Workshop

Carbon Dioxide Sequestration & Biodiversity

Bratislava, 9-10 November 2009

Carbon Biosequestration –

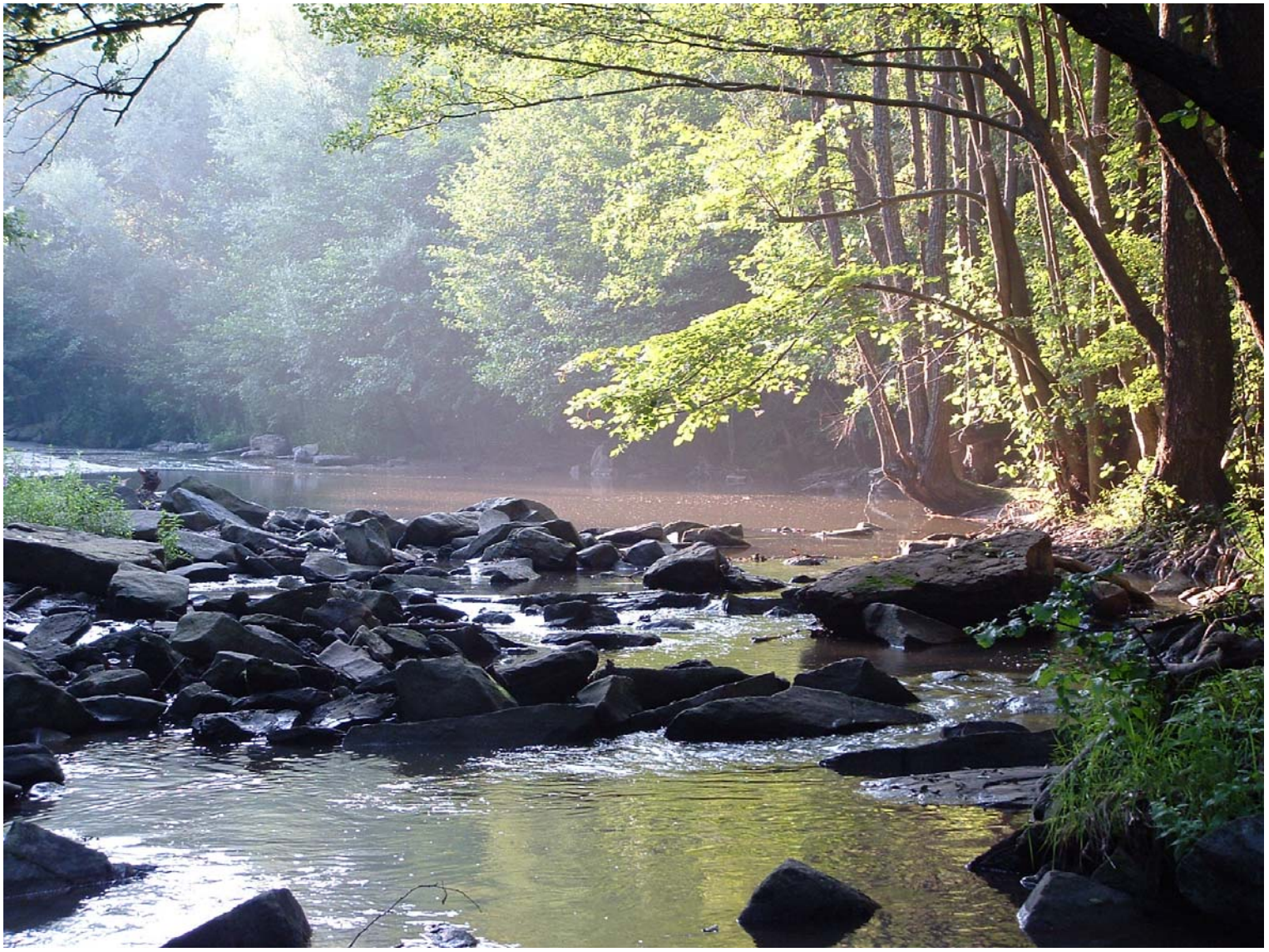
- **technical potential for mitigating climate change**

&

- **treatment in existing international climate policy.**

Overview by Daniela van Elburg-Velinova, EUCC, The Netherlands

It is increasingly recognized that avoiding catastrophic climate change will depend on holding the average increase in global temperatures to well below 2^0 C. That will require reduction of global emissions of GHG with about 80% below 1990 levels by 2050. Achieving cuts of such magnitude will require major reductions in all sources of GHG emissions.



