
RESCU
Carbon Exchange
White Paper
Unifying Fields
Foundation

The RESCU Carbon Exchange

"Only when the last tree has been cut down, the last fish been caught, and the last stream poisoned, will we realise we cannot eat money."
Cree Indian Prophecy

1. Executive Summary

Recent price developments of essential raw materials indicate that the world's natural resources are finite. The predictions contained in a report of the Club of Rome in 1968 about the "limits of growth" are becoming reality.

Prices of energy have doubled and carbon allowances[1] in the European compliance market have increased from about € 30 to € 85/MTCO2eq. These price increases will eventually filter through to the prices of fertilisers, petrochemical products, steel, cement, electricity, building materials, etc. Therefore everything which is manufactured by processes, which pollute or diminish the planet's natural capital, gets more expensive.

In the last hundred years significant amounts of human and natural capital were converted to financial capital. The currently prevailing economic system does not account for the value of the services the world's ecosystems provide to humanity. Therefore there was no cost or penalty associated with the destruction of essential ecosystems. It is self-evident that this degenerative economic system must soon come to an end.

Now, at the beginning of 2022 it looks like the moment of reckoning has arrived. Nature's capacity to provide resources for our society has almost been depleted. Only a deep existential crisis will awaken our society that things must change. Climate change is accelerating and essential life resources are becoming unaffordable for an increasing percentage of the world population. As a consequence social inequality is rising rapidly.

As the prophecy of the Cree Indians states, our society will soon learn that 'we cannot eat money'. A new regenerative economy, which accounts for the real value of nature's ecosystem services emerges.

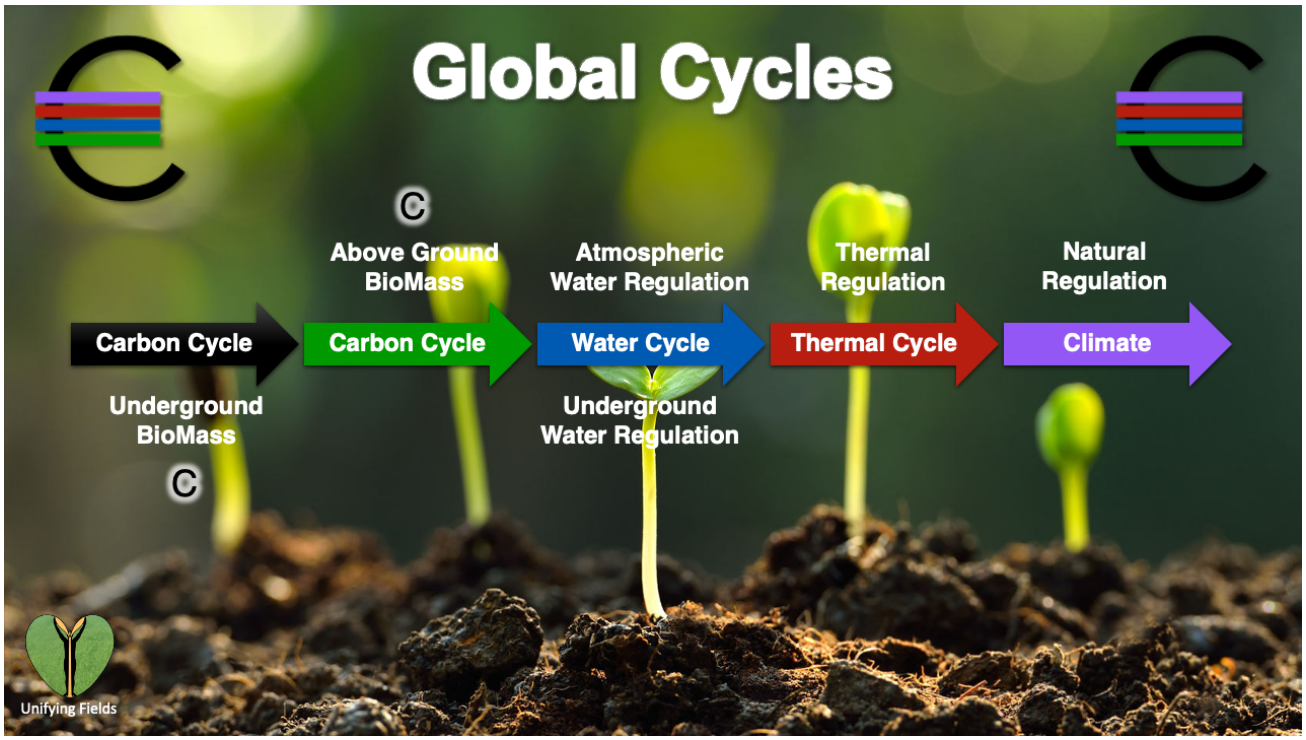
Our society can only survive when we create and participate in a new value exchange system which converts financial capital back to natural capital.

The **RESCU Carbon Exchange**, which enables the transition from a degenerative to a regenerative economy, has recently been created by the Unifying Fields Foundation. The currency of the new '**Carbon Exchange**' is the Restoration Currency Unit: **RESCU**

This White Paper describes how the **RESCU** functions. The **RESCU** exchange system converts existing currencies such as the Euro, US Dollar, Yen, Yuan, etc. into the value of the services natural ecosystems provide to humanity. The **RESCU** offers the possibility for all citizens to help shape the new regenerative economy, by neutralising their carbon footprints based on a new set of metrics reflecting the latest scientific insights. ***Carbon***, an essential life enhancing element, constitutes the basic metric for the new economy.

2. Life Evolving Cycles in Nature

Climate change is the result of the breakdown of a number of natural cycles which power the services which 'intact ecosystems' provide to our society. As explained above the element **Carbon** plays an important role as an inter-connector between the various natural cycles which create, maintain and evolve life on Earth.



In the soils of the earth, we find the '**below ground biomass**' which contains **carbon** in many forms. **Organic carbon** in the soil nourishes life. It's **colour is black.** It is called '**Terra Preta' (Black Earth)** by the indigenous peoples. When the **soil** contains adequate amounts of **organic carbon** the soil is healthy, alive and fertile.

Organic carbon stimulates the growth of **'above ground biomass': plants, trees and forests. Trees and plants** also receive fertiliser from the atmosphere in the form of CO2, stimulating growth of **above ground biomass.** Trees also produce oxygen, essential for life. Some trees also convert nitrogen from the atmosphere to a natural nitrogen fertiliser.

The canopy of a tree has a leaf surface area[2] (LAI: Leaf Area Index) of about 3-4 m2 for each m2 of ground surface. Therefore **trees** evaporate lots of **water** originating from the soil and transport **water vapour** to the **atmosphere**. Therefore trees are very powerful **air conditioners**. They **cool** the environment[3,4] with a power density of 200-300 W/m2.

The **root systems** of **trees** store **water** in the **below ground biomass.** Therefore, **t**he root systems of trees and forests act as **carbon** buffers as well as **water** buffers. This prevents water run-off to rivers when there is heavy rain and prevents **floods**. Therefore **trees** perform crucial functions in the **above** and **below** ground **water cycles and in the atmospheric thermal Cycles.**

On the landmass of the earth the **below ground and above ground Carbon Cycles regulate the below ground and above ground Water Cycles.**

This regulates the Thermal Cycles which subsequently regulate the Global Climate.

Only optimally functioning natural life cycles create a life enhancing environment in which nature, animals and people can thrive. Healthy natural cycles are the basis for a healthy society and a healthy economic system.

In the last 10.000 years about 2,5 trillion trees were removed[5,6,7] from the face of the earth. About 50% of the total CO2eq stored in the trees (2,5 trillion tons) is now in the atmosphere, 25% is absorbed by the oceans (causing ocean acidification) and about 25% was absorbed by the remaining above and below ground biomass. Also about 133 billion tons of carbon (490 billion tons of CO2eq) were removed from the soils of the earth through degenerative agricultural practices[8]. And lastly the burning of fossil fuels released 1.35 trillion tons of CO2 (370 billion MT of carbon) to the atmosphere.

