Parliamentary **Assembly**
**Assemblée** parlementaire

Parliamentary Assembly
Assemblée parlementaire
COUNCIL OF EUROPE CONSEIL DE L'EUROPE

**For debate in the Standing Committee — see Rule 15 of the Rules of Procedure**

**Doc. 11180**
8 February 2007

# Capture of carbon dioxide as a means of fighting climate change

Report
Committee on the Environment, Agriculture and Local and Regional Affairs
Rapporteur: Mr Vladimir GRACHEV, Russia, European Democrat Group

*Summary*

The fight against climate change is mainly based on implementation of the Kyoto Protocol, which is largely intended to reduce greenhouse gas emissions. Looking beyond their reduction, however, it also foresees the development of the capture and storage of carbon dioxide by "carbon sinks" constituted, for instance, by forests, soils and even oceans, which have a natural capacity to absorb and store carbon dioxide from the air.

Bearing in mind the current energy shortfall and our inability to make this good with the available sources of renewable energy, the only way to achieve a drastic reduction in greenhouse gas emissions is to develop energy savings and alternative energies. However, carbon dioxide capture and storage technologies are also likely to make a contribution to the fight against climate change.

The Assembly is convinced that efforts to develop new technological processes which help to absorb carbon dioxide need to be stepped up. It therefore invites member states to develop the capture and storage of carbon dioxide in the fight against climate change and to implement international, national and local policies and measures to develop carbon sinks.

## A. Draft resolution

1. Climate change is one of the major threats to sustainable development and the world economy, as well as to mankind's health and welfare.

2. The Parliamentary Assembly is aware of the seriousness of this problem and recalls its support for the United Nations Framework Convention on Climate Change and for the Kyoto Protocol, which is aimed at stabilising greenhouse gas concentrations in the atmosphere.

3. The Assembly refers in particular to its Resolutions 1243 (2001) on the Kyoto Protocol on climate change: need for committed international solidarity, and 1292 (2002) on the World Summit on Sustainable Development: ten years after Rio, and to its Recommendation 1594 (2003) on follow-up to the World Summit on Sustainable Development: a common challenge, and its Resolution 1406 (2004) on global warming – beyond Kyoto.

4. The Assembly welcomes the entry into force of the Kyoto Protocol on 16 February 2005 following its ratification by the Russian Federation.

5. The comprehensive action plans for implementing the Kyoto Protocol depend on measures for reducing greenhouse gas emissions on the one hand and increasing absorption of those gases on the other. For this purpose, it is necessary to encourage and develop the second most important instrument for combating climate change, namely the capture and storage of carbon dioxide by living matter.

6. Carbon capture and storage systems and technologies are attracting attention at the highest level both as a mechanism for higher energy efficiency and as instruments in the fight against global climate change. The concept of carbon sinks is based on the natural ability of forests and soils to absorb carbon dioxide from the atmosphere and temporarily store it.

7. The Assembly welcomes the signing of the international charter on carbon dioxide capture and storage and the setting up of the Carbon Sequestration Leadership Forum, with the participation notably of Australia and the United States, which are among the countries that have not ratified the Kyoto Protocol. This forum provides a framework for the major industrialised countries to work together and aims to promote technologies which can reduce greenhouse gas emissions from coal power plants and produce hydrogen for use as a source of energy, particularly in the transport sector.

8. The Assembly regrets that, at the 12th United Nations Conference on Climate Change, held in Nairobi from 6 to 17 November 2006, political and technical discussion of carbon dioxide storage and capture was deferred to the 2007 conference.

9. The Assembly considers that given the current situation of energy deficit and the inability to cover it with the available renewable energy sources, the only way to drastically reduce greenhouse gas emission is to develop alternative energies.

10. The Assembly considers that the fight against climate change should be central to the actions of all society's political, economic and social players. Governments, parliaments, local and regional authorities as well as civil society should, each at its level, become involved in the control and the reduction of greenhouse gas emissions.

11. The Assembly calls on the parties to the international charter on carbon dioxide capture and storage to continue their efforts to propose new legal, economic and organisational measures to stimulate activities in the field of carbon capture.

12. The Assembly calls on the Council of Europe member and observer states to:

12.1. take additional measures to further the implementation of the targets set in the Kyoto Protocol to the United Nations Framework Convention on Climate Change;

12.2. continue negotiations and consultations with the States Parties to the Kyoto Protocol and the United Nations Framework Convention on Climate Change on questions of economic, environmental, scientific and technical co-operation, particularly with regard to carbon capture and storage;

12.3. co-ordinate their activities at European and global level, particularly through co-operation with UN bodies and other international organisations and institutions;

12.4. take comprehensive measures to support natural mechanisms for capturing and storing carbon dioxide and affording comprehensive protection to, and improving the quality of, natural reservoirs and sinks;

12.5. develop specific national policies aimed at reducing the obstacles to natural carbon dioxide storage;

12.6. step up efforts to implement effective mechanisms to promote new technological processes contributing to carbon capture and the conservation of fuel resources;

12.7. implement national policies and measures for developing carbon sinks through the use of more sophisticated technologies for absorption by agriculture and forestry ;

12.8. introduce policies and action plans at national level for conserving vegetation and, in particular, restoring forests, maintaining the potential of carbon capture of the oceans and cleaning rivers and seas, which are natural carbon sinks;

12.9. give local and regional authorities relevant powers and means allowing them to fight climate change;

12.10. increase the natural potential for carbon uptake and develop carbon sinks, in particular by:

12.10.1. facilitating identification and location of the sources of forest fires;

12.10.2. improving prevention of spontaneous peat fires through irrigation;

12.10.3. encouraging the use of fertilisers and other substances to stimulate and speed up photosynthesis by land plants;

