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Report of The STAP Workshop on Technology Transfer in The Energy Sector

Amsterdam, The Netherlands
January, 19-20, 1998

Prepared by
The Scientific and Technical Advisory Panel (STAP)
Of the Global Environment Facility (GEF)

January 1998

STAP Secretariat
United Nations Environment Programme

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PREFACE

It is a pleasure to present the Report of *The STAP Workshop on Technology Transfer in the Energy Sector*. The Workshop described in this report was held on January 19-20, 1998 at the Institute of Environmental Studies, Vrije University, Amsterdam, The Netherlands. The Workshop brought together international energy/technology experts from both developed and developing countries working on this issue as well as representatives from the GEF Secretariat and the Implementing Agencies. This group was convened by the Scientific and Technical Advisory Panel (STAP) of the Global Environmental Facility (GEF) in order to examine the most promising strategies for introducing low clean and low GHG emitting and innovative energy technologies in developing countries. In addition, the issue of technology transfer was addressed as a process for creating a sustainable capacity for introducing into developing countries market energy technologies characterized by both reduced GHG emissions and enhanced local benefits.

The STAP reports on "A Systems Approach to Technology Transfer and Innovation" and "A Private Sector-led Strategy for Accelerating the Introduction of New Environment Technologies in Developing Countries", as well as the case studies presented during the Workshop provide much of the basis for the findings and recommendations contained in this report. In addition, STAP will finalize and submit for the Council's consideration, further guidance on Technology Transfer and Innovation in the Energy Sector.

This workshop report was prepared by the Workshop Co-ordinators, Prof. Chihiro Watanabe and Dr. Charla Griffith-Brown under the guidance of the STAP Working Group on Climate Change and Energy.

Pier Vellinga

Chairman of STAP

January, 1998

EXECUTIVE SUMMARY

In order to advise the GEF as to the most promising strategies for introducing clean and low GHG-emitting and innovative energy technologies in developing countries, STAP convened a workshop on technology transfer in the energy sector. The outputs of the workshop form the basis of STAP's advice to the GEF.

Scope

The workshop addressed the issue of technology transfer as a process for creating a sustainable capacity for introducing into developing country markets energy technologies characterized by both reduced GHG emissions and enhanced local benefits. International technology transfer, inter-sectoral spillovers and domestic technology generation are significant variants of this process.

Major Findings:

STAP concludes that:

1. Capacity Building: **Capacity building is needed to assess, select, import or develop, manage, adapt or replicate appropriate innovative energy technologies and also to innovate**

    a) A base-level of indigenous technological capability is needed for each of the major candidate innovative energy technologies;

    b) An energy technology assessment capacity independent of both the pressures of technology promoters and the technology selection process is critical to informing the decision making processes about the merits of alternative technologies.

    GEF could assist regional training initiatives that emphasize energy technology fundamentals, technology assessment, and a wide range of skills required for effective technology development, marketing and management.

2. The Private Sector: **Facilitating major roles for the private sector is essential**

    a) Coherent policies aimed at unleashing the industrial dynamism of the "virtuous cycle" of innovation, market growth and price decreases for the new technologies are needed (including incentives, energy price reforms and other mechanisms);

    b) The encouragement of a transparent and competitive environment is vital;

    c) Equitable user-supplier agreements and appropriate financial/regulatory modalities are required.

    GEF could promote new instrumentalities (e.g. concessions, auctions, competitive set-asides) to harness the demonstrated capacity of competitive markets for technological innovation and technology transfer.

3. Research and Development: **R&D is needed to enhance the prospects that innovative energy technologies will conform to local needs**

   a) International industrial collaborative R&D would be especially efficient;

   b) To maximize the prospects for technology diffusion potential intellectual property rights conflicts should be resolved

   GEF could facilitate initiatives that address these challenges.

It is further recommended that elements of technology transfer be built into the operational programmes by requiring capacity building in as many projects as possible and by facilitating greater private sector participation and energy R&D activities.

1. INTRODUCTION

The transfer of new clean and low greenhouse gas (GHG)-emitting energy technologies to markets in developing countries and the need to define the types of technologies and modalities for their transfer have been identified by the Global Environment Facility (GEF) Secretariat and the Implementing Agencies (UNEP, UNDP and the World Bank) as important issues which the Scientific and Technical Advisory Panel (STAP) of the GEF should address. To help address this issue, STAP convened a workshop on "Technology Transfer in the Energy Sector" 19-20 January, 1998. The workshop was held at the Institute for Environmental Studies, Vrije University, Amsterdam and brought together international experts from the OECD/IEA, Australia, Brazil, China, India, Japan, the US, and The Netherlands. Participants included representatives of the GEF Secretariat, the STAP Secretariat, UNDP, UNEP, and The World Bank, the Dutch Council, and other relevant organizations.

The workshop addressed the issue of technology transfer as a process for creating a sustainable capacity for introducing into developing country markets energy technologies characterized by both reduced GHG emissions and enhanced local benefits. International technology transfer, intersectoral spillovers and domestic technology generation are significant variants of this process.

2. AIM AND OBJECTIVES

The principal aim of the workshop was to help STAP develop practical recommendations to the GEF Council, Implementing Agencies and GEF Secretariat regarding technology transfer mechanisms that reduce energy and environmental constraints and also contribute to sustainable economic growth.

Strategies for fostering climate friendly technology transfer to developing country energy markets and enhancing domestic technology development mechanisms were explored. Emphasis was given to systematic mechanisms that induce industrial vitality for innovation, market growth and price reduction in both developed and developing countries, and activate a perpetual cycle of technology transfer and assimilation.

3. STRUCTURE AND FORMAT

There were two types of workshop presentations:

Overviews

Two overview papers presented during the first session provided a conceptual framework for the workshop. One addressed the need for international mechanisms for technology development in developing countries while the other outlined a systems approach to technology transfer in the energy sector. A third and final overview paper presented in the last workshop session provided insight and practical instrumentalities for private-sector led technology transfer initiatives.

Case Studies

Experts presented case studies drawn from experiences in India, Brazil, Australia, China, Taiwan, South Africa and South Korea. The case studies provided concrete examples of success and failure of technology transfer in the energy sector and offered relevant information

on and practical insights into the mechanisms used to transfer technology in the energy sector in different institutional contexts. The case studies presented were:

- An analysis of compact fluorescent lamp (CFL) and photo-voltaic (PV) technology transfer in India;
- Technology transfer in the Brazilian sugar cane and ethanol industries;
- Energy efficiency improvement via technology transfer for Brazilian refrigerator technology;
- The social and political dimension of energy sector technology transfer in Australia;
- Technology transfer in the iron and steel industry of China;
- Technology transfer case analyses from the cement and steel industries in South Korea, Taiwan and South Africa.

4. MAJOR EMERGING THEMES

The major themes emerging from the workshop included:

- **Capacity Building:** the building of local capacity is essential for effective technology transfer;

- **The Private Sector:** private sector involvement under competitive conditions is crucial because most innovation is generated by the private sector which has the financial resources to support innovation [currently foreign direct investment (FDI) exceeds multilateral aid]. Additionally, the capacity of competitive markets to support technological innovation and technology transfer is well established;.

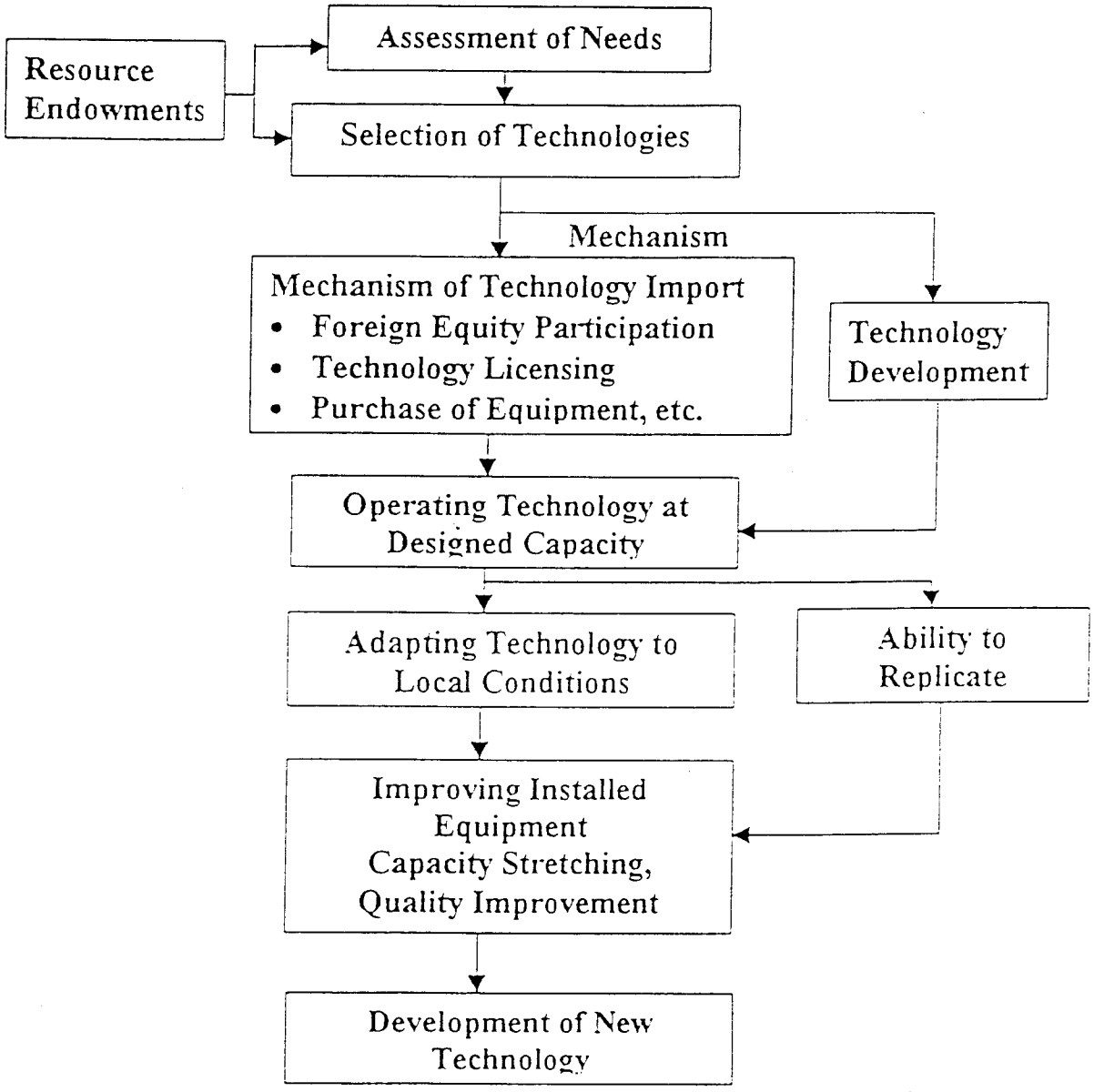
- **Research and Development:** R&D is needed to enhance the prospects that innovative energy technologies will conform to local needs.

5. CONCEPTUAL FRAMEWORK

The challenge in the context of the energy sector is to maximize technology transfer for critical innovative technologies in order to improve energy efficiency and provide cleaner energy supplies so as to support sustainable development goals. In order to achieve these objectives a self-sustaining "virtuous cycle" of industrial vitality for innovation, market growth and price reduction must be catalyzed and supported. The adoption and diffusion of innovative energy technologies is critical for this endeavour.

Technology transfer interactions between users and suppliers takes place within the broader context of global and national circumstances. The process can include the transfer of technology from abroad, intersectoral spillovers, and domestic technology generation through research and development (R&D). Some R&D is typically needed in support of technology transfer to make the technology better suited for local conditions. Figure 1 provides an illustrative model for the process. Because technology transfer occurs largely between firms, a private sector-led strategy for accelerating the introduction of innovative energy technologies in developing countries is required. Capacity building in developing countries is needed to assess, select, import or develop, manage, adapt or replicate appropriate environmental energy technologies and also to innovate - with the goal of using such technologies to reconcile the objectives of economic development and environmental protection.

Figure 1: Steps to Various Levels of Technology Transfer



Given the steps (Figure 1) required to create a sustainable technology transfer system, technology transfer for clean and low greenhouse gas (GHG) emitting energy technologies is a capacity building exercise involving several steps of specific critical processes including research and development (R&D). The R&D dimension is critical for widespread adoption and diffusion in the local context and for creating inter-sector spillovers.

