UNITED NATIONS

Convention to Combat Desertification

Distr.
GENERAL

ICCD/CRIC(5)/8
7 December 2006

Original: ENGLISH

COMMITTEE FOR THE REVIEW OF THE IMPLEMENTATION OF THE CONVENTION
Fifth session
Buenos Aires, 12–21 March 2007
Item 6 of the provisional agenda

CONSIDERATION OF WAYS AND MEANS OF PROMOTING KNOW-HOW AND TECHNOLOGY TRANSFER FOR COMBATING DESERTIFICATION AND/OR MITIGATING THE EFFECTS OF DROUGHT, AS WELL AS OF PROMOTING EXPERIENCE SHARING AND INFORMATION EXCHANGE AMONG PARTIES AND INTERESTED INSTITUTIONS AND ORGANIZATIONS

Note by the secretariat

Summary

1. The consideration of ways and means of promoting know-how and technology transfer for combating desertification and/or mitigating the effects of drought, and of promoting experience sharing and information exchange, as an agenda item for the Committee for the Review of the Implementation of the Convention (CRIC) revisits a subject that has been of importance to the Committee, and that has featured during its previous sessions.

2. The gap in technological advancement between developed and developing countries points to the continued need for a dynamic and enabling international environment supportive of international cooperation, particularly in the areas of technology transfer processes to promote know-how, experience sharing and information exchange.

3. Important to the provision of information exchange is assistance to developing countries and countries with economies in transition in narrowing the digital divide, thereby for instance, creating the appropriate opportunities to enhance their process for reporting the implementation of the United Nations Convention to Combat Desertification (UNCCD). Moreover, it would also be mutually beneficial to harness the potential for development of information and communication technologies, through technology transfer on mutually agreed terms and the provision of financial and technical support.

4. Critical to success in the promotion of know-how is the creation of partnerships conducive to investment and technology transfer, development and diffusion, in order to assist developing countries, as well as countries with economies in transition, in sharing best practices and promoting programmes of assistance, and to encourage collaboration between corporations and research institutions in order to enhance industrial efficiency, agricultural productivity, environmental management and competitiveness.

5. This document describes some of the ideas and topics covered by document ICCD/CRIC(3)/7, including the basic concept of technology transfer and its application to desertification; it also indicates some of the transfer processes possible in promoting know-how, experience sharing and information exchange.

6. There are a number of constraints affecting the transfer of (environmentally sound) appropriate and adaptive technologies, which include limited financial resources, institutional and policy constraints, insufficient capacity and limited access to information.

7. There is no single prescription for successful technology transfer (or integration) which would be appropriate to all situations. Technologies applicable to dryland areas affected by desertification and drought vary widely from place to place.

CONTENTS

I. RATIONALE FOR PROMOTING KNOW-HOW AND TECHNOLOGY TRANSFER

A. The principle of cooperation

1. Article 6 of the Convention obliges developed country Parties to promote and facilitate access by affected country Parties, particularly affected developing country Parties, to appropriate technology, knowledge and know-how. Additionally, article 12, regarding international cooperation, states, inter alia, that cooperation should take place to ensure the promotion of an enabling international environment including the field of technology transfer. Article 18 addresses the transfer, acquisition, adaptation and development of technology, and states that Parties will promote, finance and/or facilitate the financing of the transfer, acquisition, adaptation and development of environmentally sound, economically viable and socially acceptable technologies relevant to combating desertification and/or mitigating the effects of drought. Furthermore, article 18 requires Parties to the Convention to fully utilize relevant existing national, subregional, regional and international information systems and clearing-houses for the dissemination of information on available technologies, their sources, their environmental risks and the broad terms under which they may be acquired.

2. The scientific provisions of the Convention relating to technology transfer are reflected in the broad area of scientific and technical cooperation, as well as in research and development, and information collection, analysis and exchange.

3. Technology transfer geared towards the fight against desertification may cover broad issue areas which include land management practices and traditional techniques for soil and water conservation, as well as protected area management systems, pastoral systems, silvicultural (agro-forestry, afforestation, reforestation) practices, techniques for genetic selection of desired plants, efficient crop husbandry techniques and practices, value-adding processing techniques for farm produce, end-use technologies and the promotion and use of traditional dryland-suited technologies, knowledge and coping mechanisms.