12.10.4. encouraging the large-scale use of physical, physicochemical and biological methods to eliminate oil films on the surface of natural bodies of water;

12.10.5. developing, through existing genetic engineering, plant species capable of storing more biomass than the currently existing natural species;

12.10.6. developing the waste-free use and processing of forest resources by national economies and improved forest management;

12.10.7. using non-mouldboard tillage methods in agriculture and promoting perennial crops through the use of organic fertilisers such as manure;

12.10.8. reducing the quantities of methane and nitrogen oxide emitted by agriculture by improving livestock breeding and soil treatment methods and by using new types of fertiliser and new ways of introducing them into the soil;

12.11. create a mechanism, similar to the trade market to reduce greenhouse gas emissions, which will allow major greenhouse gas emitters to plant forests and invest in water resource purification, in their own or another country, to contribute to the fight against climate change;

12.12. adopt, as part of the comprehensive plans for implementing the Kyoto Protocol for 2006-2010, measures aimed at reducing emissions and increasing the absorption of greenhouse gases in the different sectors of the economy.

13. The Assembly invites member and observer states that have not yet done so to sign and/or ratify the Kyoto Protocol.

14. It also calls on the states parties to the Kyoto Protocol, together with the states parties to the United Nations Framework Convention on Climate Change, to continue negotiations and consultations on questions of economic, environmental, scientific and technical co-operation to increase the levels of stored and captured carbon and establish international co-operation to:

14.1. implement projects and technologies for carbon sequestration and partnership schemes to promote technologies for producing hydrogen as an alternative energy source to fossil fuels;

14.2. create economic mechanisms to facilitate investment in reforestation, water resource purification and other measures to develop biogenic carbon sinks.

15. The Assembly calls on national parliaments to organise national parliamentary debates on the subject with a view to adopting all appropriate measures to reduce greenhouse gas emissions and promote carbon dioxide capture and storage.

16. Lastly, it calls on the Congress of Local and Regional Authorities of the Council of Europe to continue its activities aimed at encouraging and increasing the number of innovative projects by local and regional authorities to combat climate change.

## B. Explanatory memorandum by Mr Grachev, Rapporteur

**Contents**



### I. Introduction

1. Climate change is one of the major threats to sustainable development, mankind's health and welfare and the world economy. It thus requires a responsible, joint and solidarity-based response from the international community. Being aware of the importance of the problem, the international community, under UN auspices, drew up the Framework Convention on Climate Change, which is aimed at stabilising greenhouse gas concentrations in the atmosphere at a safe level. 180 states are Parties to the Convention.

2. The Kyoto Protocol, signed in 1997, provides for the achievement of specific targets aimed at reducing "greenhouse gas" emissions in industrially developed countries, which account for the highest volume of such emissions.

3. The Parties to the Kyoto Protocol must monitor the balance of greenhouse gases in their territories, focusing on emissions by industry and the energy and transport sectors. Assessing the sequestration of the carbon or $CO_2$ in the atmosphere by the plant cover in their territories is an equally important task.

4. The aim of this report is to:

- support the Kyoto Protocol, which has now come into force;
- to promote the second fundamental principle of the fight against climate change, which is the absorption of carbon dioxide by living matter through photosynthesis;
- to combat deforestation and the pollution of the world's oceans, which, by destroying ecological cycles and processes, seriously undermine nature's potential to regulate itself.

5. In the motion for a recommendation which gave rise to this report[1], the Committee of Ministers is recommended:

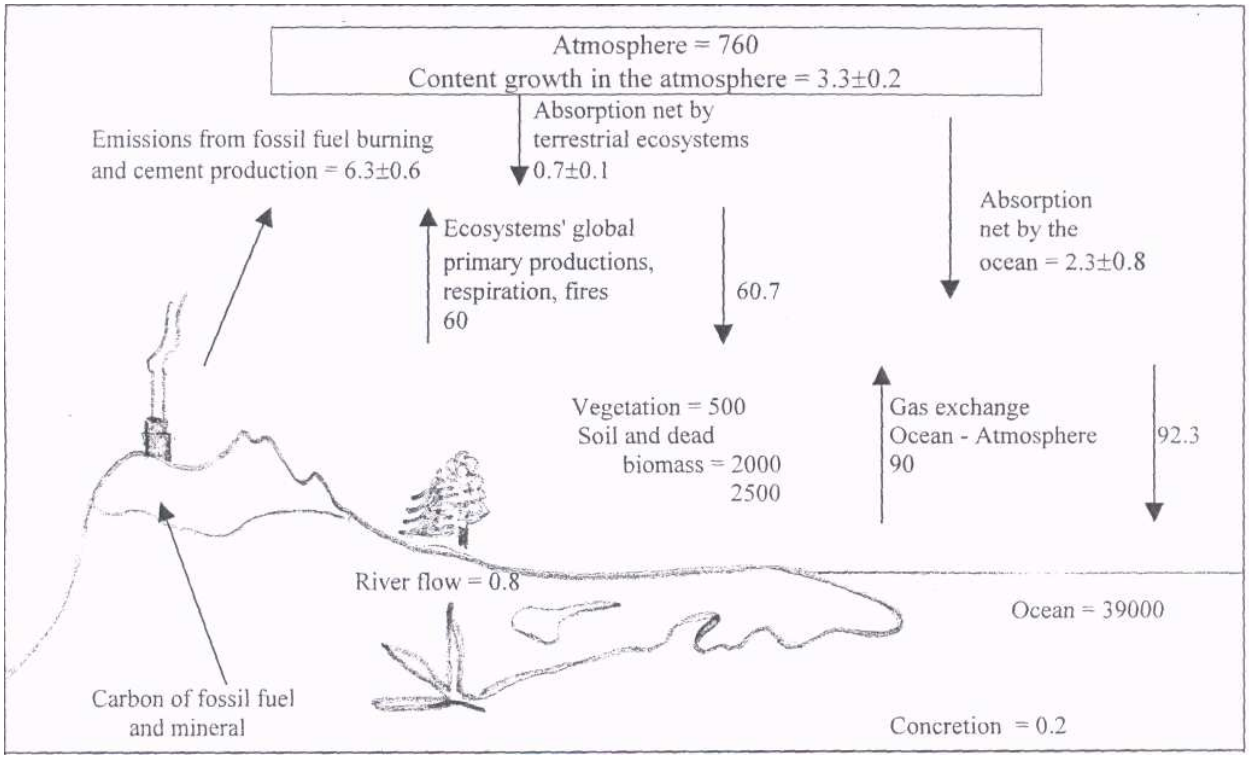
- to consider the need to develop a global policy to promote the second fundamental principle of the fight against climate change, based on the sequestration of carbon dioxide by plants;
- to urge the member states to pursue the national policies and action plans aimed at restoring forests and purifying rivers and seas, and contributing to the process of absorbing carbon dioxide from the atmosphere;
- to create a mechanism – similar to the trade market to reduce emissions into the atmosphere – that allows major carbon dioxide emitters to plant forests and invest in water resource purification in their own or another country to contribute to the fight against climate change;
- to identify the most appropriate means of co-ordinating these activities at European and international level, including cooperation with UN bodies and other international agencies and organisations.