6. FOSTERING A MARKET DYNAMIC FOR TECHNOLOGY TRANSFER

All evidence collected indicated that facilitating major roles for private sector involvement is essential. Effective technology transfer requires unleashing the industrial dynamism of the "virtuous cycle" of innovation, market growth and price decreases as a result of both experiential learning and continual incremental technological improvements. This dynamic can be a robust characteristic of market development for many modest-scale, modular technologies that will be needed to reduce GHG emissions while providing clean energy services (e.g. energy-efficient end-use technologies, most renewable energy technologies, micro-turbines and fuel cells). With coherent supporting policies, there are good prospects for quickly bringing about convergence between the costs of many such innovative energy technologies and the costs of conventional energy technologies, once the new technologies are launched in the market. In this context, encouragement of a transparent and competitive environment was determined to be vital. Furthermore, it was found that equitable user - supplier agreements and appropriate financial modalities are needed.

7. OPERATIONAL RECOMMENDATIONS TO GEF

It is recommended that elements of technology transfer be built into existing operational programs by:

- Fostering capacity building at every step;
- Emphasizing technology replication;
- Including monitoring and evaluation of technology impacts and acceptance before and after projects;
- Encouraging the use, application and development of flexible and performance-based standards carefully constructed in light of past experience that shows rigid non-performance based standards can become a hindrance to innovation;
- Enhancing prospects for inter-sectoral technology spillovers.

7.1 CAPACITY BUILDING: Enabling Technology Transfer and Assimilation

To enhance the likelihood that the technology transfer process carried out in international collaborations (including industrial collaborations) will be effective and efficient, a base level of indigenous technological capability is needed for each of the major candidate innovative energy technologies.

To this end, the GEF should assist regional training initiatives relating to these technologies. This training would emphasize the fundamentals of the new technologies as well as conventional energy technologies, technology assessment (for assessing the prospects for innovative energy technologies, their potential societal impacts, including rebound effects and the institutional issues relating to their dissemination), and a wide range of skills required for effective technology management. To be most effective, these initiatives should be co-financed by local firms that would ultimately benefit from the enhanced technological capabilities of trainees.

Abundant evidence indicated that developing countries generally do not have the capacity to sufficiently assess their energy technology needs and that supplier preferences and disciplinary biases have sometimes resulted in failure of widespread diffusion of innovative energy technologies. Accordingly, energy technology assessment capacity is needed to properly inform various energy decision-making processes about the merits of alternative energy technology options. The technology assessments to be provided should be high quality, peer reviewed analyses and the technology assessment process should be insulated from both the pressures of technology promoters and the technology selection process.

7.2 THE PRIVATE SECTOR: A Framework for Encouraging Private Sector- Led Initiatives

Major roles for the private sector are needed because most innovation is generated by the private sector, and because the private sector has the financial resources needed to support innovation. In fact, foreign direct investment (FDI) now exceeds multilateral aid. Moreover, the capacity of competitive markets for technological innovation and technology transfer is well established.

Private sector resources can be mobilized to bring new innovative energy technologies to market by creating a transparent and competitive environment in which user-supplier agreements are equitable, and appropriate financial/regulatory modalities are available. These conditions are essential for launching the desired new technologies in the market and accelerating the process of bringing about convergence between costs of these technologies and conventional energy technologies.

Recommendations for providing linkages between the GEF and the private-sector include GEF's helping countries put into place instruments that can harness the demonstrated capacity of competitive markets for technological innovation and technology transfer. For countries that have not yet introduced market reforms in the energy sector (e.g. where state-owned electric utilities still dominate power systems) regulations that encourage independent power producers (e.g. qualifying co-generators or renewable energy suppliers) to sell electricity to the grid (e.g. as in Mauritius and Brazil) should be considered. For rural areas remote from utility grids, concessions for renewables (modeled after concessions in the oil and gas industries) could be considered for quickly developing competitive markets. For countries that have already carried out major energy sector/capital market reforms, market-based instruments such as auctions [e.g., the Renewable Non-Fossil Fuel Obligation (NFFO) in the UK] or competitive set asides [e.g., the Renewable Portfolio Standard (RPS), which is being pursued in the United States] should be considered for rapidly "buying down" the prices for new energy technologies toward market clearing levels vis a vis conventional energy technologies. Where appropriate, concessions should also be considered together with NFFO or RPS-type instruments in grid-connected applications.

7.3 R&D: Fostering R&D to Improve Assimilation and Sustainability

The technology transfer process should involve significant R&D to enhance the prospects that innovative energy technologies will conform to local needs. International industrial collaborative R&D would be especially efficient. The GEF could help catalyze such collaborative energy R&D (which might be supported by governments). Also, to maximize the prospects for technology diffusion, the GEF help resolve potential conflicts relating to Intellectual Property Rights.

Innovative energy technologies developed for industrialized country conditions will often have to be retailored to make them better suited to developing country conditions. Thus some portion of the R&D effort in industrialized countries should be oriented to designing innovative energy technologies suitable for developing country applications. Much of such R&D should be carried out collaboratively with developing country partners. The recent report to President Clinton by the Energy Research and Development Panel of the President's Committee of Advisors on Science and Technology recommended major new collaborative energy research, development, demonstration and commercialization initiatives with developing countries as an important component of an overall US energy R&D strategy for addressing the energy challenges of the 21st century. Some GEF targeted research resources should be directed to helping define processes for such collaborative activities.

Such collaborative R&D programs, coordinated with existing GEF programs, could also be helpful in capacity building, as a complement to the capacity building assistance that might be provided by multilateral agencies. For example, existing industrial joint ventures might be encouraged to include an R&D dimension with some of the resources available for this collaborative R&D.

CONCLUSION

This report`s primary recommendation is that elements of technology transfer be built into GEF`s operational programs by requiring capacity building in as many projects as possible and by facilitating greater private sector participation and energy R&D activities. In the context of this broader practical recommendation STAP specifically concludes that:

- To promote ***capacity building*** GEF could assist regional training initiatives that emphasize energy technology fundamentals, technology assessment, and a wide range of skills required for effective technology development, marketing and management;
- To facilitate major roles for the ***private sector*** GEF could promote new instrumentalities (e.g. concessions, auctions, competitive set-asides) to harness the demonstrated capacity of competitive markets for technological innovation and technology transfer;
- To encourage the ***R&D*** required to improve the prospects that energy technologies will conform to local needs GEF could facilitate initiatives such as international industrial collaborative R&D to address these challenges

STAP considers it urgent to implement these operational recommendations and strongly advises GEF to take prompt measures to facilitate these activities.

APPENDIX A. LIST OF PARTICIPANTS

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* *Professor Lowe`s paper was presented in absentia by Charla Griffy-Brown and discussed during the workshop*

APPENDIX B. ABSTRACTS OF CASE STUDIES AND OVERVIEW PAPERS PRESENTED AT THE WORKSHOP

Overview Papers

Deployment of Climate-Friendly Energy Technologies in Developing Countries: The Need for International Collaboration
Hans Jorgen Koch

Abstract

The IEA's long experience with international collaboration on energy technologies gives us unique skills in fostering voluntary, flexible mechanisms to stimulate and support complex, multi-party activities. The IEA, with the OECD, proposes to add value to bilateral and multilateral efforts to support deployment of climate-friendly technologies in developing countries by providing a forum - a technology co-operation agreement - to promote exchange of experience and to guide and initiate voluntary, flexible collaborative activities. Collaboration in this area could help to avoid overlaps and duplication of efforts of bilateral and multilateral agencies, streamline IEA/OECD and Climate Technology Initiative (CTI) activities, and simplify developing countries' relationships with a wide range of agencies engaged in technical co-operation. A pilot activity for the technology cooperation agreements, on best practice in coal power generation in China, has been initiated by the IEA's Working Party on Fossil Fuels. IEA/OECD activities in this area could perhaps directly support the work of the UNFCCC on technology transfer, following a precedent established by the Climate Technology Initiative.

A Systems Approach to Technology Transfer in the Energy Sector
Charla Griffy-Brown and Chihiro Watanabe

Abstract

This work will focus on elucidating a systems approach for enhancing technology transfer mechanisms in the energy sector. The purpose of this paper is to set the stage for creating a strategic total system for enhancing the host-donor relationship in energy sector technology transfer. First existing technology transfer processes are explained and important factors in technology adoption and diffusion are identified. The host-donor relationship is then discussed in the context of market conditions and their intersection with the energy sector. Finally, conclusions are dawn from the mechanisms described as to systems considerations essential for optimizing technology transfer in the energy sector.

A Private Sector-Led Strategy for Accelerating the Introduction of New Environmental Energy Technologies in Developing Countries
Robert H. Williams

Abstract

This paper discusses: (*i*) the importance for developing countries of "environmental energy technologies" (*defined here as energy technologies that have a high degree of inherent cleanliness and safety, without the need for complicated or costly cleanup or safety equipment*), (*ii*) the urgency of capacity-building in developing countries to select, design, construct, market, and manage appropriate environmental energy technologies with the

goal of using such technologies to reconcile the objectives of economic development and environmental protection_i.e., to promote sustainable development, and (*iii*) the promise of the international industrial joint venture as an instrument for accelerating the introduction of such technologies in developing countries. The focus here is on new environmental technologies that are not yet established in the market. The elements of the argument are as follows:

- The production and use of energy are aggravating local, regional, and global environmental problems in the developing world, making it increasingly difficult to meet developmental goals and improve quality of life with conventional energy technologies.

- There is a large latent market in the developing world for EETs, which will be needed to respond to ever stronger public concerns about the environment and the difficulties in meeting environmental goals by adding environmental controls to energy technologies originally designed without consideration for environmental problems.

- There has been major progress in advancing a wide range of environmental energy technologies (EETs), with good prospects for continuing gains, if research and development (R&D) and demonstration and commercialization (D&C) activities aimed at bringing EETs to market are increased. Moreover, there are good prospects for bringing about quickly convergence between the costs of EETs and the costs of conventional energy technologies, once EETs are launched in the market, if there are coherent policies aimed at unleashing the industrial dynamism of the "virtuous cycle" of market growth and price decreases for EETs as a result of both "learning by doing" and continuing incremental technological improvements.

- Although public sector resources for accelerating the introduction of EETs into the energy sectors of developing countries are scarce, there are enormous private sector resources potentially available for this purpose.

- Few private-sector financial resources are currently committed to the pursuit of EETs, but substantial amounts of these resources could be directed to such purposes, because: (*i*) private firms in the industrialized countries have been heavily involved in the development and commercialization of new EETs that offer the potential for meeting environmental objectives without compromising economic aspirations, and (*ii*) the governments of developing countries potentially have the power to insist that foreign direct investment (FDI) be focussed on such technologies and thereby conform to sustainable development objectives.

- Firms from the industrialized countries with this capacity can efficiently transfer the "tacit knowledge" relating to such EETs to other firms, including firms in developing countries, via international industrial collaborations, of which the joint ventures are especially promising.

- Firms from the industrialized countries will make such technology transfers, if agreement can be reached on the protection of intellectual property rights, and if these firms perceive that such transfers will give them gain access to developing country markets for these technologies_which are potentially very large.

- In developing countries, lower production costs could be realized more quickly for EETs than is feasible in already-industrialized countries, because of both the much larger early-market potential arising from rapid energy-demand growth and the much lower wage rates in developing countries for given levels of skills.

- In those developing countries *where reforms have led to effective market forces in the energy sector*, governments will have the power to stimulate the creation of the large latent markets for these EETs and to make them efficient: (*i*) by insisting as conditions for market access that energy technologies being transferred meet sustainable-development criteria and that the foreign firms be committed to transferring these technologies to local industry, and (*ii*) by creating institutional frameworks and competitive market conditions that make it possible to launch EETs in the market, aggregate these markets for small-scale EETs, and quickly bring about cost convergence between new EETs and conventional energy technologies.

- The proposed strategy for technology transfer would require new policies for bilateral cooperation, for multilateral development-assistance, and on the part of developing country governments.

- For those developing countries that pursue this strategy, the result could be that state-of-the-art EETs will migrate to these countries, which could potentially become world leaders in the export of such technologies.

This thesis defines a new industrial paradigm for energy development. Yet it does not require radical institutional restructuring. Many international industrial collaborations of various kinds are already in place and new ones are being formed continually, at an accelerated pace_collaborations involving "South/South" and "triangular" collaborations (e.g. a collaboration involving firms from a developing country in the early stages of its development, a rapidly industrializing country, and an industrialized country), as well as "North/South" partnerships. Many of the financial and institutional arrangements required to bring about the kinds of industrial collaborations proposed here are already in place or are about to be established_but for *conventional energy technologies*. Some modification of these arrangements will be required when emphasis is shifted to EETs_largely because a different and broader set of actors will be involved_e.g., more small- and medium-scale enterprises will be involved, from both developing and industrialized countries, and with this broader set of actors, it is to be expected that the scope for industrial collaboration will be widened.

