Fundamentals of Ecology Writing Lab Reports: Results and Discussion

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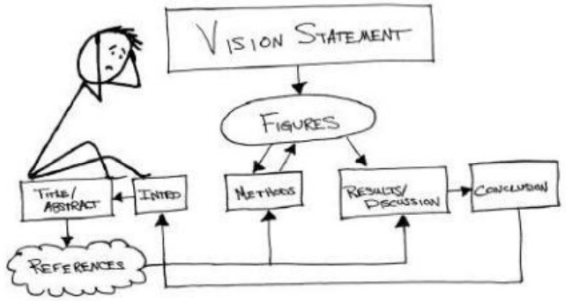
23 May 2023

Please sit with your groups!

THURSDAY - PRACTICALS - ENV 220			Week	Teacher	Groups	Room	Important deadlines
22/02/24	11h15-13h	Introduction to practicals	1	J. Deluigi	Terrestrial	GRC001	
29/02/24	11h15-13h	Setting up experiments in the field	2	All TAs	Terrestrial	GRC001	Inform the experimental setup to TAs by email by 28/02/24
7/3/24	11h15-13h	Scientific writing part I	3	D. Touchette	All groups	GRC001	
14/03/24	11h15-13h	Introduction to R	4	All TAs	All groups	GRC001	Flip room lecture to watch before 14/03/24 (on moodle)
21/03/24	11h15-13h	How to do statistical analyses	5	C. Bachofen	All groups	GRC001	
28/03/24	11h15-13h	Field measurements 1	6	All TAs	Terrestrial	GRC001	
4/4/24	Easter Holiday						
11/4/24	11h15-13h	Field measurements 2	7	All TAs	Terrestrial	GRC001	Mid-term report provided to Tas by 12/04/24
18/04/24	11h15-13h	Data vizualization in R	8	J. Deluigi & M. Bergström	All groups	GRC001	
25/04/24	11h15-13h	Field measurements 3	9	All TAs	Terrestrial	GRC001	
2/5/24	ENAC Week						
9/5/24	Ascension Day - Holiday						
16/05/24	11h15-13h	Field measurements 4	10	All TAs	Terrestrial	GRC001	
23/05/24	11h15-13h	Scientific writing part II	11	D. Touchette	All groups	GRC001	Weighting of plant material in GR B2 423 before 24/05/24
30/05/24	11h15-13h	Questions / Discussion	12	All TAs	All groups	GRC001	
FINAL REPORT SUBMITTED on MOODLE BY 7/06/24							



How to write the report

What is a lab report?

A document that outlines the results of a scientific experiment or investigation.

It typically includes:

- Description of the experiment or investigation
- Methodology used
- Data collected
- Analysis of the data
- Conclusions drawn from the analysis (interpretation).

The assignment

Rough draft:

- Introduction and Methods
- Maximum 2 pages
- Intro includes ≥ **4 references**
- Due April 12th

Final report:

- Maximum 5 pages
- Includes Table(s) & Figure(s)
- Discussion includes **≥ 2 references**
- Due June 7th

Do NOT copy previous reports.

