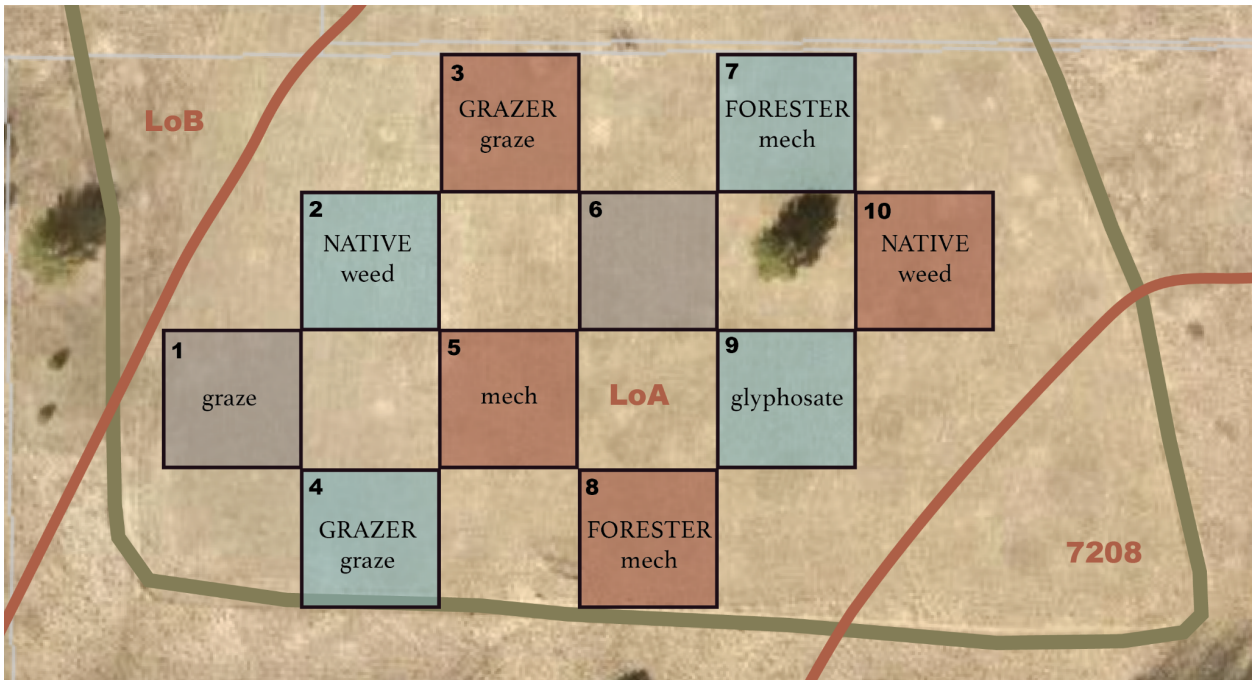
Reforesting a Door County Oldfield

An Experimental Approach to Land Restoration



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Version 1

A Target for Restoration & Research

The Crossroads campus exists as both a gateway to the natural beauty of the Door Peninsula as well as a site for education in the realm of environmental studies. The recent acquisition of a 4.5 acre oldfield parcel on the eastern front of campus has created an opportunity to connect Crossroads' users to an existing 10,000 acre contiguous forest of both private and public parcels which stretches from Sturgeon Bay to Jacksonport along the coast of Lake Michigan. This small piece of land holds the potential to be reforested into a stand of upland hardwood trees that would be exemplary of a healthy northern mesic forest. The path to attain this goal is an uncertain one, and this fact leads to the necessity of experimentation and the documentation of processes and results. The reforestation of the oldfield site will consist of long term research plots which seek to overcome past degradation, encourage active community participation in management and measurement and, ultimately, prescribe best practices to attain the desired result of a healthy native forest from an oldfield site.

Historic Use and Contemporary Consequences

Oldfield sites such as this are not uncommon throughout the Door Peninsula and the rest of Eastern Wisconsin. What was once an ancient mixed forest of unfathomable size and quality was transformed, within a generation, into cropland and homesteads leaving little to no mature stands intact. As the small 40 acre farm has given way to more industrialized production, plenty of parcels have fallen out of active agricultural use and been left fallow for years. Without active intervention in the remediation of the land, agricultural weeds and other undesirable species have the ability to colonize and retain an iron grip over any successional processes and would result in an unwelcome stasis. This site in particular is susceptible to such a condition.

