



PROPERTY OF

*The  
University of  
Michigan  
Libraries*

1817

ARTES SEQUITUR VERITAS

**A PLAN FOR THE SUSTAINABLE MANAGEMENT OF NATIVE  
ROUGHS AT CRYSTAL DOWNS COUNTRY CLUB**

by

Michael DeVries  
//

A practicum submitted  
in partial fulfillment of the requirements  
for the degree of  
Master of Landscape Architecture  
(Natural Resources)  
in the University of Michigan  
April 1994

Practicum Committee:

Assistant Professor Robert Grese, Chair  
Associate Professor Terry Brown

## **ABSTRACT**

This study details the history of long rough areas on golf courses and the philosophies on long rough of Alister Mackenzie and Perry Maxwell. It compares the British and American philosophies on maintenance with particular reference to long rough areas. Case studies of the treatment of long rough and natural areas at several old, distinguished golf courses and at several new golf courses are examined. This background information is then applied to Crystal Downs Country Club, along with the club's history of long roughs, the current plant species composition of the roughs, and the local area's native plant communities, to determine a management plan to provide for a sustainable system of maintaining native roughs at the club. Prescribed burning, mechanical removal techniques, and chemical applications are explored for their effectiveness in managing the natural areas with little-to-no impact on the environment and playability of the course. A prescribed burning plan is presented, with detailed mapping of the order of burning. A monitoring system is set up to assess the effectiveness of the burn program and to note changes in the long rough composition. Additional information provided includes a native plant species list for the golf course natural areas and a pre-burn checklist for prescribed burning precautions.

## ACKNOWLEDGMENTS

I would like to thank the following: Annie and Maggie for their inspiration and support; Robert Grese and Terry Brown for their insight, support, and review; Michael Morris for allowing me to implement this study, supporting it at Crystal Downs, and reviewing the rough draft; all the members of Crystal Downs who provided me with information and recognized the importance of the study; Tom Doak for employing me in 1988 and teaching me the finer points of golf architecture, as well as providing pictures for this document; Brian Lewis for his support, interest, and advice; Ian Grandison for his advice on graphics; the numerous individuals in the golf business for their assistance with information and insight; and to Arthur Hills for reviewing my proposal.

I dedicate this work to my grandfather, Robert Jennings Payette, Sr., whose love of golf, Crystal Downs, and the Crystal Lake area have influenced me to pursue the game for my enjoyment and work.

## THE TABLE OF CONTENTS

ABSTRACT	ii
ACKNOWLEDGMENTS	iii
THE TABLE OF CONTENTS	iv
THE LIST OF TABLES	viii
THE LIST OF ILLUSTRATIONS	ix
I. INTRODUCTION	1
The Statement of the Problem	1
The Importance of the Study	1
II. THE USE OF UNMAINTAINED ROUGH AREAS IN GOLF COURSE DESIGN	3
History of unmaintained, rough areas on golf courses	3
Rough Maintenance Standards	5
Dr. Alister Mackenzie's Philosophy on Rough	8
Perry Maxwell's Philosophy on Rough	10
Mackenzie and Maxwell Work with Native Vegetation Areas	11
Current Examples of Natural Areas on Golf Courses	14
Prairie Dunes Country Club	14
Shinnecock Hills Golf Club	16
High Pointe Golf Club	18
Chicago Golf Club	19
Olympia Fields Country Club	21
The Honors Course	21
Indianwood Golf & Country Club	22
TPC (Tournament Players Club) at Dearborn	23
Applewood Golf Course	24
Fox Hills Country Club	25

Sand Hills Golf Club	26
Orchards Golf Club	27
Summary of Case Studies	27
III. THE DESIGN OF CRYSTAL DOWNS	29
Description and History of the Site	29
Evolution of the Golf Course	30
Mackenzie's Opinion of the Rough Today	37
Native Plant Communities Relevant to Crystal Downs	40
Dunes	41
Meadows	43
Forests	44
Prairies	45
Composition of the Natural Areas of the Golf Course	47
Native Grass Species	48
Pest Grasses	49
Purposely Planted Grasses	49
Forbs	50
Native Species Not to be Encouraged	51
Pests	52
Woody Plants	52
Wildlife	54
IV. THE MANAGEMENT PLAN	55
Goals	55
Objectives	56
Management Strategies	56
Prescribed Burning	57
Zone A -- Self-contained	60

Zone B -- Wide open	62
Zone C -- Wide-to-fairly open	62
Zone D -- Hardwoods	62
Zone E -- Pines	62
Mechanical Removal Techniques	62
Chemical Applications	64
Target Species	67
Planting	68
Implementation	68
Sequencing for Burns	69
1 <sup>st</sup>	71
2 <sup>nd</sup>	72
3 <sup>rd</sup>	72
4 <sup>th</sup>	74
5 <sup>th</sup>	74
6 <sup>th</sup>	74
7 <sup>th</sup>	75
Monitoring	75
Visual Research Registration Viewpoints	76
V. SUMMARY AND CONCLUSIONS	80
BIBLIOGRAPHY	83
ADDITIONAL REFERENCES	86
APPENDIX A: Crystal Downs Native Rough Plant List	90
Grasses and Grasslike Plants	90
Forbs	90
Ferns	92
Shrubs	93



APPENDIX B: Glossary of Terms Related to Golf and this Study	94
APPENDIX C: Pre-Burn Fire Checklist	97

## THE LIST OF TABLES

Table 1	Distinguished Golf Courses with Natural Areas	11
Table 2	Native Dune Species to Integrate into the Rough	42
Table 3	Native Species of the Grass Zone to Integrate into the Rough	42
Table 4	Native Meadow Species to Integrate into the Rough	43-44
Table 5	Forest Species to be Integrate into Rough Edges	44
Table 6	Species to be Integrated that are Associated with Prairies	46-47
Table 7	Existing Grass Species to be Encouraged	48
Table 8	Existing Pest Grasses	49
Table 9	Grasses Purposely Planted	50
Table 10	Existing Native Forb Species to be Encouraged	50
Table 11	Existing Alien Forb Species Not to be Encouraged	51
Table 12	Existing Native Species Not to be Encouraged	51
Table 13	Existing Pests / Noxious Weeds	52
Table 14	Existing Native Woody Plant Species	53
Table 15	Existing Alien Woody Plant Species	53
Table 16	Main Species to Target for Reduction	67
Table 17	Visual Monitoring Chart	76
Table 18	Visual Monitoring Registration Points	77

## THE LIST OF ILLUSTRATIONS

Figure 1	British Rough Standards	7
Figure 2	American Rough Standards	7
Figures 3	Distinguished golf courses with natural areas	
	3a: Integration of golf course with coastal dunescape	12
	3b: Use of natural scrub and long grasses	12
	3c: Use of long grasses	13
	3d: Use of existing natural prairie composition	13
Figure 4	Close-up of Prairie Dunes natural prairie rough	17
Figure 5	Long rough on the 13 <sup>th</sup> hole at Shinnecock Hills	17
Figure 6	Long grass, sumac, and ferns. 13 <sup>th</sup> hole, High Pointe	20
Figure 7	Long grass (fescue). 8 <sup>th</sup> hole, Chicago Golf Club	20
Figure 8	Location Map of Crystal Downs Country Club	29
Figure 9	Hole #6, Goebel course	31
Figure 10	Hole #6, Goebel course	31
Figure 11	#9 Green overlooking the front nine holes (circa 1930's)	34
Figure 12	#18 Green from hill across from the clubhouse (circa 1930's)	34
Figure 13	#9 Green overlooking the front nine holes (1965)	38
Figure 14	View from #1 tee (1993)	38
Figure 15	Plan of the Crystal Downs Country Club Golf Course	39
Figure 16	Fire Control Sensitivity Map	61
Figure 17	Mechanical Removal & Mowing Map	65
Figure 18	Prescribed Burn Sequence Map	70
Figure 19	View from clubhouse to #18 green (circa 1930's)	73
Figure 20	View of #18 green area (circa 1990)	73
Figure 21	Visual Monitoring Registration Points Map	78

Note: Photographs for figures 1, 3b, 3c, 5, 6, and 7 provided by Tom Doak.

## **I. INTRODUCTION**

### **The Statement of the Problem**

The purpose of this study is to develop a management plan to improve the visual character and functionality of the natural area ecosystems at Crystal Downs Country Club through sustainable maintenance practices.

The process to acquire and assimilate information was varied and non-traditional. Old photographs, home movies, and descriptions, both written and verbal, of Crystal Downs were accumulated to determine the correct design and intent of the golf course from its inception. Personal contact, mainly through phone calls and written correspondence, was used to gather unrecorded information from knowledgeable individuals. This information was also related to visual information in the form of home movies and photographs from the 1930's to verify conditions of the site in its early days.

Traditional forms of research were also utilized. Studies and theories pertaining to golf course architecture and maintenance, native plants, prairies, and wildlife habitat were consulted to determine the appropriate practices to be undertaken.

### **The Importance of the Study**

This study is important to stress the promotion of native plants and processes in the maintenance of golf courses to improve the wildlife and plant diversity of a golf course and its surrounding area. It is important to

demonstrate the willingness of one of the world's finest golf courses<sup>1</sup> to develop a strong ecological management program that is sensitive to both the history of its course and the game of golf.

Recently, the popular press has increased the public's awareness of the use of chemicals on golf courses.<sup>2</sup> Whether the allegations are true or not, the use of any man-made product on a golf course is now viewed by the public as unnecessary and environmentally unsafe. It is important to provide alternative methods of maintenance which are publicly supported.

Parts of the unmaintained roughs of Crystal Downs are being taken over by invasive and exotic species. Hopefully, through the implementation of alternative, chemical-free, environmentally-sound maintenance practices, these problem species can be controlled. The use of these techniques at Crystal Downs could serve as a model for similar maintenance practices to be instituted at less distinct or newly built courses.

It is important to demonstrate the ability to integrate natural areas into the design of golf courses, how to manage them economically as well as ecologically, and so they are aesthetically pleasing and playable for golfers.

---

<sup>1</sup>Crystal Downs is ranked by *Golf* magazine as the 15<sup>th</sup> best course in the world and by *Golf Digest* magazine as 14<sup>th</sup> in the U.S.A. *Golf*, (vol. 35, #11, November, 1993), p. 75, and Ron Whitten, "America's 100 Greatest," *Golf Digest*, (vol. 44, #11, November, 1993), pp. 62-80.

<sup>2</sup>John Grossman, "How Green are these Fairways?," *Audubon*, (vol. 95, #5, Sept.-Oct. 1993), pp. 90-99; Mike Purkey, "Environment: Is golf a hero or villain? Sometimes the answer is both," *Golf*, (vol. 35, #1, Jan. 1993), pp. 66-67; and Bruce Selcraig, "Greens Fees," *Sierra*, (vol. 78, #4, July/Aug., 1993), pp. 70-77, 86-87.

## II. THE USE OF UNMAINTAINED ROUGH AREAS IN GOLF COURSE DESIGN

### History of unmaintained rough areas on golf courses

The links of Scotland where the game started

consisted of rich alluvial deposits of soil left upon sand dunes by a river as it flowed into the sea. True links, then, would be the golf courses formed by nature on or near river estuaries. The earliest Scottish links were designed entirely by nature. A typical links consisted of high, windswept sand dunes and of hollows where grass grew if the soil was reasonably substantial.<sup>3</sup>

Players would use the best areas available to play, trying to avoid the rough, sandy dunes where gorse, heather, and tough marram grass would grow, as these plants were more difficult to play from. Golf courses utilized the indigenous landscape as best as possible, designing holes with whatever vegetation nature had provided. Modern golf courses, on the other hand, have concentrated on using hybrid turfgrasses throughout the course, distinguishing the fairway from rough areas by differing levels of maintenance for the turfgrass .

The rough areas of the first golf courses were not always the ideal hazard, as it was often impossible to play a ball out of them or injured the

---

<sup>3</sup>Geoffrey S. Cornish and Ronald E. Whitten, The Golf Course (New York, Rutledge, 1987), p. 16.

unprotected players with the spiny gorse. The designers in the early part of the twentieth century "believed in fairly stalwart rough--the type called '4-iron rough,' meaning that, unless you were lucky, the 'longest' club you could hope to play from an average lie in the rough was the 4-iron."<sup>4</sup> Yet the tenacity of the rough areas challenged the players to do better than their best, and when successful, their triumph caused celebration.<sup>5</sup> Herein lies one of the golf's main psychological interests-- the defeat of some seemingly overwhelming landscape. The bigger and more vicious the hazard, the more enjoyment and sense of accomplishment it will bring when it is overcome. In addition, the natural diversity of the landscape was seen to enhance the game: "The great variety of landforms within an area of links land produces a variety of environments in which different types of vegetation will develop. It is this great variety in vegetation within the area of a links course which produces such a challenge to the golfer."<sup>6</sup>

Golf courses currently comprise large areas of recreational lands and a significant portion of that land is maintained at high levels. Some courses maintain the entire property that the course encompasses in hybrid turfgrasses while a significant minority leave part of the rough as "natural areas" with little or no maintenance. These natural areas represent a largely untapped resource for conserving a broad variety of indigenous grasses and plant life that is disappearing in today's world of hybrids, cultivars, and introduced plant species. In addition, these natural areas can represent a distinctive and important element in the play of a golf course and provide ecological and biological diversity at the same time.

---

<sup>4</sup>Herbert Warren Wind, "20<sup>th</sup> Century Designers and Their Methods," *Golf Digest*, (Dec., 1966), p. 38.

<sup>5</sup>Bernard Darwin, *Golf Courses of the British Isles*, (London, Duckworth & Co., 1910), p. 34.

<sup>6</sup>Robert Price, *Scotland's Golf Courses* (Aberdeen, Aberdeen University Press, 1989), pp. 100-101.

## **Rough Maintenance Standards**

The current British philosophy on course maintenance is similar to that of the past. British courses are not concerned with perfectly maintained turf throughout the golf course. Much of their rough is high native grasses, gorse, heather, and scrub; it is a tangled mess that looks, and can be, imposing. But, on occasion, it may provide a good lie from which to play your ball. Nonetheless, the character of the rough is in harmony with its site and changes with the surrounding landscape as the passing of the seasons takes place.

There are varying degrees of rough on a golf course in the United States. The "normal" rough is usually mowed to a height of 2-3 inches, with a collar of rough at 1-1.25 inches adjacent to the fairway in some cases. The "long" rough, if included, is beyond the normal rough and is usually an minimally maintained area, growing much higher and sometimes being incorporated into a "natural area." The predominant American vision of a golf course is one of immaculate, close-cropped turfgrass. A majority of the golf courses in the United States have been synonymous with a lush, green carpets of grass--in essence, artificial landscapes with little or no relationship to their surrounding environment. They are a maintenance-intensive land use with many non-native plant species introduced to the landscape. This image of golf is reinforced every April with the Masters tournament, the first major tournament of the year, played at Augusta National Golf Club in Augusta, Georgia. Each spring, the public is given a "look" at Augusta National, with "not a blade of grass out of place"<sup>7</sup> and flowers in full bloom. It is an image that is attained without a concern for cost and has caused Ron Whitten to term the Masters' appearance "The Look." It is "The Look" that

---

<sup>7</sup>Ron Whitten, "Perfection vs. Reality," Golf Digest (vol. 45, #4, April 1994), p. 124.



other American golf clubs unrealistically try to maintain without realizing that Augusta National is only maintained like that for the Masters, and that is a great week for golf, but it is not what regular golf courses normally look like.<sup>8</sup>

It is apparent that the British philosophy concerning playing conditions and maintenance is more relaxed than Americans'. They integrate what nature has provided for them to play on and do the best they can with it, not sacrificing the native landscape, but allowing it to create interest in their designs. Their philosophy is aptly described in this quote from the noted golf writer, Bernard Darwin:

There should as a rule be two degrees of rough, purgatory and hell. It seems unfair but it is often the case that the man who goes one foot off the course lies in the grass just as thick as he who goes twenty or forty. The moderate sin should only entail purgatory--there should be some chance of a startling recovery. And apart from grounds of abstract justice, hunting for lost balls is a sad nuisance both to ourselves and those who play behind us. That is another reason for not having the rough one uniform "hell."<sup>9</sup>

Darwin advocates that variety in the severity and extent of punishing rough will only increase the enjoyment of the golfers. If you happen to land in what appears to be an impenetrable tangle, but are lucky enough to find a good lie, then so be it. The golf course will fit in with the surrounding landscape better and provide interest to players. It will also serve as native shelter to many small animals.

---

<sup>8</sup>Ibid., pp. 123-126, 135. Note: Mr. Whitten does not condemn Augusta National or the Masters, only "The Look." It is also important to note that Augusta National was originally designed by Alister Mackenzie (with many revisions since then, including some by Perry Maxwell) and that the course, particularly around the creeks, was not maintained to today's maintenance standards until at least 30 years ago, as evidenced in the article by Mr. Whitten.

<sup>9</sup>Darwin, Bernard, "In the Rough," The American Golfer (New York, Random House, 1964-reprint from original 1922 serial), p. 26.



Figure 1: British rough standards--an inland course which utilizes heather and long grasses. 5<sup>th</sup> hole, Sunningdale (Old), Berkshire, England.



Figure 2: American rough standards--all rough grass maintained on a regular basis and no unmaintained areas. 11<sup>th</sup> hole, Oakland Hills, Birmingham, MI.

The American rough is more uniform in providing a consistent lie depending on where a golfer hits her ball; it more fairly assigns a lie to a player depending on where she hits it. This makes for an equitable game, but often leads to much land being highly maintained, even if the area is generally out-of-play except for the most poorly struck ball. This study is concerned not with the maintained normal rough, but with long rough, which has always had a place on the golf course at its origins in Scotland but has disappeared from many American courses. Darwin's "hell" rough has its place on golf courses and this management plan looks at methods to sustain this rough for both golfers and the environment.

### **Dr. Alister Mackenzie's Philosophy on Rough**

Dr. Alister Mackenzie was a Scottish physician who began practicing golf architecture as an avocation, gave up his medical practice by 1909 and then became one of the masters of golf course architecture. Many of his courses are recognized among the best in the world (see table 1) and he is credited with influencing golf architecture with the strategic design he employed with Bobby Jones at Augusta National.<sup>10</sup>

Mackenzie's design philosophy is frequently condensed into the thirteen principles he delineated in his book, Golf Architecture, and one of the most significant is the seventh, where he states, "The course should have beautiful surroundings, and all the artificial features should have so natural an appearance that a stranger is unable to distinguish them from nature itself."<sup>11</sup> Mackenzie's foremost thought in design was "to conserve existing natural features, and where these are lacking to create formations in the spirit

---

<sup>10</sup>Wind, Dec. 1966, p. 40.

<sup>11</sup>Alister Mackenzie, Golf Architecture, (London, Simpkin, Marshall, Hamilton, Kent & Co., 1920), p. 24.

of nature herself."<sup>12</sup> This would require Mackenzie to use not only the natural landforms but the native vegetation also, as a manipulated landscape can't blend into a natural one without using the same plant species.

Mackenzie sought a golf course with infinite variety: some long carries off the tee; formidable looking hazards to overcome; a safe route for the timid player and a more challenging, yet rewarding if executed correctly, route for the better golfer; as well as the absence of the annoyance of looking for lost balls. He specifically points out that rough grass is of little interest as it does not stir excitement in the player and yet is often more difficult to overcome, and that long grass bordering fairways makes bad golfers because it does not allow for a variety of playing routes to the green. While condemning long grass, he remarks highly about the use of rushes and whins on the links courses of Scotland as stimulating hazards to overcome. These native plants work to integrate the golf course into the surrounding landscape in a natural fashion. Mackenzie stated that "it is an important thing in golf to make holes look much more difficult than they really are. People get more in doing a hole which looks almost impossible, and yet is not so difficult as it appears."<sup>13</sup> Long grass utilized as a hazard to be overcome and thus providing strategy as well as penalty would stimulate the golfer in the play of a hole.

