

Setting up an integrative research approach for sustaining wild rice (*Zizania palustris*) in the Upper Great Lakes region of North America

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Abstract

Culture, cultivation and landscape change form the basis of this integrative study in the Upper Great Lakes region of North America. Declining across its native range, natural wild rice provides sustenance as a food source and limited economic benefits to both Native Americans and Americans of European descent. Relationships to wild rice however differ greatly between the two cultures as the Native Americans have historically considered wild rice a sacred gift, while non-Indians view it more strictly as a resource. Cultivation takes place using a variety of methods, regulated by policies that are complicated by the national, tribal, state and provincial borders that bisect the region. The authors propose an integrative approach to studying this changing system using cultivation as a framework through which cultural relationships and landscape change are examined and synthesized.

Keywords: transdisciplinary; landscape change; culture; production; plant husbandry

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Introduction

Wild rice (*Zizania palustris*) is an aquatic grass, native to North America. An annual, wind-pollinated plant, wild rice occurs in both natural and cultivated stands and is harvested for its highly nutritious seed. Once widely distributed across the eastern United States and southern Canada, wild rice is primarily found today in the shallow lakes and slow-moving streams of the Upper Great Lakes region (Oelke et al. 2000). Often covering vast stretches of open water so that they resemble fields, the natural wild rice found today is for all purposes the same ‘wild’ rice (non-domesticated) that Europeans first encountered when arriving in North America (Vennum 1988).

Wild rice has a long history of use by Native Americans (First Nations) in the Upper Great Lakes region (Jenks 1900; Mather and Thompson 2000; Valppu 2000; Huber 2000). Harvesting rice for food, and hunting waterfowl within its aquatic beds, the Ojibwe (Chippewa) people were bound to wild rice through stories and subsistence. Legend tells of the historic Ojibwe migration westward along the Great Lakes to the land where “food grows on water” and ceremonies and customs surrounded its use and harvest (Vennum 1988; LaDuke 2003).

The Ojibwe, up until the early 1900s, were the primary beneficiaries of the market for wild rice. With the advent of mechanization and the movement to paddy production by Euro-Americans in the mid-1900s, the Ojibwe were almost totally removed from any market profits (Vennum 1988). Today, while nearly all of the world’s wild-rice production occurs in the United States and Canada, only a small fraction of the producers are Native Americans. The total production of wild rice in the 1990s averaged 11-14 million pounds (processed weight) annually, with paddy wild rice making up 87-94% of the crop and lake and river wild rice supplying the rest. The value of all forms of this crop is estimated at US\$15-\$25 million per year (USDA 1996).

Wild rice can be viewed as two entities – one an economic crop grown and harvested on private lands or cultivated in natural lakes (Canada) and the other a naturally occurring grain that grows in public waters and is available (through permits) to any resident who would like to harvest it. This second category, defined here as ‘natural wild rice’, is of particular interest in our research.

In 1999, a conference on wild-rice research and management was held in Carlton, Minnesota, USA. Representatives from Canada, the USA and Native American communities on both sides of the border participated. Papers presented during the conference highlighted wild-rice research from the perspectives of archaeology, ecology, management, genetics and reproduction, and conflict and concerns (Williamson, Dlutkowski and McCammon Soltis 2000). Absent from the research presented was a ‘big picture’ look at wild-rice landscapes across the Upper Great Lakes region. A report on the conference by the U.S. Environmental Protection Agency (1999) confirms the cultural tension around the issue of wild rice and wild-rice research, and calls for increased understanding of wild-rice distribution tendencies and candid discussions on who is managing the rice and for what purposes.

The question we pose for this research is: Under which circumstances are wild-rice landscapes increasing/decreasing? Our interest lies in addressing this question through the lens of landscape ecology, using cultivation as a framework to explore the influences of natural and cultural drivers on wild rice landscapes. This paper sets forth the reasoning for using an integrated research approach and proposes methodology to accomplish these goals.

Study area

Wild-rice landscapes, for the purposes of this study, are geographic areas shaped and influenced by human cultivation of wild rice (*Zizania palustris*) that currently sustain, or are known to have sustained in the past 150 years, harvestable acreages of wild rice. The study region is the Upper Great Lakes area of North America, encompassing the northern portions of Minnesota and Wisconsin in the USA and the province of Ontario, Canada to the north. This glaciated alluvial region, described by Jenks in 1900 (reprint 1977) as the 'wild-rice district,' contains many low-gradient streams connecting numerous lakes, often with substrates of mucky, organic sediments that support the largest remaining concentration of wild-rice growth in North America.

