

GIS-based Spatial Analysis of *Oenothera perennis* in Northeastern Illinois

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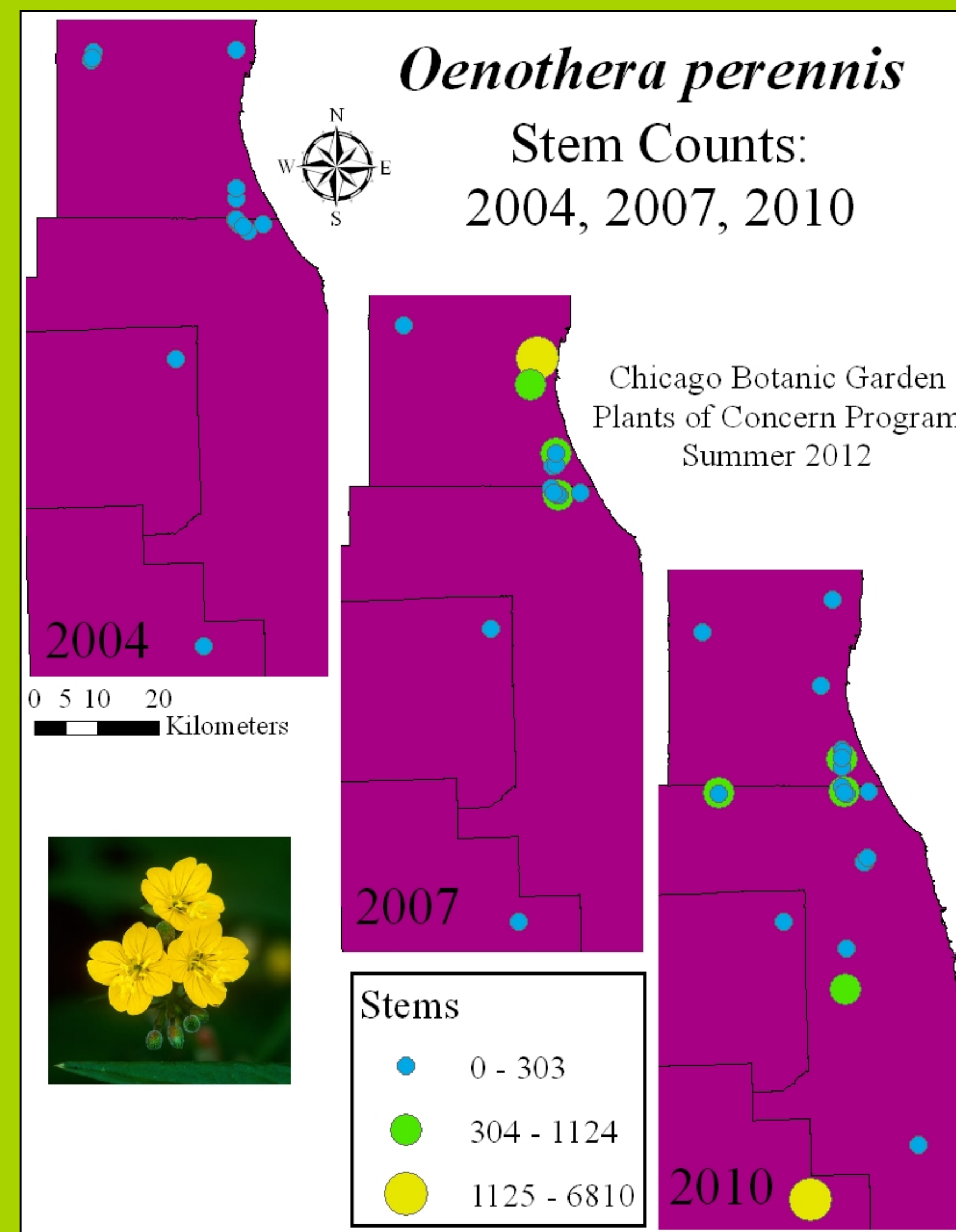


Figure 2: Distribution of stem counts for *Oenothera perennis* across Northeastern Illinois for selected years 2004, 2007, and 2010. The graphs indicate that not only has the spatial distribution increased, but also the number of stems.

