Duarte Pond - Proposal for Completion of Analyses and Production of Final Report

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In the initial phase of research on the history of fire and vegetation dynamics on the Great Plain of Martha's Vineyard we obtained a 5.8 m core from the center of Duarte Pond in about 3 m of water and commenced preliminary analyses. Initial findings indicated that the core was intact, containing a continuous stratigraphic record for much of the post-glacial period, and showed no obvious discontinuities, breaks or evidence of erosional episodes. The upper 100 cm of the core were sub-sampled for pollen, loss-on-ignition, and charcoal, which yielded records showing a good, reliable, and continuous record for the last 1000 years, from the pre-settlement period to the present. The initial sedimentary record yields some surprises, especially when compared to the diagrams resulting from Andrea Steven's work and the historical and modern record from our previous study. In particular :

- Pine pollen percentages are high at the time of settlement and then decline progressively with evidence for European land use. These data suggest that pine may actually have been more abundant in the Plain landscape than previously interpreted and, in conjunction with Steven's work, suggest that pine may have been more common on the northern moraine than towards the south coast

- Grass pollen values are low (5%) during the pre-settlement period and then rise dramatically with European land use suggesting that open grassy area, grasslands, savannas, etc. were not important before European settlement but were generated by European activity.

- Ericaceous species (heath plants) were also very low before European settlement and become apparent, and just barely so, after European activity. Thus there is no evidence for extensive heathland or heath-dominated vegetation at the site at any time.

- Charcoal values increase substantially after European settlement, stay high for much of the historical period, and then decline over recent decades. Current charcoal values are approximately the same as pre-European values. Thus it appears that historical fire frequency was greater than during the pre-European period.

- A number of early features in the record are puzzling and raise the potential for pre-European human impact or extremely early European impact on the vegetation and area around the pond. Notably, at approximately 70-75 CM (well before the major increases in non-arboreal pollen [NAP]) there are traces of agricultural weeds and a pronounced dip in organic matter (LOI), indicative of local disturbance.

Recommendations for Further Work

Based on these initial results it appears that Duarte Pond provides an excellent record for determining the very long-term history of fire, vegetation and environment on the Great Plain. In particular, the record appears highly relevant to current management concerns on MFCSF. Therefore we propose to complete the analyses and dating on this core and undertake complementary studies of archaeological, historical, and fire history records for the portion of the

Great Plain surrounding Duarte Pond. The proposed work should greatly complement prior Harvard Forest work on the MFCSF and should provide an unparalleled data base for developing long-term conservation plans for the area. Specific activities to be undertaken under this effort are described below.

1. **Development of a detailed chronology using Pb-210 and C-14.**

   The high resolution nature of the emerging record demands that a very detailed chronology be developed such that changes in the physical and palynological characteristics of the stratigraphy can be matched to emerging historical records and archaeological data. To-date our analyses have focussed on biological and physical characteristics of the sediments. We propose to subsample the core and to undertake Pb-210 analyses at the Harvard Forest and to contract with an outside laboratory to undertake 4-5 C-14 dates in order to develop a sound chronostratigraphy.

2. **Additional palynology.**

   There is need to enhance the detail in critical areas of the existing stratigraphy, such as the very early NAP rise, and to extend the stratigraphy to somewhat greater depth so that pre-settlement changes can be understood. Thus we propose to undertake additional, detailed palynology to enhance the resolution of the existing diagram. This work will make this diagram compatible with other high-resolution data that we are developing for other portions of the Cape and Islands.

3. **Complete macroscopic and microscopic charcoal analyses.**

   Our current charcoal assessment is fairly crude. We have recently purchased new equipment that will enable us to develop a very precise stratigraphy of both macroscopic and microscopic charcoal for the entire core. These new data will greatly refine our interpretation of changes in the fire regime through time and should increase our ability to separate out local (watershed) versus landscape and regional fires.

4. **Integrate archeological and historical information into the interpretation.**

   In contrast to previous studies on MFCSF, we currently have very little information on the history and archaeology of the area around Duarte Pond. Clearly, development of a detailed and spatially explicit database on land-use activities, fire, archaeological sites, etc. is a critical component of the type of reconstruction that we are pursuing and thus we would propose to undertake the required research to assemble this. Specifically, recent assessments of all of the available archeological material and information by Mitch Mulholland at UMass, a collaborator of ours on many projects, should provide an excellent context for assessing the early changes in the diagram. For historical and fire information we will consult the sources utilized in the earlier Foster and Motzkin report.

5. **Synthesis and development of a final report.**

Once the paleoecological, archaeological, and historical data are assembled we will complete an integrative analysis, compare results with prior Harvard Forest and other studies and develop a final report. We also anticipate publishing the results of this study in major scientific or conservation journals.

6. Data archiving and availability.

All data acquired through this project will be made available to the MNHESP and will be permanently archived at the Harvard Forest where it will be accessible to all interested scientists and conservationists.

Budget

The proposed activity represents a considerable amount of effort, travel, research, and contracted expenses. Consequently we request a budget of $7000 to undertake and complete this study.