JORNADA BASIN SCHOOLYARD
LONG-TERM ECOLOGICAL RESEARCH (LTER) PROJECT

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS MICROCLIMATE ACTIVITY

Chihuahuan Desert Nature Park
Created by Ray Bowers

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
MICROCLIMATE ACTIVITY

TEACHER INFORMATION

ABSTRACT: Measurements of temperature and relative humidity will be taken at the soil surface and at 15cm, 30cm, and 60cm below the surface. These measurements will be taken every other week during the school year using the Vernier LabPro and sensors. The recorded data will be graphed to illustrate the affect of depth on temperature and relative humidity. Conclusions about depth, temperature and relative humidity will be related to animal's adaptation to life in the desert.

GRADE LEVEL (S): 3--12

OBJECTIVES: Students will:

Measure and record temperature and relative humidity at different depths
Calculate the total and average temperature and relative humidity
Graph the temperature and relative humidity data
Draw conclusions about temperature and relative humidity and depth

NATIONAL STANDARDS:

Science as Inquiry – Development of:
- Abilities necessary to do scientific inquiry (3-12)
- Understandings about scientific inquiry (3-12)

Life Science – Development of an understanding of:
- Populations of organisms in ecosystems (5-12)

Earth and Space Science – Development of an understanding of:
- Changes in earth and sky (3-5)
- The structure of the earth system (5-12)

Science in Personal and Social Perspectives – Development of an understanding of:
- Changes in the environments (3-5)

NEW MEXICO STANDARDS:

Students will:

- **Content Standard 1:** Understand science concepts of order and organization
  K-4: A1 & B1; 5-8:A1 & B 1&2; 9-12: B1
- **Content Standard 2:** Use evidence, models, and explanations to explore the physical world
  K-4: A1, B1 & C1; 5-8:A1, B2, &C3; 9-12: B1 & 2
- **Content Standard 5:** Acquire the abilities to do scientific inquiry
  K-4: A3, B1&2, & C6; 5-8:A1&2, B1, 2, &6, & C; 9-12: A1&2, B2, & C
- **Content Standard 6:** Understand the process of scientific inquiry
  K-4: A1&3, B1 & 2, & C1; 5-8:A1, C1,D1&2F1&2, &G3; 9-12: A1, B1, D1,E1&2 & F1&2
- **Content Standard 9:** Know and understand the concepts of energy and energy transformation
  K-4: A2&4; 5-8: A6; 9-12: A1
- **Content Standard 11:** Know and understand the synergy among organisms and the environment of organisms
  K-4: E1&2; 5-8: A1&B3; 9-12: B3
- **Content Standard 12:** Know and understand properties of earth science
  K-4: D2&4; 5-8: A2D1&2; 9-12: D3

MATERIALS:

- Site and Habitat Description Protocol
- "Temperature and Humidity at Different Depths Weekly Student Data Sheet" and "Temperature and Humidity at Different Depths Monthly Data Sheet."
- meter stick
- 70cm long piece of perforated 3 inch PVC pipe
- one 3 inch female adapter and clean-out plug
- graph paper
- colored pencils
- Vernier Lab Pro
- Vernier stainless steel temperature probe
- Vernier humidity sensor
- Vernier logger Pro
- Computer (Power Macintosh with System7.6 or newer Pentium or compatble PC with Windows 95 or newer) or a Texas Instruments Graphing Calculator (TI-73 or greater)

BACKGROUND: The weather report gives the general weather conditions of an area. However, the environment has many variations such as surface texture and color, pockets, grannies, slopes, and types of vegetation. These will create variations in light, heat, moisture, and air movement. These small areas where variations in the climate are found are known as microclimates. In this activity temperature and humidity will be measured. Humidity is measured as a percentage of moisture in the air compared to how much moisture the air could actually hold.

PROCEDURES:

- Do the "Schoolyard Mapping and History Activity" before starting this activity.

SITE PREPARATION

1. Choose a well-drained site to avoid having the test pipe filling with water.
2. Fill out a "Site and Habitat Description Protocol" form for a three-meter radius around the site.
3. Dig a hole that is 74cm deep.
4. Insert the perforate 3-inch PVC pipe into the hole so the perforations are next to the hole's side. This should help to keep the fill soil out of the pipe. Slip the 3 inch female adapter over the end of the pipe so the top of the adapter is level with the soil surface. Screw the clean-out plug into the adapter.
5. Fill in the hole around the pipe and again make sure that the top of the adapter is level with the ground.
6. Allow the pipe to sit for two weeks to allow the soil to settle. After two weeks fill in around the pipe if needed.

DATA COLLECTION and EVALUATION

1. Use instructions to install the Logger Pro software on your computer or the DataMate program on your calculator.
2. Use the Lab Pro instruction manual to set-up the Lab Pro and attach the sensors. Make a copy of the Lab Pro instructions in the manual on collecting data for the students to use when they take measurements.
3. Students will work in groups of two. One student will be the recorder and weather observer; the other student will take the measurements.
4. Mark the wires with a permanent marker at the appropriate distances for the depths that the measurements will be taken.
5. Rotate these task so each class member has an opportunity to take the measurements.
6. Readings will be taken at the soil surface (0cm) and at 15cm, 30cm, and 60cm below the surface.
7. Take readings at the same time of day every other week during the school year.