Introduction

By utilizing over 10 years of plant monitoring data from the Plants of Concern Program at the Chicago Botanic Garden, and exploring GIS-based spatial analysis tools, this project will not only answer questions about the distribution and health of *Oenothera perennis* in northeastern IL, but also provide maps, visuals, and data to enhance the message of Plants of Concern. This project aims to map the general spatial pattern of *Oenothera perennis* in the Plants of Concern monitoring area (see Figure 1). Lastly, this project aims to determine whether management (mowing, brush removal, burning, herbaceous plant removal) has increased, and whether it has helped *Oenothera perennis*.

Oenothera perennis

Oenothera perennis, the Small Sundrop, is an Illinois native perennial wildflower. Also commonly referred to as the Evening Primrose, this plant prefers full or partial sun, moist to dry conditions, sandy soil, and is often found in prairies and open woodlands. Listed as threatened by the Illinois Endangered Species Protection Board, *Oenothera perennis* is only found in the very northeastern part of the state.

Plants of Concern

Created in 2000, Plants of Concern is a regional rare plant-monitoring program that assesses long-term trends in rare plant species by gathering critical data. Coordinated by the Chicago Botanic Garden, Plants of Concern works with trained volunteers, scientists, land managers, private landowners, and public and non-governmental conservation agencies. Plants of Concern has monitored over 176 species in 6 counties in Northeastern Illinois.

Results

Stem Counts

The annual stem count has increased from 141 in 2001 to 2,289 in 2011. The number of subpopulations that are monitored has increased from 5 in 2001 to 14 in 2011. From Figure 2, the distribution of monitored *Oenothera perennis* by the Plants of Concern program has increased across the four county region in Northeastern Illinois.

Land Management

From Figure 3, the number of subpopulations increased from 2004, to 2007, to 2010. In 2004 only 7/16 subpopulations were managed—about 44%. In 2007, 14/24 subpopulations were managed—about 58%. Lastly, in 2010, 17/29 subpopulations were managed—about 59%.

Point Pattern Analysis

The point pattern analysis shown in Figure 4 displays the standard deviational ellipses and the population mean centers for 2004, 2007, and 2010. The Plants of Concern monitored sites have become more densely concentrated around the northeastern counties, Lake and Cook.

Stem Density

Figure 5 displays the stem density for *Oenothera perennis* for 2004, 2007, and 2010. From the three maps, the stem density has greatly increased throughout the Plants of Concern monitored populations.

