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PLANT TRANSPIRATION IN THE CLOUD FOREST

Transpiration Introduction

Transpiration is the loss of water from the leaves of plants. Stomates are tiny pores on the surface of leaves that allow for the passage of oxygen and carbon dioxide during photosynthesis. You may have seen these tiny openings while looking at the leaves on your desk with the microscope. The stomates also allow water molecules to pass through. About 90% of the water a plant loses escapes through the stomates. For each molecule of water that evaporates from a leaf by transpiration, another molecule of water is drawn in at the root to replace it. Lack of water causes the stomates to close and prevent further dehydration of the plant. Transpiration is a safe process for plants, as long as the roots can absorb water molecules at the same rate they are being lost from the leaf surfaces.

There are many environmental conditions that change the rate of photosynthesis and, in turn, the rate of transpiration. Light intensity changes the rate of photosynthesis and also changes the temperature around the plant. The greater the light intensity and temperature, the more water is lost from leaf surfaces. Humidity also plays a role in transpiration – drier air makes evaporation of water faster. The presence and intensity of wind also plays a large role in transpiration rate because it changes the humidity of the air surrounding the plant, replacing moist air with drier air. The amount of moisture present in the soil will affect transpiration as well. When water from the soil is unavailable, stomates will close in an attempt to retain water. Finally, different species of plants transpire at different rates. Those plants adapted to live in very arid conditions, such as cacti, will conserve water by reducing transpiration, but species such as the leafy liverwort that grow in very wet areas like the cloud forest can transpire continually without desiccation.

What is transpiration?

What are the environmental factors that can affect transpiration?

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Think about the plants that you see outside the window right now. Do you think they are experiencing a lot of transpiration right now? Why or why not?



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PLANT TRANSPIRATION IN THE CLOUD FOREST Station Worksheet

Directions: You will be visiting four different stations that contain information and data collected from the cloud forest ecosystem of Monteverde, Costa Rica. Find the section of the worksheet that matches the station you are working at. Answer the questions provided. It may be helpful to have the *Transpiration Introduction* handout with you and use it to help you write informed answers.

STATION #1 → PLANT WATER STRESS

- 1) Examine the PLANT WATER STRESS data and graph. Write a two to three sentence statement that summarizes the information.

- 2) At which location are the plants experiencing the lowest rate of transpiration? Explain your choice.

- 3) Looking at the data, do you think plants in the cloud forest ecosystem are experiencing the same rate of transpiration throughout the day? Why or why not?

- 4) What environmental condition(s) might change the rate of transpiration throughout the day?



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STATION #2 → SOIL MOISTURE

- 1) Examine the SOIL MOISTURE data and graph. Write a two to three sentence statement that summarizes the information.

- 2) At which location are the plants experiencing the greatest rate of transpiration? Explain your choice.

- 3) Which environmental condition(s) might play a role in transpiration in this situation?

STATION #3 → ANNUAL RAINFALL

- 1) Examine the ANNUAL RAINFALL data and graph. Write a two to three sentence statement that summarizes the information.

- 2) At which location are the plants experiencing a greater rate of transpiration? Explain your choice.

- 3) Which environmental condition(s) might play a role in transpiration in this situation?



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STATION #4 → TRANSPIRATION & CLOUD FOREST

Examine the *Canopy In The Clouds* media below. Write down important information regarding transpiration and the cloud forest ecosystem that you learn from each piece of media. If you find additional hotspots that are helpful, record the location and information so you can refer to it again later, if needed.

Media	Important Information
<i>Panorama #1 ~ Canopy Hotspot #1</i>	
<i>Panorama #4 ~ Hotspot #3</i>	
<i>Panorama #5 ~ Hotspot #3</i>	
<i>Additional Media Video "Drip Tips"</i>	



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PLANT TRANSPIRATION IN THE CLOUD FOREST
Station Data & Graphs

PLANT WATER STRESS

PLANT WATER STRESS LEVELS			
Time	Low Elevation (Pano #1)	Mid Elevation (Pano #2)	High Elevation (Pano #3)
6:00	0.572	0.416	0.16
8:00	0.792	0.476	0.16
10:00	1.14	0.532	0.176
12:00	1.28	0.524	0.288
14:00	1.188	0.652	0.536
16:00	0.62	0.512	0.444
18:00	0.508	0.476	0.228
20:00	0.472	0.312	0.312
22:00	0.42	0.344	0.228
0:00	0.436	0.468	0.24
2:00	0.344	0.404	0.204
4:00	0.328	0.444	0.18