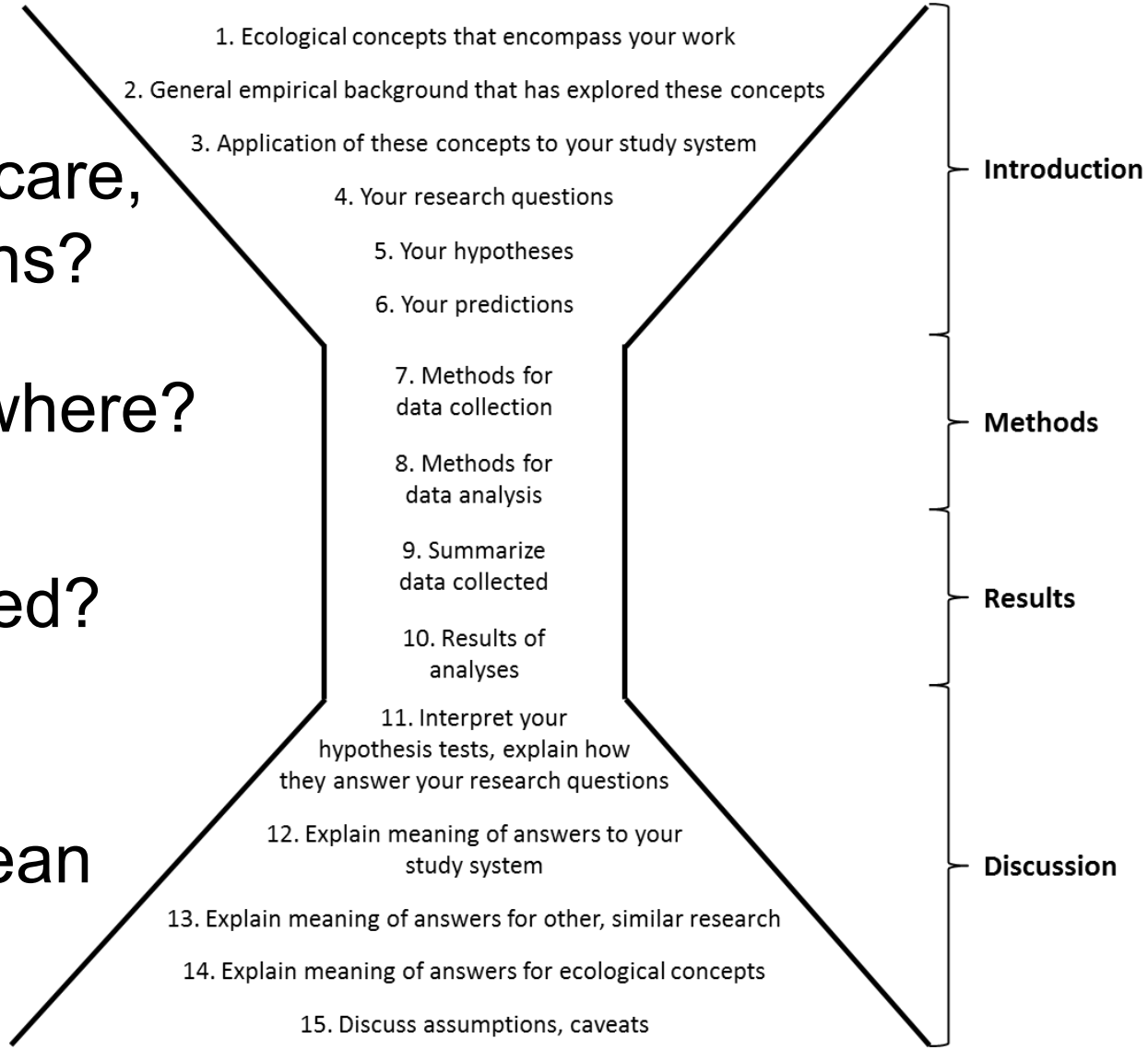
Lab report format

What topic, why care, and expectations?

How, what, and where?

What happened?

