

What makes soil hard and compacted?



Explore the impact of human activity on soil.

Setting: Outdoors

Time: < 3 hours

Concepts: plant, diversity, living things, human activity

Skills: comparing & contrasting, collecting data

Subject(s):

- ✓ Earth Sciences
- ✓ Mathematics

Ages:

- ✓ 12-14
- ✓ 15-17

Materials:

- Long, sharpened pencil
- Large can with both ends removed
- Tape measure
- Water
- Measuring cup (500 mL)
- Paper
- Stopwatch or timer
- Pen/pencil for recording



Safety First!

Choose sites that are safe for pedestrians. Ask for adult assistance when needed.

What to do!

1. With an adult, go into your backyard or down to a local park.
2. Find sites that have different amounts of human traffic. Include areas that have a lot of traffic (e.g. walkways), areas that have moderate traffic (e.g. under a tree), and areas that have little or no human traffic (e.g. base of a shrub). Do not use roads or areas where cars may be driving.
3. Push the sharpened end of the pencil down into the soil of one of these areas. Push down on the pencil with the palm of your hand. Keep on pushing until it becomes it cannot go deeper into the soil.
4. Measure the depth to which the pencil penetrated the soil.
5. Repeat step 3 & 4 in different spots of your site. Take an average of the three samples per site. Record your data.
6. Take the can and twist it down into the soil to a depth of 5cm.
7. Using the measuring cup, pour 500 mL of water into the can.
8. As soon as you have poured the water into the can, start your stopwatch. Measure the amount of time it takes for the water to disappear. Record your data.
9. Repeat step 3-8 in the different sites mentioned in step 2.

Table:

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Site location	Pencil depths	Average pencil depth	Time for water to disappear
1			
2			
3			
4			
5			

What's happening?

Any activity at the surface of the soil will affect the amount to which the soil will compact. People and animals walking over the surface will push down and compact the soil. Areas that have higher levels of activity will have soil that is more compact. The amount of this compaction will affect the soil's ability to absorb water. If there is poor absorption of water, plants will not be able to grow as well. Increased surface activity also affects the chance of a plant getting established in the first place.

If an area that has seen little, or no activity, suddenly gets an increased level of activity, the amount and diversity of vegetation in the area will change. This occurs as hiking pathways emerge from continuous foot traffic. As you can see, activity on the surface of the Earth will ultimately affect the amount and type of plants that can and will grow there.

Why does it matter?

Compacted soils are a major concern for farmers and agriculturists, because of the possibility of reduced crop growth. Also, since compacted soils are less able to absorb water, the risk of runoff that causes soil erosion increases.

The easiest way to overcome soil compaction is to avoid it. Prevention is achieved through reducing pressure on the soil from heavy machinery and reducing traffic on the field. If compaction is already an issue, tilling the soil (ploughing or disking) loosens and aerates (adds air spaces to) the top layers. Planting deep-rooted crops can also serve to penetrate deep compacted areas.



Investigate further!

- Collect soil samples from each of your different areas and examine them under a microscope. Do you see any differences in the composition of the soil?
- Try tilling the soil in one of your sites by loosening and mixing the soil.

Retest the site. How did your results change?