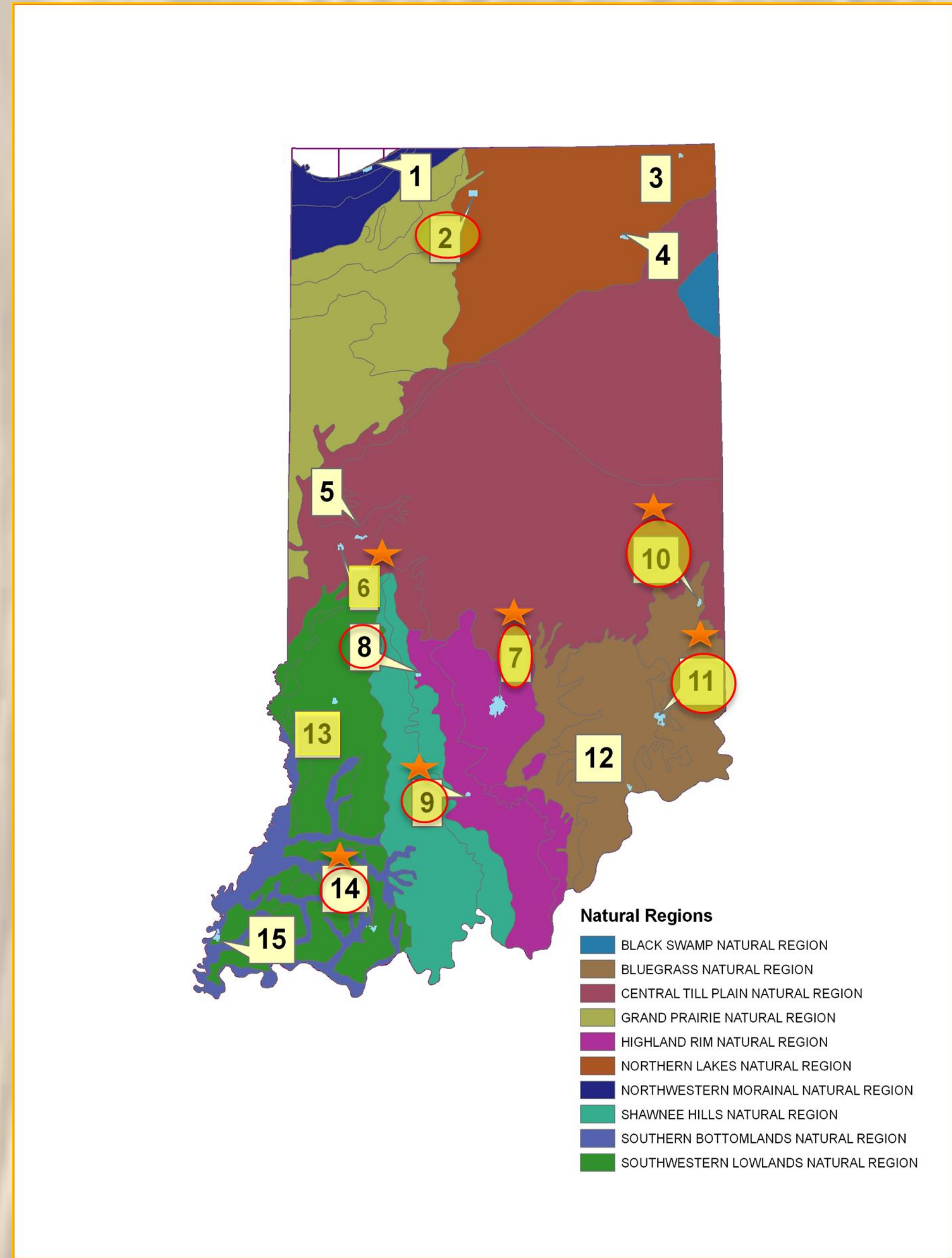


Evaluating the Recovery of Vegetation Communities in Indiana State Parks After More Than a Decade of White-tailed Deer Population Reduction

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1. Indiana Dunes SP
2. Potato Creek SP
3. Pokagon SP
4. Chain O'Lakes SP
5. Shades SP
6. Turkey Run SP
7. Brown County SP
8. McCormick's Creek SP
9. Spring Mill SP
10. Whitewater SP
11. Versailles SP
12. Clifty Falls SP
13. Shakamak SP
14. Lincoln SP
15. Harmonie SP