Mackenzie believed in allowing the natural diversity of a site to be utilized to create a unique challenge to golfers of all abilities. Many courses he was associated with used long grass and other rugged natural areas as elements of their strategic design. Long rough lining narrow fairways were

---

<sup>12</sup>*Ibid.*, pp. 37-38.

<sup>13</sup>*Ibid.*, p. 44.

not his intention, but providing for long rough areas in a variety of ways to continuously stimulate golfers would be very appropriate.

### **Perry Maxwell's Philosophy on Rough**

Perry Maxwell was Alister Mackenzie's design associate during the routing of Crystal Downs and served as the daily construction manager during the building of the golf course. His input into the course was instrumental in creating many of the fine details, particularly on the greens, where the heavy undulations are reminiscent of the "Maxwell rolls" found on many of Perry's green designs. Maxwell's Prairie Dunes course in Hutchinson, Kansas also has heavy roughs with native yucca plants, prairie grasses, and plum thickets bordering much of its golf course and the surrounding landscape.

Maxwell also believed in golf design that was as natural as possible. The limitations of dirt-moving in the first half of the twentieth century forced designers to cooperate with nature to create a design that was harmonious to the surrounding landscape. The lack of sophisticated maintenance procedures and equipment, and of budgets for them, meant that only the main areas of play (greens, tees, and fairways) received much attention. The rest of the course was unmaintained and essentially became "natural areas" that went to succession if not managed with periodic mowing or burning. These areas may not have been intended to be "natural areas" as we design or integrate them today; they were designed to take advantage of the ecosystems in the area and as natural features of the golf course due to the knowledge of the lack of maintenance they would receive. This provides

some validity to maintaining long, natural roughs on golf courses where it is not too restrictive to golf play.<sup>14</sup>

### **Mackenzie and Maxwell Work with Native Vegetation Areas**

The two designers of Crystal Downs created many of the world's finest golf courses, in reference to playability, aesthetic, and environmentally sound design standards. The following courses are recognized as some of the world's best, have been designed or redesigned by Mackenzie or Maxwell, and feature large expanses of native grasses, gorse, or scrub employed as strategic elements in the design or as borders to the holes.

**Table 1: Distinguished Golf Courses with Natural Areas**

<b>COURSE</b>	<b>LOCATION</b>	<b>DESIGNER</b>
Pine Valley Golf Club	Clementon, NJ	P.M.(r)
Cypress Point Club	Pebble Beach, CA	A.M.
Royal Melbourne Golf Club	Black Rock, Melbourne, Aus.	A.M.
St. Andrews (Old Course)	St. Andrews, Scotland	A.M.(r)
Merion Golf Club (East Course)	Ardmore, PA	P.M.(r)
Prairie Dunes Country Club	Hutchinson, KS	P.M.
Kingston Heath	Cheltenham, Melbourne, Aus.	A.M.
Royal St. George's Golf Club	Sandwich, England	A.M.(r)
Royal Troon Golf Club	Ayrshire, Scotland	A.M.(r)
National Golf Links of America	Southampton, NY	P.M.(r)
Royal Adelaide Golf Club	Seaton, Adelaide, Aus.	A.M.
New South Wales Golf Club	La Perouse, Sydney, Aus.	A.M.
Maidstone Club	East Hampton, NY	P.M.(r)
Victoria Golf Club	Cheltenham, Melbourne, Aus.	A.M.
Lahinch Golf Club (Old)	Lahinch, Ireland	A.M.(r)
Pasatiempo Golf Club	Santa Cruz, CA	A.M.
A.M.= Alister Mackenzie	P.M.= Perry Maxwell	(r)= redesign work

It is apparent from looking at these golf courses that natural areas played a large role in integrating Mackenzie's and Maxwell's golf courses into the adjacent landscape, and, from that, we can deduce that it is not

<sup>14</sup>J. Press Maxwell (son of Perry Maxwell), telephone interview, June 10, 1993.



Figure 3a: Distinguished golf courses with natural areas. Integration of golf course with coastal dunescape. 9<sup>th</sup> hole, Cypress Point, Pebble Beach, CA.



Figure 3b: Distinguished golf courses with natural areas. Use of natural scrub and long grasses. 10<sup>th</sup> hole, Royal Melbourne (west), Melbourne, Australia.



Figure 3c: Distinguished golf courses with natural areas. Use of long grasses. 14<sup>th</sup> hole, Lahinch Golf Club (Old), Lahinch, Ireland.



Figure 3b: Distinguished golf courses with natural areas. Use of existing natural prairie composition. 10<sup>th</sup> hole, Prairie Dunes, Hutchinson, Kansas.



inappropriate for Crystal Downs to have large sections of the course utilizing the indigenous vegetation as is now being done.

### **Current Examples of Natural Areas on Golf Courses**

Many well-established golf courses are currently managing natural areas with a variety of maintenance practices. The following syntheses will explore today's most pertinent procedures and how they may apply to Crystal Downs' rough management.

#### **Prairie Dunes Country Club**<sup>15</sup>

Prairie Dunes Country Club is a Perry and Press Maxwell design in the sand hills outside of Hutchinson, Kansas. Similarities abound between Crystal Downs and Prairie Dunes, primarily due to Perry Maxwell's influence on both designs, particularly in the green undulations and the use of long rough throughout the courses.

Although located in the middle of the Great Plains, the course occupies some of the finest links terrain in the world. The golf course contains extensive roughs with native prairie grasses (big bluestem, little bluestem, switchgrass, Indian grass, sand lovegrass, Eastern grama grass, Canada wild rye, and some sedges), yucca plants, and plum thickets which bring the beautiful, natural character of the surrounding landscape into the golf course.

Stan George, the golf course superintendent at Prairie Dunes, recognizes the importance of the roughs and instituted a management program for them in 1992. He utilized the expertise and assistance of many researchers and volunteers to create a progressive plan that calls for mowing

---

<sup>15</sup>P. Stan George, phone interviews and personal correspondence, May and June, 1993, and Feb. 15, 1994.

and prescribed burning of the roughs at regular intervals to meet the following objectives:

- increase native warm season grasses (prairie grasses)
- reduce cool season grass species which have been increasing in the rough areas
- reduce competition from non-desirable vegetation, including volunteer trees
- increase the amount of species of wildflowers
- enhance the appearance and health of plums and yuccas
- decrease wildfire hazard
- increase the quality of wildlife habitat<sup>16</sup>

The first prescribed burns were implemented in April, 1993. George "can't think of a negative"<sup>17</sup> impact from them and reports that the native grasses have re-established themselves vigorously. The yucca plants were a cause of some concern, but bloomed shortly after, just as the plums did.

The burns reduced the thatch layer in the roughs and allowed the native species to reassert themselves. Rainfall after the burn was considerably more than usual (40-42" versus a normal 27") and helped poison ivy and Virginia creeper to reestablish themselves. The rain also allowed some weeds to persist for a short period of time, but these were quickly crowded out. The density and height of the burned areas versus the unburned areas was similar, with the burned areas slightly taller, but having more forbs in their composition.

The prescribed burns have met their objectives and plans for other ones, weather conditions permitting, are set for each ensuing spring. George's work is the most applicable example to Crystal Downs' roughs due

---

<sup>16</sup>P. Stan George, "Managing a Return to Natural Rough," letter to the membership of Prairie Dunes, June 1, 1992.

<sup>17</sup>P. Stan George, phone interview, February 15, 1994.

to the similarities in design characteristics and Prairie Dunes' composition of native species.

### Shinnecock Hills Golf Club<sup>18</sup>

Shinnecock Hills is a distinguished golf club on Long Island, New York, one of the original five USGA<sup>19</sup> member clubs, and has hosted many important national championships. Its site is at the eastern end of Long Island and occupies rolling, sandy terrain near the Atlantic Ocean and Peconic Bay.

The course is has long rough throughout the course. The rough composition includes native species (poverty grass, switchgrass, and little bluestem), and non-native species (Scotch broom, fescues, and orchard grasses).

Peter Smith, the superintendent, has been prescribing burns every April for the past seven years. Initially performed to reduce the prevalent tick population, burning is a familiar strategy in the agricultural and Native American practices of the area. He also bush-hogs the long roughs at six-to-eight inches 3-4 times-a-year to reduce woody plant growth. The native grasses come back the strongest from the burns, the Scotch broom burns out, and the fescues and orchard grasses maintain their populations. Smith also fertilizes the roughs, which may be the cause for the continuous need to bush-hog the rough to control woody plant growth. The fertilization will promote the cultured grasses more since the native species have their nutrient requirements met by the natural conditions.

Shinnecock's long rough program is more maintenance-intensive and

---

<sup>18</sup>Peter Smith, telephone interview, June 8, 1993.

<sup>19</sup>The United States Golf Association, founded in 1894, is the official ruling body of golf in the United States and, with the Royal and Ancient Club of St. Andrews, the rules for golf throughout the world.



Figure 4 Close-up of Prairie Dunes natural prairie rough



Figure 5 Long rough on the 13<sup>th</sup> hole at Shinnecock Hills

utilizes more inputs to maintain its present character. At this time, there is no plan to try to promote their native species more and reduce the present maintenance requirements. The fact the native grasses come back strongest from the burns reinforces the use of fire to reestablish a native species composition in the long roughs at Crystal Downs.

### High Pointe Golf Club<sup>20</sup>

High Pointe, located in Traverse City, Michigan, was built in 1988 with a very progressive vegetation plan. The design utilized the rolling, northern Michigan terrain to great effect and did not require much grading to create the greens, tees, and bunkers of the course.

Large expanses of old field meadow (non-native cool season grasses such as bromes, orchard grasses, and Timothy) and sandy, fern-laden pine plantations were left intact, with the maintained portion of the course seeded in fescue cultivars. The fescue grasses grow very favorably in the dry, sandy soils of the region and require less than half of the nutrient requirements, few chemical inputs, and considerably less water than other golf turfgrasses in the region. The long rough areas of the golf course are self-sufficient ecosystems and serve as excellent borders to the golf holes as well as integrating the golf course into the surrounding landscape. At this time, the long roughs do not receive any maintenance inputs and there is no specified plan to manage the roughs for native species in the future.

High Pointe is a prime example of how a new golf course can fit in with the surrounding terrain and be less maintenance-intensive.<sup>21</sup> Although High Pointe has many typical introduced meadow grass species in its rough

---

<sup>20</sup>Mike Meindertma, superintendent of High Pointe Golf Club, telephone interview, May 14, 1993.

<sup>21</sup>"Greatest Courses 1993," *Golf*, (November, 1993), p. 75. High Pointe is ranked as the 97<sup>th</sup> best course in the United States by *Golf* magazine.

composition, its geographic and ecosystem similarity to Crystal Downs makes it an excellent example of how a course can be built in accordance with nature.

### Chicago Golf Club<sup>22</sup>

Chicago Golf Club, outside Chicago, Illinois, is also a USGA charter member and distinguished club. Their roughs consist primarily of sheep's fescue and fine fescues, but have bluegrass, annuals, and barnyard grasses creeping in where irrigation overspray occurs.

Management practices consist of mowing and chemical use to control growth and to try to maintain their desired fescue monoculture. Mowing is performed around Memorial Day at a height of 6"-7" and twice in the fall, first at 6"-7" in September, and then at 4" in late October. Fire is not an option in this situation, due to tight property lines and expensive homes bordering the course.

A growth retardant is being broadcast spread from 30'-50' into the rough to slow growth in areas where irrigation overspray occurs. A battery-operated sprayer is also utilized to spot-treat problem areas where unwanted thistles, Queen-Anne's-lace, milkweeds, and volunteer trees appear.

Most importantly, Chicago Golf Club tries to not water the fescue. If watered, the fescue first becomes unruly and then is out-competed by annuals and bluegrasses. The management requires more input to maintain the desired fescue composition and no plans at this time are included to manage for native species.

---

<sup>22</sup>William Whitley, superintendent of Chicago Golf Club, telephone interview, June 28, 1993.



Figure 6 Long grass, sumac, and ferns. 13<sup>th</sup> hole, High Pointe



Figure 7 Long grass (fescue). 8<sup>th</sup> hole, Chicago Golf Club

### Olympia Fields Country Club<sup>23</sup>

Olympia Fields, located near Chicago, Illinois, is another old established golf course and former site of several U.S. Open golf championships. It has two golf courses with typical cultivated species used for ornamental reasons. The club is now implementing a native plant and ecosystem program to replace introduced plants with indigenous species and to reduce the course maintenance requirements.

The majority of the restoration is woodland species, but there is also an open area slated for an oak savannah. Plugs, plants, and seed of prairie dropseed, cordgrass, bluejoint grass, junegrass, big bluestem, little bluestem, switchgrass, and Indian grass will be incorporated and forbs are to be introduced at a later date. At this time, no management plan has been set up, but Tom Voigt, a turfgrass extension specialist at the University of Illinois who is overseeing the plan, will coordinate the effort.

Olympia Fields' native planting program is significant because it demonstrates the willingness of clubs which have been maintenance-intensive to re-evaluate their organization and focus their efforts on ecological, as well as economical, improvement.

### The Honors Course<sup>24</sup>

The Honors Course, near Chattanooga, Tennessee, is a ten-year old Pete Dye course ranked twenty-ninth in United States.<sup>25</sup> Bluegrass, which is now being out-competed by Bermudagrass, occupies the irrigated short rough (40' wide). Jamestown fescue was seeded throughout the rough, but

---

<sup>23</sup>Tom Voigt and Dave Ward (superintendent at Olympia Fields), telephone interviews and written correspondence, May, 1993.

<sup>24</sup>David Stone, telephone interview, May 14, 1993.

<sup>25</sup>Whitten, "America's 100 Greatest," Golf Digest, (vol. 44, #11, November, 1993), pp. 62-80.



only survived in the shaded areas of the course. This led David Stone, the course superintendent, to seek sun-loving grasses growing in unmaintained areas. His search found three predominant grasses, weeping lovegrass, broom sedge, and KY31 (an aggressive fescue perennial), which he now utilizes in his low-maintenance areas.

Stone's management for these areas includes 1 pound of Nitrogen fertilizer to maintain a healthy environment that keeps weed species out, chemical spraying of invading woody plants once every five years, and an annual mowing. Primarily, he lets the areas go through their natural stages, thus allowing the grasses to blend in better with the surrounding terrain and change with the seasons.

The Honors Course's low-maintenance areas represent a more managed approach to long roughs of non-native species, yet they achieve the desired effect and are less intensive to maintain than the rest of the course.

### Indianwood Golf & Country Club<sup>26</sup>

Indianwood, north of Detroit, Michigan, has been, and will be again in 1994, the host for the U.S. Women's Open Championship. It is an old course with long fescue roughs maintained between the holes and wildflowers in particular "showy" areas.

The roughs have no irrigation and minimal maintenance is performed on them for most of the year. Each fall, they are mowed to 3-4" with a deck mower and sprayed with a boom for weed treatment. Problem areas are spot treated as needed and milkweed plants are pulled by hand to reduce the seed source and to try to remove the roots. During tournament years, 0.5 pounds of Nitrogen fertilizer with a weed suppressant is applied to invigorate the

---

<sup>26</sup>Mark Jackson (superintendent at Indianwood), telephone interview, June 11, 1993.

grasses. If necessary, some overseeding is performed with sheep fescue, chewings fescue, and Reliant and Aurora tall fescues.

The Indianwood roughs are more maintenance-intensive and lack a native plant palette, yet the effect is very effective and serves the design of the course well.

### TPC (Tournament Players Club) at Dearborn<sup>27</sup>

The TPC of Michigan, designed by Jack Nicklaus in 1990, is a new golf course in Dearborn, Michigan, where the Senior Players Championship tournament is held every year. It utilizes long roughs to buffer mitigated wetland areas and as borders to golf holes throughout the course. The short, maintained rough composition is 65% fine fescue, 25% bluegrass, and 10% perennial rye. The mitigated wetland areas are composed of thirty species native to the Rouge River floodplain, with emergent, sub-emergent, and wet meadow species delineated into different zones.<sup>28</sup>

Mike Giuffre, the course superintendent, tries to minimize herbicides and fertilizers whenever possible and to use hand removal techniques to extract unwanted plant material. Verti-cutting to remove duff, combined with 0.9 pound of fertilizer to stimulate growth, is done in the spring. A mowing is performed in the fall to remove other thatch and to help prevent plant suffocation. Hop-clover has been problematic and is spot-treated with Round-up or manually dug up. Giuffre feels the fertilizer is necessary for good growth and to prevent weeds from out-competing the grasses.

This is a young course and still immature in many ways. The fertilization may be encouraging the growth of non-native weed species over

---

<sup>27</sup>Mike Giuffre (superintendent at TPC of Michigan), telephone interview, June 10, 1993.

<sup>28</sup>Hank Byma, personal interviews, February 25, 1994, and March 3, 1994, and his presentation on TPC at the Wildflower Association of Michigan Annual Spring Meeting, March 7, 1994.

the native species. The long rough is now receiving more input than is probably necessary and needs time to develop a more natural state if it is to become truly low-maintenance.

### Applewood Golf Course<sup>29</sup>

Applewood, located in Golden, Colorado, is a Press Maxwell design which has reintroduced shortgrass prairie to its golf course in an effort to conserve water and nutrient inputs. The course has been pesticide-free since 1989 and has reduced its other maintenance inputs by intensively maintaining only the tees, greens, landing areas, and approaches, a total of twenty-seven acres. The other "play" areas of the course utilize fescues and ryegrasses which are irrigated to 50-60% of the evapotranspiration levels to prepare the turf for drought periods when water is not available.

Short rough areas consist of 40% hard fescues and 40% old bluegrasses which survived from the former, intensely irrigated days. The remaining 20% was dormant-seeded with buffalograss, blue grama, and wheatgrass to test their tolerance to drought and traffic. Forty acres of the course consists of native shortgrass prairie (wheatgrass, blue grama, buffalograss, needle and thread, green needlegrass, creeping foxtail, purple three-awn, and sand dropseed), areas which require little-to-no input and promote wildlife on the course. A prescribed burn program is being coordinated with the local fire district to manage the prairie. Unfortunately, the shortgrass prairie areas are not really "in play" for the golfers and therefore are not utilized well as strategic elements in the design.<sup>30</sup> This effectively reduces the integration of the golf course with the existing natural

---

<sup>29</sup>Ron Conard, "Applewood Golf Course: Reintroducing the Shortgrass Prairie and Links-Style Golf," USGA Green Section Record, (November/December, 1992), pp. 11-12.

<sup>30</sup>Scott Appleford (Boulder, CO golfer who has played at Applewood), telephone interview, Feb. 15, 1994.

landscape and weakens the potential impact of the natural areas on the design.

Applewood's association with Perry Maxwell's son and enthusiastic support of indigenous plants and ecosystems compares well with Crystal Downs' desire to use native rough habitat as a design feature. It is a prime example of what is being done to reduce a golf course's impact on the environment and of an attempt to blend in with the surrounding landscape.

### Fox Hills Country Club<sup>31</sup>

Fox Hills is a public facility outside Detroit that is experimenting with various prairie grasses for enhancing the bird habitat on its golf course. The club is a member of the Audubon Cooperative Sanctuary Program (ACSP), which is a program sponsored by the New York State Audubon Society to enhance and protect wildlife habitat and promote the conservation of natural resources on golf courses through ecologically sound management practices.<sup>32</sup>

Fox Hills is planting ten acres on the golf course with little bluestem and Indian grass and another ten acres apart from the course with switchgrass. The areas are out-of-play and are intended to attract pheasant and songbirds to the course. Their management plan is to use no chemicals and to burn the areas every three years, with mowing only to be done if necessary to cut down woody plant invaders.

Fox Hills' program will create a good prairie setting once established, but is not well integrated into the golf course. The ACSP is a great program

---

<sup>31</sup>Robert Mateja (superintendent at Fox Hills), telephone interview, June 11, 1993.