One response to the urgent and dramatic challenge of climate change has been a growing interest by governments in carboncapture and storage at power stations. Tens of billions of dollar are being earmarked for a technology that aims to remove greenhousegases from smoke stacks and bury it deep underground

The worlds ecosystems that have been doing the job of C capture and storage, in a tried and tested way for millennia, are currently being depleted at an alarming rate. *(UNEP-WCMC 2009)*

The biological management of C in tackling cliamte change has essentially two components:

- **The reduction in emissions from biological systems**

  &

- **The increase of C storage in biological systems**

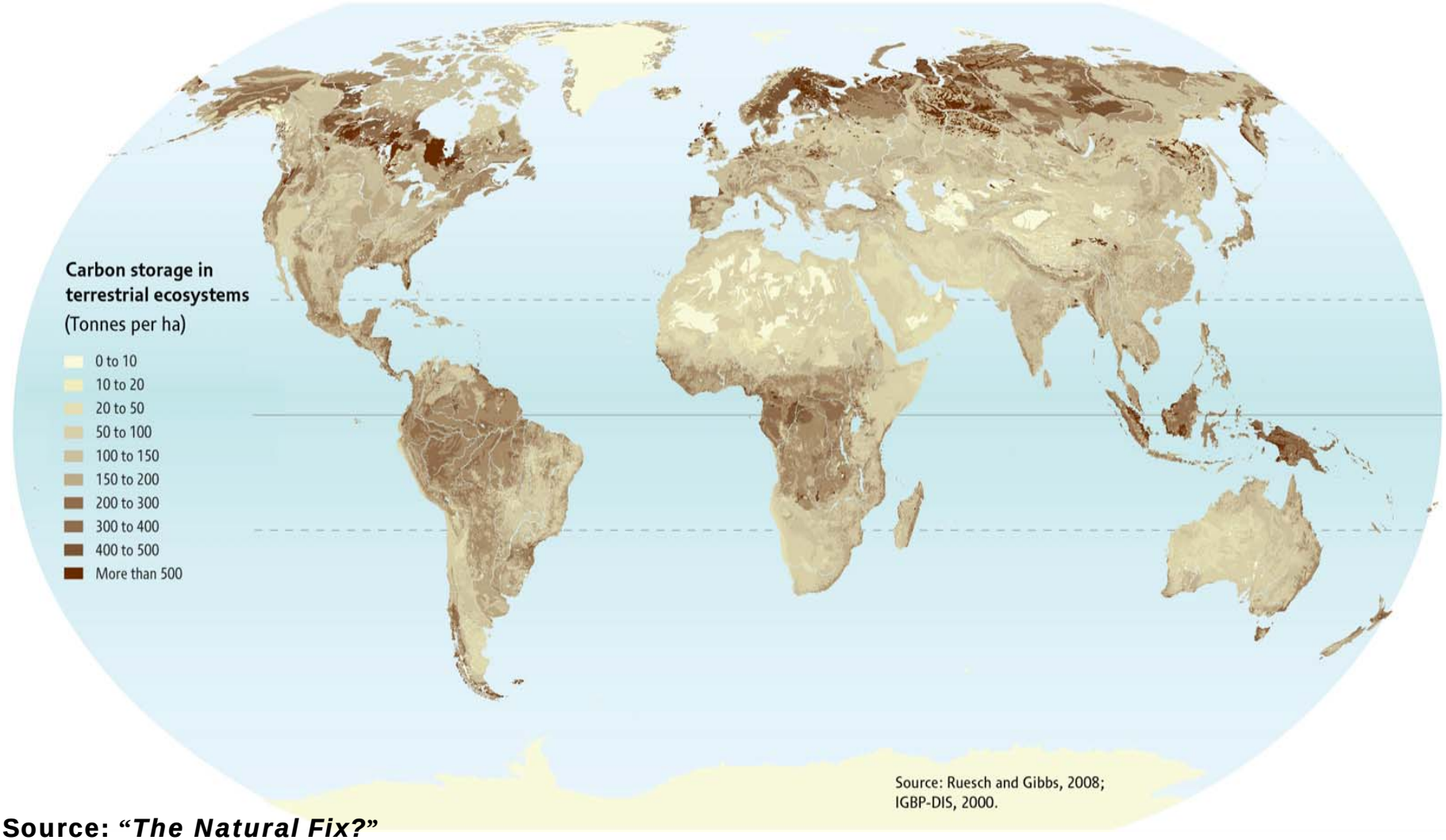
The reduction in emissions from biological systems and the increase in their storage of C can be achieved in three ways:

- *Existing stores could be protected and the current high rate of loss reduced*
- *Historically depleted stores could be replenished by restoring ecosystems and soils, and*
- *Potentially, new stores could be created by encouraging greater C storage in areas that currently have little.*

- **The maintaince of existing C reservoirs is among the highest priorities in striving for climate change mitigation**
- Safeguarding and restoring C in three systems - forests, peatlands and agriculture is considered to have the priority. Estimates suggest that these three systems might over the coming decades reduce well over 50 GT of C emissions that would otherwise enter the atmosphere.

(UNEP-WCMC 2009)

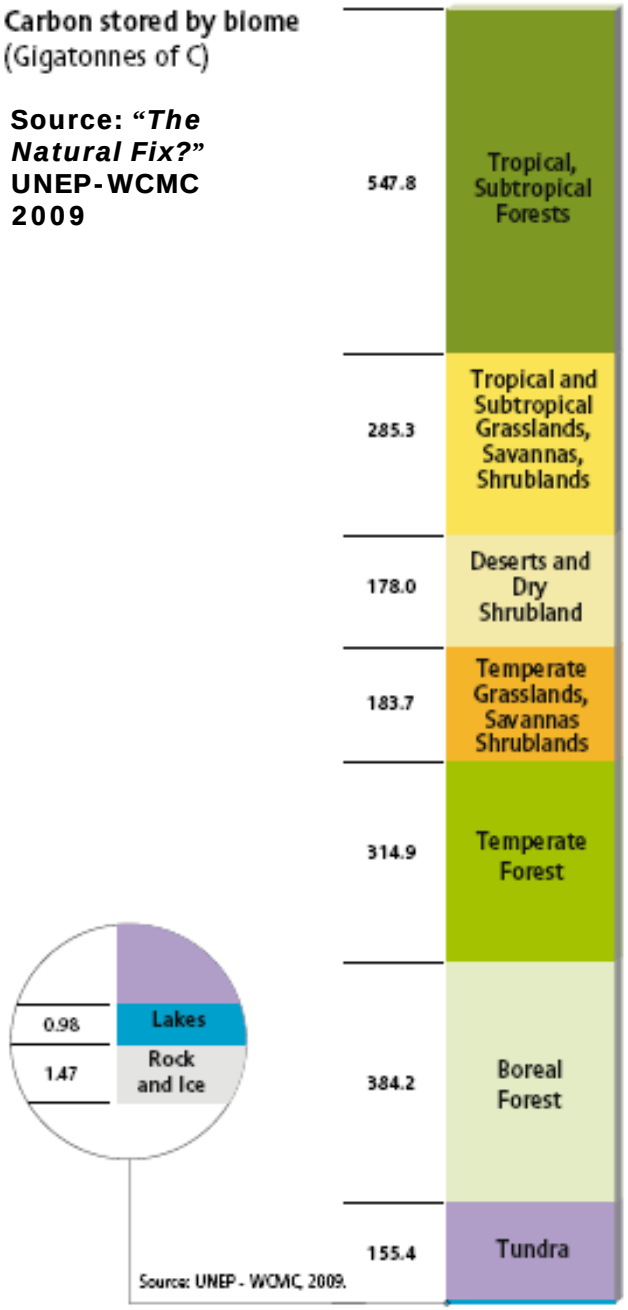
Carbon storage in terrestrial ecosystems



