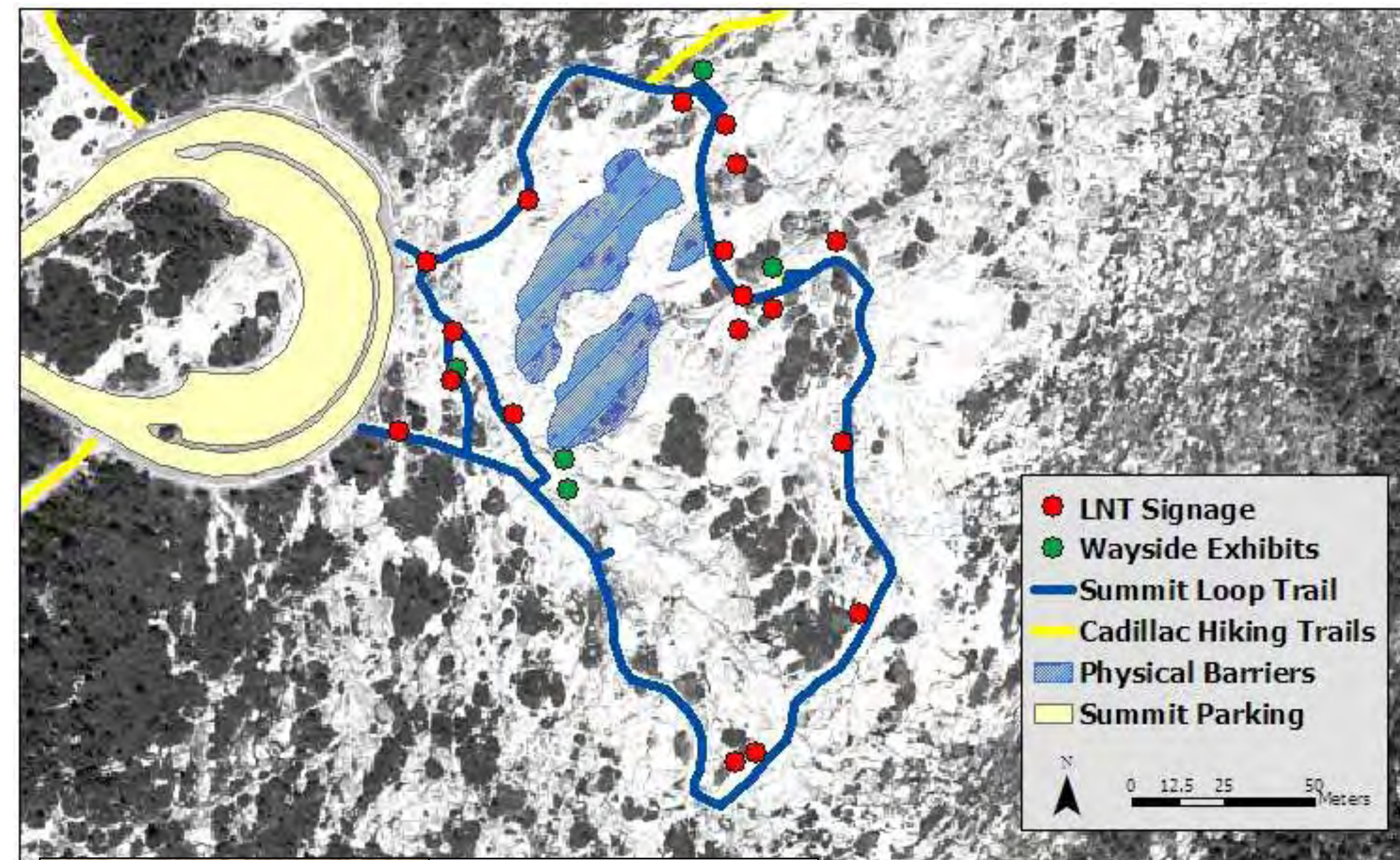


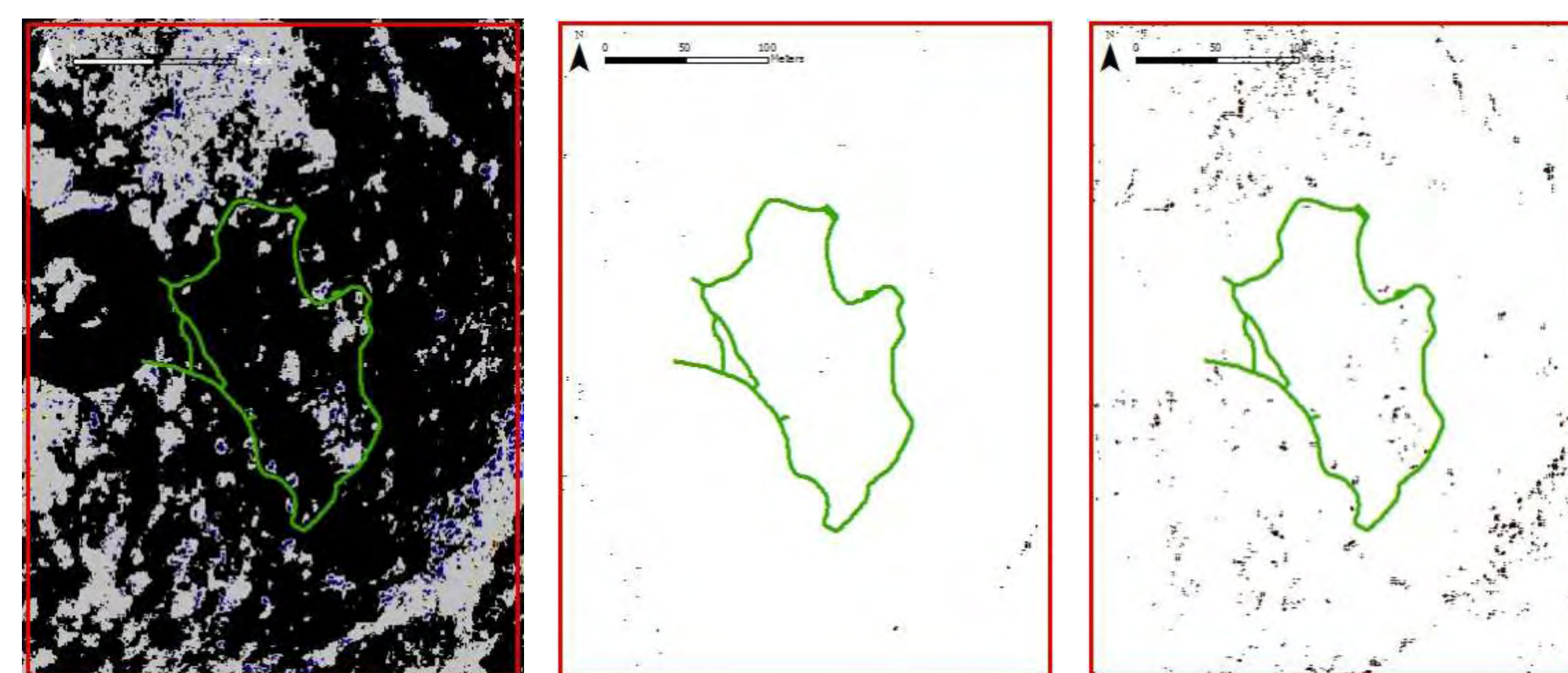
Background: Cadillac Mountain

- Only mountain in Acadia National Park (ANP) with an auto road
- Approximately 75% of ANP visitors visit Cadillac Mountain (2.2 million/year)
- Extremely high visitor use in a small and sensitive area during summer
- Both direct and in-direct management actions have been implemented since 2000
- Slow recovery from damage caused by natural disturbance or human use



- Indirect management strategies () as signage which highlights the “Leave No Trace” principle
- Direct management strategies () as physical barriers