- Significant increase in percent cover ($\alpha=0.05$, $p<0.05$)
- ★ Significant increase in species richness (S) ($\alpha=0.05$, $p<0.05$)
- Significant increase in Shannon-Weiner (H') diversity ($\alpha=0.05$, $p<0.05$)

Methods

We measured the cover of all plant species less than 50 cm tall, along 3-10 m line transects. We then calculated the overall plot percent cover for each species and species richness (S), evenness (E), and Shannon-Weiner diversity (H'). We used nonmetric multidimensional scaling to examine compositional changes within the Highland Rim Natural Region.

Results

- Herbaceous-layer percent cover increased significantly in both state parks and reference areas. However, total percent cover increased 103% in parks compared to only 30% in reference areas.
- S, E, and H' increased significantly in state parks, but not in reference areas.
- Tree seedling and shrub cover increased drastically in state parks (534% and 443%, respectively) and to a lesser extent in reference areas (175% and 217%).
- Liliaceous species and perennial herb percent covers increased by 73% and 42% in state parks and decreased by 60% and 13% in reference areas.

The Highland Rim Natural Region

- Herbaceous-layer cover increased significantly in both state parks and the reference area. S and H' increased significantly in Brown County and Spring Mill State Parks.
- Changes in herbaceous-layer composition in the state parks and the reference area trended towards increasing similarity.
- The current composition of McCormick's Creek and Spring Mill State Parks is associated with an index of long-term deer reductions (deer index; total deer harvested/initial abundance estimate/park size), whereas Brown County State Park composition is associated with more recent deer reductions (H/E recent 3 year average; H/E = harvest per hunter effort).



Figure 2. A vegetation plot in Turkey Run State Park in 1996 (left) and in 2010 (right). Woody vegetation regeneration is evident in the 2010 photograph.

