

Soil Formation

Dana Desonie, Ph.D.

Say Thanks to the Authors

Click <http://www.ck12.org/saythanks>

(No sign in required)



To access a customizable version of this book, as well as other interactive content, visit www.ck12.org

CK-12 Foundation is a non-profit organization with a mission to reduce the cost of textbook materials for the K-12 market both in the U.S. and worldwide. Using an open-source, collaborative, and web-based compilation model, CK-12 pioneers and promotes the creation and distribution of high-quality, adaptive online textbooks that can be mixed, modified and printed (i.e., the FlexBook® textbooks).

Copyright © 2016 CK-12 Foundation, www.ck12.org

The names “CK-12” and “CK12” and associated logos and the terms “**FlexBook®**” and “**FlexBook Platform®**” (collectively “CK-12 Marks”) are trademarks and service marks of CK-12 Foundation and are protected by federal, state, and international laws.

Any form of reproduction of this book in any format or medium, in whole or in sections must include the referral attribution link <http://www.ck12.org/saythanks> (placed in a visible location) in addition to the following terms.

Except as otherwise noted, all CK-12 Content (including CK-12 Curriculum Material) is made available to Users in accordance with the Creative Commons Attribution-Non-Commercial 3.0 Unported (CC BY-NC 3.0) License (<http://creativecommons.org/licenses/by-nc/3.0/>), as amended and updated by Creative Commons from time to time (the “CC License”), which is incorporated herein by this reference.

Complete terms can be found at <http://www.ck12.org/about/terms-of-use>.

Printed: October 15, 2016

flexbook
next generation textbooks



AUTHOR

Dana Desonie, Ph.D.

CHAPTER 1

Soil Formation

- Describe the factors that affect soil formation: weathering, climate, parent rock, slope, time and biological activity.



How are these two soils different?

What color is the soil on the left? What color is the soil on the right? Why do you think they differ so much in color? Which soil do you think is better for growing things? See below to find out!

Soil Formation

How well soil forms and what type of soil forms depends on several different factors, which are described below.

Soil development takes a very long time. It may take hundreds or even thousands of years to form the fertile upper layer of soil. Soil scientists estimate that in the very best soil forming conditions, soil forms at a rate of about 1mm/year. In poor conditions, it may take thousands of years!

Weathering

Soil formation requires weathering. Where there is less weathering, soils are thinner. However, soluble minerals may be present. Where there is intense weathering, soils may be thick. Minerals and nutrients would have been washed out.

Climate

Climate is the most important factor determining soil type. Given enough time, a climate will produce a particular type of soil. The original rock type does not matter. Two rocks of the same type will form a different soil type in each different climate. This is true because most rocks on Earth are made of the same eight elements. When the rock breaks down to become soil, the soil is the same.

The same climate factors that lead to high weathering also produce more soil.

- More rain weathers minerals and rocks more. Rain allows chemical reactions especially in the top layers of the soil.

- More rain can dissolve more rock. More rain can carry away more material. As material is carried away, new surfaces are exposed. This also increases the rate of weathering.
- Higher temperatures increase the rate of chemical reactions. This also increases soil formation.
- In warmer regions, plants and bacteria grow faster. Plants and animals weather material and produce soils. In tropical regions, where temperature and precipitation are consistently high, thick soils form. Arid regions have thin soils.

Soil type also influences the type of vegetation that can grow in the region. We can identify climate types by the types of plants that grow there.

Parent Rock

The original rock is the source of the inorganic portion of the soil. Mechanical weathering breaks rock into smaller pieces. Chemical reactions change the rock's minerals.

Soil may form in place or from material that has been moved.

- **Residual soil** forms in place. The underlying rock breaks down to form the layers of soil above it. Only about one-third of the soils in the United States are residual.
- **Transported soil** has come in from somewhere else. Sediments can be transported into an area by glaciers, wind, water, or gravity. Soils form from the loose particles that have been transported and deposited.

Slope

Weathered material washes off steep slopes and so does not stay in place to form soil. Soil forms where land areas are flat or gently undulating.

Time

Soils thicken as the amount of time available for weathering increases. The longer the amount of time that soil remains in a particular area, the thicker it will be.

Biological Activity

Biological activity produces the organic material in soil. **Humus** forms from the remains of plants and animals. It is an extremely important part of the soil. Humus coats the mineral grains. It binds them together into clumps that hold the soil together. This gives the soil its structure. Soils with high humus are better able to hold water. Soils rich with organic materials hold nutrients better and are more fertile. These soils are more easily farmed.

The color of soil indicates its fertility. Black or dark brown soils are rich in nitrogen and contain a high percentage of organic materials. Soils that are nitrogen poor and low in organic material might be gray, yellow, or red (**Figure 1.1**). Soil with low organic material is not good for growing plants.

Summary

- Many factors affect soil formation. Some are climate, rock type, slope, time, and biological activity. Differences in these factors may produce different types of soil.
- Soil type determines what can grow in a region.
- Humus is the decayed remains of living organisms. Humus makes soil fertile.

**FIGURE 1.1**

This sandy soil shows evidence of very little organic activity. Plants grow, but are far apart and short-lived. This means that little soil can form. The soil that's there has little organic content.

Review

1. Why is climate more important than rock type for determining the type of soil that forms?
2. How would you create a very thick, organic-rich soil?
3. How would you create a very thin, sandy soil?
4. Why is time important for soil formation?

Explore More

Use the resource below (start at 0:50) to answer the questions that follow.



MEDIA

Click image to the left or use the URL below.

URL: <https://www.ck12.org/flx/render/embeddedobject/178558>

1. What does soil start as? What changes that material?
2. What is really important in creating a good soil?
3. What makes up soil texture?
4. What types of soil holds water? What type holds air?
5. What does a gardener need to do to the soil to make it better for growing plants?

References

1. Mike Baird. [An area with sandy soil and low fertility](#) . CC BY 2.0