

No Fire on the Mountain: Has fire suppression caused population declines of an imperiled ground squirrel?

A Test of the Fire Suppression Hypothesis

Alyssa Livingston

Courtney J. Conway

Eva Strand

Abstract

The Northern Idaho Ground Squirrel (*Urocitellus brunneus*) is listed as threatened under the Endangered Species Act. The prevailing hypothesis for the species decline is encroachment of trees into its habitat due to fire suppression. However, this hypothesis has not been rigorously tested. Using geographic information systems and aerial imaging, I compared changes in abundance of the squirrels' populations to changes in forest canopy coverage over the past 40 years. These comparisons allowed me to test the prevailing hypothesis for the population declines of this rare species by testing the prediction that forest fire suppression has allowed tree growth and encroachment into the squirrel's habitat. This hypothesis predicts that the areas with the most pronounced population declines of Northern Idaho Ground Squirrels will have the most pronounced forest encroachment in the areas used by these squirrels. Our results indicate a 50% increase in tree cover over the colonies and the historical range for the last 40 years.

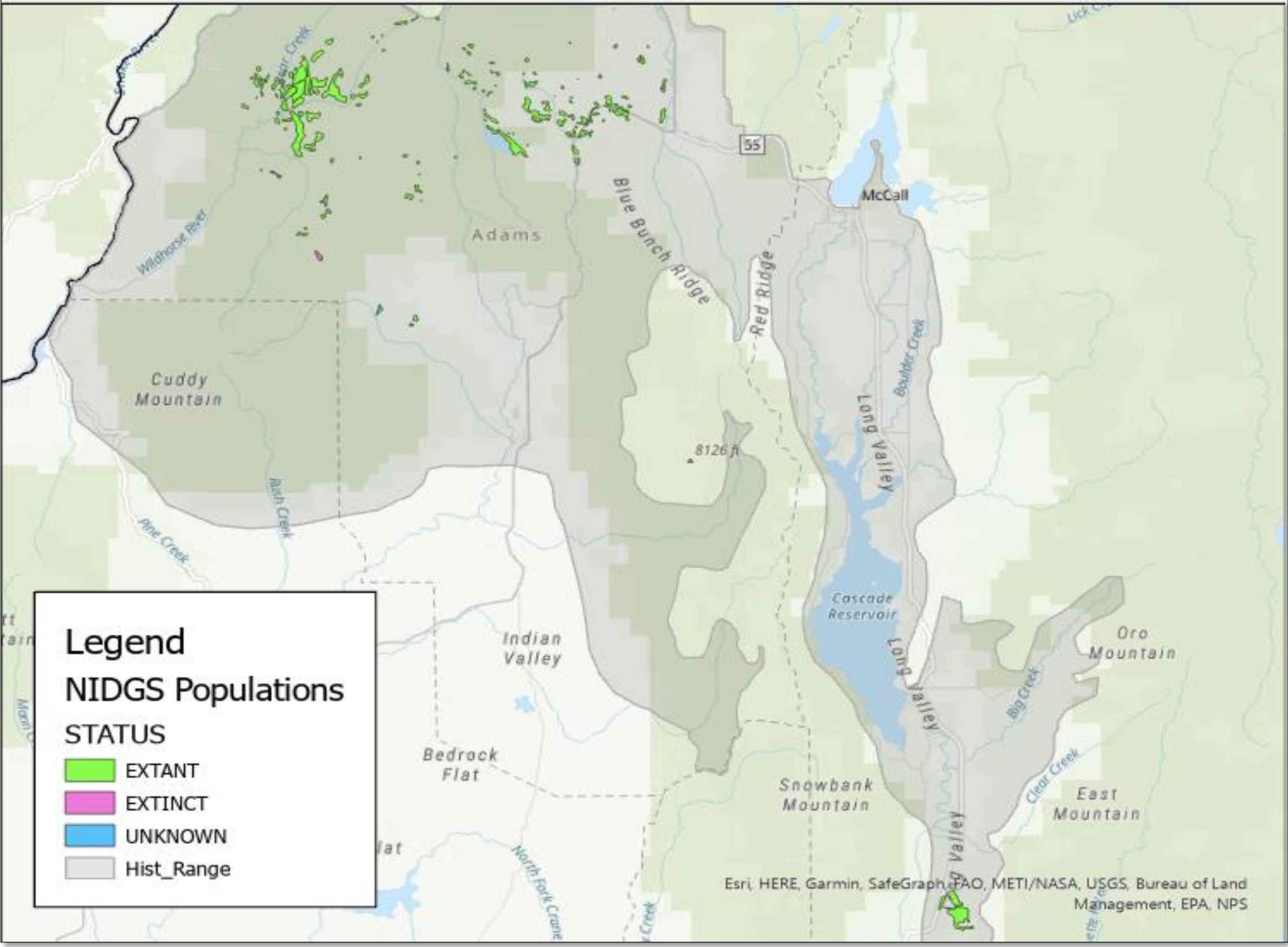


Figure 1: Map of Northern Idaho Ground Squirrel (NIDGS) colonies illustrating their status – extant, extinct, or unknown.