<sup>32</sup>Jean McKay (ecologist of the New York Audubon Society), telephone interview, May 13, 1993 and provider of pamphlet "Audubon Cooperative Sanctuary Program for Golf Courses," New York Audubon Society (Selkirk, NY, 1993).

with over 800 member courses. Its efforts to promote natural resources on golf courses is being very well-received by the golf industry and will help to integrate golf courses into their surrounding natural landscape.

### Sand Hills Golf Club<sup>33</sup>

Sand Hills is a yet-to-be-opened golf course in the native shortgrass prairie of the Sand Hills region in northwestern Nebraska. Ben Crenshaw and Bill Coore merely routed the 18 holes from the existing terrain, smoothed the future maintained golfing areas, installed irrigation and planted turfgrasses for the tees, greens, and fairways. It is an example of minimal disturbance at its finest that resulted in only 4000 yards of dirt being moved and the retention of the surrounding indigenous vegetation, making it reminiscent of the original links courses of Scotland.

Although Sand Hills Golf Club hasn't hosted a big tournament, or even been played, it is receiving rave reviews for its use of the natural landscape without disturbance and Dana Fry, a leading golf course architect with Hurdzan Design Group of Columbus, Ohio, has predicted that "within 10 years, it will be No. 1 in the world."<sup>34</sup>

The golf course reflects the desire to return to design that works with existing landforms and ecosystems just as golf did at its origin. However, at this time, no management plan to maintain these plant regimes has been initiated.

---

<sup>33</sup>Ron Whitten (*Golf Digest* architecture editor), telephone interview, June 28, 1993, and Mark Leslie, "Coore-Crenshaw Nebraskan track stirring whirlwind of speculation," Golf Course News, (vol. 5, no. 2, Feb. 1994), p. 41.

<sup>34</sup>Dana Fry, quoted by Mark Leslie in "Coore-Crenshaw Nebraskan track stirring whirlwind of speculation," Golf Course News, (vol. 5, no. 2, Feb. 1994), p. 41.

### Orchards Golf Club<sup>35</sup>

The Orchards is a 1993, award-winning golf course by Robert Trent Jones, Jr. just north of Detroit, Michigan.<sup>36</sup> The course occupies former barley and oat fields as well as crosses or abuts several existing wetland areas. It is desired that the out-of-play areas which were fields maintain the same "old prairie look," but only to a certain height. This is accomplished by using Squirrel-tail grass and Canada wild rye as the predominant grass species to give a texture and motion similar to the former agricultural products. The wetland areas are left untouched with supplemental planting in areas with species similar to those at the TPC of Michigan course.

The use of prescribed burning may be performed in future years when the native grasses are well established, but the primary management technique now is mowing to suppress weeds which may be crowding out the desired species.

### Summary of Case Studies

These case studies represent a variety of ways to integrate natural areas with a golf course. Some of the courses are old and well established clubs with an extensive history of long roughs, others are new developments, and each course uses long roughs for different reasons: visual, strategic design, and/or environmental. Management techniques include prescribed burning, chemical applications, and mechanical removals such as mowing or hand-pulling.

---

<sup>35</sup>Doug Ingram, project manager for The Orchards' designer, Robert Trent Jones, Jr., telephone interview, Feb. 23, 1994, and Hank Byma, personal interviews, Feb. 25, 1994, and March 3, 1994.

<sup>36</sup>The Orchards was named one of the best new courses to play by *Golf*, "Top 10 You Can Play," Feb. 1994, pp. 40-47.

Most of the courses are concerned mainly with the look of the rough areas and that the desired appearance is often maintained for consistency like the rest of the regularly maintained areas of the golf course. Because of this, the use of techniques to specifically target native species is usually only applied if those species are part of the intended look of the course's long rough areas. However, many courses are now aspiring to reintroduce native species into appropriate habitats to enhance the flora and fauna of their golf courses and that will require that management take into account what reinforces the natural systems more.

The intent of this study is to try to develop a management program which will promote the growth of native species in the rough and reduce the amount of inputs required to maintain them, thus creating a self-sustaining system. These case studies have shown that the use of prescribed burning has best promoted native species growth and that the use of mowing and chemical applications has mainly been employed to retard undesirable species, mainly woody plants and "weedy" wildflowers.

### III. THE DESIGN OF CRYSTAL DOWNS

#### Description and History of the Site

Crystal Downs Country Club is located in the northwest corner of the Lower Peninsula of the state of Michigan (T 27 N, R 16 W), Benzie County, just north of the town of Frankfort, subdivisions 27, 33, 34 and 35 of Lake Township. The geology of the site was determined by the deposition of glacial drift from the most recent ice sheet approximately 10,000 years ago. The result is sandy, well-drained soils which form wind-blown sand dunes near the lakeshore and wooded bluffs and inland.

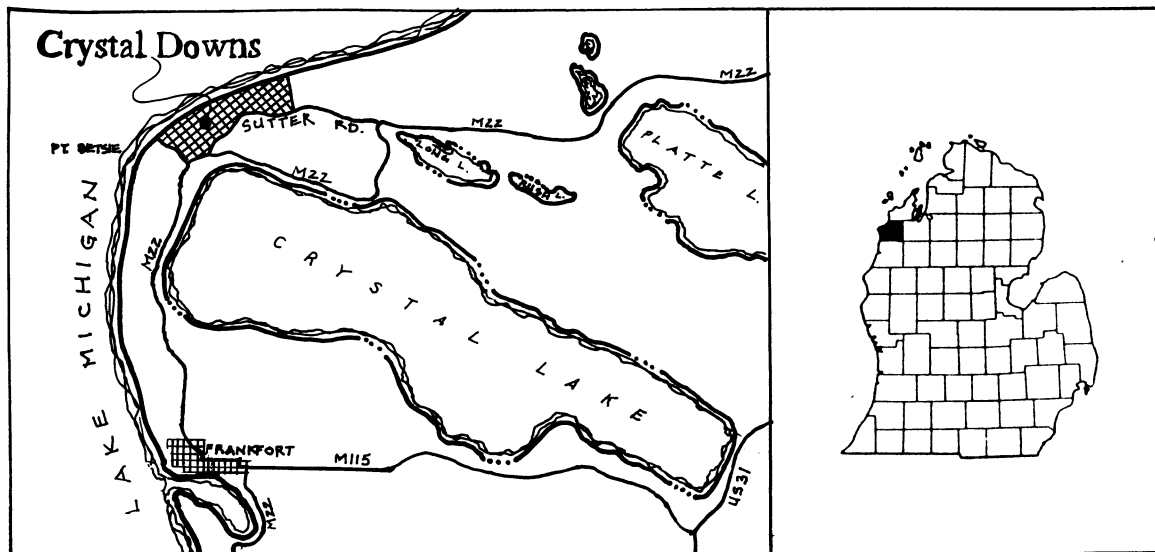


Figure 8 Location Map of Crystal Downs Country Club<sup>37</sup> LEFT--northwest corner of Benzie county RIGHT--location of Benzie county in the Lower Peninsula of Michigan

<sup>37</sup>Mapbook of Michigan Counties, (Michigan Natural Resources Magazine, Two Peninsula Press, 1984), p. 14.



The club's site is just north of Point Betsie on a high bluff above Lake Michigan, overlooking Crystal Lake to the east and the Sleeping Bear Sand Dunes and Manitou Islands in Lake Michigan to the north and west. The description of the land from the original 1838 land survey indicates third-rate, rolling land and poor soils with beech, black oak, aspen, pine, sugar maple, and hemlock for forest cover with a sandy beach on Lake Michigan. The surveyors even considered that it was not worth a re-survey in the future.<sup>38</sup> It should be noted that these descriptions were utilized primarily to indicate the worth of the resources and farming potential of the land, whereas, today, the land is probably more valuable than any other in Benzie County due to the incredible, scenic views and the golf course.

The club's site was formerly two farms, one was the Oliver family's and the other Adam Lockhart's,<sup>39</sup> which were purchased by the Manitou Realty Company, formed by Walkley Ewing and four others to develop the land for lot sales and a golf course with a family atmosphere. Initially, there was a rudimentary 9-hole golf course designed in 1926 by Eugene Goebel, a park planner from Grand Rapids.

### **Evolution of the Golf Course**<sup>40</sup>

The original golf course was disappointing to Mr. Ewing and, in the fall of 1928, he contacted Robert Hunter, author of a then-recent book on golf architecture, The Links, to recommend a golf architect. Hunter heartily

---

<sup>38</sup>1838 land survey of Benzie County, telephone correspondence with Benzie County Government Center assistant, January 25, 1994, and Leonard Case, Benzie County--A Bicentennial Reader, (Honor, Michigan, Platte River Printing, 1987), pp. 9-13.

<sup>39</sup>The Lockhart farmhouse was located on what is presently the driving range, adjacent to where a row of Sugar maple trees still stands from that era. The foundation of the old barn also remains in the rough area to the right of the eighth hole.

<sup>40</sup>Frederick R. Baird, Crystal Downs Country Club, (Frankfort, MI, Crystal Downs Country Club, 1981), pp. 5-12.

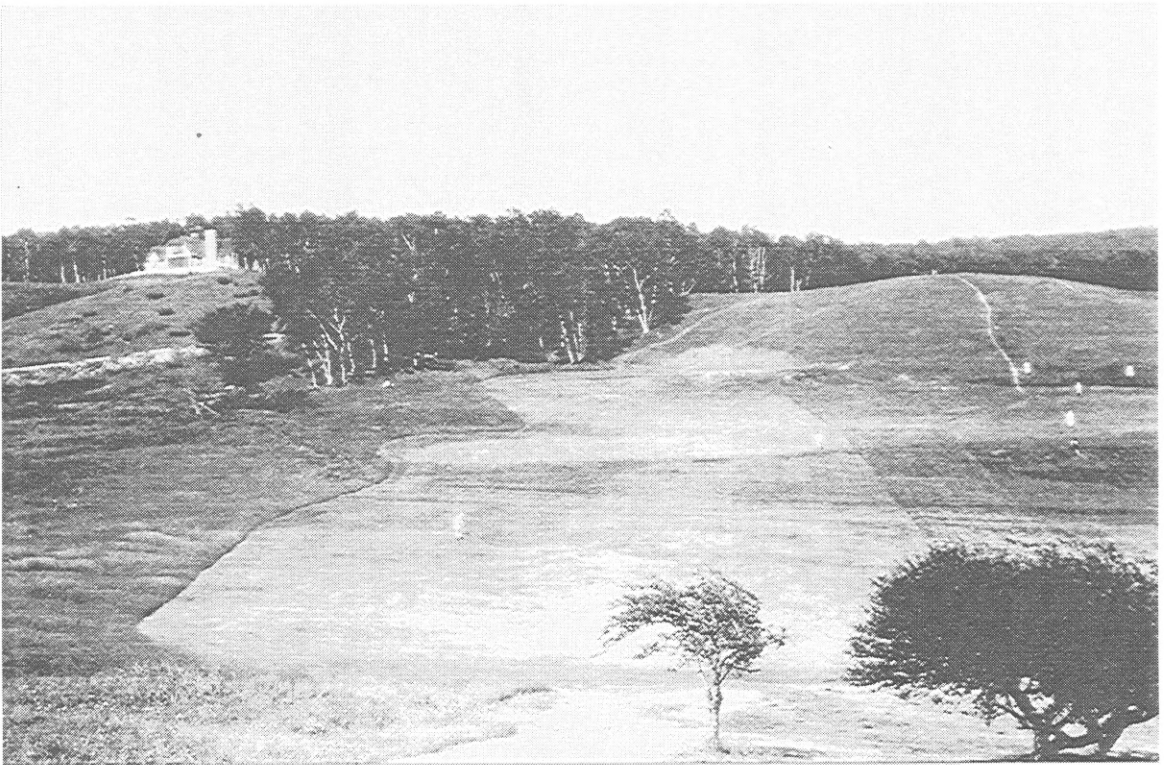


Figure 9 Hole #6, Goebel course (picture taken from the tee, located where the present #9 forward tee is; green is in the middle of the hill below #18 tees; note the long rough on the left)



Figure 10 Hole #6, Goebel course (looking back toward the tee from the road which circles around the eighteenth hole)

endorsed Dr. Alister Mackenzie, his associate in California on a number of projects, as the best there was and that it would be possible to have him visit on his way back to England. Mackenzie reluctantly delayed his trip to make the stopover, and was accompanied by his associate Perry Maxwell. Mackenzie was quite displeased with delaying his return to his native home until Ewing drove along the Lake Michigan shoreline en route to Crystal Downs. The Doctor's attitude changed abruptly as he and Maxwell began envisioning outstanding golf courses all along the lakeshore's rolling sand hills.

The two golf architects remained at Crystal Downs for several days of course designing and produced the current routing. This was done out of sheer enthusiasm for the potential of the site and without any promise of payment due to a lack of funds at that time. Mackenzie supposedly made detailed pictures for the contours of each green<sup>41</sup> and agreed to have Maxwell return in the spring of 1929 to supervise the construction.

Construction in those days consisted of using horses and scrapers for any necessary earth-moving, a time-consuming process that allowed for subtle grades and study of the landforms during the construction. A tractor winch and bucket and drag-line were used to level the seventeenth fairway, but this was the only severe earth-moving on the golf course. The front nine holes were completed and in play by fall 1929, but as a result of the Depression, the back nine was not finished until 1933.

The character and subtlety of the golf course can be attributed to Alister Mackenzie's vision and direction and the diligence given that during Perry Maxwell's supervision of the construction. The front nine, tenth, and

---

<sup>41</sup>There are no known existing Crystal Downs drawings by Mackenzie, although there was at one time a blueprint of the original Goebel course, but it has disappeared.

eighteenth holes were built on the rolling, open expanse below the clubhouse site atop the bluff above Lake Michigan. It is land that would typically be called "downs" in England and, as such, is why the club's name incorporates it. Holes eleven through seventeen rise up through a northern hardwood forest to a plateau above Lake Michigan in a traditional links fashion of holes out and then back to the clubhouse. The fourteenth hole is the outermost section of the golf course and occupies a promontory that overlooks the Platte Bay, Sleeping Bear Sand Dunes, and Lake Michigan to its northwest. Its view is one that has inspired many golfers and traditionally has been a spot for resting during the round before the final four holes.<sup>42</sup>

The course was maintained in typical fashion for the day. The greens were of a lush, peat-based foundation and were the only portion of the course that was irrigated. Fairways were sparse and dry and demanded the use of "winter rules" throughout the year. There was some unmaintained roughs in the links style; it was a wispy rough with long grass but not a punishing gorse.<sup>43</sup> Mackenzie and Maxwell would be amazed at the changes in maintenance procedures from their day, possibly envisioning a course with a different character. Today, the difficulty is trying to retain the meaning and character of the course they built within the parameters of today's advanced maintenance techniques, without destroying their design.

Roy Oliver, son of the original landowner of part of the club, was involved in the construction of the golf course and roads of the club and served as the grounds superintendent until 1961. His assistant, Ronald

---

<sup>42</sup>The view from the fourteenth hole has been obscured for many years by maturing trees and was just restored in the fall of 1993 to reflect the condition and prominence it used to have. Information concerning the importance of this spot was related on a visit to the club by Mrs. Elizabeth Purvis, daughter of Crystal Downs founder, Walkley Ewing, and by member Robert Kirshner, during a taped conservation of the origins of the club in July, 1993.

<sup>43</sup>John Peterson (Mr. Peterson is a lifelong resident of Frankfort, MI, observed the construction of the course, and was a long-time member of the club), telephone interview, September 13, 1993.



Figure 11 #9 Green overlooking the front nine holes (circa 1930's)



Figure 12 #18 Green from hill across from the clubhouse (circa 1930's)

Haswell, who also worked on the construction and maintenance of the golf course from the beginning, became superintendent and kept that position until 1978. Ronnie, as he was known to everyone, continued to serve the club as the grounds adviser until his passing in 1992.<sup>44</sup> Larry Hendershott served from 1978-1981 and Tom Mead from 1981-1986. Mike Morris, a Frankfort resident most of his life, has been the superintendent since 1987. The relatively small number of maintenance superintendents, particularly during the first fifty years of the club, has allowed the major design elements of Crystal Downs to remain relatively unchanged throughout its history. Recently, however, two green committees have brought in professional golf course architects to consult on minor revisions to the golf course which, fortunately, have not affected the subtle playing character of the golf course or drastically altered any of the design elements.

The roughs were unmaintained during the early years for economic and functional reasons and the fairways were mowed with a gang mower. The course resembled play much the way Mackenzie envisioned it, with numerous routes to the hole possible, allowing all levels of golfers to search out their own strategy. Roy Oliver performed prescribed burns each spring throughout the long rough, but not adjacent to the wooded portions, from the thirties to the sixties. This enriched the soil, fertilized grass shoots, and allowed a clean base from which to play.<sup>45</sup> The Frankfort Golf Club, a nine-hole municipal course, also burned its rough areas, and there, right up to the woods.<sup>46</sup> These practices would help to promote indigenous grass and forb

---

<sup>44</sup>Brad Crawford, Crystal Downs maintenance crew member since 1972, telephone interview, February 20, 1994.

<sup>45</sup>Tom Mead, telephone interview, February 20, 1994.

<sup>46</sup>Robert Laubach (Crystal Downs member and long-time Frankfort resident who helped with the former prescribed burns), telephone interview, October 16, 1993.

production and maintain the area in a grassland state and support the use of fire today to replicate former conditions and playability.

During World War II, the maintenance crew was reduced to Roy Oliver and Clive Haswell. As a result, the back nine was left unattended and the fine turf went to weeds. The fescue grasses planted for the fairways produced seedheads which drifted into the long rough areas on holes twelve through sixteen and voluntarily seeded themselves. The light, wispy character found today on much of the dry, sandy areas on holes 12 to 16 is the result of this period's lack of maintenance. The front nine was maintained, but not at the previous high standards, and patches of quackgrass and clover appeared. In 1944, two Scotsmen played the course and commented on how Crystal Downs' greens were the only ones in the U.S. which "had a cushion on them"<sup>47</sup> like their courses back home. This accolade surely relates to the quality and nature of the golf that Crystal Downs presented and emphasizes the relation to the traditional playing styles of the original courses in Scotland.<sup>48</sup>

When Ronnie Haswell became the superintendent, the burning was discontinued and Clive Haswell would instead mow the long rough areas to manage the build-up of the rough and for fire prevention. This was first done with a sickle-bar mower and later with a 5-gang "blitzer" unit. Irrigation was introduced to the fairways in 1963, thus improving the quality of the primary playing areas of the golf course. Due to the emphasis on a "American-manicured" golf course during the sixties and seventies, all of the

---

<sup>47</sup>Clive Haswell, cousin of Ronnie Haswell and member of the maintenance crew from 1937 to 1977, telephone interview, February 23, 1994.

<sup>48</sup>Haswell, telephone interview.

grass on the course was maintained on a regular basis, including all but the most out-of-play areas to the perimeter of the golf holes.<sup>49</sup> (see figure 13)

When Tom Mead became superintendent, the roughs were let go to the present state of long, unmaintained grassland and natural succession. According to several long-time residents and members of the club, the long rough areas are now much thicker and more lush than they have been before. In certain places, such as the left side of the fourth hole and the right side of the eighth hole, it is too difficult to play from the rough, if it is even possible to find your ball. Figure 14 gives a current view of the rough from the first tee and Figure 15 is a map of the golf course as it exists today.

### **Mackenzie's Opinion of the Rough Today**

Mackenzie's opinion of the long roughs at Crystal Downs today would be positive. He would appreciate the natural integration of surrounding native plant systems into the golf course, particularly since the roughs flow with the contours of the land to create contrast and excitement for the golfers. He would not approve of those areas where the rough becomes quite thick and the potential for a lost ball is more probable, but where the grasses and forbs create a thinner cover with the possibility for a good or bad lie are prime examples of what constitutes an area where luck could give a emotional lift to a player.

Photographic evidence of the roughs from the original 9-hole Goebel-designed golf course and the Mackenzie layout in its early years shows long unmaintained rough areas at the sides of the holes. This evidence, along with Mackenzie's golf course principles, suggests that the rough at Crystal

---

<sup>49</sup>Haswell, telephone interview.

