

Natural Grass Playing Field Case Study: Martha's Vineyard, MA

Improving the quality of grass playing fields with data collection and organic management

COMMUNITIES ON THE ISLAND of Martha's Vineyard, Massachusetts – Chilmark, Edgartown, Oak Bluffs, and West Tisbury – have chosen to work with a non-profit group, [The Field Fund](#), to manage their natural grass playing fields. The Field Fund was formed in 2017 with a goal of providing quality grass playing fields that can support the full demands of local youth and adult recreational activities, and increase community access to pesticide-free play spaces. This case study provides information on maintenance practices, costs, use, successes, and challenges for three natural grass field complexes managed by The Field Fund.



Children playing soccer at West Tisbury School field

In its work with towns and schools, The Field Fund has chosen to use a combination of established organic management techniques and innovative technologies to pinpoint the needs of each field and allocate resources with precision. The Field Fund worked with a consultant to design the project and to create individualized maintenance plans for the fields. The Field Fund places a high priority on maximizing availability of the fields for play. Their techniques are designed to ensure that fields are never closed for maintenance.

Elements of organic management include frequent aeration, frequent mowing, soil testing, and the use of organic fertilizer and soil amendments. These practices are designed to create a healthy ecosystem with an active soil microbial community and a strong root system. In addition to these organic techniques, The Field Fund uses technologies such as drone photography and soil moisture mapping to assess field maintenance needs. Information collected through these techniques makes it possible to target the field areas needing additional maintenance, and to reduce total maintenance costs. The Field Fund also chose a mixture of grass types that are resilient in the Massachusetts climate and provide maximum root stability to withstand sports activity.

The Field Fund tailors maintenance to the use needs of each field. Some fields need only simple maintenance; others benefit from more support, including use of innovative technologies, to match their usage demands. Annual costs per acre range from \$4,900 to \$10,600. These costs are about 30% higher than would be faced by mainland communities for the same activities, due to additional costs associated with transporting materials and equipment to an island, as well as higher labor costs overall.

Fields maintained by The Field Fund are fully meeting the needs of their communities. None of The Field Fund partner fields were closed due to field conditions in 2019. By using organic maintenance practices, they are protecting their limited water resources and creating quality fields both for general use and for organized sports.



Introduction

This case study focuses on the organic management of natural grass on athletic fields on Martha’s Vineyard, managed by The Field Fund in collaboration with town and school partners. This is the third in a series of case studies created by the Toxics Use Reduction Institute (TURI), intended to share the experiences of communities that have chosen to invest in organically managed natural grass athletic fields. The first two case studies described the experiences of the [City of Springfield](#) and the [Town of Marblehead](#). The Springfield and Marblehead case studies show what can be accomplished with use of core organic

management techniques. This case study presents how precision technologies can be used alongside core organic management techniques, for those communities that have resources for additional investment.

This case study, and the companion case studies, help to answer questions faced by many communities. These include questions about annual costs of maintenance, field use hours, and how to make the transition to organic management.

Overview

Children, teens and adults on Martha's Vineyard have played on grass fields for generations. As in other communities, these fields are used for physical education (P.E.), organized sports, pick-up games, and general use. In 2017, a group of Martha’s Vineyard parents established The Field Fund, Inc. (www.fieldfundinc.org), with a goal of providing support to Martha's Vineyard schools and towns seeking to improve, or better maintain, their grass playing fields using organic practices. The Field Fund’s services are funded through donations and grants. Their services include assistance with ongoing maintenance, purchase of materials and equipment, education/training for groundskeepers and other community members,

and assistance in redesigning existing fields and adjacent playing surfaces.

The Field Fund received a TURI community grant award in fall 2017 to support its healthier playing fields initiative. The funds purchased an \$8,500 slicing aerator, used to reduce compaction, improve drainage, and encourage healthy root systems.

As of September 2020, The Field Fund was supporting five athletic field complexes in partnership with four schools and towns, each with different use needs. Table 1 summarizes these field areas and their uses. Data presented in this case study were collected throughout 2019.

