John Heinz National Wildlife Refuge: A Wetlands Pilot Study

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Angle-Wing Katydid

Wetland Habitat from Past to Present

ABSTRACT

Anthropogenic activities have historically reduced the spatial extent and health of wetlands habitats across Pennsylvania. A sample study area was established at the John Heinz National Wildlife Refuge (the Refuge) to characterize the existing wetlands and a GIS time-series analysis of historical aerial photographs was conducted to determine how land use changes may have impacted the upland boundary of the wetlands habitat. While results indicated little change in the spatial extent of the wetlands, the surrounding area showed rapid conversion of agricultural land abundant in the 1930s to suburban and industrial uses following the post-war period by the 1960s. Preserving the health and extent of the Refuge is critical to maintaining biodiversity, flood prevention, filtration of pollution, a migratory habitat for birds (including rare and endangered), and a recreational area for the community.

Key words: John Heinz National Wildlife Refuge, wetlands, historical aerial photographs, GIS time-series analysis.

Research Objectives

- Characterize existing wetland habitat at the John Heinz National Wildlife Refuge.
- Measure to what degree human impacts have changed the spatial extent of the wetland habitat over time.
- Compare field measurements against GIS-based analysis of the upland-marsh boundary.

Study Area

John Heinz
National Wildlife Refuge at Tinicum

Approximate study area
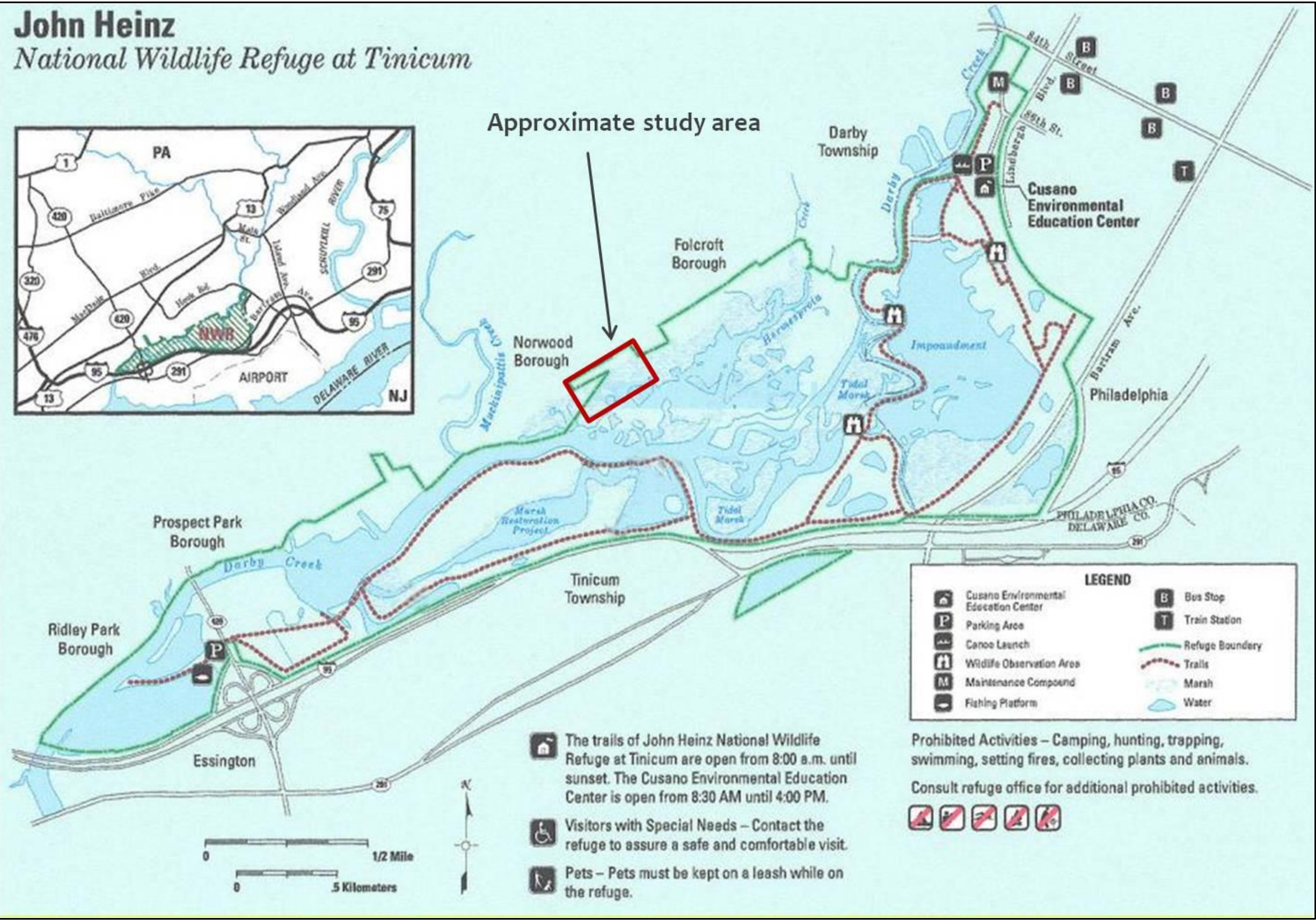
About the John Heinz National Wildlife Refuge

