TESS GARDNER – DeVlieg Taylor Undergraduate Research Scholar 2011
Undergraduate in Geology and Earth and Environmental Systems
Idaho State University

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Dear Janet and the DeVlieg Foundation,

I would like to thank you for the truly amazing opportunity of being a DeVlieg undergraduate scholar. Coming from an undergraduate background in Geology and Earth and Environmental Systems, this venture has given me the chance to plunge, hands on, into the ever-fascinating world of ecology and biology. My project, which focuses on the implications of natural disturbance regimes on primary productivity, has opened my eyes to a whole new realm of earth sciences.

My summer at Taylor Wilderness Research Station was absolutely unforgettable. Not only is the flight into the wilderness full of breathtaking views, life at Taylor itself is full of dynamic beauty. The accommodations in the DeVlieg cabin are incredible and each day in the wilderness seems to unveil a new adventure.

This summer, I was able to obtain metabolism data through the use of microcosm chambers, collect periphyton filter samples, estimate the surface area of rocks utilized in metabolism studies, record photosynthetic active radiation (PAR) light data, gather stream discharge data, collect stream nutrient samples, and monitor tributary flow regimes throughout my study reaches within six Big Creek tributaries. Since I have been back at ISU for the fall semester, I have begun processing the periphyton filter data as a step to calculate periphyton biomass and gross primary productivity (GPP) of the streams incorporated within the research. After the filter data has been processed, GPP and biomass data will be compared with corresponding light regimes, flow disturbance, tributary nutrient composition, and previously compiled invertebrate survey data to test for relationship correlations.

I am heading back into Taylor tomorrow morning with a previous DeVlieg undergraduate scholar, Matt Schenk, and a geosciences Ph.D. student to collect stream mobility data through the tracking of passive integrated transponder (PIT) tagged rocks within the study tributaries. The streambed mobility parameter of the study will move to further accommodate for the scouring effects of flow disturbance on lotic primary producers.

This project would not have been possible without the support of the DeVlieg Foundation. I am honored to have been able to partake in this opportunity and would like to thank all of you for making this research project possible.

Sincerely, **Tess Gardner**

How is Primary Productivity Affected by Disturbance in Wilderness Streams of Central Idaho?

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Abstract – In the western U.S., changing climate has been linked to shifts in terrestrial and hydrologic disturbance regimes such as fire and floods, and these may affect stream ecosystems by altering factors that control aquatic primary production. However, there have been few investigations of the mechanisms by which this may occur, largely because measurements of primary production can be methodologically challenging and surrogates for this process (e.g., biomass of primary producers) are usually used instead. I propose to investigate drivers of primary production in an effort to assess impending effects on this process of climate change and shifts in natural disturbance regimes. Using metabolism microcosms, I will measure primary production in six streams of the Big Creek watershed in the Frank Church 'River of No Return' Wilderness, central Idaho. These streams encompass diverse gradients of solar insolation, temperature, substrate stability, and hydrologic regime within a relatively small area accessible from the Taylor Wilderness Field Station, which will allow me to analyze the relative role of these various factors for stream productivity. In particular, past research has suggested that variation in light (largely a function of past wildfire disturbance) and streambed disturbance (driven by flow regime and substrate character) may play important roles in governing both primary and secondary (invertebrates and fish) production in these streams, but an explicit test has not been conducted due to a lack of direct measures of primary production. Therefore, in addition to primary production, in each stream, I will measure light input, streamflow, and streambed disturbance to evaluate their relative effects, but will also assess other factors that affect primary production and must be accounted for as covariates, such as temperature, nutrients and potential grazing pressure. My study will provide basic information about primary production in these wilderness streams and may provide insight into how this important ecosystem process may occur under future conditions.

Objectives

This project will help determine the factors that regulate primary production in wilderness streams of central Idaho, and, within this domain of streams, will characterize the relationship between biomass and rates of production. As global climate change is likely to alter the drivers of primary production via changes in disturbance and hydrologic regimes, this study will help assess how climate change may impact primary production in the future. Objectives encompassed in the study will include:

1) Measure and monitor periphyton (primary producers attached to the streambed) standing crop biomass and rates of primary production in six tributaries of Big Creek within the vicinity of Taylor Wilderness Field Station.
2) Measure and monitor a suite of environmental factors which have the potential to affect periphyton biomass and primary production. This objective will include the analysis of both explanatory and covariate environmental factors. Explanatory components encompassed in this study will include solar insolation and streambed disturbance affected by fire and high flows. Covariate factors of temperature, nutrient concentration, and invertebrate grazing will also be addressed to assess their underlying importance to lotic primary production.

By accomplishing these objectives, the study aims to address the working hypothesis that gross primary production (GPP) increases with solar insolation and streambed disturbance, but that the relationship is interactive and non-linear, such that as disturbance increases beyond a threshold, GPP stabilizes or declines.