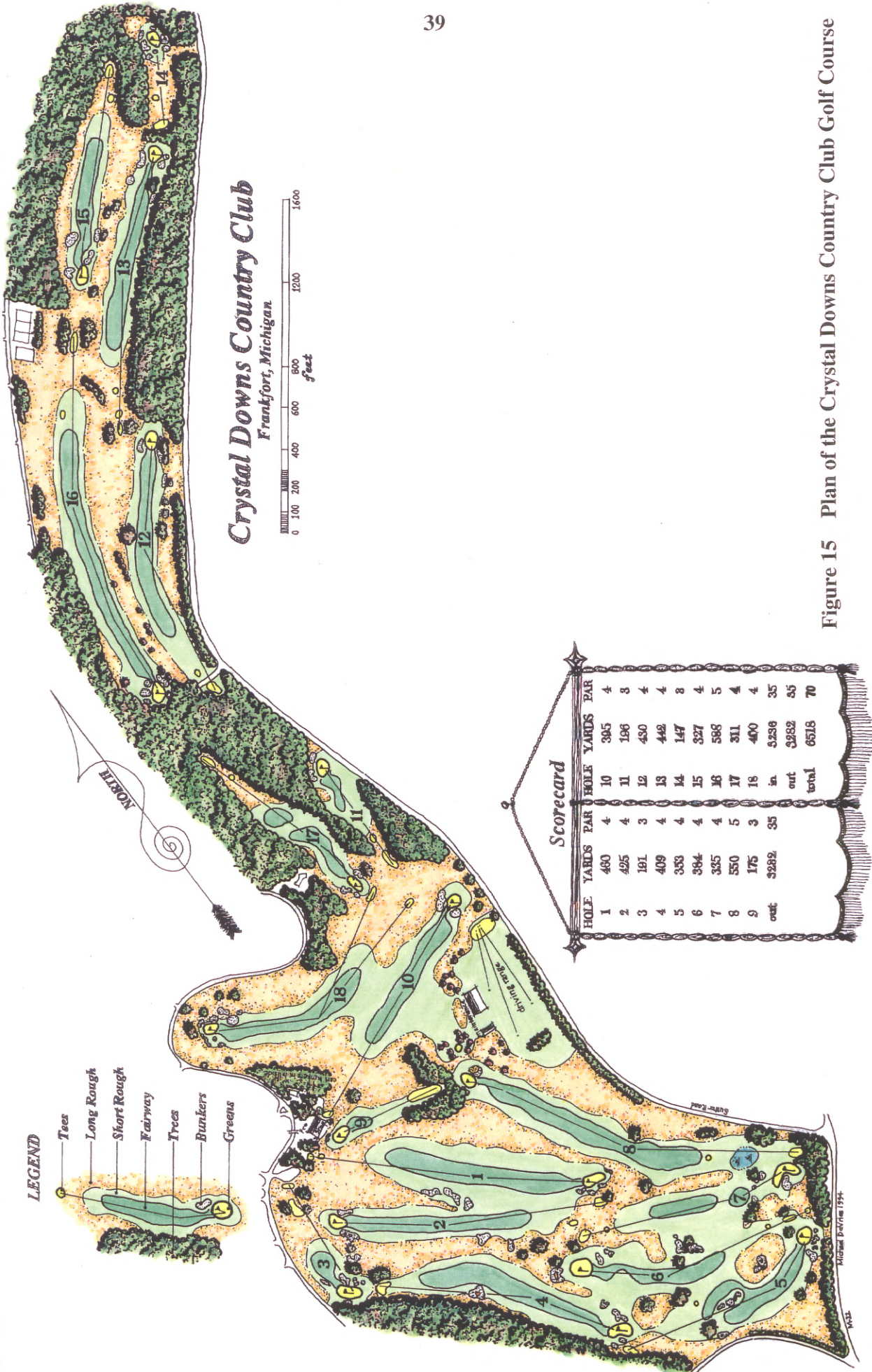




Figure 13 #9 Green overlooking the front nine holes (circa 1965)



Figure 14 View from #1 tee (circa 1993)



# Crystal Downs Country Club

Frankfort, Michigan

0 100 200 400 600 800 1200 1600  
feet

**LEGEND**

- Tees
- Long Rough
- Short Rough
- Fairway
- Trees
- Bunkers
- Greens

**Scorecard**

HOLE	YARDS	PAR	HOLE	YARDS	PAR
1	480	4	10	385	4
2	425	4	11	196	3
3	191	3	12	430	4
4	409	4	13	442	4
5	353	4	14	147	8
6	384	4	15	327	4
7	355	4	16	588	5
8	550	5	17	311	4
9	175	3	18	400	4
out	3282	35	in	5236	35
			out	3282	35
			total	6518	70

Figure 15 Plan of the Crystal Downs Country Club Golf Course

Michael Payne 1994

Downs is natural, appropriate, and in harmony with the site and that Mackenzie did not reject these conditions in building the course.

It seems that the nature of the long rough is appropriate but that some areas need to be managed more to promote the design principles of Mackenzie and Maxwell: an absence of the annoyance of looking for lost balls, the course should be natural, and there should be an infinite variety of strokes required by the golfer to play, including a number of heroic carries off the tee. The rough could be thinned in areas to facilitate the ease of finding a ball and more variety in the plant composition of the rough would blend it in with the surrounding natural environment while providing various lies to the player.

### **Native Plant Communities Relevant to Crystal Downs**

In 1900, Sutton and Sons noted in their chapter "Laying-out and Up-keep of Greens" in Horace Hutchinson's The Book of Golf & Golfers that "The native or indigenous herbage, therefore, is of the greatest importance and an unfailing guide in the selection of the best grasses for any given locality." They were referring to the maintained portion of the golf course, but their statement applies to unmaintained areas of the golf course even more. Native species are adapted to the climate, blend in with the surrounding vegetation, and can give a course a unique character based on its plant material.

Crystal Downs occupies a varied piece of land which incorporates, or is adjacent to, many different plant associations: dunes, meadows, and forests. These communities provide a basis for what plant species should be incorporated into the rough areas to replicate the natural ecosystems that surround the golf course and to integrate them into the course. In addition,

prairies provide an example of a sustainable grassland from which management techniques can be adapted.

### Dunes

There are many different dune formations in northwest Michigan. Dunes are characterized by moving sand particles in open, exposed areas with strong sunlight, little moisture, high winds, good drainage, and low soil fertility. Plant establishment is usually initiated by beach grass, which holds the sand in place and reduces the wind so other plants may establish themselves. On Crystal Downs, there are two locations which have sand dune formations: adjacent to the donut bunker on the fourth hole and the fourteenth hole.

The bunker on the fourth hole has a very sandy lip and adjacent area on its south side towards the bluff and woods. *Ammophila breviligulata*, Beach grass, forms a dense lip to the bunker and is well suited to play. The shadow cast from the large bluff to the south has kept the area thin enough to play from, but has also not filled in much past the area adjacent to the bunker lip.

The fourteenth hole is a short par three with no fairway and little short rough around the green. The land is rolling sand with a sparse vegetative cover of various fescue and meadow grasses, bracken fern, and Staghorn sumac that is bordered on the left by a northern hardwood forest visually dominated by white birch and on the right by white pine trees. The soil is rather poor here and the vegetation may be improved by utilizing some of the dune plants that are adapted to the conditions.

These two areas would benefit from the addition of some of the following dune species and vegetation that is distinguished as a part of the "sand, grass, and conifer zones" of the "Pine Plains."<sup>50</sup>

**Table 2: Native Dune Species to Integrate into the Rough<sup>51</sup>**

<i>Anemone multifida</i>	Red anemone / Red windflower
<i>Arabis lyrata</i>	Lyreleaf mustard
<i>Arenaria stricta</i>	Sandy spurrey
<i>Artemisia caudata</i>	Dune wormwood
<i>Asclepias tuberosa</i>	Butterflyweed
<i>Campanula rotundifolia</i>	Harebell
<i>Hudsonia tomentosa</i>	False heather
<i>Lathyrus japonicus</i>	Beach pea
<i>Lilium philadelphicum</i>	Wood lily
<i>Prunus pumila</i>	Sand cherry
<i>Senecio obovatus</i>	Roundleaf ragwort
<i>Shepherdia canadensis</i>	Buffalo-berry / Soapberry
<i>Smilacina stellata</i>	Starry false Solomon's-seal
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Zigadenus glaucus</i>	Dune lily / White camas

**Table 3: Native Species of the Grass Zone to Integrate into the Rough<sup>52</sup>**

<i>Andropogon gerardii</i>	Big bluestem / Turkeyfoot
<i>Arctostaphylos uva-ursi</i>	Bearberry
<i>Coreopsis lanceolata</i>	Lance-leaved coreopsis
<i>Danthonia spicata</i>	Poverty grass / Oatgrass
<i>Elymus canadensis</i>	Canada wild rye
<i>Linnaea borealis</i>	Twinflower
<i>Melampyrum lineare</i>	Cow wheat
<i>Monarda punctata</i>	Horse mint
<i>Oenothera biennis</i>	Evening primrose
<i>Rosa blanda</i>	Smooth rose

<sup>50</sup>Paul W. Thompson, Vegetation and Common Plants of Sleeping Bear, (Cranbrook Institute of Science, 1967), pp. 16-21.

<sup>51</sup>Ibid., pp. 11-16. Species are listed as members of a particular plant zone.

<sup>52</sup>Ibid., p. 21. Species are listed as members of a particular plant zone.

The false heather and sand cherry are plants which could provide a nice contrast to grass areas and would be challenging to play from, similar to the gorse and heather found in Scotland. The harebell will do well in a meadow situation and butterflyweed is a prairie forb.

### Meadows

The majority of the rough areas are reminiscent of meadow communities that have been untended for a number of years. The plant composition is one with many various introduced and native grasses, volunteer woody species, successional woody species, and numerous forbs. The former farm that is now the golf course was used for orchards, as evidenced by the apple and pear trees near the maintenance area and on holes 12 and 16. Grazing was probably common as the land was highly undulating, not of a high quality for row-cropping, and the lack of an apparent smoothing of the landscape from a tilling operation. Many of the plant species listed previously are typical of this ecotype. Other species that may be present or could be incorporated into the rough and are typical of meadow communities in the region are listed in Table 4.

**Table 4: Native Meadow Species to Integrate into the Rough<sup>53</sup>**

<i>Anaphalis margaritacea</i>	Pearly everlasting
<i>Antennaria neglecta</i>	Field pussytoes
<i>Antennaria plantaginifolia</i>	Plantain-leaved pussytoes
<i>Erigeron strigosus</i>	Daisy fleabane
<i>Euphorbia corollata</i>	Flowering spurge
<i>Gnaphalium macounii</i>	Clammy everlasting
<i>Gnaphalium obtusifolium</i>	Sweet everlasting / Catfoot
<i>Grindelia squarrosa</i>	Gum plant

<sup>53</sup>Ibid., pp. 36-38.

**Table 4: cont.** (Native Meadow Species to Integrate into the Rough)

<i>Krigia biflora</i>	Two-flowered cynthia
<i>Monarda fistulosa</i>	Wild bergamot / Beebalm
<i>Physalis heterophylla</i>	Clammy ground cherry
<i>Physalis subglabrata</i>	Smooth ground cherry
<i>Rosa carolina</i>	Pasture rose
<i>Solidago altissima</i>	Tall goldenrod
<i>Solidago graminifolia</i>	Grass-leaved goldenrod
<i>Solidago juncea</i>	Early goldenrod
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Verbena hastata</i>	Blue vervain
<i>Verbena stricta</i>	Hoary vervain

### Forests

The forests surrounding the golf course are typically beech-sugar maple northern hardwood forests, which are interspersed with oak and pine pockets where it is drier, more exposed, or of poorer soil. Where forests intersect the golf course, attempts should be made to use appropriate woodland forbs which will transition the rough areas into the woods and provide for a playable area that is not too dense.

**Table 5: Forest Species to Integrate into Rough Edges<sup>54</sup>**

<i>Aralia nudicaulis</i>	Wild sarsaparilla
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Comandra richardsiana</i>	Bastard toad flax
<i>Helianthemum canadense</i>	Frostweed
<i>Viola canadensis</i>	Canada violet
<i>Viola pensylvanica</i>	Smooth yellow violet

<sup>54</sup>Ibid., pp. 25-27.

## Prairies

Prairie plants have adapted to frequent fires by retaining most of their biomass below ground and having bud and food-storage systems that are also underground or resprout rapidly after fire. Prairies demonstrate how a sustainable, grass-dominated ecosystem can be managed. The use of fire to manage its ecosystem and maintain a warm season grass state can be transferred very easily to a golf course, another grass-dominated system. The use of fire as a management tool on golf courses is very logical for a number of reasons:

- Golf courses often have large expanses of area which can be returned to native habitats and fire will help maintain or establish that habitat in a more natural state.
- Golf courses have built-in firebreaks established with its mowed rough and fairway areas.
- Golf courses have sophisticated irrigation systems so water is immediately available for controlling a prescribed burn throughout the golf course.
- Golf courses have large machinery to cut firebreaks if necessary.
- Fire is a "natural" method of controlling plant growth and development versus the use of herbicides and fertilizers.
- Fire is a "natural" method of controlling pests and an alternative to the use of chemical pesticides.

Crystal Downs has many prairie species native to the site in its rough composition which would benefit from a fire regime. And although prairies were not the dominant ecotype in this part of Michigan, the jack pine plains



of central northern Michigan is a region which requires the impact of fire to open the seeds of the jack pine and perpetuate its ecosystem.<sup>55</sup>

**Table 6: Species to be Integrated that are Associated with Prairies<sup>56</sup>**

<i>Koeleria macrantha</i>	Junegrass
<i>Panicum virgatum</i>	Switchgrass
<i>Schizachyrium scoparius</i>	Little bluestem
<i>Eragrostis spectabilis</i>	Purple lovegrass
<i>Panicum capillare</i>	Witch grass
<i>Sorghastrum nutans</i>	Indian grass
<i>Asclepias syriaca</i>	Common Milkweed
<i>Aster laevis</i>	Smooth Aster
<i>Aster macrophyllus</i>	Large-leaved Aster
<i>Eupatorium maculatum</i>	Joe Pye Weed
<i>Fragaria virginiana</i>	Wild strawberry
<i>Lithospermum canescens</i>	Hoary puccoon
<i>Mentha arvensis</i>	Wild mint
<i>Rudbeckia hirta</i>	Black-eyed susan
<i>Rhus typhina</i>	Staghorn sumac
<i>Rubus occidentalis</i>	Black raspberry
<i>Rubus strigosus</i>	Red raspberry
<i>Spiraea alba</i>	Meadowsweet
<i>Arabis lyrata</i>	Lyreleaf mustard
<i>Arenaria stricta</i>	Sandy spurrey
<i>Artemisia caudata</i>	Dune wormwood
<i>Asclepias tuberosa</i>	Butterflyweed
<i>Campanula rotundifolia</i>	Harebell
<i>Lilium philadelphicum</i>	Wood lily
<i>Smilacina stellata</i>	Starry false Solomon's-seal
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Coreopsis lanceolata</i>	Lance-leaved coreopsis
<i>Danthonia spicata</i>	Poverty grass / Oatgrass
<i>Elymus canadensis</i>	Canada wild rye
<i>Monarda punctata</i>	Horse mint
<i>Oenothera biennis</i>	Evening primrose
<i>Rosa blanda</i>	Smooth rose
<i>Antennaria neglecta</i>	Field pussytoes
<i>Erigeron strigosus</i>	Daisy fleabane
<i>Euphorbia corollata</i>	Flowering spurge

<sup>55</sup>Dr. Burton Barnes, lecture from NR438 (Woody Plants), University of Michigan, Fall 1992.

<sup>56</sup>Binda Reich, Guide to the Arboretum Prairies; U. of MI class NR 691, Southeastern Michigan Native Herbaceous Plants Guide; Robert Grese, Michigan Prairie/Oak Opening Species, U. of MI class NR 691 handout; Prairie Nursery Company, Prairie Nursery Wildflowers Catalog, Westfield, Wis., 1992; and Peter Schramm, The "Do's and Don'ts" of Prairie Restoration.

**Table 6: cont.** (Species to be Integrated that are Associated with Prairies)

<i>Gnaphalium macounii</i>	Clammy everlasting
<i>Gnaphalium obtusifolium</i>	Sweet everlasting / Catfoot
<i>Grindelia squarrosa</i>	Gum plant
<i>Krigia biflora</i>	Two-flowered cynthia
<i>Monarda fistulosa</i>	Wild bergamot / Beebalm
<i>Physalis heterophylla</i>	Clammy ground cherry
<i>Physalis subglabrata</i>	Smooth ground cherry
<i>Rosa carolina</i>	Pasture rose
<i>Solidago altissima</i>	Tall goldenrod
<i>Solidago graminifolia</i>	Grass- or Lance-leaved goldenrod
<i>Solidago juncea</i>	Early goldenrod
<i>Solidago nemoralis</i>	Gray goldenrod
<i>Verbena hastata</i>	Blue vervain
<i>Verbena stricta</i>	Hoary vervain
<i>Carex pensylvanica</i>	Pennsylvania sedge
<i>Comandra richardiana</i>	Bastard toad flax
<i>Helianthemum canadense</i>	Frostweed

Inclusion of these species in any future planting regimes would enhance the rough's ability to reduce maintenance by utilizing plants already adapted to the existing natural system, to maintain a sustainable ecosystem by allowing native plants to adapt to the site's individual characteristics, to improve diversity by including many species that are appropriate for the site and may have been on the site prior to development, and to provide for the enjoyment of golfers and naturalists alike.

### **Composition of the Long Rough Areas of the Golf Course**

The long rough at Crystal Downs is a diverse palette of plant species: some natives, some exotics, some purposely planted by humans, and some volunteered in from surrounding ecosystems. Tables seven through fifteen indicate the primary plant species that occur commonly throughout the long rough areas of the course.

The rough is primarily open, dominated by grasses with forbs interspersed to varying degrees, from dominating a space like the goldenrods can do to being absent or hidden by the grasses. Woody plants are primarily mature specimen trees in the middle of the rough areas, but the bordering forested areas are volunteering pioneer trees and shrubs into the rough areas near the edges. The encroachment of woody plants is a natural process that will continue without a management plan to control it.

Species were identified on site from August to October, 1993, from pictures of the course, from years of familiarity with the golf course, and from information provided by Tom Mead and Mike Morris.

#### Native Grass Species

There is much Little bluestem and Switchgrass currently in the roughs, with the other native species scattered about in a few places. A fire regime would help establish a healthier environment for them, hopefully promoting them enough to subsequently crowd out invasive and alien species.

**Table 7: Existing Grass Species to be Encouraged**

<i>Ammophila breviligulata</i>	Beach grass
<i>Eragrostis spectabilis</i>	Purple lovegrass
<i>Koeleria macrantha</i>	Junegrass
<i>Oryzopsis racemosa</i>	Rice-grass
<i>Panicum capillare</i>	Witch grass
<i>Panicum virgatum</i>	Switchgrass
<i>Schizachyrium scoparius</i>	Little bluestem
<i>Sorghastrum nutans</i>	Indian grass

## Pest Grasses

These species dominate the current long rough environment as they do many old field and meadow habitats throughout Michigan. A late spring prescribed burn program would help to promote the native species above and retard these pest grasses, although Hungarian and smooth bromes are not as affected by fire. It is probably not possible to completely eradicate these species without the use of chemicals or significant disturbance, but hopefully these typical meadow species can be reduced to where they do not dominate the rough system and allow for some plant diversity.

**Table 8: Existing Pest Grasses**

<i>Bromus spp.</i>	Brome grass
<i>Dactylis glomerata</i>	Orchard grass
<i>Phleum pratense</i>	Timothy

## Purposely Planted Grasses<sup>57</sup>

These non-native grasses were planted throughout the early years of the course as turfgrasses and survive with minimal maintenance and a lack of irrigation. It is believed that they will continue to persist with the native grasses because they have been subjected to, and survived, various maintenance techniques throughout the history of the club, including drought, fire, and mowing.