B. Need for paradigm change

4. A further underpinning principle of technology transfer for desertification and the ways and means of promoting a particular approach to technology transfer is the Convention's challenge to the scientific community — social scientists as much as physical scientists — to put itself at the service of communities in dryland areas. This "demand-driven" approach to promotion is a challenge requiring a deeper appreciation of the concept of experience sharing and information exchange. The Convention articulates a philosophy of technology cooperation that needs to replace the traditional top-down paradigm of technology transfer. The Convention advocates successful technology transfer. as a key to the building of cooperative partnerships beginning at the local level.

5. It is noteworthy that community-participation and a bottom-up approach, which are cornerstones of the Convention, need to continue to be integrated further into the mainstream national development process, particularly in the affected developing country Parties. The principles emphasize the role and involvement of local-level stakeholders and decision makers, the role and involvement of institutions, political and economic incentives and the inter-relation

between poverty, population growth and land degradation, all of which have become embodied in the national action programmes (NAPs).

6. The development and transfer of environmentally-sound technologies between countries and within them is an important part of a global response to desertification and land degradation in the drylands, in order to slow and to reverse the degradation process and also to enable people and societies to adapt to changes that do occur.

II. THE LINK BETWEEN TECHNOLOGY TRANSFER, KNOW-HOW AND PREVENTION OF LAND DEGRADATION AND COMBATING DESERTIFICATION

A. An integrated approach

7. The Committee on Science and Technology (CST) has been addressing traditional knowledge from the drylands as one of its standing agenda items, and has made a number of observations and recommendations based on reports from ad hoc panels (Matera, Italy, 1999; Bonn, Germany, 2000).

8. There is no single prescription for successful technology transfer (or integration) that can be considered to be appropriate to all situations. For instance, technologies applicable to economies in the drylands of the least developed countries experiencing different stages of development vary widely from place to place, as do local conditions (e.g., degree of aridity). The situation is dynamic and it is the human capacities and relevant institutions and networks that allow recipients to assess, select, adapt and make optimum use (often innovative) of technology.

9. A starting point for understanding the link between technology transfer to the drylands and those countries affected by land degradation is that the wider use of appropriate and adaptive (often innovative) technologies integrated with traditional knowledge and techniques to combat land degradation can form an important part of an effective response to the phenomenon. Traditional and local technical knowledge, know-how and practices, collectively referred to as traditional dryland technologies, represent accumulated knowledge and experience of interactions between a group of people, their physical and biological environments, and the production systems.

10. The transfer of (environmentally sound) technologies for combating desertification encompasses a broad range of traditional technologies, knowledge and policy instruments. These include scientific know-how, traditional dryland knowledge, assessment and monitoring technologies and integrated information management systems (to counter the digital divide).

11. The challenge is to optimize the exchange of know-how between land users and soil and water conservation specialists, such as technicians, extension workers, planners, coordinators and decision makers. There are a number of existing technologies that could help to address the problem of desertification, and whose dissemination is necessary. For example, in the World Overview of Conservation Approaches and Technologies (WOCAT) there is a wealth of information on soil and water conservation. Such organizations have identified technology

transfer, especially from industrialized to developing countries, as an important element in this process.

12. The involvement of a wide range of stakeholders, among them people and agencies in the dryland areas and including Governments, private sector entities, financial institutions, non-governmental organizations (NGOs), research and teaching institutions, businesses and so on, is considered important in order to avoid the transfer of inadequate, unsustainable or unsafe technologies. It is also essential that recipients should be able to build on traditional dryland knowledge systems that are appropriate to their actual needs and capacities through, inter alia, community-based participation.

B. Techniques already identified

13. When discussing technology transfer in relation to combating desertification and land degradation, it is important to consider the techniques identified by the Parties to the UNCCD (see annex I). Traditional technologies to combat desertification – which focus on slowing land degradation – relate to the following broad subject areas, among others: control of wind or water erosion, water conservation, soil fertility, plant protection, forestry, social structures among the nomadic, semi-nomadic and sedentary peoples and housing architecture and energy. Annex II provides a summary of key conclusions and recommendations arrived at by the ad hoc panels formed by the CST to consider further the matter of traditional knowledge.

