Investigating Photosynthesis using Egeria najas

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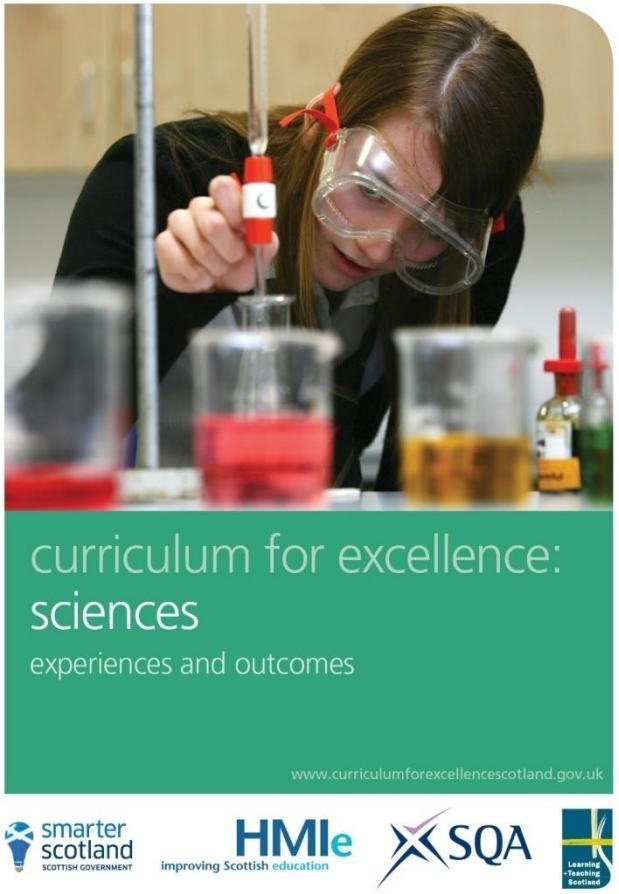
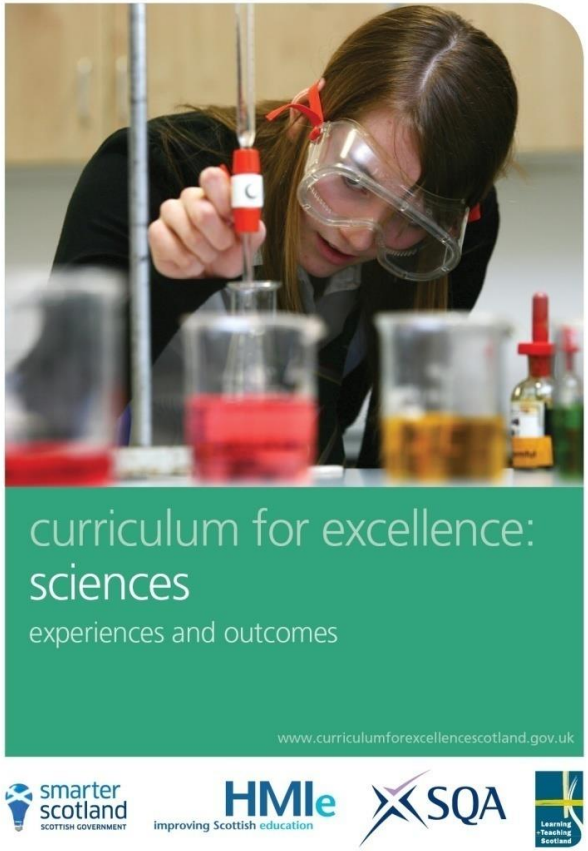
Curriculum for Excellence: Sciences Experiences and Outcomes

I have collaborated on investigations into the process of photosynthesis and I can demonstrate my understanding of why plants are vital to sustaining life on Earth [SCN 3-02A]



Curriculum for Excellence: Sciences Experiences and Outcomes



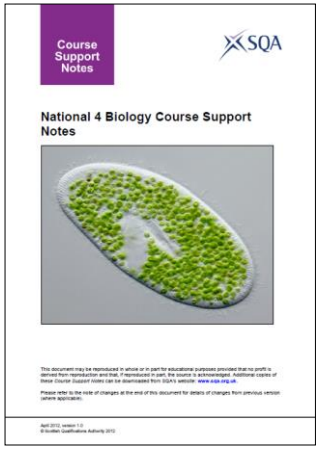
Through exploring the carbon cycle, I can describe the processes involved in maintaining the balance of gases in the air, considering causes and implications of changes in the balance [SCN 4-05b]

Limiting factors: carbon dioxide concentration, light intensity and temperature and their impact on photosynthesis and plant growth. Analysis of limiting factors graphs.

Techniques - *measuring the rate of photosynthesis*

The effect of limiting factors on photosynthesis.

Elodea/Cabomba investigations to find out about limiting factors.



Cabomba caroliniana

Wonderful alternative to Elodea canadensis....

EU list of invasive alien species.....

an offence in the UK to keep, cultivate, breed, transport, sell or exchange this species, or release it, intentionally or unintentionally, into the environment.