Therefore about 4.2 trillion tons of CO2eq was displaced, of which 2.1 trillion tons ended up in the atmosphere, 1.05 trillion tons was absorbed by the ocean and 1.05 trillions tons were recycled back to above and below ground biomass. The Climate will be rebalanced when all displaced carbon is put back where it belongs. See Appendix A for further information on the carbon balance.

As has been shown **carbon** plays a key role in the growth and health of above and below ground biomass. Therefore we write the word **Carbon as Carbon,** just to remind us of the importance, fertility and versatility of the element **Carbon** in both the **above** and below ground biomass.

3. Greenhouse Gas Emissions: the Negative Value of Carbon

When we appreciate the functioning and interaction of the various cycles it is obvious that regulating the global climate begins with the restoration of the global **Carbon** cycle.

- **Carbon** has a negative value when it is transported in the form of CO2 (carbon-dioxide) from below ground biomass to the atmosphere by cutting trees and practising destructive agricultural practices, such as animal farming.

- **Carbon** has a negative value when underground fossil fuel reserves (coal, oil, gas) are burned to provide energy to society and transported to the atmosphere and oceans.

- **Carbon** has a negative value when it is emitted to the atmosphere in the form of methane (CH4). The fossil fuel industry is responsible for 30% of CH4 emissions and agriculture (mostly the animal farming) is responsible for 40% of all global CH4 emissions to the atmosphere[9,10,11].

CH4 is another identity of carbon and it has a much larger global warming potential than CO2. Since the start of the Kyoto protocol it was assumed that the Global Warming Potential (GWP) of methane was 25-28 times the warming effect of CO2. However in the last 10 years there was a growing consensus amongst scientists that this factor should be at least 80 or even as high as 120 or more.

It was acknowledged during the last climate conference in Glasgow (November of 2021) that the new GWP for CH4 is at least 84 and that there should be more focus on reducing CH4 emissions from fossil fuel exploration, agriculture and in particular animal farming.

As scientists have also calculated that the GWP factor[12,13,14] of CH4 could be as high as 120 or more UFF has therefore taken the position to base its calculations on a GWP of CH4 of 100.

Close to 100% of all CH4 emissions accumulate in the atmosphere, where CH4 breaks down to CO2 at a half-life rate of 8-12 years. When the rate of CH4 accumulation in the atmosphere exceeds the rate of transformation to CO2 the concentration of CH4 increases rapidly and its resulting warming effect magnifies.

The atmosphere is the only natural sink for CH4 and its capacity to transform CH4 to CO2 has been exceeded in the last 200 years ever since to rapid increase in large scale industrial farming.

Therefore the CH4 concentration in the atmosphere is currently increasing at a rate of 8 PPB per year. This is 0.8 PPM of CO2 equivalents per year.

The emission of CO2 has a different dynamic. About 50% of all CO2 emissions accumulate in the atmosphere, 25% is absorbed by the oceans and 25% is absorbed by above and below ground biomass.

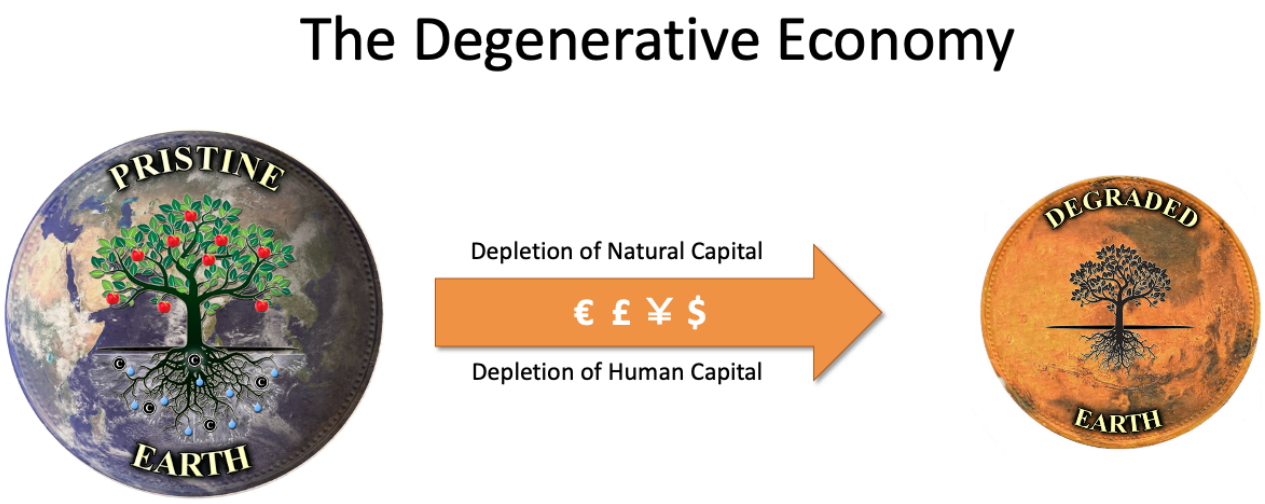
In the oceans CO2 causes acidification of the ocean waters, which has a negative effect on ocean life and its capacity to absorb more CO2. While oceans and the atmosphere are no natural sink for CO2, we have also reduced the capacity of the natural sinks (trees, plants, soils) on the landmass of the earth by almost 45%.

This why the concentration of CO2 in the atmosphere is currently rising by 1.6 PPM per year. Together with the increase in CH4 emissions the effective CO2eq concentration rises by 2.4 PPM per year. This is 30% more than was assumed so far.

The recent discovery and acknowledgement of the higher warming effect of CH4 is a serious matter. It throws a different light on the effectiveness of the various climate change mitigation strategies, it reduces the still available carbon budget to limit global warming to 1.5 or 2.0 degrees Celsius and further increases the need to address climate change in the most (cost) effective manner.

4. The Degenerative Economy

Our current degenerative economic system is best characterised by the massive conversion of carbon contained in valuable ecosystems where it has a highly positive value, into carbon contained in the atmosphere and the oceans where it has a significantly negative value.



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It is obvious that both CO2 and CH4 emissions are degenerative in nature and have significant negative values. As the capacity of all natural ecosystems and carbon sinks is decreasing global warming is accelerating.

The inflation of the prices of oil, gas, electricity, fertiliser, cement, steel and food indicates that we have reached a limit. It is the limit of growth of a degenerative economy, which has outgrown its purpose: *the growth and evolution of life.*

*As the **negative value** of carbon emissions is rapidly increasing it means that bringing carbon back in the form of CO2 towards its natural sink must have an increasingly **positive value.** Carbon sequestration in soils, plants, trees and forests is the only option to deal with increasing CO2 emissions.*

*Carbon sequestration in **above** and **below** ground biomass is a very valuable feedback loop, which, until recently, has not received the credit it deserves. As the concentration of CO2 in the atmosphere has risen by about 50% from 280 ppm to about 415 ppm it also means that trees and plants are growing faster than ever before.*

For CH4, the more powerful greenhouse gas, a different approach is necessary. The only natural sink For CH4 is the atmosphere. Therefore there is no other option than to reduce CH4 emissions.