<sup>57</sup>These species are typical of what was planted on golf courses in the 1920's (Ross Goodner, Chicago Golf Club 1892-1992, Chicago Golf Club, Wheaton IL, 1991, pp. 149-150), and were identified as part of the turfgrass composition of Crystal Downs by Tom Mead during his tenure as superintendent.

**Table 9: Grasses Purposely Planted**

<i>Agrostis gigantea</i>	Redtop
<i>Agrostis stolonifera</i>	Creeping bent
<i>Agrostis tenuis</i>	Rhode Island / Colonial bent
<i>Festuca spp.</i>	Fine fescues

Forbs

Tables five and six indicate the wildflower species found throughout the rough in varying degrees. The goldenrods, common milkweed, and clovers have the most significant populations throughout the site while the other species are scattered more selectively. The use of maintenance procedures that encourage the native species and discourage the alien species is preferred.

**Table 10: Existing Native Forb Species to be Encouraged**

<i>Asclepias syriaca</i>	Common Milkweed
<i>Aster laevis</i>	Smooth Aster
<i>Aster macrophyllus</i>	Large-leaved Aster
<i>Coreopsis spp.</i>	Coreopsis / Tickseed
<i>Eupatorium maculatum</i>	Joe Pye Weed
<i>Fragaria virginiana</i>	Wild strawberry
<i>Lithospermum canescens</i>	Hoary puccoon
<i>Mentha arvensis</i>	Wild mint
<i>Rudbeckia hirta</i>	Black-eyed Susan
<i>Solidago spp.</i>	Goldenrods
<i>Pteridium aquilinum</i>	Bracken fern

**Table 11: Existing Alien Forb Species Not to be Encouraged**

<i>Achillea millefolium</i>	Yarrow
<i>Berteroa incana</i>	Hoary Alyssum
<i>Cirsium vulgare</i>	Bull thistle
<i>Hypericum perforatum</i>	Common St. John's Wort
<i>Leonurus cardiaca</i>	Common Motherwort
<i>Silene vulgaris</i>	Bladder campion
<i>Solanum dulcamara</i>	Nightshade
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover

Native Species Not to be Encouraged

These plants are native species but present problems for those individuals who (1) suffer from the hayfever caused by the yellow pollen that is distributed from nodding flower heads and/or (2) are highly allergic to the oil of the plant and susceptible to develop a sensitive rash. Ragweed is scattered throughout the site, but is not too prevalent. Poison ivy is found in patches adjacent to #9 tee (left side and back), under the apple trees and in the woods on #16, below #18 tees, and in particular vigor behind #18 green adjacent to the road where the path to the beach is located. The poison ivy represents a particular problem for eradication, as smoke from burning it can drift and affect lungs from inhalation or the oil can be transmitted by pulling the plants. The poison ivy should be treated with a chemical application to avoid any potential contact which may lead to illness.

**Table 12: Existing Native Species Not to be Encouraged**

1. <i>Ambrosia artemisiifolia</i>	Ragweed
2. <i>Toxicodendron radicans</i>	Poison ivy

Pests<sup>58</sup>

These are exotic, invasive plants referred to as 'noxious' weeds by land managers because they cause havoc with the natural ecosystem. "Once exotics become naturalized, they often change the species composition, alter the structure, and reduce the species diversity of native plant and animal communities."<sup>59</sup> Spotted knapweed and Queen Anne's Lace are the most problematic species on the site, found throughout the rough area. Spotted knapweed quickly invades a disturbed area and dominates sections of the rough on holes 8, 10, and 18.

**Table 13: Existing Pests / Noxious Weeds**

<i>Centaurea maculosa</i>	Spotted knapweed
<i>Cirsium arvense</i>	Canada thistle
<i>Daucus carota</i>	Queen Anne's Lace
<i>Verbascum thapsus</i>	Common Mullein

Woody Plants

These plants represent a transition to forested ecosystems and do not fit in with the established open grassland intent of the long rough areas, except as small groupings or specimen trees that are already established in the design. Most of these plants are pioneer woody species which are the first to establish in open areas. In general, management techniques should take into account preventing any further spread of woody plants in the long rough, because without prevention, these species will alter the rough into a habitat that is forested and covered with woody vegetation and contrasts the

<sup>58</sup>Bob Grese, "Exotic plant pests in the Midwest," handout from NR 691: Planting Design/Management, School of Natural Resources, University of Michigan, 1993.

<sup>59</sup>Francis M. Harty, "Exotics and their Ecological Ramifications," Natural Areas Journal, (vol. 6, #4), p. 22.

design intent of Mackenzie and Maxwell. Tables 14 and 15 list the common woody plants currently found on the golf course.

**Table 14: Existing Native Woody Plant Species**

<i>Betula papyrifera</i>	White birch
<i>Cornus stolonifera</i>	Red-osier dogwood
<i>Juniperus communis</i> var. <i>depressa</i>	Ground juniper
<i>Juniperus horizontalis</i>	Creeping juniper
<i>Juniperus virginiana</i>	Eastern red cedar
<i>Populus tremuloides</i>	Trembling aspen
<i>Prunus pensylvanica</i>	Pin cherry
<i>Prunus serotina</i>	Black cherry
<i>Prunus virginiana</i>	Choke cherry
<i>Rhus typhina</i>	Staghorn sumac
<i>Rubus occidentalis</i>	Black raspberry
<i>Rubus strigosus</i>	Red raspberry
<i>Quercus rubra</i>	Red oak
<i>Spiraea alba</i>	Meadowsweet
<i>Thuja occidentalis</i>	Northern White-cedar

**Table 15: Existing Alien Woody Plant Species**

*Picea pungens*, Colorado blue spruce --A native of the Rocky mountains and inappropriate in the golf course landscape here.

*Populus nigra* 'Italica,' Lombardy black poplar -- A common European ornamental cultivar that is inappropriate in the golf course landscape here. Planted adjacent to the tees on Nos. 3 and 9.

*Rosa* spp., Roses -- Not a problem at this time, but monitoring of their spread and appropriateness of the particular species may be important. Note: many Roses are native species; inappropriate alien spp. may be troublesome.



## Wildlife

Wildlife on the golf course is abundant, particularly in the rough areas where maintenance does not disturb their habitat very often. Typical songbirds of northern Lower Michigan, butterflies, crows, groundhogs, squirrels, raccoons, skunks, moles, and gophers are familiar sights in and around the golf course. Some of these animals are pests and cause problems in the maintenance of the course, while others are pleasant distractions. White-tailed deer, coyotes, badgers, bobcats, rough-legged hawks, red-tailed hawks, and foxes have also been sighted on the course. It seems that the natural areas attract the predators for hunting of the smaller mammals.

Any impact on the wildlife of the golf course should be considered in the management of the roughs to ensure the success of the system for plants, animals, and golfers.

## **IV. THE MANAGEMENT PLAN**

This plan will consider the goals and objectives for the sustainable management of the currently unmaintained long roughs, management strategies and proposed plantings for the area, the implementation of the strategies on a timeline, and develop a monitoring program for the site.

The plan takes into consideration the plant ecosystems discussed in the previous chapter and how functional those species are for golf, regarding the playability, design intent, and maintenance factors. The plan will also look upon the case studies of other golf course natural areas found in chapter two to determine the best methods to apply to meet the goals and objectives of the plan.

### **Goals**

- 1) Establish a sustainable, native grassland ecosystem to the long rough areas of the course.
- 2) Increase the plant and wildlife diversity by reintroducing natural processes and native plant species to the site.
- 3) Demonstrate how golf courses can improve the biodiversity of a landscape and provide a sanctuary for native plant ecosystems and yet maintain playability so as to not discourage golfers.

## **Objectives**

- 1) Remove the exotic and naturalized species from the rough areas by recommended practices and keep them out. Invasive species from nearby fields and the surrounding community provide a large source of seed for these types of plants. It is imperative to keep them off the site.
- 2) Utilize low-maintenance procedures for the effective management of the roughs and discourage the use of chemicals if at all possible, as this is environmentally objectionable and costs money.
- 3) Provide space for the establishment and propagation of locally desirable or endangered plant species, possibly harvesting the seed produced in the roughs for planting of other natural areas or for commercial sale.
- 4) Make the rough more playable for the golfers: a thinner rough for ease of playing out and for finding a golf ball, yet retaining the rugged naturalness that is now evident.
- 5) Develop a timeline for the establishment of the strategies suggested and a monitoring program to determine if the goals and objectives of the plan have been successful.

## **Management Strategies**

Due to the large scale (approximately 160 acres) of the golf course and generally contiguous nature of the rough, it is important to maintain a continuous program throughout the site and not do just a part of the area. The proximity of areas with similar species, and their potential to act as a seedbank for the re-establishment of undesirable species in the rough, reaffirms the importance of employing the strategies throughout the course. Prescribed burning, mechanical removal techniques like mowing and selective cutting, and herbicide applications will be discussed for their

various effectiveness of meeting the goals and objectives of the management plan.

### Prescribed Burning

Fire is a tried-and-true method of maintaining warm season (prairie and other late season species) grasses and forbs as the dominant ecosystem in many situations. Prescribed burning replicates the natural wildfires which helped to perpetuate prairies for thousands of years and benefits grasslands in many ways.<sup>60</sup>

- Fire will burn off the organic fuel that is built up in the existing rough areas and return nutrients to the soil.
- The resulting blackened earth will seem bare at first, but has prepared a seedbed that will heat up faster and stimulate warm season grass and forb seedlings to spring forth with vigorous new growth.
- Fire will increase the species diversity of a site.
- Fire will scorch or kill undesirable and fire-intolerant woody plants and suppress the existing cool season Eurasian grasses which have already sprouted (for spring burns).
- Fire will allow for the development of dormant native seeds which have been crowded out by the Eurasian species for a number a years.

In addition, a prescribed burn is typically performed only once a year, does not require any inputs other than labor, and is an inexpensive form of

---

<sup>60</sup>Daryl Smith, "Fire, a natural phenomena," Iowa Prairie Blazingstar, (University of Northern Iowa, Vol. II, Issue 1, Spring 1990), p. 1.

management, as long as the proper precautions are taken so that a fire does not become unmanageable.

The effects on animal communities is varied; some habitats and nests may be destroyed in the burns, but an enhanced environment and increased seed production will result and stimulate a healthier ecosystem. Another possible short-term effect is an increase in erosion until some plants become established again. Because the long rough areas are not watered and are bordered by healthy, maintained turfgrass, erosion should not pose a problem for most of Crystal Downs, but holes four to eight have a clay base and some steep undulations which should be monitored for any potential problems.

The timing of a prescribed burn will affect the plant growth depending on the development stage of cool season plants and the emergence or absence of warm season plant development. Annual grasses and forbs, woody plants, cool season grasses, and perennial forbs are most affected by late-spring burns, when they have well-developed shoots which can be scorched into shock and not fully recover enough to overshadow the desired perennial warm season grasses, which are still dormant but will soon begin their life-cycle. Winter and early- and mid-spring burns are less effective on those undesired plants due to dormancy and may not help in reducing a high number of plants if that is a goal. *Poa pratensis*, Kentucky bluegrass, a common turfgrass found in the short rough at Crystal Downs, is reduced by burning at any time of year.<sup>61</sup>

Mid-spring burns will favor little bluestem, which is the most widespread native grass at Crystal Downs, but these burns are not as

---

<sup>61</sup>Gene Towne and Clenton Owensby, "Long-term Effects of Annual Burning at Different Dates in Ungrazed Kansas Tallgrass Prairie," (Journal of Range Management, 37, 5, September, 1984), pp. 392-7.

effective in depleting the cool season invasive grasses as a late-spring burn. Depending on the year's particular weather trends, Crystal Downs' mid-spring would be in mid-to-late April and late spring would be four weeks later. Due to the abundance and relative dominance of the undesired cool season grasses at Crystal Downs, the first few prescribed burns should be late-spring burns to be most effective in reducing the amount of thatch and undesirable plant material which is preventing the development of desired warm season grasses and forbs.<sup>62</sup>

Using prescribed burns as a management tool is effective and cost-efficient if precautions are followed so that the burn is conducted in a safe and knowledgeable fashion. Good planning and preparation of the site and individuals conducting the burn and caution are the best measures to performing a successful burn. The checklist in appendix C provides a good reminder of any details, information, or safety precautions which may have been overlooked.<sup>63</sup>

A typical golf course irrigation system is capable of pumping at least 500 gallons per minute through automatic sprinkler heads, quick-coupler sprinkler heads, and hoses through a system which covers the entire golf course. A more portable system is available by using a 300 gallon sprayer with a hose or spray-boom to specifically water areas.

Firebreaks are any section of land that does not permit fire to cross to another area: typical firebreaks include roads, water, bare dirt, shortly mowed vegetation, and areas already burned (a blackline). On a golf course,

---

<sup>62</sup>Ibid.

<sup>63</sup>Wayne R. Pauly's How to Manage Small Prairie Fires is an excellent how-to guide for preparing for and implementing a prescribed burn. Prepared for the Dane County Environmental Council and the Dane County Highway and Transportation Dept., Madison, Wisconsin, April 1982.

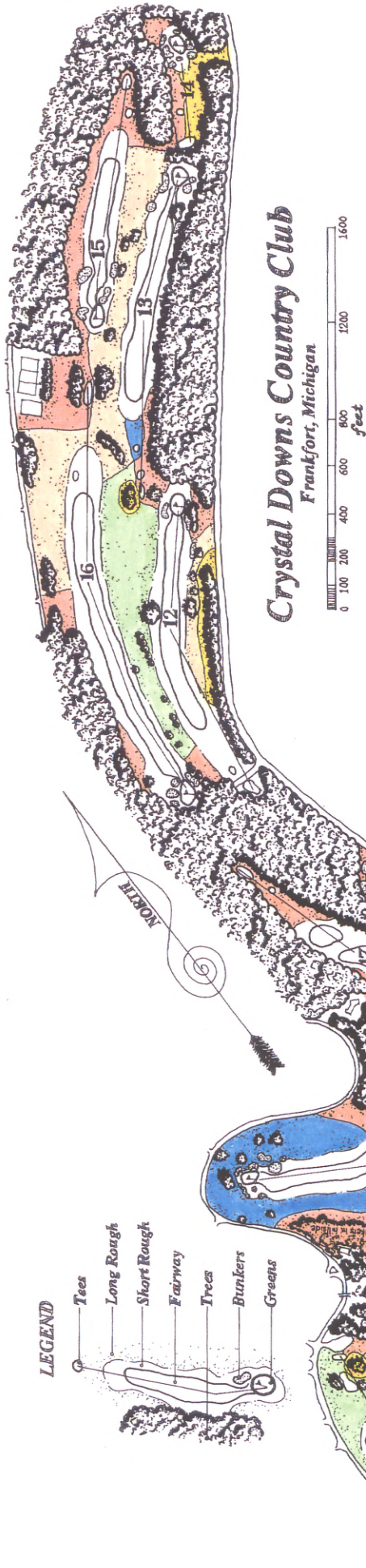
all the maintained turfgrass areas, maintenance and cart paths, and streams and ponds are firebreaks to control a prescribed burn.

The Crystal Downs roughs contain many different types of vegetation and terrain and, hence, different areas of the course are more susceptible to problems with prescribed burning than others due to their proximity to certain hazards. For this reason, the following zones and Fire Control Sensitivity Map (figure 16) designate areas of unmaintained rough on the golf course in accordance with their hazard potential.

These zones are to be used as precautionary guidelines because the golf course is actually an excellent place to do prescribed burns due to (1) the modern irrigation system which can pump water instantaneously where needed, (2) the existence of natural firebreaks where the course is already maintained on a regular basis, and (3) the existence of a crew that is very familiar with the site. If possible, the local fire department should be involved in any fire preparations and burn procedures. Their assistance and expertise will help ensure a safe burn and continued support of a prescribed burn program.

#### Zone A -- Self-contained (blue)

These areas have their margins defined by established firebreaks such as mowed turf, cart paths, service paths and trails, and roads. Their sites are generally devoid of any woody plants that are desirable to protect and therefore are highly desirable sites for a prescribed burn. In fact, the continued elimination of woody plant species in these areas is preferred.



**Figure 16 Fire Control Sensitivity Map**

**Zone A -- Self-contained (blue)**

These areas have few, if any, trees and woody plants to protect. Firebreaks are available from mowed grass, cart paths, service paths, or roads.

**Zone B -- Wide open (green)**

These areas have few trees and woody plants that need special attention. Firebreaks are available from mowed grass, cart paths, service paths, or roads.

**Zone C -- Wide-to-fairly open (tan)**

These areas have some trees and woody plants that need protection. Firebreaks are usually, but not always, available from mowed grass, cart paths, service paths, or roads.

**Zone D -- Hardwoods (cherry)**

These areas have hardwoods on one side to protect. Firebreaks are available from mowed grass, cart paths, service paths, and roads, but must be manufactured near the hardwoods for safety.

**Zone E -- Pines (yellow)**

These areas have pines on one side to protect. Firebreaks are available from mowed grass, cart paths, service paths, and roads, but must be manufactured near the pines for safety.

**Scorecard**

HOLE	YARDS	PAR	HOLE	YARDS	PAR
1	460	4	10	385	4
2	425	4	11	196	3
3	191	3	12	430	4
4	409	4	13	442	4
5	353	4	14	147	3
6	384	4	15	327	4
7	335	4	16	588	5
8	550	5	17	311	4
9	175	3	18	400	4
out	\$282	35	in	\$286	35
			cut	\$982	85
			total	\$618	70

MICHAEL D. WILSON 1984



#### Zone B -- Wide open (green)

These areas have a few specimen trees or some woody vegetation that require special attention, but the area is primarily open and presents a good habitat for a burn.

#### Zone C -- Wide-to-fairly open (tan)

These areas have some specimen trees or large clumps of woody vegetation that require special attention, but the area is generally open and presents a fairly good habitat for a burn.

#### Zone D -- Hardwoods (cherry)

These areas are bordered on at least one side by a Northern Hardwood Forest dominated by beech and sugar maple. Their sites are more sensitive to burning due to the potential for the fire to spread to a woodland, particularly where those trees that are more susceptible to fire (pines, beech, and sugar maple) dominate. These areas should be burned with restrictions imposed or only under more favorable conditions.

#### Zone E -- Pines (yellow)

These areas are bordered on at least one side by a pine community. Their sites are the most sensitive to burning due to the fire potential of the pines. These areas should be burned with caution, restrictions imposed, and only under the most favorable conditions.

### Mechanical Removal Techniques

Mechanical removal techniques consist of mowing, hand-removal, cutting, girdling, and any other physical removal from the site which

changes the composition of the vegetation. Its use could be time-consuming and expensive as it may require many hours of labor and/or equipment to perform the desired tasks. The size of the area to be impacted by these methods is proportional to the input necessary to carry out these operations. But its use can be very effective in selectively removing specific species or for thinning areas than other more "efficient" methods, which may not be as selective but are cost less to perform.

Mowing of turf areas on the golf course is common and serves to maintain an area in a manicured monoculture for the express purpose of playing golf. Exclusive mowing of Crystal Downs' natural areas would promote the continuation of the existing rough composition (primarily Eurasian grass species). However, in areas where substantial amounts of thick or emerging woody plant growth exist, the use of a bush hog, flail mower, or rotary deck mower could be used to 1) cut down the material to provide a more concentrated burn and 2) to injure and expose undesirable woody plants before a fire scorches them. The mowed area would also help in defining the margins for where a firebreak is to be established, thus ensuring more control over the burn process. Hand-cutting or girdling of unwanted larger specimens could be done to remove them.