14. Technology that has been developed in the areas of genetic engineering in crop production can be relevant to areas affected by drought and desertification. It is important to focus on technological advances in, for instance, the development of crop varieties that are drought tolerant, and of plants that have enhanced qualities through genetic selection for adaptation to dryland habitats where the soil moisture is perpetually low. The role of scientific advancement in addressing food security and environmental protection through research in the adaptive characteristics of dryland plants and crops is of critical importance. The introduction and popularization of fast-growing species in dryland habitats for various uses such as soil protection, crop improvement and building construction materials, should be encouraged. Technological advancement in these areas, coupled with the transfer of the requisite technology from countries where it has been developed, tested and perfected, should be enhanced for the dryland areas.

III. SOME KEY REFLECTIONS ON THE PROCESS OF, PREREQUISITES FOR AND BARRIERS TO PROMOTING KNOW-HOW AND TECHNOLOGY TRANSFER

15. The UNCCD commits its Parties, inter alia, to “promote, finance and/or facilitate the financing of the transfer, acquisition, adaptation and development of technology” (article 18). In order for this to be achieved, both traditional drylands knowledge and environmentally sound technology must be disseminated widely; this needs to be done quickly enough and to be continued for sufficient time to allow a slowing of land degradation and eventually stabilization. There is a pressing need to ‘open the channels’ by which technologies could be diffused. The major technology transfer pathways include government-initiated, private-sector driven,

community-driven and multi-lateral pathways. Various types of adaptive technology, information and experience flow to these technology transfer pathways.

16. Over time, most technology transfer has traditionally taken place within the countries that generate the technologies, which means within or between industrialized countries.

17. However, the transfer of technologies from developed to developing countries has been underscored as important in the UNCCD process, as being one of the main ingredients for the successful implementation of the Convention. 'South-South' transfer stands out as an important focus area for experience sharing and information exchange.

A. Commonly encountered constraints

18. There are a number of constraints affecting the transfer of (environmentally sound) appropriate and adaptive technologies, which include limited financial resources, institutional and policy constraints, human resource capacity problems and limited access to information. Barriers to the spread of adaptive technology, know-how, experience and information exist in almost all sectors, in developed and developing countries and in countries with economies in transition. Often the approach to the barrier to technology development and dissemination is as important as the technologies themselves. The identification of the barrier, its analysis and prioritization need to be suited to the situation if they are to be overcome. Commonly encountered barriers for the developing countries include: lack of information, the digital divide, insufficient human capabilities, political and economic barriers such as lack of capital, high transaction costs, lack of full cost pricing, trade and policy barriers, limited understanding of local needs, business limitations such as the aversion to risk felt by some financial institutions, and inadequate environmental codes and standards.

19. The limited impact of information exchange and agricultural research in desertification-prone areas stem from a wide range of problems, including not only the inherent biophysical challenges of development in affected areas (scarcities of water, organic matter, and nutrients) but, in addition, policy and social factors such as: low priority for national investment, narrow, sectoral or disciplinary approaches, and insufficient infrastructure and institutional environments.

20. A common barrier to all approaches to technology transfer for slowing land degradation is that in the absence of stakeholder consultation, the proposed technology falls prey to conventional assumptions, such as that land degradation has already gone beyond the point of no return, that farmers are insufficiently aware of degradation processes, that traditional practices are not changing but disintegrating, that lack of financial resources limits the willingness and ability of farmers to invest in land, that local institutions hinder rather than encourage land-enhancing measures, and that farmers are unable to cope with changing environmental and socio-economic contexts without outside intervention and transfer of (insufficiently tested) solutions.

B. Need for effective enabling environment

21. There is a definite role for government policy where technology transfer and information exchange is concerned. Many Parties may tend to consider their main role in technology transfer as facilitating the role of the private sector by removing barriers. Constraints such as insufficient

human capability, trade and policy barriers, the digital divide or an aversion on the part of business to non-commercial risks are not barriers that are likely to be eroded quickly, if at all, in the normal course of business.

22. Parties can, however, act both to improve and to create the broad 'enabling environment' in which technology transfer (knowledge) flourishes. Parties can act both by providing favourable conditions for transfer and by participating in it directly. There is no single agenda for successful technology transfer to combat desertification and the world situation is constantly changing. Document ICCD/CRIC(3)/7 refers to a number of projects supporting the UNCCD process which are described along with a number of pathways and techniques for promoting the flow of knowledge through pathways.

23. For Governments, creating a multifaceted enabling environment means addressing a wide variety of issues including: creating sound macroeconomic conditions, encouraging the involvement of social organizations and national institutions for technology innovation, building human and institutional capacities for selecting and managing technologies, underpinning sustainable markets for environmentally sound technologies, supporting national legal institutions that reduce risk and protect intellectual property rights, developing codes and standards, encouraging research and technology, and developing the means to address equity issues and respect existing property rights. Major aspects of such an enabling environment are described briefly below.