The land has been used as a hayfield for the last twenty years with no obvious inputs to improve soil health or herbaceous quality. The Crossroads Land Restoration School (LRS) conducted a vegetative survey of the parcel in July of 2022 resulting in a list of 21 species, 18 of which were considered weedy and/or exotic. The Floristic Quality Index (FQI) of the survey was a 0.65 on a 10 point scale meaning the oldfield is of extremely low quality

relative to a native meadow. The LRS also conducted a two sample soil survey the same month to gather data on the health of the growing substrate in terms of available organic matter and essential nutrients for plant growth. The results of this test remain forthcoming as of this printing, but the samples show a poor color in regards to organic composition and no doubt lack in available nutrition for healthy crop growth without amendments.

The soil and vegetation conditions alone are cause for restorative action; however, it should also be noted that the surrounding landscape is largely devoid of the mature species we would hope to find in a more natural northern mesic disturbance. The mature maples, oaks and birch that would seed their replacements after a windthrow, fire or timber harvest event are not present within dispersal range. According to the expected tree data [see appendix] few of the species we would hope to be present to seed a successional forest are on site. One mature white pine (*Pinus strobus)* stands in the middle of the oldfield with more native pines on the western edge of the parcel that were deliberately planted within the last decade. Aside from these numerous white pines, there are a healthy amount of aspen saplings (*Populus spp.)* spreading into the field from the eastern edge, most likely as clones of the existing aspen that make up the fencerow of trees. On this fencerow to the east and south are a few large cherry trees (*Prunus spp*.) which would be welcome in our succession, as well as one large sugar maple (*Acer saccharum*) that serves as the only hardwood seed source nearby.

Considering now the undesirable seed source, there are a number of exotic Scotch pine (*Pinus sylvestris)* on site with one large specimen on the neighboring southern parcel which has the ability to seed out. Aside from these pines there are a number of aggressive and exotic shrubs on the southern and eastern edges primarily composed of honeysuckle (*Lonicera spp*.). These undesirable woody species could be seen as a threat to the long term rehabilitation of the oldfield and pose a challenge as the majority are rooted on neighboring parcels.

A Desirable Trajectory

Without action this oldfield has a likely trajectory of further degradation or, at least, a continued impaired stasis. Honeysuckle has highly aggressive tendencies and, like the parcel to the south, the oldfield site could very likely be impaired by it within a decade if not dealt with properly.

Historic and contemporary data, as well as ecological and aesthetic desires, help us to understand that a mature upland hardwood forest is a good and practical target of this oldfield parcel. The lack of representation of this habitat type within the Crossroads campus, and the surrounding landscape at large, are also justifications for this desired trajectory. The immediate neighboring parcels lack any complex forest cover and much of the contiguous forest to the east is pine-dominated upland or cedar-dominated lowland which does not include stands of hardwoods that we would like to see as examples of mature northern mesic structure.

