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AD HOC WORKING GROUP ON LONG-TERM COOPERATIVE ACTION UNDER THE CONVENTION
Third session
Accra, 21–27 August 2008

Agenda item 3 (a–e)
Enabling the full, effective and sustained implementation of the Convention through long-term cooperative action now, up to and beyond 2012, by addressing, inter alia:
A shared vision for long-term cooperative action
Enhanced national/international action on mitigation of climate change
Enhanced action on adaptation
Enhanced action on technology development and transfer to support action on mitigation and adaptation
Enhanced action on the provision of financial resources and investment to support action on mitigation and adaptation and technology cooperation

Ideas and proposals on the elements contained in paragraph 1 of the Bali Action Plan

Submissions from intergovernmental organizations

1. The Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA), at its first session, invited Parties and accredited observer organizations to provide additional information, views and proposals on paragraph 1 of the Bali Action Plan (decision 1/CP.13), as may be required for each session.[1] It requested the secretariat to post these submissions on the UNFCCC website.

2. The AWG-LCA, at its second session, further requested the secretariat to compile submissions from Parties and intergovernmental organizations into separate miscellaneous documents, and make them available one week prior to the respective sessions for consideration by the AWG-LCA.[2]

3. The secretariat has received seven submissions from intergovernmental organizations for the second session of the AWG-LCA. As requested by the AWG-LCA, they have been posted on the UNFCCC website.[3] In accordance with the procedure for miscellaneous documents, these submissions are attached and reproduced[4] in the language in which they were received and without formal editing. The secretariat will continue to post on the relevant web page of the UNFCCC website the submissions received after issuance of the present document.

[1] FCCC/AWGLCA/2008/3, paragraph 23.
[2] FCCC/AWGLCA/2008/8, paragraph 27.
[3] <http://unfccc.int/parties_and_observers/igo/items/3714.php>.
[4] These submissions have been electronically imported in order to make them available on electronic systems, including the World Wide Web. The secretariat has made every effort to ensure the correct reproduction of the texts as submitted.

4. Submissions received from Parties have been compiled in document FCCC/AWGLCA/2008/MISC.2. Submissions received from non-governmental organizations will, in line with established practice, be posted on the UNFCCC website at <http://unfccc.int/parties_and_observers/ngo/items/3689.php>.

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PAPER NO. 1: CONVENTION ON BIOLOGICAL DIVERSITY

Summary of information on the conservation and sustainable use of biodiversity relevant for reducing emissions from deforestation and forest degradation in developing countries

Introduction

At its ninth meeting, the Conference of the Parties to the Convention on Biological Diversity (CBD), requested the Executive Secretary to summarize information on the conservation and sustainable use of biodiversity relevant for Reducing Emissions from Deforestation and Forest Degradation in developing countries (REDD) found within existing documents. Parties further requested that the Executive Secretary provide this information to the Executive Secretary of the United Nations Framework Convention on Climate Change with the intention that it be transmitted to the third and subsequent sessions of the Ad Hoc Working Group on Long-term Cooperative Action (decision IX/16, paragraph 16).

In response to this request, the Executive Secretary has prepared the attached summary including relevant information from CBD publications such as Technical Series Nos. 4[1], 10[1], 25[2] and 29[3] and the report of the Viterbo Workshop on "Forests and Forest Ecosystems: Promoting Synergy in the Implementation of the three Rio Conventions" (April 2004)[4]. The summary also includes information from reports to which the CBD contributed, such as the Millennium Ecosystem Assessment[5] and the Intergovernmental Panel on Climate Change (IPCC) Technical Paper V "Climate Change and Biodiversity"[6].

Biodiversity, Productivity and Carbon Sequestration

Forest ecosystems store large quantities of carbon in vegetation and soil. They exchange carbon with the atmosphere through photosynthesis and respiration. They can also be sources of atmospheric carbon when they are disturbed. In the case of carbon stored in a standing forest that is close to "carbon balance", there is an economic value to the carbon stored however, whether such a forest can realize such storage values depends on what is likely to happen in the absence of some protective or sustainable-use

[1] Secretariat of the Convention on Biological Diversity (2001). The Value of Forest Ecosystems. Montreal, SCBD Technical Series No. 4.

[1] Secretariat of the Convention on Biological Diversity (2003). Interlinkages between Biological Diversity and Climate Change. Advice on the Integration of Biodiversity Considerations into the Implementation of the United Nations Framework Convention on Climate Change and its Kyoto Protocol. Montreal, SCBD Technical Series No.10.

[2] Secretariat of the Convention on Biological Diversity (2006). Guidance for Promoting Synergy Among Activities Addressing Biological Diversity, Desertification, Land Degradation and Climate Change. Montreal, SCBD Technical Series No. 25.

[3] Secretariat of the Convention on Biological Diversity (2007). Emerging Issues for Biodiversity Conservation in a Changing Climate. Abstracts of Poster Presentations at the 12th Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity. Montreal, SCBD Technical Series No. 29.

[4] http://www.unccd.int/workshop/docs/finalreport.pdf

[5] Millennium Ecosystem Assessment (2005). Washington, Island Press.

[6] Gitay, H., Suárez, A., Watson, R.T., and D.J. Dokken (2002). IPCC Technical Paper V – Climate Change and Biodiversity. IPCC, Geneva, Switzerland. pp 85.

measure. Forests that are threatened in the near-to-medium future have a storage value that can be realized through protective measures.

Currently, the biosphere is a net sink of carbon, absorbing approximately 20 per cent of fossil-fuel emissions. Terrestrial ecosystems alone currently absorb carbon dioxide (CO_2) at a rate of about 1–2 gigatonnes (Gt) of carbon per year. Carbon release or uptake by ecosystems affects the CO_2 and methane (CH_4) content of the atmosphere at the global scale and thereby global climate. As such, forest, agricultural lands, and other terrestrial ecosystems offer a significant potential for climate-change mitigation through changes in land use (e.g., afforestation and reforestation), avoided deforestation, and agriculture, grazing land, and forest management. The estimated global potential of biological mitigation options is on the order of 100 Gt C (cumulative) by the year 2050, equivalent to about 10-20 per cent of projected fossil-fuel emissions during that period, although there are substantial uncertainties associated with this estimate. The largest biological potential is projected to be in subtropical and tropical regions.

An average closed primary forest contains some 280 tonnes of carbon per hectare and, if converted to shifting agriculture, would release about 200 tonnes of carbon. Open forests would begin with around 115 tonnes of carbon per hectare and would lose between a quarter and third of this amount when converted. Furthermore, a study using Norway's carbon tax of about USD $49 per tonne of CO_2 as an expression of the social cost of fossil fuels, shows that the implied value of the forest as a carbon sink in Norway exceeds the value of the forest stand as timber by a factor of between 3 and 30, depending on the discount rate used.

At present, deforestation and land-use change are estimated to contribute to approximately 20 to 25 per cent of carbon emissions, in addition to being a major cause of global biodiversity loss. The mitigation potential of slowing rates of tropical deforestation has been estimated to be about 11-21 Gt of carbon over the period 1995-2050 on 138 million hectares. Protection of forests through REDD therefore has the potential to deliver both climate-change-mitigation and biodiversity-conservation benefits.

Some components of biodiversity affect carbon sequestration and thus are important in carbon-based climate-change mitigation when afforestation, reforestation, reduced deforestation, and biofuel plantations are involved. Biodiversity affects carbon sequestration primarily through its effects on species characteristics, which determine how much carbon is taken up from the atmosphere (assimilation) and how much is released into it (decomposition, combustion). Particularly important are the speed at which plants can grow, which governs carbon inputs, and woodiness, which enhances carbon sequestration because woody plants tend to contain more carbon, live longer, and decompose more slowly than smaller herbaceous plants. Plant species also strongly influence carbon loss via decomposition and their effects on disturbance.

Biodiversity and Permanence

Biodiversity and permanence are important components to consider when designing REDD projects. Ecosystem resilience, which is generally accepted to be linked to biodiversity in most cases, increases the permanence of the carbon pool. Usually, areas allocated to conserve biodiversity represent long-term and more secure stores of carbon. Normally, relatively mature ecosystems are preferred for conservation purposes, and they are usually managed to reduce the likelihood of disturbance, thus minimizing human activities that could release stored carbon. As such, protected areas represent a form of avoided deforestation or devegetation.

Benefits to Biodiversity from REDD

In addition to climate--change mitigation benefits, slowing deforestation and/or forest degradation can provide substantial biodiversity benefits. Primary tropical forests contain an estimated 50–70 per cent of all terrestrial species, and tropical deforestation and degradation of forests are major causes of global biodiversity loss. Tropical forests are currently experiencing significant rates of deforestation (averaging 15 million hectares annually during the 1980s, and emitting 1.6± Gt of carbon per year). Tropical deforestation and degradation of forests are major causes of global biodiversity loss. Deforestation and forest degradation reduces the availability of suitable habitats for species coexistence, may cause local extinctions, and can decrease both population and genetic diversity. Hence, reducing the rate of deforestation and degradation is key to halting the loss of biodiversity in forests.

Pilot projects designed to avoid emissions by reducing deforestation and forest degradation have produced marked ancillary environmental and socio-economic benefits. These include biodiversity conservation, protection of watersheds, improved forest management, enhanced livelihood options and local capacity-building. Sustainable forest management is also closely linked to reducing deforestation while enhancing biodiversity as well as to poverty eradication, employment and broader development goals. Although avoided deforestation is not currently an eligible Clean Development Mechanism (CDM) activity under the United Nations Framework Convention on Climate Change, it is an important mechanism to maintain biodiversity.

Projects to avoid deforestation in threatened or vulnerable forests that are biologically diverse and ecologically important can be of particular importance for biodiversity. Although any project that slows deforestation or forest degradation will help to conserve biodiversity, projects in threatened/vulnerable forests that are unusually species-rich, globally rare, or unique to that region can provide the greatest biodiversity benefits. In particular, projects that protect forests from land conversion or degradation in key watersheds have potential to substantially slow soil erosion, protect water resources, and conserve biodiversity. Projects that are designed to promote reduced-impact logging as a carbon offset may produce fewer biodiversity ancillary benefits than forest protection (i.e., not logging) at the site level, but may provide larger socio-economic benefits to local owners and prove to be a more viable option, particularly in areas where the communities are largely dependent on the forest for their livelihood.

In temperate regions, deforestation mainly occurred, when it did, several decades to centuries ago. In recent decades, deforestation has been most prevalent in the tropics. Since the remaining primary tropical forests are estimated to contain 50–70 per cent of all terrestrial plant and animal species, they are of great importance in the conservation of biodiversity. Tropical deforestation and degradation of all types of forests remain major causes of global biodiversity loss. Any project that slows deforestation or forest degradation will help to conserve biodiversity.

Afforestation, reforestation, and avoided deforestation projects may have off-site consequences, including implications for biodiversity. For example, conserving forests that would have otherwise have been deforested for agricultural land may displace farmers to lands outside the project's boundary. This has been termed "leakage". Projects may also yield off-site benefits, such as the adoption of new land-management approaches outside a project's boundary through technology diffusion or the reduction of pressure on biologically diverse natural forests. It is important that reduced deforestation in one location does not simply result in intended or unintended deforestation at another location.

Scenarios for Reduced Deforestation and Biodiversity Conservation and Sustainable Use

Projects under a REDD mechanism can be designed to maximize benefits to biodiversity conservation and sustainable use. Afforestation, reforestation, and avoided-deforestation projects with appropriate management, selection criteria, and involvement of local communities can enhance conservation and sustainable use of biodiversity. Specific management options to realize the synergies between carbon sequestration and biodiversity include adopting longer rotation periods, altering felling-unit sizes, altering edge lengths, creating a multi-aged mosaic of stands, minimizing chemical inputs, reducing or eliminating measures to clear understorey vegetation, or using mixed-species planting, including native species. Furthermore, forest-related investments have been proven to be one way of effectively addressing the objectives of all three Rio conventions at the same time. As such, a systematic analysis of where and when synergies come into play provides a very good opportunity to increase the cost effectiveness of Official Development Assistance (ODA).

The most effective and immediate way of increasing net sequestration in terrestrial ecosystems is to reduce deforestation to only the most essential levels. Much of the 2 million Gt of carbon released annually from forest clearance arises from the demand for agricultural and pasture lands in developing countries. Some of this is necessary to maintain food production levels; some clearing leads to only short-term uses before the land is abandoned as degraded grasslands and often maintained that way by frequent fires. In other cases, the land reverts to forest with an uptake of carbon, often to be cleared again. An immediate challenge to international institutions is to find a way to ensure that deforestation is limited to only that which leads to the long term delivery of essential ecosystem goods and services and that the services provided by intact forests are properly valued.

Scenarios that limit deforestation show relatively better preservation of regulating services. Tropical deforestation could be reduced by a combination of reduced tropical hardwood consumption in the North, technological developments leading to substitution, and slower population growth in the South (the "TechnoGarden" scenario in the Millennium Ecosystem Assessment) or through greater protection of local ecosystems (the "Adapting Mosaic" scenario). In contrast, in the scenarios that are not proactive with regard to the environment, a combination of market forces, undervaluation, and feedbacks lead to substantial deforestation not only in the tropics but also in large swaths of Siberia (the "Order from Strength" and "Global Orchestration" scenarios).

In addition, forest protection through avoided deforestation may have either positive or negative social impacts. The possible conflicts between the protection of forested ecosystems and ancillary negative effects, restrictions on the activities of local populations, reduced income, and/or reduced products from these forests, can be minimized by appropriate stand and landscape management, as well as using environmental and social assessments and by enhancing stakeholder involvement, including prior informed consent from indigenous and local communities.

Promoting synergies between REDD and biodiversity would also benefit from filling gaps in the knowledge base and stimulating discussion on forest conservation through practical experience and implementation of pilot projects. Within developing countries, a number of priorities have been identified including capacity-building, financial assistance and technology transfer. Specific attention should also be given to wildland fires and their management as an important component of national and local action.

Another scenario to enhance the effectiveness of REDD-biodiversity links is through data collection, dissemination and analysis, and the use of early warning systems to provide the data needed for policy planning and implementation of projects at local and national level. The specific data requirements, however, require identification.

Within the framework of sustainable forest management, there is a need for a system of criteria and indicators to address the synergistic value of sustainable forest management projects with the aim of finding win-win options and to increase the value of the project in terms of realizing multiple benefits. This would not duplicate the work of the regional criteria and indicator processes for sustainable forest management, but would rather complement it by identifying case-studies that countries consider as having a high potential for synergies.

Case-studies and articles on REDD and the conservation and sustainable use of biodiversity: abstracts of poster presentations at the twelfth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the CBD (Paris, 2007)[7]

Title	Authors	Summary
Achieving Multiple Benefits through a UNFCCC Mechanism on Reducing Emissions from Deforestation	Valerie Kapos, Lera Miles, Peter Herkenrath UNEP World Conservation Monitoring Centre	REDD mechanisms can provide opportunities to contribute towards the goals of a range of multilateral environmental agreements and mechanisms, including the CBD, by helping to ensure that forests continue to provide vital ecosystem services, conserve biodiversity, and enhance livelihoods. The design and implementation of the mechanism affects the degree to which these other benefits are obtained. The article also recognizes that efforts to reduce rates of deforestation can also be associated with risks to ecosystems services , depending on the drivers of land-use change that are causing forest loss.
Forests and Climate Change-Mitigation and Adaptation Activities in Polish Forest Management	Dr. Roman Michalak Ministry of the Environment, General Directorate of the State Forests, Poland	Polish national experiences show that sustainable forest management offers a significant potential to sequester carbon. The concept of sustainable forest management includes the three main climate change mitigation approaches: sequestration by increasing the size of carbon pools, e.g., through afforestation; reforestation and other activities, by conservation of existing carbon pools, i.e., avoiding deforestation; as well as by substitution of fossil fuel energy by the use of biomass. The case-study highlights the need for enhancement of cooperation between the climate, biodiversity and forest related processes.

[7] Secretariat of the Convention on Biological Diversity (2007). Emerging Issues for Biodiversity Conservation in a Changing Climate. Abstracts of Poster Presentations at the Twelfth Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity. Montreal, Technical Series No. 29, i–viii + 112 pages.

Title	Authors	Summary
Assessment on Peatlands, Biodiversity and Climate Change	Faizal Parish (Global Environment Centre) and Andrey Sirin (Laboratory of Peatland Forestry and Hydrology, Institute of Forest Science, Russian Academy of Sciences)	The large scale degradation of peatlands, including forested peatlands, has major implications for climate change, biodiversity and people. Peatlands are the most efficient carbon stores of all terrestrial ecosystems. However, anthropogenic disturbances have led to massive increases in net emissions of greenhouse gases from peatlands. Integrated management of peatlands is required incorporating a range of approaches on different land-use areas.
Intact Forest Landscapes - Protecting Carbon and Biodiversity	Janet Cotter, Phil Aikman, Christoph Thies, Nathalie Rey and Martin Kaiser Greenpeace International	Using the example of the Democratic Republic of the Congo, the study demonstrates that the losses of carbon from forest fragmentation and selective logging are significant and that there is a need to protect Intact Forest Landscapes (IFL), not only for their biodiversity, but also for their carbon stocks.

PAPER NO. 2: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

Cooperative sectoral approaches and sector-specific actions, in order to enhance implementation of Article 4, paragraph 1(c), of the Convention Global Long-term Goal

August 19th, 2008
Submission by Food and Agriculture Organization of the United Nations

3rd Session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA3), Accra, 21-27 August 2008

Subject: Cooperative sectoral approaches and sector-specific actions, in order to enhance implementation of Article 4, paragraph 1(c), of the Convention

Information note: **The carbon sequestration potential in agricultural soils**

1. Introduction

The major natural sinks of carbon dioxide are oceans, soils and living and dead biomass, mainly plants – including forests. This short information note provides an overview of the potential of soil as a carbon sequestration option.

Currently the Clean Development Mechanism, established under the Kyoto protocol, considers only afforestation and reforestation as acceptable sequestration activities. It is suggested that the post-2012 regime would benefit if soil carbon storage could be recognized as an eligible carbon sink in all land use systems, in particular agricultural soils. Indeed, the IPCC (2007) noted that soil carbon sequestration is the mechanism that holds the greatest global mitigation potential.

The negotiations initiated at COP-13 of UNFCCC, on strategies and incentives for Reduced Emissions from Deforestation and Degradation (REDD) were focusing on developing countries and forest lands. However there are opportunities for soil carbon sequestration across all climatic zones and a wide range of cropping, grazing and forestry land use systems. Moreover, there are multiple benefits of management practices that restore soil carbon including reversing degradation and desertification, enhancing productivity and the provision of a range of ecosystem services and increasing resilience to climate change. If recognised as an eligible carbon sink, as well as mobilising the adoption of good practice by the large scale commercial farming sector, multiple benefits could accrue to smallholders and the millions of poor farmers and herders who have currently no access to the Kyoto mechanisms.

As agriculture including grasslands cover such a vast land area, although the amount of carbon stored in their soils and vegetation per unit area is lower than in forests, the potential carbon storage is significant. The total agricultural area in the world amounts to 5.0 billion ha. Of this, about 1.5 billion ha (30.4%) is arable land and land under permanent crops and the remaining 3.5 billion ha under permanent pastures and another 1.7-2.5 billion ha is rangelands. Agricultural activities and land-use change such as deforestation contribute about one third of the total greenhouse gas (GHG) emissions and are the largest sources of methane and nitrous oxide emissions.

In view of the above facts, it is only natural that the sectoral approaches that will be discussed in one of the AWG-LCA3 workshops should not overlook the importance of the agriculture sector, including rainfed and irrigated croplands, pasture and rangelands and agroforestry.

2. Order of magnitude of soil carbon sequestration

The global soil carbon pool amounts to 2500 Gt (gigatons), whereas the biotic pool is 560 Gt (Lal, 2004). Most agricultural soils have lost 30% to 75% of their antecedent soil organic carbon (SOC)

pool or 30 to 40 t C ha-1. On a global scale, carbon loss from soils is mainly associated with soil degradation, including accelerated erosion and mineralization, and land use change, and has amounted to 78+/- 12 Gt since 1850. Consequently, the present organic carbon pool in agricultural soils is much lower than their potential capacity (Lal et al, 2007). The restoration of wastelands, degraded/desertified soils and ecosystems (e.g., afforestation, improved pastures) and adoption of improved farm management practices can enhance soil organic carbon and improve soil quality and soil health. Such management practices include organic agriculture, conservation tillage, mulching, cover crops, integrated nutrient management including use of manure and compost, and agroforestry, as well as improved management of pastures and rangelands (FAO, 2007).