24. Taking the broad view of technology transfer to combat desertification implies that a very wide range of stakeholders will be involved, and that they must act and interact to open an equally wide number of channels or 'pathways' by means of which technology will transit. Article 6 of the Convention obliges developed country Parties to promote and facilitate access by affected country Parties, particularly affected developing country Parties, to appropriate technology, knowledge and know-how. The broad area of scientific and technical cooperation in the Convention, as well as research and development and information collection, analysis and exchange, also reflects the importance of technology transfer.

C. Engaging the key stakeholders

25. The exact pathway that any technology will follow in transfer will vary depending on the stakeholders involved, the sector, country circumstances, and the type of technology. Technology transfer needs to involve many stakeholders interacting along any of a number of pathways. Successful transfer in the desertification context would need to rely on the possibility of interaction among different stakeholders. For instance, the motivation of a multinational corporation seeking to expand its share of international markets is very likely to be different from that of an NGO concerned with the appropriateness of technologies transferred in a local context and with social and cultural impacts. In spite of their very different roles and motivations, such stakeholders must be able to cooperate and to form both formal and informal partnerships encouraging transfer. Here again there is an important role for Governments: enlightened policies can facilitate such partnerships and foster communication. Some key stakeholders are: developers, land owners, suppliers, local community suppliers, buyers, recipients and users of technology (e.g. private firms, state enterprises and individual consumers), financiers and donors, Governments, international institutions, NGOs and community groups.

26. Involvement of community institutions is an essential part of successful technology transfer. The activities of local government agencies, consumer groups, industry associations and NGOs can help to ensure that the technologies being adopted (integrated) within a particular country/region are consistent with sustainable development goals. These insights underline the importance for Governments of strengthening the networks through which such organizations can contribute to technology transfer.

27. Research into technology transfer in recent years has highlighted the advantages of integrating the actions of people and organizations involved in the transfer process into mechanisms that increase effectiveness. Integrated actions by stakeholders such as specialized government agencies, energy service companies, NGOs, university liaison departments, regional technology centres, research and technology organizations and cross-national networks can reduce barriers, ensure that technological know-how is disseminated broadly, and augment the existing dissemination systems.

D. Specifically targeted capacity strengthening

28. It is essential for a country Party that is a recipient of technology to select its own way that is unique to the particular circumstances, taking into account the necessary social, economic and institutional arrangements. Successful integration of technologies requires a capacity on the part of recipients to enable the adaptation to new circumstances and the acquisition of new skills. If this is to be achieved, capacities need to be built at all stages of technology transfer, with a focus on human, organizational and information assessment skills. It noteworthy that capacity building needs to be adapted to local circumstances, to specific local barriers, and to the culture and interests of local stakeholders.

29. The importance of modern technology and digital datasets in the sustainable management of dryland ecosystems is particularly apparent in the use of remote sensing with satellite imagery: the use of the Global Positioning System (GPS) and the Geographic Information System (GIS) to enhance dryland management and planning. Information on dryland crops, pastoral land use and wildlife habitat management or on floodwater spreading for the artificial recharge of groundwater is particularly important. The need for an integration of traditional and modern technologies, which ideally would lead to ‘appropriate and adaptive technology’, should be accessible and affordable by low-income populations of drylands.

IV. CONCLUSIONS AND RECOMMENDATIONS

30. Work in UNCCD continues to focus on the integrated approach to technology transfer and know-how, and underlines the need to have this included in the mainstream development agenda. It emphasizes the role of institutions, political and economic incentives and the interrelation between poverty, population growth, security and land degradation. It is hoped that this approach will bring the Parties closer to developing appropriate integrated solutions to the problems of desertification and drought. The emphasis placed on an integrated approach, and the close linkage with the UNCCD policy and decision-making framework embodied in the national action programmes and in pilot studies, are key to bringing together researchers, community members, policy makers and other stakeholders who need to work together to achieve successful outcomes.

31. Technology transfer demands changes not only in the way resources are used in combating desertification and land degradation, but also in the way information is managed. Decision makers are expected to make technical decisions that are ecologically, economically, and socially acceptable. On the other hand, information sources for making such decisions should be easily available, organized, timely, accurate and dependable.