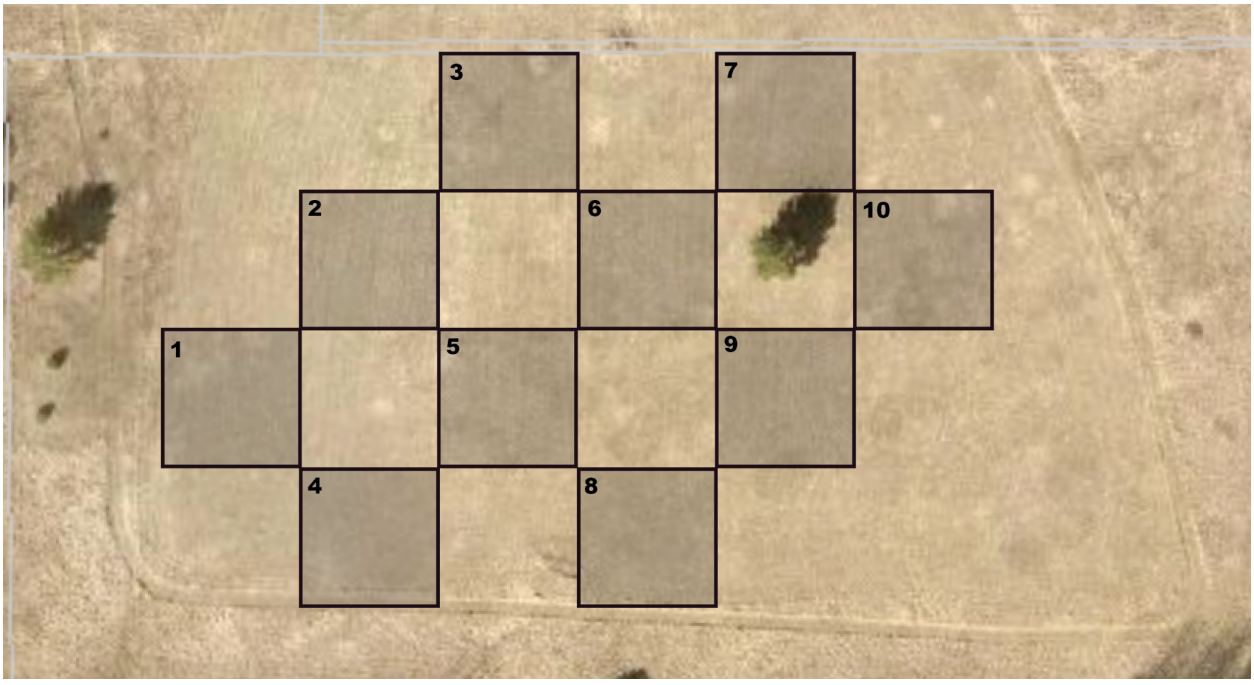
The Wisconsin Department of Natural Resources (DNR) has identified a number of natural communities throughout the state including the Northern Mesic Forest which we will use as our ecological reference model.[1] This forest community once dominated the landscape of Northeast Wisconsin and provided countless resources for natural and human communities alike. This broad forest community contains many local varieties such as sugar maple being co-dominant with beech (*Fagus grandifolia)* and hemlock (*Tsuga canadensis*) as well as more complex subcanopy and herbaceous layers.

The plan proposed here has an ultimate trajectory of being a mature beech & maple dominant forest with these main structural components being present. These large 100 foot trees take time to grow, of course, especially when starting from an oldfield site as we are. In an attempt to reach a “climax forest” the approach needs to approximate that of natural succession where certain pioneering groups of trees dominate for a period of time while changing the soil, ground layer and canopy for alternative species to take root. The first phase of this transformation hopes to achieve two things in the next five years - the establishment of a young forest from an oldfield, and a well documented pathway of how that goal was attained in order to be of practical use.

The Plan

Conducting research is part of Crossroads' mission, therefore this plan will seek to generate practical restoration data as well as reforest the land. The relatively homogenous nature of the oldfield site and the novelty of the acquisition makes for a good opportunity to experiment with a variety of different practices in regards to establishing an early successional forest. The three variables which will be tested are site preparation, herbaceous cover, and prescribed maintenance [see appendix].

The whole parcel is 4.5 acres with the interior (land within the current mowed path) being 3 acres. The 1.5 acres outside the path is subject to encroachment by surrounding species and has no prescriptive plan at this time other than the monitoring and removal of undesirable species on par with the rest of the Crossroads campus. Of the interior 3 acres, roughly 2 acres is defined as Longrie loam class A (0-2% slope). The reforestation plots will be laid out within this soil class as to negate variability in results due to underlying soil differences.



There will be 10 plots, each planted with the same mix of five species: red oak (*Quercus rubra*), sugar maple (*Acer saccharum*), paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*) and basswood (*Tilia americana*). These are based on three references to the vegetation found specifically on Longrie loam and one reference to the early seral stage of Northern Mesic Forest [see appendix].

