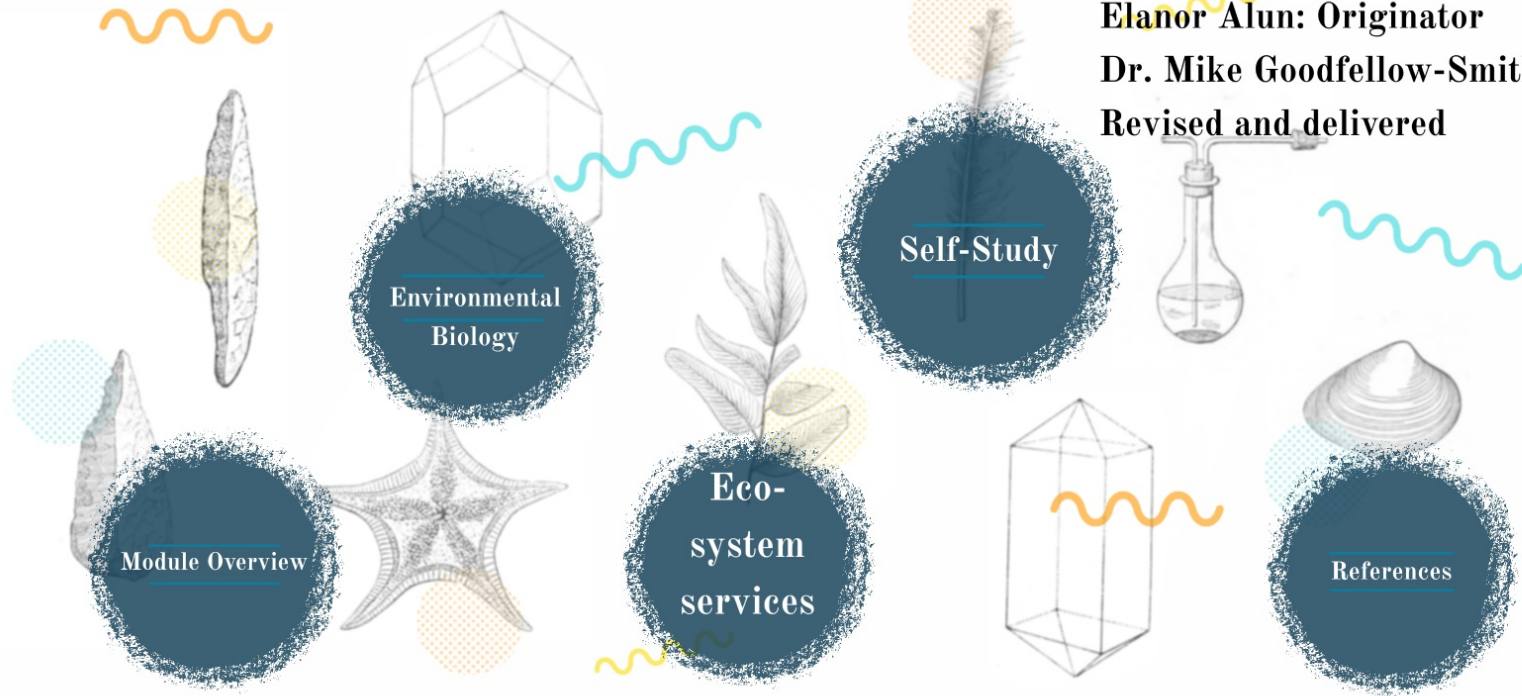

Introduction



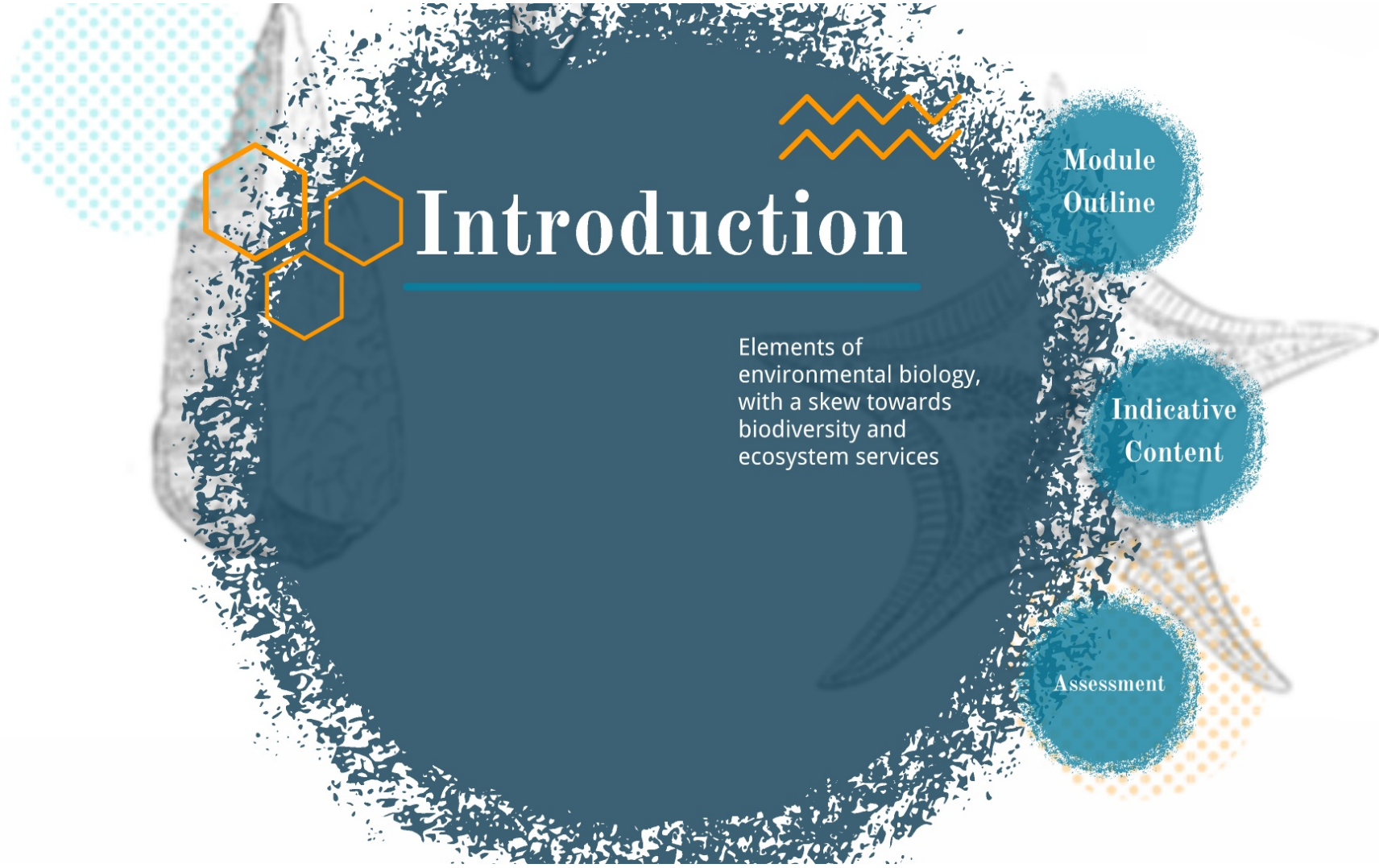
Biodiversity and Ecosystem Services

Lecture 1

Elanor Alun: Originator

Dr. Mike Goodfellow-Smith:

Revised and delivered



Introduction

Elements of
environmental biology,
with a skew towards
biodiversity and
ecosystem services

Module
Outline

Indicative
Content

Assessment

Aims and Learning Outcome

Module aims

To explore the concept of biodiversity and ecosystem services, along with both the practical and ethical considerations of ascribing value to facets of the natural world.