[1] Doc. 10425 "Beyond Kyoto: the second pillar in the fight against climate change – accumulation of carbon dioxide".

## II. Theories about carbon storage and sequestration

6. Over the next 30 to 50 years, 90% of world energy needs will continue to be covered by fossil fuel resources, and carbon sequestration will have major consequences in this area as it will make it possible to reduce the impact of human activities on the environment.

7. Currently, the main natural regulators of anthropogenic climate change are the world's oceans. The absorption of carbon dioxide by the oceans is a very complicated process. $CO_2$ not only dissolves in water but turns it into ionic forms of $HCO_3$ and $CO_3$, and the balance between these compounds depends on temperature, the water's acidity and a number of other factors. All this is directly linked with the sea's plant and animal life. Ultimately, carbon precipitates to the ocean bed in the form of sea organisms' skeletons. Scientists are actively studying these processes. But it is still hard to say how the ocean will behave if $CO_2$ concentration in the atmosphere is greater. Will it also absorb more or will it absorb less, which is a more dangerous scenario, which could lead to accelerated climate change?[1]




The carbon global balance on average for 10 years from 1980 to 1998. Reserves – billions of tons C. Flows – billions of tons C/year.[2]

8. According to forecasts, particularly up to 2100, the warming of the atmosphere by radiation will be determined mainly by the anthropogenic heightening of the greenhouse effect. Natural factors will not have a significant enough effect in the space of one century. Simplified model calculations can be divided into three stages. Firstly, forecasts of $CO_2$ emissions (as well as other gases and aerosols) are produced. Secondly, the concentration of $CO_2$ and other gases and aerosols in the atmosphere is calculated. Thirdly, at the most complex level, models of general atmospheric and oceanic circulation are used to produce annual figures for the future, including temperature, precipitation and snow cover data.

[1] Source: C. Turley, J. Blackford, S. Widdicombe, D. Lowe, F. Gilbert, P. Nightingale Reviewing the Impact of Increased Atmospheric C02 on Oceanic pH and the Marine Ecosystem. In: Avoiding Dangerous Climate Change Symposium, Met Office, Exeter 1-3 February 2005. www.stabilisation2005.com.

[2] Source: LULUCF, 2000. Land-Use, Land-Use Change and Forestry. A Special Report of the IIPCC. Cambridge Univ. Press, www.cambridge.org

9. The average global temperature rose by 0.6°C in the 20th century, but it is being forecast that in the 21st century it will increase three times as much. The 2°C increase in the average temperature means that in some regions, it will rise by 5°C or more. The largest increases are expected in the Arctic regions.

10. At worst, the average temperature will rise by as much as 6°C and in some regions by 10-15°C. This will cause a fundamental climate change and, almost certainly, adverse weather conditions of ever-increasing frequency and intensity.

11. It is important to emphasise that anthropogenic $CO_2$ emissions, and the ability of humankind to reduce them, will have a crucial impact on the next one hundred years of our history.

12. The rise in the world's ocean water levels is of special concern. Arctic ice is melting and glaciers are retreating all over the world. Articles forecasting the disappearance of the Greenland and Antarctica icecaps and even a new Flood abound in the press.

13. According to scientific forecasts, the short-term outlook is not that dramatic. In the 21st century, sea levels will rise between 10 and 90 cm. However, even a 50-90 cm increase will lead to the destruction of numerous shoreline constructions and problems such as coastal erosion and the salinification of drinking water.

14. In the long term, rising sea levels may become humankind's main challenge. For instance, if all of Greenland's glaciers were to melt, ocean levels would rise by 7m, but this would take many years. Similarly, if air temperatures in Greenland rose by 5-6°C, the sea level would rise by 3m over the next 1000 years. A complete thaw in Antarctica would result in a 100m rise, but this would take place on a different time scale altogether, taking several thousand years.

15. The Council of Europe member states can and must play an active role in finding effective and environmentally-friendly ways of managing natural resources.

16. Carbon storage and sequestration systems and technologies are attracting attention at the highest level, not only as a mechanism for higher energy efficiency, but also as instruments in the fight against global climate change.