The plots themselves will be 1/10th of an acre in area (66ft by 66ft, 20m by 20m) which are small enough to allow for practical management of the various prescriptions as well as ease of scalability (factor of 10) but large enough to foster a forest community and make a tangible impact on the reforestation of the entire parcel. In order to maintain distinguishable and measurable differences, each of the ten plots will be isolated from the others by un-numbered 'control' plots of equal size in-between. This will allow for more vigorous scientific comparison as well as 360° access to each plot.

Site Preparation

The first bifurcation in approach is informed by the question of, "Between fire and glyphosate, which is the best method for site preparation?" Multiple state agencies recommend some herbicide treatment in regards to existing ground cover on a site being planted with saplings.[2] [3] Research has also been done showing the efficacy of burning off existing vegetation to promote new tree growth.[4] What this plan prescribes is for four plots be treated with glyphosate in the manner in which the WI DNR recommends, and four to be treated with a controlled burn in accordance with the Wisconsin Prescribed Fire Council's standards.[5] Two plots will be left in oldfield condition as part of their treatment pathway. The specific details of each approach should be documented along with the costs and labor associated with each for each plot.

Herbaceous Cover

The second bifurcation in approach is informed by the question of, "Which of the three prescribed seed mixes is the best herbaceous layer?" At this decision point, four of the plots will be left unseeded and planted - two which were entirely unprepared and one of each chemically treated and burned. This is mainly to showcase the raw effects of fire and glyphosate on

the existing vegetation and soil but also to measure the differing effects that cover crops have on the saplings relative to the natural regrowth in vegetation. The three cover treatments are designed as follows:

Grazer mix - 60% perennial ryegrass, 40% fescue, 2% white clover
Forester mix - 100% winter wheat
Native mix - 23 species of wildflower and 6 species of grasses

The grazer mix is a blend of species recommended for both soil health and the diet of a grazing animal.[6][7] The forester mix suits the given site conditions based on DNR reforestation literature[3] and was recommended directly by Door County forester Jake Schroeder via email (July 21, 2022). The native mix is an alternative to exotic agricultural seed and is utilized as an example of an ecologically friendly and species-diverse cover crop.[8] The specific implementation of each of these crops should be informed by the literature but all require time and energy for seedbed preparation, germination and proper establishment months before tree planting can begin.

Tree Planting

Once the herbaceous layer of each plot is seeded or established, the planting can commence in the spring. The five tree species being used are available from the Wisconsin DNR's nursery which offers bare root saplings 2-3 years old. 100 trees of each of the five species will be planted - 50 trees per plot, 10 trees of each species per plot. They should be planted randomly within the plot, but should maintain a minimum of 6’ distance from plot edge and from any other tree. The trees should be planted in the same manner and at the same time in all 10 plots with a 5' tree tube placed around each after planting is completed. Best practices should be used in ensuring the survival of each sapling including timely retrieval from the DNR, proper handling, adequate hole size, proper planting depth, and sufficient watering immediately after being planted.

Five foot high tree tubes are available online to ensure saplings are protected from deer browse and other predation in their establishment years. 5’ cedar stakes are recommended for these tubes and can be made from locally harvested lumber acquired at Henschel Sawmill (4650 W Townline Rd, Carlsville, WI).

Plot Maintenance

The third and final bifurcation in approach is informed largely by the previous decision of which cover to plant but is also dependent on desired management input.

The Shropshire breed of sheep is being utilized around the world and in Door County for vegetative mowing as well as lamb and meat production. Plots 1, 3 and 4 should be grazed by the second year of planting as the cover will have established enough to be a viable food source for upwards of half a dozen Shropshire Sheep. Plot 1 could be grazed earlier if the natural vegetation is in need of a trim and the sheep are ready for a trial run. The use of sheep in silvopasture systems has the cost equivalent of a regular herbicide treatment but adds the benefit of soil improvement via excrement. Ideally these sheep are run all five years but are the most vulnerable variable to contend with as the flock's specific habits and health are subject to change. Overall, the hope is to show that pasturing sheep on a parcel of new saplings is a viable alternative to mechanical and/or chemical maintenance.

