CONFERENCE OF THE PARTIES
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Agenda item 4 (a)(ii)

UNFCCC WORKSHOP ON EMISSION FACTORS AND ACTIVITY DATA

Note by the secretariat and report

I. INTRODUCTION

A. Mandate

1.   The Conference of the Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), at its second session, requested the Convention secretariat "to provide a forum for the exchange of experiences in the development of emission factors and activity data" for the estimation of the greenhouse gas (GHG) inventory (decision 10/CP.2).

2.   In response to this request, the UNFCCC secretariat organized the UNFCCC Workshop on Emission Factors and Activity Data, which was held in Havana, Cuba from 16 to 18 September 1998 back to back with the Intergovernmental Panel on Climate Change (IPCC) Expert Group Meeting on National Feedback on the Revised 1996 IPCC Guidelines. Seventy-six participants from 44 countries attended the Workshop, including representatives from national teams in charge of compiling GHG inventories and from international bodies, as well as independent experts.

B. Scope of the note

3.   This document comprises an introduction by the secretariat describing the goals and conduct of the workshop and indicating projected follow-up activities, together with reports on the energy sector and the land-use change and forestry sector prepared by the two working groups that were formed.

C. Goals

4.   The main goals of the Workshop were:

        (a)   To initiate a process for the exchange of experience in the development of emission factors and activity data for the estimation of greenhouse gas inventories;

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(b)   To contribute to improving the accuracy, consistency and comparability of GHG inventories of developing countries;

(c)   To prioritize needs for accurate and reliable activity data and emission factors;

(d)   To suggest short-term and long-term measures, at regional and national levels, for institution and capacity building to sustain the generation of quality activity data and emission factors.

D. Working process

5.   Two technical papers, based on the review of GHG inventories of 36 non-Annex I Parties, were provided to serve as a background for discussion. In order to compile as much information as possible and because of the small number of initial national communications currently available, the two papers also included information on inventories provided by other sources. It is however recognized that the information available in the technical papers could have been more useful if a larger number of GHG inventories had been officially available. The two technical papers were:

(a)   "Emission Factors and Activity Data of Greenhouse Gases Inventories in Developing Countries, Part I Energy Sector"; and

(b)   "Emission Factors and Activity Data of Greenhouse Gases Inventories in Developing Countries, Part II Land-Use Change and Forestry".

6.   After a general discussion during the initial plenary session, two working groups were organized, one on the energy sector and the other on the land-use change and forestry sector. Participants were primarily from Africa, Asia and Latin America, with 46 persons participating in the energy working group and 27 in the land-use change and forestry group. The working groups were organized to identify in more detail key issues, potential activities and measures to enhance the quality of activity data and emission factors. The criteria used towards this end were both the relevance to the total amount of GHG emissions reported in the inventories and the short-term feasibility of improving the estimates. Thus, identified short-term priorities reflect more important issues to be addressed with feasible measures in a reasonable time-frame, while less relevant and less urgent matters that would be more difficult to implement were accorded long-term priority.

E. Next steps

7.   In conjunction with COP 4, the secretariat will organize a special event which could be the first in a series of regular meetings providing a forum for the exchange of experience in the development of greenhouse gas emission factors and improvement of activity data. The exchange of experience would be facilitated if non-Annex I Parties wishing to do so provide GHG inventories to the secretariat.

8.   The secretariat will also organize additional workshops at the regional level, depending on the availability of GHG inventories and provided that the required supplementary funding for this is made available by Parties through voluntary contributions to the Trust Fund for Supplementary Activities. The regional workshops could provide a basis for the exchange of experience among non-Annex I Parties. In this regard, the UNFCCC secretariat could compile information on inventories from non-Annex I Parties for the purpose of improving their quality and assessing needs and constraints, including possible ways to overcome them. Information from the above process could be made available to the Subsidiary Body for Implementation (SBI) and/or the Subsidiary Body for Scientific and Technological Advice (SBSTA).

II. REPORT ON THE ENERGY SECTOR

A. Activity data

9.   All participants agreed that the energy balance is a crucial tool to obtain appropriate activity data on the energy sector. The capacity to develop and enhance (disaggregate into end-uses/devices) energy balances has to be strengthened as a first step. The availability of detailed energy balances will make it feasible to use the technology-based approach and help to explain the difference between the results from top-down and bottom-up methods. Participants also remarked that there are other benefits of doing the energy balance, including economic and energy planning and identification of mitigation options.

