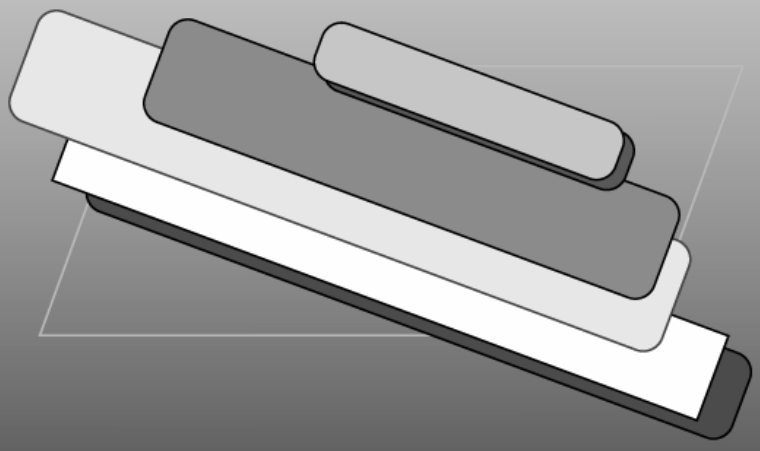
Meeting on verification of country-level carbon stocks and exchanges in non-annex I countries



Rome, 27-29 September 2000

REPORT ON THE

FAO/GTZ

MEETING ON VERIFICATION OF COUNTRY-LEVEL CARBON STOCKS AND EXCHANGES IN NON-ANNEX I COUNTRIES

Rome, 27 - 29 September 2000

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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EXECUTIVE SUMMARY

Sixteen Experts of various disciplines were invited in September 2000 by FAO and the Deutsche Gesellschaft für Technische Zusammenarbeit GTZ GmbH (German Agency for Technical Co-operation) to debate issues related to the verification of carbon stocks and exchanges at the national level in non-Annex I countries. The emphasis was originally on National Reports, but the discussion was broadened to cover the spectrum of issues related to Verification from the level of National Reports to Projects under the Clean Development Mechanism.

The report is organised into the analysis of (1) carbon in the context of ecosystems, food security and sustainable development, (2) operational aspects followed by (3) a discussion of the areas where further work is required and where FAO could endeavour to expand its participation in the process ("The road map").

Main conclusions:

1. Carbon in the context of ecosystems, food security and sustainable development.

1.1 Only a holistic landscape-ecosystem approach has the potential to facilitate the understanding of carbon dynamics, as well as the much debated issues of carbon permanence, reversibility of sequestered carbon, leakage, baselines and the links between biomass and soil carbon storage. At the project level, all carbon pools and all fluxes should be included in the verification and accounting. The fate of agricultural and wood products and impacts of carbon cycle intensification on other pools and fluxes (e.g. nitrogen, water…) needs to be studied in greater detail.

1.2 Projects must generate enough environmental and societal value for stakeholders - in particular the people living in project areas - to derive clear benefits in terms of food security and sustainability of development. The verification process will have to pay due attention to those benefits, to avoid projects being abandoned after their completion and turning into carbon sources.

1.3 Together with the ecosystem approach and sustainability as a major project selection criterion, an ecoregional approach could simplify and improve the verification process (a stratification procedure would facilitate calculations and reduce costs). Eco-regions are understood as a combination of agro-ecological and agro-economic zones, i.e. areas where both environmental and socio-economic conditions, as well as human activities, are homogeneous enough to warrant the meaningful use of standard emission factors, reference values and methods yielding consistent and accurate data on carbon pools and fluxes.

2. Operational aspects.

2.1 Carbon accounting systems have to be simple. They might be based on land use practices, but both the land-based approach and the activity-based approach would be needed, whenever there are multiple activities on the same land. Process, spatial and temporal consistency in the method used is most important. At the same time, there is need for

pragmatism to keep costs acceptable. A programme approach, involving policy and legal measures, together with incentives for stable livelihoods would also diminish risks. Regional monitoring by government agencies may help and this could be done together with the establishment of regional baselines.

2.2 The operationalization of the Kyoto Protocol should match the Parties' capabilities. A series of guidelines will be needed covering *inter alia* criteria for project selection, eligibility, additionality, baseline methodology, error propagation, etc. Ecoregional guidelines on sampling strategies and data processing, among others for soil carbon, would be useful. Revised inventory guidelines and improved monitoring techniques for the developing countries are required by ecoregions, since the current guidelines are often deemed not appropriate.

3. The road map.

3.1 Carbon databases in agriculture, forestry and soils should be centralised in a transparent and widely accessible system, and an information strategy should be developed. FAO could be the repository of the meta-data bases and databases, and the custodian of the ecosystem and biosphere models that will be used to extrapolate flux and process measurements to the appropriate regional, national and global scales. Uncertainty in carbon data could be overcome through increased scientific knowledge about the carbon cycle, strengthening of the institutions involved, a reduction in sampling errors and thus improved statistics. Soil carbon has been a neglected aspect and FAO should start the compilation of more accurate data. Moreover, because the available data are currently primarily collected for other purposes than carbon accounting, there is a need to design and implement improved inventory systems.

