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TRADITIONAL KNOWLEDGE

Addendum

SYNTHESIS ON TRADITIONAL KNOWLEDGE IN DRYLAND ECOSYSTEMS

Note by the secretariat

By its decision 14/COP.2, paragraph 2(b), the Conference of the Parties requested the secretariat to prepare a report on traditional knowledge in dryland ecosystems, drawing on the discussions that took place at the second session of the Committee on Science and Technology and the synthesis report on traditional knowledge (ICCC/COP(3)/CST/2). This report will also be submitted to the fifth meeting of the Subsidiary Body on Scientific, Technical and Technological Advice of the Convention on Biological Diversity.

CONTENTS

LIST OF ABBREVIATIONS

CBO	Community-based organization
CILSS	Permanent Inter-State Committee for Drought Control in the Sahel
COP	Conference of the Parties to the UNCCD
CST	Committee on Science and Technology of the UNCCD
IDRC	International Development Research Centre (Canada)
IFAD	International Fund for Agricultural Development
INCD	Intergovernmental Negotiating Committee for the UNCCD
NAP	National action programme (to combat desertification)
NGO	non-governmental organization
OSS	Observatory of the Sahara and the Sahel
TK	Traditional knowledge
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme

EXECUTIVE SUMMARY

1. Traditional knowledge, as related to combating desertification in the ecosystem of the drylands, comprises a wide range of accumulated experience. This experience covers natural resource management techniques in both agricultural and pastoral systems, institutional and organizational arrangement, as well as beliefs and values. Article 18 of the United Nations Convention to Combat Desertification invites affected country Parties to incorporate TK in their national action programmes (NAPs) to combat desertification.

2. At its first session, the Conference of the Parties encouraged Parties to provide reports on TK and requested the secretariat to prepare a synopsis of these reports (decision 20/COP.1). The issue was again considered at the second session of the Committee on Science and Technology, in 1998. Some representatives highlighted their experience with TK, and others emphasized the need to develop synergies by integrating TK with modern technology. At the end of its second session, the COP decided to appoint an ad hoc panel with the following terms of reference: identification of successful experiences, strategies for integrating TK with modern technology and mechanisms for promoting successful approaches. Moreover, COP 2 requested the secretariat to complete work on compiling TK, and make a synthesis of this work available to the CST at its third session. The secretariat was further requested to (a) explore ways of linking the work of the CST on TK with similar work being done in other conventions, and (b) prepare a report on TK in dryland ecosystems.

3. The secretariat recruited consultants to prepare TK working papers to be examined at subregional and regional meetings in countries of Asia, Africa, and Latin America and the Caribbean. At a later stage, these papers were compiled into a global report (ICCD/COP(3)/CST/2). The report includes an extensive list of information relevant to land-use systems, farming, and animal production, as well as food processing and storage. It also includes aspects of the social structure and the associated management of natural and wildlife resources.

4. The long list of TK in the dryland ecosystem is indicative that TK is dynamic and has built-in mechanisms that enable local communities to survive the unfavourable topographic, edaphic and climatic conditions which characterize their fragile environment. However, a more differential approach to studying the TK system is needed to cope with the new facts of modern life. The study should take account of the recent fundamental changes in power relations between local, national and international actors. Moreover, adjustments are inevitable for any progress towards the sustainable use of natural resources in an intimately interconnected, global environment.

5. There is general agreement that the best way out of the potential social instability of the dryland communities is to integrate TK with modern technology. Three possible approaches are available: (a) scientists may take certain elements of TK and incorporate them into the body of Western expert knowledge; the hybrid knowledge is subsequently disseminated more widely; (b) the relevance of non-Western cultures and their respective knowledge systems may be validated holistically, at the same time recognizing the problem of its appropriation by Western scientists; and (c) the so-called “actor-oriented approach” may be adopted, where the dualistic distinction between Western and non-Western knowledge is abandoned. The objective is an elucidation of the actor’s own interpretations and strategies, and how these interlock through negotiation and accommodation.