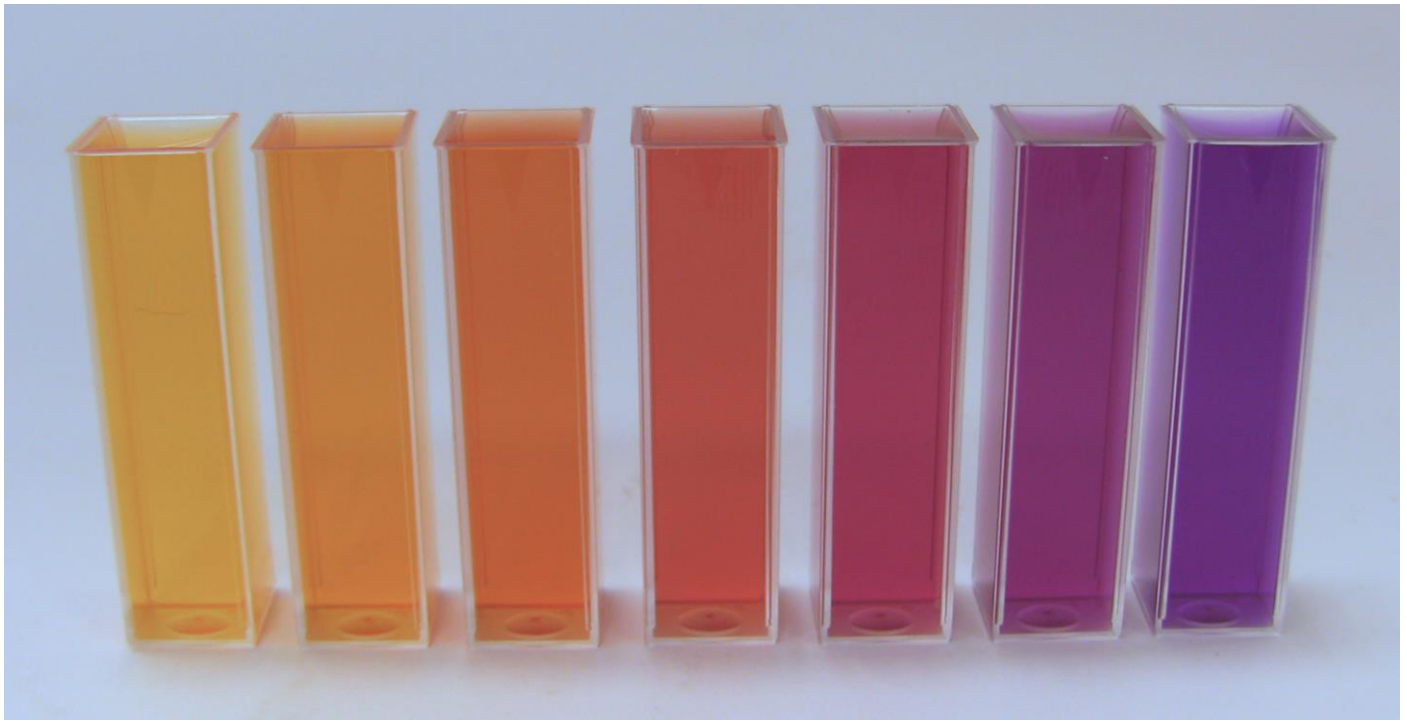
Egeria najas

- *Water plant*
- *Non-native so care in disposal!*
- *Aquarium 'oxygenator'*
- *Narrow serrated leaves – easily confused with Egeria densa….*

Hydrogencarbonate indicator

- *Used to measure [CO_2]*
- *Orange/red in air*
- *Increasingly yellow as [CO_2] increases*
- *Orange → red → magenta → deep purple as [CO_2] decreases*

Hydrogencarbonate indicator



pH 6.8 → *9.2*

(in 0.4 increments)

Fun with photosynthesis 1:

- *Compare the effect of Egeria najas on hydrogencarbonate indicator in light and dark conditions*

- *From knowledge of hydrogencarbonate indicator, make deductions about gas exchange in plants under different conditions*

Before starting:

- *Wash two empty Bijou bottles with a small quantity of hydrogencarbonate indicator, then discard the indicator (wash in sink)*

- *If there is any colour change, rinse again*

- *Continue until there is no colour change*

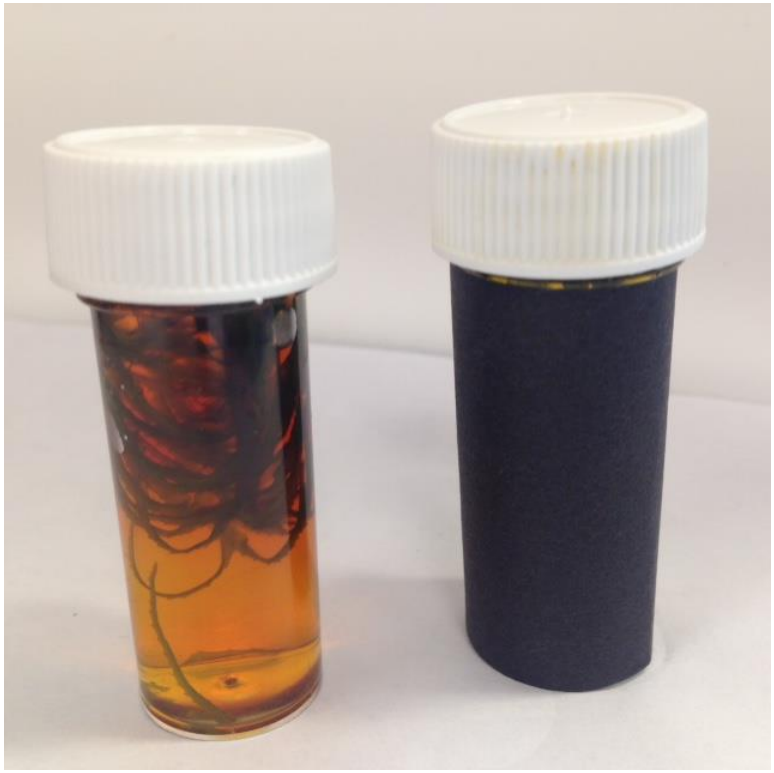
1. *Cut 2 x 3cm lengths of Egeria najas stem*

Add 1 piece to each of two empty Bijou bottles

2. *Fill each bottle with hydrogencarbonate indicator*

3,4. Cover one Bijou with black paper. Irradiate both bottles.

(30-40 min)



Fun with Photosynthesis 2

- *To investigate gas evolution under different lighting conditions*

- *To contribute to the development of an understanding of why plants are vital to sustaining life on Earth*

A piece of Egeria najas equal to the length of a boiling tube.

Place in the boiling tube, stem end upwards

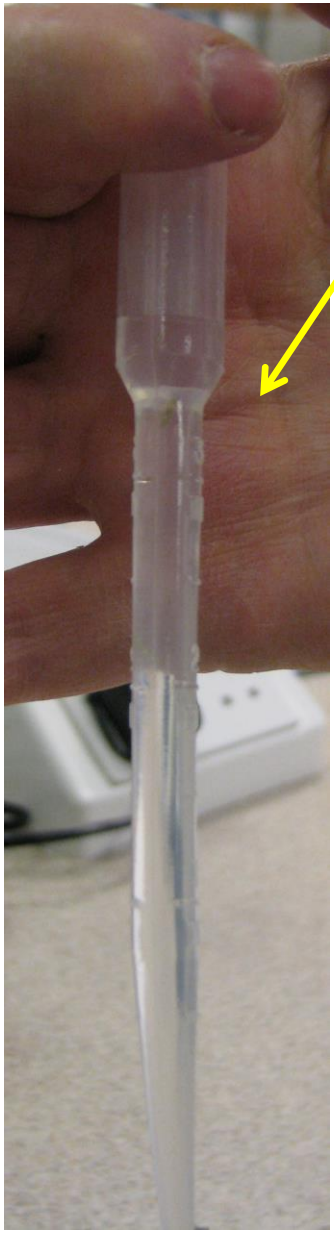
2. *Trim the leaves exposing the final 3 cm of the stem*

Fill boiling tube with 1% sodium hydrogencarbonate

2. *Cut the stem under the liquid*

3-5. *'Play' with lamp*

6. *Squeeze the bulb of a 3 cm^3 plastic pipette very tightly and extract fluid until pipette fills*



7. *Seal pipette by placing Blu-tack™ over tip*

8,9. *Cut pipette at 3 cm^3 mark, then top up any fluid lost from the weighing boat*

Full pipette essential!

