The Effects between Climate Change and Biodiversity

The relationship between the effects of biodiversity and climate change is complex and dynamic. Moreover, climate change can directly impact the growth and development of plants, animals, and other organisms (Gray, S. B. et al, 2016; Cavicchioli, R. et al., 2019).

Climate change is causing an array of changes on land, such as more frequent and more intense floods, longer and more frequent heat waves, more intense storms, and sea level rise that is encroaching on coastlines. As a result, life on land is changing in distribution and abundance, with some species able to adapt to the new conditions while others are not. The loss of plant and animal life can have far-reaching consequences for ecosystems and the services they provide to humans (Gunderson, D. R. et al, 2006).

Why are Biodiversity and Life on Land important?

The objective of life on land (SDG 15) is to sustainably manage forests, combat desertification, halt and reverse land degradation, and end biodiversity loss.

Firstly, forests are vital to life on Earth. They cover 31% of land area on Earth and have many important functions:

- Purify the air
- Filter water
- Prevent erosion
- Offset climate change

Moreover, 80% of terrestrial species live in forests.

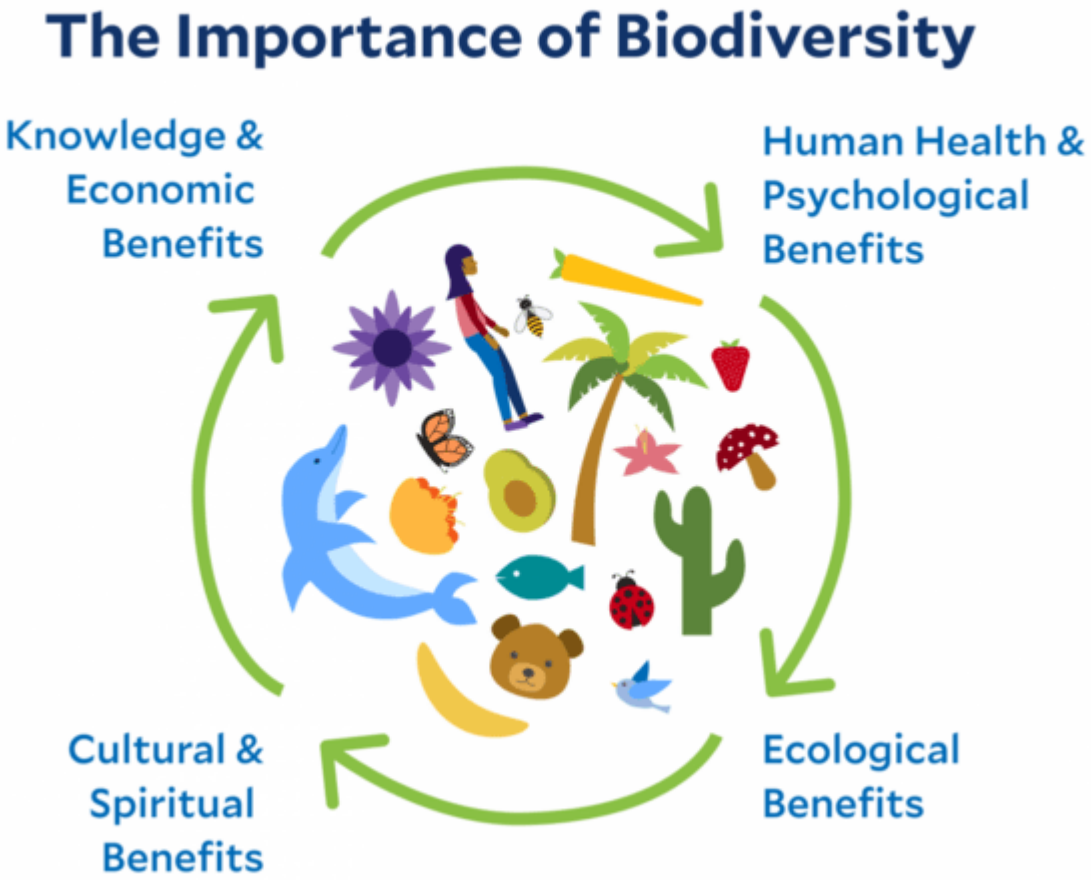
Secondly, land degradation affects 75% of people in poverty. Land degradation is the process of polluting and/or degrading the quality of soil. However human activity and extreme weather events often causes this process. Land degradation prevents ecosystem services and agricultural production from thriving.

Moreover, desertification is an extreme case of land degradation in which originally productive soil turns to a desert. As a result, there is a loss of symbiotic plant and animals.

Desertification can lead to serious health complications such as:

- Threaten nutrition and water supplies
- Lead to more water- and food-borne diseases
- Cause respiratory diseases
- Spread infectious diseases with migrating populations

Lastly – Biodiversity entails all life forms (animals, plants, fungi, and microorganisms) and there interactions that provide sustainability in ecosystems. It is a critical mechanism that supports all life on Earth.