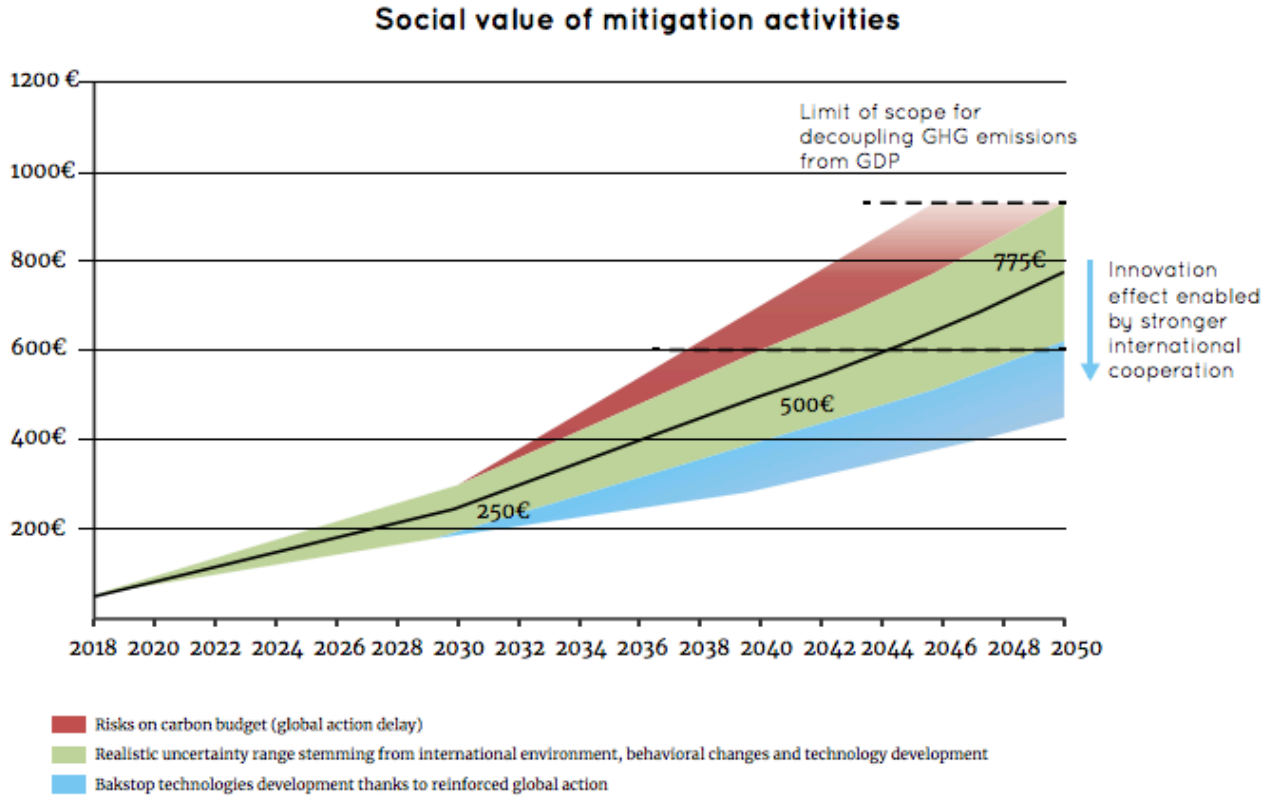
As 40 % of all man-made CH4 emissions originate from animal farming the most effective action perspective to which every person can make a contribution is clear: '*Eat less meat and more plants; it strengthens the immune system at a critical time'.*

Whereas carbon has both a **negative** value and a **positive** value, many science institutes have focussed on calculating the negative value of carbon. This is in science circles nominated as the Social Cost of Carbon, the SCC, also called the SCCO2. The SCC[15] is calculated by determining the cost of damages our society may experience in the future as the result of climate change related events: hurricanes, tornados, floods, drought, sea-level rise and a negative effect on economic development.

The estimates scientists have calculated vary according to the assumptions and are in the range of € 50-25000/MTCO2eq. During the last five years many other articles have been written about this and a likely range emerged[16, 17, 18, 19] between € 250-700/MTCO2eq. But recent assessments[20] dating from 2021 also indicate that the SCCO2 could be in the range of € 3000/MTCO2eq.

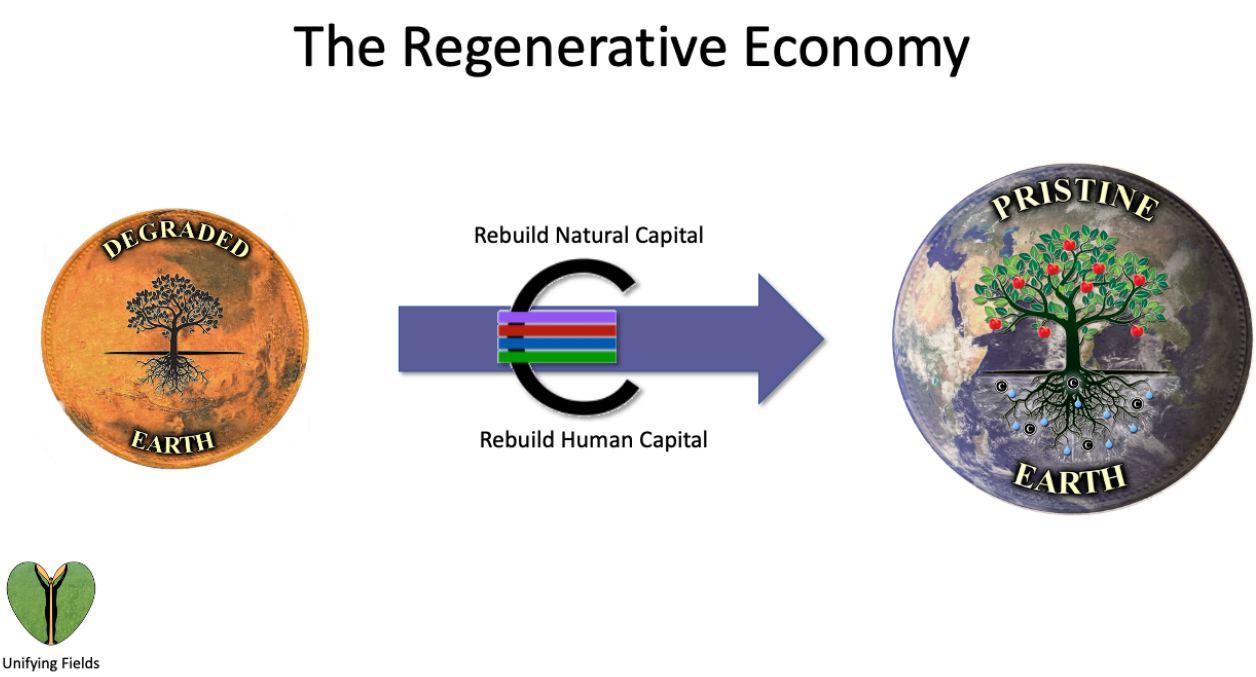
If we take the GWP for CO2 as Unity and CH4 for 100, then it follows that annual total CO2eq emissions amount to 75 billion tons, compared with the 50 billion tons previously assumed. Taking the value of MTCO2eq emission at € 500 shows that the current global economy (GDP € 80 Trillion) causes € 40 trillion of negative carbon value each year. It means that each Euro spent on products people buy creates € 0.5 in negative carbon value.

This poses an important question: *how does the economy look if people start to neutralise their carbon footprint and when these funds are used to power effective and positive carbon value creating restoration activities? This is the onset of the regenerative economy in which every person can participate. The regenerative economy starts when people and companies neutralise their carbon footprint at values which are reflected in the graphic below[16]*



5. The Regenerative Economy

The new regenerative economy is powered by the new ***positive value of carbon***. The value creation by bringing carbon back into the ecosystem is significant because the carbon cycle powers the water cycle, the thermal cycles, the restoration of the climate and finally the new regenerative economy.



The new regenerative economy kickstarts when individuals, families, companies and other organisations neutralise their footprints at an appropriate valuation.

It must be stated that the valuation of climate mitigation activities, defined as the social cost of carbon, was made before the new methane factors emerged.

Therefore these values will increase substantially if the new methane climate change metrics would be applied.