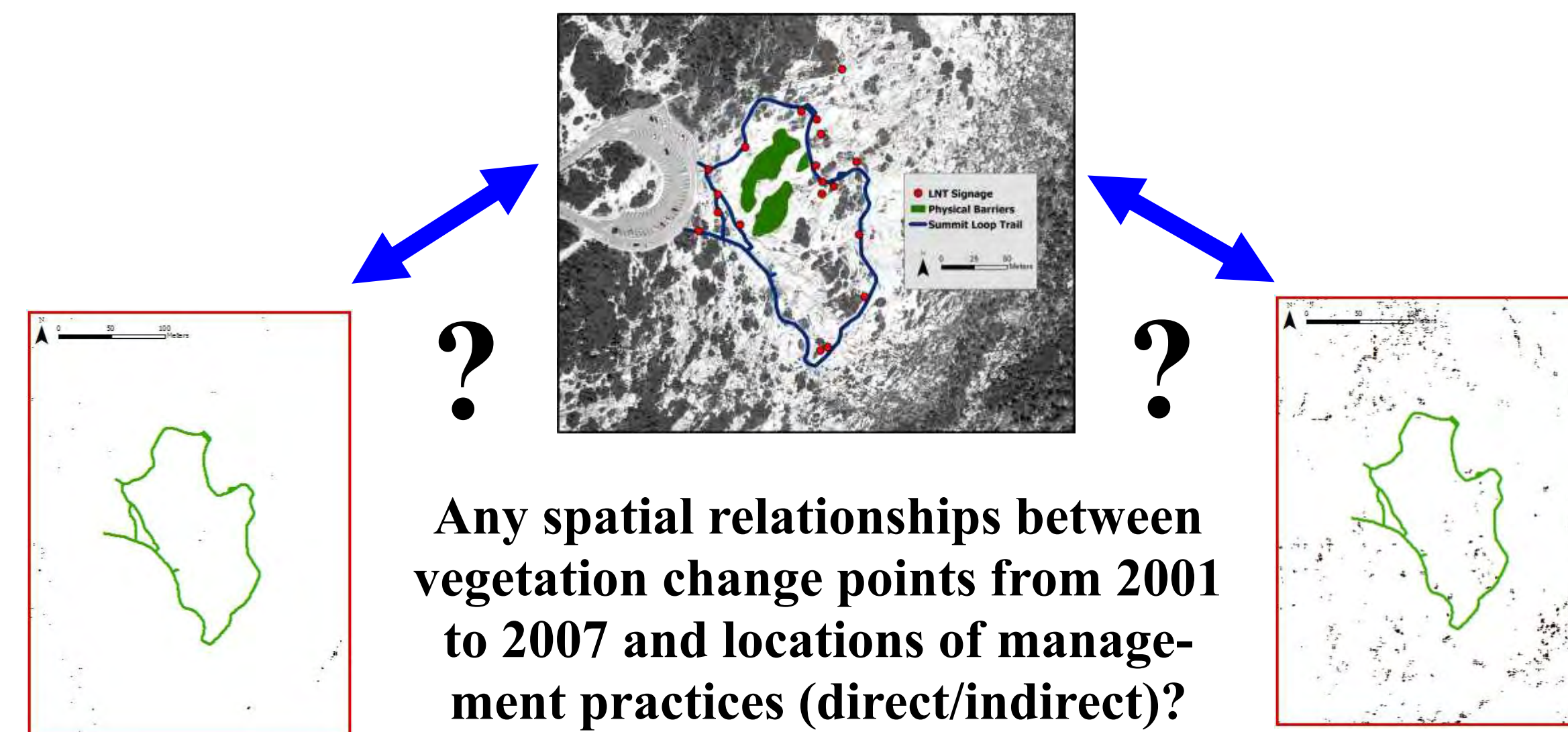
NDVI Vegetation Change Analysis



(a) NDVI result (: increased : decreased)
(b) Decreased vegetation cover points
(c) Increased vegetation cover points

NDVI change detection analysis result between 2001 and 2007 using multi-spectral high spatial resolution remote sensing datasets.