Considering all greenhouse gases, the global technical mitigation potential[8] from agriculture (excluding fossil fuel offsets from biomass) will be between 1.5 and 1.64 Gt C-eq per year by 2030 (Smith et al., 2008). Soil carbon sequestration (enhanced sinks) is estimated to contribute about 89 percent to this mitigation potential (Smith et al., 2007).

Management-related factors that can prevent or reduce soil carbon losses and restore soil carbon content include: conservation practices that reduce loss of soil matter through erosion; conservation tillage and protective vegetation cover to reduce oxidation by tillage or high soil temperature; maintenance of organic residues to provide cover and carbon inputs; restoration of soil biota and their ecological processes that breakdown organic inputs to soil organic carbon fractions and stable organo-mineral complexes. In addition, such practices contribute to improved soil fertility and productivity, enhanced above-ground biodiversity, and increased infiltration, reduced runoff and enhanced soil moisture retention, thereby reducing risk of drought and desertification. If such management practices are maintained over several years or decades the total amount of carbon sequestered will be substantial, though in some years the attainable level may be lower than the potential due to climatic vagaries and human management factors.

The global potential of soil organic carbon sequestration is estimated at 0.6 to 1.2 Gt C year, comprising 0.4 to 0.8 Gt C year through adoption of recommended management practices on cropland soils, 0.01 to 0.03 Gt C year on irrigated soils, and 0.01 to 0.3 Gt C year through improvements of rangelands and grasslands (Lal et al., 2007). This adds to the potential of C sequestration in biomass in forest plantations and short rotation woody perennials.

[8] The technical mitigation potential includes all greenhouse gases. Nitrous oxides and methane are converted to CO_2 and C equivalent using their global warming potentials.

3. Benefits associated with higher soil carbon

Increasing carbon content in the soil, through better management practices, produce a number of benefits in terms of soil biodiversity, soil fertility and soil water storage capacity and hence productivity. Soil carbon sequestration through the restoration of soil organic matter can further reverse land degradation and restore soil "health" through restoring soil biota and the array of associated ecological processes. In particular, through improved soil water storage and nutrient cycling, land use practices that sequester carbon will also contribute to stabilising or enhancing food production and optimizing the use of synthetic fertilizer inputs, thereby reducing emissions of nitrous oxides from agricultural land. Conservation tillage practices also reduce significantly the use of fuel and hence gaseous emissions.

Soil carbon sequestration is thus very cost effective and could take effect very quickly (FAO, 2008). It also constitutes a valuable win-win approach combining mitigation (CO_2 is removed from the atmosphere) and adaptation, through both increased agroecosystem resilience to climate variability and more reliable and better yields (production and income generation).

Under climate change scenarios, increased temperature may enhance soil organic matter mineralization in colder regions of the world, releasing carbon dioxide from soils (FAO, 2001). Improved soil management will mitigate the effects of global warming by improved and permanent soil cover.

Soil carbon storage was hitherto left out of international negotiations because of envisaged difficulties of validation of amounts and duration/permanency of sequestration. However, in addition to the undisputable multiple benefits of soil carbon storage, soil sampling for verification purposes is less expensive and more accurate than the indirect estimation of carbon stored in living biomass.

4. Conclusions

FAO has been advocating sustainable soil management practices through promoting agricultural technologies that restore carbon pools and soil quality (e.g. soil conservation techniques, organic matter management and conservation agriculture, biodiverse farming systems improved pasture and rangeland management, etc.). FAO has prepared a Global Carbon Gap Map that identifies areas of high carbon sequestration potentials and is developing local land degradation assessment tools that includes a simple field measurement of soil carbon. FAO is also working with partners that are developing tools to measure, monitor and verify soil carbon pools and fluxes of greenhouse gas emissions from agricultural soils, including cropland, degraded land and pastures. Incentives for sequestering carbon and for reducing greenhouse gas emissions (GHG) from agricultural soils, and support by Governments and development partners, would encourage smallholders at subsistence level as well as larger commercial farmers and herders to adopt improved management practices and by so doing enhance their productivity while contributing to reversing degradation and desertification, conserving biodiversity, and mitigating and adapting to climate change. The soil carbon sequestration potential is large and deserves to be incorporated into the post-Kyoto regime.

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PAPER NO. 3: INTERNATIONAL CIVIL AVIATION ORGANIZATION

Main activities undertaken by the International Civil Aviation Organization in the field of environmental protection

Written Submission of International Civil Aviation Organization (ICAO) to the third Session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA)

(Accra, 21 - 27 August 2008)

Executive Summary

Despite the relatively small level of the contribution of international aviation emissions to the total CO_2 emissions generated by anthropogenic activities (approximately 1.3%) the continuous growth of the sector (forecast to increase at an average annual rate of 4.6% between 2005 and 2025) raises questions on the future contributions of this activity to climate change and on the most effective way of addressing those emissions in a future climate agreement.

Although emissions from domestic aviation can be considered using the same approach applied to emissions from other activities situated within a State, international aviation emissions differ as they are not contained within a single State, and may occur within the territory of other States or in areas such as the upper atmosphere and over the high seas. International aviation also operates within a specific legal framework, established under the Convention on International Civil Aviation - the "Chicago Convention" - in 1944 and now ratified by 190 States.

With that background, the Kyoto Protocol established that the limitation or reduction of greenhouse gases from international aviation should be pursued working through ICAO, while action on domestic aviation emissions should use the same approach as emissions from other domestic activities.

The aviation industry has a very good environmental record. Standards and Policies to address the impact of aviation on the environment were established by ICAO in the early 70's. Aircraft today are 70 per cent more fuel efficient than the first generation of aircraft. Operational measures can deliver substantial savings with regard to fuel burn (around 12%) and the Organization has been instrumental in facilitating States action in this area. ICAO is also exploring various market based measures to address aviation emissions.

The 36th Session of the ICAO Assembly in 2007 established the Group on International Aviation and Climate Change (GIACC) consisting of 15 high-level government officials from States that are geographically representative of developed and developing countries alike. Their collective mandate is to develop and recommend to ICAO an aggressive programme of action for international aviation and climate change to be considered by the Organization under a timeline that takes into account the 15th Conference of the Parties to the UNFCCC in Copenhagen, at the end of 2009. In July, GIACC held its second meeting and discussed the possible establishment of short, medium and long term goals for fuel burn. They also formed smaller working groups to expedite work on goals, measures and means to evaluate progress to reduce aviation GHG.

Cooperation with other UN bodies and in particular with the UNFCCC process is paramount to achieving a sound and effective solution for addressing aviation emissions. While this ongoing dialogue is certainly a prerequisite to effective and lasting progress, it is not sufficient by itself. It is also critical that States' representatives taking part in meetings within the UNFCCC and ICAO align their respective views and positions to ensure that emissions from international aviation will be considered in the most effective way under the upcoming climate agreement.

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Introduction

The International Civil Aviation Organization (ICAO) is a United Nations (UN) specialized agency responsible for aviation matters. This paper presents the main activities undertaken by the Organization in the field of environmental protection in particular in addressing aviation greenhouse gases (GHG). It is intended to provide a basis for discussions related to international aviation, to the work of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) under the topic cooperative sectoral approaches and sector-specific actions, in order to enhance implementation of Article 4, paragraph 1(c) under the Convention.

The Convention on International Civil Aviation (also known as the Chicago Convention), was signed on 7 December 1944 and currently has 190 Contracting States. ICAO was established as an organization to secure international cooperation with the highest possible degree of uniformity in regulations and Standards regarding international civil aviation matters. Air transport is one of the safest forms of transport due mainly to the existence of global Standards and policy implemented in a harmonized manner by States within the ICAO framework. Principles of the Chicago Convention have been regulated through international Standards and recommended practices (SARPs) contained in the 18 Annexes to the Convention.

The 96 articles of the Chicago Convention establish the privileges and restrictions of all Contracting States. The Convention accepts the principle that every State has complete and exclusive sovereignty over the airspace above its territory and provides that no scheduled international air service may operate over or into the territory of a Contracting State without its previous consent.

ICAO has a sovereign body, the Assembly, and a governing body, the Council. The Assembly meets at least once every three years and is convened by the Council. Each Contracting State is entitled to one vote, and decisions of the Assembly are taken by a majority of the votes cast except when otherwise provided for in the Convention. At these meetings, the complete work of the Organization in the technical, economic, legal and technical cooperation fields is reviewed in detail, and guidance is given to the other bodies of ICAO for their future work.

The council of ICAO is comprised of states categorised into three “parts”: Part I - States of chief importance to air transport, Part II - States which make the largest contribution to the provision of facilities for international and Part III - ensuring geographic representation.

1. ICAO’s work on environmental protection

In December 2004, the Council of ICAO approved six Strategic Objectives for the period 2005-2010, Safety, Security and Environmental Protection being the core ones. Specifically for Environmental Protection three goals have been adopted:

a) limit or reduce the number of people affected by significant aircraft noise;
b) limit or reduce the impact of aviation emissions on local air quality; and
c) limit or reduce the impact of aviation greenhouse gas emissions on the global climate.

Annex 16 - *Environmental Protection* sets the Standards and Recommended Practices relating to environmental protection. Volume I for aircraft noise and Volume II for aircraft engine emissions. ICAO has also developed studies, guidance and policies to reduce aviation emissions based on three approaches: reduction of emissions at source through technological innovation (cleaner and more efficient engines and

airframes); reduction of emissions through operational measures (e.g. more efficient air traffic management); and through market based measures.

1.1 Aircraft engine emissions framework

The Kyoto Protocol includes binding emission reduction targets for developed countries (Annex I parties), for the period 2008-2012. Emissions from domestic aviation are included in the total emissions reported and subject to the above targets. Emissions from international aviation, due to the methodological and legal issues involved (including provisions under the Chicago Convention) were included under Art. 2.2 of the Kyoto Protocol, which reads: *"The Parties included in Annex I shall pursue limitation or reduction of emissions of greenhouse gases not controlled by the Montreal Protocol from aviation and marine bunker fuels, working through the International Civil Aviation Organization and the International Maritime Organization, respectively"*.

1.1.1 Key facts and figures: current/future

Aviation is a major catalyst of economic development. Around 2.2 billion passengers are transported by air every year. International traffic represents almost 60% of the total scheduled passenger traffic and about 83% of freight air traffic. Total scheduled passenger traffic worldwide is forecast to increase at an average annual rate of 4.6% (2005–2025).

ICAO conducts studies and analyses of regional differences in international airline operating economics with the aim of estimating and comparing airline costs in different regions of the world. As part of these analyses, fuel consumption is estimated from information of each airline's scheduled operations obtained from the Official Airline Guide (OAG), using a fuel consumption formula specific to each aircraft type. From these fuel consumption figures, it is possible to estimate emissions for any airline on each scheduled flight sector flown by taking into account the aircraft type operating the flight. ICAO has modelled data to estimate fuel consumption (CO_2 emissions) on an annual basis, either by equipment type (aircraft model, jet/non-jet, passenger or cargo), by service category (international or domestic) or by origin/destination (route group, country or city) broken down at different levels such as, country of departure, country pair or country of airline registration.

ICAO has estimated that around 229 134 million litres (187 890 million tonnes) of jet fuel were consumed in the year 2005 – 83 742 million litres (68 668 million tonnes) in total by domestic aircraft (passenger and cargo) and 145 391 million litres (119 221 million tonnes) by aircraft used for international operations (passenger and cargo). This represents approximately 519 511 million tonnes of CO2, 189 868 million tonnes and 329 643 million tonnes of which can be attributed to domestic and international operations respectively.

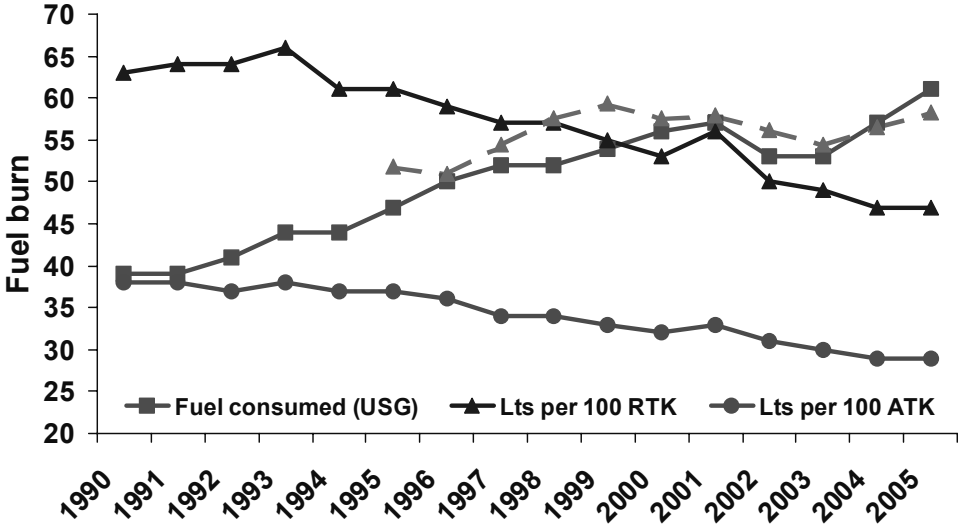
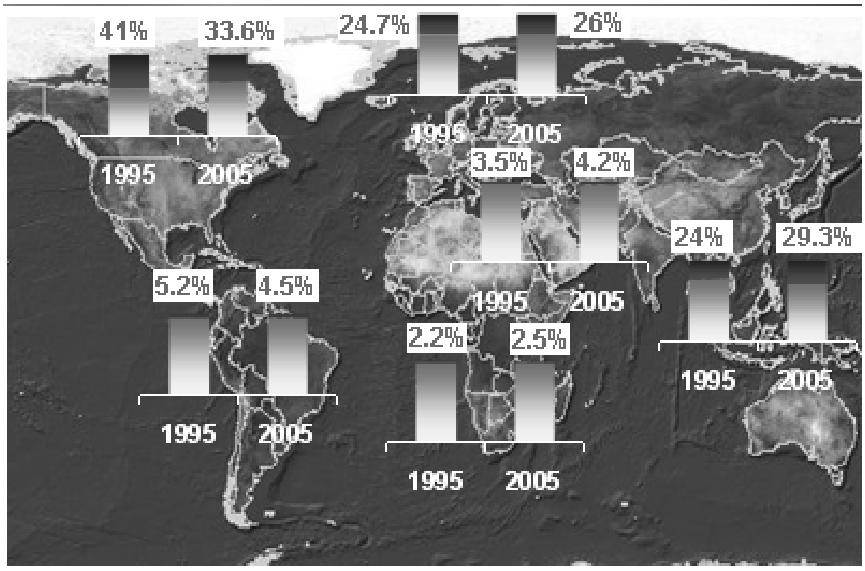
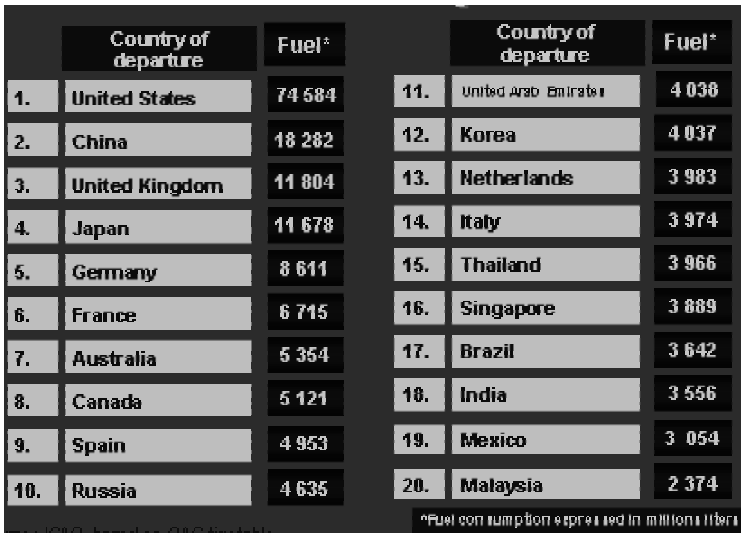


Figure 1 - Fuel consumption vs capacity evolution
AAGR – Average Annual Growth Rate; ATK - Average tonnes km; RTK – Revenue tonnes km



Source: ICAO based on OAG timetable

Figure 2 - Regional fuel consumption as percentage of the global



	Country of departure	Fuel*		Country of departure	Fuel*
1.	United States	74 584	11.	United Arab Emirates	4 036
2.	China	18 282	12.	Korea	4 037
3.	United Kingdom	11 804	13.	Netherlands	3 983
4.	Japan	11 678	14.	Italy	3 974
5.	Germany	8 611	15.	Thailand	3 966
6.	France	6 715	16.	Singapore	3 889
7.	Australia	5 354	17.	Brazil	3 642
8.	Canada	5 121	18.	India	3 556
9.	Spain	4 953	19.	Mexico	3 054
10.	Russia	4 635	20.	Malaysia	2 374

*Fuel consumption expressed in millions liters

Figure 3 - Fuel consumption by top twenty countries of departure

	PASSENGER SERVICES					
	Cargo Services	Fuel*	International+	Fuel*	Domestic	Fuel*
1.	United States	7 750	1. United States	20 220	1. United States	46 613
2.	China	2 956	2. United Kingdom	10 611	2. China	6 979
3.	United Arab Emirates	1 611	3. China	8 346	3. Japan	3 910
4.	Korea	1 111	4. Germany	7 088	4. Russia	3 006
5.	Japan	994	5. Japan	6 774	5. Australia	1 930
6.	Germany	812	6. France	5 412	6. Canada	1 918
7.	Netherlands	725	7. Spain	3 693	7. Brazil	1 672
8.	France	605	8. Singapore	3 531	8. Indonesia	1 257
9.	India	481	9. Thailand	3 255	9. Mexico	1 232
10	Luxemburg	457	10 Netherland	3 249	10 Spain	1 209

*Fuel consumption expressed in millions liters

Source : ICAO based on OAG timetable +Including Domestic legs of International Services

Figure 4 - Fuel consumption for the top 10 countries by category of service (by country of departure)

	AIRLINE	Fuel*
1.	American Airlines	11 490
2.	United Airlines	9 086
3.	Delta Airlines	8 465
4.	British Airways	7 172
5.	Northwest Airline	6 731
6.	Lufthansa	6 565
7.	Air France	6 167
8.	Southwest	5 412
9.	Singapore Airline	5 386
10.	Continental	5 263

*Fuel consumption expressed in millions liters

Source: ICAO based on OAG timetable

Air Transport Bureau

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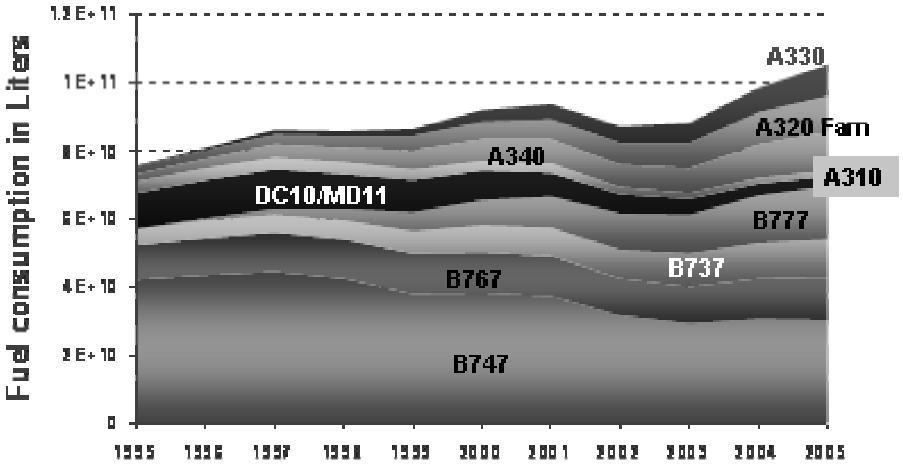
Figure 5 - Fuel consumption by top ten airlines



10 aircraft types services represent more than 80% of global fuel consumption through 1995 to 2005 for Passenger International services

Source: ICAO based on OAG timetable

Air Transport Bureau

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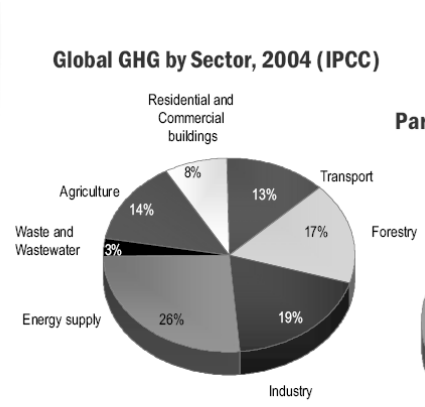
Figure 6 - Fuel consumption evolution by major aircraft type on international Passenger Services

1.1.2 Key aviation and climate change figures

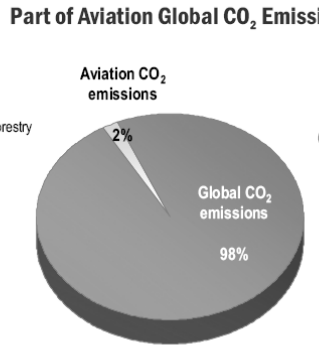
The most comprehensive assessment to-date concerning aviation's impact on the upper atmosphere is contained in the Intergovernmental Panel on Climate Change (IPCC) Special Report on Aviation and the Global Atmosphere (1999). The emissions considered in that report were: carbon dioxide, water vapour, carbon monoxide, hydrocarbons, particles, oxides of nitrogen, and sulphur compounds. The base year for the study was 1992 and it contained forecasts for 2015 and projected scenarios for 2050.

