UN-REDD PROGRAMME | REDD+ ACADEMY

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REDD+ MONGOLIA

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REDD+ ACADEMY

REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION

LEARNING JOURNAL

1

FOREST, CARBON SEQUESTRATION AND CLIMATE CHANGE

Director of UNREDD Mongolia National Programme
Tungalag.M

Dear Learner,

Welcome to the Mongolia REDD+ Academy journals, providing you with an overview of REDD+ planning and implementation, developed by some of the world's leading REDD+ experts. It has been designed to accompany you in your learning journey, covering all the main REDD+ topics, from the basics to the finer points of setting reference levels, monitoring, allocation of incentives and stakeholder engagement.

The modules presented in this journal will equip you with the necessary knowledge to better understand the various components of Mongolia's work on REDD+ readiness and in determining policies and measures to contribute towards the countries Forest and Climate Change National Strategy.

I encourage you to apply this knowledge and do your part to make REDD+ a success in Mongolia!

GOVERNMENT OF MONGOLIA

REDD+ MONGOLIA

BRIEF INTRODUCTION OF THE UN-REDD MONGOLIA NATIONAL PROGRAMME

Mongolia became a partner country of the UN-REDD Programme in June 2011 and National REDD+ Readiness Roadmap officially adopted by the Ministry of Environment and Green Development and Tourism. UN-REDD Mongolia National Programme based on National REDD+ Readiness Roadmap started to implement in September 2015 approved by the Programme Policy Board.

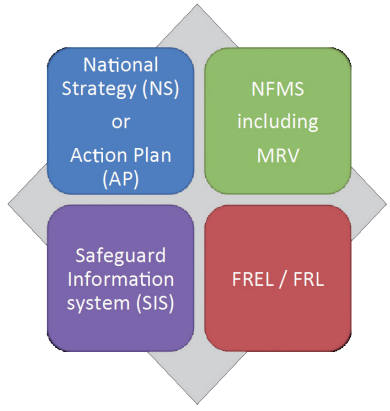
UN-REDD is a United Nations collaborative initiative on Reducing Emissions from Deforestation and Forest Degradation (REDD+). The Programme was launched in 2008 to assist developing countries prepare and implement national REDD+ strategies. It builds on the expertise of the Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). The program is currently working in over 74 countries, mainly in tropical developing countries. Mongolia is the only country with significant amounts of boreal forest and being the most northerly country and faces unique climate change and ecological issues that are not observed in other countries.

In addition, support to Cook Islands, Gambia, Kribati, Marshall Islands, Niger, Palau, Senegal, Sierra Leone, Tongo and Tuvalu.

MAIN GOAL

The overall goal of the UN-REDD Mongolia National Programme is to support the Government of Mongolia in designing and implementing its National REDD+ Strategy or Action Plan and in meeting the requirements under the UNFCCC Warsaw Framework to receive results-based payments. The UN-REDD Programme supports nationally-led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including Indigenous Peoples and other forest-dependent communities, in national and international REDD+ implementation.

This comprises work on the four design elements for REDD+, 1 National Strategy &/or Action Plan, 2 National Forest Monitoring System, 3 Safeguards Information System, 4 Forest Reference Level.



The National Programme also counts on key national counterpart institutions and development partners to play active roles and take on specific responsibilities in maintaining the momentum in the REDD+ management processes and prioritizing and implementing those strategic options identified through the Programme.

REDD+ Mongolia

As a signatory to both the UN Framework Convention on Climate Change (UNFCCC, in 1992) and the Kyoto Protocol (1997), Mongolia is fully aware of the causes and potential impacts of climate change. Mongolia is therefore striving to reduce its greenhouse gas (GHG) emissions while maintaining its path of economic development. Mongolia's vast surface area includes approximately 17 million hectares of forest – an area roughly the size of Nepal. These forests can be categorised into two broad zones: northern boreal forests and southern Saxaul forests. The northern boreal forests cover approximately 13.2 million hectares and the southern saxual forest, which is largely an arid zone shrub vegetation covers 4.6 million (Ministry of Environment and Tourism, Mongolia, 2015). M ongolia's forests have great potential to contribute towards the country's sustainable development goals and innovative policies on Sustainable Development. This may arise through the provision of ecosystem services and goods, such as timber, non-timber forest products, water services, and biodiversity, provide resources for communities, such as non-timber forests products and firewood. The implementation of sustainable forest management strategies can also reduce greenhouse gas emissions from reducing forests degradation and deforestation and enhance services and carbon stocks.

REDD+ ACADEMY

The REDD+ Academy is a coordinated REDD+ capacity development initiative led by the UN-REDD Programme and the UNEP Environmental Education and Training Unit, which seeks to match the scale of the global climate change mitigation challenge and enable systematic, focused capacity development to deliver REDD+ on the ground.The REDD+ Academy is a comprehensive response to capacity building needs identified by the countries receiving

support from the UN-REDD Programme. The main aim of the REDD+ Academy is to empower potential "REDD+ champions" with the requisite knowledge and skills to promote the implementation of national REDD+ activities.The REDD+ Academy is also available (in English) on the following website and can do online tests and collect a certificate for completed courses:

http://unccelearn.org/login/index.php

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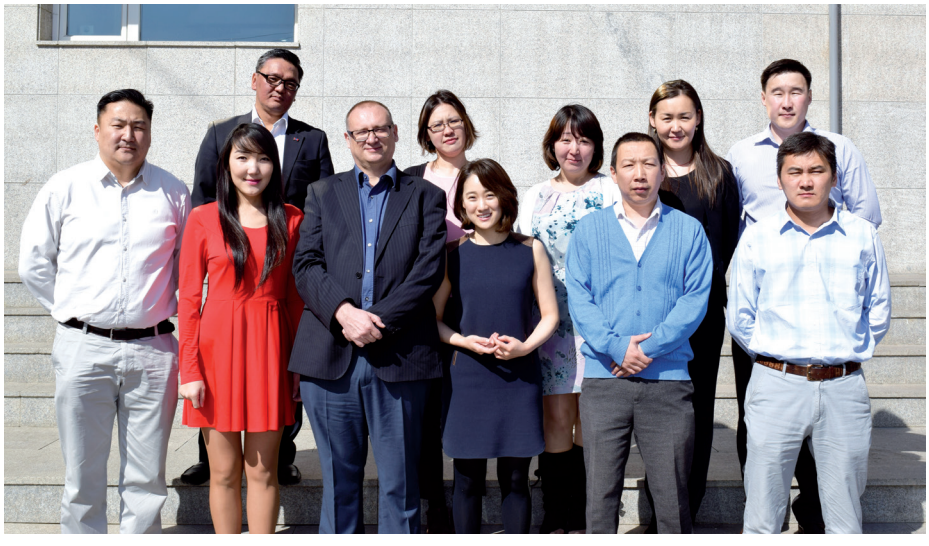
REDD+ Academy Journals in Mongolia

