CATASTROPHIC

A card game to support systems thinking in Biology

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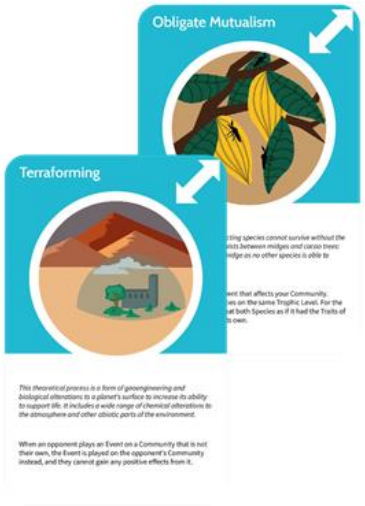
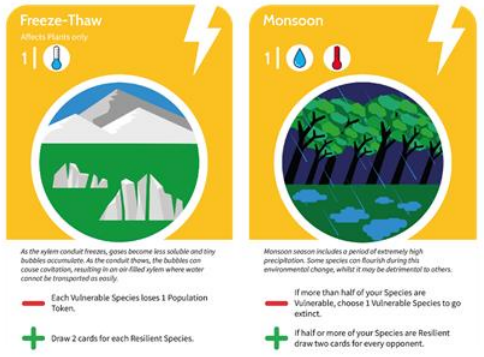
What is Catastrophic?

Catastrophic is a card game designed to help players understand how the small things in life can affect large scale processes around the world.





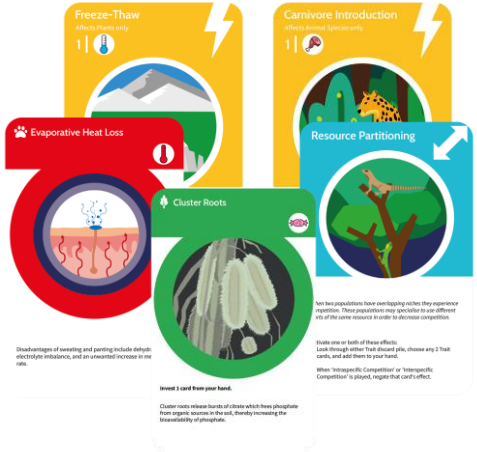
Who made Catastrophic?

Outcome of a collaborative design process at the University of York, between the Departments of Biology, Education and TFTI.

Designed and made by students, for students.

Prototype

2018



2019

2020

What are we doing here today?

- A brief introduction to Catastrophic in stage 1 Biology at York
- Impact on engagement and learning
- Catastrophic in the pandemic

What are the learning outcomes?

Catastrophic ties into several module learning outcomes of Animal and Plant Biology, including:

- Review the adaptive significance, organisation and function of the principal organ systems of **animals** and **plants**, and how these may vary with body plan, size and environmental circumstance.
- Describe and appreciate the diverse physiological strategies that allow **plant** and **animal** life in **different environments**.
- Review the **historical events** is needed to explain modern ecosystems.
- Review of the population dynamics of single and multi-species communities.
- Describe the simple **emergent patterns** in community structure and their causes.
- Review the global distribution of biodiversity, and current threats to biodiversity.
- Describe and explain the ecological factors which make a good invader, and the consequences of invasions.

TL:DR This is a 30 credit module with an appropriate, but still daunting, amount of content in the first year of our Biology programme

What was the plan?

- To make a card game to support learning in this large module
  - To bring diverse topics together
  - To understand how small things, like whether a plant tastes nice, affect ecosystem scale things, like how a volcano erupting might change animal and plant diversity
  - To help students transition from school to university, and make friends
  - To pull students away from MOAR CONTENT and towards understanding, evaluating, and connecting
  - To normalise having fun while learning

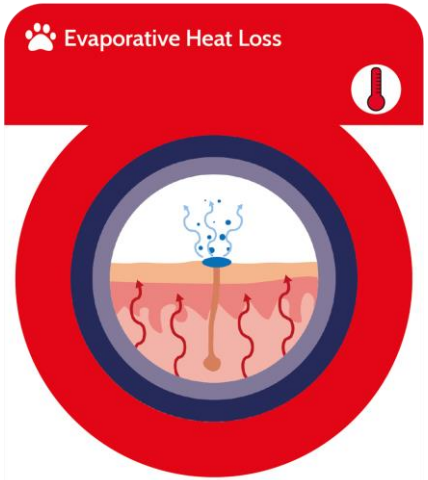
How does it work?