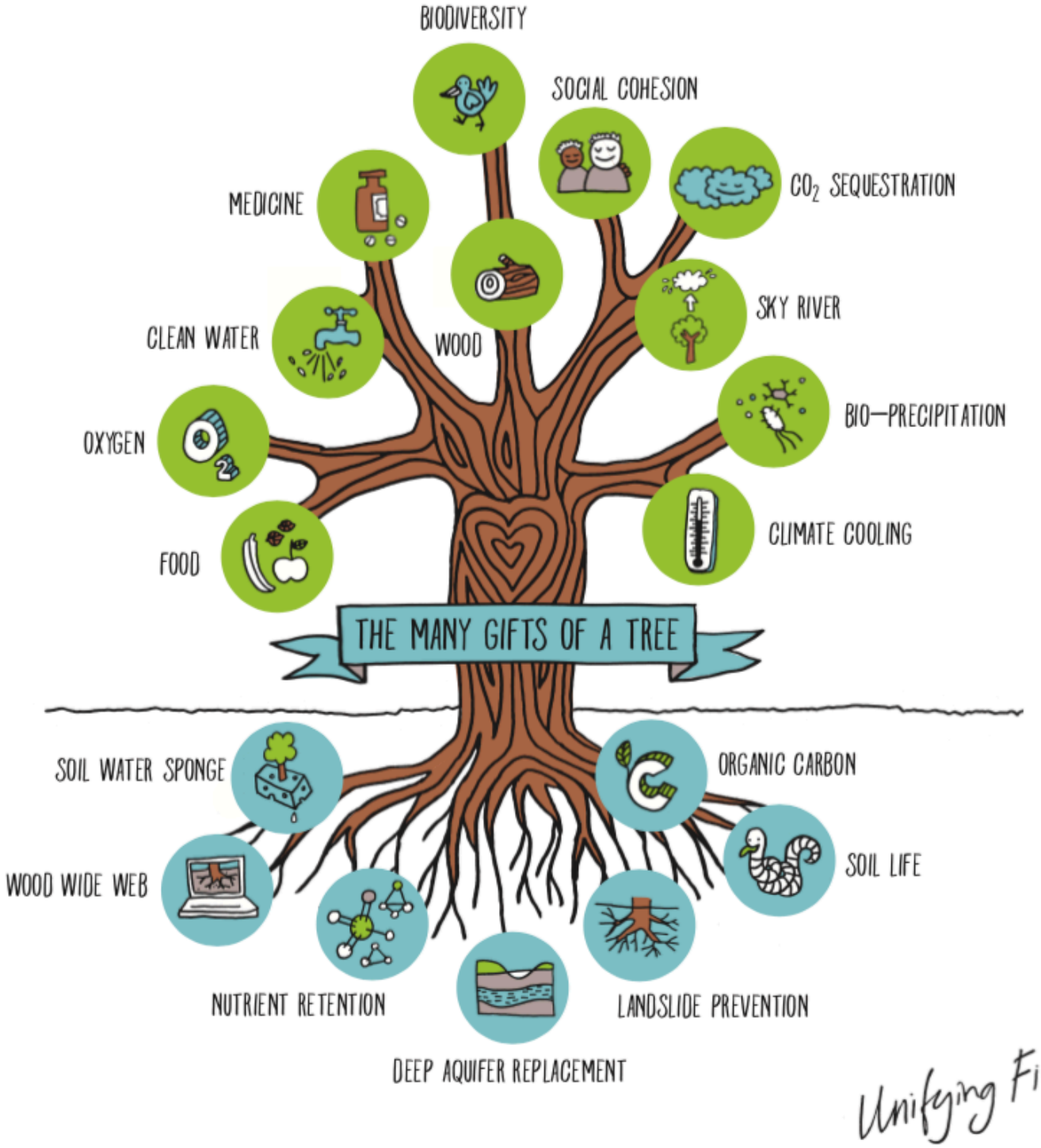
For instance if the factor of 100 is used for the CH4 warming effect these values will further increase from the range of € 250-700 to a range of approximately € 350-950. A study published in September of 2021 suggests new values[20] are in the order of € 3000/CO2eq.

The above metrics indicate that climate science is evolving and that all the new insights which are now emerging lead to the conclusion that climate change is accelerating and that the time available to limit global warming to 1.5 or 2.0 degrees is more limited than we thought so far.

6. The Positive Value of Carbon Footprint Neutralisation

When carbon is sequestered in underground and above ground biomass it creates significant positive value for our society.

This can best be seen when we picture the many functions which trees and forests perform in their pristine and natural state.



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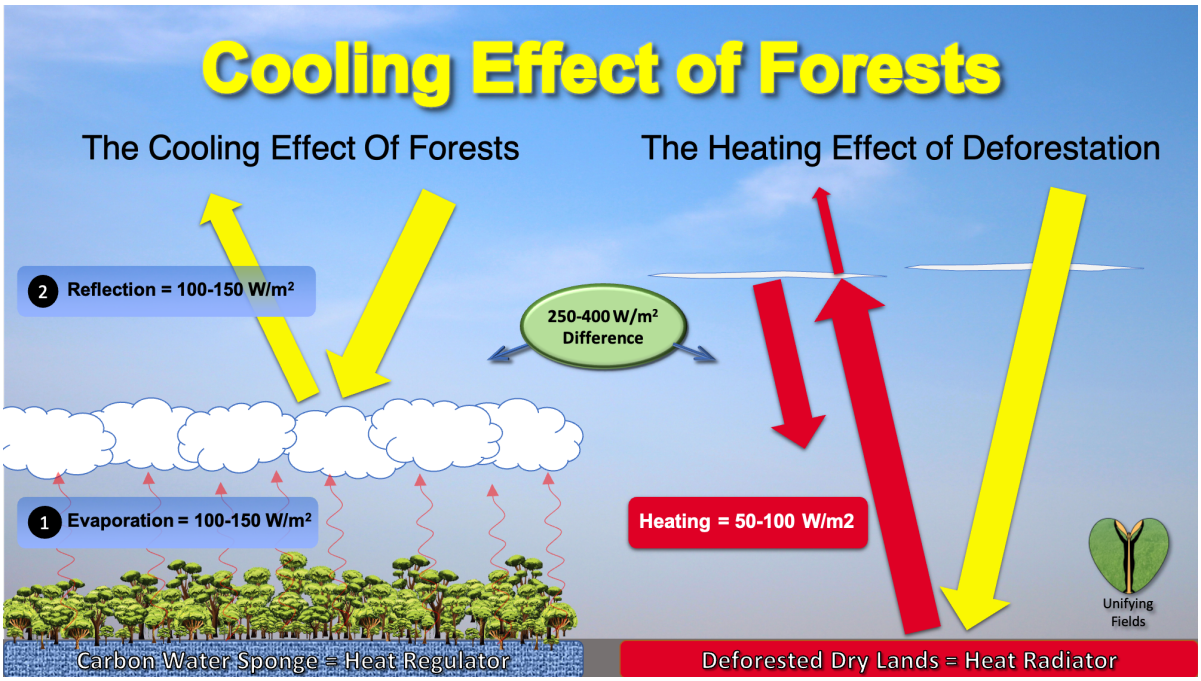
As shown before, the carbon cycle drives the water cycle and thereby the capacity of the trees and forests to cool the environment. This cooling effect also has a significant effect on local and global thermal cycles and the local and global climate.

Carbon Cycle → Water Cycle → Thermal Cycle → Climate

When we calculate the effect which one single tree has on water circulation, water availability and water purification through evaporation and condensation it indicates that one tree can create approximately € 200-400 worth of water related services each year.

When calculations are performed concerning the value of atmospheric cooling a tree creates we need to take the information reflected in graphic below into account.



As trees evaporate water from the surface of their leafs. Water vapour naturally rises because it is lighter than air. At higher altitude this forms clouds and, under certain conditions, rain.

The clouds block the sun and approximately double the latent heat flux originating from the process called “evaporative-cooling”. As the heat of condensation occurs at the top of the clouds this heat can now escape to space.

When we calculate the net change in cooling/heat fluxes caused by reforesting degraded lands and take into account the difference in carbon sequestration of forests and carbon emissions from degraded land a surprising result emerges. It indicates that the ecosystem changes result in a value creation associated with the net cooling effect of the land change expressed per tree is in the range of € 300-450/year.

Each trees produces oxygen at rate equal to the amount 12-18 people need to breathe[21]. The estimated value of this service is approximately € 250-300/year.

