Ecological Monitoring Plan for Grassland and Shrubland Habitats on Naushon Island

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to the

Naushon Trustees &
The Nature Conservancy Islands Program

by

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Naushon Island Ecological Monitoring Plan

Protocol: Long-term Ecological Monitoring and Short-term Adaptive Management Monitoring

Areas Where Protocol will be Implemented:
Throughout the grasslands (sandplain grasslands, pasture, and panicum grasslands) and shrublands (maritime shrubland) on Naushon Island. Specifically, the following nine areas: Nonomesset, Uncatena (Timmy Point and Uncatena Pasture), North Pasture, Jim Field, Mt. Surat region, Broom Enclosure, Protected Field, Lighthouse Pasture, and the Western Hills region will be monitored.

Justification/Issues being addressed:
Naushon's grasslands are continuously being encroached upon by invasive plant species such as Scotch broom (*Cytisus scoparius*), Dyer's greenweed (*Genista tinctoria*), black swallowwort (*Cynanchum louiseae)* and oriental bittersweet (*Celastrus orbiculatus*) as well as native shrub species such as catbrier *(Smilax rotundifolia)* and huckleberry *(Gaylussacia baccata)* as represented in the maritime shrubland natural community. Maritime shrubland is estimated to cover approximately 1,100 acres (20% of the Island) (Polatin 2006).

Likely as a result of shifting land management practices, shrubs have invaded abandoned pastures where limited and sporadic passive management has occurred resulting in grassland losses estimated at 33% between 1951 and1999 (Schroeder 2002). Sites that were actively managed with grazing, fire, and regular mowing saw only a 5% loss to grasslands between 1951-1999 (Schroeder 2002).

Shrublands as a natural community provide habitat for a variety of birds, such as Eastern towhee and Common Yellow Throat. Many of these species are well represented in the Cape and Island region. However, there are several grassland species that are in serious decline in the coastal region, such as grasshopper sparrow, savanah sparrow, and upland sandpiper, due to many factors such as habitat fragmentation, land development, and lack of ecological land management.

Reasons for grassland restoration/reclamation include concerns for biodiversity that rely on grassland habitat (insects, plants, grassland nesting birds), wildfire hazard management, and a more aesthetic desire to return portions of the landscape to a historic agricultural time when grasslands dominated.

Summary of work to date/Land management history:
During the 18th and 19th centuries, massive deforestation resulted in most of the Elizabeth Islands being almost completely denuded of trees. However, Naushon retained substantial areas of beech and oak forest that appear to have never been clear cut and may represent the last forest of its kind in coastal New England (Foster and Motzkin 2005).

From 1750 to 1930, Naushon supported a flock of sheep numbering from 1000-2000 head, as well as cattle, horses, goats and other assorted animals. By the 1940's the flock size fell below 1000 animals, and by the 1960's, as management focus shifted from agriculture to recreation, sheep ceased to be a major factor in maintaining open pastureland. By the end of the 1980's coyotes had colonized Naushon. Predation risk from coyotes forced residents to restrict grazing animals to pastures near the farm, and reduced the manageable herd size to approximately 30 animals. At present there are sheep and horses that graze a very limited portion of the island (Schroeder 2002a). White tail deer are numerous on Naushon. In the summer of 2006, approximately 20 cows were experimentally introduced to 40 acres of the island near Mount Surat. Effectiveness of these cows in managing grasslands has not yet been assessed.

Residents of Naushon undertook, and recorded, many land improvement projects since the 1840's. Land management entries from 1859 through 1885 indicate that Scotch broom and several varieties of trees were being actively planted over as much as 500 acres in the sandy middle portion of the island (one area of which is referred to as "The Desert") to stabilize the sandy soils. Tree varieties planted included pitch pines, Scotch pines, American yellow pine, fir species, catalpas, white spruce, locust, tree of heaven, and larch. Beach grass was widely planted as was barberry for wildlife forage in 1891. Between 1953 and 1958, broom spread to areas that impeded access to the West End. In response, residents employed brush cutters and herbicides to control infested areas of Scotch broom, poison ivy, and catbrier (Emerson 1984). Though many constructive land improvement projects have been completed on the island it is easy to see how invasive plants may have intentionally or unintentionally been spread.

