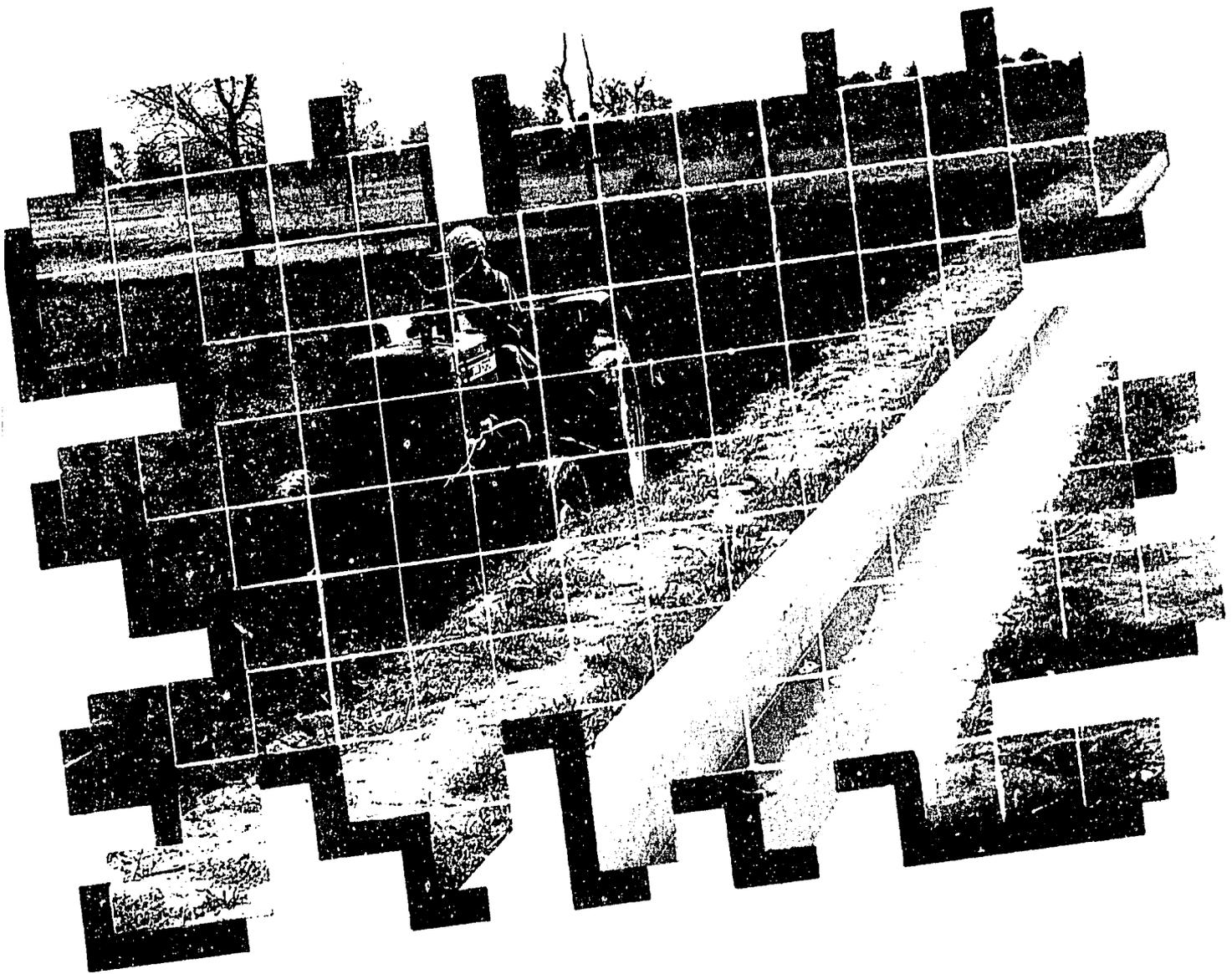


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National Conference on Agricultural Sustainability and Natural Resource Management



Organized by
Ministry of Food, Agriculture and Cooperatives
In association with
Ministry of Environment and Urban Affairs
Sponsored by
USAID Mission to Pakistan, Islamabad

PROCEEDINGS OF THE NATIONAL CONFERENCE
ON
AGRICULTURAL SUSTAINABILITY AND
NATURAL RESOURCE MANAGEMENT
IN PAKISTAN

Editors

Pervaiz Amir
M. Yousaf Chaudhri
Mahmood H. Nasir

Sponsored by

Ministry of Food, Agriculture & Cooperatives,
Ministry of Environmental & Urban Affairs and USAID
Pakistan

1992

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FOREWORD

Despite phenomenal growth in agricultural production in the past, food availability in Pakistan has remained precariously balanced. Because of a high population growth rate, the gap between supply and demand for food and other agricultural commodities will widen in years to come. There is little scope to extend cultivated area as the resource base for agricultural production, particularly land and water, is already shrinking due to non-agricultural uses like urbanization, industrialization and construction of roads. The increasing degradation of the resource base because of its unplanned exploitation has further aggravated the situation, resulting in declining productivity. Any future strategy to develop agricultural production, aimed to eradicate hunger and poverty amongst masses, will rely exclusively on increased productivity per unit area by promoting more efficient resource use in a sustainable manner.

The Government feels concerned about this state of affairs and has recently taken initiatives towards ameliorating the situation. Formulation of a National Conservation Strategy (NCS) is the most important amongst these. It is heartening to note that with financial support from USAID a group of agriculturists, administrators and policy makers from federal and provincial agencies including Northern Areas and Azad Jammu and Kashmir, have gathered in Islamabad to discuss issues relevant to agricultural sustainability and natural resource management, to develop a strategic plan of action. It is also a matter of great satisfaction that the proceedings of this conference have been compiled in such a short period, so that the recommendations can be used in the formulation of implementation plans and programs. Besides providing updated information on a vital subject, this document will symbolize a collaborative effort between the Ministry of Food and Agriculture and Ministry of Environment in addressing a problem of national concern. The efforts made by Asianics Agro-Dev (International) in compiling these proceedings deserve full appreciation.

We hope the document will help relevant federal and provincial agencies to develop action plans for sustainable agriculture and natural resource management. Our ministries look forward to assist with the implementation of these ideas.

Anwar Saifullah Khan
Minister for Environment

Lt Gen (Retd.) Abdul Majid Malik
Minister for Food, Agriculture
and Cooperatives

PREFACE

The National Conference on Agricultural Sustainability and Natural Resource Management was held at Islamabad on 15-16 April, 1992, as a follow up of similar conferences held earlier in the provinces. It was jointly organized by the Ministry of Food, Agriculture and Cooperatives and Ministry of Environment with financial support from USAID. Asianics Agro-Dev International, an Islamabad based private consulting firm in Agricultural Development, was engaged as conference facilitator.

The primary objective of the Conference was to evolve consensus on broad based Pakistani perceptions on steps needed to support sustainable agriculture into the 21st century. It was specifically targeted at developing a 3-4 point achievable strategic plan, establishing institutional infra-structure for continued post-conference activities and evolving consensus on approaches to implement the strategic plan.

A Steering Committee comprised of representatives of relevant Federal and provincial agencies, guided the scope and format of this conference and selected the following four themes for deliberations.

1. Sustainable use of soils.
2. Sustainable use of water resources.
3. Managing rangelands and livestock and preventing desertification.
4. Sustainable Bio-diversity.

Participating agencies were provided a briefing paper as guide and asked to prepare position papers under each theme, describing the state of the art and suggesting ways and means for improvement towards achieving agricultural sustainability. These position papers formed the basis of a working paper compiled for conference discussions and formulating the ultimate recommendations.

Participants of the conference included the GOP ministerial level officials of the relevant ministries, provincial nominees representing different sectors concerned with sustainability issues, relevant private sector institutions, farmers and women representatives and representatives of the bilateral and multilateral donors. A participatory decision making approach was used to bring all participants to a consensus position on achievable strategic plan with clear cut goals, identified resources for achieving these goals, and a comprehensive action plan.

The two-day conference was organized into six sessions including an inaugural and a concluding session. It was inaugurated by Lt Gen (Retd) Abdul Majid Malik, the Federal Minister for Food, Agriculture and Cooperatives. In his address the Minister, besides emphasizing the urgent need to evolve sustainable agricultural production systems, advised participants, while formulating their recommendations and plans of action, to keep in view the domestic resource constraint, the government's declared policies of self reliance and equitable distribution and the need for grass root level participation in program implementation. Dr. Amir Muhammad, President, Asianics, gave a Keynote address that highlighted the major sustainability issues, discussed some of the strategy options and proposed an agenda for action. In another Keynote Address Mrs. Nancy Tumavick, Deputy Director USAID Mission, Islamabad, emphasized that sustainability of agricultural production base is essential to Pakistan's security and under-scored key aspects of sustainability that the conference participants should look into. Mr. Lutfullah Mufti, Secretary, Ministry of Food, Agriculture and Cooperatives and Mr. Zulifqar Ali Qureshi, Additional Secretary Incharge, Ministry of Environment, welcomed the participants on behalf of their respective ministries and introduced them to some of the initiatives that the Government has taken towards achieving the objective of sustainable agriculture and natural resource

management. Mr. Ismet Hakim, FAO Representative in Pakistan, presented a global view of challenges, strategies and program implementation for sustainable agricultural and rural development.

The first working session of the conference was presided over by **Ch. Muhammad Iqbal, Minister for Agriculture, Punjab**. The regional and federal delegates presented their respective perceptions of sustainable agriculture and natural resource management which were discussed thoroughly in the second working session (Presided over by **Mr. Abdul Rehman Khan, Vice Chancellor, NWFP Agriculture University, Peshawar**) to formulate a prioritized list of issue points. For this purpose the issue points presented in the perceptions were listed on charts and were prioritized through consensus voting. In the third working session participants were split into four groups corresponding to conference themes, and each group formulated action plans for selected issue points in their respective thematic areas, clearly defining the objectives, sequences of proposed actions, agencies and persons responsible for execution and the proposed time frame. Each group chairperson was assisted by a competent facilitator. The recommendations and Plans of Action formulated by various groups were presented for finalization in the 4th joint session of the conference delegates presided over by **Dr. Zafar Altaf, Chairman Pakistan Agricultural Research Council**. The organizational structure required at the Federal and Provincial level to implement the proposed Action Plan was also discussed and consensus developed.

The recommendations and proposed Action Plans were finally presented in the concluding session presided over by **Mr. Anwar Saifullah Khan, Minister for Environment** as the Chief Guest. In his concluding remarks, the Chief Guest emphasized the need for an integrated approach to sustainable resource management, right from goal setting to implementation with the primary objectives of attaining self sufficiency in agriculture and alleviating poverty. The Minister particularly stressed the need for effective population control.

This publication, provides a record of conference activities and has been organized into four sections. Section I contains a brief introduction to the conference, and includes full scripts of all addresses presented in the Inaugural and Concluding sessions. The Strategic Plan developed by the participants as a result of their deliberations during the conference and the issue points presented in regional and Federal perceptions are given in section II. A pre-conference briefing paper and a conference working paper both prepared by Asianics, and all position papers provided by the provinces are reproduced in section III. Lists of conference participants, official nominees of the participating agencies, members of the National Steering Committee, and those of thematic groups formed to develop action plans on priority issues are placed in section IV.

ACKNOWLEDGEMENTS

As facilitator for this Conference on Agricultural Sustainability and Natural Resource Management, Asianics Agro- Dev International is grateful to the organizers, the Ministry of Food, Agriculture and Cooperatives, and the Ministry of Environment, in extending all necessary support for its successful conduct. The Federal Ministers for Food and Agriculture, Lt Gen (Retd) Abdu' Majid Malik, and Environment, Mr. Anwar Saifullah Khan, graced the inaugural and concluding sessions, respectively, which was indicative of their concern about the sustainability issues and of their personal keenness in success of this conference. Mr. Lutfullah Mufti, Secretary Food and Agriculture, and Mr. Zulifqar Ali Qureshi, Additional Secretary, Incharge, Environment Division, deserve our appreciation for their cooperation in planning and implementation of conference program. Our special thanks are due to Dr. Imtizaj Hussain, Agriculture Development Commissioner, and Mr. Abeedulah Jan, Inspector General of Forests, who as conveners of conference committees made significant contribution towards a successful conference.

The United States Agency for International Development (USAID), Islamabad, provided the financial support to organize the Conference. Mr. Arnold J. Reddy (Chief Agriculture and Rural Development Division, O/ARD), Dr. John Swanson (Deputy Chief Agriculture and Rural Development Division O/ARD), Dr. Ronald Senykoff (Project Officer, MART, ARD) and Mr. Assad Bukhari (Project Management Specialist, O/ARD, USAID) helped sharpen the focus of the conference. In particular Dr. Senykoff and Mr. Assad Bukhari participated in all aspects of planning activities under this conference and also took part in the deliberations of the steering committee. To all we express our grateful appreciation for their contributions.

The material provided by the provincial delegates, formed the basis of conference discussions and recommendations. We gratefully acknowledge their efforts in this regard. We also feel obliged to all participants including women leaders, agro-industry firms, farmers and NGO representatives who took part in the conference deliberations and contributed in a professional manner.

To all others who helped in their own special way we would like to express our thanks.

Pervaiz Amir (Manager Technical Assistance)
M. Yousaf Chaudhri (Senior Program Manager)
Mahmood H. Nasir (Program Officer)

SECTION I



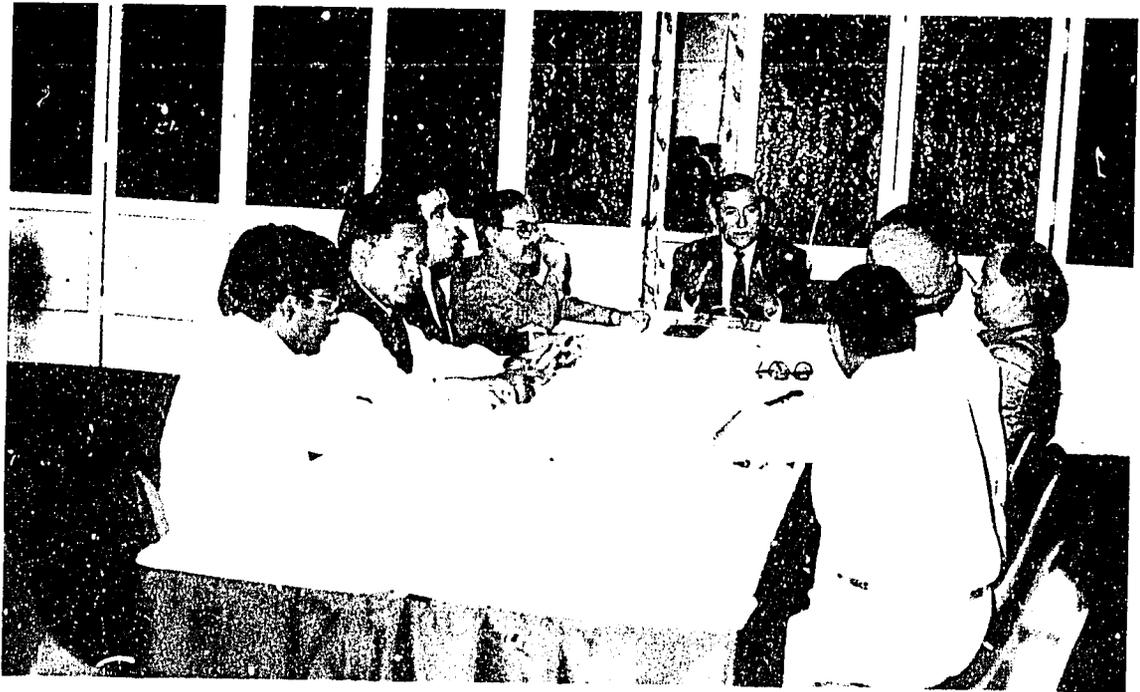
Lt. Gen. (Retd) Abdul Majid Malik, Federal Minister for Food, Agriculture and Cooperatives giving his inaugural address.



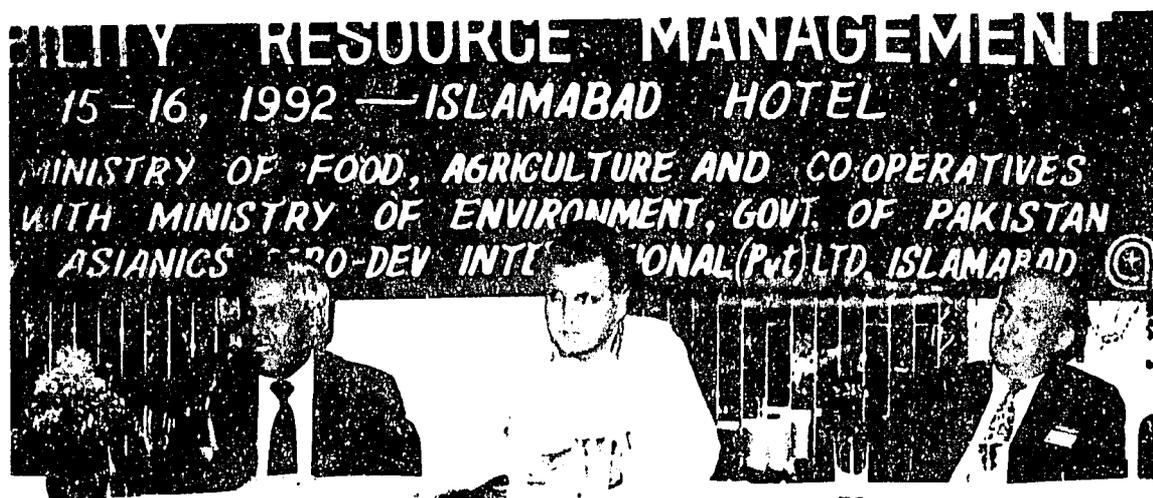
Ms Nancy Tumavick, Deputy Director, USAID Islamabad, addressing the inaugural session of the conference.



Group Discussions in progress in Thematic group meeting



Group Discussions in progress in Thematic group meeting



Anwar Saifullah, Minister for Environment and Urban affairs, presiding over the concluding session of the conference.



Abdul Rehman Khan, Vice Chancellor NWFP Agricultural University Peshawar, presenting recommendations in the concluding sessions.

INTRODUCTION

Agricultural systems that have been built over the past few decades, have contributed greatly to alleviation of hunger and raising of living standards of Pakistani people, by substantially increasing total production and per hectare yield of major agricultural commodities. Introduction of fertilizer-responsive high-yield varieties and use of higher inputs were the key elements contributing to these successes. In the process, however, numerous problems of longer term sustainability of these production systems have arisen. There is increasing evidence and concern about the degradation of production resources, decline of productivity and environmental pollution, potentially damaging to human and livestock health. Instability of several production systems is evidenced by low response to fertilizer, emergence of micro-nutrient deficiencies, excessive soil erosion, increasing water-logging and salinity, degradation of the watersheds, massive deterioration of vast rangelands, erosion of genetic diversity, development of pesticide resistance in insects and presence of toxic elements in food and feed chains. Miracle technologies made it easy for farmers to forget the importance of maintaining the fine balance between man's needs and the laws of Nature.

Although these problems attracted attention of the planners, policy makers and research and development experts in the past, only in the recent years has agricultural sustainability become an issue. With a growing public concern over weather changes resulting from global warming, environmental pollution, toxic wastes and the like, concept of sustainability has finally begun to receive the attention it rightly deserved. There is growing realization that unless appropriate steps are taken to make the system sustainable the trend is bound to lead to a disastrous situation.

Sustainable agriculture has been defined by the TAC (Technical Advisory Committee) of CGIAR (Consultant Group on International Agriculture Research) as "The system that involves the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources". Evolving such a system will require a comprehensive approach to agriculture and awareness of both long- and short term effects of any farming practice.

The above concept of sustainable agriculture fits well into the Pakistani situation where environmental degradation is proceeding unchecked and burgeoning population is placing tremendous pressure on natural resources to fulfil basic needs of society. Conscious of the gravity of the situation Government of Pakistan has taken some important initiatives in this direction, the most important one being the formulation of a National Conservation Strategy. The Ministry of Food, Agriculture and Cooperatives, in collaboration with USAID, has been pursuing the broader agricultural sustainability issues through a series of conferences held at the provincial level during May, 1990. The objective of these conferences was to define the critical human, physical and environmental/natural resource management issues pertaining to the future sustainability of agriculture in Pakistan at the grass root level. The issues of sustainability vary from province to province and their definition of agricultural sustainability as stated in these conferences was as follows:

- To utilize the natural resources of water, soil and climate for the benefit of human race and to conserve them for the sake of future generations (BALOCHISTAN).
- To improve productivity for the general welfare of peoples along with maintenance and enhancement of natural resources with the aim of striking a balance between human requirements, productivity and the environment (NWFP).
- To develop a system which is productive, profitable, preserves the natural resources base, protects the environment, contributes to improvements in human health and welfare and can be maintained over time (PUNJAB).
- To achieve and maintain the quality of life for all rural people, both present and future through imposition of the rule of law guaranteeing protection and security, satisfaction of basic human needs in

an equitable manner and increased productivity and natural resource enhancement which should leave the environment improved for future generations (SINDH).

As a follow up to the provincial conferences the National Conference on "Agricultural Sustainability and Natural Resources Management" was held to analyze current policies and practices that have lead to unsustainable agricultural development, identify an action agenda based on the results of provincial conferences and reach consensus on broad based Pakistani perceptions on steps needed to support sustainable agricultural development into the 21st century.

