RUTGERS CRSSA

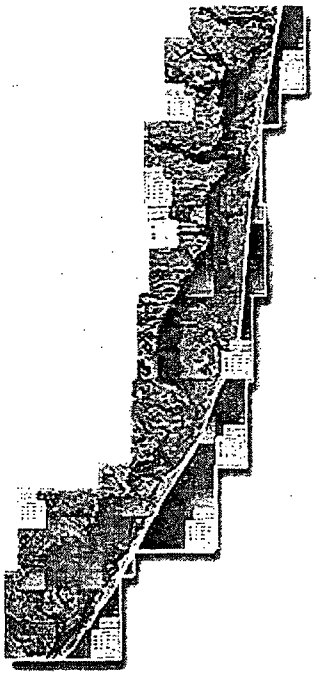
ON-GOING: Submerged Aquatic Vegetation Mapping 2004/05.

DATA POSTED 09/21/04: Yr 2003 Submerged Aquatic Vegetation GIS data available >>

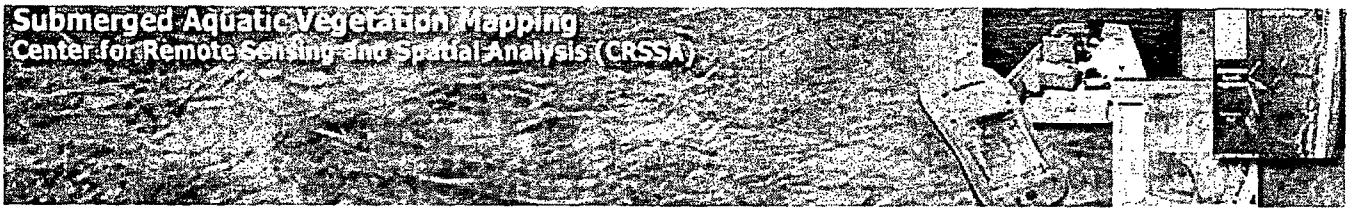
BARNEGAT BAY - LITTLE EGG HARBOR
Submerged Aquatic Vegetation Mapping

Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA), Rutgers University

Due to the ecological importance of seagrasses and recent indications of disease and dieback, we have synthesized existing mapped survey information concerning the spatial and temporal distribution of seagrass beds in Barnegat Bay, New Jersey. Over the past four decades, various government agencies and scientists have surveyed and mapped seagrass distributions in the bay. These maps were digitized and input to a Geographic Information System (GIS) to facilitate visual and spatial pattern analysis.



Web site updated September 2004 to include the Year 2003 SAV mapping information as part of CRSSA's continuing Coastal Studies and for the Barnegat Bay National Estuary Program; web site updates with support from CRSSA. This SAV web site was originally created by CRSSA in 2002 with funding by the New Jersey Department of Environmental Protection (NJDEP) through the Jacques Cousteau National Estuarine Research Reserve (JCNERR) for JCNERR Coastal Decision Maker and education outreach programs. Highlighted are the submerged aquatic vegetation (SAV) data used by CRSSA (Rick Lathrop, John Bognar) and Rutgers University Marine and Coastal Sciences (Sybil Seitzinger, Renee Styles) in their research efforts published 2001. Also highlighted are Year 2003 SAV data generated by CRSSA (Rick Lathrop, Paul Montesano, Scott Haag) utilizing 1-meter resolution digital aerial photography. SAV graphics/maps under 'View Maps' created by Scott Haag. Initial graphic design and continued support by John Bognar. Site last updated September 23, 2004.



> SAV Surveys and Mapping Methods ::

1968 & 1979 1985-87 1996-99 2003 Gallery

1960's and 1970's

Mapped information on the spatial distribution of seagrass beds for Barnegat Bay was derived from several sources. The first systematic survey was undertaken in **1968** (U.S. Army Corps of Engineers 1976). The methods for this study were not detailed but are presumed to be a boat-based survey. There were several mapping efforts during the **1970's**. The lower portion of Little Egg Harbor was mapped based on spring time aerial photography acquired in 1977, as a pilot project to examine the feasibility of mapping submerged aquatic vegetation (SAV), including seagrass beds, with aerial photography (Good et al. 1978). Based on the success of this project, the Earth Satellite Corporation mapped the state's entire Atlantic coast and produced a 1:24,000 scale map series for the entire bay based on interpretation of black & white aerial photography and low altitude sea plane reconnaissance during the summer of 1979 (photos taken June and August, field checked July through September) (Macomber and Allen 1979). For both the 1968 and 1979 survey, four general types of SAV communities were mapped (eelgrass *Zostera marina*, widgeongrass *Ruppia maritima*, mixed eelgrass and widgeongrass and sea lettuce *Ulva lactuca* dominated) at various levels of density. We table digitized the above paper maps for later GIS analysis using existing shoreline GIS data as a base map. The U.S. Fish & Wildlife Service (USFWS) incorporated the Earth Satellite Corporation maps into the National Wetland Inventory (NWI) for the state of New Jersey.

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1985-87

During the years 1985 to 1987, information on eelgrass distribution, water depth and bottom sediments was collected in conjunction with an estuarine shellfish inventory of Barnegat and Little Egg Harbor bays (Joseph et al.,1992). These surveys spanned the spring, summer and autumn seasons. Benthic samples were collected at approximately 0.4 km (one-quarter mile) intervals in the deeper waters (greater than 0.9 m; 3 feet) of the bay, for a total of 489 stations. The extreme northern end of the Bay (i.e., Metedeconk River) was not surveyed. Based on this survey, the distribution of eelgrass beds was then interpolated and mapped onto a nautical chart base map and produced as figures (Joseph et al. 1992). The resulting map included two areas that were not explicitly sampled (i.e. the boat did not enter due to the shallow depth and no benthic samples

were taken) but where visual reconnaissance noted the occurrence of eelgrass beds. These two areas were included as containing eelgrass (for a total of 896 ha) in our analysis. We table digitized photocopies of the maps, using existing shoreline GIS data as a base map to provide ground control points.

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1996-99

A field survey of seagrasses was conducted during the summers of 1996, 1997 and 1998 (McLain and McHale 1996) and 1999 (Bologna et al. 2000). The middle portion of the bay was mapped in 1996, the northern portion in 1997 and the southern portion (e.g., Little Egg Harbor) in 1998. The southern portion of the bay was re-mapped in 1999 using a differentially corrected (post-processing) global positioning system (GPS). During boat-based surveys, SAV beds were identified and boundaries were mapped onto a 1:40,000 scale NOAA nautical chart (Charts # 12324 and 12316). The dominant species (i.e., *Zostera* or *Ruppia*) was noted. These annotated charts were then table digitized and integrated with the GPS mapped data.

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2003

The purpose of this study was to map the areal extent and density of submerged aquatic vegetation within the Barnegat Bay and Little Egg Harbor, New Jersey as part of ongoing monitoring for the Barnegat Bay National Estuary Program. We examined the utility of multi-scale image segmentation/object-oriented image classification approaches to seagrass mapping. Our remotely sensed approach allowed for determination of seagrass at 4 levels of density (including shallow sand/mud flats with < 10% seagrass cover), rather than a simple presence/absence, with a comparatively high degree of consistency and accuracy (68% overall accuracy for 4 categories and 83% accuracy for a simpler presence/absence map). While the aerial digital camera imagery employed in this study had the advantage of flexible acquisition, suitable image scale, fast processing return times and comparatively low cost, it had inconsistent radiometric response across the individual images. While we were not successful in using the eCognition software to develop a rule-based classification that was universally applicable across the 14 individual image mosaics that comprised our 73,000 ha study area, the manual classification approach that we developed provided a flexible and time effective approach to mapping seagrass. This multi-scale image segmentation approach coupled with field transect/point surveys has the potential to be more replicable than strictly boat-based surveys and/or visual image interpretation and allow for more robust conclusions regarding change in areal extent, location and spatial pattern of seagrass beds through time. In the present study based on imagery collected in May 2003, we mapped 5,184 ha of seagrass beds. This area is less than the 6,083 ha of seagrass documented from boat-based surveys conducted between 1996-1999. We do not believe that the difference of 899 ha represents a significant change in seagrass extent between the dates of the two studies, but most likely is an artifact of the difference in mapping techniques.

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CRSSA SAV web site designed and maintained by CRSSA. Original 2002 web site start-up funding by the New Jersey Department of Environmental Protection (NJDEP) through the Jacques Cousteau National Estuarine Research Reserve (JCNERR) for JCNERR Coastal Decision Maker and education outreach programs; continued web updates with support from CRSSA. SAV site is a segment of CRSSA's Barnegat Bay web site. Page last updated September 23, 2004. See front/home SAV page for more credit information.

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Since 1989, the Grant F. Walton Center for Remote Sensing and Spatial Analysis (CRSSA) has been located in a dedicated two-story section of the Environmental and Natural Resource Sciences building on the Cook College campus of Rutgers University in New Brunswick, New Jersey. CRSSA provides students, faculty, staff, and other researchers with state-of-the-art facilities for remote sensing and geographic information systems (GIS) teaching and research.