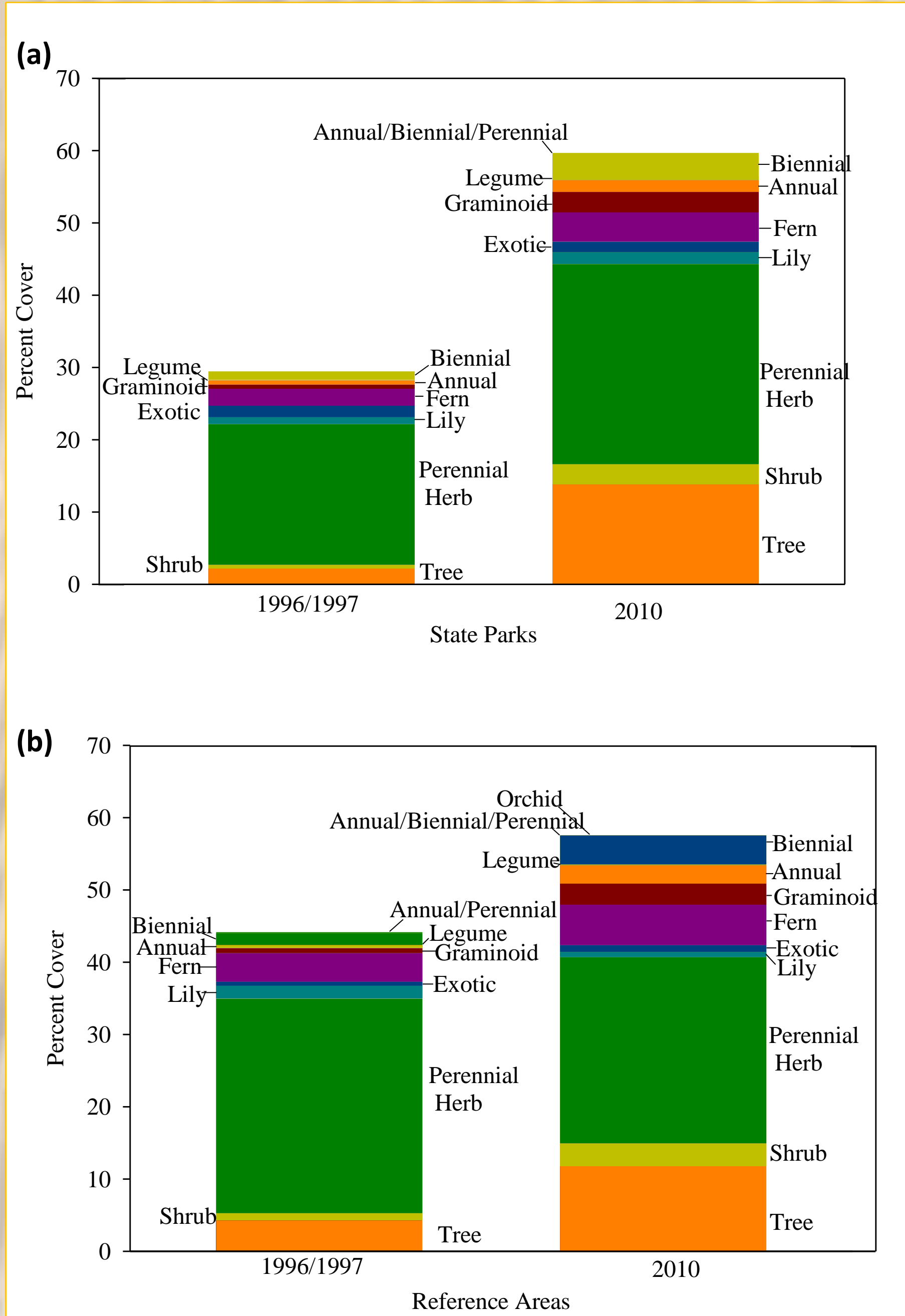


Figure 3. Mean percent cover of vegetation functional groups in (a) state parks and (b) reference areas in 1996/1997 and 2010.

