Nature-Based Solutions to Climate Change

Very often climate change solutions and mitigation techniques focus on new technologies. For many reasons, technology should not be relied on for the answer. Nature-based solutions can be helpful and should not be forgotten; they might even be preferable for a variety of reasons: practical, ecological and philosophical. We often are caught up in the news cycle about new techs and are excited about what's happening in tech development. This may in fact blind us to implementing the nature based strategies that we already know work really well. So, what are these nature-based solutions and how can they help us in the fight against climate change?

What are Nature-Based Solutions?

Nature-based solutions (NbS) enhance biodiversity and ecosystems while simultaneously addressing challenges within society (Seddon et al., 2020). Many experts believe that NbS are the most realistic way to approach the eco- and climate disasters we have caused.

These solutions include benefits including:

- Protecting biodiversity
- Carbon sequestration methods
- Enabling communities to be resilient to climate change risks
- Contributing to food security
- Supporting sustainable businesses

Unfortunately, these solutions are not a quick-fix and do require resources. Moreover these solutions do not have the capability to reverse climate change but to mitigate the acceleration. NBS can provide an estimated 37% of mitigation.

There are four types of nature-based solutions to climate change: forest restoration/conservation, sustainable agricultural practices, ocean-based practices and coastal wetland restoration.

According to research, NbS vary in 3 ways (Seddon et al., 2020):

- Address a range of interventions
- Differ in how they support ecological processes
- Differ in management and implementation

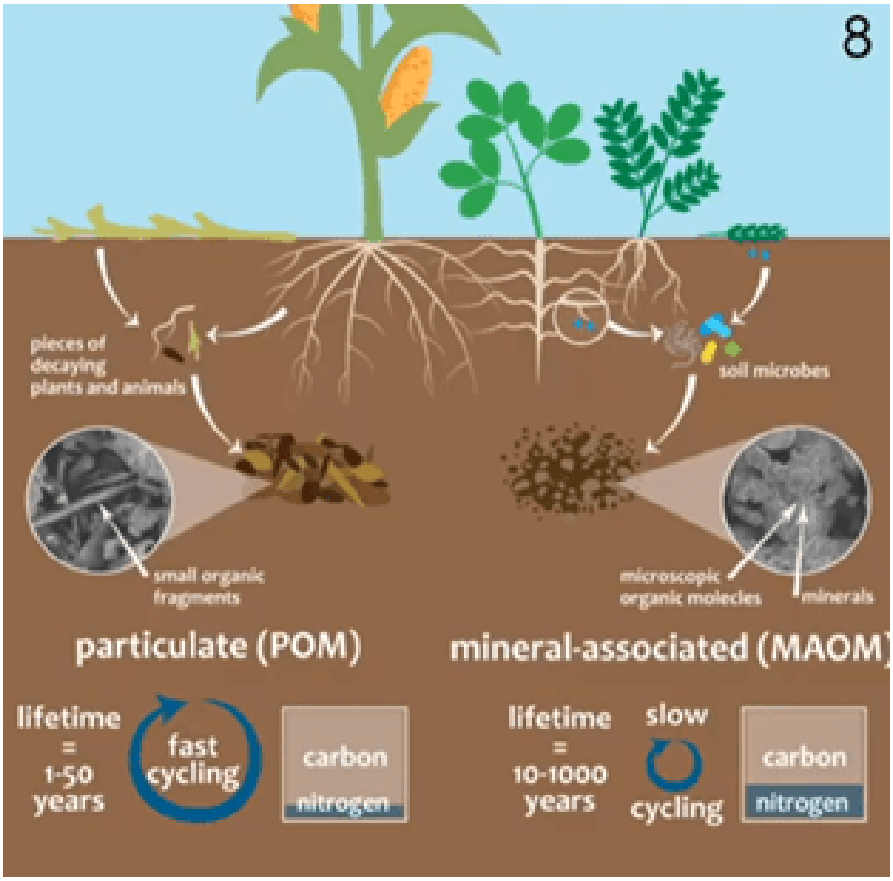
In this article we will be focusing on forest restoration and more specifically carbon sequestration in soil.