8. Record the measurements and weather observations on the " TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS WEEKLY STUDENT DATA SHEET." There are three spaces for recording weekly measurements in case they are needed.
9. If this activity is done when the change between daylight and standard time occurs, stay with the same Sun time that was started with, 9:30 daylight time = 8:30 standard time.
10. At the end of the month calculate the average temperature and relative humidity for each height, and record this on the " TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS MONTHLY DATA SHEET."
11. Graph the average temperature and relative humidity each month. Use a different color of pencil for each depth. Make a color key to identify which color represents which depth.
7. This graphing project could be done individually by the students or as a class project.

CONCLUSIONS: Allow the students to draw conclusions from the graphs. How does depth affect temperature and relative humidity? Does the weather affect the temperature and relative humidity at different depths? How would the conclusion about depth's affect on temperature and relative humidity relate to animal behavior in the desert?

SAMPLES

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
DAILEY STUDENT DATA SHEET

STUDENT NAME(S) *Cynthia Centigrade and Hector Humid* .

LOCATION *North High School; 456 N. Main St* .

Las Cruces, NM .

TIME: *Tuesday, 10:30 am* .

Temperatures °C **Relative Humidity %**
Depth in cm **Depth in cm**

Date	0	15	30	60	0	15	30	60	Weather
2 Jul, 02	*60°*				*5%*				*Partly cloudy, slight winds from the west, no precipitation*
16 Jul, 02	*50°*				*20%*				
30 Jul, 02	*54°*				*18%*				
Total	164				*43*				
Average	***55°***				***14%***				
6 Aug, 02	*48°*				*22%*				
20 Aug, 02	*54°*				*15%*				
X	*X*				*X*				
Total	*102*				*37*				
Average	***51°***				***19%***				

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
MONTHLY STUDENT DATA SHEET

STUDENT NAME(S) *Cynthia Centigrade and Harold Humid* .

LOCATION *North High School; 456 N. Main St* .

Las Cruces, NM .

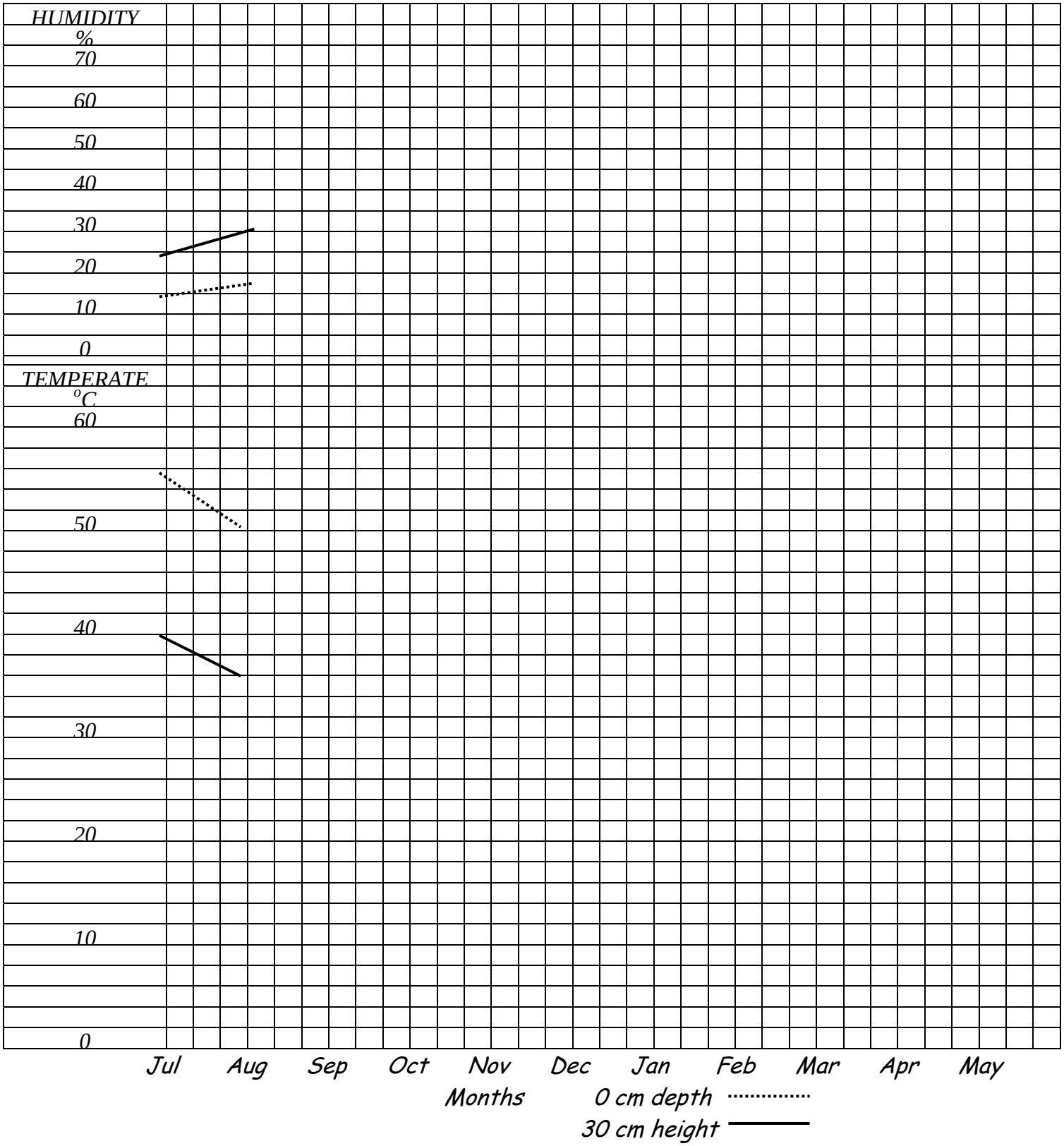
TIME: *Tuesday, 10:30 am* .

