hand-broadcasting it as evenly as possible over the target area. (Break up any clumps of seed that may have formed in storage before broadcasting it.) It is not necessary to roll the seed into mud balls as some historical efforts have done. We recommend seeding at a rate of roughly 50 pounds per acre, as this level is generally adequate. However, this rate is suggested in large part because of financial concerns; existing beds typically seed themselves at much heavier rates. If cost is not a great concern, heavier seeding rates will not be detrimental, and may have some advantage in areas where heavy browsing by geese, swans or muskrats is a concern. Note that good quality seed is heavy and should sink quickly, but some lighter seeds or empty hulls (“floaters”) are usually present.



Rice is easily sown by hand.

Multiple-Year Seeding: On natural beds, the manoomin stand which grows in any particular year will be the product of at least 4-5 different years of seed production. It is generally beneficial to replicate this in seeding efforts by continuing to seed sites for multiple years. Although some seedings will show immediate response, it is best to begin each seeding effort with the expectation that it may take 3-5 years to determine if a site can be successfully established. A lack of results the first year could indicate that poor quality seed was used or that poor environmental conditions existed that spring, however, the lack of a first year response does not necessarily mean the site is unsuitable.



The results of a successful initial seeding.

Size of the Seeding Area: Because of its great attractiveness to various species of wildlife, small or linear stands of wild rice may be vulnerable to excessive herbivory, especially if habitat conditions are sub-optimal. Thus, seeding areas of less than an acre, or where the bed would be limited to a narrow band of suitable depth, are usually not recommended.

Where a large area of wild rice is the ultimate goal, it is generally best to begin with a test seeding of smaller areas 2-3 acres in size, and establishing some success on those sites before expanding into the labor and expense associated with larger seedings. You may wish to delineate the boundary of your seeding area using GPS technology to assist with follow-up monitoring.

Monitoring: It is very helpful to monitor seeding efforts. The first step is simply to document which areas were seeded, and the source and amount of seed planted. Depending on the project, a simple sketch on a lake map may suffice, or you may want to track the pathway of the seeding boat using GPS.

Over the subsequent growing season, make several visits to the site to document how plant development is proceeding, keeping detailed notes. If plants initially grow well but later wither and die, there may be a nutrient or disease problem; if plants grow well, but get nipped at/near the water line, heavy herbivory may be occurring; if no growth occurs, there may have been a problem with seed viability, the site may be unsuitable, or its suitability may have been affected by a temporary change in water levels or some other factor. A good response will confirm the suitability of the site and suggest the seeding can be expanded. It's often useful to take pre/post planting pictures of the area. Good monitoring is critical to determining future actions - and it's equally important to archive all this information in a way that can be retrieved by yourself or others in future years.

Exclosures: Exclosures, used to keep carp, geese or other herbivores out of recently seeded areas, are expensive, labor intensive, and generally unnecessary. Occasionally, however, exclosures can provide important insights into site suitability, or suggest why a historic bed may have declined. And certain geographic configurations can allow fairly large areas to be fenced off in a cost effective manner, allowing identified problems to be addressed. On Clam Lake (Burnett County, WI) for example, small exclosures were used to help establish that the rice bed was being negatively impacted by carp (later, underwater nets were used to exclude carp from a large bay of rice habitat).

Erecting exclosures on public waters requires a permit. Contact your state or tribal natural resource agency if you are considering using exclosures as part of a restoration effort.



Monitoring can help determine if excessive herbivory is occurring.



Exclosures suggested that carp contributed to the decline of rice on this lake (T. Havranek photo).

REASONABLE EXPECTATIONS

As noted above, wild rice abundance on established beds can vary significantly from year to year. This variability, which even includes occasional crop failures, is natural, does not require reseeding, and should be expected to occur on restored sites as well. However, long-term annual monitoring can help determine if a bed is declining. If a well-established bed gradually weakens over several years, it may suggest that water levels are being held too stable, or that some disturbance is needed to benefit the rice. If you have concerns, contact a natural resource biologist familiar with manoomin management or the Great Lakes Indian Fish and Wildlife Commission for assistance.



Annual variation in abundance should be expected with manoomin.

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