6. The compilation of validated TK in the dryland areas is the first step forward. Community-based organizations and non-governmental organizations have a significant role to play in this connection. It is fortunate that several national and international centres and networks are now completely devoted to TK systems. The functions of these centres include providing national data, designing training methodologies, and linking between national and international partners.

7. It may be said in conclusion that farmer-scientist or pastoralist-scientist interaction is the best way to help all parties learn simultaneously. The results of farmer and pastoralist experimentation would be the baseline for disseminating the improved dryland technologies on a wide scale. It is necessary for socio-cultural, economic and institutional factors to be assessed, to confer credibility on the whole process of integrating TK with modern technology.

I. INTRODUCTION

A. Addressing natural resources management in drylands

8. The stability of many communities in dryland areas has been coming under increasing social and economic pressures in the last few decades. Small-scale farmers and pastoralists constitute the majority of the rural population, affording only a low input production system. The high rate of population growth adds negatively to the problem, as farmers and pastoralists are obliged to produce their energy, food, fodder, and income from decreasing supplies of land. This process often leads to land degradation, and woodland and pasture destruction in many rural parts of the developing countries. The problem becomes more acute given the high expectations of many people seeking an easy way to a softer life.

9. Many detailed investigations have been undertaken to define a set of rational solutions to this complicated problem. It was once assumed that the transfer of technology, such as large-scale irrigation schemes, and the implementation of rigorous national or regional policies, such as settlement of pastoralists, might offer an ideal solution. However, time and experience have demonstrated that this classic top-down approach, which developed and imposed inappropriate policies and imported inappropriate technologies was not only a waste of resources, but also served in many cases to exacerbate the life support system of the people living in the affected areas (Thompson, 1994). A report in 1990 by the World Bank stated that “lack of understanding of traditional production systems, which were developed over time through adaptation to difficult conditions” is a key reason for the lack of success of most development efforts in the drylands.

10. Aside from the dominant top-down approach, the most important reasons for failure in the soil and water management programmes in the dryland areas include the use of production systems which are complicated, expensive, and difficult to maintain in terms of both labour and capital. Therefore, such systems may be difficult to replicate at a reasonable cost and sustainable output. There is also insufficient training of local users of the system, and a heavy reliance on imported machinery for the construction of conservation works (Barraclough, 1993). The literature indicates a consensus that appropriate policy and technology are vital and must be developed with the participation of local people, who would find a policy or a technology appropriate based on a specific combination of factors. In this context, socio-economic, gender, and cultural considerations are key factors.

B. Definition and characteristics of traditional knowledge

11. Over the past two decades, many scientists and social workers have been closely associated with the dryland ecosystems, watching how local people manage their resources and could survive the often harsh circumstances of their life. A set of knowledge systems was identified and subsequently given interchangeable names by different workers: indigenous knowledge by Warren and Rajasekaran (1993), people’s knowledge by Gupta (1989), farmer’s practices by Kerr (1991), technical

knowledge by Mathias-Mundy (1992), and traditional knowledge by Norgaard (1984) and IFAD (1993). The systems are often collectively referred to as traditional knowledge; and abbreviated TK.

12. TK, as it relates to desertification processes, comprises a wide range of accumulated experience of natural resources and management techniques in both agricultural and pastoral systems, institutional and organizational arrangements, as well as beliefs and values. All these dimensions need to be duly considered in development decisions and interventions. Odera (1999) reported that TK represents accumulated cognitive and perceptive experiences of interactions between a group of people, their physical and biological environments, and the production systems. The quality and quantity of TK vary among community members, depending on age, gender, social status, intellectual capability and professional occupation. Language, religion and socio-cultural aspects are also important differentiating factors.

13. Warren and Rajasekaran (1993) reported that TK may be considered as a systematic body of knowledge acquired by local people through the accumulation of experience, informal experiments, and an intimate understanding of their environment in a given culture. Local people, including farmers, landless labourers, women, pastoralists, and cattle rearers are the custodians of the TK systems. These people are well informed about their own situations, their resources, what works and what does not work. They are also aware of the possible impact of a change in one factor on the other parts of the production system. Warren and Rajasekaran (1993) described TK as:

- Adaptive skills of local people, usually derived from experience and learned through family members over generations;
- Time-tested natural resource management practices;
- Strategies and techniques developed by local people to cope with socio-cultural and environmental changes;
- Practices that are accumulated by farmers due to traditional experimentation and innovation;
- Trial and error problem-solving approaches by groups of people to meet the challenges they face in their local environment; and
- Decision-making skills of local people to draw upon their resources.