17. The G-8 action plan, adopted in Evian in 2003, states that the G-8 countries are ready to significantly extend the availability of and access to environmentally-friendly and effective fossil fuel management technologies and carbon sequestration systems and to continue joint R&D and broad international cooperation, including the implementation of demonstration projects.

18. The Carbon Sequestration Leadership Forum forms part of these technological carbon sequestration projects, providing a framework for the industrialised countries to work together and bringing together representatives of the 15 signatories of the organisation's Charter (Russia, the United States, Great Britain, Colombia, Australia, Canada, Norway, the European Union, Italy, China, India, the Republic of South Africa, Japan, Brazil and Mexico).

19. This international partnership aims to promote technologies which can reduce the emissions and greenhouse gases produced by coal power plants and produce hydrogen for transport fuel and power generation. In September 2004, in Melbourne (Australia), the Forum, which now has 18 members including the EU, held its second meeting at ministerial level, during which 10 projects on carbon sequestration and storage were approved and the technology "road map", defining the future thrust of international cooperation, was adopted.

20. Forum members propose new legal, economic and organisational measures to stimulate activities in the field of carbon sequestration. In this connection, the Russian Federation is making ever increasing efforts to introduce incentives for the development of new technological processes and inventions that contribute to carbon absorption and keep fuel and energy consumption levels down.

21. Another approach to solving the problem of carbon storage and sequestration is to take advantage of the natural ability of forest ecosystems to sequester carbon dioxide from the atmosphere. Woodlands play the role of a natural "reservoir". The concept of carbon reservoirs is

based on the natural ability of forests and soils to absorb carbon dioxide ($CO_2$) from the atmosphere and temporarily store it.

22. Under the Kyoto Protocol, every ton of carbon which is (temporarily) stored in the reservoir means that, in the long term, an additional ton of the carbon contained in fossil fuel emissions can be released into the atmosphere. Carbon sequestration projects will enable industrially developed countries to continue using more than their legal share of natural resources and lands. The most intensive carbon reservoir-related activities are likely to be in the South, where land and labour are cheaper. As a result, some of the land involved in carbon sequestration projects in the South will be impossible to use within decades. By acting in this way, industrially developed countries will be able to continue burning large quantities of fossil fuel.

23. Measures to reduce emissions and increase the absorption of greenhouse gases in various economic sectors should form part of the comprehensive plans to implement the Kyoto Protocol to the UN Framework Convention on Climate Change for 2006-2010 in Council of Europe member states. Research work aimed at developing carbon dioxide sequestration and long-term storage technologies should also be planned.

24. The Council of Europe member states will continue to negotiate and consult with the states Parties to the Kyoto Protocol and to the UN Framework Convention on Climate Change on questions of economic, ecological, scientific and technical cooperation including matters relating to carbon storage and sequestration.

## III. Humankind's global challenges and climate change

25. Anthropogenic climate change is a relatively short-term effect. On a scale of tens of thousands of years, and even of millions of years, it is insignificant, and even the worst scenarios does not threaten the survival of human beings as a species. However, within the next few centuries, climate change could have a powerful adverse effect on people's lives. There are many dramatic examples. One was the severe heat wave in Western Europe in summer 2003, when about 20,000 people died in France alone.

26. Nevertheless, it would be wrong to compare human and economic losses as a result of climate change with other serious global problems, such as famine, AIDS and shortages of drinking water. The effects of climate change are mostly indirect. Its main effect is to create an adverse context which significantly exacerbates other problems. The rule of "the weakest link" also applies here. For example, there are more and more droughts in Africa, floods in Bangladesh are getting heavier and heavier, and all of this causes more deaths from famine and disease. Scientists predict that, in the near future, there will be millions of climate refugees – people who have had to abandon their homes because they were unable to adapt to new conditions.

27. These changes are happening so fast that nature cannot adapt. Animals and plants do not have the time to migrate or change. Humans could live in the climate of dinosaurs, but they would need time to adapt, gaining immunity against new tropical diseases, etc.

28. Consequently, although climate change is fundamentally different from other global challenges, it does greatly exacerbate them.

29. It will be impossible to solve the problem in 10 or 20 years, even if we mobilise all our resources and energies. Climate is not just a matter of redistributing resources (as with food supplies, where some countries do not have enough, whereas others have plenty).

30. In the 20$^{th}$ century the average global temperature rose by 0.6±0.2°C. The temperature on land rose more than the temperature over the ocean. The warming was more apparent in the increase in minimum temperatures (at night) than the rise in maximum temperatures (during the day). In many regions, especially the Arctic, the warming has amounted to several degrees. Furthermore, the temperature rise is very unevenly spread throughout the seasons. On average, the warming in the winter and spring months in North America, Western Europe and Eastern Siberia over the last 30 years amounts to 1°C per decade. In some regions, there has been an "accumulated" rise of 5°C or more.

31. There has been a significant increase in the number of especially hot days. The unprecedented and disastrous heat wave in Western Europe in the summer of 2003, when about 20 thousand people died, is a well-known example. There has also been an increase in the number of days on which unusually high temperatures have been recorded in certain regions of Russia, especially in winter and spring. Over the last 50 years, the rate of warming has increased to 2.7°C/100 years, and since 1970 the trend has been about 4°C/100 years. The warming process is obvious in winter and spring and almost imperceptible in autumn. In Western Siberia and Yakutia, winter temperatures have risen by 2-3°C in the last 30 years, while in the European part of the country, the rise has been much less pronounced (1°C maximum). In western regions, there has even been a decline in autumn temperatures.[1]

32. Paleo-environmental records based on ice cores, tree rings, lacustrine bottom sediments and coral reefs show that most ecosystems, can tolerate a global variation of two degrees. Humankind has already used up one third of this allowance.