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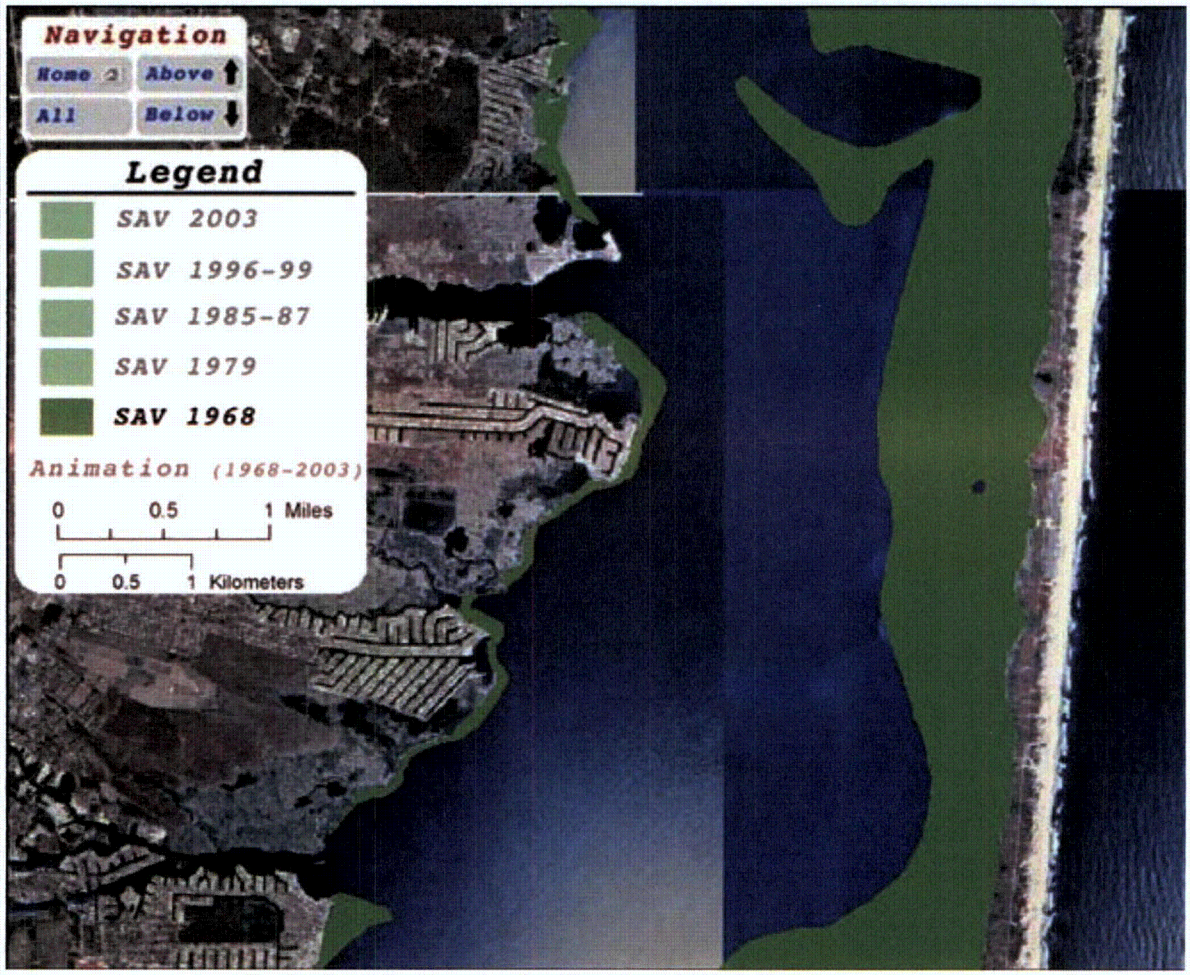

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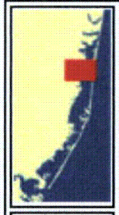

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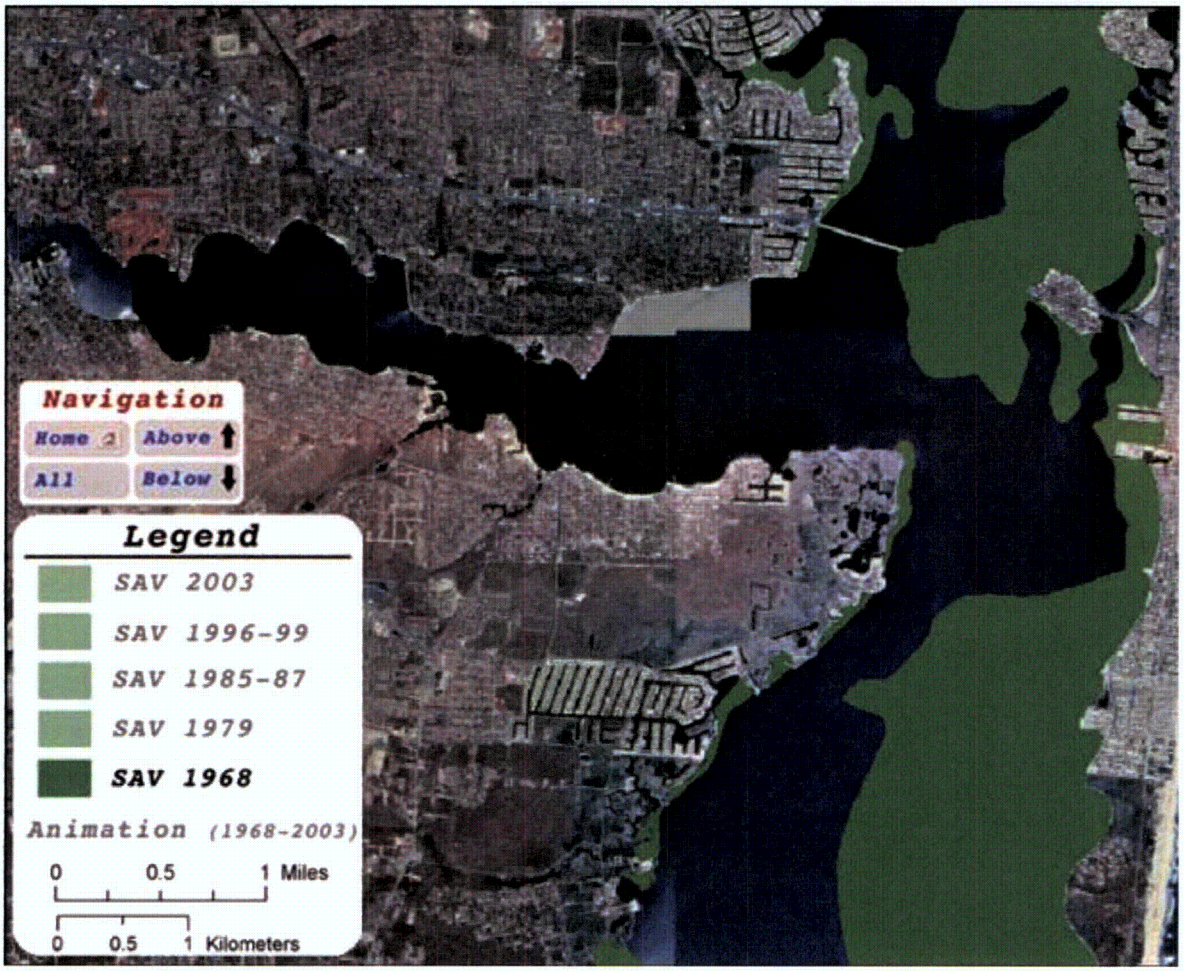

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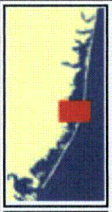

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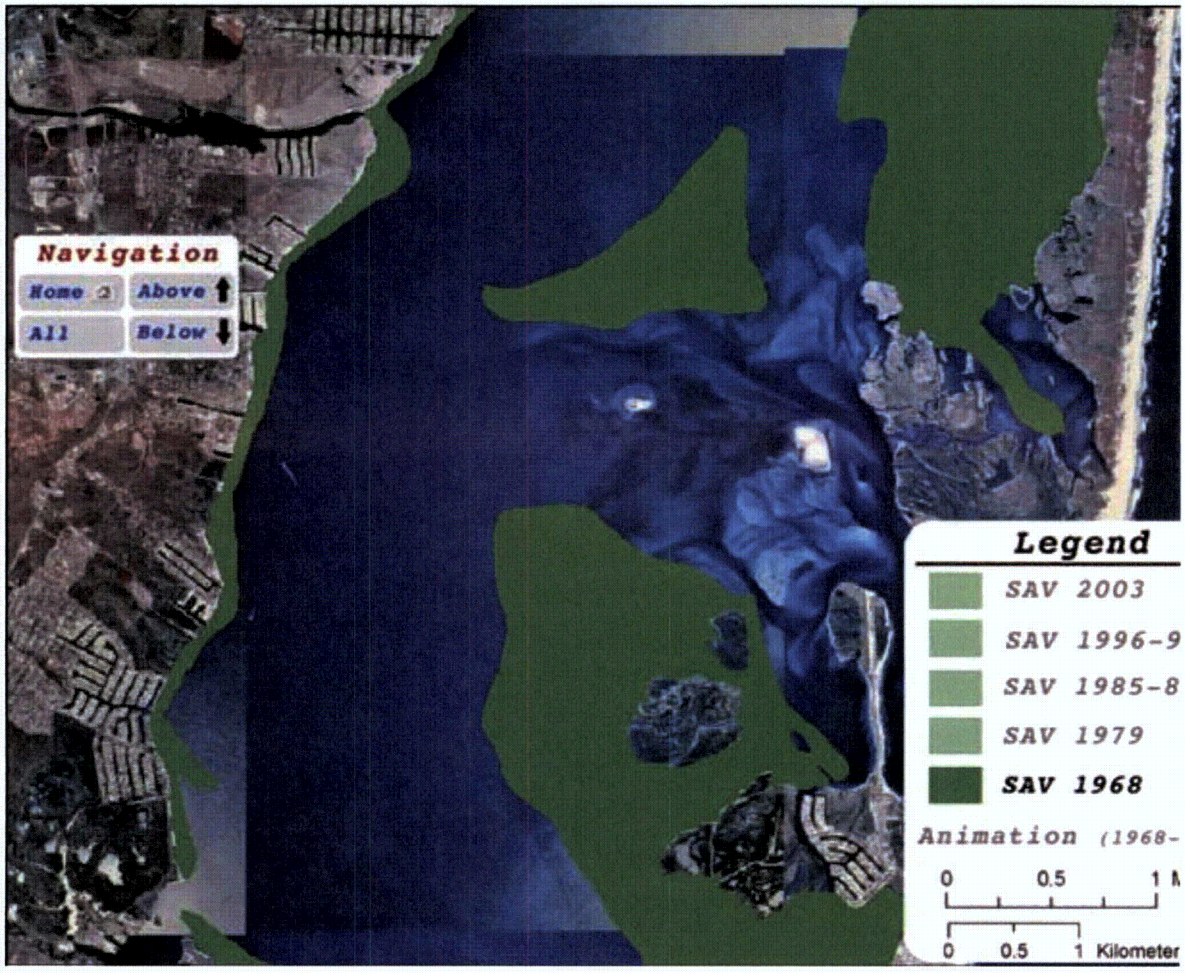