Residents undertook several attempts to use prescribed fire beginning in April 1957 with a burn at the north end of Uncatena Island (Emerson 1984). More regular burning was undertaken between 1991 and 1999 in order to reclaim grassland areas from encroaching catbrier, Scotch broom, and other shrubby vegetation. These burns were focused mainly on Nonamesset Island, Uncatena Island, and Protected Field on Naushon Island. (Hodges 2000).

Over the past several years, land managers on the island are implementing a Grassland Reclamation Program with a primary focus on intensive mowing and/or burning of catbrier infested areas and sponsoring research projects.

Monitoring Goals, Questions and Objectives to be addressed by the Protocol:

On Naushon there are several different types of monitoring which all have a slightly different focus which should be understood and acknowledged in order to clearly define the monitoring goals, questions, and objectives:

Longterm Ecological Monitoring: Establishing longterm monitoring plots with baseline data and photos throughout Naushon's natural communities would be a worthwhile endeavor. Information gathered now can help land managers detect changes over time such as the decline of a particular plant species, trends in vegetation, or tracking forest pests and pathogens such as Beech Bark Disease (*Nectria coccinea).* Aerial orthophotos can be used to analyze various changes or trends. Photomonitoring of areas where photos have been historically taken can be a rich source of monitoring information.

Effectiveness Monitoring: Active Land Management (Grassland Restoration): Are land management activities accomplishing the goals of grassland restoration/reclamation and leading to the desired trajectory? We need to track a variety of land management practices such as mowing, prescribed burning, conservation grazing, seeding, and liming. We need to know in advance what active management practices will be done in a given year so that monitoring can be planned accordingly. A photograph and vegetation assessment should be conducted before a management activity. In areas where management has already taken place or is ongoing, we need to conduct interviews, locate pre-management photos, and consult aerial photos in order to determine the approximate vegetative state of the management unit before the management activity occurred. In many cases it can be assumed or recalled that the area consisted of dense 90% catbrier 5-6' in height. We need to be able to track what happened on this unit (as precisely as possible) and then establish a photomonitoring point and a basic vegetation survey to track the unit annually. The desired outcome of this type of monitoring procedure is the ability to track the vegetation response to the management. Did the management activity impact the vegetation as we hypothesized or expected. Designing a simple monitoring procedure to answer these questions is simple enough. The challenge is in organizing the management information so that it can be adequately tracked.

Effectiveness Monitoring: Invasive Plant Mapping, Monitoring, and Control: Invasive plant monitoring is a relatively simple procedure. One needs to build a database/map of all invasive plants on Naushon. New
One very helpful tool for tracking multiple management activities is through The Nature Conservancy's *Weed Information Management System.* I use this system to track my own projects. The software is free for download at http://tncweeds.ucdavis.edu/wims.html.

Baseline and Trend Monitoring: Unmanaged Shrubland and Grassland Areas: In addition to having monitoring plots in grassland management areas it will be informative to monitor the conditions of grasslands and shrublands that will not be a part of the restoration/reclamation program. These areas can serve as study controls by which managed area monitoring results may be compared. Monitoring will establish baseline monitoring conditions to document the normal conditions of the areas. Longterm

monitoring of these sites also serves the purpose of detecting trends and changes in habitat characteristics.

Baseline and Trend Monitoring: Rare Plant Mapping and Monitoring: Rare plant locations should be surveyed and compiled with gps/gis. Rare plant populations should be monitored periodically to understand how management or lack of management is affecting them.

Monitoring Goals:
Well defined goals and objectives are key to successful monitoring. Goals may change over time.

- **Short-term (1-3 years):** To monitor actively managed grassland and shrubland conditions (vegetative composition and biodiversity) on Naushon in order to provide land managers with information to make better informed management decisions that will enable an adaptive management framework process to take place.

- **Short-term (1-3 years):** To monitor invasive plant control activities.

- **Short-term (1-10 years)**: track the effects of land management on vegetation and biodiversity in managed areas as compared to unmanaged areas to detect trends.

- **Long-term (10+ years):** gain an understanding of overall trends in vegetation/habitat that is actively managed as compared with unmanaged or passively managed sites. The digital aerial photograph archive should prove a worthwhile tool for this task.