II. TRADITIONAL KNOWLEDGE AND THE CONVENTION TO COMBAT DESERTIFICATION

A. Relevant references in the Convention

14. TK is mentioned in many places throughout the United Nations Convention to Combat Desertification. The relevant articles are as follows:

- Article 16, paragraph (g);
- Article 17, paragraph (c);
- Article 18, paragraphs 1(e) and 2(a), (b), (c), and (d);

- Article 19, paragraph 1(d);
- Article 20, paragraph 6; and
- Article 4 of the African annex, paragraph 1(d).

15. Article 18, paragraph 2, of the Convention is the most extensive and elaborate in dealing with TK. It states that:

> "The Parties shall, according to their respective capabilities, and subject to their respective national legislation and/or policies, protect, promote and use in particular relevant traditional and local technology, knowledge, know-how and practices and, to that end, they undertake to:
>
> (a) Make inventories of such technology, knowledge, know-how, and practices and their potential uses with the participation of local populations, and disseminate such information, where appropriate, in cooperation with relevant intergovernmental and non-governmental organizations;
>
> (b) Ensure that such technology, knowledge, know-how and practices are adequately protected and that local populations benefit directly, on an equitable basis and as mutually agreed, from any commercial utilization of them or from any technological development derived therefrom;
>
> (c) Encourage and actively support the improvement and dissemination of such technology, knowledge, know-how and practices or of the development of new technology based on them; and
>
> (d) Facilitate, as appropriate, the adaptation of such technology, knowledge, know-how and practices to wide use and integrate them with modern technology, as appropriate."

B. Decisions of the Intergovernmental Negotiating Committee for the Convention to Combat Desertification

16. Decision 10/7, taken by the Intergovernmental Negotiating Committee for the Convention to Combat Desertification at its tenth session, invited members and observers to submit to the Interim Secretariat suggestions on the modalities of the work of the Committee on Science and Technology. Relevant suggestions are those concerned with inventories of TK. It further requested the secretariat to submit a report based on these submissions for consideration by the CST.

17. It was realized that there might be a role for the CST in standardizing the presentation of the data to be used in research inventories developed by regions or subregions. It was also realized that a number of initiatives had already been taken, particularly in the Sahel region. In 1997, the Permanent Inter-State

Committee for Drought Control in the Sahel undertook a study of rural know-how in the areas of water and soil conservation, protection and restoration of soil and the analysis of data in management of natural resources. The United Nations Environment Programme has an ongoing initiative identifying successful land-use practices using indigenous and new technologies. UNEP has joined with others in identifying and disseminating successful soil and water conservation techniques, and collaborates with the International Development Research Centre of Canada in identifying local and traditional indicators. The Observatory of the Sahara and the Sahel has also produced a strategy for dealing with this matter.

18. Thus the UNCCD contemplates that the Parties will prepare such inventories themselves (which could be done in the local or regional context). Accordingly, the CST might wish to focus on developing methodologies for information-sharing, disseminating inventories and ways to link traditional knowledge to modern technologies and methods. It might request the secretariat to prepare a commentary on the overall role of traditional and local technology and how it might be linked to modern technology, where appropriate. The methodology developed for preparing inventories might take account of the need to examine factors leading to the success or failure of certain techniques.

C. Decisions of the Conference of the Parties at its first session

19. Decision 20/COP.1 refers to the secretariat report on the modalities and timing of the work of the CST on inventories of research and traditional knowledge (ICCD/COP(1)/CST/5). The Conference of the Parties:

- Encouraged Parties and observers to collate information they had in respect of the use of traditional and local technology, knowledge, know-how and practices and to provide reports on that topic to the secretariat;

- Requested the secretariat to prepare a synopsis of such reports for consideration by the CST at its second session;

- Requested the CST at its second session to allocate a full additional day to allow for a review of the secretariat report and discussion of the topic and to reach conclusions and recommendations.