Plant Traits

Invest 1 card from your hand.

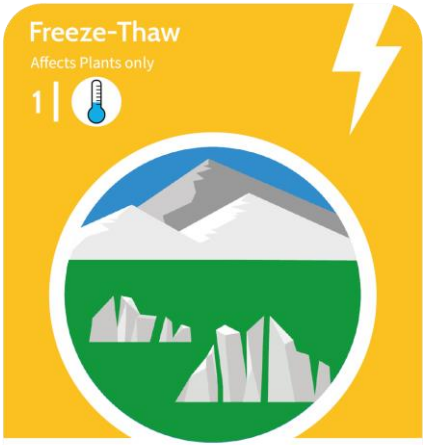
Cluster roots release bursts of citrate which frees phosphate from organic sources in the soil, thereby increasing the bioavailability of phosphate.

Animal Traits



Disadvantages of sweating and panting include dehydration, electrolyte imbalance, and an unwanted increase in metabolic rate.

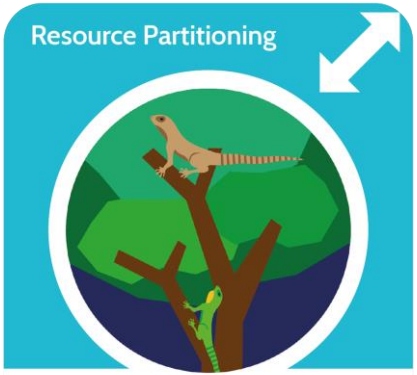
Events & Interactions - Nature Calls



As the xylem conduit freezes, gases become less soluble and tiny bubbles accumulate. As the conduit thaws, the bubbles can cause cavitation, resulting in an air-filled xylem where water cannot be transported as easily.

Each Vulnerable Species loses 1 Population Token.

Draw 2 cards for each Resilient Species.



When two populations have overlapping niches they experience competition. These populations may specialise to use different parts of the same resource in order to decrease competition.

Activate one or both of these effects:
Look through either Trait discard pile, choose any 2 Trait cards, and add them to your hand.

When 'Intraspecific Competition' or 'Interspecific Competition' is played, negate that card's effect.

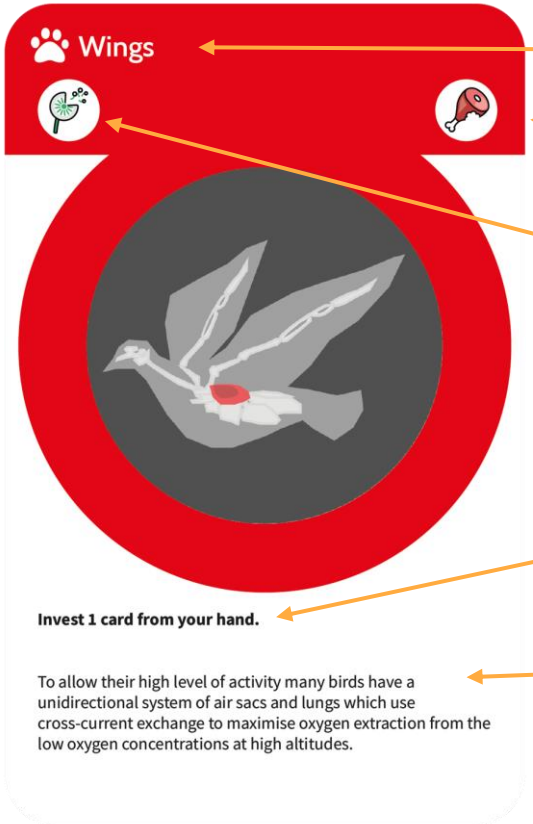
Catastrophic Aims

The aim of Catastrophic is to use **Plant** and **Animal** **Traits** to make **Plant** and **Animal** **Species**...

…that form a community with a Catas**Trophic pyramid** and other **Interactions**…

…that is able to survive when **Events** occur that change environmental conditions.

Navigating the Trait cards



Trait name.