- **Long-term (10+ years):** Once the grassland/shrubland monitoring is established it may be desirable to monitor conditions of other wetland and forested natural communities on Naushon

Monitoring Plan Objectives:
Objectives are quantifiable and become the criteria by which you judge the effectiveness of your monitoring program. Monitoring objectives are distinct from management or conservation objectives which need to be established by Naushon land managers. Objectives tell *who, is going to do what, when, how much,* and *how we will measure it.* This monitoring plan has three proposed primary objectives:

- To name a monitoring coordinator who will do the work of establishing a monitoring program following this plan.
- To establish 30 monitoring plots in spring/summer 2008 before the training session.
- To train at least eight monitoring volunteers in the monitoring protocol during a summer 2008 six hour session on Naushon.

- Maintain biodiversity and productivity of grassland resources
- Detect changes in plant cover and production by plant functional group; detect changes in plant species richness.

Monitoring Questions:

- **Long-term:** How/at what rate is grassland/shrubland vegetation community structure (species composition and abundance) changing over time?
- **Short and long-term:** Are grassland management practices furthering the conservation objectives of restoring/reclaiming grasslands? Are management activities benefiting desired wildlife species such as grassland birds, insects, and indicator plants?
- **Short-term:** Are invasive plant management activities controlling the target invasive plants?

Methods Introduction:

At the request of Naushon land managers I have sought to develop a monitoring protocol that would be simple and straightforward enough for motivated volunteers to undertake. The methods should be relatively quick and simple so that an amateur naturalist with basic plant and bird identification skills would be able to collect informative and useful data. We agreed that equipment should not be specialized or expensive, but should consist of readily available equipment such as digital cameras, recreational grade gps units, and compasses. We also talked about using widely available and inexpensive software for mapping and file sharing. The methods that I will present include photomonitoring, a simple vegetation survey, and a bird point count survey. Through the process of designing the monitoring protocol I realize the importance of designating one person the responsibility to perform several tasks: establish the ecological monitoring plots and fill out Photomonitoring Site Description Sheets (Appendix A), train and coordinate the volunteers, setup and manage the electronic file system, manage the database, analyze the data, and compile a photomonitoring reference binder (Appendix B). Furthermore, I believe that it will be important to your monitoring plan to include supplemental surveys at regular intervals in order to answer more technical questions about the state of the grassland/shrublands (vegetation, soils, and wildlife). These surveys include more in depth vegetation transects, grassland bird surveys, and potentially insect surveys that should be conducted by specialists. This information should be designed to inform the basic monitoring plan and help inform more specific monitoring questions.

Methods Summary:

Permanent plots to monitor grassland and shrubland/heathland vegetation will be established using the following protocol: Vegetation monitoring sites should be established throughout the grassland/shrublands on Naushon during the summer of 2008. Monitoring plots shall be placed in both actively managed and unmanaged sites. Within

each of the nine monitoring regions, a minimum of 3 permanent points will be established depending on the size, variability, and active management of the given region. A group of people familiar with the island's natural and cultural resources should be involved in the initial selection of the points to ensure a balanced and meaningful sample of biodiversity and land use patterns. A three part protocol will be conducted at each point consisting of vegetation plot sampling, photomonitoring, and a bird survey (point count) at each permanent point. Vegetation sampling may be conducted annually in managed sites and every several years in unmanaged sites, from early July through early September, during the peak growing season and when monitoring volunteers are likely to be on the island. This method provides an unbiased, objective, and repeatable method to measure species composition and relative abundance (Kent & Coker 1992, Smartt et al. 1974). If management is going to happen at any point during the sampling period, monitoring should be done before, and at least one month after the management occurs.

A training session to familiarize volunteers with the point locations, sampling methods, their data sheets and both micro and macro photo production should be conducted in the summer of 2008. A Monitoring Coordinator should be selected from the volunteers to help schedule the volunteer's monitoring trips and the processing of their data.

In 2008, a maximum of 30 survey points should be chosen in the active grassland management and passive grassland/shrubland areas. Points should be concentrated on the following nine regions for the year 2008: Nonomesset, Uncatena, North Pasture, Jim Field, Mt. Surat, Broom Enclosure, Protected Field, Lighthouse Pasture, and Western Hills, with the possibility of more sites (and monitoring points) added in the future. There should be some attempt to establish random points, however, points should be chosen based on accessibility and vantage, i.e. a point on a rise near a path would be preferable to a point in a hollow. It would be a very good idea to conduct a meeting beforehand with those who have a good knowledge of the island in order to strategize on appropriate areas. For example, there are likely historical photos of Island landmarks where it would be informative to collect data and replicate the photos over time.