20. The secretariat received reports from 12 Parties and five observers. These reports are concerned with a very wide range of traditional and local knowledge, know-how, and practices stemming in many instances from experience handed down from generation to generation in response to the social and local environment. The reports reveal the use of a variety of techniques in combating desertification, in which can be classified by topic as follows:

- Control of wind or water erosion;
- Water conservation;
- Improvement of soil fertility;

- Plant protection;
- Forestry;
- Social structures; and
- Housing architecture.

21. The reports differ in origin and content. Some are very detailed, with lengthy explanations; others are very brief and others still address only organizational issues, without commenting on farming techniques. Many contain no information or comments either on the overall role of traditional and local technology or on how such technology might be linked to its modern counterpart. Nor is there always information on the participation of non-governmental and community-based organizations in gathering information on traditional and local technology, knowledge, know-how, and practices.

D. Second session of the Conference of the Parties: Committee on Science and Technology

22. At its second session, the CST considered the subject of traditional knowledge, on the basis of the synopsis prepared by the secretariat. The prominence of traditional knowledge in planning and implementing the national action programmes, and the need for synergy between local knowledge systems and modern science, and for partnership between scientists and local experts were all pointed out. Links between traditional and modern technology were referred to.

23. Speakers emphasized the need to develop synergies to integrate traditional knowledge with modern technology, bearing in mind the implications of intellectual property rights and harnessing the positive attributes of traditional knowledge. To respond to key threats to traditional knowledge, representatives identified several broad measures, including creating an enabling environment for women, identifying and developing synergies and complementarity among conventions, drawing up and implementing the NAPs to improve living conditions, and introducing traditional knowledge education in all sectors of society.

24. The secretariat highlighted its ongoing compilation of traditional knowledge in certain subregions. The final report will describe the techniques and outline the extent to which they are transferable.

E. Summary of discussion by the Chairman of the Committee on Science and Technology

25. The Chairman made a statement to summarize the contributions made by the members of the CST. The key issues emanating from the deliberations may be encapsulated as follows:

(a) The use of traditional and local technologies, knowledge, know-how, and practices stands out as complementary to the efforts to combat desertification and mitigate the effects of drought. It is therefore appropriate to make inventories

in this domain, and to compile and share information, exchange experience, and establish communication networks to improve information flow so that beneficiaries are ensured of access;

(b) There is a need to develop synergies and to integrate traditional knowledge with modern technologies while addressing:

- The legal implications of intellectual property rights;
- Ways of harnessing the positive attributes of traditional knowledge;
- Traditional socio-economic benefits to be derived from the development and use of the knowledge; and
- Inclusion of traditional knowledge in the national action programmes to combat desertification.

(c) Women have an important responsibility in food production and management of natural resources because of their knowledge and experience which are essential to decision making, and management with regard to the environment and sustainable development. In this context, a gender-sensitive and enabling environment should be created at policy and practical levels. In addition, indigenous knowledge networks that are gender-sensitized should be developed, as well as indicators to improve socio-economic aspects.

26. The following were identified among the threats to traditional knowledge:

- Encroachment by inappropriate modern technologies;
- Population dynamics;
- Marginalization of women;
- Poverty;
- Climate change; and
- Loss of biological diversity.

27. Several broad measures were identified that could be used to confront the above-mentioned threats, as follows:

- Creating an enabling environment for women through appropriate land tenure;
- Identifying and developing synergies and complementarity among the Convention on Biological Diversity, the United Nations Framework Convention on Climate Change, the Ramsar Convention, the UNCCD and other relevant conventions, while emphasizing the pivotal role of the UNCCD; and
- Drawing up and implementing the NAP to combat desertification, with a view to improving the living conditions, particularly at the community level.

28. Recognizing the importance of education, training, and public awareness to the use of traditional knowledge, the CST emphasized the need to introduce traditional knowledge in all sectors of society.