The IPCC AR4 revision of 2007 includes an update of the main finding of the Special Report as well as new findings related to aviation emissions, including influence of contrails and aerosols on cirrus clouds and the climate impact of oxides of nitrogen and methane. In addition, a range of technological options were examined by IPCC showing possible progress through substantive reductions in fuel usage that could arise from the introduction of more radical technologies. New findings related to aviation emissions *inter alia* are the following:

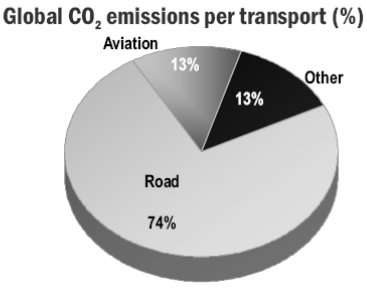
- Total aviation CO_2 emissions is approximately 2 percent of CO_2 emissions;
- The amount of CO_2 emissions from aviation is projected to grow around 3 to 4 percent per year; and
- Medium-term mitigation for CO_2 emissions from the aviation sector potentially can come from improved fuel efficiency. However, such improvements are expected to only partially offset the growth of aviation CO_2 emissions.



In 2004, the entire global transport sector was responsible for 13% of all greenhouse gases emissions.



Aviation (domestic and international) accounts for about 2% of all global CO_2 emissions.



Total aviation accounts for about 13% of CO_2 emissions from transport sources compared to 74% of total transport CO_2 emissions from road transport.

Figure 7 - Global CO_2 emissions and global Green House Gases (GHG) per sector Source - IPCC

Regarding the assessment of aviation cloudiness, for 2005 aircraft operations, persistent contrails added about 0.01 W m^{-2}, with about a factor-of-three uncertainty, to climate forcing from human activities. This is less than 1% of the climate contribution from CO_2 increases and of the total anthropogenic radiative forcing. The contrail contribution has been revised downward by about a factor of two from the 1999 IPCC assessment due to improved estimates of contrail cover and cloud radiative effects. Contrail cirrus is an additional radiative forcing component, but currently has no best estimate. Aviation soot aerosol is expected to have increased the number of atmosphere particles in the upper atmosphere, which can potentially change cirrus cloud properties.

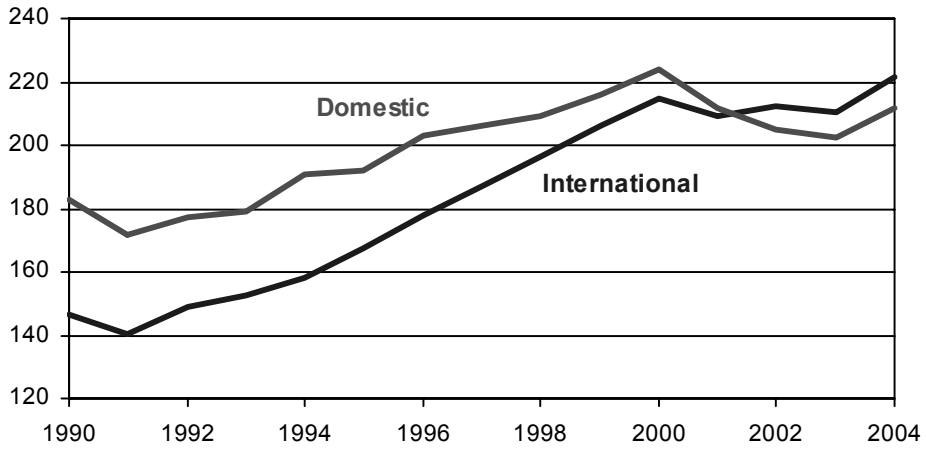


Figure 8 – Annex I Parties - International and domestic aviation emissions CO_2 growth
Source: UNFCCC (data excludes the Russian Federation)

1.2 Why is international aviation currently addressed differently under the UNFCCC Kyoto Protocol

Several key characteristics of international aviation led to its inclusion in Article 2.2 of the Kyoto Protocol, and should be considered in defining a post 2012 agreement. One of them is the complexity of monitoring and collecting information and assigning emissions of a mobile nature. An international aircraft route might include the overfly of different sovereign States and the high seas, and there is currently a debate over the allocation of these emissions.

Air transport is a fast, reliable mode of transport with no comparative alternative for long distance travel. Actions on international air transport taken by a State might have direct impact on the operations in another State. In order to collect the required data and put in place effective measures to address international aviation emissions, global, harmonized, and regulated actions need to be taken.

2. ICAO initiatives to address aviation emissions

The Committee on Aviation Environmental Protection (CAEP), a technical committee of the ICAO Council, addresses aviation environmental aspects, updating and developing ICAO's Standards and Recommended Practices as well as related guidance material for both aircraft noise and aircraft engine emissions.

Aircraft engine emissions are directly linked to fuel consumption. Overall fuel efficiency for civil aviation can be improved through a variety of methods for example, by increasing aircraft efficiency through technology, improved operations and efficient air traffic management. ICAO's work on environmental protection began as far back as the 70's. In 2001, the ICAO Assembly requested the Council to continue studying policy options to limit or reduce the environmental impact of aircraft engine emissions calling for special emphasis to be placed on the use of technical solutions, while continuing consideration of market-based measures, and taking into account potential implications for developing and as well as developed states.

The 36th Session of the ICAO Assembly was held in September 2007 and all contracting States agreed on a comprehensive plan of action comprised of four major elements:

1) The regular assessment of the impact of aviation on the environment and the continued development of tools for this purpose;
2) The vigorous development of policy options to limit or reduce the environmental impact of aircraft engine emissions and the provision of advice as soon as possible to the Conference of the Parties of UNFCCC on technical solutions and market-based measures;
3) The continued development and updating, through CAEP, of standards and guidance for Contracting States, on the application of measures aimed at reducing or limiting the environmental impact of engine emissions; and
4) The formation of a group in January 2008 to develop and recommend to ICAO an aggressive Programme of Action on International Aviation and Climate Change. This high-level group, known as GIACC, is composed of Senior government officials representative of all ICAO regions, with the equitable participation of developing and developed States. The work of GIACC is inclusive and involves consultation with all stakeholders concerned. GIACC held its first meeting in February 2008 and the second in July. In all, four meetings are planned, following which the Council of ICAO will convene a high level meeting to review the Programme of Action recommended by GIACC.

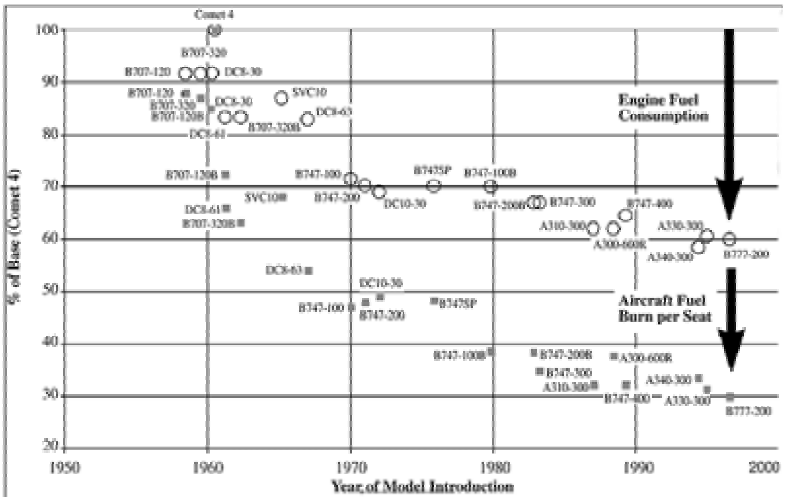
The decisions and recommendations of the Assembly on environmental protection issues are contained in Assembly Resolution A36-22 – *"Consolidated Statement of continuing policies and practices related to environmental protection"*. GIACC's recommendations on actions to be taken and common strategy to be applied are consistent with Appendix K of this Resolution. The Group will conduct work on the basis of consensus, avail itself of the technical work of CAEP while taking into consideration developments in other UN bodies. It will also make periodic reports. This Resolution is enclosed in Annex 1 of this paper.

2.1 Technology

With constant improvements in fuel efficiency from technological innovations, carbon dioxide emissions from aviation are growing at a slower rate than air traffic. Today's modern, large transport aircraft are 70% more efficient than they were 40 years ago. Improvement in engine fuel efficiency has come mainly from the

use of modern high-bypass engine technology that relies on increasing engine pressure ratios and higher temperature combustors as a means of increasing engine efficiency.

Figures 9 and 10 show the fuel efficiency improvement trends in large commercial aircraft resulting from innovations in airframe and engine designs from the early 1960s until today.



IPCC Special Report on Aviation And the Global Atmosphere

Figure 9 – Trends in transport aircraft fuel efficiency Source: IPCC

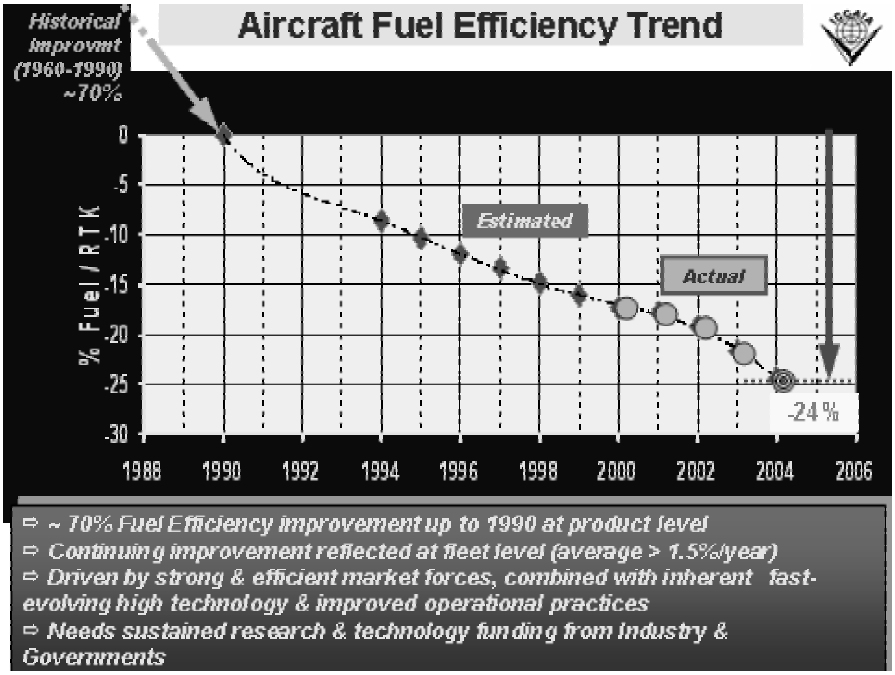


Figure 10 – Fuel Efficiency Trends by Generation of Engine Source: ICCAIA

There has been a notable increase in NO_x stringency translating into a reduction in allowed NOx levels, of about 40 percent beyond the original ICAO standard for NO_x adopted in 1981 (applicable in 1986), as shown in Figure 11. Although NO_x Standards were initially intended to address local air quality, they also contribute to reduce the impact of aviation on climate, as NO_x may be a precursor of ozone formation.

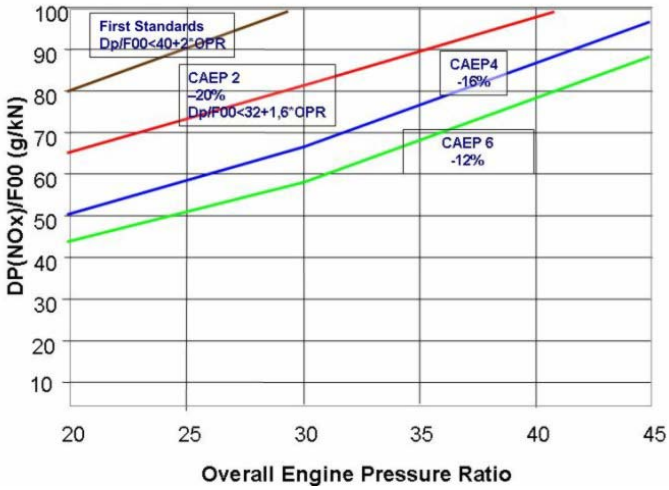


Figure 11 – ICAO NOx Emissions Stringency Trends Source: ICAO

Successful initiatives have led to substantive reductions in worldwide passenger air traffic fuel consumption (litres per passenger per 100 kms). Aircraft in the 1970s consumed about 12 litres of fuel to carry one passenger over a distance of 100 kilometres. Figure 12 illustrates technological improvements in the world passenger fleet. Fuel consumption averaged 8 litres per passenger/100 km in 1985, 5 litres per passenger/100 km in 2005, and is projected to come down to 3 litres per passenger/100 km in 2025. The A-380 has a fuel efficiency of 2.9 litres per passenger/100 km in 2005 (20 years ahead of the projected fuel efficiency average for the world fleet). It therefore generates CO_2 emissions as low as 80g per passenger kilometre. It is noteworthy that this is comparable to the level of fuel efficiency for a mid-sized diesel car. Current regulatory proposals for the car industry aim at 140g of CO_2 per kilometre in 2009 and 120g in 2012. Boeing's new B-787 Dreamliner aircraft is estimated to be 20 percent more fuel efficient than comparable size aircraft.

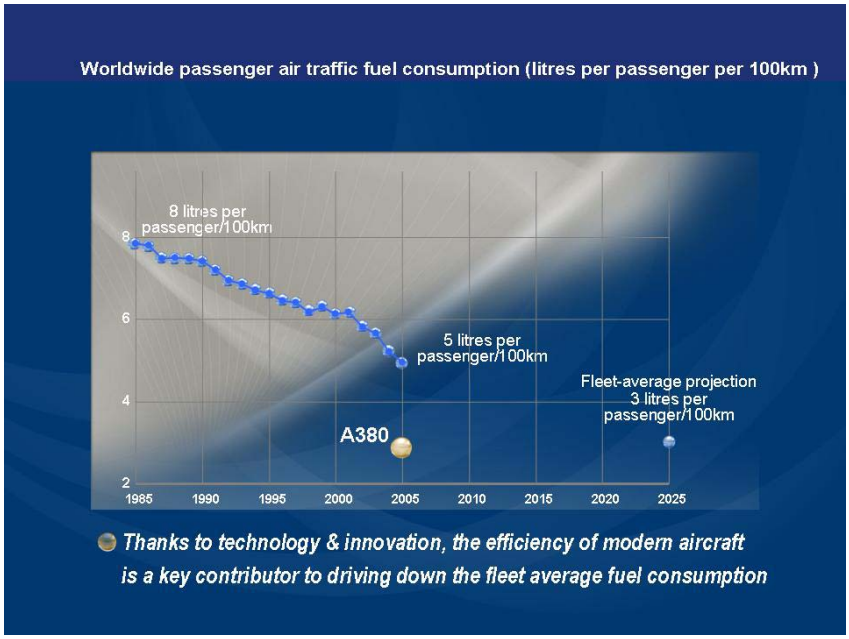


Figure 12 - Changes in Aircraft Fuel Efficiency - Source: Airbus.

2.1.1 Main achievements in technology

The introduction of ICAO Standards has contributed to the introduction of new technologies in the in-service fleet and to substantial reductions of NOx, HC and CO_2 and continued improvement is expected. Mandatory certification of new aircraft according to ICAO Standards has resulted in more efficient and cleaner aircraft.

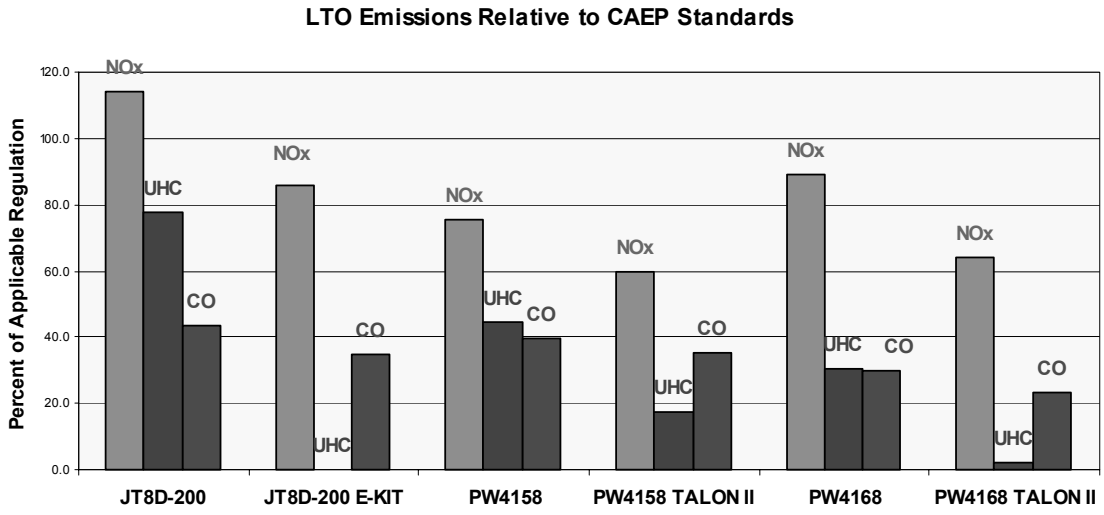


Figure 13 – Relative Reductions in Pollutants from Aviation by Engine Type Source: Pratt & Whitney.

Figure 13 shows examples of relative reductions in emissions levels from landings and take-off (LTO) before and after implementation of ICAO's Standards. For example, in the first comparison from left to right for the

Pratt & Whitney JT8D-200 engines, emissions levels for NOx, UHC, and CO are at their highest. However, after compliance with ICAO's Standards from P&W JT8D-200 E-Kit, the overall levels of emissions dropped significantly. In fact, unburned hydrocarbons have been virtually eliminated. Similar examples exist for aircraft engines from other manufacturers.

2.1.2 Future work

CAEP is currently studying the possibility of having medium and long term fuel burn technology goals, including the study of the potential use of alternative fuels and the development of a new environmental technical manual for aircraft engine emissions. Future work also includes the possible development of CO_2/fuel efficiency metrics and parameters. The possibility of using alternative fuels is also being researched by the major aircraft manufacturers, as described in the following paragraphs, and it is foreseen that ICAO will play a crucial role by assisting with the development of the regulatory framework.

Alternative Fuels

Currently, most civil aviation aircraft around the world use kerosene based on crude oil. This fuel provides a good balance of properties required for aviation. However, concerns over rising fuel costs, energy supply security and the environment, have led to the need to investigate the development of alternative fuels. A viable alternative aviation fuel could offer important benefits such as stabilizing world fuel prices and reducing the uncertainty and vulnerability that comes from too much reliance on petroleum as the main fuel source. In addition, alternative fuels could increase the environmental performance of air transport, allowing it to substantially reduce CO_2 emissions.

Aircraft and engine manufacturers are currently investigating synthetic jet fuels (e.g. from coal, natural gas, or other hydrocarbon feedstock) as well as bio-fuels. The type of fuel that is of immediate interest to aviation is termed a "drop-in" fuel, (i.e. a direct substitute fuel) that can be used without any substantial modification to engine or aircraft.

2.2 Operational measures

A significant way of achieving reduction in emissions is to shorten flight times and hence fuel consumption through improvements to the air traffic management (ATM) system. Such improvements have the potential to provide more direct routings for aircraft, as well as reducing the time spent in holding patterns waiting to land or queuing while waiting to depart.

According to the 1999 IPCC Special Report, improvements in ATM operational procedures could reduce aviation fuel burn by between 6 and 18%. A further 2 to 6% could come from improvements in other operational measures.

ICAO's main focus for operational measures is on the Global Air Navigation Plan. This plan requires environmental aspects to be taken into account right from the outset, when designing, developing and operating ATM systems. Emissions-related aspects of the plan include the flexible use of airspace; air traffic flow management; dynamic and flexible route management; terminal area design and management; aerodrome design and management; and performance based navigation.

2.2.1 Main achievements in operational measures

The aviation community has been working on ATM operational improvements for decades. The work accelerated with the onset of Communication/Navigation/Surveillance and ATM systems (CNS/ATM). Technology development has been more rapid in recent years and improvements are now coming about even quicker. A major operational improvement was the implementation of Reduced Vertical Separation Minima (RVSM), which brought significant operational benefits to aircraft operators in terms of reduced fuel burn, availability of optimal flight levels, and increase in capacity, while also benefiting the environment.