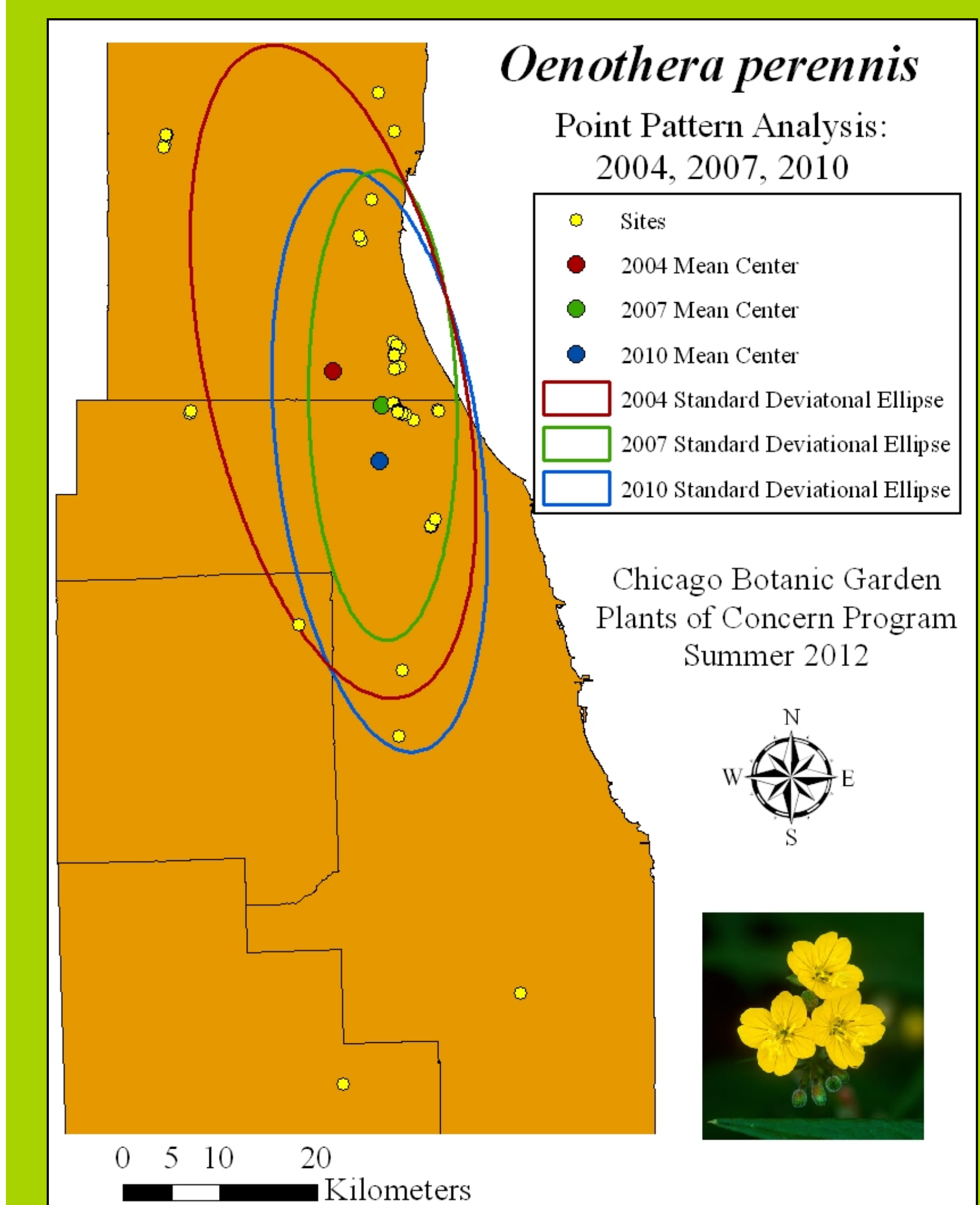


Figure 4: Standard Deviational Ellipses for *Oenothera perennis* populations across Northeastern Illinois for selected years 2004, 2007, and 2010.