Plot Establishment:

Once a location for a point is chosen it will be given a unique identification number, its GPS coordinates will be recorded and a ~2' PVC pipe with the identification number written on it will be placed at the point. For added visibility, especially in shrubby areas, the point may also be flagged with a piece of flagging tape also containing the point's identification number. If the area is well known it may be possible to substitute the PVC pipe with detailed directions as to where to take the photo. Alternately, metal rebar stakes can be hammered into the ground and capped at the sharp ends. This is a more subtle material, however it is harder to locate and potentially hazardous to mowing equipment. A metal detector may be needed to relocate metal stakes.

The monitoring will be done with photos and three brief data sheets (a photomonitoring log, one for vegetation and the other for birds) to be filled out each time a point is

monitored. The proposed data sheets are represented in Appendix C as a photomonitoring log, Appendix D for vegetative data and Appendix E for bird survey data.

Plot Overview: The pvc pipe or metal rebar stakes will determine the middle of the monitoring plot. The vegetation monitoring plot will be 5 meters by 5 meters in area and will always be placed in the northeast corner of the monitoring plot (the center point will always be the southwest corner). The bird survey radius plot will consist of a 50 meter radius rotating from the center point (Figure 1).

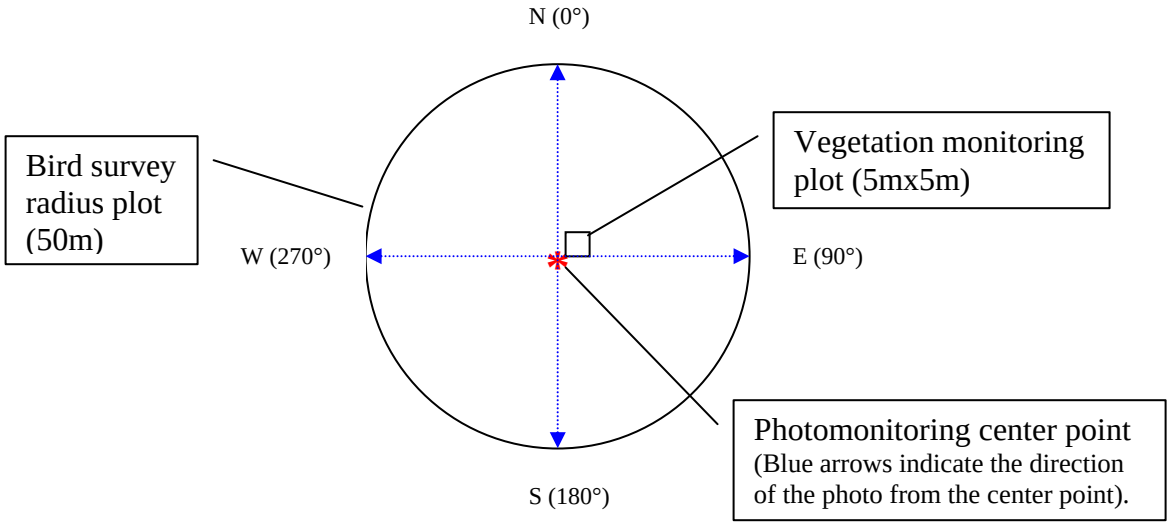

Figure 1. Basic monitoring plot overview for photomonitoring, vegetation , and bird point count surveys.

Photomonitoring*:*

Photo point monitoring is an easy, inexpensive, and effective method of monitoring vegetation and ecosystem change. It consists of repeat photography of an area of interest over a period of time, with photographs taken from the same location and with the same field of view as the original photo. With appropriate site marking and documentation, photos can be precisely replicated by different people many years apart. The preferred method of photomonitoring is using a 360 degree panoramic view. However this requires a tripod, a camera with a wide angle lens, and photo stitching software. It is possible to do panoramic photos without a wide-angle lens but this requires around twelve pictures verses six with a wide-angle lens. Because we are trying to accommodate the equipment that Naushon monitoring volunteers will likely have on hand, we are recommending that instead of taking panoramic pictures the trained monitors will take one picture in each of the four cardinal compass directions (based on magnetic north). The four pictures should still give a good view of the vegetation around the survey point and will be

enough to show any changes over a period of time. Additional photos at a given point may be taken to capture special landscape/vegetation features that otherwise might be missed.