ICAO supported the development of RVSM, which was first implemented in 1997. RVSM has led to significant environmental benefits and will soon cover all airspace around the world. Studies[9] in the European regions have shown that RVSM leads to a reduction of NOx emissions, sulphur oxide emissions, and the reduction of total fuel burn (average of 80 kg fuel saving per flight).

Additional ICAO guidance to achieve fuel efficiency through operational measures is provided in Circular 303 - Operational Opportunities to Minimize Fuel Use and Reduce Emissions. That document identifies and reviews various operational opportunities and techniques for minimizing fuel consumption, and therefore emissions, in civil aviation operations. Operations covered in the guidance are: aircraft ground-level and in-flight operations, ground service equipment (GSE) and auxiliary power units (APUs), with potential actions to facilitate their broader application.

2.2.2 Future work

ICAO has a central role to play in planning for the implementation of operational improvements. In addition to developing the necessary standards and guidance material, ICAO has developed a global ATM Operational Concept that was widely endorsed and used as the basis for planning. ICAO also provides the planning framework through the Global Air Navigation Plan and several other documents and tools that support planning and implementation efforts.

Every ICAO region has identified performance objectives and has developed work programmes to bring near and medium term benefits, while integrating those programmes with the extensive work already accomplished.

Work is also under way to define operational goals for fuel burn, to update Circular 303 and on new guidance material on Continuous Descent Approach.

2.3 Market based measures

Market-based measures are policy tools designed to achieve environmental goals at a lower cost and in a more flexible manner than traditional command and control regulatory measures. ICAO has developed policies and guidance material and has been collecting information on three market-based measures to reduce emissions: voluntary measures; levies and emissions trading. The Organization is also exploring the potential use of carbon offsets for aviation.

In order to facilitate the exchange of information on voluntary activities aimed at reducing the impact of greenhouse gases (GHG) from aviation on climate, ICAO has collected information on voluntary actions by

[9] EUROCONTROL January 2002.

States and aviation stakeholders and has placed it on the ICAO website. Sharing the information will help entities to initiate environmental protection measures or improve their current activities. A template agreement for voluntary measures was developed and is available to States.

ICAO has also published guidance on local emission-related levies (*Guidance on Aircraft Emissions Charges Related to Local Air Quality* (Doc 9884). It also has long-standing policies covering charges in general and has developed separate policy guidance to States on taxation (*ICAO's Policies on Taxation in the Field of International Air Transport,* Doc 9082).

Nevertheless, the current focus of ICAO work in market-based measures to address aviation emissions is emissions trading. ICAO has developed guidance for use by States for incorporating international aviation emissions into trading schemes. The guidance focuses on aviation-specific issues, identifies options and offers potential solutions among which that:

- Aircraft operators be the accountable international aviation entity for purposes of emissions trading;
- Obligations be based upon total aggregated emissions from all covered flights performed by each aircraft operator included in the scheme;
- States, in applying an inclusion threshold, consider aggregate air transport activity (e.g. CO2 emissions) and/or aircraft weight as the basis for inclusion;
- States start with an emissions trading scheme that includes CO_2 alone;
- States apply the Inter-governmental Panel on Climate Change definition of international and domestic emissions for the purpose of accounting for greenhouse gas emissions as applied to civil aviation;
- States will need to put in place an accounting arrangement that ensures that emissions from international aviation are counted separately and not against the specific reduction targets that States may have under the Kyoto Protocol;
- Regarding trading units, States will need to consider economic efficiency, environmental integrity, and equity and competitiveness when making a choice.

On the question of geographic scope the guidance recommends that : "*States that wish to incorporate emissions from international aviation into their emissions trading schemes consistent with ICAO A36-2 (Appendix L) should not implement an emissions trading system on other Contracting States' aircraft operators except on the basis of mutual agreement between those States*".

The last ICAO Assembly agreed on the importance of emissions trading as a major tool, together with the reduction of emissions at source and operational measures, for controlling the impact of aviation emissions on the environment. A main point of discussions was how to reconcile the concept of common but differentiated responsibilities contained in the Framework Convention with the concept of non-discrimination contained in the Convention on International Civil Aviation. Of particular concern among the majority of States was the inclusion of operators from other States providing services to a State or region, in an emissions trading scheme being operated by that State or region, which would be applied to all emissions from the flight, even those emissions that were created outside the boundaries of that State or region. These States considered that participation in an emissions trading scheme should only be on the basis of mutual consent. An Assembly Resolution (A36-22) was consequently developed which contained this element of mutual consent. Forty-two European States (which comprise approximately 20% of ICAO's member States) reserved their position regarding this aspect of the resolution.

CAEP is now addressing the main issues related to linking GHG emissions trading schemes including aviation. It is also addressing the potential for emissions offset measures to mitigate effects of aviation on climate change and on the potential for using emissions trading and offsets to address local air quality.

2.3.2 ICAO Carbon Calculator

ICAO has developed a carbon calculator and methodology for the calculation of carbon dioxide emissions attributable to air travel. Officially launched in July 2008, the Calculator makes it possible to estimate the emissions attributed to their air travel. It is simple to use and requires only a limited amount of information from the user. The methodology applies the best publicly available industry data to account for various factors such as aircraft types, route specific data, passenger load factors and cargo carried. The ICAO Calculator is universal, neutral and transparent. The feedback so far from Contracting States, industry and users is very positive and ICAO intends to apply suggestions received to continually improve the Carbon Calculator.

2.4 Cooperation with other UN agencies

ICAO, as the UN specialized agency for civil aviation, is collaborating with its UN sister organizations in the global effort to limit or reduce emissions from international civil aviation and it is determined to provide the world with the leadership and guidance required to move towards a sustainable global air transport system, in an environmental-friendly manner.

During the past years ICAO participated in numerous UN high-level environmental events and provided technical advice to UN panels, notably the UNFCCC and the IPCC. ICAO also cooperates with a number of other UN bodies including a) the United Nations Environment Programme (UNEP); b) the Montreal Protocol on Substances that Deplete the Ozone Layer; c) the UN Commission on Sustainable Development (CSD); d) the UN Economic Commission for Europe (UNECE) Convention on Long-range Transboundary Air Pollution; e) the World Health Organization (WHO); f) the International Maritime Organization (IMO); and g) the World Meteorological Organization (WMO) and most recently with the h) World Tourism Organization (UNWTO).

3. Main developments in ICAO since the Bonn Climate Change Talks

Since ICAO last reported in Bonn, two major events haven taken place in Montreal. ICAO organized a workshop on aviation and carbon markets in June and GIACC held its second meeting in July. An update is also presented below, on the ICAO Carbon Calculator developments.

3.1 Aviation and Carbon Markets Workshop

In the context of providing timely information, ICAO organized in Montréal, in June 2008, a Workshop on aviation and carbon markets. The keynote speaker at this event was Mr. Yvo de Boer, Executive Secretary of the UNFCCC via video conference. The objective of the event was to familiarize participants with key issues related to aviation emissions and carbon markets. A variety of approaches including emissions trading and carbon offset programmes were addressed, together with a broad discussion on other Kyoto flexible mechanisms and the opportunities for a global aviation carbon market. The workshop programme included

presentations on emerging discussions on possible funding mechanisms for mitigation and adaptation. It is worthy of note that several ICAO Contracting States have already initiated voluntary initiatives on aviation based on ICAO guidance in this area. More information on this event, including copies of presentations, may be found on the ICAO website at www.icao.int/2008/wacm.

3.2 Developments in the GIACC

In July, GIACC held its second meeting and discussed the possible establishment of short, medium and long term goals for fuel burn. Three smaller working groups were formed to expedite work on goals, measures and means to evaluate progress to reduce aviation GHG. The next meeting will take place in February 2009 and the recommendations of GIACC are to be submitted to ICAO at a time which would take into account COP 15, in December 2009.

3.3 Carbon Calculator future development

ICAO is now in the phase of disseminating the methodology and promoting the use of the tool by other entities. Several airlines and other UN agencies have shown interest in using the ICAO calculator on their web sites and several suggestions have been received via the online suggestions forum.

Frequent requests for guidance regarding the use of non-CO_2 multipliers have also been received from the public and ICAO has asked the IPCC to provide guidance on the appropriateness of multipliers. Therefore, the inclusion of a multiplier for the consideration of non-CO_2 gases will be evaluated when the scientific community reaches agreement on the issue.

ICAO is also considering the best way to link the tool to offset programmes. This is exploratory work and more information will be available at the beginning of next year.

4. Next steps and concluding remarks

International aviation's contribution to the total CO_2 emissions generated by anthropogenic activities is relatively small compared to other energy and transport sectors, but it is growing. While domestic emissions can be treated similarly to other sectors, emissions from international aviation are, by definition, global in nature and cannot be circumscribed to national or recognized geographic boundaries. Assigning international emissions is an extremely complex task at best and difficult to implement or enforce.

ICAO has developed policies, standards and guidance on aircraft engine emissions for the use of parties in their national policies to reduce emissions. This has lead to 70% more fuel efficient aircraft today than the first generation of jet aircraft. General improvements are to be expected when the ICAO Global Air Traffic Management Plan is implemented worldwide. Furthermore several ICAO Contracting States, like Japan and Canada, have already initiated voluntary initiatives based on ICAO guidance.

Regarding the specificities of developed and developing countries, ICAO has already considered different treatment of States and Regions such as for example the Policy on aircraft noise. The differential phase out of Chapter 2 aircraft, adopted in ICAO, is an example of success in environmental guidance and policies considering a special treatment for developed and developing countries in the implementation of ICAO policy. It should also be noted that, for the first time last year, the Principle of Common but Differentiated

Responsibilities (CBDR) was included in the Assembly Resolution, and GIACC's programme of action, to be presented in 2009, is also taking this principle into consideration.

To be able to clearly assess the effectiveness of global measures and to monitor progress, a clear baseline to which the measures to reduce emissions can be compared and an objective and timelines for future emissions reduction still need to be defined. Availability of timely data on the current and future growth prospects of aviation emissions is paramount to enable Parties to include international aviation emission reductions into their overall greenhouse gases reduction objectives.

ICAO provides an official, unbiased and effective international forum that has demonstrated its effectiveness in developing globally harmonized environmental standards that have substantially increased the energy efficiency of air transport worldwide.

ICAO is also in the best position to ensure optimum compatibility between environmental sustainability and the safety, security and efficiency of the global air transport system, without which the continued integrity of air operations could be compromised. That is to say that an environmentally-friendly mode of transportation must also be a safe, secure and efficient one. ICAO believes that an effective solution for aviation emissions will involve a global framework encompassing a basket of measures of a technological, operational and market-based nature and tailored to the specific realities of States and regions. This basket of measures is being considered by the GIACC and will be part of the Programme of Action to be presented to COP15 in 2009.

This is particularly important given that air transport is a driver of economic activity and, as such, a key contributor to achieving the United Nations Millennium Development Goals, particularly in less-developed, landlocked countries which depend on air travel to reach international markets for their goods and for attracting business and tourist travel.

While direct cooperation between the UNFCCC and the ICAO processes is essential, effective collaboration must also be encouraged within each of the respective Contracting States. In many cases, for example, there should be more communication between government authorities responsible for the environment and those responsible for civil aviation, so that the positions and proposals of Contracting States in international gatherings of ICAO and UNFCCC are better aligned so as to allow a more complete view of a State's policies and programmes. This will ultimately result in a true reflection of the will of the Parties to these processes.

ANNEX 1
A36-22 - Consolidated Statement of continuing policies and practices related to environmental protection

Whereas in Resolution A35-5 the Assembly resolved to continue to adopt at each ordinary Session a consolidated statement of continuing ICAO policies and practices related to environmental protection;

Whereas Resolution A35-5 consists of an introductory text and a number of Appendices concerning specific but interrelated subjects;

Considering the need to reflect developments that have taken place since the 35th Session of the Assembly in the field of aircraft noise and engine emissions, including new ICAO guidance material on market-based measures to limit or reduce emissions from aviation; and

Considering the need to define specific appendices to reflect ICAO's policy to address aviation's impact on local air quality (Appendix H) and global climate (Appendices I, J, K and L);

The Assembly:

1. *Resolves* that the Appendices attached to this Resolution and listed below constitute the consolidated statement of continuing ICAO policies and practices related to environmental protection, as these policies exist at the close of the 36th Session of the Assembly:

Appendix A — General

Appendix B — Development of Standards, Recommended Practices and Procedures and/or guidance material relating to the quality of the environment

Appendix C — Policies and programmes based on a "balanced approach" to aircraft noise management

Appendix D — Phase-out of subsonic jet aircraft which exceed the noise levels in Volume I of Annex 16

Appendix E — Local noise-related operating restrictions at airports

Appendix F — Land-use planning and management

Appendix G — Supersonic aircraft — The problem of sonic boom

Appendix H — Aviation impact on local air quality

Appendix I — Aviation impact on global climate — Scientific understanding

Appendix J — Aviation impact on global climate — Cooperation with UN and other bodies

Appendix K — ICAO Programme of Action on international aviation and climate change

Appendix L — Market-based measures, including emissions trading

2. Requests the Council to submit at each ordinary session of the Assembly for review a consolidated statement of continuing ICAO policies and practices related to environmental protection; and

3. Declares that this resolution supersedes Resolution A35-5.

APPENDIX A

General

Whereas the preamble to the *Convention on International Civil Aviation* states that "the future development of international civil aviation can greatly help to create and preserve friendship and understanding among the nations and peoples of the world . . ." and Article 44 of that Convention states that ICAO should "develop the principles and techniques of international air navigation and . . . foster the planning and development of international air transport so as to . . . meet the needs of the peoples of the world for safe, regular, efficient and economical air transport";

Whereas many of the adverse environmental effects of civil aviation activity can be reduced by the application of comprehensive measures embracing technological improvements, more efficient air traffic management and operational procedures and the appropriate use of airport planning, land-use planning and management and market based measures;

Whereas all ICAO Contracting States agreed to continue to pursue all aviation matters related to the environment and also maintain the initiative in developing policy guidance on these matters, and not leave such initiatives to other organizations;

Whereas other international organizations are emphasising the importance of environmental policies affecting air transport;

Whereas the sustainable growth of aviation is important for future economic growth and development, trade and commerce, cultural exchange and understanding among peoples and nations; therefore prompt action must be taken to ensure that it is compatible with the quality of the environment and develops in ways that alleviate adverse impacts;

Whereas reliable and best available information on the environmental effects of aviation is essential for the development of policy by ICAO and its Contracting States;

Whereas as far as there are recognized interdependencies of the environmental effects from aviation, such as noise and engine emissions, they need to be considered when defining source control and operational mitigation policies;

Whereas airspace management and design can play a role in addressing the impacts of aviation greenhouse gas emissions on the global climate, and the related economic and institutional issues need to be addressed by States, either individually or collectively on a regional basis;

Whereas cooperation with other international organizations is important to progress the understanding of aviation's impacts on the environment and in order to develop the appropriate policies to address these impacts;

Recognizing the importance of research and development in fuel efficiency and alternative fuels for aviation that will enable international air transport operations with a lower environmental impact;

The Assembly:

1. *Declares* that ICAO, as the lead United Nations Agency in matters involving international civil aviation, is conscious of and will continue to address the adverse environmental impacts that may be related to civil aviation activity and acknowledges its responsibility and that of its Contracting States to achieve maximum compatibility between the safe and orderly development of civil aviation and the quality of the environment. In carrying out its responsibilities, ICAO and its Contracting States will strive to:

a) limit or reduce the number of people affected by significant aircraft noise;

b) limit or reduce the impact of aviation emissions on local air quality; and

c) limit or reduce the impact of aviation greenhouse gas emissions on the global climate;

2. *Emphasizes* the importance of ICAO continuing to demonstrate its leadership role on all international civil aviation matters related to the environment and *requests* the Council to maintain the initiative in developing policy guidance on these matters, which recognises the seriousness of the challenges which the sector faces;

3. *Requests* the Council to assess regularly the present and future impact of aircraft noise and aircraft engine emissions and to continue to develop tools for this purpose;

4. *Requests* the Council to maintain and update knowledge of the interdependencies and trade-offs related to measures to mitigate the impact of aviation on the environment so as to optimise decision making;

5. *Requests* the Council to establish a set of aviation environmental indicators which States could use to evaluate the performance of aviation operations and the effectiveness of standards, policies and measures to mitigate aviation's impacts on the environment;

6. *Requests* the Council to disseminate information on the present and future impact of aircraft noise and aircraft engine emissions and on ICAO policy and guidance material in the environmental field, in an appropriate manner, such as through regular reporting and workshops;

7. *Invites* States to continue their active support for ICAO's environment-related activities, and urges Contracting States to support activities not foreseen in the budget by providing a reasonable level of voluntary contributions;

8. *Invites* States and international organizations to provide the necessary scientific information to enable ICAO to substantiate its work in this field;

9. *Encourages* the Council to continue to cooperate closely with international organizations and other UN bodies on the understanding of aviation impacts on the environment and on the establishment of policies to address such impacts; and

10. *Urges* States to refrain from environmental measures that would adversely affect the orderly and sustainable development of international civil aviation.

APPENDIX B

Development of Standards, Recommended Practices and Procedures and/or guidance material relating to the quality of the environment

Whereas the problem of aircraft noise in the vicinity of many of the world's airports, which continues to arouse public concern and limit airport infrastructure development, requires appropriate action;

Whereas the Council has adopted Annex 16, Volume I — *Aircraft Noise*, which comprises noise certification standards for subsonic aircraft (except Short Take Off and Landing /Vertical Take Off and Landing) and has notified Contracting States of this action;

Recognizing noise and Local Air Quality -related charges are in use at some airports and ICAO policy guidance exists on this subject (*ICAO's Policies on Charges for Airports and Air Navigation Services*, Doc 9082);

Whereas aircraft engine emissions have an environmental impact at both the local and global levels which, while not fully understood, is a cause of concern;

Whereas the Council has adopted Annex 16, Volume II — *Aircraft Engine Emissions*, which comprises emissions certification standards for new aircraft engines and has notified States of this action;

Whereas the Council has established a Committee on Aviation Environmental Protection (CAEP) for the purpose of assisting in the further development of Standards, Recommended Practices and Procedures and/or guidance material on aircraft noise and aircraft engine emissions; and

Noting Resolution A35-14 (Appendix Q), drawing the attention of aircraft manufacturers and operators to the need for future generations of aircraft to be designed so that they are capable of being operated efficiently, and with the least possible environmental disturbance, from aerodromes used for the operation of present-day jet aircraft;

The Assembly:

1. *Welcomes* the adoption by the Council in June 2001 of the new, more stringent aircraft noise standard in Annex 16, Volume I, Chapter 4 and the new, more stringent standards for emissions of oxides of nitrogen to be implemented on 1 January 2008;

2. *Requests* the Council, with the assistance and cooperation of other bodies of the Organization and of other international organizations, to continue with vigour the work related to the development of Standards, Recommended Practices and Procedures and/or guidance material dealing with the impact of aviation on the environment;

3. *Welcomes* the adoption by the Council in March 2007 of the medium- and long-term technology goals for Nitrogen Oxides (NO_x);

4. *Requests* the Council, with the assistance and cooperation of other bodies of the Organization and of other international organizations, to establish medium and long term technology and operational goals related to noise and fuel burn, in addition to the recent development of NO_x goals;

5. *Requests* the Council to ensure that its Committee on Aviation Environmental Protection (CAEP) pursues its work programme in the noise and emissions fields expeditiously in order that appropriate solutions can be developed as quickly as possible, and that the necessary resources are made available to do so;

6. *Urges* Contracting States from regions of the world that are currently under-represented in CAEP to participate in the Committee's work;

7. *Requests* the Council to provide States and International Organizations information on available measures to reduce the impact of aviation operations on the environment so that action can be taken using the appropriate measures;

8. *Urges* Contracting States to follow, where appropriate, the ICAO provisions developed pursuant to Clause 2 of this Appendix; and

9. *Requests* the Council to continue the work on developing and employing scenarios for assessing the future environmental impact of aviation emissions and to cooperate with the IPCC in this area.