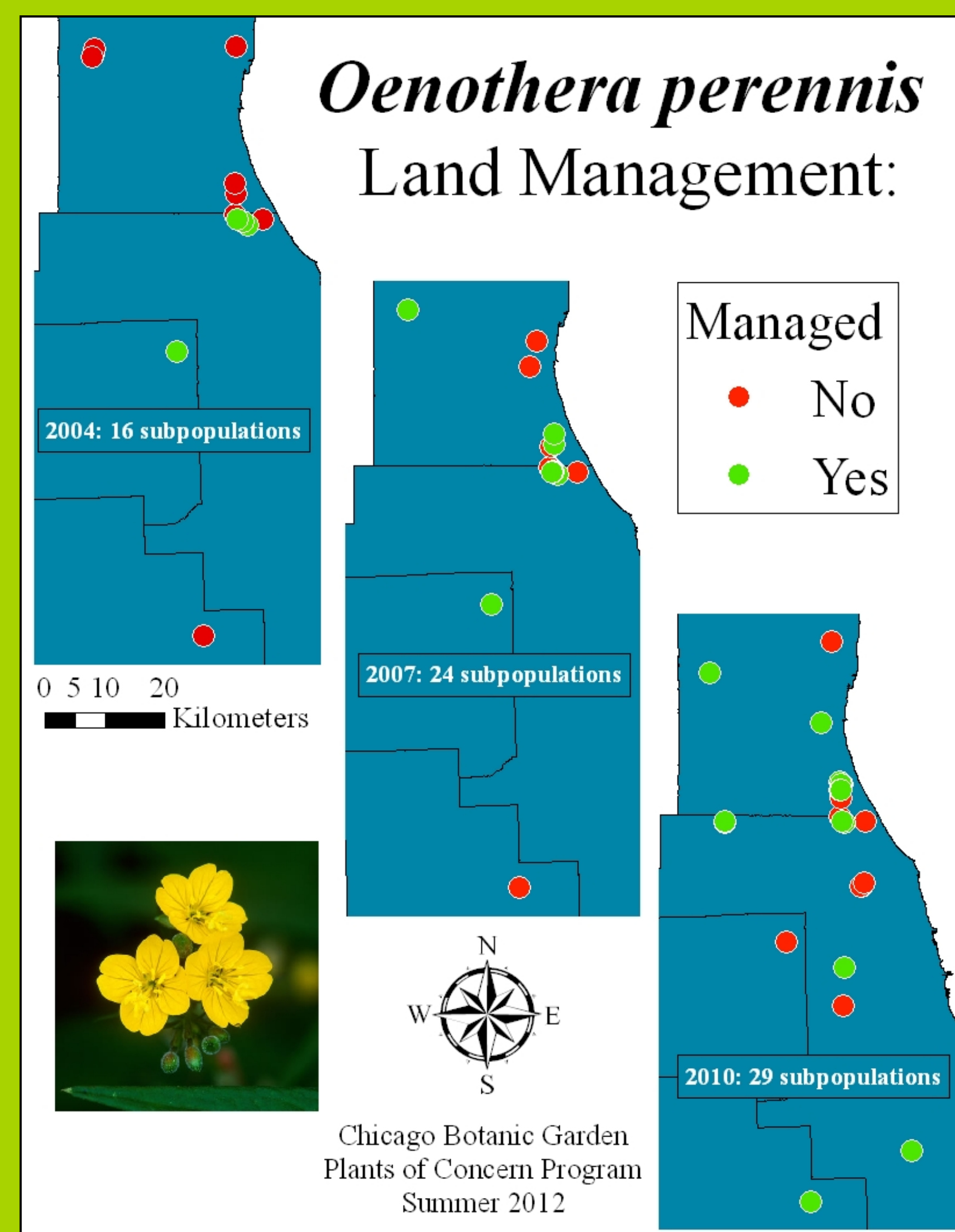


Figure 3: Land Management for subpopulation sites of *Oenothera perennis* across Northeastern Illinois for selected years 2004, 2007, 2010. Land Management includes burning, brush removal, herbaceous plant removal, and mowing.

Methods

- Queried all data that has been collected for *Oenothera perennis* from 2001 to 2011 from Plants of Concern database
- Sorted, organized, and cleaned up pertinent data from the excel formatted spreadsheet
- Imported excel spreadsheet to ArcMap10 and reformatted for conversion to shapefile (.shp) format
- Standardized all shapefile data to the geographic coordinate system WGS84
- Re-projected all shapefile data to the projected coordinate system State Plane NAD 83 Illinois East (meters)
- Created graduated cylinder maps for *Oenothera perennis* stem counts
- Created maps for *Oenothera perennis* stem density using ArcToolbox
- Added an attribute field for all management, and created a map using unique value categories
- Using ArcToolbox Point Pattern Analysis tools, created a map for mean center, and standard deviational ellipses.
- Created subpopulation site specific maps
- Created a general site distribution map
- Analyzed maps and data for *Oenothera perennis* to better understand its spatial distribution from 2001-2012

