Forestry Suppliers Lesson Plan

Soil Moisture

Forestry Suppliers' Soil Analysis F.I.E.L.D. Kit™
Fundamental Investigation of the Environment Leading to Discovery™
Study Kit Correlated to National Science Education Content Standards

If you're interested in soil studies for classroom activities, consider the Forestry Suppliers' Soil Analysis F.I.E.L.D. Kit. Use the kit for the exercises outlined in this Lesson Plan, as well as other related activities (see "Further Studies" section for a few ideas).

This F.I.E.L.D. Kit is available exclusively from Forestry Suppliers and includes some of the items used in this lesson plan. All kit items may also be purchased individually. Call our Sales Department at 1-800-647-5368 or visit us on the web at www.forestry-suppliers.com.

Fields of Study:
- Earth Science
- Mathematics

National Science Education Content Standards Correlation

Grades	A	B	C	D	E	F	G
K-4	✓			✓	✓		✓
5-8	✓				✓	✓	✓
9-12	✓				✓		✓

Soil Analysis Kit Contents Stock Number 36845

Qty.	Description	Required For This Lesson Plan K-4	5-8	9-12	Stock Number
1	Soil Color Book, GLOBE Earth Colors				77369
1	Soil Texture Kit				77330
1	Keck Sand Shaker				53691
1	Soil N-P-K Kit				77960
1	Soil Thermometer				89028
1	Soil Sample Bags, 18 oz.				79227
1	Soil Sample Tube	✓	✓	✓	76971
1	Hydrion pH Papers, 0-13	✓	✓	✓	78105

Grades K-4

Background

All plant life requires three basic things: light, soil, and water. Some plants thrive in a very hot, arid environment with sandy soil. The desert regions provide a backdrop for plants with these needs. Other plants need continuous moisture, a warm humid environment with just the right amount of sunshine. Rain forest plants could never survive in a desert setting. Even some houseplants cannot tolerate full exposure to the sun. Different plant types have very different needs. You can control the amount and type of light your houseplants receive. For example, African violets prefer artificial light while other plants grow well in a windowsill. The amount of water or moisture a plant receives can also be controlled. You can also make sure your plants are healthiest by supplying them with fertilizer or other needed nutrients specific for that particular plant.

Soil type is very important to someone simply growing plants in their home as well as to the farmer who grows thousands of acres of crop plants, such as corn, rice, soybeans, wheat or cotton. A soil type which is good for one plant, may not serve the needs of another plant very well. Some soils tend to hold moisture quite well while others remain dry most of the time. Most of us have used a sponge; sponges take up water and hold it because they are composed of very "absorbent" material. A small sponge can hold more water than a large ordinary cloth. Some soil types are like an ordinary cloth while others are like a sponge that can absorb or hold much water.

In choosing an area to farm, a farmer must consider the soil type and its ability to hold moisture. Some land cannot support particular crops. How can someone know about the soil's ability to hold water or the moisture content of soil? In simple words, how wet or dry is dirt? Try this experiment and you will begin to learn about how much moisture is in soil, even when it looks dry!

Procedure

1. Select three different areas in which to collect soil (schoolyard, someone's backyard and maybe a flower garden or vegetable garden site.)
2. Dig about six inches into the site and collect enough soil to fill a coffee can. Seal the can with the plastic lid.
3. Remove enough of the soil (1/4 cup or less) to form a thin layer in an oven-safe baking dish and set aside for later use.
4. Weigh the empty dish to be used and record the weight. Repeat until you achieve the same weight results twice in a row. The balance being used should be sensitive enough to measure 0.1g differences.
5. Break up the collected soil as much as possible and pour a thin layer of soil into the bottom of the baking dish. Then, place the dish on the balance and record the weight.
6. Weigh three times and average the three weights to determine a final weight. (With younger students, you may want to weigh the sample until you get the same results twice in a row.)
7. Subtract the weight found in Step #4 from the weight found in Step #6 (e.g.: Step #6 - Step #4 = Weight of soil + water).
8. Heat the soil and container by one of the following methods: (Teacher must complete this step.)
   a. Place in a conventional oven at 100° Fahrenheit for 24 hours.
   b. Place in a conventional oven at 375° Fahrenheit until it is apparent that the sample is dry throughout.
   c. Place in a microwave with a rotating tray, heat on high until the sample is completely dry; make sure that the container is microwave safe.
9. Allow the container and sample to cool completely to room temperature. (A dish not completely cooled will weigh more.)
10. Weigh the container and sample again as you did in step 6.
11. Find the weight difference between the sample/container before heating and after heating and cooling. The weight difference is the weight of the moisture contained in the soil sample. The heating causes an evaporation of the water "held" in the soil.
12. Use the following formula to calculate this difference. With younger children you can simply perform the calculation difference yourself and share the value of the first weight and the final weight. They can grasp the difference if presented in this manner. With older children, they can easily calculate this difference. Example:
    A. Final weight of container and soil before heating: ___g or ___oz.
    B. Final weight of container and soil after heating: ___g or ___oz.
    C. A - B = weight of water
13. With older students, you can further the study by finding the percent of water in the soil by using the data from Steps 7 and 12:

$$\frac{\text{Weight of Water (\#12)}}{\text{Weight of Soil + Water (\#7)} \times 100} = \text{\_\_\_\_ \% water in soil sample}$$

14. Repeat procedure for all three soil samples. You can easily heat all three samples at the same time if oven space permits.
15. If the soil samples specifically differ in the moisture content, you should see a definite weight difference.

Further Studies

- Have students conduct a soil texture study by using the Forestry Suppliers, Inc. Soil Analysis F.I.E.L.D. Kit or the Soil Texture Kit. Students will be able to note differences in soil texture, which relates to the ability a soil type has in holding moisture. Younger students can easily see differences in soil texture types by using a hand held magnifier or by using a stereo microscope. (K-4)
- Students can measure the pH of the soil and make possible correlations. The Determining the pH of Soil Lesson Plan can be implemented to complete this activity. (K-4)
- Students can measure the immediate absorption and holding of moisture by obtaining equal amounts of sand and garden soil and placing the samples in a plastic cup with ten small holes punched in the bottom. Equal amounts of water can be poured through the cups and "caught" or retrieved by placing a measuring cup under the soil cup. The students can then measure the amount of water which was not absorbed and make comparisons between the different soil types. (K-4)
- Have students find information on soil types and textures and the importance to farmers and agriculture by using the school or public library. (3-4)

Rubric

- Students should be able to understand the importance of soil type as it relates to moisture retention. (K-4)
- Students should be able to identify different soil textures. (K-4)
- Students should be able to apply the procedure for mathematically finding the amount of moisture in soil by heating a soil sample. (3-4)

Assessment

- Have students list the common soil types, including those they observed during the activity. (K-4) (For younger students: clay, sand, etc.) You may want to collect basic types and have those on hand to allow the children to observe and categorize.
- Have students explain how you measure the moisture content of the soil by the weighing and heating process. (K-4)

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Content Standards Covered

A Science as inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

D Earth and Space Science
- Properties of earth materials

E Science and Technology
- Understandings about science and technology
- Abilities to distinguish between natural objects and objects made by humans

G History and Nature of Science
- Science as a human endeavor

Required Materials

The following items are required to complete all the activities in this lesson plan. Available from Forestry Suppliers, Inc.

- Electronic Balance **94003**
- Folding Pocket Magnifier **61122**

Supplied by Teacher/Student(s)

- Soil from 3 different areas
- Oven-safe baking dish
- Oven
- 3 regular size coffee cans with plastic lids

Optional Items

Optional Items available from Forestry Suppliers, Inc., that can be used to enhance this lesson plan.

- Soil Texture Kit **77330**
- Soil Sample Tube **76971**

Grades 5-8

Background

Light, soil and moisture are crucial necessities to the health and development of plant life. Specific species of plants thrive in the desert regions and are very acclimated to an arid environment with extreme changes in temperatures. Plants found near the floor of tropical rain forests would not fare well in full sunlight.

The composition of the soil plays an important part in the moisture content of a soil type. Some soil types absorb and are better able to hold water than others; some soils have low water retention. It is crucial that agriculturists and farmers understand the moisture needs of specific crops and the soil type which is best able to meet these needs. Whether producing thousands of acres of wheat, soybeans, corn or cotton or just simply caring for a backyard vegetable garden, moisture availability is an important consideration. The composition of the soil can be enhanced toward a more healthy composition by the addition of fertilizers and nutrients. Water retention cannot be so easily changed; therefore, much consideration must be given to the soil site when deciding where to plant crops.

By completing this activity, you should be able to better understand the apparent differences among some soil types concerning moisture content. Watch out for the mud!