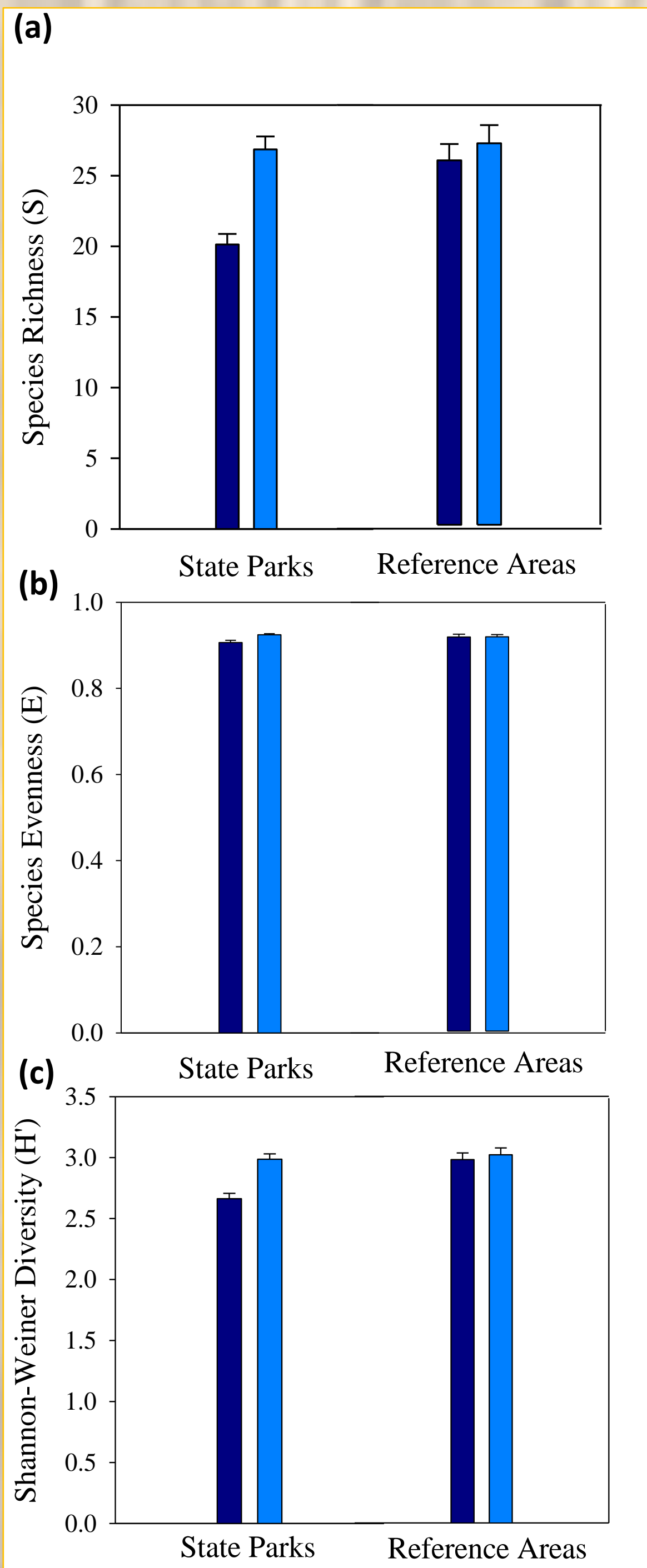


Figure 4. (a) Species richness (S), (b) evenness (E), and (c) Shannon-Weiner diversity (H') in state parks and reference areas in 1996/1997 (dark blue) and 2010 (light blue).

Conclusions

- White-tailed deer reductions in state parks over the last decade have resulted in overall increased percent cover, species richness (S), evenness (E), and Shannon-Weiner diversity (H').
- Percent cover of all functional groups has increased, with the exception of exotic species.
- Across natural regions, vegetation composition of state parks is changing to become more similar to reference areas.
- Vegetation composition in state parks varies along gradients related to deer population.
- Our results suggest that vegetation communities in parks have recovered in response to reduction efforts.



Figure 6: A malnourished white-tailed deer in Brown County State Park in 1993 (left) and a healthy white-tailed deer in Versailles State Park in 2010.

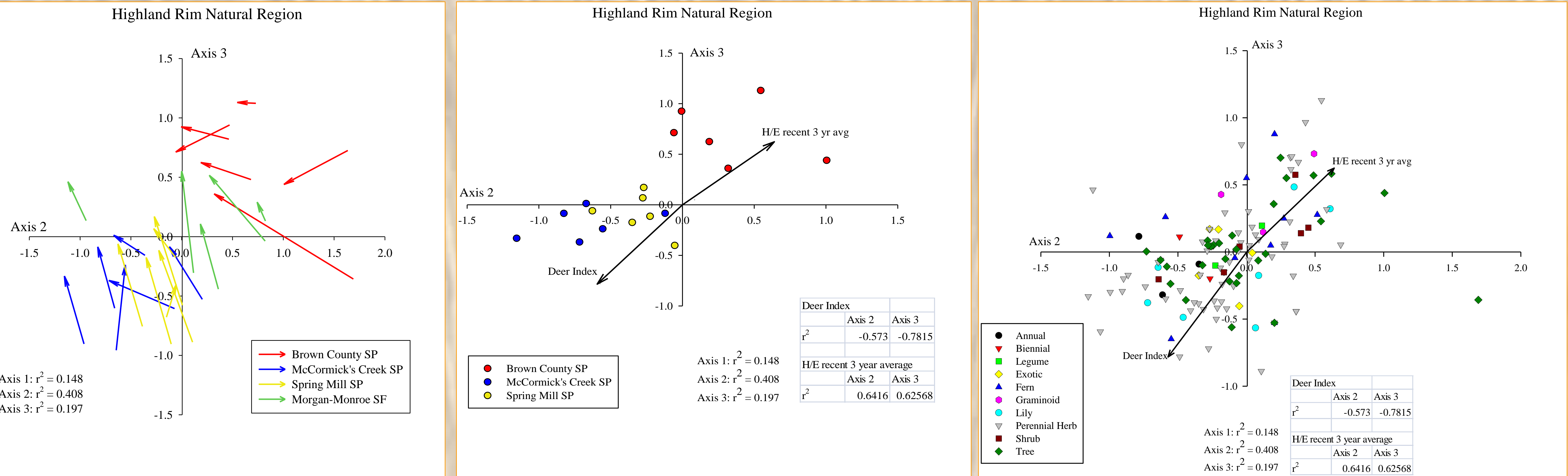


Figure 5. Non-metric multidimensional scaling ordination in the Highland Rim Natural Region showing: (a) composition change from 1996/1997 to 2010, (b) the correlation of the current vegetation composition to two deer related environmental variables, and (c) the correlation of vegetation species functional groups to the same overlaid environmental gradients.