The Importance of Biodiversity: Debatably the most important feature to life on land and climate change.
Source: Yale Sustainability

Climate Change Effects on Biodiversity

Climate change effects all biodiversity on land. It poses major stress for all ecosystems, as it disrupts key environmental processes (Malhi, Y. et al., 2020). These impacts can lead to changes in the composition of plant and animal communities, as well as alterations in the timing of life-cycle events such as flowering and migrations (Scaven V.L. et al, 2013).

In addition, climate change can exacerbate other stressors such as habitat loss, invasive species, deglaciation, and increased desertification(Nerini, F., n.d.).

Climate change alters the balance of biodiversity

Global warming is one of the many side effects of climate change, consequently threatening the natural world.

When temperatures rise plants tend to migrate to areas with cooler climate. These varying migration patterns affect any wildlife that have adapted to survive on or with said plants. Therefore negatively affecting habitats and offsetting entire ecosystems.

On the other hand, some species may thrive with an increase in temperature. If a species begins to thrive in an ecosystem in which it is not native to, it can potentially wipe out other species. These species are also known as invasive species. Invasive species are harmful to ecosystems as they decrease biodiversity while simultaneously threatening other species abundance.

For instance, Gypsy Moths. Originally from Europe, North Africa and temperate Asia, Gypsy Moths were originally introduced to America in the late 1860s. With global warming increasing the invasive species have been able to migrate further North, negatively impacting Northern ecosystems. As caterpillars, Gypsy Moth's defoliate trees in forests and farmlands.
Source: Thought Co.

Thirdly, global warming is considered to be a primary cause of deglaciation. Glaciers are important as they are keystones to life on Earth. They are fresh water reserves and affect even distant communities.

Climate change induces natural disasters that destroy biodiversity

Climate change causes natural disasters that have negative effects to biodiversity. More specifically – floods and wildfires.

There is often some misconception regarding flooding. Natural flooding is an important ecological process to drive biodiversity in many areas. Nonetheless, floods caused by climate change are not considered natural and are detrimental to ecosystems and biodiversity. Floods cause: Habitat loss, death and spread of disease.

Floodwaters can carry many microorganisms from various waterborne diseases to nutrients.

Soil erosion and desertification are other byproducts of flooding (as well as prolonged droughts, also caused by climate change). Floodwaters are able to erode soils through a process referred to as sedimentation. Sedimentation occurs when suspended sediment settle out of the water column. This process allows for the development of harmful algal blooms, the clogging of riverbeds and streams, as well as the destruction of habitats.

Droughts and heat often lead to wildfires. Both drought and heat are consequences of excessive greenhouse gas emissions, consequently leading to climate change. Wildfires, again, are controversial. There are some fire-dependent forest ecosystems that rely on wildfires (McGee, T. et al, 2015). Nonetheless, wildfires cause disproportionate damage to habitat loss and species abundance/biodiversity.

Keeping climate change In Check

Simultaneously, biodiversity and life on land is equally important to mitigate climate change effects. Life on land accounts for important carbon sinks. Basically, a carbon sink is a natural environment that has the ability to absorb excessive amounts of carbon from the atmosphere (Alexandrov, G, 2008). This process can also be referred to as carbon sequestration (Ontl, T. A., 2012).

Many of the goals set out in SDG 15 aim to halt human influence on terrestrial ecosystems. In turn by achieving SDG 15, mitigating climate change can also occur.