The specific objectives of this conference were:

- To define the critical human, physical and environmental/ natural resource management issues pertaining to future sustainability of agriculture in Pakistan.
- To develop a 3 to 4 point achievable strategic plan, which can also be incorporated into the 8th five year plan.
- To establish institutional infrastructure for continued post-conference activities and to evolve a consensus on approaches to implement the strategic plan.

The conference was attended by nominees (both public and private sector) of all relevant federal and provincial agencies including Northern Areas and Azad Jammu and Kashmir. A thorough discussion, steered by professionally competent people, helped in clarifying regional perceptions and priorities of sustainability issues.

WELCOME ADDRESS

Lutfullah Mufti
Secretary
Ministry of Food, Agriculture and Cooperatives

Honorable Minister, Distinguished delegates, Ladies and Gentlemen,

It is, indeed, an honor for me to welcome the Chief Guest and all the participants to this National Conference on Agricultural Sustainability and Natural Resource Management. We are grateful to Lt Gen (Retd) Abdul Majid Malik, Federal Minister for Food, Agriculture and Cooperatives, for sparing time to inaugurate this conference, in spite of his very busy schedule. Your presence here, Sir, is indicative of your personal interest and the Government's concern about problems of sustainability of environment in general and that of agriculture in particular.

As you are all aware, ladies and gentlemen, agriculture remains the single largest sector of our economy. Its sustainable development is, therefore, vital to the socio-economic development of the country and the well-being of its peoples, particularly the resource-poor rural masses. The World Commission on Environment and Development calls for sustainable development as development that meets the needs of the present without compromising the ability of the future generations to meet their own needs. This definition, sets a good enough framework for us to think, plan and act.

The increasing demand for agricultural products, to meet the food, feed, fibre and fuel needs of the burgeoning human population is placing tremendous pressure on the country's natural resource base, which is not only already shrinking for obvious reasons, but is also getting degraded due to lack of planning and proper management. Promotion of sustainable agricultural production system is, therefore, essential for any development strategy for the future.

Conscious of these imperatives, the Ministry of Food, Agriculture and Cooperatives, in collaboration with USAID, has been pursuing the broader agricultural sustainability issues through a series of provincial level conferences which have helped in defining critical human, physical and environmental/natural resource management issues at the grass root level. Today's "National Conference on Agricultural Sustainability and Natural Resource Management", is a follow up of the provincial conferences and is aimed, primarily, at reaching a consensus on broad-based Pakistani perceptions on steps needed to support sustainable agricultural development into the 21st Century. This conference, jointly organized by the Ministry of Food, Agriculture and Cooperatives and the Ministry of Environment with financial assistance from USAID is specifically targeted at developing an achievable strategic plan and an agenda for work on selected sustainability/environmental issues, which can also be incorporated into the 8th Five Year Plan.

Participation of the conference has been kept fairly broad and includes senior level officials of the concerned federal ministries and provincial departments, relevant private sector institutions, small farmer and women representatives and representatives of the multilateral and bilateral missions. A participatory decision-making approach will be used to bring all participants to a consensus position thus producing a strategic plan with clear-cut goals and a comprehensive action plan.

Issues of major concern chosen for discussion during this conference, include management of soils, management of water resources, management of rangelands and management of bio-diversity. Although a broad spectrum of issues become relevant to agricultural sustainability, in one way or the other, but I feel most of the pertinent issues can be brought within the scope of one of these major topics, for discussion. In their deliberations to evolve a strategic plan and an action agenda the participants are expected to consider physical, human, technological, institutional, economic and socio-cultural aspects of the various sustainability issues.

With your indulgence, Ladies and Gentlemen, I am confident, the conference will be able to evolve a feasible action plan for sustainable agricultural development in the country which is so vital for its future economic prosperity. The Government would keenly look forward to the recommendations of this conference and we in the Ministry of Food and Agriculture will be all ready to play our role in implementing these recommendations, within the available resources.

May I conclude by once again thanking Lt. Gen. (Retd) Abdul Majid Malik for consenting to inaugurate this conference and all the delegates, for making it convenient to participate.

WELCOME ADDRESS

Zulfiqar Ali Qureshi
Additional Secretary Incharge
Environment and Urban Affairs Division

Honorable Minister, Worthy participants Ladies and Gentlemen,

From the stand point of environment land is a physical entity, as well as, a system of natural resources. Land resources include soils, minerals, water and biota, including micro-organisms, plants and animals in all their biological and genetic diversity. This complex system provides much of the basic capital and resources on which development is built. It satisfies primary human's requirements of food, fibre and fuel, supplies many basic materials for industry and manufacturing and provides space for human habitation and activities. Land also meets the need of all other terrestrial species be they wild or managed. Hence land resources are of importance to a penopoly of human activities from agriculture, forestry, water management and energy production to industry and construction, human settlements, communications, infrastructure and waste disposal. Since this finite resource can not easily provide for rapidly increasing numbers of people and for a growing intensity of human activities conflicts over land use are on the rise among different social and economic interests between humans and the environment and between immediate and long term needs. Current management practices tend to approach these needs in isolation from each other, with the result that important links and impacts are ignored. Pressures on certain resources are leading to their deterioration and eventually permanent degradation. In the past, traditional systems took account of lands complexity and diversity and evolved effective management practices that conserve the resource base . However these traditional systems have not been able to go with the shear scale of modern activities if development is to be sustainable. These conflicts over the use of land and its resources must be resolved. More effective practices must be developed to promote the ecologically and economically efficient allocation of land resources along with their effective management and socially equitable use. A general framework for land use and physical planning should be based on integrative units such as the eco-system within which more specialized and sectoral plans can be developed. Improved planning and management system would require the application of more appropriate tools for data collection and interpretation as well as more accurate assessment and counting of values, costs, benefits, risks and impacts.

Fresh water is a finite resource, not only indispensable for the sustenance of life on earth but also of vital importance to all socio-economic sectors. Human development is not possible without the utilization of water resources. The multisectoral nature of water resources development in the context of socio-economic mileau has to be recognized in addition to the multi-interest utilization of water resource for agriculture, industry, urban development, hydropower, inland fisheries, transportation, recreation and other activities. Rational water utilization schemes must also be supported by concurrent water conservation and wastage minimization measures in the context of environmentally sound and sustainable development.

The benefits to be derived from trees, forests and forest lands are wide and varied. Forests are not only a source of timber and firewood but also play an important role in soil conservation, the regulation of hydrological cycles, exchanges of gases and nutrients including carbon dioxide for oxygen and the maintenance of reservoirs of rich bio-diversity. Maintaining and increasing forest cover will contribute to improved human living conditions and the preservation of bio-diversity particularly through environmentally sound land management practices. While preserving primary forest areas is critical for bio-diversity protection, planting new forests will significantly contribute to timber and firewood production, protect watersheds and soil, function as carbon sinks and in general release the pressure of exploitation on remaining primary forests. Hunger and malnutrition are endemic among developing countries. By the year 2025 about 80% of the expected global population of 8.5 billion will be living in the developing countries. The fundamental challenge facing agriculture in developing countries today is to increase food production at rapid enough pace to feed

expanding population. Such an increase has to come primarily through intensification of current agricultural production as the potential for bringing new lands under cultivation in many countries is very limited. If hunger is to be eventually eradicated in these countries, this intensification must be both ecologically and socio-economically sustainable. Agriculture is an important sector if not the backbone of the national economies of many developing countries, sometimes representing the major share of export earnings. Over the next 10 years this sector will bear most of the responsibility for providing rural economies with sufficient growth to offer employment and other remunerative activities to the bulk of their population. Without this growth the present rural/urban exodus is certain to accelerate leading to unmanageable urban squallor and in all likelihood major socio-political upheavals. Hence the need for sustainable off-farm rural development is also critical. Major adjustments are needed in national and international policies to create conditions for sustainable agriculture and rural development. A major objective is to increase food production and enhance household food security. This involves ensuring an appropriate balance between self-sufficiency and production for markets, employment and rural income generation, as well as, efficient natural resource management and environment protection. Priority must be given to maintaining and improving the capacity of higher potential agriculture lands to support expanding populations. At the same time conserving and rehabilitating low potential lands is essential. Emphasis should also be given to reforming agricultural policies relating to price, subsidies, trade, land tenure and appropriate farm practices and technologies. The first set of priority actions deals with how to effectively arrest land degradation and enrich soils. The problem of soil erosion is particularly acute in developing countries while problems of salinization, water logging, soil pollution and loss of soil fertility are increasing in all countries of the world. While the productivity of huge areas in the developing world is declining, populations are rapidly increasing and the demand for food, fibre and fuel is consequently spiralling. Long-term land conservation and rehabilitation programs with strong political support and adequate funding are essential to identify and implement with the participation of local communities. A set of priority actions on land resource planning for agriculture should be developed to systematically identify sustainable land uses and production systems for each land and climate zone. To control inappropriate land use, it is essential to take into account the actual potential, carrying capacities and the limitations of land resources. In addition a set of priority actions on sustainable plant nutrition will formulate strategies to maintain soil productivity. In many developing countries where population growth exceeds agricultural production, the goal is to increase agricultural production substantially, particularly in high potential areas without destroying soil fertility. This will require determining and optimizing the use of organic and inorganic sources to enrich soil and thus increase farming efficiency and production. Another key program is improving farm production and farming systems through diversification of farm and non-farm employment and infrastructure development. Intensification should emphasize farm management technologies such as crop rotation, organic manuring, the efficient and economically viable use of chemical inputs, agricultural waste recycling and the prevention of pre- and post-harvest, losses. Where intensification is not possible other employment opportunities such as private small scale agro-processing units, cottage industries, wild life utilization, fisheries, conservation and reclamation activities and rural infrastructure development should be created. In the context of sustainable food, fibre and medicinal crop production, there is an urgent need to safeguard the world's plant genetic resources. National and international action to conserve and utilize plant resources for agriculture should place special emphasis on indigenous capacity for plant characterization evaluation and use. Measures should be taken to strengthen network of in-situ conservation areas and improve the tools for ex-situ collections. Similarly actions on animal genetic resources for agriculture are important to increase the quantity and quality of animal products and conserve the existing diversity of animal breeds to meet future requirements.

Between 25% and 50% of pre- and post-harvest losses are estimated to be caused by pests. Pests affecting animal health are causing heavy losses and in many areas prevent livestock development. Chemical control of agricultural pests has dominated the scene but its over use has had adverse affects on farm budgets, human health and the environment and new pest problems continue to develop. Integrated pest management which combines biological control, plant resistance and appropriate farming practices should minimize the use of pesticides. Placing the component of such strategy within the economic reach of the farmer guarantees yields, reduces costs and is environmentally friendly. Integrated pest management should go hand in hand with appropriate pesticide management to allow for pesticide regulation and control. The participation of local people and communities is crucial for the success of sustainable agriculture. Peoples participation and human resource development will strengthen the capacity of rural institutions and extension services. In the end I may sum up by remarking that critical issues of agriculture and their relationship with environment and agriculture sustainability make it clear that solutions to these complex issues are essential for providing a strong natural

resource base for Pakistan. We have to find ways to work together on those issues as not only the future of mankind but of the whole planet is at stake. Demographic pressures should be contained so that increasing numbers do not place unbearable burden on the carrying capacity of the earth and on the life supporting systems. We have to make a commitment for planning of future on a collaborative basis. Let us go forward and take decisions in the broader interest of humanity our planet and our future generations. Ours is not the only generation that will inhabit this planet till eternity. Our children and then their children would be depending on natural resources as much as we do. We shall be certainly held accountable for what we do or omit to do at this stage. We must try to pass on to our future generations, a planet that is not only habitable but is also hospitable for them. Thank you Mr. Chairman.

KEYNOTE ADDRESS

Amir Muhammed
President
Asianics Agro-Dev International

SUSTAINABILITY OF AGRICULTURE - A PERSPECTIVE, PROBLEMS AND PROSPECTS

Mr. Minister, Excellencies, Distinguished Delegates, Ladies and Gentlemen,

It gives me an immense pleasure to welcome you to the National Conference on Agricultural Sustainability and Natural Resource Management. The conference is indeed timely in context of preparations for the 8th Five year Plan (1993-1998) which is being currently finalized, as well as, the national brief for the forthcoming UNCED (United Nations Conference on Environment and Development) meetings in Rio, during June 1992. Deliberations of the Conference will also hopefully complement the efforts to achieve goals of National Conservation Strategy recently approved by the Government.

The Conference is not a paper reading workshop but a forum to stimulate interactive discussion on broad aspects of agricultural sustainability in Pakistan and in-depth discussion on the four major themes dealing with soil management, water resource management, rangeland management and of bio-diversity management.

Purpose of the conference is to identify current policies and practices that lead to unsustainable agricultural development and analyze factors responsible for such practices with an objective to identify measures that would lead to sustainable agricultural development in future. Based on this analysis, the conference would recommend an action plan with prioritized set of activities at national, provincial and regional level to implement key recommendations.

Main thrust of government policies has been to bring about economic development in shortest possible period to improve the quality of life of millions of poor and malnourished people. While overall economic development is the result of integrated efforts of all sectors of national economy, agriculture is likely to remain the dominant sector for several more decades. Besides being the primary source of livelihood and employment for rural population, agriculture also provides raw material for major industries in the country and contributes a dominant share in national exports. Therefore sustainable development of agriculture sector holds the key to economic and social development, at least for the next few decades.

Development strategies during the past two decades designed to increase agricultural productivity rapidly have also resulted in extensive land degradation, soil erosion, and salinization and waterlogging of fertile agricultural lands. Inefficient use of the limited water resources has resulted in scarcity of irrigation and drinking water so that availability of irrigation water has become a major limiting factor for further agricultural development in the predominantly arid areas in the country. Unplanned use of agricultural chemicals has resulted in environmental pollution and progressively uneconomic returns on the costly investment. Such a system is not sustainable in the long-run, negative results of such practices are already visible in the form of stagnant or declining productivity at national level as well as in farmers fields.

Among the major factors responsible for unsustainable resource use are rapid growth of population and widespread poverty. Land/man ratio has been declining so that the land and water resources are no longer sufficient even to support the present population if the current agricultural practices are continued. Low income, resource poor families especially in rural areas resort to desperate, often unsustainable, agricultural practices to eke out a living and make both ends meet, with little regard for resource conservation and future productivity. Unless some impact is made on rural poverty through preferential transfer of resources, there

is very little likelihood that efforts to promote sustainable agricultural practices will make any significant impact. Simultaneous with efforts to reduce population growth, steps will have to be taken to create additional income generating and employment opportunities, especially in rural areas to absorb surplus population and increase the family incomes to subsistence levels.

CHOICE OF STRATEGIES

The choice of strategies to promote sustainable agriculture is limited for a developing country like Pakistan with little financial resources to spare for initial investment, limited arable land and water resources for horizontal expansion of agriculture, and daunting problems of population growth and widespread poverty. The main hope is increased productivity from high potential areas, through intensification.

However, most present problems of resource degradation and pollution have arisen precisely from intensive use of such areas through high external inputs. Therefore the strategies for further intensification of resource use have to be devised carefully to get maximum economic benefit with minimum resource degradation and pollution. Also, different strategies have to be devised for sustainable development of areas with different resource endowments viz., mountainous, coastal, rainfed, irrigated and rangeland areas. It will have to be ensured that in the efforts to increase agricultural production, encroachment of agriculture to areas which should be protected for other purposes is avoided. In particular, pressure on fragile marginal lands and grazing lands should be reduced.

AGENDA FOR ACTION

Promotion of sustainable agriculture will require determined action at different levels. To start with, these concerns will have to be incorporated in national policies not only through the national resource conservation strategy but also through specific policies to promote sustainable agriculture. Following measures are proposed for this purpose:

- Improve the database for agriculture, irrigation and rural development, especially incorporating resource conservation, environmental pollution, and economic efficiency concerns in the development process.
- Review agriculture and related policies, plans and programs critically to promote sustainability and efficiency.
- Incorporate concerns for environmental monitoring and accounting for natural resources in the 5-year development plans.
- Conserve and protect the natural resource base particularly land, water and bio-diversity and reduce the risk inherent in intensive agricultural development.
- Strengthen agricultural institutions to develop and disseminate alternative location-specific and profitable sustainable crop, livestock, forestry and fisheries production technologies.
- Monitor and disseminate weather changes to the farmers in different areas along with alternative sustainable crop production technologies suitable for different weather situations.
- Develop policies and technologies to promote efficient, cost effective and sustainable use of available irrigation water resources, that is already available in limited quantity.
- Develop alternative sources of rural energy supplies to promote use of FYM and crop residues as indigenous fertilizer instead of fuel.

To ensure speedy and effective implementation of government policies to promote sustainable agricultural development, it is essential to create suitable institutional mechanisms at the federal and provincial levels. It is proposed that a small cell may be established in MINFA, and focal points in provincial governments for this purpose. Functions of these cells should complement those of the cells created for implementation of National Conservation Strategy, with primary emphasis on integrated development of sustainable agriculture.

Last but not the least, it should be ensured that the institutions concerned with improvement and sustainable development of agriculture sector are themselves sustainable. Recent drastic reduction in financial support to agricultural research institutions after substantial investment in development of basic facilities and human resources, is likely to frustrate attempts at promoting agricultural sustainability. The planning process must, therefore, ensure that such institutions which play a crucial role in agricultural development are supported at an adequate level, on sustained basis.

KEYNOTE ADDRESS

Nancy Tumavick
Deputy Director, USAID, Islamabad

Honorable Minister Malik, Distinguished guests, Ladies and Gentlemen

I am pleased to participate in the inauguration of this conference. With Pakistan facing a near doubling of its population in next ten to fifteen years (116 million plus), we must ask ourselves how the rapidly rising demand of food and fiber can be met? Pakistan's land and water resources are already being stressed due to population pressures. Agriculture is both a contributor to the erosion and sustainability and a victim of other environmental abuses, such as industrialization and urbanization. Agriculture is the major sector in Pakistan and as such agricultural production and productivity are an important part of national economic growth. Before us lies a challenge of serious kind. In the broader or more global sense it is a challenge of finding more effective ways to sustain and improve our economic and social well-being as human beings living on a natural resource base that has finite limits--the earth. In regional context, our challenge, your challenge, is that of moving forward the economic development of Pakistan now and for future generations, while at the same time managing your natural resources--the agricultural production base--in a way that is sustainable.

In view of increased attention to the sustainability issue, and in anticipation of this conference, following key aspects must be considered:

First, I see that for sustainability of agriculture, our systems must operate like a well-run business. In successful business, which do not depend on external cash inflows, the expenses do not exceed income. Further, the good business maintains its physical plant just as our resource base must be maintained for sustained production. Resources depletion through mismanagement or overuse, leads to economic decline as is the case of many ocean fisheries where over-fishing has depleted the stocks. Because of changing demands and new technologies, effective management, including agricultural research, is fundamental and critical to sustainability.

Secondly, It is becoming increasingly evident that earth's natural resources are being severely stressed due to the increased population demands--the key underpinning to our environmental problems. This means that greater emphasis must be placed on future population management in order to keep a margin of safety between the land and water's total production capability and absolute demands. Our attitudes regarding resource use, population management, and commitment to problem solution must translate to immediate actions. We no longer have the luxury of academic dialogue.

Thirdly, solutions to these resource-based problems must come from heightened international cooperation that looks to local and national levels for practical answers. We are all linked together through broad international flows and geographical distribution of the world's natural resources systems. Causes and effects of deforestation, acidic rain, pollution of water resources and green house gases transcend economic, social and geographic boundaries. Strategic collaborative planning is crucial.

To meet the evolving worldwide demands for sustainability, USAID/Islamabad, has been pursuing, in close collaboration with the GOP ministries of agriculture and environment, and provincial sponsors, the broader sustainability issues. The primary objective, has been to define, through the four provincial conferences and this federal level conference, the critical human and natural resources issues pertaining to the future sustainability of agriculture in Pakistan. I know that in this two day conference you will not be able to find all the solutions. This is not your objective. However, I am hopeful that this conference begins the process of establishing a sustainable mechanism, incorporating the government, private sector and the NGO/PVO communities. In my view, sustainability of agriculture production base is essential to Pakistan's

national security. From a future perspective, this is a conference of conflict management between economic demands and long term management of the natural resources-soil-water-air and bio-diversity. Pakistan's resource use policies must be changed. The questions for your deliberations are:

- What are the key sustainability issues?
- How do these relate to Pakistan's economic goals for year 2010?
- Can Pakistan continue to increase production levels?
- At what point are production levels, resource availability and demands sustainable?

I have no doubt that this esteemed body will achieve action-oriented results. Your presence here has underscored the urgency to which we must address the sustainability issues. Let us go forward taking bold decisions, cooperating together and finding manageable solutions for the sustainability of Pakistan.

In closing, my congratulations to the ministries of Agriculture and Environment for taking a leadership role in preparing for this conference. My special appreciation also goes to the provincial ministries for their ground-breaking work in 1990 that has led to this conference.

GENERAL VIEW

SUSTAINABLE AGRICULTURE AND RURAL DEVELOPMENT

H.A. Ismet Hakim
Representative
Food & Agriculture Organization

Honorable Minister, Excellencies, Distinguished delegates, Ladies and Gentlemen,

I am very pleased to participate in this Conference on agricultural Sustainability and Natural Resource Management and on behalf of the UNDP Resident Representative and other heads of UN agencies, I wish the participants successful outcome of their discussions.

