Climate Change, Premature Seed Fall, and the Decline of Crossbills

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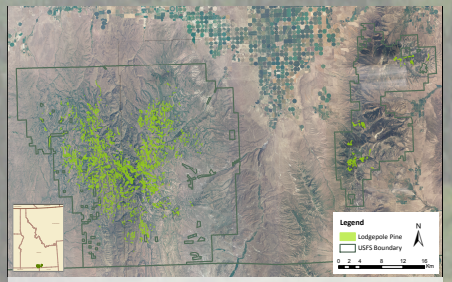
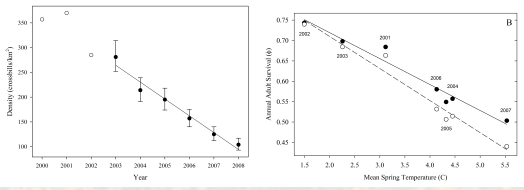
Background

South Hills Crossbills are coevolving with lodgepole pine in southern Idaho causing divergence of both birds and cones.



***Current range**: The South Hills Crossbill is endemic to 70 km² of lodgepole pine forest in the Cassia and Albion Mountain districts of the Sawtooth National Forest.*

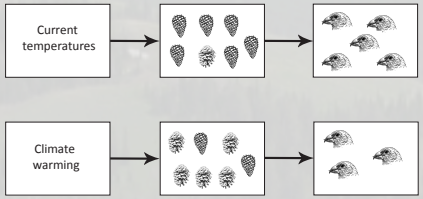
63% decline in South Hills Crossbill population size related to increasing temperatures.



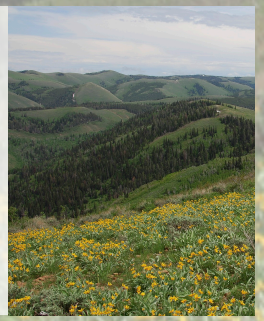
***Left**: Post-breeding annual population density of South Hills Crossbills has declined 63% between 2003 and 2008. **Right:** Annual adult survivorship of crossbills is inversely related to mean monthly spring temperature (males are indicated by solid circles, females by open circles). From L. Santisteban and C. Benkman, unpubl. ms.*

Research

Hypothesis:
Increasing temperatures cause cones to open and release their seeds, reducing food abundance for South Hills Crossbills and causing their decline.



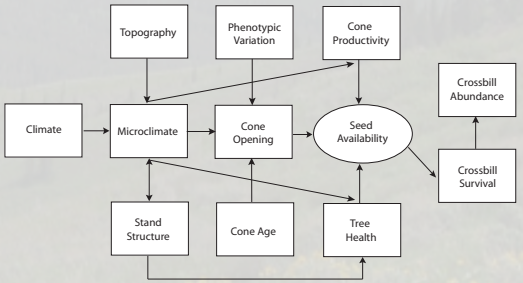
Goals:
1. Characterize the relationship between temperature, extent of cone opening, and crossbill abundance.
2. Model future crossbill abundance under different climate warming scenarios.



Methods:
1. Record ambient temperature across the landscape.
2. Model canopy temperature with cone opening temperatures to predict cone opening across the landscape.
3. Correlate cone opening with crossbill abundance from point counts.
4. Model crossbill abundance under different climate change scenarios.

Predictive Modeling

Conceptual model:
Below are the hypothesized relationships between biotic and abiotic variables. Future results will likely be synthesized with structural equation modeling.



Anticipated Results:
Conservation recommendations for the South Hills Crossbill, including a map of cooler areas for planting lodgepole pine seedlings from parents producing cones that open at higher temperatures.

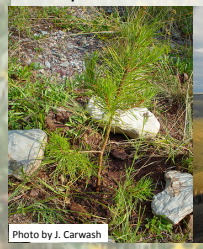


Photo by J. Carwash

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