Exploring Nature-Based Solutions: Soil Sequestration

Soil sequestration is one of the most efficient processes in terms of carbon sinks. Carbon sequestration in soil is in 3/4 of NBS: forests, agricultural lands, and wetlands.

Carbon sequestration in soil occurs via soil organic matter. Soil organic matter (SOM) is biological matter that has recently undergone decomposition. This portion of SOM is also referred to as humus. Humus is a stable form of organic matter and aids in plant growth and development. Soil organic carbon (SOC) is simply the portion of SOM consisting of carbon. This accounts for approximately 58% of SOM.

Not all SOC is equal. There are two components: particulate organic matter and mineral-associated matter. Their management differs drastically.



The difference between particulate organic matter and mineral-associated organic matter in terms of life, time, and carbon versus nitrogen sequestration.
Source: Stanford Energy

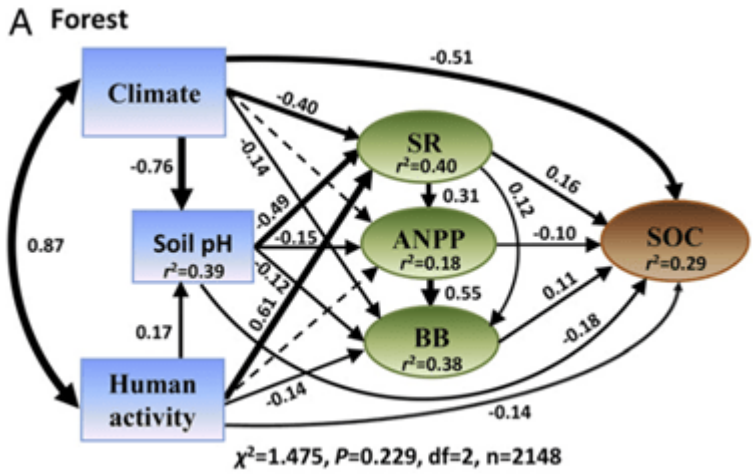
Various land management techniques also affect the amount of carbon the soil can store. More specifically the type of plants in the ecosystem highly affects the amount of soil organic matter.

Forest Conservation Impacts Soil Sequestration

Scientists and experts widely accept that soil carbon increases and reaches maximum potential in mature forests (Chen et al., 2018). More specifically, forests do not begin to sequester carbon at an impactful rate until approximately 15 years.

It is also important to note that, natural forests can store carbon more effectively than managed forests or forest products (Chen et al., 2018). Research has proven time and time again the importance of the relationship between soil and forest ecosystems (Moomaw et al., 2020).

Research shows the clear relationship between human activity and species diversity impacting SOC in forest ecosystems (Chen et al., 2018). These two variables, along with climate and soil pH have the largest effect on SOC. Human activity has a strong positive correlation with species richness which positively correlates with SOC. There is also a direct negative correlation between human disturbances and SOC. Therefore the amount of carbon that a forest and the soil within the forest is able to sequester correlates with human disturbance as well as species diversity within a forest.



Relationships between species richness (SR), aboveground net primary productivity (ANPP), belowground biomass (BB), and SOC and the effects of climate, soil pH, and human activity on SR, ANPP, BB, and SOC. Solid lines represent significant correlations while dashed lines represent non-significant correlations.
Source: Chen et al., 2018

It is important to note that species diversity affects the amount of carbon a forest and its soil can sequester.

Moreover, conservation is increasingly important as it is often that native plants have the ability to absorb the most carbon as opposed to non-native plants in it's region. For example, in New Zealand the native forests are able to absorb 60% more carbon than originally thought.

Challenges

So far so good. Nature-based solutions seem to be a very important tool in terms of climate change mitigation. That is not without it's challenges – the three most

prominent challenges in implementing nature-based solutions is: scale, time, and money.

The scale of NbS is thought to be the most prominent challenge by various experts. For the purpose of this article scale refers to amount of land and/or space needed. The amount of land footprint that it takes for carbon to absorb is considerable.