By making estimations of the numerous services the tree provides we find that this value is in the range of about € 1000-1500/year. In these calculations we have determined that the most valuable and effective place to plant a tree is in the context of a food-forest. In the food-forest, plant based food is produce and all greenhouse gas emissions associated with animal farming are eliminated.

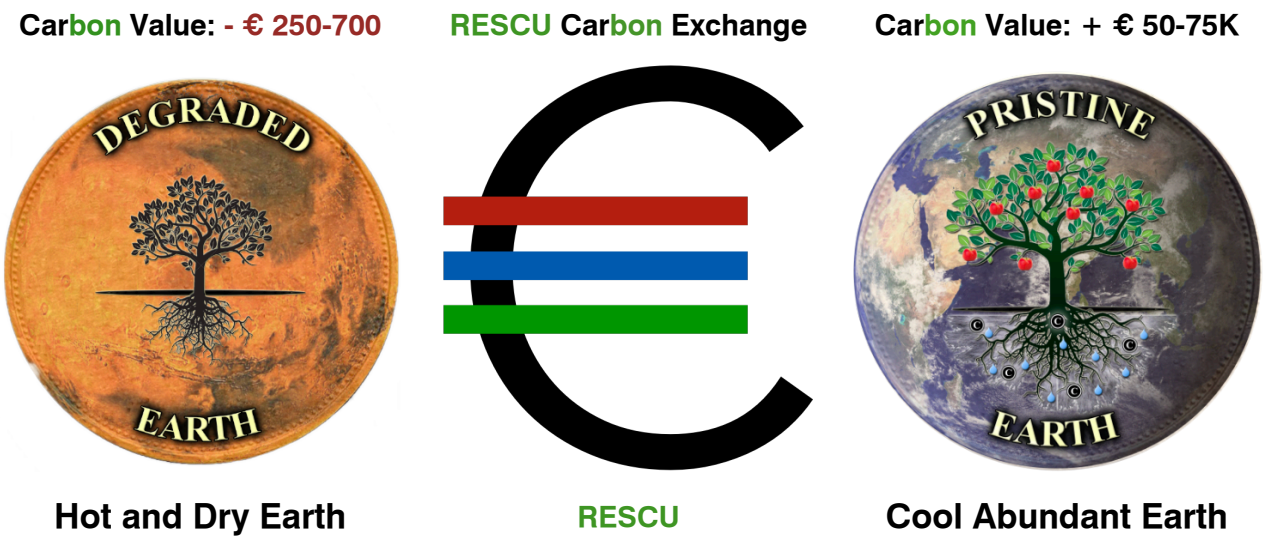
The average cost of planting a tree in a food-forest is about € 15-20. The average life of a tree is about 50 years. The average annual services of the tree are worth approximately € 1000-1500/year. This equates to € 50.000-75.000 over a life time. In this time the tree sequesters about 1 MT of CO2eq. This leads to the conclusion that the tree creates a positive value of carbon in the range of € 50.000-75.000/MTCO2eq.

This means also that a tree that costs € 15-20 to plant creates € 50.000-75.000 of ecosystem services value. Consequently the Carbon Value multiplier associated with the planting of a tree, enabled by the neutralisation of 1 MTCO2eq is in the range of about 3300-3750.

Therefore each € 1 dedicated towards the neutralisation of a person's carbon footprint creates about € 65-75 in ecosystem services value each year and € 3300-3750 times as much over a 50 year period. As the neutralisation of the carbon footprint is an annual event participants in the **RESCU Carbon Exchange** can create enormous leverage for the restoration of our planet.

Source: Kumar Alzhanov

Below is an image of the **RESCU Carbon Exchange**, the way to create a new vibrant Earth.



The new **RESCU Carbon Exchange** is an expression of a new emerging economic model. At this time most people are putting their own interests first and the interest of the collective and the planet is of a lower order.

One could say that this is the **Me**-conomy. It creates positive value for the individual and creates significantly negative value for mankind and the earth.

The birth of the **RESCU Carbon Exchange** is based on planting special kinds of trees and forests in a carefully chosen context to create optimum value for society and the restoration of valuable ecosystems. This we say is the **Tree**-Economy.

The people and organisations who participate in the neutralisation of their footprints through the **RESCU Carbon Exchange** are aware of the threat climate change poses for the future of our civilisation and the health of planet's ecosystems. They put the interest of future generations and the planet in the first place. And this we call the **We**-conomy.

7. Earth Restoration Vision

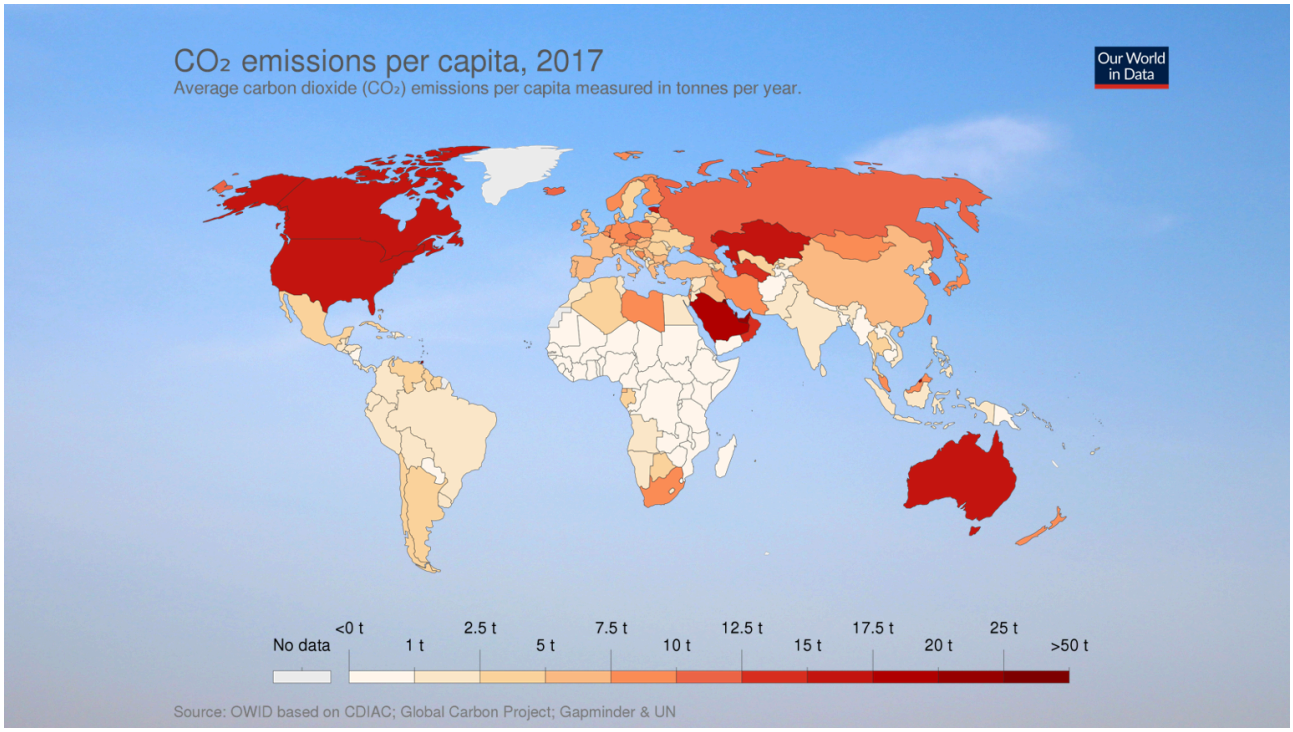
We have calculated that sequestering CO2 through the planting of trees is effective and economically attractive. One ton of CO2 sequestered in the lifetime of trees has a positive co-benefit of about € 50.000-75.000.

We have also derived that CH4 is a strong greenhouse gas, about 100-120 times stronger than CO2. Animal farming, also called livestock grazing, is the single largest cause of methane emissions. But trees do not change the nature of CH4.

Its effect can only be reduced by avoiding the emission of CH4. This was also confirmed in the latest climate change conference in November of 2021 in Glasgow, Scotland.