32. The bottom-up approach presents an opportunity for developing and promoting appropriate and well-integrated solutions to some of the problems associated with the desertification/drought/poverty nexus. In general the approach dictates that combating desertification through the promotion of know-how, experience sharing and information exchange takes place in a technology transfer paradigm based on, inter alia, soil and water conservation technologies, and techniques for dryland agriculture and coping mechanisms.

33. In many cases the development and transfer of technology depends on appropriate incentives. Governments and the private sector, as well as multilateral agencies, have a critical role in facilitating awareness raising, education, capacity building and provision of the necessary financial resources for technology development, diffusion and assimilation.

34. Country Parties are encouraged to ensure that an enabling environment is put in place to facilitate the transfer, adaptation and diffusion of technology for combating land degradation, targeted at addressing both preventative and restorative measures.

35. Targeted capacity strengthening is a prerequisite for effective transfer, adaptation and diffusion of technology. Country Parties are therefore encouraged to give particular attention to building the required capacity in order to support successful technology transfer, adaptation and diffusion at the appropriate levels.

36. It is anticipated that the CRIC will consider further action to mobilize the provision of financial resources for appropriate and adaptive technology transfer, capacity-building and the diffusion of environmentally sound technologies for support to sustainable development in affected country Parties.

Annex I

TECHNIQUES OF TRADITIONAL KNOWLEDGE

In its decision 20/COP.1, the Conference of the Parties, noting the report of the secretariat contained in document ICCD/COP(1)/CST/5 on inventories of research and traditional knowledge, encouraged Parties and observers to collate information in respect of the use of traditional and local technology, knowledge, know-how and practices, and to provide reports to the secretariat. The secretariat received reports from 12 Parties and five observers. These reports concerned a wide range of traditional and local knowledge stemming in many instances from experience handed down from generation to generation and responsive to social and cultural change and the local environment. The CST reviewed the reports in depth and noted the use of a variety of techniques which could be classified by topic as follows: control of wind or water erosion, water conservation, improvement of soil fertility, plant protection, forestry, social structure, and housing architecture.

A. Control of wind or water erosion

(a) Windbreaks: the creation around plots of barriers comprising trees or, in some instances, non-living material;

(b) Erection at right angles to the prevailing wind of obstacles (walls, banks, fences) made of stone, earth or vegetable matter (tree branches or palm fronds). These structures, the height of which is periodically increased, cause sand to accumulate; the sand can then be stabilized by covering it with branches or earth. The operation can be continued by planting species with an extensive root system or by biological fixing of the dunes;

(c) Erection of obstacles at an angle to the wind so as to force it to change direction; this leads to deviation of the sand, which therefore ceases to accumulate;

(d) The placing of large stones on the tops of dunes; this accelerates the wind around the stones, so increasing the lifting force on the sand, which is then carried further away;

(e) Spreading of water on land after ploughing; this stabilizes the fertile components of the soil by increasing soil cohesion;

(f) Building cultivated terraces separated from each other by low stone walls running along the contour lines. The distance between the walls depends on local conditions (rainfall amount, distribution and rate, geology, soil, crop types, etc.). Associated with the terraces are ditches to channel the excess water to gullies serving as natural outlets for it;

(g) In gullies, the fixing in place of flat dry stones together with logs and large branches. A simple planting scheme will help to reduce the water velocity;

(h) The use of vegetation to control erosion; the species used are chosen for their rapid growth, high density and well-developed root systems.

B. Water conservation projects

(a) Using local materials, the construction of ponds, pools and lagoons to collect water during the rainy season for irrigating crops and watering livestock. The structures are made using local materials;

(b) Construction of impoundments on small watercourses;

(c) Controlled flooding: a very old technique for conserving water and the soil which is well-suited to desert environments. During the heavy rains, part of the precipitation is absorbed by the ground and some (the proportion varies with the intensity of the precipitation and the characteristics of the soil) runs over the ground surface towards lower-lying areas. This runoff can be directed onto walled plots where its impoundment between the walls promotes infiltration. The land can then be cropped, with good yields. The critical question with this technique is whether the degree of infiltration is adequate for the intended crops;

(d) Cultivation of large areas in order to reduce soil evaporation;

(e) Greenhouse farming with water management;

(f) Construction of watertight clay or tile drains and irrigation channels in order to reduce evaporation;

(g) Construction of “qanats”, underground dykes and tunnels for the transfer of subsurface water to the surface by gravity (for agriculture or consumption);

(h) Construction of multi-level “qanats”: channels at various depths;

(i) Construction of impoundments for artificial recharge of “qanats”;

(j) The use of clay jars for irrigation;

(k) The use of textiles to keep garden soil moist;

(l) Irrigation of hillside terraces by means of channels built by farmers along the inner edge of each terrace. The water runs along these contour-line channels from the highest to the lowest terrace;

(m) Collection of water on house tops, etc. (installation of tanks) for consumption in the desert or other areas with an inadequate water supply;

(n) Rice growing based on the use of surface water in the rainy season; berms some 1.5 m high are built to prevent flooding and retain the water.