3.2 The following thematic priorities were identified. In forestry, the most relevant issues were listed as definitions (terminology, classification), statistics (areas, biomass), forest typology and forest dynamics databases. In agriculture, agro-climatic typology, land-use typology, agro-ecological zoning and farming systems typology were seen as key topics. In soils, detailed soil maps and databases should be given due attention. To assist the process, an analytical lexicon/glossary would be needed.

3.3 To assist in project design it would be most desirable to establish a global look-up table of actual and potential carbon sequestration rates by land-use and activities on an ecoregional basis. The look-up table would constitute an essential tool for the identification of good practices and project planning, among others by facilitating the definition of baselines.

3.4 The Experts discussed the potential of Benchmark Projects/Sites in the validation of the operational (testing and validation) and societal aspects of the implementation of the Kyoto Protocol. Their main emphasis would be on long-term methodological development, the assessment of the accuracy and the cost of verification, as well as capacity building (ecoregional manuals and training programmes). In the pilot phase at least some 30 benchmark projects would be required.

3.5 Dissemination of know-how, methods and data to improve the participation and involvement of national experts constitutes the most important cross-cutting issue in the verification and reporting processes.

INTRODUCTION

In collaboration with the Deutsche Gesellschaft für Technische Zusammenarbeit GTZ GmbH (German Agency for Technical Co-operation), FAO's Interdepartmental Group on Climate Change hosted a meeting of Experts from 27 to 29 September 2000 in Rome. The discussions focused on the verification of carbon emissions and sequestration in the context of Agriculture in general, and more specifically Land-use, Land-Use Change and Forestry (LULUCF). Sixteen Experts from both developed and developing countries attended, together with FAO technical staff. Their names are given in Annex I, while Annex II lists the discussion papers that were presented at the Expert meeting.

Lively discussions arose on many issues, and the Experts were not always able to reach a consensus. Nor was this the objective of the meeting: the main intention was to informally explore issues, options, open questions, gaps etc. with a view to providing FAO with a "road map" on which the Organization's Governing Bodies may decide to orient the activities [1].

The emphasis of the meeting was originally on national reports, but since there was particular interest in considering non-Annex I countries, the discussion was broadened to the spectrum of relevant issues related to Verification from the level of national reports to Projects under the Clean Development Mechanism.

The present meeting summary notes are schematically subdivided into three sections: (1) the conceptual bases of verification from an FAO perspective (*Carbon in the context of ecosystems, food security and sustainable development*), (2) practical issues (*Operational aspects*) and (3) recommendations as to the areas where further work is required to clear the way for implementation of the LULUCF aspects of the Kyoto Protocol, and where FAO could focus its activities (the "road map" proper).

1. CARBON IN THE CONTEXT OF ECOSYSTEMS, FOOD SECURITY AND SUSTAINABLE DEVELOPMENT

The first part of the meting focused on some fundamental issues in relation with the scientific and conceptual basis of the verification process.

It was found that a holistic approach to projects offered clear advantages in approaching several of the topics still debated in the context of Verification. They include, among others, definitions, terminology, project duration, carbon permanence, etc. Guidance is needed especially on the elusive dynamic aspects of storage duration of Carbon in the various pools, in particular in soils and forests.

[1] The present report was prepared by FAO. It does not necessarily reflect the views of all experts and institutions present at the meeting.

1.1 THE LANDSCAPE-ECOSYSTEMS APPROACH

1.1.1 Rationale

Most Experts agreed that verification of carbon sequestration projects and of country-level carbon stocks and exchanges should go beyond the mere accounting aspects. The duration and permanence of carbon sequestration can be ensured in the long run only if it is associated with a sustainable land-use system, an essential prerequisite for local and global food security. The value of carbon should be assessed considering social, economic and environmental aspects: the verification process should regard carbon as an indicator of sustainable land management. Sustainable development indicators will thus have to be agreed on as part of the criteria for Clean Development Mechanism (CDM) and carbon sequestration projects.

The Meeting found that the separation of soil and above-ground biomass carbon sequestration is a very artificial one. It would, therefore, be desirable to consider sequestration in the ecosystem as a whole, rather than in its separate components, thus overcoming the dichotomy between both approaches. Projects are likely to cover areas and land with multiple activities.

In order to promote a consistent "ecosystem approach", the Meeting also found that carbon dynamics should be considered in the accounting procedures. This covers essentially carbon residence times in different ecosystem components. At a later stage, the concept might be expanded to carbon in agricultural and forest products, through assessing, e.g. the average lifetime of forest products.

It is suggested that an ecosystem approach has the potential to simplify the understanding of such issues as permanence and leakage.

1.1.2 Carbon permanence

The links between permanence and duration of carbon stocks, residence time of carbon in various pools, and carbon turnover were discussed. In land use projects, residence time equals basically project duration, so that residence time, permanence and duration are largely synonymous.