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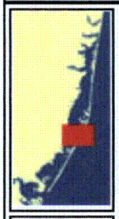

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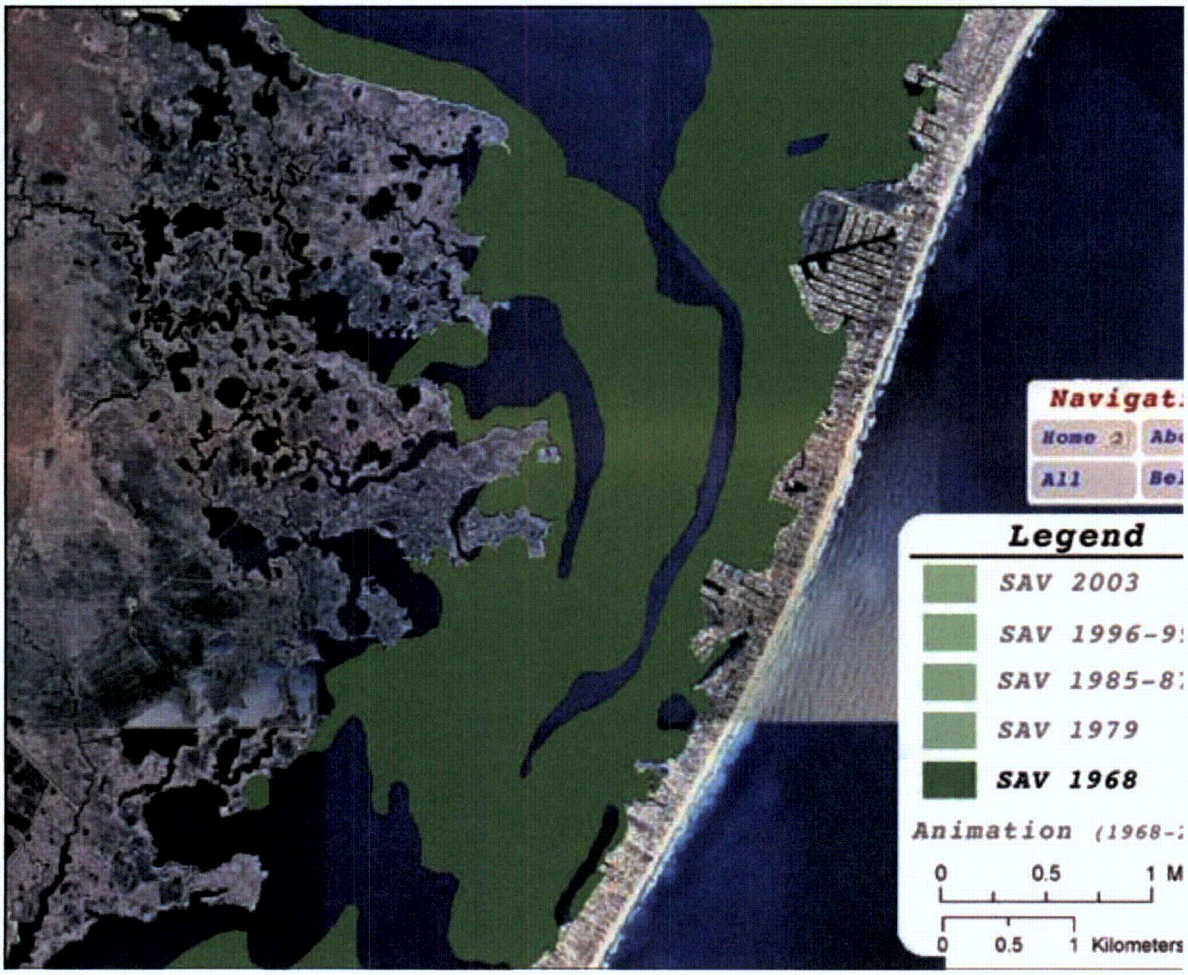

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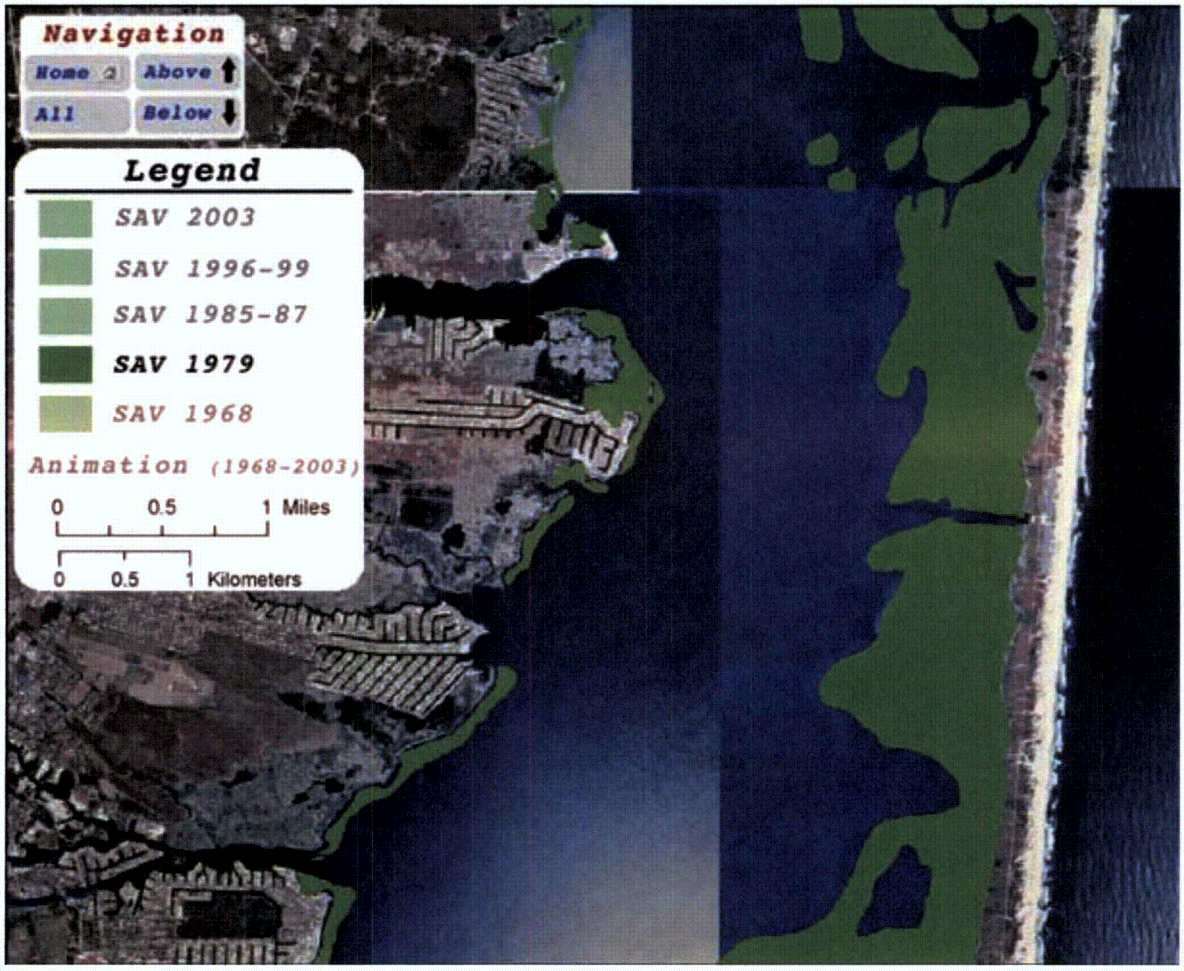

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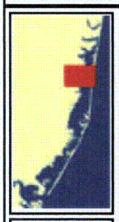

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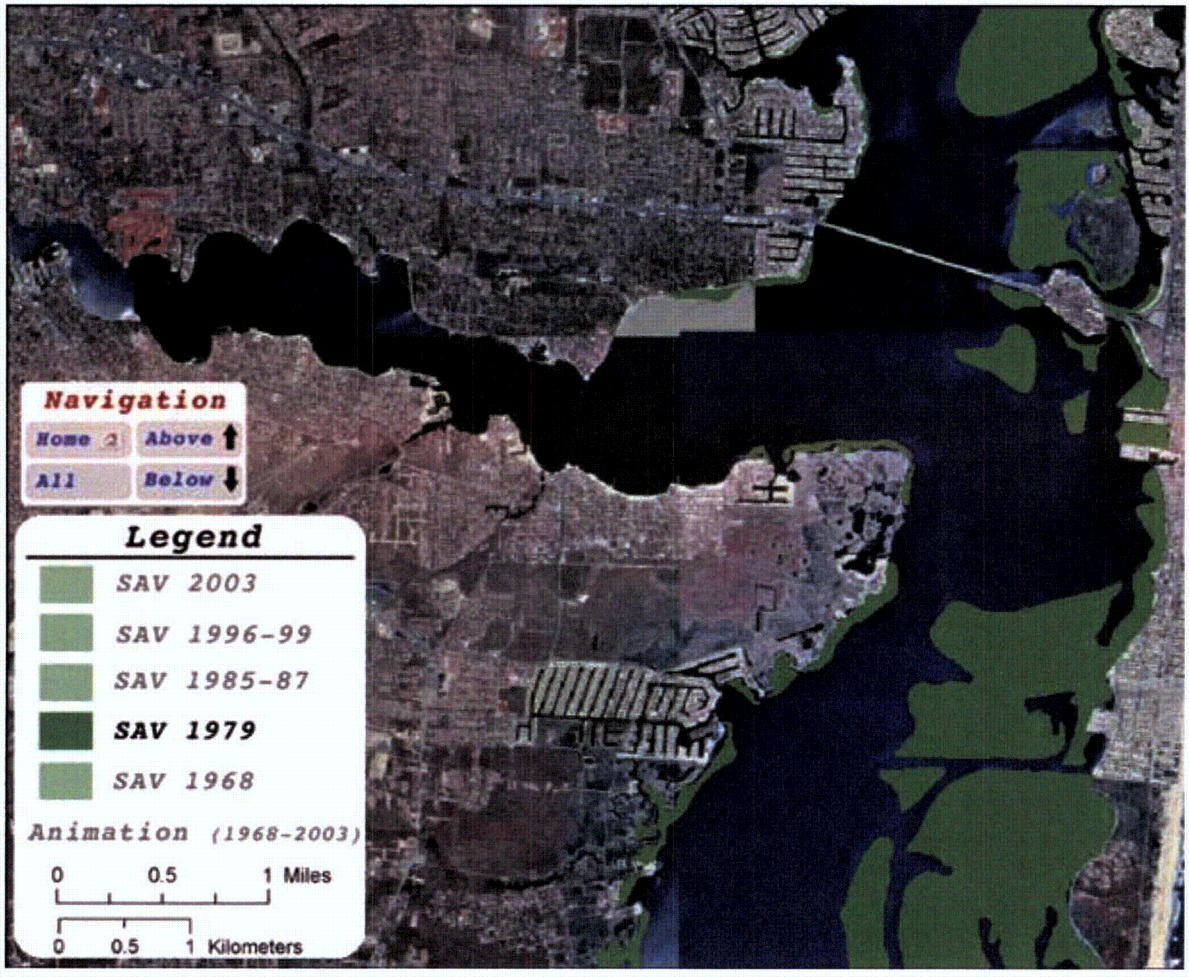