33. The Earth's climate system is highly inert and, in order to change anything (or at least to reverse the trend), action will have to be taken in advance, in our case – several decades in advance.

## IV. The need to assess the contribution of forests to the global carbon cycle and the type of assessment required

### *i. Extent of carbon exchange between forests and the atmosphere*

34. Carbon flows between the atmosphere and terrestrial ecosystems amount to 60-100 Gt/year (billions of tons per year) according to differing estimates, and more than significantly exceed industrial emissions. The absorption of atmospheric carbon through photosynthesis is partly or fully offset by $CO_2$ emissions as a result of respiration and the decomposition of dead organic matter. The carbon stocks in terrestrial biomass and dead organic matter amount to some 2170 Gt, which is almost three times the amount in the atmosphere.

35. Forests are one of the most prevalent and productive types of terrestrial ecosystems, substantially contributing to the atmospheric carbon budget. Through photosynthesis they absorb about 31.9 Gt of carbon, which amounts to more than half of $CO_2$ absorption by ground vegetation. Forests absorb so much carbon and store it for so long that they are regarded as the most effective way of avoiding the greenhouse effect.

36. The Russian Federation possesses almost one quarter of all the Earth's forests and most of its boreal forests, which are the most effective in terms of carbon absorption and length of storage in terrestrial ecosystems. Forest resources cover 1179 million hectares, i.e. about 69% of the Russian Federation's entire surface area. Estimates of the amount of carbon stocks contained in the phytomass of forest flora range from 28 to 39.8 Gt while resources in forest soils are thought to amount to somewhere between 272 and 266.7 Gt. It is in Russia's interests, as the world's largest forest power, to use its forests' potential for atmospheric carbon absorption on the basis of the Kyoto Protocol mechanisms to the full.

### *ii. Limits set by the Kyoto Protocol with regard to the assessment of forests' contribution to the global carbon cycle*

37. The Kyoto Protocol recognises the impact of forests and forestry on the balance of greenhouse gases, but limits the assessment of this impact to strictly defined kinds of activity. It requires the assessment of changes in carbon stocks as a result of reforestation, forestation and deforestation; it also provides for the possibility of assessing the contribution of forest regulation to carbon balance.

[1] Sources:
- Third national report of the Russian Federation, prepared in accordance with Articles 4 and 12 of the UN Framework Convention on Climate Change. Interagency commission of the Russian Federation on the issues of climate change. - (Moscow), 2002. - 123 c. (p.123), www.unfccc.int.
- Climate Change: The third assessment report of the Intergovernmental Panel on Climate Change (IPCC). - 2001. www.ipcc.ch. G. Gruza, E. Rankova, V. Razuvaev, and 0. Bulygina, Indicators of climate change for the Russian Federation. Climate Change. 1999. V. 42. p. 219-242.

Basically, it restricts assessment of changes in carbon stocks and flows of greenhouse gases to those directly related with economic activity in forests. Natural or almost undisturbed forests are excluded from the assessment and are not regarded as anthropogenic greenhouse gas sources or sinks under the Kyoto Protocol.

38. To meet the commitments under the Kyoto Protocol from 2008 to 2012, the only changes in greenhouse gas emissions by sources and removals by sinks that may be taken into account are those that result from direct human-induced land-use change and forestry activities, limited to afforestation, reforestation and deforestation since 1990. The guiding principles for such national systems and methodologies for the assessment of flows and sources of greenhouse gases are adopted by the Intergovernmental Panel on Climate Change (IPCC) and approved by the Conference of the Parties.

39. The IPCC governing body on effective practice considers the five major pools of carbon in forest areas to be 1) aerial biomass; 2) subterranean biomass; 3) debris; 4) forest floor; and 5) internal soil structure. Wild forest (or forest land), whose surface area is determined by each country itself and remains stable within each assessment period, is not included in the assessment. As far as managed forests are concerned, assessments must include not just the pools referred to above but also emissions of carbon and other greenhouse gases connected with natural losses from fires, hurricanes, diseases and harmful insects, annual growth of biomass and loss of biomass through commercial felling, gathering of firewood and other kinds of forest management.

40. Therefore, having restricted the assessment of the contribution of forests to the greenhouse balance to anthropogenic sinks and emissions, the Kyoto Protocol provides for the creation of a national system for their assessment, meeting certain international requirements.

41. The creation of a national system to assess greenhouse gas emissions and their absorption by sinks connected with reforestation, forestation and forest management and with changes in land use in forested areas will require changes to be introduced into existing national forest inventory and monitoring systems and a review of the statistical accounting of forestry and the whole forest sector.

*iii. The potential of forests to alleviate climate changes*

*a. Potential of reforestation*

42. According to national forest resource data, the total area of land available for reforestation in Russia on 1 January 2004 was 33.4 million hectares, comprising 25.3 million hectares of burned-out forests, 3.4 million hectares of cutover lands, 1.7 million hectares of dead forests and 2.9 million hectares of glades and wasteland. A significant proportion of this land (22.1 million hectares) may be left for natural regeneration and forestation work may be carried out only to prevent the area from becoming too overgrown or to plant more productive species. In the remaining area of land available for reforestation (11.3 million hectares), special measures need to be taken to promote natural regeneration or the growth of small areas of woodland. Therefore, the total area available for reforestation projects – with varying degrees of availability and production capacities – amounts to some 11.3-33.4 million hectares.

43. The figures cited above can be used only as a rough estimate of the maximum increase in the amount of absorbed atmospheric carbon to be taken into account for the purposes of the Kyoto Protocol.