Procedure

1. Select five different testing sites from which to collect soil to be analyzed: Your backyard, a field or garden spot, schoolyard, etc. Record observable differences seen among the soil site environments.
2. Dig approximately six inches into the site and collect enough soil to fill the coffee can or plastic bag and seal.
3. Remove enough of the soil (1/4 cup or less; or 57 grams), to form a thin layer in the bottom of the oven-safe dish.
4. Weigh the empty dish to be used and record the weight to the nearest 0.1g. For accuracy, you may want to weigh the dish three times and take the average. The balance being used should be sensitive enough to measure 0.1g differences.
5. Break the soil up as much as possible when placing in the bottom of the dish.
6. Weigh the dish with the soil sample. Record the weight to the nearest 0.1 gram.
7. Repeat step #6 three times to get an average. Record the final weight to the nearest 0.1 gram.
8. Heat the soil sample in the container by using one of the following methods: (Teacher must conduct the heating process.)
   a. Place in a conventional oven at 100° Fahrenheit for 24 hours.
   b. Place in a conventional oven at 350° Fahrenheit until it is apparent that the sample is dry throughout.
   c. Place in a microwave with a rotating tray, heat on high until the sample is completely dry; make sure that the container is microwave safe.
9. Allow the sample and container to cool completely to room temperature. (A dish not completely cooled will weigh more than one that is cooled to room temperature.)
10. Following the steps in #6 and #7, weigh the sample and container.
11. Find the weight difference between the sample/container before heating and after heating and cooling. The weight difference is the weight of the moisture contained in the soil sample. The heating causes an evaporation of the water held in the soil.
12. Use the following formula to calculate this difference:
    a. final weight of container and soil before heating: ____ grams (#7)
    b. final weight of container and soil after heating: ____ grams (#10)
    c. a - b. = ____ (weight of water)
13. Calculate the percent of water in the sample by:

$$\frac{\text{Weight of Water (\#12)}}{\text{Weight of Soil + Water (\#7)}} \times 100 = \text{\_\_\_\_ \% water in soil sample}$$

14. Repeat procedure for all soil samples. You can easily heat all samples at the same time if oven space permits.
15. If the soil samples specifically differ in the moisture content, you should note a definite weight difference.

Further Studies

- Students can conduct soil texture studies utilizing the Forestry Suppliers' Soil Analysis F.I.E.L.D. Kit or a Soil Texture Kit. Textural differences should be noted especially if moisture content varies greatly among the samples.
- Students can measure and compare the pH differences among the soil samples. Correlated activity, in the Determining the pH of Soil Lesson Plan.
- Students can quickly measure the immediate water holding ability of the different soil types by obtaining equal amounts of sand and garden soil and placing the samples in a plastic cup with ten small holes punched in the bottom. Equal amounts of water can be poured through the cups and retrieved by placing a measuring cup or graduated beaker under the soil cup. The students can then measure the amount of water which was not absorbed and make comparisons between the different soil types.
- Students can conduct research on soil types and texture and the importance of these to farmers. Use school or public library.

Rubric

- Students should be able to discuss the importance of moisture content.
- Students should be able to distinguish between the textural differences among select soil types.
- Students should be able to apply the mathematical method used in determining the percent of water in each sample to other related calculations.

Assessment

- Present students with several different soil types and have them make observations concerning the apparent textural differences.
- Have students explain the method by which they determined the water percentage in each sample.
- Have students list and explain different soil types.

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Content Standards Covered

A Science as inquiry
- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

E Science and Technology
- Understandings about science and technology

F Science in Personal and Social Perspectives
- Science and technology in society

G History and Nature of Science
- Science as a human endeavor

Required Materials

The following items are required to complete all the activities in this lesson plan. Available from Forestry Suppliers, Inc.

- Electronic Balance **94003**
- Folding Pocket Magnifier **61122**

Supplied by Teacher/Student(s)

- Soil from 3 different areas
- Oven-safe baking dish
- Oven
- 3 regular size coffee cans with plastic lids

Optional Items

Optional Items available from Forestry Suppliers, Inc., that can be used to enhance this lesson plan.

- Soil Texture Kit **77330**
- Soil Sample Tube **76971**

Grades 9-12

Background

Specific species of plants have particular needs for optimum growth; however, all plants need water, light and soil or a specific growing medium. Some species prefer an arid, hot environment while other plant types thrive in a moist, warm habitat such as a rain forest. Soil type varies within different environments since some soil types have a greater capacity for holding moisture. The moisture content of soil is key to determining which plant types may grow best within a particular environment. Agriculturists, crop farmers, as well as backyard gardeners must have an understanding of the soil requirements of the plants to ensure the greatest growth potential and crop yield. Great care and consideration must be given to crop site since soil type cannot be changed, although the nutrient composition of the soil can be enhanced by the introduction of fertilizers and supplements.