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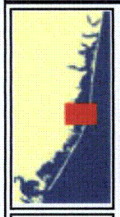

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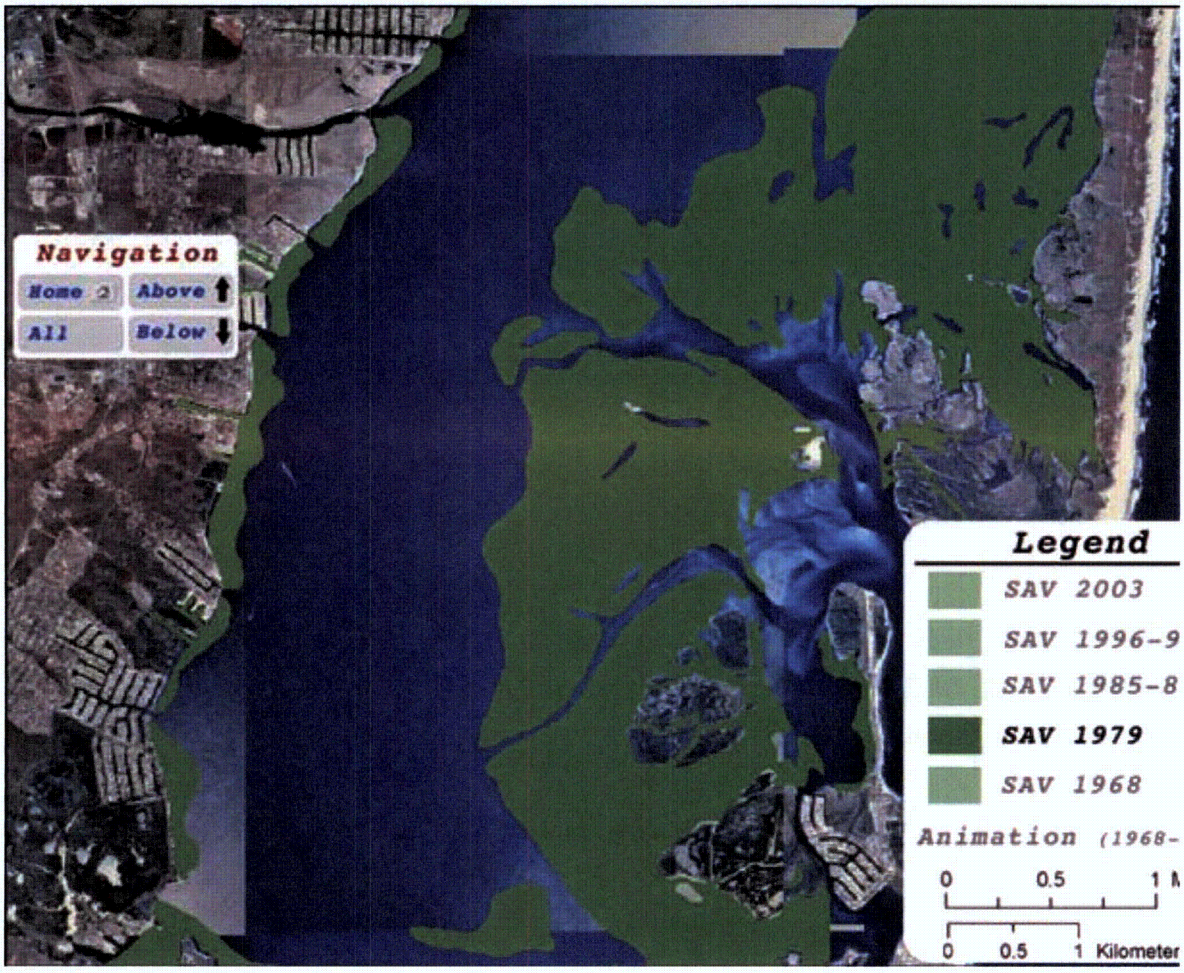

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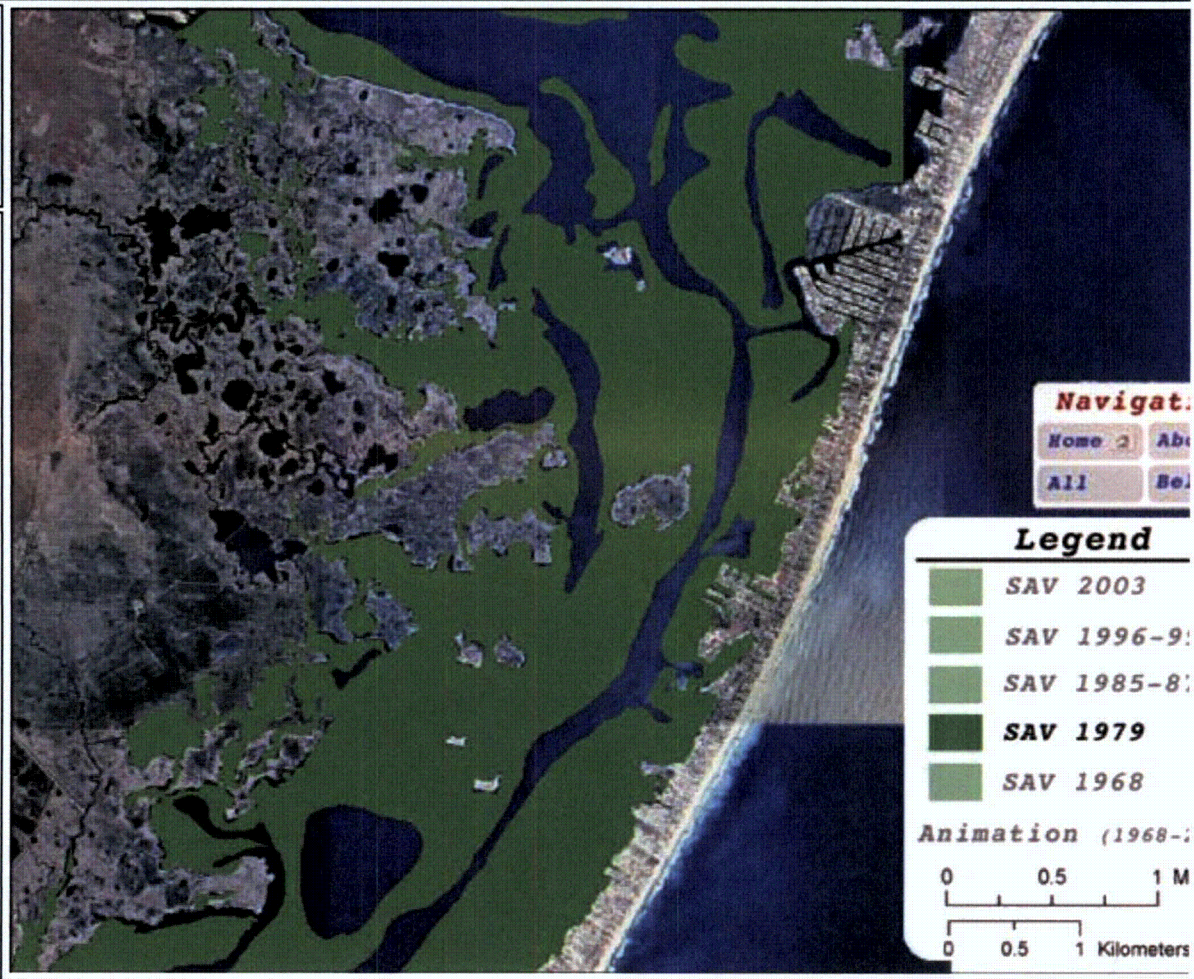