Quickly invert the full pipette and place over the stem

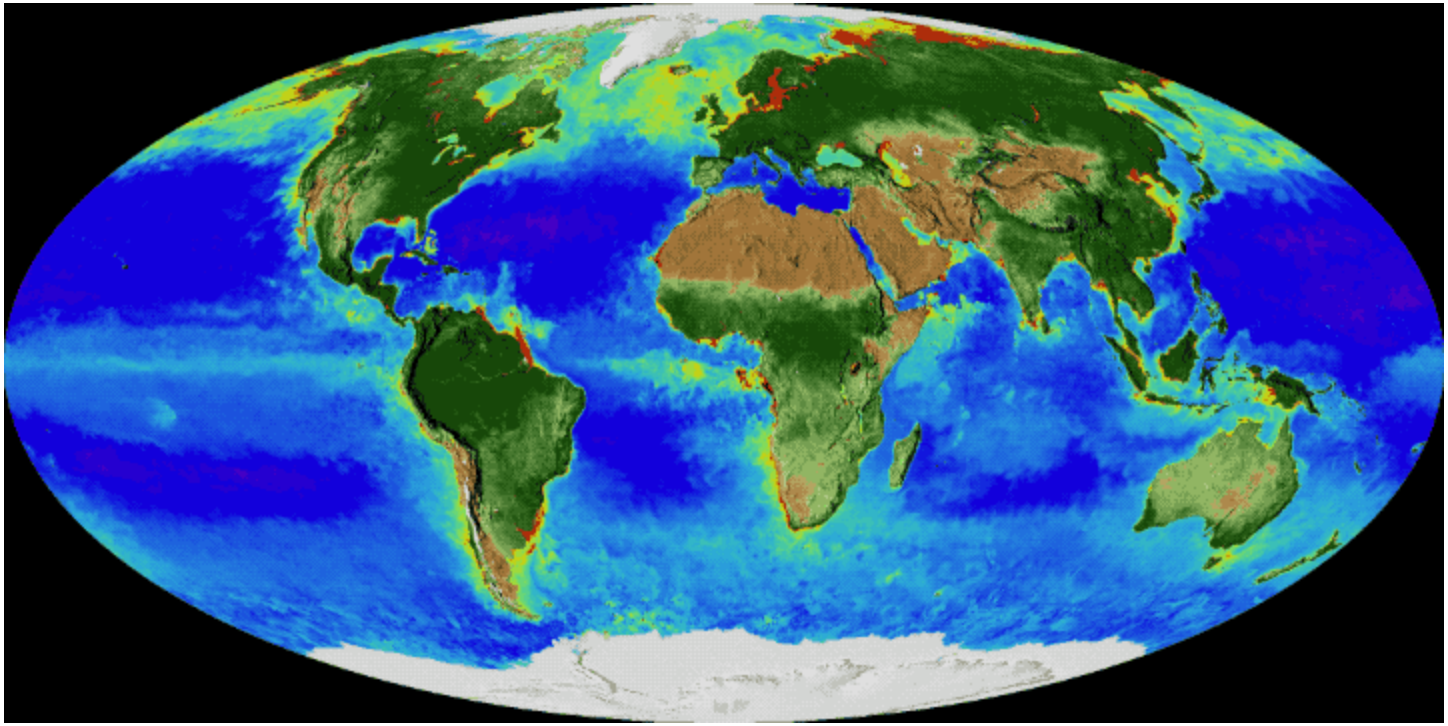
Irradiate for 30 – 40 min

Fun with photosynthesis 1

What colour changes do you notice in the hydrogencarbonate indicator?

- *Can you suggest a reason for the colour change in the*
  - *light*
  - *dark?*