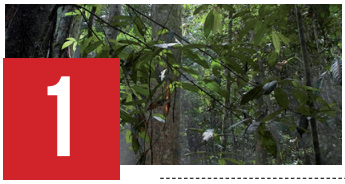
The REDD+ Mongolia journals have been developed from the REDD+ Academy journals, for more details on REDD+ National Program in Mongolia please see the following sites.

Website: www.reddplus.mn Facebook: REDD+ in Mongolia Twitter: REDD+ in Mongolia



Programme management unit, UN-REDD Mongolia national programme

LEARNING MODULES



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FOREST, CARBON SEQUESTRATION AND CLIMATE CHANGE

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UNDERSTANDING REDD+ AND THE UNFCCC

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DRIVERS OF DEFORESTATION AND FOREST DEGRADATION (DDFD)

4

NATIONAL STRATEGIES AND ACTION PLANS

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REDD+ FINANCE

1

CLIMATE CHANGE AND THE ROLE OF FORESTS

THIS MODULE SHOWS EVIDENCE THAT THE CLIMATE IS CHANGING AND SHOWS A CLEAR LINK WITH HUMAN ACTIVITY. IT THEN PRESENTS THE ROLE OF FORESTS REGARDING CLIMATE REGULATION.

THE MODULE INCLUDES EXPLANATIONS ABOUT:

- Evidence of human induced climate change and factors influencing the climate
- The regulatory role of forests, and
- How human activity impacts the climate related function of forests

CONTENT

Key messages

- There is increasing evidence from around the world that the Earth's climate is changing and human There is increasing evidence from around the world that the Earth's climate is changing and human activity is the most likely cause;
- The carbon cycle means that vegetation (including forests), soils, oceans and the atmosphere are connected, and it is important to consider the role vegetation and changes in vegetation cover play in controlling overall greenhouse gas emissions and hence climate change;
- As forests contain substantial stores of carbon, their degradation and or conversion to other land cover causes the release of some of the carbon stored within them, conversely their restoration can act as a sink for atmospheric carbon;
- The UNFCC developed REDD+, reducing emissions from deforestation and forest degradation plus the conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks, recognizing the potential role of forests in contributing to climate change mitigation.
- Mongolia is threatened by climate change risks with an above global average increase in mean temperature.
- Impacts on precipitation change, permafrost loss and desertification have already been shown..
- Forests play a role in climate change mitigation and adaptation.

Introduction

This module shows evidence that the climate is changing and shows a clear link with human activity. It then presents the role of forests regarding climate regulation.

The module includes explanations about:

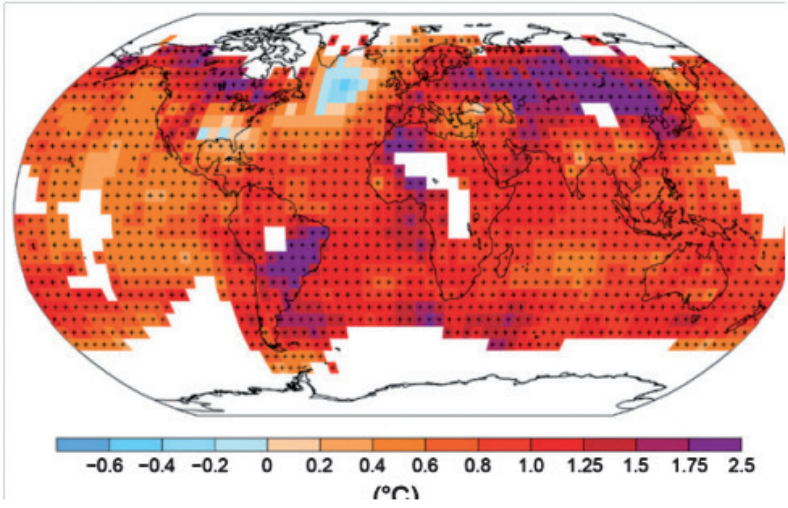
- Evidence of human induced climate change and factors influencing the climate;
- The regulatory role of forests;
- How human activity impacts the climate related function of forests.

There is increasing evidence from around the world that the Earth's climate is changing and human activity is the most likely cause. As the IPCC 2015 AR5 summary report[1] notes: "It is extremely likely that we are the dominant cause of warming since the mid-20th century".

[1] http://www.ipcc.ch/report/ar5/wg1/

These changes are most obviously seen by increasing average temperatures and rising sea levels. Figure 1.1 shows the average changes in temperature around the world between 1901 and 2012. As can be seen, apart from a couple of light blue areas which represent falling average temperatures, most of the world has experienced an increase in average temperatures represented by the orange/red and purple areas. The global average temperature increase over the period 1880 to 2012 period is 0.85°C.

Figure 1.1 Map of the observed surface temperature change from 1901 to 2012



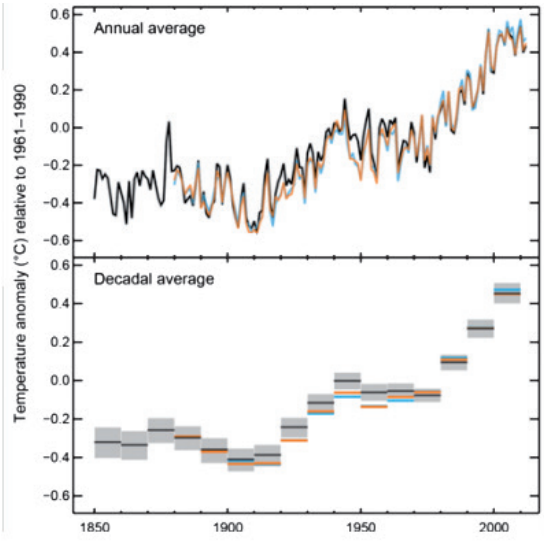
Source: IPCC, 2013

REFLECTION POINT

On average have temperatures in your region increased or decreased?