C. Improvement of soil fertility

(a) Use of natural fertilizer: animal or human excrement and decayed plant waste;

(b) *In situ* manuring: livestock is brought directly onto fields to graze and to deposit dung there;

(c) Production and use of compost from plant and household waste. The composting process can be speeded up by the addition of micro-organisms;

(d) Production and use of a mixture of animal dung, urine, forest litter and household and agricultural waste, including ash from cooking fires;

(e) Maintenance of soil fertility by green manure, the manure coming either from natural vegetation or from crops intended for ploughing in;

(f) Use of nitrogen-fixing plants;

(g) Mixing of forest litter directly into the soil;

(h) Mixing of animal carcasses into the soil;

(i) Spreading on the ground, in order to increase soil permeability, of sugar cane ash obtained from sugar refineries;

(j) Spreading of liquid sugar-industry waste. This is suitable for any soil capable of growing sugar cane, but is also very effective on compacted, saline or eroded soils. It increases both the organic matter content, especially of nitrogen and carbon (a humic substance), thereby improving soil stability, and the bacterial biomass;

(k) Liming to prevent soil erosion and reduce evaporation;

(l) Application of clay (loam) as mulch to protect the ground surface;

(m) Use of gravel to reduce the risk of soil erosion;

(n) Improvement in the texture of heavy soils by adding sand;

(o) Crop rotation to ensure better management of soil fertility and moisture;

(p) Fallowing in order to maintain soil fertility;

(q) Careful choice of soil-preparation techniques;

(r) Use of multi-bottom ploughs and animal draught power to minimize tillage (for soil preparation and to facilitate crop-growing without inverting soil profiles);

(s) Appropriate soil management; the best example is considered to be the method used by the Jyapu, a Newar community in the Kathmandu valley. Jyapu farmers rarely use livestock, preferring to till the soil with hand tools such as hoes and using black shale compost as manure;

(t) Soil conservation: the traditional "zai" technique employed in Burkina Faso is an intensive technique involving manure management and water-saving. It consists in digging holes in the ground and filling them with manure during the dry season. This attracts termites, which digest the manure; the latter is then more easily taken up by roots and increases soil porosity. Seeds are sown in the holes. This highly efficient technique enables communities with very limited resources to regenerate even badly degraded soil. When not being used for growing, the holes can provide water storage space.

D. Plant protection

(a) Preservation of the natural vegetation: choosing species to suit micro-climatic conditions; growing drought- and heat-resistant species; growing salt-resistant species;

(b) Prohibition of grazing: the preservation and protection of areas of rangeland, especially in depressions rich in alluvial deposits and forage plants;

(c) Harvesting of spontaneous fodder and burning of land to promote re-growth;

(d) Irrigation of crops in winter to control frost;

(e) Use of birds (e.g. starlings) to control insects (e.g. crickets);

(f) Harvesting outside full-moon periods in order to minimize insect infestation;

(g) Application of ash to plants;

(h) Application of diluted urine to plants and seeds in order to clean them and give them some protection against disease and insects;

(i) The use of common, usually stronger, species of plants.

E. Forestry

(a) Creation of forests using local species of trees and bushes and planting fodder trees and bushes;

(b) Creation of nurseries for reforestation and desert pastureland; development of orchards and reforestation in the desert;

(c) Simultaneous planting of sorghum or millet seeds and saplings. The cereals are cut to a height of 50 cm or more so as to protect the saplings, which then benefit from the soil moisture and manure. The high cutting also promotes natural regeneration of all sorts of species, ensuring considerable genetic diversity;

(d) Growing of coffee together with forest species known to provide beneficial shade; use of the same system to grow cocoa;

(e) Use of clearings for small-plot growing of a variety of vegetables in forests.