Let me start by saying that agriculture, forestry and fisheries are the sectors of activity which make the largest use of renewable resources of the planet, are most dependent upon environmental conditions and, conversely, have caused and can cause further environmental changes. However, sustainable development is not merely concerned with the environmental dimensions of development, but has a much wider scope. Sustainable development is the management and conservation of natural resource base, and the orientation of technological and institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations. Such sustainable development (in the agriculture, forestry and fisheries sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable.

The issue faced by many countries including Pakistan is how and where to intensify agriculture, without depleting the resource base and degrading the environment. The challenge is to shift agriculture - including fisheries and forestry - onto a more productive but sustainable growth path. Current rates of crop and pasture land loss, land degradation, deforestation, over-exploitation of fish (shrimp) resources and even mineral fertilizer and pesticide use are not sustainable in many parts of the country and as such the production/farming systems are unsustainable. It will not be an easy challenge to meet. The acute human and livestock population pressures in some areas mean the greater production will have to come from a relatively static or even declining land resource base. Moreover, institutional and structural rigidities in social and economic systems will constrain rapid changes at the operational level.

CHALLENGES AND OBJECTIVES

Strategies for Sustainable Agriculture and Rural Development (SARD) should address the following three challenges:

- Intensification of agriculture is imperative to meet the needs of rapidly growing population, where by year 2000, an additional 32 million peoples must be fed from a resource base which is shrinking due to diverse forms of degradation. However, intensification may carry problems of pollution, contamination and waste disposal, which can affect natural resources, environment and health.
- Present agricultural practices do not offer sufficient opportunities for gainful employment. Due to poverty in rural areas, the people either eke out their livelihood at the expense of the natural resources which are their sole means of survival, or leave the country side in search of employment in cities or abroad
- The global dimensions of a number of environmental threats such as the depletion of natural resources, climate challenge, air and water pollution, deforestation, desertification and loss of biological diversity.

Achievement of these challenges depend upon:

- Resource endowment of a country.
- Existing environmental constraints.
- Demographic situation and trends.
- Traditions and preferences of the people.
- Available technologies and human skills.

If, to be sustainable, agriculture must meet the challenges of food security in quantitative and qualitative terms, providing more employment and better incomes, contributing to the eradication of poverty, while at the same time conserving the natural resources and protecting the environment, then the status and role given to farmers must be commensurate with their responsibilities vis-a-vis other segments of the population; giving agriculture sector better terms of trade versus industry or tertiary sectors. Similarly, the terms of trade between the agricultural producers and those who process, market and consume agricultural products, the urban dwellers in particular, should be influenced so as to take better account of the cost to farmers and other rural people of natural resource conservation and environmental protection in rural areas.

POLICY FRAMEWORK

An appropriate overall policy framework favorable to SARD, that promotes sustainable economic growth while safeguarding the natural resource base, should be developed which may include:

- Create an overall economic environment conducive to growth with equity.
- Create an overall policy environment enabling people's participation in which individuals can express their choices and associate with others.
- Establish a population policy that aims at both a sustainable rate of population growth and an optimal size of population at which growth should stabilize, given current knowledge of the stock of natural resources and the technologies to exploit them.
- Induce changes in lifestyles, dietary habits and other consumption patterns, and to reduce wastage.

Agricultural Sector Policy Review, Planning and Program

Adoption of SARD policy objectives will generally call for major revisions in:

- Agricultural policies and rural development plans and programs.
- Guidelines and methodologies for policy analysis.
- Agricultural planning and project appraisal.

Multiple requirements for achieving SARD and their implications depend on a country's needs and conditions. However, three major objectives should guide the choice of options:

- **Improving efficiency:** Intensification of agriculture and accelerated rural development should be achieved, not by using ever-increasing amounts of resources and inputs, but rather by using them more efficiently.
- **Increasing resilience and minimizing risks:** Minimize the risk and degradation hazards in the use of resources and inputs, in the choice of technologies, and in post-harvest and marketing processes.
- **Promoting diversity:** Diversification will provide opportunities for more efficient use of the diversity of environments, local resources and cultures. Combining on-farm with off-farm activities, including the

development of local processing industries, cottage industries and tourism, is another way of diversifying production while relieving pressure on the farm resources.

STRATEGIES

To attain these objectives a number of parallel actions of government, rural community, and production units levels are required. The main elements which may compose the national strategies are:

People's Participation and Development of Human Resources

The participation of local communities to take more responsibility in decision-making and implementing rural development programs cannot be over emphasized. This implies more decentralization by developing more power down to local level, by providing incentives for local community initiatives and people participation. For this purpose allocate clear rights with regard to resource use at local level, including those related to the role of women in agriculture. Education, training and support services have to be provided to enable people to assume responsibility for managing their resources sustainability and protecting their environment. The role of voluntary organizations and communication programs in this regard should be enhanced.

Integrated Production System Management and Diversification of Rural Incomes

To meet the objectives of improved efficiency, increased resilience, minimized risks and promotion of diversity, implies modifications to existing production systems. The type of production, the patterns of land and water use and other economic activities in rural areas should be better adapted to the diversity of local resources in each agro-ecological zone, while seeking to develop their comparative advantages. The integration of diverse types of production on the farm and among farms provides opportunities for waste recycling and reduces the need for external inputs. Where intensification by diversification and integrated management of farming systems not possible is other possibilities should be developed such as part-time, off-farm employment, wildlife utilization, aquaculture and fisheries, multiple use of forest resources, light manufacturing cottage industries, recreation and tourism.

Improving Efficiency and Reducing Risk in the Use of Natural Resources and Inputs

Successful integrated action at government, rural community and production unit levels should be supported by specific interventions for key resources of agriculture and key production inputs, in order to ensure safe and efficient use. The major areas for interventions are:

- Land use planning and soil conservation, including the development of land zoning and land use monitoring systems, programs to promote soil conservation practices and land rehabilitation;
- Improved water management in both rainfed and irrigated agriculture;
- Conservation and use of genetic resources (plant and animal);
- Integrated plant nutrition systems seeking to optimize the use of diverse plant nutrition sources (biological, organic, mineral) to increase and sustain soil productivity, while protecting water resources and avoiding plant nutrient depletion
- Integrated pest management with a two pronged approach, promoting the use of biological techniques, genetic resistance and appropriate farming practices, and minimizing the use of pesticides.
- Integrated rural energy development and utilization to assist in the energy transition in rural areas.

Each of these areas requires a combination of activities ranging from policy and standard-setting down to people's participation in grass-roots programs, and includes related elements of research, extension and training, development of support-services to the farmers, special credit facilities or other guidelines, regulatory controls and standards.

IMPLEMENTATION

Cooperation Based on Flexible Framework

The implementation of SARD strategies involves many *actors*. The individual farmer and other rural dwellers, the rural communities, the private sector, the government and government institutions, particularly the ministries, responsible for the agriculture and rural sector, and related non-governmental organizations. Success in achieving SARD largely depend on a flexible reference framework for cooperation and coordination and a process of mobilization of efforts by which all actors can see their respective and the complementarily of their action.

Activities in Support of Sustainable Development

Recognizing the crucial role of small farmers and their organization in programs for sustainability and environmental protection, UN agencies have introduced particular approaches in many of their field programs. FAO has prepared a Plan of Action on People's participation aimed at promoting sustainable rural development.

FAO Conference in November, 1991 adopted Resolution 2/91 on FAO Activities related to Sustainable Development and Environment. The Conferences agreed that

Strategies for sustainable agriculture and rural development (SARD) should face the challenges of ensuring food security, eradicating poverty and conserving natural resources. It underlined the pressing need to alleviate hunger and malnutrition, to introduce land reform to ensure people's participation in the development process as well as employing market processes, and, in particular, to enhance the role of women in all activities leading to sustainable development.

The Conference agreed that the objectives of sustainable development and environmental protection should permeate all aspects of agriculture, forestry and fisheries development. It also underlined the need to promote diversified production systems and land use patterns, improving efficiency, increasing resilience and minimizing risks. In the search for sustainable farming systems, activities such as cottage industries, agribusiness, tourism and recreation could be sources of off-farm employment and serve to diversify sources of income.

In promoting sector policy adjustments, FAO and other concerned UN agencies will make use of comparative advantage in this field to facilitate the process of conducting policy reviews, formulating strategies and developing the appropriate institutional mechanism and tools for SARD at the national level. The programs and projects on policy assistance, comprehensive food security and WCARRD follow up activities at the policy level and related supporting information and monitoring systems are relevant for this field. At the rural community level, as regards grass-roots programs aimed at the development of local organizations and capacities for people's participation, the programs and projects on education, training and extension and the proposed Action Plan for People's Participation, the Plan of Action on Women Agricultural Development and the Development Support Communication Program are very relevant. At the production unit level, as regards the integration of the necessary activities, inputs and management practices to achieve SARD, in particular those related to plant and animal production and, where appropriate, the diversification of activities to improve rural income quality of life in rural areas, the programs and projects on farming systems and their diverse components as well as those related to processing and agro-allied industries in rural areas, and the attendant credit and marketing systems are of interest.

Programs and projects related to key natural resources could be tapped, namely those related to land use planning and soil conservation, water resource management, and the conservation and use of plant and animal genetic resources; and those related to the safe and efficient use of the key inputs for agriculture. These programs have three groups of activity focussing respectively on; (i) plant nutrients, including programs and projects on integrated plant nutrient systems; (ii) pest management, including programs and projects on integrated pest control and related projects for the control of pesticides use; (iii) rural energy, including programs and projects for the formulation of national strategies and technology transfer for integrated rural energy development. There are also programs and projects related to forestry and fisheries supporting SARD such as the "Forest, Trees and People" Program (FTP), the Tropical Forests Action Program (TFAF) and

programs on agriculture, inland fisheries, artisanal fisheries and marine fisheries.

In addition to the above global programs and projects, at country level, the Government of Pakistan with the support of FAO, UNDP, WB, ADB and other donors has prepared and carried out a number of programs, projects and activities, contributing to sustainable development and protecting the environment. Special mention should be made to (a) National Conservation Strategy which has identified 14 case areas for priority implementation, and most of them have relevance to sustainable agriculture and rural development; (b) the Forestry Sector Master Plan which has highlighted three sets of goal related to: environment and agricultural/livestock enhancement, production of forest based products and non-forestry social and economic goals; and (c) the findings and recommendations of the FAO Field Program Review and Development Mission which brought to our attention the major constraints to increasing production and productivity in Pakistan. Some will have negative effects to sustainability and environment such as constraints on policy, human resource development, and degradation of the resource base. The Mission recommends the development of an integrated agriculture production and resources management system in different agro-ecological zones where the concerns for sustainability and environment will be highlighted and will specifically take into account: (i) people's participation and human resources development; (ii) integrated systems and diversification of income; (iii) sustainable use of basic natural resources - land, water, bio-diversity, and (iv) safe and sustainable use of key inputs such as fertilizer; pesticides and energy. These programs will be complemented by the proposed UN joint program on income and employment generation in rural areas.

UNDP has been an active supporter in the formulation of the National Conservation Strategy (NCS) for Pakistan and will provide support to the actual implementation of the NCS with particular emphasis on capacity building within governmental and non-governmental institutions. In this regard, work has already started by UNDP and IUCN in identifying a Sustainable Development Network (SDN) in the country. An important aspect of UNDP assistance would also be skill development for improved pollution control and natural resources management within the private and public sectors. Soil rehabilitation, re-afforestation, improved land use practices including watershed management, integrated pest management and toxic waste disposal would remain areas of continued support in the new country program.

As an example of concerted efforts on sustainable development, the Government of Balochistan program to improve the rangeland, water and livestock resources and to establish sustainable production systems through introduction of proper resource management could be mentioned. The purpose is to address the problems of degradation of natural resources specially grazing land, soil erosion, reduced water infiltration, livestock feed and quality development of livestock. Because of the complexity of the issue, an integrated multi-disciplinary program approach is required and appropriate strategy has been evolved for rehabilitation and management of Balochistan resources. The program includes the core project Integrated Livestock and Range Development, and support projects on Animal Nutrition Feed Resources Development, Watershed Planning and Management, Water Harvesting and Conservation and Strengthening Agricultural Planning. The Range Management Research and Education Project at Pakistan Forest institute in Peshawar will backstop this program, which is assisted by UNDP and FAO

In AJ&K and Northern Areas, package of projects within agreed programs on Integrated Agriculture and Rural Development are being developed, while as indicated earlier programs on integrated production and resources management are being planned for various agro-ecological zones in Pakistan aiming at sustainable development and protection of environment.

INAUGURAL ADDRESS

Lt. Gen.(Retd) Abdul Majid Malik
Federal Minister for Food, Agriculture and Cooperatives

Ladies and Gentlemen

It is a matter of pleasure and great personal satisfaction for me to have this opportunity of presiding over the inaugural session of this National Conference on Agricultural Sustainability and Natural Resource Management. I am particularly happy, as Minister of Food and Agriculture, that deliberations have been planned on a topic which is becoming increasingly important for the future development of agriculture in our country and about which the government, in recent years, has felt extremely concerned. I would like to appreciate the support provided by USAID in organizing this conference.

Ladies and Gentlemen

Many of us have witnessed the phenomenal growth in production of wheat and rice during the Green Revolution era, and more recently the unprecedented development in cotton production. Introduction of new technologies supported by appropriate policy actions by the government, including strengthening of institutional infra-structure, made it all possible. But in the wake of this development numerous problems of longer term sustainability, have emerged. There is increasing evidence and concern about the degradation of production resources, decline of productivity and environmental pollution, potentially damaging to human and livestock health. In our excitement, and sometimes complacency, about these growth trends, the longer term sustainability aspects of development efforts were largely neglected and I have no hesitation in saying that all of us, including politicians, policy makers, administrators and scientists are guilty of this neglect.

Instability of several production systems has been evidenced inter alia by degradation of watersheds, excessive soil erosion, increasing waterlogging and salinity, decreasing response to fertilizers, emergence of micronutrient deficiencies in soil, development of pesticide resistance in insects and presence of toxic elements in food and feed chain. I must emphasize that unless appropriate steps are taken to make the system sustainable the trend is bound to lead to a disastrous situation and considering that agriculture is and is likely to remain the dominant sector of our economy for several decades to come, our very survival will be in jeopardy. With the population growing at an exorbitant rate, the country will have to produce more food and other agricultural commodities under conditions of shrinking land and water resources and expanding biotic and abiotic stresses. We need to urgently plan for these imperatives.

Environmental protection is now being reviewed by development planners as a means for eradication of poverty and meeting the basic needs of the rural and urban poor. This, however, calls for the commitment of all levels of society-government, individuals and organizations, industry and scientific community to the cause of protecting the basic life support systems of land, water, flora, fauna and of the atmosphere.

I am glad to hear that the Conference is aiming at critically analyzing policies and practices that have led to unsustainable agricultural development and recommending an action plan with prioritized set of activities at the national and regional levels. The Government would keenly look forward to these recommendations and within available resources would make every effort to implement these. As some of you would know, a National Sustainability Steering Committee has already been constituted that will coordinate and monitor implementation of the action plan.

I would, however, urge the participants that in developing short and long term strategies they should keep the following few things in mind. Firstly, availability of financial, physical and human resources will remain a constraint for implementing any action plan. The action plan should, therefore, be developed with these

constraints in view. It should also correspond, as far as possible to the Government's declared policy of self-reliance. Secondly, the Government is committed to an equitable development of all areas in the country. The strategy options should, therefore, be recommended for all major agro-ecosystems in the country, including rainfed, irrigated and mountainous ecologies. It should be socio-politically acceptable and equitable. Thirdly, the proposed action plan should spell out a mechanism of involving people at grass-roots level, because in the last analysis it is their commitment and indulgence that would make any program of sustainable agricultural development successful. Village level community organizations will probably be more effective in implementing such a program.

With these few words, ladies and gentlemen, I feel pleasure in inaugurating this conference and wish all of you success in your deliberations. The Islamabad weather is pleasant and I hope you will find your stay here personally enjoyable and professionally rewarding.

CONCLUDING ADDRESS

Anwar Saifullah Khan
Minister for Environment and Urban Affairs

Dr. Amir Muhammad, Mr. Reddy, Distinguished Participants

I am most grateful to Dr. Amir Muhammad for inviting me to chair the concluding session of this very important seminar. I am happy to be here and I am very pleased that my Ministry has been associated with it. I would like to assure you that we would be at your call. Our support shall always be there. We have to make our country agriculturally self sufficient especially in wheat. Of course we will not forget the objective of the seminar that is agricultural sustainability.

Ladies and Gentlemen,

As we are all aware optimal use of land and its resources requires simultaneous consideration of all aspects of the environment and social and economic development to augment action on specific resource use issues. The integrated management of soils, minerals, air, water and plant and animal life is extremely essential. Governments need assistance to make choices that will get the most sustainable benefits from land. We have to strengthen our institutions so that an integrated approach can be used at all stages of decision making from goal setting to implementation. Legislation, regulations and economic incentives should encourage the rational use of land. Programs should be planned for an entire eco-system or watershed area. Research is needed to determine the capacity of land and of the interaction among various land uses and environmental processes. Pilot projects should experiment with new methods of land management. Regional and international sharing of information and experiences should be encouraged and this is what I suggested at a meeting in New Delhi to the SAARC Ministers of Environment that we must share our experiences because our problems are quite similar. We all live in a region which is quite close to each other and I am glad that there was a consensus on this issue and we all agreed to share our experiences.

Ladies and Gentlemen,

Mismanagement of forests is linked to degradation of soil and water, loss of wildlife and biological diversity and pollution and global warming. Each year some 17 million hectares of tropical forests are lost as a result of agricultural and industrial expansion, overgrazing, excessive or poorly managed tree cutting for timber or fuel and similar human pressures. Meanwhile air pollution and fires are depleting the wooded lands in many developed countries. This loss of forests also accelerates other environmental problems, lowers the quality of life of millions of people and reduces country's options for development. Development that is sustainable will also require actions to raise the value and yields of varieties of forest products. This will increase employment and income, foreign exchange earnings and returns on its investment.

Rapid population growth putting increasing pressures on production resources, is the basic cause of unsustainability. We have to control our population. There are no two opinions about it and I think people representing all walks of life agree that population is a problem and we have to tackle it bravely head-on. We have to control our population because in the year 2000 probably we are going to cross 150 million and in another 10 years after that, we are going to have 200 million people in this country and that is the limit.

So population pressures, unsustainable agricultural and industrial practices, land ownership, employment opportunities and the crushing external debt, are the issues that have to be addressed.

The overuse of marginal lands for farms and livestock, causes a cycle of desertification and poverty. Halting the spread of deserts will require action to protect areas that are still viable. To combat desertification, improved land and water use and reforestation are essential factors. Increased research and the provision of

alternative livelihoods for subsistence farmers and herders are also needed. Desertification affects 1/4th of the earth's land area and 1/6th of its people. Preventing further loss of productive land to deserts should be our first priority. In order to alleviate poverty that is associated with unsustainable land use in arid regions, support for rural cottage industries and other alternatives to subsistence farming and livestock herding, should be popularized.

Feeding an expanding world population will require a combination of increased food production and land conservation. We should therefore improve farm planning and management. With greater input from farmers, raise the output of food and other farm products, without depleting the nutrients or poisoning the soils, and maintain the diversity of plants and animal species. World food needs are projected to increase 50% by the end of this century and to triple by the year 2050. To feed the vast majority who live in the developing countries, land now in use will have to yield more and land that has been degraded will have to be rehabilitated and protected. As farming becomes increasingly specialized, farmers become more vulnerable to environmental stresses. Farmers should be informed about crop rotation and other methods of conserving soil nutrients. The use of organic manure and other techniques to reduce reliance on chemical fertilizers should be encouraged. Biological means of controlling insects and the use of plant species that resist pests are better long term options than the present reliance on chemicals which are costly and harmful to human health and the environment. Steps to safeguard the diversity of species used in farming must be taken. Erosion, salinization, water logging and soil pollution are consequences of harmful farming practices. Increase in farm yields depends on reversing these trends of land degradation. Well planned national and regional zoning and management measures as well as rehabilitation of the most critically affected and vulnerable areas are required to be taken in hand immediately. Developing countries need to have assistance to improve their capability to plan and manage agricultural policies rationally.

In the end, I appreciate the support provided by USAID, from the Ministry of Agriculture and from my own Ministry, I also appreciate the support and the contribution of all the distinguished participants and I am looking forward to the action plan. Let me assure you ladies and gentlemen, that the government is very keen to give the importance that agriculture deserves. This is a sector on which depends the livelihood of the vast majority of Pakistanis and the honor of our country. Our ministry and myself, appraised the methodology developed beginning with the four provincial conferences which many of you participated in 1990, and I believe that this grass root approach has given us a clear perception of the problems of sustainability in Pakistan. It has strengthened our commitment and raised our awareness about the natural resource needs of Pakistan.

I would once again in the end like to thank you for giving me opportunity to be with you.

SECTION II

As stated earlier, the regional delegates to the conference presented their respective perception on Agricultural Sustainability and Natural Resource Management which lead to the formulation of a list of issue points for each region. These issue points were discussed thoroughly by the conference participants and prioritized on regional basis. Out of prioritized list, 5 issues were then selected to develop a strategic plan for immediate action. Besides, the conference participants made some general recommendations relevant to the topic. The Strategic Plan, list of issue points split into priority issue and others, and the general recommendations are presented in the following sections.