Figure 1.2 shows how temperatures have varied, between 1850 and 2010, in comparison to the average temperature of 1961-1990. The graph shows, for example, that in 1850, the average temperature was 0.4 degrees cooler than the average temperature between 1961 and 1990. The top part of the graph presents the annual averages, while the bottom one shows the average for decadal periods.

Figure 1.2 Observed global mean combined land and ocean surface temperature anomalies

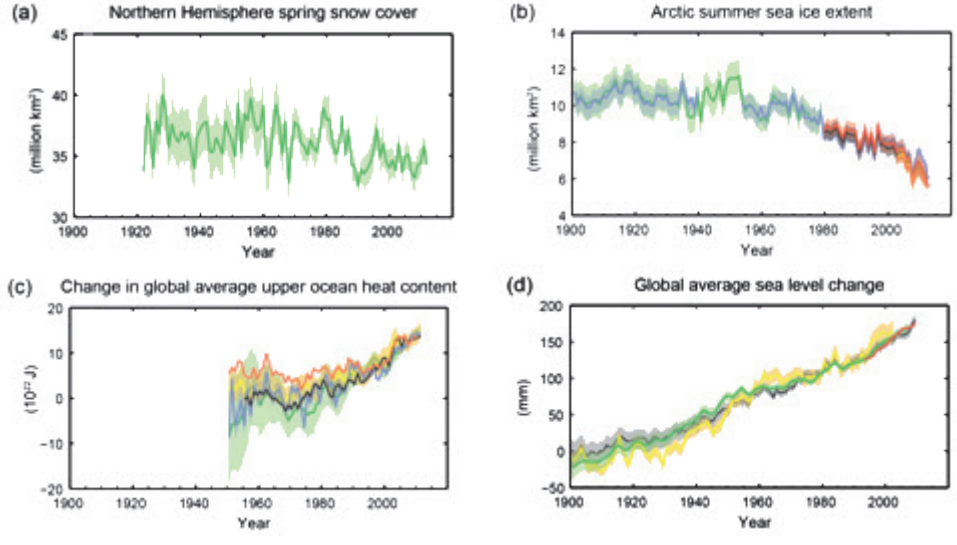


Source: IPCC, 2013

Figure 1.2 clearly shows that over this period, average temperatures have been increasing, and that the three last decades have been the hottest; each successively warmer at the Earth's surface than any preceding decade since 1850.

The rise in temperature is not the only evidence of a changing climate: Figure 1.3 illustrates the changes measured in several other ways.

Figure 1.3 Multiple observed indicators of a changing global climate



Source: IPCC, 2013

Figure 1.3(b) shows that Northern Hemisphere snow cover and Arctic summer ice are falling, particularly since 1960. The melting snow and ice ends up in the oceans, which contributes to higher average sea levels (around 15 cm already over the observed period). In spite of the melting ice water, global upper water layers have warmed since 1950, when the measurements started.

REFLECTION POINT

Have you already noticed impacts of climate change? (e.g. changing in the timing of the seasons, species movements, changes in the frequency of extreme events).

Are you aware of any changes within Mongolia that have been attributed to climate change?

Are you aware of the predicted threats from a warming planet on Mongolia?

What is causing climate change?

As mentioned previously, humans are the most likely cause of recent changes in the earth's climate, but the climate system is complex, and is influenced by several natural effects such as variations in solar radiation, the natural greenhouse gas effect, naturally occurring aerosols, water currents, etc.

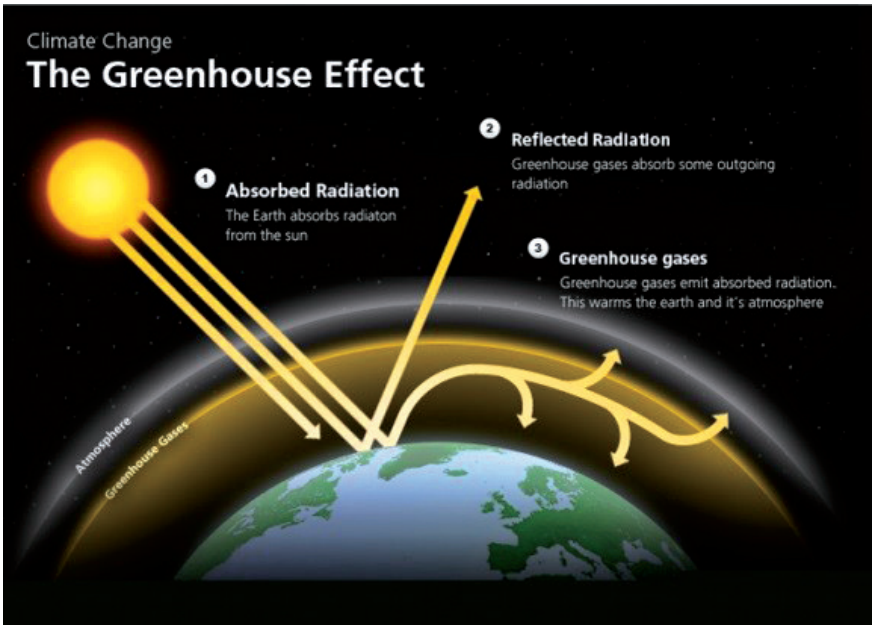
The Greenhouse Effect

The greenhouse effect is a natural phenomena through which carbon dioxide in the atmosphere (and a few other Greenhouse Gases (GHGs) including methane and nitrous oxide) keep the solar rays that hit the earth surface from reflecting back into the outer space, thus heating the earth's atmosphere. Figure 1.4 illustrates the greenhouse effect and how it operates and how GHGs contribute. The GHGs absorb some of the reflected radiation and then re-emit it, including back down to the earth's surface, heating the atmosphere. There are several GHGs and their impact depends on their 'global warming potential', as well as the amount of the gas in the atmosphere.