Cross-curricular opportunities



https://www.space.com/38806-nasa-satellites-watch-earth-breathe-video.html

NASA film – Watch Earth breathe

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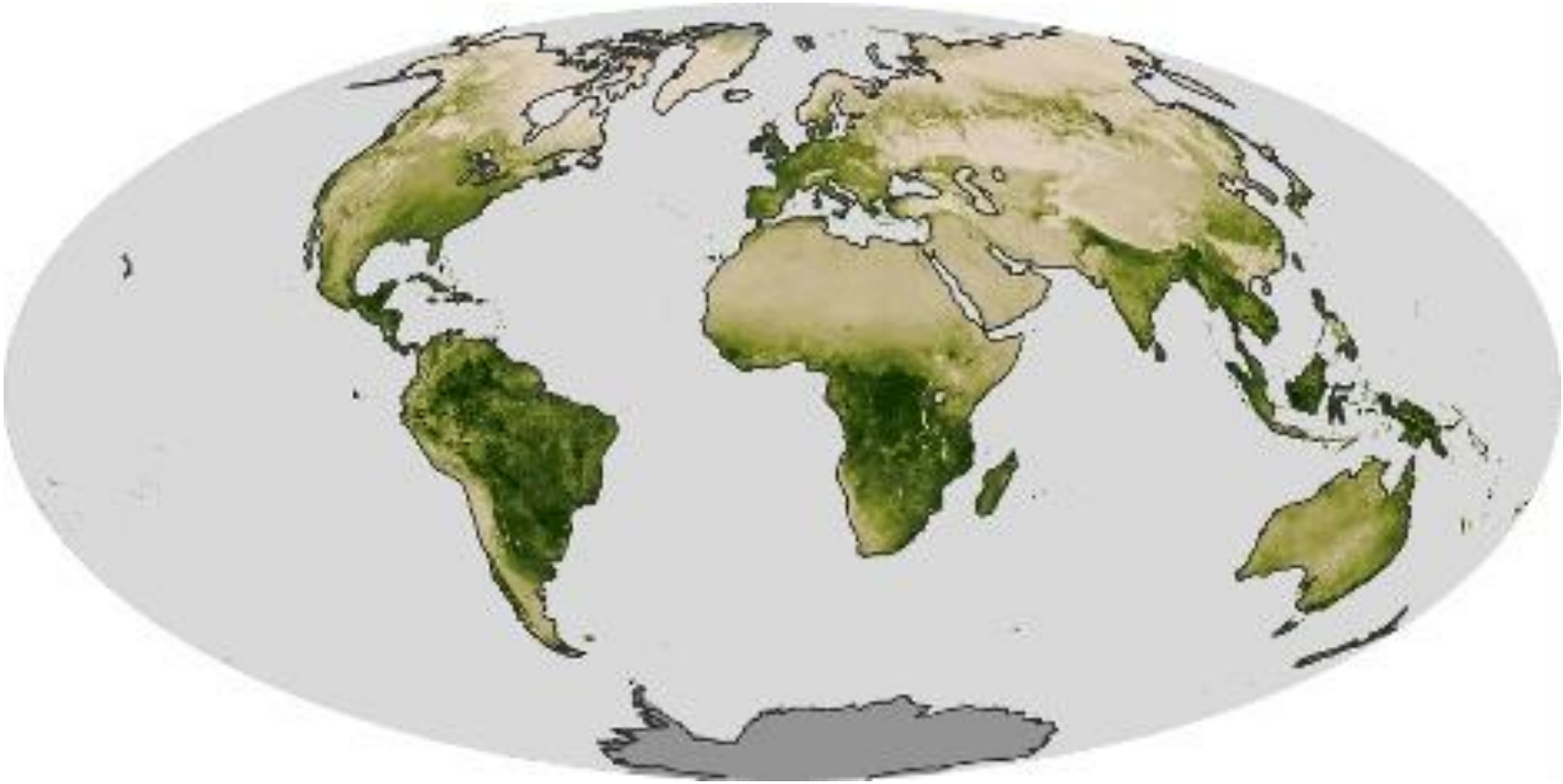
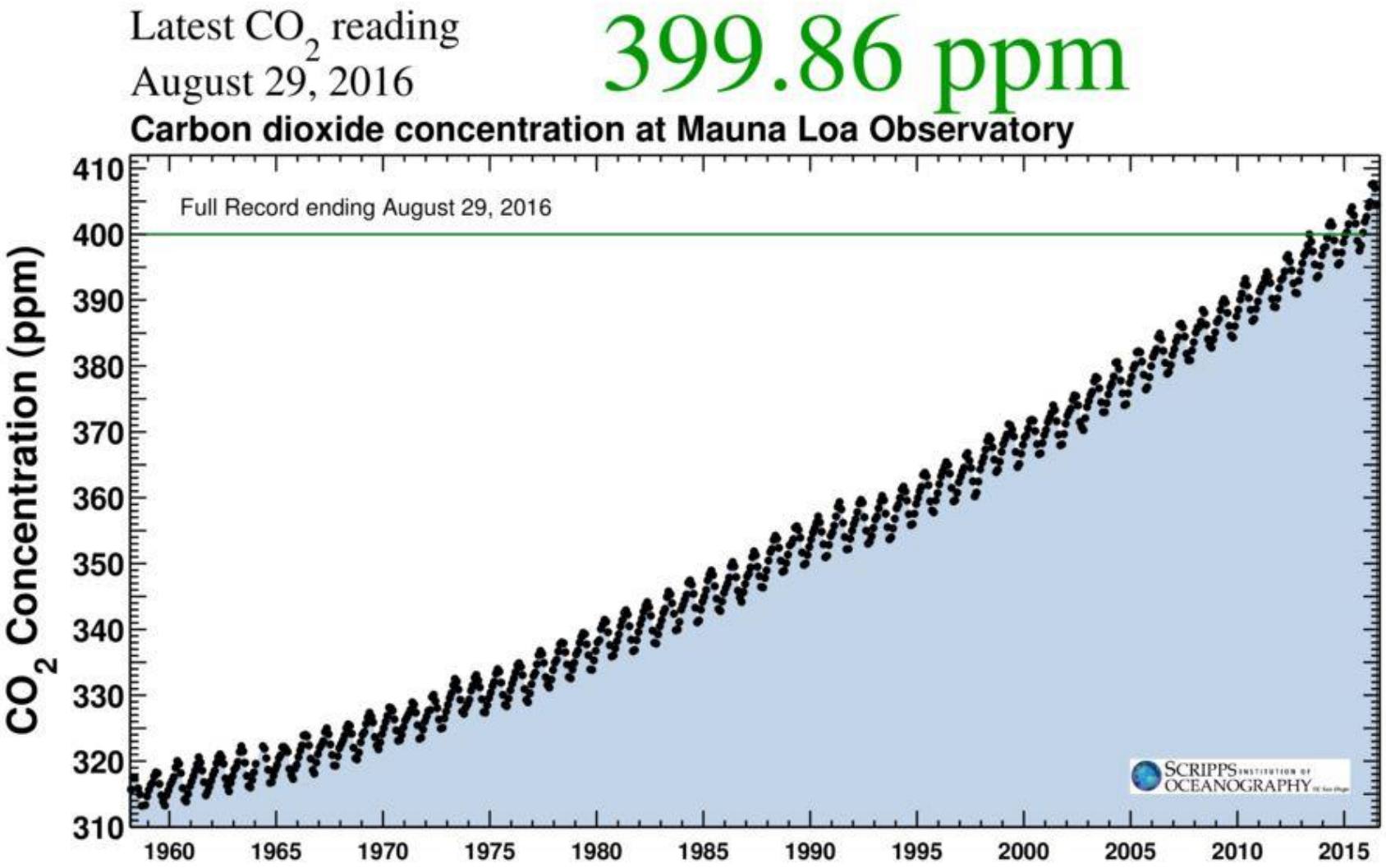
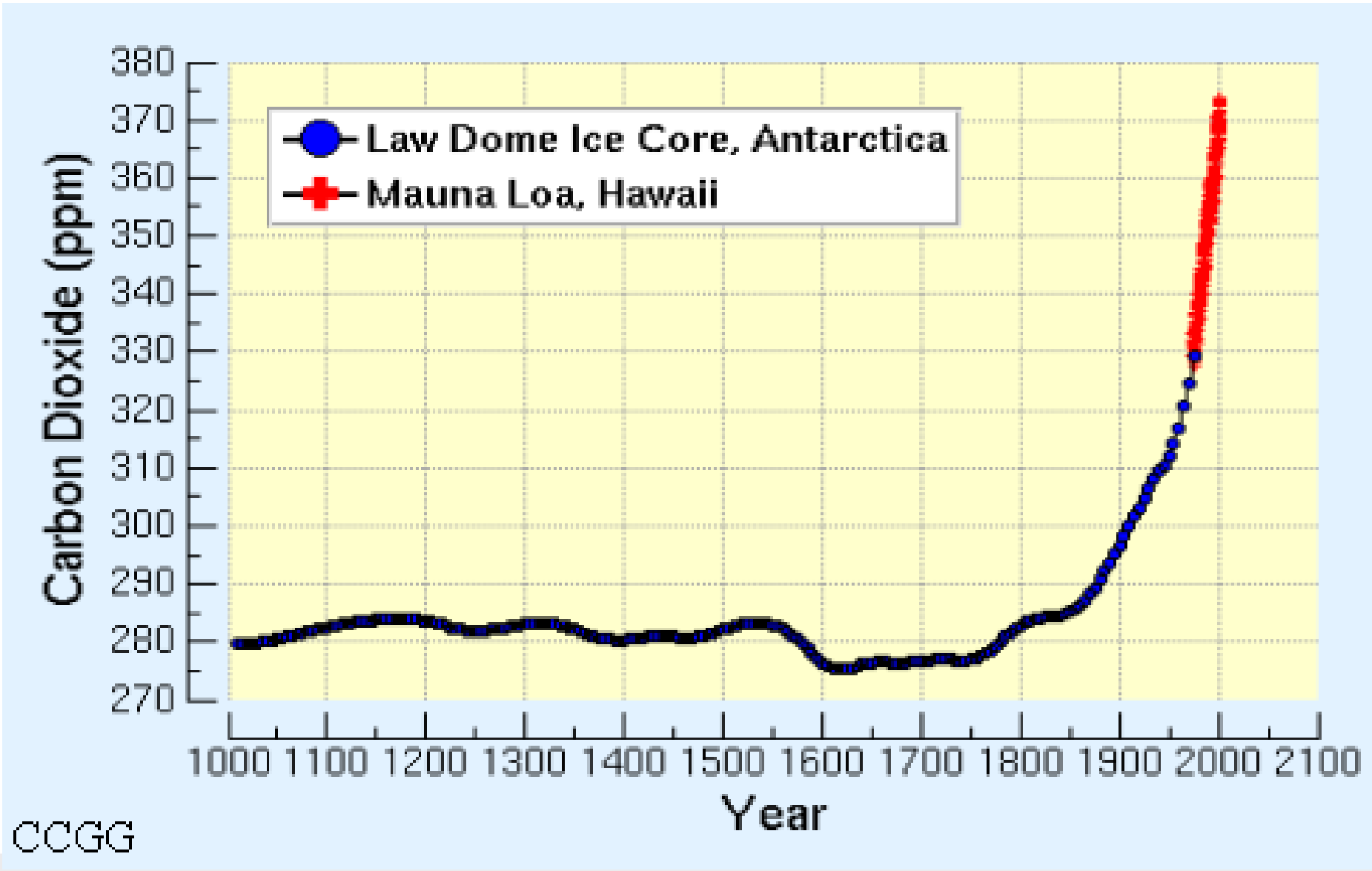
Cross-curricular opportunities

