Geology and Hydrology of a Costa Rican Cloud Forest

Cloudbridge Nature Reserve

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Research Outline

I. My goal in conducting research in a cloud forest near Mt. Chirripó in Costa Rica is to analyze the water systems of that region, and determine its importance to the environment and surrounding communities.

A. Examine the importance of the geologic features and structures in the area, and determine the importance to the water budget.

1. Take rock samples, identify minerals present in rock
2. Determine the mineral's effect on water chemistry
3. Take rock samples, examine the porosity
    a. bake rocks in oven at 120°, determine rock porosity through change in volume.
    b. grain sizes, how well they are sorted and rock type
4. Find soil/rock outcrops, examine soil horizons

B. Use this basic knowledge of the geology to examine the ways in which the cloud forest filters water to the communities.

1. analyze water chemistry of rainfall in forest at high elevations
    a. TDS
    b. pH
    c. Dissolved oxygen
    d. temperature
2. analyze water chemistry in water of streams at the head at high elevations
    a. TDS
    b. pH
    c. Dissolved oxygen
    d. temperature
3. analyze water chemistry in water of streams at the base at low elevations
    a. TDS
    b. pH
    c. Dissolved oxygen
    d. temperature

C. Apply this knowledge of filtering affects to the surrounding communities/towns

1. With topographic maps, determine the drainage basin that includes the cloud forest

2. Find the communities or towns that extract water from this basin
3. Explore these communities, and discuss with families how they get their water (well, treatment facility etc.)
4. Take water samples from the homes and examine the chemistry.

D. Measure the water budget (on a weekly basis, to account for changes in climate and seasons)

1. Create water budget equation
    a. measure stream flow and create a hydrograph
        i. Use Rorabaugh method to determine groundwater recharge from baseflow
    b. measure precipitation
        i. establish various locations for rain gauges
        ii. gather averages per week
            a. Theissen method
            b. Isohytel method
    c. examine water bodies at lower elevations, measure change in storage
    d. using basic water budget equation, find groundwater flow
    e. Quantify evapotranspiration
        i. examine plant types, and stomata qualities
        ii. research amount of evapotranspiration in cloud forest
        iii. (stemflow)?

E. Research the ecology of the Costa Rican cloud forest, and its sensitivity to water systems.

1. Plant types and their sensitivity
2. Climate changes and how they affect these plants
3. The deforestation of the lower elevation rainforest and its effects on the environment
4. Regional animal life, and their sensitivity to changes in climate and water systems