The global warming potential of methane and nitrous oxide are much larger than that of carbon dioxide but a far larger amount of carbon dioxide is emitted into the atmosphere.

In principle, the greenhouse effect is a good thing, as otherwise the planet would be too cold for humans to survive, but the increase in greenhouse gases has led to an increase in the "warming potential" of the atmosphere, and this is related to the changes in the climate observed. Mankind is, in effect, putting an extra blanket around the earth.

Figure 1.4 The greenhouse effect

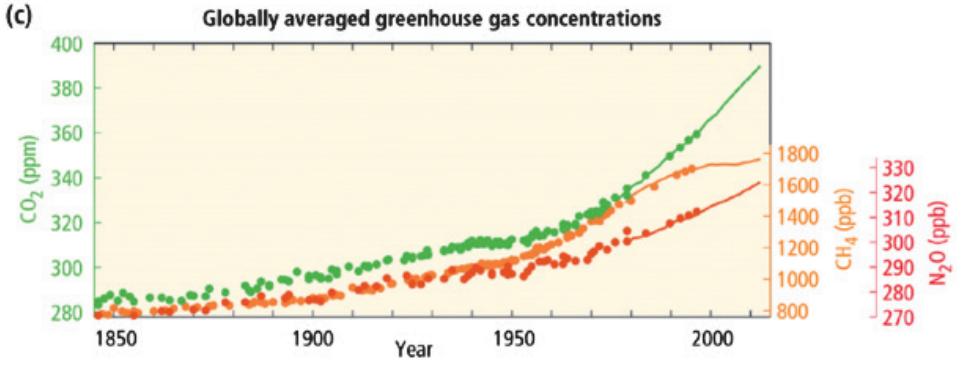


Source: EDF Energy, 2015

There is now a consensus amongst the scientific community that the cause of actual (and future) climate change is anthropogenic (from humans), mainly by the intensification of the greenhouse effect caused by the emission of greenhouse gases in the atmosphere.

The warming of the climate system is unequivocal, and the largest contribution comes from the increase in the atmospheric concentration of carbon dioxide (CO2), which is man-made. The IPCC states it clearly: it is extremely likely (95%) that human influence has been the dominant cause of the observed warming since the mid-20th century. The figure 1.5 shows how the concentration of atmospheric CO2, methane (CH4) and Nitrous oxide (N2O) have increased in the recent past.

Figure 1.5 Globally averaged greenhouse gas concentrations



Source: IPCC, 2013

REFLECTION POINT

Are the following statements True or False?

Without the greenhouse effect the planet would be too cold to live on.

Climate change is a result of an increase in the concentration of these greenhouse gases mostly from anthropogenic sources, such as the burning of fossil fuels, agriculture and deforestation.

How does climate change link to the carbon cycle and forests?

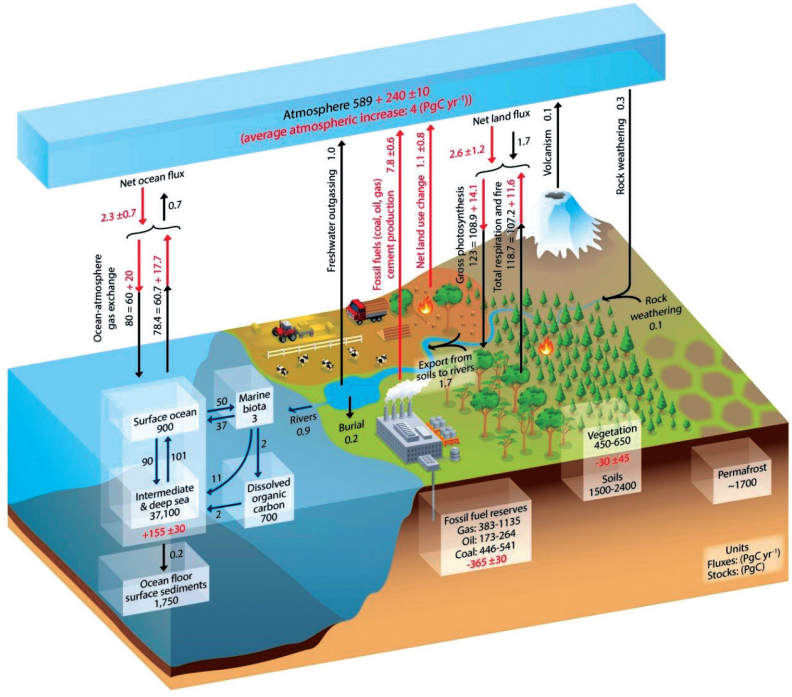
Carbon can be found in a variety of different forms and locations. These include in living organisms (including trees and other plants), fossil fuels (coal, oil and gas) and carbon dioxide within the atmosphere. The absolute quantity held within these different locations at a specified time is called the stock, and changes in these stocks are referred to as fluxes. Carbon flows between these stocks through a number of processes collectively known as the "carbon cycle". The fluxes include natural processes such as plant growth and respiration, and human interventions such as the burning of fossil fuels and destruction of forests. Figure 1.6 below illustrates the global carbon cycle with its stocks and flows, which are shown in two ways:

1. How they were before large human intervention (roughly before 1750 – black figures and arrows);
2. How they were changed with human intervention since the industrial revolution (red figures and arrows).

Human actions, such as the burning of fossil fuels, cement production and land use

change are creating increased emissions. But these bigger emissions from 'sources' (stocks producing carbon (C) output to the atmosphere) are compensated partly by larger emissions from the atmosphere into 'sinks' (processes or mechanisms that remove carbon dioxide from the atmosphere), particularly the ocean and the land sinks. Forests are both stock and sources of greenhouse gas emissions.