Avoiding CH4 emissions is the number one priority at this time and the most effective strategy to limit global warming to 1.5 or 2.0 degrees C. Therefore, the best climate change mitigation strategy in which each citizen can make a contribution is to change our individual diets, eat less meat and more plants. For this we need to grow food-forests. In the food-forest the trees also have the greatest co-benefit.

To kickstart the **We**-conomy we can decide to neutralise our personal, family, company or organisation footprint. Below is an image of the carbon footprint of nations in the world.



Source: https://ourworldindata.org/co2-emissions

In the Netherlands the average carbon footprint is around 10 MTCO2eq per capita. If we take a mean **negative** value of the footprint at € 500/CO2eq each person in the Netherlands creates a **negative** impact on the environment equal to € 5000 per year. It is clear that the average person may not be able to neutralise the footprint at this cost.

Therefore it is most effective if people with larger footprints who can afford to pay for its neutralisation neutralise at a price at the high end of the range, say € 700/CO2eq.

However, the participation in the **RESCU Carbon Exchange** can also begin with the planting of one or more trees at a cost of € 20 per tree. This tree will create an ecosystem services value of about € 1000-1500/year. Therefore the **RESCU Carbon Exchange** enables everyone to participate in the creation of the **We**-conomy.

A wise man said: “every journey of a thousand miles begins with the first step”. Another wise man said: “Do not go where the path may lead. Go instead where there is no path and leave a trail”. And another wise man said: “participating is more important than winning”. But by participating in the **RESCU Carbon Exchange** at whatever level of commitment everybody wins.

As stated before it is the intention to start with the planting of trees in food-forests in Europe. This impressive video[22] shows how food-forest are created and what value they create for our society: https://www.youtube.com/watch?v=gSPNRu4ZPvE

Later it is the intention to plant trees on a large scale in other areas of the world to enhance the ***biotic pump action*** of trees[23,24]. This phenomenon was discovered by Russian scientists about 20 years ago. They found that forests at the coastlines of the world’s landmasses transport water vapour from the oceans to the land.

This video gives a short summary of this important natural principle, which has been largely ignored by todays foresters: https://www.youtube.com/watch?v=kKL40aBg-7E.

The biotic pump action of trees is further magnified by the action of trees which is called ***bio-precipitation.*** This phenomenon has also been discovered some 15 years ago. During evaporation of water vapour from the leafs of the tree bacteria are emitted to the atmosphere which increase the probability of rain.

This beautiful short video[25] explains how this works: https://www.youtube.com/watch?v=gFyNMUY1zgA

Trees are thus not only air conditioners, but also water vapour transporters from oceans to the landmass and also powerful rainmakers. This is why trees restore the water cycle of the landmass and create so much value for local economies where trees and forest are regrown according to the recently discovered functioning of nature in relation to the water cycle.

UFF has also created a plan to restore the biotic pump in all areas in the world where this is of critical importance.

This plan will be reflected on the new website of the Unifying Fields Foundation where more information about the **RESCU Carbon Exchange** Initiative will be provided.

In view of the significant flux of new information about the dynamics and social costs of climate change we have updated the metrics associated with the assessment and neutralisation of the carbon footprint. Particularly the footprint of the consumption of beef and pork has been updated to account for the new insights into the global warming potential (GWP) of methane(see Appendix B).

When the **RESCU Carbon Exchange** gains momentum we envisage that more and more food forests will be created, that local shops will arise which sell the local produce to the local people and training/educational centres will start to flourish.

Below are some images of food-forest facilities and associated training centres

Source: https://natuurlijkhenriette.nl

Source: http://www.bomencentrumnederland.nl

8. How the RESCU Carbon Exchange works

The **RESCU Carbon Exchange** initiative invites individuals, families, companies and other organisations to participate through the neutralisation of their carbon footprint. One **RESCU** is equal to one MT CO2eq. If one MTCO2eq is emitted to the atmosphere it has a negative value which is represented by the SCCO2, the social cost of CO2. Depending on the approach taken to calculate the SCCO2 it has a negative value in the range of approximately € 250-700. If 1 MT of CO2eq is sequestered in biomass in the optimum context (the food-forest) it has a positive value in the range of € 1000-1500 in a year or € 50.000-€75.000 over the lifetime of the average tree.

By participating in the **RESCU Carbon Exchange** a person, family or organisation can create significant value for local communities or society at large. Besides neutralising the carbon footprint participants can also choose to just plant trees. As one tree costs about € 15-20 to plant the barrier to entry is very low. Every participation counts.

Participation works as follows:

- The staff of **RESCU Carbon Exchange** will assist people in determining the individual carbon footprint through the application of the metric of the CO2eq. This footprint is usually anywhere between 2 and 15 tons of CO2eq for a family, depending on the current lifestyle. The detailed metrics of determining the footprint are provided in Appendix B.

- A choice can be made as to the price which an individual or family is prepared to pay for neutralising its carbon footprint. This price range is € 250-700/MTCO2eq. This determines the amount of Euro's that should be paid to the **RESCU** organisation by the participant.

- The carbon footprint is determined annually on the basis of information which the participant provides. The key factors determining the carbon footprint are initially being determined by the amount of kWh electricity used in a particular year, the amount of m3 of gas used for heating and cooking, the litres of fuel used (LPG, gasoline or diesel) for driving, the number of flights and their destination (single or return) and the best estimate of the amount of kg and type of meat consumed in that year.

- The Euro's paid to the **RESCU** organisation for the neutralisation of the footprint will be used to assists farmers and other organisation to create food-forests in their local community.

- Participation is on an annual basis and can be terminated with reasonable notice before the end of a particular calendar year.

- Participants will receive a monthly newsletter as to the progress of the **RESCU** initiative, interesting news items related to the climate, lifestyle, experiences of participants, etc. Together the participants create a bridge to a thriving future.

9. Why participation in the RESCU Carbon Exchange is important

In this last and closing section of this White Paper we summarise some important points, crucial insights and transformative scientific findings.

1. It is estimated that 12.000 years ago when people first started to remove trees to create agricultural land there were 2 million people and 5.5 trillion trees. That was 2.750 million trees for each person. Today that there are 435 trees for each person. If today every person planted 250 trees the amount of trees would be the same as 12.000 years ago. It goes without saying that those trees should be planted in the optimum context and location to bring the planet to its original and pristine state.

2. In those past 12.000 years unsustainable agricultural practices have removed 133 billion tons of organic carbon from the worlds agricultural soil and degraded the remaining 5 billion hectares of agricultural land. On the land we can only produce food through using artificial fertiliser, pesticides, insecticides and genetically modified organisms. Oil is a major component in manufacture. The remains of these unhealthy chemicals are in our food today, thereby affecting human health at a massive scale.

3. The removal of trees and the use of unsustainable large scale industrial agricultural practices about 3 trillion tons of CO2eq were displaced into the atmosphere and the oceans. The emission of CO2 from fossil fuel burning amounted to 1.2 trillion tons of CO2 displacement. Together with the CH4 emissions resulting from the exploration of fossil fuels and unsustainable agricultural practices global natural resources have been depleted to critically low levels and the global climate is now in a serious imbalance threatening the future of our civilisation. It is time to act intelligently and diligently. As Federica Mogherini said: "*we need to start sharing not the burden, but the responsibility*"

4. The most effective strategy to create a better future is for each person to participate in the **RESCU Carbon Exchange.** This will facilitate the planting of trees in the right context, in the right time and in the right place. Though the **RESCU Carbon Exchange** the significant negative value of carbon emissions are turned into the very significant positive value of carbon sequestration in trees, forest and soils. This will kickstart the regenerative economy.

5. The **RESCU Carbon Exchange** offers everybody the opportunity to participate in one way or another. People with large footprints could make a significant contribution by neutralising their footprints at a high value to create significant impact. The same applies to companies and other type of organisations. But also everyone else can participate by planting a number of trees each year, knowing that if all people were to plant 250 trees in the next 10-20 years the world would be a better place.