44. It has been estimated that the reforestation of suitable areas of land using tree species with similar productivity levels to that of natural forests under equivalent climate conditions will result in average carbon sequestration levels, once the forest has reached a steady state, of about 1 tonne per hectare per year for all regions and latitudes. This means that, if all the available areas in Russia are reforested, some 33 to 34 million tonnes of carbon will be sequestered per year once the plantations have started to function steadily.

*b. Potential of forestation*

45. Forestation can be carried out on suitable non-forested lands to create windbreaks and/or encourage biological regeneration (of damaged agricultural land or other land spoilt by human activity). Scientists estimate the total surface area of land requiring protective forestation for various reasons in Russia to be some 14 million hectares and that 3.2 million hectares of this land should be planted with windbreaks. Damaged agricultural land and land of other types are thought to amount to some 9.5 million hectares and so the total area of land available for forestation may range from 10.8 to 20.3 million hectares. This does not include released (abandoned) agricultural lands, whose area is estimated by various authorities to amount to several dozens of millions of hectares and for which a separate study will be required as to the advisability of their afforestation.

*c. Potential of forest management*

46. Along with reforestation and forestation, measures to preserve forest resources, increase forest productivity and enhance protection from fire, harmful insects and diseases can contribute substantially to increased absorption and the reduction of greenhouse gas emissions. Such measures can be regarded as forest management activities within the meaning of the Kyoto Protocol.

47. Measures to increase forest productivity may include the reconstitution of forested areas, mainly by planting on highly productive forest lands containing incomplete saplings.

48. Increased protection from forest fires, harmful insects and disease can play a big part in reducing greenhouse gas emissions. Forest fires throughout the Russian Federation account for tens to hundreds of millions of tonnes of $CO_2$ emissions every year. These can be divided into pyrogenic emissions, which occur in the process of burning vegetable matter, and after-fire emissions, which occur as the vegetation killed by the fire decomposes. The scale of these emissions is determined entirely by the size of the area on fire and the degree of fire damage to the forest.

49. The urgency of the need to reduce greenhouse gas emissions caused by fires stems both from the high inflammability of boreal forests and from the danger that forest fires will increase in their number and extent as a result of global warming. A similar situation is being observed in respect of greenhouse gas emissions caused by damage and loss of plantations affected by infestations of insects. In some years, harmful insects and diseases have comparable adverse effects on forests to forest fires. They can be reduced through a combination of prevention and eradication measures forming part of forest management activities.

50. Particular attention should be paid to the problem of reducing greenhouse gas emissions caused by wood use and processing. Of the hundreds of millions of cubic metres of timber that are felled every year, 20-30% is lost in wood-cutting areas. A large proportion of the timber that is removed becomes technological waste. Greenhouse gas emissions caused by the destruction of wood left in wood-cutting areas can be reduced through the introduction of new technologies for the use and processing of timber, and the possibility of using all the timber that is removed as a result of improved felling methods.

51. The potential of forest management as a means of increasing absorption and reducing greenhouse gas emissions is comparable to the potential of forestation and reforestation. Consequently, a separate study should be prepared on managed forests and efforts to increase the contribution of forests to the alleviation of global climate change should be stepped up. This review has examined only the most obvious forest management measures, easily interpreted in terms of their impact on the carbon cycle, but their implementation will make it easier for us to honour our commitments under the Kyoto Protocol and encourage investment in forestry intended to enhance the ecological potential of forests.

## V. New approaches to forestry and agriculture

*i. Forestry and agriculture are important sources of carbon dioxide, methane and nitrous oxide*

52. Forests contain large amounts of carbon. Some forests act as “sinks”, absorbing carbon from the air, while other forests, whose carbon exchange is balanced, act as “reservoirs”. Deforestation and

changes in land use make the world's forests a net source of carbon dioxide emissions. Intensive agricultural practices such as cattle farming, rice growing in irrigated fields and the use of fertilizers, result in anthropogenic emissions of a considerable amount of methane and a large quantity of nitrous oxide. Fortunately, today we have methods and technologies which enable us to substantially reduce net greenhouse gas emissions from forests and agriculture and, in many cases, cut production costs, increase yields and reap other economic and social benefits.

*ii. If carbon dioxide emissions by forests are to be reduced, they will need better protection and management*

53. Legally protected areas play a role, but deforestation should also be tackled through policies that lessen the economic pressures on forest lands. Much forest destruction and degradation is caused by the expansion of farming and grazing. Other forces include market demand for commercial timber and local demand for fuel wood and for other forest resources necessary for a subsistence economy. These pressures can be eased by increasing agricultural productivity, slowing population growth, involving local people in sound forest management practices and timber-harvesting operations, implementing measures to guarantee that commercial timber is used sustainably, and addressing the underlying social, economic and political factors which spur migration into forest areas.

*iii. The quantity of carbon stored in trees, plants, soil and solid wood products can be increased by means of an appropriate system of "storage management"*

54. When secondary forests and degraded land are protected or used efficiently, they usually recover naturally and start absorbing significant amounts of carbon. If the soil on which they grow is fertilized, it can hold additional amounts of carbon and be used to plant new trees. The quantity of carbon stored in wood products can be increased by designing them so that they will last as long as possible, sometimes even exceeding the usual life cycle of wood.

*iv. Sound forest management can contribute to the formation of forest biomass as a renewable resource*

55. Some of this biomass can be used instead of fossil fuel; this approach has greater long-term potential for the reduction of net emissions than just growing trees to store carbon. Planting forests on degraded or non-forested lands increases the amount of carbon stored in trees and soil. In addition, using forests to produce fuel wood instead of coal or oil can help to preserve the underground carbon reservoirs constituted by fossil fuels.