Figure 1.6 Global carbon cycle for the 1990s



Source: IPCC, 2015

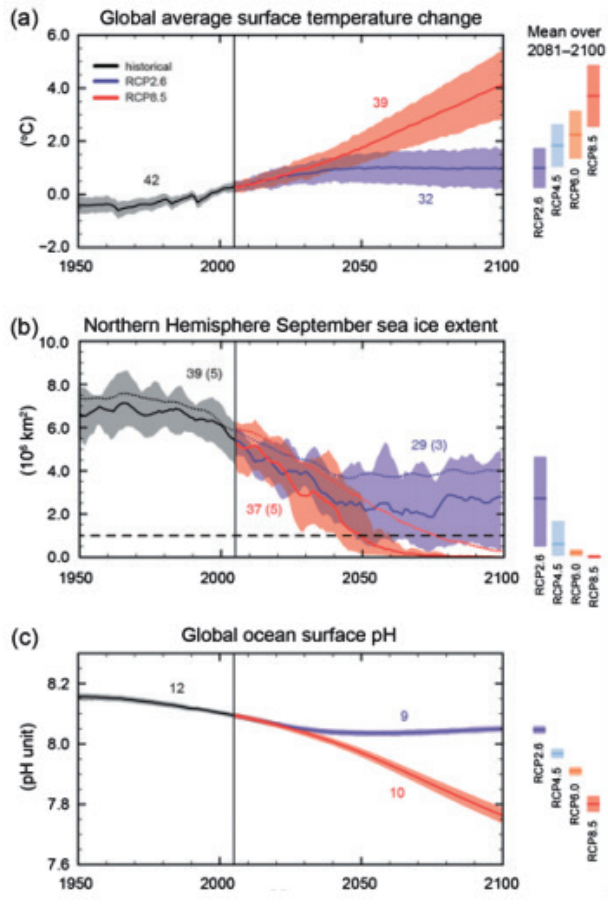
The carbon cycle means that vegetation (including forests), soils, oceans and the atmosphere are connected, and it is important to consider the role vegetation and changes in vegetation cover play in controlling overall greenhouse gas emissions and hence climate change. Overall, the most recent assessments by the IPCC estimate that anthropogenic net CO_2 emissions from land use change represent about 10% of the total anthropogenic emissions (IPCC AR5 WGI[2]).

[2] http://www.ipcc.ch/report/ar5/wg1/

Expected changes in the future

There is little doubt that climate change is happening, and that it is being caused by human activity through the enhancing of the greenhouse effect by increasing greenhouse gas emissions. Several scenarios have been produced to provide an idea of what the future climate could look like. The scientific community has produced Representative Concentration Pathways (RCP), which are projections based on emission scenarios until 2100. These projections are based on scenarios which describe several ways in which emissions could fluctuate in the future. RCP 8.5 presents a continuous growth of emissions, RCP 6 and RCP 4.5 present intermediate situations, and RCP 2.6 present projection with a scenario of sharp emission reductions. These projections are useful for informing decisions related to future climate. The projections for change in temperature are shown in Figure 1.7.

Figure 1.7 Simulated time series from 1950 to 2100



Source: IPCC, 2013

Figure 1.7 shows that unless important action is taken to reduce emissions; there will be drastic changes in the climate which will strongly affect the environment.

Current international agreements have set a goal that the rise in average world temperature should not go higher than 2°C above pre-industrial levels. The link between emissions since the 1850s and temperature increases means that emissions need to be capped at a certain level of cumulative emissions (the level that corresponds to the 2°C increase). If emission rates stay at the current levels, the remaining budget 'quota' would be used up in about 30 years.

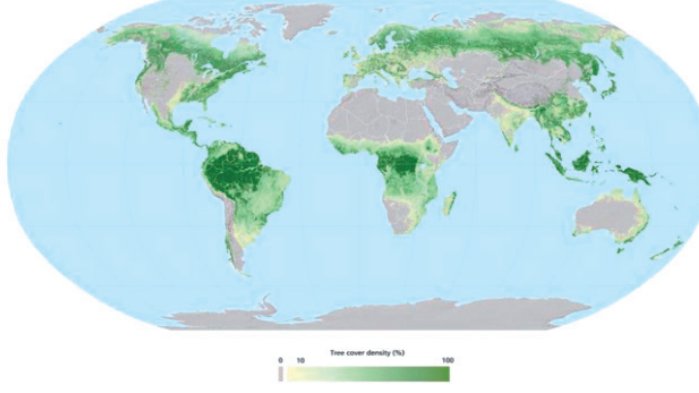
In other words, unless strong mitigation actions are urgently adopted, the limit of a 2°C temperature rise will quickly be passed and a much more uncertain climate future awaits.

The extent of forests and forest carbon stocks

Globally, forests cover about 4 billion ha or 31% of the world's land surface (relative to a pre-industrial area of 5.9 billion hectares of forests). Most forests occur in the tropics and in large areas of the Northern hemisphere in Canada, the US, Europe, Siberia and China, as shown in Figure 1.8.

The different forest (and other) biomes contain varying amounts of carbon, as presented in Figure 1.8. At a global scale tropical forests contain the largest carbon stock (547.8 million tonnes C in tropical and subtropical forests). There are also differences within tropical areas, with mangrove forests and swamp forests containing particularly high levels of biomass[3] in their vegetation cover and soils.

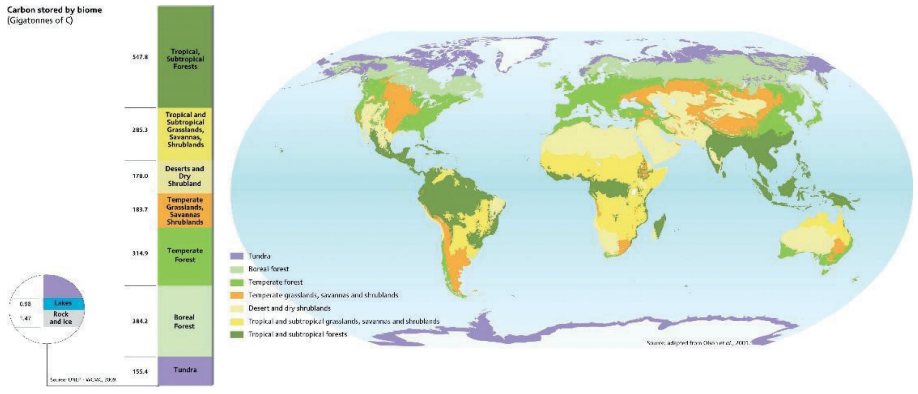
Figure 1.8 Forest cover in 2010



Source: FAO, 2010.