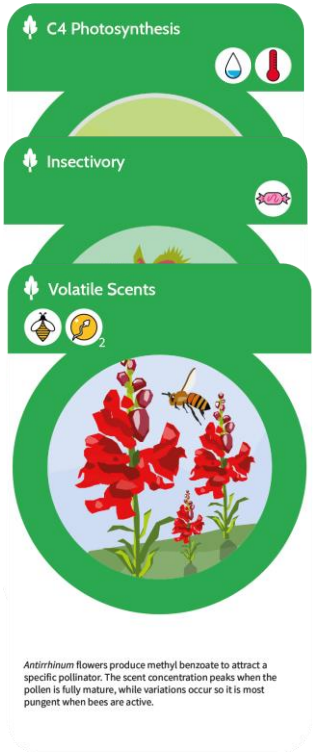
Condition icons - if a Species has this Trait, what is it well adapted for?

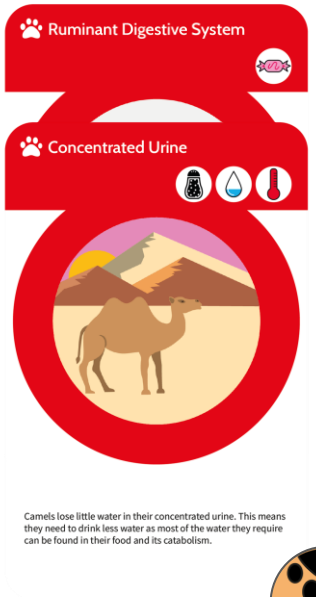
Attributes - if a Species has this Trait, what is it good at?

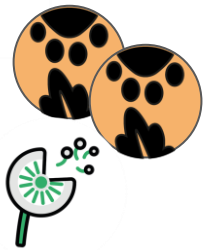
Game mechanics - any extra information you might need to play this card.

Flavour text - information about this Trait.

Making a Plant or Animal Species out of Trait cards







Trait cards can be combined to make **Species.** Species may be complex (have lots of Traits) or very simple (have only one Trait).

These cards combined represent a population of individuals, all of that Species. Species with dispersal traits have larger populations.

You can't put an animal Trait into a plant and vice versa.

Communities develop in a food web

Plants form the base layer.

Animals need two food sources each, so your community is going to develop into a pyramid shape.

The first layer of animals are herbivores, the second are carnivores, and you could keep going to get apex predators as well.

The Play

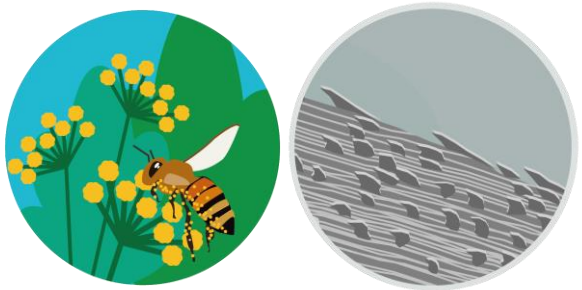
Interactive phase:
Choose **3 of 5 actions** with which to change your Community.

Adaptive phase:
Responding to events in your environment.