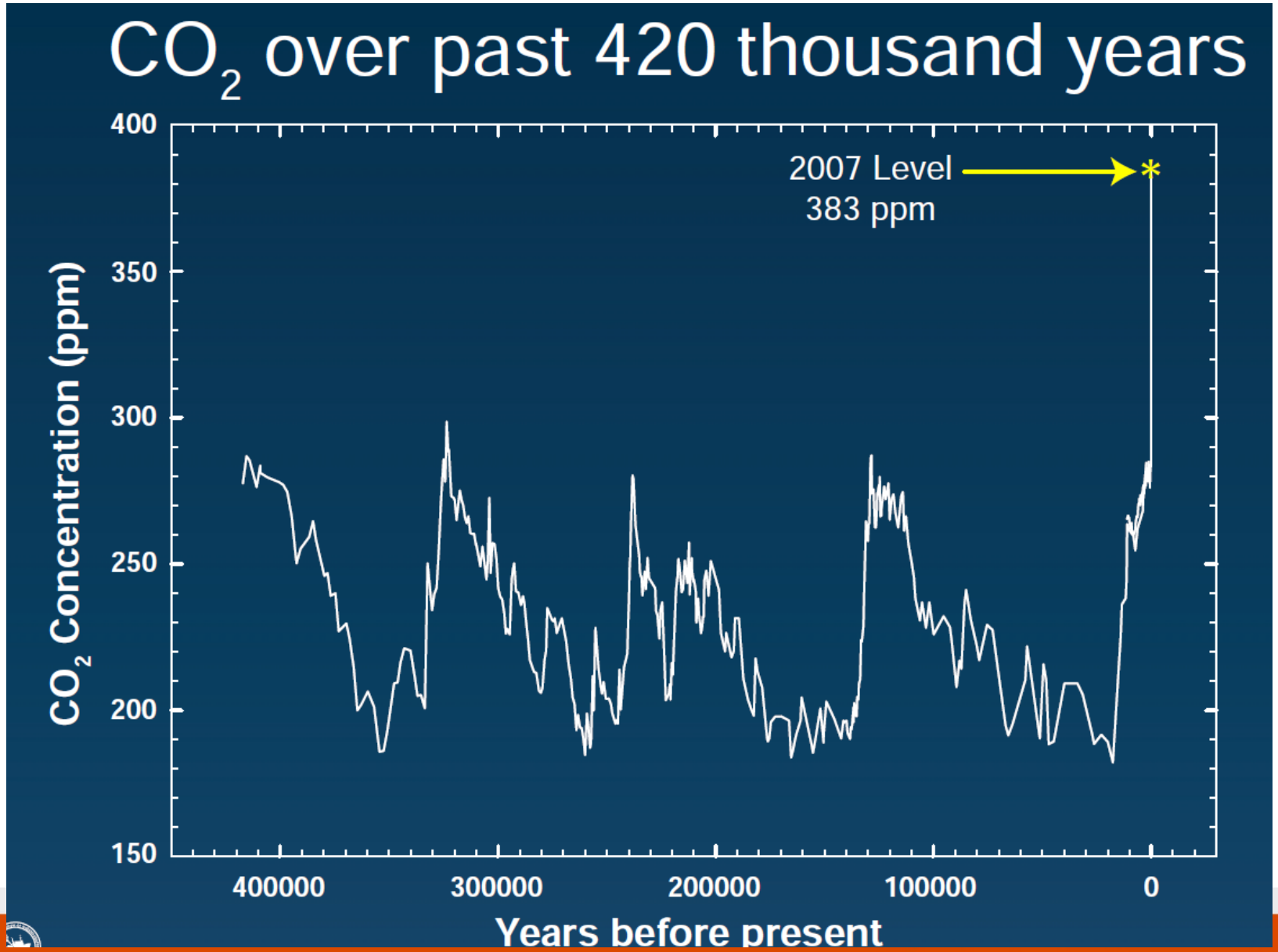


Atmospheric CO_2 measured at Mauna Loa - Keeling Curve (taken from Scripps Institution of Oceanography)