- II.1 Strategic Plan
- II.2 List of Issues
- II.3 General Recommendation

II.1 STRATEGIC PLAN

During Conference deliberations each province provided a listing of issues related to agricultural sustainability and natural resource management. Through a participatory decision making process, priority issues that needed immediate attention were identified on regional basis. Finally, to facilitate initiation of an action program five key areas were selected. The purpose of narrowing down areas was to initiate action on selective components and mini-projects that can be accomplished in a short horizon. The five areas are:

- Water Resource Conservation (Balochistan).
- Establishment of Soils Research Institute (Punjab).
- Reclamation and Management of Water logged and Saline soils (Sindh).
- Rapid Survey of Major Watersheds in NWFP.
- Conservation of Bio-diversity (Countrywide).

1. Water Resource Conservation (Balochistan)

Water Resource Conservation, both surface and underground, is a key element in sustainable agricultural development in Balochistan. With a very low aquifer recharge rate, the mining of sub-soil water needs to be well balanced and its use for irrigation purposes very efficient. Similarly proper harvesting of available surface water flows in Balochistan is necessary to store water for irrigation purposes, prevent soil erosion due to flash floods and encourage aquifer recharge through seepage. Egypt, Jordan and Israel have successfully demonstrated techniques to store water at low cost. To assess the present status, fully understand the various techniques available and start a pilot project. Arid Zone Research Institute, in close association with Agriculture Research Institute (Sariab) have expressed interest to quickly put together a proposal and initiate activities in this area. The proposal and preliminary activities will be accomplished within six months of the conference and a brief report made available to interested parties.

2. Establishment of Soils Research Institute

A number of physico-chemical and biological factors are constraining soil productivity as is evidenced by reduced input use efficiencies and lower crop yields. The respective role of these factors needs to be thoroughly investigated to evolve appropriate technologies for maximizing productivity on a sustainable basis. Furthermore, without adequate soil analysis facilities and ability to map agro-ecological zones, it is difficult to plan farming systems on the basis of comparative advantage. To accomplish this a well equipped soils research institute capable of conducting research on all aspects of soil management is most desirable. What type of facilities are needed to upgrade such an institute depends upon a well-thought thorough plan that outlines the mandate of the institute and provides a short and long term perspective of opportunities, constraints and resources required. The Director of Soil Fertility Research Institute Lahore, has shown keen interest in putting together such a plan. Time frame for this activity is 6 months after completion of the conference.

3. Reclamation and Management of Water logged and Saline Soils

A substantial portion of cultivated land in Sindh is affected by Water-logging and salinity and the area is rapidly increasing. As such management of these lands has become a priority issue in Sindh for sustained agricultural development Canal lining to prevent seepage, effective drainage systems, appropriate soil and water management technologies for reclamation and crop production techniques suitable for such lands were considered as possible approaches. During the conference consensus could not be developed on an immediate initiative to manage this situation. The Soil Science departments of Sindh Agricultural University and Agricultural Research Institute, Tando Jam and DRIP (Drainage Research Institute of Pakistan), Hyderabad are relevant institutes that can develop and implement such an initiative. These institutes will be approached through delegation leader.

4. Management of Watersheds

Soil erosion and steppe degradation because of unplanned habitation and farming is a common problem in NWFP. Considering the socio-cultural implications, participation of active village level organizations is essential for the success of any watershed management program. To adequately plan a watershed development strategy, basic information is vital. Such information is presently lacking. The NWFP Agriculture University, Peshawar, in close collaboration with Pakistan Forest Institute can address this question by conducting a rapid rural appraisal survey within a short period. The main objective of this survey will be to ascertain the present status of watersheds, problems associated with their development, the existing village level organizations and their present role and help outline an action plan to safeguard these watersheds from further environmental degradation. Vice-Chancellor of Agriculture University, Mr. Abdur Rehman Khan, who is an accomplished forester has shown interest in providing leadership for such a survey on pilot basis. This could eventually provide the basis for a large scale effort. Time frame is 6 months after the Conference.

5. Conservation of Bio-diversity

Introduction of high yield varieties of crops and clearing of wild habitats for agricultural purposes is fast eroding the genetic diversity that had existed in the form of well adapted land races of field and horticultural crops and forest tree species. To collect and preserve such a genetic diversity, as a pool of desirable genes, a comprehensive strategy is required. As a first step the existing germplasm collection available with various federal and provincial institutes needs to be inventoried and untapped genetic resources in various parts of the country identified. Data collection can be done with the help of provincial institutes and farmer involvement. Mr. Rashid Anwar, Incharge Plant Genetic Resources Program at NARC, Islamabad, has shown keen interest to coordinate this activity. Time frame has not yet been bounded, but it is expected that for some non-conventional crops, the data can be collected within 6-8 months depending on seasons of production.

This draft is being circulated to all concerned for perusal and necessary action.

II.2 LIST OF ISSUES

PUNJAB

PRIORITY ISSUES

1. Soil fertility including fertilizer supply, quality, balancing
 - Need for establishing a Soils Research Institute.
2. Water management.
 - Acute shortage of water, need for efficient water management.
3. Salinity, waterlogging and water quality.

- Use of marginally fit or unfit tubewell water for irrigation; technologies for management of saline and water logged soils.
4. Conservation of genetic resources.
 - Particularly old land races and genetic diversity still available in remote areas both for plants and livestock. Need for in situ conservation and establishing properly equipped gene banks.
 5. Land consolidation.
 - Essential for a more efficient use of farmers resources.

Other Issues

6. Soil Erosion
7. Degradation of Rangeland
 - Urgent need for rangeland management technologies and regulatory mechanism to ensure their planned use for rehabilitation.
8. Soil Impediment
9. Soil Pollution
 - Resulting from industrial wastes and use of agricultural chemicals.
10. Ground Water Recharge
 - Need for water harvest technologies that would encourage seepage and recharge of sub-soil water.

BALUCHISTAN

PRIORITY ISSUES

1. Excessive mining of underground water resource with no comparable recharge of aquifer.
 - Need for a check on water mining and for increasing efficiency of water use.
2. Degradation of rangeland and livestock management.
 - Considering the role of rangelands in Baluchistan's economy there is need for separate administrative organization for rangelands supported by a Rangelands Research Institute. There is also a need for small ruminants research Institute.
3. Soil erosion and soil management.
4. Lack of marketing infrastructure for fruits and vegetables.
5. Development of marine fisheries resource.
 - Management plan for shrimp trawling.
 - Regulate deep sea fisheries.
 - Develop fishing Coast in Baluchistan.

Other Issues

6. Design, operation and maintenance of irrigation dams.
 - Need to be more appropriate and efficient.
7. Electricity Tariff
 - High fixed tariffs usually inhibit tubewell operations.
 - Should be on actual use basis.
8. Salinity and drainage in Nasirabad
 - Need for technologies for reclamation and productive management of saline and water logged soils.
9. Loss of Bio-diversity
 - Well planned programs for conservation of plant and animal bio-diversity existing in the province should be implemented.
10. Women in Development Issues
 - Liberty
 - Health care Centers
 - Social Centers
 - Training-cum-production centers
11. Lack of resources for research
 - Research needs to be adequately funded to support sustainable agricultural development.
12. Need for a more effective coordination of provincial departments related with agriculture, possibly under an ACS.

AZAD JAMMU AND KASHMIR

PRIORITY ISSUES

1. More effective watershed management.
 - To prevent soil erosion and regulate water flow.
2. Hydel power generation as alternate source of energy.
 - This will help to prevent deforestation
3. Development of rainwater conservation techniques.
 - For better agriculture in dry areas.
4. Emphasis on adaptive research.
 - For adaptation and dissemination of production technologies.
5. Diversification to high value crops.
 - Research strengthening needed to identify such crop and evolve suitable production technologies.

NORTH WEST FRONTIER PROVINCE

PRIORITY ISSUES

1. Lack of participatory village level organizations.
2. Degradation of watersheds, forests, grazing lands and livestock.
3. Loss of soil through human habitation, inefficient use of irrigation water, inappropriate use of pesticides.
4. Availability of certified seed, fruit plants and other farm inputs.
5. Marketing infrastructure for fruits and vegetables.

Other Issues

6. Loss of Bio-diversity.
7. Depletion of Forests.

SINDH

PRIORITY ISSUES

1. Waterlogging and salinity including reclamation of land.
 - Reclamation measures.
 - Technologies for management of water logged and saline soils.
 - Lining of canals to prevent seepage.
 - Desilting of dams.
2. Human resources development.
 - Availability of trained manpower is a constraint to implementation of development programs
3. Government Policies.
 - A critical analysis of government policies in relevance to sustainable agriculture.
4. Preservation of environment in Indus Delta.
 - By checking intrusion of sea water
5. Social Forestry.
 - Needed to prevent environmental degradation, check soil erosion and generate income.

Other Issues

6. Availability of certified seed of improved varieties and other inputs like fertilizers is a constraint-integrated farm supply service will help.
7. Maintenance of Irrigation System.
 - Greater resources needed.

8. Ineffective institutional infrastructure.
 - Strengthening and improving coordination.
9. Lack of mechanization research facilities.
 - Need for separate mechanization research institute in Sindh.
10. Need for a formal institutional infrastructure to follow implementation of recommendation of this conference.
11. Lack of appropriate facilities for disease diagnosis in livestock and field and horticultural crop plants.
 - Strengthening of relevant laboratories.
12. Management expertise in agriculture is lacking.
 - A course in Agri-business management should be added to curricula in agricultural universities.
13. Lack of proper economic analysis of agricultural activities.
 - Need for strengthening of agricultural economics research units.
14. Support price mechanism for agricultural communities should be made efficient and incentive oriented.

FEDERAL

MACRO

1. Rethink of the Definition of agricultural sustainability.
 - Emphasis on human being.
2. Allocation of resources and their utilization.
 - Need for a more rational allocation and efficient utilization with effective checks and balances.
3. Flexibility in decision making at different levels of policy formulation and administration and development planning and implementation.
4. Institutional development and reorganization.

MICRO

5. Shortage of resources for salinity control.
6. Management of irrigation water and drainage.
7. Waste recycling can yield valuable products.

NORTHERN AREAS

1. Lack of appropriate institutional infrastructure for accessibility to the community.
 - ◆ Need for strengthening of agricultural development institutions and creating active village level community organizations.
2. Inadequate input supplies.
 - ◆ Because of remoteness, possibility of subsidizing input supplies should be considered.
3. Deforestation.
 - ◆ Community involvement in reforestation and preventing deforestation must be ensured.
4. Lack of marketing infrastructure.
 - ◆ Transport means is a major constraint
5. Lack of appropriate technology.
 - ◆ Needs strengthening of research infra-structure with a major emphasis on adaptive research.

II.3 GENERAL RECOMMENDATIONS

1. Set a mechanism for equitable price of agro-products to enable farmers to follow sustainable practices.
2. Establish a database for natural resources inventory especially related to agriculture.
3. Establish a secretariat for the productive working of NSSC. The NSSC should identify practices that lead to unsustainability, formulate strategies for their prevention, estimate cost for elimination and identify mechanism including subsidy for elimination of unsustainable practices.
4. Set up mechanism for inter-departmental coordination in agriculture in each province and geographical region and promote coordination between federal Ministries of Food and Agriculture, and Ministries of Environment and Water.
5. Empower communities at grass-roots level to plan and implement different activities concerning resource use in this area.
6. Establish sections in Ministry of Food and Agriculture and at provincial level to carry out assessment of agriculture development on natural resources.
7. Train and sensitize urgently a large number of people in government, private sector and at grass-roots level to plan and execute sustainable development strategies and programs.

SECTION III

BRIEFING PAPER

BACKGROUND

With rising demand for agricultural products such as food, feed, fibre and fuel relative to the possible expansion of the resource base, the concept of sustainable agricultural development has become most pertinent aspect of any development strategy. The significance of promoting a sustainable agriculture production system is essential when viewed in terms of important linkages that could result to promote efficient resource use in a sustainable manner to eradicate hunger and poverty amongst masses. Sustainability has been defined in several ways but a dynamic concept that has been developed by the Technical Advisory Committee of the Consultative Group on International Agricultural Research states that:

" Sustainable agriculture should involve the successful management of resources for agriculture to satisfy changing human needs while maintaining or enhancing the quality of the environment and conserving natural resources."

This definition which specifically mentions the maintenance/enhancement of environment and links sustainability to the capacity of an agricultural production system to satisfy human needs fits well in the Pakistani context where environmental degradation is proceeding unchecked and the burgeoning population is placing tremendous pressure on the natural resource base to fulfil basic needs of society.

To cope with this situation GOP's Ministry of Food, Agriculture and Cooperatives in collaboration with USAID has been pursuing the broader agricultural sustainability issues through a series of conferences held at the provincial level. The objective of these provincial conferences held in May 1990 was to define the critical human, physical and environmental/natural resource management issues pertaining to the future sustainability of agriculture in Pakistan at the grass root level from a wide spectrum of people. The proceedings and outcome of these conferences have been documented and circulated.

As a follow-up a National Conference on Agricultural Sustainability and Natural Resource

Management has been planned for 15-16 April 1992, to identify an action agenda based on the results of provincial conferences, and to reach a consensus on broad based Pakistani perceptions on steps needed to support sustainable agricultural development into the 21st Century. The conference is specifically targeted at developing a 3-4 point achievable strategic plan, resource allocated for work on sustainability/environmental issues which can also be incorporated into the 8th five year plan. As a result of the regional conferences, under the leadership of Ministry of Food, Agriculture and Cooperatives and Ministry of Environment, the National Sustainability Steering Committee (NSSC) has been formally established. The national conference objectives include further strengthening the institutionalization of this task force for continued post conference activities and to evolve a consensus on approaches to implement the strategic plan by establishing a sustainability secretariat within the GOP.

CONFERENCE FORMAT

The participation in the conference will consist of GOP ministerial level officials, Regional Committees representing different sectors concerned with sustainability issues, relevant private sector institutions and bilateral, multilateral mission representatives. A participatory decision making approach will be used to bring all participants to a consensus position thus producing an achievable strategic plan with clear cut goals, resources for achieving goals identified and a comprehensive action plan.

The Steering Committee of National Sustainability Conference comprising of Federal and Provincial representatives has agreed to the following four themes for the conference:

- Sustainable use of soils.
- Sustainable use of Water Resources
- Managing Forests Rangelands and livestock and preventing desertification.
- Sustainable Bio-Diversity.

Underpinning to above technical level issues on

sustainability is the much broader and key issue of management planning and financing for agriculture research since without effective well defined, applied and basic research programming agricultural sustainability for Pakistan cannot be achieved. To this it is vital that strategic planning processes be incorporated and prioritization of agricultural sustainability topics and allocation financial planning discussed.

All member of NSSC including the Regional Sustainability Committees, Federal institutions and donors are expected to prepare comprehensive position papers on each of these themes which should cover the following aspects:

- Their own concept of the theme.
- Prioritized list of Sustainability issues relevant to the theme in their province or sphere of work.
- A brief description of the relevant institutional infra-structure and ongoing R&D activities.
- Suggestions for future actions and possible actions which each member as an individual or collectively with other members can take to alleviate these issues.
- Identification of public/private agencies/group suited to provide further assistance relative to sustainability of agriculture and better Natural Resource management.
- Possibilities of expanding the natural bases i.e ocean resource, solar energy, cultivable land etc.

These regional position papers will be merged into working papers highlighting the issues points and will form the basis of conference discussions.

BRIEF ON CONFERENCE THEMES

A brief for each of the themes is provided below:

Soil

- Conservation of the physical substance of the soil by preventing erosion which is caused by wind or water. Destruction of vegetative cover through cutting or overgrazing and excessive cultivation of unprotected land on steeper slopes predisposes it to this type of degradation.
- Maintenance of soil fertility by ensuring that the off take of nutrients through crops harvests does not exceed their addition by weathering from sub-strata, fixation of nitrogen from the

atmosphere, application of fertilizer and various forms of organic recycling. This requires availability of site specific recommendations for appropriate crop rotations and balanced fertilizer uses based on soil-fertilizer-crop response data. The existence and efficiency of basic/applied/adaptive research infrastructure, transfer of technology organization and the input supply system becomes important for this purpose.

- Maintenance of soil structure and chemical characteristics through proper, technical and cost effective tillage and correction of salinization and water logging by use of appropriate reclamation techniques (i.e gypsum and horizontal/ vertical drainage). Excessive mechanized cultivation often leads to soil compaction and creation of a hard pan below the soil surface. This often reduces water permeability which decreases productivity of the soil. The condition can be amended by rationalizing cultivation and occasional deep ploughings.
- Preservation of soil microbial activities by proper crop rotation, appropriate tillage and prevention of build up of toxic chemicals in the soil.
- Methods for improved value addition of agro-products thus increasing return to farmers and thereby enabling them to adopt cost efficient sustainable agriculture techniques.

Bio-diversity

Bio-diversity refers to the diversity of biological species that exist in an eco-system. Conserving bio-diversity is important both for environmental protection and development. The term bio-diversity has multifaced interpretation amongst people. To a watershed manger it refers to conserving forests above the farmlands to control erosion and regulate water supply downstream, to an ecologist it is linking protected areas together, thereby providing mechanisms for expanding population of key species, for a geneticist it is conservation of the genetic resources for evolving more productive varieties and plants and breeds of animals and to a pharmacist it is survey and conservation of plant and animal species for their possible medicinal value.

Specific actions needed to conserve bio-diversity are:

- Complete and maintain a comprehensive system of protected areas: to adequately conserve viable

populations of most species, these protected areas will need to be supplemented by appropriate policies in surrounding lands delivering benefits to human populations. This in turn may require changes in how the benefits of conservation are distributed involving changes in land tenure, agricultural incentives and restoration of degraded lands.

- Improve conservation of wild plants and species.
- Improve knowledge and understanding of species and ecosystems.
- A combination of in situ and ex situ conservation to maintain species and genetic resources. This would require a comprehensive system of collection, evaluation, documentation and storage of genetic resources (i.e. establishment of a Gene Bank)
- Improved use of pesticides, herbicides and insecticides etc.

Conservation of species has been practiced with a narrow sectoral view of species such as fisheries, forestry, economic crop plants, wildlife etc, but broader approaches are now required to show how the various sectors can each work to their own mandates yet contribute to national and international objectives of conserving bio-diversity.

Managing Forests, Rangelands, Livestock and Preventing Desertification

MANAGING FORESTS AND RANGELANDS

Perhaps the most chronic and persistent development problem faced by Pakistani policy makers is developing barani areas. Rangelands which comprise almost 60 percent of total landmass of Pakistan are largely ignored in development planning. These rangelands show continued signs of degradation eventually leading to desertification and thus rendering a major resource incapacitated to contribute to the national economy. A major portion of the small ruminant population, camels and semi arid cattle breeds depend on rangelands for feeding. Overgrazing in the absence of a systematic effort of regenerating appropriate vegetative cover has rendered many rangelands no longer capable of supporting livestock production. This is particularly so in Balochistan and Sindh provinces. To achieve sustainable development in rangeland areas the following problem areas must be addressed:

- Problems related to determining optimal carrying capacity of the different types of

ranges.

- Lack of range rehabilitation technologies based on successful experiences of other Middle East and North American countries.
- Complete defiance of grazing and forrest laws which themselves are considered obsolete and need careful review and revision.
- Lack of expertise that can develop micro/macro strategies to enhance productivity of rangelands.

LIVESTOCK PRODUCTION SYSTEMS

Broadening of the genetic base of local livestock breeds by introducing exotic blood has significantly changed the characteristics of traditional, semi-commercial and commercial production systems. The crop-livestock and range-livestock interfaces determine the long term sustainability of any system. Systematic evaluation of the national feed resource and continuing expansion require careful planning. Given the relatively high proportion of feed cost as a percent of total cost of production it is prudent that alternative feed resources that lower the cost of production are identified. A complementary feed resource could possibly be that of appropriate and tested fodder trees and shrubs which also links well with environmental concerns. Similarly, the design and testing of appropriate technologies through farmer participation has been neglected in the past. These approaches can help design sustainable production systems that are both technically and economically efficient and also preserve the essential elements of the domestic production systems. The crop-animal-soil-human relationships must be taken into account when addressing the broader concepts of sustainability. The following issues warrant careful consideration:

- Diversification and more efficient utilization of the biological and synthetic feed resource bases.
- Lack of general stock upgrading to enrich livestock resources. Our local livestock breeds have high potential to be developed into milch/beef breeds. In fact they have already been used by other countries. They could be improved by crossing with exotic milch/beef bloodlines. But we are spoiling our high yielding breeds of Sahiwal, Red Sindhi by crossing them where the potential for increasing per head milch/beef production is lesser than our local breeds.
- Long term issues of erosion of genetic pool through indiscriminate slaughter of high grade

animals in large cities (i.e Karachi, Peshawar and Lahore). This is perhaps the most burning issue warranting action from policy maker through introduction of proper legislation.

- Need for urgent national level evaluation of imported breeds and overall comparison of their performance over local breeds. Perhaps in the case of cattle and buffalo local breeds i.e Sindhi, Sahiwal, Nili-Ravi are more appropriate than imported breeds like Holstein Frisian and Jersey. New breeds should be introduced only after careful evaluation of their contribution to long term sustainable production and efficient utilization of the resource base.
- Lack of animal health facilities in rural areas.
- Well coordinated national and international livestock marketing systems that assure farmer adequate returns and enhance the profitability of the livestock enterprise.
- Less attention to development of fresh water and crop based fish production systems. Philippines, Thailand and Indonesia have successfully demonstrated high returns to integrated rice-fish production systems.