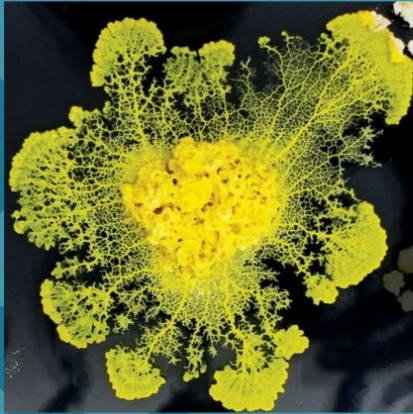
This is a diverse module that covers a lot of different topics.

Learning outcome

Upon the successful completion of this module, you should be able to:

- Demonstrate a fundamental knowledge of the earth's biodiversity and the earth's ecosystems, including human distribution, population, and the effects on the natural environment.
- Convey and determine the variety and classification of organisms.
- Understand and appreciate what is meant by ecosystem services and the applicability of the concept to conservation biology.

Indicative Content



- Introduction to biology, classification and taxonomy
- Environmental processes such as nutrient cycling and the ecology and evolution of organisms
- Biomes, habitats and ecosystems, including keystone species and how organisms respond to stressed environments
- Biogeochemical cycles, energy pyramids and food webs
- Ecosystem interactions, including predator-prey cycles, mutualism and competition
- Animal behaviour including communication, reproductive strategies and migration
- Invasive species
- Conservation biology

Indicative Content

Taxonomy

- Classification (what is a species?)
- Evolution

Genetics

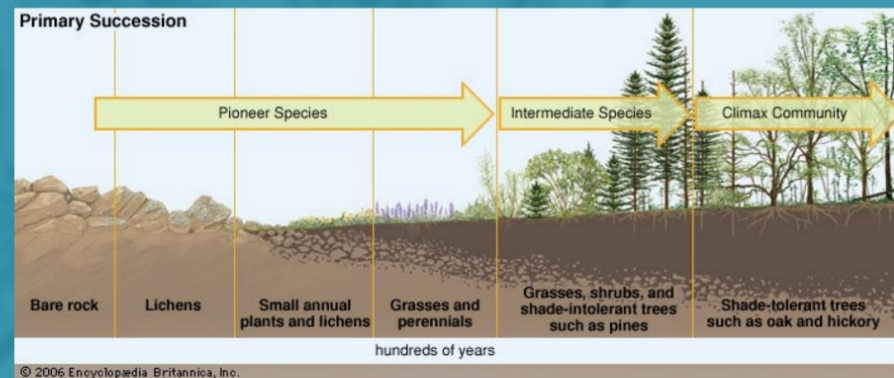
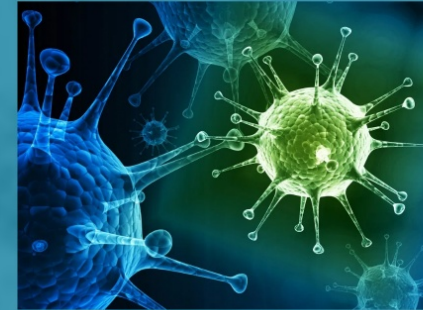
- Cell Biology (minor)
- Population genetics
- Mutations
- Herd immunity
- Disease

Biomes and Habitats

- Biomes
- Succession
- Seed distribution methods
- Stressed environments

Biogeochemical Cycles

- Producers – consumers – decomposers
- Energy pyramids
- Nutrient cycle



Indicative Content



Animal Behaviour

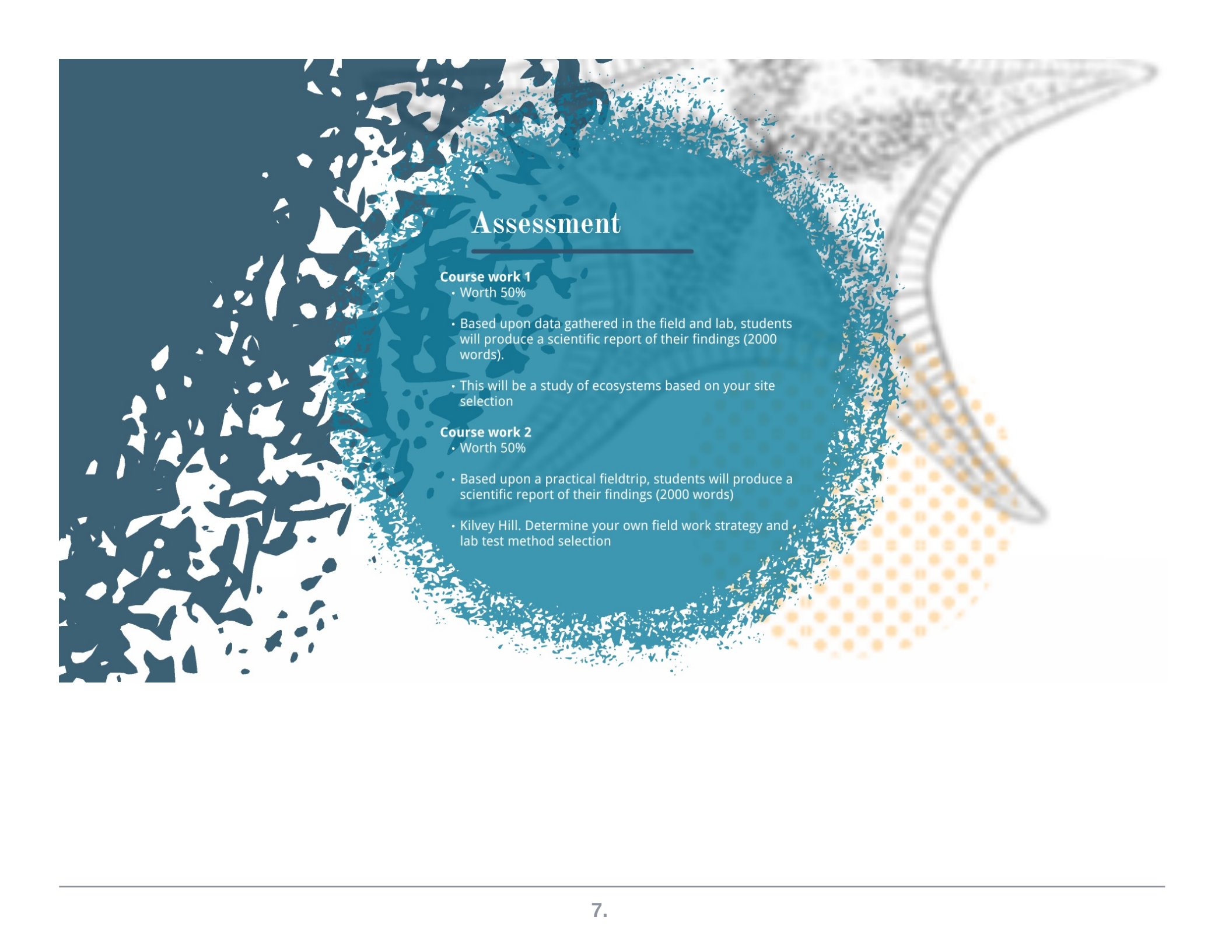
- Reproductive strategies
- Herds vs loners
- Nocturnalism/diurnalism
- Migration
- Predators, scavengers, prey