Table 1: Organically managed athletic fields in Martha’s Vineyard

Park	Area (sq. ft.)	Sports/other information
Oak Bluffs School	119,790	Soccer, lacrosse, recess and P.E. activities
West Tisbury School	87,120	Soccer, track, and P.E. activities
West Tisbury Town	60,984	Soccer, Little League baseball, and pick-up games
Edgartown School	54,450	Recess and P.E. activities, pickup games, lacrosse camps
Chilmark School	26,136	Recess and P.E. activities, informal baseball, soccer, lawn tennis, summer camp, recreational use, and community gatherings

Project Design and Startup

The Field Fund’s work is tailored to the needs of each school or town. Individual fields have varying needs depending on the amount of formal and informal recreational use they receive each year.

The Field Fund begins each new project by meeting with stakeholders, including school administrators, local Parks and Recreation departments, and facilities caretakers, to identify existing or desired field usage, existing maintenance practices and challenges, time constraints, and town regulations. Once a relationship is formed, The Field Fund coordinates directly with facilities staff regarding mowing and scheduling maintenance around school activities. The Field Fund also works with natural grass athletic field consultants at Natural Grass Advisory Group (NGAG) to develop a rehabilitation plan and to create a maintenance

plan by season that includes organic grass management techniques.

The Field Fund uses soil testing, an important step in organic grass care, to understand existing physicochemical characteristics and balance of nutrients for each field. Fostering a healthy balance of these soil characteristics is essential to supporting healthy grass root systems. Soil test findings are used to create a unique maintenance for each field.

The Field Fund coordinates field maintenance with each field's respective school or town partner and places a high priority on ensuring that fields can be used continuously, regardless of maintenance activities. Partnering towns and schools have never been asked to close a field during or after maintenance by The Field Fund.

Hours of Activity: Examples from Three Athletic Fields

Decision makers often ask how many hours of activity they will be able to schedule on a natural grass playing field. NGAG applies the principle that a natural grass field can accommodate any amount of play; maintenance practices simply need to be adjusted based on amount and type of activity. Thus, the number of hours recorded for the fields highlighted in this case study were not the maximum number of hours possible. Rather, the fields were used for the number of hours needed by the community, and The Field Fund was able to focus on improving the overall quality of their playing fields.

Playing fields in Martha’s Vineyard cover a wide range of use needs. Some fields are needed for school related activities only. Other fields, such as Oak Bluffs, are also regular practice and game locations for sports leagues. Towns and schools that have partnered with The Field Fund have been

able to meet all of their use needs, with few cancellations due to weather-related field conditions.

Based on information provided by Martha’s Vineyard athletic directors, P.E. teachers, and The Field Fund, TURI was able to compile scheduled sports team use as well as estimated informal recreational use hours for three field complexes: Oak Bluffs School fields, West Tisbury School fields, and West Tisbury Town field. These complexes are used primarily by youth, but also by some adult sport teams. They are used mainly in the spring and fall, but are open year-round.

Hours of sports team use were estimated by multiplying the number of scheduled practices and games per week by the number of hours scheduled for each activity.

Field Closures

None of The Field Fund partner fields were closed due to field conditions in 2019. The Field Fund encourages schools and towns to leave fields open for play unless there is standing water on the fields. Pooling is uncommon on these fields due to

the regular aeration and the relatively high amount of sand in the soil. However, if pooling occurs after a rainstorm, coaches are able to shift play away from the puddled area to a drier area on the field.

Oak Bluffs School Fields

The Oaks Bluff School field complex consists of one regulation 11v11 soccer field and one regulation 9v9 soccer field.¹ The total playing area of the two playing fields at Oak Bluffs measure 2.75 acres, or approximately 120,000 square feet. The fields are mainly used for soccer in the fall and spring as well as hosting recess and physical activity for 445 students. The Oak Bluffs fields host some of the practices and games for Martha's Vineyard Island League Soccer and the Martha's Vineyard Youth

Lacrosse league, as well as school activities (e.g., recess, P.E. classes).

The Oak Bluffs school fields were rebuilt in the summer of 2018. Work began on June 27, 2018. Both fields were open for the start of the school year just over two months later, on September 4, 2018, three weeks after seeding. Both fields were overseeded again on September 3 and the grass continued to fill in throughout the season.



A. Oak Bluffs School fields rebuild project: Excavation on July 3, 2018; B. Seeding of fields, August 15, 2018; C. Overseeding before first game on new field, September 3, 2018; D. Oak Bluffs School fields on May 21, 2019

¹ 11v11 indicates 11 players per team and 9v9 indicates nine players per team.