10.   The participants prioritized the key issues related to activity data for each region as shown in table 1.

Table 1. Key issues related to activity data by region: preliminary assignment of priorities by participants

Activity data	Africa		Asia		Latin America	
Key issues	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Biofuel transformation	1		1		3	
Residential	1		1			4
Industry end-uses	3		2		2/1	
Transport	2			3	2/1	
Small-scale / informal (commerce / industry)		4	2			5
Autoproducers		5		4		5
Bunkers		6		5		5

Note: 1 = highest priority

B. Emission factors

11.   The wide variety of fuels used for different purposes and in different operating conditions in developing countries often makes it difficult or inappropriate to employ the default values of GHG emission factors provided in the IPCC Guidelines. Participants identified the sources where either default emission factors provided by the IPCC do not suit developing countries' conditions or where suitable default emission factors were not provided:

(a)   Kerosene and other fuels used for lighting;

(b)   Cars with catalytic converters, especially in relation to N_2O emissions;

(c)   Wood and other biofuels used in cooking stoves;

(d)   Charcoal production from wood and other feedstocks;

(e)   Biomass fuels : wood and charcoal, but also agricultural wastes, rice hulls, coconut shells, sugarcane bagasse, among others;

(f)   Black liquor and other biomass residues used in industrial applications;

(g)   Different coal types with high ash and sulphur contents;

(h)   Power generation plants, given the specific design, maintenance, operating conditions and different fuels used in developing countries, and especially in the case of autoproducers;

(i)   Hydropower plants with large reservoirs (CO_2 emissions have to be accounted for in the land-use change and forestry sector, but methane emissions are particularly relevant).

12.   The participants prioritized the key issues related to emission factors for each region as shown in table 2.

**Table 2. Key issues related to activity data by region:
preliminary assignment of priorities by participants**

Emission factors	*Africa*		*Asia*		*Latin America*	
Key issues	Short-term	Long-term	Short-term	Long-term	Short-term	Long-term
Residential sector / biofuel combustion / transformation	1		2/3		1	
Transport	1		2/3		1	
Fugitive emissions	2		1		1	
Non-energy uses		3		4		4
Net calorific values		4		4		5

Note: 1 = highest priority

C. Quality and uncertainties

13.   The participants agreed that it is difficult for developing countries to report uncertainty estimates according to the IPCC Guidelines. They suggested that Parties could compile GHG inventories in the fuel combustion sector through both top-down and bottom-up methods to compare results, and in this way problems could be identified in order to improve the quality of the estimation and therefore reduce uncertainties.

D. Measures to improve activity data and emission factors

14.   A number of measures were suggested by the participants to improve the process of compiling national GHG inventories, at both national and international levels:

(a)   At the national level:

(i)   The establishment of a network of research institutions to support government agencies in the elaboration of GHG inventories;

(ii)   The improvement of national energy balances through capacity building, the development of software and appropriate surveys for data collection;

(iii)   The establishment of better links with existing national environmental agencies to connect inventory work with local air pollution issues. Mandatory or voluntary environmental audits, reporting of emissions by industries and vehicle inspections to check conformity with local air pollution standards are possible ways of getting data for GHG inventories;

(iv)   If indirect methods can not be applied (see subparagraph (b) (ii)), when necessary, biomass surveys should be integrated with household surveys. Biomass consumption survey updating methodologies should be developed.

(b)   At the international level:

(i)   Accessing, review and analysis of existing databases through networking of national, regional and international institutions and the development of a Web site of existing reports, data and methodologies;

(ii)   Assessing the possibility of developing indirect methods for estimating biofuel consumption (in the residential and informal sectors) in order to minimize the need for expensive and time-consuming surveys at the national level.

