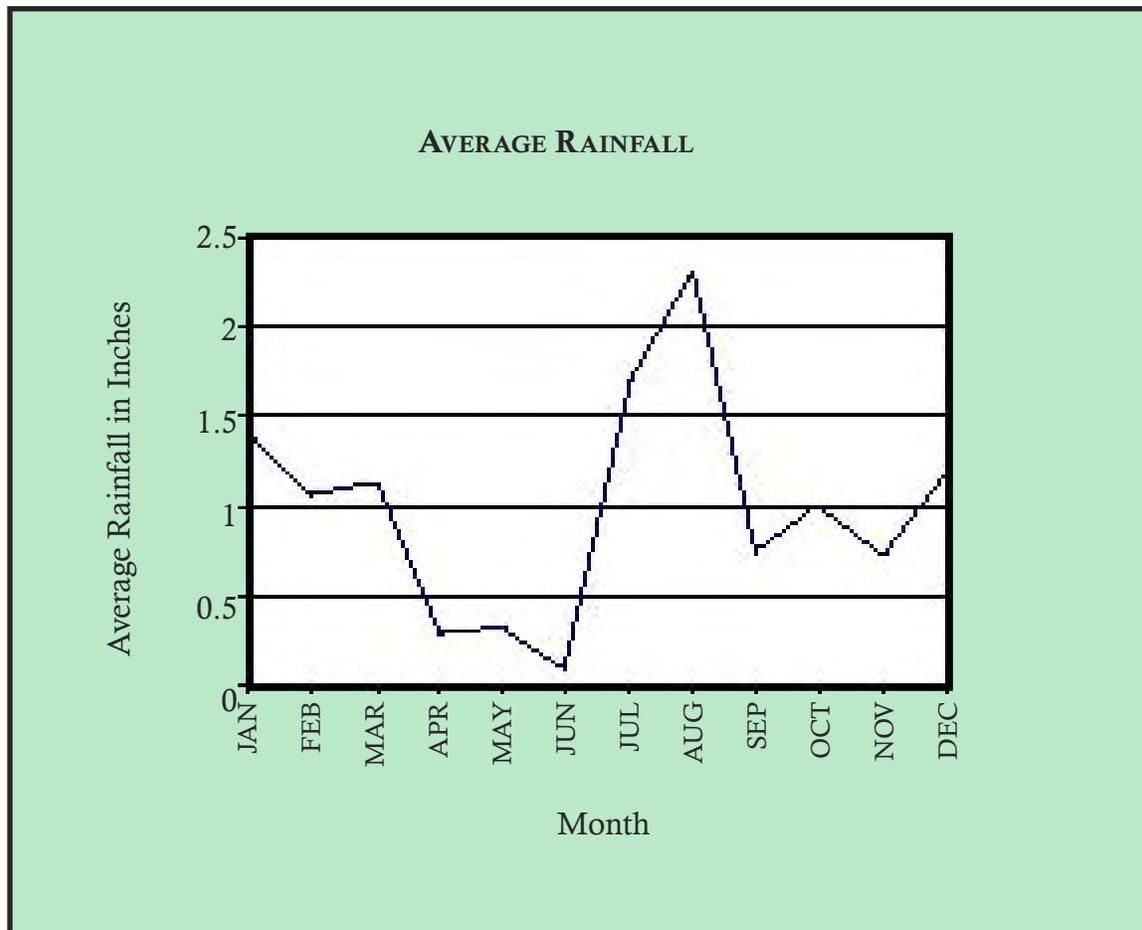
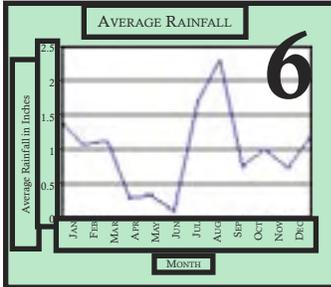


LESSON 6

WHY THE SANTA CRUZ



By graphing rainfall and temperature patterns and comparing data in two specific sites, students will learn how environmental conditions affected human settlement along the Santa Cruz River.



LESSON OVERVIEW

By graphing rainfall and temperature patterns and comparing data in two specific sites, students will learn how environmental conditions affected human settlement along the Santa Cruz River.