Finally there is a need to reconsider the contribution of the country's marine resources to the economy. Development of coastal area fisheries can help boost the national economy.

SUSTAINABLE USE OF WATER RESOURCES

Pakistan is basically an arid country with mainly desert or semiarid climate with extremes of temperatures and less than optimum precipitation in most areas. Successful crop production is therefore possible only through artificial irrigation. The country is blessed with the World's largest contiguous canal irrigation system. Besides, underground water reservoirs are being exploited for irrigation through private and public sector tubewells.

Nevertheless water resources are not unlimited and as a long term strategy need to be managed on a sustainable bases to ensure adequate support to future agricultural development. The following aspects need to be considered for sustainable use of water resources:

- Proper Watershed Management to prevent soil erosion and silting of dams and reservoirs, this involves ensuring perennial vegetation cover and

minimum tillage practices in the watersheds. Provision of some incentive to local farmers/inhabitants of the watershed areas will need to be made to provide them economic return for lower tillage and deforestation activities.

- Checking water seepage in canal transmission through lining and other means and also preventing transmission losses. This will prevent water logging and salinity - will need a comprehensive drainage system.
- Sustainable exploitation of groundwater resources, particularly balancing extraction with recharge.
- Ways and means of using groundwater of less than optimum quality for agricultural purposes. Possibility of forming artificial lakes on river banks or at end of present irrigation systems where water can be stored in flood season, then harvesting sweat water with tubewells from areas having waterlogging problems and storing this water in these reservoirs for onward transmission to unirrigated areas.
- On-farm management of irrigation water which would include prevention of transmission losses, judicious application to crops, use of overhead irrigation systems (sprinkler and drip irrigation) and interculture and mulching of fields to prevent evaporation losses.
- Proper water harvesting and conservation in rainfed areas would prevent flash floods, enhance percolation and if stored properly will make water available for life saving irrigation to crops.
- Ensuring a minimal flow of water in river Indus to prevent, ocean water encroasion into Indus thus destroying the mangrove forests in Indus delta and also preventing saline water table from rising in Sindh thus causing soil salinity.
- Research on introduction of economic crops for areas having water logging and salinity.

PUNJAB

RESOURCE MANAGEMENT AND DEVELOPMENT ACTIVITIES FOR INCREASING CROP PRODUCTION

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Abstract: *Important components of agriculture are Land, Water, and fertilizers. The delineation of high quality agricultural land and water supplies help to enhance the intensity and multiple cropping leading to increased area and agricultural production. This paper outline the resource management and developmental activities for increasing crop productivity. Constrains are also discussed.*

INTRODUCTION

Pakistan is bestowed with best land and water resources. The land base stretched over 79.61 million hectare and traversed by Indus River and its tributaries with annual flow of 142 m.a.f. The agriculture is practiced on 20.43 million hectare and another 10.91 m. hectare are considered as culturable waste. The river water is tamed into canal network which commands about 14.79 million hectare with farmgate delivery of 65 m.a.f. per annum. Nearly one fourth of cropped area is dependent on rainfall. Punjab shares 68.52 percent land use and 61.0 percent farmgate deliveries of irrigation water resources.

LAND RESOURCES

The inventory of physical resources such as land and water is essential for development of agriculture. The delineation of high potential agricultural land and quality water supplies help to develop the cropping pattern and selection of crops leading to increase both in cropped area and agricultural production. Punjab has the best irrigation system. Majority of cultivated lands are commanded by canals community known as C.C.A. The irrigated area in the Indus Plain is categorized into four classes and is shown in Table 1.

Inventory of cultivated land in CCA indicates that about 48 percent (2.99 m.ha.) of cultivated area is very good (Class I) agricultural land which has no soil limitation and is suitable for intensive irrigated agriculture. These lands possess very high potential. About 44.1 (2.89 m.ha.) is covered by good (Class

II) land which has minor limitations but responds to good management. The soil problem is moderate to severe in Class-III land occupying 5.0 percent (0.33 m.ha.) with low potential but crop yields can be profitably increased by improved technology. The uncultivated part is only 5.3 percent (0.35 m.ha.) categorized as Class IV land where sodicity is common hazard, of which three-fourth portion is economically reclaimable with use of gypsum if provided in sufficient quantities.

Table 1: Extent of different kinds of land in CCA

Category	m.ha		
	Pakistan	Punjab	% CA(Pb)
A. Cultivated			
Class I	4.16	2.99	45.6
Class II	5.82	2.89	44.1
Class III	0.78	0.33	5.0
Class IV	0.48	0.35	5.3
Sub-Total	11.24	6.56	
B. Un-cultivated	2.23	1.32	
G-Total	13.47	7.88	

WATER RESOURCES

Pakistan agriculture is prominently irrigated. The cultivable area (14.79 m.ha.) is commanded by the irrigation system. The annual flow of the Indus River and its tributaries averages to 142 m.a.f., of which, 90.0 m.a.f water is diverted into canals. It is

further supplemented by 40.66 m.a.f: groundwater pumped through tubewells. The annual farmgate delivery in Punjab is 65 m.a.f with breakup shown in Table 2.

Table 2: Sources and Season-wise Delivery of water at Farmgate in Punjab

<i>No. Particulars</i>	<i>Total Quantity available ma.f</i>
1. Surface water	32.30
2. Ground Water	31.30
3. Total Water	63.60
4. Feet Per Acre	2.57

The annual growth rate of irrigation water availability has been 1.5 percent since 1985 which correspond to increase of 1.3 percent in irrigated area during the same period. The marginal growth rate both for water availability and expansion of area has significant implication for the future of extensive agriculture.

IDENTIFICATION OF CONSTRAINTS

The constraints in soil and water resources need focussing to provide adequate check on the deterioration of soil and water productivity. These constraints are classed into three main groups.

Soil Constraints

Soil is a dynamic system and is subject to changes brought about by the weathering agencies, continuous cropping and management. To check the trend disadvantageous to soil as economic crop media, following soil maladies require attention for proper management:

SALINITY/SODICITY

The salt-affected soils in Indus plain were formed as results of gradual deposition of salts in land of in the land scape from the time immemorial but hastened by the rise of groundwater table following the commissioning of irrigation system and emergence of barrier to natural drainage from railway and road network. The extent and kind of salt affected land are shown in Table 3.

Salinity and sodicity are two distinctly different soil diseases. The former is an engineering problem, curable by leaching with good quality water while the later is developed through alkalization process and can be reclaimed by use of gypsum and other amendments.

Table 3: Extent and Value of Salt Affected Soils in Punjab.

<i>Nature of Problem</i>	<i>Area in m/hac.</i>		
	<i>Pakistan</i>	<i>Punjab</i>	<i>% of Total</i>
Saline	0.63	0.43	18.2
Saline Sodic	5.13	1.89	80.1
Gypsiferous Sodic	0.12	0.04	1.7
Total	5.88	2.36	

SOIL EROSION

Soil erosion is an important phenomenon adversely affecting the productivity of our cultivated soils. The estimate of Punjab Agricultural Economic Information Board indicate that about 1.4 m.ha. are affected by erosion in Punjab alone which accounts for 17.7% of the total area in eleven districts. Water and wind are imperceptibly taking away the upper fertile layer. The process of erosion is more active on sloppy and naked lands (Table 4).

Table 4: Soils and Water Losses Under Different Slopes and Cropping Systems in Punjab

<i>Slope %</i>	<i>Soil Loss in t/ha/y</i>		<i>Run-Off %</i>	
	<i>Mono-Cropping</i>	<i>Mixed Cropping</i>	<i>Mono-Cropping</i>	<i>Mixed Cropping</i>
1	2.7	2.5	18	14
5	87.4	49.9	43	33
10	125.1	85.5	20	18
	109.08	68.8	27.75	21.1

The menace of erosion is threat to valuable resource and need appropriate measures to trap the vanishing soils.

SOIL IMPEDIMENT

Physical properties of soil frequently affect plant growth and limit plant response to applied fertilizers. Marked reduction on both top and root growth is result of soil compaction. The mechanized cultivation causes soil compaction. The impediment is induced due to lack of modern equipments. The effect of soil moisture on grain yield is shown in Table 5.

Table 5: Soil Moisture Percentage and Grain Yield as Affected by Tillage Treatments in 1983-85 Rabi Seasons in Barani areas of Punjab.

Tillage Treatment	Moisture Percentage				Grain Yield (Kg/ha)
	0-15	15-30	30-45	Average	
A. 1983-84					
Cultivator	2.8	13.7	16.5	14.3	2501b
Moldboard	13.8	13.7	16.1	14.5	3800a
B. 1984-85					
Cultivator	11.74	11.22	10.36	11.11	2130b
Moldboard	12.02	14.58	16.70	14.45	2890a

SOIL ENVIRONMENTS

Soil environments which play important role in the availability of nutrients to growing plants. The indiscriminate use of systematic insecticides and weedicides, adversely affect the micro-flora in the soil. These limited biological activities affect the conversion rate of essential nutrients into available form. In addition the desertification and urbanization of agriculture lands are the other serious constraints.

Water Constraints

The development of groundwater started soon after the initiation of SCARPS in the Punjab and increase in the number of private tubewells has been phenomenal. The number has increased to 2,52,000 tubewells during 1988, of which two-third are diesel operated. Groundwater pumpage from private and public tubewells added 40.66 m.a.f annually. The increased groundwater supply has significantly improved productivity since timely availability of water is critical variable for higher crop yields.

QUALITY OF WATER

The groundwater reservoir is brackish in nature and rich in sodium. The WAPDA estimates that about 16 m/acre of irrigated areas are underlain by hazardous water while Soil Survey Department of Pakistan holds the view that 15 m.a.f of water being pumped annually has sodicity problem. The

monitoring of tubewell both in public and private sectors showed that almost 75 percent tubewells pumped out substandard water, which is invariably rich in sodium (Table 6 and 7).

Table 6. Extent of Marginal and Hazardous Water in Punjab

No. of Tubewells Monitored	Marginal Well		Hazardous Well	
	Well	%	Well	%
1. Public Sector				
1977 Shallow	449	25	830	46
1050 Deep	241	23	604	58
2. Private Sector				
1242	264	21	665	54

Irrigation is known to be a necessary evil. Annually 4.3 ton/acre salts are being added in CCA from tubewell and canal supplies.

Table 7: Salt Built-Up Through Surface and Ground Water in Punjab

150 ppm	55.95 m.a.f	11.3 m/ton	Salts	(Total running water)
1000 ppm	25 m.a.f.	34.0 m/ton		
1500 ppm	8000 T/well	14.0 m/ton		
1000 ppm	2000 T/well	40.0 m/ton		
			88.0 m/ton	Salt in CCA
Total CCA 20.3 m/ton				
Addition of Salt/acre. 4.3 ton/year				

Data from trials in farmers field indicated gradual drop in intercept (Yields from unfertilized plots) over time. Drastic cut in yield of 41.49 percent has been recorded from soils commanded by tubewell alone and 23.21 percent supplemented with canal supplies (Table 8).

Table 8: Effect of Different Irrigated Water(s) On Fertilizer Use Efficiency in Wheat in Punjab

Surface of Irrigation	Control Q/Acre	Fertilizer Plots 46-30-0	% Decrease in use Efficiency
Canal	6.15	10.20	-
Canal-cum-Tubewells	5.42	8.53	23.21
Tubewells	5.50	7.91	41.49

Nutritional Constraints

Soils of Pakistan are generally calcareous with higher pH and low organic content (less than 1 percent) and are known for higher P fixation capacity. Also the continuous mining since ages without material efforts for replenishment, has impoverished the soil to an extent where they cannot nourish the healthy plants.

DEPLETING FERTILITY

The fertility evaluation in the laboratories has revealed an annual loss of 8.76 ppm and 0.23 ppm in potassium and phosphorus, respectively. Similar trends were observed in control plot where decrease in yield was 14 kg/ha/yr in wheat crop. The drain on P-reserves has been peculiar over period. The soil-P has decreased from 6.23 ppm in 1971-75 to 4.22 ppm during 1986-90. The yield of intercept and treated plot @ 50 kg/ha P₂₀2/ha below, indicated the declining trends (Table 9).

Table 9. Decreasing Yields Trend in Wheat in Punjab

Year	Intercept Kg/ha	Yield @ 50 kg/ha
1965-71	3725	4109
1975-83	2924	3273
1987-90	2791	3262

IMBALANCE FERTILIZATION

In spite of substantial progress made in development and improvement of fertilizer application, only 82 kg/ha is used at present. So far, nitrogenous fertilizers are most popular and easily available. Use of nitrogen alone has increased the

need for phosphorus and potassic fertilizers. Deficiency in supply system (75% N, 25% P₂O₅ and 2% K₂O) was the other cause for serious imbalance in nutrition. Low P-consumption has depressed the yield to almost 50 percent. The use of K in negligible quantity has its own repercussion (Table 10).

Table 10. Nutrients Removal by Crops in Punjab soils

Particulars	N	P ₂ O ₅	K ₂ O
Removal by crops	722	387	2329
Addition from Fertilizer	953	265	1245
Balance	+231	-122	-1084

Besides optimum use, the balance of fertilizing elements is important for higher yields. Among the micro nutrients there is inherent deficiency of zinc in our soils while others are becoming limiting factor for crop production over period. Sulphur, a mobile element is needed in all types of soil.

RESEARCH MEASURES/PROPOSALS

Forementioned constraints limit crop yields. Furthermore, present efforts and their distribution are insufficient to provide reasonable degree of certainty. To alleviate these constraints, adequately developed technology is needed to permit continuing increase in production. Following measures/policies are suggested to abridge this gap.

- Improve national agricultural productivity by expanding/strengthening soil and plant nutrition research.
- Reclaim salt-affected (sodic) soils and ameliorate marginally fit tubewell waters through use of amendment.
- Strengthen soil advisory service in order to rationalize the use of fertilizer and render advice on soil and water management.
- Create infrastructure for fertilizer supplies at farmgate in proper mix.
- Develop liaison/system for transfer of production technology.

A number of institutions are already involved in soil plant nutrition research. Besides ensuring full

involvement of these institutions, covering geographical areas and utilizing existing resources, the major focus be on strengthening, catalyzing and increasing the quantity and quality of research in priority zones.

DEVELOPMENT STRATEGIES

The following strategies are suggested:

Soil Research Institute

Establish a Soil Research Institute with adequate facilities for soil plant nutrition research in the province. The institute would give lead to a systematic approach for developing an effective soil management, low chemical input system, soil and water conservation and crop tolerance to soil stresses and so on. The proposed institute could be located at a main research center and disciplines related to soil and water placed under its folds. The neglected fields like soil physics, plant nutrition and soil/water management be added to make the institute a model to overcome specific problems through use of modern methodology.

Supply of Fertilizer at Farmgate

Ensure the supply of fertilizer in required quantities and recommended brands at farm gate. Nonavailability add to reluctance of farmers for procurement and application.

Enactment of Fertilizer Law

Control legally the quality production and marketing of fertilizers/amendments.

Gypsum Subsidy

Subsidize gypsum prices which helps in reclamation of sodic/saline sodic soils and amelioration of sub-standard irrigation water.

Credit Availability

Make credit available for small farmers, which have neither means to apply fertilizer nor have access to avail the credit facilities/opportunities.

Transfer of Technology

Transfer improved production technology developed through research, to farmer's fields. Mobile advisory service could help identify constraints and render advice for proper management the on spot.

Training of Field Staff/Farmers

Arrange periodic training for field staff associated with farming community to abreast the latest developments in soil research. Presently

training is imparted to Field Assistants, expand and strengthen these facilities for training of field officers and progressive farmers. To broaden the knowledge of field staff arrange periodic visits to research laboratories.

Research Allocation

Research in soil and fertilizer provides new avenues for improving the health and productivity of soil and can pave the way to green revolution, but this discipline has not been getting due attention in the past in the scenario of developmental activities. At present, the financial support is inadequate compared to crop sector. The allocations need to be raised for meeting the requirements and vitalizing research activities.

SUMMARY

Basic resources for agriculture are land and water. Cropped land during the last fifteen years has increased compared with population growth rate. The depletion of live storage at Mangla and Terbela dam @ 0.034 and 0.150 m.a.f. per year due to siltation is of significance implication. Therefore, the management of these resources is vital for achievement of sustainable agriculture. The inventory of cultivated area in CCA indicates that about 74 percent soils are good (class-I and II) with very high crop potential. These soils also respond to good management. The salinity/sodicity occurs over 1.61 m.ha (20.5 percent) in CCA. In addition, about 0.27 m. ha are under waterlogging. The barani area, one-fourth of total cultivated lands is suffering from erosion. The fragmentation of holdings and utilization of productive land for non-agricultural uses, are other social constraints.

Water is a limiting resource both for irrigated and barani agriculture. It comprises Indus River and its tributaries and supplemented through installation of about 2,67,000 tubewells. The diversion of 3.5 acre ft at the source, to hardly 2.0 acre ft is available in the rhizosphere. The groundwater quality is a serious concern for irrigated agriculture since the bulk of aquifer is brackish in nature and rich in sodium. About 75 percent of tubewells, are pumping sub-standard water thus aggravating the salinity and sodicity hazard.

PLAN OF ACTION

Research in soil and water has provided new avenues for improving the health and productivity of soils and groundwater development but could not pave their way in the over all scenario of national planning. The following measures are, therefore, suggested for future policy.

Land

Land is a dynamic source which is affected by the weathering agencies, continuous cropping and management practices. To check the trends disadvantageous to soil as economic crop media, the immediate attention is required to:

- Establish a Center of Excellence for Soil Plant Nutrition Research with adequate facilities in the province. The institute would give lead to systematic approach for developing and effective soil management, low chemical input system, soil and water conservation and crop tolerance to soil stresses. The neglected fields like soil physics, plant nutrition and soil/water management will be added to make the institute a model to overcome specific problems through use of modern methodology.
- Ensure the supply of fertilizer in required quantities and recommended brands. Nonavailability of fertilizers add to the reluctance of farmers for procurement and application.
- Soil amendment with gypsum helps reclamation of sodic/saline sodic soils and amelioration of sub-standard irrigation waters. But high price remains the main constraint for its use as ameliorant. Therefore, provide gypsum at subsidized rate to farmers.
- Encourage the farmers for consolidation of their fragmented farms. Transfer fees should be abolished for the farmers wanting to consolidate their land. The proper legislation is imperative to safeguard the irreversible use of productive land.
- Research work on soil-moisture-fertilizer technology such as the use of terraces, bunds, check dams and water ways have been developed for areas facing erosion. However, implementation of package in the farmers fields is very slow. The research and promotion of the water harvesting practice in barani areas need proper streamlining.
- The saline land and brackish water are the bear realities. The future development will come through efficient use of these degraded sources. The research has been initiated to develop the seed and fertilizer technology suitable under these conditions. Such programs be augmented for more meaningful results.
- Arrange periodic training for field staff

associated with the farming community to abreast the latest developments in soil management. Presently the training is imparted to Field Assistants but it should be expanded for training of field officers and progressive farmers. The training visits to research farms/laboratories would broaden the outlook and knowledge on agriculture production.

Water

On the basis of the identified problems and constraints pertaining to inadequate and inefficient operation, management and maintenance of surface and groundwater resources, following recommendations are made for inclusion in the National Agricultural Policy.

- Strengthen the irrigation water management program by expanding on-farm water management and command water activities through improvement of community water courses and precision land levelling by introducing laser controlled equipments. The water user association as NGOs be entrusted with joint operation of public and private tubewells and distribution of other inputs and credit facilities by registering them as multi-purpose agricultural cooperatives.
- Improve the development and management of water resources in Barani area by (i) Introducing low cost, high efficiency pressurized irrigation systems, (ii) Installation of locally developed low cost, energyless hydra-ram pumps on natural springs and streams, (iii) Introducing the water turbine pumps for lifting irrigation water and small hydra-power generation, (v) Construction of large and small water reservoirs and (v) Commissioning of command area development program of small dams in barani areas.
- Manage the water resources in riverain areas with installation of shallow tubewells and introducing sprinkler/drip irrigation methods.
- The disinvestment /privatization of SCARP tubewells; installation and operation of shallow tubewells with mobile pumping sets and modification of SCARP tubewells by replacing them with centrifugal pumps be initiated to develop ground water resources.
- The reclamation of deteriorated lands be entrusted to a private organization. At present, 2548 tubewells are pumping highly saline groundwater, adding salts to culturable lands

and causing loss of 5.0 m.a.f usable water and eliminating chances of skimming. It needs be considered for their replacement by shallow multi-strainer tubewells.

- Establish a Water management research institute to undertake research, development and training in land and water resources, particularly for investors of shallow groundwater and development of low cost technologies for barani, semi-desert sub-mountainous and water scarcity areas of the Punjab.

Fertilizer

Inadequate and imbalance fertilization is wasteful effort that failed to achieve the desired benefits. In view of the importance of fertilizers for crop production and to the long term growing needs for fertilizers and their use-efficiency, the following measures are suggested:

- Ensure the supply of different fertilizers at farmgate in proper mix of recommended brand.
- Persuade the farmers to use complex fertilizers instead of urea alone. Promote the use of trace elements.
- Treat the salt-affected soils and areas commanded by sub-standard tubewells with gypsum to increase the use efficiency of fertilizer. Encourage the application of gypsum at subsidized price.
- Support private investment for the production of nitrogen fertilizers. Develop long term purchase contracts with phosphate + potash fertilizer producers in order to guarantee supplies and stabilize purchase prices of fertilizers. Production of nitrophos is another field to meet the requirement for balance fertilization.
- Soil Fertility Organization be strengthened to establish, maintain and operate local soil testing laboratories that will test soil samples for plant nutrient deficiencies, harmful pH level and chemical and mineral deposits. The mobile advisory service could help the farmers to forestall the wasteful expenditure on fertilizer and render advice for proper management of soil and water on the spot.
- Enacting the fertilizer law to eliminate the materials of varying compositions and substandard product which adversely affects crop production.