Case Studies

Technology Transfer for Capacity Building - A Study of Two GHG reducing technologies in India

Vinish Kathuria and Jyoti Parikh

Abstract

Article 4 of the framework convention on climate change (FCCC) expressly commits the Annex 1 countries to provide financial resources and technology to developing countries so as to control, reduce or prevent GHG emissions. The present paper argues that the ultimate goal of any action in the field of transfer of technology (TT) should not be just to apply particular technological solutions to the GHG problem, but to enhance the capabilities of developing countries to select, import, assimilate, adapt and create the appropriate technologies. The paper also looks into the various dimensions of TT that results in capacity building in developing countries. Using case studies of two GHG reducing technologies - one from the demand side (Compact Fluorescent Lamp, CFL) and another form the supply side (Photo-voltaic Cells, PVs), the present paper tries to find out whether the TT has been adequate in significant capacity building or not. The case studies show that the technology absorption is still incomplete. High up-front costs and lack of awareness (information) has resulted in significant under-utilization of capacities, thus acting as major barriers in their diffusion. The paper also looks into the various market and government related barriers forestalling the diffusion of various GHG reducing technologies.

The Role of Copersucar in improving Technology for Ethanol Production from Sugar Cane in Sao Paulo

Isaias de Carvalho

Abstract

This paper describes the historical role of Copersucar (an industrial organization of sugar cane and can alcohol producers) in improving the productivity of making ethanol from sugar cane in Sao Paulo, Brazil. This work also discusses plans for future gains and the technology context with specific examples. The work also deals specifically with technology transfer as well as R&D planning and control. Economic and public policy issues dealing are also discussed.

The Evolution of Energy-Efficient Refrigerator Technology in Brazil

Howard Geller

Abstract

This case study examines technological innovation and technology transfer relating to the development of energy-efficient refrigerators in Brazil. Industrial structures are described, including domestic and international joint venture companeis. Trends in refrigerator compressor technology are also discussed with a comparison of compressor produced for domestic and export markets. Public Policy issues are described, including appliance labeling and other energy-efficient promotion policies in Brazil.

Technology Transfer: Toward Sustainable Energy Supply and Use in Australia
Ian Lowe

Abstract

As energy is a key input to modern society, a sustainable pattern of energy supply and use is absolutely crucial to the development of a sustainable society. The current pattern of energy supply an use in Australia does not meet any of the three criteria for sustainability, and there are serious political obstacles to developing an approach which would be genuinely sustainable. Recent examples of successful technology transfer provide grounds for optimism, while examples of failure demonstrate the scale of the barriers. Transfer of technology is the key achievement of a sustainable energy system. This paper summarises the pattern of energy supply and use in Australia to identify some opportunities for change, then describes some recent attempts to transfer technology.

The Potential of Energy Efficiency Improvement in China's Iron and Steel Industry and a Case Study of Technology Transfer
Xiulian Hu, Jiang Kejun and Zheng Shuang

Abstract

This paper focuses on the energy efficiency improvement and CO2 emission reduction in China's steel industry and the role of the introduction of advanced technology. The status of technology and energy eficiency of China's steel industry is 20 to 30 years behind that of industrialized countries. The bridge between efficiency and technology should be built by the introduction of advanced technology. We use an ERI-AIM model to analyse the effect of energy efficiency improvement and CO2 emission reduction based on technology selection in the marketplace. A selected technology transfer case in Capital Steel Corporation which is involved in collaborative work with Japan's Steel Company is introduced. We conclude that a mechanism should be constructed for technology transfer to improve energy efficiency in China to protect our common environment. There is a big opportunity to reduce GHG emission in China's steel industry if advanced technology can be well diffused.

Energy Efficient Technologies in the Cement and Steel Industry - Experiences in Developing Countries
Ernst Worrell

Abstract
Transfer of advanced industrial production technologies to industrializing and developing countries can be successful. Examples in the cement and steel industry are studied. The technologies were originally developed in industrialized countries. The main reasons for the success seem to be the technical capabilities of the local industries, and the access to foreign technology. The choices for the implementation of such an advanced technology seem to be resource determined (local resources, dependence on imports). Economics play a role as well, e.g. reduced capital costs in the case of greenfield plants, reduced operating costs, and access to capital. More study is needed to the role of risk assessment in the decision making process and technology choice by the investors.

Report of the Eleventh Meeting of the Scientific and Technical Advisory Panel (STAP)

Amsterdam, The Netherlands, 21-23 January, 1998

STAP Secretariat
United Nations Environment Programme

INTRODUCTION

1. In accordance with its programme of work, the Scientific and Technical Advisory Panel (STAP) held its eleventh session in Amsterdam, The Netherlands, 21-23 January, 1998.

Agenda Item 1: Opening of the Meeting

2. The Meeting was opened by Prof. Pier Vellinga, Chairman of STAP. He welcomed all participants to Amsterdam and the STAP meeting.

Agenda Item 2: Adoption of the Draft Provisional Agenda and Organisation of Work

A. Agenda and Organisation of Work

3. The meeting adopted the draft provisional agenda and organisation of work as contained in documents UNEP/GEF/STAP/11/2/Add.1 and UNEP/GEF/STAP/11/2/Add.3

B. Participation

4. The STAP members attending the meeting were: Prof. Pier Vellinga, Prof. Helen Yap, Dr Rokhayatou Daba Fall, Dr. Stein Hansen, Prof. Jyoti Parikh, Prof. Chihiro Watanabe, Dr. Robert Williams, Dr. Stephen Karekezi, Prof. John Woods, Dr. Jorge Soberon and Dr. Mohd Nor Salleh.

5. Mr. Masonori Kobayashi of the CCD also attended the meeting.

6. The representatives from the GEF Secretariat and Implementing Agencies who attended the meeting were Dr. Alan Miller (GEF Secretariat) Mr. Lars Vidaeus (World Bank), Mr. Ahmed Djoghlaf (UNEP), Mr. Rafael Asenjo (UNDP), Dr. Mark Griffith and Ms. Anne-Marie Verbeken (STAP Secretariat).

Agenda item 3: Report of the Implementing Agencies and Subsidiary Bodies of the Convention

7. The representative of the GEF Secretariat briefed the meeting on the status of the Operational Programmes on Transport and Carbon Sequestration; the results of the Monitoring and Evaluation studies, namely the Overall Performance Study, the Project Implementation Review, and the report on Lessons Learnt and on ongoing discussions of strategic issues. The meeting was informed that at the November, 1998 Council Meeting, the Council will be advised on the basic principles which will form the core of the Transport Operational Programme whereas work will commence on Carbon Sequestration Operational Programme in the near future. In this regard Panel members expressed the wish to be actively involved in the evolution of both of these operational programme.

8. The representative of the GEF Secretariat also informed the meeting that the replenishment discussions should be completed by early February, 1998. The meeting was informed that the Secretariat is still giving consideration to the modalities for operationalising the Targeted Research Committee. On the issue of the planning for the GEF Assembly, reference was made to the information booklet prepared by the GEF Secretariat on the Assembly. It contained the Provisional Agenda and the logistics for the Assembly. According to the programme, the STAP panel is scheduled for 2 April, 1998 from 11.15 to 13.00hrs.

9. The UNEP/GEF Executive Co-ordinator presented the meeting an overview of UNEP/GEF activities that are relevant to STAP's work. Specific reference was made to proposals submitted for consideration at UNEP's January, 1998 bi-lateral with the GEF Secretariat. These included "Strengthening of the GEF Focal Points" and "Structural Learning Pilot Project". Reference was also made to the Global International Waters Assessment and the ongoing discussion with interested governments about co-financing as well as to bio-safety, and the envisaged review role of STAP in this area. The meeting was also informed of UNEP/GEF's follow up to a number of issues raised by STAP at its last meeting, namely, the formulation of a Targeted Research initiative on fire and biological indicators. On both issues, draft documents were submitted for STAP review and comments.

10. The Meeting was also informed of the progress made to date on STAP reconstitution. Specific reference was made to the Information Note submitted by UNEP to the November 1997 GEF Council Meeting on the process and modalities for the operation of the STAP Search Committee established by the Executive Director of UNEP to co-ordinate the selection process. The meeting was also informed that the final meeting of the Search Committee will be held on January 26-27, 1998 in Paris, France. The Executive Co-ordinator of UNEP/GEF submitted a written report.

11. The Executive Co-ordinator of the World Bank/GEF emphasized in his presentation the importance of STAP, in particular with respect to its maintenance of a high quality Roster of Experts, its strategic thinking underpinning the formulation of GEF Operational Programmes and its role in Selective Reviews.

12. He indicated that if the World Bank is to increase its work programme, a higher administrative budget will be required. He identified a number of conditions underpinning the Bank's long-term programme development, namely the streamlining of GEF processes, the mainstreaming of the global environment in Bank operations, and the development of new strategic partnerships in areas such as Renewable Energy to create win-win opportunities.

13. He expressed his concern about the substantial inflow of medium-sized projects, the screening of which is taking up a considerable amount of time. He noted that it is important to develop rules on what constitutes incremental costs in agrobiodiversity related projects and he raised the question of the potential role of STAP in the quality control of the medium-sized projects.

14. The representative of the Secretariat of the Convention to Combat Desertification (CCD) informed the meeting of the activities of the CCD and drew attention to the innovativeness of the thematic networks it has initiated.

Agenda item 4: Report by the STAP Chairman and Other Panel Members on Inter-sessional Activities

15. Dr. Helen Yap, Vice-Chair of STAP, reported on STAP's participation in the National Academy of Science (NAS) Workshop on Building Scientific Capacity into GEF Enabling Activities and Operations, held in Washington D.C. on November 3, 1997. Reference was made to the STAP presentations and the leadership provided by STAP Chairman. One of the major observations made, was the fact that the workshop identified the lack of participation by the local scientific and technical community in GEF work in the countries where GEF projects were being implemented. To overcome this deficiency and to involve the scientific community in GEF work, it was suggested that workshops could be convened, at the regional and sub-regional levels, in various regions of the world, as a first step in sensitising the wider

scientific and technical community about the GEF. STAP is now awaiting the report of the NAS. This report will form the basis of further recommendations of STAP to GEF.

16. STAP was represented at the NAS workshop by Prof. Pier Vellinga, Dr. Helen Yap, Dr. John Woods, Dr. Jorge Soberon and Dr. Mark Griffith.

17. The STAP Chairman reported to the meeting on his participation in the Tenth Meeting of the GEF Council Meeting held in Washington D.C. in November 1997. He informed the meeting that the overall response of the Council to STAP's work was generally positive. He drew the Meeting's attention to the Council's decisions on STAP, namely

a) With respect to the STAP reconstitution, the guidelines set out in the "Terms of Reference of STAP" approved by the Council in October 1995 should be followed ;

b) The Implementing Agencies should include information in project proposals as to how the STAP Roster's Technical Review had been taken into account in the preparation of the project proposal;

c) The importance of using experts from the STAP Roster emanating from the region in which a project is to be implemented;

d) The Roster be broadened to include expertise in science and economics and that the gender balance in the Roster should be improved;

e) The Chair of STAP present to each Council meeting a list of STAP activities and information on their implementation status;

f) The Search Committee for the reconstitution of STAP should include representatives of the International Council of Scientific Unions (ICSU) and the Third World Academy of Science (TWAS) and the Chairpersons of the Scientific and Technical Bodies of the Conventions in Biodiversity and Climate Change.

18. Prof. Chihiro Watanabe reported on his participation in the Conference of the Parties of the UNFCCC convened in Japan in December, 1997. Specific reference was made to a session convened during the COP on the Global Observation Systems. Issues which were raised which could have relevance for STAP included capacity building for climate network and the consideration of the effectiveness of existing global observation systems.