Understanding how to basically determine the moisture content of soil is important for many reasons. Global food concerns cause scientists to consider ways to obtain the highest crop yield from sometimes small areas of crop land. Knowing the specific soil needs of a species would definitely be important in this consideration.

By completing this lab activity, you will have a better understanding of the specific moisture content differences among various soil types.

Procedure

1. Select five different testing sites from which to collect soil to be analyzed: Your backyard, a field or garden spot, schoolyard, etc. Record observable differences seen among the soil site environments.
2. Dig approximately six inches into the site and collect enough soil to fill the coffee can or plastic bag and seal.
3. Remove enough of the soil (1/4 cup or less; or 57 grams), to form a thin layer in the bottom of the oven-safe dish.
4. Weigh the empty dish to be used and record the weight to the nearest 0.1g. For accuracy, you may want to weigh the dish three times and take the average. The balance being used should be sensitive enough to measure 0.1g differences.
5. Break the soil up as much as possible when placing in the bottom of the dish.
6. Weigh the dish with the soil sample. Record the weight to the nearest 0.1 gram.
7. Repeat step #6 three times to get an average. Record the final weight to the nearest 0.1 gram.
8. Heat the soil sample in the container by using one of the following methods: (Teacher must conduct the heating process.)
   a. Place in a conventional oven at 100° Fahrenheit for 24 hours.
   b. Place in a conventional oven at 350° Fahrenheit until it is apparent that the sample is dry throughout.
   c. Place in a microwave with a rotating tray, heat on high until the sample is completely dry; make sure that the container is microwave safe.
9. Allow the sample and container to cool completely to room temperature. (A dish not completely cooled will weigh more than one that is cooled to room temperature.)
10. Following the steps in #6 and #7, weigh the sample and container.
11. Find the weight difference between the sample/container before heating and after heating and cooling. The weight difference is the weight of the moisture contained in the soil sample. The heating causes an evaporation of the water held in the soil.
12. Use the following formula to calculate this difference:
    a. final weight of container and soil before heating: ____ grams (#7)
    b. final weight of container and soil after heating: ____ grams (#10)
    c. a - b. = ____ (weight of water)
13. Calculate the percent of water in the sample by:

$$\frac{\text{Weight of Water (\#12)}}{\text{Weight of Soil + Water (\#7)}} \times 100 = \text{\_\_\_\_ \% water in soil sample}$$

14. Repeat procedure for all soil samples. You can easily heat all samples at the same time if oven space permits.
15. If the soil samples specifically differ in the moisture content, you should note a definite weight difference.

Further Studies

- Students can compare possible textural differences among the different soil types utilizing the Forestry Suppliers' Soil Analysis F.I.E.L.D. Kit or the Soil Texture Kit. Definite textural differences should be noted; especially if moisture content varies greatly among the samples tested. (9-12)
- Students may measure the pH value of the various soil samples by using the correlated Lesson Plan activity Determining the pH of Soil. (9-12)
- Students may conduct research on specific soil and texture types by using the school or public libraries or by contacting a local soil and water conservation agency or a private soil lab. (9-12)
- Students can quickly measure the immediate water holding ability of the different soil types by obtaining equal amounts of sand and garden soil and placing the samples in a plastic cup with ten holes punched in the bottom. Equal amounts of water can be poured through the cups and retrieved by placing a measuring cup or graduated beaker under the soil cup. The students can then measure the amount of water which was not absorbed and make comparisons between the different soil types. (9-10)

Rubric

- Students should be able to discuss the importance of soil moisture content by relating this to plant type.
- Students should be able to distinguish between the textural differences among select soil types.
- Students should be able to apply the mathematical method used in determining the percent of water in each sample.
- Students should be able to make related global inferences concerning the importance of soil type and moisture holding ability.

Assessment

- Presented with several different soil types, students will make observations concerning the apparent textural differences.
- Students will list and explain the different soil types concerning the observable moisture-holding ability of each.
- Students will calculate the percent of water when given information concerning the drying of a soil sample.

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Required Materials

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Supplied by Teacher/Student(s)

- Soil from 3 different areas
- Oven-safe baking dish
- Oven
- 5 regular size coffee cans with plastic lids

Optional Items

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- Soil Texture Kit **77330**
- Soil Sample Tube **76971**
- Re-sealable Plastic Bags (pk 100) **79147**