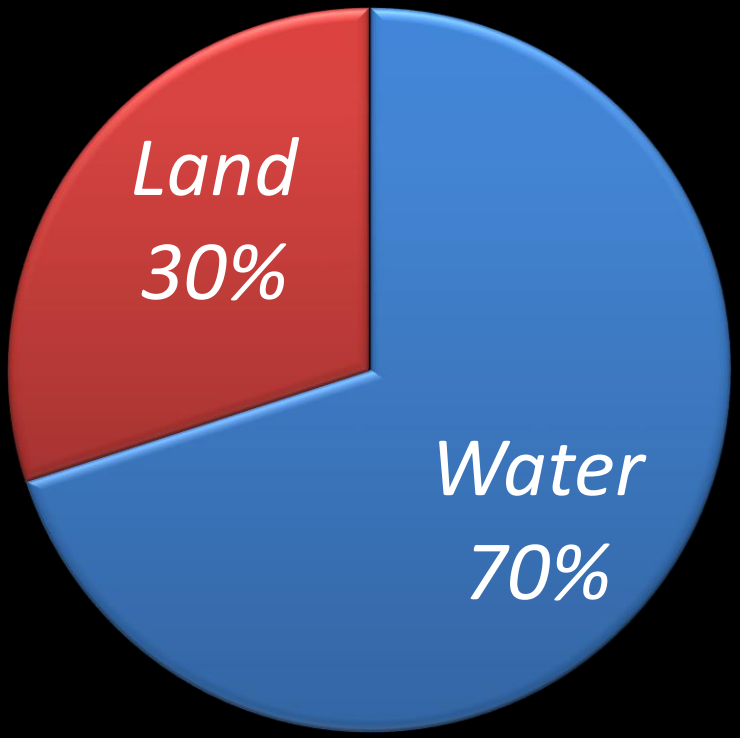



Law Dome Ice Core, Antarctica
Mauna Loa, Hawaii
Carbon Dioxide (ppm)
380
370
360
350
340
330
320
310
300
290
280
270
1000 1100 1200 1300 1400 1500 1600 1700 1800 1900 2000 2100
Year
CCGG

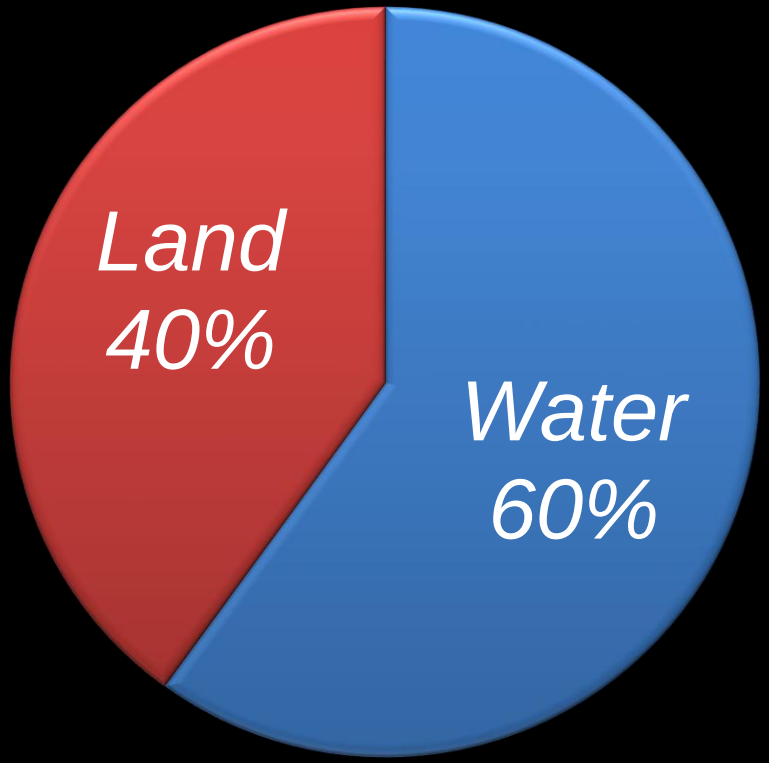
(Taken from Scripps Institution of Oceanography)