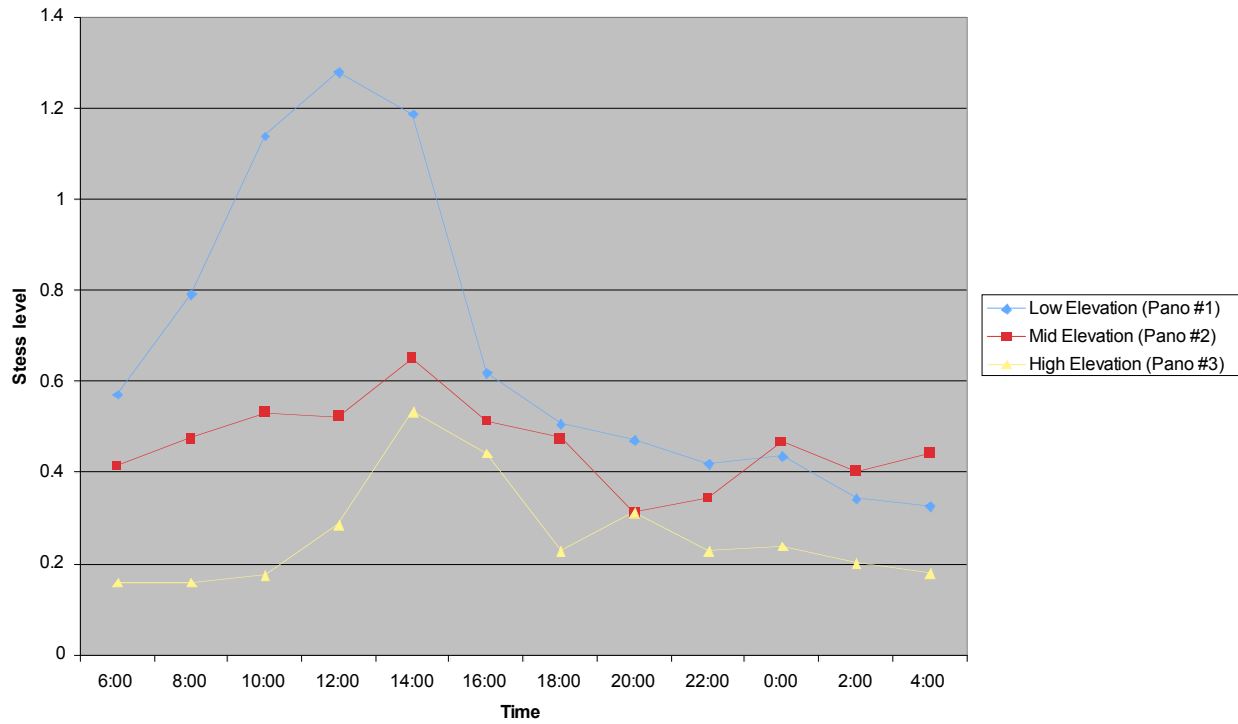


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Plant Water Stress
High # = More Water Stress



SOIL MOISTURE

SOIL MOISTURE IN THE CLOUD FOREST	
Location	% Soil Moisture
Low Elevation Panorama #1	8.2
Mid Elevation Panorama #2	10.3
High Elevation Panorama #3	58.4

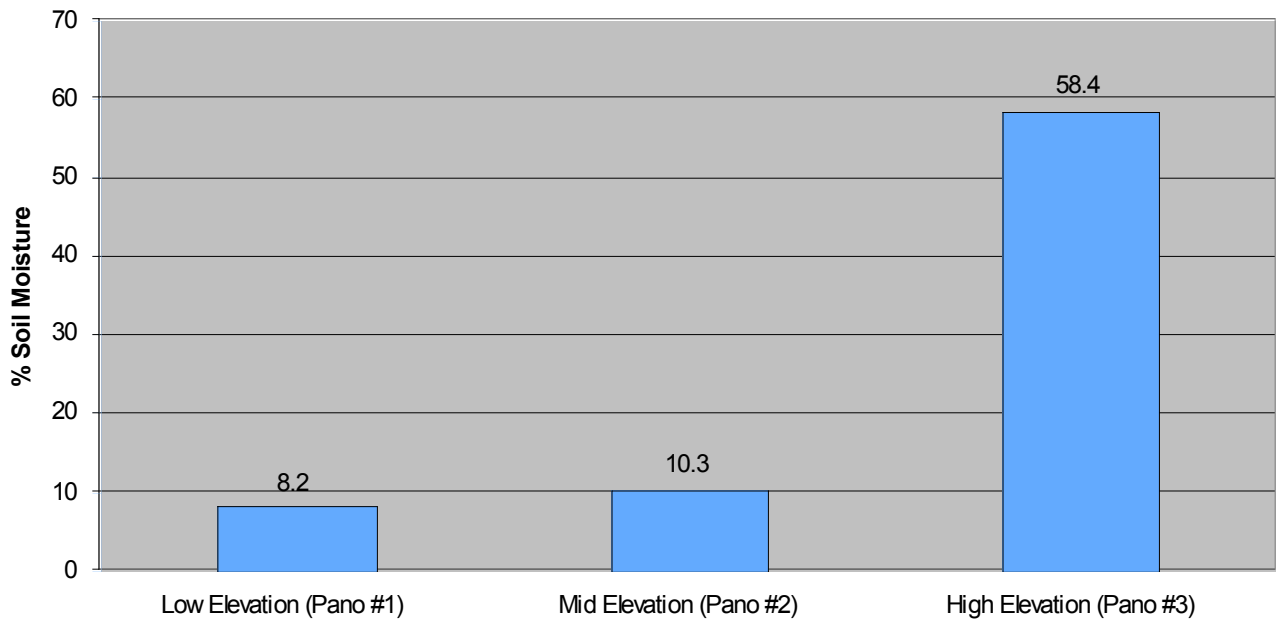


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Soil Moisture in the Cloud Forest