Subjects

Math, Science, and Social Studies

Standards

Science as Inquiry
History and Nature of Science
Science in Personal and Social Perspectives
Earth Science

Objectives

Students will:

1. Graph and compare the rainfall and temperature patterns from two areas.
2. Discuss how cultures selected their home-sites based on environmental factors.

Preparation

Read the Background Information and review the graphs and charts on **Pages 6.2-6.6**; Copy **Master Page 6.5**, either for groups or individuals; have available pencils, graph paper and rulers.

Time

One or two 50-minute sessions.

Vocabulary

Pimeria Alta, acequia

WHY THE SANTA CRUZ?

TEACHER BACKGROUND INFORMATION

In the article, “Kino’s Unforeseen Legacy,” Dr. Sheridan speaks of environmental, economic and social/cultural conditions that were influential in determining the history of the Pimeria Alta, the historical designation for much of the Sonoran desert. For the O’odham people, and later the Spanish and Americans, environmental conditions influenced their lifestyle and choice of where to settle.



ARIDITY:

Since most of the Pimeria Alta only gets about five to fifteen inches of rainfall a year, water was a precious and relatively rare commodity. It is essentially the lifeblood of the area and almost all settlements were located close to or along the Santa Cruz River.

RAINFALL PATTERNS:

The two rainy seasons, winter and summer, have very different characteristics. In winter, rain falls more with greater frequency and tends to soak the ground in gentle, long-duration showers. Rain tends to fall over a wide area. Since the temperature is cooler, less rain evaporates back into the air before it can be absorbed by the ground or plant roots. Summer, in contrast, brings dramatic downpours that cause flooding. Summer rains are more sporadic than the winter rains and the rainfall patterns tend to be uneven. Some areas get drenched while others remain bone-dry. High summer temperatures can evaporate much of the rain that falls before it has a chance to get into the ground.

LESSON 6 - WHY THE SANTA CRUZ?

RIVER OASIS:

The Santa Cruz River provided a very different environment from that found in the “uplands,” (uphill and away from the floodplain). Rich soils and shallow groundwater levels allowed dense woodlands of mesquite and other trees to flourish in the lowlands, while nearer the river channel cottonwoods and willows created shady canopies with a lush understory of plants. The river itself flowed all year round in many places or else had a spring or cienega providing reliable water for both animals and humans. Villages such as Guevavi, Sonoita, Tumacácori, Tubac, and San Xavier were all located at places that offered year-round water supplies.

O’ODHAM ADAPTATION:

The O’odham were well-adapted to their environment but experienced major resource limitations. They farmed by utilizing floodplains near the river and collecting monsoon rainwater to water their crops of corn, beans, and squash. They may have brought water from the river to their fields via “acequias” or canals. Besides enduring drought periods, which caused crop failures, they suffered when summer rains were too heavy, washing out their floodplain crops. In addition, the O’odham lacked a winter crop and were forced to gather foods or hunt for survival. Because they could utilize wild foods so efficiently, the O’odham people survived such times, but had to move a great deal to gather enough wild foods to survive, sometimes ranging over great distances just to feed their families.

PART 1

1. Discuss present day weather patterns in the Santa Cruz Valley:

When is the hot season?

How hot does it get?

Is it as hot in the Santa Cruz Valley as it is in Tucson? Phoenix?

Why is there a difference?

How cold does it get in winter?

When is the rainy season?

Does it ever flood?

2. Working in teams, hand out copies of “Rainfall in the Santa Cruz Valley” chart on **Master Page 6.5**. Using the chart as a reference, ask students to try to answer the following questions.

When does the most rainfall occur? The least?

Which rainy season has more consistent rainfall?

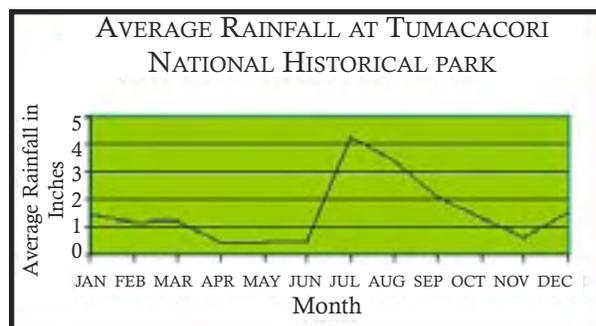
If you were farmers, which season would be best for growing crops?

