VEGETATION ANALYSIS AND SPATIAL VISUALIZATION OF A TIDAL SALT MARSH

by

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Abstract

Mitchell Marsh, a tidal salt marsh in the Salmon River Estuary, was diked in the early 1960s. Restoration of the marsh, which began in late 1978, consisted of partial dike removal. Several studies have been conducted in the marsh, addressing the status of the developing salt marsh plant communities. Species composition data have been collected in the marsh for the years 1978, 1979, 1980, 1984, 1988, 1993, 1999, and 2004.

Previous studies used multivariate methods, which did not address the spatial variation present in the developing communities. This study introduces an innovative method for representing spatial and temporal variation present in plant community distributions. To achieve this, several methods were used. First, cluster and indicator species analyses were performed in PCORD to identify plant assemblages for each year. Second, universal kriging was performed using the Geostatistical Analyst in ArcGIS. This resulted in a prediction map representing the spatial distribution of the plant assemblages. Third, an animation of the kriged plant assemblages was created to display continuous spatial plant assemblages from 1978 through 2004.

The vegetation analysis results were very similar to those found in previous year-by-year studies conducted in the marsh. Initially the marsh was composed of wet pasture assemblages that mostly died off by 1980. The only assemblage that persisted beyond 1980 was a high marsh assemblage identified by *Argentina egedii*. By 1984 the salt marsh assemblages identified by *Carex lyngbyei*, *Distichlis spicata*, and *Argentina egedii* were developing. These assemblages varied slightly in composition and distribution over the years but presently appear much like they did in 1984.

The innovative methods introduced in this study allow the interpretation of spatial and temporal distributions of plant communities. The results from this study may be added to the wealth of data on salt marsh ecosystems and will provide a building block for creating and interpreting visual representations of landscapes, ecosystems, and communities. In combination with many other studies, this one may help in the management and protection of this highly productive ecosystem.
manipulation, or animation. Although these errors may not be erroneous, the effect on the study could be substantial.

In the vegetation analysis only three assemblages were identified when in fact there were could be several more. The various smaller assemblages were forced together in three broader assemblages. This clumping does not actually result in an error but rather misrepresents the assemblages in the marsh by generalizing the finer-scale variations present. The cluster dendrograms (Appendix C) display the smaller homogeneous assemblages and from them a general idea can be interpreted importance.

The interpolated surfaces resulting from the kriging analysis contain inherent errors. During the modeling phase of the study, attempts were made to minimize the prediction error. Error sources in the image manipulation phase of the project could only be attributed to user error. These errors would be evident from the misalignment of images, masks, and plots or the general appearance of the results would not be what was expected. Another error was introduced by the smoothing of the results for the animation. However, this error does not provide false results but, rather, simply smoothes the transition between assemblages.

Conclusion

The objectives of this study were (1), to continue the vegetation monitoring at the Mitchell Marsh; (2) visually represent the plant assemblages and their corresponding distribution; and (3) to animate these changes in assemblage structure and distribution that lead to the existing conditions in the marsh. All of these objectives have been successfully completed and the results have met the expectations of the project. The continued monitoring of the marsh has made it possible to conduct further analysis in the
future using similar time intervals and will provide additional data regarding the status of salt marsh restoration in Oregon. Interpretation of the plant assemblages and their distributions can be made more readily from the results of the kriging and the animation provides an interpretable display of the marsh over time. In addition, the animation makes it possible to identify possible trajectories in the distribution of plant assemblages.

There are many possible studies that could address a large number of questions still unanswered regarding the Mitchell Marsh. It is known that many environmental factors influence plant distribution in salt marshes and this study could not address all of these due to various constraints. Elevation and the related inundation frequency and duration, and salinity are two of the additional factors that could be included in a future analysis. Also, not addressed by this study were the roles played by the many marsh creeks present in the marsh and their relatively important role in the distribution of plant assemblages.

The results from this study may be added to the wealth of data on salt marsh ecosystems and will provide a building block for creating and interpreting visual representations of landscapes, ecosystems, and communities. In combination with the many other studies conducted in the estuaries of Oregon and the world, this study may help in the management and protection of this highly productive ecosystem.