The Oak Bluffs fields have the highest use needs of the three athletic fields highlighted in this case study. Over the course of 2019, the Oak Bluffs School fields were jointly used by sports teams for just over 380 hours. Adding recess and P.E. time leads to an estimated total of just over 890 hours of use for 2019. Approval is generally required for organized sports teams to use the Oak Bluffs

School field complex. However, the fields are available for community use without special arrangements. Informal recreation was not included in the 2019 annual estimate of use hours, as the campus was closed during the summer for school building renovations. Table 2 shows estimates of the total number of use hours by sports teams and the school in 2019.

Table 2: Oak Bluffs School fields (two fields)

Sport	Age group	Season	Weeks	Total use: hours per week	Total use hours per season ^a
MV Island League Soccer	Youth	Fall	8	42	340
Lacrosse	Youth	Spring	12	4	48
Total documented sports team use – all seasons					380
Recess	Youth	Fall, spring	37	3	110
Physical education	Youth	Fall, spring	16	25	400
Estimated total hours – all seasons					890

Note: Informal recreation was not included in the 2019 annual estimate of use hours, as the campus was closed during the summer for school building renovations.

^a Due to rounding to two significant digits, totals may not correspond to the sum of the separate figures.

West Tisbury School Fields

The West Tisbury School (pre-K through 8th grade) has two multi-purpose fields with a total area of two acres, or just over 87,000 square feet. The fields host a variety of school activities, scheduled sports, and informal recreational uses.

The West Tisbury School fields are the main site for the island's recreational soccer program, which hosts 300 children aged four to ten annually. These fields also host the school's track team activities as well as the school's daily recess and P.E. classes. During the spring, the field is used primarily by the recreational soccer program and the West Tisbury School P.E. classes for around 15 hours per week.



Soccer game at West Tisbury School

In the fall, these fields are used by the recreational soccer program, the school track team, and the school for recess and P.E. classes, for a combined total of 26 hours per week. Over the course of 2019, the West Tisbury School fields were used by sports teams for just over 220 hours in the fall and

spring seasons. Adding estimated school use time and informal summer recreation leads to an estimated total of around 470 hours of use in 2019. Table 3 shows the total number of hours of field use for each sport per season.

Table 3: West Tisbury School fields (main field) ^a

Sport	Age group	Season	Weeks	Total use: hours per week	Total use hours per season ^{a,b}
MV Soccer Recreation Program	Youth	Spring, fall	15	11	170
MV Island League Soccer	Youth	Fall	8	3	24
Track	Youth	Fall	8	4	32
Total documented sports team use – all seasons					220
Physical education	Youth	Spring	10	4	40
Physical education	Youth	Fall	10	5	50
Recess	Youth	Spring, fall	36	3	110
Informal recreation ^c	Youth/adult	Summer	10	5	50
Estimated total hours – all seasons					470

^a Hours are presented for main 75 x 110 yard field. A small grass play area is located adjacent to this field and is also used for some recess and informal recreation.

^b Due to rounding to two significant digits, totals may not correspond to the sum of the separate figures.

^c This is a conservative estimate that includes pickup games and occasional camp use.

West Tisbury Town Field

The West Tisbury Town field is adjacent to the West Tisbury School’s fields and covers 1.4 acres, or approximately 61,000 square feet. This field is used for youth soccer, youth baseball, adult soccer, and pick-up games by community members year round. In the spring, the West Tisbury Town field was used for 12 hours per week for soccer practice and games. In summer, the women’s adult soccer league used the West Tisbury Town field for four hours per week for practice and games. During the fall season, this field was used for the Island League youth soccer



Aeration at West Tisbury Town field

program for 12 hours per week for eight weeks. The informal recreational use by the surrounding community occurs throughout the entire year.

Over the course of 2019, the West Tisbury Town field was used by sports teams for around 250 hours. Adding estimated informal use time leads to an estimated total of around 390 hours of use for 2019. Table 4 shows the total number of hours used by adult and youth teams as well as informal recreational use for 2019.

