

## Investigation 2: The effect of sunlight on biomass

### Moderator comments

Personal engagement x/2	Exploration x/6	Analysis x/6	Evaluation x/6	Communication x/4	Total x/24
1	2	3	2	2	10

### Evaluation

Mark	Descriptor
1–2	<ul style="list-style-type: none"> <li>Strengths and weaknesses of the investigation, such as limitations of the data and sources of error, are <b>outlined</b> but are restricted to an <b>account of the practical or procedural issues</b> faced. 1</li> <li>The student has <b>outlined</b> very few realistic and relevant suggestions for the improvement and extension of the investigation. 1</li> </ul>
3–4	<ul style="list-style-type: none"> <li>A conclusion is <b>described</b> which is relevant to the research question and supported by the data presented. 3</li> <li>A conclusion is described which makes some relevant comparison to the accepted scientific context. 3</li> </ul>
<b>Moderator's award</b> 2	<p><b>Moderator's comment</b></p> <p>A conclusion is drawn that is relevant and, as far as can be judged, is supported by the data. There are a lot of other factors that have not been considered (or controlled), making it difficult to accept the conclusion. There is an attempt to set the conclusion in a scientific context. Some other factors that may have influenced the investigation are identified. These could have been controlled by more appropriate site selection. Some important factors were not considered (the only one mentioned is irrigation and there are no details). The improvements remain vague (bigger samples, longer drying time, more precise measuring methods).</p>

### Conclusion

The data supports the null hypothesis that there is no difference in biomass of grass in the sun and in the shade.

A possible explanation is as follows. Grass is a primary producer of biomass because it can fix inorganic matter (carbon dioxide). Biomass is therefore an indirect measure of productivity of an area. Grass in the sun receives more sunlight to use for photosynthesis. During photosynthesis, light energy is converted into chemical energy. When there is more light, more light energy is absorbed and used for the production of more chemical energy. Productivity can then said to be greater in the area with a greater biomass. In this experiment, the results did not show a statistically significant difference in biomass. Even though the average biomass of the grass in the sun was greater than that of the shaded area (table 1 and 2), it was not significant. This could be due to the role of other variables, such as amount of water and limited sample size.

An: Interpretation weakened by poor presentation of the analysis.

**Comment [PB18]:**  
Ev: conclusion set in scientific context

**Comment [PB19]:**  
Ev: Relevant conclusion but difficult to support from the limited data

**Comment [PB20]:**  
Ev: Consideration of uncertainties is too vague.

## Limitations

There are other variables that may have affected the biomass of the grass in each area. The amount of water each area receives could not be controlled. Quite often, there are sprinkles watering the grass. The amount of water each area receives can affect the rate of photosynthesis, which will affect grass growth. If the grass in either area received more water, the results could be an over estimation. In my procedure, the sample size was sufficient, however not large enough to show significant results. The data in the shaded area was more variable than the data in the sun exposed area (Figure 2). The variation could possibly be decreased if the sample size was increased. Additionally, the 10cm<sup>2</sup> quadrats were sometimes difficult to determine and measure precisely. The shade sampling area was near a recreational area, where a cement 4-square court is built. The shade area may experience more direct human contact and trampling, resulting in less grass. The grass was patchier. This could result in an under estimation of the biomass of the grass in the shade. Also, due to the warm tropical climate and frequent sun, the shade area may be used more than the sun-exposed area for shade to avoid sun exposure.

Ev: Not clear. Was the sample size big enough or not? Clearly the evidence suggests that it was not.

Ev: Ought to refer to standard deviations

Ev: Identifies a number of factors that may also influence the outcome.

## Modifications

To be more precise with measurements, I would construct a meter-squared quadrat that is pre-divided into 100 ten centimeter squared quadrats. This would allow much more uniform precision, decreasing human error. When biomass was taken, some grass samples were still moist, and did not dry fully. In order to ensure that water mass was not a factor affecting grass biomass, the grass would have been left longer to dry, if time permitted. An experiment that controls the amount of water each area receives, as well as human contact, with more precise measuring methods would be ideal and more accurate in determining if there is a difference in biomass of grass in the sun and the shade.

Ev: The modifications do not concern most of the weaknesses identified.

Ev: Did not consider the impact of management other than irrigation.

Ev: Or use an oven and repeat the measurement of mass until it is constant.

Ev: Too vague. Lacks concrete suggested improvements e.g. put a fence around the areas to keep out humans.