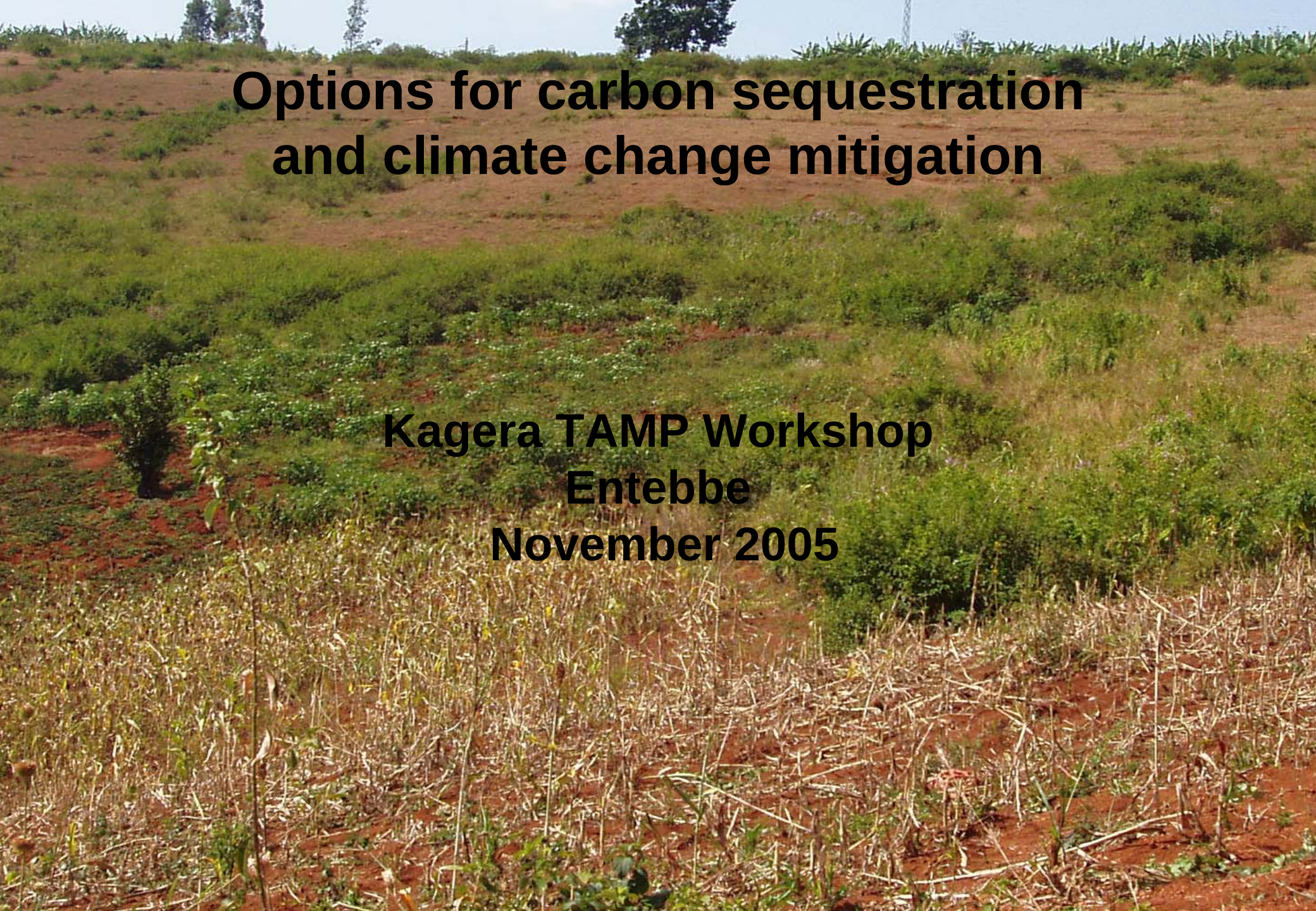


Options for carbon sequestration and climate change mitigation

Kagera TAMP Workshop
Entebbe
November 2005

Background

- Concern that emissions of greenhouse gases resulting from human activity are causing changes in the Earth's temperature and weather systems
- The main greenhouse gases (GHGs) that are causing the temperature rise are: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and a group of chlorine and fluorine containing gases such as halo carbons (HFC's) per-fluorocarbons (PFC's) and sulphur hexafluoride (SF_6).
- The main anthropogenic greenhouse gas is CO_2.
- CO_2 is produced from the combined actions of widespread conversion of natural vegetation to agricultural lands, deforestation, fossil fuel combustion and a range of industrial processes.