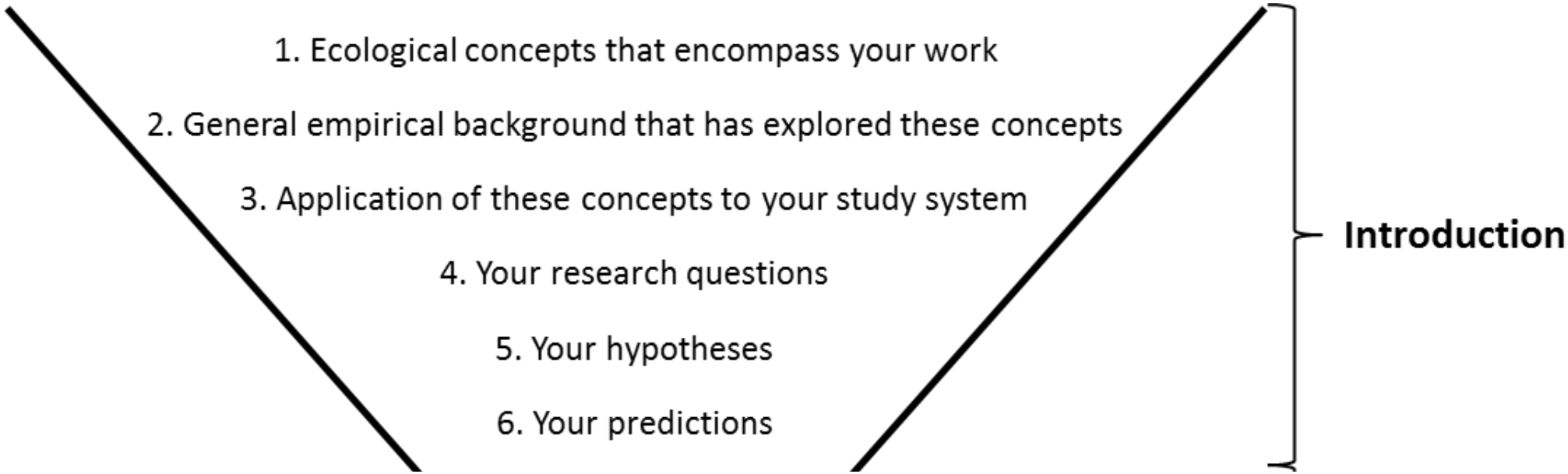
What does it mean and why?



Common areas to improve Introduction & Methods

1) **Connection between context and research question**

   E.g., Providing background on how temperature affects plant growth, then forming a hypothesis on soil moisture. How is temperature and moisture connected?



Common areas to improve Introduction & Methods

2) Using specific language and useful information

E.g.1, Instead of "We measured soil humidity,“ use "We measured soil humidity with a TDR-100 at 10 cm depth".

E.g.2, “We ended up with a excel spreadsheet for our dataset”, “In the laboratory”, “To produce the figure we need”, “Statistical tests are needed”… not required

E.g.3, Use past tense in the Methods, and you don’t need to sub-sub-divide the sections ☺

Common areas to improve Introduction & Methods

3) Incorporating references

E.g., Instead of “Carbon cycling in streams is influenced by various factors (Smith et al., 2018),” use “high levels of terrestrial organic carbon inputs have been shown to increase carbon export from streams (Aufdenkampe et al. 2016).”

Introduction

Lichens are prevalent and widespread in polar and alpine environments (Printzen et al. 2012, Armstrong 2017). They are complex holobionts, defined as a symbiotic association of fungal mycobionts, algal/cyanobacterial photobionts, and often with a non-photosynthetic microbial community (Miral et al. 2022). These complex microbial associations make lichens highly adapted to hostile conditions of cold habitats (Printzen et al. 2012). Alpine

Reference section (end of the report)

Printzen C, Fernández-Mendoza F, Muggia L *et al.* Alphaproteobacterial communities in geographically distant populations of the lichen *cetraria aculeata*. *FEMS Microbiol Ecol* 2012;**82**:316–25.

Prjibelski A, Antipov D, Meleshko D *et al.* Using SPAdes de novo assembler. *Curr Protoc Bioinformatics* 2020;**70**:e102.

Pulliainen J, Luojus K, Derksen C *et al.* Patterns and trends of Northern Hemisphere snow mass from 1980 to 2018. *Nature* 2020;**581**:294–8.

Questions on Introduction & Methods?

Results

Provides a concise summary of the data you collected and analyzed during the course of your investigation. Reports the empirical results, observations, measurements, and results of any statistical analyses performed.

NO INTERPRETATION!

