Remote Sensing of Terrestrial and Submerged Aquatic Vegetation in Fire Island National Seashore: Towards Long Term Monitoring

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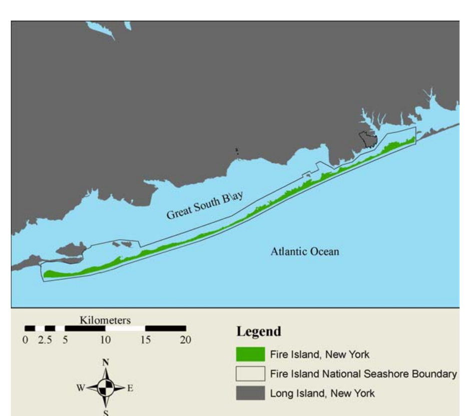
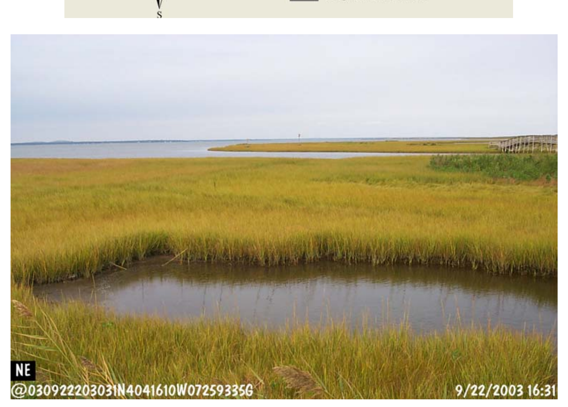
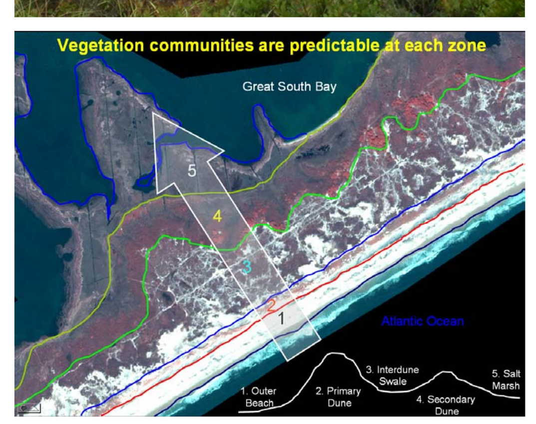
INTRODUCTION

The Fire Island National Seashore (FINS) is located on Fire Island, a member of Long Island barrier island system in the State of New York. As a barrier island the vegetation communities and spatial patterns on Fire Island are dynamic as the result of interactions with driving forces such as sand deposition, storm-driven over wash, salt spray, surface water, as well as human disturbances. Therefore mapping the vegetation on FINS is an important task for the Inventory and Monitoring Program of the Northeast Coastal and Barrier Network (NCBN).

The NCBN identified two further efforts to enhance the existing vegetation map. Firstly, updating of the vegetation mapping product should be completed on a regular basis to ensure monitoring of the dynamic changes of the vegetation communities in this barrier island. Therefore exploration of new data sources and approaches that could efficiently update the vegetation maps is necessary. Recent development of high spatial resolution satellite remote sensing images can meet the goals of the project. Secondly, a missing component from the existing vegetation map was the information about submerged aquatic vegetation (SAV) such as seagrass species and beds. Seagrass communities are among the richest and most productive coastal systems. Seagrass protect and improve water quality, provide shoreline stabilization, and are important habitats for an array of fish, birds, and other wildlife. Natural and human impacts on these vital resources from population growth, pollution, physical damage and other activities can disrupt the growth of seagrass communities and have devastating effects on their health and vitality. Inventory and monitoring are required to determine the dynamics of seagrass ecosystem and management and restoration for these rich resources. Extraction of information about SAV at the FINS becomes necessary.



