Restoring the Biosphere

Biosphere Restoration Plan

In this section we deal with the practical implications of restoring the Biosphere and reducing atmospheric CO_2 to preindustrial levels

10,000 years of human impact

Carbon in living things 10,000 years ago:

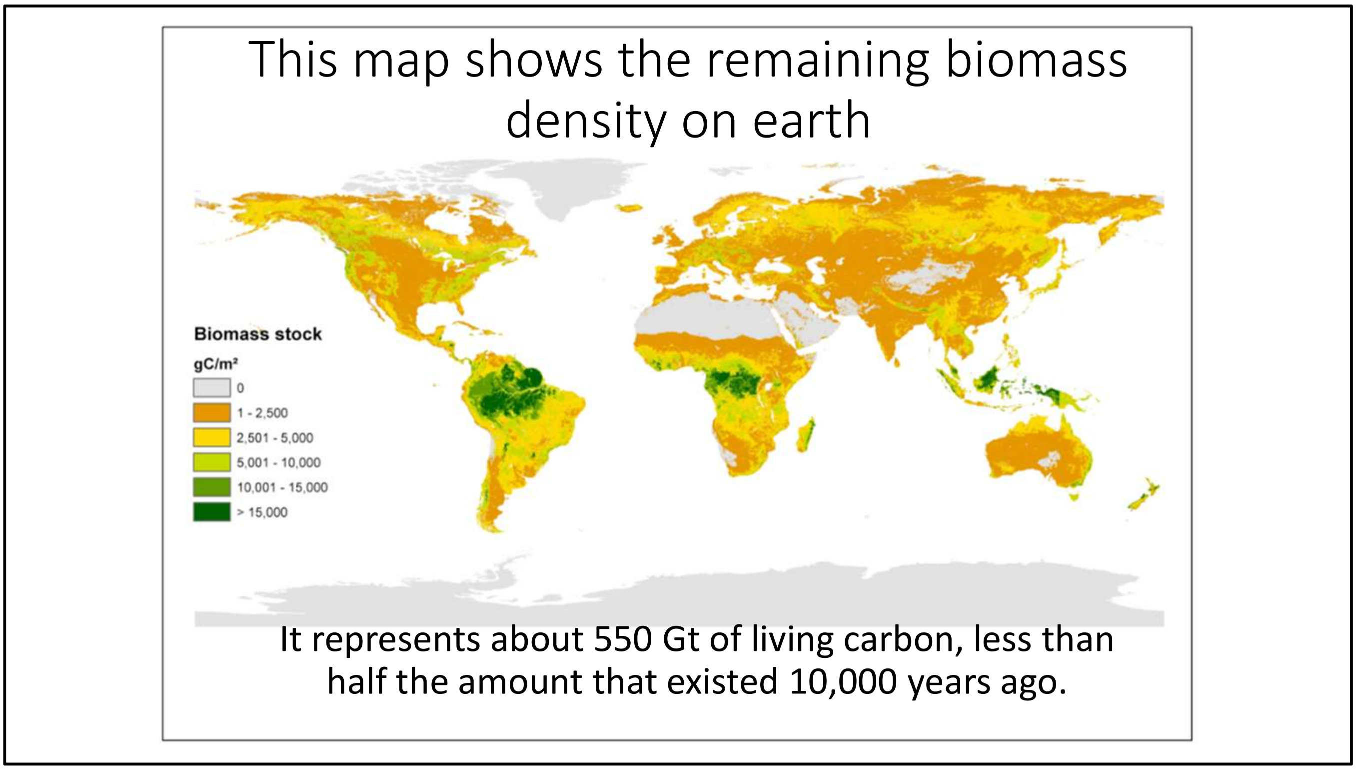
More than 1,100 Gt

Now reduced to 550 Gt

Increasing human impacts started to overwhelm the biosphere's ability to regulate temperature sometime around 1970.