~2 paragraphs with at least one Table/Figure

Results

A good Results section should:

- Accurately and objectively represent the data collected.
- Describe the results of the statistical analyses performed.
- Use Figures and Tables to effectively show data, and refer to them in the text.
- Be organized following the flow of the experiment.

A good Results section should NOT:

- Interpret the results.

16S amplicon sequencing generated 394 unique ASVs, after processing (Figs 2 and 3, Supplemental File S2). The prokaryotic community was composed exclusively of bacteria. The dominant bacterial phylum (63% on average) was *Proteobacteria* (recently renamed *Pseudomonadota*; (Oren and Garrity 2021), followed by *Firmicutes* (renamed *Bacillota*) (13.5%), and *Acidobacteria* (11.5%). Only

Which one is better?

a) The mean heights of the plants in the control group, low nitrogen group, and high nitrogen groups were 20.3, 25.1, and 29.6 cm, respectively.

b) The heights of the plants in the different groups were 20.3, 25.1, and 29.6 cm.

Which one is better?

a) The results were different between groups.

b) Using a one-way ANOVA to calculate the effect of nitrogen fertilizer level on plant height, the results demonstrated statistically significant ($p = .03$) height differences between groups (Table 1).

Which one is better?

a) The correlation was significant, indicating the increase in temperature causes the increase rate of decomposition.

b) The correlation was significant, indicating a strong relationship between temperature and decomposition.

Which one is better?

a) **RESULTS:**

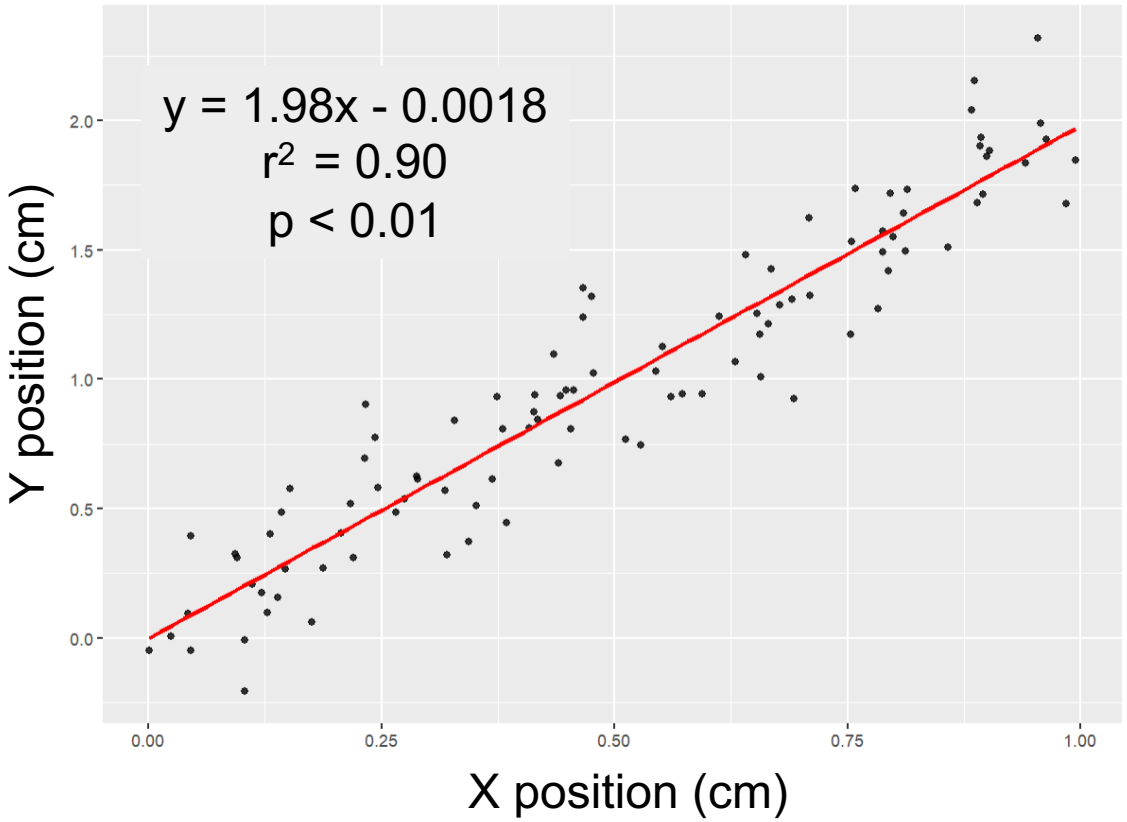
The difference in plant growth demonstrates that fertilizer application is critical to maximizing yield.

