CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34818

Project Title

Freezing Warm: Thermopoles in the Snow

Abstract

Objectives/Goals

We wanted to find out why animals make subnivean (meaning in the snow) homes in the freezing cold snow during winter.

Methods/Materials

We conducted our experiment in January in Virginia Canyon, near our home in the Sierra Nevada Mountains at 9,740 feet (2,968 meters) elevation. This snowy location is home to lots of subnivean animals, like the Douglas tree squirrel. We wanted to measure the temperature of snow and air at the same time. To accomplish this, we invented the thermopole. Thermopoles are long PVC pipes that we drilled holes in every 3 or 9 cm to allow attaching iButtons with wire and mesh. An iButton is a thermometer that records the temperature at any interval you choose, and stores it. We placed 7 thermopoles in 4 different scenarios: open air, bush, snow-covered bush, and pure snow. We left the thermopoles out for a week. To test the effect of an animal's body heat in their subnivean home, we made a snow cave and spent the evening in it. We placed a thermopole in our cave along with other iButtons in the cave and outside of it.

Results

After analyzing our iButtons' data, we found that at night, it is much warmer under the snow than above. For example, on our Red Zebra thermopole in pure snow, on January 20th at 6 a.m., it was -2.5°C at the very bottom of the thermopole in the snow, while it was -11.5°C at the very top of the pole in the air. The warmest place for an animal to sleep at night is near the ground under the snow. Also, this location is warmer when there is more snow on top of the animal. We also found that body heat has a substantial affect on a snow cave's warmth. Snow isn't like a heater, but more like a blanket, keeping warmth instead of creating it.

Conclusions/Discussion

Our data show that it is warmer in the snow than in the air above at night. We concluded that this is why animals spend the night there. Another thing our data revealed was that in drought years like this one, animals have a much harder time surviving than usual because of the lack of snow; sleeping outside can kill them when it gets below about -20° C. Even further in the future, climate change will reduce the amount of snow drastically, causing animals to start freezing to death at night because there won't be cold snow to keep them warm at night.

Summary Statement

By making thermopoles to measure snow and air temperatures and placing them in different locations, we found that freezing snow is warmer than air at night.

Help Received

Dr. Connie Millar lent us the iButtons and gave us information about subnivean animals and snow. Our parents and Dr. Millar asked questions to help us analyze our data. Caelen's dad helped us use Excel and the iButtons. Jordyn's dad constructed our snow cave. Caelen's mom proofread the text for the board.