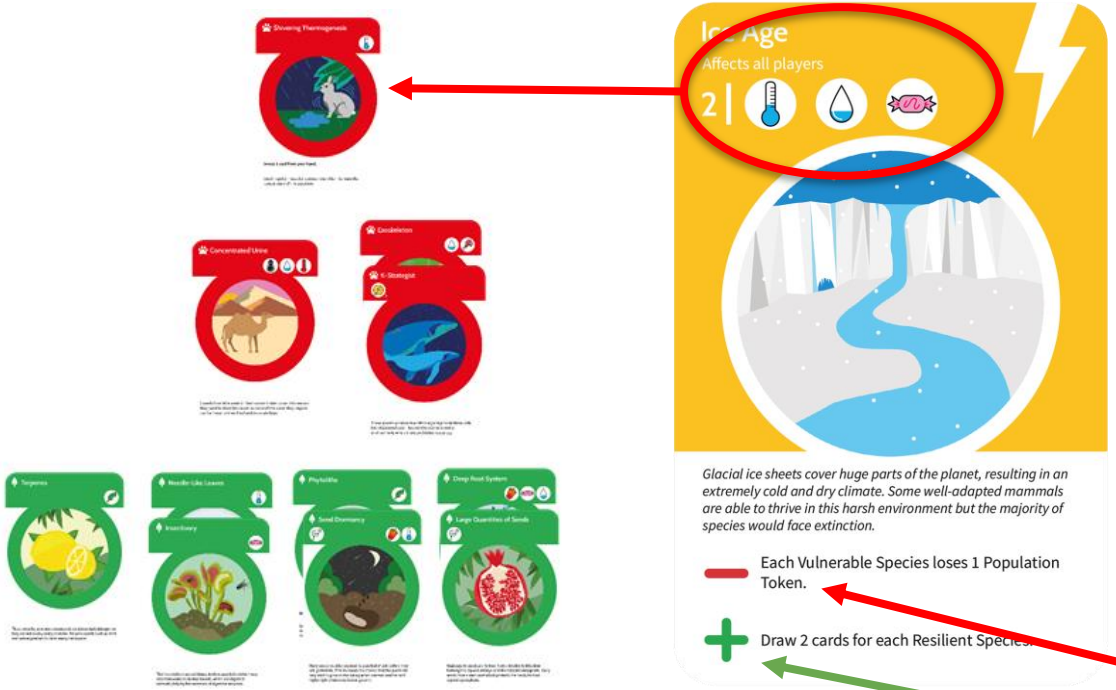
Possible Actions

- **Draw** - up to your Resource Number (usually 7).
- **Discard** - as many cards as you like.

- **Introduce** - add new Species.
- **Mutate** - swap Traits in any Species.
- **Evolve** - add Traits to any Species.



Events change Communities



The condition icons on Event cards indicate what a Species must be adapted to in order to be **Resilient.**

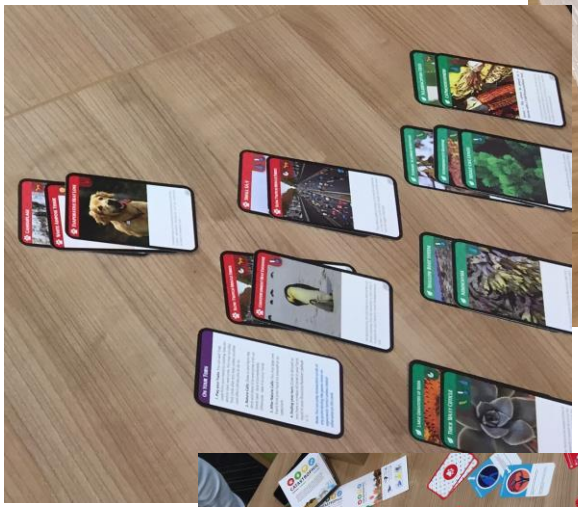
The number indicates how many of those conditions a Species must have to avoid being **Vulnerable.**

Follow the negative effects and then the positive effects.

In the before times

Catastrophic was used ‘in person’ in 2018 (v1) and 2019 (v2)

- All (~200) stage 1 Biologists given their own physical copy each year
- Taught to play in person in a workshop, and continued to play with each other throughout the year
- Learned about biological communities and human communities
- A Catastrophic-themed assessment rounds off the year



Evaluating engagement

- More than half of the 2018 cohort were still playing it at the end of the year
- 60% of students who had played the game thought it had had a positive effect on their motivation and learning:

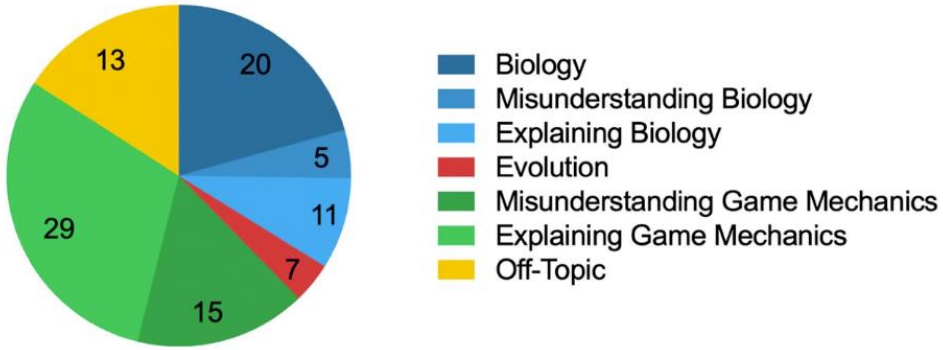
  “*It makes me excited to learn more in this module*”
  “*Has made me think about how certain traits of plants and animals can help them survive events*”
  “*Increases the time spent interacting with biological concepts within this module*”