Source: *"The Natural Fix?"*
UNEP-WCMC 2009

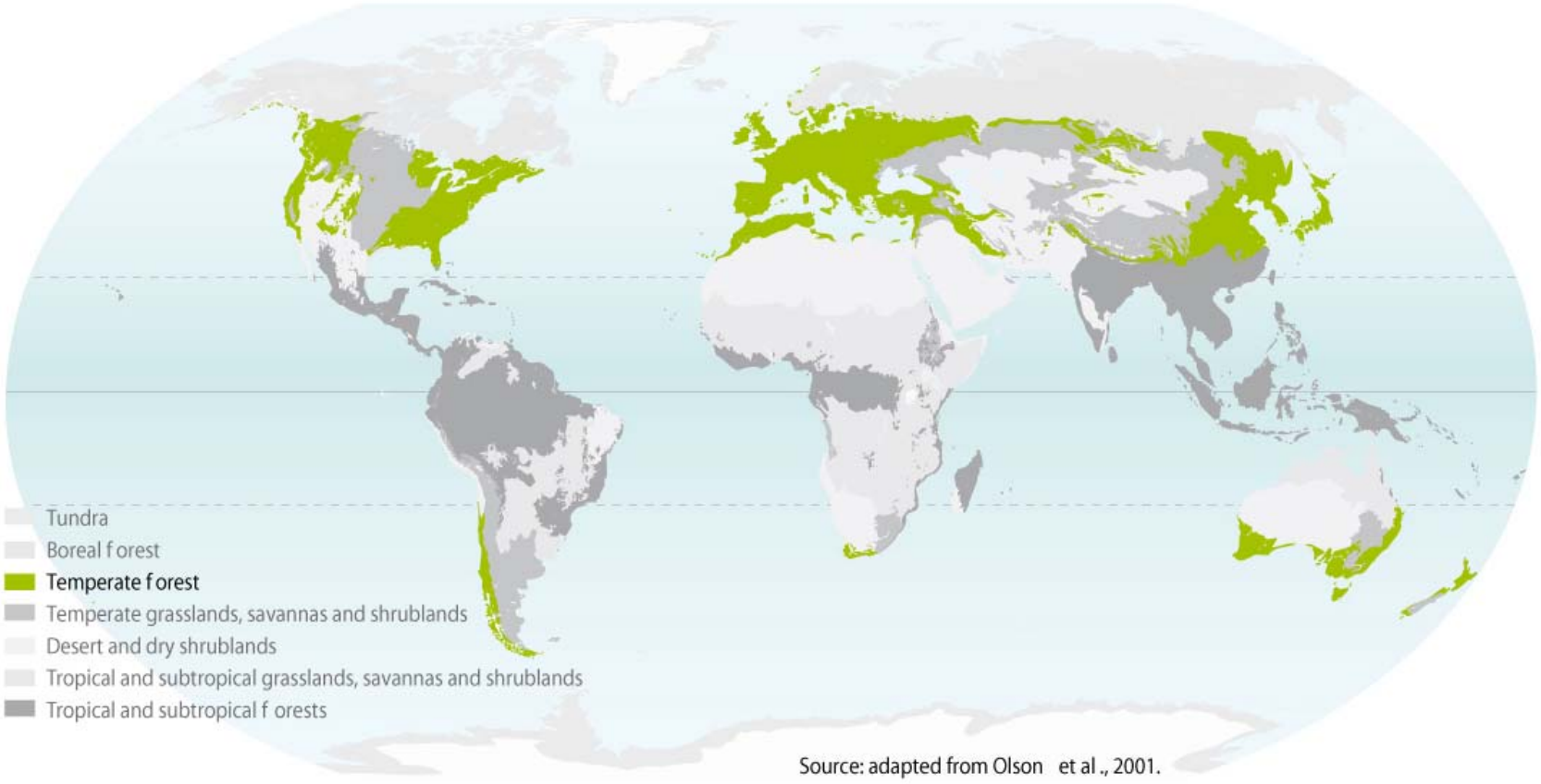
Carbon stored by biome
(Gigatonnes of C)

Source: *"The Natural Fix?"* UNEP-WCMC 2009



Dividing the world into seven biomes, we estimate that tropical and subtropical forests store the largest amount of carbon, almost 550 Gt. The boreal forest biome then follows with carbon