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Project Description

The Northern Idaho Ground Squirrel (NIDGS) is a threatened species endemic to central Idaho. With already small numbers dropping, the species is threatened by extinction. The main hypothesis for population decline is habitat loss due to fire suppression, causing more trees to grow and encroach into natural clearings, which are the squirrel's habitat. This leads to a loss of suitable habitat for the squirrel and subsequent population decline. This hypothesis, however, has never been directly tested. The main objective for this project is to test the prevailing hypothesis for the squirrel's population declines.

Methods

- Programs utilized for this project: ArcGIS, Rangeland Analysis Platform, Google Earth Engine, and aerial photographs from the USDA over the past 40 years.
- Obtained ground squirrel count data from state and federal agencies to document variation among colonies in population declines.
- Documented change in tree cover over the past 40 years within Northern Idaho Ground Squirrel 1) historical range and 2) mapped colonies.
- Synthesized all these data to determine if the encroachment of trees is a likely cause of the squirrel's decline in abundance.

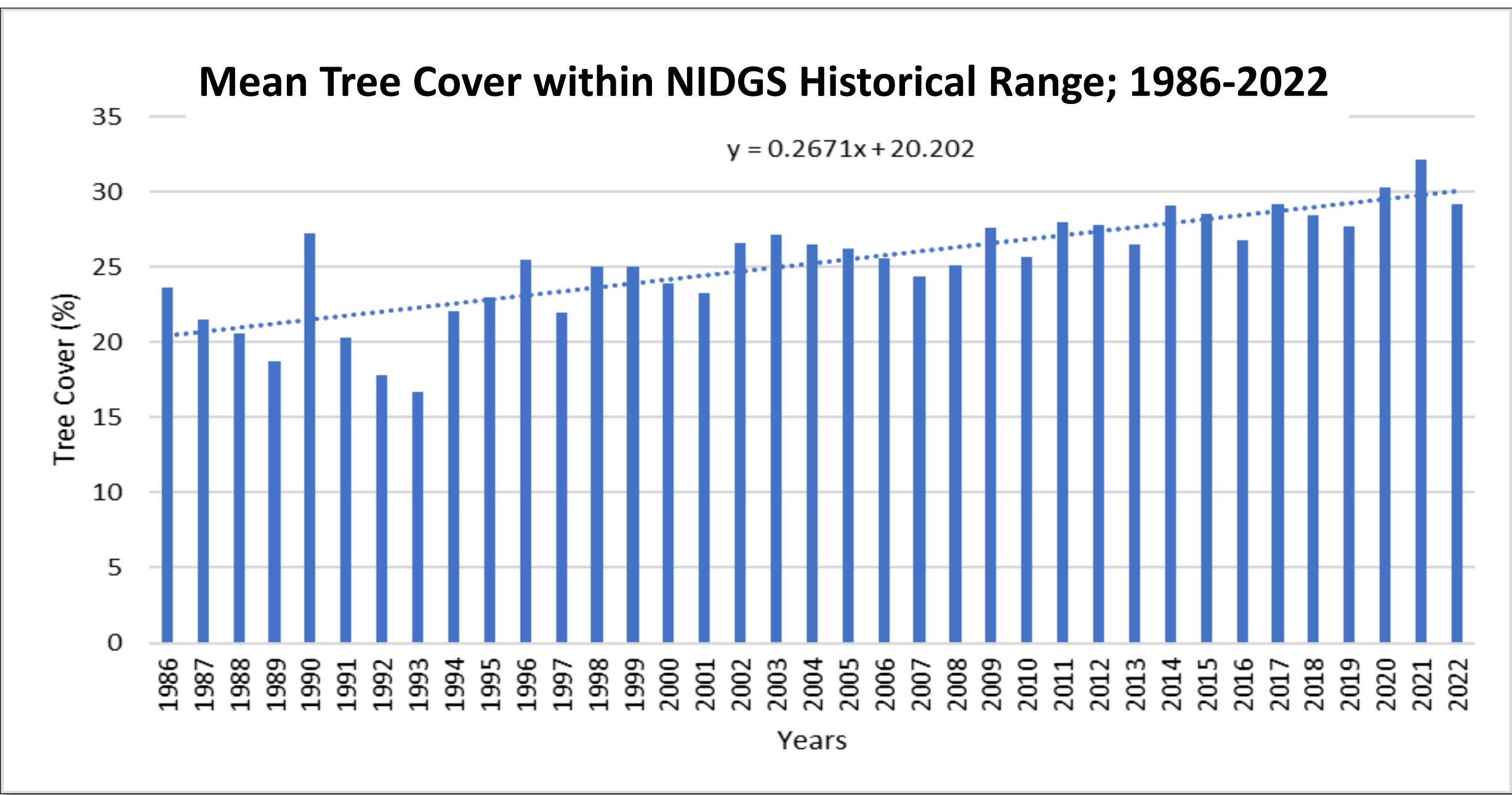


Figure 2: Change in the mean tree cover for the historical range of Northern Idaho Ground Squirrels (NIDGS) from 1986-2022.