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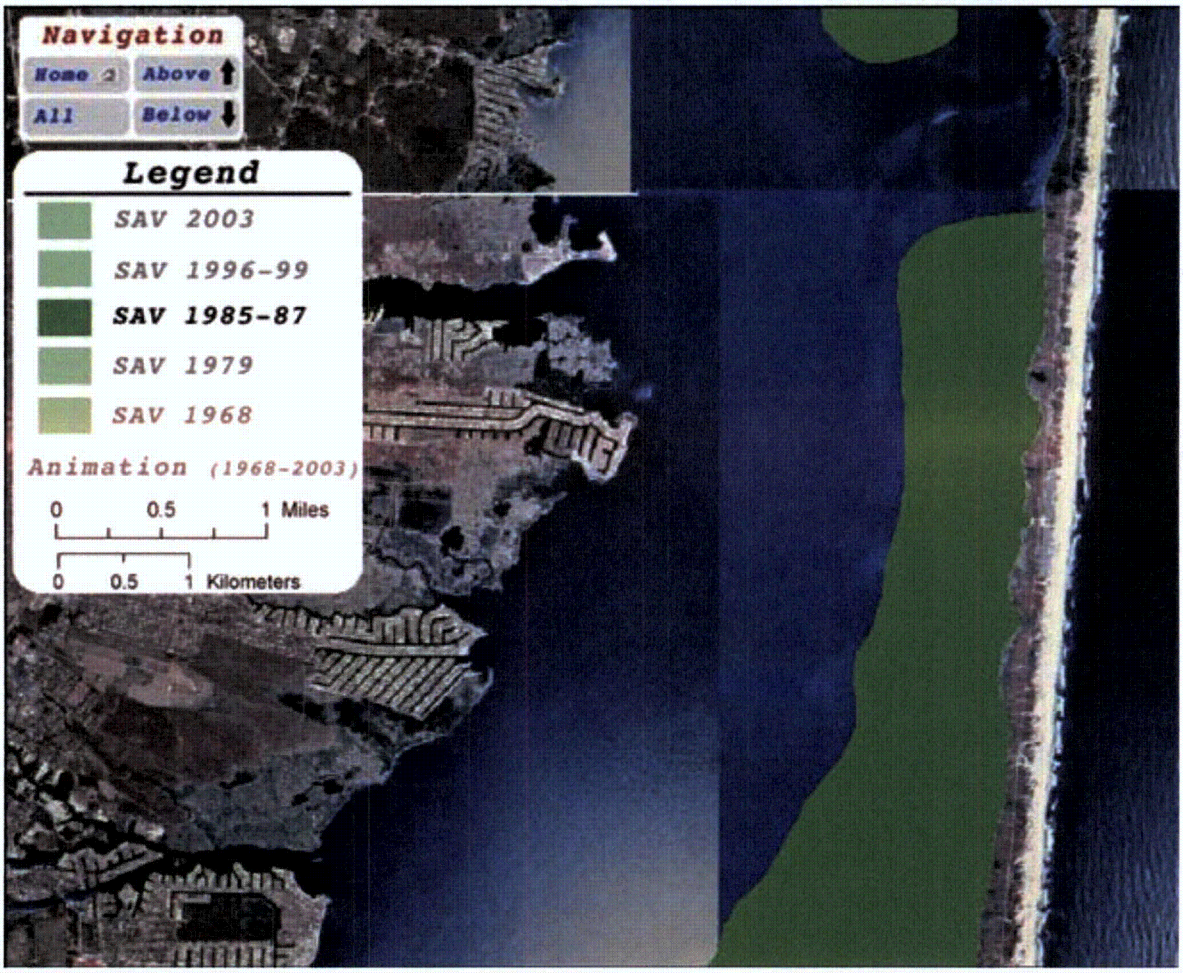

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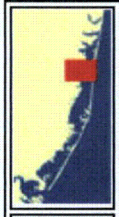

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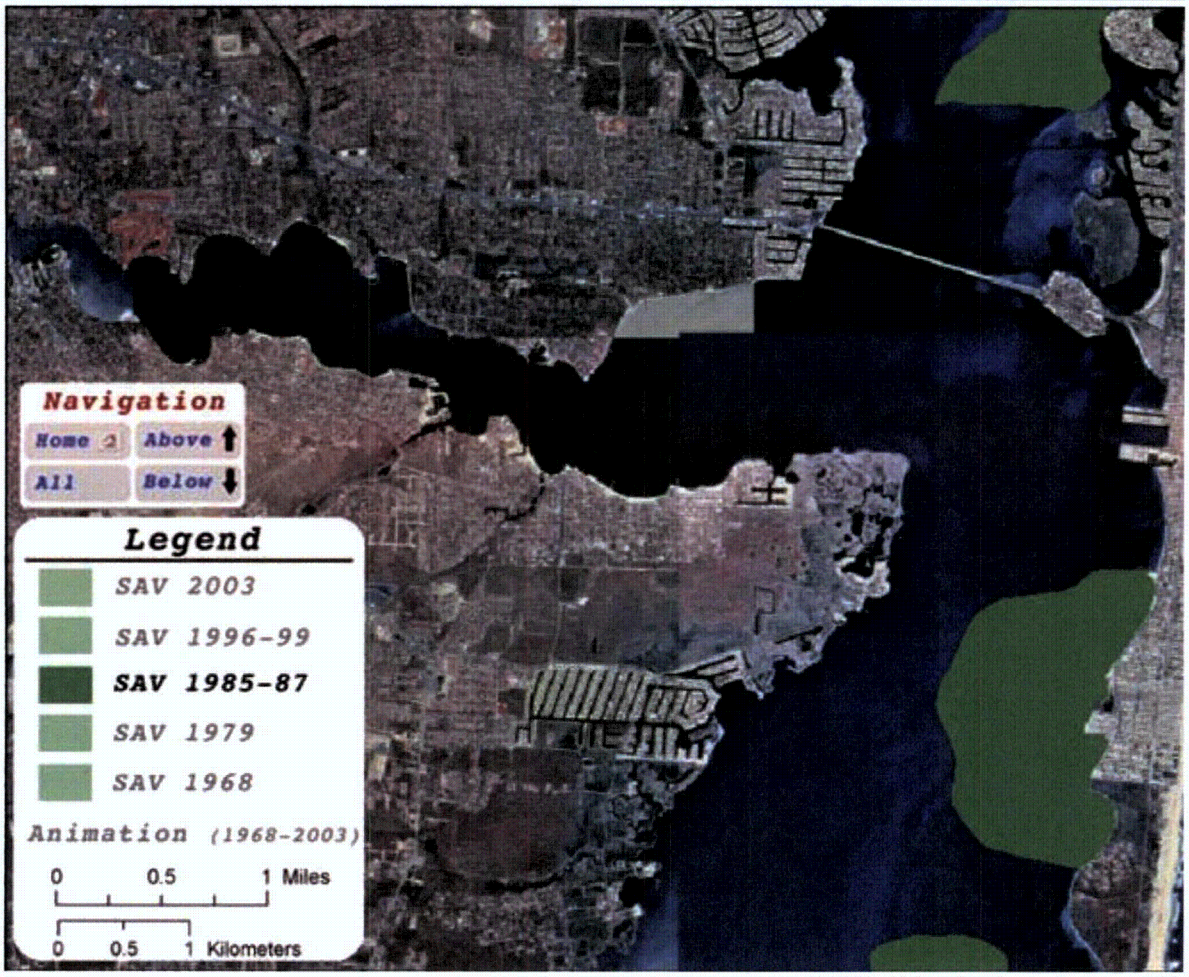

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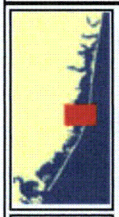

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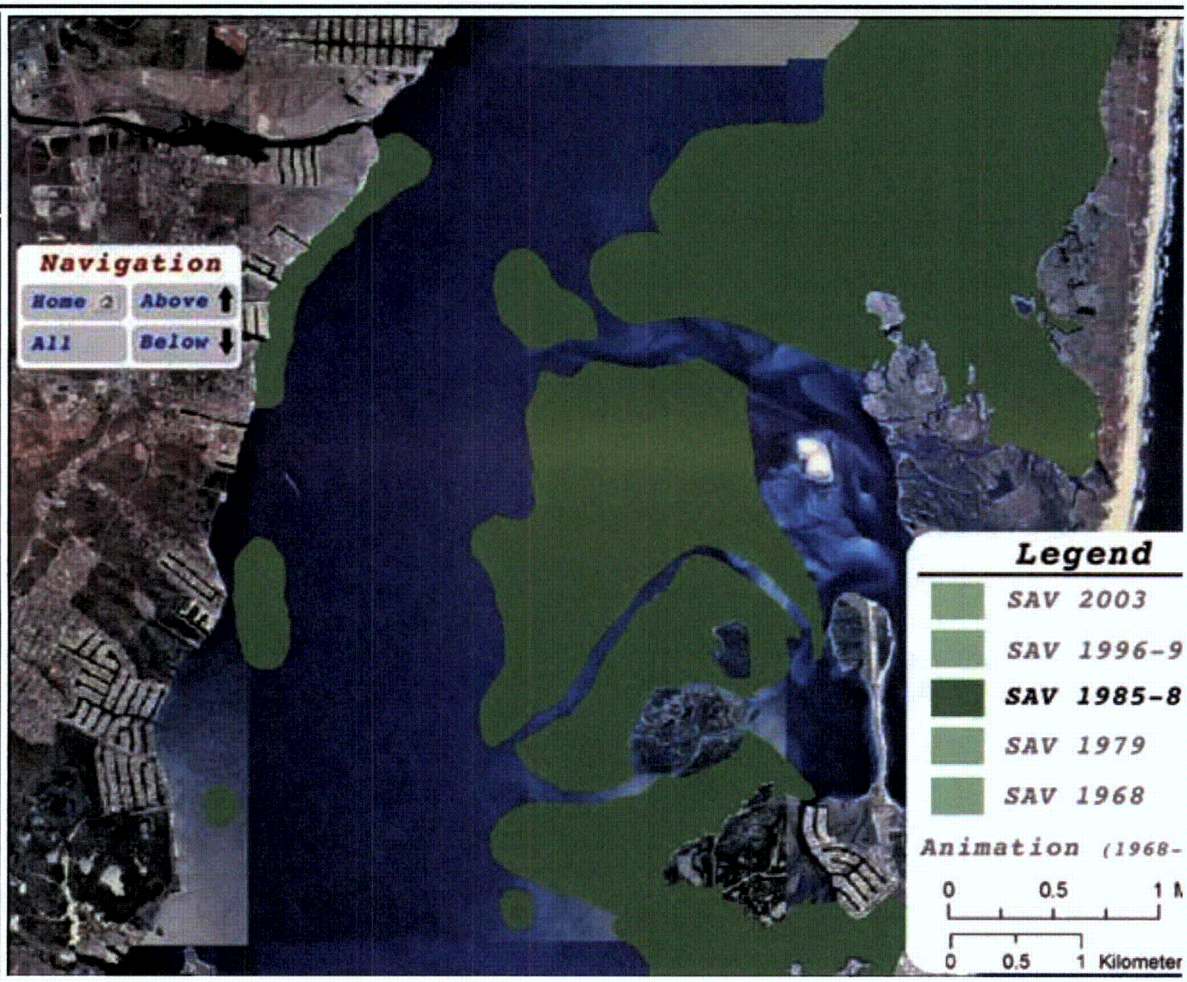