Background (cont.)

- Global temperatures and weather have changed in the past – but never at such a rapid rate has been recorded over recent decades.
- In 2001 the IPCC predicted mean global temperatures to increase by between 1.4 and 5.8^{0}C over the coming century – which will cause changes in temperature, distribution of rainfall, the frequency and intensity of extreme weather and sea level rise.
- Global greenhouse gas emissions will rise by 52% by 2030, unless the world takes action to reduce energy consumption .(source - the latest annual World Energy Outlook report from the International Energy Agency (IEA). (source www.bbc.co.uk Monday, 7 November 2005)

Implications

- The changes predicted include not only changes in temperature patterns but also changes in the distribution of rainfall, changes in the frequency and intensity of extreme weather and sea level rise.
- Africa already has a highly variable and unpredictable climate (including frequent droughts, floods and other extreme events).
- If the global temperatures do rise significantly, there are likely to be a range of repercussions on the planet's systems and balance.
- Ecosystems, agriculture & forestry, water resources, human health and industry are all sensitive to the planet's climate.
- Impacts of climate change will not be uniform across the globe – generally humid areas are likely to become wetter and dry areas even drier.

Implications (cont.)

- Poorest countries and their peoples, who have contributed least to global GHG emissions, are the most vulnerable.
- **WHY?**
- Poor people tend to live in high risk areas and lack economic & social resources, meaning they are ill-equipt to adjust to rapid changes in long-term conditions. ("…livelihoods built for generations on particular patterns of farming may become quickly unviable" (WWF, 2005)
- Local economic and social conditions in many parts of the Kagera Basin have driven poor people to marginal areas and forced them to exploit natural resources to support their livelihoods.
- Climate change is likely to further erode the quality of the natural resource base - without intervention this ill reinforce conditions of poverty.

Anticipated impacts of climate change on East Africa

[from Orindi,V.A. and Murray,L.A. (2005)]

- Decreased rainfall, increased temperature and evaporation in dry areas
- Frequent drought spells leading to severe water shortage
- Change of planting dates of annual crops
- Increased fungal outbreaks and insect infestations due to changes in temperature and humidity
- Decline in crop yields
- Increased risk of food shortage and famine
- Reduction in ecosystem integrity, resilience and decline in biodiversity
- Increased potential of malaria transmission and burden on the countries' health care systems.

How can these increasing levels be reduced or stabilized?