6. The founders of the **RESCU Carbon Exchange** will do their utmost to provide educational materials to ensure that our current generations become aware of the magic workings of nature and reconnect with the natural world of which we are a product.

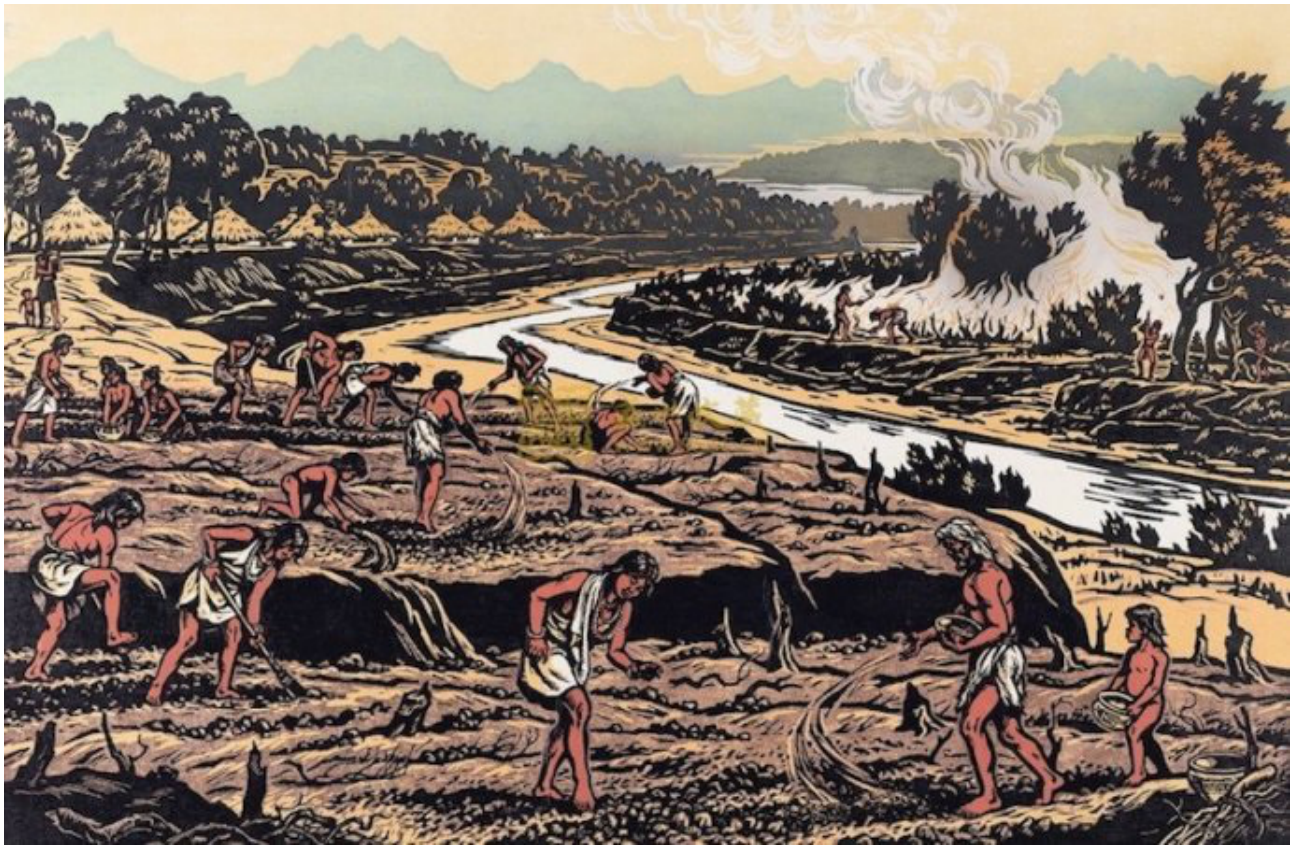
Appendix A. Carbon Displacement in the last 12.000 Years

1. Carbon emissions due to the removal of Trees

A now famous scientist (Thomas Crowther) and his team set out many years ago to count the number of trees on our planet at the present time. He found that the planet is currently populated with 3.0 trillion trees[26].

He also determined that about 12000 years ago, when people settled, started to domesticate animals and created local agricultural lands by cutting trees, there were 5.5 trillion trees. In the last 12.000 years of our civilisation on earth we ave removed 2.5 trillion trees or 46% of the original tree population.

As the average tree consists of fixes 1 ton of CO2 in a life time, this CO2 was released again to the atmosphere over time. This released 2.5 trillion tons of CO2 to the atmosphere and removed 680 billion tons of carbon from the above ground biomass.



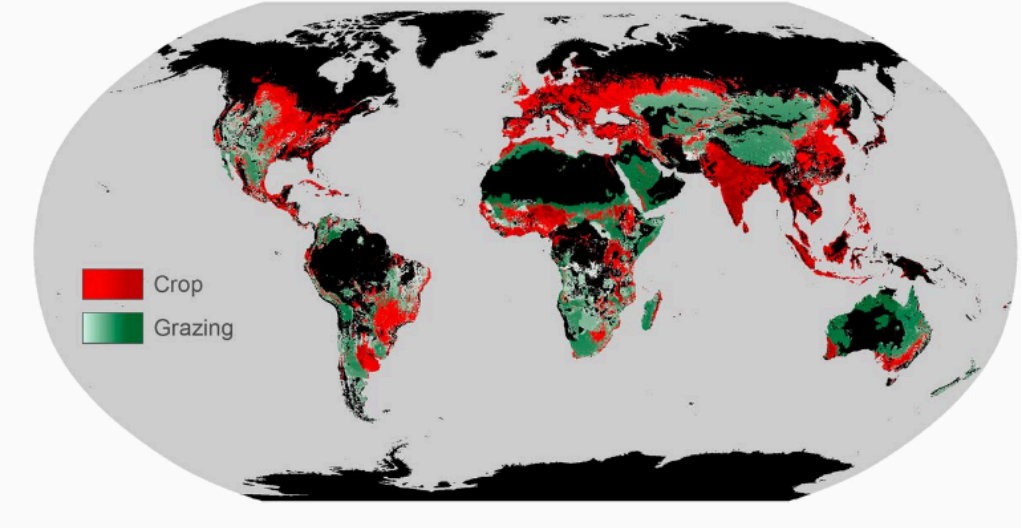
"Trees are among the most prominent and critical organisms on Earth, yet we are only recently beginning to comprehend their global extent and distribution".

Thomas Crowther

The loss of trees was mainly due to the onset of degenerative agricultural practices taking place in grazing land for cattle and lands where (mono) crops were planted.