Established in 1972 by an act of Congress to preserve the last 200 acres of freshwater tidal marsh in the state of Pennsylvania.
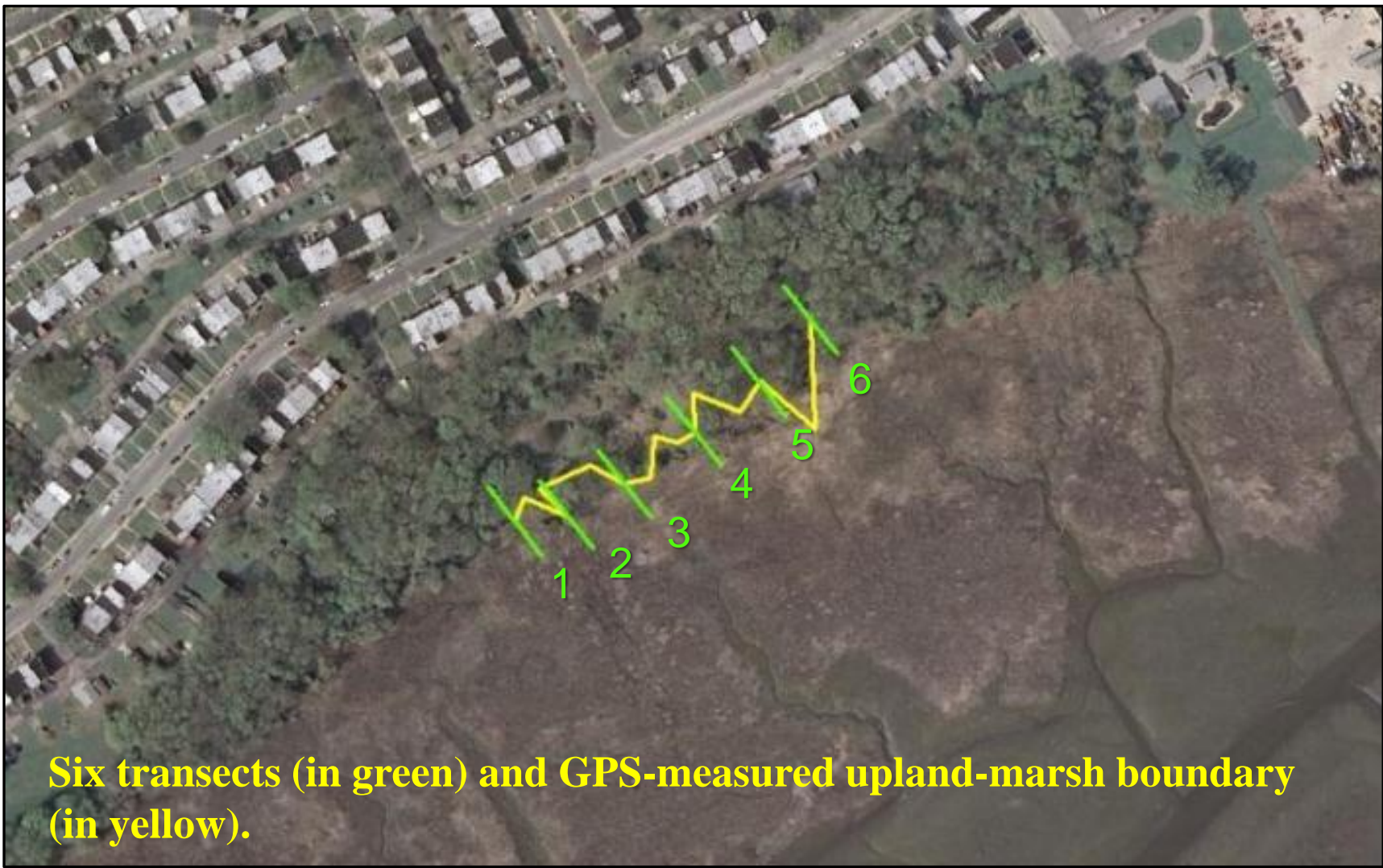
Cattails (foreground) and phragmites (background)

Lower Darby Creek

Crude oil residuals in saturated marsh soil.