Invasive Species

Conservation Biology

- Applying environmental biology in the field
- Keystone Species
- Indicator species
- Habitat restoration
- Ecosystem restoration
- Mutualism vs competition (inc. the wood wide web)

Lab Sessions



Assessment

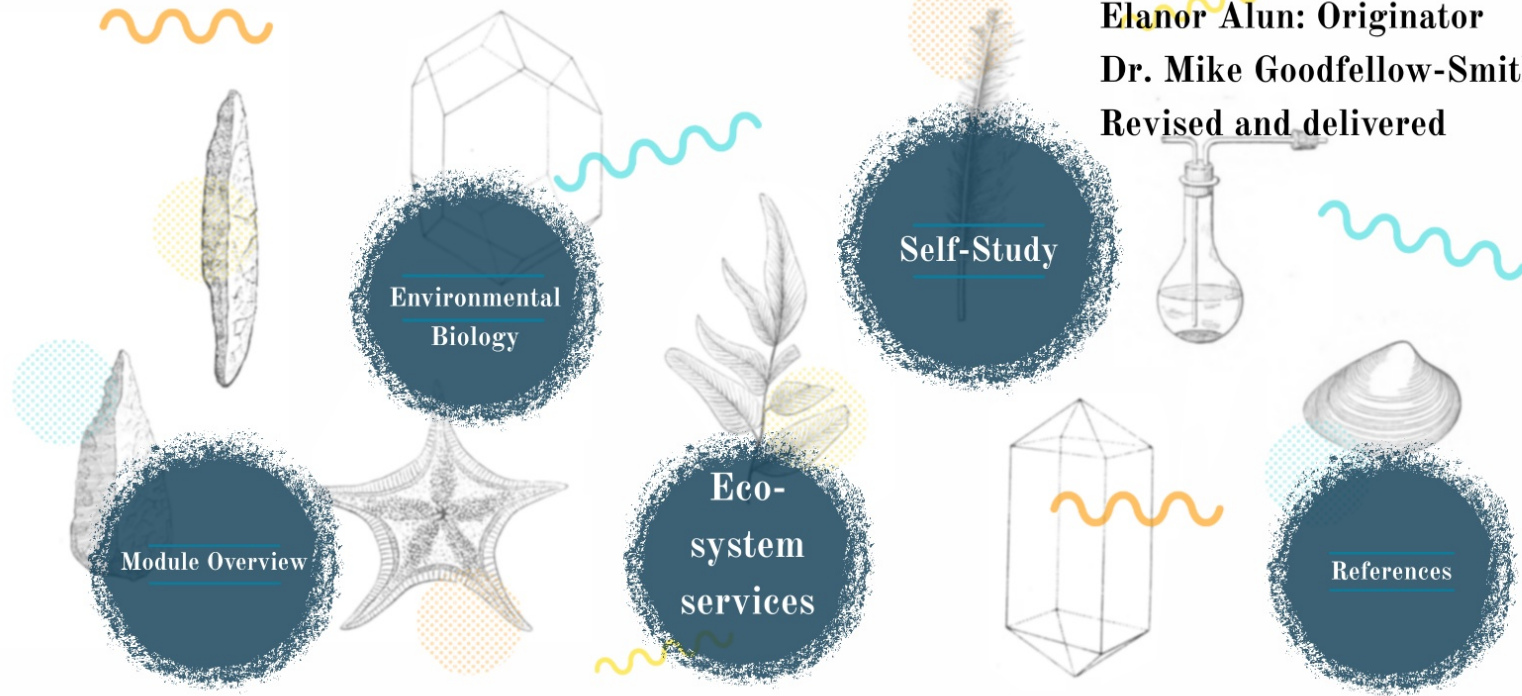
Course work 1

- Worth 50%
- Based upon data gathered in the field and lab, students will produce a scientific report of their findings (2000 words).
- This will be a study of ecosystems based on your site selection

Course work 2

- Worth 50%
- Based upon a practical fieldtrip, students will produce a scientific report of their findings (2000 words)
- Kilvey Hill. Determine your own field work strategy and lab test method selection

Introduction



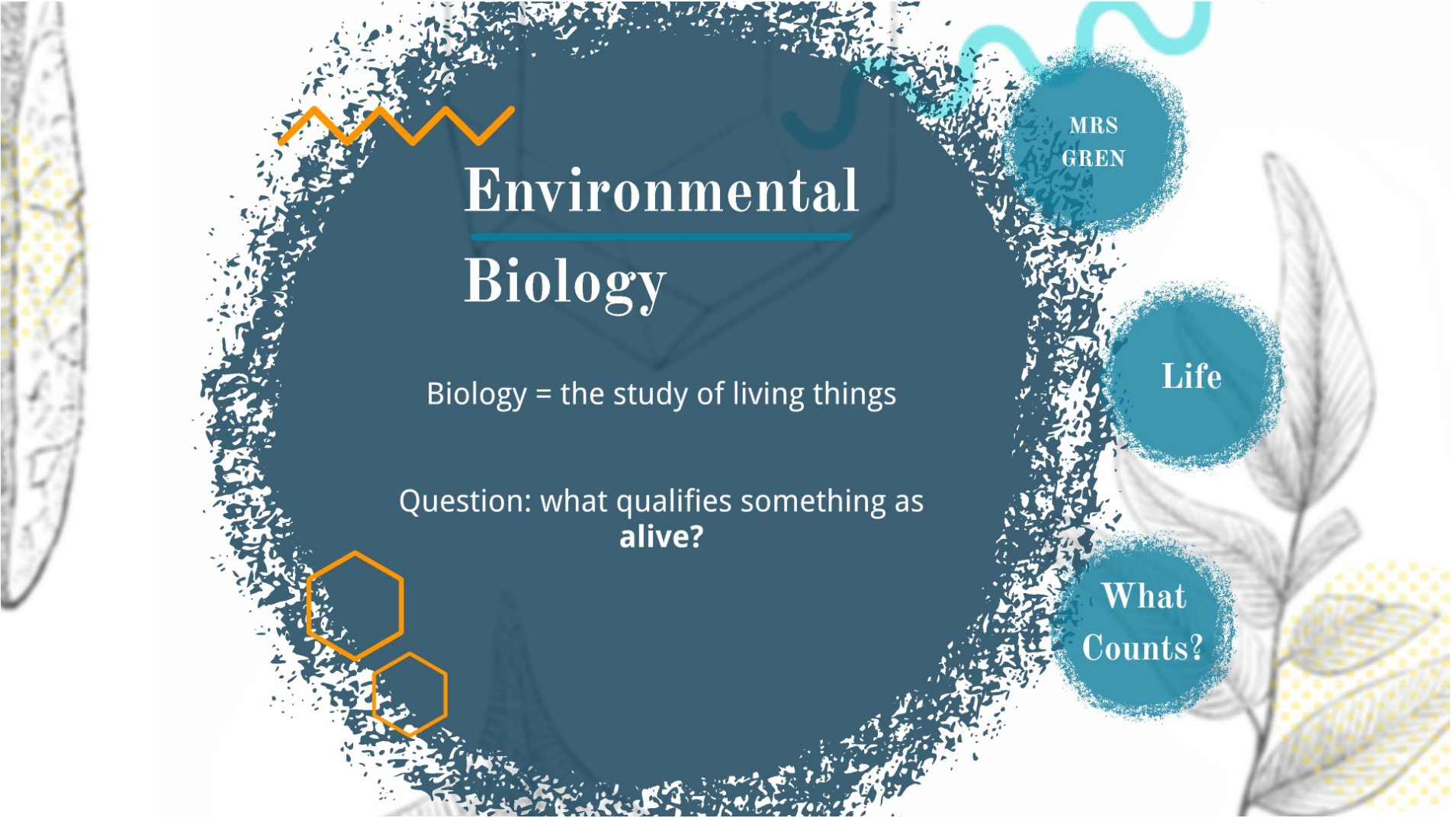
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Environmental Biology

Biology = the study of living things

Question: what qualifies something as
alive?