F. Decisions of the Conference of the Parties at its second session

29. At its second session, the Conference of the Parties took note of the synopsis of reports on traditional knowledge compiled by the secretariat. It requested the secretariat to complete work on compiling the most important applied traditional knowledge on a subregional and regional basis, and make a synthesis of this work available to the CST at its third session. The secretariat was further requested to (a) explore ways and means of linking the work of the CST on traditional knowledge with similar work being undertaken under other relevant conventions, and (b) prepare a report on traditional knowledge in the dryland ecosystems (decision 14/COP.2).

G. Establishment of an ad hoc panel of experts

30. By its decision 14/COP.2, the COP also decided to appoint an ad hoc panel on traditional knowledge, to identify successful experience and conclusions relating to: threats confronting traditional knowledge, strategies for integrating traditional knowledge with modern knowledge based on specific case histories, and mechanisms for promoting and exchanging successful approaches.

31. At its closing meeting, the COP accepted nominations of experts from the following Parties: Armenia, Central African Republic, Cuba, Germany, Ghana, India, Jordan, Peru, South Africa and Switzerland.

32. The ad hoc panel convened in Matera, Italy from 15 to 18 July 1999. It reviewed background documents provided by the secretariat, which included an interesting variety of useful techniques and practices to combat desertification and reflected the value residing in the diversity of traditional knowledge. Based on these documents, the panel had a rich discussion and developed a common understanding of the term “traditional knowledge” and its systemic and dynamic characteristics.

33. The panel members presented successful experiences of local development based on traditional knowledge in all continents and developed criteria for building on traditional knowledge to generate sustainable development at the local level.

34. The panel discussions included also: (a) threats and constraints to the maintenance and development of traditional knowledge; (b) strategies to integrate traditional and modern knowledge; and (c) mechanisms to effectively promote and exchange approaches and innovations developed by local communities.

35. Taking into account that local and traditional knowledge is dynamic and includes processes of innovation relevant to combating desertification, the panel proposed to the Conference of the Parties a number of recommendations. The report of the panel is contained in document ICCD/COP(3)/CST/3.

H. Synthesis report on the most important and widely applied traditional knowledge

36. This synthesis report on traditional knowledge contained in document ICCD/COP(3)/CST/2 includes systems of classification and sets of empirical information relevant to land-use systems, farming, animal production, food processing and storage. It also includes some aspects of the social structure and the associated management of natural and wildlife resources. The main topics covered are:

- Site amelioration practices;
- Soil and water conservation practices;
- Agricultural practices;
- Water management techniques and practices;
- Energy;
- Pasture and range;
- Forest development;
- Utilization of wildlife;
- Specialist skills;
- Community-based organizations; and
- Recommendations.

37. This very long list is indicative that TK is dynamic and has built-in mechanisms to accommodate new changes and dimensions. Moreover, the diversity of TK entails many methodologies for identifying indigenous technical terms, and elucidating the mental framework for decision-making. These inherent characteristics may explain how local populations in the drylands cope with the unfavourable topographic, edaphic, and climatic conditions which characterize their fragile environments. Regardless of where or how they live, the dryland communities continue to learn and subsequently develop new TK, in order to thrive in one case and survive in another.

III. INTEGRATING TRADITIONAL KNOWLEDGE WITH MODERN TECHNOLOGIES

A. Possible approaches

38. Many workers such as Hausler (1993), Barraclough (1993) and Seely (1998) are of the opinion that a more differential approach to TK systems is needed. They argue that it is essential to refrain from the simplistic notions of using TK as a new panacea or the latest fad in development practice, while distracting attention from the fundamental changes necessary for the sustainable environmental management of dryland resources. Hausler (1993) predicted that the effect of this would be a legitimization of “more of the same”, with a slight improvement in business as usual. Fundamental changes in power relations between local, national, and international actors are inevitable for any meaningful changes towards the sustainable use of natural resources in an intimately interconnected, global

environment. Most important of all is the sensitive approach to the interaction between TK and Western scientific technology.