For this landscape analysis we are interested in the anthropogenic forces acting upon the landscape over the past 120 years and the effects on wild-rice distribution today. Beginning in the mid-1800s and lasting until the early 1900s logging stripped the land of trees and brought in roads and settlement behind it. Construction of dams for hydropower exploded in the 1930s, and the 1950s and '60s saw the beginnings of mechanical cultivation and paddy production. Within this landscape natural wild rice continued to survive, and in some areas thrive, yet overall distribution and abundance declined (Tynan 2001; Pillsbury and Bergey 2000; Vogt 2000; Drotts 2000).

Social system

When considering the wild-rice landscapes of the Upper Great Lakes region, the inclusion of human activities is essential. Tress and Tress (2001) identify landscape as the particular point where culture and nature come together. What makes wild rice interesting as a landscape study is that two significantly different cultures are involved in the management and cultivation of this natural resource and the relatively small land base falls under the jurisdiction of multiple nations (Figure 1).



Figure 1. National, state and tribal boundaries in study area

Issues of harvest and sustainability for wild rice are interwoven across the Upper Great Lakes in a complex association of political boundaries and water management. Since the majority of natural wild-rice production occurs on waterways that are public, management typically falls under state or provincial governments. However, wild rice growing within tribal reservation lands in the United States is governed by the tribes and not under the authority of the state or province. In between these two scenarios are 'Treaty Ceded Areas' which fall under state control but allow Native Americans to harvest wild rice under their tribal authority.

Behind all of this are the people who harvest rice, whether Ojibwe or Euro-Americans. Some harvest rice for subsistence, others harvest rice for recreation or economic gain, but they all bring a perspective and relationship to wild rice with them. For the Ojibwe, wild rice has often been a constant presence in their existence, defining family traditions and weaving through the history of their people. Euro-Americans have grown to enjoy the taste of wild rice, venturing out to purchase or pursue the wild grain as a family tradition, occasional hobby, or as serious gatherers. Conflicts have arisen, often as a result of cultural differences around harvest and cultivation issues. Mechanical harvesting, introduced in the 1940s, was quickly banned in the United States but encouraged in Canada. The early machines, in addition to being able to harvest in half an hour what two people in a canoe harvest in a day, extensively damaged the plants and removed up to 90% of the seed leaving less for next years crop (Vennum 1988). Today genetic mapping and bio-engineering of wild rice for agricultural production have raised voices of concern, especially in the Native American community, around the effects manipulated seeds will have on natural wild-rice stands (LaDuke 2003). Recognizing the history and cultural differences that underlie these areas of conflict and disagreement is important to moving forward in managing wild-rice landscapes for a sustainable future.

Cultivation

Archeological evidence from pollen records indicates that wild rice was probably present in harvestable quantities at various times within the past 9,000 years (Huber 2000). Evidence of processing and use of wild rice as a food source shows up in the archaeological record about 2000 years ago (Valppu 2000). In the United States and Canada, wild-rice use has been mainly associated with the Ojibwe (Ojibway, Chippewa) Indians of the Upper Great Lakes region, harvesters of this grain for the past three centuries (Vennum 1988).

The phrase 'wild rice' does not differentiate between rice that is harvested from natural stands and rice that has been planted and harvested in paddies. Although both utilize the plant *Zizania palustris*, the effort and technology invested to grow and harvest the crop are significantly different. Across the Upper Great Lakes region cultivation and harvest of wild rice occur in a variety of ways: through seeding of natural lakes, water-level manipulation to encourage growth on dammed flowages, centuries-old hand-harvesting, mechanical harvesting and the use of paddies for agricultural production.

All of these levels of plant husbandry can be found in the Upper Great Lakes region today, yet researchers have been slow to document influence on landscape change or the cultural relationships that have shaped them.

An integrative approach

Landscape ecology provides an appropriate interdisciplinary approach to the study of wild-rice landscapes. Support for this type of integrative approach is evident in the recent publication of books such as *Integrating Landscape Ecology into Natural Resource Management* (Liu and Taylor 2002), *Cultural Landscapes and Land Use* (Dieterich and Van der Straaten 2004), and *Sustainable Landscapes and Lifeways* (Buttimer 2001), which explore the utilization of landscape research towards issues of resource management across human-impacted landscapes and including society as an active participant.

Interdisciplinary landscape research, according to Fry (2001, p. 160), is that which “...endeavours to understand the underlying relationships between different subjects and develop theory across disciplinary boundaries to gain a transdisciplinary understanding of landscape processes”. Tress and Tress (2001) move further on this by describing transdisciplinary landscape research as coordinating scientific approaches from the natural and social sciences and involving society as part of the research process. Using an integrated approach in landscape research, influenced by systems thinking and transdisciplinarity, has been suggested in the literature as a means for bridging theory and practice, and moving towards a more ‘holistic’ understanding of landscapes (Palang, Mander and Naveh 2000; Naveh 2000; Bastian 2001).