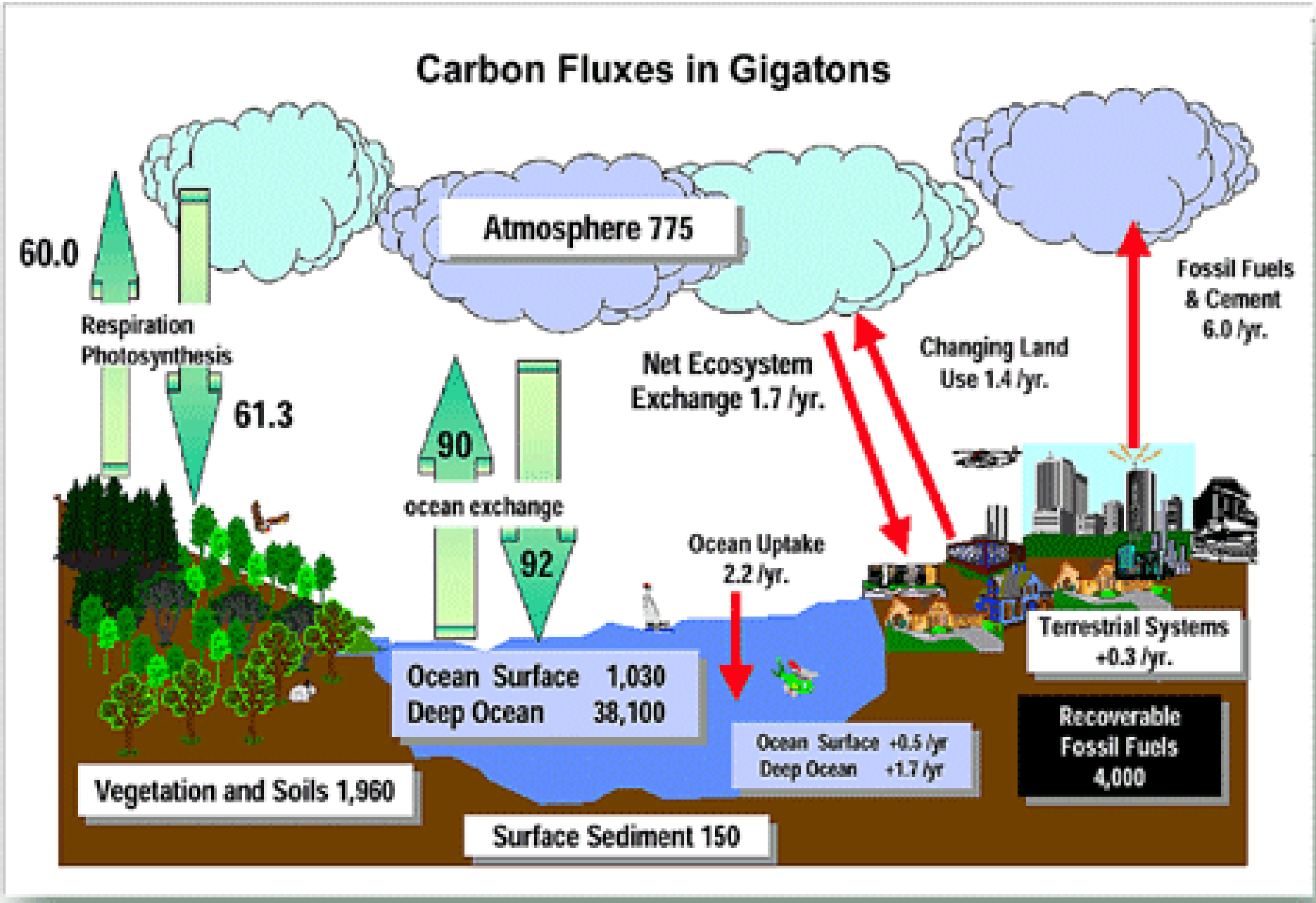
Potentially, there is a wide range of ways to reduce emissions of greenhouse gases.

In the case of CO_2, reductions can be achieved by:

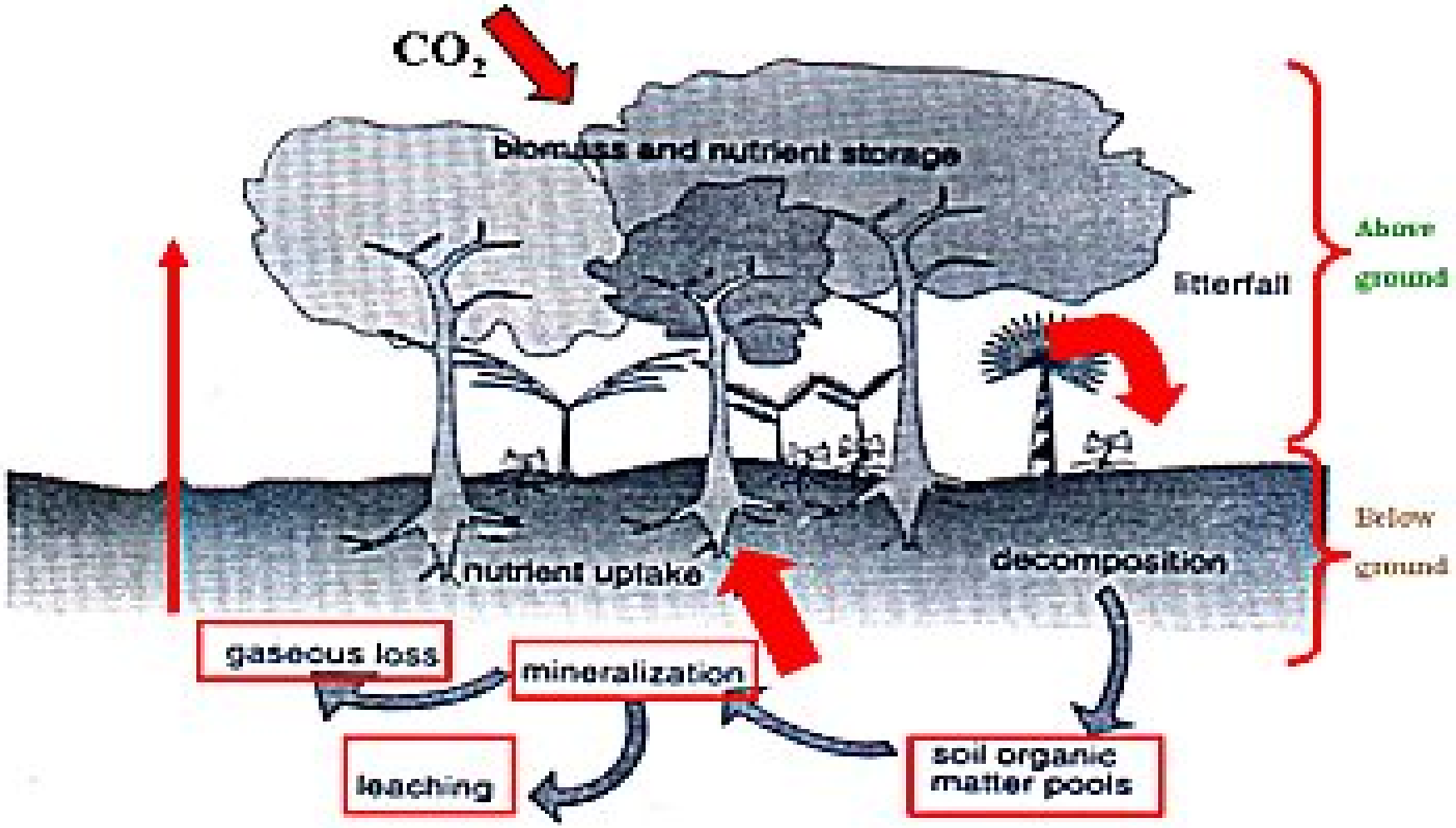
- Reducing the demand for energy;
- Altering the way in which it is used;
- Changing the methods of producing and delivering energy.

Demand for energy can be influenced by a number of means that include fiscal measures and changes in human behaviour. However, in the technical area, there are a number of distinct types of option for reducing emissions which are:

- Improving energy efficiency;
- Switching to low carbon fuel;
- Switching to no-carbon fuels;
- **Preventing CO_2 from fossil fuel combustion building up in the atmosphere**.


Carbon Fluxes in Gigatons
Atmosphere 775
60.0
Respiration
Photosynthesis
61.3
90
ocean exchange
92
Net Ecosystem
Exchange 1.7 /yr.
Changing Land
Use 1.4 /yr.
Fossil Fuels
& Cement
6.0 /yr.
Ocean Uptake
2.2 /yr.
Terrestrial Systems
+0.3 /yr.
Ocean Surface 1,030
Deep Ocean 38,100
Ocean Surface +0.5 /yr
Deep Ocean +1.7 /yr
Recoverable
Fossil Fuels
4,000
Vegetation and Soils 1,960
Surface Sediment 150

Plant / Soil / Atmosphere Carbon Cycle



Carbon Sequestration (CS)

