LAND EROSION

Running Off With Soil

What is the relationship between rainfall and runoff?

ACTIVITY

Activity Overview

Tropical forests have the highest yearly rainfall of any place on Earth. When it rains for long periods of time and the soil cannot absorb more water, the water runs off downhill into streams, rivers, lakes, and oceans carrying soil particles with it. The process by which material such as soil is worn away by water is known as erosion. Plants play a major role in reducing erosion by anchoring soil particles in place. When the land is cleared of plant life, erosion becomes an ecological problem. This is true in any environment, but especially in tropical forests.

In this activity, you will examine the relationship between rainfall and runoff on Barro Colorado Island (BCI) over a period of one year. Table 1 shows monthly total values for rainfall and runoff in one year. You will examine the data and use the TI-73 Explorer™ to graph and analyze the values.

What is the average and total rainfall at BCI for the year? What is the average runoff at BCI? When it rains heavily does runoff increase?

Table 1

Data source: 2002 Meteorological and Hydrological Summary for Barro Colorado Island – Smithsonian Tropical Research Institute.

Month	Rainfall (mm)	Runoff (mm equivalents)
1	159	114.7
2	10.2	7.6
3	46.6	4.8
4	141.1	1.6
5	215.3	7.8
6	228.1	15.4
7	396.8	104.1
8	396.8	146.8
9	172	58.9
10	157.4	40.8
11	324.4	153.4
12	53	16.7

Note: The months are represented by numbers in order to easily graph the values (1=January, 12=December).

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Procedure

1. Reset the TI-73 Explorer™ to the default settings.

a. Turn on the TI-73 Explorer™.

b. Press [2nd] [MEM] [7] [2] [2].

c. Press [2nd] [MEM] [6] [ENTER].

2. Enter your data in the TI-73 Explorer™.

a. Press [LIST].

b. Enter the number that represents each month from Table 1 in L1. After entering each number press [ENTER].

c. Enter the monthly rainfall from Table 1 in L2**.** After entering each number press [ENTER].

d. Enter the monthly runoff from Table 1 in L3**.** After entering each number press [ENTER].

L1	L2	L3 1
1	159	114.7
2	10.2	7.6
3	46.6	4.8
4	141.1	1.6
5	215.3	7.8
6	228.1	15.4
7	396.8	104.1

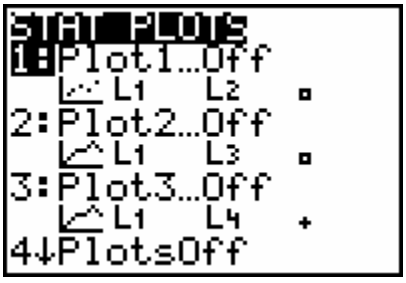
L1(1)=1

3. Graph your data.

You will set up two line graphs on the same plot, the first showing rainfall and months, and the second showing runoff and months.

Make a graph of Rainfall and Months.

a. Press [2nd] [PLOT] [1] [ENTER] [▼] [▶] [ENTER] to select line graph (📈).



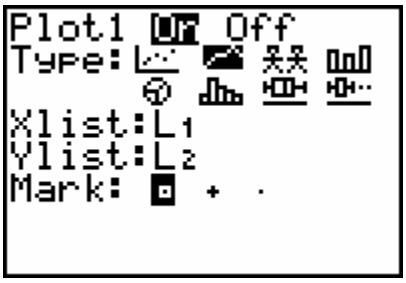
Materials*

TI-73 Explorer™

TI-73 Explorer™

* This activity has been written for the TI-73 Explorer™ but you can easily substitute the TI-83 or TI-83 Plus.