39. In this context, Hausler (1993) outlined three possible approaches. In the first approach, natural scientists, anthropologists and development experts may take certain elements of TK and incorporate them into the body of Western expert knowledge. Such hybrid knowledge is subsequently disseminated to farmers and local people in a wider geographic extent. Even though it may yield important technical facts, this approach simply reifies existing power relations and the primacy of Western expert knowledge within the developmentalist framework. Moreover, it should be remembered that TK is highly location-specific and based on close observation over a long period of time. It is embedded in culturally based value systems, systems of production and consumption, and ways of living and relation to natural environment.

40. The second approach is the “knowledge system view” where two types of knowledge – Western scientific and TK – are distinguished on the basis of their characteristics. TK is personal, particular, intuitive, implicit, indecomposable, and orally transmitted. Western scientific knowledge is analytical, impersonal, universal, cerebral, and transmitted in written form. This approach validates the relevance of non-Western cultures and their respective knowledge systems holistically. At the same time, it recognizes the problem of its appropriation by Western scientists. Very informative comparisons and revealing accounts of the interaction between Western and TK systems were produced. However, the approach is conceptually seen in a dualistic and somewhat opposing relationship.

41. The third approach is the so-called “actor-oriented approach” where the dualistic distinction between Western and non-Western knowledge is abandoned. The objective is an elucidation of the actor’s own interpretations and strategies, and how these interlock through processes of negotiation and accommodation. It is emphasized that our understanding of all knowledge is partial and is based on a particular perspective. What is needed in this approach is a set of methodologies for handling the complex relation evolving in interface situations of development interventions that would allow for a more differentiated understanding of how bodies of knowledge shape struggles and negotiations between local groups and intervening parties. Here, intervention is not seen as a linear process of implementing a plan of action, but rather as an ongoing transformation by which knowledge is negotiated and jointly created through social encounters in which certain power dynamics are operating.

B. Possible problems

42. A casual inspection of the life support system of dryland communities would reveal that things are not as easy as they may look. A descriptive analysis of the circumstances is even harder because it is often postulated that an outside researcher who may wish to investigate these processes is really an intrinsic part of such studies.

43. Norton et al. (1998) later took up this particular concept. They argued that cross-cultural communication has always been an obstacle to positive interaction between local communities and the outsider. Each side has its own filter or frame of mind through which people perceive and make sense of the situations before them. Though this idea is better understood today, its extreme importance to agricultural development is not. Much of the logic and belief that makes farming behaviour "rational" is implicit even to possessors of that knowledge. Therefore, an outsider can easily miss key elements to conclude that actions are not rational, a phenomenon named "decontexturalized rationality" by sociologists. Anthropologists, and particularly ethnoscientists, have recently developed a theory and techniques to elicit components of the knowledge system and make concepts and principles clear and relevant to outsiders.

44. Warren and Rajasekaran (1993) are of the opinion that a good portion of the problem can be attributed to the fact that the TK systems, for the most part, have never been recorded systematically in written form. As such, they are not easily accessible to agricultural researchers, extension workers, and development practitioners. Hence, by recording these systems, outsiders can understand better the basis for decision-making within a given society. Furthermore, by comparing and contrasting TK systems with the scientific technologies generated through international and national research centres, it is possible to identify where exogenous technologies can be utilized to improve endogenous systems.

C. Effect of the market

45. There is a general tendency to support the notion that traditional cropping and pastoral systems, if judged by environmental and livelihood criteria, have often been superior to modern ones depending on new technologies and the purchase of many externally produced inputs. TK production systems were often less risky, more equitable, and made fuller productive use of available human and natural resources. There is no doubt that modern science and technology can make a big contribution in improving the cropping and pastoral systems. Nonetheless, introducing modern technologies without their negative social and environmental impacts is much more difficult and complex than has been widely assumed.

46. To the extent possible, improved farming systems should be based on the accumulated knowledge and experience of the local communities. Moreover, low-input production systems tend to be advantageous because they are less disruptive of traditional social systems and minimize dependency of local people on the volatile terms of trade in national and international markets. Intermediaries and officials at all levels also often exploit small farmers and pastoralists dependent on a high proportion of externally purchased inputs.