Photomonitoring points should be selected based on the several parameters discussed previously depending on the monitoring goal for a given area. Landscape photos should give a representative view of the area and feature a distinctive landmark in the background to aid in taking follow-up photos in the future. These landscape photomonitoring points may be used in some cases as a stand alone monitoring procedure that requires no vegetation or bird monitoring procedures to be done. One can record large areas of bare soil, erosion, weed and shrub invasions, and burns using landscape photos. Plot or close-up photos can be used to document ground cover, residual dry matter, erosion, rare species, and weeds.

Photomonitoring Protocols:

Method:

Each point should be monitored at approximately the same time(s) each year.

1. A GPS unit will be used to locate the monitoring points.
2. Once the point has been located, use a compass to locate the four main compass points, then place pin flags, one each at N, E, S, and W, five meters from the center point. The top of each flag should be approximately one foot above the ground.
3. Before any photos are taken, fill in the top of the Photomonitoring Log (Appendix C) and then a photo of the data sheet should be taken. This will enable the photos to be matched with the correct monitoring point. At this point the photos of the macro plots (4 landscape photos in each cardinal direction) and the micro plot (5x5m vegetation plot) can be taken (the microplot is always located in the northeast corner of the monitoring plot and the center point will always represent its southwest corner). To keep track of which direction the photos are taken, I recommend that the photos be taken in the order, N, E, S, W, and then the micro plot. To take the macro plot photos the top of the flag should be placed at the bottom of the picture. For the micro plot photo the top of the flag should be at the very top of the photo. If a tripod or monopod is available it should be used with the camera lens set at a height of five feet five inches. If no tripod is available the surveyor should attempt to hold the camera at 5.5'.

Equipment required:

For routine monitoring

GPS unit
Digital camera
Extra batteries
Compass
Clipboard and data sheets
Tripod (if available)

Measuring tape (100ft/30meters)
Pin flags
Flagging tape
Copies of original photos and data (site locator field book with reference binder)
Metal detector (as necessary with low metal rebar stakes)

For establishing plots
PVC pipe, rebar stakes, or fence posts (to establish plots)
Mallet/hammer
Folding meter board (to establish baseline scale of reference for 1st round of photos) - see Hall 2001 for notes on construction
Spray paint to mark rebar stakes/pvc for easy spotting
Thick black weatherproof ink markers

References: Dingeldein et al. 2005; Elzinga et al. 1998; Mcdougald and Dudly 2003; Hall 2001.

Vegetation Survey:
Along with the photos, a Plant Survey Data Sheet will be filled out (Appendix D). The vegetation plots are 5m x 5m (Figure 1). Generally speaking, 5m x 5m plots are the standard for shrubs or herbaceous species over 1 meter tall (Dombois and Ellenburg 2003; Elzinga et al. 1998). The data sheet will be divided into three categories: bare ground, grass, forbs, and shrubs. Volunteers will identify species of plants as they can within the plot. The surveyor will estimate the approximate percent cover of the different types of vegetation covering the plot using the Daubenmire (1959) system (Appendix D).

Method:
1. Locate and delineate vegetation plots with pin flags, tape, and compass.
2. Fill out top of Vegetative Data Sheet (Appendix D)
3. Establish percentages of vegetative types (bareground, grasses, forbs, shrubs) by way of visual estimate.
4. Refer to Daubenmire percentage class at bottom of data sheet to estimate Daubenmire #.
5. Estimate height of vegetation using meters/centimeters and vigor estimate based on the table in Appendix D.

Note: This is a simple method, but will need explanation and practice during the orientation session.

Equipment required:
Compass
Clipboard and data sheet (Appendix D)
Measuring tape (100ft/30meters)
Pin flags

References: Mueller-Dombois and Ellenburg 2003; Elzinga et al. 1998.

Bird Point Count Survey:
Simple bird surveys can yield very good information about how well the management practices are influencing the presence of shrubland or grassland bird species. Mass Wildlife's Upland Program uses a similar, but more in depth method for monitoring a site before and after management activities to the method that I will discuss below. Many other agencies, groups, and researchers concerned with tracking breeding bird populations utilize point count surveys as well. Birds respond very dramatically to habitat modifications (Jill Liske-Clark, MassWildlife, Upland Program Coordinator personal communications). In shrubland environments within coastal areas one can expect to find birds such as Rufous-sided Towhees (*Pipilo erythrophthalamus*), Gray Catbirds (*Dumetella carolinensis*), Common Yellowthroats (*Geothlypis trichas*), Ovenbird (*Seiurus aurocapillus*) and Black-and-white Warbler (*Mniotilta varia*).