MRS
GREN

Life

What
Counts?

MRS GREN



Good start, but it gives a problem.

Do mules count as alive?

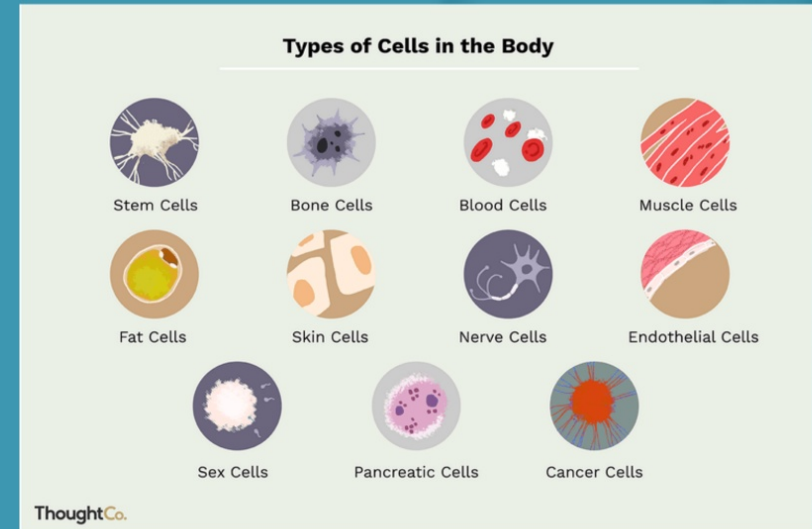
Does fire?

7 Characteristics of Life

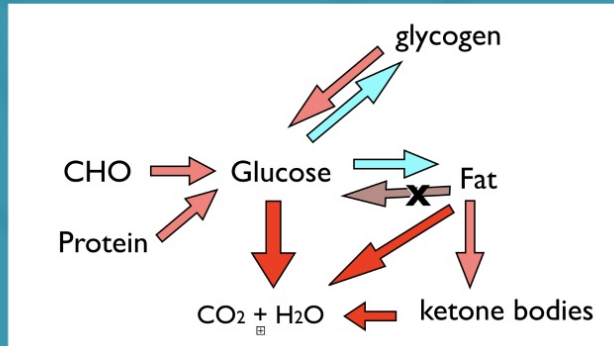
Organisation

Parts that are specialised and coordinated.

Even the parts inside a single cell are organised and complex; multicellular organisms are more complex again, as their cells make up tissues, organs.....



7 Characteristics of Life



Metabolism

Life depends on huge numbers of chemical reactions that interlock and produce energy for everything from movement to growth to reproduction to healing and maintenance.

These reactions occur from nutrients consumed by the organism – these biochemical reactions are known as metabolism.

Split into two parts: anabolism and catabolism. Anabolism makes complex molecules from smaller ones, and uses energy; Catabolism the breakdown of complex molecules in living organisms to form simpler ones, together with the release of energy; destructive metabolism.

7 Characteristics of Life

Homeostasis

For cells to function, they need the right environment – things like temperature, pH, etc.

The body's ability to maintain this internal environment so it can run its cells properly is called homeostasis; this is what heat regulating mechanisms like sweating/shivering come under.



7 Characteristics of Life



Growth

Living organisms undergo (regulated) growth – individual cells get larger, but also, multicellular organisms will accumulate more cells via cell division.

This needs large, complex molecules such as proteins and DNA.

7 Characteristics of Life

Reproduction

Several organisms may be unable to do this; mules are automatically sterile, for e.g.

But, outside of problems experienced by an individual, the species should have the ability. This may be either asexual (self-replicating), or sexual (two parents combining genetic material.)



7 Characteristics of Life



Response

Specifically, this is a measure of whether or not an organism responds to its environment.

More obvious in animals (reacting to fire, for e.g.), less so in plants – but present (turning towards sun, away from disturbance, etc)

Some plants have more obvious responses of course, like to touch.



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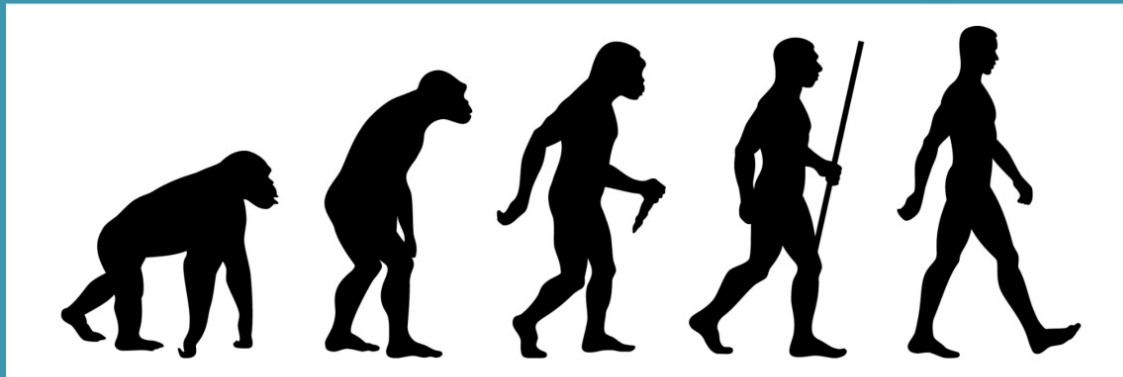
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7 Characteristics of Life

Evolution

At a population level, organisms can change their genetic makeup over time to respond to the environment they're in.

This may be down to natural selection, which allows adaptation.



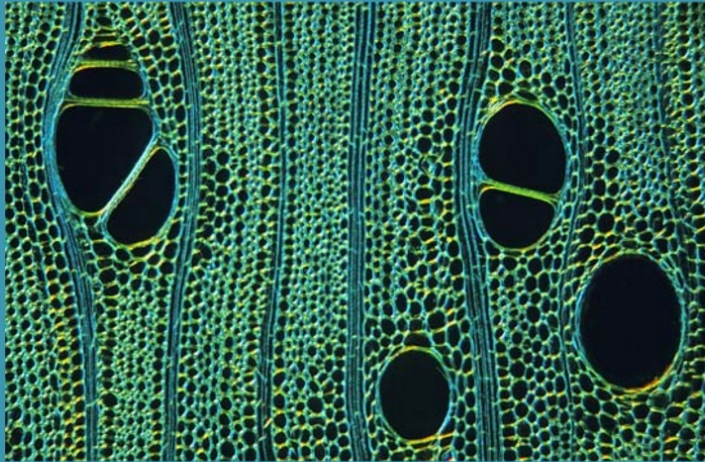
What Counts?

Reproduction is tricky.