Understanding the cultural and natural drivers that influence wild-rice landscapes can provide a knowledge base from which to develop more targeted resource management strategies for wild rice. Approaching wild-rice landscapes from a systems perspective we recognize the natural system or land base that supports the landscape, the social systems relating to cultural knowledge and beliefs about this landscape, and the interaction between these two systems that is manifested through cultivation. Of course, there are other external sociological factors such as economics, management and land use that influence this landscape but are not the focus of investigation.

Proposed methods

In this integrated research approach, cultivation provides a framework through which the cultural context is viewed to identify relationships and impacts on wild-rice landscapes. The basic question of whether or not wild-rice landscapes are declining or increasing and how cultivation and culture affect that change is addressed using a multi-scale scenario approach.

Initial investigations will identify wild-rice landscapes in existence today at a broad scale across the Upper Great Lakes region. Spatial analysis will be conducted exploring the multiple themes of dam structures, roads, settlement and land use in relation to existing wild-rice beds. Once this baseline regional data set has been developed, representative local sites within catchment basins can be identified for fine-scale analysis, utilizing the cultivation framework below.

Cultivation framework

William Doolittle (2000) identifies five levels of plant husbandry in *Cultivating Landscapes of Native North America*. The simplest level is gathering of wild foods, while the most intense is the planting, harvesting and tending of domesticated species (agriculture). Applying Doolittle’s levels to wild-rice plant husbandry we identify four levels across the Upper Great Lakes region: simple *gathering* on natural stands, by

two people using a canoe (used across the region); *encouragement* of wild rice through seeding of new rice beds and/or water-level management on dammed flowages; *cultivating* natural lakes by seeding them with wild rice and then mechanically harvesting them (Canada); and *agricultural production* of wild rice, the most intensive form, involving the construction of paddies, seed selection and planting, fertilization/protection and mechanical harvesting.

Two ricing sites will be selected for fine-scale analysis at each of these four levels of plant husbandry classification – one within reservation boundaries and one outside. Within each site a more in-depth analysis of landscape change will be conducted using aerial photos, historical documents, permit data and personal interviews. Personal interviews will also be used to gather information on the history of cultivation on that site, identification of participants, relationships to ricing, and perspectives on wild-rice sustainability. In Finland, personal thematic interviews were used to establish relationships and perspectives of various stakeholders involved in fishing. Similar to wild-rice landscapes, fisheries use in Finland has evolved from heavily subsistence-oriented base to a more tourism/recreational base and involves issues of private and public ownership (Salmi and Muje 2000; Tonder and Jurvelius 2000).

Conceptual model

The development of both qualitative (interviews and historical) and quantitative (permit data and landscape metrics) data sets up a conceptual model to identify the influences of natural and cultural drivers on wild-rice distribution. We have developed a format for this model similar to a Rose diagram in which the relative magnitude and direction of petals provide a visual pattern of influence or change (Figure 2). Within our research we are concerned with direction of change (increasing or decreasing wild rice) and the drivers influencing this change. The cultural and natural influences are the drivers.

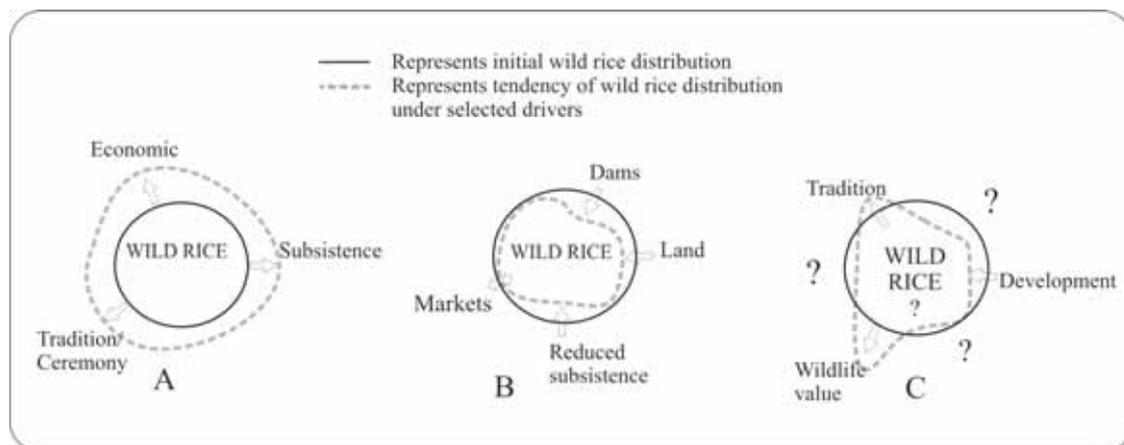


Figure 2. Influence of natural and cultural drivers on wild-rice distribution during three different time periods. (A) Pre-settlement (pre-1850s); during this time wild-rice distribution was expanding and natural drivers were relatively stable. (B) By the 1970s wild-rice distribution had begun to decline and the supporting land/water base had undergone significant changes, along with a change in dominant culture. (C) Today (2004) we recognize that multiple natural and cultural drivers are influencing wild-rice distribution, but the overall direction is unclear.