NWFP

SOIL SUSTAINABILITY

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Abstract: *The importance of soil sustainability is stressed as viable and successful agricultural development is impossible without a soil-plant system based on sound and scientific management program.*

INTRODUCTION

Environmental degradation, deterioration of natural resource base, rapid population growth, and fast urbanization and industrialization, sustainability of agricultural system has become extremely important. To maintain the agro-ecological and terrestrial balance, adaptation of measures leading to agricultural sustainability and management of overall natural resources cannot be over-emphasized.

By the end of this century, Pakistan, with 0.67% of the world's land will have to accommodate 4% of the world's population. This scaring fact warrants for much more careful thinking, planning and formulation for maintaining and improving the natural resources. Without effective and meaningful research and development strategies, the realization of the goal of conservation of the major national resources such as soil, water and air would never be possible.

The modern concept of sustainability is "successful management of resources for agriculture to satisfy changing human needs while maintaining and enhancing the quality of the environment and conserving natural resources". Data on land and water (Table 1) will help to understand the problems for sustainability of natural resources.

Only 25% of the land is under cultivation and 5.2% under forest. The remaining portion is either range land or cultivable waste.

Table 1: Water and Land Resources in Pakistan

<i>Total Land Area</i>	<i>M. Hectares</i>
Cultivated	20.70
Cultivable	11.80
Land not available for Cultivation	25.30
Forest	04.57
Unclassified	15.00
<i>Total</i>	<i>77.87</i>

SUSTAINABLE USE OF SOILS

Crop intensification has led to problems of maintaining soil fertility. Organic matter depletion, trace mineral deficiencies and decreased diversity of soil organisms are symptoms of decreasing sustainability. Therefore, the sustainable use of soil essentially demands using it according to its capability, treating it according to its needs for obtaining maximum possible productivity under an economically feasible system. Sustainable use of soil must include adequate measures to maintain the quality and quantity of soil environment on permanent basis. The central concept of soil sustainability must ensure:

- ◆ Maintenance of its physical, chemical and biological properties in a balanced form.

- Avoiding deterioration of soil physical properties, depletion of soil fertility for optimum agricultural productivity.

Unfortunately, our very basic and vital soil resource is threatened with serious problems such as severe accelerated erosion, waterlogging, salinity-sodicity, poor fertility and soil pollution. These processes affect both quality and quantity of soil.

Soil Erosion

About 4.45 million ha are threatened by water erosion and directly affected by loss of productivity, gullung and mass wastage. The impact of water erosion causes multiple colossal losses. In addition to the loss of valuable top soil and water the massive siltation in the down streams reservoirs, flood plains, beds of rivers, canals and water distribution systems virtually proves to be phenomenal problem (Table 2).

Table 2: Rate of siltation in Mangla and Tarbela dams in Pakistan.

Land affected by ater erosion	3b%
Estimate of erosion at Tarbela catchment	2.4 Kg. M ⁻²
Rate of soil carried by Chenab and Jehlum	4-7 (10) ³ Mg Yr. ⁻¹
Rate of siltation in Mangla Reservoir	48.27 x 10 ⁶ M ³ Yr. ⁻¹
Rate of siltation in Tarbela Reservoir	167.75 x 10 ⁶ M ³ Yr. ⁻¹

Due to sedimentation in Mangla and Tarbela, the nation is losing approximately Rs. 2340 million per year due to loss of fertile soil, shrinkage of storage capacity, reduction in agricultural products, power generation and industrial output.

Waterlogging, Salinity and Sodicity

About 40,000 ha land is affected by waterlogging and salinity. As such 5.7 million ha area is under the affect of waterlogging and salinity. For a sustainable agricultural development, along with the efforts of SCARP, IWASRI, WAPDA, other research institutions must get involved to combat the problem of waterlogging and salinity. Questions which need to be considered include:

- Is tubewell installation effective to lower the water table?
- Is gypsum application based on sound laboratory analysis?
- What are the prospects of reusing saline drainage water?

- Would tile drainage system succeed?

Soil Fertility and Environmental Quality

In a sustainable system, soil fertility should be maintained to get optimum economic production without the ill effects of over fertilization on the environmental health such as crops, surface and ground waters. The Pakistani soils have inadequate content of available N and P for optimum crop production, even micronutrients (Fe, Cu, Zn and B) are considered inadequate for crop growth. To avoid extra cost and to prevent contamination of water resources indiscriminate application of N,P and K fertilizer must be discouraged. Similarly, the factor of cost benefit must be considered while deciding the applications of micronutrient. The percent increases in yield associated with application of micronutrient need to be evaluated in terms of total net productivity in relation to total cost.

Residual Soil Phosphorus

The soils of Pakistan are calcareous and alkaline in nature. Because of high CaCO₃ (ranging from few percent of over 20%) and high pH value (7.5 to 10.0), the continuous application of phosphatic fertilizers can form a pool of insoluble soil-P. Proper adsorption-desorption studies on soils receiving heavy P fertilizer, can prove useful in determining actual P needs of the soil. Nitrogenous fertilizers known to acidify soil rhizosphere may be helpful in increasing the solubility of insoluble soil solid phase P and thus render it bioavailable.

Biological Nitrogen Fixation

Nature has provided an abundant source of dinitrogen (N₂) to mankind in the atmosphere. Unfortunately, we have not exploited the potentially significant source of biological N₂ fixation in terms of crop species. Research and extensive outreach work is needed to communicate the benefit of natural N to the farmers fields.

Soil Pollution

To sustain the quality of soil desirable for environmental health, it is important to consider the sources of pollution such as atmospheric fall out, soil waste disposal, use of industrial effluents for irrigation and residual affect of pesticides as integral part of a sustainable agricultural system. Most of the industrial effluents rich in toxic chemicals and heavy metals (Pb, Cd, Hg, and Cr) are either used directly for irrigation or dumped into rivers, the water of which is lifted for irrigating agricultural crops. Due to lack of water treatment plants, the domestic waste waters, although rich in nutrients, contain heavy metals known to be carcinogenic and mutagenic.

In Pakistan about 520 Mg (tons) Pb is released per year from vehicles. Soil wastes amounting to 47920 Mg per day is generated, out of which 50% is collected and disposed directly into the land. Several tons of chemicals are dumped into the Kabul River in the form of industrial effluents. The water of Kabul River is used for irrigation and in some cases for drinking waters. Such activities are essentially causing serious adverse effects on terrestrial-aquatic environments.

SUGGESTIONS FOR FUTURE ACTION PLAN

Soil Erosion

To control soil erosion by wind and water an integrated program is required for successful application of the approved soil and water conservation practices such as mulching, cover cropping, proper crop rotation, stream bank stabilization, contour ploughing contour-strip cropping, terracing, levelling and construction of ponds and small dams in rained areas.

Waterlogging and Salinity

In the light of the technical evaluation of SCARP performance, revised strategies need to be adopted. It has to be determined upto what extent tile drainage system is being successful in lowering the water table and in removal of salts. What are the after effects of drainage system on irrigation water demand of crops in reclaimed areas? Should sustainability of the sub-soil drainage system be a problem, has to be evaluated.

Soil Fertility

Fertilizer application must be made soil specific and crop specific. Arid regions may show promising results to low level of fertilizer application, if proper varieties are available to farmers. It is believed that application of N and P beyond 100 Kg ha⁻¹ for common cereal crops may not be advisable. Micronutrient application must be minimized until and unless the need for application is proved through laboratory and field results.

Soil Pollution

Intensive studies are needed to evaluate the magnitude of soil pollution through fertilizers, pesticides and industrial and domestic wastes. Major industrial regions should be considered for detail investigations on priority basis.

Water Treatment Plants

Currently the facilities of waste water treatment plants are virtually non-existing. Such plants can prove extremely useful in preventing the pollution of soil and water resources and will essentially help in maintaining the soil and water sustainability.

Farmers Training Program

Imparting training and advising several thousand farmers at their door steps may be difficult for extension and research workers. It may be advisable for research centers and agricultural universities to impart training to farmers every year at their campus. This training can focus on important issues such as soil sampling, fertilizer application, importance of legumes, proper soil and water conservation measures.

Inter-Institutional Coordination

Inter-Institutional coordination in different research areas can help promote the realization of goals of sustainability. Exchanging ideas may prevent duplication of research programs and will certainly prove helpful in complementing each others knowledge and technical know-how.

Proper Statistical Applications

For validity and applicability of research data, statistics can be an important tool. Statistics must be involved well in advance before planning and designing any field experiments. Precision and accuracy must be given priority in research.

Legislation for Planning and Developing Housing and Industrial Estates

Currently many housing and industrial estates are constructed unscrupulously and indiscriminately on fertile and productive agricultural land. With proper legislation such construction can be planned on land which is otherwise non-productive. Proper planning of township will also provide adequate drainage facilities which will reduce the chances of soil and water contamination.

NWFP

MANAGING FORESTS, WATERSHED, GRAZING-LANDS, LIVESTOCK AND PREVENTING DESERTIFICATION

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INTRODUCTION

Sustainable management of forests, grazing and livestock is management which yields optimum benefits to the nation and local people, while improving the productive potential of soil, forest growing stock, grazing-land vegetation, and livestock herd for sustained production in the future, at an increasing level of productivity.

SUSTAINABLE MANAGEMENT OF FORESTS

Well-stocked Reserved Forests suitable for intensive management

FACTORS RESPONSIBLE FOR DEPLETION

- Theft of timber for commercial gain.
- Cutting and lopping of trees, for use and firewood.
- Grazing, which prevents the regeneration of forests.
- Encroachment on forest land, for agriculture.

ACTION NEEDED FOR SUSTAINABLE MANAGEMENT

- Depoliticize Forest Department by merging Forest Department and Forest Development Corporation into Forestry Corporation responsible directly to the Chief Minister, and charged with forest management, timber harvesting, and establishment of primary forest industries.
- Stop all political interference in the appointments and transfer of forest employees, from Forest Guard up. Appointments should be on merit and transfers in the public interest.

- Rationalize size of forestry jurisdictions to make them amenable to intensive forest management.
- Invest massively in the improvement of timber harvesting, forest regeneration, and establishment of primary forest industries to open avenues of employment for rural mass, thereby weaning them away from illicit cutting and lopping of trees and dependence on livestock.
- Increase the stake of local people in sustainable management of reserved forests by restoring the same proportion between the market price of timber and the seigniorage fee payable to local people, as existed at the time of promulgation of this fee.
- Use enhanced seigniorage fees, and social forestry, watershed management, and grazing management projects to organize local communities for improving forest protection.
- Regenerate harvested areas promptly, ensuring them effective protection from grazing, as long as required, with the collaboration of local communities.
- Reduce the demand for wood as domestic fuel, supply gas to small towns in hills.
- Educate the Judiciary and the Executive in environmental concerns, especially in importance of forests and serious consequences of deforestation.
- Revise relevant provisions in Forest Acts to restore their deterrent capacity which has been greatly eroded since the Acts were passed.

Protected Forests, with 60 percent Share of the Local People in the Sale Proceeds from Timber

FACTORS RESPONSIBLE FOR UNSUSTAINABLE MANAGEMENT

- Theft of timber for commercial gain.
- Cutting and lopping of trees, for use and firewood.
- Grazing, which prevents the regeneration of forests.
- Encroachment on forest land, for agriculture.
- Complications of shared ownership.
- Unlimited rights of user.
- Short history of scientific management.

ACTION NEEDED FOR SUSTAINABLE MANAGEMENT

Following action needed for sustainable management on the lines of Kalam Integrated Development Project:

- Organize local communities for participation in forest protection and management and timber harvesting; and improved agriculture, grazing land management, and livestock husbandry.
- Provide effective technical support for all the above.
- Provide seed money to encourage the village communities to embark on the above mentioned ventures which would become self-sustaining eventually.

Guzara Forest of Hazara Civil Division

FACTORS RESPONSIBLE FOR UNSUSTAINABLE MANAGEMENT

Guzara Forests under the management of the cooperatives of their owners:

- Concerns about equity as regards small Guzara owned and the landless.
- Concerns about sustainability high harvest cuts and inadequate regeneration.

Guzara Forests under the management of Forest Department:

- Lack of sensitivity of Forest Department to the

needs of the Guzara forest owners.

- Inadequate regeneration.

ACTION NEEDED FOR SUSTAINABLE MANAGEMENT

- Review the management of Guzara Forests, both under the co-operatives of their owners, and Forest Department, and take remedial measures.

Communally Owned Moist Mountain Lands

FACTORS RESPONSIBLE FOR UNSUSTAINABLE MANAGEMENT

- Lack of knowledge.
- Lack of social control on communal land.
- Lack of resources.

ACTION NEEDED FOR SUSTAINABLE MANAGEMENT

Following action needed for sustainable management on the lines of Kalam Integrated Development Project:

- Organize local communities for participation in forest protection and management and timber harvesting; and improved agriculture, grazing land management, and livestock husbandry.
- Provide effective technical support for all the above.
- Provide seed money to encourage the village communities to embark on the above mentioned ventures which would become self-sustaining eventually.

Communally and Privately owned Semi-Arid Rainfed Grazing Lands

FACTORS RESPONSIBLE FOR UNSUSTAINABLE MANAGEMENT

- Lack of knowledge.
- Lack of social control on communal land.
- Lack of resources.
- Paucity of available local knowledge.

ACTION NEEDED FOR SUSTAINABLE MANAGEMENT

- Organize local communities for participation in forest protection and management and timber harvesting; and improved agriculture, grazing land management, and livestock husbandry.

- Provide effective technical support for all the above.
- Provide seed money to encourage the village communities to embark on the above mentioned ventures which would become self-sustaining eventually.
- Obtain relevant foreign research information.
- Conduct "farming systems" type of research on local problems, ensuring the collaboration of the local.
- Communities at all stages.

WATERSHEDS

Factors Responsible for Degradation

- Human and livestock population in excess of the carrying capacity of the mountain land.
- Deforestation.
- Cultivation of steep mountain slopes.
- Cultivation of sloping land without adopting adequate soil conservation measures.
- Overgrazing.

Action Needed for Sustainable Management

- Start massive integrated area development projects covering all the following minimum components:
- Organizing local communities for effective project implementation.
- Creating an efficient and effective mechanism for the motivation of people; delivery of relevant information and supply of needed inputs for forestry, mountain agriculture and horticulture, soil conservation, grazing management, and animal husbandry; and improving marketing of products from mountain lands.
- Implement proposals for the sustainable management of forests, grazing lands, and livestock.

LIVESTOCK

Factors Responsible for Non-sustainable Management

- Inadequate feed.
- Debilitating parasites and diseases.
- Inefficient marketing.
- Price control on livestock and their products.

Action Needed for Sustainable Management

- Organize local communities to effectively receive and act on knowledge needed for sustainable management of livestock.
- Enable the efficient availability of relevant animal husbandry and animal health information.
- Increase the yield of maize grain and stores in the moist mountains.
- Increase the intensity of agriculture on all cultivated land, and include fodder in crop rotations.
- Remove price controls on livestock products to make scientific animal husbandry profitable.
- Promote the efficient marketing of livestock and their products to increase off-take, and reduce the size of standing herd, for balancing it with available feed.

PREVENTING DESERTIFICATION

Factors Responsible for Desertification

All factors are responsible as described above, for the sustainable management of forests, grazing lands, and livestock.

Action Needed to Prevent Desertification

All steps indicated in the foregoing account, for promoting the sustainable management of forests, grazing lands and livestock.

NWFP

DEVELOPMENT POTENTIALS OF NWFP BARANI TRACTS - A NATURAL RESOURCE BASE FOR SUSTAINABLE AGRICULTURE

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Abstract: *The paper discusses possible avenues to be explored for developing barani areas. These includes: (i) suitable high yielding varieties specifically for rainfed areas, (ii) better and timely cultivation for moisture conservation, (iii) use of balanced fertilizer at right time, and (iv) weed control at appropriate time.*

INTRODUCTION

Agriculture continuously plays an important role in Pakistan's economy as it supports three-fourth of the country's population for their sustenance, employs 52% of the total labor force, accounts for 26.3% of GDP, contributes about 80% of foreign exchange earnings and provides raw material for major industries. Therefore, the economic well-being of the people of Pakistan critically depends upon the efficient performance of its agriculture sector.

Pakistan joins the international community of nations to fight the menaces of poverty, hunger and malnutrition faced by the people of developing countries and thus stands committed to the welfare of millions residing in rural areas. All this urges efficient utilization of all possible agricultural resources to meet the food and fiber requirements of rapidly growing population in Pakistan.

Over the last two decades, agriculture in Pakistan has advanced rapidly. The strategy in the sixties was directed mainly towards achieving self-sufficiency in agricultural products, through expanded use of subsidized inputs, including irrigation and adoption of improved varieties; during later part of seventies and early eighties, the success resulted largely from introduction of high yielding varieties, improved production technologies and price support policies of the government. As a result of sound strategies and development policies adopted by the Government of Pakistan, the agriculture sector has recorded impressive gains during the last decade.

The National Commission on Agriculture have identified constraints and suggested sound policies, strategies and development priorities for rapid growth in agriculture sector especially to transform the present agriculture from self-sufficiency in food to export and agro-industrial base.

Increasing rate of population at the annual rate of 3% has increased the significance of food production in arid and semi-arid regions of Pakistan. The rainfed (barani) lands in Pakistan at present, are being managed at extremely primitive levels of technology. Although these lands constitute 24 percent (5.0 m. ha) of the cultivated area (20.5 m. ha), they yield only 10 percent of Pakistan's agricultural production. Consequently, low farm income has resulted in a subsistence living of the people residing in these areas. However, there is no denying the fact that by improving management of rainfed areas and employing appropriate technology, productivity and ultimately income of barani farmers can be greatly increased. It has been established that in barani lands, two to four times more yield can be obtained in wheat, oilseeds, pulses, maize, and other crops by adopting improved package of technology including (i) suitable high yielding varieties specifically for rainfed areas, (ii) better and timely cultivation of moisture conservation, (iii) use of fertilizers at right time, and (v) weed control at appropriate time. Most suitable agronomic practices right from land preparation to harvesting as well as agricultural machinery specifically designed for rainfed lands are needed which would aim at

moisture conservation by special techniques and also a change in cropping pattern to bring about a significant improvement in agricultural production.

SIGNIFICANCE OF OUR DRYLANDS

Our non-irrigated or rainfed areas, the bulk of which constitute arid and semi-arid lands, were left out of the green revolution as they were considered as high risk for agriculture. However, their contribution to the national food supply suggests that these areas are too big a resource to be ignored. These rainfed crop lands contribute a significant percentage of wheat production, jowar, millet, pulses, gram, ground-nut and rapeseed and mustard production to the overall national production.

Nearly 70% of the livestock population in the Punjab is supported by the Punjab barani tract, more than 80% of the livestock population in Balochistan is sustained by arid lands of this province which contributes nearly one-fourth to country's sheep and goat population and a significant percentage of livestock populations in NWFP and Sindh are supported by arid and semi-arid regions of these provinces.

BARANI AREAS OF NWFP

Barani areas, which constitute 60% of cultivated land in NWFP are well-spread throughout the three agro-ecological zones of the province:

Northern Zone

It comprises high mountains fertile valleys of Malakand and Hazara Divisions where average rainfall varies from 600 mm at the southern end to over 1300 mm in the north. The area is suitable for raising both Kharif and Rabi crops, including oilseeds, pulses as well as for range development. Forests are already well established in these area. Range development would open field for animal husbandry and poultry development. About 60% of the culturable land in this zone is rainfed.

Central Zone

It is situated in the wide flat valley floor of the Kabul and lower Swat rivers eastward from Peshawar. This zone is intensively irrigated and only 35 percent of the culturable land is barani under mono-cropping system or mixed cropping mainly in rabi season. In some areas, Kharif crops i.e. maize, millet and sorghum, some oilseed crops and pulses, etc., can be grown.

Southern Zone

It lies south of Peshawar where rainfall is less

reliable and varies from 500 mm in the northwest corner of the zone to less than 250 mm in the south. This includes Kohat and D.I. Khan Divisions. It is absolutely rabi season mono-crop area. Important crops of this zone are wheat, barley, gram, rape mustard and pulses. In some cases, mixed cropping (wheat, gram or gram and rap/mustard, etc.) is also practiced. Both the central and southern zones also provide ample scope for the promotion of animal husbandry program, rangeland management and afforestation. About 70% of the cultivated area is barani.

Though rich in soil, the productivity of agriculture from these areas is much less than that of irrigated areas. This is clearly illustrated by the following area and production figures:

Crop	Area		Production	
	Total(ha)	Barani(%)	Total(Ton)	Barani(%)
Wheat	781,936	61	906,526	41
Barley	079,834	83	060,102	73
Gram	097,001	93	53,791	89
Oilseed (Rape & Mustard)	36,391	93	16,097	90
Maize	440,925	47	580,567	32
Bajra	13,467	92	6,009	91
Sorghum	21,385	91	11,115	90
Groundnut	4,994	91	7,839	88
Pulses	16,760	100	11,468	100

This disproportion between the area and production of barani lands could be attributed to:

- Uncertain and inadequate rainfall particularly in the arid and semi-arid zones
- Lack of appropriate farming technology for rainfed agriculture
- Inadequate focus of the past as well as of the on-going developmental programs on a planned and coordinated development of barani areas

- Inability of the local farmers to have access to adopt even the available technologies on account of their poor financial conditions.