The Bird Survey methodology consists of ten minute point counts located at each survey point. The plots will ideally be surveyed between May 24 - July 15th
This technique involves the observer recording the bird species on the data sheet (Appendix E). Point counts will be 50 meter fixed radius to allow comparability among different habitats. However, all birds detected beyond 50 m will also be recorded to allow total detection of species.

Method:
Prior to the actual survey, observers will calibrate their eyes and ears to the 50-m fixed radius. Observers should mark off 50 m either by pacing or with a meter tape in several locations within the habitat patch. Calling birds should be repeatedly identified and the distance noted. The observer should keep doing this until he/she is confident that he/she can determine if a bird is calling from inside or outside a 50-m fixed radius.
If a bird flees within 50 m of the survey point as the observer is traveling to or from that point, the bird should be recorded as being within 50 m as long as that bird has not been recorded previously. Each individual bird detected will be recorded as male, female, or unknown. Birds can be detected visually, by call, or by song. Birds that were detected flying over the point, rather than detected from within the vegetation, should be recorded separately.

Data should be recorded on a point count data form. More than one individual can be recorded per line. For example, if 3 male catbirds were heard singing < 50 m from the survey point, they would all be recorded on the same line (see sample datasheet below). Additionally, if a bird that was initially mapped outside the 50 m fixed-radius flies to within 50 m of the survey point during the recording period, this bird should be recorded as being within 50 m of the survey point on the point count data form.

Equipment required:
Bird Field Guides
Data Sheets

Check list of Birds
Binoculars
GPS Unit
Thermometer

References: Ralph et al. 1995; Ralph et al. 1993; USGS and CWS 1998.

Note: This method is geared toward volunteers who have birding experience. It would be a good idea to have at least one team person who is skilled in bird identification. This method will require moreexplanation and practice during the orientation session.

Other Methods:

Vegetation Transects: The center photomonitoring points may be used to collect additional vegetation information through surveys that can be done perhaps every 5 years or as appropriate for sites that undergo management activities. Typical methods for quantitative vegetation monitoring include *Line-point intercept* (for plant cover and composition) and *belt transects* (for invasive species). These procedures can be built into the methods outlined above using the same or a similar plot structure as proposed. For example, the *Line-point intercept method* can be used to quantify portions of the 4 macro plots by extending a measuring tape 50 meters and collecting vegetation data every half to full meter. For a detailed discussion of this and other methods for measuring plant cover and/or composition, see Elzinga et al. 2001.

Conservation Grazing Monitoring: Grazing is a management technique that requires regular monitoring to assure that management targets are reached without resulting in habitat degradation such as erosion.

During the beginning stages of conceptualizing the monitoring needs for the conservation grazing project (within the 2006 prescribed burn site near Mt. Surat) I had envisioned the use of several grazing exclosures to serve as a control with which we might separate the effects of the prescribed fire from the ongoing conservation grazing. Upon talking with Alec Forbes who managed the project, I realized that there were/are several areas excluded from the fenced paddock areas that may be used to monitor the differences between burned areas and burned and repeatedly grazed areas of the site.

During my research I did locate specifications for grazing exclosures in a rangeland demonstration project white paper (Hart and Field 2004). These exclosures were constructed of 6 ft. wire panels and T-posts measuring 6'x 6'. Another project within the Zumwalt Prairie in Oregon monitored by The Nature Conservancy did not name the dimensions of the ungulate exclosures used, but they appear (based on photos in the report) to be approximately ½ acre (Dingeldein et al. 2005).

References: Pellant et al. 2005; Herrick et al. 2005.

Grassland Nesting Bird Surveys: There have been several grassland bird surveys conducted on Naushon. The earliest official survey that I am aware of was performed by Jeremy Hatch in 1988 (Hatch 1988). The Massachusetts Audubon Society has been surveying grassland birds on the Cape and Islands for several years now. I have seen surveys performed by Peter Vickery and Andrea Jones (Vickery 1993). Apparently Andrea Jones wrote her master's thesis on grasshopper sparrows on the Elizabeth Islands. I suggest that MassAudubon be encouraged to continue their grassland monitoring activities on Naushon every 5 years.