Nonliving things may show some, but not all, properties of life. For instance, crystals of snow are organized—though they don't have cells—and can grow but don't meet the other criteria of life.

Similarly, a fire can grow, reproduce by creating new fires, and respond to stimuli. However, fire is not organized, does not maintain homeostasis, and lacks the genetic information required for evolution.

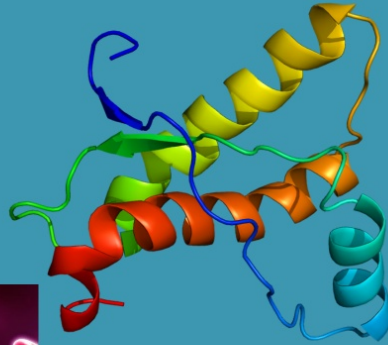
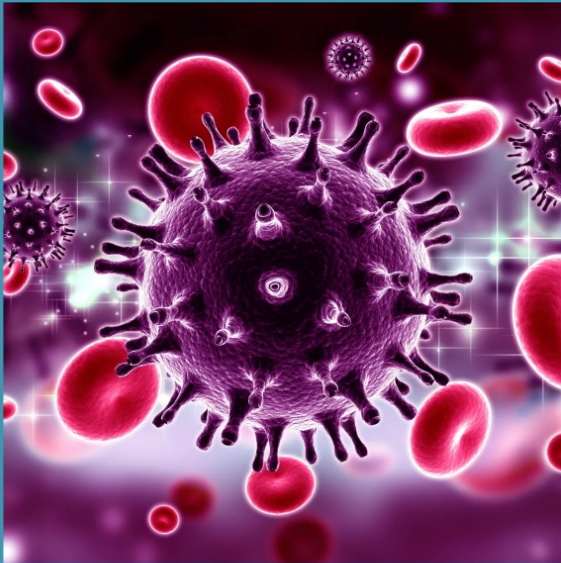




Living things may keep some properties of life when they become nonliving, but lose others. For instance, if you looked at the wood in a chair under a microscope, you might see traces of the cells that used to make up the living tree.

However, the wood is no longer alive, and, having been made into a chair, can no longer grow, metabolize, maintain homeostasis, respond, or reproduce.

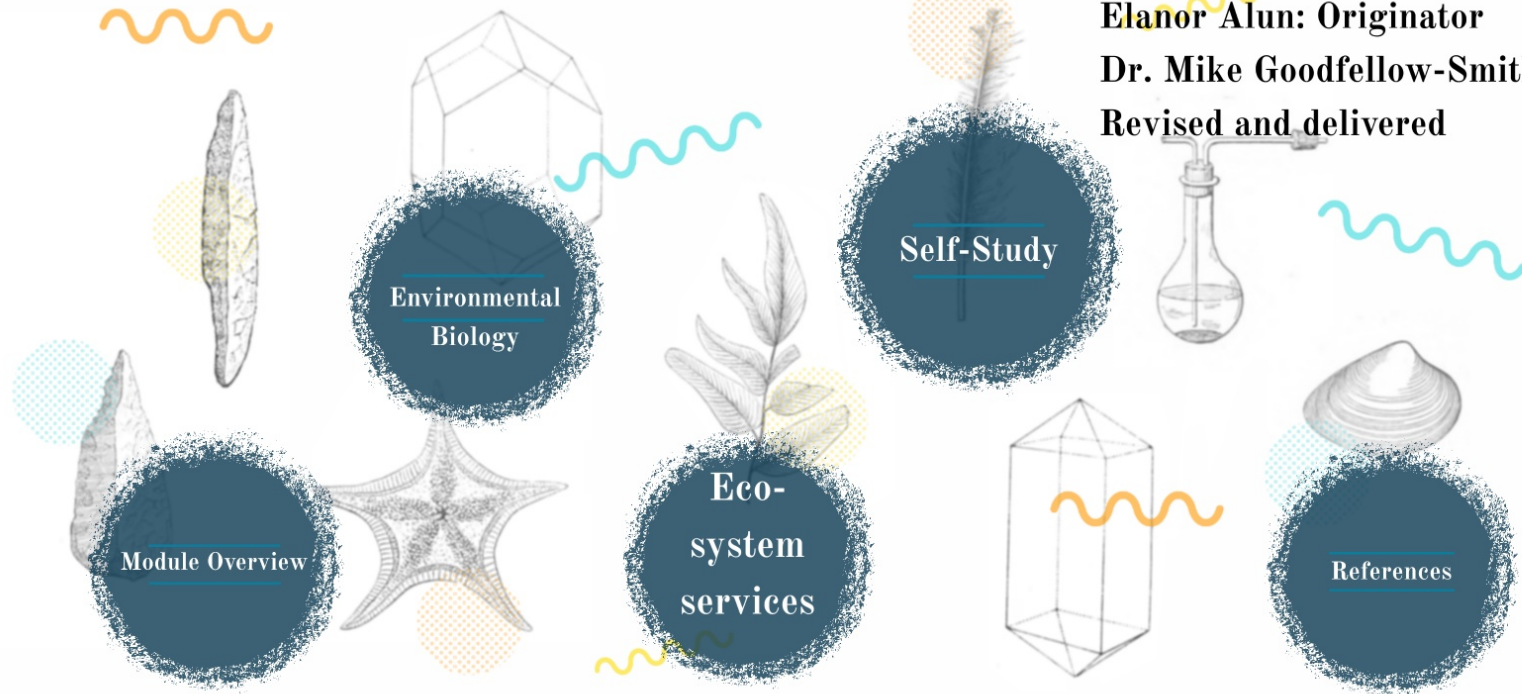
The Undead



Viruses have lot of properties, but they do not have a cellular structure, nor can they reproduce without a host. Similarly, it's not clear that they maintain homeostasis, and they don't carry out their own metabolism.

Some even simpler molecules, such as self-replicating proteins—like the “prions” that cause mad cow disease—and self-replicating RNA enzymes, also have some, but not all, of the properties of life.