[3] Biomass is the total mass of living organisms in a given area or volume; dead plant material can be included as dead biomass. The quantity of carbon contained in biomass varies slightly between vegetation types but on average, a ton of biomass equates to half a ton of carbon.

Figure 1.9 Carbon storage by ecosystem



Source: Kapos, V., Ravilious, C., Leng, C., Bertzky, M., Osti, M., Clements, T., Dickson, B. (2010)

REFLECTION POINT

Referring to figure 1.9, what different ecosystem types are there in your country?

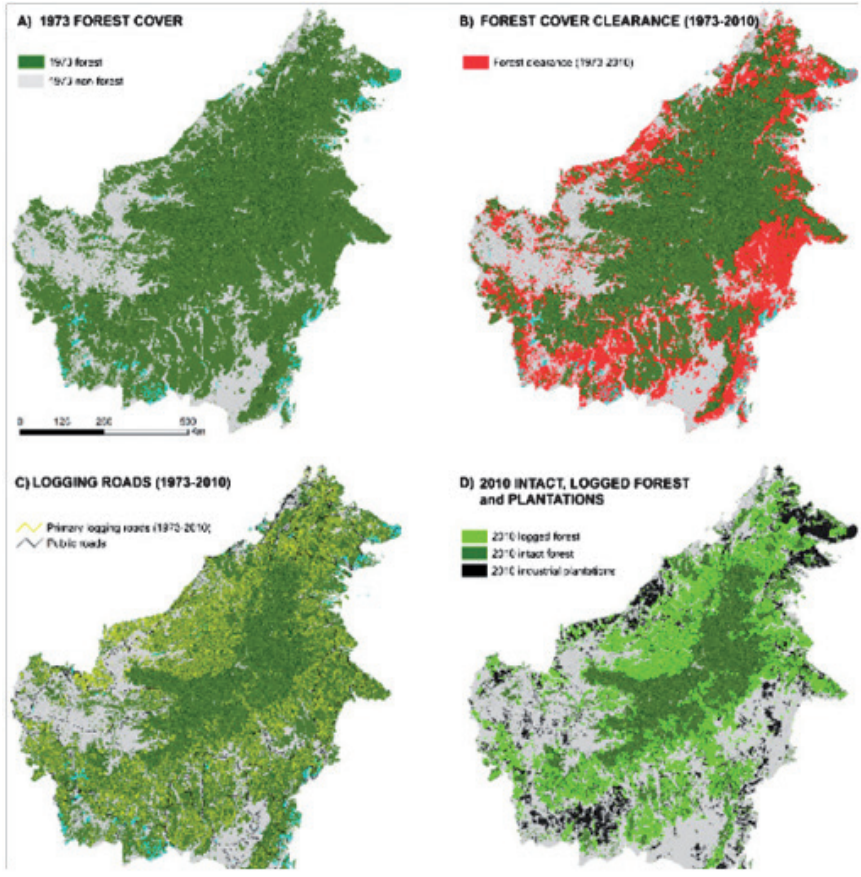
How much forest is there and where is it situated? Are there different types of forested habitat (e.g. mangroves, swamp-forests)?

Emissions from forest carbon stocks

As forests contain substantial stores of carbon, their degradation and or conversion to other land cover causes the release of some of the carbon stored within them. Forest degradation is defined as human activities negatively impacting on the forest, causing the partial removal and loss of ecosystem function, but where some forest cover remains, for example through damage from selective logging. The level of emissions depends on the amount of carbon stored in the forest, the extent to which the vegetation cover and soil structure is damaged or destroyed, as well as what happens to the land afterwards. Particularly high emissions will result if the vegetation is completely destroyed and then the area is burned afterwards, as is carried out during slash and burn agriculture in some parts of the developing world.

The extent of forest destruction is very high in some areas. For example, a recently published study on deforestation in Borneo shows that deforestation has reduced the once large forest cover on Borneo (75.7%) by one third, as shown in figure 1.10.

Figure 1.10 Evolution of forest cover on Borneo Island



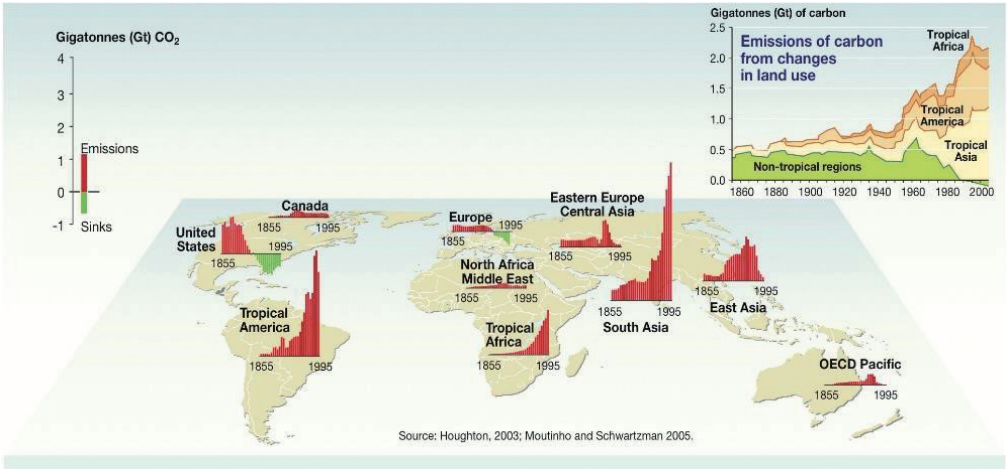
Source: Gaveau *et al.,* 2014

Historically, deforestation was largely in the US, Europe and Eastern Europe. Today, the largest deforestation rates are observed in tropical rain forest regions. Figure 1.11 shows that the USA and Europe have reversed the trend and are now increasing their forest cover. This highlights an important issue, that although the destruction of forests causes the release of carbon dioxide, their restoration can act as a sink for atmospheric carbon. As mentioned previously, the net contribution of land use change to global emissions is about 10% (0.9 PgC/yr). This contribution is calculated by combining both emissions due to deforestation and the sequestration of carbon due to forest recovery. The gross emissions from deforestation and degradation are larger than the net emissions (about 2.8 ± 0.5 PgC/yr for the 2000s, IPCC AR5 WGI, 2013[4]) because of the significant regrowth that compensates for the gross emissions.

