Biofilm Presentation Transcript

Slide 1

Greetings! The following is the spring project by the Ames DEVELOP Team. The title of our project is "Hyperspectral Biofilm Classification Analysis to Determine Carrying Capacity for Migratory Birds in the South Bay Salt Ponds." Our authors are, Wei-Chen Hsu, Amber Kuss, Tyler Ketron, Andrew Nguyen, Alex Remar, Michelle Newcomer, and Dr. Skiles

And for those who don't know, biofilm, also known as "microphytobenthos," is a mixture of microscopic, multiple-celled diatoms and algae that serve as a significant food source for migratory birds in highly productive tidal marsh ecosystems.

Slide 2

The applied sciences related to our project are Ecological Forecasting and Water Resources. Our community concerns are to provide a habitat for endangered species, to increase shorebird foraging and migration habitats, and to understand the changes in vegetation colonization of marsh habitat during the restoration process. Our seven partners include the United States Geological Survey, the California Coastal Conservancy, the San Francisco Estuary Institute, the United States Fish and Wildlife Service, the National Wildlife Refuge System, the California Department of Fish and Game, and the San Francisco Bay Conservation and Development Commission.

We would also like to take the time to thank our four science advisors, Erich Fleming, Brad Bebout, Leslie Bebout, and Angela Detweiler.

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Our study area, shown at the bottom of this slide, is the southern margin of the San Francisco Bay, in California, which is currently home to the most extensive tidal wetland restoration project ever undertaken, the South Bay Salt Pond Restoration Project. Remember that biofilm significantly contributes to the carrying capacity of this ecosystem by providing a substantial food source for large bird communities. Our project objectives are to use a GER-1500 spectroradiometer to create a spectral library of biofilm, to monitor the spatial distribution and density of biofilm throughout the South Bay, to provide a taxonomic classification of the dominant biofilm species in the South San Francisco Bay Area, and to estimate the South Bay Salt Pond Restoration Area's carrying capacity of shorebirds.

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This slide shows the three major field and lab methods used in our project. For species classification, we took biofilm samples from their natural habitat, prepared them onto microscope slides, and then counted the distribution of species that we saw. Additionally, we used a GER instrument to take spectral measurements of biofilm out in the field. Using ERDAS Imagine software, we then created a spectral library of biofilm. We also extracted Chlorophyll-a from biofilm samples in order obtain measurements of biomass.

Slide 5

In this project, we used the Landsat 5 and IKONOS sensors to detect the presence of vegetation and biofilm on the marsh habitat. We also used the Hyperion EO-1 sensor to run a spectral angle mapper classification of biofilm. The equation shown in the center of this slide gives the correlation coefficient between Hyperion imagery and our biofilm spectral library in order to map the spatial distribution of biofilm.

Slide 6

We have now gotten to our field and lab results. The top figure shows that Navicula is the dominant biofilm genus in our study area. The bottom figure shows that the results of the chlorophyll-a analyses match the observed density of biofilm.

Slide 7

This slide shows the results of our Hyperion spectral angle mapper classification. Locations shaded green are areas of high biofilm density, and yellow are areas of low biofilm density. The image on the left shows the spatial distribution of biofilm throughout the entire study area, and the image on the right shows zoomed-in, high resolution sections of our study area. From this analysis, we have determined that biofilm covers over 28 million square meters in the South Bay Salt Pond Restoration Area.

Slide 8

We also analyzed nine Landsat NDVI images, taken over the past four years, to further map the presence of biofilm. In the map on the right, pixels that were classified as biofilm in multiple Landsat images appear yellow and red and represent areas where biofilm is likely to be present.

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The shorebird carrying capacity of the South Bay Salt Pond Restoration Area was estimated using the four variables outlined in the equation above. We have calculated that biofilm in the South San Francisco Bay, alone, can feed approximately 200,000 shorebirds per day!

Slide 10

For our project conclusions, we have determined that Biofilm has a unique spectral signature that can be identified by satellite imagery, Biofilm appears to flourish in tidal bayside mudflats where vegetation is not present, Navicula is the dominant biofilm Genus in our study area, and lastly, biofilm, alone, can feed approximately 200,000 shorebirds within our study area per day!!!

Slide 11

Displayed here, are the benefits to our partners, and concludes our presentation. We hope you enjoyed our project and we thank you for listening!