However, the Meeting noted the new and significant development in the process of negotiations, transferring the carbon liability for a project to the Emission Reduction Units (ERU) acquiring Party. This may imply more stringent criteria for eligibility.

A more specific problem is how to distinguish decaying forest biomass (in particular wood) prior to the establishment of a project, from slash and other biomass after the intervention. Growing trees may create a steady-state pool of carbon over several harvesting cycles, but the tree-soil complex including the roots constitute a longer-term storage. If a dead tree stays on the site and is not harvested, it will eventually turn into humus and soil carbon. The residence time of the organic material and the resulting turnover rate of carbon depend on a number of biophysical and biological factors. Again, the complexity of the interactions and exchanges

between the pools can be simplified, from an accounting and verification point of view, if an ecosystem approach is adopted.

1.1.3 Leakage

While the feasibility of nation-wide full carbon accounting is debated, the latter is generally considered the only way to exclude leakages at the project level.

The ways to deal with leakage vary from extremely complex and comprehensive approaches to simplistic ones. There is thus a clear need for standardisation of requirements and guidelines. At the same time, there is a need for pragmatism, if only to keep costs at an acceptable level. Regional baselines are often regarded as one of the techniques to achieve this goal.

It was noted that leakage could be reduced through a combination of an ecosystem approach and a programme approach, involving policy and legal measures, together with incentives for stable livelihoods of the populations affected by or involved with projects.

1.2 SUSTAINABILITY INDICATORS

As indicated, it is essential to evaluate the sustainability of projects. There are several sets of criteria and indicators to draw from other sectors (work co-ordinated by UN/DESA and CSD), as well as from ecoregional processes such as those for Sustainable Forest Management (e.g. the Montreal, Helsinki, and Lepaterique processes).

Next to socio-economic indicators, it may also be necessary to develop new, more specific ones. It can be argued that carbon-based indicators would play a central role, precisely because of the ecological functions of carbon. In addition, carbon can also be seen as a common denominator between the Conventions on climate change, biodiversity and desertification, and wetlands. For instance, high soil carbon levels are a sign of good structural resilience of soils against erosion and other forms of degradation (which are the main causes of desertification): they are also mostly associated with healthy ecosystems and a high degree of soil micro-organisms and invertebrate biodiversity.

The development of new indicators, or the adoption of existing ones, will require inputs from other fora, in particular the other Conventions, the United Nations Forum on Forests (UNFF), as well as from the ecoregional Sustainable Forest Management (SFM) processes.

1.3 THE ECOREGIONAL APPROACH

Ecosystems undergo very largely predictable and systematic changes according to prevailing climate, soil and land-use practices. The land units affected are broadly described as agro-ecological (and to some extent agro-economic) zones. The wording “ecoregions” is used below to indicate land areas with similar pedoclimatic as well as land-use and socio-economic conditions.

Significant improvements of accuracy and cost effectiveness could be achieved for a number of activities relevant to verification if an ecoregional approach were adopted. For instance, guidelines and good practice guides, baselines, emission factors, biological variables and conversion factors, etc. should all be made available by eco-regions. Within this approach remote sensing can assist in improving stratification.

Two basic methods can be used for verification, direct measurement and activity modelling. Direct measurements can be simplified since ecoregional variables can be inferred from the knowledge about the eco-region, therefore concentrating on azonal variables and thus improving sampling efficiency. Carbon changes can be detected in this way at a reasonable cost during a long- term period.

Activity modelling, typically using input-output models, can be simplified as well through the knowledge about the variability of inputs and their distribution according to ecoregions.

2. OPERATIONAL ASPECTS

This section focuses on some of the issues, methods and constraints that need to be considered in the ambit of the verification of carbon projects. Since there exists as yet little experience, the implementation of projects on a large scale should also be seen, and designed, as a "global learning process". Many aspects will have to be clarified, refined and agreed on literally "on the road". Among others, the Experts proposed that all guidelines should systematically be updated and made available.

2.1 SIMPLICITY, ACCURACY AND CONSISTENCY

Several Experts disagreed with a common view in the current debate among policy makers that LULUCF and soil sector data are affected by larger uncertainties than in other sectors. In general, the errors attached to agricultural data at the national level are comparable with those affecting, for instance, energy statistics.

The Meeting stressed that the debate on consistency vs. accuracy is not an either-or situation: compromise must be found between simplicity, accuracy and consistency. Part of perceived uncertainty derives from the complexity of the sampling schemes. In addition to the standard qualities of transparency and consistency with scientific principles, comparability across parties and over time appears as a most desirable feature of verification systems.

It is also arguable that, while the current verification systems are rather well defined, their complexity (e.g. baselines that are too open) is reflected in a lengthy negotiations process. Therefore the Verification procedures should indeed be simplified.

Some participants deemed that simplicity and consistency are more relevant than accuracy. For instance in the "human induced" activities (for which it is desirable to find a generally accepted definition) the accuracy of carbon sequestration due to "unknown causes" (CO_2 fertilisation, climate change) may be very high. This is a typical case where a very simple and conventional (but "consistent") verification system might be based on land use practices.