MAJOR CONSTRAINTS

Major constraints in the development of barani areas are:

Crop Sector

- Lack of perfected production technology.
- Lack of public or private inputs supplying agencies.
- Financial position of farmers cannot take risk of putting at stake both seed and fertilizer as well as physical efforts.
- Inadequate availability of credit, both from commercial banks and cooperatives.
- Higher prices/hire charges of farm machinery, i.e., tractors, bulldozers and so on.
- Weak financial position of farmers do not allow them to land development which is uneven.
- Higher cost of inputs is constantly going up due to withdrawal of subsidies, that affects purchasing power of the poor farmers.
- Lack of infrastructures.

Livestock

Since income from agriculture is limited, bulk of the population of Barani areas depends upon livestock as supplementary source of livelihood. However, even income from this supplementary source is constrained due to lack of proper and adequate feed for maintenance of livestock.

Forestry and Rangelands

About 2/3rd of barani areas comprises rangeland. Unfortunately, this useful natural resource is being depleted/impoverished due to heavy biotic pressure. Forestry development is hampered by lack of cost effective xerophytic species and technology.

Agricultural Engineering/Soil Conservation

Barani soils are very much prone to erosion hazards both through winds and rains. These hazards have played havoc in barani areas and have rendered these lands uncultivable/unproductive.

Much efforts in the field of soil conservation are needed to reinstate productivity of the land and rehabilitate farming.

Notwithstanding its existing shortcomings and problems, barani tract in the province possesses great potential for making a substantial contribution towards realization of our future production targets and socio-economic goals. All what is required is to work out a viable strategy and sustained efforts for its implementation.

DEVELOPMENT STRATEGY

In order to bring out an overall improvement in the condition of barani areas, on an uninterrupted basis, an integrated area development approach will have to be adopted. This will include:

Improvement of Agricultural Production

- Intensification of research on barani agriculture under the on-going as well as new programs to be implemented with a sizable contribution from national agencies.
- Land levelling and soil conservation practices.
- Creation/supplementation of irrigation facilities through:
 - Installation of tubewells for exploitation of ground water.
 - Construction of small dams for harnessing torrents/run-off.
 - Small irrigation schemes for utilizing the water of springs/perennial streams wherever possible, including lift-irrigation scheme.
- Production of seed varieties suited to barani conditions.

Development of Livestock farming

- Improvement of rangelands.
- Introduction of improved fodder varieties.
- Expanded implementation of artificial insemination program for cattle and introduction of improved breeds of sheep and goats for cross-breeding.
- Training of farmers in cattle breeding, dairy management and poultry farming.
- Introduction of rational grazing/stall feeding practices.

- Establishment of feed mills.

Extension of tree cover

- Private lands.
- Community land.
- State lands.

Road Network

- Establishment of a wide-spread network of rural roads for facilitating transportation of agricultural produce to the best possible market.

Institutional Arrangements

- Establishment of institutional arrangements for streamlining the marketing of agricultural produce.

Agro-Industries

- Establishment of agro-based industries to generate income as well as employment opportunities.

It is indeed encouraging to note that parameters for Pakistan's present agriculture sector policies were laid down in the Report of National Commission on Agriculture (March, 1988) and were subsequently reflected in the Seventh Five Year Plan (1988/89-1992/93) and the National Agricultural Policy Statement of May, 1991. The latter statement advocates an agricultural policy of self-reliance, social equity, export orientation, sustainable

agriculture and enhanced productivity. Its basic objectives are:

- To achieve self-sufficiency in cereal and other essential farm products and increase production of high-value crops for export.
- To ensure stable support prices for agricultural outputs and adequate availability of agricultural inputs, including credit.
- To improve marketing infrastructure.
- To conserve land, water and forests as agriculture's resource base.
- To fill the research gaps and ensure rapid transmission of new technologies.
- To enhance the role of private sector in all agricultural activities, emphasizing agri-business and agro-industry.

In line with government policies, the NWFP Provincial Government now intends to commence a long-term development program on province-wise basis to improve the quality of life and income-earning opportunities in barani areas. Realizing that the development of barani areas is not linked to the development of agricultural sector, the NWFP Provincial Government is of the view that a program, which focusses on improvement of agricultural productivity and the creation of off-farm income earning opportunities, supported by the provision of basic physical and social infrastructure, will have the widest possible positive impact in barani areas.

NWFP

THE ROLE OF BIO-DIVERSITY IN SUSTAINABLE AGRICULTURE

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Abstract: *Bio-diversity mainly aims at the diversity of biological species which exist in an eco-system. Conservation of bio-diversity plays an important role firstly for environmental protection and secondly for development. This paper presented the role of bio-diversity in sustainable agriculture.*

INTRODUCTION

It is of great importance for the conservation of bio-diversity that one should maintain a comprehensive system of protected areas so that viable population of most species is adequately conserved. It will be of much use to lay emphasis that the protected areas are supplemented by appropriate policies in the surrounding lands so that the human population could be benefitted. By doing so the need will arise for proper distribution of benefits that will arise for conservation by involving changes in land tenure, agricultural incentives and reservation of degraded land. These step will include:

- Improvement in wild plants and species conservation.
- Enhancement in knowledge and understanding for conserving species and work for betterment in an eco-system.
- Establishment of a gene bank for collection, evaluation, and maintain species and genetic resources in combination of in situ and ex situ conservation.
- Improvement in the use of herbicides, pesticides and insecticides that will play a pivotal role for sustainable agriculture including the issue of bio-diversity.

It will be pertinent to mention that there has been a narrow sectoral view of species such as fisheries, forestry, economic crop plants, and wild life, etc., as far as conservation of species is

concerned. Now there is a need for broader approaches in order to ascertain as to how different sectors can work to their own mandates and still to contribute to the national and international objectives of conserving bio-diversity.

PRESERVATION OF GERmplasm

Agricultural germplasm is the plants or animals for which modern agriculture has derived varieties and breeds. Germplasm although applied to whole organisms or their parts such as seeds, tubers, pollen and semen, etc., also refer to their genetic composition.

Simply speaking, germplasm collection of soybean may look similar to another field of soybean but it will be genetically diverse grouping which a breeder may use to develop new varieties or novel characteristics to existing ones. Once isolated and identified, microorganisms can be maintained in pure cultures that can be stored, dried or kept at freezing temperatures. Plant germplasm can be maintained as seeds, tubers, cuttings of branches, sterile tissue culture or field plantings. Animal germplasm is most frequently maintained as herds, flocks or similar assemblages.

Germplasm resources of crop species according to their use and place of origin can be divided into:

- Wild relatives.
- Primitive cultivars and land races.
- Breeding lines.

- Cultivated varieties.
- Engineered lines.
- Special genetic stock.

Animal germplasm is found as wild species, specially developed breeds and traditionally developed breeds.

Collection and maintenance of germplasm today includes in situ conservation of natural habitats or planted pure stand in the place of origin and ex-situ conservation by cold storage, cryogenic preservation, tissue culture or field collection of plants.

GENETIC EROSION AND THE NEED TO CONSERVE GERmplasm

Since the beginning of scientific plant breeding, a decline has taken place in both the number of crop species and the genetic variation within species. In fact, the range of genetic diversity of the world's major crops may well be declining rapidly. With the use of improved varieties that have spread, there has been accelerated loss of the genetically diverse traditional land races through displacement.

One rationale for preserving genetic diversity is to ensure against future agricultural catastrophe, investment for future need and a matter of moral principle. Plant breeders have drawn extensively on the genetic diversity of crop germplasm to achieve tremendous gains seen in the past two decades. Further gain will, however, require continued availability of such materials and expansion of existing collection. Assembly and management of these collections of genetic resources faces many obstacles. First in the genetic erosion, the loss of uncollected materials continues. Once in collections, materials can still be lost through improper management and negligence. National programs particularly in developing countries are to be strengthened, enabling them to make full use of their materials and to make proper management for their conservation.

In conclusion, it is added that the collection and maintenance of genetic resources in all nations has made significant progress in the past decades. The advances in developing nations have mainly been due to the efforts of international agencies and technical assistance for researchers, institutions and foundations in the developed world. Although significant international collections exist for the crops of major importance to global agriculture, considerable work still remains to be done in establishing national and regional programs for

many minor and important food crops, livestock, forages and forest species as well as those of esthetics value. Perhaps most important step is to develop a germplasm maintenance and plant breeding infrastructure, which will make a base for their own food security. The primary constraints to this development are human and financial resources.

USE OF INSECTICIDES, PESTICIDES AND HERBICIDES

The most reasonable way to minimize pollution by pesticides and yet still to retain control over pests is to use integrated pest management (IPM), which is becoming main stay of sustainable agriculture. The IPM means a pest management system that in the context of associated environment and population dynamics of the pest species utilizes all suitable techniques and methods in as compatible a manner as possible and maintains the pest population at levels below those causing economic injury. Such a management system uses several approaches to pest control. Chemical control with pesticides remains but as just one part of a coordinated control strategy that also encompasses biological, competitive and biorational controls. Environmental concern is another compelling reason for adoption of IPM.

Besides the environmental and health concerns, another problem is the development of resistance to pesticides. As a result, pesticides become increasingly ineffective, leading to pest control failure. A more recent example of pesticide failure is the inactivation of certain pesticides by soil microorganisms. Microbes in some soils now degrade pesticides so quickly that the efficacy of pesticides is rapidly diminished. This effect has been noted with several herbicides and some insecticides. Affected crops abroad include maize, vegetables and managed forests.

Other factors that argue IPM approach over use of pesticides alone are the decreased crop yield and increased diseases associated with some pesticides. It is stated that the yield of lettuce has been decreased by several common pesticides because of their adverse effects on photosynthesis and transpiration. The use of some herbicides has been associated with increased susceptibility to insects and diseases. For example, the use of 2,4-D on corn increased susceptibility to corn leg blight, corn leaf aphid and corn borer.

It has been estimated that insect of wide scale pesticides usage the annual losses of around 33% have occurred in over all potential production in U.S. (Bawdry 1982). Insecticides use has increased 10 fold since 1940, yet crop losses have doubled over

this period (Pimental et al. 1983). In contrast, the stability and minimal resistance associated with IPM makes it quite attractive.

PROPER WATERSHED MANAGEMENT

To prevent soil erosion, silting of dams and reservoirs in the low lands especially involves ensuring perennial vegetation cover and minimize tillage practices in the watersheds. Provision of some incentives to local inhabitants doing farming in watershed areas will help to provide them economic return for lower tillage and deforestation activities.

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BALUCHISTAN

SUSTAINABLE AGRICULTURE IN BALUCHISTAN

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Abstract: *This paper appraises the sustainable agriculture in Baluchistan. Sustainable use of soils, rangeland, livestock including marine life, maintaining bio-diversity and role of cooperatives and women are discussed.*

INTRODUCTION

Baluchistan, with a suitable soil and climatic conditions for a wide range of fruit, vegetable and field crops, has great potential for enhanced agricultural production. The total geographical area of 34.7 million hectare is spread over five ecological zones covering the coastal areas to about 2700 meter above sea level. The pattern of agriculture is quite distinct and variable according to the different ecological zones. Shortage of irrigation water is the main constraint to agricultural productivity. Out of 1.5 million hectares arable land, only 0.5 million ha could be irrigated. The main sources of irrigation water are canals in the plains and tubewells and Karezes in the upland. The rest of the area is dependent on the annual precipitation, ranging from 300 - 400 mm in the northeast to 75-100 in south-western part of the province.

Since a significant development of new water sources is uncertain to doubtful, the scarcity of water throughout Baluchistan necessitates that maximum efficiency should be achieved from existing supplies. Despite the awareness of water scarcity, observations indicate that it is frequently wasted through over-irrigation, inadequate conveyance delivery system, and inefficient application methods and so on. Research must present the farmers with new or additional applicable water management alternatives to achieve this goal of maximum efficient and sustainable utilization of present supplies.

SUSTAINABLE USE OF WATER

Issues Affecting Sustainability

GROUND WATER MINING

The WAPDA Hydro-geology Project has

estimated the total ground water availability, in Pishin-Lora basin 145 cusecs (130 MCM/yr). Exploitation of ground water has been an uncontrolled expansion. UNDP, ten years ago, determined that discharge was greater than recharge in the Quetta and Mastung valleys, and that Mangochar valley was close to this condition that ground water falls in excess of 1 meter every year.

DESIGN OF FLOOD IRRIGATION WORKS

Survey of 56 Flood Irrigation Schemes developed in early 1960s showed that only 22 were deemed to be operating satisfactorily, with 21 having considerable operational problems, and 13 having suffered major engineering failures and virtually abandoned.

OPERATION AND MAINTENANCE

The revenue collected from Abiana on the basis of average irrigated and the type of crop grown is very small due to:

- Underassessment of abiana charges and ineffective collection in general.
- Outspoken reluctance by farmers, in particular in small farmer-managed systems, to pay water charges.
- Some crops are exempted from abiana.

SALINITY AND DRAINAGE

The province not only suffer seriously from salinity problems or drainage problems but certain saline sodic soils exist in the Zhob valley. This problem is currently being dealt with as part of the Federal Rehabilitation Project.

Possible Solutions to Improve Sustainability

GROUND WATER

Development Legislation

Enforce existing legislation. Control the over-exploitation by controlling the pumping of ground water supplies. The draw down in specific areas/valleys should be checked, otherwise they have to foresee a famine for drinking water.

Electric Tariff Level and Charge Structure

Electricity charges by WAPDA should be review. Though these charges are high but are based on the power of the electric motor installed and unrelated to the hours of pumping resulting in an inefficient use of water.

Higher Efficiency Systems

Wells and tubewells are usually owned individually and provide a clean water source and thus lend themselves for use with potentially high irrigation efficiency systems as much as drip, trickle or bubble irrigation. The experiment with these systems in initial stages have shown promising results. From these onwards, the water Users Association may be entrusted the operation and maintenance of the system but they must be offered training in technical aspects of the technology.

SUSTAINABLE USE OF SOIL

Soil is often considered as the most vulnerable to deterioration by mankind. Decline and fall of great civilizations is linked with abuse of this natural resource. The future of mankind, is thus, to a great extent dependent on the conservation of this natural resource and maintenance of its productivity.

Issues Affecting Sustainability

Control of soil erosion and maintenance of soil fertility are the major elements of sustainable use of soil. Soil erosion in Balochistan is a serious problem, more than 0.4 million hectares of range land is affected annually by wind and 0.08 hectares by water (Forest Department Stat. 1991). Considering the small area available for cultivation (1.5 million ha), this is a tremendous loss of this natural resource. Main causes of erosion are:

- Overgrazing.
- Indiscriminate cutting of forests, bushes and shrubs.

Soil conserving wing of the Forest Department has

undertaken following actions to control soil erosions:

- Watershed management in Quetta/Mastung area.
- Integrated range management with the components of survey and sustained production of cover vegetation.
- Sand Dune stabilization in already eroded land.

To ensure sustainability in soil nutrient management, a modest effort is underway employing the concept of Integrated Plant Nutrition System (IPNS). The system aims to maintaining and enhancing soil fertility and plant nutrient availability for sustaining crop productivity through optimizing organic and inorganic plant nutrients required in an integrated manner.

Possible Solutions to Improve Sustainability in Soil

To control soil erosion the future strategy would be:

- Protection of natural vegetation by deferred grazing.
- Providing alternate source of fuel to the population.
- Avoiding frequent following and providing cover crops as management option.
- Adoption of conservation tillage.
- Afforestation and further protection of forests.
- Construction of "Bunds".
- Gully plugging.

Biological crop husbandry could be evaluated to maintain and enhance a sustainable soil plant nutrient regimen, the options would be:

- Incorporation of soil micro-organism such as Rhizobia for atmospheric N fixation and micorhyzea for phosphorus absorption in soils.
- A cropping strategy for using, retaining and removing excess N from soil, which include temporal and spatial rotation with row crops in total cropping system. Include legumes which not only improve nitrogen availability but also improve soil physical properties.

- The biological advantage of inter-cropping has in complementary use of growth resources, such as light, water and nutrient, reduction of soil erosion, because soil is covered during most of the growing season.
- Proper use and interpretation of soil test, which has great potential for reducing input of chemical fertilizer without affecting yield.

MANAGING FOREST RANGE LAND, LIVESTOCK AND PREVENTING DESERTIFICATION

The bulk of Balochistan livestock population is herded, mainly in the higher rainfall areas of Northeast Balochistan. About 93% of Balochistan is classified as range land, of which 60% (21 m. ha) is used for grazing. This range land provides 90% of feed for sheep, goats and camels. The sheep and goat population of Balochistan has increased rapidly during past 30 years from 1.9 million in 1955 to 18.4 million in 1986 (Masood *et al.* 1988).

Issues Affecting Sustainability

Range land resources and soil condition are rapidly degraded by the high stocking rates coupled with destruction of vegetation cover by Afghan refugees. Limitation of fuel wood in patchy populated areas has forced people to cut trees, shrubs and bushes. Such situations have invited menaces of wind and water erosion which have reduced the range land potentials from 10-50% (GOP 1983).

In addition to the poor nutritional and malnutrition problems, diseases are responsible for the economic losses in the sheep and goat industry of Balochistan, and parasitic disease seems to be of potential importance (Khan *et al.* 1988). The survey studies of livestock management project of Arid Zone Research Institute (AZRI) on infestation of different parasitic diseases indicated that 79 percent of the sheep were found to be infested with internal parasites. The maximum incidence was 94% in Kalat (Khan *et al.* 1988).

Possible Solutions to Improve Sustainability

In order to preserve the precious natural resources and have sustainable resource management of range lands, the following practices should be considered for implementation.

- The involvement of tribal system deferred and rational grazing will help to revive sustainability

of range lands.

- Encourage the participation of farmers and Agri-business by introducing commercial ranching in marginal lands and high potential range land area.
- Plant the suitable forest trees and shrubs for arid environment, in combination with promising grasses in different range ecologies for sustained productivity of forage from the range lands.
- Evaluate forage germplasm for bio-diversity. Identify and select the best species and biotype of the desired parameters for range rehabilitation and revegetation.
- Balochistan having 93% of area as range land and 50% small ruminants, warrants immediate need of a national institute for range management.

RECOMMENDATIONS

In order to enlarge the spectrum of efforts for agricultural sustainability and to maximize its effectiveness, the following measures are suggested:

- Formation of Co-operative Farm Services Societies for small farmholders.
- Establish a Provincial Federation of Farm Services societies.
- Executives of the forementioned Co-operatives should include representatives of the concerned departments.
- Federal bank for Cooperative should offer loan to the Provincial Bank for Co-operatives more liberally and should levy only the service charges on the loan;
- Provincial Government with the financial assistance of International Agencies should provide the facilities of godowns, ware-houses and cold storage at the district headquarters by allocating fund through PSDP for the construction of the same.

STRATEGIES FOR PROMOTING SUSTAINABILITY OF MARINE FISH RESOURCES OF BALOCHISTAN

Existing Situation and Suggestions for Sustainability

The Fish production regime of Balochistan is still traditional and entirely small in scale in comparison with the fish production in Pakistan. The

essential infrastructure and amenities like fresh water, power, landing facilities, town planning, road-links are not developed sufficiently enough to warrant an accelerated progress to promote the speedy growth of fisheries sector of Balochistan. This has led to the decline of investment opportunities and further development of fish processing industry. The ADP allocation of 2.6% in the 7th Five Year Plan for 70% of fishing coast (800 km) of Balochistan is quite in-sufficient to make this important sector productive. In order to attain sustainability in growth, there is a need for equitable distribution of resources among two maritime provinces within their territorial strips. But as a consequence Sindh having 30% fishing area is practically exploiting 80% resources. Consequently, the shrimp, lobsters and prawn production and exports have declined.

Fisheries is the only means of livelihood for 0.2 m communities and is, therefore, the only means of socio-economic development of the coastal region of Balochistan.

The overall fish stocks estimated in Balochistan is 0.6 m. metric tones. Of these, 0.3 m tones can safely be harvested for sustainable yields, presently 0.1 m tones are being harvested.

In certain pockets shell-fish resources except shrimps and lobsters are practically virgin. There is need to introduce technologies to avail of these unexploited resources. There are excellent beck waters like Sonmiani and Kalamath bays.

Marketing of Makran coast fish is unhealthy. The coastal roads leading to Karachi market are shingled and extremely poor. During rainy periods, these roads get closed even for months. The vehicles used are not refrigerated. Thus catches go waste before reaching destination after paying high charges of transportation. In order to over-come such problems direct marketing centers of Kattar may be exploited because they are nearer than Karachi.

RECOMMENDATIONS

- Balochistan coast is still safe from vagaries of industrial pollution, greatest threat is only from Persian Gulf. Establish a station at Gwadar to monitor environmental threat from oil tanker traffic from Persian Gulf.
- At the moment fishermen are reluctant to exploit those fish resources because of market considerations. Finding economical and approachable market outlets could enhance sustainable fish production.

- Accessible bank loans for fishermen for fleet expansion to maximize fish catches, should be provided.