E.   Conclusions and recommendations for the energy sector

15.   The main conclusions and recommendations of the energy working group were:

(a)   There is a potential for improving the completeness, accuracy and comparability of GHG inventories in the energy sector reported by non-Annex I Parties. Actions towards this end should address the following key issues as short-term priorities:

(i)   Improvement and extension of national energy balances to include detailed energy end-uses and efficiencies by technology, equipment vintage and operating conditions, particularly in the residential, transport and industry sectors;

(ii)   Surveys of energy consumption in the residential sector, and studies of emission factors for biomass fuels used in rural areas;

(iii)   Studies of the road transport sector: operating conditions of vehicle fleets and emission factors for non-CO_2 gases;

(iv) Determination of fugitive emission factors for different coal types and processing activities;

(v) Calculation of fugitive emissions of methane and CO_2 from oil and gas systems;

(vi) Development of emission factors for the biomass transformation processes.

(b) A number of initiatives in non-Annex I Parties to improve the availability of activity data and emission factors were also identified. In order to extend the application of these successful approaches, selected efforts to strengthen the existing capability in developing countries are recommended. Some targeted actions could be supported by existing programmes and institutions. The establishment of regional reference centres within existing developing country institutions, with relevant experience in the field, could help address the key issues described above and thus provide clearing houses for the following activities:

(i) Dissemination of information (compiling and providing access to existing data and documentation, through the establishment of Web sites and databases);

(ii) Critical review of published/unpublished information (collection and analysis of the background documentation of GHG inventories, and organization of technical workshops to discuss the results of the reviews);

(iii) Establishing the need for further research and coordinating the launching of studies to meet these needs; in order to disseminate the results the organization of training courses and workshops will be necessary.

III. REPORT ON THE LAND-USE CHANGE AND FORESTRY SECTOR

16.   The working group on the land-use change and forestry sector discussed the issues and problems related to activity data and emission factors in the sector, identified the measures, programmes and activities required to improve activity data and emission factors in the short term and long term, and considered the resources required. Regional variations with respect to availability and access to activity data and emission factors, as well as infrastructure and technical capacity, were also briefly discussed.

A. Activity data and emission factors

17.   The activity data and emission factors could be considered at three levels based on spatial or geographic variations, namely:

    (a)   At the national level;

    (b)   According to vegetation (forest or plantation) types within a country; and

    (c)   According to vegetation types at regional (multiple country) level.

18.   The key activity data and emission factors and the relevant issues identified at different geographic levels are presented in table 3.

Table 3. Land-use change and forestry: Key activity data and emission factors and related issues and problems

Key activity data / emission factors	Key issues
a) Activity data and emission factors to be generated at the national level	
- Commercial timber harvest - Traditional fuelwood use - Other wood use - Biomass conversion factors	1. Data availability is very limited for non-commercial wood 2. Limited information on fuelwood consumption (particularly in Africa) 3. Quality of existing data is uncertain 4. Difficult to trace sources of fuelwood (from land clearing, or from existing forests) 5. Limited information on conversion ratio for timber to total above-ground biomass

Key activity data / emission factors	Key issues
b) Activity data and emission factors to be generated according to vegetation types at the national level	

- Area of forest / plantation
- Area converted annually
- Area converted over different periods of time
- Area of abandoned land
- Fraction of biomass burned on-site and off-site and left to decay
	1. Scarcity of data
	  - Most countries do not have adequate data on area under forest and rates of forest conversion, biomass fraction for on-site and off-site burning and left to decay
	  - Most often expert judgement is used
	  - Africa: data availability very limited
	2. Limited access to existing satellite imagery and forest inventory data
	3. Reliability of existing data uncertain
	4. Forest categorization; different in the countries from that given by the IPCC (FAO)

c) Activity data and emission factors to be generated for vegetation types at the regional level	

- Biomass before and after conversion
- Annual growth rate :
  *Forest
  *Plantation
  *Abandoned land
- Soil carbon density
- Combustion efficiency
	1. Forest categorization used by countries is different from the IPCC Guidelines, limiting the use of default values
	2. Broader global or tropical region level default values, not relevant to forest types in countries
	3. Significant information is available but not compiled and made accessible
	4. Field measurements lacking

19.   The issues and problems related to activity data and emission factors may be summarized as follows:

(a)   Lack or inadequacy of data (e.g. on area of forest or plantation, area converted annually);

(b)   Lack of access to currently available data for many countries (forest inventory data on above-ground biomass, annual growth rate and so on, or satellite assessment data on land cover under forests);

(c)   Variation in activity data and emission factors according to forest type or plantations within a country and across countries (e.g. above-ground biomass and annual growth rate);

(d)   Variation in activity data over the years (e.g. area converted annually), and variation in above-ground biomass and growth rates with age of plantation or regenerating forest;

(e)   Quality and reliability of existing data is uncertain (e.g. fuelwood consumption, land-use change);

(f)   Variation in activity data according to socio-economic status (fuelwood use);

(g)　　　Differences among countries and regions with respect to availability of and access to data, as well as infrastructure and technical capacity (e.g. South-East Asia and different regions of Africa).