b) DISCUSSION:

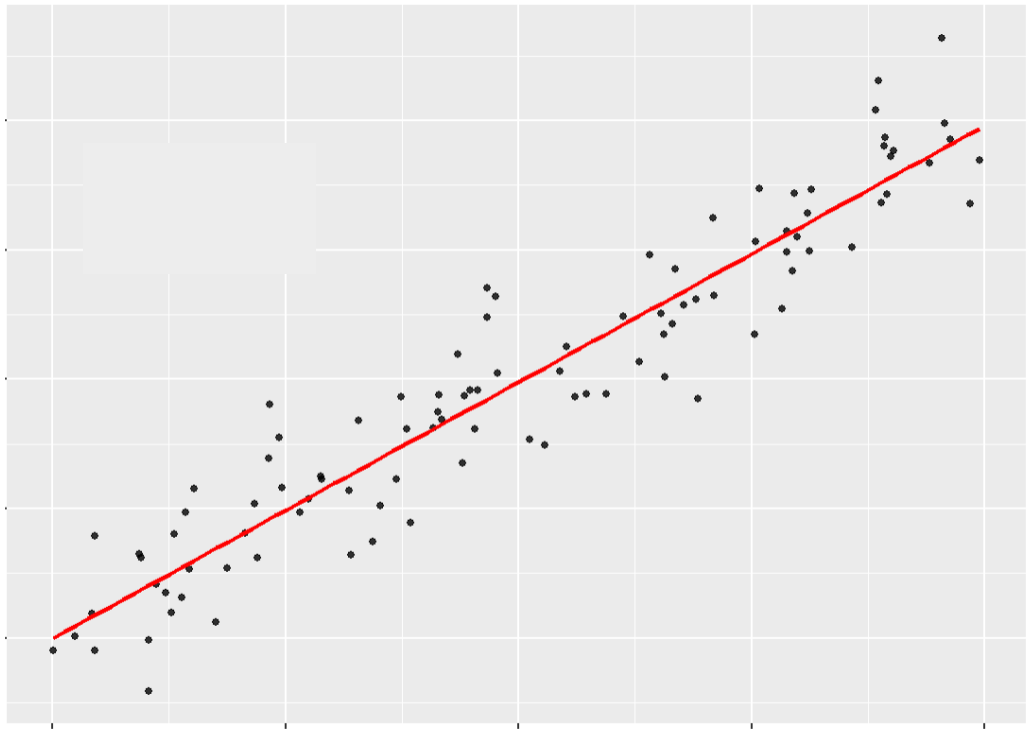
The difference in plant growth demonstrates that fertilizer application is critical to maximizing yield.

Which one is better?

a)



b)



Which one is better?

a)

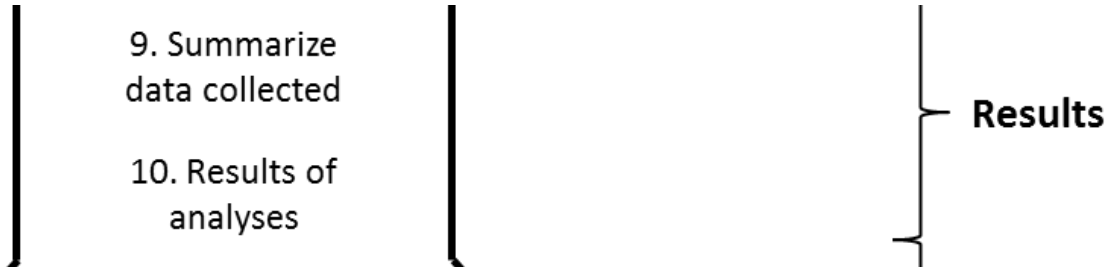
ID	Length	Mass
C04	12.2342342	1.2341423
E14	17.1523423	1.423432
N41	15.143423	1.043232
C22	1.4234123	1.6532423

b)