It is essential that the primary objectives of the Kyoto Protocol be kept in mind, e.g. to reduce atmospheric carbon concentrations and to "reward" Parties who reduced atmospheric carbon using the available mechanisms. On the other hand, reduced emissions should be interpretable in terms of improved sustainability, as indicated above. Putting too much emphasis on consistency rather than on accuracy may eventually result in situations where data from different sources will no longer tally or contradict scientific knowledge about the carbon cycle.

The level of uncertainty in reporting and verification also depends on the investment in building up the institutions that will generate more accurate statistics in the future. Procedures to monitor carbon in biomass and soils at landscape and regional level already exist, and sampling costs are not excessive.

FAO could contribute to the debate by systematically compiling accurate data on agriculture, soils and forestry. For non-Annex I countries the overall purpose should be to focus on a more comprehensive approach than a project-based approach, to develop large data bases which can be used for monitoring of activities beyond the scope of individual projects.

Sufficiently accurate methods to estimate the uncertainties connected with Full Carbon Accounting are not yet available. Substantial resources should be allocated for further development of ways to determine uncertainty, as a prerequisite for verification of the Kyoto Protocol. Moreover, because the currently available national data are primarily collected for other purposes than carbon accounting, there is a need to adapt current inventory systems to accommodate the requirements for carbon accounting.

This includes the validation of efficient remote sensing methods for data collection and for reliable verification of the implementation of the Kyoto Protocol. It would also be desirable to compile guidelines on error propagation with a view to provide more adequate methods to countries. This could take the form of an expert system.

Specific problems are encountered in the area of methods to verify certain activities such as biomass utilisation and fuelwood, carbon storage in wood products and proxy versus direct measurement. Monitoring and verification efforts would be significantly reduced if greater standardisation of data could be achieved. There is need to compile and distribute existing data in units and formats compatible with the needs of users. Data should be compatible with the accuracy requirements, and cover information on stocks and flows, by pools, activities, climate, soil type, country, biomass, soil, necromass, etc. This is well in line with the ecoregional approach advocated above.

As indicated, soil carbon is often erroneously perceived as a particularly weak point. Similarly, the controversial topic of possible inclusion of avoided deforestation would benefit from a systematic compilation of the available scientific evidence. There is need for characterisation of current rates of deforestation and likely trends. This would help removing the perception that this activity could be easily used for "environmental blackmailing".

2.2 VERIFICATION IN PRACTICE

The verification process should not only verify carbon stocks and reduction of emissions, but also ensure that the verified process contributes to durable[2] removal of carbon from the atmosphere and, eventually, to the improvement of the livelihood of the people.

In line with the ecosystem approach, ecosystem models must play a part in the verification process, to ascertain consistency of data sources and to ensure that the verification takes into account all the aspects of carbon, including socio-economic aspects.

Once that the Kyoto Protocol is ratified, standards will have to be developed, for which those presently applied by the Société Générale de Surveillance (SGS) and others will be useful

[2] „Durable" understood in this context as „extending beyond the Commitment Period".

starting points. The process may also benefit from experiences gathered in developing the different systems for forest certification. The process of verification should be public and a significant involvement in review and verification may be expected from NGOs, independently from the formal process of verification.

It was noted that the project documentation had to be lodged with the CDM or Joint Implementation office. A crucial step ahead would be the consolidation and the harmonisation of the available information, so that the institutions responsible for carrying out the verification have the necessary information easily available. An independent peer-review (scientists and experts commenting on the content of the reports) could be established.

On "who" should implement verification, it was stated that objectivity and neutrality could be achieved only if a different body carried out each separate step (validation, monitoring, verification and certification). From a project development perspective, the most accurate data and methods available should be used and the process should be open to criticism and scrutiny (NGOs, donors). The private sector could play an important role in verification, but not until the scientifically endorsed practices and models are developed. National panels could also evaluate projects and international scientific and technical panels could eventually support the verification.

The Meeting noted that many conflicts of interest could potentially arise in connection with verification. Conflicts could develop on institutional aspects (involving, for instance, private companies, Government, NGOs, etc), on technical issues linked to the implementation of projects (e.g. on baselines, carbon sampling schemes), and on the impact of projects on the livelihood of the people affected by the project. As far as feasible, an analysis of interests and possible conflicts should be part of the design of projects and of their verification schemes.

2.3 GUIDELINES

A series of guidelines will be needed covering *inter alia* criteria for project eligibility, additionality and baseline methodology. If the CDM is adopted, demand for experts and reference data will increase considerably. Ecoregional guidelines on sampling strategies, among others for soil carbon, emission factors etc. will be urgently required. In-depth analysis of already submitted National Communications could give good indication on how to assist the Parties in moving forward.

There is a need to match the Kyoto Protocol requirements with the Parties' capabilities, the most serious bottleneck being how to operationalise it. A practical solution would be a basic form to which a set of criteria and principles are progressively added. Such a practical approach would help reducing the high costs of implementation providing basic guidelines on how to calculate sinks and sources.