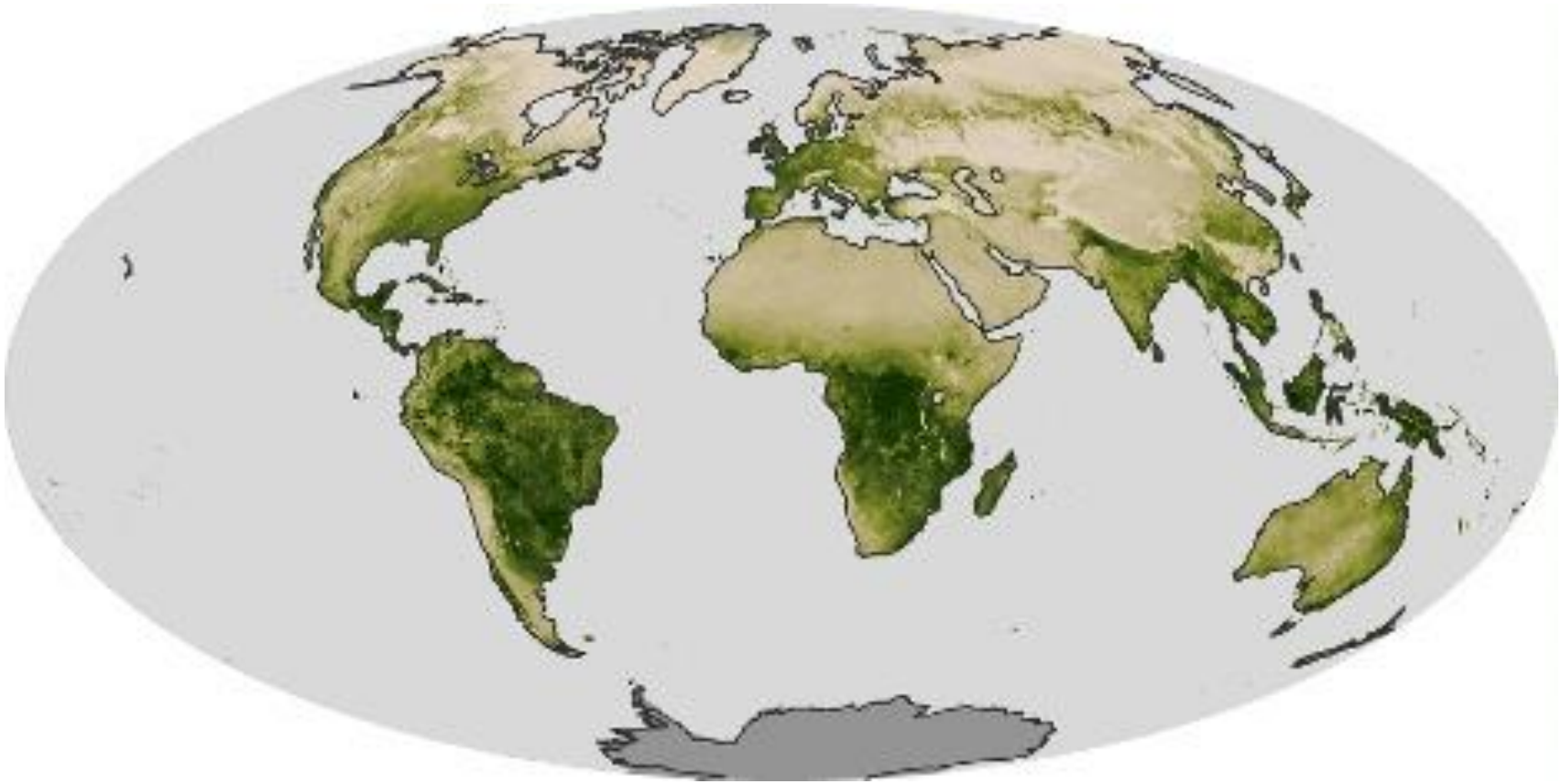


Planet Earth



Photosynthesis on Earth?