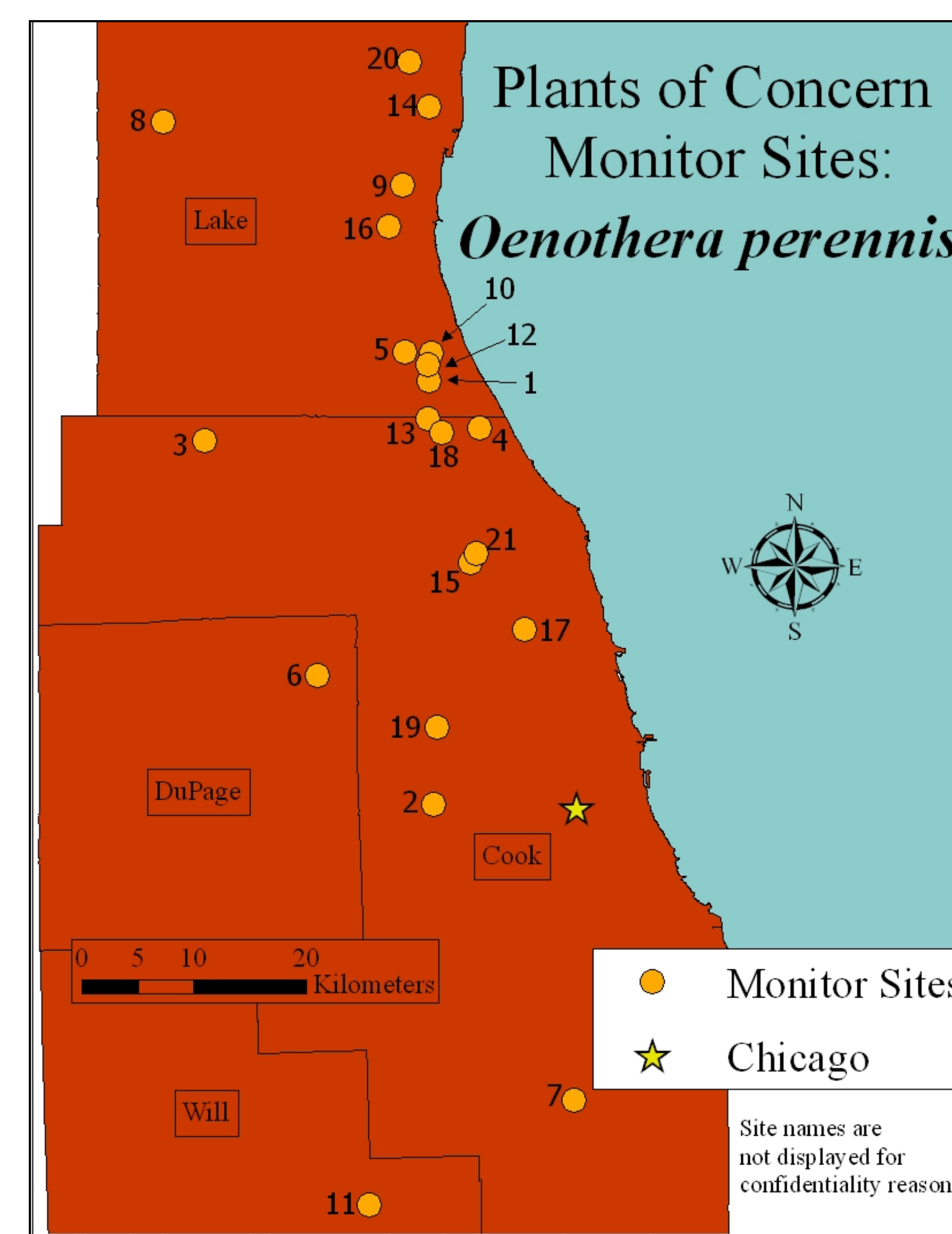


Figure 1. Study Area: Lake, Cook, DuPage, and Will counties of Northeastern Illinois

Conclusion

- The stem counts, stem density, and spatial distributions of *Oenothera perennis* have increased across the Plants of Concern monitored populations
- Plants of Concern has vastly increased its monitoring capacity in Northeastern Illinois
- GIS-based spatial analysis and mapping is extremely useful to better understand the data that has been collected since 2001 by Plants of Concern
- GIS mapping provides a great medium of communication for the Plants of Concern program to boost its message for conservation purposes as well as to the general public
- It would be useful to focus on each of the four management practices to see how they affect stem counts for *Oenothera perennis*
- It would be useful to gather GPS polygons from each population to better compare the individual sites to one another