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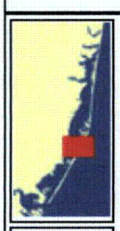

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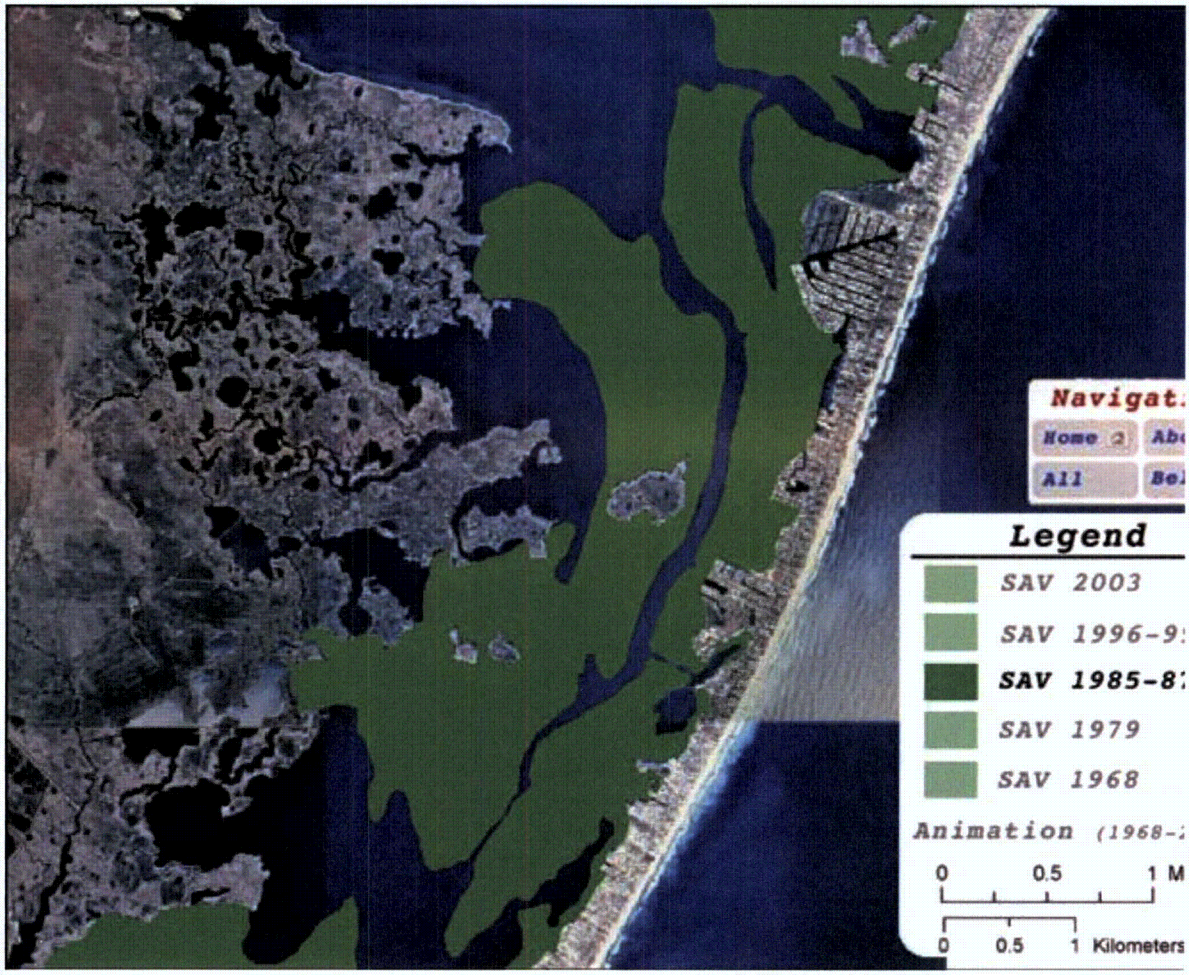

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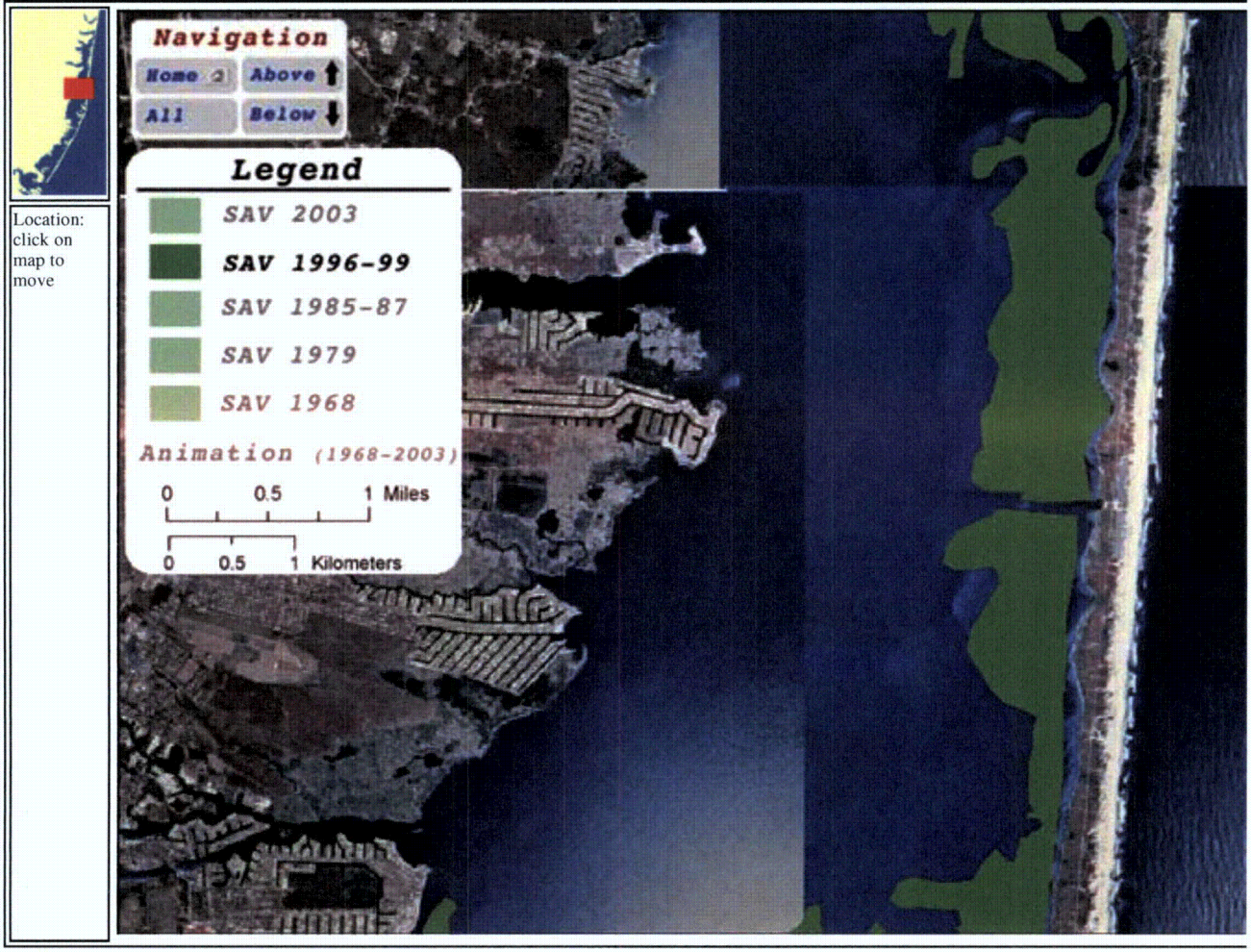

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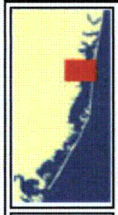

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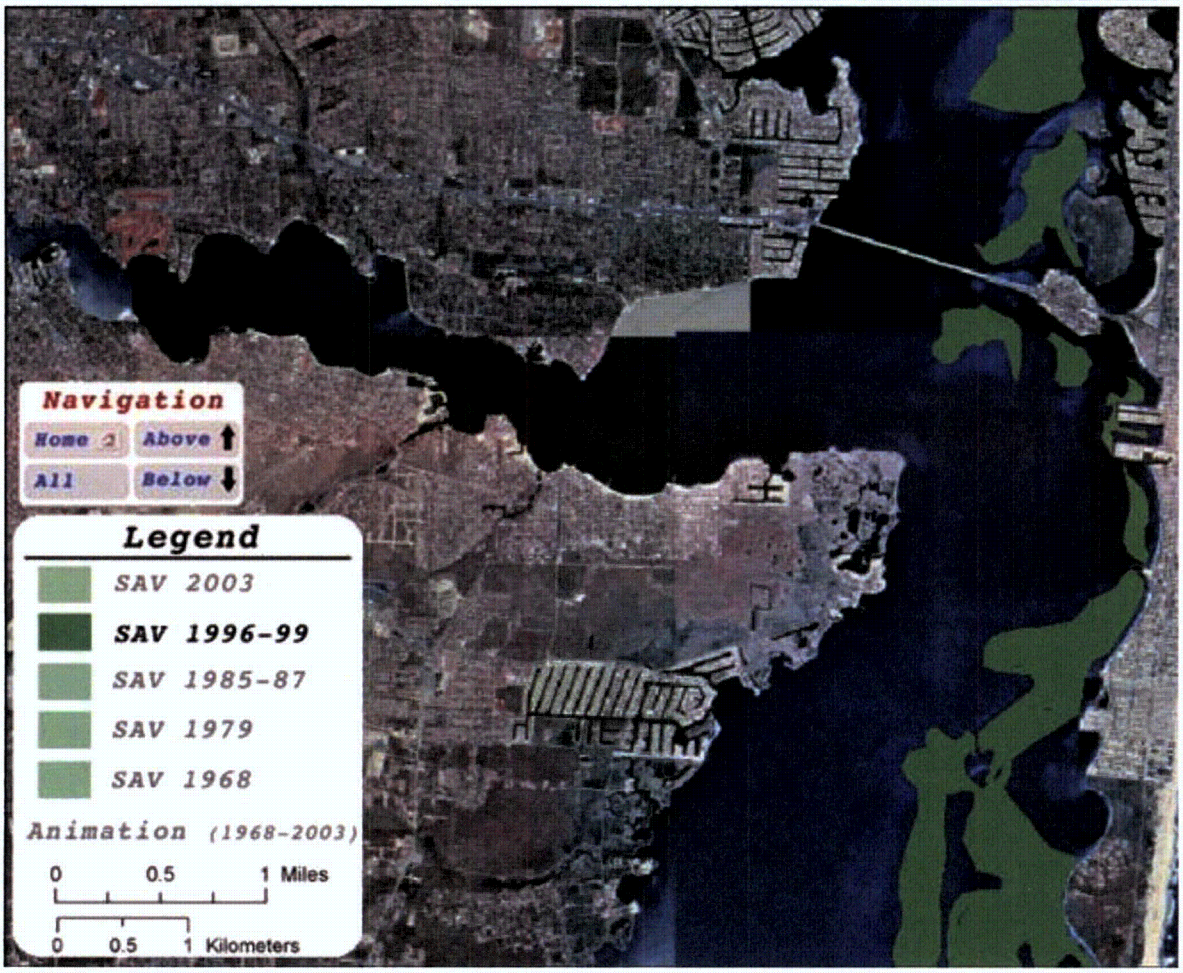

