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# Physiological Effects of habitat disturbance in the Wandering Gartersnake (Thamnophis elegans)

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## I. Introduction

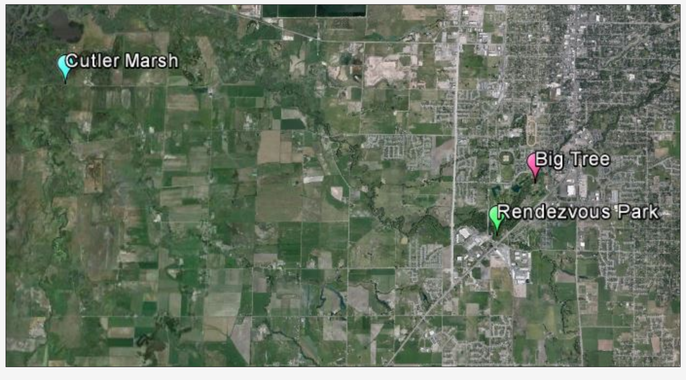
The wandering gartersnake, *Thamnophis elegans*, overwinters in hibernacula in Logan, Utah.

Over the last three years, two hibernacula have been studied at Rendezvous Park. In the fall of 2012, a disturbance event occurred directly around two hibernacula, including removal of downed trees, stream bank damage, and clearing of vegetation.

The three populations in this study include Cutler Marsh (low disturbance), Rendezvous Park (medium disturbance), and Big Tree (high disturbance).

At the time of emergence the following spring of 2013, snakes were collected and blood samples were taken to measure corticosterone, an energy mobilizing hormone similar to cortisol in humans and an indicator of stress, and immune efficacy.

We hypothesize that the Rendezvous Park and Big Tree populations will have altered levels of corticosterone and lowered immune efficacy when compared to the Cutler Marsh population.

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## II. Methods

Adult male gartersnakes were collected at three locations in Cache Valley, Utah in the spring of 2013.

Within the first three minutes of capture, blood was collected to establish baseline levels.

Snakes were subjected to a uniform stressor: 30 minutes in an opaque, breathable bag. Blood was collected again to assess post-stress levels.

Baseline and post-stress samples were analyzed using a radioimmunoassay.

Immune system efficacy was measured through a bacterial killing assay with *E. coli*.

Analyses of variances (ANOVAs) were performed to compare the populations in regards to both corticosterone and bacterial killing ability.

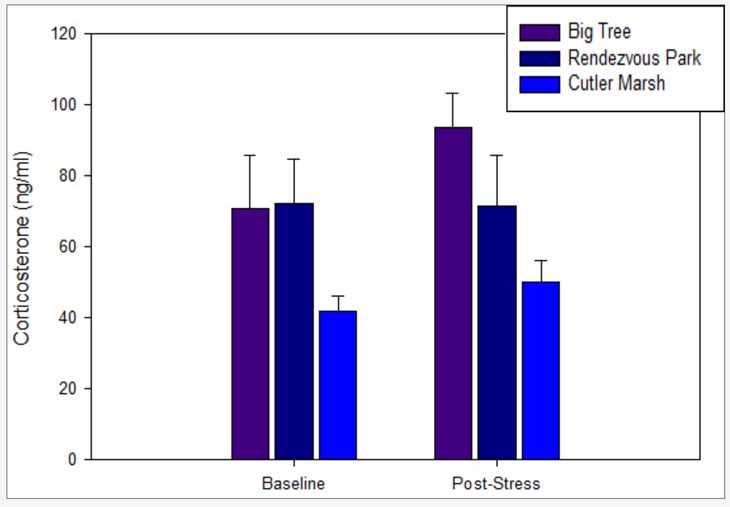


**Figure 1**: Comparison between baseline (initial) and post-stress concentrations of corticosterone in the three populations of Wandering Gartersnakes in Cache Valley

## III. Results

**Corticosterone levels**: Baseline CORT of Big Tree was higher than the Cutler Marsh ($p$ = 0.0284). This was related to body condition, with healthier snakes having a lower CORT response. Post-stress CORT of Big Tree was significantly higher than Cutler Marsh ($p$ = 0.0126) (Figure 1).

**Bacterial killing ability**: Rendezvous Park had a significantly lower post-stress bacterial killing ability ($p$ = 0.04) (Figure 2).

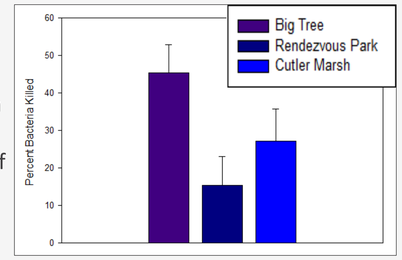


**Figure 2**: Comparison of post-stress bacterial killing ability in the three populations of the Wandering Gartersnake in Cache Valley

## IV. Conclusions

Baseline and post-stress CORT levels were elevated at Big Tree which is the site with the most human activity, including both habitat disturbance and proximity to a walking trail.

Bacterial killing ability of Rendezvous Park was lower after a stressor, indicating the immune system has a lower ability to respond after stressors.

Habitat disturbances are a known stressor that can have serious impacts. While the Big Tree population had the largest deviations from Cutler Marsh, it is important to realize this is a field study with many variables, and this study investigated possible effects on stress physiology and immune systems.

Future work includes continuing this project in 2014 after continued habitat destruction in the fall of 2013. Both 2013 and 2014 data will be compared to historic data samples at the same sites.

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