APPENDIX C

Policies and programmes based on a "balanced approach" to aircraft noise management

Whereas a goal of ICAO is to promote the highest practicable degree of consistency in international civil aviation, including environmental regulations;

Whereas the uncoordinated development of national and regional policies and programmes for the alleviation of aircraft noise could hinder the role of civil aviation in economic development;

Whereas the severity of the aircraft noise problem at many airports has given rise to measures which limit aircraft operations and has provoked vigorous opposition to the expansion of existing airports or construction of new airports;

Whereas ICAO has accepted full responsibility for pursuing a course aimed at achieving maximum compatibility between the safe, economically effective and orderly development of civil aviation and the quality of the environment, and is actively pursuing the concept of a "balanced approach" for the reduction of aircraft noise and guidance on how States might apply such an approach;

Whereas the balanced approach to noise management developed by ICAO consists of identifying the noise problem at an airport and then analysing the various measures available to reduce noise through the exploration of four principal elements, namely reduction at source, land-use planning and management, noise abatement operational procedures and operating restrictions, with the goal of addressing the noise problem in the most cost-effective manner;

Whereas the assessment of present and future impact of aviation noise is an essential tool for the development of policy by ICAO and its Contracting States;

Whereas the process for implementation and decisions between elements of the balanced approach is for Contracting States and it is ultimately the responsibility of individual States to develop appropriate solutions to the noise problems at their airports, with due regard to ICAO rules and policies;

Whereas, the ICAO guidance developed to assist States in implementing the balanced approach (*Guidance on the Balanced Approach to Aircraft Noise Management* (Doc 9829)) has been subsequently updated;

Recognizing that solutions to noise problems need to be tailored to the specific characteristics of the airport concerned, which calls for an airport-by-airport approach, and that similar solutions could be applied if similar noise problems are identified at airports;

Recognizing that measures to address noise may have significant cost implications for operators and other stakeholders, particularly those from developing countries;

Recognizing that States have relevant legal obligations, existing agreements, current laws and established policies which may influence their implementation of the ICAO "balanced approach";

Recognizing that some States may also have wider policies on noise management; and

Considering that the improvements in the noise climate achieved at many airports through the replacement of Chapter 2 compliant aircraft (aircraft which comply with the noise certification standards in Volume I, Chapter 2 of Annex 16 but which exceed the noise levels in Volume I, Chapter 3 of Annex 16) by quieter aircraft should be safeguarded by taking account of the sustainability of future growth and should not be eroded by incompatible urban encroachment around airports;

The Assembly:

1. *Calls upon* all ICAO Contracting States and international organizations to recognize the leading role of I*CAO in dealing with the problems of aircraft noise;*

2. *Urges* States to:

   a) adopt a balanced approach to noise management, taking full account of ICAO guidance (Doc 9829), relevant legal obligations, existing agreements, current laws and established policies, when addressing noise problems at their international airports;

   b) institute or oversee a transparent process when considering measures to alleviate noise, including:

      1) assessment of the noise problem at the airport concerned based on objective, measurable criteria and other relevant factors;

2) evaluation of the likely costs and benefits of the various measures available and, based on that evaluation, selection of measures with the goal to achieve maximum environmental benefit most cost-effectively; and

3) provision for dissemination of the evaluation results, for consultation with stakeholders and for dispute resolution;

3. *Encourages* States to:

a) promote and support studies, research and technology programmes aimed at reducing noise at source or by other means;

b) apply land-use planning and management policies to limit the encroachment of incompatible development into noise-sensitive areas and mitigation measures for areas affected by noise, consistent with Appendix F to this Resolution;

c) apply noise abatement operational procedures, to the extent possible without affecting safety; and

d) not apply operating restrictions as a first resort but only after consideration of the benefits to be gained from other elements of the balanced approach and in a manner which is consistent with Appendix E to this Resolution and taking into account the possible impact of such restrictions at other airports;

4. *Requests* States to:

a) work closely together to ensure the harmonization of programmes, plans and policies to the extent possible;

b) ensure that the application of any measures to alleviate noise are consistent with the non-discrimination principle in Article 15 of the Chicago Convention; and

c) take into consideration the particular economic conditions of developing countries;

5. *Invites* States to keep the Council informed of their policies and programmes to alleviate the problem of aircraft noise in international civil aviation;

6. *Requests* the Council to:

a) assess continuously the evolution of the impact of aircraft noise;

b) ensure that the guidance on the balanced approach in Doc 9829 is current and responsive to the requirements of States; and

c) promote the use of the balanced approach, for example through workshops; and

7. *Calls upon* States to provide appropriate support for this work on ICAO guidance and any additional work on methodologies, and for the assessment of the impact or effectiveness of measures under the balanced approach as necessary.

APPENDIX D

Phase-out of subsonic jet aircraft which exceed the noise levels in Volume I of Annex 16

Whereas certification standards for subsonic jet aircraft noise levels are specified in Volume I of Annex 16;

Whereas for the purpose of this Appendix, a phase-out is defined as withdrawal of a noise-based category of aircraft from international operations at all airports in one or more States;

Whereas the Committee on Aviation Environmental Protection has concluded that a general phase-out of Chapter 3 aircraft operations by all the countries which imposed a phase-out on operations of Chapter 2 aircraft is not supported on cost-benefit grounds;

Whereas some States have implemented or initiated phase-outs of aircraft which exceed the noise levels in Volume I, Chapter 3 of Annex 16, or are considering so doing;

Recognizing that the noise standards in Annex 16 are not intended to introduce operating restrictions on aircraft;

Recognizing that operating restrictions on existing aircraft may increase the costs of airlines and could impose a heavy economic burden, particularly on aircraft operators which may not have the financial resources to re-equip their fleets, such as those from developing countries; and

Considering that resolution of problems due to aircraft noise must be based on the mutual recognition of the difficulties encountered by States and a balance among their different concerns;

The Assembly:

1. *Urges* States not to introduce any phase-outs of aircraft which exceed the noise levels in Volume I, Chapter 3 of Annex 16 before considering:

   a) whether the normal attrition of existing fleets of such aircraft will provide the necessary protection of noise climates around their airports;

   b) whether the necessary protection can be achieved by regulations preventing their operators from adding such aircraft to their fleets through either purchase, or lease/charter/interchange, or alternatively by incentives to accelerate fleet modernization;

   c) whether the necessary protection can be achieved through restrictions limited to airports and runways the use of which has been identified and declared by them as generating noise problems and limited to time periods when greater noise disturbance is caused; and

   d) the implications of any restrictions for other States concerned, consulting these States and giving them reasonable notice of intention;

2. *Urges* States which, despite the considerations in Resolving Clause 1 above, decide to phase out aircraft which comply with the noise certification standards in Volume I, Chapter 2 of Annex 16 but which exceed the noise levels in Volume I, Chapter 3 of Annex 16:

a) to frame any restrictions so that Chapter 2 compliant aircraft of an individual operator which are presently operating to their territories may be withdrawn from these operations gradually over a period of not less than 7 years;

b) not to restrict before the end of the above period the operations of any aircraft less than 25 years after the date of issue of its first individual certificate of airworthiness;

c) not to restrict before the end of the period the operations of any presently existing wide-body aircraft or of any fitted with engines that have a by-pass ratio higher than 2 to 1; and

d) to inform ICAO, as well as the other States concerned, of all restrictions imposed;

3. *Strongly encourages* States to continue to cooperate bilaterally, regionally and inter-regionally with a view to:

a) alleviating the noise burden on communities around airports without imposing severe economic hardship on aircraft operators; and

b) taking into account the problems of operators of developing countries with regard to Chapter 2 aircraft presently on their register, where they cannot be replaced before the end of the phase-out period, provided that there is proof of a purchase order or leasing contract placed for a replacement Chapter 3 compliant aircraft and the first date of delivery of the aircraft has been accepted;

4. *Urges* States not to introduce measures to phase out aircraft which comply, through original certification or recertification, with the noise certification standards in Volume I, Chapters 3 or 4 of Annex 16;

5. *Urges* States not to impose any operating restrictions on Chapter 3 compliant aircraft, except as part of the balanced approach to noise management developed by ICAO and in accordance with Appendices C and E to this Resolution; and

6. *Urges* States to assist aircraft operators in their efforts to accelerate fleet modernization and thereby prevent obstacles and permit all States to have access to lease or purchase aircraft compliant with Chapter 3, including the provision of multilateral technical assistance where appropriate.

APPENDIX E

Local noise-related operating restrictions at airports

Whereas certification standards for subsonic jet aircraft noise are specified in Volume I of Annex 16;

Whereas for the purposes of this Appendix an operating restriction is defined as any noise-related action that limits or reduces an aircraft's access to an airport;

Whereas Appendix C to this Resolution calls for States to adopt a balanced approach to noise management when addressing noise problems at their international airports;

Whereas the scope for further reductions in noise at source is limited in that past improvements in noise reduction technology are being gradually assimilated into the fleet but no significant breakthroughs in technology are anticipated in the foreseeable future;

Whereas at many airports, land-use planning and management and noise abatement operational procedures are already being used and other noise mitigation measures are in place, although urban encroachment continues in certain cases;

Whereas implementation of the phase-out of aircraft which comply with the noise certification standards in Volume I, Chapter 2 of Annex 16 but which exceed the noise levels in Volume I, Chapter 3 of Annex 16 (as provided for in Appendix D to this Resolution) has been completed in some States and, assuming continued growth in aviation activity, without further action the number of people exposed to aircraft noise at some airports in those States may increase;

Whereas there are significant regional differences in the extent to which aircraft noise is expected to be a problem over the next two decades and some States have consequently been considering placing operating restrictions on certain aircraft which comply with the noise certification standards in Volume I, Chapter 3 of Annex 16;

Whereas if operating restrictions on Chapter 3 aircraft are introduced at certain airports, this should be based on the balanced approach and relevant ICAO guidance (Doc 9829) and should be tailored to the specific requirements of the airport concerned;

Whereas these restrictions could have a significant economic impact on fleet investments of aircraft operators from States other than those in which the restrictions are imposed;

Recognizing that these restrictions go beyond the policy established in Appendix D to this Resolution and other relevant policy guidance developed by ICAO;

Recognizing that ICAO places no obligation on States to impose operating restrictions on Chapter 3 aircraft;

Recognizing that the noise standards in Annex 16 were not intended to introduce operating restrictions on aircraft and, specifically, that the new standard contained in Annex 16, Volume I, Chapter 4 is based on the understanding that it is for certification purposes only; and

Recognizing in particular that States have legal obligations, laws, existing arrangements and established policies which may govern the management of noise problems at their airports and could affect the implementation of this Appendix;

The Assembly:

1. *Urges* States to ensure, wherever possible, that any operating restrictions be adopted only where such action is supported by a prior assessment of anticipated benefits and of possible adverse impacts;

2. *Urges* States not to introduce any operating restrictions at any airport on aircraft which comply with Volume I, Chapter 3 of Annex 16 before:

a) completing the phase-out of aircraft which exceed the noise levels in Volume I, Chapter 3 of Annex 16, at the airport concerned; and

b) fully assessing available measures to address the noise problem at the airport concerned in accordance with the balanced approach described in Appendix C;

3. *Urges* States which, despite the considerations in Resolving Clause 2 above, permit the introduction of restrictions at an airport on the operations of aircraft which comply, either through original certification or recertification, with Volume I, Chapter 3 of Annex 16:

a) to base such restrictions on the noise performance of the aircraft, as determined by the certification procedure conducted consistent with Annex 16, Volume I;

b) to tailor such restrictions to the noise problem of the airport concerned in accordance with the balanced approach;

c) to limit such restrictions to those of a partial nature wherever possible, rather than the complete withdrawal of operations at an airport;

d) to take into account possible consequences for air transport services for which there are no suitable alternatives (for example, long-haul services);

e) to consider the special circumstances of operators from developing countries, in order to avoid undue hardship for such operators, by granting exemptions;

f) to introduce such restrictions gradually over time, where possible, in order to take into account the economic impact on operators of the affected aircraft;

g) to give operators a reasonable period of advance notice;

h) to take account of the economic and environmental impact on civil aviation; and

i) to inform ICAO, as well as the other States concerned, of all such restrictions imposed; and

4. *Further urges* States not to permit the introduction of any operating restrictions aimed at the withdrawal of aircraft that comply, through either original certification or recertification, with the noise standards in Volume I, Chapter 4 of Annex 16.

APPENDIX F

Land-use planning and management

Whereas land-use planning and management is one of the four principal elements of the balanced approach to noise management;

Whereas the number of people affected by aircraft noise is dependent on the way in which the use of land surrounding an airport is planned and managed, and in particular the extent to which residential development and other noise sensitive activities are controlled;

Whereas activity may increase significantly at most airports and there is a risk that future growth may be constrained by inappropriate land use near airports;

Whereas the phase-out of subsonic jet aircraft which comply with the noise certification standards in Volume I, Chapter 2 of Annex 16 but which exceed the noise levels in Volume I, Chapter 3 of Annex 16 has succeeded at many airports in reducing the size of the noise contours depicting the areas where people are exposed to unacceptable noise levels as well as in reducing the total number of people exposed to noise;

Considering it essential that these improvements should be preserved to the greatest extent practicable for the benefit of local communities;

Whereas it is also expected that the new standard contained in Annex 16, Volume I, Chapter 4 will increase the opportunities for operators to replace aircraft in their fleets by quieter aircraft;

Recognizing that while land-use management includes planning activities that may primarily be the responsibility of local authorities, it nevertheless affects airport capacity, which in turn has implications for civil aviation; and

Whereas guidance material on appropriate land-use planning and noise mitigation measures is included in the Airport Planning Manual (Doc 9184), Part 2 — Land Use and Environmental Control, which has recently been updated;

The Assembly:

1. *Urges* States that have phased out operations of Chapter 2 aircraft at their airports as provided for in Appendix D to this Resolution, whilst preserving the benefits for local communities to the greatest extent practicable, to avoid inappropriate land use or encroachment whenever possible in areas where reductions in noise levels have been achieved;

2. *Urges* States to ensure that the potential reductions in noise levels to be gained from the introduction of quieter aircraft, particularly those complying with the new Chapter 4 standard, are also not avoidably compromised by inappropriate land use or encroachment;

3. *Urges* States, where the opportunity still exists to minimize aircraft noise problems through preventive measures, to:

a) locate new airports at an appropriate place, such as away from noise-sensitive areas;

b) take the appropriate measures so that land-use planning is taken fully into account at the initial stage of any new airport or of development at an existing airport;

c) define zones around airports associated with different noise levels taking into account population levels and growth as well as forecasts of traffic growth and establish criteria for the appropriate use of such land, taking account of ICAO guidance;

d) enact legislation, establish guidance or other appropriate means to achieve compliance with those criteria for land use; and

e) ensure that reader-friendly information on aircraft operations and their environmental effects is available to communities near airports; and

4. *Requests* the Council to:

a) ensure that the guidance on land use in Doc 9184 is current and responsive to the requirements of States; and

b) consider what steps might be taken to promote land-use management, particularly in those parts of the world where the opportunity may exist to avoid aircraft noise problems in the future.

APPENDIX G

Supersonic aircraft — The problem of sonic boom

Whereas since the introduction of supersonic aircraft in commercial service action has been taken to avoid creating unacceptable situations for the public due to sonic boom, such as interference with sleep and injurious effects to persons and property on land and at sea caused by the magnification of the sonic boom; and

Whereas the States involved in the manufacture of such supersonic aircraft, as well as other States, continue to carry out research into the physical, physiological and sociological effects of sonic boom;

The Assembly:

1. *Reaffirms* the importance it attaches to ensuring that no unacceptable situation for the public is created by sonic boom from supersonic aircraft in commercial service;

2. *Instructs* the Council, in the light of the available information and availing itself of the appropriate machinery, to review the Annexes and other relevant documents, so as to ensure that they take

due account of the problems which the operation of supersonic aircraft may create for the public and, in particular, as regards sonic boom, to take action to achieve international agreement on measurement of the sonic boom, the definition in quantitative or qualitative terms of the expression "unacceptable situations for the public" and the establishment of the corresponding limits; and

3. *Invites* the States involved in the manufacture of supersonic aircraft to furnish ICAO in due course with proposals on the manner in which any specifications established by ICAO could be met.

APPENDIX H

Aviation impact on local air quality

Whereas there are growing concerns about the impact of aviation on the atmosphere with respect to local air quality and the associated human health and welfare impacts;

Whereas many pollutants affecting local and regional air quality from aircraft engines have declined dramatically over the last few decades;

Whereas the impacts of aviation emissions of NO_x (nitrogen oxides), PM (particulate matter), and other gaseous emissions need to be further assessed and understood;

Whereas the impacts of aviation emissions on local and regional air quality is part of the total emissions in the affected area and should be considered in the broader context of all sources that contribute to the air quality concerns;

Whereas the actual local air quality and health impacts of aviation emissions depend on a series of factors among which are the contribution to the total concentrations and the number of people exposed in the area being considered;

Whereas ICAO has established technical standards and fostered the development of operational procedures that have reduced significantly local air quality pollution from aircraft*;*

Whereas Article 15 of the *Convention on International Civil Aviation* contains provisions regarding airport and similar charges, including the principle of non-discrimination, and ICAO has developed policy guidance for Contracting States regarding charges (*ICAO's Policies on Charges for Airports and Air Navigation Services*, Doc 9082) including specific guidance on noise-related charges and emissions-related charges for local air quality;

Whereas the ICAO Council had adopted on 9 December 1996 a policy statement of an interim nature on emission-related charges and taxes in the form of a resolution wherein the Council strongly recommends that any such levies be in the form of charges rather than taxes, and that the funds collected should be applied in the first instance to mitigating the environmental impact of aircraft engine emissions;

Whereas such charges should be based on the costs of mitigating the environmental impact of aircraft engine emissions to the extent that such costs can be properly identified and directly attributed to air transport;

Whereas the ICAO Council has adopted policy and guidance material related to the use of emission-related charges to address the impact of aircraft engine emissions at or around airports; and

Noting that the Council has agreed that it would be useful to develop a report that would consider the application of all measures relating to local air quality emissions, using technological, operational and market-based approaches and that ICAO is currently working on this issue*;*

The Assembly:

1. *Requests* the Council to monitor and develop its knowledge of, in cooperation with other relevant international bodies such as WHO, the effects of aviation emissions of particulate matter, nitrogen oxides and other gases on human welfare and health, and to disseminate information in this regard;

2. *Requests* the Council to continue its work to develop technologically feasible, environmentally beneficial and economically reasonable standards to further reduce the impact of local air pollution from aircraft;

3. Requests the Council continue its work to develop long-term technology and operational goals with respect to aviation environmental issues, including nitrogen oxides from aircraft;

4. *Requests* the Council continue to foster operational and air traffic improvements that reduce the impact of local air pollution from aircraft;

5. *Encourages* action by Contracting States, and other parties involved, to limit or reduce international aviation emissions affecting local air quality through voluntary measures and to keep ICAO informed;

6. *Welcomes* the development and promotion of guidance material on issues related to the assessment of airport-related air quality and requests the Council to actively pursue this activity, aiming for the completion of the Airport Air Quality guidance in 2010;

7. *Requests* the Council to work with States and stakeholders in promoting and sharing best practices applied at airports in reducing the adverse effects of aviation emissions on local air quality;

8. *Welcomes* the development of the guidance on emission charges related to local air quality and *requests* the Council to keep up-to-date such guidance and *urges* Contracting States to share information on the implementation of such charges; and

9. *Urges* Contracting States to ensure the highest practical level of consistency and take due account of ICAO policies and guidance on emissions charges related to local air quality.

APPENDIX I

Aviation impact on global climate - Scientific understanding

Whereas a comprehensive assessment of aviation's impact on the atmosphere is contained in the special report on *Aviation and the Global Atmosphere*, published in 1999, which was prepared at ICAO's request by the Intergovernmental Panel on Climate Change (IPCC) in collaboration with the Scientific Assessment Panel to the Montreal Protocol on Substances that Deplete the Ozone Layer;

Whereas the IPCC special report recognized that the effects of some types of aircraft emissions are well understood, it revealed that the effects of others are not, and identified a number of key areas of scientific uncertainty that limit the ability to project aviation's full impacts on climate and ozone;

Whereas ICAO requested that the IPCC include an update of the main findings of the special report in its Fourth Assessment Report, published in 2007;

The Assembly:

1. *Requests* the Council to:

   d) continue to take initiatives to promote information on scientific understanding of aviation's impact and action undertaken to address aviation emissions and continue to provide the forum to facilitate discussions on solutions to address aviation emissions; and

   e) continue to cooperate closely with the IPCC and other organizations involved in the assessment of aviation's contribution to environmental impacts on the atmosphere.

2. *Urges* States to:

   promote scientific research aimed at continuing to address the uncertainties identified in the IPCC special report on Aviation and the Global Atmosphere and in the recently released Fourth Assessment report; and

   ensure that future international assessments of climate change undertaken by IPCC and other relevant United Nations bodies include updated information on aircraft-induced effects on the atmosphere;

3. *Encourages* the Council to promote improved understanding of the potential use, and the related emissions impacts, of alternative aviation fuels; and

4. *Encourages* the Council and States to keep up to date and cooperate in the development of predictive analytical models for the assessment of aviation impacts.