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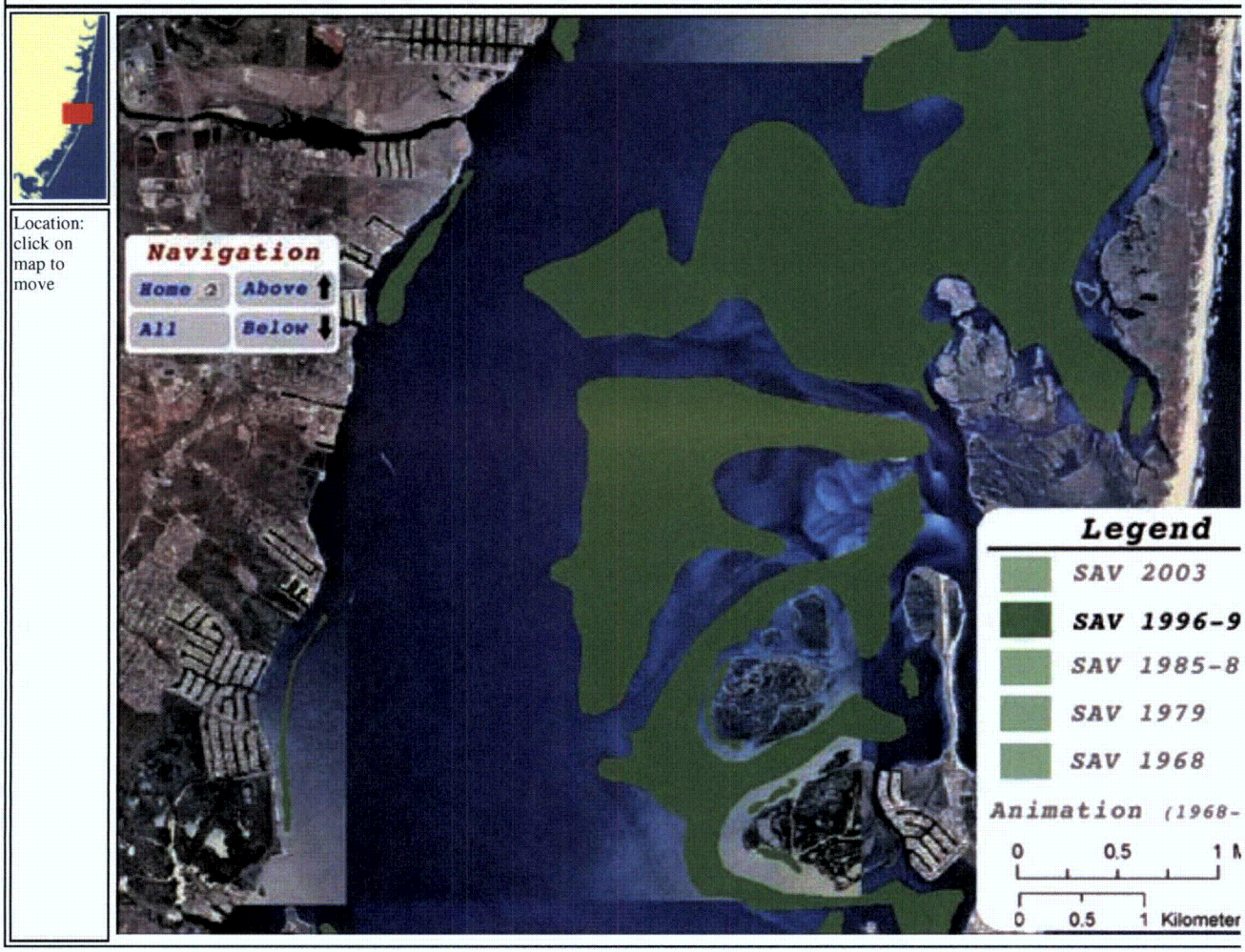

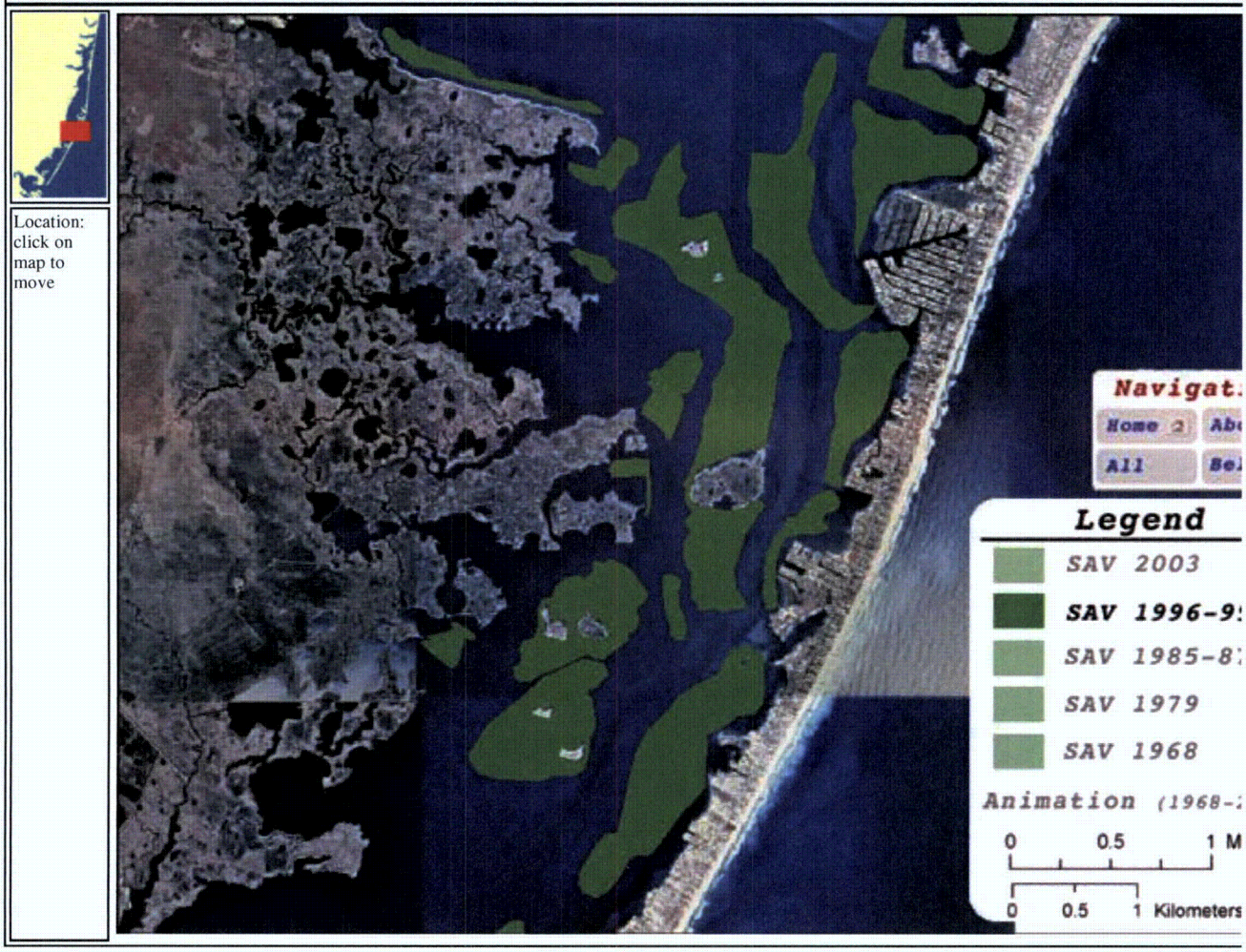
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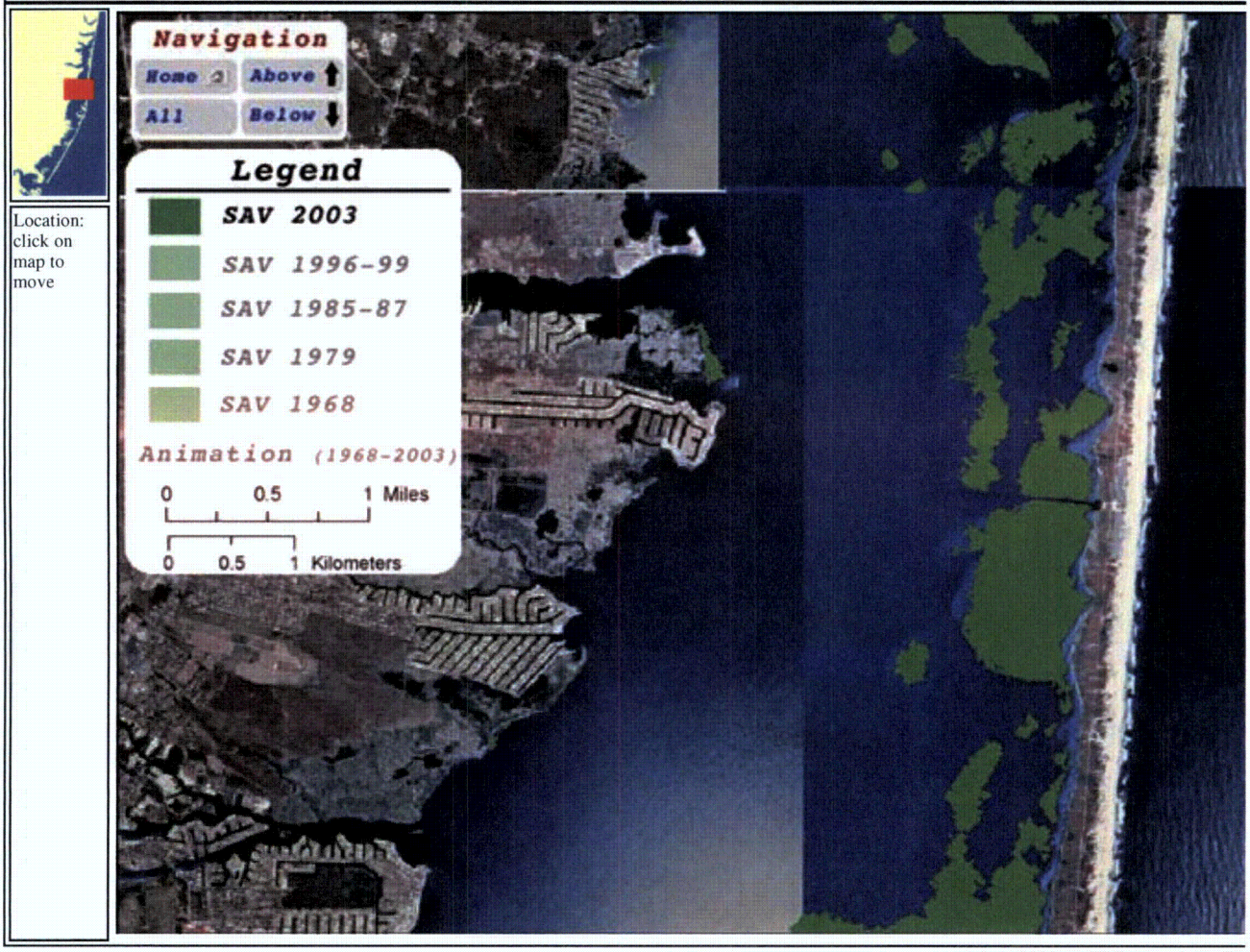