Temperate forest



Source: "*The Natural Fix?* "
UNEP-WCMC 2009

Temperate Forests

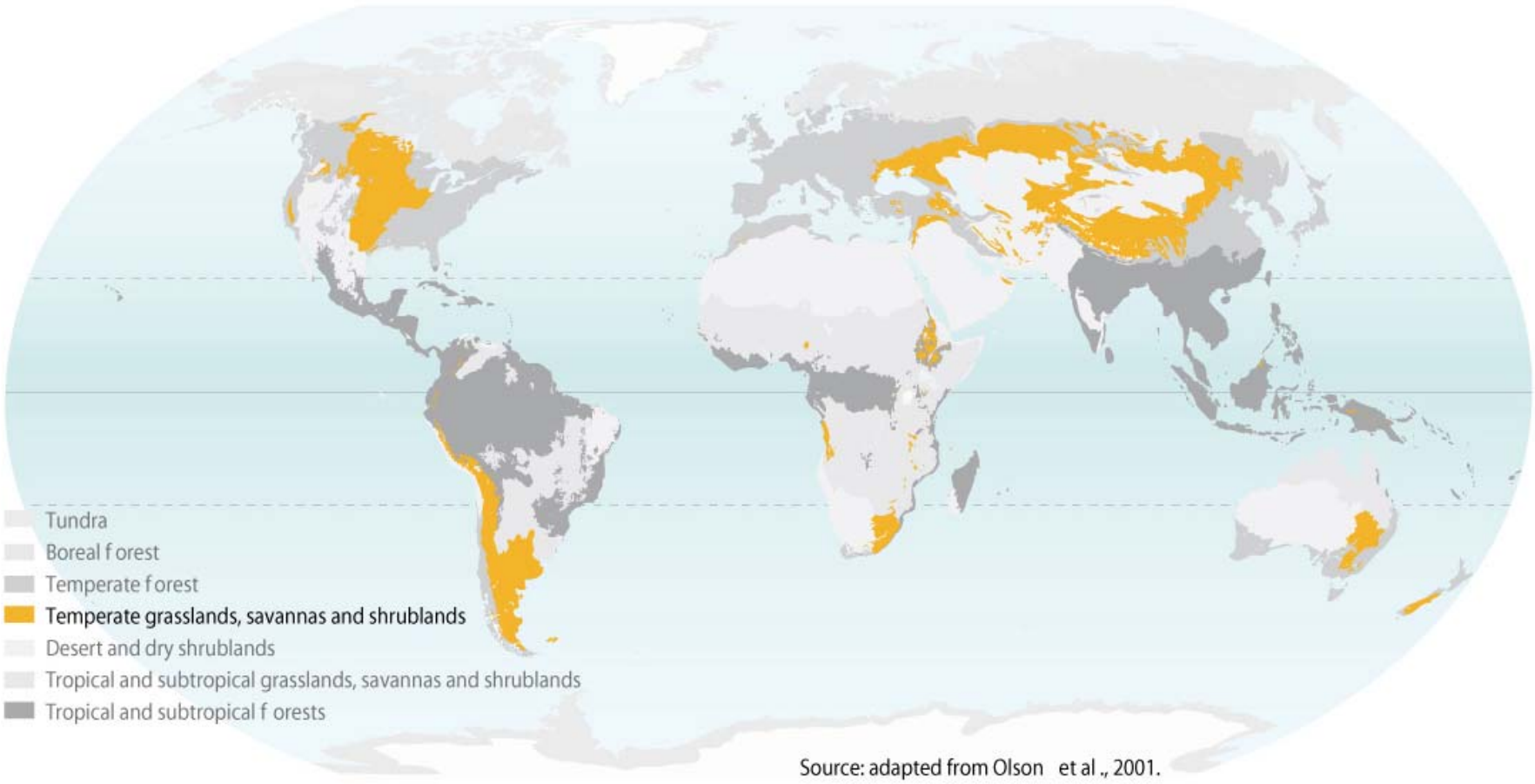
- Temperate forests are active carbon sinks and they are generally relatively high in animal and plant diversity.
- Where demand for land and/or water allows, reforestation would enable carbon sequestration and could provide other benefits including high biodiversity.

Temperate Forests

- The overall C store for temperate forests has been estimated at 150 and 320 t/ha, of which plant biomass accounts for ca 60% and soil C - for the remainder.
- In Europe, forests take up 7-12% of European C emissions. Further reforestation and improvement in management could increase C sequestration in the short term.

Sources: UNEP-WCMC 2009. Amundson 2001, Goodale et al. 2002, Janssen et al 2003, Jandl et al. 2007.