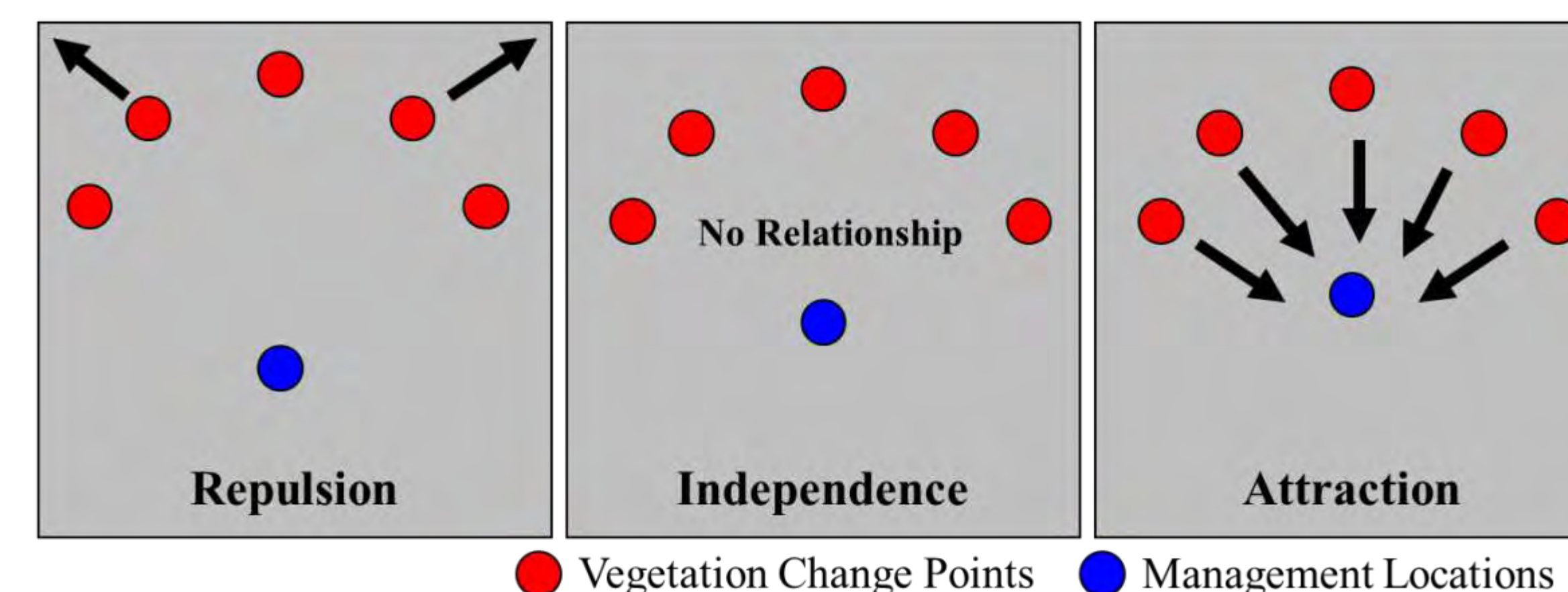
Study Question & Objective



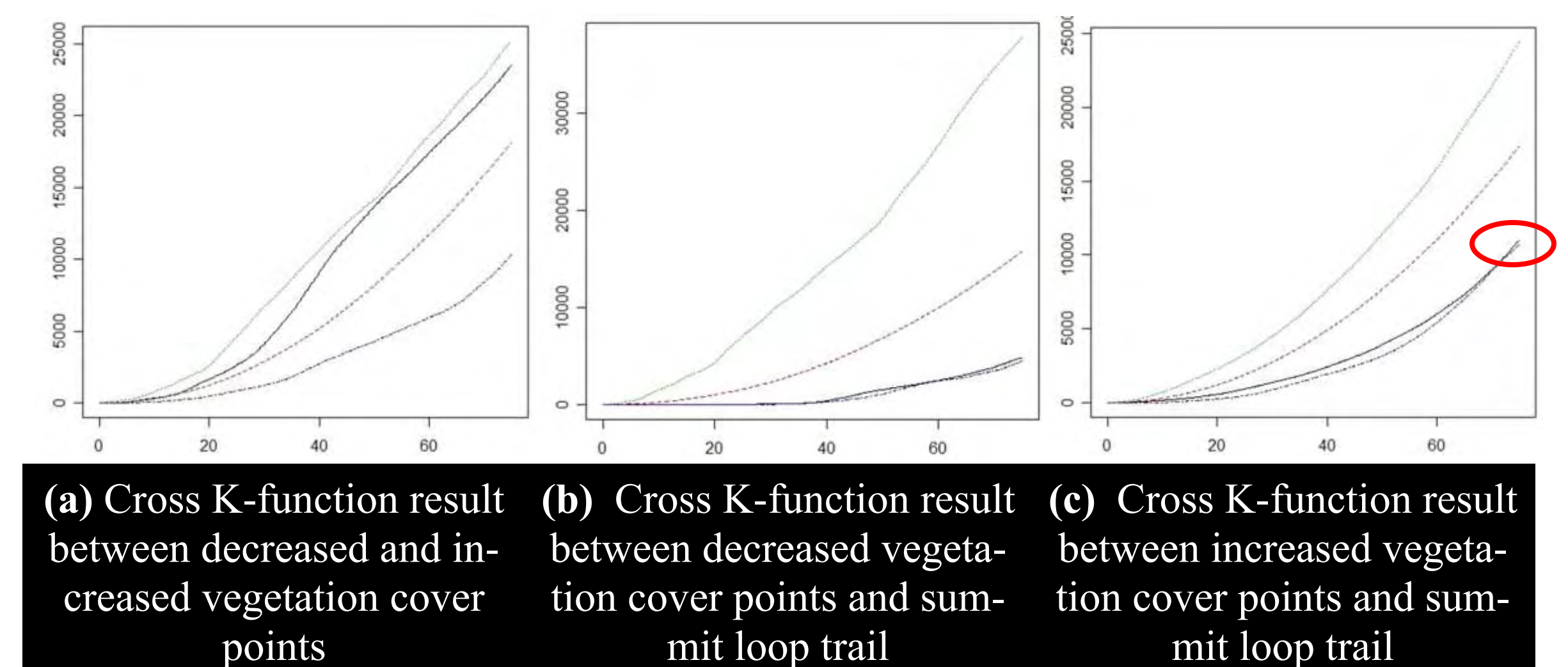
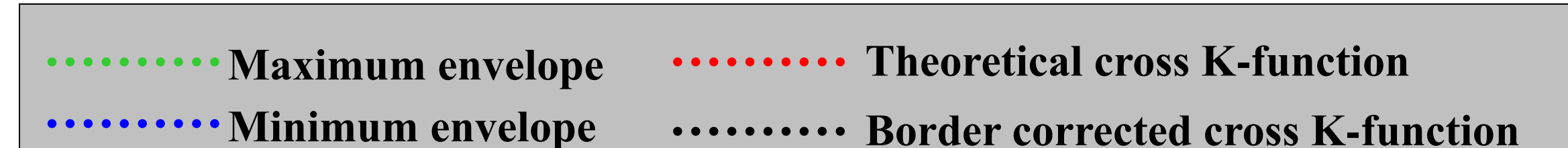
This study presents a novel method for verifying the effect of spatial containment management practices, where visitors are asked or required to use established or designated sites to reduce the amount of vegetation impact and enhance vegetation recovery. Using a bivariate point pattern analysis based on cross K-function, we attempted to prove the spatial efficacy of the management practices at Cadillac Mountain Summit, Acadia National Park, Maine, USA.