Agenda item 5: Discussion on Outstanding Issues in the Various Thematic Areas

19. To assist the meeting in the consideration of the agenda item, the Secretariat prepared a document UNEP/GEF/STAP/11/5. The ad-hoc working group Co-ordinators/Task Team Leaders reported on the status of outstanding and forthcoming activities.

a) Land Degradation

i) *Follow up to STAP Workshop on Land Degradation*: Continue to give consideration to the nature of the follow-up to the STAP Expert Group on Land Degradation, including providing Strategic Advice on the types of projects which GEF should finance in the area of Land

Degradation as well as further clarifying the interlinkages between Land Degradation and the other GEF focal areas;

ii) *Dryland Biodiversity*. Provide advice on the sustainable use of dryland biodiversity, including the interplay of local and global benefits;

iii) *Carbon Sequestration*: Contribute to the STAP "think paper" on Carbon Sequestration particularly, as it relates to sequestration by growing of biomass;

iv) *Selective Review*: It was agreed that the ad-hoc working group on land degradation will undertake a selective review of the UNDP/World Bank Project entitled "Madagascar Environment Programme Support". On the basis of the observations made by Dr. Rokhayatou Fall on her preliminary mission to Madagascar in November, 1997, the meeting agree that site visit be undertaken at the end of May or early June, 1998 to coincide with the Implementing Agencies planning mission. The Terms of Reference for the STAP Selective Review are to be finalized. It was agreed that Dr. R. D. Fall will take the lead in the STAP Review in collaboration with one or two regional experts. The World Bank informed the STAP that a Quality Assurance group had done a review of the Madagascar project in the framework of a review of biodiversity projects in Africa on which STAP could build in its own review.

b) ***International Waters***

i) *Progress on the Study on Best Practices with Regard to the Application of Science and Scientific Tools in GEF Projects*. The Chairman of the Working Group presented the final draft of the Manual of Best Practices for International Waters, "Emerging Technologies for Measurement, Monitoring and Analysis of International Waters". It was agreed that this document will be used as an input into the STAP Expert Group Workshop on Emerging Technologies in International Waters. (A summary of the Manual is attached at Annex I);

ii) *Workshop on Emerging Technologies*: The meeting was provided with a status report on the STAP workshop on Emerging Technologies to be held February 24-26, 1998 in the Philippines. The Workshop will be attended by about 12 experts from both industrialized and developing countries, including six presenting accounts of new techniques, and four presenting case studies of GEF International Waters projects. These experts will be joined by project managers and others to discuss the best way to adapt the emerging technologies to the needs of GEF projects. It was agreed that the GEF Secretariat should make a substantive presentation on "*Overview of the GEF International Waters Portfolio*";

iii) *Issues which STAP should address in GEF II*: The Working Group outlined a number of issues which the next STAP could address:

a) Continued interaction with the implementation of the Global International Waters Assessment (GIWA) with STAP serving on the Project Steering Committee;

b) Selective Review of the Danube River Basin Environmental Management/Black Sea, or the Benguella current projects as well as follow-up to the Lake Victoria Environmental Management Project, Selective Review undertaken by STAP in 1997;

c) Review Papers: Two papers on "International Waters and Biodiversity" and "The Impact of Climate Change on International Waters" which were identified by the ad hoc Working Group as important areas. Closely related to this is a study on globalisation;

d) Follow-up on Emerging Technologies with demonstration projects. This should be the subject of a possible research project designed to make International Waters portfolio stronger.

c) Climate/Energy

i) *Strategies for Operationalizing STAP's work on Transport*: The Panel expresses the desire to continue its input into the Operational Programme on the transport sector drawing upon the conclusions of the STAP "Workshop on Options for Mitigating GHGs Emission from the Transport Sector";

ii) *Workshop on Technology Transfer and Innovations in Developing Countries*: The ad hoc Working Group presented the final report on the STAP Workshop on Technology Innovation convened on January 19-20, 1998 prior to the Eleventh meeting of STAP in Amsterdam, The Netherlands (see Annex II). The main findings are summarized as follows:

a) *Capacity Building*: Capacity building is needed to assess, select, import or develop, manage, adapt or replicate appropriate innovative energy technologies and also to innovate

(i) A base-level of indigenous technological capability is needed for each of the major candidate innovative energy technologies

(ii) An energy technology assessment capacity independent of both the pressures of technology promoters and the technology selection process is critical to informing the decision making processes about the merits of alternative technologies

GEF could assist regional training initiatives that emphasize energy technology fundamentals, technology assessment, and a wide range of skills required for effective technology development, marketing and management.

b) *The Private Sector*: Facilitating major roles for the private sector is essential

(i) Coherent policies aimed at unleashing the industrial dynamism of the "virtuous cycle" of innovation, market growth and price decreases for the new technologies are needed;

(ii) the encouragement of a transparent and competitive environment is vital;

(iii) equitable user-supplier agreements and appropriate financial modalities are required.

GEF could promote new instrumentalities (e.g. concessions, auctions, set-asides) to harness the demonstrated capacity of competitive markets for technological innovation and technology transfer.

c) *Research and Development(R&D)*: R&D is needed to enhance the prospects that innovative energy technologies will conform to local needs

(i) International industrial collaborative R&D would be especially efficient;

(ii) To maximize the prospects for technology diffusion potential intellectual property rights conflicts should be resolved.

GEF could facilitate initiatives that address these challenges.

It is recommended that elements of technology transfer be built into the Operational Programmes by requiring capacity building in as many projects as possible and by facilitating greater private sector participation and energy R&D activities

iii) *Contribution of GEF Operational Programme on Carbon Sequestration*: It was agreed that a ½ day brainstorming session will be convened on the first day of the twelfth meeting of STAP to explore key issues relating to carbon sequestration both via the growing of biomass in which carbon is stored and via decarbonization of fossil fuels and the storage of separated CO_2 (e.g. underground). To facilitate the preparation for the brainstorming the Working Group will prepare an issue paper to be circulated at least one month before the twelfth meeting of STAP in June 1998.

iv) *Basic Materials Processing Industries*: The importance was highlighted of identifying a role of GEF in promoting energy friendly technologies in basic material processing industries in developing countries. GEF should look into financing the incremental cost of adopting a policy scenario as opposed to a market scenario.

v) *Strategic Advice:* The Working Group made the point that timing is critical with respect to energy technologies. Due to the structural reform policies and related liberalisation/privatisation of the power

sector being undertaken in developing countries a window of opportunities for the introduction of RETs exist (for energy, for combating soil erosion and/or for enhancing biodiversity). However, if the opportunity is not taken to introduce these technologies while the new market conditions are being introduced in developing countries, the opportunity will be lost.

d) ***Biodiversity***

i) *STAP Expert Group Workshop on Sustainable Use*: The ad hoc Working Group presented the final report of the Workshop held in Malaysia on November 24-26, 1998. As a response to the needs identified by GEF, Implementing Agencies and Secretariat, STAP convened a workshop with international experts on Sustainable Use of Biodiversity. The main findings of the Workshop are summarised below:

- *Development of sustainable use projects requires the participation of local stakeholders as full partners*

  Present efforts to protect biodiversity mainly rely on external capital and management practices. However, a Sustainable Use approach requires skills, shared values and goals, incentives and institution building. It requires the involvement of local stakeholders like local communities and the private sector in all stages from the definition of the project to the final sharing of the benefits. Especially skills regarding the interaction of socioeconomic and ecological systems will be needed. To address these requirements capacity building and staff training at all levels and in all organisations involved in project identification and project development is essential.

- *Conservation will take place in diversified ecosystems*

  Biodiversity conservation will take place within a mosaic of ecologically interdependent areas, each having different functions and use intensities, ranging from intensely managed, unprotected and simplified areas to little managed, diversified and protected areas, with various shades in between. Sustainable use projects will add diversity to such complex landscapes. In the end, conservation will be possible only in sustainably managed, diversified landscapes. As the knowledge to achieve this goal is usually not available at the start of a project, implementation schemes should be flexible and adaptive as experience and knowledge of the ecological and the social systems accumulates.

- *Economic Analysis suggests that market mechanisms subject to safe minimum standards of conservation may constitute important conservation tools*

- Economics with safe minimum standards imposed, prescribes joint implementation of conservation and sustainable use measures while they are still affordable;

- Economics also encourages technological progress as a means to increase the substitutability of man-made capital for natural capital. Economics can prescribe policy packages that combines such encouragement with the system of incentives and disincentives that combine to enhance conservation and sustainable use.

- Economics applied to compare alternative use options can establish what incentives it takes (e.g. in $/ha.) to induce the land holders to sustainable use practices; assuming that the different preferences and endowments of different actors are realistically reflected.

- Economics has developed a menu of ways to estimate the benefits of sustainable resource uses and conservation. Benefit categories and appropriate estimation methods are available so that the total economic value of an area can be estimated for alternative management regimes.

- *Global benefits through replication should be the slogan of sustainable use projects*

Criteria for sustainable use projects should not be limited to the global significance of components of biodiversity. Any incremental cost and global benefit estimates should incorporate the notion of replicability and the related (potential) gains. The major challenge of sustainable use projects is to develop new ways of combining use and conservation. Often the existing incentive structure at local, national or international level does promote unsustainable use. Through experimentation and innovation new schemes can be identified that will help to remove barriers in knowledge and institutions.

- *Concepts identified for sustainable use projects, examples*

In the case of arid- and semi-arid ecosystems a number of specific activities were suggested for protected areas and buffer zones; rangelands, wild foods and cropping land husbandry:

- promotion of multi land-use/multi-species production systems;

- enhancing/protecting biodiversity by application of *ad hoc* grazing methodologies described in the literature;

- development of integrated management systems aiming at diversifying and enhancing the productivity in a sustainable regime.

In coastal and marine ecosystems focus is on the development of multiple use schemes forming a mosaic, containing: (i) protected, off-limit areas, set aside for replenishment of populations of species and for aesthetic purposes and tourism, (ii) regulated

areas, (iii) farmed areas (aquaculture, serving the production function), (iv) open access areas. In such schemes rights and incentives must be allocated to the "stakeholders" whose responsibility it is to conserve and sustainably manage a resource.

In forest ecosystems, the recommendations covered both extractive (timber and non-timber) and non-extractive (ecosystem services like watershed catchments, soil stabilization, tourism, etc.) uses. These include:

-removal of alien species and introduction of native species;

-promote shift to better logging techniques; training of forest dwellers and small-scale loggers;

-promoting wildlife management in forest areas predominantly managed for timber;

-development of certification regimes and practices;

-reversing free access situations, and establishing of adequate ownership and control regimes (community property rights should not be confused with open access regimes).

- *Indicators development, research and monitoring should be integral parts of any sustainable use project*

Indicators are indispensable for monitoring the development of projects and should equally focus on the ecological, as on the socioeconomic aspects. A hierarchical set of indicators would help to identify corrective measures and to pinpoint potential areas of conflict. Research on the dynamics of variables underlying indicators will often be required to interpret correctly their behaviour. The research may include:

-development and assessment of indicators;

-multi-species modelling, risk management and monitoring systems;

-adaptive management schemes;

-review and development of appropriate policy frameworks to facilitate sustainable use;

-identification and adoption of positive incentives/cross transfers;

-study impact of alien species;

-identification of water resource status/constraints;

-inclusion of biodiversity considerations in Environmental Impact Assessment (EIA);

-analyse potential similarities in terrestrial "green revolution" that lead to diversity loss and to present fisheries techniques and the potentiality of alternative strategies and techniques;

-analysis of biosafety aspects of mari-culture;

-economic evaluation of the functions of natural systems: for example the role of coral reefs in coastal protection and the contribution of coral reefs, see grass beds and mangroves to fisheries production;

-the relations between local indigenous knowledge and scientific knowledge as related to specific cases.

- *Time is crucial. It takes at least 5 to 10 years to implement and gain sufficient experience with a sustainable use project*

  A sustainable use project usually involves the development of new practices in the use of biological resources and new ways of generating livelihoods. Institution building and the generation of trust through experience are crucial elements for sustainability. From case studies it is clear that the nature and the timing of the financial support is more crucial than the volume.

ii) *Selective Review*: A progress report on the plans for the Selective Review on "Sustainable Development and Management of Biologically Diverse Coastal Resources in Belize" was presented by the ad hoc Working Group. A Task Team co-ordinated by Dr. J. Soberon and composed of Dr. S. Hansen and Prof. Yap has been established to undertake the Selective Review. It was agreed that the team will visit the project site during March 1998. The meeting also agreed that the Working Group should prepare Terms of Reference and a Selective Review for discussion with the Task Manager of the project.

It was also agreed that STAP will undertake, with the assistance of external assistance, Selective Reviews of the UNEP biosafety projects. Dr. J. Soberon was appointed as Task Co-ordinator for this exercise;

iii) *Biodiversity Indicators*: It was agreed that STAP will review the proposal submitted by UNEP on this issue and provide consolidated comments to UNEP. The Panel supported UNEP's initiative.

(e) Targeted Research

A number of issues relevant to Targeted Research and STAP's role in this process were considered by the meeting, namely:

- *The modalities for the operation of the GEF Targeted Research Committee in order to maximise STAP's input into this process*. It was agreed that the Targeted Research concepts should be considered at an early stage by the Research Committee to ensure consistency with the GEF Targeted Research Policy. It was also agreed that a meeting of the GEF Research Committee be convened as soon as possible to consider the targeted research concepts that have already been submitted to the GEF Secretariat and the STAP Chairman;

- *The need for STAP to facilitate a process aimed at operationalizing the GEF Targeted Research Policy*. To this end it was agreed that STAP convenes a half-day brainstorming session on the first day of the twelfth meeting of STAP in June, 1998 to address this issue. The GEF Secretariat, the Implementing Agencies and some members of the incoming STAP will be invited to participate in this meeting. It was also agreed that the STAP Secretariat in collaboration with the STAP Chairman will prepare a

discussion document for the brainstorming session. The aim of the brainstorming session is to investigate how STAP's expertise with regard to research can be utilized in a more upstream phase of Targeted Research project development as well as identify the modalities for operationalizing the Targeted Research Policy. In addition, the session will consider Emerging issues which the GEF should elaborate and if needed, support financially, through Targeted Research; for example, collaboration in new energy research and development between developed and developing countries. It was noted that this is an emerging issue which could leverage considerable additional resources.

(f) *Publication of STAP Documents*

A major issue of concern raised by the meeting was the publication of STAP Documents. The general consensus of the meeting is that the route of using the GEF Publication Committee was too long to be effective. In this regard specific reference was made to the documents under consideration by the Publication Committee which have not been published thus far.