[4] http://www.ipcc.ch/report/ar5/wg1/

There are several causes for deforestation and forest degradation, which are addressed more in depth in ***Module 3: Drivers of Forest Degradation and Deforestation*.**

Figure 1.11 Historical Forest Carbon Balance 1855-1995



Source: GRID-Arendall, 2015

REFLECTION POINT

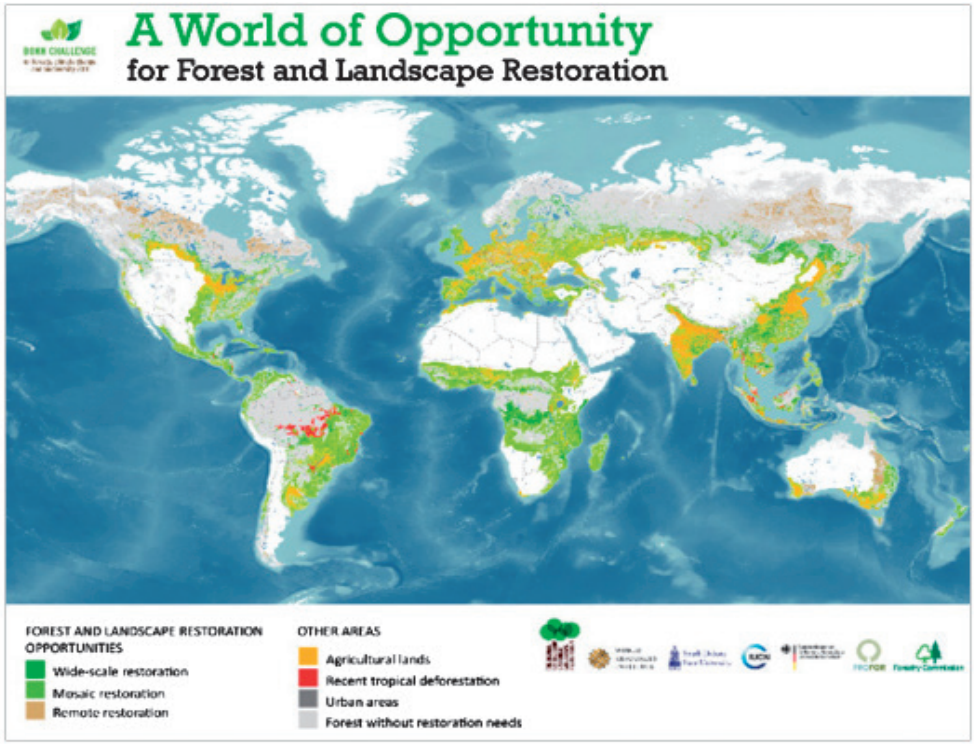
Why is it so important to understand the link between deforestation and degradation in addressing the issues of climate change?

Carbon sequestration potential of forests

Forests are not only potential sources of carbon emissions to the atmosphere; they can also act as carbon sinks, sequestering carbon both as they grow when they are being restored to the biomass sink and as part of the terrestrial carbon sink.

More than two billion hectares worldwide may offer some form of opportunities for restoration. In areas that were deforested but that are not currently densely populated or cultivated, it may be possible to undertake some form of restoration, ranging from complete reforestation of closed canopy cover to more mosaic restoration that includes restored forest areas interspersed with other land uses including agroforestry, small scale agriculture and settlements. Such restoration sequesters carbon, with the level of sequestration depending on the extent of recovery of plant biomass and soil carbon. This potential is illustrated in figure 1.12.

Figure 1.12 Forest and landscape restoration opportunities



Source: WRI, 2015

The observed increases in atmospheric carbon dioxide are lower than would be expected if anthropogenic emissions were considered alone, due to the combined action of natural land and ocean sinks of carbon dioxide which removed an average 55% of the total anthropogenic emissions every year during the period 1958–2011 (IPCC 2013, AR5 WGI). The increased storage of carbon in terrestrial ecosystems not affected by land use change is partially caused by enhanced photosynthesis at higher carbon dioxide levels, and it means that intact forests are helping to act as a buffer against anthropogenic carbon dioxide emissions.

ADAPTATION AND MITIGATION

- Climate Change Mitigation refers to efforts to reduce or prevent emission of greenhouse gases. Mitigation can mean using new technologies and renewable energies, or reducing emissions from deforestation and forests degradation.
- Adaptation is adjustment in natural or human systems in response to actual or expected climatic changes or their effects.
- Resilience is the increase in the ability of species or ecosystems to

absorb or adapt to the effects of climate change, e.g. by building forest ecosystem complexity or livelihood models which can withstand climate impacts

Climate Change - The long-term impacts on forests due to climate change are not yet fully comprehended in Mongolia, but include the effects of permafrost melting (which reduces soil moisture) and increased risk of forest fire. Climate change is also a factor which may be an underlying cause of increased forest vulnerability from pathogens and pests, with changed life cylces, and increasing frequency and severity of droughts creating an environment more conducive to pests. Pest and pathogen may increase in the future as a result of climate change, as has occurred in other boreal forests areas in the world.

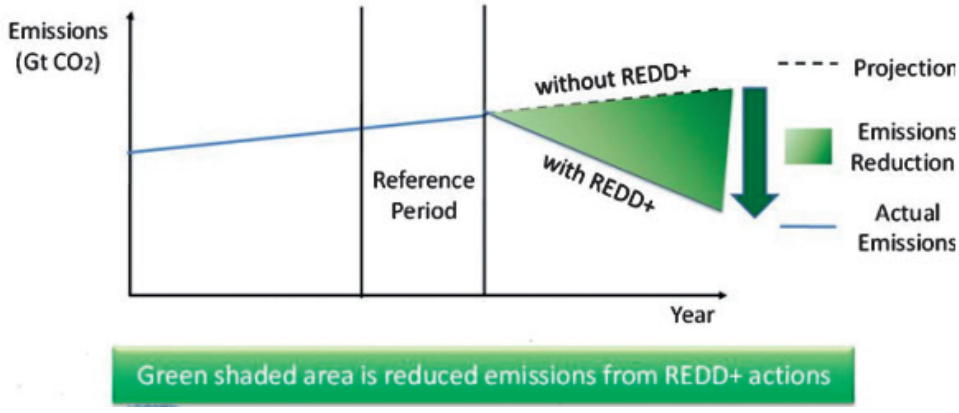
Forests and climate change mitigation

The links between forests and the carbon cycle mean that actions that affect the forest sector can have a large impact on greenhouse gas emissions and so on climate change. The total amount of carbon dioxide in the atmosphere can be reduced by decreasing emissions from both deforestation and forest degradation. Maintaining standing forests can preserve their role in the terrestrial carbon sink and restoring forests can increase the sequestration of carbon by forests thereby decreasing the overall levels of carbon dioxide in the atmosphere.