APPENDIX J

Aviation impact on global climate - Cooperation with UN and other bodies

Whereas the ultimate objective of the United Nations Framework Convention on Climate Change (UNFCCC) is to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system;

Acknowledging the principles of non-discrimination and equal and fair opportunities to develop international civil aviation set forth in the Chicago Convention, as well as the principles and provisions on common but differentiated responsibilities and respective capabilities under the UNFCCC and the Kyoto Protocol;

Whereas the Kyoto Protocol, which was adopted by the Conference of the Parties to the UNFCCC in December 1997 and entered into force on 16 February 2005, calls for developed countries (Annex I parties) to pursue limitation or reduction of greenhouse gases from "aviation bunker fuels" (international aviation) working through ICAO (Article 2.2);

Whereas the Kyoto Protocol provides for different flexible instruments (such as the Clean Development Mechanism – CDM) which would benefit projects involving developing States;

Whereas the first commitment period of the Kyoto Protocol expires in 2012 and discussions on the follow up to this instrument are being undertaken and ICAO will need to continue to address its responsibility and demonstrate leadership to limit or reduce GHG emissions from international civil aviation;

Whereas all stakeholders expect ICAO to demonstrate leadership in mitigating the negative effects of GHG emissions by aviation, and to develop a vision to integrate these environmental objectives into ICAO's Business Plan and other ICAO programmes;

Recognizing, the relevance of climate change and economic development in the context of the UN Millennium Development Goals (MDGs) and the role of aviation in helping achieve these goals;

Noting it is important to address aircraft emissions without losing sight of their proper context in assessing overall GHG emissions from aviation, the transportation sector, and general economic activity; and

Noting that different regions of the world are experiencing wide differences in absolute levels of aviation emissions and aviation emissions growth rates both internationally and domestically;

The Assembly:

1. *Requests* the Council to:

   f) ensure that ICAO exercise continuous leadership on environmental issues relating to international civil aviation, including GHG emissions;

   g) continue to study policy options to limit or reduce the environmental impact of aircraft engine emissions and to develop concrete proposals and provide advice as soon as possible

to the Conference of the Parties of the UNFCCC, encompassing technical solutions and market-based measures, and taking into account potential implications of such measures for developing as well as developed countries; and

h) continue to cooperate with organizations involved in policy-making in this field, notably with the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) and its Subsidiary Body for Scientific and Technological Advice (SBSTA);

APPENDIX K

ICAO Programme of Action on international aviation and climate change

Whereas ICAO and its Contracting States recognize the critical importance of providing continuous leadership to international civil aviation in limiting or reducing its emissions that contribute to global climate change;

Whereas the rapid growth of civil aviation, has generally increased the aviation industry's contribution to greenhouse gas emissions;

Acknowledging the principles of non-discrimination and equal and fair opportunities to develop international civil aviation set forth in the Chicago Convention, as well as the principles and provisions on common but differentiated responsibilities and respective capabilities under the UNFCCC and the Kyoto Protocol;

Whereas the ICAO Council has developed policy options to limit or reduce the environmental impact of aircraft engine emissions from civil aviation and work is in progress on technology and standards, on operational measures and on market-based measures to reduce emissions;

Noting that, to promote sustainable growth of aviation, a comprehensive approach, consisting of work on technology and standards, and on operational and market-based measures to reduce emissions is necessary;

Noting that emphasis should be on those policy options that will reduce aircraft engine emissions without negatively impacting the growth of air transport especially in developing economies;

Acknowledging the significant progress made in the aviation sector, with aircraft produced today being about 70 percent more fuel efficient per passenger kilometre than 40 years ago, with airlines of some Contracting States achieving net reductions in emissions over the past several years despite a simultaneous increase in operations, and with the commitment of the international airline industry to achieving a further 25 percent fuel efficiency improvement between 2005 and 2020;

Noting that the next generation of aircraft technology and modernization of air traffic systems are expected to deliver additional improvements in flight and fuel efficiency that can be encouraged by ICAO through its Global Air Navigation Plan;

Recognizing that ICAO Standards and goals for NO_x, although intended to address local air quality, will also help reduce the impact of aviation on the climate;

The Assembly:

1. *Requests* that the Council facilitate action by States by vigorously developing policy options to limit or reduce the environmental impact of aircraft engine emissions, developing concrete proposals and providing advice as soon as possible to the Conference of the Parties of the UNFCCC, encompassing technical solutions and market-based measures, while taking into account potential implications of such measures for developing as well as developed countries;

2. *Requests* the Council to:

i) form a new Group on International Aviation and Climate Change composed of senior government officials representative of all ICAO regions, with the equitable participation of developing and developed countries, with technical support provided by the Committee on Aviation Environmental Protection, for the purpose of developing and recommending to the Council an aggressive Programme of Action on International Aviation and Climate Change, based on consensus, and reflecting the shared vision and strong will of all Contracting States, including:

1) an implementation framework consisting of economically efficient and technologically feasible strategies and measures that Contracting States can use to achieve emissions reductions, encompassing *inter alia*:

— voluntary measures (e.g. offsetting);

— effective dissemination of technological advances both in aircraft and in ground based equipment;

— more efficient operational measures;

— improvements in air traffic management;

— positive economic incentives; and

— market-based measures;

2) identification of means by which progress can be measured;

3) identification of possible global aspirational goals in the form of fuel efficiency for international aviation and possible options for their implementation; and

4) reporting progress resulting from the actions implemented by Contracting States and Stakeholders;

j) convene at an appropriate time, taking into account the fact that the fifteenth meeting of the Conference of the Parties (COP15) of the UNFCCC will be held in December 2009, a high-level meeting to review the Programme of Action recommended by the Group;

3. *Requests* that the Council, working through the Committee on Aviation Environmental Protection, continue to develop and keep up-to-date the guidance for Contracting States on the application of measures aimed at reducing or limiting the environmental impact of aircraft engine emissions and to conduct further studies with respect to mitigating the impact of aviation and climate change;

4. *Encourages* Contracting States and the Council, taking into account the interests of all parties concerned, including potential impacts on the developing world, to evaluate or continue evaluating the costs and benefits of the various measures, including existing measures, with the goal of addressing aircraft engine emissions in the most cost-effective manner;

5. *Requests* that the Council provide the necessary guidance and direction to ICAO's Regional Offices to assist Contracting States with studies, evaluations and development of procedures, in collaboration with other States in the region, to limit or reduce GHG emissions on a global basis and work together collaboratively to optimize the environmental benefits that can be achieved through their various programmes;

6. *Requests* States to encourage the industry to establish challenging goals to constantly improve its performance in aviation emissions reduction;

7. *Requests* Contracting States to accelerate investments on research and development to bring to market even more efficient technology by 2020;

8. *Requests* States to elaborate and report on a set of actions and plans to reduce by 2020 airspace congestion that is contributing to delays and unnecessary fuel burn;

9. *Request* States to encourage airport operators to improve efficiency of airside operations and to implement ground side efficiency measures to reduce carbon intensity;

10. *Requests* that the Council, working through the Committee on Aviation Environmental Protection:

k) report on an annual basis on the progress achieved in average in-service fleet fuel efficiency and the aggregate annual amount of fuel burned in international civil aviation working in close cooperation with the industry;

l) forecast the overall potential for aviation emissions reduction in the in-service fleet; and

m) evaluate and quantify further reduction opportunities for consideration by the upcoming session of the Assembly;

11. *Requests* the Council to undertake the necessary action in support of the ICAO emissions initiative, including the pursuit of the ICAO objectives to limit or reduce the impact of aircraft emissions, to foster collaboration among its Contracting States, and to monitor and report on progress made in this area. In particular, the Council should:

n) explore relevant parameters and develop medium and long term technology goals for aircraft fuel burn and report back by the next Assembly;

o) continue to develop the necessary tools to assess the benefits associated with ATM improvements, and to promote the use of the operational measures outlined in ICAO guidance (Cir 303) as a means of limiting or reducing the environmental impact of aircraft engine emissions;

p) implement an emphasis on increasing fuel efficiency in all aspects the ICAO's Global Air Navigation Plan;

q) foster, as appropriate, regional, inter-regional and global initiatives with Contracting States to enhance air traffic efficiencies to reduce fuel consumption;

r) encourage Contracting States to improve air traffic efficiency, which leads to emissions savings and to report on progress in this area;

s) request Contracting States to submit an inventory of actions they are taking to reduce aviation emissions in their respective countries; and

t) promote the use of new procedures and technologies that have a potential to provide environmental benefits on the operation of aircraft;

12. *Requests* the Council to encourage States and stakeholders in promoting and sharing best practices applied at airports in reducing the adverse effects of GHG emissions of civil aviation;

13. *Requests* the Council to encourage States and stakeholders to develop models of flow control and air traffic management that optimize environmental benefits;

14. *Requests* States to:

u) encourage the necessary research and development to provide more environmentally efficient engine and aircraft designs;

v) accelerate the development and implementation of fuel efficient routings and procedures to reduce aviation emissions;

w) accelerate efforts to achieve environmental benefits through the application of satellite-based technologies that improve the efficiency of air navigation and work with ICAO to bring these benefits to all regions and States;

x) promote effective coordination between their authorities involved in aviation in designing more environmentally beneficial air routes and improved operational procedures for international civil aviation;

y) reduce legal, security, economic and other institutional barriers to enable implementation of the new ATM operating concepts for the environmentally efficient use of airspace; and

z) cooperate in the development of a regional measurement and monitoring capability in order to allow for the assessment of the environmental benefits accrued from the measures above;

15. *Encourages* action by Contracting States, and other parties involved, to limit or reduce international aviation emissions through voluntary measures, and to keep ICAO informed, and r*equests* the Council to instruct the Secretary General to keep up-to-date guidelines that ICAO has developed for such measures, including a template voluntary agreement, and to make available such experience to all parties concerned.

APPENDIX L

Market-based measures, including emissions trading

Whereas market-based measures, including the use of emissions trading, are policy tools that are designed to achieve environmental goals at a lower cost and in a more flexible manner than traditional regulatory measures;

Recognizing that Contracting States are responsible for making decisions regarding the goals and most appropriate measures to address aviation's greenhouse gas emissions taking into account ICAO's guidance;

Acknowledging the principles of non-discrimination and equal and fair opportunities to develop international civil aviation set forth in the Chicago Convention, as well as the principles and provisions on common but differentiated responsibilities and respective capabilities under the UNFCCC and the Kyoto Protocol;

Recognizing that the majority of the Contracting States endorses the application of emissions trading for international aviation only on the basis of mutual agreement between States, and that other Contracting States consider that any open emissions trading system should be established in accordance with the principle of non-discrimination;

Recognizing the need to engage constructively to achieve a large degree of harmony on the measures which are being taken and which are planned to provide an appropriate response to the challenge of aviation and climate change while respecting the principles above;

Whereas ICAO policies make a conceptual distinction between a charge and a tax, in that "a charge is a levy that is designed and applied specifically to recover the costs of providing facilities and services for civil aviation, and a tax is a levy that is designed to raise national or local government revenues which are generally not applied to civil aviation in their entirety or on a cost-specific basis";

Whereas ICAO has developed policy guidance to Contracting States on taxation (*ICAO's Policies on Taxation in the Field of International Air Transport*, Doc 8632), which recommends *inter alia* the reciprocal exemption from all taxes levied on fuel taken on board by aircraft in connection with international air services, a policy implemented in practice through bilateral air services agreements, and also calls on Contracting States to the fullest practicable extent to reduce or eliminate taxes related to the sale or use of international air transport;

Whereas the ICAO Council had adopted on 9 December 1996 a policy statement of an interim nature on emission-related charges and taxes in the form of a resolution wherein the Council strongly recommends that any such levies be in the form of charges rather than taxes, and that the funds collected should be applied in the first instance to mitigating the environmental impact of aircraft engine emissions;

Whereas such charges should be based on the costs of mitigating the environmental impact of aircraft engine emissions to the extent that such costs can be properly identified and directly attributed to air transport;

Noting that there remains a number of issues of a legal and policy nature regarding the implementation of GHG charges and the integration of aviation into existing emissions trading systems that have not been resolved;

Noting that ICAO has issued *Draft Guidance on the Use of Emissions Trading for Aviation* (Doc 9885);

Whereas Contracting States have legal obligations, existing agreements, current laws and established policies; and

Whereas the establishment of carbon offset schemes has helped to raise public awareness of climate change, and may contribute to emissions reductions in the short term;

The Assembly:

1. *Encourages* Contracting States and the Council to adopt measures consistent with the framework outlined below:

aa) Emission-related charges and taxes

1) *Affirms* the continuing validity of Council's Resolution of 9 December 1996 regarding emission-related levies;

2) *Recognizes* that existing ICAO guidance is not sufficient at present to implement greenhouse gas emissions charges internationally, although implementation of such charges by mutual agreement of States members of a regional economic integration organization on operators of those States is not precluded; and

3) *Urges* Contracting States to refrain from unilateral implementation of greenhouse gas emissions charges;

bb) Emissions trading

1) *Urges* Contracting States not to implement an emissions trading system on other Contracting State's aircraft operators except on the basis of mutual agreement between those States;

2) *Requests* States to report on new developments, results and experiences in this area; and

3) *Requests* the Council to:

a) finalize and keep up-to-date for use by Contracting States, as appropriate, and consistent with this and subsequent Resolutions, the guidance developed by ICAO for incorporating emissions from international aviation into Contracting States' emissions trading schemes consistent with the UNFCCC process; and

b) conduct further studies, as appropriate, on various aspects of the implementation of emissions trading systems and evaluate the cost effectiveness of any systems put in place, taking into account the effect on aviation and its growth in developing economies in line with the principles stated above;

c) conduct an economic analysis of the financial impact of including international aviation in existing trading schemes and undertake literature review of cost-benefit analysis of existing trading systems with a special emphasis on how they have been applied to other sectors in order to draw some pertinent lessons learned for the aviation sector;

cc) Carbon offsets

1) *Requests* the Council to examine the potential for carbon offset mechanisms as a further means of mitigating the effect of aviation emissions on local air quality and climate change; and

2) *Requests* the Council to collect and disseminate information on the results of carbon-offset programmes implemented by States and other Organizations regarding aviation emissions;

dd) Clean Development Mechanism (CDM)

1) *Invites* Contracting States to explore the use of the Clean Development Mechanism (CDM) related to international aviation.

PAPER NO. 4A: UNITED NATIONS UNIVERSITY

Climate change and migration: impacts, vulnerability, and adaptation options

SUBMISSION BY THE UNITED NATIONS UNIVERSITY (UNU)

Climate change and migration:
impacts, vulnerability, and adaptation options

18 August 2008

3rd session of the Ad Hoc Working Group on Long-Term Cooperative Action under the Convention (AWG-LCA 3). Accra 21-27, 2008-08-14

Keywords: Climate change, migration, adaptation, humanitarian assistance, Article 4.1(e), Article 4.1(f), Nairobi Work Programme, Bali Action Plan

1. Introduction

Today, environmental change including climate change presents a new threat to human security and a new situation for migration.[1] Climate change-related migration[2] has the potential to become a phenomenon of a scale and scope not experienced in human history. Migration may be an adaptation mechanism for those with the resources to move early and far enough away from danger. However, in extreme cases and for those with fewer means to move, migration may be an expression of failed adaptation—an attempt to escape from imminent suffering or even death. Faced with an unconceivable scale of environmental change, migration may be an adjustment mechanism of first resort, or a survival mechanism of last resort.[3] (Renaud et al. 2007). Climate change related migration is a topic of relevance for Article 4, paragraph 1(e) and 1(f) of the Convention, the Bali Action Plan, and the Nairobi Work Programme.

2. Evidence about climate change and migration

Gradual and sudden environmental changes are resulting in substantial human movement and displacement.[4] The scale of such migration flows, both internal and cross-border, is expected to rise, with large impacts.

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[1] Adger, W. N.; Kelly, P. M.; Nguyen, H. N. (2001): Environment, society and precipitous change. In: Adger, W. N.; Kelly, P. M.; Nguyen, H. N. (Eds): Living with Environmental Change: Social Vulnerability, adaptation and resilience in Vietnam. Routledge, London.

[2] The United Nations University uses the IOM working definition of environmentally induced migration: *"Environmental migrants are persons or groups of persons who, for compelling reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad" (IOM 2007a).*

[3] Renaud, F.G.; Bogardi, J.J.; Dun, O.; Warner, K. (2007): *Control, Adapt or Flee: How to Face Environmental Migration?* InterSecTions no. 5/2007, United Nations University Institute for Environment and Human Security, Bonn.

[4] Afifi, T.; Warner, K. (2008) *The Impact of Environmental Degradation on Migration Flows across Countries*. Working Paper No.5/2008. UNU-EHS Working Paper Series. Bonn: United Nations University, Institute for Environment and Human Security.

Estimates of environmental migration fluxes have been published, and there is a growing consensus that migration will increase substantially in the future.[10]

2.1 How many environmentally induced migrants?

Gradual and sudden environmental changes are resulting in substantial human movement and displacement. The scale of such flows, both internal and cross-border, is expected to rise, with unprecedented impacts on lives and livelihoods. The most widely cited estimate of 200 million migrants by 2050 suggests that environmentally induced migration could soon involve almost 3 percent of the *world* population in just four decades from now. [6] The social and economic costs of this uprooting, accounting for both losses and responses, have not been calculated.[7]

Figure 1 indicates areas where drought, desertification, and other forms of water scarcity are estimated to affect as much as one-third of the world's human population and could contribute to people migrating away from these areas to secure their livelihoods. Main projected trajectories are added where climate change-related migration can be expected in the future.

[5] See Myers, N. (2002): Environmental refugees: a growing phenomenon of the 21st century. In: *Philosophical Transactions of The Royal Society B*. vol. 357, pp. 609-613. and Myers, N. (2005). *Environmental Refugees: An Emergent Security Issue.* 13th Economic Forum, Prague, 23-27 May.

[6] Brown, Oli (2008): Migration and Climate Change. In: International Organization for Migration (IOM): *Research Series* No. 31, IOM Geneva.

[7] All of these estimates, including their underlying methods and assumptions are subject to debate Black 1998, Bates 2002). The complexity of interactions makes reliable estimations of environmentally induced migrants challenging (Döös 1997). Quantification is further complicated by the fact that environmentally induced migration is mostly internal (at least in the initial phase). Nevertheless, few authors contest that environmentally induced migration falls much below 20 million environmentally induced migrants *today*.

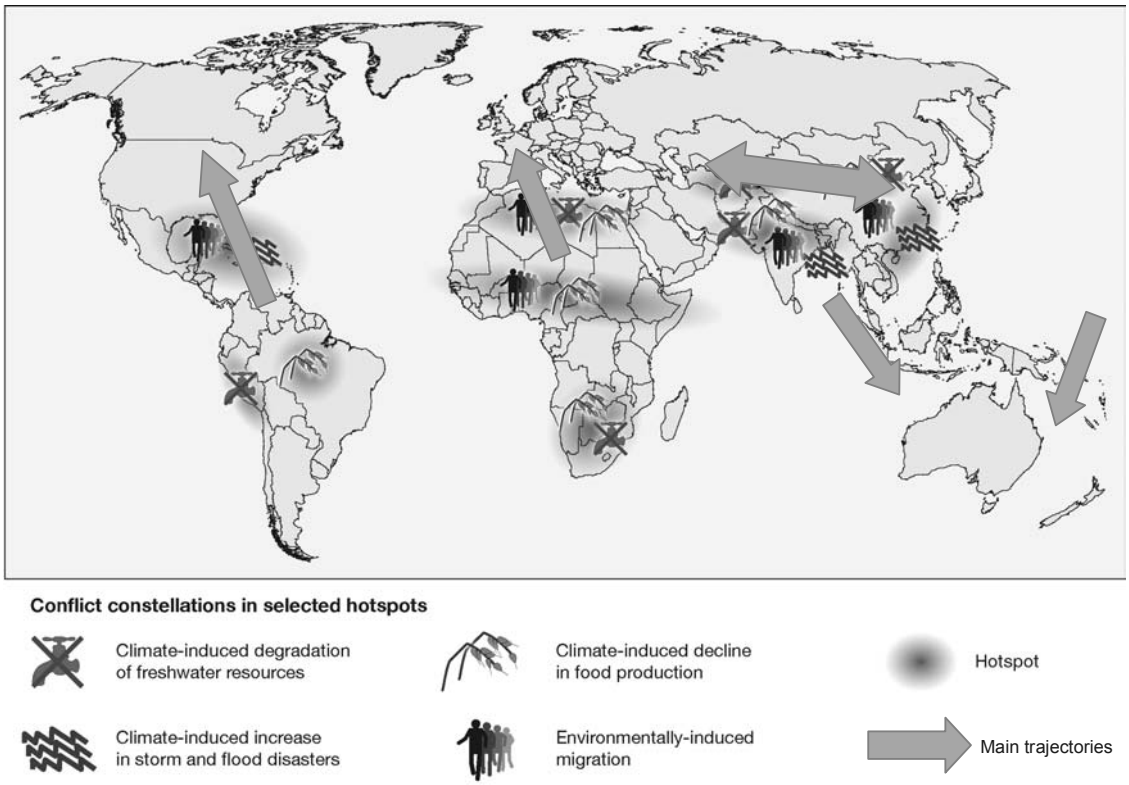


Figure 1: A map of conflict and migration induced by environmental stressors
(Source: German Advisory Council on Global Change WBGU (2007): Climate Change as a Security Risk)

2.2 Evidence from fieldwork

Research is starting to address the knowledge gaps in order to inform decision makers on ways in which to manage climate change-related migration. Emerging research and fieldwork, and particularly the results from 24 case studies in a global comparative study of environmental change and migration confirm that environmental factors contribute to migration. The current environmental signal in migration is detectable. An analysis of field studies yields 3 main results:

Environmental factors currently contribute to migration

Environmental factors interact with other factors to influence migration. The principle current pathway through which environmental change affects migration is through livelihoods, especially in rural areas. Livelihoods deteriorate due to changing climatic conditions and land degradation over time. The more direct the link between environmental quality and livelihoods, the stronger the role of environmental push factor in migration choices. The ability to earn a livelihood in a given climate and environment is one of the determining factors that potential migrants are concerned about for the future.