Other potential surveys relevant to grassland/shrubland monitoring:

Lepidopteran (Butterfly) Surveys
Invertebrate Surveys
Small Mammal Trapping

Data Filing and Organization:
A series of folders and files should be created and posted on the internet that will be readily available to all volunteers. Collected data from both the vegetative and bird surveys should be uploaded here. An example of an established system can be found at: http://www.njaudubon.org/Research/CitizenScience/Grassland_Surveys.html. A program such as Google Docs (http://www.google.com/google-d-s/intl/en/tour1.html) would allow volunteers to upload and download information from varying locations. It would not be difficult to design a simple and inexpensive website that would serve as the hub for the Naushon monitoring project. A mapping program such as Google Earth Plus may be subscribed to for $20/year; however I am unsure about the logistics of sharing a subscription with several parties. Google Earth Plus provides a GPS interface and operates using kml files (keyhole markup language) which can be translated into the shp files used in ArcGIS. ArcGIS should remain the central hub for the database, but it will be important to have a mechanism for volunteers to upload gps data. It is possible with many Garmin gps units to import and export data using free software such as DNR Garmin (http://www.dnr.state.mn.us/mis/gis/tools/arcview/extensions/DNRGarmin/DNRGarmin.html) made available from the Minnesota Department of Natural Resources. This way an Excel file with all the monitoring points can be placed within an accessible folder for downloading. The Excel file can be cut and pasted into dnr garmin which, in turn, can be uploaded onto a gps unit. A technology tutorial will be a necessary component of the orientation session.

Data Analysis:

The monitoring protocol has been designed for a simple analysis and not necessarily for rigorous statistical procedures.

Photomonitoring:

After the photos are downloaded to a computer each one should be relabeled with the monitoring point number, direction, date, and macro or micro. For example a photo from point 02 taken of the macro to the north on August 10, 2007 might be labeled 02NMacro08.10.2007

Photomonitoring photos and information should consist of a series of expandable folders (one for each monitoring area), each containing maps, directions, a site locator field book, site descriptions, other descriptive data, and the actual digital photo data. Simple photo album software such as Picasa may be used to associate file data for successive years.

A computer database may be the ideal system for organizing and filing the data. Databases to organize and archive pictures are available commercially. A simple hypertext markup language (HTML) database can also be developed and used to organize and file the photo point monitoring data. An HTML database allows easy access and updating capabilities using a web browser. In addition to archiving pictures on a database, maps can be scanned and entered into the database. Descriptive information can also be scanned or entered directly into the database. Regardless of the filing system used, a backup archive is recommended in the event that documents or pictures are unintentionally destroyed or databases become corrupted. Ideally, this archive should be kept in a separate location from the original data.

Vegetation Surveys:
All data should be entered into a Microsoft Excel spreadsheet in order to generate basic summary statistics, such as averages and standard deviations, and to represent those statistics graphically. Further analysis can be accomplished through determining the density, relative density, frequency, relative frequency, coverage, and relative coverage for the plots. Other useful calculations include importance values for the predominant species, species diversity, and species-area curves. Ordination and classification of plant communities will further allow land managers to examine changes in total species composition over time. Statistical paired t-tests and repeated measures ANOVA can be used to analyze change in individual features of permanent plots (e.g., species richness, frequency or cover of a given species) between two measurement intervals.

Bird Surveys:
Point count field data should be submitted electronically using either a provided Microsoft Access data entry form or through and Excel spreadsheet. All data for all sites surveyed will be submitted in one Access database file or Excel spreadsheet. Hard copies of point count field datasheets should not be submitted, but should be retained by the volunteers for at least one year in the case that any questions arise from the monitoring coordinator. The orientation session will need to cover the basics of entering data into an Access database or Excel spreadsheet.

2008 Proposed Monitoring Schedule and Expected Interim Products:

Activity	Who	Product/Deliverable	Time
Initial meeting to plan where to establish monitoring plots, talk about 2008 management activities and how to monitor accordingly.	Monitoring Committee consisting of interested and knowledgeable community members	Meeting minutes/notes	Spring 2008
Establish 30 monitoring plots and collect baseline data (photomonitoring, vegetation survey, and bird survey).	Monitoring Coordinator	1. Reference binder with all monitoring photos and associated plant and bird data. 2. Maps, gps waypoints, and datasheets will have to be prepared and uploaded to internet file system. 3. Develop written reference materials to help orient volunteers. 4. Organize/produce materials for training session.	Summer 2008
Conduct 6-8 hour training session with core group of volunteers to introduce project and orient group on project methods.	Monitoring Coordinator		Summer 2008

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