From the literature we can identify drivers that influenced wild-rice landscapes historically. Ojibwe sustenance, family traditions and economic trade in the period of European exploration appear to have maintained or expanded the distribution of wild rice (Jenks 1900). Within the last 50-plus years we have seen a decline in wild-rice distribution along with changing land use, increased settlement and changes in the hydrological regime. In addition we have new drivers, such as agricultural production (paddy rice), bio-engineering, regulation and management and competing resource use. How then are these drivers influencing wild-rice landscapes today?

Approaching this question through our framework of cultivation methods, and addressing the issue of culture (Ojibwe vs. Euro-American) by using paired sites, allows us to look at natural and cultural drivers under specific interactions. Two scenarios will be developed under each of the four cultivation approaches (*gathering, encouraging, cultivation and agricultural production*) using the conceptual model outlined in Figure 2. Natural and cultural drivers, identified from the literature, personal interviews and historical site analysis as having an impact on wild-rice distribution are then paired with landscape change and permit data to provide a visual pattern of current local wild-rice landscapes. When these data are looked at across the eight case studies, re-occurring patterns may emerge.

Brought together and connected by the landscape of wild rice, the case studies offer windows into the intricate interactions influencing wild-rice growth, harvest and distribution (Figure 3). The development of each scenario (circle) within the overall landscape framework should provide a more complete understanding of our interactions with wild-rice landscapes today.

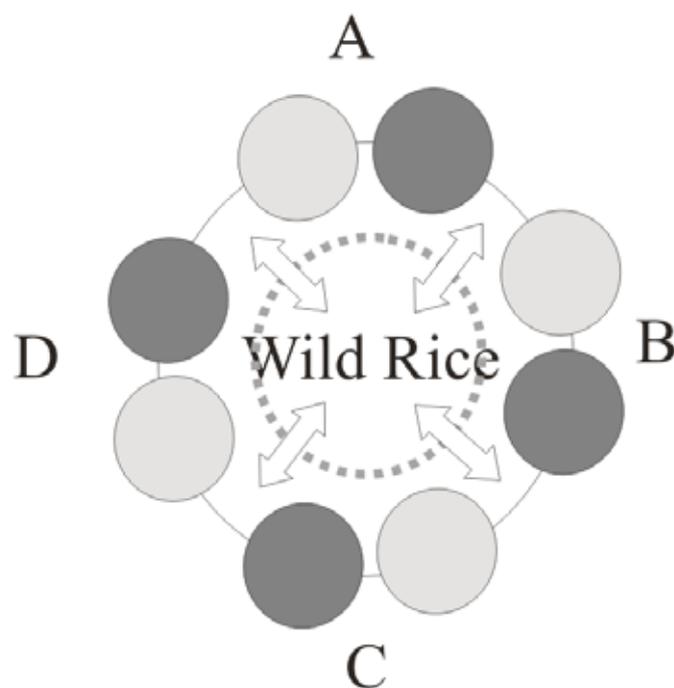


Figure 3. Conceptual model of integrative research. Filled circles represent the eight paired case studies, two each (Ojibwe and Euro-American) under A) gathering; B) encouragement; C) cultivating; and D) agricultural production. The eight case studies provide direction for the increase or decrease in wild-rice landscapes overall (middle circle) and are connected to each other.

Conclusions

This work is seen as a first step in the process of understanding the direction wild-rice landscapes are heading in the Upper Great Lakes region. There is much that this research will not measure, such as long-term hydrological flows, weather patterns, genetic variability of the wild rice, market influence and energy inputs. Measurement of wild-rice distribution is also constrained by the fluctuating nature of wild-rice populations from year to year.

This research will provide a baseline from which to measure future wild-rice distribution, case studies resulting in documented landscape change, and cultivation scenarios that provide an integrated look at the influences on wild-rice sustainability and cultural relationships. Resource managers looking to develop strategies for protection of wild-rice landscapes while managing human activities will find valuable tools and information in this study.

Not all people who value wild-rice participate in its harvest. Beginning our research with those who have an intimate connection through cultivation is a first step towards understanding the wild-rice landscapes of today. Further research will need to be done looking at new or existing drivers and changes in use or influence by social groups outside the realm of cultivation.

Acknowledgements

Opening photograph “Harvesting Natural Wild Rice”: Photo courtesy of the Minnesota Office of Tourism.

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