Methodology

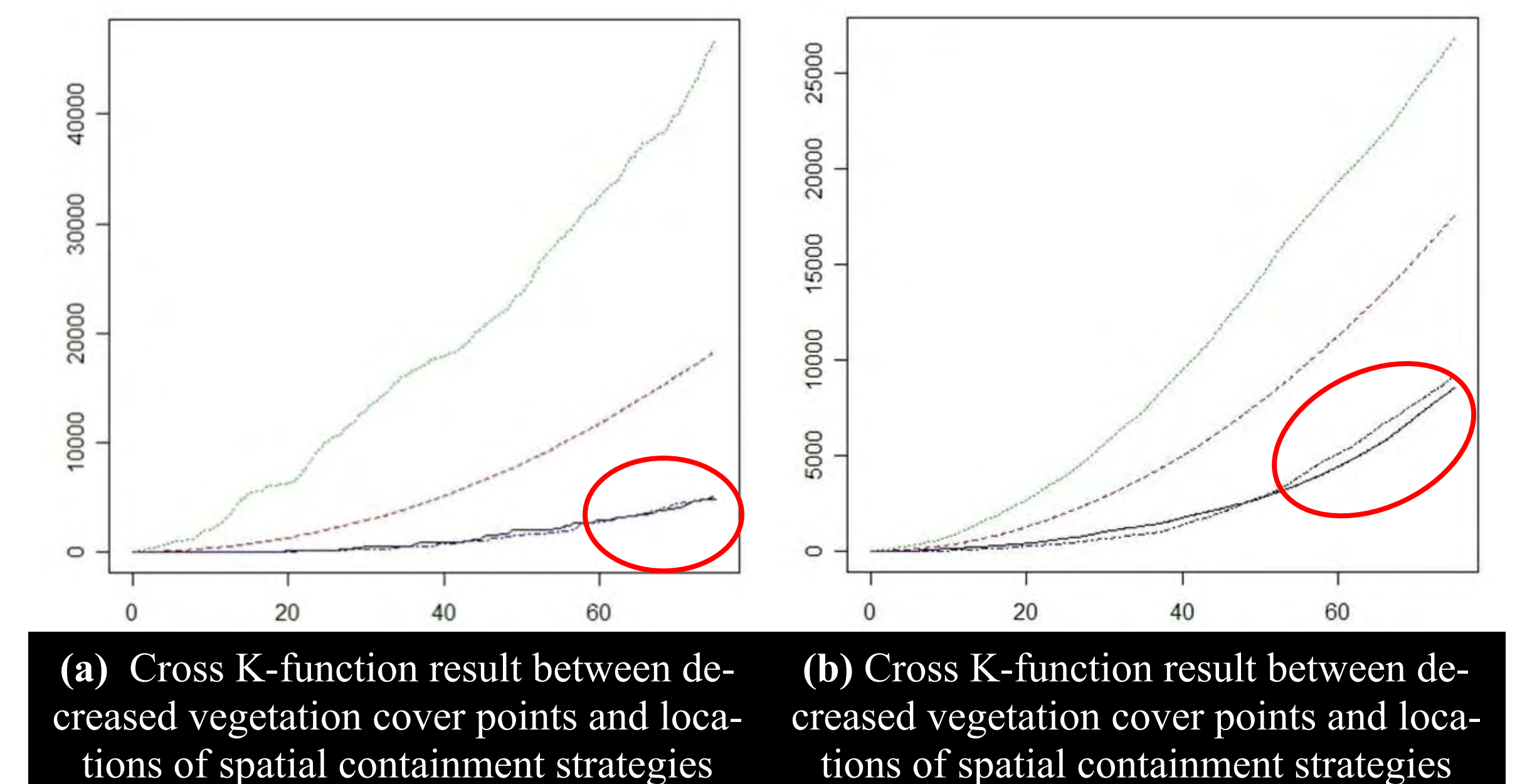
- Data: Point dataset 1(vegetation change points within 100m buffering area from the summit loop trail) and dataset 2 (locations of management practices)
- Cross K function: expected number of points of pattern j within a distance h of an arbitrary point of pattern i , divided by the overall density (λ_j) of the points in pattern j
- $K_{ij}(h) = E(\#(\text{type } j \text{ events} \leq h \text{ from an arbitrary type } i \text{ event})) / \lambda$
- Cross K function represents one relationship among independent, attraction, and repulsion
- Programming software: R (statistical software package)



Results



When the hypothesis of independence between the two types of events was tested using the envelopes with 99 simulations, it was verified that the border corrected cross K-function lines was plotted under the minimum envelope line, especially 80m in distance: **Repulsion**.



The cross K-function results between the increased/decreased vegetation cover points and the locations of management practices suggested the same repulsive relationships from 50 to 80m in distance. These results suggest that both decreased and increased vegetation cover points are not spatially distributed in a closer proximity from the locations of management practices: **Repulsion**.

The spatial containment management strategies have been effective to spatially repulse the creation of the impacted vegetation points in a closer proximity during the intended timeframe. However, the results also indicated ineffectiveness to spatially attract vegetation regeneration points around the locations of management practices by showing the same repulsive relationships.

Discussions & Limitations

- Spatially effective or ineffective?
- Unfavorable environment for vegetation recovery (low recovery in a closer proximity)
- Spatial & temporal scales of analysis