Cutting of woody plant species three weeks prior to a burn may remove the immediate seed production and then any suckering sprouts from these cuttings will be damaged by the subsequent fire.<sup>64</sup> It may be necessary to periodically cut any persistent suckers if the fires do not initially kill them,

---

<sup>64</sup>Another technique is to burn shrubs while in their present condition to stress the plant more and subsequently cause it to decline. This procedure is advocated by Matt Huemann, naturalist for Washtenaw County in southeastern Michigan, who uses prescribed burns for brush control in many of the Washtenaw County's parks (telephone interview, November 30, 1993). For a golf course, though, the visual perception to the golfer may require the removal of the plant material to maintain a "clean" appearance and not have a charred tree standing in the middle of the rough. It may not be as beneficial to the wildlife (dead wood is used by various wildlife species), but it may provide more acceptance of a burn program by golfers.

but over time, fire will inhibit the invasives. This is not a technique which has been studied but may prove efficient for select areas of golf courses where burning is appropriate but inhibited by woody plant growth.

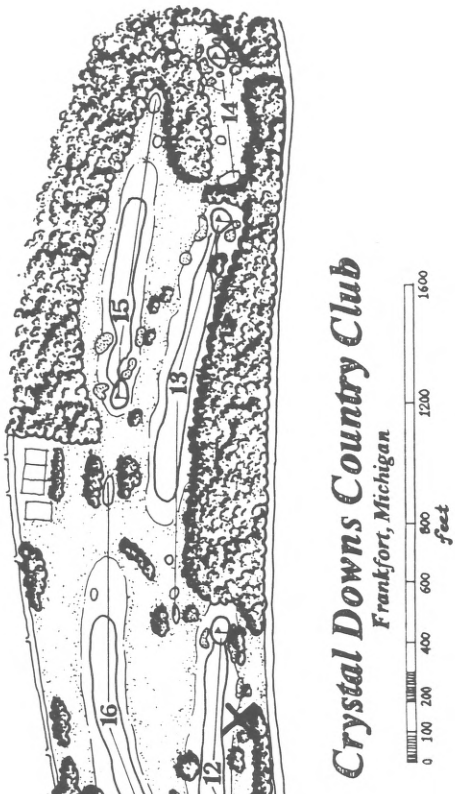
Crystal Downs' recent tree removal program was very beneficial in restoring the original design intent of the golf course, but some trees were inadvertently missed and should be removed. These trees are indicated by an 'X' on the Mechanical Removal & Mowing Map (figure 17). The Lombardy poplars mentioned previously should also be removed as they are not in character with the design intent of the course and are past maturity. Two other suggestions for improving the course are removing the entrance hedge on hole five and the tree plantings around the cart storage bunkers. At the entrance, the hedge would be replaced by native prairie grass species which would be maintenance-free except for the long rough management already designated for hole five. The cart storage bunkers could be effectively hidden with the planting of *Andropogon gerardii*, Big bluestem, which can attain a height of eight feet and would blend in with the hillside and restore a sweeping view up to the clubhouse.

### Chemical Applications<sup>65</sup>

Herbicides provide an efficient way of eliminating many broadleaf weed species, grasses, or non-specifically any plant. Methods to apply herbicides include hand spraying with a portable backpack sprayer or long hose extension from a large unit for small area applications, boom spraying for large area applications, and sponge or wick applications directly to a cut stem for sensitive area applications.

---

<sup>65</sup>Mike Morris, interviews, 1993 and 1994, and Vegetation Management Manual, (Illinois Nature Preserves Commission, Springfield, IL, 1990), vol. 1, nos. 2, 7, 9, 12, 23, and 25.



**LEGEND**

- Tees
- Long Rough
- Short Rough
- Fairway
- Trees
- Bunkers
- Greens

**Figure 17 Mechanical Removal & Mowing Map**

**Double Donut Patch**

Area of long rough to be mowed prior to burning to test intensity of burn versus an unprepared area.

**Cart Bunkers & Entrance Hedge**

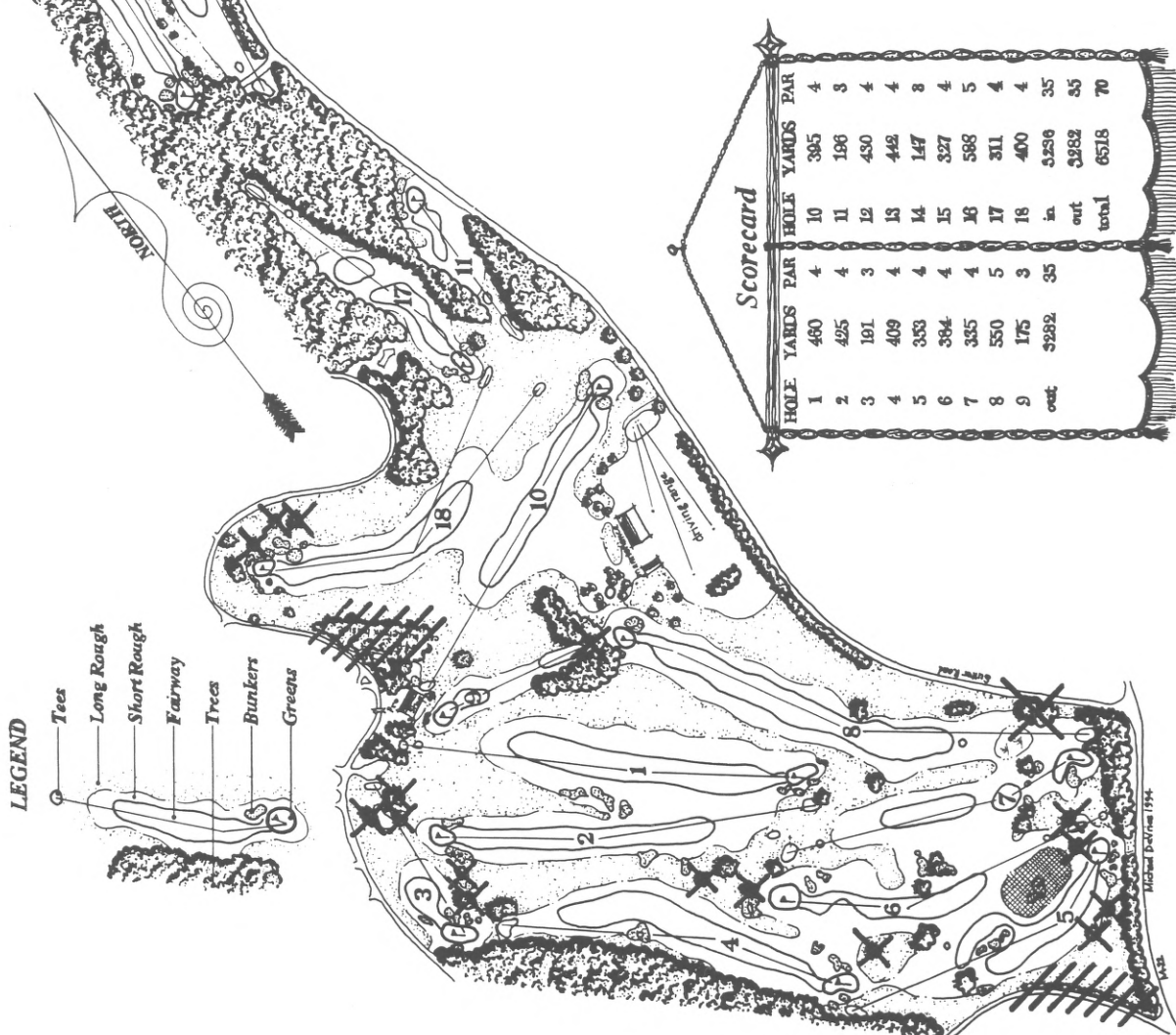
Replace existing cart bunker vegetation with Big bluestem and other tall prairie grasses to hide bunkers and open hillside up to view of the clubhouse. Replace entrance hedge with long rough composition to immediately integrate the arrival with the natural golf course landscape.

**Individual Trees**

These trees are inconsistent with the design intent of the golf course, are visual obstructions, and are not conducive to a prescribed burning regime.

**Scorecard**

HOLE	YARDS	PAR	HOLE	YARDS	PAR
1	460	4	10	385	4
2	425	4	11	198	3
3	191	3	12	450	4
4	409	4	13	442	4
5	353	4	14	147	8
6	384	4	15	327	4
7	335	4	16	588	5
8	550	5	17	311	4
9	175	3	18	400	4
cut	3282	35	in	3286	35
			out	3282	35
			total	6518	70



Michael Post/Case 1594  
1535

The use of chemicals is expensive and requires careful preparation to prevent overspray to non-targeted areas, leaching from excessive rain due to inappropriate timing, and must be carried by certified spray applicators. Most golf course superintendents use integrated pest management (IPM) techniques, are certified to apply chemicals, and do utilize spray applications for various pest controls. Golf courses also utilize modern sprayers to efficiently and correctly apply any chemicals.

The use of chemicals in controlling pest species in natural areas could be effective. Crystal Downs has tested several areas with a 50% solution of 2, 4-D ( a broadleaf herbicide) in front of the fifteenth tee area, below the eighteenth pro tee, to the right of the tenth hole, and between the first and eighth holes. The area on fifteen was initially clean, but saw many of the same undesirable species come back while eliminating some desired plants. The patch on eighteen consisted of primarily fescue grasses and spotted knapweed in a narrow strip surrounded by mowed grass and separated from rough in a similar condition by a dirt cart path. The test area was clear of spotted knapweed and contained only fescue grasses, thus accomplishing its task of removing the spotted knapweed. The area to the right of hole ten had similar results to the test on fifteen. On the area between one and eight, assistant superintendent Steve Hammon has noticed a reduction in the desired native grass *Schizachyrium scoparius*, Little bluestem, in sprayed areas versus unsprayed areas. This indicates that the Little bluestem is not tolerant as most grasses are of 2, 4-D. These test areas demonstrated how a chemical application may remove the target species but also unintentionally take some desired species with it.

The most effective use of herbicides on golf course natural areas would be if the entire palette of existing species is undesirable and needs to

be eliminated. This could be done with a large spray boom on a tractor and cover a large area efficiently prior to a seeding to clean the area of any weed seed. The other use of herbicides would be in select areas to target species which affect a small but important area.

For Crystal Downs, the use of sponge applicators or hand sprayers to target small problem areas (for example, poison ivy) may be required where prescribed burning and physical removal is not appropriate or is ineffective. As always, directions for broadleaf, grass, or general herbicides should be followed to prevent drift into or accidental application of non-target areas.

### Target Species

The following species are the most pervasive pests throughout the "rough" and are the species to be targeted for reduction and replacement with native grasses and forbs. These species tend to overwhelm the site with prolific seed production, early blooming periods, late season growth, and the subsequent shading out of other less tolerant species.

**Table 16: Main Species to Target for Reduction**

<i>Achillea millefolium</i>	Yarrow
<i>Ambrosia artemisiifolia</i>	Ragweed
<i>Centaurea maculosa</i>	Spotted knapweed
<i>Cirsium arvense</i>	Canada thistle
<i>Daucus carota</i>	Queen Anne's Lace
<i>Bromus spp.</i>	Brome grass
<i>Dactylis glomerata</i>	Orchard grass
<i>Phleum pratense</i>	Timothy
<i>Toxicodendron radicans</i>	Poison ivy
<i>Trifolium pratense</i>	Red Clover
<i>Trifolium repens</i>	White Clover
<i>Verbascum thapsus</i>	Common Mullein

Prescribed burns, particularly late spring burns, are the preferred treatment of these non-native species because it deters their advancement while allowing the native warm season species to develop a healthy system which will eventually inhibit the non-natives from establishing themselves on the site. Spotted knapweed is one of the most difficult pests on the site and, yet, may not be affected by burning.<sup>66</sup> If it continues to be a problem, spraying or physical removal techniques may be necessary. Particular caution should be maintained near patches of poison ivy, as the smoke from it will irritate throats and lungs. As previously stated, use of an herbicide to control it should be performed.

### Planting

There is no current plan for planting species except for the indicated replacement plantings noted for the entrance and the cart storage bunker areas. If prescribed burning fails to bring out native plants in the seedbed, then planting with a no-till drill or hand-seeding (to prevent excessive disturbance of the contours of the golf course) may be necessary to establish a more diverse native ecosystem. Appendix A is a listing of appropriate native plants for the roughs at Crystal Downs.

### Implementation

Crystal Downs' golf course is a very beautiful landscape with many desirable features, views, and habitats. This plan will try to enhance the character of the course by reintroducing a native plant regime through a prescribed burn program. The existence of many desirable native species and possibly many more in a dormant seedbank below the Eurasian grasses

---

<sup>66</sup>Robert Grese, noted in correspondence.

makes this program economical, environmentally sensitive by replicating a natural process, and less disruptive to the play of the golfers and nature using the site. This plan will allow nature to assign plants to where they are most suited to proliferate and to restore itself to a sustainable system with a wide diversity of plants and animals.

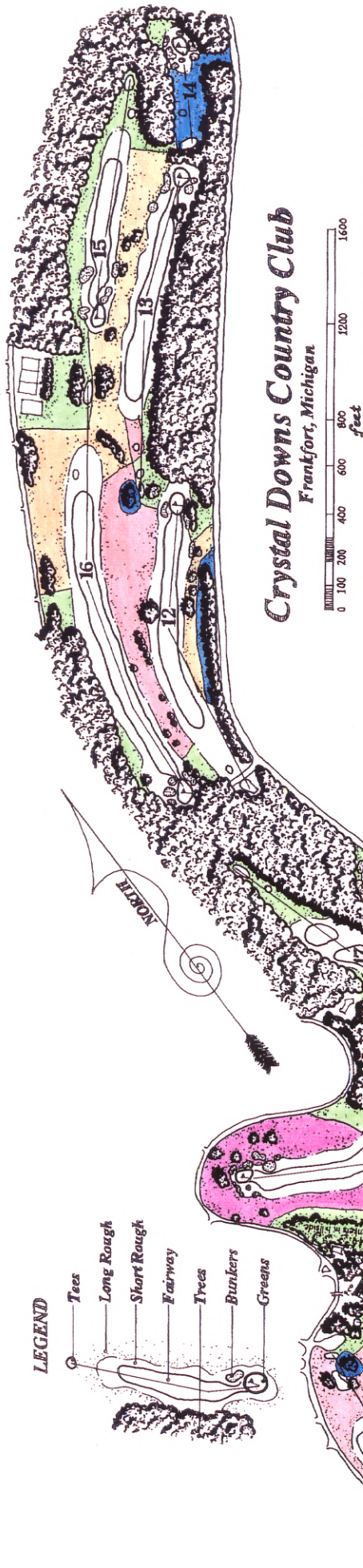
The golf course will be set up into zones for burns on a priority basis. This way, if weather conditions prohibit the entire course from being burned, targeted research and problem areas can be addressed first. Annual burns should be maintained for the first three-to-five years in order to reduce the non-native grasses and to re-establish native seed sources on the site, thus preventing the need for a widespread planting (and subsequent disturbance) of the rough. If establishment of the grassland is sufficient at Year 5, three-to-five burns per ten years can be done *ad infinitum* to maintain the grassland state of the rough. Otherwise, additional procedures other than prescribed burning will have to be initiated.

The preferred time for prescribed burns at Crystal Downs is the first half of the month of May. At this time, the cool season grasses and 'weeds' have begun to establish themselves, but not seeded yet. Burning at this time will retard their further growth and promote conditions for the warm season grasses (still dormant, but soon to begin blooming). Burns should be conducted in accordance with local fire regulations and proper prescribed burn techniques.

### **Sequencing For Burns**

The first three burn priority zones are chosen for (1) their ease of conducting a safe burn, (2) the composition of species in those areas, and (3) the ability to use these areas for scientific study to determine the





# Crystal Downs Country Club

Frankfort, Michigan



### LEGEND

- Tees
- Long Rough
- Short Rough
- Fairway
- Trees
- Bunkers
- Greens

**Figure 18 Prescribed Burn Sequence Map**

**1st (yellow)**  
Self-contained areas between holes 5 & 6.

**2nd (orange)**  
Area between holes 2, 4, & 6 that contains a large patch of Black raspberry, *Rubus occidentalis*, on the left side of the fourth hole and behind number six green.

**3rd (lavac)**  
Area around the second half of hole number 18.

**4th (peach)**  
Areas on holes 1, 2, 3, 6, 7, 8, 10, 12, 13, 16, and the practice area near the maintenance yard.

**5th (tan)**  
Areas on holes 13, 15, 16, and 18.

**6th (green)**  
Areas of Zone D -- Hardwoods.

**7th (blue)**  
Areas of Zone E -- Pines and hole #14, which is a unique combination of a mixture of pines and hardwoods with long rough in between.

### Scorecard

HOLE	YARDS	PAR	HOLE	YARDS	PAR
1	480	4	10	385	4
2	425	4	11	196	3
3	191	3	12	430	4
4	409	4	13	442	4
5	353	4	14	147	3
6	384	4	15	327	4
7	335	4	16	588	5
8	550	5	17	311	4
9	175	3	18	400	4
cut	3282	35	in	3236	35
			out	3282	35
			total	6518	70

Michael P. P. / 1984

M-32

effectiveness of the burn program in re-establishing native species, controlling exotics and woody species, and promoting a fair and equitable component to the game.

**1<sup>st</sup>** (yellow) Self-contained areas between holes 5 & 6.

It is recommended that the two isolated patches of rough located between holes 5 and 6 be the first burn site. These self-contained areas have a continuous firebreak around them from the maintained rough of the golf course, thus making for an easier and more manageable size to burn, and hence safer burn conditions.

As an experiment, the patch nearer number five tees should be mowed at 4-6" to create a duff layer that loosens the thatch up. This may or may not improve the quality of the burn and/or effect the Eurasian grasses, but will be simple and quick to perform. It is also important to note the *Quercus rubra*, red oak, seedlings near the large mature red oaks near the border of this patch and the sixth hole at the top of the hill. It may be desirable to save several of these to replace the two large specimens now there. Protecting some from the burn and not others could test the hardiness of the local species in this situation.

As these areas that do not have large patches of desired native species, it is recommended that some species (see plant list in Appendix A) be seeded in by hand to encourage their growth. Scattered seeding of native grasses and forbs throughout the burn areas will help to establish the desired plants. Upon their establishment, the burn will contribute the necessary processes for the plants' continued natural seeding and proliferation. Once a healthy grassland is established, it will promote these native species and prohibit the invasive pests from encroaching upon the site.

**2nd** (orange) Area between holes 2, 4, & 6 that contains a large patch of Black raspberry, *Rubus occidentalis*, on the left side of the fourth hole and behind number six green.

The Black raspberry should be controlled in this situation as it catches many errant shots but is impenetrable and golfers are unable to retrieve their balls from it. The Eurasian grasses in this area are also quite thick and have crowded out the native species. This is in part due to the hydrology of the hill on the right of number four, which seeps water towards this area. There is not standing water, as tile removes any excess, but the moisture content is higher in this area than elsewhere on the course. Also in this area is a Blue spruce, *Picea pungens*, which is inappropriate for the site and should be removed, either manually or with a burn scorching it.

**3rd** (lilac) Area around the second half of hole number 18.

This area contains extensive clumps of Little bluestem, *Schizachyrium scoparius*, and an increasingly evident population of volunteer choke cherries, junipers, and other woody vegetation. Some of this woody vegetation should be cut prior to the burn in order to remove much of the seed source. Originally, the area was completely wide open with only grasses and forbs to the ridgetops. This is evident in old pictures where the distinctive character of milkweeds are plainly seen against the grasses of the hillsides. (see figures 12, 19 and 20 to compare between the 1930's and today)

This amphitheater setting is seen from the clubhouse and many private homes above it and one hillside is the home of some recent golf cart storage bunkers. These concrete bunkers have had much vegetative planting to obscure their appearance, but it does not blend in well with the natural



Figure 19 View from clubhouse to #18 green (circa 1930's)



Figure 20 View of #18 green area (circa 1990)

hillside. Developing a cohesive planting of native roughs, particularly taller grass species, such as Big bluestem, here, would help to camouflage the cart storage area and not make it protrude onto the natural landscape.

Returning the openness to the hole would also provide better views of the players playing the eighteenth hole, a favorite pastime of those passing by on the road that bisects the hillside.