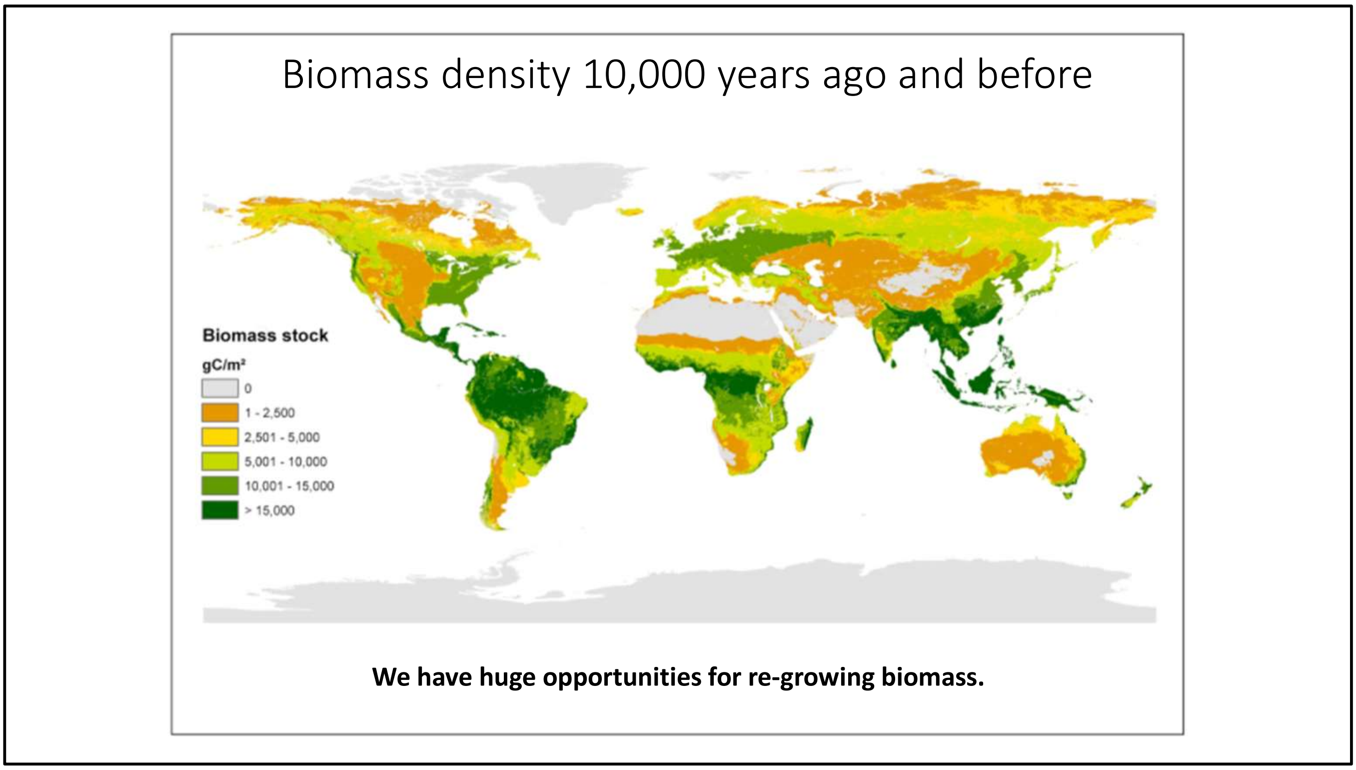
Our knowledge of the Earth's living carbon account, is still very sketchy, especially in the oceans, so these figures are rough. However, a reduction in living carbon of over 50% is hard to dispute.

Terrestrial vegetation, all the trees and plants on the planet, contain about 550 Gt of carbon, according to the latest research, with animals accounting for only around 2 Gt but animals play a massive roll in the circulation of nutrients and many plants are totally dependent on animals for their reproduction and disbursement.



This map shows the current density of carbon in biomass, in grams per square metre

You can think of this as the cupboard for living carbon assets, being half empty!



The Earth prior to significant human impact with circa 1100 Gt of carbon in living biomass

We know that Earth has previously supported twice as much life

Loess Plateau Restoration before and after, an area the size of Belgium.

Image from Gaia University Webinar with John D. Liu

China may be the world's biggest polluter (although nowhere near, based on emissions per head), but they are also carrying out some of the largest land restoration projects, as seen in this picture of the Loess Plateau Restoration.

The impacts on landscapes can be dramatic, in just a few years consider the value change.

Now consider doing this on vast areas of land and the wealth it will create.

This requires irrigation, which requires clean energy and intelligent land husbandry allowing natural regeneration to occur.

The Great Green Wall in Africa

Key requirements for delivering these projects are huge amounts of clean energy, financing and manpower, once established natural regeneration can take over.

This will work because large-scale environmental restoration is highly profitable.

Environmental restoration and climate management will more than double the available productive land and add massively to overall global wealth.