Plots 2 and 10 will require some selective weeding to ensure woody invasives are kept out, but ideally the native seed mix will hold its cover well across the five year trial while showing that a native mix can hold its own relative to more traditional covers while also benefiting the ecology and aesthetics of the plot.

Plots 5, 7 and 8 should be maintained via weed whacking or mowing, whichever is most practical over the five year trial. Weed whacking would require that 150 trees are individually attended to multiple times each growing season increasing the labor input whereas mowing would be faster but potentially more damaging and costly in terms of fuel consumption. The recommendation is for one to be tried consistently on all three plots for a season and perhaps adjusted the following season to try the other method of mechanical control.

Plot 9 should be the only plot with an extended chemical treatment regime whereby two or three times a season the area surrounding each tree tube is sprayed with glyphosate to kill back any encroaching vegetation.

Plot 6 is the only plot which should be left entirely alone for the duration of the five year trial to showcase the practicality of a hands-free method of planting. Perhaps the trial will show this is just as effective as more intensive methods of plantation establishment.

Staying the Course, Planning the Future

The ten plots all have the same goal of establishing a healthy early successional forest within five years but will attempt to attain this target by ten different approaches to allow for enough variation in outcome to begin to approximate best practice based on:

a) Total Cost (in dollars)
b) Total Labor (in hours)
c) Diameter at Breast Height (DBH) of planted saplings
d) Height Class of planted saplings (I: 0-3', II: 3'-6', III: 6'+)
e) Vegetative Survey using random transects across each plot with a 0.5m by 0.5m quadrat at equal intervals of 5m

By maintaining an ongoing record sheet, the workers and volunteers of Crossroads will be contributing to the establishment of research at this institution - research that has real world benefits to the surrounding community and the LRS students who come to learn more about the various practices being employed to restore the natural landscape.

Five years after the initial planting of saplings on these plots, the data can be amended with a conclusion and the study/plots adjusted for future management. The long term goal of reforesting the parcel into a Northern Mesic Forest of beech/maple dominance should remain in place, but new species based on the reference community could be incorporated over time including native shrubs and even ground cover as the canopy develops. Various other ideas can be trialed and executed within the 10 plots or between the plots in order to better understand the process of succession and the role we can play in assisting as ecological restorationists.

Appendix

Plot #	Preparation	Cover	Plant	Maintenance	Name
1	0	0	5' tree tube	graze	*raw graze*
2	glyphosate	native	5' tree tube	weed	*chem native*
3	burn	grazer	5' tree tube	graze	*grazing burned*
4	glyphosate	grazer	5' tree tube	graze	*grazing treated*
5	burn	0	5' tree tube	mech	*weed whack*
6	0	0	5' tree tube	0	*hands free*
7	glyphosate	forester	5' tree tube	mech	*chem prep*
8	burn	forester	5' tree tube	mech	*burn prep*
9	glyphosate	0	5' tree tube	glyphosate	*pure chemical*
10	burn	native	5' tree tube	weed	*burn native*

burn:	Create 6' firebreaks in late/summer fall by mowing vegetation surrounding plot. In spring (late April-early May, shorter firebreak vegetation should green up while plot remains burnable
glyph:	Mow the field during the summer, then allow at least 8 inches of new growth to occur in late summer and early fall. Apply a contact herbicide like Round-up or Accord (2 quarts per acre sprayed)*
grazer:	60% perennial ryegrass, 40% fescue, 2% white clover
forester:	Plant 1.5 bushels of winter wheat per acre as a cover crop in spring before planting trees
native:	1lb/0.1 acre land restoration seed mix $115
graze:	mob graze 4-6 ewes during growing season
weed:	hand pull "problem species" 1hr a month during growing season, amend plan as needed
mech:	weed whack 1' around base 1x a month during growing season

		N.Mesic Young Seral*	Lakeshore**	USDA***	NRCS****
Populus	tremuloides	x	x	x	
Betula	papyrifera	x	x		x
Quercus	rubra	x	x		x
Acer	saccharum	x	x	x	x
Tilia	americana	x	x		
Pinus	strobus		x		
Abies	balsamea			x	
Fraxinus	americana	x			

*	#1 in References
**	#3 in References
***	#9 in References
****	#10 in References

References

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