*v. Agricultural soils are a net source of carbon dioxide emissions, but they can be turned into a net sink*

56. Improved agricultural methods designed to increase agricultural productivity can result in the absorption and capture of larger amounts of carbon by agricultural soils. Simple measures include leaving the remains of crops in the soil and shallow tillage or even no tillage at all as carbon escapes more easily from soil which is turned over or left bare. In the tropics, the quantity of carbon in soil can be increased by leaving more crop residues in the soil, growing perennial (year-round) crops and reducing the length of fallow periods. In semi-arid areas, the length of summer fallow can be reduced through more efficient water use or by growing perennial feed crops (which also eliminate the need for tillage). In temperate regions soil carbon quantities can be increased by more effective use of animal manure.

*vi. Methane emissions from livestock can be reduced using new feed mixtures*

57. According to some estimates, cattle account for 80% of annual global methane emissions in the livestock sector. Feed additives can increase fattening rates, thus reducing methane emissions per unit of beef produced. For example, when, as part of rural development projects in India and Kenya, vitamins and mineral salts were added to feed mixtures for local dairy breeds, milk yield increased and methane emissions were reduced.

*vii. Methane emissions caused by rice-growing in irrigated fields can be substantially reduced by changing irrigation practices and fertilizer use*

58. About 50% of all land used to grow rice is irrigated. Today's rice-growers can control water supply and yield on only about one-third of the world's rice fields. Methane emissions are higher in rice-growing systems where rice fields are permanently under water. Recent experiments suggest that draining fields at certain times in the crop cycle can drastically reduce methane emissions without lowering rice yields. Additional technical options for the reduction of methane emissions include adding sodium sulphate or coated calcium carbide granules to the urea-based fertilizers now in common use, or replacing urea altogether and using ammonium sulphate as the source of nitrogen for rice crops.

*viii. Nitrous oxide emissions in agriculture can be minimized using new fertilizers and new application techniques*

59. Spreading nitric fertilizers and animal manure on crops releases nitrous oxide into the atmosphere. Enhancing nitrogen assimilation by crops can reduce the nitrogen needed to grow a given quantity of food. Other measures are aimed at reducing the quantity of nitrous oxide generated as a result of the use of fertilizers and reducing the amount of nitrous oxide that is released into the atmosphere as a result of farming practices. One approach is to use nitric fertilizers at a time and in a quantity suited to the particular crop. The interaction of fertilizers with local soil and climate conditions can also be influenced by optimizing tillage, irrigation and drainage systems.

*ix. Carbon storage in agricultural soil can also help to achieve other ecological and socio-economic aims*

60. Carbon storage often improves soil fertility. In addition, methods such as shallow tillage, broader cover and greater use of perennial crops prevent erosion, thus improving water and air quality. All these advantages often justify the use of carbon storage methods in themselves, regardless of how much they are contributing to the reduction of climate change. However, it is necessary to ensure that carbon storage does not increase levels of nitrous oxide as a result of greater soil humidity and fertilizer use.

## VI. Conclusions

61. The rapporteur supports a policy of honouring commitments to stabilise and reduce greenhouse gas concentrations in the atmosphere resulting from the use of fossil fuels.

62. Emphasis should be laid on the need to encourage and develop the second most important instrument for combating climate change, namely the absorption and storage of carbon dioxide by living matter.

63. Regrettably, there is currently no accurate method for estimating variations in atmospheric carbon dioxide following its absorption and storage by living matter.

64. However, this situation should not prevent the implementation of national policies and measures to increase flow volumes through the use of more sophisticated techniques for absorption by agriculture, forestry and crops, and should not put a check on other human activities geared to maintaining the oceans' potential for absorption and storage.

65. Conservation of vegetation and of the oceans' potential with regard to increasing flow volumes through biogenic processes, and particularly the action of phyto and zooplankton, is essential.

66. Additional measures of an institutional nature, co-ordinated between the different institutions and accompanied by economic mechanisms, need to be drawn up to further the implementation of the targets set in the Kyoto Protocol to the United Nations Framework Convention on Climate Change.

67. To achieve the aim of an overall increase in flow volumes on the basis of biogenic accumulation of carbon dioxide, it is vital to ensure that certain obstacles are eliminated, and in particular forest fires, forest clearance, spontaneous peat fires, oil films covering the surface of seas and oceans, the death of phyto and zooplankton, which play a role in absorbing and storing carbon

dioxide and its compounds, the slowing down of phytosynthesis and carbon dioxide use by plants, surface pollution of water basins by oil films (due to ships emptying their tanks and discharging waster water, drilling for oil at sea, shipwrecks of oil tankers, discharges of waste water by land-based industries), etc.

68. The natural potential of forests to absorb carbon dioxide should also be exploited, which, moreover, in accordance with the requirements of the Kyoto Protocol for industrialised countries, would make it possible to release one tonne of carbon contained in a fossil fuel in exchange for one tonne of carbon dioxide stored in the reservoir.

69. The public authorities must take comprehensive measures to support natural mechanisms for absorbing and storing carbon dioxide and affording comprehensive protection to, and improving the quality of, natural reservoirs and sinks.

70. The comprehensive action plans adopted by the Council of Europe member states for implementing the Kyoto Protocol to the United Nations Framework Convention on Climate Change should contain measures for reducing emissions and increasing absorption of greenhouse gases by various economic sectors, together with scientific research in the field of technologies for sequestration and long-term storage of carbon dioxide.

71. Given that land plants and the species forming the plankton found in the oceans absorb approximately 100 Gt of carbon dioxide, it is vital to pursue national policies and take overall measures to increase flow volumes through biogenic processes, for which appropriate, targeted measures are needed.