3. Model and ask students to plot and graph rainfall over time at Tumacácori.

a. Add the monthly rainfall data for each of the ten years.

b. Find the average by dividing the total monthly rainfall by ten.

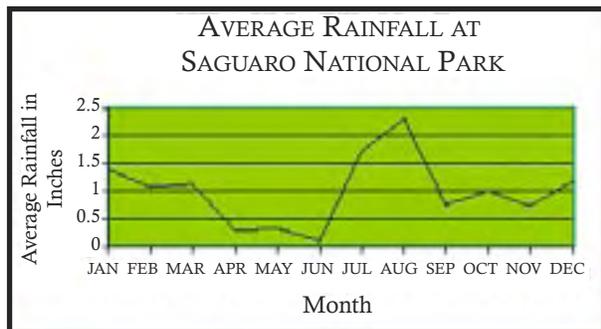
c. Plot the averages over time.



This graph is for teacher use only.

LESSON 6 - WHY THE SANTA CRUZ?

4. Repeat the graphing exercise for Saguaro National Park.



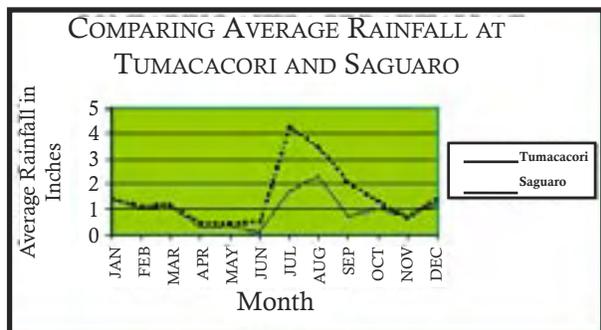
This graph is for teacher use only.

5. Discuss the following

Are there any differences between the rainy seasons?

Do you think you could grow corn in the desert? Why or why not?

6. Make a graph that includes both areas.



This graph is for teacher use only.

7. Discuss and compare similarities and differences between the two sites.

Which area received more rain? Why?

Based on rainfall, which area would be better to live in if you were a farmer?

What year might be a particularly good year for farming? Why?

What was the worst year?

Which years would a farmer be likely to lose his corn crop if he planted in June or July? Why?

(Rainfall of five inches or more in a month would create a flood in summer months; six or more inches for winter months. In years #2, #4, #6, #7 and #8 there occurred corn losses from flooding and in #1 from too little rain.)

What do you think happened to the Pima Indians in year #1?

(They would have to rely on wild foods only, as their crops would have failed.)

PART 2 - Optional

1. Repeat the assignment using temperature data on *Master Page 6.6*.

2. Compare and discuss the two sites combining temperature and rainfall.

Would they answer the questions in the same way?

Enrichment

- As an evaluation, have students do Part 2 and on paper answer the same questions as in Part 1.
- Use the Project WET groundwater model to examine the underlying groundwater resources in our area and activities related to the river.
- Do the Activity: "Water Wonders," Project Learning Tree (PLT) # 44.

NOTES

RAINFALL IN THE SANTA CRUZ VALLEY
 TOTAL MONTHLY RAINFALL (INCHES) FOR TUMACÁCORI NHP

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
#1	2.0	2.1	1.5	0	0.2	0.1	3.3	3.2	0.9	3.4	2.8	3.6
#2	2.8	0.8	1.4	0	0.5	0.9	3.4	1.9	0.2	0.1	0.3	0.4
#3	0.4	2.0	0.8	0	0.1	0.1	0.6	2.5	0.8	0	0	0.1
#4	1.5	0.7	1.9	0.1	1.0	0	6.9	4.1	2.0	1.1	0.7	0
#5	1.1	0.1	0.7	0	0	0.3	2.2	3.1	1.9	0	0.4	3.8
#6	1.9	1.2	3.3	0.1	0	0	3.2	4.8	6.4	6.7	0.8	0.7
#7	2.0	0	0	0.4	0.1	1.5	10.6	3.8	1.5	1.1	0.7	4.1
#8	2.1	1.3	0.1	0.7	0	0	5.2	2.6	2.9	1.5	0.8	0.4
#9	0	1.6	1.3	0	0.4	0.4	5.3	3.9	0.5	0.2	0.4	1.6
#10	0.6	1.9	0.4	1.3	0.6	0	3.3	5.3	2.6	0.8	0.2	1.7