F. Social structures

(a) There are three types of lifestyle: nomadic, semi-nomadic and sedentary. The distances covered by the population groups who practise them vary widely, entailing differences in management and type of livestock farming and, in the case of semi-nomads and nomads, the presence or otherwise of irrigated agriculture on rivers or lakes. Nomadic herders use their pastureland in a seasonal pattern (transhumance), moving their animals from one zone to another depending on the availability of water and grass. This provides protection against weather risks and prevents the degradation of vegetation;

(b) "Motselo" (in Botswana, a form of cooperative and bank involving 5-15 people (men and women who are not necessarily related). Membership of such a group is voluntary and lasts until the end of the loan and borrowing cycle. Each person puts in an agreed sum of money or quantity of seeds or an equivalent amount of work, all of which is then used as well as possible in the light of local knowledge in order to increase the group's monetary wealth. The types of activities supported may include cooking or the brewing and sale of local beer. The cash contributions are used to purchase requisites such as sugar or cooking or brewing equipment. Labour expended in production or marketing is also considered as a capital contribution. All the income is allotted in turn to the members of the "motselo", who then use the money to develop their farms by purchasing equipment or to meet social needs (family celebrations, burial ceremonies, etc.). The advantages are: the structure is simple, the funds are turned over rapidly, investment is simple and free from conditions, so everyone can afford it, the funds and profits go directly to the members, and very poor people can take part by contributing labour;

(c) Water resources management by local communities or farmers' committees. Their skills and knowledge are passed on from one generation to the next, ensuring that water resources are soundly managed;

(d) Pastureland protection and access control by a community organization that defines rights and roles and enforces sanctions (in connection with pasture management). Knowledge, however, varies from group to group and region to region and depends on local conditions, the responses to particular problems and the given group's geographical or social isolation. In Nepal, pastureland is managed in accordance with religious beliefs;

(e) Management and control by the local population of access to forest resources;

(f) Development through agriculture of unused floodplains; this can, as in the case of Niger, stabilize the population by increasing food availability. It also introduces a new form of agriculture; the partial replacement of millet, the staple foodstuff, by rice can help to reduce excessive cultivation of millet and prevent desertification;

(g) The use of waste products – from coffee processing, sugar-refining or sunflower-oil production – as animal feed;

(h) Promotion of *Vigna* (several varieties) for human and animal consumption; this has high protein value. The residual matter can be used as green manure;

(i) Storage of cereals and seeds in kitchens, where the carbon monoxide and carbon dioxide prevents their becoming infested with insects.

G. Architecture and energies

(a) Protection of structures (houses, equipment sheds, stables, etc.) by having them outside natural-disaster (flood, storm, etc.) hazard zones;

(b) Building of chimneys in houses to improve ventilation and thereby reduce summer temperatures;

(c) Inclusion in buildings of arches, domes and high ceilings to keep down temperatures;

(d) Insulation of walls with clay or straw to keep out heat or cold;

(e) Construction of basements for their cooling and food-conservation qualities;

(f) Construction of ice pits in mountainous areas and around towns so as to be able to build up stocks of ice for the summer;

(g) Production of hinged doors and windows and wooden “venetian” blinds to shield against solar radiation;

(h) Building of dovecotes with a view to using the birds’ droppings as a manure supplement;

(i) Building in villages of artificial drainage systems so as to retain some moisture in dry areas;

(j) Use of windmills and water mills; use of solar energy;

(k) Use of briquetted sugar-industry waste as a household energy source (residual crop matter is dried and briquetted);

(l) Use of rice straw as fuel;

(m) Construction using maize or millet stalks, wheat straw, weeds and other waste. This contributes towards keeping villages clean and limiting numbers of rodents and insects.

Annex II

SUMMARY OF RELEVANT CONCLUSIONS AND RECOMMENDATIONS OF THE CST AD HOC PANELS ON TRADITIONAL KNOWLEDGE

1. Based on the previous work of the two CST ad-hoc panels on traditional knowledge to combat desertification, a number of recommendations for technology transfer at national and subregional levels have been put forward for implementation:

(a) Techniques developed in arid Xinjiang and Gansu Provinces for establishing narrow shelterbelts systems, which play a large role in preventing farmland from wind hazards and sand disasters, should be applied in the semi-arid regions and dry sub-humid areas in regions where physical conditions are similar;

(b) Introduction of practices of straw checkerboards and clay/pebble/chemicals mulching for fixing drifting sands should be conducted in the watershed areas of loess and hilly areas for revegetating eroded landscapes where the prevailing wind is frequent, the sand source is rich and soil and water loss is serious;