After further discussion of the issue with the GEF Secretariat and the Implementing Agencies representatives, it was concluded that STAP's publications were not reaching the Council Members, the Implementing Agencies and the wider community in an adequate form and a timely manner, despite the demand. The STAP Secretariat was charged with the responsibility of initiating a UNEP/STAP publication series.

The Implementing Agencies especially the World Bank and UNDP expressed the desire to be able to access all STAP publications, including papers prepared for the various STAP Workshops. It was agreed that STAP, with the help of UNEP, should increase its efforts in publishing all their work through reports and through the World Bank, UNDP and UNEP internet.

To enhance the dissemination of information on emerging issues and their implications for the GEF, it was suggested that STAP members at each meeting of STAP prepare a brief overview of key developments in science and technology in their respective areas for distribution at STAP meetings.

Agenda item 6: Preparations for the GEF Assembly

20. The representative from the GEF Secretariat gave an overview of the status of the preparations for the Assembly and circulated the "Information Booklet" produced by the GEF Secretariat for the first GEF Assembly, and Associated meetings. With respect to STAP participation in the Assembly, the meeting was informed that the STAP Chairman will make a statement on the first day of the Assembly, on April 1 1998, and the Panel on Science and the Global Environment organised by STAP will take place on April 2, 1998 from 11.15-13.00 hrs

21. In terms of STAP's preparation for the Assembly

a) the Panel considered the document entitled "Highlights of STAP's Work During GEF 1: 1995-1998" and approved it. The document is attached as Annex IV. The document was subsequently transmitted to the GEF Secretariat to be processed as part of the documentation for the First GEF Assembly;

b) the Panel agreed that the theme for the STAP Panel at the GEF Assembly should be "How Science and Technology can help the GEF to Address Global

Environmental Issues". It was further agreed that the panel will consist of: Prof. Pier Vellinga, Prof. John Woods, Dr. Robert Williams and Dr. Jorge Soberon; with Prof. Jyoti Parikh chairing the panel session. Each STAP member will address the issue from the perspective of their working group, and the STAP Chairman will address the inter-linkages between the focal areas.

c) It was agreed that the presenters will prepare written presentations which will be circulated to all STAP members for review before the Assembly. It was also agreed that the GEF Secretariat will cover the costs of the four STAP members consistent with the information received from the GEF Secretariat. The four persons are Dr J. Soberon, Prof John Woods, Dr R Williams and Dr R.D. Fall. It was agreed that STAP will cover the costs of the STAP Chairman and Dr Mohd Salleh to the Assembly.

Agenda item 7: Priority Issues which STAP Could Address in GEF Phase II

22. To facilitate the consideration of this agenda item by the Panel, the meeting had before it UNEP/GEF/STAP/11/7 entitled "Preliminary Ideas on Priority Issues which STAP Could Address in the GEF Phase II". The Panel had a substantive discussion on this issue and made a number of specific recommendations which should be integrated in the UNEP/GEF/STAP/11/7. These are summarised as follows:

a) In the Climate Change focal area, emphasis should be placed on climate change and energy on the one hand and climate change and adaptation on the other;

b) There is a need to further strengthen the relationship between STAP and the Subsidiary and Technical Bodies of the Conventions of Climate Change and Biodiversity. Suggestions which were made to enhance such relationships included the preparations of joint papers by STAP and the representatives of the Subsidiary Bodies on Science and Technology, and the need for STAP to convene a strategic session at least once per year with the Scientific and Technical Bodies of the Conventions to discuss work plans for the coming year;

c) Greater emphasis should be placed on involving the private sector in STAP's work. To this end STAP capacity in private sector involvement should be broadened as a means of increasing STAP strategic partnerships;

d) A major area of focus for STAP in the future will be inter-linkages between the focal areas. A number of specific issues were identified which should be addressed by STAP under this theme include;

i) carbon sequestration. The focus could be on two sets of issues namely sequestration by biomass and underground storage of carbon where there is economic value, e.g. carbon for enhanced coal recovery and/or carbon injection for deep bed methane;

ii) land based sources of marine pollution and its implications for land-use planning, biodiversity and international waters;

iii) the relationship between biodiversity and climate change, e.g. how to embed biodiversity models into climate change models;

iv) Closely related to this is the issue of information generation, processing and dissemination;

v) Coastal habitat degradation/climate change linkage.

23. Emerging issues which were identified which STAP II should consider under specific focal areas included:

- Climate Change:
  - * innovation in the basic materials processing industry;
  - * Renewable Energy Resources Assessment;
  - * transport;
  - * integrated resource planning including energy efficiency issues.
- International Waters
  - * a globalization study to clarify which aspects of the global international waters system is relevant to the GEF.
- Biodiversity
  - * Further clarification of what is meant and understood by agrobiodiversity in the GEF context;
  - * biosafety;
  - * validation of indicators;
  - * issues relating to access and property rights such as tenural-and-access rights, policy instruments such as legislation, incentives and other complementary policy instruments.

24. It was also agreed that STAP's role in the Monitoring and Evaluation process, particularly as it relates to how scientific and technical issues play themselves out in individual projects, should be better defined. It was felt that the GEF Portfolio has developed sufficiently to allow an assessment of the scientific and technical constraints affecting project design and implementation.

25. With respect to the possible areas of expertise which should be recommended for inclusion into the reconstituted STAP consensus was reached on the following:

a) Biodiversity

Specialist in aquatic biodiversity, terrestrial/land degradation; forest biodiversity and social aspects of biodiversity, possibly with experience in land degradation;

b) Climate Change

Specialists in climate, impact and adaptation; technology development and transfer, preferable from the private sector; industrial process technology and energy;

c) International Waters

Specialists in aquatic science, climate and global change; freshwater and hydrology and coastal and marine;

d) Cross Cutting

Resource economist

Agenda Item 8: Any Other Business

26. Twelfth meeting of STAP: It was agreed that the twelfth meeting of STAP should me convened from June 16 to 19, 1998 in Washington, D.C. This meeting will be a joint meeting of the outgoing and incoming STAP. The basic structure of the meeting is as follow:

June 16, 1998:	a.m. Brainstorming on Carbon Sequestration p.m. Brainstorming on Operationalizing the GEF Targeted Research Policy
June 17, 1998:	Meeting of current STAP to conclude all outstanding work
June 18, 1998:	Joint Meeting of the Outgoing and Incoming STAP
June 19, 1998:	Orientation meeting of the Incoming STAP.

27. It was agreed that the following documents be finalized by February 10, 1998 and forwarded to the GEF Secretariat for inclusion into the formal documentation for the March GEF Council Meeting.

a) Report of the STAP Expert Workshop on the Sustainable Use of Biodiversity;
b) Report of the STAP Workshop on Technology Transfer and Innovation;
c) Executive summary of Emerging Technologies and Methods in International Water projects.

Agenda item 9: Adopting of the Report

28. The Meeting considered the draft report and entrusted the STAP Secretariat to incorporate the comments made.

Agenda item 10: Closing of the Meeting

29. The Meeting was closed at 13.00 on January 23, 1998. In accordance with the STAP Programme of Work for FY 98, the twelfth meeting of STAP will take place in Washington, D.C. U.S.A., June 16-19, 1998.

Report of the STAP Expert Group Workshop on Sustainable Use of Biodiversity Components

Kuala Lumpur, Malaysia
November 24-26, 1997

Prepared by the
Scientific and Technical Advisory Panel (STAP)
of the Global Environment Facility (GEF)

January 23, 1998

STAP Secretariat
United Nations Environment Programme

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PREFACE

It is pleasure to present the report of *The STAP Expert Group Meeting on Sustainable Use of Biodiversity Components*. The Workshop described in this report was held on November 24-26, 1997 in Kuala Lumpur, Malaysia. The Workshop brought together international biodiversity experts from both developed and developing countries working on this issue as well as representatives from the GEF Secretariat and Implementing Agencies. This group was convened by the Scientific and Technical Advisory Panel (STAP) of the Global Environmental Facility (GEF to clarify the concept of sustainable use and to provide strategic and operational advise to the GEF.

The STAP Reports on "An Ecological Perspective for Sustainable Use of Biodiversity Components: Indicators of Sustainability" and "Sustainable Use: An Economic Perspective" as well as the case studies presented during the Workshop provide much of the basis for the finding and recommendations contained in this report. In addition to this workshop report, STAP will finalize and submit for Council's consideration, further guidance on Sustainable Use of Biodiversity Components.

This workshop report was prepared by the STAP Working Group on Biodiversity.

Pier Vellinga
Chairman of STAP

January, 1998

EXECUTIVE SUMMARY AND MAIN FINDINGS

As a response to the needs identified by GEF, Implementing Agencies and Secretariat, STAP convened a workshop with international experts on Sustainable Use of Biodiversity. The aim of the workshop held in Malaysia from November 24-26 was to clarify the concept and to provide strategic and operational advise to the GEF. Scientific papers on the economic, ecological and social aspects of sustainable use and case study reports provided the input for the workshop. The results of the discussions made clear that a major shift in the way of conservation has been defined and practised and would be needed in order to include successfully the sustainable use component. For many of the institutions involved in biodiversity conservation this does require a paradigm shift. The main findings of the workshop are summarised below.

- *Development of sustainable use projects requires the participation of local stakeholders as full partners*

  Present efforts to protect biodiversity mainly rely on external capital and management practices. However, a Sustainable Use approach requires skills, shared values and goals, incentives and institution building. It requires the involvement of local stakeholders like local communities and the private sector in all stages from the definition of the project to the final sharing of the benefits. Especially skills regarding the interaction of socioeconomic and ecological systems will be needed. To address these requirements capacity building and staff training at all levels and in all organisations involved in project identification and project development is essential.

- *Conservation will take place in diversified ecosystems*

  Biodiversity conservation will take place within a mosaic of ecologically interdependent areas, each having different functions and use intensities, ranging from intensely managed, unprotected and simplified areas to little managed, diversified and protected areas, with various shades in between. Sustainable use projects will add diversity to such complex landscapes. In the end, conservation will be possible only in sustainably managed, diversified landscapes. As the knowledge to achieve this goal is usually not available at the start of a project, implementation schemes should be flexible and adaptive as experience and knowledge of the ecological and the social systems accumulates.

- *Economic Analysis suggests that market mechanisms subject to safe minimum standards of conservation may constitute important conservation tools*

  - Economics with safe minimum standards imposed, prescribes joint implementation of conservation and sustainable use measures while they are still affordable;

  - Economics also encourages technological progress as a means to increase the substitutability of man-made capital for natural capital. Economics can prescribe policy packages that combines such encouragement with the system of incentives and disincentives that combine to enhance conservation and sustainable use;

- Economics applied to compare alternative use options can establish what incentives it takes (e.g. in $/ha.) to induce the land holders to sustainable use practices; assuming that the different preferences and endowments of different actors are realistically reflected;

- Economics has developed a menu of ways to estimate the benefits of sustainable resource uses and conservation. Benefit categories and appropriate estimation methods are available so that the total economic value of an area can be estimated for alternative management regimes;

- *Global benefits through replication should be the slogan of sustainable use projects*

Criteria for sustainable use projects should not be limited to the global significance of components of biodiversity. Any incremental cost and global benefit estimates should incorporate the notion of replicability and the related (potential) gains. The major challenge of sustainable use projects is to develop new ways of combining use and conservation. Often the existing incentive structure at local, national or international level does promote unsustainable use. Through experimentation and innovation new schemes can be identified that will help to remove barriers in knowledge and institutions.

- *Concepts identified for sustainable use projects, examples*

In the case of arid- and semi-arid ecosystems a number of specific activities were suggested for protected areas and buffer zones; rangelands, wild foods and cropping land husbandry:

- promotion of multi land-use/multi-species production systems;

- enhancing/protecting biodiversity by application of *ad hoc* grazing methodologies described in the literature;

- development of integrated management systems aiming at diversifying and enhancing the productivity in a sustainable regime.

In coastal and marine ecosystems focus is on the development of multiple use schemes forming a mosaic, containing: (i) protected, off-limit areas, set aside for replenishment of populations of species and for aesthetic purposes and tourism, (ii) regulated areas, (iii) farmed areas (aquaculture, serving the production function), (iv) open access areas. In such schemes rights and incentives must be allocated to the "stakeholders" whose responsibility it is to conserve and sustainably manage a resource.

In forest ecosystems, the recommendations covered both extractive (timber and non-timber) and non-extractive (ecosystem services like watershed catchments, soil stabilization, tourism, etc.) uses. These include:

- removal of alien species and introduction of native species;

- promote shift to better logging techniques; training of forest dwellers and small-scale loggers;

- promoting wildlife management in forest areas predominantly managed for timber;

- development of certification regimes and practices;

- reversing free access situations, and establishing of adequate ownership and control regimes (community property rights should not be confused with open access regimes).