Introduction



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Self-Study

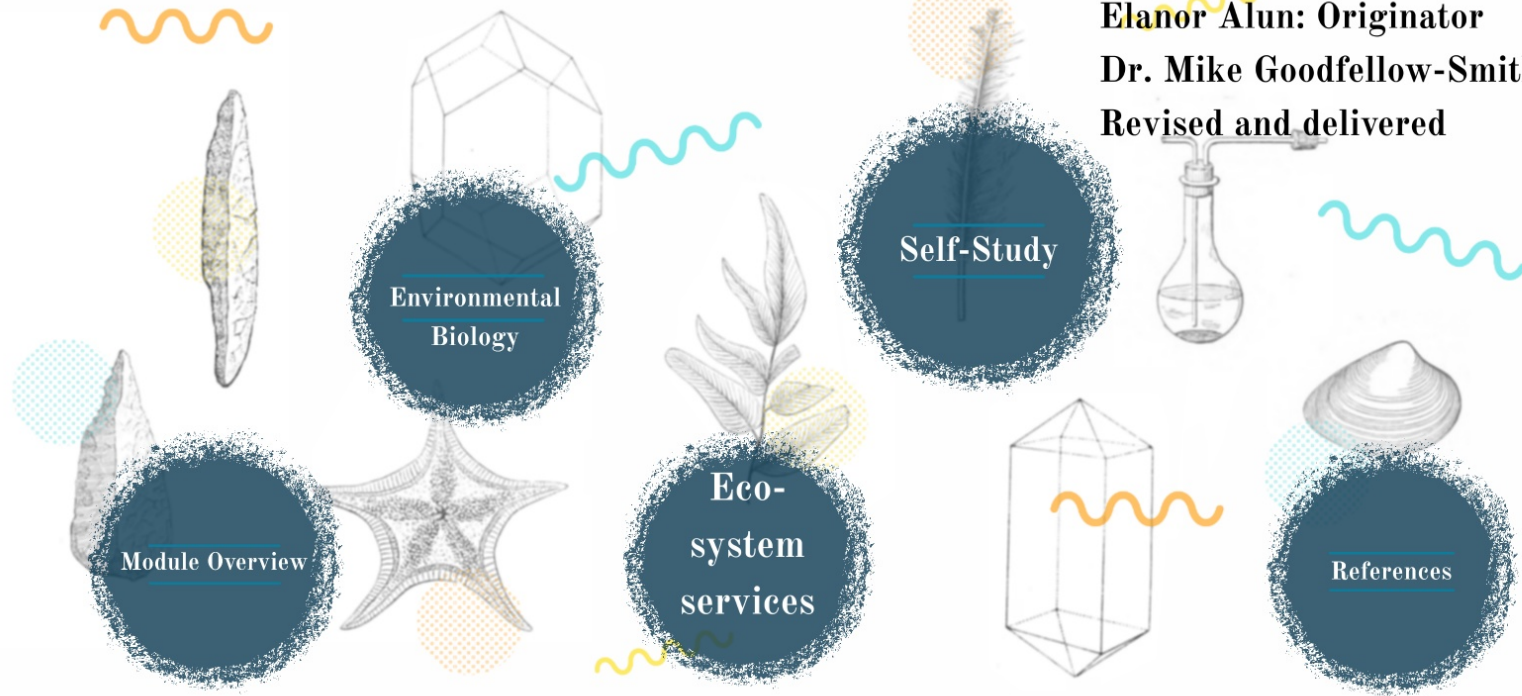
Investigate in more detail how bioremediation works.

In particular, focus on phytoremediation, and the use of trees to remediate heavy metals in soil.

How does the process work? How effective is it?



Introduction



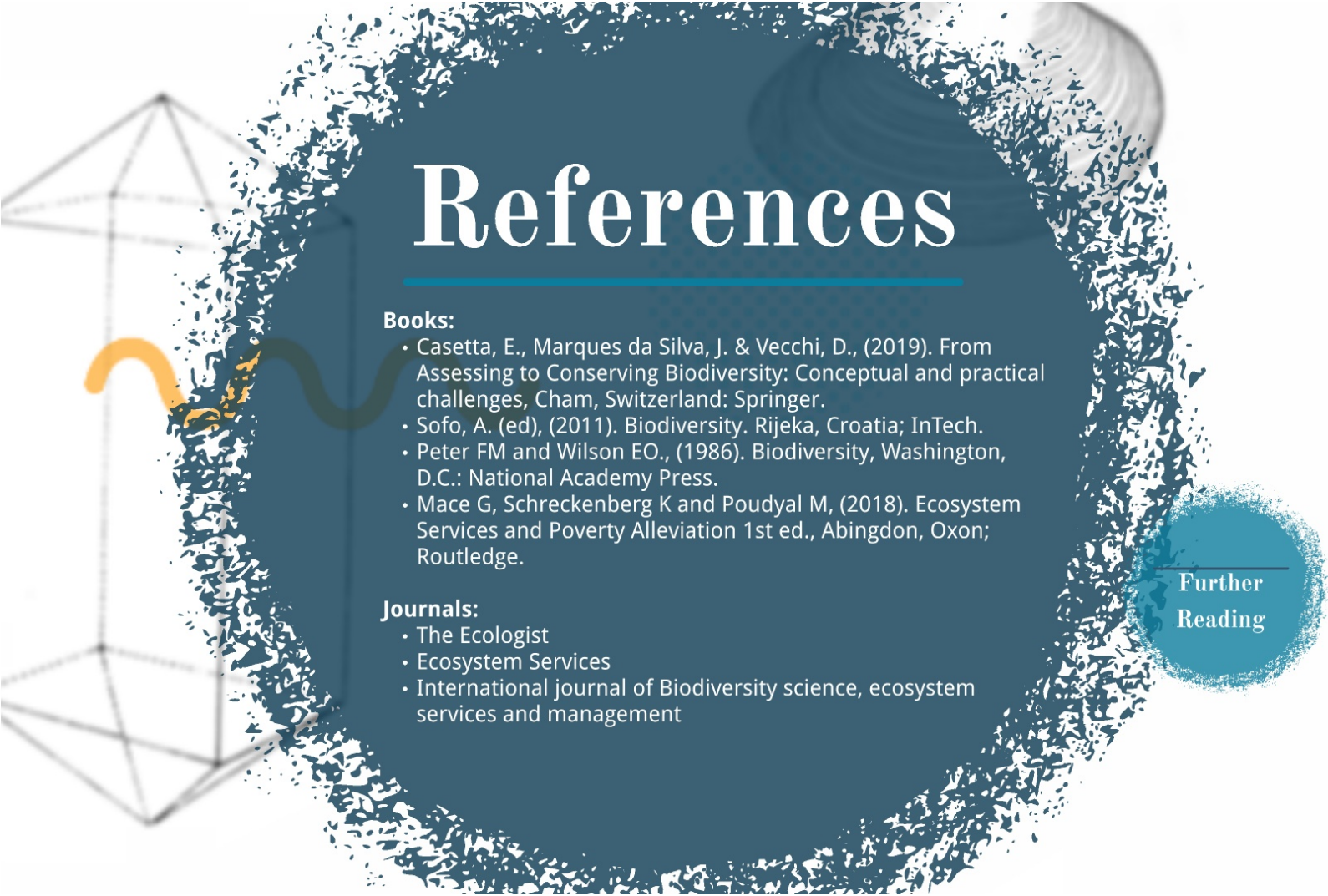
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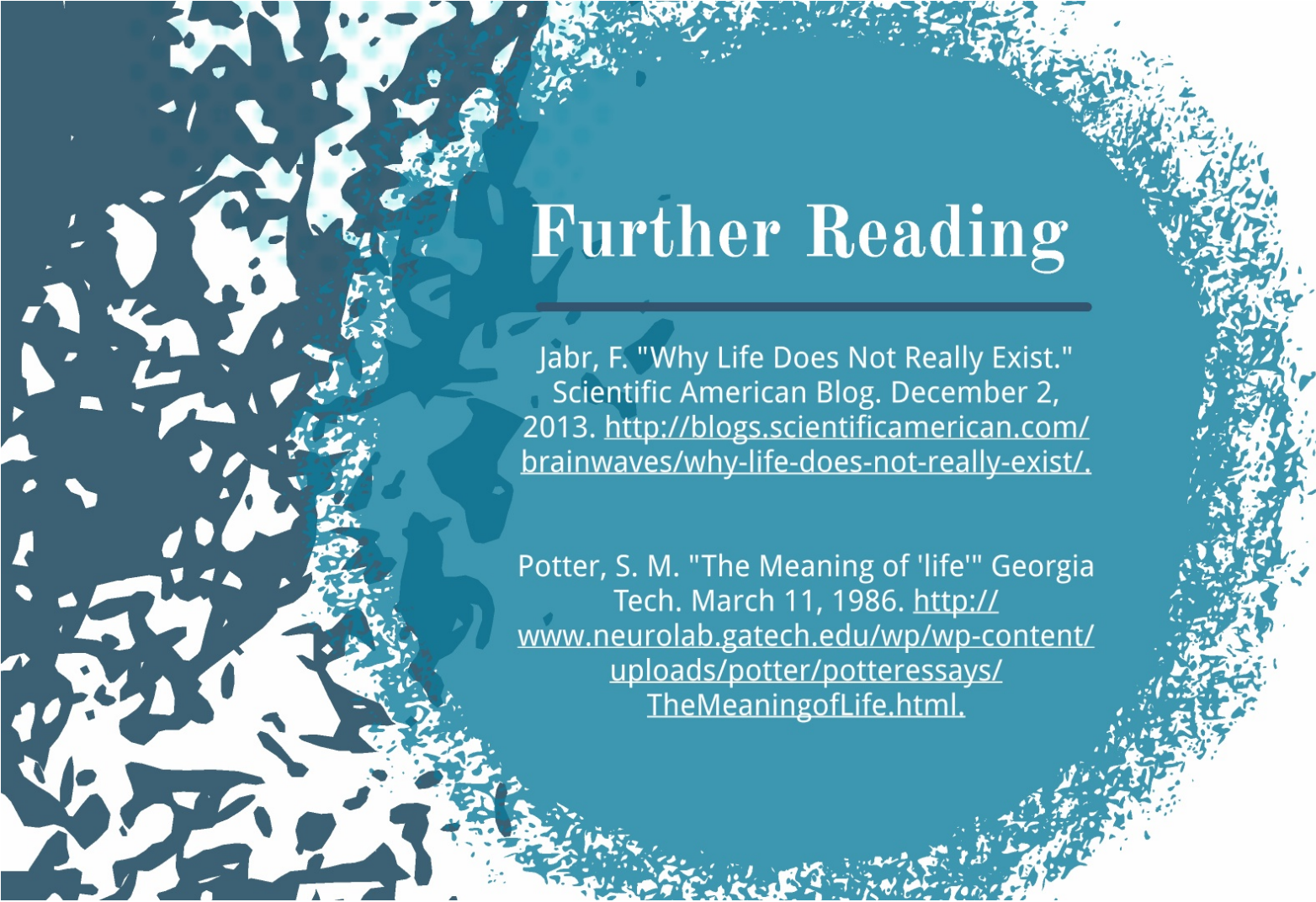
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- Sofo, A. (ed), (2011). Biodiversity. Rijeka, Croatia; InTech.
- Peter FM and Wilson EO., (1986). Biodiversity, Washington, D.C.: National Academy Press.
- Mace G, Schreckenberg K and Poudyal M, (2018). Ecosystem Services and Poverty Alleviation 1st ed., Abingdon, Oxon; Routledge.