Results

Two main analyses were run on ArcGIS Pro: zonal statistics of change in tree cover over the past 40 years within the historical range of the Northern Idaho Ground Squirrel and within the squirrels' colony areas only. Results of the first test show that there has been an increase in tree cover in the historical range over the past 40 years. The effect size shows a 50% increase in tree cover through the entirety of the historical range. Results of the second test show that there has also been an increase in tree cover in the squirrels' colonies over the past 40 years. The effect size again shows a 50% increase in tree cover within extinct and extant colonies.

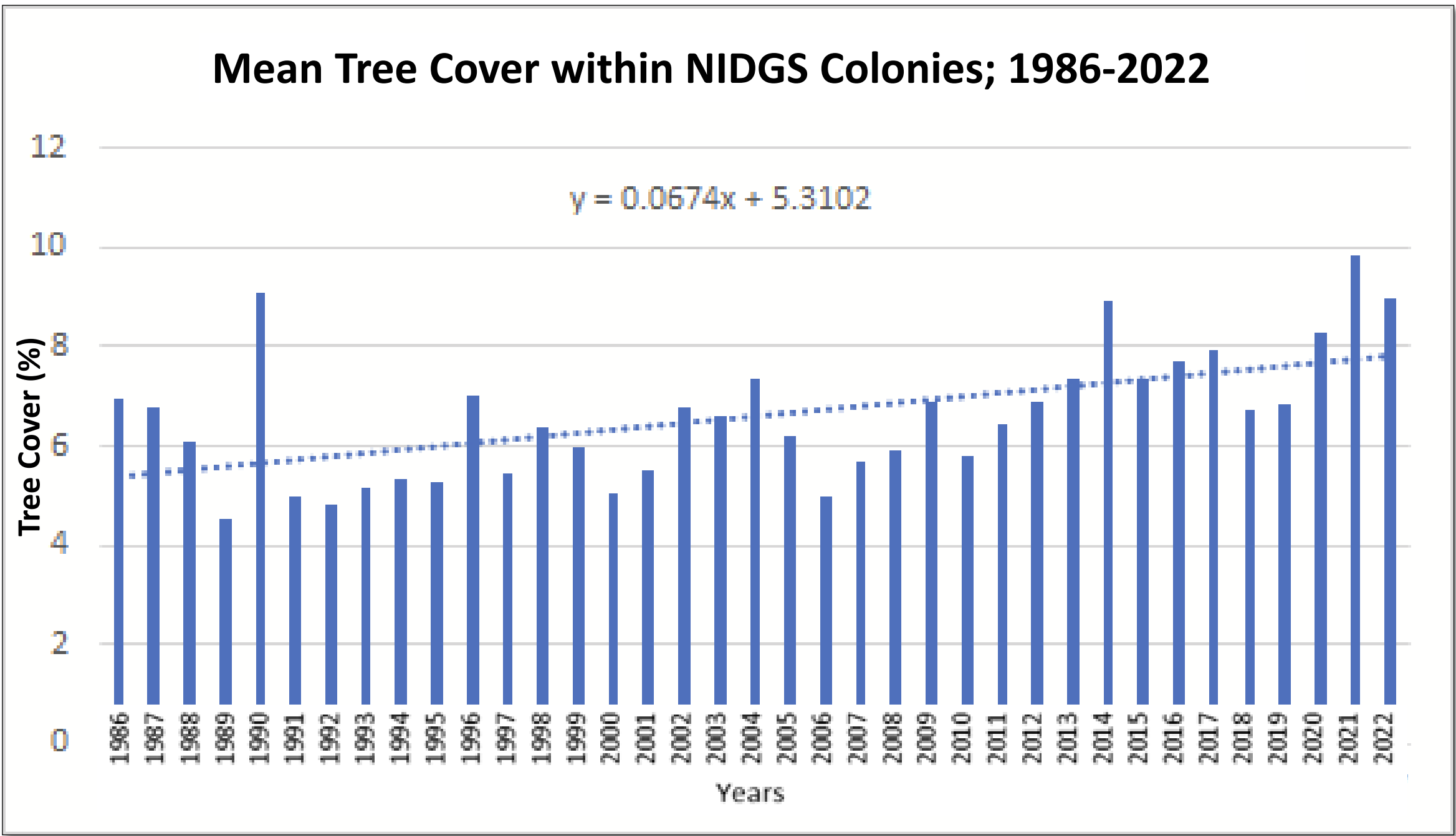


Figure 3: Change in the mean tree cover within colony footprints of Northern Idaho Ground Squirrels (NIDGS) from 1986-2022.

Conclusions

The fire suppression hypothesis – that squirrel population declines are caused by tree encroachment due to fire suppression - was supported based on 2 predictions. Forest canopy cover has significantly increased over the last 40 years in both the historical range of the Northern Idaho Ground Squirrel and also in the explicit colonies within their range. Canopy cover within the historical range (15% cover) was higher than canopy cover within the actual colonies (5% cover). Experts on this rare species believe that these squirrels need areas with <15% canopy cover.