ANNUAL RAINFALL

Month	ANNUAL RAINFALL (mm)	
	Low Elevation (Pano #1)	High Elevation (Pano #3)
September	530.4	671.4
October	866	883.2
November	356	273.4
December	80.6	223.2
January	9.6	78.4
February	59.8	180.4
March	25.6	114.8
April	1.2	28.4
May	115.5	248.7
June	334	346.8
July	268.4	275.9
August	325.5	312.5

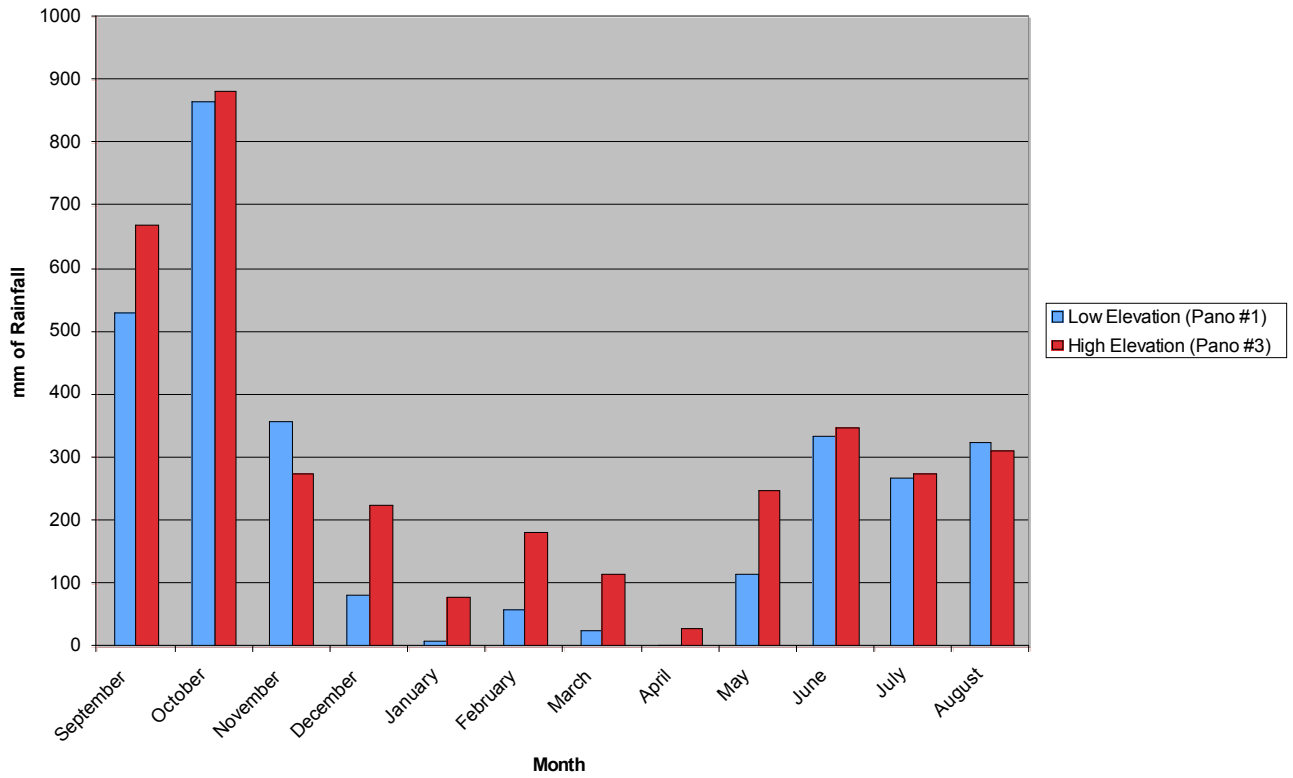


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Annual Rainfall





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PLANT TRANSPIRATION IN THE CLOUD FOREST
Transpiration & Water Student Assessment

Directions: Answer the questions below regarding transpiration and the cloud forest.

- 1) What is transpiration? Explain your answer using scientific vocabulary.

- 2) Examine Panorama #1, Canopy Hotspot #1. What environmental factor is influencing transpiration here? Do you think the plants in this location are transpiring at a high or low rate? Why?

- 3) Examine Panorama #2, Canopy Hotspot #1. What environmental factor is influencing transpiration here? Do you think the plants in this location are transpiring at a high or low rate? Why?

- 4) Examine Panorama #5, Hotspot #1. What environmental factor is influencing transpiration here? Do you think the plants in this location are transpiring at a high or low rate? Why?

- 5) Discuss the relationship between water in an ecosystem and transpiration in plants. How does one impact or influence the other? Use examples from the cloud forest or your local ecosystem to help explain your thoughts.