(c) Technologies for establishing bio-farms in steppe or rangeland areas, initiated to preserve the over-grazed rangeland in semi-arid and dry sub-humid areas, should be extended to desert steppe regions in the regions of Far East, Central Asia, East Africa and South America, where there is a risk of desertification;

(d) Application of the practices for soil conservation, runoff harvest and the terrace tillage system, which occur in the watershed areas on loess and hilly regions facing creeping sands, should be popularized in areas affected by problems of rangeland degradation and soil erosion;

(e) Adaptation of windmill and solar energy should be encouraged in the regions facing a lack of fuel wood, coal and gas, and wire-fence protection should be introduced in the arid preservations and biodiversity reserves located in regions with dense animal populations;

(f) Air-seeding techniques for fixing shifting sands and revegetating gully loess hills should be widely adopted in the over-grazed steppe areas for creating fodder-farms and shed-fed animal breeding and restoring the interrupted ecosystem in countries characterized by problems of mobile dunes and shifting sands;

(g) Agro-forestry, which was successfully practised in China's North Central Plain regions for fertilizing soil and improving farmland, and the agro-fertilizer approach in Brazil, should be operated on a trial basis in the newly developed arable land in oases or along the periphery of deserts where annual rainfall varies from 350-500 mm;

(h) Practices for further harvesting runoff on piedmont or in foothills should be introduced to the loess areas for managing watershed, seasonal river and depression areas with runoff afforestation.

2. The expert panels on traditional knowledge also recommended that the following modern technologies should be introduced, particularly in those countries which have established international and regional cooperation programmes with the other partners and developed countries:

(a) Water saving techniques, such as sprinkler irrigation, drip irrigation, micro-drop irrigation and fertilization systems;

(b) Greenhouse cultivation, introduction and silviculture of pioneer plants;

(c) Solar energy development, biogas farms and gases exploitation for avoiding the plunder collection of fuel wood, and introduction of innovative cooking/heating facilities;

(d) Mechanization of afforestation and grazing land fodder harvest;

(e) New artificial materials for fertilizing soil and holding moisture in sandy soil;

(f) Introduction of newly developed soil conditioners to those regions with limited precipitation, particularly the arid and hyper arid areas in North-West China, the Sahelian region, West Asia and the Middle East;

(g) Transfer of newly developed water release and conservation chemicals agents to the Nile Valley, the Yellow River and Yangtze River basins, the Amdaya Valley, the Ganges River, Arab Gulf countries, and the Sahelian and North Africa regions for the development of large-scale plantation and landscape gardening;

(h) Continuing to popularize the application of root generating chemicals to increase the quality of seedlings, widen the scale of revegetation and encourage cultivation on a traditional farming basis.

3. As part of the international effort to transfer traditional knowledge and modern techniques for combating desertification, the following scientific and technological exchanges should be encouraged:

(a) A qualified personnel exchange programme, including professors and postgraduates in fields relating to combating desertification, state laws and policies, new technology development and pioneer species innovation;

(b) A technician and decision maker exchange programme in specialized fields at national, subregional and regional levels through international efforts and interregional initiatives on re-training and education;

(c) A student exchange programme, including university study and awareness education and public awareness raising at senior/junior school level;

(d) A demonstration and extension service exchange programme, including technical training, study tour and ground observation, and grass-roots technical demonstration.

4. Information exchange and information sharing are important elements in establishing international linkages and communication between affected developing and developed countries. The following activity should be encouraged between the interested Parties to the UNCCD:

(a) Facilitation of exchange and utilization of information on appropriate technology, knowledge, know-how and practice among the affected countries should be conducted, and the involvement in this exercise of relevant partners including international institutions, NGOs and other civil societies, and community-based organizations, should be fostered through the Global Mechanism, the United Nations Environment Programme, the United Nations Development Programme/United Nations Office to Combat Desertification and Drought, the World Bank, the Global Environment Facility, the United Nations Educational, Scientific and Cultural Organization, the Food and Agriculture Organization of the United Nations, the World Meteorological Organization, and other United Nations bodies;

(b) Exchange of knowledge of the methodologies for developing benchmarks and indicators for the implementation of the UNCCD, impact indicators of desertification and experience in desertification monitoring and assessment should be carried out between national departments, subregional and regional institutions through all means of communication.

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