Migration occurs when tipping points are approached and exceeded

If certain regions experience systematic collapse in livelihood chains, environmentally induced migration could affect millions of people and come at a time when tipping points have been crossed for critical

ecosystem services.[8] Due to migrant network connections, environmental degradation can perpetuate existing migration patterns. Climate change could drive movements of people in zones between countries and regions. Such migration flows could occur in already-resource stressed environments—areas where large scale humanitarian assistance or peace keeping could be required.

Climate change, resettlement, and adaptation

Some governments are already planning for the relocation and resettlement of affected populations. Government responses vary from offering "mobility incentives" to mandatory resettlement programmes, with mixed results. Relocation moves people out of harm's way. But resettlement is also expensive, and exposes displaced people to the loss of livelihoods, debt, and disintegration of communities without addressing the environmental stressor itself. More needs to be understood about migration and resettlement in coping with and adapting to climate change.

4.Support Nairobi Work Programme & Bali Action Plan

Action can and must be taken today to address migration as a reaction to changes in climatic conditions. Parties are encouraged to contribute to the five pronged approach outlined above and actively engage in discussion and exchange of experience in addressing environmentally induced migration. In particular, contribution to the NWP and the Bali Action Plan in areas like data and observations as they relate to climate change-related migration is needed.

As a first step regional migrations observations such as that which will be taken by the ACP, detailed regional and country level assessments of environmental states and migratory flows, as well as pilot projects of adaptation measures should be envisaged. Assessment of methodology developed within the European Commission-funded EACH-FOR project (www.each-for.eu) could be further refined and applied on a larger scale to help contribute to efforts under Article 4, paragraph 1(e) and 1(f) of the Convention, the Bali Action Plan, and the Nairobi Work Programme.

5. Five pronged policy approach

Some organizations have decided to concert their respective activities and to form the Climate Change, Environment and Migration Alliance (CCEMA) as a multi-stakeholder global partnership. The major aims of the Alliance are to mainstream the environmental and climate change considerations into the migration management policies and practice and to bring migration issues into the world's on-going environmental and climate change as well as development discourse. The Alliance is being conceived by the International Organization for Migration (IOM), the United Nations Environment Program (UNEP), United Nations University (UNU), and the Munich Re Foundation (MRF). Some policy points that could be considered under the NWP and BAP to address climate change and migration include:

- **Build a strong scientific basis**: As the window for identifying appropriate adaptation pathways for climate change narrows, it is imperative to address how changing environmental conditions affects individual and group decisions to migrate. Robust definitions are needed for environmentally

[8] Galaz, V.; Moberg, F.; Downing, T.; Thomalla, F.; Warner, K. (2008). Ecosystems under pressure. A policy brief for the International Commission on Climate Change and Development. Stockholm Resilience Centre, Stockholm Environment Institute, United Nations University Institute for Environment and Human Security. Stockholm, January 2008.

induced migrants and people displaced by environmental push factors. These definitions can facilitate identification, measurement, characterization, and appropriate policy responses.

- **Increase awareness**: Knowledge about environmental degradation and climate change can arm governments, migrants, and potential migrants against losses in human security. At the national level, countries must understand how environmental processes and environmental quality affect living standards of their populations. Public awareness raising is also an essential issue to be addressed in potential receiving countries and regions. Awareness can help avoid mal-adaptation.
- **Improve legal frameworks**: At the regional level, multilateral dialogue may be necessary about how to address, coordinate, and ease environmental pressures as well as migration that results in part because of climate change. Policy and legal frameworks need to address environmentally induced migration. Frameworks must be established for dealing with individuals and groups induced to migrate because of environmental change. Legal frameworks may be developed within rights-based and humanitarian approaches.
- **Adequate humanitarian response**: Gradual and sudden environmental changes will result in substantial human movements and displacements, and these situations will require sufficient and timely humanitarian efforts to avoid escalating crises. Natural disasters may displace larger numbers of people for relatively short periods of time, while the steady and continuous impact of climatic drivers are likely to permanently displace many more people in a less visible way.
- **Strengthening institutions and policies**: Institutions in source and receiving countries should work together to ensure safe, non-criminal, and orderly migration relations.

6. Join forces to address climate change- & migration

The time to address the effects of dangerous environmental change including climate change is now. Action must be concerted and swift: Policy makers, the scientific community, civil society and other actors must seek solutions for those people who are currently migrating and who may be induced to migrate in order to seek safe and sustainable existences. The active collaboration of regional and intergovernmental organisations is imperative.

With increasing numbers of the world´s population living in areas particularly exposed to the negative consequences of climate change, urgent action is needed to identify adaptation pathways that prevent or at least reduce environmental migration flows. A rapid and collaborative effort is needed to discuss options including resettlement, and understand the implications of climate change related migration for affected countries and regions. Fundamentally, the discussion of climate change-related migration revolves around human security and the quest to secure freedom from fear, freedom from want, and freedom from hazard impact. Achieving human security in the face of climate and environmental change requires urgent policy attention and adaptation action *today*.

PAPER NO. 4B: UNITED NATIONS UNIVERSITY

Accelerating the development and scaling up of environmentally, socially and economically sound technologies in the energy and transport sectors in developing countries

UNU Contribution to AWG-LCA 3 under UNFCCC

Accra Climate Change Talks, 21-27 August 2008

Workshop on
"Cooperative sectoral approaches and sector-specific actions, in order to enhance implementation of Article 4, paragraph 1(c), of the Convention"

Accelerating the development and scaling up of environmentally, socially and economically sound technologies in the energy and transport sectors in developing countries

Dr René Kemp, Senior Research Fellow, UNU-MERIT
August 4, 2008

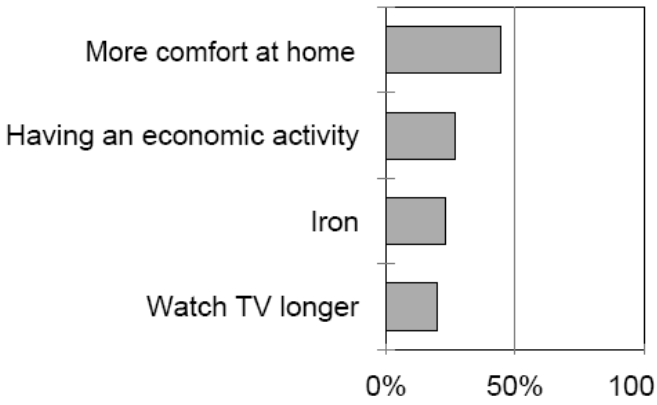
***Synopsis**: The accelerating of the development and scaling up of environmentally, socially and economically sound technologies in the energy and transport sectors may help to reduce Greenhouse Gas (GHG) Emissions. But as this document will show, it is not a simple and straightforward issue, given the multitude of relevant concerns at different levels, requirements for use and dangers of shifting problems. Instead of giving policy prescriptions, this document outlines relevant issues for consideration in decision-making. It is a think piece for making better choices by decision makers at different levels by drawing attention to tradeoffs and temporal issues.*

1. About half of all people in developing countries are dependent for fuel on traditional biomass (wood, dung and crop residue). Three quarters of these live in China, India and Sub-Saharan Africa. The use of traditional biomass is forecast to decrease in many countries by the International Energy Agency (IEA) but overall the IEA forecasts that by 2030 the total number of people reliant on biomass will not have changed significantly (UK Parliamentary Office of Science and Technology, 2002).
2. Poverty and the related use of traditional biomass are factors in deforestation and degradation of forests. Shifting to modern energy sources, such as electricity and petroleum-based fuels, may help to deal with those problems and may decrease GHG emissions. Burning wood is energy inefficient and contributes more GHG per energy service. But access to modern energy sources which is so desirable from a development point of view may stimulate GHG emissions in a longer-time frame through increased energy use.
3. Shifting to modern energy sources is no easy matter. For solar home system projects, challenges are to demonstrate sustainable and replicable business models, develop regulatory models of energy-service concessions, and integrate rural electrification policy with solar home system delivery (Marinot et al, 2001). Green electricity faces competition from not so green electricity. Simply having access to the technology will not guarantee that people in need will receive the energy services.
4. In general, no energy source and energy technology are pristine. They all involve tradeoffs. Some of the tradeoffs are immediate, such as the tradeoff between capital costs and maintenance costs; other

tradeoffs are more long-term. One possible tradeoff is between GHG protection and poverty alleviation. There is a risk that the climate protection agenda of developed countries conflicts with the agenda for poverty alleviation of developing countries. This calls for an assessment of tradeoffs and research into possible mechanisms for containing negative effects. At the moment we lack a good understanding of such tradeoffs and how these can be managed.

5. The notion of sustainable development helps to consider various effects and tradeoffs by giving attention to environmental and social side-effects of economic development. Fossil fuel technologies are generally viewed as non-sustainable because they rely on depletable resources (gas, oil, coal) whose combustion produces greenhouse gases as well as other emissions. For stationary sources, however, carbon emissions can be captured and stored for re-use at a later time. Fossil fuels can thus be made more sustainable. Renewable energy technologies on the other hand are frequently referred to as *sustainable* energy technologies. Yet wind turbines kill birds and energy crops are grown in non-environmentally benign ways. Even photovoltaic electricity, arguably the most pristine source of electric power, is not completely free of effects on the environment. As with any consumer product, the raw materials for PV systems must be shipped to factories, and completed products must be shipped from factories to consumers. There is also an issue of safe disposal at the end of its lifetime. From this, it follows that sustainable development should not be viewed as a technological project but as a project of reflexive modernization aimed at anticipating negative impacts and dealing with them (preferably in a proactive manner but this is not always possible). To do so requires a host of control policies and institutional mechanisms for learning about system-wide effects and ways to limit harmful effects (Kemp, 2008).
6. Renewable energy technologies (RET) are often advocated for developing countries because they are viewed as more sustainable. But many RET have fallen into disuse and have not been able to meet user demand.

Unmet Needs for Electricity for Solar Home Systems in Sri Lanka



Source: The International Bank for reconstruction and Development/World Bank, 2003

The optimal choice of technology will be specific to each location and depends on a number of factors: including resource availability, affordability, ease of access and local capacity to absorb, use and maintain the technology. It will also depend on the services and uses desired in each locality, as

not all technologies are adaptable and cost-effective for particular end uses (UK Parliamentary Office of Science and Technology, 2002).

7. Stopping deforestation and desertification is desirable both from an economic and environmental point of view and is to be pursued actively through separate policies and joined-up policies. Desertification may be fought through irrigation policies but deserts may also be used for electricity production. From a climate protection point of view, a very interesting option is to redevelop deserts for energy use. It has been calculated that covering just 0.5% of the world's hot deserts with a technology called concentrated solar power (CSP) would provide the world's entire electricity needs, with the technology also providing desalinated water to desert regions as a valuable byproduct, as well as air conditioning for nearby cities. The costs of the production of CSP are now around $50 per barrel of oil equivalent to the cost of building a plant. That cost is likely to fall sharply, to about $20, as the production of the mirrors reaches industrial levels. It is about half the equivalent cost of using the photovoltaic cells that people have on their roofs (Trieb and Knies, 2004; Guardian, 2006). Cost reductions may come from research but also depend on deployment and scale economies, so a deployment policy is called for achieving cost reductions. As with any option, there are also sustainability to be considered both in design choices and the management of CSP systems. But the risks appear far lower and better manageable than, for example, the risks of using biomass for energy. Further research however is needed here.
8. Impacts are co-produced by various actors (Rip and Kemp, 1998). They are coproduced by actors through technology choices in a market context, with individual and collective choices being shaped by framing conditions and the social and political context. Impacts are not caused by technology in a simple way. There may be knock-on effects. Choices now may affect choices for the future through designs and organizational arrangements that become the basis for development (path dependencies). The task for policy is to create sustainable configurations. This is an ongoing task for multiple decision makers that requires a multitude of policies. Benefits at the global level should not be achieved at the expense of disadvantages at the local level. This calls for proper assessment of various configurations and for creating institutional arrangements to deal with negative effects.
9. From a sustainable development point of view, relevant criteria for energy systems can be said to be:
    - Produce energy in the right form at relatively low cost and modest investments;
    - Lead to an increase in income for the poor people;
    - Use technologies which are appropriate or adaptable to local circumstances and can still be improved;
    - Form the basis for new SME;
    - Improve the currency position of a country;
    - Be amply available;
    - Have proven to satisfy at other places;
    - Diminish the environmental burden;
    - Improve the position of women;
    - Links up with the other WEHAB topics (Water, Energy, Health, Agriculture, and Biodiversity).

    Source: Daey Ouwens (2006)
10. Innovation for sustainable development puts paradoxical demands on policy. On the one hand, there is a need to stimulate innovations with sustainability benefits given the many barriers to innovations whose benefits are undervalued in the marketplace, which have to compete with well-developed options that have benefited from dynamic scale and learning effects, system economics and institutional adaptation. At the same time, policy has to deal with risks associated with the new technologies and make sure that they are sustainable as much as possible. There is a need for support

and control at the same time. A possible solution is to balance both: to make support conditional and to create institutions for containing side effects (Kemp, 2008).

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PAPER NO. 5A: WORLD BANK

Contributions to global climate deliberations: the experience of the BioCarbon Fund, the Forest Carbon Partnership Facility and the Forest Investment Program

This paper is being distributed as background to discussions at the third session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) August 21-27, 2008.
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Introduction

An introduction to the World Bank's initiatives in three areas of forestry is presented. These document the experiences of two forest carbon initiatives, i) the **BioCarbon Fund** which deals with forestry under the Clean Development Mechanism, with reducing emissions from deforestation and degradation (REDD) at the project level and with other land use changes; ii) the **Forest Carbon Partnership Facility** (FCPF) which focuses on national level REDD; and iii) the **Forest Investment Program** (FIP) to be established under the Strategic Climate Fund.

I. THE BIOCARBON FUND

Introduction

This note summarizes the challenges for forestry projects under the Clean Development Mechanism (CDM). As of July 2008, only one forestry project is registered under the CDM; the registration occurred in November 2006. Although more projects should be coming through the pipeline, this rate clearly shows the difficulty in undertaking these projects.

However, the importance of forestry and land use changes to the climate change solution and their contribution in improving livelihoods and environment cannot be overstated. Forestry and land use are one of the few opportunities for poor rural communities to access the booming carbon market.

The BioCarbon Fund is a fund where Participants from both the public and private sectors which focuses on land use, land-use change and forestry project-based activities. These activities are mainly for Afforestation / Reforestation and are developed under the CDM; a number of projects in the BioCarbon fund are testing ways to reduce emissions from deforestation and degradation (REDD) and in agricultural activities. Below are the main points that have been learned through the experiences of the BioCarbon Fund primarily, the Prototype Carbon Fund and others.

Issue 1: Only afforestation / reforestation are allowed under the CDM
Implication: This misses major climate change mitigation opportunities and results in a fragmented approach to sound land management practices.

Solution: The CDM needs to be more inclusive of all forest and land use activities. The Joint Implementation (JI) mechanism does not exclude these activities; ways can be found for the CDM also. To prevent any risk of market flooding, specific limits or caps could be imposed on the volume of eligible credits.

Issue 2: Temporary credits – Replacement after 60 years

Implication: This can have a perverse effect because it could imply that parties to a contract decide to cut a forest down after 60 years in order to buy permanent credits to replace the temporary credits. The requirement to replace also impacts on market demand and the consequent discount temporary credits produce little incentive to implement forestry projects under the CDM.

Solution: There are a number of ways this could be dealt with. For example, remove the rule and allow indefinite temporary crediting; grandfather temporary credits and convert them to full CERs after a period of time, if necessary at a discount; or examine the buffer approach adopted by some voluntary schemes as a type of insurance for loss of some carbon.

Issue 3: Temporary credits – Two-types of temporary credits

Implication: A cumbersome and difficult-to-understand two-type of temporary credit system that contributes to confusion over the concept of temporary crediting.

Solution: Consolidate temporary credits, most likely keeping tCERs, and consider alternatives for the permanence issue that is more acceptable to the market. To date, tCERs have proved to be more popular than lCERs as the five-year renewal "lease" of tCERs is seen to be more favorable to both buyers and sellers of these types of credits.

Issue 4: A/R can only happen on lands without forest since December 31, 1989

Implication: Another rule that does not consider ecological integrity and where honest efforts to reforest lands deforested after 1989 cannot be supported.

Solution: Although this time frame may have made sense at the time of establishing the rules, time has moved on and this needs to be reflected in the rules. The rules need to allow Agriculture, Forestry and other Land Use activities on land deforested after 1989 as long as it can be proven that natural forest was not cut down in order to undertake a carbon-crediting activity. This is technically possible and would mean project entities would need to prove that the CDM did not create an incentive to cut down the existing forest.

The four issues above highlight some of the critical areas that need to be addressed to make forestry projects more *attractive* to undertake. In order to make project *easier* to undertake, some additional issues would need to be considered, such as simplifying methodologies, or examining the expensive and onerous monitoring approach to nonsignificant criteria in forestry projects, such as leakage due to fuel use. The latter could be addressed by allowing reasonably-conservative, discount factors to account for this. It is important to note, that making projects easier to undertake, does not mean compromising their contribution to climate change mitigation.

II. THE FOREST CARBON PARTNERSHIP FACILITY

Deforestation and land-use change are the second leading cause of global warming. They account for about 20 percent of global greenhouse gas (GHG) emissions, and over a third of emissions from developing countries. In many developing countries, deforestation and forest degradation[11] account for a majority of carbon emissions. For example, in Brazil and Indonesia, deforestation and land-use changes represent an estimated 70 percent and 80 percent of emissions, respectively. Although there remain divergent opinions as to whether deforestation and forest degradation in tropical and sub-tropical countries should be included in a future climate regime, there is an emerging consensus that this issue must be effectively addressed, as it would otherwise limit the options for reducing GHG emissions and GHG concentrations to acceptable levels.

Deforestation for agricultural expansion, cattle ranching, logging, and plantation development, can deprive the poor of access to resources. Lacking viable alternatives, poor people often convert forests into farms that soon become unproductive due to degraded topsoil conditions. This process destroys sustainable sources of timber and related forest products that offer long-term stability and exchanges them for short-term income generation. Finding new funding sources to tackle deforestation and degradation also holds promise as a tool for reducing poverty among forest-dependent people and promoting their sustainable development.

In the face of this continuing challenge, the international community is exploring the potential of utilizing carbon finance to provide some of the necessary resources. Although there currently exists no regulatory instrument under the United Nations Framework Convention on Climate Change (UNFCCC) to compensate reductions in emissions from deforestation and degradation (REDD) in the form of carbon payments, the Parties to the UNFCCC are discussing the possibility of creating such an instrument in the future. It is in this context that the World Bank, prompted by a range of stakeholders, in 2006 proposed the creation of a Forest Carbon Partnership Facility (FCPF or Facility). The FCPF will assist developing countries in their efforts to reduce emissions from deforestation and degradation (REDD). It will have the dual objectives of building capacity for REDD activities in developing countries and testing—on a relatively small scale—a program of performance-based incentive payments in pilot countries. The overall development objective of the Facility will be to set the stage for a much larger system of positive incentives and financing flows in the future. As such, the direct impact of the FCPF in reducing emissions from deforestation and degradation would be relatively limited, but the framework and approaches that would be tested and proved under the FCPF would inform Parties to the UNFCCC as they negotiate a future climate regime which may include REDD.