It was noted that many of the coefficients given by the Inter-Governmental Panel on Climate Change (IPCC) needed updating, among others on soil emissions: new and innovative activities are not covered by the IPCC Guidelines and, consequently, no default factors are available. Based on various examples brought forward by the participants, the Meeting

agreed to preferably use local data rather than the present IPCC default values. The eco-zones approach has the potential to provide better "guesses" than default values; it can also assist in identifying realistic values for the new and innovative activities.

A greater level of detail is required for many activities. For instance, land clearing can be done using many methods, e.g. bulldozing the roots out or leaving them in the ground. Guidance is needed on in-situ carbon storage duration, as well as on how to deal with other greenhouse gases.

In order to keep pace with the rapidly evolving methodologies, an electronic version of the UNFCCC Reference Manual could be continuously revised to provide guidance for new project types, by taking advantage of experience gained with projects submitted, and have them continuously contributing to the "global learning process".

GEF and donor countries should assist in project preparation in the initial stage, in order to reduce the financial burden to developing countries. In particular, the experience that the first projects will generate should contribute to the gradual improvement of the Reference Manual, with good practices to be used by both Annex I and non-Annex I countries. The good practice guidelines should be as widely applicable as possible, building up the confidence in the system.

2.4 FOREST INVENTORIES

Different strategies are needed to improve the estimates of major indicators of forest ecosystems (above and belowground biomass by fraction, annual biomass increment, dead vegetation organic matter). They include the development of new technologies for inventories and databases, further research on biomass estimation, use of local coefficients and addressing both methodological and data issues. The inventories already completed reveal data gaps and research needs. The Experts considered a transition to a permanent (continuous) inventory desirable, which would be modified for carbon assessment needs, permit a significant improvement of the verification process and decrease the uncertainties.

In the case of projects, the ecosystem approach would require the whole landscape - beyond the forest area - to be taken into account, including agroforestry and shelterbelts. This leads to new requirements for the forest inventory information base, which would become part of an Integrated Land Information System comprising all land-cover classes of a landscape. Because of the sustainable forest management imperative, the system boundaries should be defined in terms of homogeneous land units (landscapes).

Forest surveys will be relying heavily on remote sensing, in particular the use of aircraft-based methods at project scale. New forest inventory and monitoring system based on the multi-sensor remote sensing applications are urgently needed, starting with the adaptation of existing remote sensing platforms and sensors to the new requirements.

2.5 MONITORING

Appropriate methodologies and procedures and a monitoring plan for verification of the activities carried out under projects are fundamental issues under the CDM.

While projects shall obviously be monitored in detail, there is also a need for less detailed "background" monitoring of major components of the carbon budget and for spot checks. Forest ecosystems, land use change and activities at other spatial levels (from landscape to country) will be included, in order to identify areas where carbon may be "leaked" into the atmosphere outside "registered areas".

In many instances, spot checks will be conducted through an institutional arrangement in the country although they will need to be subjected to close independent scrutiny. Following the Kyoto Protocol incentives, the ultimate goal seems to be the development of a scientifically robust national (regional) terrestrial biota full carbon budget, including consideration of all natural and human-induced disturbances.

The Meeting also insisted that methane and nitrous oxides should receive due attention. This point stresses the relevance of the activity-based approach which has a much better chance to capture non-CO_2 than the land based approach, or, what is more desirable, a combination of both. Remote Sensing (RS) will play a key role in monitoring: although remote sensing-based indices and estimates may be inaccurate, they constitute unbiased information which will turn out to be an important criteria, as already pointed out above in the discussion of accuracy, consistency and simplicity.

Current work on atmospheric inversion techniques also suggests that it may be possible in the near future to downscale atmospheric observations to obtain information at regional level. Only the use of models to integrate the observations from satellites, aircraft, ground sampling, atmospheric sampling and tower measurements of NEE (Net Ecosystem Exchange) will help minimising uncertainties, solve problems of different spatial scales and sampling frequencies, etc. Geo-information systems offer appropriate tools for reliable up-scaling and decision making at landscape level, which would completely correspond to the Sustainable Forest Management paradigm and the Kyoto incentives.

The ultimate goal of the accounting systems/models will be the estimation of carbon pools and fluxes. To a significant extent, the models impose observation requirements. Since many factors interact to affect the carbon cycle, both above and below the soil surface, information on terrestrial carbon must be obtained with a relevant frequency and with an acceptable spatial resolution for which both are dependent upon significance and rate of carbon pools changes. Spatially explicit net carbon release studies using soil carbon pools of regions undergoing rapid afforestation and deforestation are also needed for improved estimation of net carbon balance of forest ecosystems. Ecosystem and biospheric models coupled with satellite RS data and geographic information systems can be used as valuable tools to upscale carbon amounts (pools) and fluxes to the appropriate regional, national and global scales.

3. THE "ROAD MAP", AREAS WHERE FAO COULD FOCUS ACTIVITIES

Section 3 builds on the observations of the previous sections. The various areas in which there is need to work in order to operationalize the verification process, was largely regarded by the Experts as a "road map" for FAO, schematically illustrated in Annex III. The "road map" can contribute to the general discussion in the Governing Bodies of the Organization, who decide on FAO's programme.