Table 4: West Tisbury Town field

Sport	Age group	Season	Weeks	Total use: hours per week	Total use hours per season ^a
MV Island League Soccer	Youth	Fall	8	12	96
Little League baseball	Youth	Spring	10	12	120
Women’s Soccer League	Adult	Summer	8	4	32
Total documented sports team use – all seasons					250
Estimated informal recreation use ^b			28	5	140
Estimated total hours – all seasons					390

^a Due to rounding to two significant digits, totals may not correspond to the sum of the separate figures.

^b This is a conservative estimate that includes pickup games and occasional camp use.

Maintenance

The Field Fund's maintenance protocols focus on improving overall soil health and increasing soil organic matter in order to create athletic fields that can recover quickly from compaction and tolerate drought conditions. Maintenance plans range from basic best practices to high-tech, depending on the athletic demands of the field. Costs are about 30% higher than would be faced by mainland communities for the same activities, due to additional costs associated with transporting materials and equipment to an island, as well as higher labor costs overall. Fields used mainly for formal sports use require more maintenance; less maintenance is required for fields used mainly for P.E. classes and other lower-impact activities. In addition to applying best practices such as regular aeration and soil testing for all fields, The Field Fund employed a natural grass athletic field consulting group, NGAG, to help create tailored rehabilitation and maintenance plans for each field. All maintenance labor was subcontracted.

Soil Testing

Soil samples were analyzed by Logan Labs in Ohio for pH and soil nutrients such as phosphorus, potassium, and nitrogen. Soil at Oak Bluffs fields and West Tisbury School fields was tested using a paste extraction. Paste extractions measure the same variables as a standard soil test, but can also identify which nutrients are immediately available



Soil sample collected from playing field in Chilmark

for use by grass roots when dissolved in water. Soil samples from Oak Bluffs fields and West Tisbury School fields were also used to determine the proportions of clay, silt, sand, organic matter, and fine gravel.

Aeration and Mowing

Aeration is a critical part of The Field Fund's organic grass maintenance because it relieves compaction, resulting in improved drainage, decreased need for irrigation, and a softer, more protective playing surface. For surface aeration, The Field Fund uses a spike aerator, which drives large spikes into the soil to create space to allow oxygen, water, and any added products to reach the plant roots. This aerator opens 14% of the field surface area each time it is used, without damaging the grass. In 2019, The Field Fund also rented a deep reaching hollow-tine aerator for subsurface aeration. This aerator relieves compaction by pulling out plugs of soil. The Field Fund aerated the entire fields two to three times per year, and high traffic areas an additional one or two times per year.



Spike aerator used by The Field Fund

It is important to mow grass frequently and with sharpened blades, especially in the summer during peak growing season. Fields managed by The Field Fund are mowed twice per week in the peak grass-growing season, and once per week or as needed in the shoulder seasons.

Choosing and Adding Grass Seed

The Field Fund adapts to Martha's Vineyard's sandy soils and weather conditions by using a combination of perennial ryegrasses and Kentucky bluegrass. Kentucky bluegrass creates a strong root structure, while the perennial ryegrasses fill in plentiful grass blades. This seed combination creates heat-tolerant, durable fields that are able to support heavy use nearly year round.

Two techniques are used to plant grass seeds on The Field Fund fields: slit seeding and overseeding. Slit seeding uses a slice aerator to create holes to drop the seeds under the soil surface. Overseeding involves spreading the seeds on the surface of the soil using a spreader. Slit seeding is typically performed twice a year.

Fertilizers and Soil Amendments

Decisions about fertilizer and soil amendments are based on soil test results and the unique conditions of each field. The Field Fund works with NGAG and a practicing turf grass agronomist to create the nutrient management plan. The exact products used vary based on nutrient testing, availability, and cost. The Field Fund uses organic fertilizer and soil amendments, such as humic acid and calcium silicate, to balance soil pH and physical properties of the soil. The Field Fund also works to increase organic matter in the soil, which can decrease the need for fertilizer over time and improve water retention capacity. Loam and sand are used for field repairs and topdressing high-use areas.