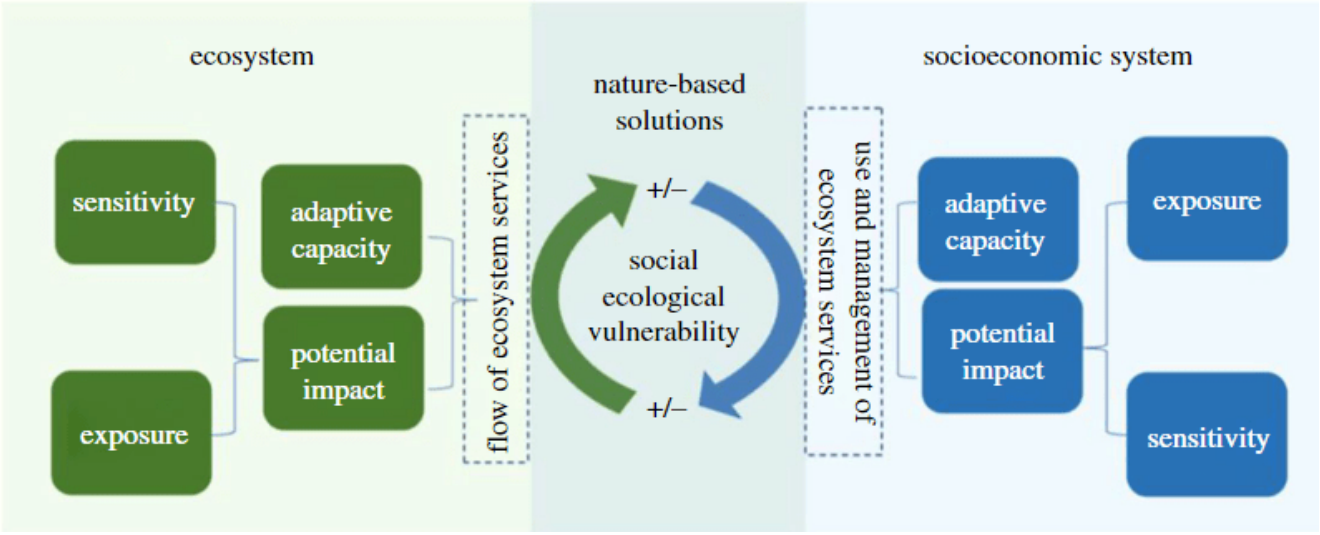
Time is a factor that greatly influences the effectiveness of nature-based solutions. Some NbS take many years before implementation and then take additional years or decades to take effect (Kabisch et al., 2017). As we know, climate change is an exacerbating crisis and time is not on our side. The quicker techniques can be implemented – the better.

On another note in regards to time challenges, with climate change exacerbating it is very difficult to attempt to restore and conserve natural environments with changing climate. The intensity and frequency of the challenges caused by climate change allow for more problems (Seddon et al., 2020). Ecosystems certainly are resilient but with these everchanging issues that are arising more rapidly, there are major shifts within ecosystems in shorter time periods. This causes challenges to restoration and conservation (Seddon et al., 2020).

Lastly, money. Everything costs money including research, obtaining land, and projects (Hagedoorn et al., 2021). This is a challenge many climate change mitigation techniques battle. It is difficult to find funds and investors for nature-based solutions (Hagedoorn et al., 2021).

why Focus on Nature-Based Solutions

Although there are challenges in using nature-based solutions, it is still a promising mitigation technique (Moomaw et al., 2020). NbS aim to meet many goals besides just climate change such as: disaster risk mitigation, food and water security, biodiversity loss and human health, and economic development.



Ecosystems and socioeconomic system variables are interwoven when nature-based solutions are implemented sustainably.
Source: Seddon et al., 2020

At its core, sustainability simply means the ability to continue, to survive. 'Thrivability', by contrast, is the next step, beyond sustainability. THRIVE believes that humanity can do better with the knowledge currently available to us. We want to instil the idea that sustainable solutions not only prevent disaster, but offer the potential for societies to flourish.

The THRIVE Framework examines issues and evaluates potential solutions in relation to this overarching goal of thrivability. It is about making predictive analyses using modern technology that support environmental and social sustainability transformations. Nature-based solutions will help us achieve thrivability into the future.

To learn more about how The THRIVE Project is researching, educating and advocating for a future beyond sustainability, visit our website. You can follow our informative blog and podcast series, as well as find out about our regular live webinars featuring expert guests in the field. Sign up to our newsletter for regular updates.