The Experts identified several critical areas related to the verification process in which efforts could concentrate in the future in order to facilitate the operationalisation of the CDM and other Kyoto mechanisms in the crop, livestock, soils and forest sectors. They include (1) a central repository of data and methods and the custody of models, methods and guidelines, (2) improved and standardised definitions, (3) project selection criteria and look-up tables, (4) benchmark projects and finally (5) the dissemination of data, tools etc.

Full carbon accounting may still be an inaccessible target with existing technology, but it would be desirable, although non-Annex I countries will only rarely have appropriate bases of data in the required format, i.e. spatially explicit with a high resolution. It was recognised by several Experts that FAO is in a unique position to assist in this process by collecting the information, ensuring transparency and consistency, and making the information, methods and standards available to all countries.

3.1 A REPOSITORY OF REFERENCE DATA AND INFORMATION, MODELS, METHODS AND GUIDELINES

The verification of national reports and projects requires reference data. FAO already has a number of carbon-relevant data such as national statistics on agriculture, collected by the Statistics Division in the Economic and Social Department, the Forest Resources Assessment, the AfriCover project, the Soils Map of the World, etc.

The Organization could also play a more active role regarding reliable data on existing carbon stocks, in particular for large countries where even small relative errors (i.e. accurate data) can represent huge quantities of biomass, carbon or emissions. The benchmark projects mentioned below should eventually constitute a primary source of information on data accuracy.

Data accuracy varies significantly according to a number of variables, which should be examined more systematically. They include, among others, the scale (national, provincial or local data), the source (technical source – i.e. ground sampling, atmospheric sampling, satellite imagery – and institutional source), and the type of greenhouse gas under consideration.

Activity data and emission factors remain a major bottleneck in reference information that can be applied to compare projects in the same region. The Meeting recommended to

systematically assemble relevant data in a global data system where soils will require special attention if they are eventually to be used as carbon sinks. In this respect, it was noted that the Agriculture Department of FAO is proposing the establishment of a soil carbon-monitoring network. The resulting data banks should be accessible to all, together with database management and analytical procedures (such as quality control criteria).

In the context of verification, models will be needed to ensure the consistency of different data sources and to define baselines. As, strictly speaking, there are no "objective models", the final assessment of pools and fluxes will eventually depend on the selection of the model(s) and the model parameters. The Meeting thus found that, in addition to data, the related methods and guidelines should also be standardised and maintained by a neutral entity. The activity also includes the dissemination of the tools under consideration, as well as training etc.

An expanded set of models based on a repository of empirical data from the various regions would be needed. FAO's role could be to be the custodian, since there is need to institutionalise the responsibility for the operationalisation of the information system.

3.2 SOME THEMATIC PRIORITIES

The forest definitions applied by FAO play an important part in the current UNFCCC discussions. Participants stated that the final choice of definitions made by countries in relation to climate issues will have implications for FAO's future Forest Resources Assessments and other statistical data collection. The concept of forest type/attributes will gain importance.

FAO should also contribute to the ongoing discussions on definitions in the context of land use, land use change and forestry. The Organization offers a unique and authoritative experience in the area, deriving not only from the long-term involvement at all levels in Forestry planning, monitoring and management, but also from the mandate received from the Members. In agriculture, agro-climatic typology, land-use typology, agro-ecological zoning and farming systems typology were seen as key topics. In soils, detailed soil maps and databases should be given due attention.

The Experts found that there is a need for a comprehensive and critical document about existing definitions and concepts, covering the spectrum from science to the legal texts (UNFCCC and Kyoto Protocol), the institutions, and the implementation of the international climate agreements. A lexicon with a focus on the areas that come under the mandate of FAO is much needed.

3.3 CARBON LOOK-UP TABLE AND PROJECT SELECTION CRITERIA

In line with the ecosystem approach, FAO has a role to play in ensuring that projects are not only carbon storage experiments, but also a step towards more sustainable agricultural development at the local scale. This clearly indicates that one of the criteria for project selection will be the minimum size to be adopted if they are to be viable in the long run. In

addition to sustainability considerations, the criteria for project selection must also include Government priorities and other societal aspects.

The methodology should include the identification of current national emission hot spots, the preparation of a look-up table (matrix) showing the economic, social and carbon implications of land-use changes and management practices, etc. A simplified prototype of a look-up table is shown below. The description of a given transition, such as the A→Z transition in the first row would include not only the carbon gains and looses, but also the costs if applicable, the impacts on the livelihood of people, sustainability considerations etc.

		To land-use or management type …			
		A	**…**	**Y**	**Z**
From Land-use or management type…	**A**	Not applicable		This transition was never observed	Description of A→Z transition
	….				
	Y	Description of Y→A transition		Not applicable	Description of Y→Z transition
	Z	Description of Z→A transition		Description of Z→Y transition	Not applicable

It is likely that countries will choose activities that give a high return capitalising on improving the carbon situation. The involvement of all stakeholders at project level will ensure transparency. Experience in project formulation in FAO indicates that the institutional and legal issues are most important in assessing projects. Needless to say, every project should have a built-in verification plan.