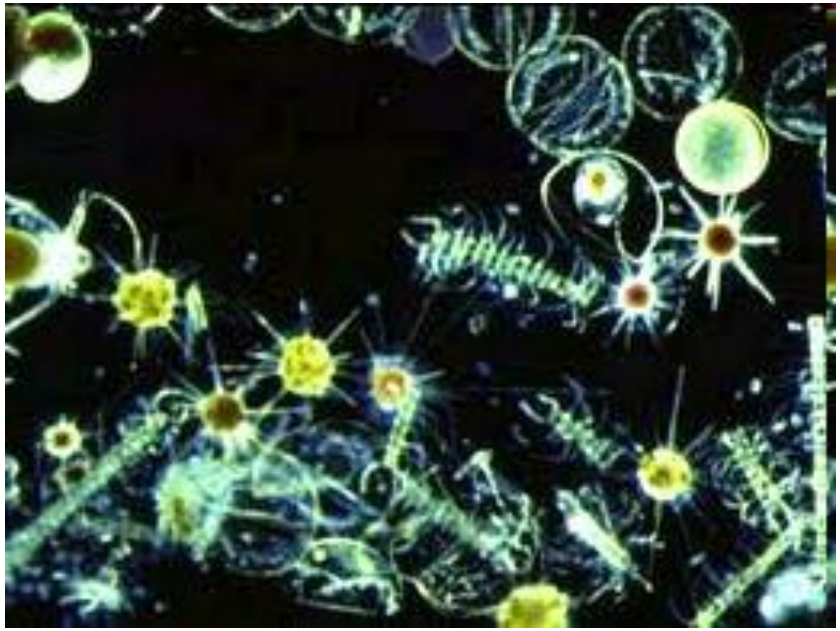




http://earthobservatory.nasa.gov/GlobalMaps/

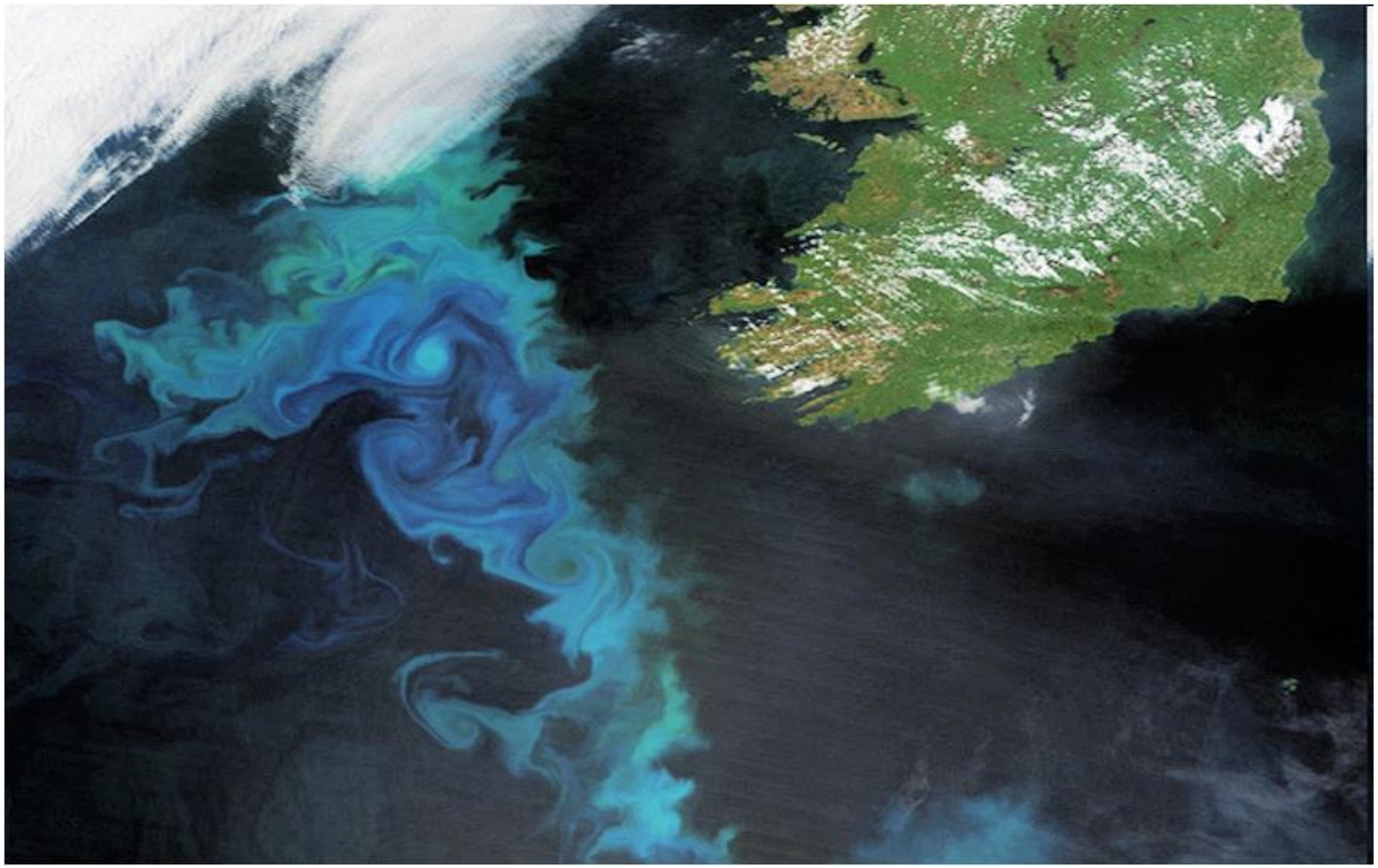
Phytoplankton – a ‘micro’ view

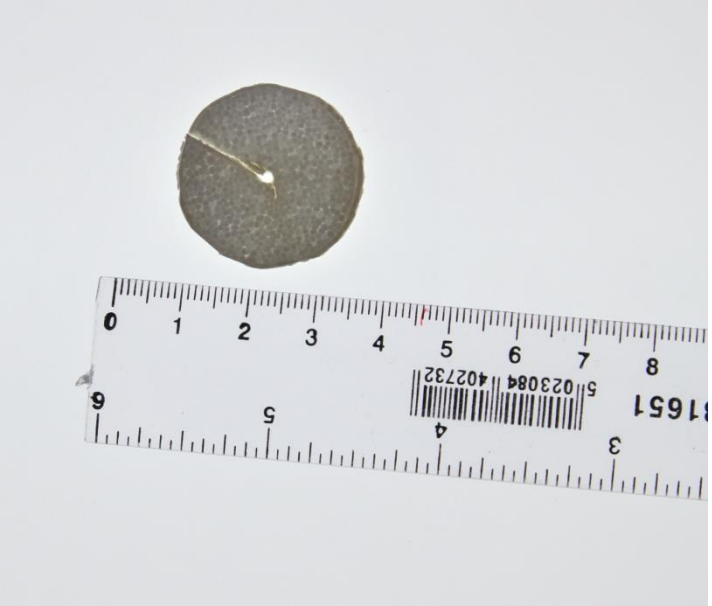
Wikipedia image

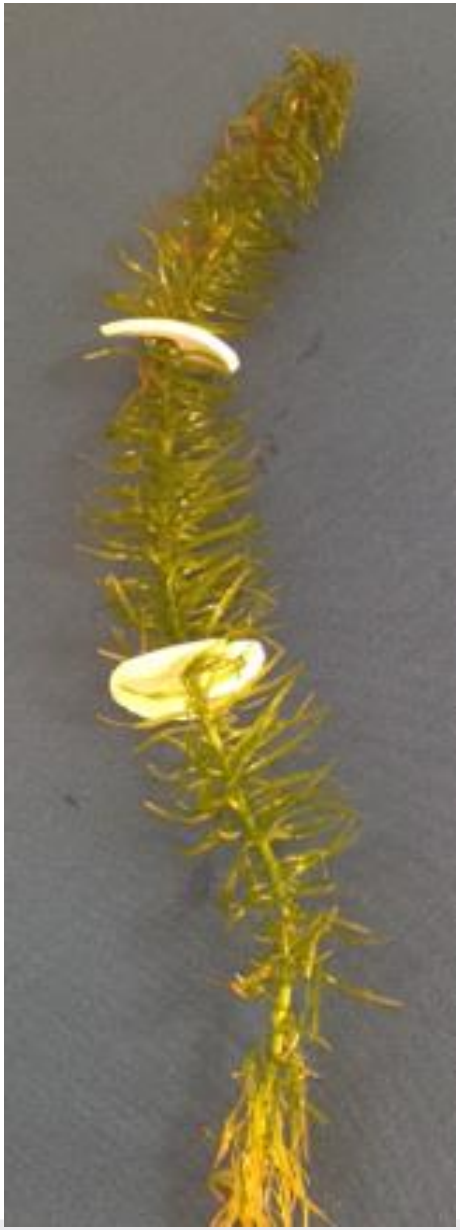


Phytoplankton – a ‘macro’ image

NASA images







For each of the statements below circle True or False

1	Plants can only photosynthesise in the presence of light	True	False
2	In darkness plants add oxygen to the atmosphere	True	False
3	Plants use oxygen in the presence of light	True	False
4	Water is one of the raw materials for photosynthesis	True	False
5	Most of the materials for plant growth come from the soil	True	False
6	In darkness plants add carbon dioxide to the atmosphere	True	False
7	Plants produce oxygen in the presence of light	True	False
8	Photosynthesis in plants produces sugar molecules	True	False
9	Oxygen is one of the raw materials for photosynthesis	True	False
10	Carbon dioxide is required for plant growth	True	False
11	Chlorophyll is a plant enzyme that acts in a similar way to a catalyst	True	False
12	Temperature makes no difference to the rate of photosynthesis	True	False
13	Glucose is an end product of photosynthesis	True	False
14	Green light is required for photosynthesis	True	False
15	Photosynthesis produces proteins and vitamins as well as carbohydrate	True	False

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1	*Plants can only photosynthesise in the presence of light*	*True*	*False*
2	*In darkness plants add oxygen to the atmosphere*	*True*	*False*
3	*Plants use oxygen in the presence of light*	*True*	*False*
4	*Water is one of the raw materials for photosynthesis*	*True*	*False*
5	*Most of the materials for plant growth come from the soil*	*True*	*False*
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