72. Initiatives by the member states to promote more efficient and environmentally clean use of natural resources and carbon sequestration should be stepped up as a matter of urgency. The member states should therefore take the necessary measures to:

- identify and locate the sources of forest fires;
- prevent spontaneous peat fires through irrigation;
- encourage the use of fertilisers and other substances to stimulate and speed up photosynthesis by land plants;
- encourage the large-scale use of physical, physicochemical and biological methods to eliminate oil films on the surface of natural bodies of water;
- develop, through existing genetic engineering, plant species capable of storing more biomass than the currently existing natural species;
- develop the waste-free use and processing of forest resources by national economies and improved forest management;
- encourage the use of mouldboardless soil treatment methods in agriculture and promote perennial crops through the use of organic fertilisers such as manure;
- reduce the quantities of methane and nitrous oxide emitted by agriculture by improving livestock breeding and soil treatment methods and by using new types of fertiliser and new ways of introducing them into the soil;
- increase the natural potential for carbon uptake and the flow volumes.

73. It is important to establish international co-operation to:

- implement projects and technologies for carbon sequestration and partnership schemes to promote technologies for producing hydrogen for transport fuel and power generation;

- create economic mechanisms to facilitate investment in reforestation, water resource purification and other measures to increase biogenic flows.

74. Lastly, negotiations and consultations should be continued with the States Parties to the Kyoto Protocol and with the States Parties to the United Nations Framework Convention on Climatic Change on questions of economic, environmental, scientific and technical co-operation to increase the levels of stored and sequestered carbon.

*Reporting committee:* Committee on the Environment, Agriculture and Local and Regional Affairs

*Reference to committee:* Doc. 10425, Reference No. 3051 of 28 January 2005

*Draft resolution* adopted unanimously by the committee on 24 January 2007

*Members of the Committee*: Mr Walter **Schmied** (Chairman), Mr Alan **Meale** (1e Vice-Chairman), Ms Elsa Papadimitriou (2nd Vice-Chairperson), Mr Pasquale **Nessa** (3rd Vice-Chairman), Mr Ruhi **Açikgöz**, Mr Toomas **Alatalu**, Mr Gerolf Annemans, Mr Ivo Banac (alternate: Mr Miljenco **Dorić**), Mr Tommaso Barbato, Mr Rony **Bargetze**, Mr Jean-Marie **Bockel**, Mr Mauro Chiaruzzi, Mrs Pikria Chikhradze, Mr Valeriu **Cosarciuc**, Mr Osman **Coşkunoğlu**, Mr Alain **Cousin**, Mr Taulant Dedja, Mr Hubert **Deittert**, Mr Tomasz Dudziński (alternate: Mr Dariusz **Lipiński**), Mr József **Ékes**, Mr Bill **Etherington**, Mr Nigel **Evans**, Mr Ivàn **Farkas**, Mr Adolfo **Fernández Aguilar**, Mr György Frunda, Ms Eva Garcia Pastor, Mr Peter Götz, Mr Vladimir Grachev (alternate: Mr Valeriy **Sudarenkov**), Mr Kristiin **Gunnarsson**, Ms Lena **Hallengren**, Mr Poul Henrik Hedeboe, Mr Rafael **Huseynov**, Mr Stanislaw **Huskowski**, Mr Jean **Huss**, Mr Fazail Ibrahimli (alternate: Ms Aynur **Guliyeva**), Mr Ilie **Ilaşcu**, Mr Mustafa **Ilicali**, Mrs Fatme Ilyaz (alternate: Mr Zahari **Georgiev**), Mr Ivan **Ivanov**, Mr Bjørn **Jacobsen**, Mr Gediminas **Jakavonis**, Mrs Danuta **Jazłowiecka**, Mrs Liana Kanelli, Mr Karen Karapetyan, Mr Victor **Kolesnikov**, Mr Gerhard Kurzmann, Mr Ewald **Lindinger**, Mr François Loncle (alternate: Mr Jean-François **Le Grand**), Ms Kerstin **Lungren**, Mr.Theo **Maissen**, Mr José Mendes Bota (alternate: Mr Abilio **Dias Fernandes**), Mrs Maria Manuela **de Melo**, Mr Gilbert Meyer (alternate: Mr Daniel **Goulet**), Mr Vladimir Mokry (alternate: Ms Svetlana **Smirnova**), Mr Stefano **Morselli**, Mr Žarko Obradović, Mr Pieter Omtzigt (alternate: Mr Leo **Platvoet**), Ms Gordana Pop Lazić, Mr Ivan **Popescu**, Mr Cezar Florin **Preda**, Mr Jakob **Presečnik**, Mr Lluís Maria **de Puig**, Mr Jeffrey Pullicino Orlando, Mrs Adoración Quesada (alternate: Mr Iñaki **Txueka Isasti**), Mr Dario **Rivolta**, Ms Anta Rugāte, Mr Fidias **Sarikas**, Hermann Scheer (alternate: Mr Detlef **Dzembritzki**), Mr Ladislav **Skopal**, Mr Christophe **Spiliotis-Saquet**, Mr Rainder **Steenblock**, Mr Vilmos Szabó, Mr Kimmo **Tiilikainen**, Mr Nikolay Tulaev, Mr Victor **Tykhonov**, Mr Tomas Ulehla, Mr Geert Versnick, Mr Rudolf **Vis**, Mr Harm Evert **Waalkens**, Mr Klaus Wittauer, Mr G.V. Wright, Mr Mykola Yankovsky, Mr Blagoj **Zašov**.

N.B. The names of those members present at the meeting are printed in **bold.**

*Secretariat to the Committee*: Mr Alfred Sixto, Mr Bogdan Torcătoriu and Mrs Marine Trévisan