The challenges for carbon sequestration in projects are mainly the conversion of marginal and degraded lands and their restoration to more sustainable status (esp. increased carbon and biological activity in degraded soils). It was noted that high soil carbon concentrations could be obtained by adopting more efficient cultivation systems. Good land management practices that favour these processes are known, but technical, economic and political choices, as well as a large training effort, would have to be made if "farmers" should adopt better practices.

Market considerations will play an important role in the selection of CDM projects. Lands with the least cost will come first and farmers will want to minimise risk-making innovations that maximise production in addition to sequestering carbon or reducing emissions. This implies that project selection criteria will have to assess the adaptability of the stakeholders of the project at all levels, and their role as partners in achieving the project objectives.

Attention to all stakeholders will be an essential element in the compilation of the look-up table.

The Experts also found that the look-up tables should be developed on an ecoregional basis, and updated periodically. The matrix should present the existing knowledge and show the gains from the different activity changes in different circumstances.

Regional panels should be constituted, in order to develop and test the application of the look-up table at national and project levels. The panels would also contribute to build trust and confidence of non-Annex I countries in the project identification and selection criteria. Needless to say, carbon projects, in particular the benchmark projects (see below) should contribute towards enriching the matrix, in particular as regards baselines.

3.4 BENCHMARK PROJECTS

FAO and other international organisations should cooperate in developing benchmark projects with bilateral partners, and take full advantage of FAO's decentralised offices at regional and country level.

Research institutions should be involved, including those of the Consultative Group of International Agricultural Research (CGIAR), with the support of multilateral and bilateral development co-operation, to substantiate baselines and project design with ad hoc research, as well as establishing field laboratories to train research staff.

Benchmark projects will specifically focus on the operational (testing and validation) and societal aspects of the implementation of the Kyoto Protocol. Their main emphasis will be on methodological issues and capacity building, and provisions will be made to use them for demonstration purposes.

Benchmark projects are real Joint Implementation or CDM projects of various kinds operated on a "pilot" basis: in addition to their carbon sequestration or CO_2 emission reduction objective, they will undergo very close monitoring in view of improving the whole project concept, particularly their relevance for people. A detailed record would be kept of all the phases and data regarding technical issues, methodological uncertainties, standards, weaknesses in the guidelines, cost, etc.

It is estimated that there will be need for at least some 30 benchmark projects. Some of the most urgent needs are to establish site selection criteria, find the available information, develop a matrix on best practices, validate rates and design sampling methods. A manual providing the methodology and training programmes for staff in different ecoregions should be developed.

A different approach than the one used for the pilot phase (AIJ projects) might be adopted, since the pilot phase did not capture the experience because the structures were not in place.

FAO might help in developing the standards and methods, in creating a data collection system and establishing central databases, doing analytic work and assisting in setting up long-term experiments (20 years). The need to make key information very rapidly (even near real-time) was also highlighted.

3.5 DISSEMINATION

There is a rising demand for capacity building and information on all issues connected with the implementation of the mechanisms under the Kyoto Protocol.

On the basis of the experience gained with reference data and information, verification tools and methods will need to be made available to countries. This includes verification know-how proper, but also the set of techniques that can be used to increase carbon storage, as well as the emphasis on the implications of projects for sustainable development and food security.

FAO is in a good position to help in the process of validation and dissemination through its regional and country experience and decentralised structure.

ANNEX I

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ANNEX II

PRESENTATIONS

The present annex lists the discussion papers that were presented at the expert meeting. Full texts or slide shows are available from FAO upon request.

- **Current inventory and reporting requirements for non-Annex I Countries**
  Eveline Trines, UNFCCC Secretariat

- **Views of IIASA regarding full carbon accounting**
  Michael Gluck, IIASA

- **GHG inventories for the LUCF sector in South East Asia: status and strategies to improve estimates**
  Damasa B. Magcale-Macandog, IGES

- **Verification of carbon stocks in soils: a proposal of a soil monitoring network**
  Michel Robert, FAO consultant

- **Eligibility criteria and experience in assessing forestry projects**
  Gareth Phillips, Société Générale de Surveillance

- **Verification and uncertainties of a national terrestrial biota full carbon account, based on experience from the case study for the Russian Federation**
  Anatoly Shvidenko, IIASA.