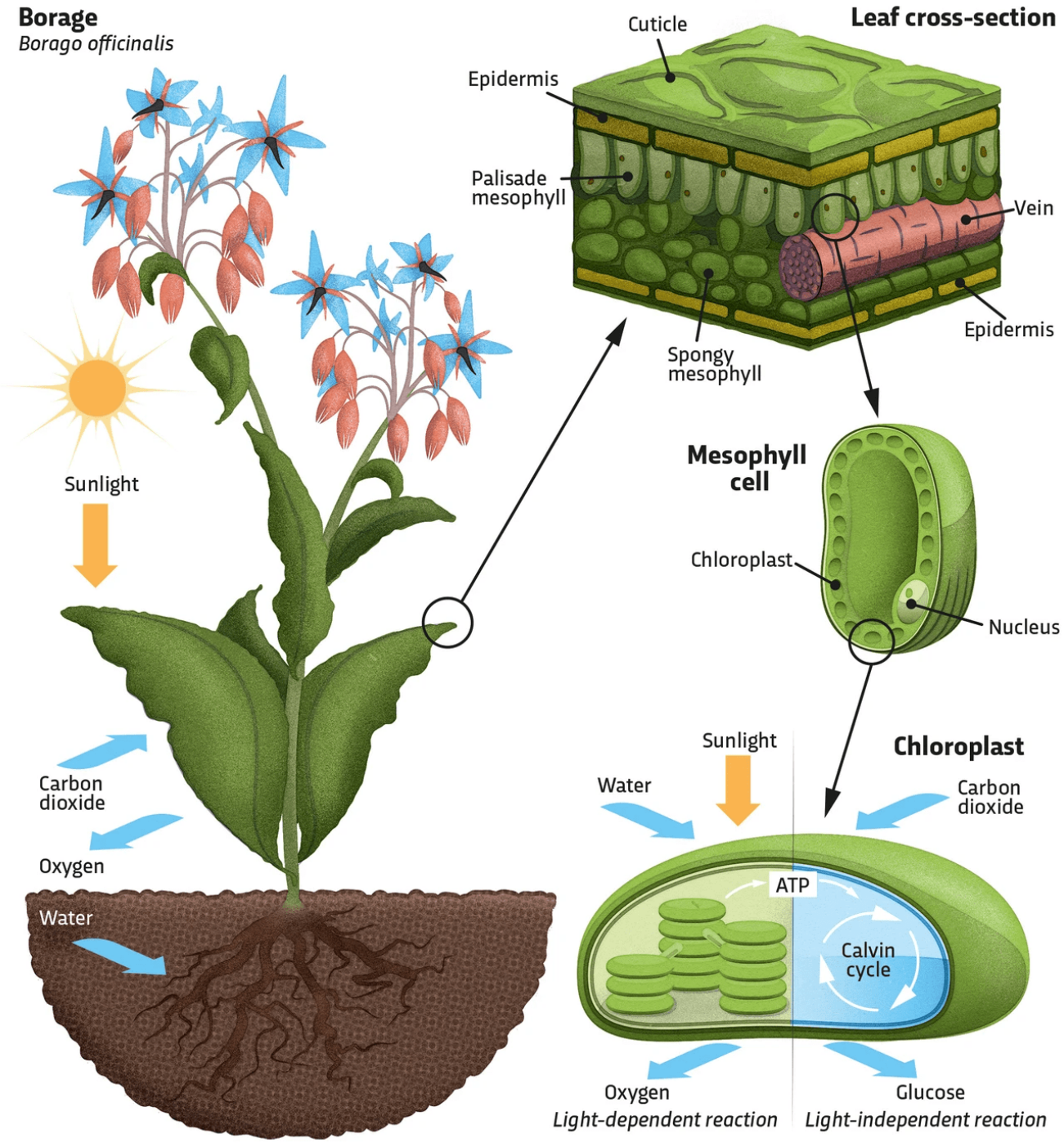
> *"It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century."*
>
> *The Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment Report (2014)*

Presently, there are two major carbon sinks on land that aid in absorbing excessive amounts of carbon in the atmosphere: soil and plants.

Sequestering carbon from the air

Another notable carbon sink is plants. Plants absorb carbon from the atmosphere via photosynthesis. Light energy, carbon dioxide, and water are certainly essential for plants to create energy and oxygen.

There are 2 steps to photosynthesis: The light-dependent reaction and the Calvin cycle. Both of which occur in the chloroplasts. In short, the chloroplast is where the magic happens.