B. Quality and uncertainties

20.　　　The reliability of activity data (e.g. area converted annually, forest area) in the forestry sector is very low. Data on some parameters are not available. Thus, the national experts make extrapolations and their own judgements. Discussion on uncertainties is premature, given the limitations of data availability, variability and reliability.

C. Measures to improve activity data and emission factors

21.　　　The measures for improving activity data and emission factors were discussed at three levels:

(a)　　　According to geographic variation (vegetation type specific within a country and at regional level);

(b)　　　Short-term and long-term measures; and

(c)　　　National, international and regional measures.

22.　　　Short-term measures:

(a)　　　Data at *national level* (e.g. commercial harvest, traditional fuelwood and other wood use, and biomass conversion factor):

　　(i)　　　Review the existing literature (surveys and studies) on fuelwood consumption, commercial harvest, etc. (along with sampling methods);

　　(ii)　　　Prepare national level database;

　　(iii)　　　Conduct workshops to assess, evaluate and use the database.

(b)　　　Forest and plantation type specific data *within a country* (e.g. area of forest and plantation, area converted annually, area abandoned):

　　(i)　　　Conduct review of the existing literature;

　　(ii)　　　Compile and assess the existing forest inventory data covering all the parameters;

　　(iii)　　　Provide access to the existing satellite imagery;

       (iv)   Identify institutions at national and regional level which have capacity to process and use satellite imagery;

       (v)   Develop capacity for interpreting, validating and using existing satellite imagery (ground surveys, aerial photography) and forest inventory;

       (vi)   Conduct training programmes to enhance capacity.

(c)   Activity data and emission factors *at regional level* according to forest and plantation types (e.g. above-ground biomass, annual growth rate, soil carbon density, combustion efficiency). The regions could be defined using the Food and Agriculture Organization (FAO) classification. For example tropical forest regions are:

       (i)   Africa – East Sahelian Africa, West and West Sahelian Africa, Central Africa and Southern Africa;.

       (ii)   Latin America – Central America and Mexico, tropical South America and Brazil;

       (iii)   Asia – South Asia, continental South-East Asia and insular South-East Asia.

(d)   The activity data and emission factors could be potentially generated and used *at regional level* to improve the GHG inventory in the short term. The measures are:

       (i)   Review the existing published and unpublished literature and forest department inventories;

       (ii)   Prepare regional database on activity data and emission factors;

       (iii)   Prepare regional default values;

       (iv)   Conduct workshops to review, assess and, if possible, share regional default values.

23.   Long-term measures: The long-term measures should aim at promoting the national efforts for generating activity data and emission factors. Some of the measures suggested are as follows:

(a)   *National activity data* – Field studies have to be initiated to generate primary data on fuelwood and commercial wood use, conversion factors, etc. at different locations in each country. There is a need to develop methodologies for conducting field studies for generating comparable data. Training programmes and workshops have to be organized at national and regional level. Variations due to socio-economic, seasonal and location factors

need to be considered. Field monitoring for assessing the rates of extraction from different forest types and locations in the country is essential;

(b)   Forest and plantation type specific activity data and emission factors *at country level.* In the long term, it is necessary to generate all vegetation and soil related activity data and emission factors at each country level:

(i)   Identifying institutions at national level and providing infrastructure for (1) conducting field and laboratory studies, (2) analysis and interpretation of data, and (3) using the data to generate a quality GHG emissions inventory;

(ii)   Enhancing technical capacity through training programmes and workshops on methodology, data analysis and interpretation (particularly satellite imagery);

(iii)   Initiating forest inventory studies in the dominant forest types, monitoring them periodically, compiling and making them available to experts preparing national inventories;

(iv)   Coordinating with existing programmes such as the Tropical Forest Assessment (of FAO) and the land-use and land-cover change programmes (of the International Geosphere-Biosphere Programme - IGBP) to ensure that all countries are covered under their programmes and the satellite imagery data become accessible to the national experts;

(v)   Initiating soil carbon monitoring studies;

(vi)   Preparing a national-level database on activity data and emission factors for periodic updating and use by the national experts making the emissions inventory as well as other experts involved in national forest conservation and development programmes.