Methods

Six transects (in green) and GPS-measured upland-marsh boundary (in yellow).

- Six (6) transects on the northern bank of Lower Darby Creek to record arboreal/wetlands species and perform i-Tree analysis.
- Time-series analysis performed in ArcGIS on historical aerial photographs to track land use changes in study area vicinity.
- Comparison of field-measured upland-marsh boundary to 2010 aerial photograph.

Soil sample

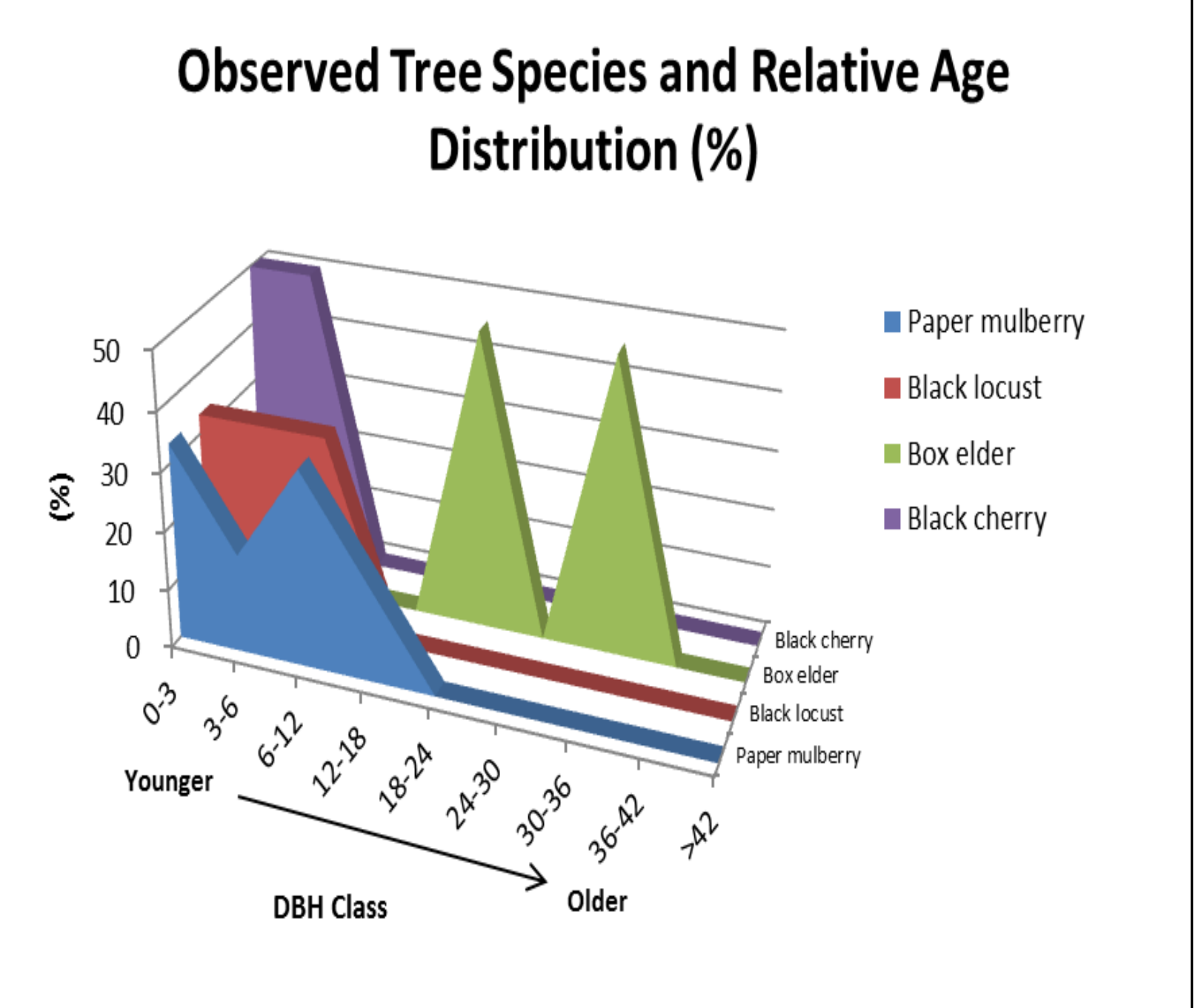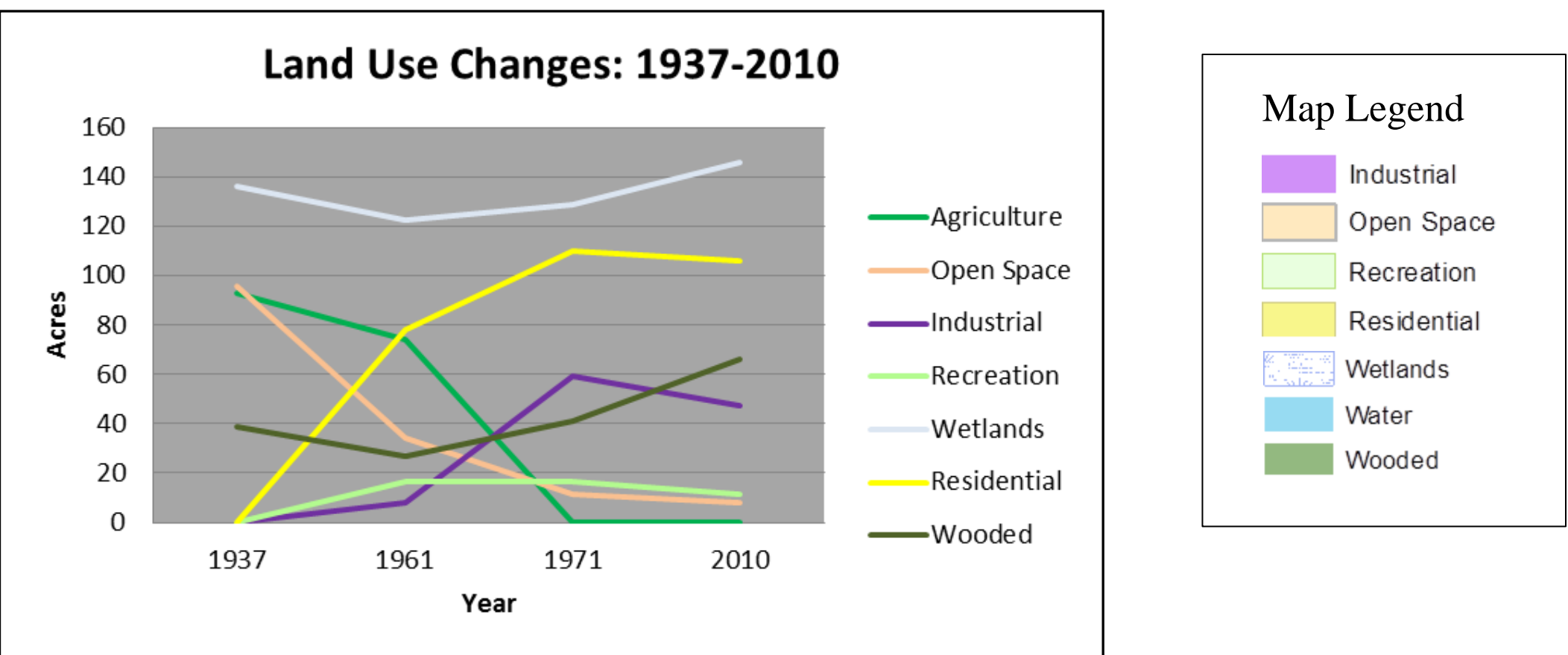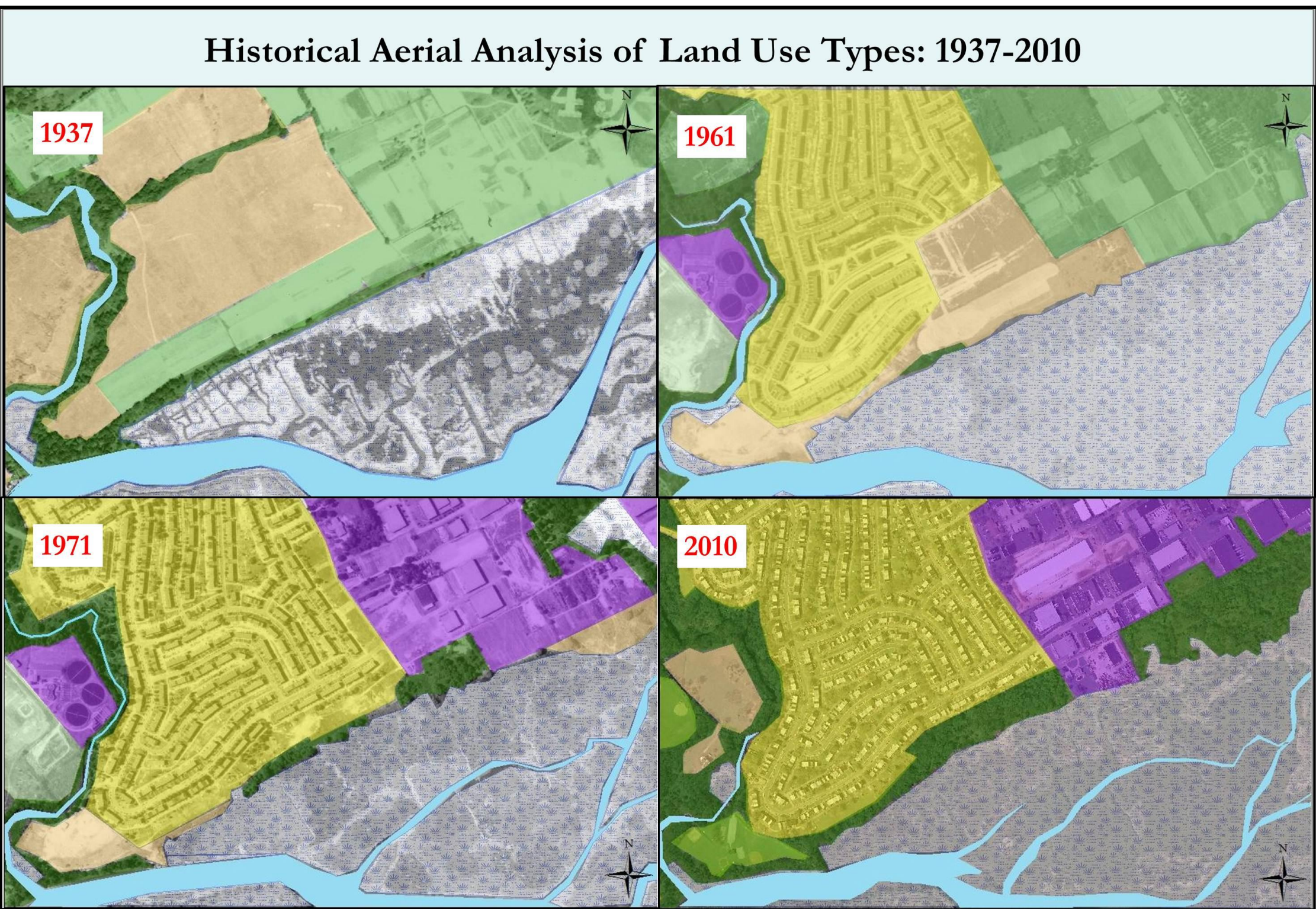A. Kaufman measures the diameter at breast height (DBH) of a tree.