Temperate grasslands, savannas and shrublands



Source: "*The Natural Fix?*"
UNEP-WCMC 2009

Temperate Grasslands

- Much of the original area of temperate grassland has been cleared for agriculture.
- In Europe, areas of natural temperate grasslands occur in the Eastern part.

Temperate Grasslands

The C storage of plant biomass of temperate grasslands is between 0,68 and 7,3 t C/ha.

However, their soil organic C tend to be higher than those of temperate forests: 133 t C /ha

Sources: Fan et al 2008, Amindson 2001

WETLANDS

- Wetlands cover about 8-10% of the world's land surface (depending on how they are defined: e.g. whether peatlands and flooded forests are included).
- If peatlands are not included, the carbon pool contained in wetlands is estimated to amount up to 240 gigatons (Gt) out of a total of about 2100 Gt. Wetlands therefore play an important role in the global carbon cycle.

  (Sahagian and Melack 1998, IPCC 1996).

Wetlands

- Global wetlands preserve about 240 Gt of C, on an area of 0.35 10^9 Ha.
- In comparison to wetlands, forests (boreal, temperate, and tropical), store all together 1148 Gt and account for 4.17 10^9 Ha.
- Therefore, wetlands account for less land area but store a wealth of carbon. *(IPCC)*

- When coastal wetlands and peatlands are included, wetlands represent the largest component of the terrestrial biological carbon pool.

(Dixon and Krankina, 1995).

Wetlands in Europe

Wetlands cover about 9.9% of the whole of Europe alone, about 4.4% of the EU, 4.4% of non-EU Europe excluding the Russian Federation and 12.7% of the Russian Federation. In southern European countries, wetlands are now scarce (0.3-2.1% of the land area).

Wetland Degradation

The loss and degradation of wetlands is driven by several factors. Increased demand for agricultural land, population growth, infrastructure development, river flow regulation, invasion of non-native species and pollution constitute major causes of wetland degradation and loss.

Some Wetlands have even been transformed into waste dump sites.

Wetland Degradation

About two-thirds of the European wetlands that existed 100 years ago have been lost leading to a substantial decrease in the number, size and natural habitat of large bogs and marshes, and small or shallow lakes. (*European Commission, 1995*)