RAINFALL IN THE DESERT

TOTAL MONTHLY RAINFALL (INCHES) FOR SAGUARO NATIONAL PARK

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
#1	2.0	0.9	0.3	0.3	Trace	Trace	1.9	1.0	1.2	1.1	1.3	0.3
#2	0.1	1.8	1.4	Trace	0.2	0	1.7	0.6	0	0.6	0.6	1.3
#3	0.7	1.4	0.8	Trace	0.7	0.7	0.6	1.0	1.3	0.4	0.3	1.4
#4	0.4	0.6	0.2	1.8	0	0.1	1.2	4.2	0.1	2.8	0.5	0.3
#5	0.8	0.1	0.9	0	0.1	0.1	2.2	2.2	0	1.1	0.4	0.3
#6	1.4	0.7	1.5	0.5	0.1	Trace	4.8	1.7	1.2	0.8	0.5	3.2
#7	1.3	0.7	1.7	0	0	0	0.4	0.2	0.9	1.0	1.2	1.2
#8	2.0	2.2	2.1	0.2	1.1	0.1	3.8	4.8	1.7	0.6	0	0
#9	5.2	1.0	0.7	0	0.3	0	0	5.6	0.2	--	1.3	0.5
#10	0	1.3	1.7	0.1	0.8	Trace	0.4	1.7	0.8	0.6	1.1	3.2

LESSON 6 - WHY THE SANTA CRUZ? - MASTER PAGE 6.6

TEMPERATURES IN THE SANTA CRUZ VALLEY
MONTHLY MAXIMUM/MINIMUM TEMPERATURES FOR TUMACÁCORI

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1978	66 -- 66 23	74 31	81 30	90 37	102 48	100 57	95 57	92 47	87 42	70 29	62 5	
1979	59 18	69 25	70 28	82 31	87 34	99 45	102 56	96 53	99 56	91 32	73 16	72 24
1980	68 26	72 29	71 30	82 31	87 35	104 43	102 62	97 57	96 51	86 32	78 24	76 24
1981	69 28	74 21	71 31	85 32	88 42	103 53	97 64	96 58	93 50	84 31	81 28	75 19
1982	67 22	71 22	75 23	84 --	89 40	98 46	98 56	96 59	94 44	87 33	72 26	63 21
1983	67 22	67 28	69 29	75 26	90 36	97 43	99 54	93 53	91 56	80 45	72 24	69 26
1984	66 23	70 22	78 28	80 29	96 38	96 53	92 61	91 59	92 51	78 40	73 21	65 25
1985	62 26	68 17	74 25	85 32	91 37	102 44	98 58	95 53	89 47	82 42	72 24	70 22
1986	74 22	72 26	77 31	84 32	92 35	99 50	93 58	94 62	91 42	83 35	73 28	66 21
1987	67 17	67 24	71 26	82 37	84 38	98 53	97 52	91 54	87 46	85 43	71 23	62 14

TEMPERATURES AT SAGUARO NATIONAL PARK
MONTHLY MAXIMUM/MINIMUM TEMPERATURES FOR SAGUARO

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1978	77 32	80 34	90 40	96 38	106 46	111 60	110 67	104 67	102 55	100 50	86 38	78 21
1979	74 30	85 31	85 37	92 39	100 44	114 57	113 68	106 60	108 61	101 46	85 32	82 36
1980	75 35	86 38	79 40	98 40	100 46	114 57	112 63	110 67	108 65	106 46	93 39	87 35
1981	83 37	89 34	86 38	98 39	97 54	113 70	109 67	109 68	103 64	93 46	90 39	85 32
1982	81 31	86 35	82 36	93 43	101 49	109 61	109 65	108 65	106 57	94 45	85 35	80 31
1983	77 33	81 36	85 43	91 37	109 49	107 59	116 71	105 64	107 61	87 55	82 33	79 33
1984	77 31	77 34	87 39	96 39	108 49	105 62	107 65	107 63	103 61	89 47	89 30	73 31
1985	71 29	81 23	81 33	94 45	99 50	112 54	109 66	108 66	99 54	96 47	87 32	77 28
1986	83 39	87 29	89 37	93 41	103 47	107 64	109 64	105 65	102 50	90 46	80 40	78 33
1987	83 22	81 31	83 35	96 41	96 49	109 63	109 67	104 63	101 60	101 56	81 34	81 24