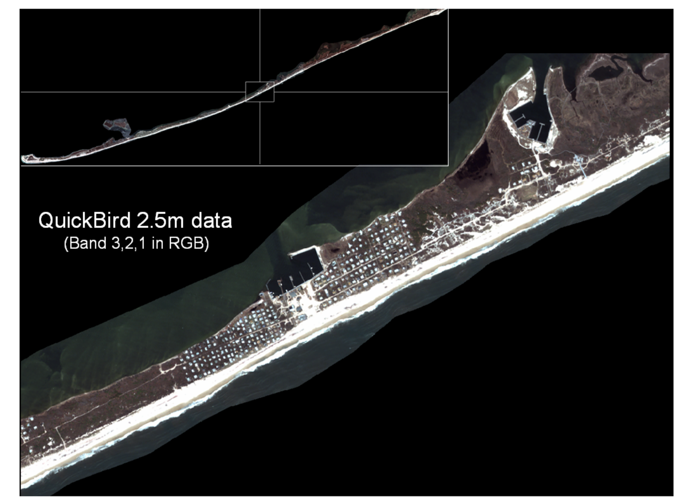


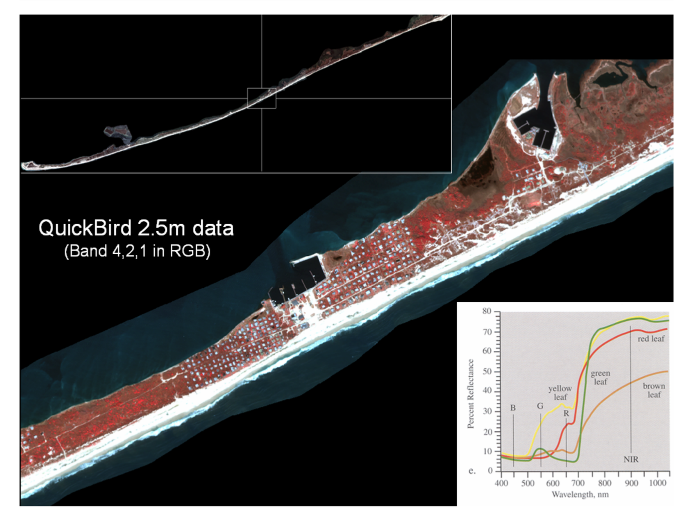


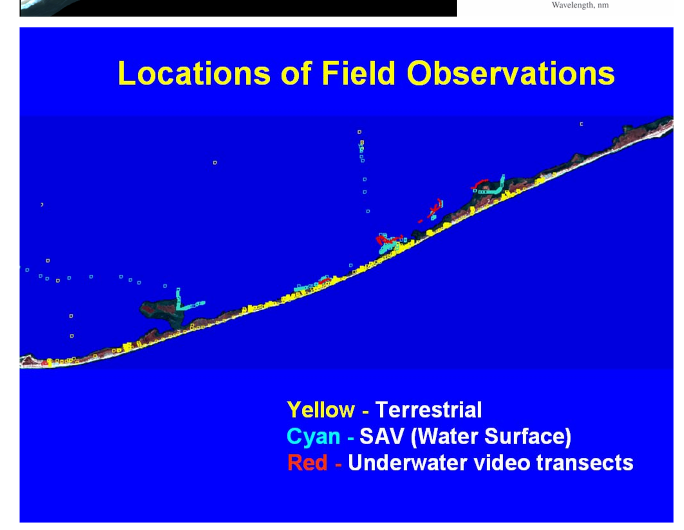
METHODS

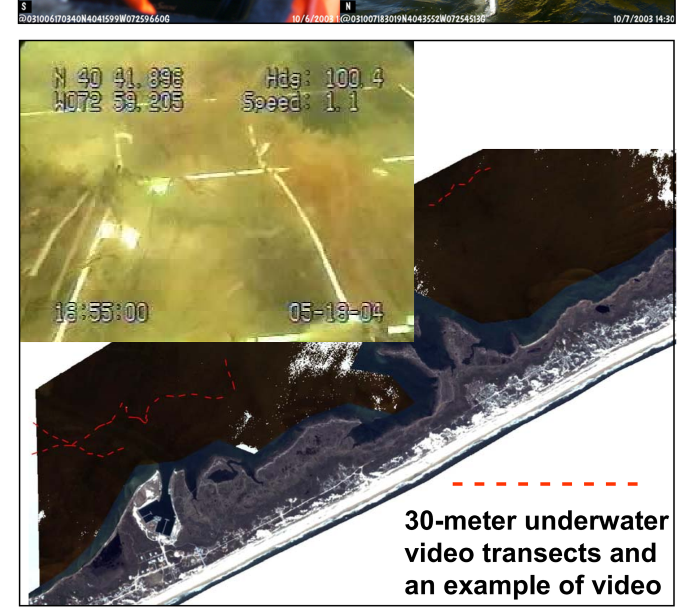
We used high spatial resolution QuickBird-2 satellite remote sensing data to map both terrestrial and submerged aquatic vegetation communities of the National Seashore. We adopted a stratified classification and unsupervised classification approach for mapping terrestrial vegetation types. The classification scheme included detailed terrestrial vegetation types identified by previous vegetation mapping efforts of the National Park Service and three generalized categories of high density seagrass, low density seagrass coverage and unvegetated bottom to map the submerged aquatic vegetation habitats. We employed under-water videography, GPS-guided field reference photography, and bathymetric data to create the virtual field reference database (VFRDB) and to support remote sensing image classification and vegetation mapping.

The *stratified classification, i.e. from local-to-global-approach* was to mask out the categories that were most likely to mix using existing FINS GIS vegetation map as the base line, so that the classification could be focused on the vegetation types and communities identified by the previous vegetation mapping project. The advantages of this protocol were to: value the NPS previous vegetation mapping efforts; keep the classification system consistent; meet the goal of updating vegetation map; valid for change analysis and monitoring; and it was a simple protocol for future mapping replication.