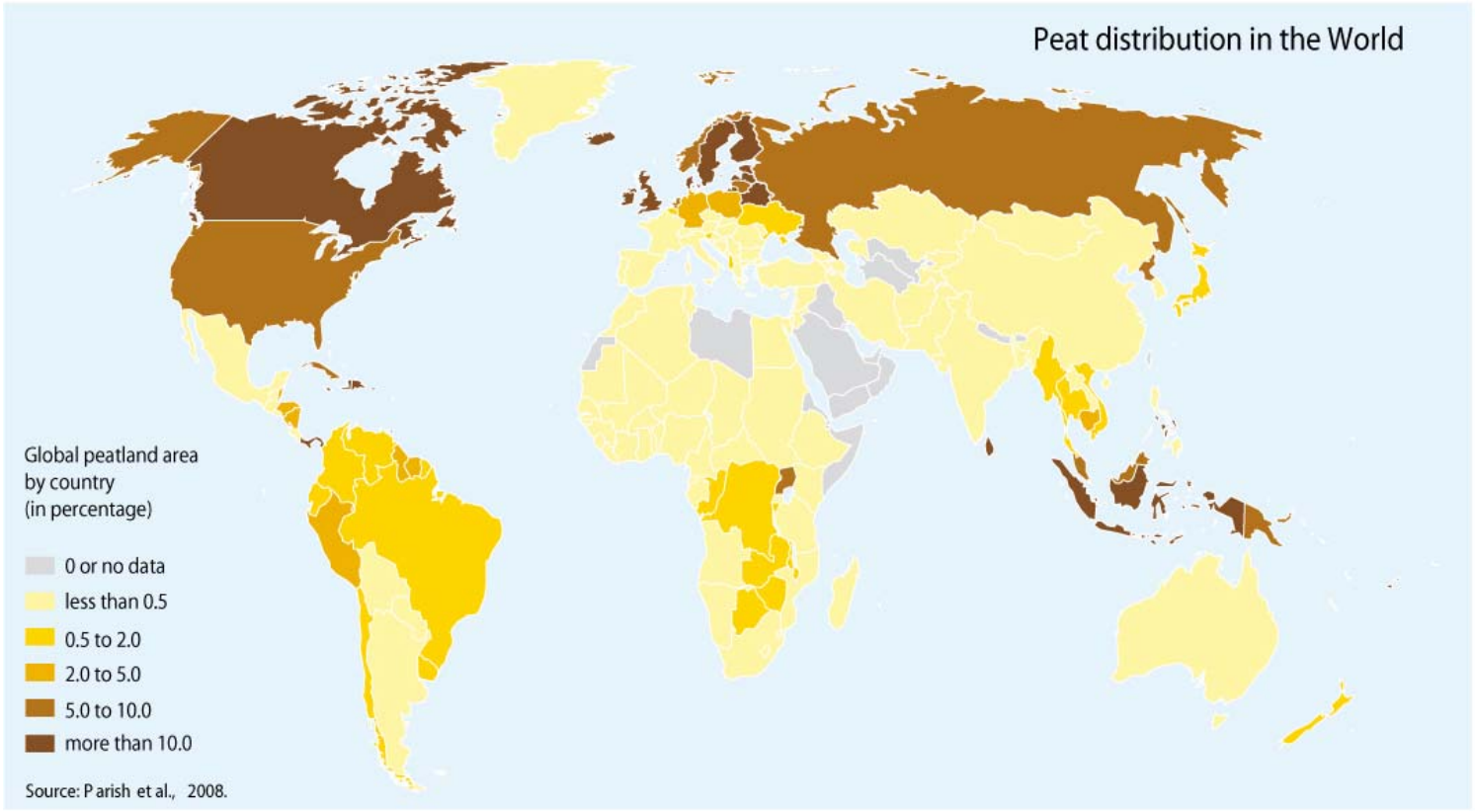
Peatlands

Peatland soils store a large amount of carbon but there is a grave risk that much of this will be lost as peatland ecosystems worldwide are being converted for agriculture, plantations and bioenergy. Conservation and restoration of tropical peatlands is considered a global priority.

(UNEP-WCMC 2009)

Peatlands

Peatlands capacity for storage is huge; with estimates suggesting that ~550 Gt of C is stored globally in peat soils *(Sabine et al. 2004*), and a worldwide average of 1450 t C per ha *(Parish et al. 2008).* These areas are globally widespread but cover a tiny proportion of land area making peatland among the most space effective carbon stores of all ecosystems.



Source: *The Natural Fix?*
UNEP-WCMC 2009

Peatlands

- Due to their anaerobic character and low nutrient availability, peatland carbon stocks increase continuously.
- However, when peatlands are drained, mineralization generates considerable emissions, ranging from between 2.5 and 10 t C ha^{-1} yr^{-1}. Drainage of tropical swamp forest can amount to 40 t C ha^{-1} yr^{-1}. Total carbon emissions from wetland conversion to agricultural land is estimated to range between 0.05 and 0.11 Gt C yr^{-1} .

  (Maltby and Immirzy 1993). (Ramsar)

Peatlands

- Great quantities of C are curerntly being lost from drained peatlands and unless urgent action is taken this loss will increase further as the area of drained peatlands is steadily increasing.
- There is uncertainty over the degree of C losses from drained peatlands, but in all probability losses are already significant: 0,5-0,8 Gt C per year, which forms a significant fraction of antropogenic emissions of GHG.

(Parish et al. 2008; Verwer et al. 2008)

Carbon management in human-dominated ecosystems

- The largest readily achievable gains in C storage are in agricultural systems where the technical potential for C mitigation is significant.
- In the agricultural sector, if best management practices were widely adopted, 0,5 – 0,6 GT of CO_2-e can be sequestered per year by 2030, which is comparable to emissions from the sector - the aim is to make the agricultural sector C neutral by 2030. *(UNEP-WCMC 2009)*

Agricultural sector

- About 90% of the potential for C mitigation could be achieved through C sink enhancement and ca 10% from emissions reductions.
- The largest mitigation potential lies in cropland management, grazing land management and the restoration of cultivated organic soils and degraded lands.