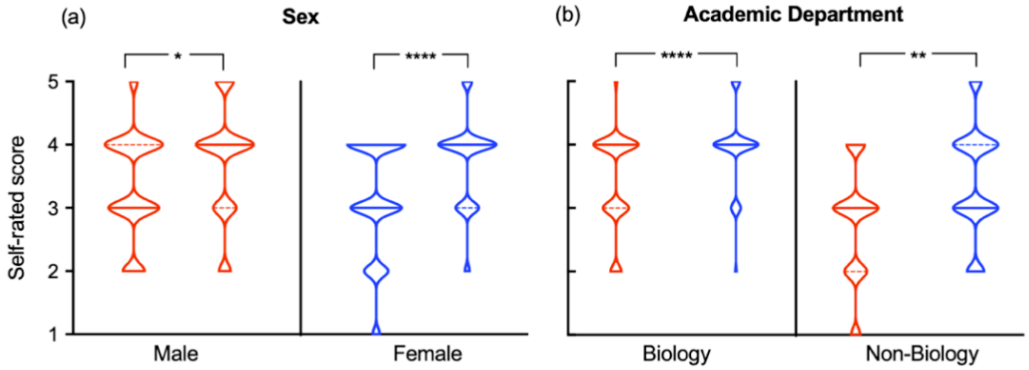
- Students sought out other biologists in halls of residence to play the game

Evaluating learning

- Focus groups indicated that conversations during Catastrophic play shifted from game mechanics to biology, with an emphasis on explanation and understanding.

- Surveys before and after playing indicated that Catastrophic increased self confidence in knowledge for female students, and for non-biologists.

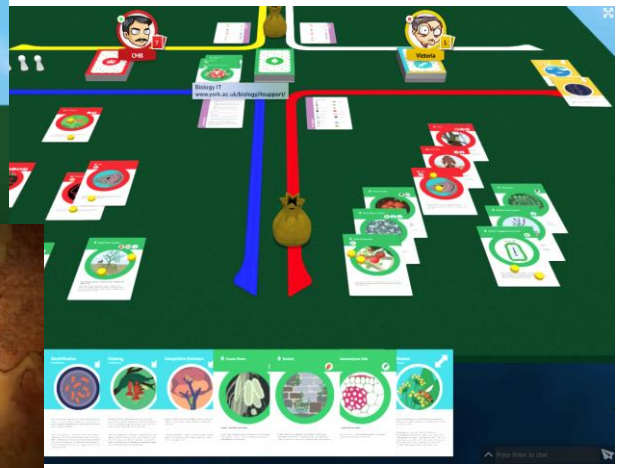




In Covid times

2020 had other plans

- Challenge to fit everyone into teaching spaces
- Couldn’t let everyone breathe on each other/touch all the cards
- Tight budgets for e.g. printing



Catastrophic went online at Tabletopia (sandbox games app available in Steam)

- Taught it in breakout rooms and dedicated sessions over Zoom
- Created trailers for engagement
- Supported with a choose your own text adventure

When asked, “Which activities make you feel more connected to your course?” Catastrophic was one of two workshops mentioned by name.

“*I'm so impressed that there is a game for this module!*”

“*I was just wondering if there is any chance I could get my hands on a physical copy of the game? I spend so many hours staring at a screen whilst studying that I try to avoid screens in my free time.”*

Catastrophic Conclusions

- Games can be great for teaching and learning
- Games are often good for building community
- Games can help even online, in a pandemic
- ...but not everyone will appreciate it

“Catastrophic is a no from me.”

You can play too!

Web: catastrophic.york.ac.uk
Twitter: @Catastrophic_CG, #CatastrophicGame
Insta: catastrophicgame

CATASTROPHIC

Thanks to:
Ben Kirman, Kerry Knox (academic team)
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