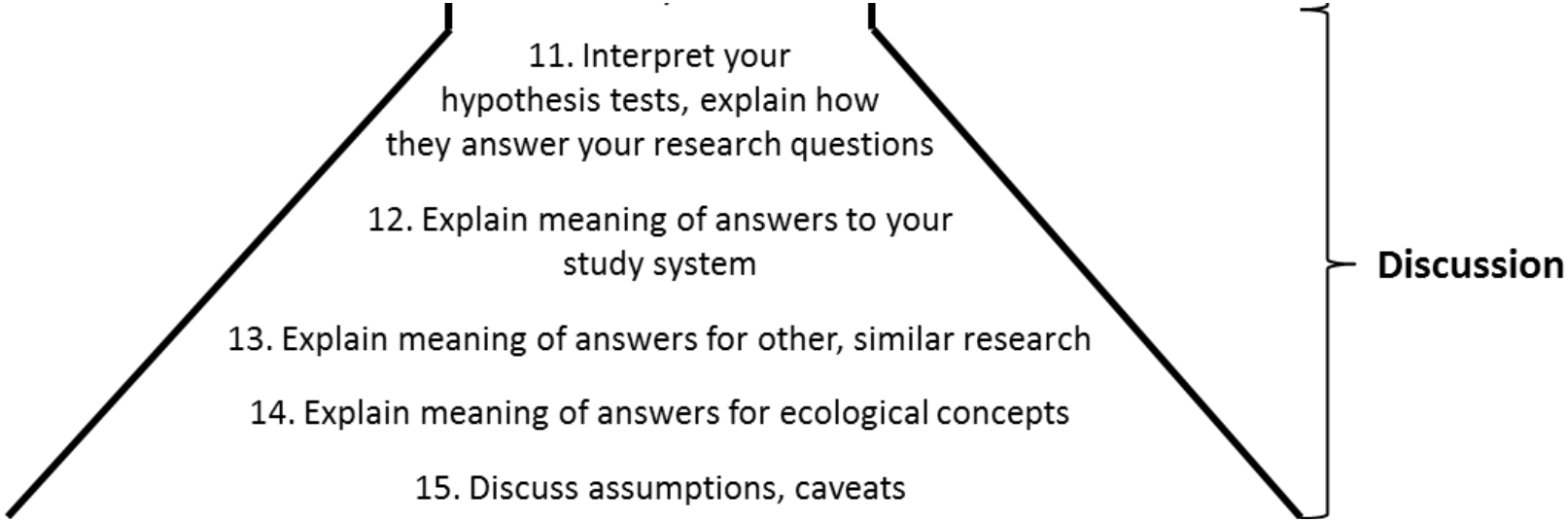
ID	Length (cm)	Mass (g)
C04	12.2	1.23
E14	17.1	1.42
N41	15.1	1.04
C22	1.4	1.65

In your groups…

1) What are the key results (i.e., values) that will be included in your Results?
2) Draw one Figure.
3) Outline one Table.



Discussion



Effectively summarizing and interprets the results obtained during the experiment, including comparing with expectations (hypothesis), considerations of limitations, and the relation to larger scientific concepts and theories.

≥ 3 paragraphs

Discussion

A good Discussion section should:

- Describe the key findings of the analysis.
- Address how the results support the initial hypothesis.
- Include citations to further support conclusions or identify how results do not match previously reported results.
- Describe what the results of the experiment mean for the broader scientific concepts described in the Introduction.