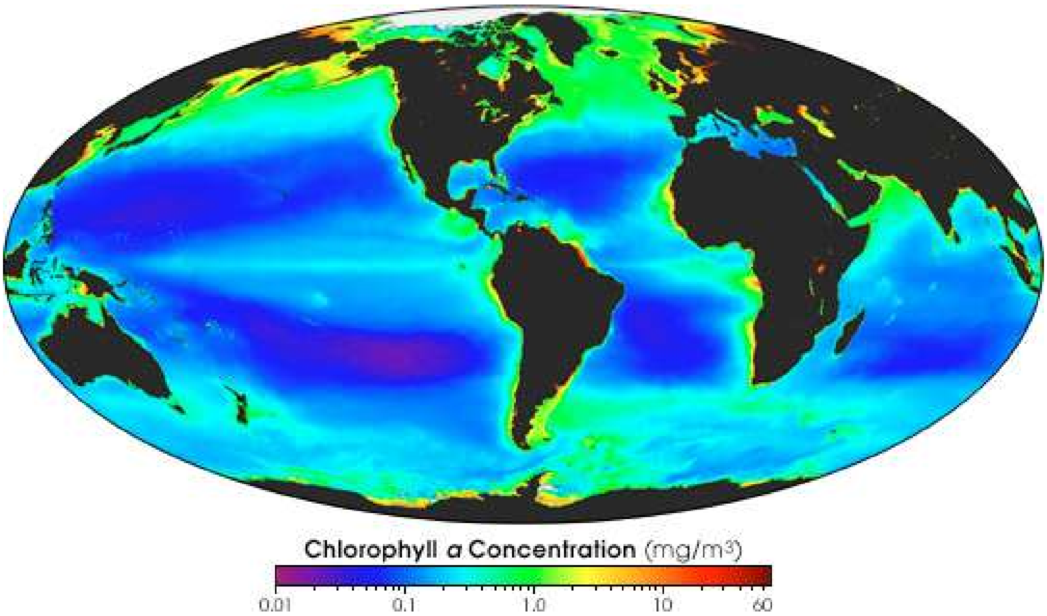
Freeing up space for the additional biomass and feeding the world at the same time?

The rapidly expanding agricultural technology market, allows us to grow food using a fraction of the space, utilising much less water and produce high-quality crops, all year round, in controlled environments

Food can be produced where it's needed, removing transportation costs and greatly reducing its carbon footprint. It's a great way to re-purpose redundant retail space in the high streets, creating new high-quality jobs and breathing life back into our towns.

Fast growing algae can produce both fuel and food, from which synthesised proteins, and even directly grown animal muscle, can be produced that will be of extremely high quality, pesticide and antibiotic free and as no sentient animals will be involved, is cruelty free as well.

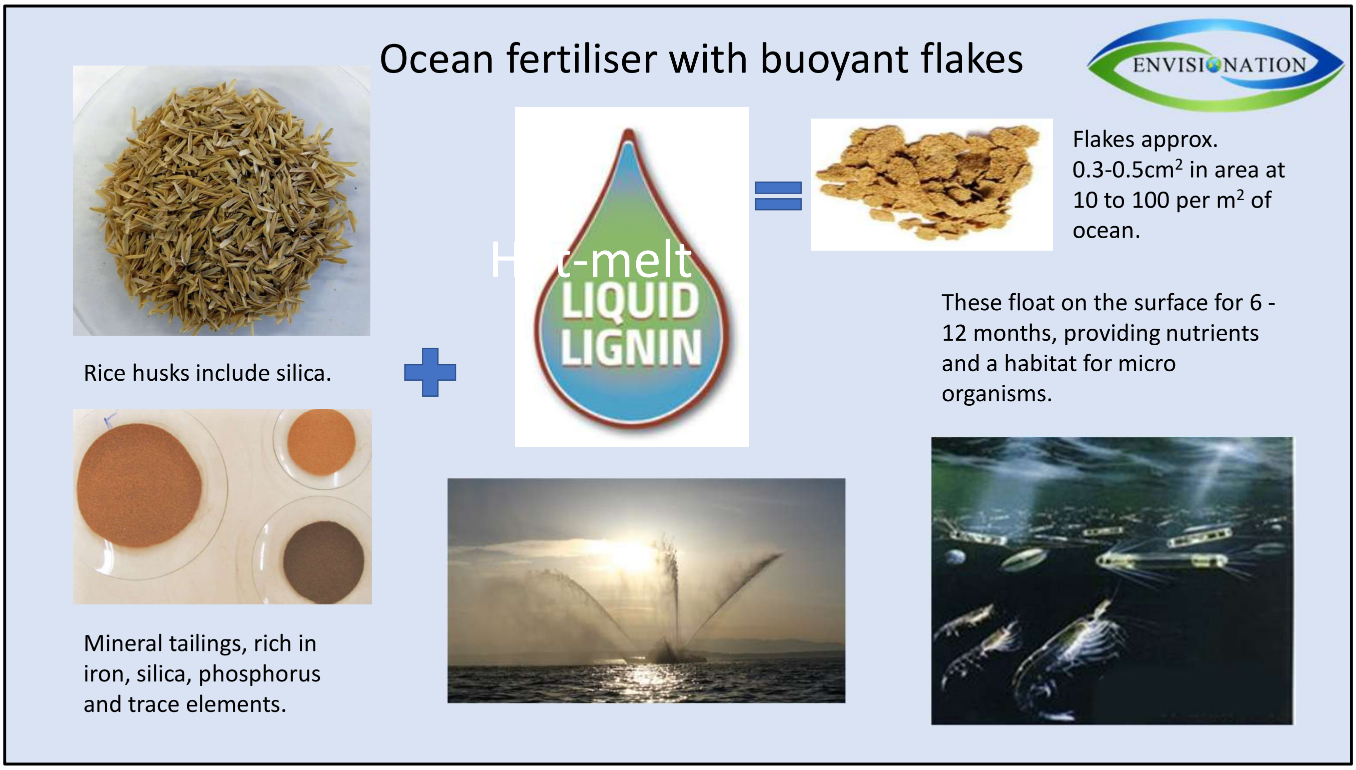
Vast areas of the oceans are also available for biomass regrowth



