Biology for environmental management pocketguide

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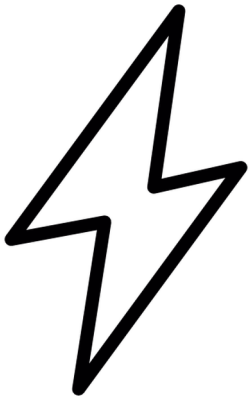
Chapter 1

Introduction



Welcome to biology for environmental management. The goal of this course is to examine global grand challenges that we face through the lens of solutions from science. Science can be magical because it provides us with incredible outcomes in so many domains of the human endeavour. Here, we work to find the magic spells from science for the environment to promote the well-being of people and the planet.

If you are electing to engage with this learning opportunity formally for BIOL4265 at York University, here is the official course outline.

There is an opportunity for us to mobilize science to do social good. We we can leverage what we know, what we do not know, i.e. uncertainty, and what we need to know, to enable conservation, protection, and better management of the environment. This benefits the environment. It benefits us. Here are the ten simple rules the underpin an evidence-informed philosophy for the entire course (Lortie and Owen, 2020).

Learning outcomes

1. Critically read environmental science peer-reviewed journal publications.
2. Reverse-engineer the critical reproducible science tools using peer-reviewed publications.
3. Appreciate the extent and scope of environmental challenges we face globally.
4. Explain the balance between direct human needs and environmental health.
5. Do a formal synthesis such as meta-analysis or systematic review.
6. Effectively communicate scientific synthesis findings to the public.

Structure

Module 1.

Read a total of 9 useful peer-reviewed science publications.
Test your practical knowledge by applying to a new challenge.

Module 2.

Choose your own adventure (i.e. a dimension of an environmental challenge you care about).
Draw a comic or infographic to communicate challenge to the public.
Write a short synthesis paper on this topic for a scientific audience.

Rationale

For each environmental management challenge case examined, students will be responsible for reading the literature provided at their own pace. The professor will facilitate learning as needed.

The goal is to become more literate environmental citizens and develop, consolidate, and evaluate critical environmental science thinking and problem solving.

The first module highlights some of the most pressing challenges and more common replicable tools used by the scientific community. The summative test is provided immediately at the start of course to enable asynchronous work and provide a clear, transparent, and testable outcome for this module.

The second module provides an opportunity for students in this upper-year offering to do a deep dive into a topic that care about deeply. The dimension of the challenge and the solution they pick is open provided it is well articulated. The graphical assignment is a stepping stone or scaffolding to the final paper.

It is also a chance to be as creative as students elect to be with communicating science to the public. The final paper is an Ignite, Forum, or Mini-review format contribution on their topic appropriate for a general science journal. These types of papers are increasingly common and important in science and used extensively for evidence-informed decision making by leaders.

License

Chapter 2

Outline

Here is an overview of the content and topics covered in this course of study. Complete are your own pace, asynchronously. However, please check the official course outline if you are doing the work for credit to ensure you submit summative work at the appropriate times.

Instructions

Read and and use the papers to link environmental challenges that we collectively face with potential solutions. Only one solution per challenge is suggested here, but there are many dimensions to each challenge and numerous solutions too.

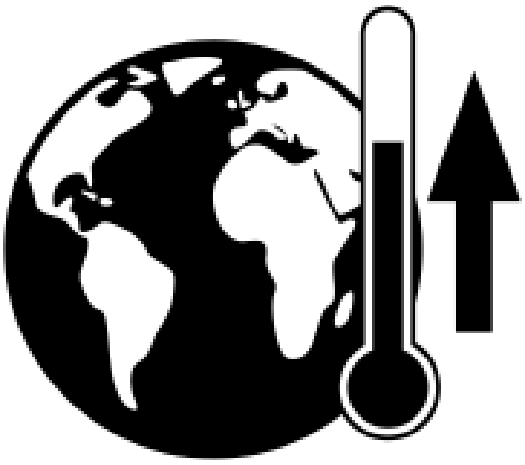
The link to decks are optional. They are my interpretation of the papers from a science-to-magic philosophy and identify the salient elements and concepts from each reading that resonated with my perspective as an ecologist.

Schedule

week	grand challenges
1	[Ten simple rules to facilitate evidence implementation in the environmental sciences](https://
2	[climate change](https://agupubs.onlinelibrary.wiley.com/doi/abs/10.1029/2010GL042845) & [
3	[pollinator declines](http://science.sciencemag.org/content/339/6127/1611) & [deck](https://fi
4	[invasive species](https://link.springer.com/article/10.1007/s10530-017-1461-x) & [deck](https:
5	[land use challenges](https://esajournals.onlinelibrary.wiley.com/doi/full/10.1002/ecs2.2367) &
6	prep for test
7	[take-home test](http://www.nrcresearchpress.com/doi/10.1139/cjfas-2016-0520#.W6Uwoy-ZM
8	choose your own adventure (i.e. challenge): search lit, read, sketch ideas
9	complete & submit scientific comic or infographic
10	choose your own adventure: write paper (review, systematic review, or meta)
11	choose your own adventure: write paper
12	choose your own adventure: submit final synthesis paper

