

Permafrost Melting - Teacher Notes

Permafrost is frozen rock, soil and organic materials. It occurs at high altitudes and high latitudes and acts as a long-term carbon sink. Permafrost can vary in thickness from 1 meter to 1,500 meters. It occupies 25% of the land in the Northern Hemisphere occurring in a belt of land stretching from Siberia to China and in North America. In the Southern Hemisphere it is found in Antarctica, the Antarctic mountains and in the Andes Mountains. Ground must remain frozen for two consecutive years to be classified as true permafrost. Presently most of the permafrost has remained continuously frozen since the last Ice Age. More shallow permafrost was added during cold periods about 6,000 years ago and about 400 years ago.

AIM To demonstrate an effect of repeated melting and freezing of soil



Before freezing



After repeated thawing

Materials

- One take-away container
- Soil to almost fill the container
- Water to moisten soil
- 12 toothpicks
- Access to a freezer

Method

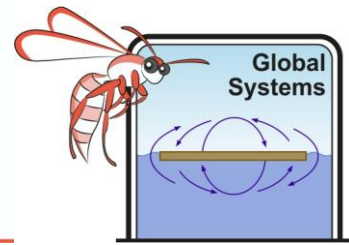
1. Fill the take away container almost to the top with soil
2. Moisten the soil with water. It should be moist not wet.
3. Place toothpicks upright in a regular grid pattern in the soil
4. Freeze overnight
5. Observe the toothpicks and note any changes to grid
6. Soil surfaces are very rarely horizontal. Tilt up one end of the container
7. Thaw
8. Observe the toothpicks and observe any changes to grid
9. Observe the surface of the soil

Observations

Describe any changes to the toothpicks after freezing. **NONE. They were still upright**

Describe any changes to the toothpicks after thawing (and draw what they looked like in the space above) **The toothpicks were no longer vertical.**

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Describe the surface of the soil after thawing. *The soil slumped to the downw; the container (LANDSLIDE!)*

Conclusion

What did your observations tell you about the effect of freezing and thawing?

The soil becomes unstable and moves.



Discussion

What do you think would happen to a road or railway laid onto melting permafrost? *It would twist and bend as the surface moved after thaw.*

Dawson is a town in northern Canada, which is famous for gold mining, and buildings sinking into the ground due to seasonal permafrost melt. If possible, visit <http://vimeo.com/23935951> and view the video for an amusing takes on living with (and without) permafrost in Northern Canada.

Using your findings

Explain how two other examples of infrastructure and services would be affected by melting permafrost.

Coastal erosion of previously ice hardened land affecting harbours, houses and roads.

Landslides due to thaw melt and loss of friction.

Ground subsidence due to thaw "swallowing" houses, hospitals, commercial buildings, roads and railways

Oil and gas pipelines being twisted and fractured

Changes in frost dependant plants and animal's habitats

Disappearance of rivers and lakes, which used to lie above the impermeable permafrost zone