- *Indicators development, research and monitoring should be integral parts of any sustainable use project*

Indicators are indispensable for monitoring the development of projects and should equally focus on the ecological, as on the socioeconomic aspects. A hierarchical set of indicators would help to identify corrective measures and to pinpoint potential areas of conflict. Research on the dynamics of variables underlying indicators will often be required to interpret correctly their behaviour. The research may include:

- development and assessment of indicators;

- multi-species modelling, risk management and monitoring systems;

-adaptive management schemes;

- review and development of appropriate policy frameworks to facilitate sustainable use;

- identification and adoption of positive incentives/cross transfers;

- study impact of alien species;

- identification of water resource status/constraints;

- inclusion of biodiversity considerations in Environmental Impact Assessment (EIA);

- analyze potential similarities in terrestrial "green revolution" that lead to diversity loss and to present fisheries techniques and the potentiality of alternative strategies and techniques;

- analysis of biosafety aspects of mari-culture;

- economic evaluation of the functions of natural systems: for example the role of coral reefs in coastal protection and the contribution of coral reefs, see grass beds and mangroves to fisheries production;

- the relations between local indigenous knowledge and scientific knowledge as related to specific cases.

- *Time is crucial. It takes at least 5 to 10 years to implement and gain sufficient experience with a sustainable use project*

A sustainable use project usually involves the development of new practices in the use of biological resources and new ways of generating livelyhoods. Institution building and the generation of trust through experience are crucial elements for sustainability. From case studies it is clear that the nature and the timing of the financial support is more crucial than the volume.

1. Introduction

At a Strategic Session convened by STAP during its Seventh Meeting in November 1996, the issue of sustainable use of biological diversity was identified as a priority area by the GEF Secretariat and the Implementing Agencies (UNEP, UNDP and the World Bank). As a consequence, STAP organised the Expert Group Workshop on Sustainable Use of Biological Biodiversity in Malaysia from November 24-26, 1997. The goal of the workshop was to provide strategic and operational advise to the GEF on sustainable use of biodiversity in various ecosystems (i.e. forest, mountain, arid and semi-arid and coastal and marine) including considerations of local knowledge systems, sharing of benefits and incremental costs. In collaboration with the IUCN's Sustainable Use Initiative (SUI), the STAP Biodiversity Working Group commissioned a number of case studies which illustrate generic factors/principles of sustainable use.

The workshop brought together international biodiversity experts, some of whom presented case studies outlining key issues to sustainable use of biodiversity in Pakistan, Malaysia, Brazil and Zimbabwe (See Annex 1 and 2 for Workshop Programme and List of Participants). The case studies focused on ongoing projects aimed at promoting the sustainable use of biodiversity and reflect different ecosystems, cultural approaches and different focus and scale of use. They also highlighted the elements which are essential in promoting the sustainable use of biodiversity. Moreover, papers were presented on the scientific and technical issues underpinning the sustainable use of biodiversity as well as the operational framework both within the GEF and the Convention on Biodiversity for addressing sustainable use initiative. Some of the challenges faced by the Implementing Agencies in identifying and preparing GEF projects in the area of sustainable use of biodiversity were specifically addressed.

This workshop report summarizes the main findings of the previously mentioned papers and identifies emerging issues pertaining to the sustainable use of biodiversity. Drawing on the recommendations from the workshop papers and discussion session, the paper presents strategic directions for the GEF in identifying and supporting projects addressing the sustainable use of biodiversity.

2. Sustainable Use of Biological Diversity - Operational Background

A major goal of the conservation movement over the past two decades or so has been to find common ground between conservation, economic and social development objectives. *The World Conservation Strategy* prepared by IUCN in 1980 was one of the first documents to articulate the concept of sustainable use. This was followed by *Caring for the Earth: A Strategy for Sustainable Living in 1992* which redefined the concept of sustainable use more realistically. These have provided the basis of the IUCN's Sustainable Use Initiative, an interdisciplinary framework to enhance knowledge about the social and biological factors that affect the sustainability of uses of wild renewable resources.

The Convention on Biological Diversity (CBD) has three interconnected objectives that acknowledges the need of achieving the related goals of conservation and sustainable use: "the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources . . ." (for the purpose of this workshop, we shall not restrict our discussion to benefits arising from "genetic resources" strictly speaking, but will use a more general concept of benefits arising from use of any component of biodiversity).

The Convention defines sustainable use as "*...the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generation.*[1]"

While recognising that protected areas are likely to be the cornerstone of biodiversity conservation, the issues of sustainable use of biodiversity as well as fair and equitable sharing of benefits of are critical to the long-term utilisation of biodiversity resources. Notwithstanding this, the issue of benefit sharing has not received the detailed attention it deserves among those formulating legal measures for operationalising the Convention on Biodiversity and despite the large number of attempts to use it as a complementary strategy, there are very few clear cut cases of success.[2]

The GEF Global Environment Facility (GEF) is the interim financial mechanism for the Convention on Biological Diversity. From an operational standpoint, the GEF has identified a number of sustainable use options; namely sustainable use of species; genes including the sustainable use of genetic materials of species and sustainable use of space that species occupy (e.g. ecosystem, habitat, range) on which emphasis should be placed. However, the GEF still faces a number of challenges in addressing the issues of sustainable use:

- *lack of baseline information, for example on species, their status, distribution and population biology parameters; and on the properties and functioning of the ensembles of populations of many species in ecosystems.*

- *Lack of local scientific and technical expertise required to assess and monitor the ecological sustainability of a project.*

- *Lack of local (community, regional and country) institutions capable of organising and maintaining the efforts required for the social and economic sustainability of a project and of ensuring that the benefits are shared equitably.*

- *Lack of agreement on values and goals among stakeholders*

- *Lack of regulatory frameworks, clearly defined access rights, and markets for the goods produced.*

- *Lack of an agreed and clearly defined definition of the meaning of global benefits in locally defined sustainable use projects. This impinges on the calculation of incremental costs.*

In view of the above, it is not surprising that in many cases the Implementing Agencies have been experiencing difficulties in identifying and developing sustainable use projects. Some of the major obstacles faced by the Implementing Agencies for the identification and preparation of sustainable use projects relate to the determination of

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[1] The Convention on Biological Diversity, Article 10

[2] M.S. Swaminathan Research Foundation, A Conceptual Framework for Promoting Benefit Sharing of Conservation and Use of Plant Genetic Resources. Paper prepared for UNEP under contract FP/1200/97-02.

eligibility, incremental and recurrent costs, and sustainability of GEF interventions, within an ecosystems approach and in a context of national or global markets. During the workshop these issues were discussed from different perspectives.

3. Issues Addressed at the Workshop

The background papers presented at the workshop provided the scientific, technical and conceptual basis for addressing some of the challenges for a sustainable use of biodiversity.

Following the guiding principles of the Convention and the GEF Operational Strategy, background papers were divided among ecological, economical and social issues. Emphasis was placed on the ecosystem approach as an organising framework for the consideration of sustainable use.

Ecologically speaking sustainability refers to the maintenance of the composition, structure and functioning of ecosystems and therefore indicators focusing on all levels of ecosystem structure were proposed. The essence of the background papers covering these issues appear in section 4. From a social perspective, issues related to the existence of local institutions, conflicts of values and goals and ownership of resources were discussed. The essence of this discussion appears in section 5. Finally, from an economical perspective, the background paper clarified the relations between sustainable use and sustainable development and provided a discussion on the meaning of what is to be sustained and underlying economical assumptions. This is covered in section 6.

4. The Ecosystem Approach

An ecosystem (in some cases called a landscape) should be considered as a mosaic of ecologically interdependent areas each having different functions and use intensities, ranging from fully managed/exploited to unmanaged/protected areas, with various shades in between. Under an ecosystem approach to the sustainable use of biodiversity, management acknowledges the various components of a given ecosystem (or cluster of naturally linked ecosystems), both ecologically, socio-economically and regulatory, and also the human-induced physical, chemical and biological influences on the system (or cluster of systems) in that context.

The art of sustainable use requires the creation of management systems such that the users of the various parts of the ecosystem take up their share in the responsibility to conserve the ecosystem as a whole. This requires innovative incentive structures and related institution building. It also may require in depth knowledge of the functioning of ecosystems, their complexity, dynamics and their resilience, likewise it requires insight and even foresight in regard to socio-economic variables such as market developments. As this knowledge is usually not available, implementation schemes should be flexible and adaptive regarding the ecological and the social systems involved. However, cases were mentioned in which without exhaustive knowledge a diversified management of complex ecosystems is possible. Adaptive management should also take this possibility into account.

Given the complex and layered structure of ecosystems and their forms of use, the need for a hierarchical set of indicators of sustainability was identified as necessary in the context of monitoring the sustainable use of components of biodiversity. A hierarchical set of indicators has the potential of pinpointing to conflicts arising from the extraction of some

components at other levels. The function of such ecological indicators of sustainability is to provide a manageable system of evaluation criteria that can be used by decision makers to evaluate whether the management of any particular system is depleting the qualities in which people are interested.[3] It was concluded that ideally, any set of indicators should be supported by research that clarifies their relevance and interpretation.

The case of coastal ecosystems was especially pointed out as one in which linkages with other systems (land and open ocean) are considered highly important. Essential activities that must be done are establishing a baseline and subsequent monitoring in order to determine whether uses of the system are becoming unsustainable. It is therefore necessary to develop a hierchical set of indicators for the monitoring of the resilience of the ecosystem, allowing for continous feedback, learning and modification of its management.

Despite the fact that ecologists have a large number of empirical generalisations and reliable models and theories, a recurring theme in the workshop papers and discussion sessions was our limited knowledge about particular ecosystems or about the details of application of theory to specific situations. Because of this, targeted research was identified as a critical element in furthering understanding of sustainable use. This could take the form of stand alone projects or as an essential part of sustainable use initiatives.
GEF should consider support for targeted research projects addressing sustainable use of biodiversity. Areas of focus could include:

(i) *The role of species richness in ecosystem variables like productivity or resilience;*

(ii) *The interrelations between biodiversity depletion and socio-economic factors (the root causes problem);*

(iii) *How useful are indicators and what do they indicate? In other words, research on the dynamics of the underlying variables that indicators are supposed to model;*

(iv) *Research to determine how do changes in diversity at one level affect other levels;*

(v) *The development of analytical methods for risk analysis, innovative methods of multispecies modelling and development of adaptive management methods, as well as biodiversity impact especially for vulnerable components of ecosystems;*

(vi) *Development of methods for simplified Rapid Assessment Procedures (RAPs);*

(vii) *Development of data information management schemes;*

(viii) *In the absence of adequate information and control systems, more emphasis needs to be placed on the understanding of traditional and indigenous approaches to the management of diversified ecosystems. Research on ethnoecology is required;*

(ix) *Research on the economic evaluation of the functions of natural systems: for example the role of coral reefs in coastal protection and the contribution of coral reefs, sea grass beds and mangroves to fisheries production.*

5. Social Issues: Conservation through Community Development.

To this day, many of the efforts to conserve biodiversity have been characterised by sets of values and goals defined externally to the local inhabitants of a given region and implemented by relying significantly on external financial resources and knowledge. The ideal protected area is conceived as uninhabited or inhabited by "indigenous peoples" isolated from the rest of the world and wise enough to maintain the structure and functioning of their ecosystems. However, most conservation should be taking place in areas where local inhabitants are present and are indeed part of wider economies. Moreover, it is common that their local knowledge either is being eroded or is becoming irrelevant to tackle the complications of new situations. The conventional approach to conservation by protected areas basically requires know how about ecosystems management and it requires capital. On the other hand the experience has shown that a conservation approach based on the sustainable use of ecosystems (or its components) has additional requirements, such as skills regarding the interaction of socio-economic and ecological systems. In particular, issues about values and incentives, development of institutions and ownership of resources, were regarded as very relevant.

Incentives were identified as central to consideration of the sociological and anthropological dimensions of sustainable use. Incentives which determine preferences for the modes of use vary significantly from global to local levels and their capability can only be achieved when local inhabitants acquire on economic interest in the long-run preservation of ecosystem that governments and international agencies want to protect.

An economic incentive mechanism which proved particularly useful is the use of community based conservation funds. Mechanisms such as Trust Funds as in the case of the Zimbabwe Case Study and Village Conservation Funds in the case of the Pakistan Case Studies proved to be important mechanisms in providing a financial basis for initial investments and running the operation. The mechanism also provided opportunities for continued community participation. The local communities are able to manage and make sustainable use of natural resources provided there are local organisations for collective action; their capacity is built; and they are empowered and given support (technical and instrumental) to be able to function and develop.

Along with the existence of economic or other kinds of incentives, strong institutions established by the community and which underwrite the need to conserve natural resources seem to determine the sustainability of natural resource uses.