Chapter 3

Climate change



Learning outcomes

1. Explore one set of dimensions associated with a changing climate.
2. Link science for cities to your life.

3. Explore one tool that can enable replicable solutions.

Context

We experience weather but live with climate. Climate is complex. Climate change has both effects on us and is a response to many drivers including anthropenic processes. The reading provided examines urban effects specifically (McCarthy et al., 2010). Use the ten simple rules suggested to structure your analysis of this paper (Lortie and Owen, 2020). There is at least one solution that can enable better science. Replication and being able to test the same ideas again can be done using an open-source, and free, programming language to work with data, draw plots, and do statistics. R is one such tool, and it can be used to promote solutions for others to try with their challenges because the code can be shared (i.e. fondly recall math classes, show your work), and this documentation of science using data improves our solutions (Lortie, 2017).

Reflection questions

1. What are some of the other dimensions of climate change?
2. What tools or other solutions do scientists in many fields use to address a changing climate?
3. What is the biggest challenge of this issue that must be addressed and would R help?

Formative checklist or steps

1. Read the paper.

2. Consider the questions provided, to guide your thinking and practice implementing evidence to do magic (i.e. potentially use science to address challenges). These are not graded, and the purpose is to reflect and actively engage with readings.

3. Review the slide decks (optional) after you read and consider the two papers to see if similar concepts resonated with you.

Chapter 4

Pollinator declines

Learning outcomes

1. Appreciate the relative importance of pollinators globally.
2. Identify the links between pollinators, plants, and functional ecology.

3. Explore one tool that can enable replicable solutions.

Context

We need to eat. Pollinators provide many fundamental ecological services including interactions with plants that we use for crops and sustenance. Most

flowering plants are not wind pollinated. This reading explores co-occurrence patterns between plants and pollinators to document long-term declines (Burkle et al., 2013). Not great news. However, there are solutions - many. One of the most exciting to me is citizen science. Citizen science is a powerful tool for conservationists (McKinley et al., 2017). It is also profound because we are all citizens, together, and scientific thinking comes naturally to humans. We love to count, observe natural systems, and have strong inherent tendencies to connect with nature. This is a solution for many global grand challenges associated with the environment.

Reflection questions

1. Does the species/taxa of pollinators matter?

2. Citizen science can measure processes, but can it also be used to help conserve or protect or restore too?

3. How can citizen science at universities be better enabled? How do we link what we learn with what we do?

Formative checklist or steps

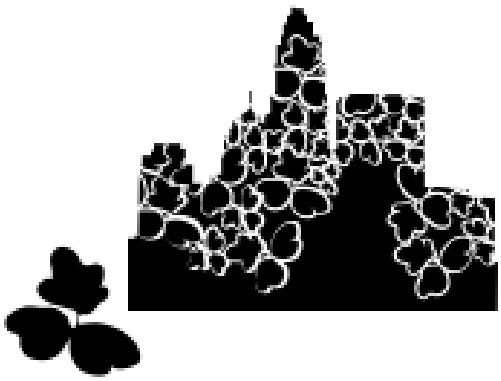
1. Read the paper.

2. Consider the questions provided, to guide your thinking and practice implementing evidence to do magic (i.e. potentially use science to address challenges). These are not graded, and the purpose is to reflect and actively engage with readings.

3. Review the slide decks (optional) after you read and consider the two papers to see if similar concepts resonated with you.

Chapter 5

Invasive species



Learning outcomes

1. Be able to define invasive species.
2. Describe some of the ways that ecologists test invasive species.

3. Examine whether a grand challenge needs a small or large (even global) team.

Context

Invasive species are a global issue. Introduced species that become invasive can dramatically and irrevocably modify ecosystems. The paper provided here is an exceptional example of leveraging fundamental science, i.e. biogeography, with the contemporary study of this issue (Nielsen et al., 2017). To study a species from one place in another, particularly between continents, teams in science can do the work more efficiently and more effectively. Team science is thus a logical solution to this issue (Goring et al., 2014). As you know from your science work, collaboration is not always easy though particularly when the work is being evaluated - whether in a class for groupwork or by a university of its researchers or by funding agencies in contrasting the merit of a researcher. Working with others to tackle global grand challenges is critical, but we also need to adapt how we value work in teams in science.

Reflection questions

1. What is biogeography?

2. Are invasive species always 'bad' or problematic?

3. How we up-value scientists that are more inclusive and collaborative?

Formative checklist or steps

1. Read the paper.

2. Consider the questions provided, to guide your thinking and practice implementing evidence to do magic (i.e. potentially use science to address challenges). These are not graded, and the purpose is to reflect and actively engage with readings.

3. Review the slide decks (optional) after you read and consider the two papers to see if similar concepts resonated with you.

Chapter 6

Landuse challenges

Chapter 7

Test prep

Chapter 8

Test

Chapter 9

Synthesis science

Chapter 10

Scientific communication

Chapter 11

Meta-analyses

Chapter 12

Paper writing

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