D. Conclusions and recommendations for the land-use change and forestry sector

24.   The working group on the land-use change and forestry sector discussed and identified the key activity data and emission factors, and the issues and problems in generating, accessing and using the data, and suggested short-term and long-term measures to improve the quality of activity data and emission factors, to enable preparation of reliable and comparable national GHG inventories.

25.   The issues related to activity data and emission factors are:

(a)   Lack or non-availability of data;

(b)   Currently available data (from forest inventory and satellite imagery) are not accessible; and

(c)   Inadequacy of institutional infrastructure and technical capacity to access, assess and use the existing data in the short term, and to generate primary data in the long term.

26.   The two critical activities relevant to generation of activity data for making emissions inventories relate to:

(a)   Lack of periodic data on land cover and land-use change (according to vegetation types in a country), and;

(b)   Lack of forest inventory studies to generate several parameters required to make emissions inventories (e.g. above-ground biomass, growth rate, and soil carbon density).

27.   There are variations among countries and regions with respect to availability of data (satellite imagery assessment or forest inventory findings), technical capacity and institutional infrastructure (e.g. some countries of South-East Asia and West Africa). Thus, the measures required are likely to be different for different countries and regions.

28.   Short-term measures: The main goal of short-term measures is to enable the countries to access the existing data, evaluate them and use them in making reliable GHG inventories. The activities could involve the following:

(a)   Assisting developing countries (through training programmes and workshops) in accessing, evaluating and using the existing data;

(b)   Organizing literature reviews (published and unpublished) on all the activity data, assess the available data and prepare databases and regional default values for the identified parameters. These regional default values need to be reviewed and shared at the regional level through workshops;

(c)   Identification of national and regional technical institutions that could act as national or regional focal points, participate in capacity-building programmes, undertake compilation, preparation and review of activity data and regional default values.

29.   Long-term measures: The main goals in the long term are to:

(a)   Increase scientific and technical capacity in the countries to undertake research and monitoring to generate vegetation and location specific activity data and emission factors;

(b)   Build institutions or enhance the capacity and infrastructure of the existing institutions;

(c)   Internalize GHG inventory through; internalizing the process for data collection, validation and use, by establishing long-term programmes for activity data generation.

30.   The three long-term activities to be initiated for generating reliable and comparable activity data and emission factors are as follows:

(a)   Initiate sustained, periodic land cover and land-use change monitoring programme (rate and pattern):

   (i)   Satellite assessment;

   (ii)   Ground validation;

   (iii)   Interpretation;

   (iv)   Report preparation and dissemination;

(b)   Initiate forest inventory studies (covering all vegetation and soil parameters):

   (i)   Developing methodology;

   (ii)   Locating and establishing permanent plots;

   (iii)   Conducting periodical measurements;

   (iv)   Compiling data and analysis;

   (v)   Report preparation and dissemination;

(c)   Biomass consumption and extraction studies:

   (i)   Developing methodology;

   (ii)   Conducting field survey on consumption patterns and monitoring extraction from different forest types;

   (iii)   Compilation and reporting;

(d)   These activities could be operationalized and sustained through:

   (i)   Institution building and infrastructure support;

   (ii)   Training and capacity building;

   (iii)   Dedicated research and monitoring;

(iv)   Networking and information sharing workshops;

(v)   Increased and sustained funding from national, bilateral and multilateral institutions.

31.   Several developing countries have initiated programmes to generate data on forest area, biodiversity, vegetation status and so on, to assist in forest conservation and sustainable forest management programmes. All the infrastructure and human capacity developed for generating activity data and for preparing GHG emission inventories as well as the data generated, will be useful for promoting the national and global forest conservation and sustainable forest management programmes. The developing countries may have to initiate the process of improving the quality of forestry data, for the multiple benefits.

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