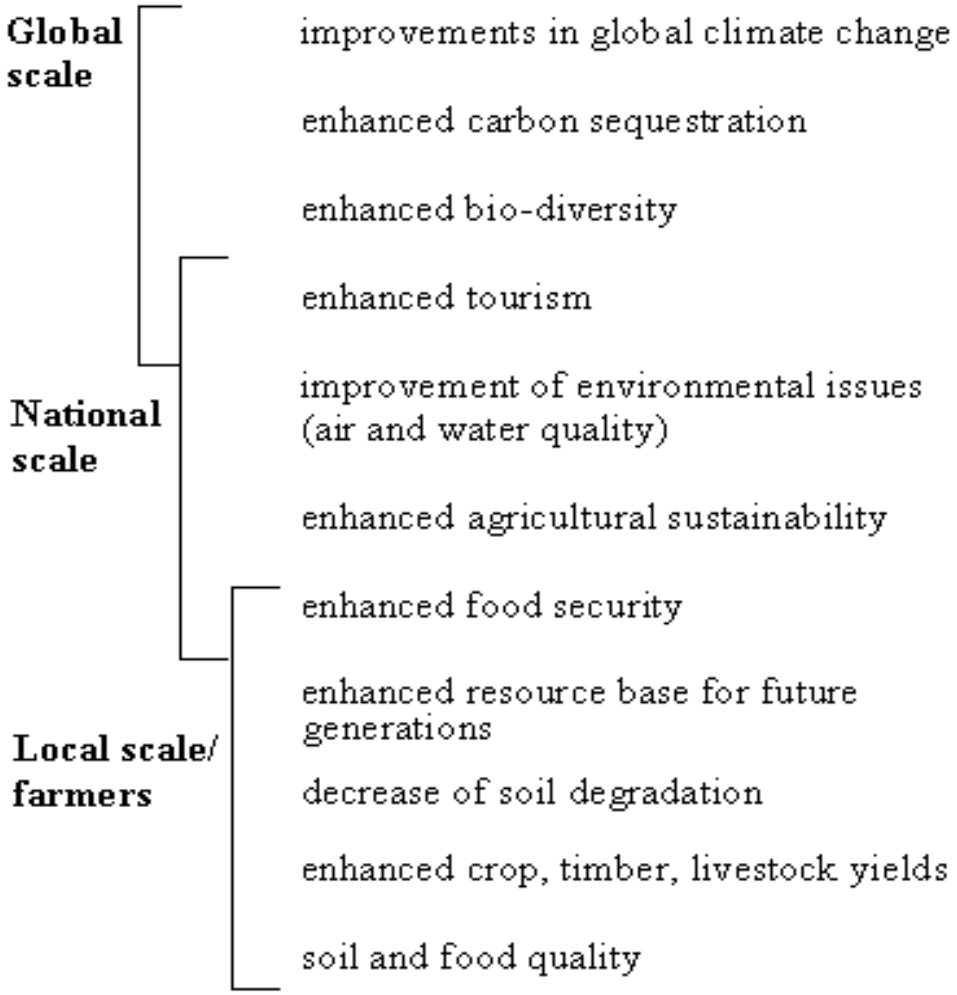
– also know as "carbon sinks"

- The UN Convention to Combat Desertification (CCD) and the UN Framework Convention on Climate Change (FCC), with its Kyoto Protocol (KP), share a mutual goal – the proper management of carbon.
- The development of agriculture during the past centuries and particularly in last decades, has entailed widespread clearance of natural vegetation, including forests and the depletion of soil carbon stocks created through long-term evolution – contributing the GHG CO_2 to the atmosphere.
- Restoration, to which all three Conventions refer, can only occur through improved land use and crop management, through practices leading to the proper placement of carbon in the geosphere (plant / soil system) at the same time as contributing to food security.
- Restituting carbon to those lands delepeted of the capacity to be productive would also contribute to - "**preventing CO_2 building up in the atmosphere**" .

Carbon Sequestration (CS) (cont.)

- Increasing vegetative cover, particularly through planting of trees (e.g. woodlots and agroforestry) is a "low cost land use change which can be rapidly implemented".
- The degradation of soils due to reduction in organic matter has proved to be reversible (FAO World Soils Report 96, 2001).
- Global estimates predict that soils could sequester around 20 Pg C in 25 years, more than 10 % of the anthropogenic emissions.