Cherry

Results

Historical Aerial Analysis of Upland Boundary of Wetlands: 1937-2010

1937

1961

1971

2010

GPS Points
GPS Upland Boundary
Aerial Upland Boundary

0 25 50 100 150 200 Feet   Source PASDA

Observed Tree Species and Relative Age Distribution (%)

Paper mulberry
Black locust
Box elder
Black cherry

DBH Class

Younger   Older

Historical Aerial Analysis of Land Use Types: 1937-2010

1937

1961

1971

2010

Land Use Changes: 1937-2010

Acres

Year
1937   1961   1971   2010

Agriculture
Open Space
Industrial
Recreation
Wetlands
Residential
Wooded
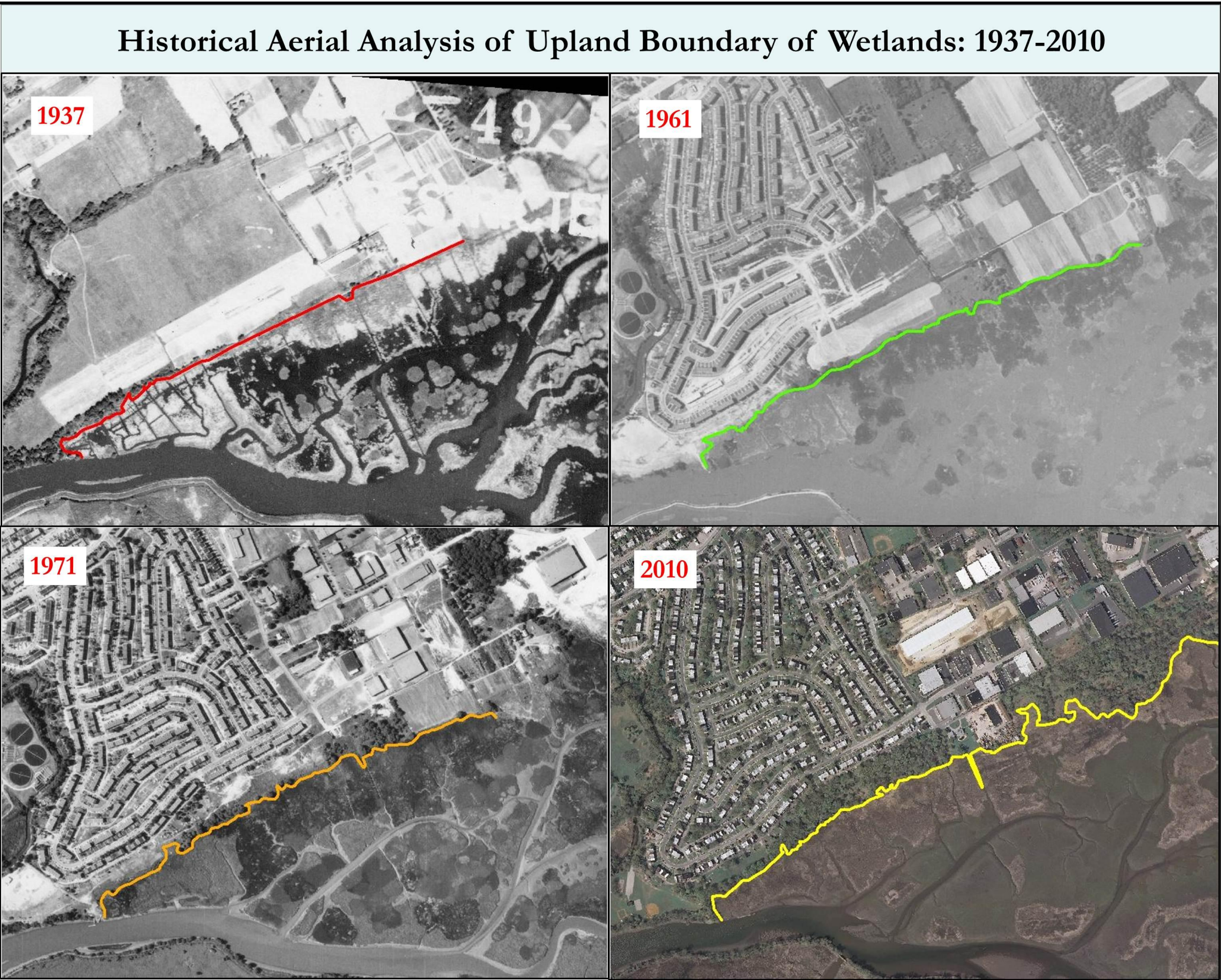
Map Legend

Industrial
Open Space
Recreation
Residential
Wetlands
Water
Wooded

Conclusions

- i-Tree analysis traced observed paper mulberry, black locust, box elder, and black cherry as relatively young-aged (~20-40 years), confirming aerial analysis results.

- Abundant agricultural land during 1930s was replaced by residential and industrial uses from post-War suburbanization and related industrialization by the 1960s.

- Further suburbanization and heavy industry resulted in complete loss of agricultural land and clearing of woodlands along north wetland boundary by the 1970s.

- GIS time-series analysis determined no significant change in spatial extent of the upland boundary of wetlands within study area.

- Field measurement of upland-marsh boundary showed greater irregularity compared to aerial interpretation, suggesting need for more accurate GPS survey equipment.

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