Journals:

- The Ecologist
- Ecosystem Services
- International journal of Biodiversity science, ecosystem services and management

Further
Reading

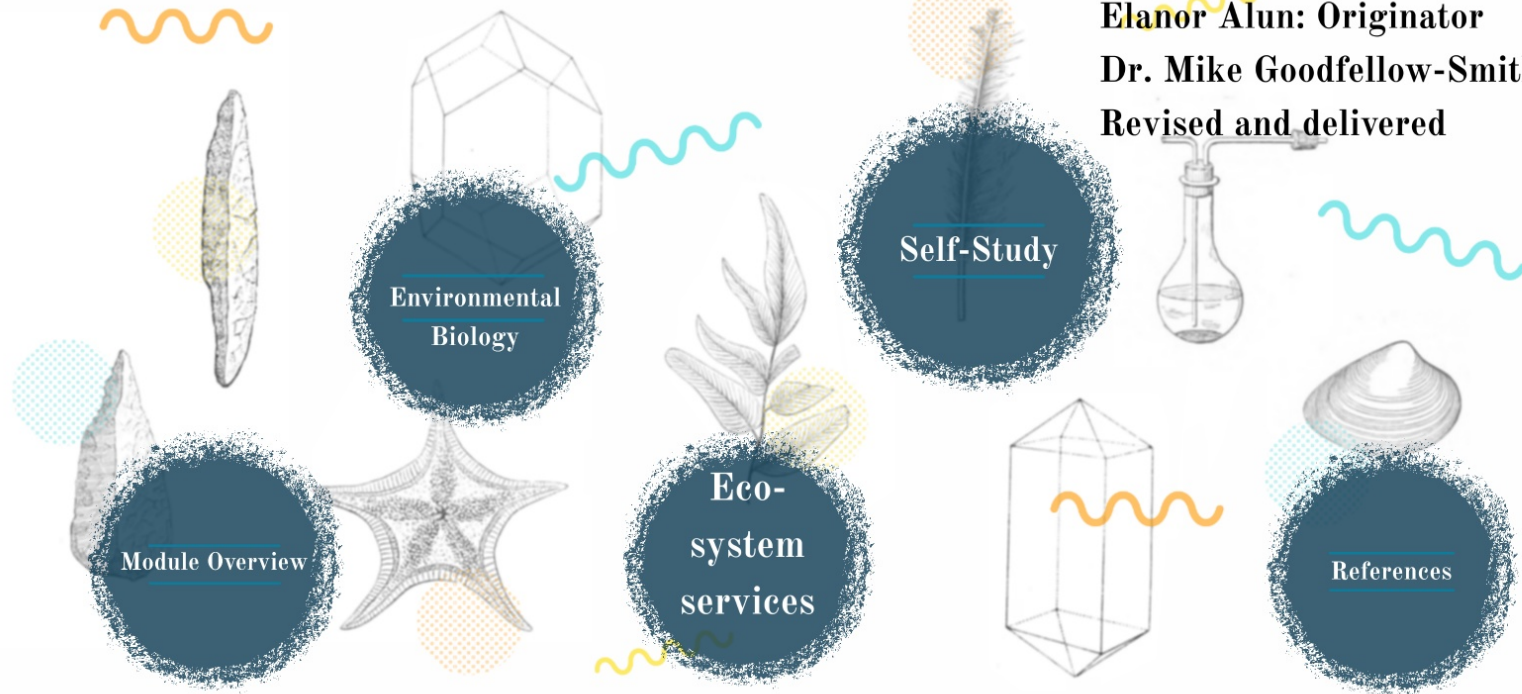


Further Reading

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Potter, S. M. "The Meaning of 'life'" Georgia Tech. March 11, 1986. <http://www.neurolab.gatech.edu/wp/wp-content/uploads/potter/potteressays/TheMeaningofLife.html>.