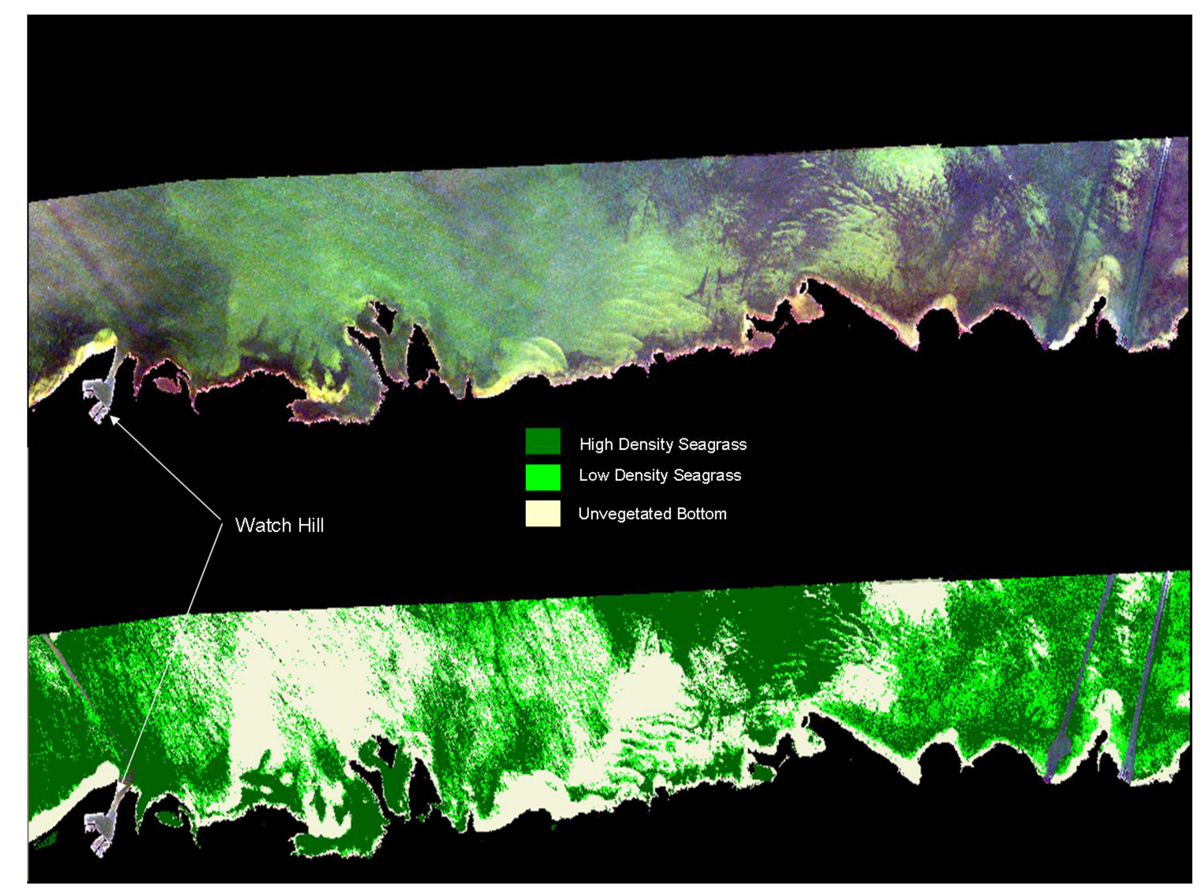


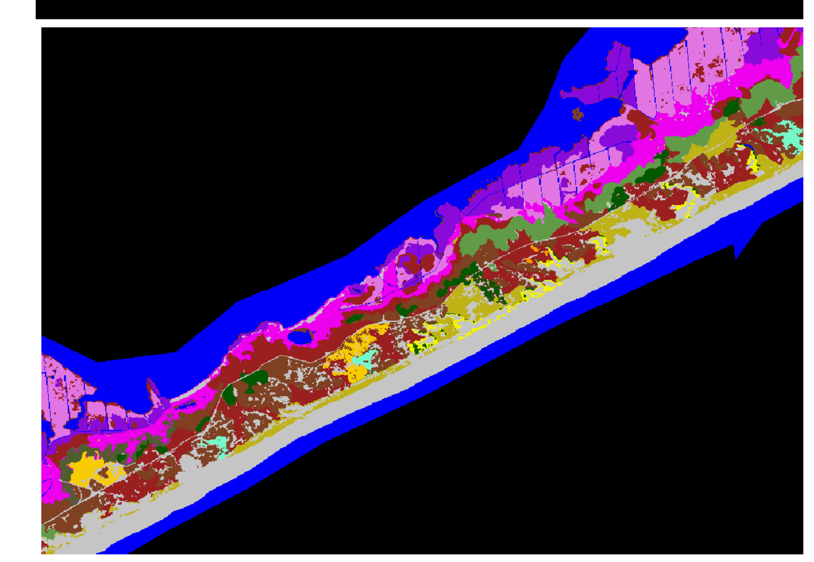


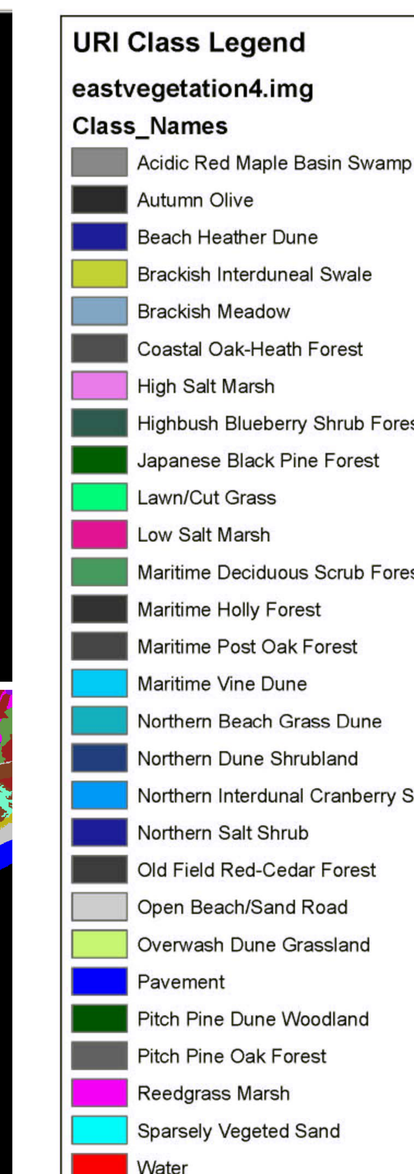
RESULTS

This study achieved approximately 82% overall classification accuracy for the terrestrial vegetation types. The unsupervised classification for SAV habitat classified 2246 hectares of seagrass habitat within the park boundaries. Of this total 69 percent (1544 ha) was classified as high density seagrass (>25 % cover) and 31 percent was classified as low density seagrass (5-25% cover). Overall classification accuracy was 75%. The under-water video transects provide critical data in SAV habitat mapping and monitoring. The VFRDB provided benchmark data for long-term monitoring and comparison in remote sensing vegetation mapping.