It's not just on land, the oceans are also available for biomass regrowth, and plankton and seaweeds grow fast

Those dark blue areas are ocean deserts, caused by overfishing and whaling. They are potential great ocean pastures, that we must learn to manage and a key part of the global living carbon account.

Restored oceans are dramatically more productive, and they cool the planet because greened seas reflect away more of the Sun's radiation. Furthermore, plankton release dimethyl sulphide and that stimulates cloud formation, which also reflects away incoming solar radiation.



The Envisionation team is involved in the development of ocean nutrient restoration technologies using buoyant flakes, made of recycled waste materials and designed to make essential nutrients bioavailable long term, allowing natural ocean ecosystems to regenerate.

Over the course the next 15 years, as carbon markets develop, this is likely to grow into one of the world’s largest ever business, as it will greatly increasing productivity as well as pulling carbon down at low cost.

Targeting equilibrium at no more than 0.5°C warmer than pre-industrial

Carbon dioxide in the atmosphere is now at:	426 ppm CO_2 = 907 Gt C
We can't stop year on year emissions increasing before 2033 and although we will be reducing emissions thereafter, we will still be adding CO_2 even as it's drawn down until at the earliest 2050 (Net zero), we are committed to at least.	470 ppm CO_2 = 1001 Gt C
To that must be added:	
Emissions from thawing permafrost, a big unknown so add	30 ppm CO_2 = 64 Gt C
as partial pressure of CO_2 reduces in the atmosphere the oceans, will release CO_2 back to the atmosphere so add up to 50%	100 ppm CO_2 = 213 Gt C
Subtract target for CO_2 in the atmosphere	-300 ppm CO_2 = 639 Gt C
Total carbon to be removed from atmosphere is:	**300 ppm CO_2 = 639 Gt C**

The mathematics of regaining control

Our target for a planet that can start to recover equilibrium at no more than 0.5ºC degrees warmer, requires atmospheric $CO_{2.}$ to be reduced down to 300 ppm. Converting to Giga Tonnes of carbon, by multiplying by 2.13 suggest that we need to drawdown 639 Gt of carbon.

Notes:

- 2025 426 ppm rising by 2.8 ppm and increasing every year until 2033 adds 30 ppm. Then falling to net 0 ppm over 17 years @ 2.8ppm/2 = 24 ppm so best case add 54 ppm = 470 ppm by 2050
- There will be off gassing from ocean as the partial pressure decreases in the atmosphere, so assume 50% returning to the atmosphere to be removed so add 100 ppm CO2 = 213 Gt C
- The target must be low enough for the oceans to shed excess heat back into space if we are to eventually stop the ice caps from melting – we may have to go lower to 280 ppm or below
- Adjustment will need to be made taking account of the reflectivity changes in the planet that biosphere restoration will bring

Returning to atmospheric CO_2 levels of 300 ppm by 2050 requires carbon drawdown

Re-growing Earths biomass to 1100 Gt i.e. to pre significant human impacts 10,000 years ago draws down:	258 ppm CO_2 = 550 Gt C
Direct air mechanical capture?	18 ppm CO_2 = 40 Gt C
Chemical systems such as accelerated rock weathering, and adding biochar and basalt to soils	24 ppm CO_2 = 50 Gt C
Total	**300 ppm CO2 = 640 Gt C**

Re-growing the missing 50% of Earths biomass draws down 550 Gt of atmospheric carbon leaving us with up to 90 Gt to capture by other means

Direct air capture technologies are advancing fast, as is the science of accelerated rock weathering.

Systems for producing biochar with advanced pure pyrolysis, the heating of waste organic materials in the absence of oxygen, which breaks down and chemically produces a gas that can be used, as fuel, but retaining the carbon content as char. This, along with basalt powder, can be added to soils, where it remains stable for potentially, thousands of years, while enhancing plant and microbial productivity.