The large expanse between holes one and eight has a similar composition of species, but lacks woody vegetation except near the eighth green. These two areas could be compared for species variation and change.

**4<sup>th</sup>** (peach) Areas on holes 1, 2, 3, 6, 7, 8, 10, 12, 13, 16, and the practice area near the maintenance yard.

These areas are generally open and represent prime areas for recovery by native species and few problems for burning.

**5<sup>th</sup>** (tan) Areas on holes 13, 15, 16, and 18.

These areas are generally open and represent prime areas for recovery by native species, but often have many larger clumps of woody vegetation that makes burning them more problematic.

**6<sup>th</sup>** (green) Areas of Zone D -- Hardwoods.

These areas are bordered on at least one side by a Northern Hardwood Forest dominated by beech and sugar maple. Their sites are more sensitive to burning due to the potential for the fire to spread to a woodland, particularly where those trees that are more susceptible to fire (pines, beech, and sugar maple) dominate.

**7<sup>th</sup>** (blue) Areas of Zone E -- Pines and hole #14, which is a unique combination of a mixture of pines and hardwoods with long rough in between.

These areas are bordered on at least one side by a pine community. Their sites are the most sensitive to burning due to the fire potential of the pines. These areas should be burned with caution, restrictions imposed, and only under the most favorable conditions. The newly restored view from the fourteenth green has cleared out trees behind the green and measures should be taken to include it in the burn program. This will retain the view that was lost for a number of years due to maturing trees.<sup>67</sup>

## **MONITORING**

Much of the source information for this study was obtained from old photographs and home movies. Despite the sometimes poor quality of the images, it was evident from the information where long rough grass existed on the golf course and how much woody plant material was included. With today's advancements in video technology, the use of VHS or 8mm recordings will be able to record the changes in the rough composition with increasing accuracy, ease, and simple reproduction.

The target areas for experimentation (burn sequence numbers 1, 2, and 3) were videotaped on October 17, 1993, from a series of registration points set up on marked sprinkler heads and from easily distinguished landmarks. It is a simple procedure to replicate these same research viewpoints, along with general views, on the golf course today (see following charts and map).

---

<sup>67</sup>The restored view and clearing behind #14 green has not been observed by the author as of this writing. Reports from Mike Morris and others indicate that the view is as spectacular as has been reported in the past and it appears that the area would be an excellent place to sustain a meadow ecosystem to retain the view.

## Visual Research Registration Viewpoints

Visual monitoring of the research areas should be done via 4-season video tape recordings (photographs or slides also, if desired) of the site according to the following timeline. It is important to view scenes at the same time of the month, at about the same time of the day, under similar conditions, and with the same camera (or focal length) in order to get results that can be compared against each other.

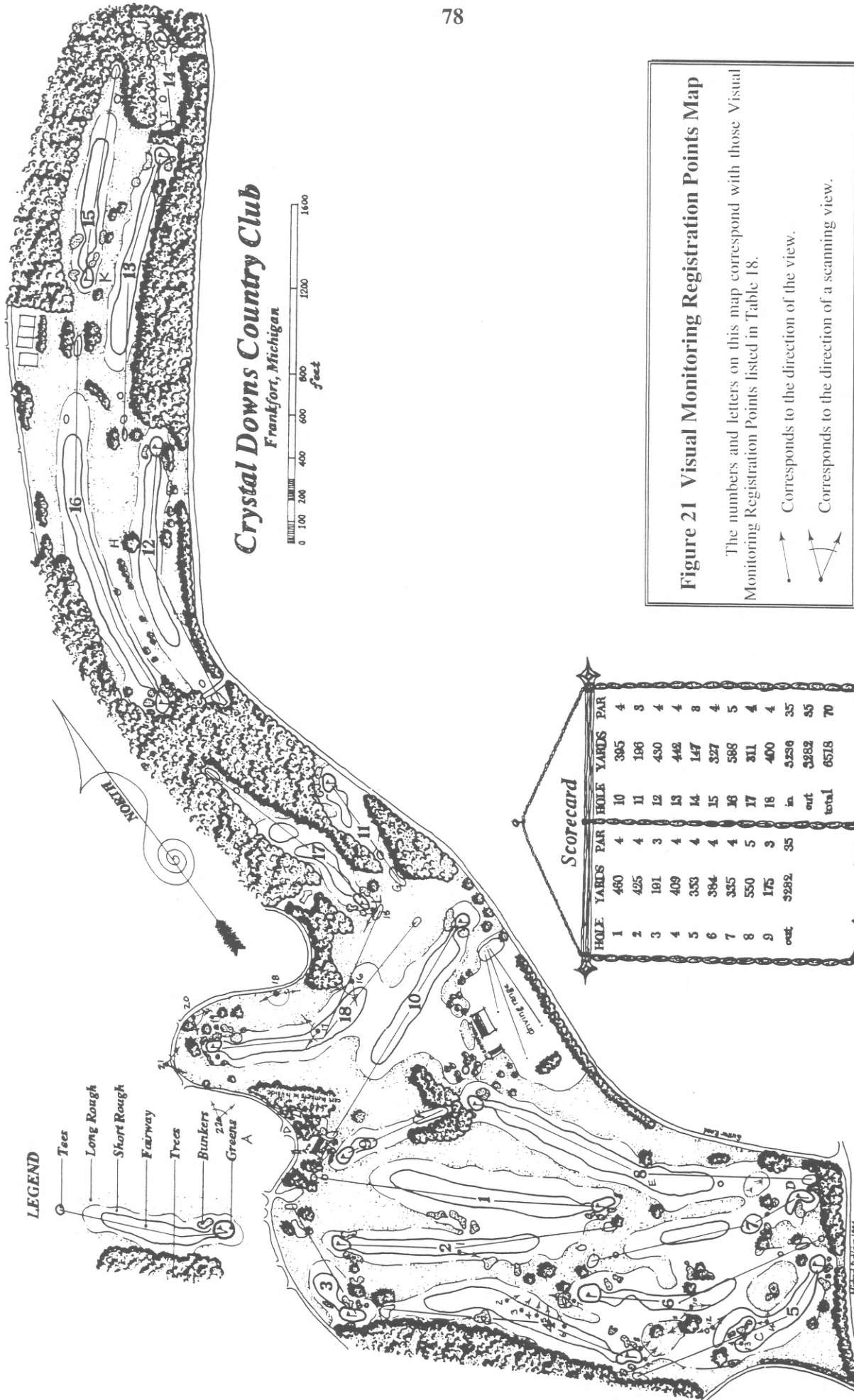
**Table 17: Visual Monitoring Chart**

<u>Years</u>	<u>Months to Monitor Viewpoints</u>
1	January, March through November
2-3	March through November
3-6	April through October
7-10	April, June, August, October
11+	August
Close-ups	Visual record of plant species and wildlife for comparison and cataloging of the diversity of the rough areas ecosystems.
Annual	General taping of the golf course from many of the high vantage points to see the general condition and change of the course. Viewpoint areas include the clubhouse and pro shop areas, hill on #5, hump between #7 green and #8 tee, former Goebel tee in #8 fairway, #9 tee, #11 tee, left of the beech tree on #12, #14 tee, clearing behind #14 green, left of #15 green, and the hump behind #17 green.
Miscellaneous	Recording of any significant event that may effect the maintenance or future change in plant composition.

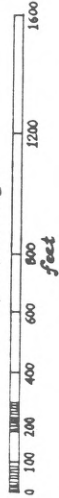
**Table 18: Visual Monitoring Registration Points**

<b>NO.</b>	<b>HOLE</b>	<b>REGISTRATION SPOT</b>	<b>AREA VIEWED</b>
1	2	sprinkler yardage marker 163	<i>Rubus</i> patch
2	4	sprinkler yardage marker 206	<i>Rubus</i> patch
3	4	sprinkler yardage marker 180	<i>Rubus</i> patch
4	4	sprinkler yardage marker 155	<i>Rubus</i> patch
5	4	sprinkler yardage marker 133	<i>Rubus</i> patch
6	4	sprinkler yardage marker 111	<i>Rubus</i> patch
7	6	green donut bunker hump	<i>Rubus</i> patch
8	4	old tee from Goebel course	Oak patch
9	4	back left of green	Oak patch
10	6	sprinkler yardage marker 160 left	Oak patch
10	6	sprinkler yardage marker 160 left	Double donut patch
11		below Oak trees	Oak patch
12	5	hump below ladies tee	Oak patch
12	5	hump below ladies tee	Double donut patch
13	5	beginning of fairway at top of hill	Oak patch
13	5	beginning of fairway at top of hill	Double donut patch
14	5	sprinkler yardage marker 121 left	Oak patch
14	5	sprinkler yardage marker 121 left	Double donut patch
15	17	hump behind green	valley of 18
16	18	bottom of cart path	valley of 18
17	18	sprinkler yardage marker 148 right	valley of 18
18	18	below road on old maintenance path on rt. (stony)	valley of 18
19	18	large knoll right of green and above bunker	valley of 18
20	18	parking space from former Townsend residence	valley of 18
21	18	bend in road across from path down to beach	valley of 18
22		clubhouse lawn	valley of 18
A		clubhouse area	general
B		pro shop area	general
C	5	hill of fairway	general
D		hump between #7 green and #8 tee	general
E	8	former Goebel tee in fairway	general
F	9	tee area	general
G	11	tee area	general
H	12	left of big beech tree	general
I	14	tee area	general
J	14	clearing behind green	general
K	15	left of green	general
L	17	hump behind green	general





### Crystal Downs Country Club Frankfort, Michigan



**LEGEND**

- Tees
- Long Rough
- Short Rough
- Fairway
- Trees
- Bunkers
- Greens

**Scorecard**

HOLE	YARDS	PAR	HOLE	YARDS	PAR
1	460	4	10	385	4
2	425	4	11	186	3
3	181	3	12	430	4
4	409	4	13	442	4
5	353	4	14	147	8
6	384	4	15	327	4
7	335	4	16	588	5
8	550	5	17	311	4
9	175	3	18	400	4
cut	3282	35	in	5258	35
total			out	2982	35
			total	6518	70

**Figure 21 Visual Monitoring Registration Points Map**

The numbers and letters on this map correspond with those Visual Monitoring Registration Points listed in Table 18.

- ↖ Corresponds to the direction of the view.
- ↗ Corresponds to the direction of a scanning view.

Michael B. Wilson 1994

Management activities (either current or changes in procedures), noticed changes in vegetation (particularly evidence of new species or loss of others), dates of visual monitoring, and general weather conditions and outlook should be noted for future reference. Proper record-keeping is essential if the rough area is to be enjoyed by golfers and wildlife alike.

By thoroughly recording the conditions of the research areas in the first few years, the success of the burn program can be monitored and altered to determine the best methods for re-establishing and maintaining the roughs at Crystal Downs and similar areas on other golf courses. General recording of the golf course will assist the club, as well as the maintenance of the course, with the history of the grounds, club, and major events.

The video will also be a beneficial in communicating to club members what procedures and changes have taken place over time. Keeping the membership informed of the care taken to manage the rough areas, the improvements in playability, and the increased habitat diversity will provide the maintenance crew continued support to properly manage the rough areas.

## V. SUMMARY AND CONCLUSIONS

Crystal Downs Country Club occupies a site that has been described as having the loveliest view in the United States and that when Adam Lockhart's farm was transformed into a golf course, that "man has added to, instead of destroyed, the beauty of the scene."<sup>68</sup> The landscape is truly spectacular and the golf course blends into the terrain due to the skillful design work of Alister Mackenzie and Perry Maxwell.

Today, one of the key elements that helps Crystal Downs retain its rugged beauty is the long roughs that wind over the site, catch errant balls, and provide habitat for plants and animals. This management plan has established guidelines to enhance the rough areas by encouraging native plant systems to return to dominance and claim the land. With healthy native plants, indigenous animals will use the areas for food, home, and transportation. Prescribed burns will keep the thatch reduced, thus lessening the wildfire potential, and give golfers a hazard that is fair and equitable to all players while giving them a more beautiful landscape to enjoy with their game.

Golf courses are an integral part of the modern landscape and will continue to be so in the future. Often, they occupy large tracts of land and sometimes that land contains large patches that can be managed with respect

---

<sup>68</sup>Hugh Fullerton, Sr., "Fullerton Describes Beauty of Crystal Downs in 1933," The Benzie County Patriot (July, 26, 1951), Resort Section, reprint of an article written in August, 1933.

to natural ecosystems and still provide enjoyment to the golfers. This report has considered grasslands as its primary study area, but similar work could integrate forest tracts into golf courses as a corridor and habitat for animals or to provide a sanctuary for endangered plants.

Grasslands and prairies were a significant part of the pre-European settlement landscape. They also fit in well with golf courses, another landscape that is dominated by grasses. In some instances, re-introduction of a fire regime may be easy and serve an existing golf course with few alterations in the maintenance program. Other courses may need to drastically change their philosophy to accommodate the different practices and strategies involved for both maintenance and golfer alike. Native grass systems also work well with new course construction as modern seeding techniques allow for large areas to be planted very efficiently.

The economics of operating a golf course are increasing due to more sophisticated, and expensive, technology, the higher cost of land, and a golfing public that demands better conditions and courses. The use of sustainable native ecosystems within golf courses is effective in reducing costs by reducing input demands but still meeting the expectations of the public. In fact, the increase in awareness in environmental issues makes the use of natural areas a public relations bonus.

Harvesting of native seed from large expanses of native areas on golf courses is a potential way to provide cash flow into a golf course. Native seeds are expensive and difficult to get in large quantities from local sources. Golf courses could be the local seedbanks for native or rare seeds that are subsequently used in rehabilitating other local natural areas. By having a local seedbank, consumers would not have to purchase seed from a distant

source and possibly receive a distinct genotype that may be incompatible with their local climate.

Most importantly, native plant systems on golf courses help to compatibly integrate a human use with nature and may help us heal some of the many degraded landscapes of our world.

## BIBLIOGRAPHY

1. Baird, Frederick R. Crystal Downs Country Club. Frankfort, Michigan: Crystal Downs Country Club; 1981.
2. Barnes, Burton V.; Wagner, Warren H., Jr. Michigan Trees. Ann Arbor, Michigan: University of Michigan Press; 1981.
3. Beard, James B. Turf Management for Golf Courses. New York: Macmillan; 1982.
4. Brown, Lauren. Grasses: an identification guide. New York: Houghton Mifflin; 1979.
5. Case, Leonard. Benzie County: A Bicentennial Reader. Honor, Michigan: Platte River Printing; 1987.
6. Cayen, et. al. Southeastern Michigan Native Herbaceous Plants Guide. Ann Arbor, Michigan: University of Michigan School of Natural Resources and Environment NR 691; 1993.
7. Conard, Ron. Applewood Golf Course: Reintroducing the Shortgrass Prairie and Links-Style Golf. USGA Green Section Record; Nov./Dec. 1992; 30(6): 11-12.
8. Cornish, Geoffrey S.; and Whitten, Ronald E. The Golf Course. New York: Rutledge; 1987; ISBN: 0-8317-3943-6.
9. Darwin, Bernard. Golf Courses of the British Isles. London: Duckworth & Co.; 1910.
10. Darwin, Bernard. In the Rough. The American Golfer; 1964--reprinted from original 1922 serial.
11. Diboll, Neil. Prairie Nursery Wildflowers Catalog: spring/fall 1992. Westfield, Wisconsin: Prairie Nursery Wildflowers; 1992.
12. Doak, Tom. The Anatomy of a Golf Course -- the art of golf architecture. New York: Lyons & Burford; 1992.
13. Fullerton, Hugh Sr. Fullerton Describes Beauty of Crystal Downs in 1933. The Benzie County Patriot. Benzonia, Michigan; July 26, 1951.

14. George, P. Stan (superintendent of Prairie Dunes Golf Club). [Letter to Membership of Prairie Dunes]; June 1, 1992.
15. Goodner, Ross. Chicago Golf Club 1892-1992. Wheaton, Illinois: Chicago Golf Club; 1991.
16. Greatest Courses 1993. Golf; November, 1993; 35(11): pp. 72-74.
17. Grossman, John. How Green are these Fairways? Audubon; Sept.-Oct. 1993; 95(5): 90-99.
18. Harty, Francis M. Exotics and their Ecological Ramifications. Natural Areas Journal; 6(4): 20-26.
19. Hutchinson, Horace G. The Book of Golf & Golfers. London: Longmans, Green, & Co.; 1900.
20. Leslie, Mark. Coore-Crenshaw Nebraskan track stirring whirlwind of speculation. Golf Course News; Feb. 1994; 5(2): 41.
21. Lund, Harry C. Michigan Wildflowers in Color. West Bloomfield, Michigan: Altwerger & Mandel Publishing; 1992.
22. Mackenzie, Dr. Alister. Golf Architecture: economy in course construction and green-keeping. London: Simpkin, Marshall, Hamilton, Kent & Co.; 1920.
23. McCallen, Brian. Top 10 You Can Play. Golf; Feb. 1994; 37(2): 40-47.
24. Michigan Natural Resources Magazine. Mapbook of Michigan Counties: Two Peninsula Press; 1984.
25. Pauly, Wayne R. How to Manage Small Prairie Fires. Madison, Wisconsin: Dane County Environmental Council; April 1982.
26. Peterson, Roger Tory; McKenny, Margaret. A Field Guide to Wildflowers: Northeastern and Northcentral North America. Boston: Houghton Mifflin; 1968.
27. Price, Robert. Scotland's Golf Courses. Aberdeen: Aberdeen University Press; 1989.

28. Purkey, Mike. Environment: Is golf a hero or villain? Sometimes the answer is both. *Golf*; Jan. 1993; 35(1): 66-67.
29. Reich, Binda. *Guide to the Arboretum Prairies*. Madison, Wisconsin: University of Wisconsin - Madison Arboretum; undated.
30. Schramm, Peter (Knox College). The "Do's and Don'ts" of Prairie Restoration.
31. Selcraig, Bruce. Greens Fees. *Sierra*; July/August 1993; 78(4): 70-77, 86-87.
32. Smith, Daryl. Fire: a natural phenomena. *Iowa Prairie Blazingstar*; Spring 1990; 2(1): pp. 1-2.
33. Thompson, Paul W. *Vegetation and Common Plants of Sleeping Bear*. Bloomfield Hills, MI: Cranbrook Institute of Science; 1967.
34. Towne, Gene; Owensby, Clenton. Long-term Effects of Annual Burning at Different Dates in Ungrazed Kansas Tallgrass Prairie. *Journal of Range Management*; Sept. 1984; 37(5): pp. 392-397.
35. *Vegetation Management Manual and Guidelines*. Springfield, Illinois: Illinois Nature Preserves Commission; September 1990.
36. Voss, Edward G. *Michigan Flora: Part II, Dicots (Saururaceae--Cornaceae)*. Ann Arbor, Michigan: Cranbrook Institute of Science and University of Michigan Herbarium; 1985.
37. Voss, Edward G. *Michigan Flora: Part I, Gymnosperms and Monocots*. Ann Arbor, Michigan: Cranbrook Institute of Science and University of Michigan Herbarium; 1992.
38. Whitten, Ronald. America's 100 Greatest. *Golf Digest*; 1993; 44(11): 62-80.
39. Whitten, Ron. Perfection vs. Reality. *Golf Digest*; April 1994; 45(4): 123-126, 135.
40. Wind, Herbert Warren. 20th Century Designers and Their Methods. *Golf Digest*; December, 1966; 17(12): pp. 36-41, 58-66.