SUSTAINABLE BIO-DIVERSITY

Limited usage of pesticides in Balochistan hasn't caused any major hazard to bio-diversity situation. The share of pesticides and fertilizers use is far below compared to their consumption in the country; in spite of the fact that crops Rabi and Kharif on one million hectare and fruits on 46 thousand hectares are grown (Provincial Statistics, 1988-89). Insecticides are the major pesticides common in use against orchard pests followed by fungicides. The pesticidal usage, in early eighties, has protected the diminishing apple and almond industry of the province, which was threatened by the scale insects and codling moth. Thus, it may be considered a support to the protection of bio-diversity. But still the need for study and promotion of animal pesticidal usage and alternate pest control techniques can hardly be denied. The misuse of pesticides and adulteration require quality control labs throughout the country. Another recommendation would be IPM development on orchard pests in Balochistan to save environmental degradation of natural biotic agents and to minimize input costs.

Possible Solution for Sustainable Bio-Diversity

An outline for action plans for the conservation of bio-diversity must include:

- Studies on problem realization, development of sound policies and enforcement of proper legislation.
- To avoid the extinction of valuable medicinal plants (Burkel 1974) due to un-regulated grazing of pastures and lands, launch a separate discipline with legislative power, responsible to undertake preservation plans and development of regulatory grazing rangelands. This body will initiate extensive survey of existing natural bio-resources and collect proper statistics regarding agencies transgressing the development of rangelands pastures. The agency may launch appropriate measures necessary for the regeneration of vegetative cover on potential rangelands and its regulation.
- Tribal systems having interaction of tribes to ecological systems cannot be abruptly changed. To administer desire, proper education is the real and dependable headway to changes in

mass behavior. The suggested organization be furnished with a strong extension component, together with training to extension staff of Agriculture and Livestock Department.

- Strengthen and provide sufficient funds to departments of agriculture, forest, fisheries, livestock, irrigation together with university and colleges, to cater studies and regulatory functions in this domain.
- Promote stronger linkages between agriculture, livestock, forest and fisheries. Lack of coordination between these agencies has proved detrimental to maintain bio-diversity.

ROLE OF WOMEN IN AGRICULTURE SUSTAINABILITY

In the rural economy women' status is very contributory and productive. The studies on women in agriculture, show that rural woman of Pakistan plays an important role in crop production activities. They not only participate in farm activities but also contribute considerably in livestock management and preparing handicrafts. These dual responsibilities at their farm level and the household level make them much productive. In order to make women efforts further productive following measures need due consideration.

RECOMMENDATIONS

- Raise the female literacy rate for their awareness, which is less than 2% and is one quarter of the national average.
- Establish rural health centers for health facilities of the rural women, which can affect participation in agriculture productive activities.
- Establish village level social centers for women and announce credit schemes for women in agriculture sector.
- Establish small scale training-cum-production units in rural areas to improve transfer of technology for poultry farming, safe storage of cereals and seeds.

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SUMMARY

Balochistan is the largest Province of Pakistan in terms of area, and the smallest population wise.

Water is very precious resource but very limited factor, in affecting the production of crop and livestock (in productive valleys). Fifty percent of small ruminants face malnutrition and disease setback due to degradation of rangelands. High grazing pressure on rangelands due to migrants and several fold increase have aggravated the sustainability of livestock.

After limited water availability agricultural production is greatly constrained due to erosion problems, low fertile lands and adverse physiological characteristics of soils.

Properly engineered check dams and delay action dams will raise water tables in wells and will reduce erosion.

- Sustainable incremental potential of 140,000 m.tons of fish be exploited on Balochistan coast provided 3,000 additional fishing vissebare provided to its fishermen.
- The earnings of the fishermen can improve 3 times by direct fish exports to middle east neighbors.
- Improvement of fish products can produce 300 percent income to fishermen.
- Extensive technical assistance tax exemptions and subsidies are required to promote the Balochistan fisheries at the level of Sindh.
- Seawater pollution and slicks need monitoring.

Environmental sustainability regarding deforestation due to shortage of fuelwood and over-grazing due to high population of small ruminants and migration of stocks from Afghanistan is much threatened. Erosion due to floods and wind need to be checked through restoration of natural fauna and flora through management and planning.

Pesticidal lower rates and adulteration need to be regularized to protect natural fauna and to escape

pest resistance problems.

The Co-operative Farm Service Societies can play an important role in the agricultural sustainability.

The farmers of Balochistan should form Co-operatives with its bodies at Union Council and Provincial level to get financial assistance and to provide services at attractive terms.

Women folk need to be involved further in farming system and for that there health care facilities and education are major constraints. The women folk comprising half of the population can increase farm production two folds if educated to keep up an healthy family.

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WORKING PAPER

The Ministry of Food, Agriculture and Cooperatives in collaboration with USAID has been pursuing the broader agricultural sustainability issues through a series of conferences held at the provincial level. The objective of these provincial conferences held in May 1990 was to define the critical human, physical and environmental/natural resource management issues pertaining to the future sustainability of agriculture in Pakistan at the grass root level from a wide spectrum of people.

This National Conference on Agricultural Sustainability and Natural Resource Management has been planned as a follow-up of the provincial conferences to reach a consensus on broad based Pakistani perceptions on steps needed to support sustainable agricultural development into the 21st Century. The conference is specifically targeted at developing a 3-4 point achievable strategic plan, which can also be incorporated into the 8th five year plan. The national conference objectives also include establishing institutional infrastructure for continued post conference activities and to evolve a consensus on approaches to implement the strategic plan.

The participation in the conference has been kept fairly broad and include GOP ministerial level officials, provincial nominees representing different sectors concerned with sustainability issues, relevant private sector institutions and bilateral, multilateral mission representatives. A participatory decision making approach will be used to bring all participants to a consensus position thus producing an achievable strategic plan with clear cut goals, resources for achieving goals identified and a comprehensive action plan.

The Steering Committee of National Sustainability Conference comprising of Federal and Provincial representatives had chosen the following four themes for the conference:

- Sustainable use of soils.
- Sustainable use of Water Resources
- Managing Rangelands and livestock and preventing desertification.
- Sustainable Bio-diversity.

All provinces were requested to prepare

position papers on each of these themes covering the following aspects:

- Their own concept of the theme.
- Prioritized list of Sustainability issues relevant to the theme in their province or sphere of work.
- A brief description of the relevant institutional infra-structure and ongoing R&D activities.
- Suggestions for future actions and possible actions which each member as an individual or collectively with other members can take to alleviate these issues.
- Identification of public/private agencies/group suited to provide further assistance relative to sustainability of agriculture and better Natural Resource management.
- Possibilities of expanding the natural bases i.e. ocean resource, solar energy, cultivable land etc.

This Conference Working paper has been compiled by using whatever information was provided in a few four position papers that have been received.

SUSTAINABLE USE OF SOIL

Soil is the medium for plant growth. Sustainability of agriculture is, therefore, vitally dependent on its sustainable use. The relevant issues are:

Soil Fertility

Continuous cropping, particularly of High Yielding Varieties, is draining plant nutrients out of the soil, and without comparable replenishment is impoverishing the soil of essential plant growth substances. This had led to declining crop productivity. Soil analysis across the country have indicated acute deficiencies of nitrogen and phosphorus and, in some areas, of potassium and micro-nutrients like Fe, Cu, Zn and B. The application of fertilizer is seldom related to soil chemical analysis and cropping sequence. The imbalanced used of fertilizer and its over and under dozing have created problems of low fertilizer use efficiency and consequently low productivity and profitability, nutritional imbalances and pollution.

Salinity and Water Logging

According to an estimate 5.7 million ha are affected by water logging and salinity and to this daunting figure almost 40,000 ha are added every year. The rise of water table, resulting from barriers to natural drainage, use of brackish sub-soil water and improper soil and water management practices are aggravating this twin menace. Vertical and horizontal drainage and use of soil amendments have been used as remedial measures but the problem is far from solved.

Soil Erosion

About 4.5 m. ha are affected by loss of productivity due to water and wind erosion. Both forms of erosion result in the loss of fertile top soil. Water erosion also leads to massive siltation of downstream reservoirs, dams, flood plains, beds of rivers, canals and water distribution systems giving rise to a numbers of related problem.

Soil Pollution

Several sources of pollution such as atmospheric fall out, solid waste disposal, spread of industrial effluents or their use for irrigation purposes, residual effect of pesticides are causing deterioration of soil health and a consequent loss of productivity. Most of the industrial effluents rich in toxic chemicals and heavy metals are either used directly for irrigation or dumped into rivers the waters of which is lifted for irrigating agricultural crops.

Suggestions for Future Action Plan

- An integrated program for successful application of the approved soil and water conservation practices should be implemented.
- Development and dissemination of soil and crop specific fertilizer recommendations.
- Adoption of soil building crop-rotations including exploitation of Biological Nitrogen Fixation.
- Efficiency of the soil reclamation technologies used so far including SCARPs should be assessed and if need be revised strategies should be adopted. Provision of gypsum on subsidized rates should receive priority.
- Magnitude of soil pollution through fertilizers, pesticides and industrial and domestic wastes should be assessed through a systematic study and based on accrued information, a strategy should be planned to combat the problem.

- Establishment of waste water treatment plants can prove extremely useful in preventing the pollution of soil and water resources and will essentially help in maintaining the soil and water sustainability.
- Agricultural research centers and agricultural universities should plan on training farmers on soil management practices conducive to its sustainable use.
- Establishment of Soil Management Research Institutes at the regional level.
- Development of saline agriculture technology for more productive use of salt affected soils and brackish water.
- Timely availability of fertilizers should be ensured.
- The quality of fertilizer and other agricultural inputs should be effectively monitored through proper enactment.

SUSTAINABLE USE OF WATER RESOURCES

Pakistan is a country with arid to semi-arid climate with extremes of temperatures and generally less than optimum rainfall. Successful crop production in most areas is, therefore, possible only through artificial irrigation. Country's agriculture is predominantly irrigated and is supported by massive perennial canal irrigation system besides a large number (over 267,000) of private and public sector tubewells exploiting the underground water resources for irrigation purposes.

In spite of this extensive irrigation system, water, remains a limiting resource both for irrigated as well as rainfed agriculture. Besides, bulk of the country's aquifer is brackish in nature and rich in sodium and almost 75 percent of the tubewells are pumping out sub-standard water which is further aggravating the salinity hazard.

Major issues relevant to sustainable use of water resources are:

Degradation of Watersheds

The main cause of instability in these watershed areas is improper land use and manipulation of the ecosystem in the form of intensified slope cultivation, excessive timber extraction and over-grazing. All this is resulting in denudation of upland slopes, enhancement of landslides and other natural

hazards, weakening the natural control of water flows and accelerating floods and siltation in the lowlands drained by the Indus and its tributaries. Underlying these problems are strong economic and social factors which limit opportunities to find or implement more beneficial methods of environmental control.

Water Management

Water is becoming a limiting factor in agriculture due partly to increased intensity of cropping and partly to diversion of water to non-agricultural uses. Another major contributing factor is the high transmission losses occurring mostly through seepage in the canals and field water courses. Apart from reducing the quantity of water available for irrigation at the farm level these losses aggravate the problem of water-logging and salinity. At the farm level there is wasteful use of irrigation water. In most cases the fields are not properly levelled and often over-supplied with irrigation water which besides resulting in wastage of water adversely affects the performance of the crop. In areas where recharge rate of the subsoil water is low, the longer term sustainability of crop production based on tubewell water is becoming questionable. The situation is particularly serious in dryer areas of the country where natural precipitation is very low. There is a tendency of excessive mining of the aquifer and in areas like Balochistan where pumping of sub-soil water has developed rather fast in the last two decades, the water table has already fallen by several meters and the tubewell discharges have greatly reduced.

Water Conservation in Rainfed areas

Efficient water harvest and the subsequent conservation of moisture for crop production is an important issue of sustainability in the rainfed agriculture. Quite often there is excessive run off of the rain water from the fields which besides water loss causes erosion of the top fertile soil. Efficient moisture conservation and utilization techniques are usually lacking in the rain-fed areas. Due to moisture stress in the soil the efficiency of other crop production practices like HYV seed and fertilizer is also reduced.

Suggestions for Action Plan

The watersheds should be sustainably managed by:

- Starting massive integrated area development projects covering all the following minimum components:
- Organizing local communities for effective project implementation.
- Creating an efficient and effective mechanism for the motivation of the people; delivery of relevant information and supply of needed inputs for forestry, mountain agriculture and horticulture, soil conservation, grazing management, and animal husbandry; and improving the marketing of products from mountain lands.
- Implement proposals of this note for the sustainable management of forests, grazing lands, and livestock.
- Strengthening of Irrigation Water Management Program by expanding the on-farm water management and command water activities through improvement of community water courses and precision land levelling.
- Improving Water Resources Management in Barani Areas by introducing low cost, high efficiency pressurized irrigation systems, installation of locally developed low cost, energy-less hydra-ram pumps on natural springs and streams; introducing the water turbine pumps for lifting irrigation water and small hydra-power generation; Construction of large and small water reservoirs and Commissioning of command area development program of small dams in barani areas.
- Improving Management of Water Resources in Riverain Area with installation of shallow tubewells and introducing sprinklers/drip irrigation methods.
- Improving Ground Water Resources by disinvestment/privatization of SCARP tubewells; installation and operation of shallow tubewells with mobile pumping sets and modification of SCARP tubewells by replacing them with centrifugal pumps.
- Establishment of Water Management Research Institute to undertake research, development and training in land and water resources particularly for investigations of shallow groundwater and development of low cost technologies for barani, semi-desert, sub-mountainous and water scarcity areas.

MANAGING FORESTS, RANGELANDS, LIVESTOCK AND PREVENTING DESERTIFICATION

Sustainable management of forests, rangelands may be defined as management which yields optimum benefits to the nation and the local people, while improving the productive potential of the soil, forest growing stock, grazing-land vegetation, and livestock herd for sustained production in the future, at an increasing level of productivity. Rangelands which comprise almost 60 percent of total landmass of Pakistan are largely ignored in development planning and as a result they show continued signs of degradation eventually leading to desertification.

Sustainable Management of Forests

WELL-STOCKED RESERVED FORESTS SUITABLE FOR INTENSIVE MANAGEMENT

Factors Responsible for Depletion

- Theft of timber for commercial gain.
- Cutting and lopping of trees, for use and firewood.
- Grazing, which prevents the regeneration of forests.
- Encroachment on forest land, for agriculture.

Action Needed for Sustainable Management

- Depoliticize Forest Department by merging Forest Department and Forest Development Corporation into Forestry Corporation responsible directly to the Chief Minister, and charged with forest management, timber harvesting, and establishment of primary forest industries.
- Stop all political interference in the appointments and transfer of forest employees, from Forest Guard up. Appointments should be on merit and transfers in the public interest.
- Rationalize size of forestry jurisdictions to make them amenable to intensive forest management.
- Invest massively in the improvement of timber harvesting, forest regeneration, and establishment of primary forest industries to open avenues of employment for rural mass, thereby weaning them away from illicit cutting and lopping of trees and dependence on livestock.

- Increase the stake of local people in sustainable management of reserved forests by restoring the same proportion between the market price of timber and the seigniorage fee payable to local people, as existed at the time of promulgation of this fee.
- Use enhanced seigniorage fees, and social forestry, watershed management, and grazing management projects to organize local communities for improving forest protection.
- Regenerate harvested areas promptly, ensuring them effective protection from grazing, as long as required, with the collaboration of local communities.
- Reduce the demand for wood as domestic fuel, supply gas to small towns in hills.
- Educate the Judiciary and the Executive in environmental concerns, especially in importance of forests and serious consequences of deforestation.
- Revise relevant provisions in Forest Acts to restore their deterrent capacity which has been greatly eroded since the Acts were passed.

PROTECTED FORESTS, WITH 60 PERCENT SHARE OF THE LOCAL PEOPLE IN THE SALE PROCEEDS FROM TIMBER

Factors Responsible for Unsustainable Management

- Theft of timber for commercial gain.
- Cutting and lopping of trees, for use and firewood.
- Grazing, which prevents the regeneration of forests.
- Encroachment on forest land, for agriculture.
- Complications of shared ownership.
- Unlimited rights of user.
- Short history of scientific management.

Action Needed for Sustainable Management

Following action needed for sustainable management on the lines of Kalam Integrated Development Project:

- Organize local communities for participation in forest protection and management and timber harvesting; and improved agriculture, grazing

land management, and livestock husbandry.

- Provide effective technical support for all the above.
- Provide seed money to encourage the village communities to embark on the above mentioned ventures which would become self-sustaining eventually.

GUZARA FOREST OF HAZARA CIVIL DIVISION

Factors Responsible for Unsustainable Management

Guzara Forests under the management of the cooperatives of their owners:

- Concerns about equity as regards small Guzara owned and the landless.
- Concerns about sustainability high harvest cuts and inadequate regeneration.

Guzara Forests under the management of Forest Department:

- Lack of sensitivity of Forest Department to the needs of the Guzara forest owners.
- Inadequate regeneration.

Action Needed for Sustainable Management

- Review the management of Guzara Forests, both under the co-operatives of their owners, and Forest Department, and take remedial measures.

COMMUNALLY OWNED MOIST MOUNTAIN LANDS

Factors Responsible for Unsustainable Management

- Lack of knowledge.
- Lack of social control on communal land.
- Lack of resources.

Action Needed for Sustainable Management

Following action need for sustainable management on the Lines of Malakand Social Forestry Project and Kalam Integrated Development Project:

- Organize local communities for participation in forest protection and management and timber harvesting; and improved agriculture, grazing land management, and livestock husbandry.

- Provide effective technical support for all the above.

- Provide seed money to encourage the village communities to embark on the above mentioned ventures which would become self-sustaining eventually.

COMMUNALLY AND PRIVATELY OWNED SEMI-ARID RAIN-FED GRAZING LANDS (RANGELANDS)

Factors Responsible for Non-Sustainable Management

- Problems related to determining optimal carrying capacity of the different types of ranges.
- Lack of range rehabilitation technologies.
- Complete defiance of grazing and forest laws which themselves are considered obsolete and need careful review and revision.
- Lack of expertise that can develop micro/macro strategies to enhance productivity of rangelands.

Action Need for Sustainable Management

- The stocking of range lands should relate to optimal carrying capacity of different types of ranges.
- Range rehabilitation technologies should be developed and adopted with the government's assistance.
- The existing grazing and forest lands should be reviewed and revised to make these effective for controlled grazing.
- Obtain relevant foreign research information and adapt it to our own needs.
- Conduct "farming systems" type of research on local problems, ensuring the collaboration of the local communities at all stages.

Livestock

FACTORS RESPONSIBLE FOR NON-SUSTAINABLE MANAGEMENT

- Inadequate feed.
- Debilitating parasites and diseases.
- Inefficient marketing.

- Price controls on livestock and their products.
- Local breeds more suitable for survival under adverse conditions than for high productivity.

ACTION NEEDED FOR SUSTAINABLE MANAGEMENT

- Organize local communities to effectively receive and act on knowledge needed for sustainable management of livestock.
- Enable the efficient availability of relevant animal husbandry and animal health information to the organized local communities, and motivate them to utilize the information.
- Increase the yield of maize grain and stover in the moist mountains.
- Increase the intensity of agriculture on all cultivated land, and include fodders in crop rotations.
- Remove price controls on livestock products to make scientific animal husbandry profitable.
- Promote the efficient marketing of livestock and their products to increase off-take, and reduce the size of standing herd, for balancing it with available feed.

Management of Bio-Diversity

Bio-diversity refers to the diversity of biological species that exist in an eco-system. Conserving bio-diversity is important both for environmental protection and development. Most development planners now view "Environmental Protection" as an effective means for the eradication of poverty and meeting the basic needs of the rural and urban poor. People are beginning to realize the critical importance of saving and sharing and the sustainable and equitable management of bio-diversity, particularly plant and animal genetic resources for achieving continuous advances in biological productivity and for adapting to global changes.

The current trend in global warming resulting from "Greenhouse" gases in the atmosphere, if not arrested, could cause changes in precipitation, temperature, ultraviolet radiation and sea levels. New breeds of plants and animal will be needed to adapt to climatic and technological changes. Today's desirable gene pool may not be the ideal gene pool of tomorrow. This calls for intensified efforts in the area of genetic resources conservation and utilization.

ISSUES RELEVANT TO SUSTAINABLE MANAGEMENT OF BIO-DIVERSITY

Genetic erosion caused by:

- Deforestation.
- Habitat destruction.
- Introduction of high yielding varieties with no effort to protect indigenous breeds and land races.
- Lack of adequate institutional infra-structure, physical facilities and operational resources for collecting, evaluating, documenting and conserving plant and animal germplasm.
- Absence of any program of conserving bio-diversity in its natural habitat or by establishing clonal repositories.
- Lack of understanding of the role of species in stability and sustainability of an eco-system.

SUGGESTIONS FOR PLAN OF ACTION

- Planning and implementing appropriate policies to control unchecked denudation of forests and destruction of habitats.
- Establishing appropriate institutional infrastructure at federal and regional levels, provided with adequate facilities and operational resources to identify major areas of bio-diversity in the country, and implement effective program for its collection, evaluation, conservation and utilization.
- Developing and implementing a program of conserving bio-diversity in its natural habitats. Major areas of bio-diversity should receive prior attention for this purpose.
- Clonal repositories should be established in suitable ecologies to conserve germplasm of horticultural and forest trees.
- Establishing programs for conserving land-races of crop plants and indigenous breeds of animals.
- Implementing a program for generation and dissemination of information on the role of species in stability and sustainability of an ecosystem.

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