The Chilmark School field and the smaller field at West Tisbury School are not fertilized due to their proximity to wellheads. The Field Fund plans to begin using organic liquid worm casting as a nutrient source.²

Other Diagnostic and Maintenance Technologies

NGAG uses technologies such as drone photography and soil sensors to pinpoint irrigation issues and compacted areas in need of extra attention. These additional technologies are not necessary for a successful organic management program, and other communities whose experience TURI has documented have not made use of them. However, these techniques provide valuable supplementary options. Directing resources to targeted problem areas rather than the entire field can help reduce costs.

Soil sensors. Periodically, NGAG uses a wireless sensor tool called POGO to measure soil water content, soil salinity, field surface temperature, and GPS location. These data are used to create a map to identify specific areas on the field in need of extra maintenance. Low soil moisture is an indicator of compaction or low organic matter



Example of moisture map using POGO sensors, provided by NGAG

content. Field crews are able to address compaction and low organic matter in these areas by adjusting irrigation or maintenance. This style of targeted maintenance is useful for fields with heavy use in particular areas, such as in the middle of soccer fields.

² Several other Massachusetts communities have also made decisions about athletic field surfacing based on wellhead zoning. For information on Zone 1 wellhead protection zones, visit [MassDEP's website](#).

Drone photography. The Field Fund also uses drone photography to determine the areas in need of specific maintenance. This unique view of the fields allows for identification of wear patterns in the fields as well as helping to monitor irrigation function. This allows The Field Fund to tailor maintenance practices while saving time and resources.

“Smart” irrigation. In an effort to conserve water in the island’s sole source aquifer, The Field Fund irrigates the Oak Bluff fields using non-potable water, and controls irrigation using a HydroPoint WeatherTRAK ET Pro3 controller. The HydroPoint is a “smart” irrigation system programmed to water the field only when necessary based on rainfall and soil moisture. The irrigation controller also takes account of site characteristics including soil type, grass type, sprinkler type, land slope, and sun exposure.

Choosing the Best Maintenance Plan

Maintenance plans for the Martha’s Vineyard fields demonstrate a wide range of approaches to

creating field surfaces that perform for different purposes. Some fields, such as Chilmark and Edgartown School fields, are used primarily for school recreation. Maintenance on these lightly used fields requires only foundational organic techniques: aeration, frequent mowing, and adding fertilizers and soil amendments based on soil testing. Other fields, such as Oak Bluffs, are used more regularly to accommodate practices and games for sports leagues and require extra attention. Table 5 summarizes the maintenance techniques used for Oak Bluffs School, West Tisbury Town, and West Tisbury School fields.

The West Tisbury Town field has some specific requirements due to the particular conditions of the location. The field tends to become compacted because it is not irrigated. Regular surface and subsurface aeration serve to keep the soil decompacted. West Tisbury School Field has a unique challenge of underground tree stumps, which decompose and leave sunken areas. This is treated by filling and overseeding these areas an additional two times per year.

Table 5: Summary of maintenance practices	
Field	Maintenance
Oak Bluffs School Fields	<ul style="list-style-type: none"> • Aerated soil on entire field 3-4 times per year^a • Overseeded 2 times per year • Mowed 2 times per week during growing season and as needed other times of the year • Fertilized according to soil tests • Irrigated using HydroPoint controller
West Tisbury Town Field	<ul style="list-style-type: none"> • Aerated soil on entire field 2-3 times per year^a • Mowed 2 times per week during growing season and as needed other times of the year • Fertilized according to soil test and weather • No irrigation
West Tisbury School Fields	<ul style="list-style-type: none"> • Aerated soil on entire field 2-3 times per year^a • Fertilized according to soil tests • Mowed 2 times per week during growing season and as needed other times of the year • Filled and overseeded sunken areas due to underground tree stumps • Irrigated with well water

^a High use areas are aerated twice during each aeration event.

Costs

Annual maintenance costs include soil testing, mowing, surface and subsurface aeration, slice seeding, grass seed, fertilizer, and irrigation adjustments. In 2019, the total annual cost of all fields managed by The Field Fund ranged from \$4,900 to \$10,600 per acre. Table 6 summarizes annual costs needed to maintain playing fields with organic practices in 2019. The costs cited in this section are specific to work on Martha's Vineyard,

which was subcontracted. These numbers also reflect a 30% "island markup." The Field Fund receives funding from private donors to cover costs for maintenance.

As noted earlier, fertilizer and soil amendments are not applied on two of the fields due to their close proximity to public water sources on the island.