2. Carbon emissions due to loss Carbon from Soils

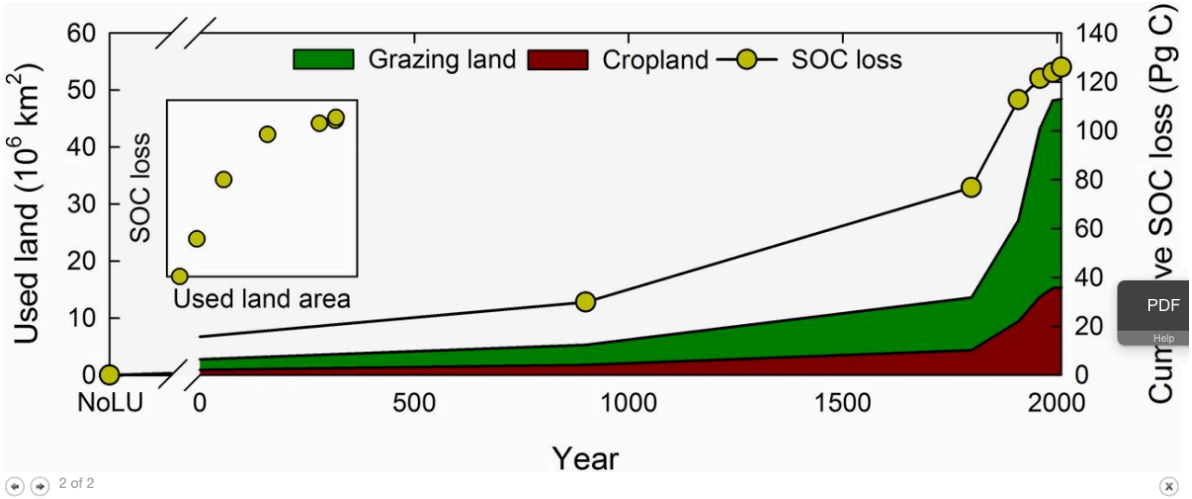
In the 2017 Jonathan Sanderman and his colleagues completed a major study concerning the loss of soil organic carbon (SOC) and soil organic matter SOM). The loss of SOC was found to be 26% in the upper 30 cm of the soil and 16% in the top 100 cm. The total loss of SOC was estimated at 133 billion tons of Carbon. Losses of SOC accelerated significantly in the last 200 years, as the world population grew and large industrial agriculture began to take hold. They found that the global carbon debt to livestock grazing and unsustainable industrial agricultural practices was world wide. The SOC loss was due to land-use change. In the map below it can be seen where the loss of SOC was mainly concentrated. The loss of carbon represents an emission of 490 billion MT CO2eq.



Source: https://

www.pnas.org/content/114/36/9575

In the graphic below it can be seen how fast cropland and grazing land increased and how this resulted in a significant increase in SOC loss. The used land represents degraded land where agriculture is only possible with artificial fertilisers and by watering crops, thereby dropping the water table and depleting underground deep water aquifers.



The area of degraded lands is now 5 billion hectares, which is most of todays agricultural land.

3. Carbon emissions due to exploration and burning of Fossil Fuels

It is estimated by several sources that the cumulative CO2 emissions originating from the use of fossil fuels is in the order of 1.35 trillion tons of CO2 or 370 billion tons of carbon.

In summary we can state that the main historical sources of CO2 emissions and carbon loss from the soils are:

	Carbon loss billion MT	CO2 emission billion MT
Cutting of Trees	680	2.500
Agriculture	133	490
Fossil Fuels	370	1.350

As unsustainable agricultural practices is the main reason for cutting trees and loss of carbon from the soil it can be concluded that agriculture is the main reason for global warming next to the use of fossil fuels. As both activities also are the main cause of methane emissions it provides information how to create a sustainable future.

Appendix B: RESCU and the Metrics of a Climate-Carbon Footprint

In the calculation of of the carbon footprint of individuals and families we recommend that the following metrics are being used:

Energy

—- 1000 kWh equates to a carbon footprint of 0.5 MT CO2eq

—- 1000 m3 of gas equates to a carbon footprint of 1.8 MT CO2eq

Source: https://www.co2emissiefactoren.nl/lijst-emissiefactoren/#brandstoffen_energieopwekking

Car Fuels

—- 1000 liter LPG equates to a carbon footprint of 1.8 MTCO2eq

—- 1000 liter gasoline equates to a carbon footprint of 2.8 MT CO2eq

—- 1000 liter diesel equates to a carbon footprint of 3.2 MT CO2eq

Source: https://www.co2emissiefactoren.nl/lijst-emissiefactoren/#brandstoffen_voertuigen

Flights

see this calculator: https://www.carbonfootprint.com/calculator.aspx

Meat

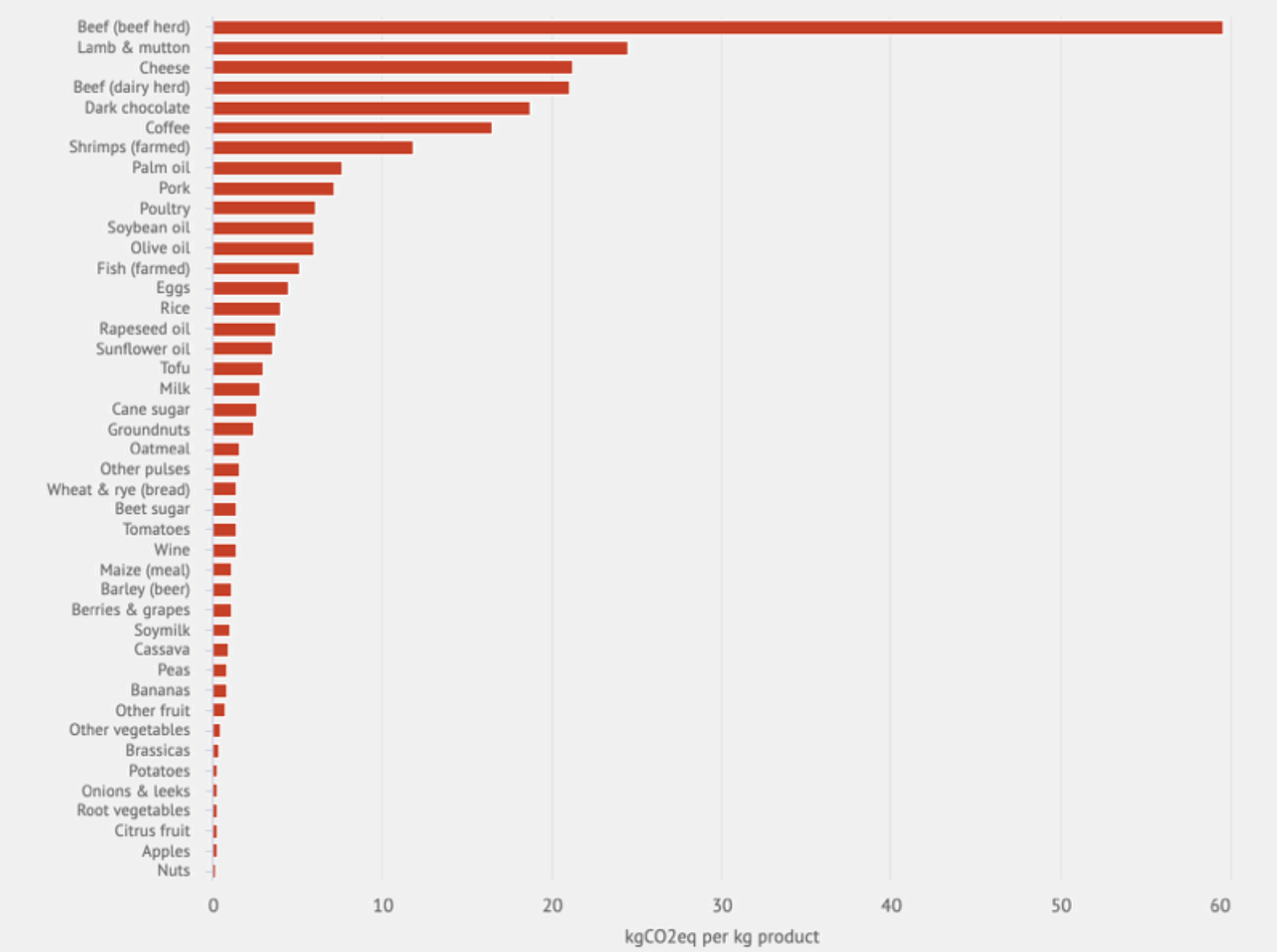
Beef meat: 1 kg equates to a carbon footprint of 60 kg CO2eq:

Pig meat: 1 kg equates to carbon footprint of 7 kg CO2

Chicken meat: 1kg equates to a carbon footprint of 6.0 kg CO2eq

Source: https://interactive.carbonbrief.org/what-is-the-climate-impact-of-eating-meat-and-dairy/

Appendix C: RESCU: Graphic of Food Footprints



Greenhouse gas emissions per kilogram for different food groups. Adapted from Dr Hannah Ritchie/Our World in Data (2020) Data source: Poore & Nemecek (2018). Chart by Carbon Brief using Highcharts.

Source: https://interactive.carbonbrief.org/what-is-the-climate-impact-of-eating-meat-and-dairy/

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