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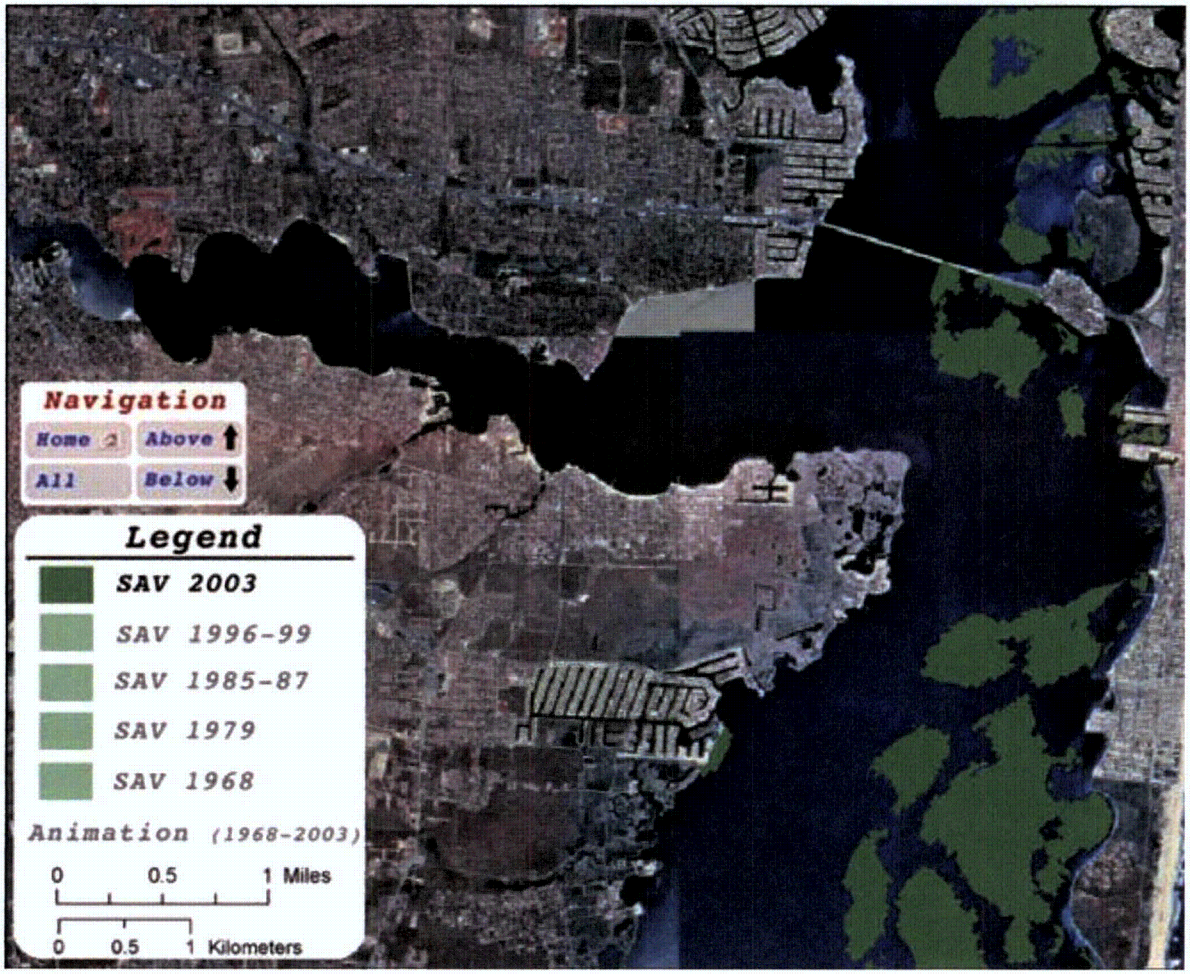

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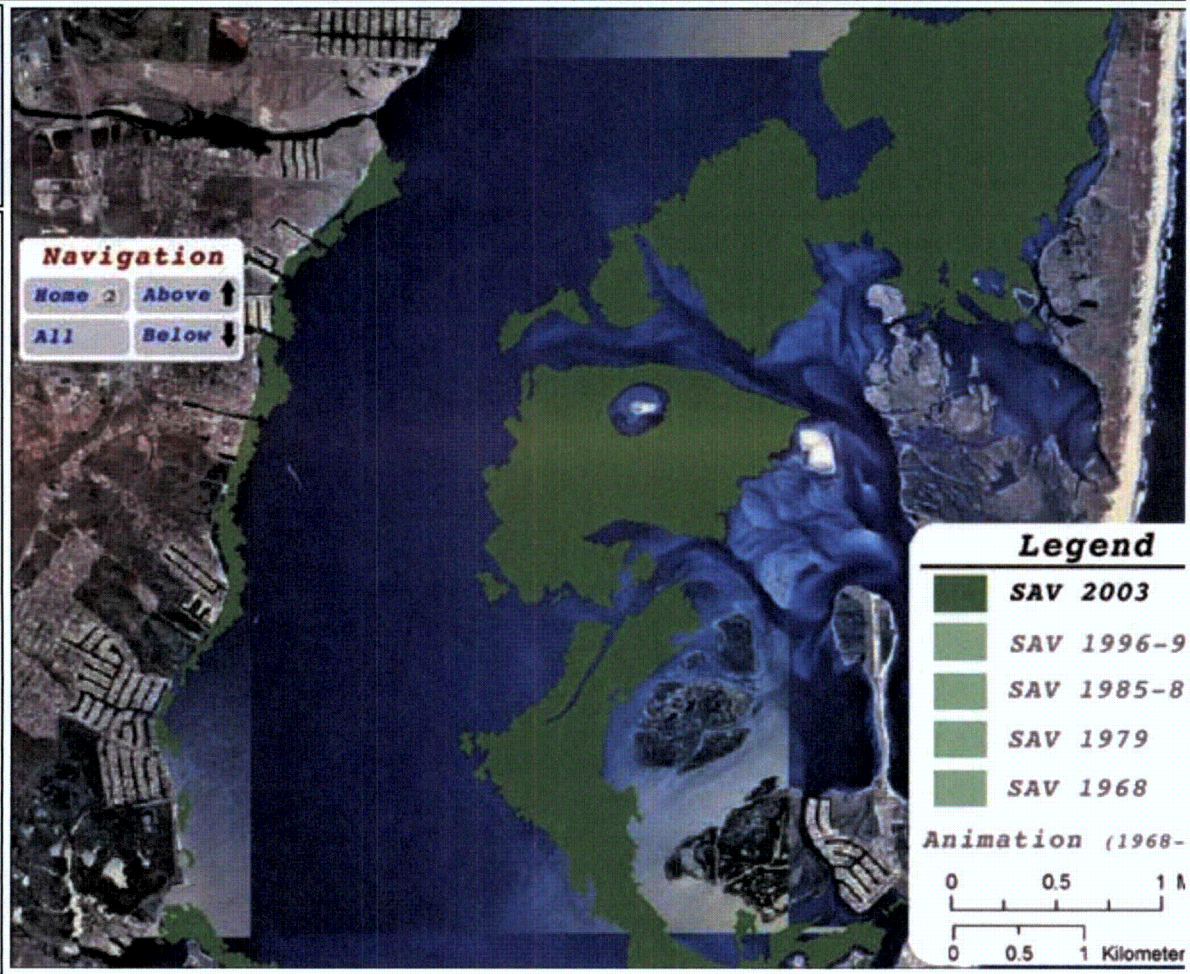

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