A draft final report can be found at:
http://www.ltrs.uri.edu/research/fiis_web/FIIS_report_draft_2_28_06.pdf

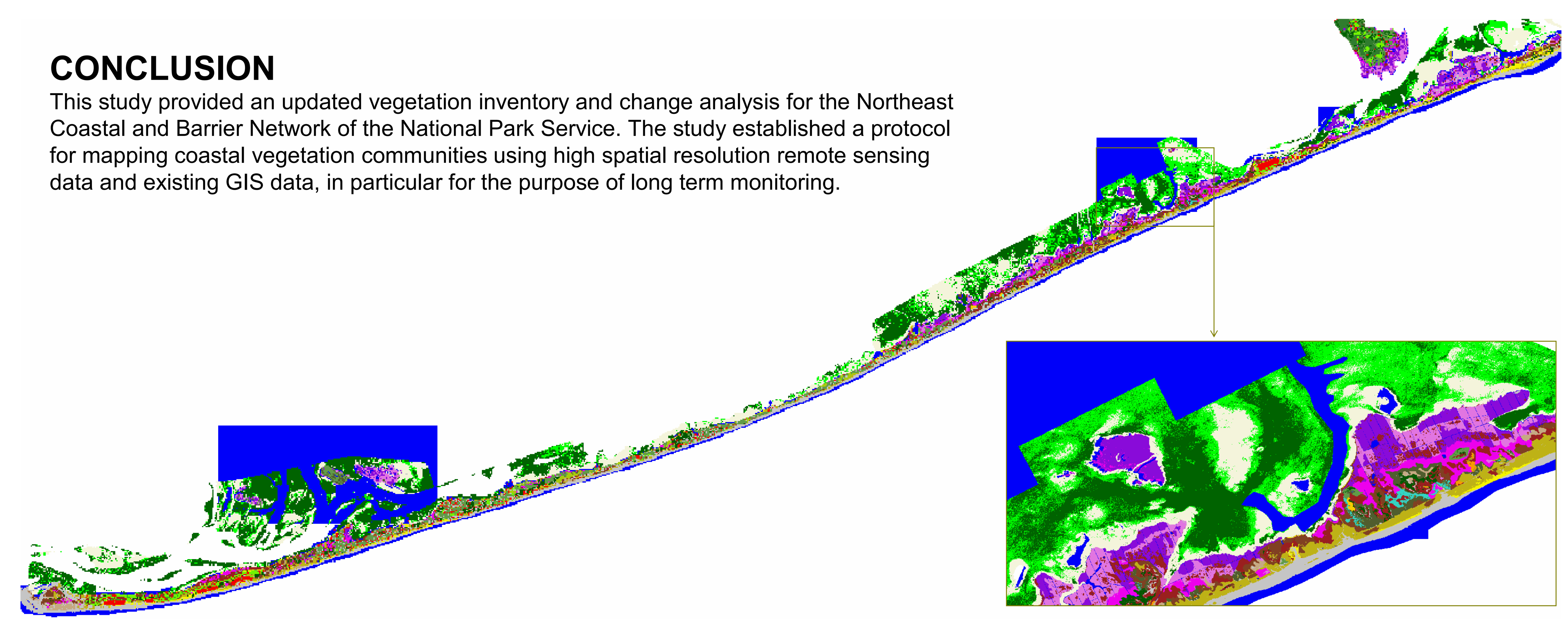






CONCLUSION

This study provided an updated vegetation inventory and change analysis for the Northeast Coastal and Barrier Network of the National Park Service. The study established a protocol for mapping coastal vegetation communities using high spatial resolution remote sensing data and existing GIS data, in particular for the purpose of long term monitoring.



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