Introduction



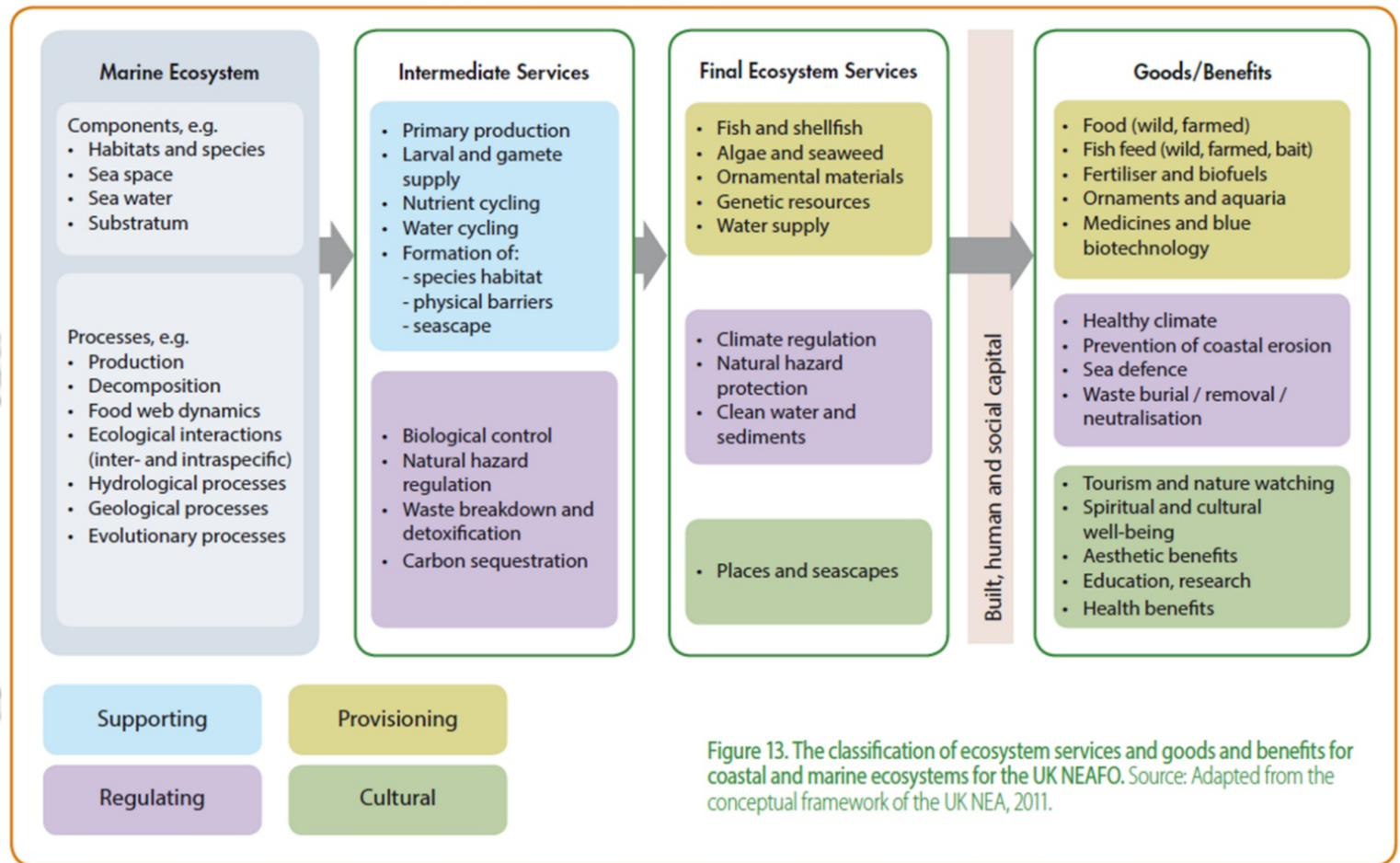
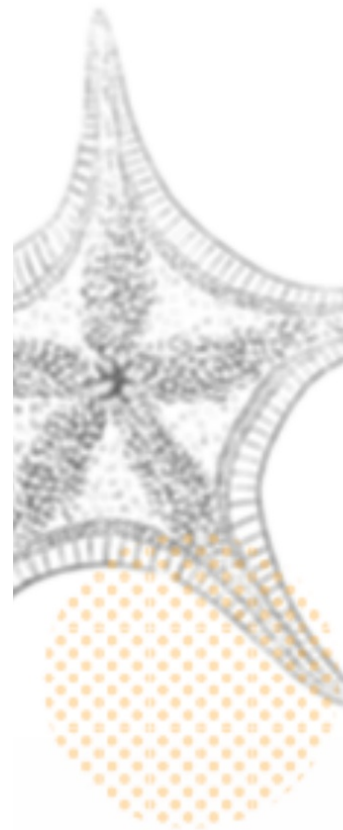
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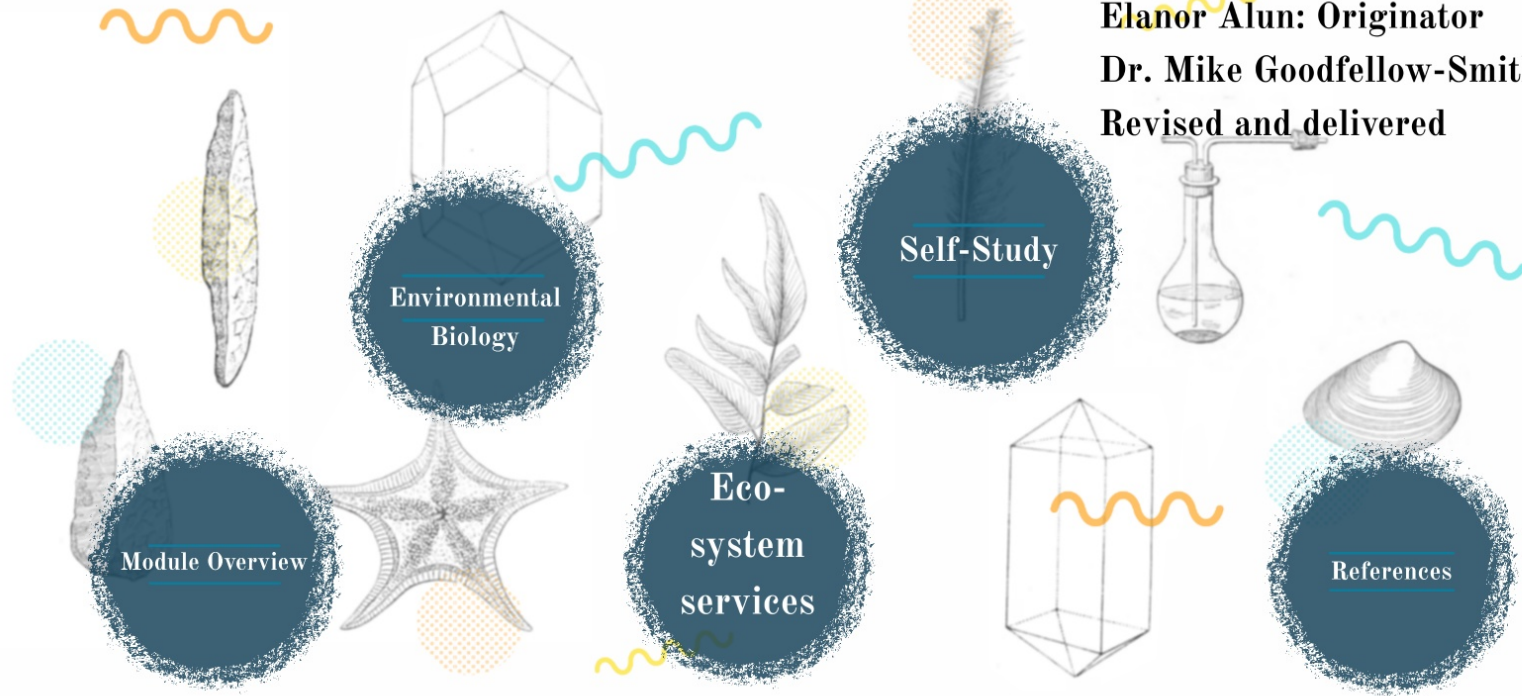
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