

## Lab: Energy Dynamics in an Ecosystem

### Environmental Science

#### BACKGROUND

Almost all life on this planet is powered, either directly or indirectly, by sunlight. Energy captured from sunlight drive the production of energy-rich organic compounds during the process of photosynthesis. These organic compounds are the **biomass** of the ecosystem. The biomass is equivalent to the **net primary productivity**, which is the net amount of energy captured and stored by the producers. This is also the amount of energy available to the next trophic level. The net primary productivity is derived from the **gross primary productivity**, which is a measure of the **total amount of light energy that was captured and converted into chemical energy (organic compounds)** during photosynthesis. To obtain the **net productivity** you must subtract all the energy that was used in cellular respiration and ultimately released as heat, from the gross productivity.

In terrestrial systems, plants play the role of producers. Plants allocate that biomass (energy) to power their life processes or to store energy. Different plants have different strategies of energy allocation that reflect their role in various ecosystems. For example, annual weedy plants allocate a larger percentage of their biomass production to reproductive processes and seeds than do slower growing perennials. As plants, the producers are consumed or decomposed, and their stored chemical energy powers additional individuals, the consumers, or trophic levels of the biotic community. Biotic systems run on energy much as economic systems run on money. Energy is generally in limited supply in most communities. Energy dynamics in a biotic community is fundamental to understanding ecological interactions.

#### Learning Objectives

- To explain community/ecosystem energy dynamics, including energy transfer between the different trophic levels.
- To calculate biomass, net primary productivity (NPP), secondary productivity, and respiration, using a model consisting of brussel sprouts and butterfly larvae.

**There are two parts to this lab:**

**Part1:** You will estimate the net primary productivity (NPP) of Wisconsin Fast Plants over several weeks.

**Part 2:** You will calculate the flow of energy from plants (producers) to butterfly larvae (primary consumers). These calculations will include an estimate of (a) secondary productivity, which would be the amount of biomass added to the larvae and therefore available to the next trophic level, and (b) the amount of energy lost to cellular respiration.

# Lab Energy Dynamics In An Ecosystem Answers

**ML Yell**



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