Table 6: Estimated annual costs for athletic fields managed by The Field Fund using organic maintenance

	Oak Bluffs School fields	West Tisbury School - large field	West Tisbury School - small field	West Tisbury Town Field	Edgartown School	Chilmark School	Total for all fields ^a
Acres (sq. ft.)	2.75 (120,000)	2 (86,000)	0.6 (25,000)	1.4 (60,000)	1.25 (55,000)	0.6 (25,000)	8.6 (371,000)
Products							
Seed	\$3,460	\$2,450	\$324	\$1,770	\$1,600	\$762	\$10,400
Fertilizer	\$3,660	\$2,010	-	\$1,550	\$1,690	-	\$8,920
Humic acid	\$772	\$558	-	\$386	\$386	-	\$2,100
Calcium silicate	\$834	\$626	-	\$417	\$382	-	\$2,260
Loam/ sand	\$100	\$260	-	\$250	\$40	\$160	\$810
Labor and rentals							
Slice seeding^b	\$2,250	\$1,800	\$900	\$900	\$900	\$1,350	\$8,100
Slice aeration^b	\$2,250	\$1,800	\$900	\$900	\$900	\$1,350	\$8,100
Labor^c	\$2,630	\$2,270	\$358	\$986	\$1,200	\$398	\$7,840
Mowing	\$3,080	\$4,610	\$210 ^d	\$3,700	- ^d	\$2,100	\$13,700
Core Aerator Rental^e	\$1,080	\$784	\$235	\$549	\$490	\$235	\$3,370
Total costs	\$20,100	\$17,200	\$2,930	\$11,400	\$7,590	\$6,360	\$65,600
Annual costs per acre	\$7,320	\$8,580	\$4,880	\$8,150	\$6,070	\$10,600	\$7,620

^a Due to rounding to three significant digits, totals may not correspond to the sum of the separate figures.

^b Price for a contractor to truck the equipment owned by The Field Fund to each site and pull with his tractor 2-3 times per year.

^c Labor includes spreading seed, fertilizer and amendments, and filling holes by contractors.

^d Some mowing was completed by school facilities staff.

^e Rented at a discounted rate from Finch Turf.

Summary and Lessons Learned

The fields maintained by The Field Fund met community needs and had few to no game or practice cancellations due to poor field conditions or maintenance in 2019. Through both field renovations and rebuilds, The Field Fund was able to revitalize fields swiftly by taking account of varying field needs, utilizing available field technology, and keeping up with regular field maintenance. The Field Fund's data-driven maintenance practices created protective play surfaces and avoided rainouts.

It is worth noting that the fields highlighted in this case study were not used for the maximum number of hours possible. Rather, they were used for the number of hours needed by the community. The information in this case study illustrates the type and frequency of maintenance activities, and associated costs, used to provide a quality play surface for the amount of activity that is desired by the communities described here. Some communities are particularly concerned about maximizing number of playable hours. In the examples described here, the primary concern was to improve the quality of the play surface while meeting the needs of the community.

It is also important to note that hours of play are not adjusted to account for type of activity. For

communities comparing artificial turf with natural grass options, it is important to understand that expected hours of use are often adjusted for activity type (e.g., one hour of football may be calculated as two hours from the perspective of wear and maintenance). No such adjustment has been made for the information presented here.



Playing field at Edgartown School

Maintenance efforts, such as aerating, mowing, and irrigation, were based on use needs of the fields. The Field Fund used innovative technologies to diagnose and maintain the more heavily used areas of fields throughout the year. For example, in 2019 the Oak

Bluffs School fields were used around 380 hours by sports leagues, and an estimated total of around 890 hours including school use. This field complex has an advanced, high-efficiency irrigation system, useful in conserving the limited water supply on the island.

While the maintenance practices highlighted here were created to match Martha's Vineyard's specific soil, climate, community needs, and sports culture, these methods can be adapted to any town, school, or community looking for a cost-effective way to maintain their playing fields.

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The Toxics Use Reduction Institute is a multi-disciplinary research, education, and policy center established by the Massachusetts Toxics Use Reduction Act of 1989. The Institute sponsors and conducts research, organizes education and training programs, and provides technical support to help Massachusetts companies and communities reduce the use of toxic chemicals.

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