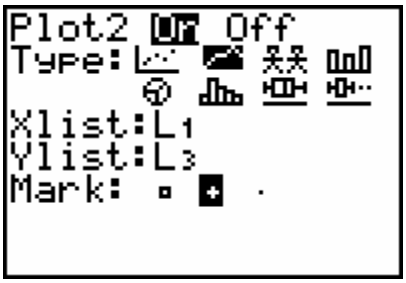
b. Press ▼ 2nd [STAT] 1 to select **L1** (month) for the X-axis.
c. Press ▼ 2nd [STAT] 2 to select **L2** (rainfall) for the Y-axis.
d. Press ▼ ENTER.



e. Press GRAPH.
f. Press ZOOM 7 to adjust the scale on your graph.

Make a graph of Runoff and Months.

g. Press 2nd [PLOT] 2 ENTER ▼ ▶ ENTER to select line graph (📈).
h. Press ▼ 2nd [STAT] 1 to select L1 (month) for the X-axis.
i. Press ▼ 2nd [STAT] 3 to select L3 (runoff) for the Y-axis.



j. Press GRAPH to see the two plots.

4. Complete the Data Analysis section. Answer the questions in your journal.

Data Analysis

While observing the graph press [TRACE] and use the arrow keys ([▶] and [◀]) to move the cursor along a line. The X-coordinate and Y-coordinate of each data point are displayed below the graph. Use the arrow keys ([▲] and [▼]) to move the cursor between each plot.

1 Which month(s) had the highest rainfall during the year?

2 Which month(s) had the highest runoff during the year?

3 Which month(s) had the lowest rainfall during the year?

4 Which month(s) had the lowest runoff during the year?

5 Which season, winter, spring, summer, or fall, was the rainiest? Explain.

6 Which season, winter, spring, summer, or fall, was the driest? Explain.

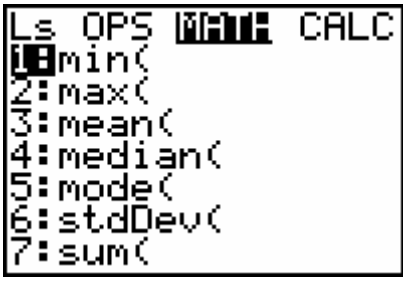
7 As the amount of rainfall increases within the sample year, does the amount of runoff increase or decrease?

8 As the amount of rainfall decreases within the sample year, does the amount of runoff increase or decrease?

9 By observing your graph, during which months would you expect erosion to be the highest? Explain.

Use your graphing device to find the average (mean) rainfall during the year.

a. Press [2nd] [STAT] [▶] [▶] to select the MATH menu.



b. Select **3:mean(** by pressing [3].

c. Press [2nd] [STAT]. Press [2] to select L2 (rainfall).

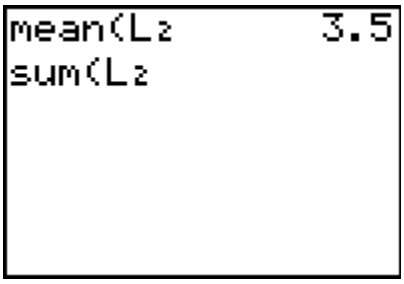
d. Press [ENTER] to find the average rainfall during the year.

10 During which months was rainfall above average?

11 Your teacher will provide the average rainfall in your area. How does the average rainfall at BCI compare with the average rainfall in your area?

Use your graphing device to find the total rainfall during the year.

a. Press [2nd] [STAT] [▶] [▶] to select the MATH menu.
b. Select **7:sum(** by pressing [7].
c. Press [2nd] [STAT]. Press [2] to select L2 (rainfall).



d. Press [ENTER] to find the total rainfall during the year.

12 Your teacher will provide the total rainfall in your area. How does the total rainfall at BCI compare with the total rainfall in your area?

Use your graphing device to find the average (mean) runoff during the year.

a. Press [2nd] [STAT] [▶] [▶] to select the MATH menu.
b. Select 3:mean(by pressing [3].
c. Press [2nd] [STAT]. Press [3] to select L3 (runoff).
d. Press [ENTER] to find the average runoff during the year.

13 During which months was runoff above average?

14 Based on your data and information provided in the research article, how might rainfall and runoff data help scientists reduce the amount of erosion that occurs in an ecosystem?