Average Temperatures °C
Depth in cm

Average Relative Humidity %
Depth in cm

Month	0	15	30	60	0	15	30	60
July	***55°***		***55°***		***14%***		***14%***	
August	***51°***		***51°***		***19%***		***19%***	

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
MONTHLY STUDENT GRAPH



STUDENT
TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
MICROCLIMATE ACTIVITY

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
MICROCLIMATE ACTIVITY

Student Name_____

QUESTION: How does the depth below the soil surface affect the temperature and relative humidity?

MATERIALS:

- Site and Habitat Description Protocol
- "Temperature and Humidity at Different Depths Weekly Student Data Sheet" and "Temperature and Humidity at Different Depths Monthly Data Sheet."
- meter stick
- 70cm long piece of perforated 3 inch PVC pipe
- one 3 inch female adapter and clean-out plug
- graph paper
- colored pencils
- Vernier Lab Pro
- Vernier stainless steel temperature probe
- Vernier humidity sensor
- Vernier logger Pro

METHODS:

1. Use instructions to install the Logger Pro software on your computer or the DataMate program on your calculator.
2. Use the Lab Pro instruction manual to set-up the Lab Pro and attach the sensors. **Make a** copy of the Lab Pro instructions in the manual on collecting data for the students to use when they take measurements.
3. Work with another student on this activity. One student will be the recorder and weather observer; the other student will take the measurements.
4. Mark the wires with a permanent marker at the appropriate distances for the depths that the measurements will be taken.

5. Readings will be taken at the soil surface (0cm) and at 15cm, 30cm, and 60cm below the surface.
6. Take readings at the same time of day every other week during the school year.
7. Record the measurements and weather observations on the " TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS WEEKLY STUDENT DATA SHEET."
8. If this activity is done when the change between daylight and standard time occurs, stay with the same Sun time that was started with, 9:30 daylight time = 8:30 standard time.
9. At the end of the month calculate the average temperature and relative humidity for each height, and record this on the " TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS MONTHLY DATA SHEET."
10. Graph the average temperature and relative humidity each month. Use a different color of pencil for each depth. Make a color key to identify which color represents which depth.

RESULTS: Refer to the " TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS MONTHLY DATA SHEET " and the graph of this data.

CONCLUSION:

Observation Site and Habitat Description Protocol
Modified from Phoenix, AZ SLTER, Ecology Explorers

Provide a habitat description of your study area. The description includes the amount and type of vegetation (or non-vegetation) at different heights within the study area. The area may vary depending on the location and type of study.

SITE DESCRIPTION

Teacher: _____ Class: _____

School Location: _____

_____

Recording Date: _____

Site Name: _____
Create a name to identify the site for which you are collecting data. (E.g. ground feeding)

Site ID: _____
Create a 3 – 5 letter and/or number code to identify this site. (E.g. Ground feeding--GRF)

Site Location: Write a brief description of where your site is located. (I.e. SW Corner of the playground):

_____

HABITAT DESCRIPTION:

Total Area Sampled: _____

Type of Cover	Total Area of Cover	Percentage of Cover
Vegetation > 150 cm:		% Tree Canopy
Vegetation 15cm – 150cm:		% Shrubs
Vegetation < 15cm:		% Other Vegetation
Algaal- lichen Crust		% Crust
Dead Vegetation		%Dead Vegetation
Gravel or soil		% Gravel or soil
Man-made Object		% Man-made Object
Paved		%Paved

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
DAILEY STUDENT DATA SHEET

STUDENT NAME(S)_____

LOCATION_____

_____

TIME: _____

Temperatures °C **Relative Humidity %**
Depth in cm **Depth in cm**

Date	0	15	30	60	0	15	30	60	Weather
Total									
Average									
Total									
Average									

TEMPERATURE and HUMIDITY at DIFFERENT DEPTHS
MONTHLY STUDENT DATA SHEET

STUDENT NAME(S)_____

LOCATION_____

_____

TIME: _____

Average Temperatures °C
Depth in cm

Average Relative Humidity %
Depth in cm

Month	0	15	30	60	0	15	30	60