Semi-natural grasslands

- Semi-natural grasslands occur throughout Europe and are sustainable ecosystems providing inexpensive and renewable food for grazing animals. However, they are being drastically reduced. The role of semi-natural grassland in the C cycle, in respond to anthropogenic disturbances, is still not sufficiently known

A biological approach to C management offers other benefits:

- **Biodiversity conservation**.
- **Soil stabilization,**
- **Water and nutrient availability,**
- **Reversal of land degradation, etc**

  which in turn will have
- **Positive impact on livelihoods of local people.**

(UNEP – WCMC 2009, Miles and Kapos 2008)

Ecosystem Carbon Management in International Climate Policy

- International climate policy only partly addresses emissions from land use change and does little to support biosequestration activities.
- Realization of the large technical potential for mitigating climate change through biological C management depends on having a suitable policy framework to enable it.

(Source: "The natural fix?" UNEP-WCMC 2009)

- The potential of ecosystem C management is recognised in the United Nations Framework Convention on Climate Change (UNFCCC) and its Kyoto protocol through the LULUCF sector.
- Under the LULUCF developed countries must report on C stock changes from afforestation, reforestation and deforestation (since 1990) and can also elect to report on additional activities of forest management, cropland and grazing land management and revegetation.

  (Source Robledo and Blaser 2008)

REDD

- Much of the discussions on future land based commitments to-date have been focused on forests.
- The Bali Action Plan adopted by the UNFCCC (Dec. 2007) mandates Parties to negotiate a post-2012 instrument for reduced emissions from deforestation and forest degradation in developing countries (REDD)
- There is every optimism governments in Copenhagen will agree to begin paying developing countries for REDD.

Shortcomings of the current policy framework

- Lack of involvement of developing countries.
- Incomplete coverage of C sources and sinks as Parties are only required to account for forestry activities. All other activities are voluntary and there is no option for wetland accounting

Shortcomings of the current policy framework

- Complex monitoring and reporting requirements
- The requirement to account for managed land only.
- The difficulties in factoring out anthropogenic from natural disturbances.

Shortcomings of the current policy framework.

Perhaps the biggest criticism is that emissions reductions from the land use sector were not taken into account in the formulation of targets for developed countries, but still can be used to meet them. This has led many to see LULUCEF as an offset mechanism, rather than one that achieves overall emissions reductions.

UNEP-WCMC 2009

- Current land use based mitigation policies do not provide the kind of framework that is required to deliver the necessary incentive mechanisms.
- The development of a comprehensive policy framework under UNFCCC for addressing ecosystem C management would be a very significant advance.

- **All the above shortcomings mean that ecosystem C management is not currently supported by international policy.**
- *This could change in the future as the next climate agreement is currently under discussion.*
- *The creation of a more effective policy framework will mainly depend on factors as I) inclusion of "all lands", and 2)whether the perception of LULUCF can be changed from an offset mechanism to a sector capable of bringing about real reductions in emissions.*

Source: "The natural fix?" UNEP-WCMC 2009

Policy on reducing of emissions through activities in non-forest ecosystems

- The Terrestrial Carbon Group (TGC) advocates the inclusion of all biomass and soil C
- The FAO proposes that agriculture be included on the grounds that its mitigation potential is high relative to the sector's emissions

And further, different parties propose:

- Complete carbon accounting in the land use sector.
- **Non-forest carbon should be included in any successor to the Kyoto protocol**

Policy on reducing of emissions through activities in non-forest ecosystems

- Improvements in the coverage of land use activities under the LULUCF are under discussion for the next climate agreement, to the extent that there is the option to include reporting on peatlands and wetland.
- However, most of the additional activities are likely to remain voluntary, as mandatory accounting across all ecosystems is neither politically or technically feasible.

Synergies between Multilateral Agreements

Synergies are sought between the UNFCCC, the CBD, UNCCD, Ramsar, etc and alongside links with national development plans.

Developing policies for ecosystem C management

- It is essential that climate mitigation policy is guided by the best available science concerning ecosystem C, and decisions should be informed by the overall costs and benefits of C management.
- When developing policies for addressing ecosystem C management it is necessary to ensure that local people are not disadvantaged and to consider the potential for achieving co-benefits for biodiversity and ecosystem services.

  (UNEP 2009)

2009 will witness important negotiations surrounding how the world will tackle climate change when governments meet at the crucial UN Climate Convention meeting in Copenhagen this December.

"...aim for an ambitious politically binding agreement .. That will chart the way for future post-Copenhagen negotiations, that lead to a legally binding global agreement"

(Environment News 20091026)