Recognizing the potential role of forests in contributing to climate change mitigation, the UNFCC developed REDD+, reducing emissions from deforestation and forest degradation plus the conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks. Module 2 presents the basis of REDD+ and the UN-REDD Programme.

REDD+ is a potentially important way to reduce total GHG emissions and thus mitigate climate change as illustrated by figure 1.13.

Figure 1.13 REDD+ Reducing emissions from deforestation and forest degradation



Forests and climate change adaption

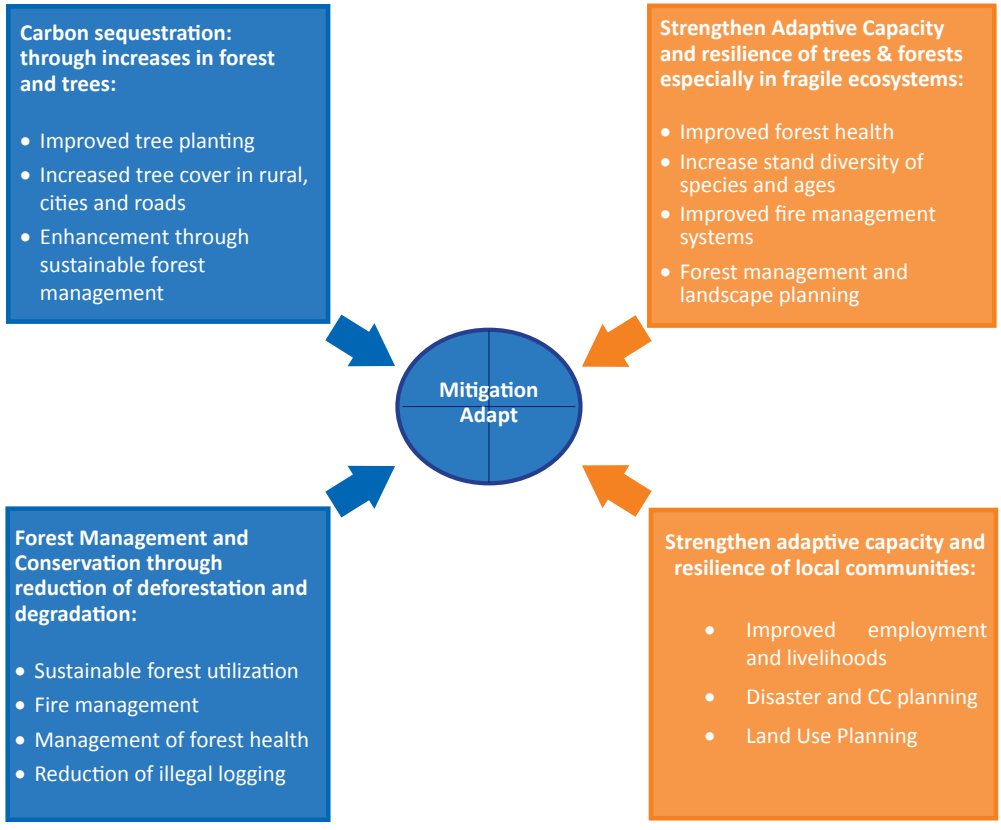
Decision makers and practitioners should take account of a number of potential challenges and trade-offs (compromises that may have to be made) when considering the relationship between REDD+ and adaptation.

First, climate change means that the current context for mitigation and adaptation measures is likely to change in the future. For example, degradation pressures from increased risk from forests fire may change. As another example, sustainable development strategies need to consider forests conservation actions, for mitigation the impacts of precipitation changes which may affect downstream development. Establishing processes to incorporate relevant information as it becomes available (for example on emerging local changes due to climate change), as part of adaptive management, can help to overcome challenges.

Overall, REDD+ and adaptation actions can be complementary, although it also needs to be noted that REDD+ actions will not be able to achieve all adaptation goals, and adaptation actions will not be able to achieve all REDD+ goals.

Integrating both adaptation and mitigation into wider forest policy and the strategies and plans of related sectors at the local to national scales can help maximize synergies and minimize trade-offs.

Figure 1.14 Climate Change Mitigation and Adaption



Source: UN-REDD Programme

How forest management and REDD+ can help tackle climate change

Land use, grazing, insects and pathogens, forests fire and illegal, or unsustainable extraction, have long been seen as a problem for forest managers for many years, adding climate uncertainty and impact to this situation presents additional challenges to managers to maintain ecosystems and develop productive and protective forests. Alterations in temperature and precipitation under climate change can impact forests in several ways. These include shifting patterns of species as a result of soil moisture conditions or environmental condition, increasing frequency and magnitude of disturbance events, intensifying the impact of forest fires and pest damage, and placing undue pressure on local communities around forest areas.

The choice of climate change adaptation approaches depends on the climate change projected to occur within a region and the local context. Ecosystem services need to

be considered in relation to human adaptation because of the dependency of livelihoods and economic sectors on them. In addition, ecosystems can provide a range of adaptation options. Therefore, conserving forests and the ecosystem services they provide can be both an adaptation measure, and contribute to REDD+ objectives at the same time.

Exercises

1. Match the correct definition with each word:

deforestation	forest degradation?
is the total removal of forest cover	is the part removal and loss of ecosystem function

2. Rank in order of importance the major impacts of climate change in Mongolia for a) herder community; b) forests, c) agriculture; d) industry and e) Mongolia's long term development plan.

Note

GOVERNMENT OF MONGOLIA

MINISTRY OF ENVIRONMENT AND TOURISM

REDD+ MONGOLIA

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UN-REDD PROGRAMME

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