47. On the other side of the equation, three considerations emerge from the rational facts of life (Barraclough, 1993). First, outside entrepreneurs will not stop trying to exploit local communities, whenever profitable opportunities exist in national or international markets. Second, many traditional or transitional

farmers and herdsmen will want to enjoy the convenience and perceived benefits of labour-saving machinery, chemical inputs, and consumer goods such as television and cars. Third, local farming systems everywhere are becoming increasingly influenced by the production and consumption patterns that are dominant in national societies and in the industrialized countries.

48. Industrial production systems increasingly dominate the national and international markets. They largely determine what is available commercially, and at what price, in the way of consumer goods, production inputs, capital goods, and technologies. In such circumstances, self-reliance as a declared objective of some local community or a country should not compromise the question of sustainability. This question will not be resolved unless the relevant social and ecological issues are resolved.

IV. LOOKING AHEAD

A. Research needs

49. It is conceded that there is a considerable qualitative gap between scientific knowledge and local traditional knowledge in many dryland areas. To close this gap, for the benefit of all parties, it is necessary that documented and validated TK be integrated with modern scientific knowledge as well as with the latest resource management techniques that are applicable to a given area. As a prerequisite to this, a concerted community action should be initiated to compile an inventory of the relevant TK system.

50. CBOs and NGOs should have a prominent role in this undertaking. Such collected TK systems can provide scientists with a major source of information, a framework for interpreting information and data, and a way of solving some of the problems they may encounter in the field (Seely, 1998).

B. Traditional knowledge centres and networks

51. Several regional and national centres have already embarked on systematic recording of TK systems for use in development (Warren and Rajasekaran, 1993), with support from three institutions in the Netherlands and the United States. The two regional centres for Africa and Asia are located in Nigeria and the Philippines. National centres now exist in Brazil, Burkina Faso, Germany, Ghana, Indonesia, Kenya, Mexico, the Philippines, South Africa and Venezuela. The three institutions mentioned provide a partnership relation with the regional and national centres. This is accomplished by developing guidelines, coordinating activities, compiling documents, and capacity-building.

52. The functions of the national centres include:

- Providing a national database where published and unpublished information on TK is maintained;
- Designing training methodologies for recording TK systems in collaboration with research centres; and
- Initiating links between originators of TK in a country and the development community.

53. The establishment of more of these centres and the strengthening of their institutional capacity, both on the national and regional levels, are highly recommended. Appropriate cross-linking between centres would facilitate the desired exchange of information. Relevant parties in the dryland areas and within the scientific community should be aware of the potential role which can be played by these centres in their common effort to combat desertification.

C. Agro-ecological mapping

54. Analysis of the prevailing agro-ecosystems is the first step towards understanding the village environment and its physical conditions. Maps and transects are drawn with the participation of the local people to demarcate ecological zones and characterize the village in terms of crops, livestock, land-use patterns, watersheds, and soil types. Subsequently, the indigenous characterization of types of farmers would uncover the socio-cultural and economic variables used to distinguish locally important categories of producers. The identification of local organizations and associations is vital for understanding traditional approaches to identifying, evaluating, and disseminating sustainable dryland management technologies. In most cases, the social scientist, in coordination with respective disciplinary scientists should provide vision and leadership for recording the TK related to the management of natural resources.

D. Identifying research-based technologies

55. It is given that farmers, pastoralists and scientists each know and understand many things, but have little overlap between their domains of knowledge. Therefore, farmer-scientist or pastoralist-scientist interaction is the best way to help both groups to learn simultaneously. Involving research-minded community individuals during the phase of identifying research-based technologies is highly recommended. These individuals are encouraged to ask questions regarding the available technologies and to decide which one(s) they want to test. During the experimentation, community representatives must be allowed to use their evaluation criteria to assess the tested dryland management technologies. The final conclusion will be based on compatibility with ecological conditions, need for institutional support, profitability, risk involved, and need for external resources.

56. The results of farmer and pastoralist experimentation would be the baseline for disseminating the recommended dryland technologies on a wide scale. During the dissemination phase, socio-cultural, economic and institutional factors should be assessed to confer credibility and replicability on the integrated or hybrid technology.

57. The role of CBOs and NGOs in the different phases of this process is indispensable. With such integrated teamwork, combating desertification in the dryland areas would certainly be cost-effective.

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