In the arena of natural resource use, where the nature of these resources demands collective management, the health of institutions that seek to accommodate diverse incentives, determine whether use will be sustainable or not. Sustainability therefore cannot be considered solely in ecological terms. Sustainable use requires sustainable institutions to manage such use.

Five loci of *incentive divergence* were identified and illustrated in the background paper on the social and anthropological dimensions of sustainable use:

(i) When there is divergence in the values and goals among local, national and international stakeholders it is important that the divergence is explicitly stated and discussed and that local conservation incentives are accorded the same or higher order as international values and goals;

(ii) ownership is key in establishing conservation incentives. Without clearly defined rights to resource access, benefits cannot be allocated equitably and resources become in fact "commons", subject to unsustainable exploitation.

(iii) Often, local people do not understand the scientific technicalities of governments and international agencies and they only accept them with a significant loss of control. In turn, some scientists might be reluctant to accept as valid the local knowledge that may be expressed in religious, mythical or metaphorical terms. One of the best mechanisms to achieve the insertion of science into policy and practice of sustainable use is through the sponsorship of debate involving villagers, rural managers, policy-makers and in scholars at regional and national levels.

(iv) Socio-ecological topography. While social topography suggests "small-scale" regimes, ecological considerations tend to mandate "large-scale" regimes. Economic considerations may also indicate "large-scale" regimes where market forces require that several owners manage and tender their resources collectively. The harmonisation of social and ecological topographies requires context-specific institutional engineering through negotiation. Projects that start with a focus on social units of organisation may have a better potential than those that start with a defined land area, as they may manage large land areas, and may be in a position to sponsor lateral incrementalism through example and mutual interest.

(v) Project and Project Implementation. Projects bring together international and local incentives for sustainable use and their contexts juxtapose two cultures of planning and implementation. These differences require institutional learning and experiential adaptation of roles and norms in new circumstances within local social units themselves.

These issues were further highlighted in the case studies. A common feature which emerged from the case studies is that sustainable use as a tool to achieve conservation requires a paradigm shift. It is not only that conservation efforts have been biased towards the "conservation" end in a conservation-use continuum, but that this conventional or classical approach relied heavily on transfer of capital and technology. The failure of this approach to be sustainable at the local level, has lead to local communities participation in development and conservation. The last decade has seen a wide variety of community-based conservation (CBC) approaches. The question is simply this: if CBC has been around for some time, has it worked? and if not, then what else is required for a sustainable use approach?.

An attempt is made here to illustrate (1) classical, (2) CBC and (3) the sustainable use or conservation through Community Development (CCD) approach through a stylised diagram (see Figure 1). Implicit in the classical approach is that the solution to conservation is in transfer of capital and technology. No attention was paid to the underlying causes, and the impact of man was controlled through coercive measures.

However, due to the inability of state institutions to exclude people, unsustainable use regimes returned and conservation measures did not prove long lasting. This approach considered people as part of the problem.

The CBC, on the other hand, shifts its emphasis on people and makes them a part of the solution. While it is difficult to generalise, however, the essence of this approach was to secure support of the local communities by allowing sustainable use in buffer zones. In some cases, as an additional incentive, socio-economic development of local communities was provided to secure their goodwill. The conservation continued to remain an agenda of the professionals and scientists. The results of CBC were better than those of the classical approach. However, the gains are generally short-lived as there is heavy reliance on external inputs. These approaches were basically used for the conservation of the protected areas through donor assisted projects. But in most cases, the national governments were unable to bear the recurring costs after the funding has ceased.

Alternatively, the sustainable use (or CCD) approach aims at putting the villagers in the "driver's seat", transferring the control and building their capacity to conserve and sustainably use natural resources. The approach becomes the sustainable use agenda of the local communities and the government institutions, and the local NGOs while the donors assume a supporting and facilitating role. Thus, conservation through sustainable use is significantly different from CBC approach.

It was concluded that the skills, incentives and institutions approach is key to (a) conservation of biodiversity outside of protected areas (over 90% of the world's area); (b) providing functional links between conservation and development; and (c) sustainable management of protected areas. This implies that promotion of sustainable use practices requires GEF input in the field of:

(i) *Skills - development (i.e. capacity building/capacity utilisation);*

(ii) *Incentives (i.e. financial arrangements such that the local community has an economic basis in wise use/conservation activities);*

(iii) *Institutions (i.e. support for the development of institutions for legal and social embedding of the incentives).*

6. The Economic Perspective.

From an economics perspective, a clarification was presented on the linkages or boundaries between sustainable development and sustainable use needs. A number of key issues were addressed including what constitutes a reasonable set of possible sustainability goals or stated differently: what exactly are we concerned about sustaining. Given the ecologist perspective of existential uncertainty and linking it to life-supportive ecosystems, an economist is lead to focus on the resiliency of the populations at stake and to search for robust policy solutions; i.e. the precautionary principle. One should allocate resources in accordance with economic efficiency criteria, but always subject to a safe minimum standard of conservation in order to reflect the biodiversity conservation insurance cost dimension for a minimum carry-over stock. Operational recommendations derived from this include:

- The creation of off-limit areas capable of acting as population "sources" (in a technical ecological sense), establishment of quotas for capture or harvesting, the setting aside of reproductive seed trees representative of the genetic pool of a population and so on;

- Economics with safe minimum standards imposed prescribes joint implementation of conservation and sustainable use measures while they are still affordable;

- Economics also encourages technological progress as a means to increase the substitutability of man-made capital for natural capital. Economics can prescribe policy packages that combines such encouragement with the system of incentives and disincentives that combine to enhance conservation and sustainable use;

- Economics applied to compare alternative use options can establish what incentives it takes e.g. in $/ha to induce the land holders to sustainable use practices; assuming that the different preferences and endowments of different actors are realistically reflected;

- Economics has developed a menu of ways to estimate the benefits of sustainable resource uses and conservation. Benefit categories and appropriate estimation methods are available so that the total economic value of an area can be estimated for alternative management regimes;

- Methods for certification of products produced in a sustainable way require economic analytic inputs as a basis for tracing commodity and energy interlinkages. For example, there are markets for sustainably produced timber and medicinal plants. The existence of certification standards and agencies capable of providing such services becomes an interesting incentive to adopt sustainable practices.

7. Global Benefits through Replication

While discussing some of the examples, it was clear that "global" benefits were often difficult to identify due to, among other things, the ecosystems in question being not pristine, or lacking threatened and endemic species, or not listed in some of the unofficial but existing "hot spot" lists or maps. This means that, as was mentioned in section 5, local values and objectives not always coincide with those that are important from a global point of view.

In view of the above, workshop participants emphasised that in addressing sustainable use projects focus should not only be placed on global uniqueness but also on replicability plus biodiversity benefits as an important criterion of global value. This is, if a project illustrates how to do conservation through sustainable use in a replicable way, the global benefits may arise from the very fact that the ideas will be adopted by other projects in different parts of the world.

Therefore GEF should consider support for the projects which place emphasis on:

- experimentation and demonstration. For example forest ecosystems activities could include demonstration of biodiversity enhancement in plantation practices in anticipation of certification practices, as well as projects using reduced-impact logging and extraction practices. In coastal and marine ecosystems emphasis could be placed on experiment/demonstration projects in the open sea that combine sustainable use, tourism, education and research; open ocean harvesting techniques

and innovative quota systems and schemes for the development of wetlands conservation.

- workshops and seminars for the dissemination of experience successful experiences as a means of accelerating the learning curve in the area of sustainable use.

8. Time is Crucial

It takes at least 5 to 10 years to implement and gain sufficient experience with a sustainable use project. Such a project usually involves the development of new practices in the use of biological resources and new ways of generating lively hoods. Institution building and the generation of trust through experience are crucial elements for sustainability. Any sustainable use project should be designed such that longer term financial support is possible. From case studies it is clear that the nature and the timing of the financial support is more crucial than the volume.

9. Additional Considerations and Recommendations for the Implementation of Diversified, Sustainable Use Projects

The workshop participants while acknowledging that the GEF operational programmes in biodiversity were general enough to address sustainable use issues, identified as the key output of the workshop the operationalising of this guidance, given the fact that sustainable use usually takes place in productive landscapes and diversified landscapes in which benefits are mainly local, whereas the GEF emphasis is on global significance.

Workshop participants concur that sustainable use project could focus on:

(i) *substitutional activities, that is, alternative means of production that are more diversity-friendly than the planned or currently practised form of sustainable production;*

(ii) *add-on activities which "top" the baseline process and provide for productive-friendly activities, without any change in the productive modalities; and*

(iii) *barrier removal exercises which can for example demonstrate a procedure which can remove existing obstacle(s) to the uses of a particular biodiversity component.*

GEF activities could focus on substitutions, add-on and barrier removal activities.

In the case of arid and semiarid ecosystems a number of specific activities are being suggested for protected areas and buffer zones; rangelands, wild foods and cropping land husbandry

- Promotion of multi land use systems/multi species production systems (plant and animal) through establishment of new marketing arrangements and marketing of the touristic value of habitats.

- Promotion of collaboration between Government and local communities to put in place regimes to sustainably harvest biological resources outside protected areas for commercial use.

- Enhancing biodiversity in grazing lands by a number of methods already in the literature; and by resolving conflicts between wildlife and domesticated animal production perhaps via promoting touristic and game alternatives.

- Promotion of coalitions for the management of large ecosystem units which addresses source user rights, tenure rights, institutional constraints and which is sensitive towards socio-ecological typologies.

- Recognition and enhancement of the economic value of wild foods, medicinal plants, land races and wild relatives of cultivars;

- Promotion of the sustainable use (consumptive and non-consumptive) of wild species;

- Establishment of institutional arrangements that regulate the sustainable use of wild foods

- Encouragement of introduction of improved local and exotic livestock breeds to reduce grazing pressure;

- Minimisation of negative effects of introduced alien species on local species;

- Research on local species, building on farmer research;

- Co-ordination of water development programmes and resource management;

- Development of integrated management systems aiming at diversifying and enhancing th productivity in a sustainable regime;

- Promotion of sustainable use of natural resources that provides benefits to resource users.
- It is necessary to address the fact that high costs of baseline establishment can hinde formulation of GEF acceptable proposals.

In coastal and marine ecosystems the following types of activities were suggested.

- Development of multiple use schemes forming a mosaic containing: (i) protected areas, set asid for replenishment for populations of species and for aesthetic purposes and tourism (ii) regulate areas (iii) farmed areas (aquaculture, serving the production function) (iv) open access areas. I such schemes rights and incentives must be allocated to the "actors" whose responsibility it is t conserve a resource. Since it is likely that conflicts may arise between various users and secto (e.g. fishing vs. tourism, aquaculture vs. shipping, etc.) GEF projects should incorpora instruments for conflict resolution or compromise such as zoning and compensation schemes;

- Allocation of exploitation rights to local fisheries communities in the form of management area Condition is that Government wants to develop a larger co-management scheme, includi legislation.

- Development of Environment Biodiversity friendly aquaculture scheme experimental/demonstration projects/dissemination of techniques and practices;

- Protection and rehabilitation of habitats for endangered species to be combined with exploitation/harvesting in comprehensive schemes.

In forest ecosystems, the recommendations for substitutional and add-on actions by GEF covered both extractive (timber and non timber) and non-extractive (ecosystem services like watershed catchments, soil stabilisation, tourism etc.) uses. These include:

- Substitution of alien-wood species plantations by plantations of suitable native species.

- Substitution of monospecific plantations by multispecies plantations.

- Substitution of high impact logging techniques to lower impact methods, and training of forest dwellers and small-scale loggers;

- Diversification of plantations and managed forests by promoting wildlife management and other non-timber forest products.

- Development of certification regimes for sustainable and diversity-friendly practices.

- Discouragement of free access situations, and establishment of clear ownership and control regimes (community property rights should not be confused with open access regimes). Where they exist, traditional control or ownership regimes may be acknowledge and strengthened as an add-on activity.

Annex 1

DRAFT PROGRAMME

STAP Expert Group Workshop on Sustainable Use of Biodiversity

Monday 24 November, 1997

Session 1: *Opening Session*
(Chaired by Dr. Stein Hansen Joint Workshop Coordinator)

08.30 a.m.
- Welcome by Dr. M. N. Salleh, Joint Workshop Co-ordinator
- Statement by the Prof. H. Zakri, Chairman of SUBSTA
- Statement by Professor Pier Vellinga, STAP Chair
- Opening Address by H.E. Dato' Abu Bakar Daud, Deputy Minister of Science, Technology and Environment, Malaysia

09.15 a.m.
- Coffee break

Session 2: *Overview and Background*
(Chaired by Dr. Mohd Nor Salleh, Joint W/shop Co-ordinator, STAP)

09.35 a.m.
- Sustainable Use Within the GEF Operational Programme, Dr. Hemanta Mishra GEF Secretariat
- Incremental Costs As They Relate to Sustainable Use of Biodiversity: Dr. Kanta Kumari
- Sustainable Use of Biodiversity. The Convention on Biological Diversity Perspective: Sally Bunning, Convention on Biological Diversity Secretariat
- Discussion

10.45 a.m.
- Scientific and technical issues relating to sustainable use of biodiversity and the interplay between local and global benefits:
- The Ecosystem Based Approach as a Basis for Sustainable Use of Biodiversity: Prof. Peter Schei, Directorate for Nature Management, Norway;
- An Ecological Perspective for Sustainable use of Biodiversity Components and Indicators of Sustainability: Dr. Jorge Soberon, STAP;
- Sociological and Anthropological Dimensions of Sustainable Use: Professor Marshall Murphree, IUCN;
- The Economics of Sustainable Use: Dr. Stein Hansen, STAP.