Principal benefits of sustainable soil carbon management at various spatial scales:



“Win-Win” Solutions

- Payment for the adoption of land use systems which generate sequestration has been touted as a “win-win” solution, where both environmental and poverty reduction goals can be attained.
- But – some land use changes which lead to CS can lead to increased poverty (plantations) and some poverty reduction measures may conflict with carbon sequestration, or be less efficient than other types of land use change as a source of climate change mitigation.
- Information of trade-offs and synergies between poverty alleviation and CS essential for designing projects which generate both.

Land use changes which generate carbon sequestration include:

- Reducing deforestation
- Generating increased forest stocks
- Expansion of forestry plantations
- Adopting agroforestry activities
- Reducing soil degradation
- Rehabilitating degraded forests
- Adoption of low / zero – tillage systems (CA)

Carbon Offset Credits

- Most of the mechanisms being developed for exchanges of carbon offset credits with developing countries explicitly require consideration of poverty alleviation and sustainable development.

A '**Carbon Offset**' is defined as:

- *"An amount of carbon withdrawn from the atmosphere by storage in vegetation and soil for sufficient time to compensate for atmospheric warming…..".*

Mechanisms being developed for exchanges of carbon emission offset credits

- The Clean Development Mechanism (CDM) of the Kyoto Protocol (Article 12) [One of several flexible mechanisms created to facilitate parties of the convention to co-operate with each other to reduce emissions of CO_2. The CDM is the only mechanism specifically designed for developing countries. Recent post Kyoto agreements consider soil sinks in countries, recognising the substantial potential of agricultural, grassland and forest soils to sequester carbon and the need for provision of national credits for the expansion of carbon sinks in agricultural soils.]
- Biocarbon Fund under the World Bank
- US may be a major source of bilateral payment programmes even outside Kyoto, with the potential passage of state and national legislation requiring emissions reductions and allowing CDM-type credit schemes
- Voluntary agreements between major developed country industries and groups of farmers in developing countries, including using Plan Vivo system (ECCM).

Eligibility of Land Use Changes

- CDM includes reforestation and afforestation, but at present specifically excludes conservation of standing forest (avoiding deforestation) and farming-based soil carbon sequestration (at least til 2012)

- World Bank's Biocarbon Fund – divided into two separate windows, one targeted at land use changes that qualify for the CDM and another wider one, which includes avoided deforestation and soil carbon sequestration.

Permanence

- Unlike reduction in emissions of CO_2, CS is reversible
- Payments likely to be discounted depending on the perceived risk of sequestration reversal; which may result in annual payments being discounted (the ton-year approach is based on the decay path of CO_2 in the atmosphere over 100 years and with this system would have to keep CO_2 from being emitted for 46.4 years in order to receive the same credit as a permanent emission reduction annual payments would be adjusted by an equivalence factor of 0.0215 – a significant reduction to land users)
- Also - poor farmers may be paid less, as they may be perceived to be at a higher risk of reversing sequestration practices (e.g. harvesting woodlots in a time of household stress / financial difficulty)

Project and Market Issues

- Over 30 carbon off-setting land use change projects have been developed on a bilateral basis.
- It is unclear which projects will qualify for CDM-based credits.
- Form of CS payment markets is still being determined – giving rise to uncertainties on both the demand and supply sides.
- Production costs of carbon associated with small-holder systems (to date) are quite variable
- High transaction costs (costs of completing a contract) associated with poor suppliers (small-holders) represent a major barrier to participation in CS market
- Transaction costs will be reduced where poor farmers are co-ordinated / consolidated into supply groups (e.g. by local government / farmers' groups / NGOs) (example given of $52 compared to $325 / hectare in Scolel Té Project, Mexico - below)

Plan Vivo Projects

- Scolel Té

  The Scolel Te project in Southern Mexico was an early test-bed project which works with communities and small scale farmers in the state of Chiapas to develop socially beneficial forestry and agroforestry systems. The project has been selling carbon offsets since 1997 and now involves over 400 farmers from 20 different communities.

- Women for Sustainable Development

  Women for Sustainable Development is working in Southern India on a variety of projects promoting climate change mitigation and rural development:

  Agroforestry and fruit orchards

  Dry land development and woodlots

  Community renewable electricity generation

Plan Vivo Projects

- Nhambita Community Carbon Project, Mozambique

  This project is currently working towards Plan Vivo certification.