[11] Forest degradation means the loss of biomass (and carbon) under the forest cover. Continuing degradation may lead to deforestation, i.e. the loss of forest cover.

The FCPF comprises of two separate mechanisms:

1. **Readiness Mechanism** – under this mechanism, the Facility intends to assist 20 or more developing tropical and sub-tropical countries prepare themselves to participate in a future, large-scale system of positive incentives for REDD. This will include, but is not limited to: (i) establishing a national reference scenario for emissions from deforestation and degradation; (iii) preparing a national REDD strategy; and (iv) establishing a monitoring system for emissions from deforestation and degradation. Indigenous groups and other forest dwellers will participate in the process so they can benefit from future carbon finance flows.

2. **Carbon Finance Mechanism** – the Facility will support a few countries that will have successfully participated in the Readiness Mechanism to join, on a voluntary basis, a second mechanism that will pilot incentive payments for REDD. The Carbon Fund will remunerate the selected countries or actors within the selected countries, in accordance with negotiated contracts, for emissions reductions that are verified independently. The Carbon Fund's payments are intended to provide an incentive to the recipient countries and the various stakeholders within each of these countries to achieve long-term sustainability in financing forest conservation and management.

Together, these two mechanisms seek to create an enabling environment and sponsor a body of knowledge and experience that can facilitate the development of a much larger global program of incentives for REDD over the medium term (5-10 years).

FCPF Status Update

Given that a large part of COP13 focused on the potential for REDD, the FCPF was publicly "launched" by Mr. Zoellick, along with nine developed country ministers and the acting President of the Nature Conservancy, during the meetings in Bali. At present, US$187 million has been pledged to the both funds of the FCPF and US$83 million has been formalized, out of which US$68 million to the Readiness Fund and the remainder to the Carbon Finance Fund. Nine industrialized countries have formalized their participation: Australia, Finland, France (the French Development Agency), Japan, Norway, Spain, Switzerland, the United Kingdom and the United States.

The FCPF has finalized consultations on the Facility's design, including a series of regional consultations with indigenous peoples and other forest dwellers, in partnership with the head of the UN Permanent Forum on Indigenous Issues. These workshops were organized and chaired by regional IP organizations. In Asia, the workshop took place in Kathmandu from February 28 to 28 and included 25 indigenous people representatives. In Africa, the consultations took place in Bujumbura, Burundi, from March 13 to 14, counting on the participation of 18 indigenous people and 9 forest dweller representatives. Finally, the workshop in Latin America took place in La Paz, Bolivia, from March 17 to 19, with the participation of 33 indigenous people and 2 forest dwellers representatives. The FCPF intends to continue a meaningful dialogue with indigenous peoples and forest dwellers, now at a country level through the Readiness activities.

There has been substantial demand for the FCPF, with letters of interest received from over 40 countries thus far. Most of these countries have done so as a result of their own positions and support for REDD in the international climate negotiations. The FCPF has also received 28 “Readiness Plan Idea Notes”, the formal request for participation in the Readiness Mechanism.

The first Steering Committee meeting of the FCPF took place on July 9-10 in Paris, where fourteen countries were selected to start implementing activities under the Readiness Mechanism. Among the countries were six in Africa (the Democratic Republic of Congo, Gabon, Ghana, Kenya, Liberia, Madagascar); five in Latin America (Bolivia, Costa Rica, Guyana, Mexico, Panama); and three in Asia (Nepal, Lao PDR, and Vietnam). The Participants Committee meeting is scheduled for September 17-19, 2008 in Washington DC.

The FCPF is in current discussion with the UN REDD Initiative, comprising the UNDP, UNEP and FAO, in order to explore potential synergies on REDD-related activities, maximize service to potential REDD countries and avoid duplication.

III. THE FOREST INVESTMENT PROGRAM

Many of the potential solutions to reducing emissions from deforestation and degradation (REDD) are well documented. But current approaches to developing climate-related programs are highly fragmented and do not include an analysis of developing country government perceptions of forest-related remedial strategies, including mitigation and adaptation measures. More consideration needs to be given to effective collaboration between governments, communities, private sector companies and financial institutions in planning and implementing programs that address climate change. These approaches need to be put into the context of the overarching global climate change agenda, linking the local and global levels.

It is becoming clear that REDD would be only one mitigation tool—albeit an important and innovative one—within a comprehensive sustainable forest management response, which would include reforestation and restoration measures, as well as the need to address the role of policies of other sectors.

Emerging Needs

Emerging analytical work and best practice examples of ongoing development assistance provide evidence that the following are indicative of a portfolio of investments that may be instrumental in addressing climate change:

- Investments to support a shift by agribusiness companies away from dependence on harvesting of rain forests towards planting on non-forest lands.
- Investments in rural development and social infrastructure programs that will help to increase agricultural productivity and create sustainable livelihood opportunities for forest-adjacent, low-income rural families that currently depend to a high degree on subsistence agriculture and on income from illegal logging.
- Investments in non-forest sector programs (agriculture, transportation, mining etc.) to ensure inclusion of specific provisions for forest protection.
- Investments in building institutional, legal and technical capacities of governments and private and communal forest stakeholders to effectively protect and manage forests as well as to undertake strategic and management planning and control.
- Investments in improving forest governance and forest sector transparency (e.g. forest inventory, log tracking systems and certification).
- Investments in forest-based industries to support increased utilization of farm forest and smallholder-based plantation resources through company/community
- partnerships.
- Investments for engaging local communities and smallholders in restoration of degraded forest ecosystems and establishment of timber/pulpwood plantations.
- Investments in community-based ownership and management of protected areas.
- Investments to support the containment of forest fires and pests and other investments in adaptation measures.

However, substantial new investment needs are also emerging in the context of REDD, especially in implementing the Forest Carbon Partnership Facility. The FCPF was designed to prepare, and demonstrate a new performance-based approach to reward

developing countries for achieved carbon emission reduction outcomes from standing forests. The FCPF Readiness Fund assists countries in building their capacity to tap into a future system of positive incentives for REDD by providing support for the development of the methodological approach and key analytical work such as for the emissions reference scenario, the monitoring system and key reforms and investment needed, but in most cases not for implementing the reforms and investments themselves. The FCPF Carbon Fund will demonstrate optional approaches for payments for achieved emission reductions against the reference scenario. The FCPF is thus not designed to provide for the investment needs outlined above, with the exception of testing payments of emission reductions. There is, therefore, a clear need for funds covering this "missing middle".

A 2007 UNFCCC study of investment needs assessed the financing needs in the order of US$ 5-6 billion a year.

The Forest Investment Program

On July 1, 2008, with G8 endorsement, the World Bank Board of Executive Directors gave their approval for the development of two climate investment funds (CIF) which will also address the role of forests in climate change. One is **The Clean Technology Fund (CTF)**. The second, **The Strategic Climate Fund (SCF)**, will provide financing to pilot new development approaches or to scale up activities aimed at a specific climate change challenge or sectoral response through targeted programs. An important objective of the SCF is to maximize co-benefits of sustainable development, particularly in relation to the conservation of biodiversity, natural resources ecosystem services and ecological processes.

As one of the targeted programs under the SCF, a **Forest Investment Program (FIP)** will be developed, aiming to finance immediate investment needs that can act as a bridge for piloting actions and learning while UNFCCC negotiations take place. The program is to be established by the end of 2008 with a view to mobilizing significantly increased funds to accelerate efforts in developing countries to reduce deforestation and degradation, promote improved sustainable forest management as a means to reducing carbon emissions, and protect of carbon reservoirs.

Taking into account the underlying causes of deforestation, the objective of the proposed FIP would be to finance transformational investments in developing countries to initiate change towards low carbon emissions and climate resilient sustainable forest management. It is understood that such investments will only be effective if made within the context of an enabling legal, institutional framework and a conducive investment climate for follow-up action by the private sector, marked by strong governance capacities in developing countries.

Inclusiveness and broad stakeholder participation will be key features of the FIP, both in its design and implementation. It is important that diverse stakeholders participate early on in the FIP development process, recognizing that a sustainable solution to deforestation and forest degradation, the promotion of sustainable forest management as a means to reducing carbon emissions, and the protection of carbon reservoirs require the

active involvement of multiple actors across society.

The FIP consultation process is currently being launched, and will follow an iterative process with various design meetings, with the aim of obtaining approval in early in 2009. The process will include, among other actors, governments in developing and donor countries, civil society groups and indigenous and forest peoples' organizations, local and international non-governmental organizations, the private sector, and foundations and will seek close collaboration from the UNFCCC, other UN agencies, the Global Environment Facility, bilateral development programs, and an emerging Global Forest Partnership.

PAPER NO. 5B: WORLD BANK

Scaling-up climate change mitigation efforts

This paper is being distributed as background to discussions at the third session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) August 21-27, 2008.

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I. Introduction

1. In recent years, the case for scaling up mitigation efforts discussed in terms of Giga-tons of needed reductions in greenhouse gas emissions per year or tens of billions of dollars of required annual investments for deployment of commercially available low carbon technologies and systems has been widely accepted. The question that now faces the international community is how to achieve this – and how fast.

2. Current efforts to mitigate climate change primarily stem from the Kyoto Protocol of the UNFCCC, along with growing voluntary efforts in different parts of the world. Kyoto mechanisms have made important contribution to mitigation efforts through bottom up approach of learning-by-doing. To enable scale up of mitigation efforts, it is necessary to build on the current scientific knowledge, technologies and experience from the project-based mechanisms to develop simplified methodological approaches for large-scale mitigation programs.

3. To achieve efficacy in scale up efforts, different approaches are likely to be appropriate for different countries and interventions. These approaches could include a combination of interventions such as taxes, efficiency standards and labels, market-based cap and trade schemes and could be defined by host countries in relation to the specific country circumstances, technology, and institutional capacity.

4. This paper shares the experience gained from the Kyoto mechanisms, outlines potential opportunities for scaling up mitigation efforts, discusses potential approaches for quantification of impacts and proposes issues for discussion.

II. The Project-by-Project Approach

5. Carbon offset projects[1] measure the reduction of greenhouse gases in comparison with the baselines, in accordance with 'business-as-usual' trends, for specific sources of emissions. This concept is used in the projects of Joint Implementation (JI) and the Clean Development Mechanism (CDM) of the Kyoto Protocol and also in registry-based systems and voluntary standards.

6. Allowance based cap-and-trade systems and trading under Art.17 of the Kyoto Protocol establish a baseline (or cap) as an emissions limit, which allows covered sources, from covered sectors, to sell emission allowances if their emissions are below the pre-defined limit, and, conversely, make them liable to buy allowances (or emission reductions) if they exceed the limit. As a result, cap-and-trade systems build the overall reduction target into a specific allocation of allowances to all covered sources. These systems are viewed as cost-effective, but they have the drawback of the initial distribution of allowances that are difficult to determine.

7. The CDM has, to date, provided significant experience with methodologies for offset projects using a bottom-up approach for methodology development combined with a rigorous review and approval process. The CDM has demonstrated that offset-based mitigation efforts can work in an international context and for a variety of project types and technologies. However, it has also become apparent that the process of creating new methodologies and applying an approved methodology to a proposed project is expensive and time consuming.

8. In response to calls for improvements to the CDM, significant progress has been made. The CDM has developed the concept of a Program of Activities (PoA). This concept is based on the idea that a program is a replication of the same or similar discrete activities to which a project-by-project methodology can be applied. While CDM PoA approach allows for scale-up of carbon offset projects, it restricts the scope of the activity to the use of one methodology for a PoA with all the requirements of a project-by-project approach. The simplification introduced by the PoA pertains more to procedures than to the analytical and methodological aspects.

9. Beyond this, scale up efforts require methodological approaches that emphasize the emission reduction trends and transformational impact rather than tracking each ton of emission reduction. It is important to note that a well-designed program and methodological approach can have the same credibility and infer the same environmental integrity on the emission reductions that is achievable under the project-based mechanisms. Programs, broadly defined, could become good vehicles to tackle sectors, sub-sector or system-wide emissions.

III. Scaling-up mitigation efforts

10. A wider-scale system of program-based emission reductions would ideally require options for outlining procedures for baseline standardization and simplification of methodologies required to scale up mitigation efforts in a cost-effective way. *Scaling up* will best occur through purposeful aggregated programs.

11. Aggregation is widely practiced in investment-focused programs. Lines of credit, establishment of cooperatives, sector-specific financing programs and local government support are all examples of channelling funds to achieve a common objective. The key difference is the scale, technological scope and the nature of the aggregator. Most investment programs are managed by financial

[1] Based on Heister, J., "Approaches to Methodologies in Carbon Finance Programs, concept note for CPF Implementation"

institutions and focus on disbursement and technical due diligence, than on monitoring of emission reduction. Broadly, aggregation can be categorized as *vertical* and *horizontal*.[2]

12. *Vertical* aggregation represents a multiplicity of similar actions in a given sector, or sub-sector. For example, these could be large scale lighting retrofit or high efficiency appliance or vehicle improvement programs; or conversions to better technologies in industrial sectors such as cement or brick making; or investments in renewable electricity generation or fossil-based power technologies that support carbon capture and storage; or energy efficiency and fuel switching programs for industrial boilers; or equipment replacement programs. The main coordinating actors behind these aggregations could be central, regional or local governments. They could also be energy utilities or associations of the industries concerned, or multinational companies in specific industries. This opportunity is relevant for a single industry as well as to large companies and government agencies.

13. *Horizontal* aggregations represent a multiplicity of actions coordinated by an agency across a range of sectors, or sub-sectors. Such possibilities include municipal or regional government programs that involve multiple actions targeting several areas, for example initiatives targeting buildings, transport and urban forestry. A program run by a city government could encompass all activities in its area of jurisdiction, with direct interventions in its own activities and regulatory and incentive-based initiatives that facilitate the participation of private sector and the general public.

14. The scale of aggregation determines both international and domestic contexts for effective engagement of investment and policy frameworks in climate mitigation efforts. This is also a pre-requisite for ensuring measurable and results oriented implementation. A crucial characteristic of an aggregated *program approach* is to enable alliances between domestic public and private agencies, financial instruments and multilateral or domestic based policy instruments. As the effectiveness of program approaches and development finance depend on government policies, aggregation would enable dialogue and negotiation between different stakeholders and opportunities to harness synergies.

15. In most cases, there are certain natural aggregators, mandated either by law, such as government agencies or by their stakeholders, such as industry associations. These natural aggregators exist in almost all countries, though with differing degrees of technical capacity, institutional support and financial capability. The fastest way to scale-up activities effectively is to find such aggregators, identify mutual interests and build their capacity. This could involve providing them assistance in gaining the required mandate, either by law or through stakeholder consensus. A strong financial incentive, such as a strong carbon price backed with technology support and financial intermediation are expected to serve as incentives.

16. The wide-ranging literature on climate mitigation opportunities provides potential approaches to climate mitigation scale-up efforts. Research by the International Energy Agency and the IPCC working groups also identify least-cost mitigation options. Areas such as demand side energy efficiency improvement offer immediate opportunities for scale up. Researchers from Princeton University have developed a concept of ‘stabilization wedges’ that focus on potential mitigation options, in several areas including, transport, fuel switching, renewable energy, efficient power generation and heating etc., also see examples below. Each component, or wedge, is estimated to have potential to reduce one Giga-ton of carbon per year in 2054.

[2] Based on Murray Ward, et al., draft paper on “Policy instruments and approaches for scaling up investment in climate change mitigation activities”, prepared for the World Bank (with Jose Alberto Garibaldi, Kate Hampton, Niklas Hohne, Martina Jung, and co-authors Alex Bakir and Steven Gray)

17. While the implementation of a global programs targeting single technological intervention or sector will have its own environmental impacts, a combination of efforts in sectors and countries could yield significant mitigation results. Examples of specific mitigation programs could include,
    - Manufacturers
        - Double the efficiency of passenger cars world-wide from 30 to 60 mpg by optimizing car size and power;
        - Ensure high-quality of Compact Fluorescent Lamps (CFLs) by assisting manufacturers to upgrade or retool facilities.
    - Joint government and private sectors
        - Using best available technology in all new and existing buildings, through design and equipment efficiency improvements;
        - Establishment of efficiency and performance standards or benchmarks and targets for phasing out lower standards.
    - City and municipal government
        - Reduce distance travelled by all passenger vehicles in half by promoting efficient public transport options and encouraging holistic urban planning and design;
        - Reduce carbon intensity of urban area by improving energy efficiency of municipal services.
    - National government
        - Raise efficiency of power plants from 40% to 60%, through renovation, modernization of electricity generation, transmission and distribution;
        - Enforce a system of efficiency standards and labels, with accelerated, dynamic phase-out of lower efficiency equipment.

IV. Quantifying impacts of the mitigation efforts

18. Like all credit based mechanisms, it is necessary with *all mitigation efforts* to establish a baseline, and then measure, report and verify performance against this. The 'metric' of this baseline needs to be measurable so as to conservatively represent reduction in emissions or enhanced sequestration. This becomes challenging, as efforts move away from project level to a broader level. Given that the largest potential for mitigation is in developing countries, the performance metric could be framed in terms of energy intensity to ensure that it does not cap improvements in the quality of life of people in developing countries.

19. Criteria for developing the metric and a corresponding measurement tool will include desirability of achieving a large-scale transformation of the economy/sector, at optimum level of transaction costs. The complexity of the tool with regard to implementation can be distinguished by criteria like the capacity needed at government level and private-sector levels to develop baselines and requirements for data, monitoring, reporting and verification.

20. It is also important to incorporate the sustainable development and non-GHG, local environmental benefits, as these are crucial in the developing country context. The transport sector is a perfect example of a strong scaling-up opportunity that is constrained due to difficulty in quantification of diverse sources of emissions, the combination of policies and technologies required to mitigate emissions and the exclusion of related environmental and social benefits.

21. As diverse emissions sources contribute to uncertainty and variability of reductions, the methodologies for large scale programs will have to develop standardized procedures that permit use of default values to promote simplification and to be cost-effective. Standardized, aggregate scale, methodologies could produce a reasonably accurate assessment of emission reductions as individual source variations in a diverse portfolio of sources can cancel out.

22. The main building blocks of a mitigation program could be quantification of benefits, stakeholder capacity and implementation mechanisms. As mitigation efforts are scaled-up, implementation mechanisms achieve economies of scale but complexities in quantification of impacts and capacity of stakeholders assume significance and capacities will have to be strengthened through national and international initiatives.

23. Compared to stakeholder capacity concern, the methodological concern may be easier to address. There are different approaches for quantifying the impact of different types of aggregators and technology mix. An aggregator could utilize direct measurement techniques (e.g., metering of activities) or adopt default values based on technical and scientific data (e.g., deeming the impact of the activity) or a judicious and conservative combination of the two. In this context, the work on establishing an urban inventory of climate impacts and mitigation options is notable. This inventory attempts to categorizes and quantify activities of a city or municipality into direct and indirect sources of emission and emission reduction. In a similar way, development of village baselines, covering typical energy use of average households in a climate and geographic area could simplify quantification efforts needed for mitigation programs.

24. The CDM Executive Board recently approved a small-scale methodology, based on deemed savings approach[3] for demand side efficient lighting projects. This methodology is unique in its simplification of monitoring requirements by building safeguards into the project design and implementation stages to ensure environmental integrity. This is the first methodology that looks beyond an individual activity, i.e., replacement of a single incandescent lamp with a compact fluorescent lamp, and allows the use of technical parameters and default values to conservatively estimate emission reductions.

25. As programs involve several stakeholders, an important aspect would be determination of a baseline envelope for programs at the aggregate level, with an indicative baseline for individual activities. Simplified and robust approaches to baseline assessment and targeting interventions for mitigation hold key to ensuring the environmental integrity of the individual activity.

26. An approach could be to shift the focus from ‘what is’ and ‘what would have been’ to “what is required”. If the greatest mitigation benefit accrues to equipment of the highest available efficiency, the program could be designed to support the deployment of the same. It is also possible to identify categories of activities, with high sustainable development and carbon mitigation benefits such as renewable energy systems and household appliances. Such generalizations will immensely support scaling-up of mitigation efforts.

[3] Ranade, Monali et. al, draft paper on “Deemed Savings Approach for CDM and CPF”

V. Points for discussion on way forward

27. Scaling-up of mitigation efforts is a realistic opportunity. Resources to achieve the scale up could be easier to mobilize once methods and approaches to design, implementation and quantification of impacts are defined.

28. There exists significant experience within the UNFCCC framework in quantifying national GHG inventories, through the National Communication efforts and in quantifying project level individual GHG measurement, through CDM and JI. What is required is to create a framework that harnesses specific GHG mitigation opportunities using natural aggregators at appropriate scales.

29. It is important to build on the current scientific knowledge, technologies and experience to encourage the development of simplified methodological approaches for large-scale mitigation programs.

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