- Discussion

12.45 p.m. - The Main Challenges for GEF Projects in the Area of Sustainable Use of Biodiversity, Perspectives from the Implementing Agencies. Joint Presentation by UNEP, UNDP and World Bank

13.30 p.m. - Lunch

Session 3: *Presentation of Case Studies (Chaired by Prof. H. Zakri, SUBSTTA)*

15.00 p.m. - Maintaining biological diversity in Pakistan through Rural Community Development - Pakistan (GEF Project) - Dr. Javed Ahmed and Dr. Faiz Ali of IUCN;

- Sustainable Use of Biodiversity: A Case Study of the Matang Mangrove in Peninsular Malaysia, Forest Research Institute Malaysia, Dr. Chan Hung Tuck

18.00 p.m. - Closure of Meeting

19.30 p.m. - Reception at Awana Golf and Country Club

Tuesday, 25 November 1997

Session 4: *Continuation presentation of case studies (Chaired by Dr. D. Fall , STAP)*

09.00 a.m. - Save Conservancy in Zimbabwe: A creative approach to Sustainable Use through a private initiative: Mr. Clive Stockil, Director Save Conservancy;

- Managing Wildlife with Local Communities in the Amazon, Dr. Rafael Pinzon Rueda, Director de CNPT.

- Discussion

10.30 a.m. - Coffee Break

10.50 a.m. - Organization of Working Groups Chaired by Prof. Pier Vellinga, STAP Chairman

11.00 a.m. - Working groups commence work

Three working groups to be convened each focusing on sustainable use issues within specific ecological zone - forest/mountain ecosystem, coastal and marine ecosystems and arid and semi-arid ecosystems. Each working group will have an introductory, presentation given by STAP members as follows:

Working Group Introductory Papers:

Working Group 1: Arid and Semi-Arid Ecosystems
by Dr. D. Fall (STAP)

Working Group 2: Coastal and Marine Ecosystems
by Dr. Helen Yap (STAP)

Working Group 3: Forest and Mountain Ecosystems
by Dr. M. N. Salleh (STAP)

13.00 p.m. - Lunch

14.30 p.m. - Continuation of Working Group Sessions

18.00 p.m. - Closure of meeting

19:00 p.m. - Dinner

20:00 p.m. - Possible continuation of working groups.

Wednesday, 26 November 1997

08:00 a.m. - Working group session continues

10:00 a.m. - Coffee Break

10:15 a.m. - Continuation of working group session and/or preparation of working group reports

13.00 p.m. - Lunch

Session 5: *Presentation of working group reports*
(Chaired by Dr. Jorge Soberon and Prof. Pier Vellinga)

14.30 p.m. - Working Group Presentations

16:00 p.m. - Consideration and adoption of final report

16.45 p.m. - Coffee break

17.00 p.m. - Closing statement

Annex II

Expert Group Meeting on Sustainable Use of Biological Diversity
24-26 November 19, 1997

List of Participants

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Annex I

Emerging Technologies and Methods for Monitoring and Analysis of International Waters: A Summary

A paper prepared by the
Scientific and Technical Advisory Panel
of the Global Environment Facility

STAP Secretariat
United Nations Environment Programme

Preface

In 1996 STAP prepared a thematic paper on International Waters which identified a number of key issues that were followed up in subsequent meetings. One of these issues was the emergence of new technologies and methods which are improving the quality and reducing the cost of water management projects in OECD countries. These methods concern the routine monitoring and analysis of lake, river, estuarine or marine waters. The need for them has arisen in part from the results of inter-comparison of measurements by leading laboratories, which have revealed the need for much higher quality control in, for example, chemical analysis. Other benefits have come from the introduction of new observing technology, especially that involving the remote sensing of the water by radars mounted on the coast or on offshore platforms, by optical imaging from aircraft or from space, and by acoustic measurements from ships. And the advent of gigaflops computers (capable of thousands of calculations per microsecond) has made it possible to integrate detailed models of the water system. The resulting simulations open the way to mathematical assimilation of observations into the models, the first step to forecasting. And once data assimilation becomes established practice, the observing system can be optimized to achieve the required information at minimum cost.

These new technologies have now emerged from experimental trials to become the method of choice for operational agencies responsible for monitoring and analysing waters. The STAP believes that they can be equally beneficial to GEF projects. However, it is clear from review of existing projects that older methods still prevail in GEF. In order to make the case for the adoption of the new methods, the STAP has prepared this volume of case studies. The chapter authors, who are leading experts in their respective fields, presented their contributions at a STAP Workshop held in the Philippines, 24-26 February 1998. The workshop brought together these experts with managers of GEF projects to discuss the practical implications of adopting the new methods in their projects. The result will be a publication which incorporates the material contained in this volume, plus additional contributions presented at the workshop and a report of the meeting. The final publication wil be made available to those involved in waters projects promoted by the Implementing Agencies through the GEF.

STAP would like to thank the chapter authors for their contributions; Dr N. C.Flemming and Ms. Sally Marine for their work in editing this volume and Prof. John Woods, Chairman of the Ad-Hoc Working Group of STAP on International Waters for co-ordinating the publication.

Pier Vellinga
Chairman of STAP

January, 1998

Introduction

One of the main points of the STAP Thematic Paper on International Waters was the need to introduce new methods into GEF IW Projects based on best practice as currently adopted by IW projects in the industrialised countries. Particular attention was paid to two generic technologies: (1) data assimilation into prognostic models of the ecosystem, (2) improved methods in sampling and chemical analysis.

These new techniques have developed during the last decade in a number of leading laboratories. They have recently been adopted operationally in projects designed to analyse marine problems in industrialised countries. The effectiveness of GEF projects can be improved by the improved quality of information and cost-saving in monitoring. The STAP has therefore advocated that the new techniques be considered for adoption in GEF IW projects. One way to proceed is to demonstrate them in a small number of existing GEF projects. It is recognised that implemention will require training and capacity building. STAP organised a workshop to introduce the methods to project managers (The Philippines, 24-26 February 1998). This report was prepared by STAP as a contribution to that process. In Part 1 it introduces the new methods and in Part 2 it illustrates them through case studies in particular regional seas.

Data assimilation into models

In the 1990s data assimilation into mathematical models has revolutionised the design of monitoring systems used to support management of environmental problems in coastal seas and lakes. The models contain in their equations a representation of processes that control the environment. Assimilating data into the models requires sophisticated mathematical techniques which were first developed in weather forecasting and have since been adapted to forecasting the environment of lakes and seas. The technique extracts far more information from observations than can be achieved through the traditional practice of mapping and statistical analysis. The classical method, still widely practised in development projects, treats the observations as mere numbers: the new technique treats them as samples of the environment. Data assimilation into mathematical models greatly enhances the capability of skilled scientists or knowledge-based systems to diagnose observations. It is the best way to obtain information about any water system that is the subject of an environmental project. The technique is illustrated most vividly in the contribution below from Wolanski, Spagnol & King, but the other case studies take it on board as best practice. It is equally applicable in a wide range of GEF IW projects. Indeed, if it is not adopted, STAP will ask why not?

Improved chemical analysis

Less mathematically dazzling, but equally important has been the development in recent years of new techniques for quality control of routine observations. The need for a major tightening up of procedures was revealed by intercomparisons between major analytical laboratories during the 1980s. A substantial effort has gone into improving existing techniques and introducing new ones. As the contribution from Loring and Bewers illustrates, the new standards make it possible, for example, to discriminate reliably between the natural and anthropogenic sources of hazardous chemicals in the sea.

Design of operational observing schemes

In recent years it has become increasingly appreciated that inhomogeneities in the aquatic environment make it diffcult to design a monitoring scheme with acceptable sampling errors. Indeed in many practical situations, sampling errors exceed analytical errors. These issues are discussed in the contribution from David Palmer. One of the striking results of adopting data assimilation into mathematical models has been the introduction of sampling schemes that are quite different from

those familiar in projects based on the classical method of mapping and statistics. In one remarkable example in the North Sea, the new techniques have made it possible to identify and quantify coastal and estuarine sources of pollutants from open water measurements, i.e. without recourse to difficult near-field measurements in estuaries and along the shore.

Other examples

The three issues highlighted above are illustrated in this report through case studies in a variety of sites around the world. STAP does not, of course, claim this is a comprehensive account of best practice in IW projects. It is a start; future editions might include new techniques and case studies from types of aquatic environment not covered here. The examples chosen for this report have each seen a substantial change in the last decade. No doubt readers can think of other examples, which STAP would be happy to consider for inclusion in future editions. Best practice is not static: it is a moving target. The aim of STAP is to search out improved methods that are being used by the leaders with a view to seeing how they can benefit GEF IW projects.

Part 1 Generic issues

Water quality in tropical estuaries

The first contribution, by Wolanski, Spagnol and King of the Australian Institute of Marine Sciences at Townsville, introduces the method of data assimilation into models and shows how it can be used to provide information about water quality in tropical estuaries, where the major polluter is mud. The authors focus on three case studies, all rivers that have been profoundly changed by man's activities: (1) the Fly river in Papua New Guinea, (2) the Mekong river in Vietnam, and (3) the Cimanuk river in Indonesia. This ensures that the recommendations are not merely academic. The figures show the kind of information available from the new technique.

Discriminating between natural and anthropogenic chemical sources

The second contribution, by Loring and Bewers of the Bedford Institute of Oceanography in Canada, addresses the problems of discriminating between natural and anthropogenic sources of metals in marine sediments. The authors draw attention to the importance of being able to make that distinction when designing practical monitoring schemes. The challenge is to develop rational expectations concerning the natural concentration of the target metal, so that a higher concentration indicates an anthropogenic contribution. They do this by granulometric and geochemical analysis referenced to a commonly occurring element; they advocate the use of lithium. The sophistication of the technique described in this contribution illustrates best practice in modern chemical analysis.

Designing a surveillance system for coastal waters

The third contribution, by David Paimer of the UK Environment Agency, addresses the problem of designing a surveillance strategy to improve environmental management of coastal waters up to three miles to sea. He draws a distinction between surveillance, designed to obtain a broad view of the state of and trends in the environment in coastal waters, from monitoring which is focused on meeting the statutory requirements derived from national, regional or international law or agreements, and investigations, designed to discover why the phenomena detected in surveys have the observed character. Best practice as illustrated by this contribution involves focusing the measurements closely on the needs arising from statutory responsibilities of the responsible agency, and on adopting the most modem methods and equipment. Airborne remote sensing is proving particularly valuable provided it is supported by a programme of in situ measurements based on littoral zones. The value of this contribution is that it illustrates a state-of-the-art surveillance programme based on traditional practice in which the data are mapped and treated statistically.

Part 2 Case studies

The Black Sea

The fourth contribution, from David Aubrey, provides a comprehensive case study showing how new techniques can be introduced into a specific region, the Black Sea. After reviewing the geography and scientific understanding relating to this regional sea, he identifies the key problems in descending order of importance: (1) eutrophication, (2) invasion by introduced species, (3) over-fishing and ecosystem damage, (4) contamination of water and sediments, (5) loss of biodiversity, (6) ecosystem imbalance, (7) response to climate change, (8) coastal development, and (9) lack of protected areas.

He identifes the negative impacts that these problems are having on the populations that have previously depended on the sea. The author then turns to the task of designing a system for monitoring and modelling these phenomena, data management, and procedures for analysis and interpretation. These sections show how the manager considers options drawn from current best practice in leading laboratories and builds up a state of the art system appropriate for the particular conditions of the region. There follows a discussion of the practical steps taken to implement the chosen procedures. The contribution closes with an annotated listing of existing environmental programs in the Black Sea.

The Caspian Sea

The Caspian is the largest enclosed water body on earth. It is intensively exploited, and subject to fluctuations of sea level due to natural variation of river flow, and anthropogenic diversion of fresh water. The economic and political situation is evolving rapidly, and the case history of ongoing attempts to manage the sea level and control contamination draws attention to the urgent need for modern methodology.

The Baltic Sea

The Baltic Sea has been studied and managed by the coastal states in collaboration for the last 100 years. This chapter describes progressive stages in the development of understanding the dynamics and biology of the Baltic Sea, culminating in an integrated programme of monitoring, data assimilation, modelling, and forecasting events for economic and environmental reasons.