  This project is working in the N'hambita community located in the buffer zone of the Gorongosa National Park. The project will help to improve the livelihoods of this very poor community by introducing agroforestry systems that will provide significant increases in income from carbon finance. These land use systems will also provide other benefits such as fruit, timber, fodder, and fuel wood, and improved soil structure. In addition, the community will benefit from improved organisational capacity and education and awareness about forest stewardship and conservation, and the introduction of novel income streams through bee-keeping and craft making. This project is part funded by the European Regional Development Fund.

Trees for Global Benefit, Uganda

A pilot phase project working with small-scale farmers in the Bushenyi District of South Western Uganda began in early 2003. Activities include forestry (for poles, fuel wood, fodder and timber) and agroforestry systems. Initial pilot phase implementation will act as a platform for eventual expansion of the project. In addition to ECCM, Uganda-based project partners include Ecotrust, and ICRAF/FORRI/NBS.

Willingness of small-farmers to be willing and competitive suppliers of credits

Opportunity costs – the benefits that producers would have to give-up in order to provide CS

Also

- Degree of food security
- Timing and amount of labour required
- Size and timing of investments and returns
- Market integration
- Incentives and constraints land users face in making decisions
- Endowment of resources (land / labour / capital)
- Property rights

Willingness of small-farmers to be willing and competitive suppliers of credits (cont.)

- Prior to the possibility of receiving payments for CS, the land user had no incentive to generate this public good
- Trade-offs between private production benefits and sequestration (land owner will lose some private benefits from land use production in order to generate payments)
- Length of time it takes to realise improvements in benefits associated with the new system

Potential Benefits of CS payments to poor farmers

- CS payments could present an important way of securing poor households, if payments can be designed to provide “insurance” type benefits
- Payment schemes may be designed to overcome investment constraints (e.g. credit packages)
- Schemes can be designed either to release labour (suitable where a local fairly high-wage non land use labour demand) or provide labour-intensive activities (where few off-farm opportunities exist) but any scheme / project must include careful assessment of labour supply and demand in current and under CS land use systems to avoid conflicting labour requirements.
- CS schemes will require that property rights are clarified

Conclusions
Carbon Sequestration Projects in Kagera

- Opportunities for small holders in all four TAMP countries to meaningfully participate in climate mitigation and receive payments which can also contribute to poverty alleviation but considerable efforts still needed to move from the objectives to reality on anything more than a limited scale.
- Will need to have a strong sustainable development component (improve livelihoods by increasing agricultural productivity / reduce risk of crop failure / provide access to better agricultural inputs) – but this is exactly in line with the Kagera TAMP.
- Are more likely to succeed if they are built upon existing institutions / initiatives / organisations, to co-ordinate groups of farmers – institutions may need to be strengthened

Conclusions
Carbon Sequestration Projects in Kagera (cont.)

- Base-line and monitoring data required, especially for CDM. In some cases the information needed is already being collected (e.g. Forest Resource Assessments, Millennium Ecosystem Assessments, Land Degradation Assessments, National Poverty Assessments) – in others necessary data exists but appropriate analyses have yet to be done
- Particularly in the case of soils, which are highly variable in space and time, data gathering will be required to provide accurate accounting of soil carbon sequestration

Conclusions
Carbon Sequestration Projects in Kagera (cont)

- Within the overall framework of the aims of the GEF supported Kagera TAMP, there seem to be opportunities to develop CS projects (particularly conservation agriculture and agroforestry).
- Uganda already has several examples of projects, from which the TAMP could learn.
- Careful analyses re labour / implications of land use are vital in each community before embarking on any project – although the development / environmental benefits may come fairly quickly, the financial benefits may take time to materialise as the market for carbon credits is still developing.

National Strategies

- ✓Signing of protocol by countries
- ✓Initial communication to UNFCCC
- ✓Developing National Adaptation Action Plans
- ✓Putting in place designated national authorities
- ✓Policy formation if existing policies inadequate
- ✓Institutional set-up


The End