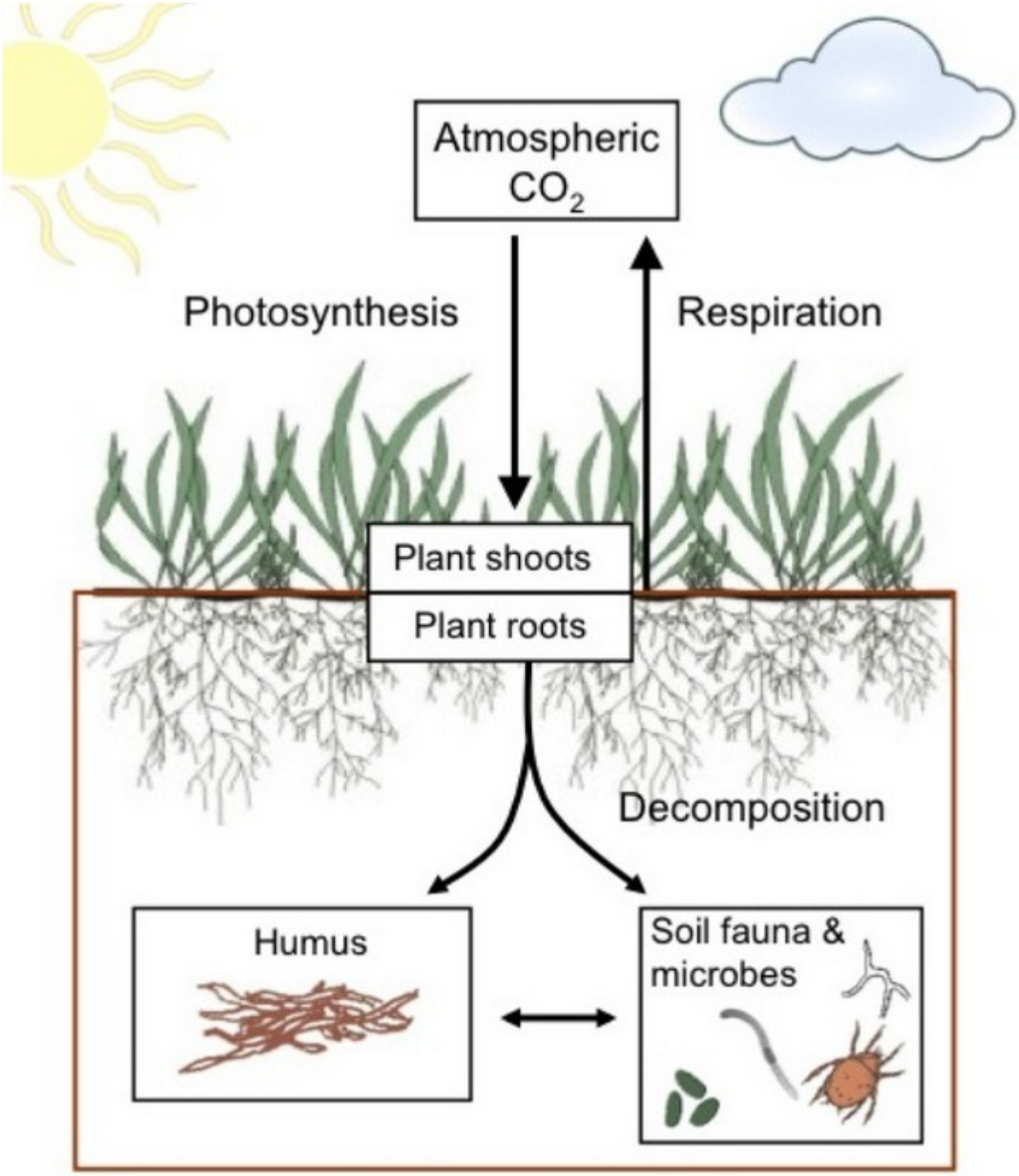


Process of photosynthesis. **Source:** Science Focus

More specifically than just plants, forests account for a major carbon storage and carbon sink. Forests absorb carbon similarly to plants but as an additional step deposit carbon as forest biomass. Anthropogenic disturbances, such as deforestation, cause carbon to be transferred back into the atmosphere.

Sinking carbon into soil

Research shows that soil holds more carbon than the atmosphere and plants. The amount of carbon that soil can store is dependent on the amount of organic matter the soil contains (Ontl, T. A., 2012). Furthermore, photosynthesis, respiration, and decomposition are important for soil organic carbon levels.



Carbon cycle in soil. **Source:** Ontl, T. A. & Schulte, L. A. (2012) Soil Carbon Storage. *Nature Education Knowledge* 3(10):35

The organic matter found in soil is commonly referred to as humus. Humus accounts for nearly 50% of carbon by weight. Soil fauna and microbes use carbon from the roots as energy (Ontl, T. A., 2012). When soil fauna and microbes decompose, the remaining carbon is transferred back into the atmosphere and to humus.

Life on land and climate change are indivisible

Not only does climate change severely affect life on land, but life on land impacts climate change.

One of the most well-known effects of climate change is its impact on biodiversity. As the planet continues to warm, plants and animals are being forced to adapt to new conditions or face extinction. For many species, this means moving to higher altitudes or latitudes where the climate is cooler. However, as human development encroaches on natural habitats, there is less and less room for species to migrate. In addition, extreme weather events are becoming more common and more intense, disrupting food chains and putting additional stress on ecosystems. As a result, climate change poses a major threat to the well-being of all life on Earth.

OUR CALL TO ACTION: 3 THINGS YOU CAN DO TO HELP LIFE ON LAND

1. Plant trees: humans should plant 1 tree for every year they're alive. Trees produce oxygen, store carbon, stabilize soil, and give habitats to wildlife.
2. Reduce, Reuse, and Recycle: The 3 R's conserve natural resources and landfill space.
3. Compost: Allowing your waste to rot in your yard cuts down on waste in the waste stream and it produces free, rich soil to use in your garden

At THRIVE we believe that there is no sustainable business in an unsustainable world. Achieving the Sustainable Development Goals is a small portion of what we aim to achieve. Join the conversation this month and be sure to check out other blogs, podcasts and webinars all relating to Life on Land and Life under Water.

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