## ADDITIONAL REFERENCES<sup>69</sup>

1. Ackerman, Jennifer. Carrying the Torch. *Nature Conservancy*; Sept./Oct. 1993; 43(5): pp. 17-23.
2. Ahrenhoerster, Robert; Wilson, Trelen. *Prairie Restoration For the Beginner*; 1981.
3. Balogh, James C.; Walker, William J. *Golf Course Management & Construction: Environmental Issues*. Boca Raton: Lewis; 1992.
4. Browning, Robert. *A History of Golf: the Royal and Ancient Game*. New York: E. P. Dutton; 1955.
5. Cornish, Geoffrey S.; Whitten, Ronald E. *The Architects of Golf*. New York: HarperCollins; 1993.
6. Davis, William H. *The World's Best Golf*. New York: Golf Digest and Pocket Books; 1991.
7. Davis, William H.; Editors of Golf Digest. *100 Greatest Golf Courses--and then some*. Trumbull, CT: Golf Digest; 1986.
8. Doak, Tom. *The Confidential Guide to Golf Courses: Thomas H. Doak*; 1989.
9. Earl, David. The Doctor and the Downs. *Golf Journal*; October, 1991; XLIV(7): pp. 18-21.
10. Edminster, Craig. Viability of low maintenance, water-conserving fine fescue in commercial landscape and golf course applications. *The Landscape Architect and Specifier News*; 1990; (10): 44-47.
11. Edmondson, Jolee. Hazards of the game. *Audubon*; 1987; 89(November): 24-37.
12. *Golf Course Management*.
13. Green, Robert; Morgan, Brian. *Classic Holes of Golf*. New York: Prentice Hall; 1989.

---

<sup>69</sup>These readings are used but not specifically referred to in the text.

14. Grese, Bob. Klondike Property: The Nature Conservancy; May 17, 1982.
15. Harker, Donald; Evans, Sherri; Evans, Marc; Harker, Kay. Landscape Restoration Handbook. Boca Raton: Lewis; 1993.
16. Ingram, Douglas R. Use of Plant Material on the Golf Course. Ann Arbor: University of Michigan; 1981.
17. Jacobs, Timothy. Great Golf Courses of the World. New York: Gallery Books; 1990.
18. Jones, Robert Tyre, Jr. Golf Is My Game. Garden City, New York: Doubleday; 1960.
19. Love, William R. An Environmental Approach to Golf Course Development: American Society of Golf Course Architects; 1992.
20. Mackenzie, Dr. Alister. Economy in Course Construction. The American Golfer; August, 1914.
21. Mackenzie, Dr. Alister. The Ideal Short Hole. The American Golfer; June, 1932: pp. 18, 44.
22. Mackenzie, Dr. Alister. Pleasurable Golf Courses. Golf Illustrated; April, 1926.
23. Mackenzie, Dr. Alister. Problems in Remodeling courses. American Golfer; May, 1933: pp. 25, 44.
24. Mackenzie, Dr. Alister. Sarazen's Nemesis at Troon. Golf Illustrated; September 1923.
25. Mackenzie, Dr. Alister. Too Many Bunkers. The American Golfer; April 1933: pp. 14, 45.
26. Magill, Arthur W. Monitoring Environmental Change with Color Slides. Berkeley, California: Pacific Southwest Forest and Range Experiment Station; December 1989; Gen. Tech. Rep. PSW-117.
27. McClain, William E. Illinois Prairie: Past and Future--a restoration guide: Illinois Department of Conservation, Division of Natural Heritage; 1986.

28. Morgan, Brian. *A World Portrait of Golf*. New York: Gallery Books; 1988.
29. Murdoch, Joseph S. F. *The Library of Golf 1743-1966*. Detroit: Gale Research; 1968.
30. Nuzzo, Victoria A.; Howell, Evelyn A. Natural Area Restoration Planning. *Natural Areas Journal*; 1990; 10(4): pp. 201-209.
31. O'brien, Patrick M. *A Role For Native or Naturalized Vegetation in Golf Course Architecture*; 1987.
32. Osborne, George C. Nature deals the deck. *Golf Course Management*; 1983; 51(9): 24-27.
33. Petrides, George A. *A Field Guide to Eastern Trees: Eastern United States and Canada*. Boston: Houghton Mifflin; 1988.
34. Saltzstein, Rob. Letting Nature Make a Course. *Golf Journal*; April, 1977; XXX(no. 3): pp. 6-12.
35. Schon, Leslie. *The Psychology of Golf*. London: Methuen; 1922.
36. Schramm, Peter. *Twelve Points About Prairie Restoration*. Galesburg, Illinois.
37. Simpson, Thomas G. *The Game of Golf*. Philadelphia: Lonsdale Library; 1931; IX.
38. Sutton, Martin H. F. *The Book of the Links: A Symposium on Golf*. London: W. H. Smith and Son; 1912.
39. Thilo, Daniel. *Multi-Uses of the Golf Course*. Ann Arbor: University of Michigan; 1982.
40. Thomas, George C., Jr. *Golf Architecture in America*. Los Angeles: Times-Mirror; 1927.
41. Travis, Walter J. *Practical Golf*. New York: Harper & Brothers; 1901.
42. USGA Green Section Record.

43. Vogl, Richard J. Fire: A Destructive Menace or a Natural Process?. Cairns, J., Jr.; Dickson, K.L.; Herricks, E.E. Recovery of Damaged Ecosystems. Charlottesville, Virginia: U. Press of Virginia; 1977: pp. 261-289.
44. Ward-Thomas, Pat; Wind, Herbert Warren; Price, Charles; and Thomson, Peter. The New World Atlas of Golf: the great courses and how they are played. New York: Gallery; 1989.
45. Weston, John. Fire as a Landscape Management Tool. USGA Green Section Record; Jan./Feb. 1994; 32(1): 14-16.
46. Weston, John. Using Native Plants in the Golf Course Landscape. USGA Green Section Record; Jan./Feb. 1990; 28(1): pp. 12-16.
47. Williams, Michael. History of Golf. Spain: Chartwell Books; 1987.
48. Wind, Herbert Warren. Understanding Golf Course Architecture. Golf Digest; November, 1966; 17(11): pp. 24-29.
49. Woehler, Eugene E. Establishment of Native Warm Season Grasses in Wisconsin. Madison, Wisconsin: Department of Natural Resources; July 1979; Report 102.

**APPENDIX A: Crystal Downs Native Rough Plant List<sup>70</sup>**

<i>Scientific name</i> Common name	Height	Flower Color	Blooming Period	Habitat DRY-MESIC-WET
---------------------------------------	--------	-----------------	--------------------	--------------------------

**GRASSES & GRASSLIKE PLANTS**

<i>Ammophila breviligulata</i> Beach grass	to 3.5'	pale yellow	July - Oct.	dunes
<i>Andropogon gerardii</i> Big bluestem / Turkeyfoot	2.5-8'	bronze-purple	Aug. - Oct.	X X X X X
<i>Carex pensylvanica</i> Pennsylvania sedge	6-12"	brown-red/purp	spring	X X X
<i>Danthonia spicata</i> Poverty grass / Oatgrass	4-24"		May - July	X X
<i>Elymus canadensis</i> Canada wild rye	3-4'			X X X
<i>Eragrostis spectabilis</i> Purple lovegrass	1-2'	purplish	July - Sept.	X X
<i>Hordeum jubatum</i> Squirrel-tail grass	1-2.5'	green-purple		X X X
<i>Juncus tenuis</i> Path rush	1-24"		June - Sept.	X X X
<i>Koeleria macrantha</i> Junegrass	1-2'			X X
<i>Oryzopsis racemosa</i> Rice-grass	2-6"			X X X
<i>Panicum capillare</i> Witch grass	4-18"	purple	July - Oct.	X X X
<i>Panicum virgatum</i> Switchgrass	3-5'	reddish purple	July - Sept.	X X
<i>Schizachyrium scoparium</i> Little bluestem	1.5-3'	rust - purplish	July - Oct.	X X X X
<i>Sorghastrum nutans</i> Indian grass	3-6'	glossy bronze	fall	X X X

**FORBS**

<i>Anaphalis margaritacea</i> Pearly everlasting	1-3'	white	July - Sept.	X X
<i>Anemone multifida</i> Red anemone / windflower	to 12"	red	May - June	X dunes
<i>Antennaria neglecta</i> Field pussytoes	4-12"	white	April - May	X X

<sup>70</sup>Reich, Guide to the Arboretum Prairies; Cayen, et. al., Southeastern Michigan Native Herbaceous Plants Guide; Robert Grese, Michigan Prairie/Oak Opening Species, U. of MI class NR 691 handout; Thompson, Vegetation and Common Plants of Sleeping Bear; Lauren Brown, Grasses: An Identification Guide; Barnes and Wagner, Michigan Trees; Edward Voss, Michigan Flora: Part I & II; Peterson and McKenny, Wildflowers: northeastern/northcentral North America; and Harry Lund, Michigan Wildflowers in color.

Scientific name Common name	Height	Flower Color	Blooming Period	Habitat DRY-MESIC-WET
<i>Antennaria plantaginifolia</i> Plantain-leaved pussytoes	3-16"	white	April - June	X X
<i>Arabis lyrata</i> Lyreleaf mustard	4-12"	white	April - May	X X
<i>Aralia nudicaulis</i> Wild sarsaparilla	12"	white	June - Aug.	X X X
<i>Arctostaphylos uva-ursi</i> Bearberry	to 12"	white	May - July	X X
<i>Arenaria stricta</i> Sandy spurrey / Rock sandwort	2-8"	white	June - July	X X
<i>Artemisia caudata</i> Dune / Tall wormwood	2-5'	green	July - Oct.	X X
<i>Asclepias syriaca</i> Common Milkweed	2-4'	whitish	June - Aug.	X X X
<i>Asclepias tuberosa</i> Butterflyweed	1-3'	orange	July - Aug.	X X
<i>Aster laevis</i> Smooth Aster	2-4'	blue - lavender	Aug. - Oct.	X X X
<i>Aster macrophyllus</i> Large-leaved Aster	1-3'	light blue	Aug. - Sept.	X X X
<i>Campanula rotundifolia</i> Harebell	6-18"	violet - blue	June - Sept.	X X
<i>Comandra richardsoniana</i> Bastard toad flax			early summer	X X X
<i>Coreopsis lanceolata</i> Lance-leaved coreopsis	1-2'	yellow	May - Aug.	X X
<i>Erigeron strigosus</i> Daisy fleabane		white	May - Oct.	X X
<i>Eupatorium maculatum</i> Joe Pye Weed	2-6'	rose - purple	Aug. - Sept.	X
<i>Euphorbia corollata</i> Flowering spurge	12-40"	white	July - Sept.	X X X
<i>Fragaria virginiana</i> Wild strawberry	4-6"	white	April - June	X X X
<i>Gnaphalium macounii</i> Clammy everlasting	2-3'	white	Aug. - Nov.	X X
<i>Gnaphalium obtusifolium</i> Sweet everlasting / Catfoot	1-2'	white	Aug. - Nov.	X X
<i>Grindelia squarrosa</i> Gum plant	0.5-3'	yellow	July - Sept.	X X
<i>Helianthemum canadense</i> Frostweed	6-20"	yellow	May - June	X X
<i>Hudsonia tomentosa</i> False heather	4-8"	yellow	May - July	X dunes
<i>Krigia biflora</i> Two-flowered cynthia	1-2'	orange-yellow	May - Aug.	X X
<i>Lathyrus japonicus</i> Beach pea	1-2'	pink-purple	June - Aug.	X X
<i>Linnaea borealis</i> Twinflower	3-6"	pink	June - Aug.	X X

<i>Scientific name</i> Common name	Height	Flower Color	Blooming Period	Habitat DRY-MESIC-WET
<i>Lilium philadelphicum</i> Wood lily	1-3'	orange-scarlet	June - July	X X
<i>Lithospermum canescens</i> Hoary puccoon	4-18"	yellow-orange	April - May	X X X X
<i>Melampyrum lineare</i> Cow-wheat	4-12"	yellow	July - Aug.	X X X
<i>Mentha arvensis</i> Wild mint	6-24"	pink - purple	July - Sept.	X X
<i>Monarda fistulosa</i> Wild bergamot / Beebalm	2-4'	lavender	July - Aug.	X X X X X
<i>Monarda punctata</i> Horse mint		rosy lilac	June -July	X X
<i>Oenothera biennis</i> Evening primrose	2-6'	yellow	July - Sept.	X X X
<i>Physalis heterophylla</i> Clammy ground cherry	1-3'	grn.-yel./brown	June - Sept.	X X
<i>Physalis subglabrata</i> Smooth ground cherry	3-5'	yellow / purple	July - Sept.	X X
<i>Rudbeckia hirta</i> Black-eyed susan	1-3'	yellow - orange	June - Oct.	X X X
<i>Senecio obovatus</i> Roundleaf ragwort	6-18"	yellow	April - June	X X
<i>Smilacina stellata</i> Starry false Soloman's-seal		white	May - Aug.	X
<i>Solidago altissima</i> Tall goldenrod	3-6'	yellow	Aug. - Nov.	X X
<i>Solidago graminifolia</i> Grass- or Lance-leaved goldenrod	1-4'	yellow	July - Oct.	X
<i>Solidago juncea</i> Early goldenrod	12-40"	yellow	June - Oct.	X X
<i>Solidago nemoralis</i> Gray goldenrod	6-40"	yellow / gold	Aug. - Oct.	X X
<i>Verbena hastata</i> Blue vervain	1-4'	blue	July - Sept.	X X
<i>Verbena stricta</i> Hoary vervain	1-4'	blue / purple	June - Sept.	X X
<i>Viola canadensis</i> Canada violet	8-16"	white	April - July	X X
<i>Viola pennsylvanica</i> Smooth yellow violet	4-12"	yellow	April - June	X X
<i>Zigadenus glaucus</i> Dune lily / White camas	1-3'	white	July - Aug.	X dunes

**FERNS**

<i>Pteridium aquilinum</i> Bracken fern	1-2'			X X X
--	------	--	--	-------

<i>Scientific name</i> Common name	Height	Flower Color	Blooming Period	Habitat DRY-MESIC-WET
<b><u>SHRUBS</u></b>				
<i>Cornus stolonifera</i> Red-osier dogwood	4-12'	white whitish (fruit)	June Aug. - Oct.	X X X
<i>Juniperus communis</i> var. <i>depressa</i> Ground juniper	2-6'	dark blue & fleshy (fruit)		X X
<i>Rhus typhina</i> Staghorn sumac	4-15'	green-yellow red (fruit)	June - July Aug. - winter	X X X
<i>Rosa blanda</i> Smooth rose	2-5'	pale pink	June - Aug.	X X X
<i>Rosa carolina</i> Pasture rose	1-3'	pink	June - July	X X X
<i>Rubus occidentalis</i> Black raspberry	3-6'	white purp/blk (fruit)	May - June July (fruit)	X X X
<i>Rubus strigosus</i> Red raspberry	18"-6'	white red (fruit)	May - June July/Aug(fruit)	X X X X
<i>Shepherdia canadensis</i> Buffalo-berry / Soapberry	to 10'	yellow red/or. (fruit)	April - May July/Aug(fruit)	X X
<i>Spiraea alba</i> Meadowsweet	1-4'	white	July - Aug.	X X



## **APPENDIX B: Glossary of Terms Related to Golf and this Study**

- cool season species** Those plants which grow and develop best when the soil temperature is consistently cooler (between 60 and 75 °F for turfgrass species<sup>71</sup>). This corresponds to the spring and fall in Michigan.
- detritus** The fuel build-up of dead plants plainly evident by the "cushy" feeling one senses when walking through many of the rough areas.
- divot** A small excavation of earth, usually caused by a golf club when it strikes the turf below a golf ball in the process of hitting a golf ball.
- fairway** The main playing surface of the golf course between the tee and the green. The fairway's cut of grass is typically  $\frac{3}{4}$  inch.
- forb** A wildflower.
- furze** Gorse.
- green** The playing surface where the cup is placed and the flagstick placed in the cup to designate the finishing point of a hole. Greens are the most highly maintained areas on a golf course, with the cut of grass at approximately  $\frac{1}{8}$  inch.
- gorse** *Ulex europaeus* "A dense, prickly evergreen shrub commonly found on British links courses, from which recovery shots are usually impossible. The term is

---

<sup>71</sup>James B. Beard, Turf Management for Golf Courses (New York, Macmillan, 1982), p. 27.

- sometimes misused in America to describe any densely vegetated area."<sup>72</sup> Also called furze or whins.
- heather** "A low-growing flowering shrub or ground cover common to British links and inland courses, from which a shot may be played with some difficulty. The term is erroneously used in the United States as a synonym for long rough."<sup>73</sup>
- lie** Refers to the resting position of the golf ball. A "good" lie allows the golfer to make clean, solid contact with the ball. A "poor" is one where vegetation, a hole, or some other obstruction prevents the golfer from making solid contact with the ball.
- natural area** An out-of-play (normally) area on a golf course that incorporates long grasses, forbs, shrubs, wetland, specimen trees, and other natural features for their ecological and design significance.
- native(s)** A plant indigenous to the site, or the site's ecotype and region, since before European settlement.
- rough** The other turfed playing surface between the tee and the green. Rough has many variations in cut, from approximately 1-1.25 inches just off the fairway to "normal" at 2-3 inches and to "long" rough, which is usually unmaintained and grows much higher. In this study, rough will indicate long rough unless further clarified.

---

<sup>72</sup>Tom Doak, *The Anatomy of a Golf Course* (New York, Lyons & Burford, 1992), p. 233.

<sup>73</sup>*Ibid.*, p. 233.

**tee** The playing surface where a golfer starts play on a hole. Also the wooden peg use at this place to support the ball above the grass. Teeing grounds are usually highly maintained areas, with the cut of grass at approximately  $\frac{1}{2}$  inch.

**"through the green"** Refers to all the playing ground between the tee and putting green.

**warm season species** Those plants which grow and develop best when the soil temperature is consistently warmer (between 80 and 95 °F for turfgrass species<sup>74</sup>). This corresponds to the summer months in Michigan.

**winter rules** A local rule in golf allowing a player to improve his lie in the fairway when conditions are below standard.

---

<sup>74</sup>Beard, p. 27.

## **APPENDIX C: Pre-Burn Fire Checklist**<sup>75</sup>

Site: \_\_\_\_\_ Date of burn: projected \_\_\_\_\_, attempted \_\_\_\_\_

### **Fire leader: initial each item after compliance**

- ( ) Authorized fire leader present.
- ( ) All required permits are obtained, at burn site, and valid.
- ( ) Adjacent residents recently notified of the plan to burn and when.
- ( ) Professional up-to-date forecast indicates weather factors will be good for at least 2 hours after fire has been extinguished.
- ( ) On-site weather indications of wind speed, temperature, and relative humidity are consistent with forecast and are within parameters of safe burning conditions.
- ( ) Equipment as required for safe burning is in working order.
- ( ) Firebreaks as required for safe burning are in place.
- ( ) Crew numbers and qualifications are sufficient to perform a safe and effective burn.
- ( ) Each crew member has the proper safety gear and clothing for a safe and effective burn.

### **Crew Briefing**

- ( ) Objectives of the burn.
- ( ) Exact area of the burn.
- ( ) Hazards in and around the burn area: volatile fuels, heavy fuels, plants to protect, fire whirls, poisonous plants (poison ivy at Crystal Downs), rough terrain, weak points in a firebreak, electrical lines, irrigation satellite stations.
- ( ) Defenses against hazards.
- ( ) Crew assistants: ignition, (holding) raking, containment (flapping), mop-up/checking patrol, fire behavior and weather and supplies.
- ( ) Ignition technique and pattern. Holding technique.
- ( ) Locations of extra equipment, fuel, water, and vehicles.
- ( ) Equipment check for proper condition.
- ( ) Authority and communications.

---

<sup>75</sup>Adapted from the Iowa Prairie Blazingstar, (University of Northern Iowa, Vol. II, Issue 1, Spring 1990), p. 11.

- ( ) Contingency plans following wind shift, equipment or firebreak failure. Escape routes and how to black-spot an area if in danger.
- ( ) Sources of assistance and how to get it.
- ( ) Special instructions regarding smoke management, questions from outsiders, etc.
- ( ) Questions?
- ( ) Crew members given opportunity to decline participation.

FIRE LEADER: \_\_\_\_\_ DATE: \_\_\_\_\_

UNIVERSITY OF MICHIGAN



3 9015 02887 2722