A good Discussion section should NOT:

- Include new data or results.
- Provide personal opinions or unsupported claims.

Discussion

2019). The dominance of *Cyanobacteria* does not seem to be universal as this phylum was present at very low amounts in our samples (0%–0.1%), this is perhaps due to *Uapishka* snow being sampled early in the winter when the snow is still mostly fresh, powdered, and frozen, while *Cyanobacteria* tend to be more abundant in late season snow (Larose et al. 2010). Low abundance of

rochloris). High abundance and ubiquity of lichen-associated taxa in the snow replicate samples regardless of other variables (anthropogenic traffic, altitude, vegetation cover, month) suggest that these taxa are part of the core alpine tundra/boreal snow microbiome. As they were able to maintain viability in the snow environment (as well as having flagellar genes in the algal/bacterial isolates), it is possible that these lichen-associated fungi, algae, and bacteria utilize the snow medium to "mix & swap" their symbiotic partners and to disperse throughout the ecosystem during snowmelt, and potentially to nearby mountain ranges including above tree-line summits during heavy winds and snowstorms.

Which one is better?

a) The higher concentration of nitrogen observed in Treatment A compared to Treatment B indicates that the addition of organic compost resulted in increased nutrient availability in the soil, supporting the hypothesis that organic amendments enhance soil fertility.

b) I think the nitrogen levels in Treatment A were higher because the organic compost worked really well in improving the soil quality.

Which one is better?

a) The higher DOC concentrations downstream are probably due to pollution.

b) The higher DOC concentrations downstream may be due to pollution, which is shown to increase organic matter concentrations in nearby streams (Smith et al. 2017).

Which one is better?

a) The species diversity in the logged forest area was low, so logging is bad for the environment.

b) The loss of habitat complexity as a result of logging may have led to the decline in species diversity, highlighting the importance of maintaining intact forest ecosystems for biodiversity conservation.

Which one is better?

a) The relatively small sample size of the observed populations may have restricted the generalizability of our findings to a larger ecological context.

b) We didn't have a lot of data, so our findings might not mean much.

Improve these examples…

These different considerations lead us to the formulation of different hypotheses. First one could state that a greater light exposure leads to a greater algae growth. On the other hand, the thrive of algae could also negatively impact leaves breakdown.

Based on these studies, we hypothesize that greater light exposure will increase the rate of leaf decomposition. While not quantified in this study, we believe this is a result of higher algal growth, which attracts additional decomposers.

Improve these examples…

Three bags were collected every two weeks. The leaves were cleaned, dried, and weighed.

Three litter bags from each of the two treatments were collected every 2-3 weeks. In the lab, the leaves were gently removed from the bags, rinsed of debris and invertebrates, and allowed to dry in an oven at 60^{o}C for one week. The dry mass of the leaves from each pack was then measured.

Improve these examples…

The plants all grew 10 to 30 cm in height. The plants which experienced drought grew less on average.

The average growth of plants in the drought conditions was 12.5 ± 5.3 cm, while in the normal conditions was 19.9 ± 6.7 cm. As determined by a t-test, the plants under drought conditions grew significantly less ($p = 0.03$).

Improve these examples…

As it was previously reported, the most accurate model to fit our olive tree leaves decomposition appears to be zero order kinetics. However in most natural processes of decomposition, first order decomposition is often observed. The difference in these results is not known.

Our finding, that leaf decomposition follows zero order kinetics, differs from previously reported studies (Evans et al. 2005; Lee et al. 2012). This difference could result from the experimental design of our study, which took place during the Spring in which the temperature of the stream increased throughout the experiment.