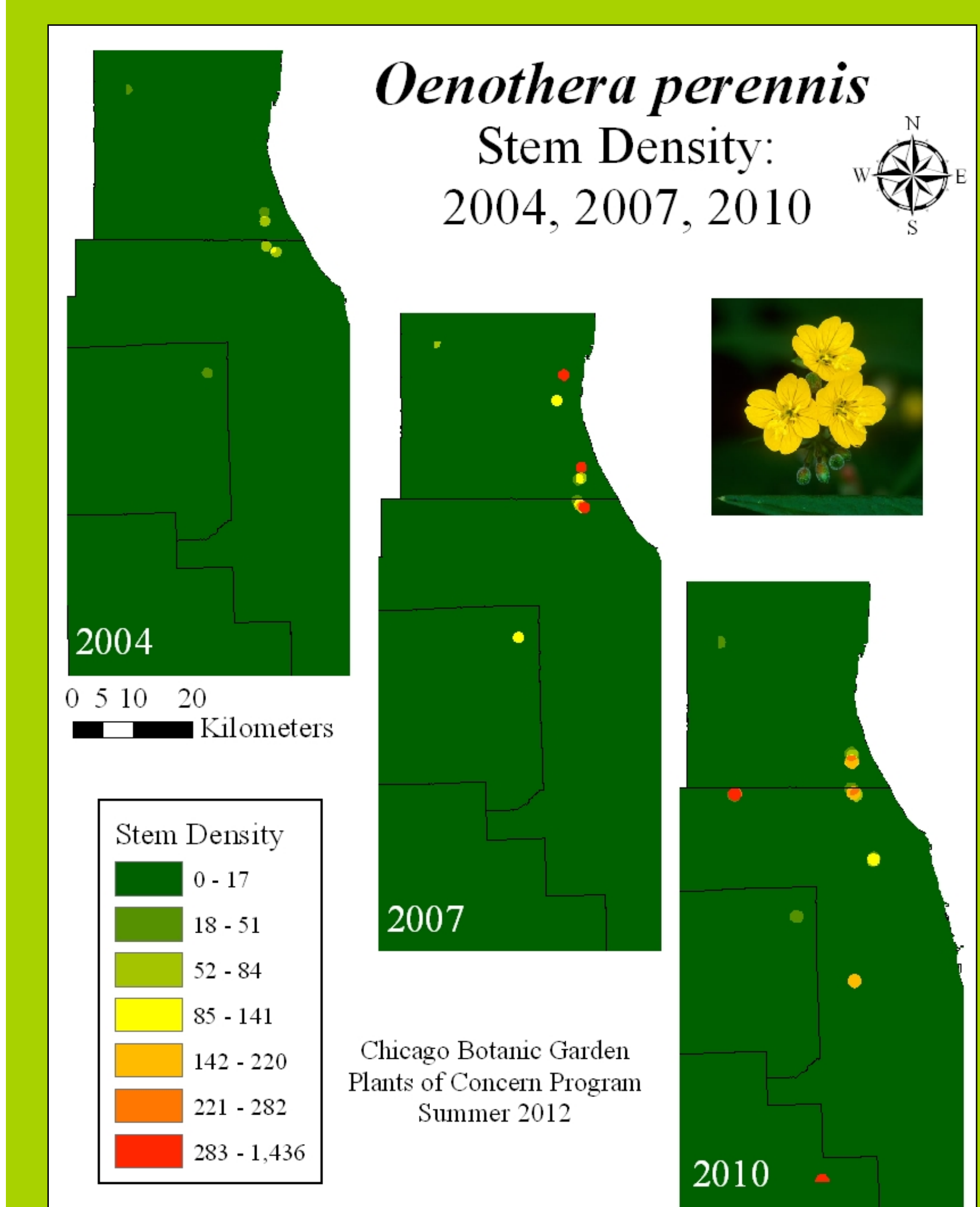


Figure 5: Stem Density for *Oenothera perennis* populations across Northeastern Illinois for selected years 2004, 2007, and 2010. The spatial distribution of *Oenothera perennis* has increased as well as the stem density from 2004.

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