- **The soil carbon sequestration potential**
  Rattan Lal, Ohio State University

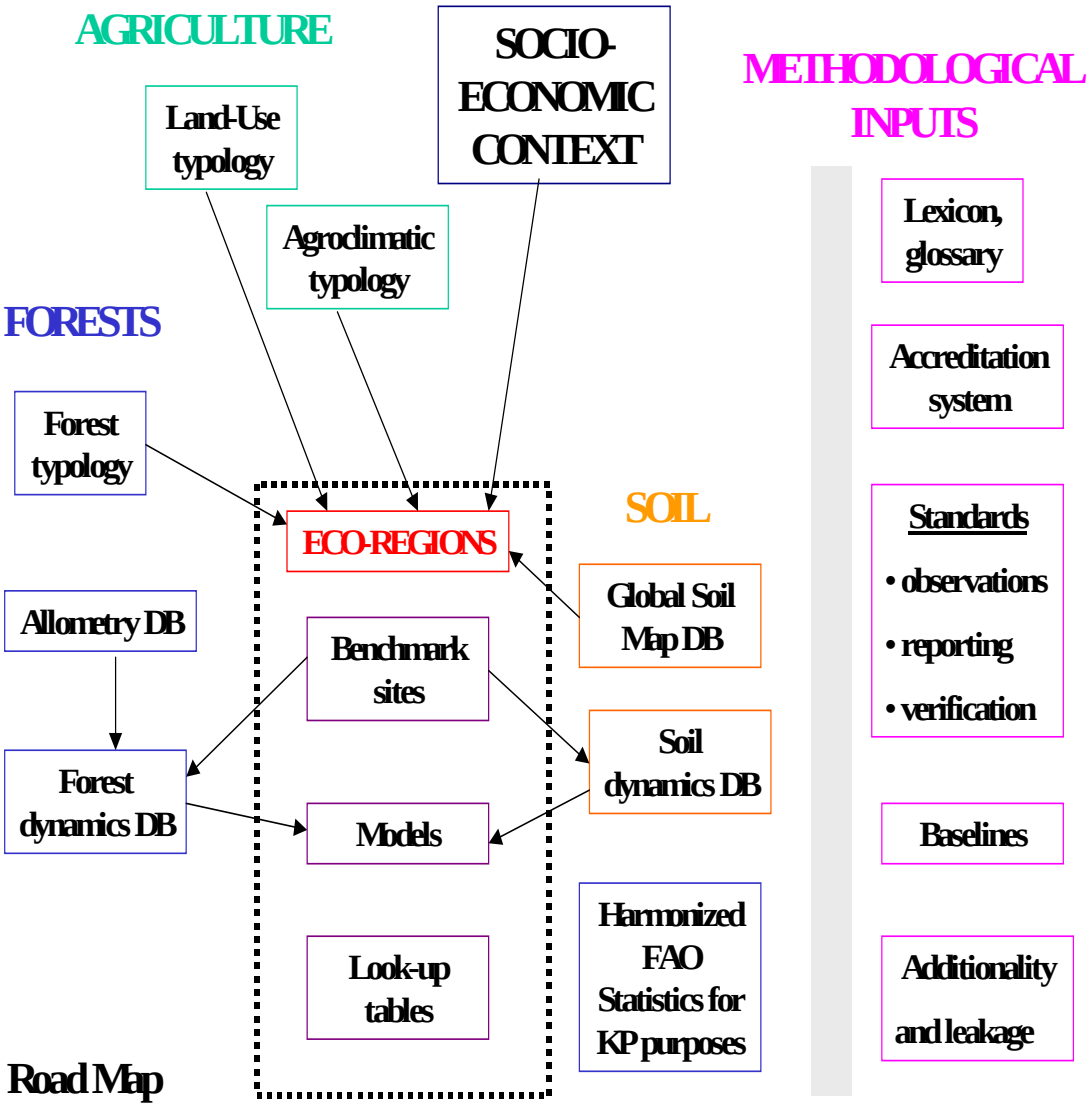
- **Country level soil stocks and CO_2 exchanges: land-use change and management for Brazil**
  Carlos Cerri, Sao Paulo University

- **Open issues and bottlenecks in verification**
  Pedro Moura-Costa, Director, EcoSecurities

ANNEX III

THE "ROAD MAP"

The figure below illustrates the "road map" introduced in the first paragraph of section 3 of the current summary. Central issues are ecoregions, benchmark sites, models and look-up tables listed in the dotted box. Ecoregions are defined based on variables drawn from the agriculture and forestry sectors, soil data and the socio-economic context. Benchmark sites, models and look-up tables will be defined by ecoregions, and they will interact with various databases in order to contribute to the methodological inputs of the climate negotiations process.



ANNEX IV

LIST OF ACRONYMS AND ABBREVIATIONS

AIJ	Activities Implemented Jointly
CDM	Clean Development Mechanism
CGIAR	Consultative Group on International Agricultural Research
CO_2	Carbon Dioxide
CSD	United Nations Commission on Sustainable Development
ERU	Emission Reduction Units
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environmental Facility
GTZ GmbH	Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
IPCC	Inter-Governmental Panel on Climate Change
LULUCF	Land Use, Land Use Change & Forestry
NEE	Net Ecosystem Exchange
NGO	Non-Governmental Organization
RS	Remote Sensing
SFM	Sustainable Forest Management
SGS	Société Générale de Surveillance
UN	United Nations
UN/DESA	United Nations Department of Economic and Social Affairs
UNFCCC	United Nations Framework Convention on Climate Change