Lab report format

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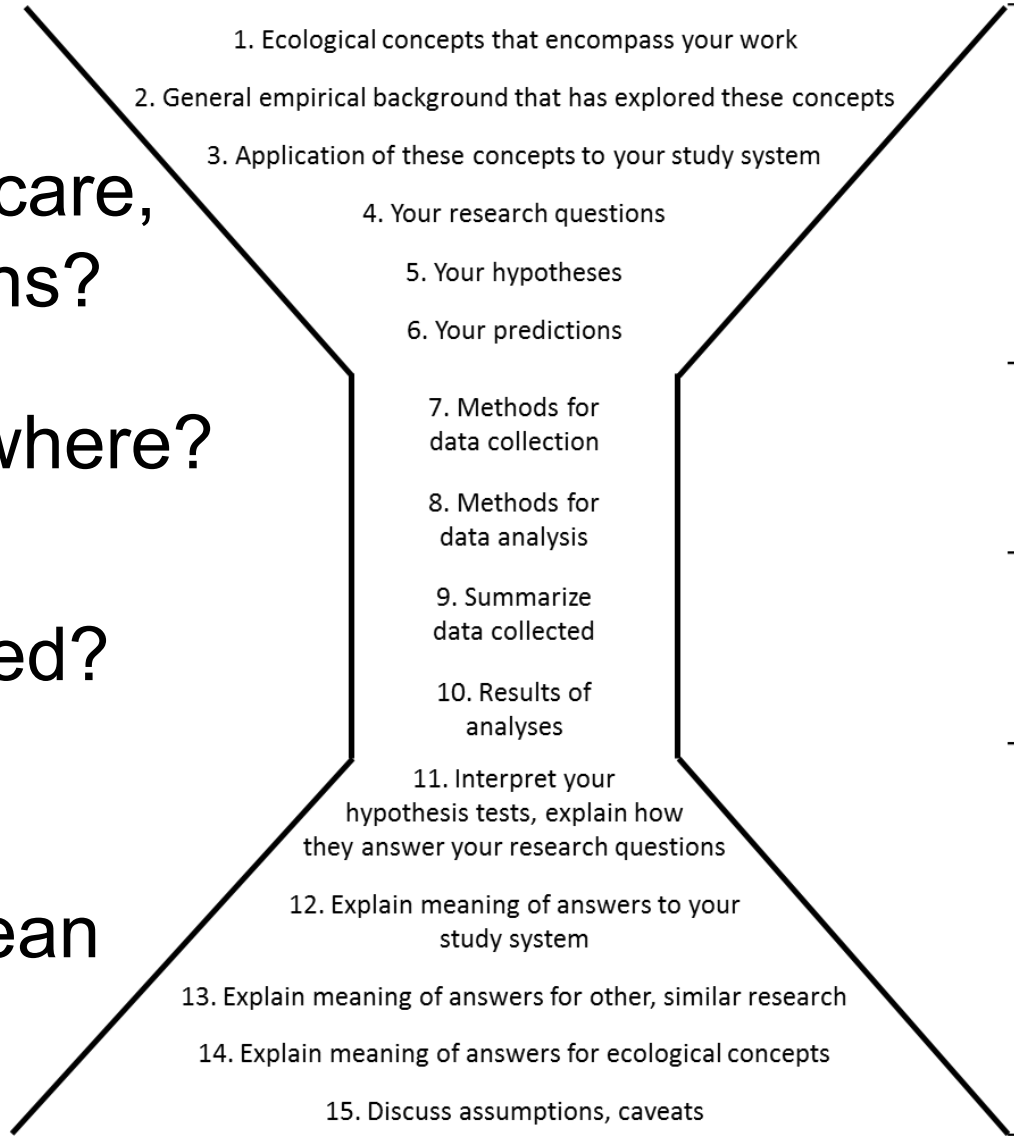
What happened?

What does it mean and why?



Introduction

3-4 paragraphs

Methods

≥ 2 paragraphs

Results

~2 paragraphs

≥ 1 Figure/Table

Discussion

≥ 3 paragraphs

In your groups…

1) Describe the outcome of your experiment in one sentence.
2) Determine if your hypothesis was correct.
3) Identify 2 broader implications of your results.